RAY SOCIETY.

A MONOGRAPH

OF THE

BRITISH ANNELIDS.

PART II.

POLYCHÆTA.

AMPHINOMIDÆ TO SIGALIONIDÆ.

PAGES 215—442; PLATES XXIV—XXVI, XXVIA, XXVII—XLII.

BY

W. C. McINTOSH, M.D., LL.D, F.R.S., ETC.

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THE

RAY SOCIETY.

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BRITISH ANNELIDS.

v.1. PART II.

POLYCHÆTA.

AMPHINOMIDÆ TO SIGALIONIDÆ.

PAGES 215—442; PLATES XXIV—XXVI, XXVIA, XXVII—XLII.

BY

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DEDICATED

TO

CHARLES HENRY GATTY, Esq., M.A.,

LL.D., F.R.S.E., F.L.S., F.Z.S., F.G.S., ETC.,

OF FELBRIDGE PLACE, EAST GRINSTEAD,

THE MUNIFICENT FOUNDER OF THE GATTY MARINE LABORATORY,

ST. ANDREWS.

TEMPORARY PREFACE.

When the author, as already explained in the Introduction to Part I, undertook the task of placing the British Marine Annelids on a more satisfactory footing, he did not foresee either the difficulties of isolated work in the country—apart from libraries and the sea-shore—or the increasing strain of very responsible official duties. Again, when he had at length secured the advantages pertaining to the sea and a university library, the constant succession of fresh labours—connected respectively with the volume on the Annelida of the 'Challenger,' the engrossing work accompanying the comparatively recent development of the scientific aspects of the Fisheries, and the foundation and superintendence of the first Marine Laboratory in Britain—were inimical to rapid progress with the subject. But this was not all; the revival of zoological science and zoological teaching in a university so admirably situated for both, the reorganisation and development of the University Museum, and the numerous official duties, requiring a large amount of time, which devolved on him might have seemed to prove almost fatal to the undertaking. But during this period he had unique opportunities of extending the knowledge of the Annelids and their distribution, so that not even the absorption of time in upholding science and medicine in the oldest Scottish university—at, perhaps, the most critical period of its existence—for a moment caused doubt as to the ultimate progress of the work.

Such a brief explanation is necessary, for it is no less than a quarter of a century since the first part was published.

The great extent of the field necessitates but a brief reference to anatomy and embryology, were it only for the cost of plates and text. These and the historical parts can follow either in this or another channel. Publication has become the more clamant since in this country no book of reference on the subject is up to date, and hence the group has not received that care from zoologists which is desirable—for instance, in extending the species and accurately defining their distribution.

Amongst those who have largely aided the author by the collection of specimens the late Dr. Gwyn Jeffreys holds a foremost place, since he took with him for several years specially prepared bottles for the preservation of the Annelids, and thus forwarded them in excellent condition. I desire to record my grateful remembrance of his constant care in this respect. Exceeding even the foregoing in number and variety of specimens come the collections made by several relatives in St. Andrews, one of whom for more than twenty years enriched the museum of the author in a noteworthy manner. Few took deeper

interest in the progress of the work than the late Prof. George Busk, whose unselfish devotion to zoology is another memorable example of the brotherhood of medicine and natural history. The late Mr. Spence Bate, of Plymouth, Dr. Baird, of the British Museum, Dr. W. B. Carpenter, Sir Wyville Thomson, Dr. Bowerbank, Dr. David Robertson, of Cumbrae, Prof. Grube, of Breslau, Edouard Claparède, of Geneva, Dr. Howden, of Montrose, Dr. Carrington, of Eccles, Mr. A. G. Moore, of Dublin, James Duncan Matthews, of Aberdeen, and Profs. Dickie, Ogilvie, and Dyce, of the same place, were of signal service in forwarding specimens. I have also to acknowledge similar and valued aid from the late Prof. Allman, Canon Norman, Prof. Ray Lankester, Mr. Whiteaves, of Canada, Ludwig von Graff, of Gratz, Mr. Brooking Rowe, Plymouth, Miss Florence Buchanan, Prof. G. S. Brady, Prof. Percival Wright, Prof. Howes, Sir John Murray, Prof. Haddon, Dr. Scharff, Dublin, Mrs. Collings, late of Sark, Dr. E. P. Ramsay and Prof. Haswell, of Sydney, Dr. John Anderson, late of Calcutta, Prof. Herdman, Mr. Beddard, Dr. Sydney Harmer, Prof. Jeffrey Bell, Mr. J. T. Cunningham, Prof. Ewart, Mr. Shipley, Mr. Parfitt, Exeter, Dr. Fulton and Mr. H. C. Williamson, of the staff of the Fishery Board, Mr. Arnold Watson, Sheffield, Mr. Shrubsole, Sheerness-on-Sea, Mr. Sibert Saunders, Whitstable, and Mr. Hornell, of Jersey.

For assistance in other respects I have gratefully to remember Prof. Giard, of Paris, Prof. Alex. Agassiz, A. E. Verrill, John Murdoch, J. Walter Fewkes, Prof. H. E. Webster, Dr. H. P. Johnson, Miss M. Lewis, J. E. Benedict, Dr. T. H. Montgomery, of the United States, Dr. J. P. Hill, of Sydney, Prof. A. G. Bourne, Madras, Prof. W. B. Benham, Otago, Prof. Harvey Gibson, Liverpool, J. Jennings Hind, Mr. Garstang, Plymouth, Prof. Gilson, of Louvain, the late Prof. Lovén, Stockholm, the late Dr. A. J. Malmgren, Helsingfors, Dr. Emil Marenzeller, Vienna, Prof. A. F. Marion, Marseilles, MM. Pruvot and Racovitza, Prof. G. O. Sars, Dr. Fridiof Nansen, Christiania, Prof. Hjalmar Théel, Stockholm, Dr. A. Wirén, Upsala, Prof. Hubrecht, Utrecht, Prof. Haeckel, Jena, Dr. W. Michaelsen, Hamburg, Prof. C. O. Minot, Boston, Prof. Playfair McMurrich, Michigan. Dr. Langerhans, Madeira, Louis Roule and Baron Jules de Guerne, Paris, Baron de St.-Joseph, Prof. Paul Hallez, Prof. Barrois and M. Malaquin, Lille, F. Mesnil, Paris, M. Caullery, Lyons, Pierre Fauvel, Caën, Julian Fraipont, Prof. Julin, Liège, Jules Bonnier, E. Brumpt, Dr. Kükenthal, Jena, Prof. Ehlers, Göttingen, Prof. B. Hatschek, Dr. R. Greef, Dr. F. Vejdovsky, Praag, Prof. Hensen, Kiel, Prof. K. Brandt, Dr. J. Reibisch, Th. Kuhlgatz, Dr. V. Häcker, Freiburg, P. Tauber and G. M. R. Levinsen, Copenhagen, Dr. R. Horst, Leiden, Dr. G. A. Hansen, Dr. C. Apstein, Kiel, Dr. Apellöf, Bergen, Ivar Ardwidsson, Dr. C. Aurivillius, Dr. D. Carazzi, Florence, Dr. S. Orlandi, Dr. C. J. Cori, A. Birula, St. Petersburg, Prof. Möbius, Berlin, Prof. Kishinouye, U. Takura, S. Goto, S. Hatai, and A. Iizuka, Tokyo, the late Prof. Moseley, Dr. Murie, Capt. Fielden, Dr. Marcus Gunn, the Duke of Argyll, and the late Sir Walter Elliot, of Wolflee. My colleague, Prof. Lawson, kindly looked over certain proof-sheets when they were delayed by an illness; Dr. A. T. Masterman also gave me his valued aid at this time. I am also indebted to Prof. Wiltshire for his careful revision and suggestions.

Various Fishery officers in Scotland, especially Mr. Bain of Peterhead, Mr. Duthie of Lerwick, Mr. Mair of Montrose, and Mr. Cooper, formerly of Aberdeen, have been of much service in forwarding specimens used as bait or otherwise interesting.

For the best of the coloured drawings from life I am indebted to my late sister, Mrs. Günther, the loss of whose delicate touch and experience has been greatly felt in the completion of the work. I have also to thank Dr. A. T. Masterman, Rev. J. M. Anderson, my artist—Miss Ada Walker, and Miss Burnet of St. Andrews, for aid in this respect. The present part contains comparatively plain examples of the group, which is remarkable for beauty of coloration in such as the Phyllodocidæ, Nereidæ, and many others.

It has been found impossible to represent all the parts required for identification from the living form, because many have not been seen alive, or if so, under circumstances inimical to anything else than preservation. Yet this is not altogether a drawback, since many workers have only spirit-specimens to deal with, and the parts so preserved retain certain useful characteristics. On this head, indeed, diverse views are held, one of the most recent being that of Dr. H. P. Johnson, of California, who asserts that descriptions from life are only advantageous in respect to colour.

W. C. M.

Gatty Marine Laboratory,
St. Andrews;
July.

DESCRIPTION

OF THE

GENERA AND SPECIES

OF THE

BRITISH MARINE ANNELIDS

(ANNELIDA POLYCHÆTA).

Order POLYCHÆTA.

Marine worms usually with a definite head (prostomium), which dorsally bears eyes and tentacles, and ventrally palps, besides possessing other sense-organs.

From the buccal region (peristomium), which frequently carries cirri or other organs, the fore-gut often sends out a protrusible proboscis—armed or unarmed. Œsophagus may have a pair of diverticula. Alimentary canal simple or branched, and a median dorsal and median ventral mesentery may be present.

Body of one or more regions, generally elongate and cylindrical, sometimes flattened and compressed, of numerous segments, which internally are marked rather by the oblique muscles than by diaphragms. The last segment in many has long ventral (anal) cirri. It is invested by a thin, tough cuticle covering a granular layer,[1] bounded internally by basement-lining, then a more or less complete layer of circular muscular fibres, while within are four longitudinal muscular bands,—as a rule, two dorsal and two ventral. The oblique muscles converge from the dorso-lateral region to the vicinity of the nerve-cords.

The segments in the free examples bear lateral processes of the body-wall (feet or parapodia), and each foot is frequently divided into a dorsal and a ventral lobe, with a spine (aciculum) to which motor muscles are attached, and a group of specially differentiated bristles, besides a dorsal and a ventral cirrus.

Respiratory organs either free branchiæ or the general surface.

Circulatory organs generally closed, contractile or non-contractile vessels. Blood red, pink, green, or pale, corpusculated or non-corpusculated (?); occasionally absent.

Perivisceral (cœlomic) fluid abundant, highly organised and corpusculated. In certain forms the perivisceral corpuscles are coloured, and the whole may act as a substitute for the circulatory fluid.

Nervous system consists of cephalic and subœsophageal ganglia with commissures, separate or closely applied longitudinal ganglionated trunks, with or without neural canals; placed in or internal to the granular layer under the cuticle. A stomato-gastric system of nerves also occurs.

Reproductive organs are developments of the perivisceral (cœlomic) epithelium in connection with the ventral blood-vessels. The products escape by the segmental organs (nephridia), or by rupture of the body-wall. Sexes, as a rule, are separate, but some are hermaphrodite. Polymorphism and asexual reproduction also occur.

The segmental organs may act as genital ducts, and are arranged in pairs in few or many segments.

Larva a trochophore. Metamorphosis during development.

Free or sedentary (errant or tubicolous).

[1] Formerly named hypoderm, a term, however, which has given rise to misapprehensions.

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

(ANNELIDA POLYCHÆTA.)

Order—POLYCHÆTA.

Family I.—Amphinomidæ.

Cephalic lobe rounded or compressed. A median and two lateral tentacles, though the latter may be absent, an elongated dorsal caruncle, and four eyes. Body elongate, oblong or ovate-oblong, feet with the dorsal and ventral divisions widely separated and furnished with cirri. Mouth removed from the tip of the snout ventrally, with modified segments laterally; protrusible proboscis devoid of jaws. Feet peculiarly modified, the dorsal lobe being extended and merged into the dorsum, but with bristles, branchiæ, and cirri. Bristles brittle, calcareous, and tubular, with gelatinous contents; rarely hook-like spines. Buccal apparatus and proboscis large and complex; alimentary canal often with a cæcum in front. Anus dorsal. Two posterior appendages. Nerve-cords either lie within the body-wall, the decussation of the oblique muscular bands being beneath them, or the latter are attached at the outer border of each trunk. Oviparous.

Sub-family—Amphinomina.

Cephalic lobe rounded, furnished with a median and two lateral tentacles; body elongate; branchiæ on the dorsum of the feet, which have their dorsal and ventral divisions widely separated. Bristles brittle, calcareous, tubular, with gelatinous contents.

Nerve-cords somewhat small and flattened, occupying an area bounded internally by a transverse band of fibres, and externally by the circular muscular layer and the granular layer beneath the cuticle. The oblique muscles are attached at the outer border of each trunk. Intestine simple.

Savigny in his 'Système' (1820) made the Amphinomæ the fourth Family of his first Order Nereidæ, characterising them as follows:—Branchiæ large, complex,

situated along the superior border of all the dorsal divisions of the feet, the first three or four excepted, or behind the border, and extending to the ventral branch, resembling a pinnatifid leaf (feuilles), with tufts or arbuscles, which generally divide at their origin into several trunks, now coalescing, and again separating more or less distantly the one from the other. Mouth with a short proboscis, opening longitudinally at the extremity, without prominent folds or tentacles, and devoid of jaws. Eyes two or four; antennæ of moderate length and generally complete. Sometimes the middle and exterior are absent; the unpaired is always present and inserted at the front of the caruncle superiorly, the latter extending to the third or fourth segment. Feet with large separate divisions, each furnished with a single bundle of bristles and without a spine. Cirri well marked, subulate, enlarged at the base, or in the form of two articulations, of which the one, large and short, serves as a support for the other, which is completely retractile. They are inserted within the orifice of the sheath, behind the bundle of bristles. The anterior feet do not differ materially from the posterior. The feet of the first and second segments exist in all the genera.

Lamarck[1] (1818) followed Savigny in his classification of the group.

Œrsted[2] placed the family Amphinomaceæ in his division Maricolæ, characterised by having bristled pinnæ, a depressed body, segments numerous and defined, and with the alimentary canal often branched. They were finally distinguished as Chætopoda Trematodina, with branchiæ completely ramose. He does not include any representative, however, in his list.

Kinberg[3] describes the Amphinomea as having the mouth inferior, formed by the anterior segments; pharynx protrusible, devoid of papillæ and jaws; cephalic lobe with four eyes and a caruncle. The cirri and branchiæ do not alternate. He divided the group into two families—the Amphinomacea and the Euphrosynea. His first family, the Amphinomacea, included *Chloeia*, Sars, *Notopygos*, Grube, *Lirione*, n., *Amphinome*, Bruguière, *Hermodice*, n., and *Eurythoë*, n. The characters were—cephalic lobe rounded; no tentacle; two antennæ; two antenniform palpi; branchiæ on few segments; dorsal and ventral divisions of the foot distinct. The representatives of these genera are more characteristic of the warmer seas, as shown by the earlier writers, as well as by Kinberg's paper and the voyage of the "Challenger." Even the expedition of the "Porcupine," in 1870, brought fine specimens of *Chloeia* from the Mediterranean. The labours of Prof. M. Sars, however, introduced in 1861 a northern example of the genus *Eurythoë*;[4] and his distinguished son, Prof. G. O. Sars, added another representative of the family in *Paramphinome*,[5] which he had found amongst the unpublished manuscripts of his father.

In the catalogue of the Royal College of Surgeons[6] an account of the circulation and the branchial plexuses of *Amphinome capillata* is given.

[1] 'An. sans Vert.,' vol. v, p. 327.
[2] 'Ann. Danic. Consp.,' p. 4, 1843.
[3] 'Öfversigt af Kongl. Vet. Akad. Förhandl.,' Aug. 14, No. 1, p. 11, 1857.
[4] 'Christ. Vidensk. Selsk. Forhandl.,' 1861.
[5] 'Some Remarkable Forms, &c., off the Norwegian Coast,' Christ., 1872, p. 45.
[6] Vol. vi, p. 14.

Ehlers (1864) placed the Amphinomea as the first family of his order Nereidea, characterising them as having the mouth on the under surface, surrounded by several segments. The head is not clearly defined, and bears a caruncle which extends over several segments. Under this family he includes *Chloeia*, *Notopygos*, *Lirione*, *Amphinome*, *Hermodice*, *Eurythoë*, *Euphrosyne*, *Spinther*, *Aristenia*, *Hipponoë*, *Lophonota*, *Zothea*, and *Didymobranchus*.

Grube, in his 'Annulata Semperiana' (1878), comprehended the Euphrosynidæ in his family Amphinomea. He describes them as having an oval or elongate body, more or less depressed, frequently tetragonal; and with one or two anal appendages. The cephalic lobe is united with the buccal segment beneath, generally with a caruncle and a bifid pre-buccal process. Tentacles one or three, sub-tentacles (palpi) two or none. Eyes two pairs. Mouth inferior. Buccal segments several, rarely one. Dorsal cirri single or double; ventral single, cirri rarely absent. Fascicles of bristles double on each side. Spines none. Bristles simple, now capillary, now unequally bifurcate; rarely compound, hooked. Branchiæ dorsal or marginal; pinnate, ramose or simple, rarely absent. Pharynx (proboscis) somewhat suboval, having neither jaws nor papillæ. This is a more detailed diagnosis than he gives in his 'Familien der Anneliden' (1851).

Claus, in his 'Grundzuge' (1880), made the Amphinominæ the first sub-family of the Amphinomidæ.

Carus describes the Amphinomea ('Prod. Faun. Medit.,' 1884) as having the mouth on the ventral surface, surrounded symmetrically by several segments; cephalic lobe little differentiated, or represented by a caruncle on the dorsal surface covering several segments. The genus *Amphinome* he characterises thus:—Head with three antennæ, four eyes, and a distinct caruncle; tentacular cirri two; caruncle covering two to three segments, more or less plicate; feet biramous, divisions distinct, a hiatus between the bristles; branchiæ arborescent, branches and ramuscles numerous.

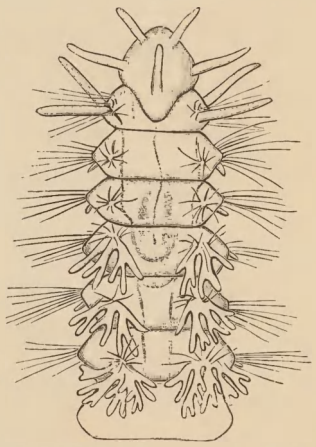
Genus I.—Paramphinome, *Sars*, 1867.

The genus Paramphinome was characterised by Sars as having a moderately elongate vermiform body, segments few. Cephalic lobe small, produced posteriorly; no caruncle; no eyes. Five short tentacles, cylindrical and subequal—a median in the posterior part of the head, two anterior, and two lateral. Dorsal and ventral cirri present in the first segment of the body, elongate, similar to the cephalic tentacles; rudimentary in the other segments. Mouth a longitudinal fissure surrounded by four fleshy lips. Anus terminal. Feet biramous, the dorsal and the ventral divisions, which are small, widely separated. The dorsal bristles are of two kinds—a shorter simple serrated series, and a longer and much more slender kind, with a spur at the base of the terminal region. Amongst these are also some long, slender, and tapering bristles—faintly and sparsely serrated towards the tip. The inferior bristles have in some the distal end of the shaft dilated and bifurcate, one of the divisions being short and simple, the other elongate and serrate; others are long and slender, with fine serrations towards the tip, while a few are shorter and more boldly serrate. Two strong and somewhat S-shaped hooks are in front of the

insertion of the dorsal bristles of the first segment. Branchiæ occur only on the anterior segments, and are large and dichotomously divided, extending across the dorsum.

PARAMPHINOME PULCHELLA.

FIG. 15.



Anterior end of *Paramphinome pulchella*, Sars. (After G. O. Sars.)
Enlarged.

Specific Characters.—Body nearly cylindrical, a little broader than high, slightly tapered anteriorly and posteriorly. Setigerous segments twenty-four to thirty-three. Cephalic lobe narrower than the first segment, produced into a conical process posteriorly. Branchiæ commencing on the fourth setigerous segment, and from four to six in number, dichotomously divided; terminal processes cylindrical. Colour pale. Length 9 mm.

SYNONYMS.

1868. *Hipponoë Jeffreysii*, McIntosh. Ann. Nat. Hist., 4 ser., vol. ii, p. 250.
1869. „ „ Idem. Trans. R. S. E., vol. xxv, p. 406, pl. xv, f. 1.
„ *Paramphinome pulchella*, M. Sars. Vidensk. Selsk. Christian. (Aar, 1868), 1869, p. 254.
1872. „ „ G. O. Sars. Remark. Forms An. Life, vol. i, p. 45, pl. iv, f. 19—35.
1873. „ „ Sars. Bid. Christ. Fauna, p. 15.
1875. „ „ Ehlers. Zeitsch. f. w. Zool., vol. xxv, pp. 17 and 31.
1876. „ „ Hansen. Annel. Norsk. Nordhavs-Exped., 1876, Nyt. Mag. f. Nat., vol. xxiv, pl. i, p. 4.
1879. „ „ Tauber. Ann. Danic., 78.

Habitat.—Dredged in St. Magnus Bay, Shetland, by Dr. Gwyn Jeffreys in 1867, at a depth of 100 fathoms. G. O. Sars found it occasionally at Lofoten in water ranging to 300 fathoms; in the Christiania Fjord in 100 to 230 fathoms; and also more frequently at Aalsund on a muddy bottom in 20 to 30 fathoms near the shore. It has even come from a depth of 600 fathoms. The species extends to Norway and the Arctic seas (Hansen).

In 1872 G. O. Sars gave an excellent description with figures of this form under the name of *Paramphinome pulchella*, M. Sars, mentioning that it is widely distributed round the Norwegian shores. As he had an opportunity of observing living specimens his description has been, as far as possible, added to the original account.

The head is rounded oval, convex dorsally, somewhat conical in front and even more so behind, since it projects over the first segment almost to its posterior border. It is furnished with five tentacles—two shorter in front and two longer on the projecting median region. The unpaired is behind the latter on the tongue-shaped posterior part of the head. No eyes are present.

The body is nearly cylindrical, a little wider than high, and tapering at both ends. The bristle-bearing segments range from twenty-three to thirty-three, are about twice as wide as long, and distinctly divided from each other. Each has a dorsal and a ventral division of the foot, and a dorsal and a ventral cirrus, the latter organs being short—except in the first and three last segments. The mouth has four fleshy lobes or lips, and the proboscis is often everted in spirit-preparations. The anus is terminal and crescentic.

The branchiæ are confined to the anterior part of the body, and appear to be normally five pairs, six pairs being less common, while four occur in younger specimens. They increase in size from before backwards, the first being on the fourth bristled segment. They are dichotomously divided, broad, fan-shaped organs, which even overlap on the dorsum. They have two primary divisions, each of which is more or less subdivided. Two lateral vessels are visible winding along the body and connected by branches with the gills, besides a median ventral vessel which anastomoses with the former.

The dorsal and ventral divisions of the foot are widely separated. The bristles of the superior lobe (Plate XXXV, figs. 19 *b*, *c*) are for the most part shorter and stouter than the inferior, the former (*b*) being one of the largest, viewed somewhat obliquely so as to show the faint serrations. When the bristle is turned round (as in *c*), the latter are scarcely observable. Besides, there are some long, slender, and tapering bristles faintly and sparsely serrated towards the tip. The inferior lobe of the foot has likewise two kinds of bristles, a few (Plate XXXV, fig. 19 *a*) with the tip of the shaft dilated and bifurcate, one of the distal portions being short and simple, the other elongated and serrate. The rest of bristles in this lobe are either long slender forms with fine serrations towards the tip, or short and more boldly serrate.

In the first body-segment, in front of the insertion of the dorsal bristles, are on each side two strong and somewhat S-shaped hooks.

The want of eyes, and of a distinctly marked caruncle, as Sars says, distinguishes it from other known representatives of the family. The form of the bristles resembles that of other members of the group, but the remarkable hooks on the dorsum of the first segment are unique.

Colour.—Pale and rather transparent, so that the dark intestine is readily visible.

The animal is somewhat sluggish, rolling itself up in a circle when irritated, so as to make the long bristles project outward like those of a *Nerine*-larva. When unmolested it uncoils and moves hither and thither with a sluggish snake-like motion.

Genus II.—EURYTHOË, *Kinberg*, 1857.

Body elongated, with flattened rectangular segments. Cephalic lobe large, rounded or pentagonal; eyes four, dorsal; a median, and two lateral tentacles; caruncle trilobed. Palpi forming two adnate lobes inferiorly in front of the mouth, each with a tentacular process or stylode (Racovitza).

Dorsal cirrus single; bristles of the dorsal lobe linear, subarticulate, others subbifid, with a serrate limb and a short process. Ventral bristles bifid. Branchiæ from the third segment backward.

EURYTHOË BOREALIS, *Sars*, 1861. Plate XXVII, fig. 16.

Specific Characters.—Head somewhat horse-shoe shaped, with two short awl-shaped tentacles (lateral) in front, and two longer a little behind. A curved line separates the head into an anterior and a posterior region, the latter more elevated and furnished with four reddish eyes, the anterior being about twice the size of the posterior. A little behind the anterior pair is a filiform tentacle, while behind the eyes the caruncle extends to the anterior border of the third bristled segment. Body elongate, straw-yellow or pale vermilion, twenty-three to sixty-seven segments, and in transverse section nearly square, though the ventral surface is most flattened. Branchiæ commence on the second bristled segment as a tuft of four papilliform processes, and generally arise behind and somewhat below the dorsal fascicle of bristles, and consist of a tuft of three or four pale finger-like processes. They are continued almost to the tip of the tail (antepenultimate segment), which terminates in a rounded papilla with a minutely crenate margin. The dorsal division of the foot has a jointed cirrus, and bristles of two kinds—bifid with a serrated limb of greater or less length, and somewhat stronger simple bristles with serrate tips. The ventral division has also a jointed cirrus, and many bifid bristles somewhat stouter and with shorter tips (about four serratures). Length one to one and a half inches.

SYNONYMS.

1861. *Eurythoë borealis*, Sars. Vid. Selsk. Forh., 1861, p. 56 (p. 9 sep. copy).
1869. *Amphinome vagans?* McIntosh. Trans. R. S. E., vol. xxv, p. 406, pl. xv, f. 1.
1876. *Eurythoë borealis*, McIntosh. Trans. Z. S., vol. ix, p. 373.
1896. ,, ,, Racovitza. Arch. Zool. Exp., 3e sér., iv, p. 179, pl. i, f. 1—6.

Habitat.—Under a stone in a tide-pool in Herm, August, 1868. Sars found a smaller example at Manger, in the neighbourhood of Bergen, in shell-sand.[1]

[1] It is doubtful if Dr. Benham's view that specimens six inches long occur all round the British area refers to this species, which appears to be rare in our seas.

The head is pale, somewhat horse-shoe shaped, with two short, conical, awl-shaped tentacles in front, and two longer ones—stylodes (Racovitza)—a little behind, opposite the wide part of the snout. A curved line separates the anterior from the posterior part of the head (Plate XXVII, fig. 16), the former being flattened, the latter more elevated, and furnished with four reddish eyes, the anterior being about twice the size of the posterior pair. A little behind the anterior pair a filiform tentacle projects upward in the middle line, and, immediately behind, the caruncle extends as a wrinkled ridge to the anterior border of the third bristled segment, and is of the yellowish colour of the rest of the dorsum.

The body is elongated, nearly cylindrical throughout the greater part of its length, only a little tapered at the extremities. The number of segments is sixty-seven in the larger, forty-one in the smaller specimens. In contraction the body is somewhat square in transverse section, the inferior surface especially being flattened. The great shortening which takes place causes the prominent rows of bristles to project very boldly. The sulci between the first three bristled segments are somewhat less marked, and the slope of the bristles more oblique, but the rest are very distinctly separated, indeed the body is occasionally more or less moniliform. The first bristled segment is small and has no branchiæ. The second has a tuft of about four papilliform branchial processes. Each segment is furnished with a dorsal and ventral division of the foot—bearing bristles, besides the branchial tuft which springs from a point behind and rather below the dorsal fascicle of bristles, and consists of about four finger-like processes arising from a common origin. They continue almost to the tip of the tail, being apparent on the third last segment. All are pale in colour.

The dorsal division of the foot (Plate XXXVI, fig. 16) has a jointed cirrus, and a group of bristles consisting—of bifid forms with elongate finely serrate tips (Plate XXXV, figs. 20 and 21), of those with shorter tips with four or five serratures, and of somewhat stronger tapering simple bristles with serrate tips (Plate XXXV, fig. 22).

The inferior division has also a jointed cirrus, and many bifid bristles somewhat stouter than in the superior division, and with shorter tips having about four serratures (Plate XXXV, fig. 23).

The tail terminates in a rounded papilla with a minutely crenate margin.

The proboscis commences at the posterior third of the fourth bristled segment (as indicated by two brownish specks), and occupies the fifth and sixth segments. It is somewhat fusiform, truncated anteriorly and posteriorly.

The specimens were of a general straw-yellow hue, somewhat paler anteriorly, and pinkish here and there from the dorsal blood-vessel.

The animal is sluggish, crawling slowly about, and contracting into a bristled mass when irritated. Occasionally the posterior extremity is twisted like a screw, and it also coils its body into one or two convolutions, the condition it assumes in spirit; hence the examination is rendered difficult, and most of the fragile bristles are broken during the efforts to decipher their structure.

This form seems to be the same as that found by Prof. M. Sars in 1861, though the brevity of his description leaves some doubt. His sole specimen was a small one of 10 mm. in length, and occurred at a depth of sixty to seventy fathoms. As in other types

of Annelids, however, forms which in the north frequent the offshore are found between tide-marks in the south. The number of the branchiæ differs slightly in the two forms, Sars giving five as the usual number. Further inquiry is thus necessary before the absolute identity can be satisfactorily ascertained.

Sub-family—Euphrosynina.

Cephalic lobe compressed, bending downwards anteriorly to the ventral surface. Dorsally a median tentacle, two eyes, and a trilobed caruncle, ventrally two eyes, two short lateral tentacles, and a pair of adnate palpi in front of the mouth.

Body oblong or ovate-oblong, segments few, feet crest-like, the dorsal and ventral divisions being indistinct. Bristles of the dorsal region brittle and hollow, with simple or bifid tips or hooks with jointed stems, accompanied by simple bristles. Branchiæ on almost all the segments. Buccal apparatus large and complex; alimentary canal simple, with only a trace of an anterior cæcum. Anus dorsal. Two posterior appendages. The nerve-cords are separate and comparatively large, and lie quite within the body-wall,—the oblique muscles, which generally bound the longitudinal ventral muscles, in this case decussating beneath them.

When Savigny established the genus *Euphrosyne* in 1820, he placed it, as his nineteenth genus, under his fourth family, the Amphinomæ of Bruguière; and several subsequent authors, such as Milne Edwards, Kinberg, Ehlers, and De Quatrefages, have adopted the same arrangement.

Kinberg (1857) made the Euphrosynea the second family of his second group, Amphinomea. A single genus and species only are mentioned. His description is—cephalic lobe compressed; neither antennæ nor palpi; branchiæ on many segments; feet crest-like and transverse. He subsequently (1867) made three groups of the Amphinomea, viz. the Chloeia group, the Notopygos group, and the Amphinome group, and gave a brief *résumé* of the literature of each. He does not, in this paper, mention *Euphrosyne* or *Spinther*.

Grube included the genus *Euphrosyne* under the family Amphinomidæ both in his earlier and later publications (1851—1878), having followed Savigny and the preceding authors in this respect. It is placed under his primary division (tribe) Rapacia.

Ehlers[1] likewise adopted Savigny's classification, placing all those with the dorsal caruncle under this group (Amphinomea). He[2] gives an account of a fossil form (*Meringosoma curtum*) from the lithographic slate of Solenhofen which approaches *Euphrosyne* in character. In his recent publication ('Florida Anneliden,' 1887) he adheres to this arrangement. Amongst other features he noticed the hollow nature of the bristles.

The Euphrosynidæ in the classification of De Quatrefages[3] were grouped under the

[1] 'Borstenwürmer,' 1864.
[2] 'Cassel,' 1869, p. 161, pl. xxxvi, f. 3.
[3] 'Annelés,' 1865.

Amphinomiens, and separated from the Aphroditidæ by the Palmyridæ, Eunicidæ and Lumbrinereidæ. The Amphinomidæ he characterised by the similar or subsimilar segments, by the absence of buccal armature or its simple nature, and by the presence of arborescent branchiæ on the segments. The separation of the Euphrosynidæ and their allies from the proximity of the Aphroditidæ does not seem to be warranted on anatomical grounds.

Claus in his 'Grundzuge' (1880) placed the Euphrosyninæ as a sub-family of the Amphinomidæ.

Carus [1] makes *Euphrosine* one of the genera of his Amphinomea, and describes it as having the head with one or several antennæ, two eyes, and a caruncle; body ovate; feet biramous, rami confluent; branchiæ springing from numerous trunks more or less branched.

In Benham's [2] (1896) classification they form part of his eighth family Amphinomidæ, placed between the Nephthydidæ and Eunicidæ, a position which, as already indicated, cannot be supported on anatomical or other grounds of value.

Genus—Spinther, *Johnston*, 1845.

Oniscosoma, *M. Sars*, 1850.

Cryptonota, *Stimpson*, 1854.

Body ovoid; dorsum more or less convex; segments few. Cephalic region incised as in the other segments, and bearing dorsal bristles, lamellæ and uncinate setæ. Eyes four, at the base of the dorsal tentacle. Buccal aperture inferior—set in the midst of the neighbouring segments. Proboscis exsertile, short and semi-tubular. Intestine pinnate. Anus posterior. Nerve-cords widely separated. Segmental organs absent. Neither cirri nor branchiæ.

Since few opportunities have occurred in this country of seeing living examples of the genus, it will most conduce to brevity and clearness if the recent work of von Graff be summarised.

Polychæta with elliptical and dorsally convex bodies gently rounded anteriorly and posteriorly, and having distinctly marked segments. The flanks have a series of short parapodia with a dorsal lamella in each segment. In the centre anteriorly is a single tentacle, while posteriorly two wart-like anal cirri occur. At the base of the dorsal tentacle are four small eyes. On the ventral surface a little behind the snout is the mouth. Posteriorly is the anus, with the reproductive aperture in front. The free dorsal lamellæ have a double row of chitinous bristles with simple or bifid tips. The parapodia have a prominent hooked and jointed bristle, and from one to four of the same kind undergoing development, besides from eight to thirteen simple bristles. The brain lies under the dorsal tentacle. The sincipital region of Racovitza is the only part of the head remaining, and consequently the middle region of the brain is alone present—both the

[1] Op. cit., 'Prod. F. Medit.'

[2] 'Camb. Nat. Hist.,' p. 318.

anterior and the posterior being absent—the result, according to Racovitza, of parasitism. The two ventral nerve-cords are widely separated, with a ganglion in each segment, and a transverse commissure. The alimentary canal has a muscular pharynx without dental armature, with paired diverticula of the middle and hind gut, and a dorsal blind gut. A vascular system is present, but both branchiæ and nephridia are absent. The sexes are separate.

The genus *Spinther* was established by Dr. George Johnston in 1845 for an Annelid (*S. oniscoides*) half an inch in length, and fully a quarter of an inch in breadth, which he had received from W. Thompson of Belfast, who had dredged it in six to ten fathoms in the neighbouring bay. It is remarkable that no undoubted example of this species has been found in British waters since that date, though another species has once been procured in the Minch. Dr. Johnston mentions its cream-yellow colour, the absence of distinct "head, tentacula, and tentacular cirri," and gives the number of the dorsal lamellæ at thirty. He correctly noticed the general form of the "feet," the presence of the cirrus and other features. He also distinguished the hooks and the various kinds of bristles, though his figures were not drawn with that scientific accuracy—probably from deficient microscopic power—which modern requirements demand. He grouped the genus under the Amphinomidæ. Unfortunately the type-specimen[1] is not in the British Museum, where Dr. Johnston's collection of Annelids is. The ciliated pits on the anterior portion of the cephalic region are probably sensory (Racovitza).

Michael Sars five years later (1850) described his *Oniscosoma arcticum*, n. g. et sp., which he had dredged in Komagfjord, in thirty to forty fathoms, on a sponge. This form had twenty segments, a tentacle and four eyes in the third segment. He gave an account of the dorsal lamellæ, the marginal expansions with the bifurcate bristles, and the ventral division with the hooks. He linked it with *Euphrosyne*.

Edouard Grube next year (1851), in his 'Familien der Anneliden,' considered that *Spinther* leaned to the Siphonostomæ or to the Amphinomea rather than to the Aphroditidæ.

A few years later (1854) Dr. Stimpson formed the genus *Cryptonota* for a similar Annelid, giving most of the characters already known, and stating further that the branchiæ resembled those of *Euphrosyne*, though he could not satisfactorily make them out.

Grube (1860), in describing *Spinther miniaceus*, a new species, placed it near *Amphinome*.

In A. de Quatrefages' 'Histoire des Annelés' Johnston's species is given at the end of the Chlorèmiens, under the genera and species of uncertain position, it being noted that while Johnston considered it near the Aphroditidæ, Grube thought it approached the Amphinomaceæ and Siphonostomæ, and that he (the author) was entirely of the latter opinion, which he based on the structure of the feet, the presence of "albuminous" matter in them, and the nature of the hooks.

Claparède in a note[2] states that the genera *Spinther* (*Oniscosoma*) and *Cryptonota* are identical.

[1] I am indebted to Prof. Jeffrey Bell for making a search.

[2] 'Arch. sc. Phys. et Nat.,' t. xxii; 'Bibl. Univ. et Rev. Scientif.,' Apr., 1865.

Malmgren in his 'Annulata Polychæta' (1867) included Sars's species under the genus Spinther—as *S. arcticus*, Sars.

In 1865 I found in the Minch, off North Uist, a form which was placed under *S. oniscoides*, Johnst., but which is clearly *S. miniaceus*, Grube, or more correctly *S. arcticus*, Sars (*non* Wirén).

Hansen next (1882) describes a form which he identified with *S. arcticus*, Sars, from the Norske Nordhavs-Expedition. The description and figures, however, as von Graff says, agree better with *S. oniscoides*, though the somewhat indifferent drawings of the bristles leave some doubt.

In the account of the Annelids of the Vega Expedition (1883) Wirén described a species which he calls *S. arcticus*, but which materially differed from Sars's form in size and in structure.

The same year Levinsen, in his systematic account of the geographical distribution of the northern Annelids, confused Sars's species with Wirén's, and made Hansen's (*S. oniscoides*) a new species.

Drasche [1] further in 1885 gave an excellent anatomical description of *S. miniaceus*, Grube. He found this species chiefly on the surface of the sponge *Tedania anhelans*, Lieberk., at Trieste. He pointed out the double nature of the dorsal membranes—of the structure of which he gives good figures. Underneath the cuticle is the hypoderm, which is thickened in certain regions. The muscular investment which occurs next is more or less continuous as an outer longitudinal and an inner circular layer, but in his figure (pl. ii, fig. 7) of the ventral region the reverse arrangement is shown. His description and figures of the cephalic ganglia (brain) are good, as are also his remarks on the eyes. He gives a clear account of the alimentary canal and of the dorsal blind gut, which joins the intestine in front of the rectum. His account of the circulatory system is brief, since he had only examined the system in section—a dorsal vessel, a ventral trunk, and transverse vessels in each segment being the chief features alluded to. He concludes his paper with remarks on the body-cavity and its septa. Between each pair of septa are the ganglia of the ventral cords and their commissure, the diverticula of the gut and the transverse blood-vessels. The rest of the cavity, in his specimens, was filled with the reproductive products. In the male the region of the dorsal blood-vessel is specially connected with the development of the sperms, as Haswell and Selenka showed in the Aphroditacea. He found no segmental organ (nephridium).

The most complete account of the genus, however, is that of L. von Graff (1887). This author had an extensive series of specimens, and brought to bear on their structure modern methods of investigation. After an historical introduction he gives the characters of the genus and the three species known, viz. *S. oniscoides*, Johnston, *S. miniaceus*, Grube, and *S. arcticus*, Wirén. The adoption of the specific term *arcticus* for the latter, however, seems to be open to some objections, since Sars's name *arcticus* has some claim to priority over Grube's term *miniaceus*, and confusion may result from the application of the same name to a different species, northern though it be. He shows that *S. miniaceus* is the smallest of the series, *S. oniscoides* considerably larger (26 mm.), while *S. arcticus*

[1] Drasche, R. von, 'Beiträge z. fenieren Anat. der Polychæta,' Wien, 1885, 14 pp., 2 pls.

reaches the length of 50 mm. A general structural description follows, and he points out the essential differences of the dorsal lamellæ in the three species. Bifid dorsal bristles only are present in *S. miniaceus*, while in the other two simple bristles accompany the former. The mouth opens on the ventral surface anteriorly, and four small brown eyes lie at the base of the tentacle, each with a short thick nerve from the cephalic ganglion. The nerve-cords are separate except for the transverse commissures. The alimentary canal consists of fore, middle, and hind gut, besides cæcal appendages. The pharynx is muscular. The mid-gut possesses generally a pair of diverticula in each segment, and terminates in an anus which has a pair of short cirri. Excretory organs are absent, but a blood-system is present. There are no differentiated branchiæ. The reproductive elements are separated from the body-wall, and lie in the body-cavity. All are parasitic on sponges.

Recently Racovitza[1] (1896) has carefully investigated the structure and homologies of the cephalic region, and he is of opinion that only the sincipital region of the head remains with the tentacle and the four eyes, and the much reduced brain internally; the latter (brain) consisting of the middle region only, whereas in Eurythoë and Euphrosyne both the anterior and posterior regions of the brain are present. This reduction of the cephalic region he attributes to parasitism on *Esperella* and other sponges.

The species show a certain amount of variation, and von Graff thinks that the somewhat radiate arrangement of the parts anteriorly and posteriorly approaches the condition in *Myzostoma*, which occurs on starfishes, while *Spinther* frequents sponges.

In the pinnate arrangement of the alimentary cæca *Spinther* differs from the typical Euphrosynina, and approaches the Aphroditidæ.

1. Spinther oniscoides, *Johnston*, 1845.

Specific Characters.—A dorsal cirrus at the end of the parapodium. The dorsal lamellæ project at the free margins and have a series of strong, simple or bifid bristles. The hooks of the parapodia are powerful, pectinate at the projecting margin, and the tip is strongly curved. Ventral surface furnished with small papillæ (warts) on the ridges which flank a median furrow. Posterior end split to the anus.

Synonyms.

1845.	*Spinther oniscoides,* Johnston.	Ann. Nat. Hist., vol. xvi, p. 8, pl. ii, f. 7—14.
1854.	*Cryptonota citrina,* Stimpson.	Marine Invest. Grand Manan, p. 35, pl. ii, f. 27.
1865.	*Spinther oniscoides,* Johnston.	Cat. Brit. Mus., p. 127, pl. xiv, f. 7—14.
1882.	,, *arcticus,* Hansen.	Annel. Norsk. Nordhavs-Exped., p. 44, pl. i, f. 1—5.
1883.	,, *major,* Levinsen.	Syst. Oversigt. nordiske Annulata, &c., Vidensk. Meddelels, p. 125.
1887.	,, *oniscoides,* Graff.	Zeitsch. f. w. Zool., vol. xlvi, p. 90, pl. vi—viii, and woodcuts.

Habitat.—Dredged off Castle Chichester, Belfast Bay, by Mr. Hyndman in 1844, and off Anglesey in seventeen fathoms (Hornell) ? (*fide* Dr. A. Merle Norman). Abroad

[1] 'Arch. Zool. Expér.,' 3 sér., vol. iv, p. 197, &c., 1896.

it has been met with in the Bay of Fundy, New Brunswick, by Stimpson and Leidy, and at Station 275 (Ost Havet) den Norske Nordhavs-Expedition 1876–8 (Hansen). Verrill includes it in his list of marine forms from Cape Cod to the St. Lawrence.

Body.—Length 11 to 26 mm., the British forms seen by Johnston approaching the first-mentioned figure, ovate or somewhat oblong, convex dorsally, smoothly rounded at each extremity. The more convex dorsum has a series of symmetrical double lamellæ, strengthened by simple or bifid bristles, the tips of which slightly project beyond the skin, these lamellæ being continuous with the feet, which in Von Graff's example amounted to forty-eight, Johnston's specimens, apparently having fewer. The ventral surface has a series of low ridges studded with minute warts, the anterior sloping forward and the posterior backward, the middle line being marked by a furrow, likewise warty. In the largest example (26 mm.) the thickness in the centre of the body was 2·5 mm., thinning off at the sides, and the breadth about 11 mm.; the height of the dorsal lamellæ in the same being 1·5 mm. The anus terminates some distance within the posterior border, the adjoining pair of ventral ridges presenting no special differentiation.

Colour.—Johnston's examples were of a uniform cream-yellow colour, while Von Graff's had a yellowish-ochre hue. Stimpson observes that his specimen was of a beautiful lemon-yellow colour, resembling very much that of some sponges occurring with it on a gravelly and muddy bottom in thirty-five fathoms in Hake Bay, Grand Manan.

Head.—This region is merged into the general contour of the body, but bears superiorly over the brain the ridge-like dorsal tentacle with four eyes at the base. The mouth opens on the ventral surface some distance behind the anterior border, often as a radiate button—from the protrusion of the proboscis.

Feet (*parapodia*).—These are distinguished by the possession of a ringed base, and the presence of a short dorsal cirrus of about four or five segments, the lamellar ridge of the dorsum curving smoothly away from it on the one hand, while on the other the golden hooks emerge near its base ventrally. The hooks, which are excellently figured by Von Graff,[1] have strongly curved and sharp points, while the terminal process of the shaft is boldly serrated. One or two of these project freely, while internally one or two are in course of development, the point appearing first, according to Von Graff, in a cellular matrix.

It is remarkable that, notwithstanding the great increase of zoological explorations of the British seas, no example of this species has been procured since Dr. Johnston described it, with fair accuracy—both with regard to external form and the characters of the bristles and hooks—from two examples forwarded by Mr. Wm. Thompson of Belfast. Moreover, Prof. Jeffrey Bell informs me the type specimens cannot be found in the British Museum. Under these circumstances the only alternative was to utilise what had been so ably written by Von Graff and others, and place materials for ready identification in the hands of future observers.

The species follows the habit of certain marine forms, adhering to sponges and feeding on them, so that the alimentary canal, including the dorsal blind sac, is packed with sponge-débris and spicules.

[1] Op. cit., pl. viii, figs. 4 and 5.

2. Spinther miniaceus, *Grube*, 1860. Plate XXIV, figs. 1, 2.

Specific Characters.—Parapodia without cirri; the dorsal lamellæ are prominent processes with leaf-like external borders. The supporting bristles are bifid and more slender than in the previous species, and arranged in a radiate manner in the leaf-like lateral lobes. The distal end of the shaft of the hook is smooth. The ventral surface appears to be smooth, but it has rows of minute warts.

Synonyms.

1850. *Oniscosoma arcticum*, Sars. Nyt. Mag. f. Naturvid., vol. vi, p. 240 (210 Sars' paper).
1860. *Spinther miniaceus*, Grube. Archiv f. Naturges, Jahrg. 26, Bd. i, p. 74, Taf. 3, figs. 3—3 *b*.
1861. „ „ Grube. Ein Ausflug nach Triest, pp. 31 and 140, Taf. 3, figs. 3—3 *b*.
„ „ *arcticus*, Sars. Særsk. aft. Vidensk. Forthandl., p. 3.
1862. „ „ Sars. Christiania Vidensk. Selsk. Forhandl., p. 52.
1867. „ „ Malmgren. Annul. Polychæt., p. 1.
1876. „ *oniscoides*, McIntosh. Trans. Z. S., vol. ix, p. 373, pl. lxvii, figs. 1—3.
1879. „ *arcticus*, Tauber. Annul. Danic., 77.
1883. „ „ Levinsen. Vidensk. Meddelelser; Kjobenhavn, p. 125.
1884. „ *miniaceus*, J. V. Carus. Prodr. Faunæ Medit., p. 208.
1885. „ „ Drasche. Beiträge zur Anat. Polychæt., Heft. 1, Taf. ii, Wien.
1887. „ „ Graff. Zeitsch. f. w. Zool., vol. xlvi, p. 93, Taf. i—v, and woodcuts.
1890. „ „ McIntosh. Ann. Nat. Hist., Aug., 1890, p. 182.
1891. „ *oniscoides*, Hornell. Trans. Liverp. B. S., p. 239.
1896. „ *miniaceus*, Racovitza. Arch. Zool. Exp., p. 197, pl. iii, figs. 22—26.

Habitat.—The Minch, near North Uist, on a yellowish sponge (McIntosh); on *Antennularia ramosa* and yellow *Halichondria* in seventeen fathoms off Holy Island, Anglesey (Hornell). Finmark and west coast of Norway; Bay of Muggia at Trieste on reddish sponges (*Tedania*); north coast of Denmark (Lütken). Stimpson (1853) found the American example of the genus also on a yellowish sponge.

Colour.—The Hebridean specimen was of a straw-yellow hue, the lamellar processes at the side being pale and marked with opaque-white spots. The Mediterranean examples are of a cinnabar tint, or dull reddish, brownish, or violet-brown, according to the colour of the sponges which they frequent.

Head.—The caruncle presents no feature of interest. The exserted pharynx is smooth and trumpet-like, thus diverging from the condition in *S. arcticus*.

Body.—Ranging from ·9 to 8·5 mm., the Hebridean example being about 5 mm., with a thickness in the centre of 1 mm. in the largest, ovate or somewhat oblong, with the sides flanked by the translucent lamellæ, which dorsally form a series of symmetrical processes provided only with bifid bristles, and in the largest examples 0·4 mm. in height. The lamellæ on the two sides of the body are separated by a median furrow. Ventrally the surface is more or less smooth, only minute warts being present, and there is no well-defined median furrow. This surface is covered with areolæ (polygonal spaces)

in the Mediterranean examples. The segments range from twelve to twenty-four. The body terminates posteriorly in two somewhat globular anal cirri.

The bristles of the dorsal lamella are all bifid (Plate XXXV, figs. 5 *a* and 5 *b*), the somewhat delicate process resembling a web stiffened by the spiculæ. They are arranged with considerable regularity, and are all characteristically curved. A sensitive papilla also occurs at the tip of each lamella laterally.

Feet.—These are more or less cylindrical. One conspicuous hook (Plate XXXV, fig. 5 *c*) in the British example projected beyond each foot, generally another of similar form (but shorter) within the tip, and the developing extremities of two in the tissues. A group of simple bristles (eight to twelve) with tapering tips also accompany the central hook.

Von Graff found considerable variation in the condition of the alimentary canal, so that he made two series, viz. the Stenocœla and the Eurycœla. He mentions also, as Grube had previously done, that the ova wander into the bases of the feet, and probably are the "opaque white spots" seen in the Hebridean example. The ripe ova have short protoplasmic processes in the body, which elongate subsequently into structures like pseudopodia, somewhat symmetrically arranged as in a Radiolarian. The spermatozoa present a head with an acute tip, two granules at the base, and a long filament.

Grube's original description was carefully drawn up, and he gave the chief features in regard to form and coloration, though his examples were small, having only twenty-two parapodia. He, however, placed too much reliance on the reddish-orange colour as distinctive from Johnston's species. Von Graff was at first inclined to place the Hebridean example under *S. arcticus*, Wirén, but further investigation showed that it was *S. miniaceus*.[1]

It is probable that the *Spinther arcticus* of Sars (1861) is this species, and there is nothing in his description to invalidate this view. As already mentioned, the adoption of his name would lead to considerable confusion.

Genus IV.—Euphrosyne, *Savigny*, 1820.

Body generally short, oblong, equally narrowed at either end, segments not numerous; two thick styles posteriorly. Cephalic lobe narrow, frontal part narrowest, a band passing downward to the inferior ridge. Eyes both on the dorsal and ventral surfaces. One median tentacle situated in front of eyes. Lateral tentacles two, very short, springing in front of the inferior eyes. Fascicles of bristles arranged on each side of the segments. Superior bristles forming a transverse row, no barbs; inferior grouped in a broad pencil. Capillary bristles unequally bifurcate. Dorsal cirri two (or three—Ehlers) on each side, the one at the inner border of the fascicle, the other at the outer margin. Ventral cirri single. Branchiæ dorsal, in rows, and more or less ramose. Palpi forming fixed lobes on each side of the mouth. Mouth opening on the ventral surface and extending over several segments. Buccal apparatus complex, alimentary canal simple.

[1] *Vide* 'Ann. Nat. Hist.,' August, 1890, p. 182.

The genus Euphrosyne of the family Amphinomæ was established by Savigny in his 'Système des Annélides' (1820) for two species (*E. laureata* and *E. myrtosa*) from the Red Sea. Briefly his description is as follows :—Mouth with a simple unarmed proboscis. Eyes distinct, two in number, separated in front by the caruncle. Antennæ incomplete, the middle and exterior absent, the unpaired subulate. Feet slightly separated, but each division provided with bristles having a minute denticle near the tip. Cirri nearly equal; an additional one resembling the others inserted at the upper extremity of each dorsal division. The last pair of feet forming two small globular cirri. Branchiæ situated immediately behind the feet, extend from the dorsal to the ventral division, and consist of seven separate arborescent tufts arranged transversely. Head very narrow and much produced (très rejeté) posteriorly, split into two lobes in conformity with the feet ventrally, and provided dorsally with a depressed caruncle which is prolonged to the fourth or fifth segment. The body is oblong or ovate-oblong, with comparatively few segments.

Lamarck adopted the foregoing views in the classification of the group.

Audouin and Milne Edwards followed Savigny in regard to the systematic position and description of the genus, and gave an account of a new species (*E. foliosa*) from the shores of France.

Grube, Ehlers, and subsequent authors made little change in the characters attributed to the Euphrosynidæ.

The Euphrosynidæ frequent both the littoral region and comparatively deep water, a distribution that characterises both foreign and British species. Thus *Euphrosyne foliosa* is diagnostic of the tidal rocks of the Channel Islands, while the other species have been procured only by the dredge. They extend to the American shores.

1. Euphrosyne foliosa, *Audouin and Edwards*, 1834. Plate XXIV, fig. 3.

Specific Characters.—Caruncle extending to the anterior part of the fifth segment, with a filiform tentacle in front between the dorsal eyes. Branchiæ much branched, with ovate expansions at the tip. The middle cirrus between the fourth and fifth branchial stems. Bristles longer than the branchiæ, which are from eight to nine in number. The serrated bristles have the longer fork peculiarly curved towards the tip. Segments thirty-one to thirty-five.

Synonyms.

1833. *Euphrosina foliosa*, Audouin and M. Edwards. Ann. d. Sc. Nat., vol. xxviii, p. 201, pl. ix, figs. 1—15.
1834. „ „ Ibid. Litt. de la France, vol. ii, p. 126, pl. ii, B, figs. 1—4.
1836–7. „ „ Cuv. Reg. An., Crochard's Edit., tab. viii, fig. 2.
1840. *Euphrosyne foliosa*, Grube. Actin., Echinod., &c., p. 84.
1841. „ „ Delle Chiaje. Descrizione, Tav. 62, Tab. 139, figs. 6—8.
„ *Lophonota Audouinii*, Costa. Ann. d. Sc. Nat. (2), vol. xvi, p. 270, pl. xiii, fig. 1.
1849. *Euphrosyne foliosa*, W. Thompson. Ann Nat. Hist., ser. 2, vol. iii, p. 355.

1851. *Euphrosyne foliosa*, Grube. Fam. der Annel., pp. 41 and 122.
1853. „ „ P. H. Gosse. Ann. Nat. Hist., 2 ser, vol. xii, p. 384.
1863. „ *mediterranea*, Grube. Archiv f. Naturges., 1863, i, p. 38, pl. iv, fig. 2.
1864. „ *foliosa*, Ehlers. Die Borstenw., p. 65.
„ „ *racemosa*, Ehlers. Die Borstenw., p. 67, Taf. i, figs. 1—11.
1865. „ *foliosa*, Johnston. Cat., p. 126.
„ „ „ De Quatrefages. Hist. Nat. Annélés, p. 408.
1868. „ „ Baird. Proceed. Linn. Soc., vol. x, p. 237 (1870).
1870. „ „ Grube. Archiv f. Naturges., 1870, p. 304.
1875. „ *Audouini*, Marion and Bobretzky. Ann. Sc. Nat., 1875, p. 10.
1876. „ *foliosa*, McIntosh. Trans. Z. S., vol. ix, p. 273.
1884. „ *Audouinii* (Claparède), V. Carus. Faunæ Medit., p. 207.
1888. „ *foliosa*, St. Joseph. Ann. d. Sc. Nat. (7), vol. v, p. 190.
1896. „ *Audouini*, Racovitza. Arch. Zool. Exp., p. 186, pls. i et xi, figs. 7—13.

Habitat.—Belfast Bay, Hyndman; Weymouth, Gosse. Plentiful under stones near the border of low water mark at Herm, Lankester, McIntosh, Hornell. Off the Hebrides, Gwyn Jeffreys. Birterbury Bay, Connemara, fifteen fathoms, Gwyn Jeffreys, Haddon. Arran Isles and Bay of Galway, E. P. Wright. Off Marsden, co. Durham, twenty to thirty fathoms, A. M. Norman.

It was discovered in European waters by Audouin and Milne Edwards, viz., on a bank of oysters and Anomiæ between Granville and Chausey in fifteen fathoms, and on a small bank of the same kind at St. Malo. Ranges to the Mediterranean, where it occurs at considerable depths.

Colour.—Some of those from Herm are of a very fine deep reddish orange on the dorsum, the branchial processes being of this colour. Ehlers describes his *E. racemosa* as of an intense red ("zwischen orange und zinnoberfarben"). Others, again, were quite greyish, or of an earthy hue. The under surface is either pinkish or pale flesh-colour. They tinge spirit brick-red. Gosse's example from Weymouth was of a bright cinnamon-red, with the median ventral line purplish. Milne Edwards' example seems to have been vividly tinted of a fine cinnabar colour, very marked on the branchiæ, and mingled with yellow and green on the dorsum. The cirri were yellow, with a band of red in the middle; while the caruncle was of a vivid red. The pinkish ventral surface had a median band of vivid red.

The *head* is wedged between the anterior segments, and is distinguished mainly by the caruncle and eyes. It is more or less linear, with the elevated region somewhat ovoid. The two dorsal eyes, which are black and of considerable size, lie at the anterior border, and have the tentacle, which does not seem to taper much, rising between them. The fillet, which runs forward from the caruncle, carries a pair of short tentacles, with tactile hair-like processes, and bending over the tip of the snout, bears the two elongated ventral eyes, which are smaller than the dorsal.[1] The dorsal part of the fillet is stated by Ehlers in *E. racemosa* to be covered with cilia, and it is probable that they also occur on the ventral surface of the band.

The body of this species forms a somewhat elongate oval, the dorsal surface being elevated, the ventral flattened. Dorsally a broad groove, smooth but for the segment-

[1] J. V. Carus, in his 'Prod. Faun. Medit.' (1884), gives the genus only one pair of eyes.

lines and the characteristic furrows of the cuticle, occupies the centre, the sides being flanked by the cirri and the dense rows of bristles and branchiæ. Each row has a palisade of bristles towards the front of the segment, the cirrus (Plate XXXV, fig. 1) standing freely a little behind, while the branchiæ form a series of arbuscles—after an interval—extending outwards from the latter. The second cirrus occurs in the position formerly noted, and is generally longer than the other appendages. The anterior part of the median groove is occupied by the caruncle, which stretches from the front to the anterior part of the fifth segment, the tentacle springing between the dorsal pair of eyes in the second segment.[1] J. V. Carus says his *E. Audouinii* (= *E. laureata*, D. Ch., and *E. racemosa*, Ehlers) has a pair of tubercle-like antennæ, seven branchial trunks, and both bifurcate and smooth dorsal bristles. The ventral surface is marked in the British examples by the presence of a slight median groove, and by the regularly arranged segments. The first bristle-bearing segment lies on each side of the median fillet, and ventrally forms a pad on each side of the middle line in front of the mouth; the second and third slope obliquely inwards towards the first, whilst the halves of the fourth are continuous behind the mouth, the outer ends being directed forward; and a similar inclination characterises the eight or nine which follow. The posterior segments, on the other hand, have the outer regions sloped backwards. Two globular cirri terminate the body posteriorly, the anus lying above them.

The *segments* are much more distinctly marked than in *Spinther*, being readily recognised dorsally by the palisades of bristles flanked by rows of branchiæ, and ventrally by the sulci between each.

The *feet* are also fairly defined for a group in which the dorsal division forms part of or becomes confluent with the dorsal arch of the body, and it is this structure which, amongst other features, gives grounds for the classification followed in the "Challenger" Annelida and in the present treatise. In each segment the innermost structure is the cirrus, which is attached rather behind the middle of the segment, and is a tapering organ of considerable length, with a filiform tip richly covered with cilia. About the middle of the segment the palisade of bristles runs from the inner to the outer border. The ordinary bristles have a well-marked spur with a slightly curved tip (Plate XXXV, figs. 15 and 16). The serrated forms have a deeply cleft tip, both limbs being curved, the longer doubly so when viewed laterally (Plate XXXV, fig. 17). Milne Edwards' figure of this bristle is quite diagnostic, though not absolutely correct. The figure of the same kind of bristle given by Ehlers for *E. myrtosa* differs only in its artistic treatment. Antero-posteriorly, again, this kind of bristle is straight (Plate XXXV, fig. 18). The palisade of bristles just mentioned terminates at the dense tuft of bifid bristles of the first-mentioned type (figs. 15 and 16) which projects from the foot on each side. This tuft includes stout forms with comparatively short bifid tips, as well as numerous slender forms with the tips almost in a line with the shaft and having serrations on the edge of the tip (Plate XXXV, fig. 17); the short spur, moreover, has a membranous guard from the tip to the side of the larger limb. The bristles in the Hebridean example were remarkably developed all over. Schmarda found a golden

[1] Ehlers describes the caruncle of his *E. racemosa* as having an ovoid basal and a compressed upper region.

fluid in the axis of the bristles of *E. polybranchia*, and more careful investigation of the British forms in life might lead to further information on this point.

In section about four rows of bristles are observed in the tufts, the more slender being guarded by outer (*i. e.* anterior and posterior) rows of large bristles. The median cirrus is situated opposite (in front of) the third branchia, and behind the palisade of bristles; De Saint-Joseph says between the second and third branchiæ.

The ventral cirrus lies between the parapodia, and is thus hidden in the ordinary position of the parts.

The branchiæ form a series of arbuscles with foliate tips ranged transversely behind the palisade of bristles. They vary in number from seven to eight. Each consists of a short main stem, which rapidly and somewhat dichotomously divides into branches terminating in the expanded ovate processes. The latter (Plate XXXV, fig. 3) have a well-marked cuticle with the subjacent granular layer (hypoderm) filling up the central region. The cells under the cuticular investment are larger and somewhat regularly arranged. So far as the preparations show, the long cilia occur on the sheltered parts of the larger branches.

De Saint-Joseph states that he has seen the red blood penetrating the branchiæ, contrary to the opinion of Claparède, but without reaching the terminal enlargement of the organ, which is shut off by a septum. This has not been observed in our examples.

Very considerable variation in the form of the branchiæ occurs during development, young examples having few branches, and the tips more or less cylindrical or only slightly tapered; then they become broadly lanceolate. What relation the condition of the terminal processes of the branchiæ have to injuries and regeneration is at present unknown, but small forms do not always show elongated tips, some measuring about a quarter of an inch presenting short branchial arbuscles with broadly ovate tips.

Reproduction.—Ripe ova occurred in the specimens from the Channel Islands in July. The axial blood-vessels of the ovaries in the species from the Cape were mentioned by Schmarda.

In describing this species for the first time Audouin and Milne Edwards observe that it differs little from *Euphrosyne myrtosa*, found by Savigny on the shores of the Red Sea. In the latter species, however, he finds but seven branchiæ, whereas in his species eight occur; and they are shorter than in *E. laureata*, and more densely tufted than in *E. myrtosa*, while the tips are large and ovoid. The caruncle, moreover, is narrow, almost linear, rather elevated, instead of being ovoid, very large, and depressed.

The same form was mentioned as British in 1844 by Mr. W. Thompson, who dredged it in Belfast Bay on shelly ground in six to ten fathoms, the discrimination of the species having been made by Prof. Allman. Mr. Gosse, again, procured it at Weymouth in 1853, and describes the minute tentacle at the tip of the caruncle as flattened and truncate instead of subulate, and the general colour bright cinnamon-red rather than cinnabar, while the median ventral line is purplish.

The *E. mediterranea* of Grube[1] appears to be closely allied if not identical with this species. It comes from Lussin Piccolo, Villa Franca, and other places on the southern shores, and the same remarks apply to Victor Carus's *E. Audouinii* (=*Lophonata Audouinii*,

[1] 'Arch. f. Naturges.,' 1863, p. 38.

Costa (?), *E. laureata*, D.Ch., *E. mediterranea*, Grube, and *E. racemosa*, Ehlers). So far as the description of *Euphrosyne racemosa* of Ehlers goes there is little to distinguish it from *E. foliosa*, for it has yet to be proved that the variation in the number of the branchiæ (eight to nine in *E. foliosa* and five and six in *E. racemosa*) is not due to age, and that the position of the middle cirrus is not due to the same cause.

Grube, who examined the species in the Parisian Museum, found that the median dorsal cirrus did not extend between the fourth and fifth branchial process, as in the figure of Audouin and Edwards, but between the second and third, as is also the case in Ehlers' *E. racemosa*. Both from the structure of the branchiæ and the structure of the bristles Grube concludes that the *E. racemosa* of Ehlers is synonymous. Grube was likewise of opinion that the *E. laureata* and *E. myrtosa* of Savigny agree with the *E. foliosa* of Audouin and Edwards. In all probability, therefore, the nomenclature might be considerably simplified. The *E. Audouinii*, Claparède, as given by Carus,[1] is probably referable to the common species (*E. foliosa*). This seems to be the dull reddish species figured by Delle Chiaje (1841). At Naples the common name is "Ti veggo rosso senza spine."

The *E. mediterranea* of Grube[2] is the same species, though Horst[3] thinks the tips of the branchiæ clavate rather than foliate. Baron de Saint-Joseph, who agrees in regard to the association of *E. racemosa*, *E. Audouinii*, and *E. mediterranea* with the present species, found that at Dinard specimens of 12 to 15 mm., and having thirty segments, were distended with ova. The *Euphrosyne intermedia*, 1888, of this author, rests mainly on the presence of longer forms of bristles—amongst the dorsal and ventral series—having the axial oil-like contents. He thinks they are offensive and contain poison. In all probability this is only a variety of *E. foliosa* with longer bristles.

2. Euphrosyne armadillo, *Sars*, 1851.

Specific Characters.—Caruncle extending to the anterior border of the fifth segment, with a proportionally long biarticulate tentacle between the dorsal eyes. Branchiæ divided dichotomously, and terminating in lanceolate processes. The bristles are of considerable length, the bifid forms having a short spur and quite smooth, the serrated kinds having the longer arm somewhat flattened, only slightly, though distinctly, curved, the serrations extending along opposite parts of the fork.

Synonyms.

1850. *Euphrosyne armadillo*, Sars. Reise i Lofoten og Finmark. Nyt. Mag. f. Naturv., B. vi, p. 211.
1861. „ „ Forhandl. Vidensk.-Selsk. (Aar, 1860), vol. viii, p. 55.
1876. „ *lanceolata*, McIntosh. Trans. Z. S., vol. ix, p. 395, pl. lxxi, fig. 1.
1886. „ *armadillo*, Langerhans. Zeit. f. w. Zool., vol. xl, p. 253.

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[1] 'Fauna Medit.,' p. 207, 1884.
[2] 'Arch. f. Naturges.,' 1863, p. 38.
[3] 'Notes from the Leyden Museum,' vol. viii, 1886.

Habitat.—Dredged in the Porcupine Expedition of 1869 on sandy mud amidst corals off the west coast of Ireland, in 173 fathoms.

The *body* appears to be somewhat flattened, and in the injured preparation is about 3 mm. in length, and consists of only about nineteen segments. The dorsum agrees generally with the typical form, except that the branchiæ differ considerably in structure, and thus give a character to the region. Both dorsal and ventral eyes are very distinct, and the tentacle is comparatively long in the example. On the ventral surface the palpi form two rounded pads in front of the mouth, and abut on the eyes in front. Posteriorly the vent is indicated by two rounded or globular processes which project on the ventral surface. The segments in the latter region are much curved, and the tips of several project beyond the globular anal cirri, the lines of the segment-junctions being in one or two almost antero-posterior.

Colour is unknown.

The condition of the single specimen is unfortunately indifferent, and it is, moreover, small (possibly immature), but the following characters were ascertained. The palisade of bristles dorsally consists of a series of smooth bifid forms with a distinct curve at the tip, which is slightly hooked, and a short spur at the base (Plate XXXV, fig. 8). The serrate kind has a proportionally longer spur, the serrations on it corresponding in extent with those on the longer fork of the bristle, which tapers a little towards the tip (Plate XXXV, fig. 13). Some present more distinct flattening of the longer limb (Plate XXXV, fig. 14), and the serrations are less marked,—indeed, only a limited area of similar extent on each side of the fork shows them clearly, though very minute processes occur on the longer limb of the fork above the former. The tips of all these bristles are distinctly curved. On contrasting them with the bristles of *Euphrosyne armadillo*, Sars, from Norway (Plate XXXV, figs. 9—12), a certain resemblance is apparent in all, but the tips both of the smooth and serrate kinds are proportionally longer and narrower in the Norwegian form, and the curvatures differ; such, however, may be due to age or other conditions. The longest tips in the case of the smooth bristles occur in the foot.

The branchiæ (Plate XXXV, fig. 2) appear to be five or six in number, and when viewed under a lens have a different character from those of *Euphrosyne foliosa*, since the tapering tips are much more slender. They branch from near the base in a similar manner, the tips being truly lanceolate. The variations, however, seen in the branchiæ of *E. foliosa* show that no strict reliance on the external appearance of these organs can be maintained. The only feature of moment is the tufted condition of the tips in the larger Norwegian examples, which also have proportionally longer terminal processes.

Michael Sars describes this species as of a pale yellowish colour, and having nineteen segments. The narrow caruncle reaches the fifth segment. Cephalic lobe elongate, narrow; the posterior (dorsal) eyes situated in front of the caruncle, at the base of the biarticulate tentacle, which is conico-acuminate, shorter than the caruncle. Two short cirri on the dorsum between the pinnæ. Branchiæ five, rarely six (two or three of the anterior and posterior segments with fewer), four to five dichotomously divided, with conico-acuminate tips. Superior edge of pinna with two cirri, ventral with one. Setæ unequally bifid, with serrations in the fork of the dorsal form, while the in-

ferior bristles are smooth, with the exception of a single small denticle near the apex. Length 8 mm., breadth $2\frac{1}{2}$ mm.

It was dredged at Manger, about three miles north of Bergen, on shell-sand.

There is still a degree of uncertainty in regard to the identity of the British and Norwegian forms, which can only be cleared up by the capture of fresh specimens in this country.

3. Euphrosyne Robertsoni, *n. s.*

Specific Characters.—The tips of the branchiæ are digitate, with only a trace of a swelling. Dorsal bristles smooth and bifid. The forked and serrate bristles somewhat resemble those of *E. foliosa*.

Habitat.—From the Firth of Clyde, whence an example was sent to the British Museum by the late Dr. David Robertson. It is labelled *Euphrosyne foliosa*, Aud. and Ed., No. 1049, 64, 6, 30, 6.

The specimen is upwards of half an inch in length, and shows a similar arrangement of the caruncle and eyes to *E. foliosa*, from which, indeed, there is little to distinguish it in external appearance with the naked eye. The branchiæ, however, differ, presenting stout stems, with dichotomously but sparsely divided tips, which have a nearly uniform diameter; for the slight enlargement in some does not alter their character as digitate processes, slightly lobate and then tapered at the tips (Plate XXXV, fig. 4). They somewhat resemble the figure of the branchiæ of *Euphrosyne myrtosa*, as given in Savigny's plate, but little reliance can be placed on it.

The dorsal palisade of bristles[1] consists of smooth bifid forms, some with longer (Plate XXXV, fig. 7) and some with shorter tips (Plate XXXV, fig. 6). The bifid serrate kind (Plate XXXVII, fig. 33) appear to approach those of *Euphrosyne foliosa*, though the curves and general character are different.

I have named this species after one of the most persevering and patient of Scotland's naturalists, who for many years devoted his energies and experience to the fauna of the Clyde, and to whose influence and example the marine laboratory at Cumbrae owes its existence.

Family II.—Aphroditidæ.

Annelids of an ovate or oblong form, convex dorsally, with a distinct head (prostomium), on which are a pair of eyes and a median tentacle, and under which is a papillose facial tubercle. No lateral tentacles; two palpi; tentacular cirri long; buccal cirri (ventral cirri of the second foot) moderately long. Proboscis large and powerful, with four thickened muscular ridges representing teeth, and tough internal

[1] I am indebted to Prof. Jeffrey Bell and Mr. Sumner for most courteously making preparations of the bristles and branchiæ and forwarding them for examination.

lining. Alimentary canal pinnately-branched, the glandular intestinal cæca being long and complex. Dorsal fimbriæ small, alternating with the scales, or absent. First foot bearing three dense tufts of bristles. Elytra fifteen pairs, occurring on the second, fourth, fifth, thereafter on all alternate segments to the twenty-fifth, and then on every third segment. Segmental organs (nephridia) opening by a well-marked papilla pointing upwards between the feet. Nerve-cords median, between the ventral attachments of the oblique muscles, or in a well-defined epidermal granular layer within the dense cuticle.

Genus V.—Aphrodita, *Linnæus*, 1735.

Eyes sessile; dorsum covered with a thick, close felt of matted simple hair; setæ of the ventral division of the foot very numerous, long, silky, and iridescent, and, like all the other bristles, simple, not barbed or toothed. Intestine with eighteen long and complex cæca (figs. 16 and 17, p. 250). Nerve-cords in a transversely elongated space between the ventral attachments of the oblique muscles, and bounded externally by the basement-tissue and the cuticle.

Swammerdam's account of *Physalus*, as this form was then called (1758), contains a notice of the three rows of bristles on the feet, which he considered only papillæ. He thought the scales the branchiæ, and was of opinion that the animal was able to "swell and bloat itself with air." He observed the ramifications of the alimentary canal and the presence of blood-vessels. He criticised Rondelet for placing it amongst sea-worms, and was inclined to relegate it to the proximity of the sea-urchins. His figures are recognisable, though the whole dorsum is rough with tufts of bristles.

Pallas, in his 'Miscellanea Zoologica' (1766), showed the propriety of removing the Aphroditæ from the Mollusca, with which Linnæus had grouped them. He indicated that a more natural classification would be to conjoin the three genera, Aphrodita, Nereis, and Serpula. He gave a general and fairly accurate description of the Aphroditidæ, the only feature requiring special notice being his observation that branchiæ are present on the dorsum, and that he included in the group *Chloeia* and Amphinome (*Pleione carunculata*).

O. F. Müller, in his 'Zoologia Danica Prodromus' (1776), included the Aphroditidæ and other Chætopods under his Helminthica Setosa, the other group being his Helminthica Mutica, in which were *Gordius*, *Ascaris*, and *Hirudo*.

In Gmelin's edition of Linnæus (1788)[1] the Aphroditaceans were placed in the Vermes Mollusca, after Doris, notwithstanding that there was little more than the general ovoid outline to suggest the relationship.

By Lamarck[2] the Aphroditidæ were grouped under his second order of Annélides, *i. e. A. Antennata*, along with Nereids, Eunicidæ, and Amphinomidæ. He simply followed Savigny.

[1] 'Syst. Nat.,' p. 3107.
[2] 'An. sans. Vert.,' 1818, tome v, p. 304.

Savigny in his 'Système'[1] made the Aphroditidæ the first family of his Néréidées, characterised by having the branchiæ in the form of a ridge or papilla situated superiorly at the base of the dorsal branch of the foot. They are absent from the second, fourth, fifth, seventh, ninth, and eleventh pairs of feet, and so on until the twenty-third or twenty-fifth. They determine by their absence that of the superior cirrus, and are replaced by scales. The scales, when present, number from twelve pairs or fewer to thirteen pairs or more, and extend to the twenty-third or twenty-fifth segments, and are followed or not by supernumerary pairs. They are formed of separate membranous lamellæ, the upper thickened, sometimes horny, the inferior delicate, and attached by a hollow pedicle to the base of the feet without branchiæ—in a position, however, corresponding to the attachment of the latter. The mouth has a proboscis and four jaws. The former is cylindrical, massive, striated transversely, and furnished with a fringe of small tentacles at the orifice. The jaws are horny or cartilaginous, flat, short, more or less free at the point, and have a vertical motion on each other. The eyes are four in number, two anterior and two posterior. The antennæ are retractile, elongated, generally complete; the median of two articulations, the first being short; the unpaired the same; the anterior always present and much larger than the others, finely ringed, conical, and with tapered tips. The feet have either two divisions or these are united—furnished with aciculi. Cirri prominent, generally composed of two chief divisions; the first, short and thick, lies at the base of the other, which is retractile. The superior cirri are large, extending beyond the bristles, while the latter pass beyond the inferior cirri. The first pair of feet have the divisions intimately united, without bristles or with numerous bristles, and the two cirri elongated like tentacles. The second pair of feet have also a long inferior cirrus, a little larger than the succeeding. The intestine is provided with numerous cæca, which are most distinct in Aphrodita proper. Savigny, from the foregoing, used the term (Aphroditidæ) in its widest sense.

In Cuvier's 'Règne Animal'[2] (Mem. Edit.) M. Audouin arranged the Aphroditidæ and Polynoidæ under the order Dorsibranchiata (corresponding to the Néréidées of Savigny).

Audouin and Milne Edwards (1834) classed the Aphrodisiens (which included *Aphrodita*, *Polynoë*, *Sigalion*, and *Palmyra*) as the first family of their Annélides Errantes, and they gave a description which defined the somewhat extensive group. One important feature is the presence of a double row of membranous scales, the elytra of Savigny, fixed on the dorsum by a pedicle to the superior division of the foot, and according to the authors filled with ova at certain periods. They occur in some on all the feet or on alternate feet, while in others they are absent. They refer to small processes attached to the under surface of the scales as branchiæ. Cirri occur on the segments devoid of elytra, with the exception of *Sigalion*, where they are present on all the segments. The feet are bilobed, each division being armed with a spine, bristles, and cirri, the last existing on every foot ventrally. In the first segment the dorsal cirri become tentacular cirri. The antennæ are attached to the head, and are three in number

[1] 'Système des Annélides,' tome i, 3e part., 1820.
[2] MM. Audouin, &c., 'Règne An.,' 1836–7.

—a median and two lateral. The eyes are usually four in number and placed in pairs—one in front of the other.

As the result of their own researches they restored the older name Aphrodisiens for Savigny's Halithées, and made three principal groups: (1) those in which the elytra alternate with dorsal cirri and branchiæ, (2) those having these organs on the same foot, and (3) those devoid of elytra. In the first tribe the authors placed *Aphrodita*, *Polynoë*, and *Polyodonta*. In the second division, which from the elongated body they termed *Aphrodisiens vermiformes*, they ranged Acoète and Sigalion; while in the third group is placed *Palmyre*. We shall deal at present only with the first mentioned, viz. *Aphrodita*, which was characterised by the authors as furnished with thirty elytra fixed to feet which bear neither branchiæ nor superior cirri, and which alternate regularly (with the exception of the fourth and fifth segments) to the twenty-fifth segment, with other feet which have cirri and branchiæ. The elytra fixed to the succeeding segments are differently arranged. Three antennæ are present. The jaws are small and cartilaginous or absent.

A sea-mouse and parts of its digestive system are figured in Tav. iv, fig. 10, of Delle Chiaje's Memoire (1822), but no description is given.

The same author[1] (1841) speaks of a pair of oval ovaries in *Polyodontes maxillosa*, filled with a transparent liquid at the dissepiments and at the bases of the feet, and of an analogous group of rosy ovaries in *Hermione hystrix*, and yellowish ovaries in *A. aculeata*. These Meckel considered to be small branchiæ. In April they had advanced considerably. He did not consider the scales respiratory, as Cuvier, Carus, and Duvernoy had done, and he supported his opinion by the presence of special branchiæ in *Sigalion squamosum*. He described the ventral ganglionic chain as a nerve-artery in *A. aculeata* and *H. hystrix*, but had seen vascular trunks in both on the intestine. The blood-vessel in his figure seems to ensheath the œsophageal trunks and ventral chain. Long before,[2] he had compared the alimentary system of the Aphroditaceans with that in such as Pleurophyllidia.

Oersted[3] (1843) signalised the Aphroditacea amongst the Nematode-like Chætopods as having imperfect branchiæ (simple). He considered the scales the branchial organs.

Grube's description of the Aphroditea in his 'Familien der Anneliden' (1851) is brief but characteristic. He included *Palmyra* under the same family.

Sir J. Dalyell[4] says that, "though seemingly timid, the Aphrodita is probably fierce and rapacious, overpowering creatures incapable of resistance; and there is even reason to believe that it occasionally devours its own kind." By Aphrodita he means the Aphroditacea.

Kinberg[5] (1857–8), following on the lines of Audouin and Milne Edwards, grouped the Aphroditea of Savigny into seven families, the first of which, Aphroditacea, corresponds with our Aphroditidæ. These have an oblong wide body, with a rounded head

[1] 'Memoire,' vol. i, p. 121.
[2] 1823.
[3] 'Ann. Danie. Consp.,' 1843, p. 4.
[4] 'Powers of the Creator,' vol. ii, p. 163, 1853.
[5] 'Eugenies Resa,' &c., p. 1, 1857–8.

and a facial tubercle between the palpi and the front of the mouth. Tentacle extending from the middle of the cephalic lobe. No antennæ. The sessile or subpedunculated eyes are situated in front of the middle of the cephalic lobe. The palpi are long, thick, tapering, and ciliated; and two tentacular cirri are on each side of the first pair of feet. The buccal cirri (ventral pair of the second feet) are longer than the succeeding. The exsertile pharynx has ridge-like transverse processes—*quasi*-cartilaginous, and resembling jaws. The branchiæ are in the form of low papillæ, situated above and internal to the bases of the dorsal cirri, and covered by the elytra. They are not always obvious. The elytra occur on segments 2, 4, 5, 7, 9, &c. The other families were Iphionea, Polynoina, Acoëtea, Sigalionina, Pholoidea, and Palmyracea.

The genus Aphrodita he distinguished as follows:—Eyes sessile (pigment-spots in pairs). First pair of feet furnished with numerous bristles, and with tentacular cirri. Dorsal division of the foot distinct from the ventral, low (small) and broad, with strong sharp spines and capillary bristles, forming a kind of felt on the dorsum; ventral division carried outwards, blunt, with numerous bristles, smooth, acute, but neither glochidiate nor bidentate.

Chenu[1] (1859) chiefly followed Milne Edwards in placing the Aphroditiens as the first family of his Annélides Errantes, the Amphinomiens and Euniciens forming the second and third families.

In the posthumous 'British Annelids' of Dr. G. Johnston, published by the British Museum in 1865, the first family, Aphroditaceæ, included not only the genera pertaining to the Aphroditidæ, but the Polynoidæ and Sigalionidæ. The author followed in his description Audouin and Milne Edwards. He gives three species of Aphrodita, viz. the common form, *A. borealis* (which is the young of the former) and *A. hystrix* (*Hermione hystrix*). Like Grube, he classified the Annelids under the Rapacia and Limivora.

De Quatrefages[2] included the whole of the group forming the subject of this fasciculus —with the exception of the Amphinomidæ and Euphrosynidæ—under the family Aphroditidæ, in which the regions of the body are similar while the segments are dissimilar. They fall under his first order Errantes. The author criticised the classification of Kinberg, and held that only two families existed in the sub-order, viz. the Aphroditidæ and the Palmyridæ, the one characterised by the presence and the other by the absence of scales. The Aphroditidæ form a very natural family of the Errant Annelids. The head bears two to three antennæ and two to four eyes; while the buccal segment is often indistinct, and with or without tentacles. The body is more or less covered by the elytra, and the segments present differences which are repeated with regularity. The antennæ (tentacles) receive their nerves directly from the brain, and their number is at most three. The external antennæ (palpi) are really the tentacles of the buccal ring, and receive their nerves from a special ganglion. The nerves of the tentacular cirri, again, come from the first ganglion of the ventral chain, being modified processes of the first pair of feet. The head bears a kind of caruncle (facial tubercle?) in front. The eyes in general are small, resting on the brain, though in some they are pedunculated and susceptible of movement. The mouth has thick lips.

[1] 'Encyclop. d'Hist. Nat.,' 1859.

[2] 'Annélés Marins, &c.,' 1865.

The feet are biramous, bearing scales or tentacular cirri, in general only the one or the other. The ventral cirrus occurs on all the feet. Some have a resplendent covering of hairs, and a felt-like coating on the dorsum protecting the scales. Those without such sometimes show a radiate arrangement of the bristles. In the scales he describes a lacunar system in connection with the general cavity of the body, and therefore he thinks Savigny was right in associating them with respiration, though he was so far misled by a balloon-like condition in imperfectly preserved specimens. He does not regard the elevated and ciliated processes on the dorsum of the feet as branchiæ, for they have no central vessel and no lacunæ, and the cutaneous tissues present no special modification. On the other hand, De Quatrefages saw in the pretended branchial function of the branching digestive system an analogy with what he had formerly described in the Æolidæ as phlebenterism.

The circulatory apparatus he says agrees with the typical condition, but is difficult to follow, as the blood is pale. There are dorsal and ventral vessels as described by Treviranus, and a third considerable trunk accompanying inferiorly the abdominal nerve-chain.

The cephalic ganglia are comparatively large, and the exterior thereof brownish red. The ventral chain has the ganglia united, though in general the two halves are distinct. No commissure exists between the lateral ganglia of the first three pairs of feet—a condition absent in the Polynoidæ. The visceral system of nerves consists of a muscular trunk and a ganglion with a connective joining the brain. It supplies the muscles of the proboscis.

The only remarks the author makes in regard to the reproduction of the group is that in a large number of examples of *Aphrodita hystrix* he found irregular mounds consisting of eggs enveloped by delicate tissue along the digestive canal and touching the body-wall. These individuals consequently showed a large number of ova or of sperms in the perivisceral cavity. Further, in a male he observed sperms escape as a white thread at the base of the ventral division of the foot about the nineteenth segment.

The classification adopted by De Quatrefages was based for the most part on external characters, such as the arrangement of the scales, the absence, alternate or continuous condition of the dorsal cirri, the nature of the antennæ (tentacles), and the jaws.

In his general remarks on the Aphroditidæ, Claparède [1] corrects the error of Williams that vibratile cilia are absent from the peritoneal surface of *Aphrodita aculeata*. This author was, however, in doubt concerning the vascular system, for though he found a dorsal and a ventral vessel according to the old observations of Pallas and Treviranus, yet he could not satisfy himself that they pertained to the vascular system. He makes a few remarks also about the respiration in the group, stating that in *Hermione hystrix*, during the alternation of expansion and contraction, the last pair of scales in the latter function are raised, and a powerful stream of water sent out. The same is seen, though to a much less notable extent, in *A. aculeata*. In the latter species bubbles of air sometimes accompany the currents, so that Swammerdam had some foundation for the remark that the Aphroditæ swallow (*gorgeant*) air. He had, however, overlooked the observation of Sir J. G. Dallyel when he said former authors had not observed these respiratory movements.

[1] 'Ann. Chét. Napol.,' 1868.

In his summary of the Aphroditacea[1] (1868) Dr. Baird showed that while Audouin and Milne Edwards included six and Grube seven species, later authors had so increased the number that Kinberg found it convenient to form most of the older genera into distinct families. He gives a description of the family Aphroditidæ after Kinberg, with four genera, viz. *Aphrodita*, *Hermione*, *Aphrogenia*, and *Lætmonice*. A succinct account of the species follows under each genus, and he seems to have acquiesced in Dr. Johnston's view that *Aphrodita borealis* was a distinct species—a position he subsequently vacated, this being only the young of *A. aculeata*. He added one or two new species to the list. His *Lætmonice Kinbergi*, however, as he afterwards admitted, is identical with *L. filicornis*, Kinberg, a species widely distributed in Northern waters.

Ray Lankester[2] found hæmoglobin in the nerve-cords of *A. aculeata*.

Grube next gave a survey of the family Aphroditidæ (which included the whole series here considered).[3] He divided the group into sub-sections thus:—A. The one segment with elytra, the other with cirri; no jointed bristles. These he subdivided as follows:—*a*. Between the elytra-bearing segments of the body one segment carrying a dorsal cirrus; in the posterior part of the body mostly two bearing cirri, or the elytra absent. 1. *Hermionea* (Aphroditacea, Kinberg). 2. *Polynoina*. The first group, the *Hermionea*, which alone concerns us at present, he classified according to the condition of the ventral bristles and the state of the eyes. (*a*) All the ventral bristles have simple tips. In *Aphrodita* he gives as characters the following:—The ventral bristles in three rows, short, thick; the dorsal bundle of all the segments bearing the elytra furnished with longer and stronger bristles and two bundles of fine hair-like bristles, the alternate segments also with another felted series, under which the elytra lie; two eyes.

Schmarda[4] included the Aphroditidæ and Amphinomidæ under his Notobranchiate Chætopods.

In his treatise on the Annelids collected by Semper in the Philippines (1878) Grube terms the family Aphroditea. Besides the characters previously stated, he mentions that all the segments bear ventral cirri and two fascicles of bristles, and that the fourth and fifth segments always carry elytra. The stomach is subcartilaginous, and the intestine has pinnate cæca.

Claus[5] (1880) grouped under the family Aphroditidæ the sub-families Herminioninæ, Polynoinæ, Acoëtinæ, Sigalioninæ, and Polylepinæ; while his second family was the Palmyridæ. Under the Sigalioninæ he embraced *Psammolyce* and *Pholoë*.

Levinsen[6] (1883) follows Malmgren's classification of the Aphroditidæ in his paper on the Northern Annelids.

Carus[7] (1884) describes the genus *Aphrodita* as having fifteen pairs of elytra on alternate feet, which are destitute of cirri; the intermediate bearing a cirrus and branchia;

[1] 'Journ. Linn. Soc.,' vol. viii, 1865.
[2] 'Ann. Nat. Hist.,' 4th series, vol. xi, p. 97, 1873.
[3] 'Sitzung. d. Schlesischen Gesell.,' 1874.
[4] 'Zoologie,' 2nd edit., 1877, Wien.
[5] 'Grundzuge d. Zoolog.,' 1880, pp. 490–98.
[6] Aftryk, af. 'Vidensk. Meddel. f. d. Nat. Foren. i. Kjobenhavn,' 1882–3.
[7] 'Fauna Mediterr.,' 1884.

tentacles three; long tentacular cirri; maxillæ small or none; dorsum covered with a close layer of felt; ventral spines simple at the apex.

In his 'Annelids of the 'Blake'' (1887) Ehlers keeps to the family Aphroditidæ, with sub-families Hermionea, Polynoina, Acoetea, and Sigalionina. The Hermionea he distinguishes by the facial tubercles and the arrangement of the scales; and he separates them from the Acoetea and Sigalionina by the condition of the branchiæ and the structure of the bristles.

APHRODITA ACULEATA, *Linnæus*, 1765. Plate XXIV, figs. 4 and 5.

Body broad, cephalic lobe inflated anteriorly, basal part of the tentacle only half the length; facial tubercle with sparsely distributed small globular papillæ; central region of the gut differentiated from the complexly lobed glandular cæca; spines of the dorsal division of the foot long, piercing the felt; capillary bristles greenish, iridescent (burnished). Ventral bristles in three rows.

SYNONYMS.

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1602. *Scolopendra marina*, Aldrovandus. Insect., p. 636, f. 1.
1634. *Physalus*, Moufet. Theatr. Insect., f. 8—15.
1677. *Vermis aureus*, Oligerus Jacobæus. Acta Hafniæ, vol. iii, pp. 87, 88, and 89.
,, ,, ,, Bartholinus. Act. Haf., vol. iii, p. 88, tab. 88.
1684. *Eruca marina Rondeletii pilis in dorso instar colli columbini variegatis*, Sibbald. Scot. Illustr., vol. ii, p. 32.
1686. *Hystrix marina*, Redi. Opusc., vol. iii, tab. 35.
1705. *Scolopendra marina*, Molyneux. Phil. Trans. Abridg., 1st edit., vol. ii, pp. 833—836, pl. xii, f. 234 and 235.
1714. *Eruca echinata marina griseo fusca*. Barrelier. Plantæ Gall., &c., p. 131, tab. 1284, n. 1.
1734. ,, ,, ,, Seba. Thesaur., vol. i, p. 141, tab. 90, f. 1—3; vol. iii, p. 9, tab. 4, f. 7, 8 (1758).
1746. *Aphrodita nitens*, Linn. Faun. Suec., p. 367, No. 1284; Mus. Adolph. Fred., p. 93.
1752. ,, *elliptica versicolor*, and the Sea Mouse, Hill. Hist. Anim., vol. iii, p. 90.
,, ,, *subrotundata*. Ibid., p. 91.
1756. *Mus marinus*, Linn. Syst., edit. 1756, p. 79.
1758. *Physalus*, Swammerdam. Biblia Naturæ (transl.), vol. ii, p. 150, tab. 10.
1762. *Aphrodita aculeata*, Baster. Opusc. Subs., vol. ii, 2, p. 62, tab. 6, f. 1—4.
1765. ,, ,, Gunner. Trondh. Selsk. Skrift, vol. iii, pp. 59—80, tab. 88.
1766. ,, ,, Pallas. Misc. Zool., p. 77, tab. vii, f. 1—13.
1768. ,, ,, Gunner. K. Norske Selsk. Skrift, vol. iv, p. 95, tab. 10.
,, *Physalus*, Jonston. Hist. Nat., vol. iv, tab. 28.
1776. *Aphrodita aculeata*, O. F. Müller. Zool. Dan. Prod., p. 218, No. 2641.
1777. ,, ,, Penn. Brit. Zool., vol. iv, p. 44, pl. xxiii, f. 25, and edit. 1812, vol. iv, p. 86, tab. 25, f. 1.
1788. ,, ,, Herbst. Vers., Bd. ix, p. 50, tab. 11.
1790. ,, ,, Linn. Syst. Nat., Gmelin, t. i, pars 6, p. 3107.
1791. *Aphrodite hérissée*, Bruguière. Encyclop. Méth., vol. vi, p. 85.
1806. *Aphrodita aculeata*, Turton's Gmelin, vol. iv, p. 79.
1807. ,, ,, Turton. Brit. Fauna, p. 136.

1816. *Aphrodita aculeata,* Cuvier. Dict. des Sc. nat., vol. ii, p. 282.
1817. ,, ,, Stewart's Elements, vol. i, p. 387.
1821. ,, ,, Treviranus. Zeit. f. Physiol., vol. iii, 2, p. 157.
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,, ,, ,, Home. Comp. Anat., vol. iv, pl. xxxix, f. 1, 2.
1825. ,, ,, Blumenbach. Elem. Nat. Hist., p. 245.
1826. *Halithea aculeata,* Lamarck. Anim. s. Vert., vol. v, p. 307, and 2e édit., vol. v, p. 542.
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,, ,, *sericea.* Ibid.
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1827. *Halithea aculeata,* Risso. L'Europ. Mérid., vol. iv, p. 412.
,, ,, ,, and *aurata.* Ibid., vol. iv, p. 413.
1828. ,, ,, Stark. Elem., vol. ii, p. 140.
,, *Aphrodita aculeata,* De Blainville. Dict. des Sc. nat., vol. lvii, p. 456, Atlas, pl. ix, f. 1.
1829. ,, ,, Delle Chiaje, Mem., vol. iv, p. 209, Tav. 68, f. 10—15.
1830. ,, ,, Règne Anim., 2e édit., vol. iii, p. 206.
,, ,, ,, Bosc. Vers., vol. i, p. 181.
1831. ,, ,, Guérin. Icon. des Règ. Anim., vol. ii, pl. ix, f. 1.
,, *Halithea aculeata,* Treviranus. Edin. Journ. Nat. and Geogr. Sc., vol. iii, pp. 51, 246.
1832. *Aphrodita aculeata,* Aud. and Ed. Ann. des Sc. nat., vol. xxvii, p. 402, pl. viii, f. 7.
1834. ,, ,, Aud. and Ed. Annél., p. 66, tab. i A, f. 7.
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1853. ,, ,, Dalyell. Pow. Creat., vol. ii, p. 170, pl. xxiv, f. 15, 16.
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1873. ,, *aculeata,* Sars. Bid. Kundsk. om Christ. Fauna, p. 1.

1873. *Aphrodita aculeata,* Willemoes-Suhm. Zeitsch. f. w. Zool., vol. xxiii, p. 347.
1875. „ „ McIntosh. Invert., &c., St. Andrews, p. 115.
1879. „ „ Tauber. Ann. Danic., p. 78.
1884. „ „ V. Carus. Fauna Medit., p. 198.
„ „ „ Webster and Benedict. Ann. Chæt. Mass., Rept. Com. Fish and Fisheries, p. 699.
1886. „ „ Harvey Gibson. Vermes, Liverpool, Proc. Lit. Philos. Soc., vol. xl, p. 148.
1888. „ „ De Saint-Joseph. Ann. d. Sc. nat. (7), vol. v, p. 146 (Polychæt. Dinard).
1890. „ „ Malaquin. Ann. Boulon, 14.

Habitat.—*A. aculeata* is by no means uncommon in deep water off the eastern shores, indeed all round the British Islands. It generally frequents a somewhat soft bottom. A specimen comes from 580 fathoms, on oozy ground in the Faröe Channel, 'Knight Errant,' 1880 ('Challenger Report,' p. 34). After great storms the beach at St. Andrews is sometimes, *e. g.* in April, 1857, strewn with multitudes, so that the retiring tide leaves a line of them for more than a mile. As the species is seldom encountered within the bay proper, many were probably brought by the currents from the off-shore grounds, such as near the Bell Rock and south-east of the Island of May. Grube, who found it in the Adriatic (Lussin?), says that, according to Claparède and Malmgren, *A. aculeata* is distributed both in the Atlantic and the North Sea, while Von Martens found it at Madeira. It extends to the shores of America (Massachusetts, &c.), and a closely allied species to the north-west coast, though the minute characters of the form from the latter region have not yet received that attention necessary for certainty.

The head in *A. aculeata* (Plate XXIV, fig. 6) is smoothly rounded in front, with a median elevation posteriorly, and thus differs from that of *Lætmatonice filicornis.* The comparatively small, smooth tentacle proceeds from the centre of the anterior curvature, and has a short basal articulation; then it gently dilates to the somewhat clavate tip of the central piece, the terminal portion beyond having a dilated basal region, after which it narrows and ends in a slightly enlarged tip. The terminal articulation varies, being longer in some, shorter in others, and often presents a fusiform outline, with the tip slightly enlarged. A little behind the tentacle is, on each side of the median line, a blackish or brownish area (in the preparations)—the eye. The palpi are proportionally shorter than in *Lætmatonice filicornis,* and taper gently from their basal articulation to the tip. One is sometimes longer than the other—from reproduction of a lost organ. They are papillose, as in *L. filicornis,* only the papillæ are somewhat shorter. The facial tubercle has sparsely distributed small globular papillæ (Plate XXXVI, fig. 23), thus differing much from *L. filicornis.* O. G. Costa's fig. 2, Tav. i, therefore, is not an accurate representation of the part in this species.

Body.—The body is somewhat ovoid or broadly spindle-shaped, with the broad end in front. The dorsum is convex, covered with the dense greyish felt in the middle, and flanked by the gorgeously iridescent green and golden hairs and lustrous brown spines. The scales are entirely concealed by the felt, while in it many foreign structures are often fixed. Segments (bristled) forty-three.

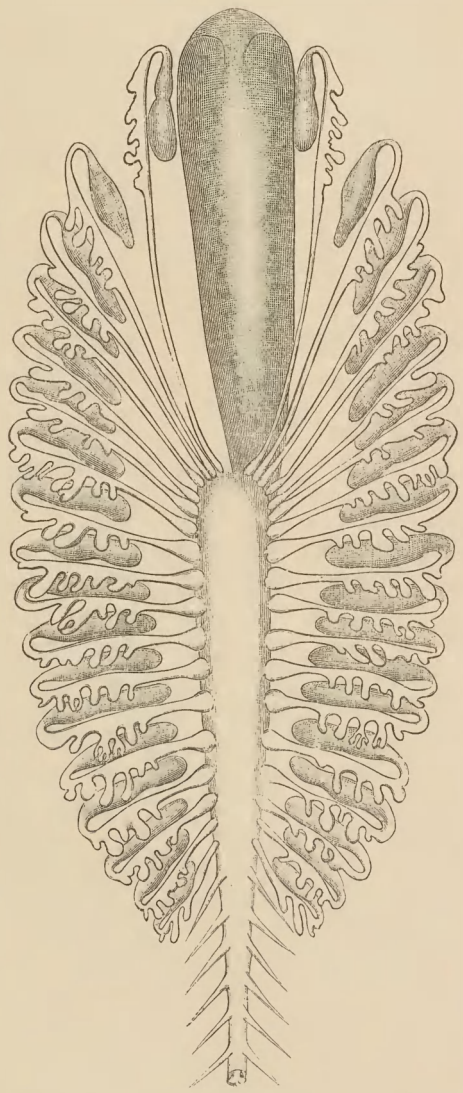
The ventral surface is flattened, and the skin is somewhat warty and rough, giving rise to the somewhat fanciful comparison by Pallas to that of the shark, and often tinged

of a brownish hue. It is marked by the transverse ridges indicating the segments. The arrangement of the folds at the mouth is seen in Plate I, fig. 1.

The papillæ of the segmental organs commence at the ninth and continue to the twenty-third foot. There thus appear to be fifteen pairs. The removal of the apertures of these organs entirely from the ventral surface is a feature of the sub-family, and distinguishes them at once from the Polynoidæ.

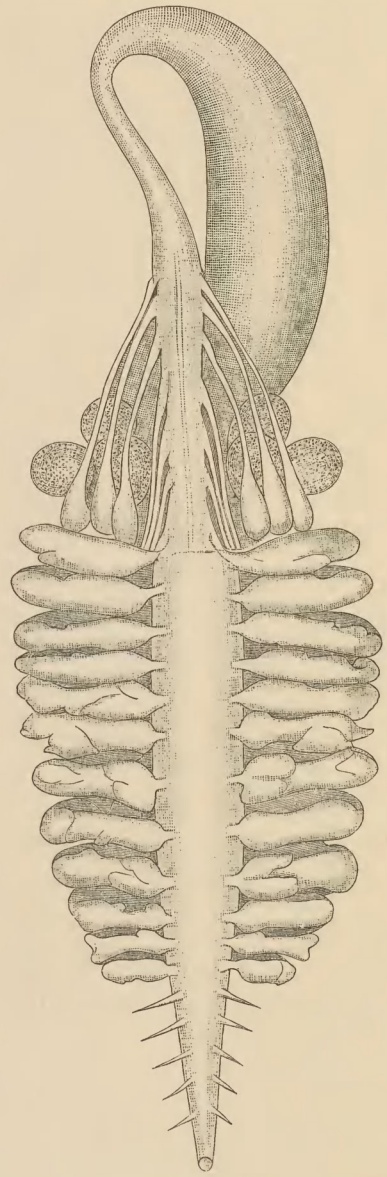
Digestive System.—The papillæ of the terminal region of the extruded proboscis

Fig. 16.



Digestive apparatus of *Aphrodita aculeata*. From a well-preserved spirit-preparation.—A. W.

Fig. 17.



Digestive apparatus of *Aphrodita aculeata* in a fresh specimen. The stomach is drawn forward.—A. W.

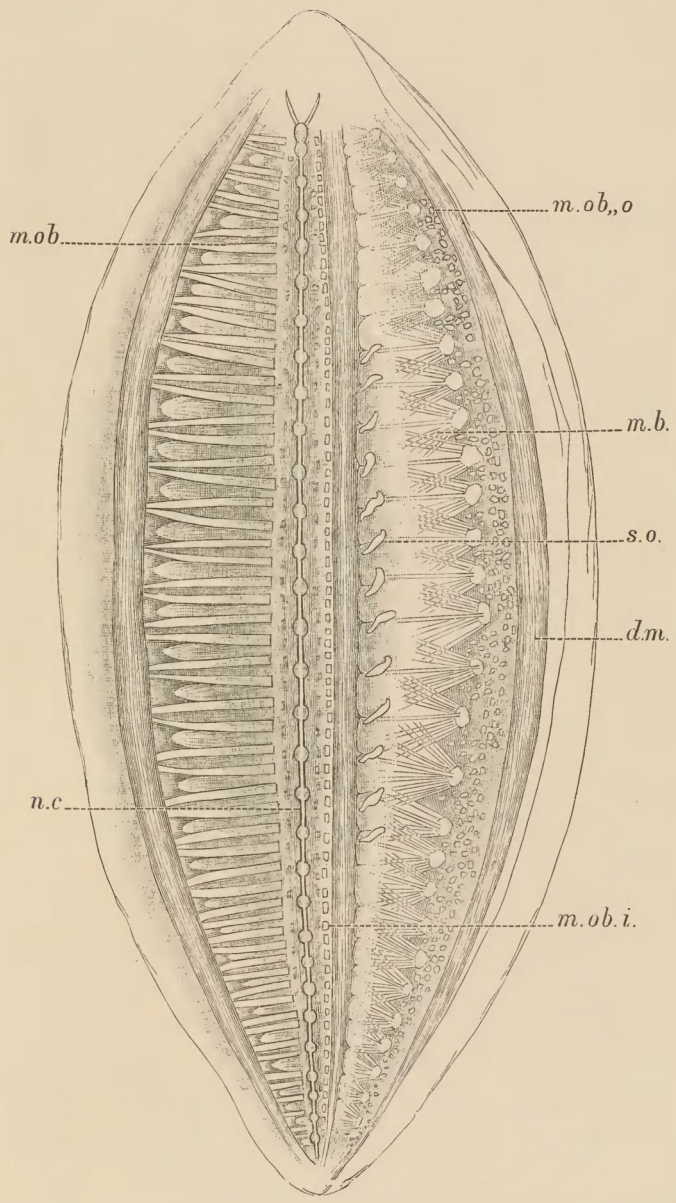
are somewhat lobate, though usually termed fasciculate (Plate XXXVII, fig. 1). They differ from those of *L. filicornis*, yet they sometimes appear as if obscurely dichotomous.

The proboscis itself is a powerful muscular organ, formerly eaten by the natives of

the Belgian shores, and even in our own country. Only shreds of a fibrillar gelatinous substance have been found in it. Grube[1] describes six layers in the organ.

About six of the anterior cæca may be considered pregastric (Fig. 16—in contraction). The lateral cæca of the gut are longer than in *Lætmatonice* or *Hermione*,

Fig. 18.



Dissection of *Aphrodita aculeata* to show the segmental organs (nephridia), *s.o.*; *d.m.*, dorsal longitudinal muscles; *m.ob.o.*, outer attachments of the oblique muscles; *m.ob.i.*, inner attachments of the oblique muscles; *m.b.*, oblique muscles; *n.c.*, nerve-cord.—A. T. M.

and form slender tubes connecting the remarkable cæca near the body-wall and the long moniliform glandular appendage inferiorly with the central system. These tubular portions of the cæca are less truly dorsal in their origin than those of the genera mentioned. The woodcut just referred to shows the canal and its appendages in a state of contraction. In the living and fresh condition the parts often present a different

[1] 1873.

aspect (Fig. 17), the cæca forming voluminous organs in the body of the Annelid. Pallas found nothing in the proboscis (his ventriculus), whereas in the gut he met with particles of fuci. In many at St. Andrews and elsewhere mud of various degrees of darkness occurs in the canal and its branches. Swammerdam thought the ramifications of the intestine anastomosed with each other.

Scales.—The overlapping, irregularly rounded scales [1] number fifteen pairs, and are of considerable size. The first two show a narrow external margin beyond the pedicle, but in the rest the latter occurs at the external border, and it is proportionally large throughout, the scale being thus firmly adherent over an extensive surface while readily moved by the muscles of the parts. The surface of the cuticle on the dorsum and the scale-pedicle is minutely papillose, but the scale proper is smooth, only a few minute papillæ occurring along the edge. They are often coated with patches of a blackish-brown granular deposit. The size of the scales does not always seem to correspond proportionally with that of the specimen. Many of the older authors, like Swammerdam, considered these organs the gills.

Dorsal Fimbriated Papillæ.—On the dorsum of the sixth foot an elevated ridge at the posterior border, rather beyond the line of the scale-pedicles, gives origin to a short process with a thin, flat, fimbriated extremity, generally of three divisions. The terminal fimbriæ of the papillæ become more complex and the process longer as we proceed backwards, the organs appearing, after the sixth, on the eighth, tenth, and every alternate foot (devoid of scales) to the twenty-sixth, when they occur on the twenty-seventh and the last, a small one on the twenty-ninth, that is on the foot behind the last scale. These organs have been interpreted as branchiæ by Pallas, Savigny, Kinberg, and others; while many, such as Cuvier, Carus, Duvernoy, and Oersted, held that the scales were respiratory organs. The great thickness of the cuticle of these processes, and the absence of large blood-vessels, as De Quatrefages showed, do not favour the view that they are special branchial structures, though the lobes of the alimentary cæca come close to them. The cuticle occasionally may be comparatively thick on the surface of branchiæ, as in certain Euphrosynidæ, but it does not attain the great density seen in these processes of the sea-mouse.

Feet.—The structure of the foot is shown in Plate XXXVI, fig. 10 (representing the tenth foot), and the organ in the various regions of the body conforms to the same pattern. The dorsal division bears the beautiful iridescent hairs, which gleam with all the beauty of a permanent rainbow. A dense and most gorgeous tuft of these, thicker than the dorsal series, occurs just above the ventral division of the foot, and extends more or less to the dorsal edge of the spines, where another dense tuft of hairs, less brilliant than the first series and much finer, occurs, and which form the felt on the dorsum. This property of felting does not appear to be due to any roughness of the exterior of these fine hairs, though fracture may render such rough, but to their flexible and attenuated condition. The tips of the hairs are often curved (see Plate XXXV, fig. 27). The first-mentioned series are brittle and gorgeously iridescent, the tips under a lens being wavy, a feature

[1] Darwin was of opinion that these were homologous with the wings and elytra of insects, "and it is not improbable that with our existing insects, organs which at an ancient period served for respiration have actually been converted into organs of flight." Unfortunately, proof is deficient.

due not to any change in outline, but to the play of light on the organs. The rainbow lustre is lost on drying these hairs in a spirit-preparation, but is again restored on immersion in water. De Saint-Joseph (1888) thinks Krükenberg [1] was wrong in considering the felt was like chitin; it is more like keratin.

The lustrous brown spines spring in a fan-shaped series from the middle of the foot, and form slightly curved sharp weapons of defence. They end in an acute two-edged tip, and readily pierce the skin. They have the same brittle chitinous structure as the other spines in this species.

In young specimens the dorsal spines are longer, more tapered and curved, and meet in the middle of the dorsum so as to guard the back, as in other Aphroditidæ. These and the rest of the spines are also often of a lighter golden hue. The thin and comparatively even coating of felt which covers the dorsum of some young specimens gives a character to such examples on clean ground, as off the west sands at St. Andrews. A great change ensues in these bristles during growth. Small specimens from a quarter of an inch upward to an inch appear to be common on muddy ground, and are densely coated with it,—as, for instance, in St. Magnus Bay, between the Skerries and Fetlar, and the Fjords of Norway (Canon Norman). On sandy ground, on the other hand, they are beautifully clean, and the long golden spines curve as guards over the dorsum.

The first foot bears a dense tuft of simple, slightly iridescent, slender, hair-like bristles, chiefly directed upwards and forwards. In the middle is another fan-shaped series directed forward and slightly curved (convexity outward). Below is a third group of similar structure, probably representing the ventral series, directed downwards and forwards, and with their convexity (for they are stiffish) downwards. On the outer side of the bases of the first two series are the tentacular cirri. This foot shows no marked division into dorsal and ventral parts, but has a somewhat clavate outline.

The second foot has the ventral division separated. Dorsally the rounded boss has externally a dense series of stiff hairs, which stand out in a fan-shaped manner, while towards the dorsal median line (Plate XXXV, fig. 25) the second or adjoining series are modified to form the very slender hairs of which the felt is composed. The ventral division bears smooth spines (Plate XXXVI, fig. 18), and inferiorly the tuft of somewhat stiff, pinnate bristles (Plate XXVI, fig. 17).

The ventral division of each typical foot, as noticed by Baster and Swammerdam, bears three series of bristles arranged in transverse rows (Plate XXXVI, figs. 10 and 22). The strongest occur dorsally, and consist of about three powerful dark brown bristles (Plate XXXVI, fig. 2 *c*), flattened at the tip, which varies in condition, though fundamentally the type is somewhat hastate, as observed in the posterior region of the body (Plate XXXVI, fig. 20). In front view (*a*) the tip resembles a broad spear, sometimes asymmetrical; in lateral view, again, the tip (*b*) is more or less tapered, and posteriorly has a slight dilatation at the commencement of the shaft.

The middle series (Plate XXXV, fig. 25 *b*) has the same type, but the bristles are paler and more numerous, about eight occurring in the row. The curvature at the tip is more distinct. Posteriorly the hastate condition is evident (Plate XXXVI, fig. 19).

[1] 'Vergleichende physiol. Stud.,' 2e ser., part 1, p. 54, Heidelberg, 1882, 8vo.

The lowest bristles are still more slender (Plate XXXV, fig. 24 *a*), and many present a remnant of the pilose coat at the tip, as in the figure. Posteriorly the hastate condition is marked (Plate XXXVI, fig. 19).

The second and third feet thus differ from the succeeding in having, instead of the most ventral series just described, a tuft of somewhat slender pinnate bristles (Plate XXXVI, fig. 17), the pinnæ in the third foot being stronger. These probably represent the primitive bristles.

The slender feet at the posterior end of the body have ventrally a series of elongated bristles, with short spikes somewhat alternately arranged distally (Plate XXXVI, fig. 3). They end in a tapering tip. These bristles are further modifications of the pinnate forms.

The warts on the feet and near their bases are often coloured dark brown or blackish, and in many also the general surface of the feet.

A small specimen (1½ inches) procured in Cromarty Frith on August 31st had the bases of two anterior feet fixed together by an elongated, hard, brownish mass, which was sunk in the tissues, and another circular patch was near. Only an indefinite granular structure was visible with the microscope, and the structure was more or less calcareous, giving off gas on the addition of hydrochloric acid. Both were firmly fixed in the skin.

Reproductive Organs.—Pallas represented the ova of *Aphrodita* as originating in the perivisceral fluid itself, a supposition in the same category as the notion that the glandular wall of the alimentary canal in the Oligochætes gives rise to the perivisceral corpuscles. At Naples Lo Bianco found the males emitting sperm in March. At St. Andrews specimens have abundant ova in May. The larvæ have not been seen.

The direction of the papillæ of the segmental organ would apparently send the reproductive elements dorsally under the felt, and as streams of water are constantly pouring through this space, the ova would be duly impregnated and aërated. The sperm would likewise be rapidly distributed all around.

A specimen off Howth, Ireland, showed *Loxosomæ,* and a delicate creeping Campanularian on the ventral surface and between the feet. In one from St. Andrews Foraminifera were thickly dotted over the ventral surface along with Balani (small), great numbers of stalked Infusorians, and an occasional very young mussel.

In the felt of the dorsum many small marine organisms are entangled, from algæ to mussels, Annelids, crustaceans, sponges, zoophytes, polyzoa, and spines of Echinoderms. Small preserved specimens are proportionally broader than the adult, and taper much more rapidly at either end. Such probably is partly due to rigid contraction. They occur from an inch downward in the stomach of the haddock, and occasionally in the stomach of the dab.

Delle Chiaje[1] records a nematode as a parasite in the dorsal felt, and as having a translucent body and a filiform tail. This is like *Phoronis* in the test of *Cerianthus* from Australia. The nematode, however, may only have lodged temporarily.

The species lives fairly in confinement, but as a rule not for a long time. The difficulty of supplying it with suitable nourishment—for mud in a confined tank soon

[1] 'Descrizione,' vol. iii, p. 138.

becomes odoriferous—is probably the cause of its mortality. In its native sites it seems to make its way in the mud and sandy mud by aid of its powerful ventral bristles, whilst its back is laved by currents of sea water under the felt which protects this somewhat delicate surface from direct contact with its surroundings. It appears to be a limivorous form, pursuing its work in the depths of the sea, where its beautifully iridescent hairs can be seen by few admirers. It does not always follow that the reasons for gorgeous apparel or brilliant phosphorescence lend themselves readily to the inquirer.

The smallest example in my collection was procured on the bottom by Dr. Alford Anderson on board the 'Garland,' on the 9th August, 1888, on the trawling grounds near the Bell Rock. It measures 3·5 mm. in spirit. The dorsum is covered with sandy mud in which are a few fine hairs. The ventral surface forms a proportionally broader area than in the adult. There are nineteen segments besides the pro- and peristomium, and there are no signs of the lustrous hairs, yet the larger bristles of the feet are prominent, though few in number. Each foot has superiorly in the ventral division a long hastate bristle slightly bent downwards at the extremity, the hastate region having a coating of fine agglutinated hairs which project beyond the tip. One or two shorter forms of the same type occur in the next row, the larger having a similar though less developed terminal coating. The third series of two smaller bristles has smooth hastate tips. The spine has a long free point. The dorsal felt is already formed as a dense interlacing series of fibres, which entangle minute particles of mud and sand. The dorsal spines are still comparatively short and pale, and do not project beyond the felt and mud of the sides.

The soberly tinted young form is thus a contrast to the adult in the colour of the bristles, spines, and hairs. Its hues coincide with the surrounding sandy mud.

Baster's account (1765) of this species is, on the whole, careful and characteristic, the arrangement of the ventral bristles and even their number having received attention. His structural remarks are also interesting, and he found the male and female elements in June. His figures are fairly accurate.

Rondelet and Swammerdam called the sea-mouse *Physalus*, while Bartholinus termed it the golden worm. Seba, Molyneux, and Barrelier, again, named it *Eruca sive Scolopendra marina*. Swammerdam was of opinion that it deserved a place near the sea-urchins, probably from the prominence of its spines.

Pallas's description of the external and internal structure is excellent. He had not, however, seen one seven inches long, as Baster reports. He describes the muscular bands, the perivisceral fluid, the digestive system, and the stomach (*ventriculus*), which the Belgian fishermen call *mentulam Aphroditæ*, and eat it boiled—a poor kind of nourishment Cuvier afterwards thought. It somewhat resembles the human uterus, he says, with its *os*. He is of opinion that the scales are not branchiæ, but that fourteen pairs of sacculate bilobate organs (the dorsal fimbriated papillæ) are. He mentions the pinnate condition of the intestine, figuring the lateral cæca, and describing their attachment to the "integument." He thinks that Redi's view of the insertion of the cæca in dorsal sacs will not bear scrutiny. The cæca communicate with the median gut freely, and chyme enters and is absorbed,—indeed, he saw particles of algæ in them, but nothing in the ventriculus or œsophagus. He corrects Redi's notion that the nerve-cord and its

ganglia formed a systemic trunk with hearts, the reddish colour being characteristic of the various parts of the nervous system in this species. The true sanguiferous system is best seen in moribund fresh examples. In the dorsal region is a membranous space (the great vein) filled with turbid lymph, and it gives off twigs between the intestinal pinnæ, and long branches anteriorly. He alludes to the anterior extremity of the great vein over the *ventriculus*, and figures it. Under the intestine is a longitudinal vessel with lateral branches. He noticed the perivisceral fluid and its corpuscles, and found ova in June in masses therein, and also spermatozoa in males, but did not know how they gained exit. It is the Söe-Muus and Gold-Muus of O. F. Müller in his 'Zoologia Danica Prodromus' (1776).

In the first volume of his 'Memorie' (1823) Delle Chiaje refers to his figures on Tav. iv, in which the exterior, the structure of the proboscis, and alimentary canal are sketched. In his fourth volume (1829) he again recurs to the same form, giving a somewhat indifferent view of the body, several sketches indicating the arrangement of the nervous and digestive systems, and the three series of bristles on the ventral surface of the foot.

Treviranus[1] described the external apertures of the segmental organs in *Aphrodita*. Delle Chiaje and he regarded them as openings by which water got into the perivisceral cavity; that in reality the ciliary current moves the reverse way.

Audouin and M. Edwards considered this the most beautiful and brilliant of all the Annelids, stating that it is called the sea-mole and sea-mouse, and that it inhabits the depths off shore, and also the oyster-banks. Rarely is it tossed on shore. The *Aphrodita sericea* of Savigny they could not find in the museum, while his *A. aurata* is probably a young example of *A. aculeata*.

Carus and Jourdan[2] figure the body of *A. aculeata* in vertical section, and also the alimentary canal, but nothing is added to previous knowledge.

In the Memorial Edition of Cuvier it is said that the flexuous bristles of Aphrodita shine with all the brilliancy of gold, and change into all the tints of the rainbow. They do not yield in beauty to the plumage of the humming-bird, nor to the most lively lustre of precious stones. The gills are concealed by the scales, and are in the form of small fleshy crests.

Sir J. Dalyell[3] (1852) noticed the habit of elevating, or, as he calls it, recurving the posterior extremity of the body, and "discharging a stream of water from an orifice there." None of his specimens fed on any substance offered to them. The account of the segmental organs of this species by Dr. Thomas Williams[4] seems to rest on a misinterpretation of the parts. He also states that the blood-vascular system is absent.

De Quatrefages (1865) gives a somewhat detailed account of its external characters. He records thirty-nine rings and fifteen pairs of scales, and a length of 16—17 centimetres (6 or 7 inches). He mentions an elevated cutaneous fold (facial tubercle?) in the middle line running to the mouth. The median antenna is implanted on a caruncle. His

[1] Tied. and Trevir., 'Zeitsch. f. Physiol.,' Bd. iii, 2, p. 157, 1829.

[2] 'Traité élém. d'Anat. comp.,' Paris, 1835, pl. v, figs. 24, 25.

[3] 'Pow. Creator,' vol. ii, p. 171.

[4] 'Philos. Trans.,' 1858, p. 134, pl. viii, figs. 26, 28.

Milnesia borealis (Johnst.) is only the young of *A. aculeata* in a somewhat imperfect condition.

Grube was of opinion that the *A. sericea* of Savigny, and *A. borealis*, Johnst., refer to this species, and that Risso's form, *A. aurata*, is the young of the same.

Claparède[1] describes the peritoneal coat of this species as being the most distinct example in the group, and he figures the fine striæ which characterise it. At intervals on this surface he found groups (*mouchets*) of vibratile cilia as in *Hermione*, and as Sharpey had long previously observed. He alludes to the ovaries which he found on the ventral surface at the bases of the feet. They were in bands (*boyau*) in the median line attached to a cord. He could not satisfy himself as to the nature of this cord. He further points out the peculiar structure of the papillæ, the bases of which can be traced to the interior of the palpi. He differs from De Quatrefages, who states that the first two pairs of ganglia are completely separated from their homologues of the other side. He considers that these ganglia do not exist; they are simply the inferior part of the œsophageal connectives.

A good account of the distribution of the blood-vessels of this species is given by Prof. E. Selenka.[2] He describes in injected specimens a dorsal and a ventral vessel running above and below the gut, the former being connected with the trunks of communication—which course in a parallel manner round the gut—by an intermediate series of inosculating vessels. A fine network is found in the dissepiments and the membranes in connection with the intestinal cæca, as well as certain vessels which end blindly over the dorsal muscles, the nephridia, and other parts. He describes also the growth of the ova in dense masses on the vascular trunks at the bases of the feet. The larger eggs have a fine membranous capsule with nuclei; the smaller ova are brownish red.

Grube[3] (1874) says that in large examples of *Aphrodita aculeata* forty-three segments occur, and that Savigny observes that the two dorsal tufts of hairs (felt) come from the elytra-bearing segments, while Audouin and Milne Edwards held that they come from the cirrus-bearing segments. Grube's examples were in the former condition.

Carus[4] (1884) mentions that it is called Ti veggo (Claparède) at Naples, a name, however, given to other forms; and that an Annelid, *Branchiomma vigilans*, Claparède, is parasitic on it.

Dr. Hugo Eisig[5] (1887) makes an interesting comparison, with figures, of the bristles and hairs of this species with the golden yellow secretion of the spinning glands of *Polyodontes maxillosus*.

[1] 'Ann. Chæt.,' Nap., 1868.
[2] 'Niederlandisches Archiv für Zool.,' Bd. i, Heft 2, p. 33, Taf. iii and iv, 1872.
[3] Op. cit., 1874.
[4] 'Fauna Medit.,' vol. i, p. 199.
[5] 'Monogr. der Capitelliden,' Naples, 1887, p. 331, *et seq.*, Taf. xxxvi.

Genus VI.—Lætmatonice, *Kinberg*, 1854.

Eyes on short peduncles placed near the anterior border of the head, dorsum covered with felt. Spines of the elytra-bearing feet glochidiate, other segments with lateral bundles of stout bristles and a tuft of hair-like bristles. Bristles of the ventral branch semi-pinnate. Intestinal cæca strictly dorsal, arising on each side of the median dorsal vessel. Segmental organs (nephridia) opening externally by a papilla directed upwards between the feet. Nerve-cords flattened, less distinctly separated than in *Aphrodita*.

1. Lætmatonice filicornis, *Kinberg*, 1855. Plate XXIV, fig. 9.

Cephalic lobe rounded, two curved longitudinal lines making it tripartite; facial tubercle with long mammillate papillæ.

Elytra obliquely reniform, with minute cells.

Glochidiate spines with three or four teeth.

Synonyms.

1843. *Aphrodita hystrix*, Oersted. Ann. Danic. Consp., p. 11.
1850. „ „ Sars. Nyt. Mag. Naturv., 1850, vol. vi, p. 210, n. 57.
1855. *Lætmatonice filicornis*, Kinberg. Ofversigt Kongl. vet. Akad., 1855, p. 382.
1857–8. „ „ Kinberg. Freg. Eugen. Resa. Zool., vol. ii, p. 7, Tab. iii, f. 7.
1859. „ „ Danielssen. Norske vid. Selsk., 4de Bd., 2 Hft., Throndhjem, p. 114.
1861. *Aphrodita hystrix*, Danielssen. Nyt. Mag. Nat., vol. xi, p. 49.
1865. *Lætmatonice filicornis*, Malmgren. Nord. Hafs-Ann., p. 53.
„ „ *Kinbergi*, Baird. Proc. Linn. Soc., vol. viii, p. 180, 1865.
„ „ „ De Quatrefages. Annelés, p. 199.
1869. „ *filicornis*, McIntosh. Trans. Roy. Soc. Edin., vol. xxv, p. 407.
1873. „ „ Sars. Bid. Christ. Fauna, p. 1.
1875. „ *Kinbergi*, Ehlers. Ann. 'Porcup.,' op. cit., p. 31, Taf. ii, f. 1, 2.
1879. „ *filicornis*, Tauber. Ann. Danic., p. 79.
1885. „ „ McIntosh. 'Challenger' Rept., p. 39.
1887. „ *Kinbergi*, Ehlers. Annel. U. S. S. 'Blake,' p. 45, pl. vii, f. 6; pl. viii, f. 1—5.
1894. „ „ Flor. Buchanan. Proc. Roy. Dubl. Soc., vol. viii (n. s.), ii, p. 170.
1896. „ *filicornis*, Roule. Camp. d. 'Caudan' (Ann. Univ. d. Lyon), p. 442.

Habitat.—This species was first dredged in British seas by Dr. Gwyn Jeffreys off the Hebrides in 1866, and often subsequently in various grounds off Shetland in depths ranging from 75 to 100 fathoms, and chiefly on muddy sand. The same persevering explorer found it off the west coast of Ireland (Valencia Island). It extends into the

Atlantic on Holtenia-ground or stones and coral, and even to the depth of 1950 fathoms ('Knight Errant'), and is found on the shores of America (Verrill) and Canada (Whiteaves). Northward it is met with in the Faroe Channel, while Grube gives from Bohuslan along the Norwegian coast to Finmark. A few examples were dredged along with *Hermione* on the oyster-ground off St. Peter Port, Guernsey, but it is absent along the eastern shores from the Pentland Frith to the south coast.

Head.—The head (Plate XXVII, fig. 2) is somewhat rounded, the median separated from the lateral region by two curved longitudinal grooves. The tentacle arises between and rather behind the ocular peduncles above the conical basal segment, and is a long, slender process gently tapering towards the tip, then slightly enlarging, forming a constriction, and lastly a bulbous swelling as shown in the figures. In none of the examples, however, did the tentacle reach the length of the great palpi, as Kinberg says, nor could Baird's description as "short and conical" apply. Its length, probably from injury, varies, but the longest are far short of the palpi, so that Kinberg's were either recently reproduced or varied in this respect. It agrees in form with a dorsal cirrus. The somewhat globular ocular peduncles occur on each side of the former, and in the preparations are devoid of pigment. The long palpi spring from each side of the facial tubercle in front, and have a smooth basal articulation, from which they gently taper till near the extremity, when a somewhat elongated dilatation occurs, after which the tip tapers to a fine point. The whole organ beyond the basal articulation is setose with long, sharp papillæ, which are finer on the distal region (Plate XXXVII, fig. 2). The slight enlargement below the tip is not evident in every example, probably from injury, but it seems to be present in the most perfect.

The facial tubercle has numerous long, mammillate papillæ, thus differing much from *Aphrodita aculeata* (Plate XXXVI, fig. 24).

The body is somewhat flattened, elongate ovoid, about equally tapered at both ends, though from the contraction of the parts and the condition of the feet the posterior end often has a slightly broader aspect. The dorsum is covered with a greyish felt, and the sides are flanked by the proportionally large and iridescent brownish bristles. These do not overlap the dorsum as in other species, only a few of the shorter bristles spreading slightly over the outer edge of the felt,[1] which is usually coated with sand, and is so flexible as to take wrinkles from the edges of the scales. The dorsal felt is formed of a moderate number of very fine hairs tapering to an attenuate point, and connected together by a fibrillar gelatinous basis, which has sand-grains, diatoms, and other algæ, mud, and foreign particles of various kinds, *e.g.* sponge-spicules and anchors of Synaptæ, in it. So far as observed the fine hairs do not terminate in hooked points as in *A. aculeata;* they spring from the inner edge of the dorsal division of the foot. The felt is friable, thicker, however, in the larger and older specimens, and more easily torn and gelatinous in the smaller. The delicate dorsal cuticle under the felt is smooth, and the body-wall of this region is much thinner than in *Hermione*. The long bronzed spines extend posteriorly somewhat beyond the line of the feet, terminate nearly in a transverse line with the body, and give a truncated outline to the region in contrast

[1] Grube thought only mucus was present.

with the anterior end. Kinberg's figure differs, therefore, considerably from British and other examples—both small and large—that have come under observation; indeed, it is more or less diagrammatic.

The entire ventral surface, including the feet, is studded with closely set globular papillæ.

The papilla of the segmental organ begins on the seventh foot as a small process, becomes a free tubular structure on the ninth, and extends to the twenty-ninth foot. The papilla is comparatively large and long.

Digestive System.—The extruded proboscis has at its extremity a densely villous border, divided into two by a bare papilla at each side. The long processes (papillæ) are divided dichotomously (Plate XXXVII, fig. 2) in a very regular manner, about five times from the base. The great proportional size of this organ—for it is more than half the length of the preserved form—is a noteworthy feature, and indicates its importance in the economy of the animal.

The pre-gastric cæca have their terminal appendages even more conspicuous than in *A. aculeata*. The intestinal cæca arise from the dorsal aspect of the gut close to the median vessel. They thus slightly differ from those of *Aphrodita* and *Hermione*. In regard to the arrangement of the terminal cæca, they approach those of the former.

In the Zetlandic examples masses of mud and mucus in the stomach were very rich in Foraminifera, sponge-spicules, radiolarians, diatoms, bristles of Annelids (Spionidæ), and fragments of crustaceans.

Scales.—Fifteen pairs, smooth, somewhat pellucid, and slightly iridescent. They are more or less rounded or ovoid, and with the exception of the first two are attached by the centre of the outer border as in *Aphrodita* and *Hermione*. While the first pair are small, they rapidly increase in size, the middle third of the body having only three or four large scales. They occur on segments 2, 4, 5, 7, and so on to 23, 25, 28, and 31.

Feet.—The long, brownish, iridescent spines which flank the sides are flattened and flexible, with the tip somewhat abruptly tapered in lateral view (Plate XXXVI, fig. 8), whereas when seen on the flattened face the sides have four or five recurved teeth (Plate XXXVI, figs. 4 and 6). The majority have three teeth on each side (Plate XXXVI, fig. 12), but some have four. The barbed bristles have guards or sheaths, or traces of these in the preparations (as in the figure), but whether they are only perfect in the young condition of the bristle is unknown. They seem to be removed readily.[1] The main part of the shaft is flat, broad, longitudinally striated, and it somewhat diminishes inferiorly, and terminates in a flattened, blunt extremity, to which the muscles are attached. For some distance above the base the shaft is paler, and shows a central band as if from an axial cavity. The spines present a distinct curvature. About twelve well-marked groups of the long spines occur in a good example. These spines retain the same essential structure posteriorly.

The first pair of feet are directed forward, and bear the tentacular cirri (which are much longer than in *Aphrodita aculeata*). Each has two tufts of pale, simple bristles,

[1] Perfect examples occasionally adhere to the felt.

which taper to a fine hair-like point. Their outline seems to be smooth, though sandy débris lodges readily amongst them. The anterior tuft is directed forwards and inwards as an expanded fan, while the compact posterior one goes inwards and backwards. A strong spine supports the foot. The bristles are similar but somewhat stronger dorsally in the second foot. In the third foot a more slender series of bristles occurs to the exterior of the cirrus, while a stronger series is dorsal. This and the next have pinnate bristles in the ventral division.

The fourth foot, which is provided with a ventral cirrus, has in the inferior division a tuft of pale pinnate bristles, like those of *Aphrodita*. The same pinnate bristles occur in the fifth foot, adjoining the ventral cirrus, while above them are a few of the ordinary kind with feathered tip and hook. In the sixth only the latter are present. The typical forms are shown in Plate XXXVI, figs. 5 and 7.

In the same way the last foot or two have a modification of the ventral bristles, for the spikes above the hook are short and distinctly separate. Moreover the last foot has pinnate bristles as in front, along with an ordinary form or two.

The feet appear to be about thirty-four, the dorsal division alternately bearing cirri and long bristles.

The dorsal cirri spring from the centre of a fringe of the more slender bristles, their places being taken in the scale-bearing segments by the long hooked spines. In the case of the cirrigerous feet a group of stout, short, brownish bristles occurs in front of the cirrus, and a somewhat longer and stronger series springs in the scale-bearing feet on the dorsal side of the long spines. All are densely covered with a muddy and sandy investment, but their surface appears to be smooth.

A typical foot, *e. g.* one bearing the long dorsal spines, has dorsally (from within outward) the slender hairs which form the felt, then a group of short stiff bristles, followed by the papilla carrying the long brown spines, which have a distinct curve. A tuft of delicate bristles occurs beneath. The scale is fixed posteriorly. After an interval the ventral branch of the foot bears the semi-pinnate bristles and the ventral cirrus.

The last pair of feet are rudimentary, and lie in ordinary positions behind the anus, which is dorsal.

The segmental organs (nephridia) point upward between the feet, and are as well developed as in *Aphrodita aculeata*.

A Norwegian example, sent by Dr. Merle Norman,[1] shows guards to the front of the dorsal spines, and a slightly hastate tip beyond the barbs. The ventral bristles seem to have shorter tips.

A series of small specimens occur from North Unst—from 5·5 mm. upwards. These have pale spines and bristles, yet all the bristles and the dorsum are densely coated with sand-grains. They were captured in July, and probably represent the growth since the previous spawning season.

Loxosomæ are common in this species on the feet, ventral surface, and on the dorsum under the scales.

[1] Op. cit., p. 171.

Reproduction.—Ova of considerable size are present in examples dredged by Dr. Gwyn Jeffreys off North Unst in June, 1867.

Kinberg (1857) characterised this species as having a rounded cephalic lobe, tripartite from two curved sulci, filiform tentacle longer than the palpi, and the median elytra reniform. It was procured on the western and northern shores of Scandinavia.

Ehlers (1875) considered the *Lætmatonice Kinbergi* of Baird as different from Kinberg's *L. filiformis*, but, as previously stated, there is no reason to doubt their identity.

Ehlers (1887), in his 'Annelids of the United States Expeditions,' considers, as he did in the former publication ('Annel. of the 'Porcupine'') that he is still dealing with a new species *fide* Baird. Only a single form appears to occur in British seas, and it extends to Norway and the American coast. His figures are the work of an artist, and thus the scientific accuracy is not beyond doubt, as a glance at the dorsal spine of his pl. viii, fig. 3, demonstrates. The peculiar flattening of the main part of the shaft, and the characteristic narrowing of the tip, have been overlooked. This form, however, may be a variety of *L. producta*, allied to *L. prod.*, var. *benthaliana*. His description gives nothing diagnostic.

2. Lætmatonice producta, var. *Britannica*.

Specific Characters.—Body ovate-oblong, of a pale flesh-tint, and devoid of dorsal felt. Scales pale, their reticulate cordate structure being better marked than in any other form. Segments forty-five. Head triangular; ocular peduncles globular at the tip, narrowed inferiorly at the peduncle; no eyes. Lateral process at the posterior part of the head smaller than in the typical forms. Papillæ of the angular facial tubercle more lobate than in *L. producta*. Glochidiate bristles with four recurved fangs, besides the process at the base of the terminal spear-tip. Ventral bristles with stiffer basal and more slender distal pinnæ.

Synonym.

1894. *Lætmatonice producta*, Flor. Buchanan. Proc. Roy. Dubl. Soc., vol. viii (n. s.), ii, p. 169.

Body more or less oblong, of a pale flesh-tint, devoid of dorsal felt, scales pale; forty-four bristled segments, which increase to the middle or behind the middle of the body, and again diminish posteriorly, though the latter region is somewhat blunt. The centre of the head is more or less triangular, with a prominent swelling, and bearing in front the two ocular peduncles, which are globular at the tip, but have a distinct peduncular portion, thus differing from those of var. *Willemoesii*, which are more or less sessile, and without a trace of eyes. Those of *L. producta* are more elongated. The lateral process towards the posterior part of the head is much smaller than in *L. producta* from Kerguelen. It forms a lobate flattened process in the latter, and nearly reaches the base of the ocular peduncles. On the other hand, in the British specimens it is only a small papilla,

touching the base of the lateral cephalic swelling. It appears to be the rudiment of a scale-bearing process. The ridge from which the tentacle arises extends backwards in the middle line, and at the posterior border of the head it bends outward on each side to bear the papilla, viz., the modified scale-bearing process. The papillæ of the facial tubercle are more lobate than in *L. producta* from Kerguelen, and proportionally less elongate. The palpi are, so far as the specimens go, less powerful than in *L. producta* from Kerguelen, but the difference in regard to the papillæ or spikes is small. Both have numerous papillæ as in *L. filicornis*. All that can be said is that perhaps they are a little more numerous towards the tip of the palpi of *L. producta* from Kerguelen. The tentacular cirri are somewhat longer than the tentacle, and their tips are rather more elongate than in *L. filicornis*, while they are shorter than in *L. producta* from Kerguelen.

The segmental papillæ begin on the posterior face of the fifth foot, and extend to the thirty-eighth. They form flattened processes somewhat more distinct than in *L. producta* from Kerguelen. Besides, in the latter form they begin on the tenth foot, and extend to the thirty-ninth.

The papillæ of the proboscis (Plate XXXVII, fig. 3) have broader tips than those of *L. filicornis*, and are less regularly dichotomous. The tips are sometimes divided into three, and occasionally are ovate, clavate, or irregularly lobate. There is not much ground for calling the thickened regions of this organ parts representing maxillæ, as Grube does.

No specimen is in a condition to give a reliable opinion of the arrangement of the dorsal spines. The papillæ bearing them are a little more prominent than in *L. producta* from Kerguelen, but this may be due to their condition, for they have evidently been subjected to considerable hardships. They probably spread, in the scale-bearing feet, over the dorsum as in the forms from Kerguelen, the feet carrying cirri having dense groups of more slender bristles.

The structure of the first two feet agrees with that in the form from Kerguelen. The other feet are also similar in structure. The tips of such of the long dorsal spines as were present agreed with the figure (Plate XXXVI, fig. 4), which shows a spine slightly turned to the left, four recurved fangs occurring on each side, besides the point at the base of the spear-like tip. The ventral bristles (Plate XXXVI, fig. 5) conform mostly to the type of *L. producta*, var. *Wyvillei*, having somewhat stiffer (stouter) basal bristles and numerous slender distal ones.

In describing this form in the Annelids of the 'Challenger,' I for some time had the varieties ranged under separate species, distinguished by certain evident characters.

The reticulate cordate structure of the scales is very well marked (apparently better than in any other species), forming a series of wavy lines like those on the sand of the sea-shore.

No parasitic Loxosomæ occur on this form, yet foreign varieties abound with them, such as *L. producta*, var. *benthaliana*, on which the remarkable new gymnoblastic hydroid, *Stylactis vermicola*, described by Prof. Allman, occurs on the under surface of the scales of this inhabitant of the depths (2900 fathoms) of the North Pacific.

The species was first procured by Prof. Haddon during the Royal Dublin Society's Survey, on a bottom of sand and gravel at a depth of 500 fathoms, fifty-four miles off

Achill Head, and recognised by Miss Florence Buchanan,[1] who thought it had hitherto been procured only at Kerguelen; but it and its varieties have a much more extensive range, even to the shores of Nova Scotia, near Halifax. The varieties described in the 'Challenger' were devoid of eyes in the preparations, as this also is.

Genus VII.—Hermione, *Blainville*, 1828.

Cephalic lobe with a single tentacle and two palpi. Peristomium bears bristles and two long cirri. Pedunculated eyes fixed to the margin of the cephalic lobe; maxillæ absent or small (thickened processes). No dorsal felt. Elytra alternating with dorsal cirri. Dorsal and ventral divisions of the feet distinct. Elytra-bearing feet with glochidiate dorsal spines, and a tuft of strong bristles over the elytra. Ventral bristles bidentate.

The pregastric and intestinal cæca are shorter than in *Aphrodita*, and even than in *Lætmatonice*, but they have large terminal dilatations. The latter are shorter than in *A. aculeata*. The lateral cæca do not approach the median line as in *Lætmatonice*. Segmental papillæ from the eighth to the twenty-ninth foot. Nerve-cords closely applied and flattened.

Hermione hystrix, *Savigny*, 1820. Plate XXIV, fig. 7.

Specific Characters.—Head broad; each ocular peduncle bearing two eyes; facial tubercle with globular or slightly ovate papillæ. Body elongate-ovoid. Segments thirty-two to thirty-three. Elytra somewhat reniform, furrowed by divergent and transverse lines, and having large rounded cells. Dorsal spines glochidiate, with three fangs on each side; ventral bristles with a spur, and, in the anterior part of the body, accessory spikes above it. The tip of the bristle is curved.

Synonyms.

1818. *Halithea hystrix*, Lamarck. Hist. des An., s. v, vol. v, p. 307.
1820. „ „ Savigny. Systèm. des Ann., Descr. de l'Égypte, t. xxi, p. 345.
1823. „ Delle Chiaje. Memorie, vol. i, p. 181, tav. iv, f. 10, 11.
1826. „ *hystrix*, Risso. L'Europ. Mérid., p. 413.
1828. *Hermione hystrix*, De Blainville. Dict. des Sc. Nat., 'vers,' p. 457, pl. ix, f. 2.
1834. *Aphrodita hystrix*, Aud. and Ed. Ann. des Sc. Nat., vol. xxvii, p. 406, tab. vii, f. 1—9; and Annélides, p. 70, pl. i, f. 1—9.
„ „ „ Cuvier. Règn. An., vol. iii, p. 207.

[1] 'Sc. Proceed. Roy. Dubl. Soc.,' vol. viii, pt. 2, No. 15, p. 169, 1893.

1836–7. *Hermione hystricella,* De Quatref. Règ. an. illust., pl. xix, f. 1.
1840. „ *hystrix,* Grube. Actin., Echin., u. Würmer, p. 88.
„ *Aphrodita hystrix,* Johnston. Ann. Nat. Hist., iv, p. 370, v, f. *a—e;* and v, p. 305.
1842. *Halithea hystrix,* Delle Chiaje. Descrizione, pp. 57 et 105, tav. lviii, f. 10.
1843. *Aphrodita hystrix,* Oersted. Ann. Danic. Consp., p. 11.
1851. „ „ Grube. Fam. der Annel., p. 36.
1856. „ „ Thompson. Fauna of Ireland (partim ?), p. 273.
1857. „ *mediterranea,* O. G. Costa. Fauna d. Reg. d. Napoli, Annel., p. 8, tav. ii, f. 1—1 *e.*
„ *Hermione hystrix,* O. G. Costa. Annel. di Napol., p. 5, Tav. i, f. 11—14, and Tav. ii, f. 1.
1858. „ „ Kinberg. Fregatt. Eugen. Resa, p. 4, tab. 2, f. 4.
„ „ *hystricella,* Kinberg. Ibid., p. 5, tab. 2, f. 1.
1861. *Aphrodita hystrix,* Danielssen. Nyt. Mag. f. Naturvid, Bd. xi, p. 49.
1864. „ „ Grube. Die Insel Lussin, &c., p. 77.
1865. *Hermione hystrix,* De Quatref. Hist. nat. d. Annel., vol. i, p. 206, pl. vi, f. 9—14.
„ „ *Kinbergi* (?). Ibid., p. 209, pl. vi, fig. 16.
„ „ *hystrix,* Baird. Proceed. Linn. Soc., vol. viii, p. 178.
„ „ „ Johnst. Cat. Brit. Ann., p. 106, pl. ii, f. *a—e* (a repetition of former).
1868. „ „ Claparède. Annel. Chétop. d. Nap., p. 48, pl. i, f. 2.
1875. „ „ Marion and Bobretzky. Ann. Sc. Nat., 1875, p. 3.
1884. „ „ V. Carus. Faun. Med., p. 199.
1886. „ „ Harvey Gibson. Vermes Liverp., p. 147.
1888. „ „ De Saint-Joseph. Ann. d. Sc. nat. (7), vol. v, p. 146.
1890. „ „ Malaquin. Ann. Boulon., p. 14.

Habitat.—A southern form,[1] abundant at a depth of fifteen to twenty fathoms off St. Peter Port, Guernsey, amongst débris of shell-gravel, dead oyster- and mussel-shells, and occasionally at various parts of the southern coast of England and Ireland. It is common in the Mediterranean. The German exploring ship 'Gazelle' procured it at Soleton Bank. It ranges to eighty fathoms.

On the whole it is partial to shell-débris, gravel, and similar regions, and thus frequents rougher ground than *A. aculeata* (Hornell).

The smooth head (Plate XXIV, fig. 8) is rounded, and the posterior fillet which bounds it is considerably overlapped in the preparations by the peduncles of the first scales. This fillet appears to bear no papilla or homologue of the scale-peduncle externally. The median ridge which runs forward to and ends in the base of the tentacle is slightly marked. The ovoid lateral swellings are more prominent than in *Lætmatonice filicornis.* The ocular peduncles are somewhat clavate, with rounded tips, and each has dorsally a well-marked black eye, and just in front of it a larger one looking forward and downward. The facial tubercle has numerous globular or slightly ovate papillæ—a few being longer (elongate-ovate).

All except the basal region of the palpus is "ciliated" with spike-like papillæ as in the foregoing species, this being a character apparently subject to little variation. The tentacle, the base of which possesses scattered globular papillæ, has a peculiarly crenate outline, slightly enlarged at the tip, and with the clavate terminal process (Plate XXXVII,

[1] The notion that it occurs "all over the British area" (Dr. Benham) does not accord with our experience. It is a southern form.

fig. 5). The tentacular cirri are similar. The dorsal cirri increase in size, but have the same structure. In all these, minute rounded glands (like papillæ) are dotted over the granular layer of the epiderm, and may be associated with sensation. They are quite beneath the cuticle, which is somewhat dense. At the tip or bulbous part of the appendix the cuticle is thin, so that the nervous expansion comes close to the surface.

Body.—About two inches long, large specimens being two and a quarter inches (De Quatrefages), and is covered dorsally by the fifteen pairs of scales, which largely overlap. They vary in tint from pale to dark brown, with a slightly iridescent purplish sheen, and are firmly fixed by their pedicles near the middle of the external border. Under a moderate power they present a fibrillar or cordate structure, and the exposed surface has a series of minute papillæ, the anterior region alone being devoid of them. The edge is smooth. The first pair are small, and have the scar for the attachment of the pedicle near the centre. They again diminish posteriorly, but the structure remains the same. The Mediterranean forms are generally darker than those from the Channel Islands.

The ventral surface of the body is covered with a firm cuticle studded with minute papillæ, which are slightly brownish, especially on the feet at the commencement of the posterior third. Anteriorly the buccal fold forms a broad, rounded, finely grooved flap, diminishing to a nearly cylindrical ridge posteriorly. The minute papillæ are numerous on the edges of the buccal fold. A median and two lateral ridges flanked by the feet characterise this surface, as in allied members of the group.

The segmental papillæ commence on the eighth foot, and continue to the twenty-ninth, that is, about the fourth foot from the tip.

The papillæ of the proboscis are, like the others, somewhat dichotomous in their division (Plate XXXVII, fig. 4), the tips of many of the processes being broadly and more or less symmetrically lobate, or having a process at one side so as to be pedate. They seem to be flattened, and thus in the preparations do not readily separate from each other. They differ much in outline from the same processes in *Lætmatonice filicornis.*

The dorsum is flanked by the lustrous brown spines (Plate XXXVI, fig. 11), which are directed backwards and slightly outwards. In some views they are brownish, while in others they have a rich golden sheen. Anteriorly the granular spines stand upwards with the curve directed towards the middle line, the inner bristles spreading over the dorsum. The lateral brush, again, on the cirrus-bearing foot is directed outwards and with a backward curve. As soon as the long spines become prominent the pedicle for the scales causes a radiate arrangement of the stiff tapering bristles (Plate XXXVI, fig. 9), which spread over the dorsum and meet those of the opposite side in a symmetrical and graceful manner. The outer bristles of this series are more erect; the inner are adpressed, so as to guard the scales. These bristles are of a rich golden colour, with pale tips.

Three recurved fangs, as a rule, occur on each side of the tip of the spines (Plate XXXVI, figs. 12, 14, and 15), besides the smaller pair at the angle of the spear-tip. They are more nearly opposite (though the last two are not so) than in *Lætmatonice filicornis.*

Feet.—The first foot has pale, simple bristles, the tufts being directed forwards and inwards, and the basal portions of the tentacular cirri are warty like the tentacle.

The second foot has dorsally a tuft of pinnately spinous bristles as in the other members of the group, for instance, *A. aculeata*,—little variation occurring in the species. In the ventral branch are two bristles (Plate XXXVII, figs. 6 and 7), an upper with a strongly spinose edge above the powerful tooth, and a lower with indications of four spines, viz. the usual powerful inferior one, the somewhat less spine above it, and indications of two others beyond, the last being slightly developed. The foot has numerous globular papillæ on its surface.

The third foot, which carries a cirrus, has dorsally and internally a series of powerful bristles minutely nodular (Plate XXXVI, fig. 9), and with a well-marked curve, while externally a group of smaller forms of a similar kind occurs. This nodular development on the surface is peculiar, and forms a swelling below the tip as if it were a secondary development. The prominent granules or minute nodules are not affected by potash. The ventral division has often stout bristles with the spinose tips above the powerful fang, as shown in Plate XXXVII, figs. 6 and 7 before mentioned; but in some the spines above the fang are only four in number, while in others they are eleven. At the ventral edge of this division of the foot are numerous pinnately spinous bristles, as indicated in the dorsal division of the second foot.

In the fourth (a scale-bearing foot) the dorsal bristles are still curved, and occasionally minutely nodular, but much longer than in the third, and the tips of some are shaped as in the hooked forms. A few shorter and straighter spines occur externally. Ventrally the powerful bristles still show spinose tips, but the spines above the inferior fang are diminishing in number, one having only two.

The fifth (likewise a scale-bearing foot) has dorsally the somewhat broad, granular bristles, the tips of the amber-coloured ventral still having spines, the number of the latter above the great fang from above downwards in the three bristles present in the example being two, three, five.

The sixth foot (cirrus-bearing) has dorsally short, curved, and slightly granular flattened bristles dorsally and internally; externally a shorter and more slender form of similar character. Ventrally three bristles occur, with two, two, and three spines above the great fang.

The seventh foot has numerous curved, granular bristles dorsally, besides the spines, some with greatly elongated tips, which, moreover, are somewhat hastate. On the ventral bristles only two spines in all are present above the fang.

In the eighth foot (cirrus-bearing) the dorsal bristles are curved and granular, with a tuft of longer and more slender bristles to the exterior (below the cirrus). The three ventral bristles had each two spines above the fang. The segmental (nephridial) papilla begins on the posterior border of this foot, completely hidden in the fissure between it and the next foot.

Dorsally in the ninth foot were numerous curved granular bristles with somewhat blunt tips. Beyond these stretch the long characteristic brown spines with the glochidiate tips. Ventrally the three bristles have from above downwards one spine above the fang, two and one. Their shafts are strongly grooved.

The tenth (a cirrus-bearing foot) has dorsally the shorter curved granular spines,

and the shorter and more slender bristles externally. Ventrally are three bristles having above the fang respectively two, one, two spines.

The thirteenth foot has dorsally scales and spines. Ventrally three bristles, the hooks above the fang being respectively one, two, one.

The fifteenth has scales and spines. Ventrally the two bristles have one spike each above fang.

The twentieth foot (cirrus-bearing) has longer and more tapered dorsal bristles, the granules on which are less distinct, especially in the tapered forms. The shorter, broader forms show the granules distinctly. Ventrally the three powerful bristles have only the great fang. A typical foot is shown in Plate XXXVI, fig. 13.

The terminal feet have dorsally the granular bristles more pointed and less curved than in front, moreover the tips are smooth ; while ventrally the tips are more elongated, and have numerous spines above the great fang. One of the smaller forms is × 90 in Plate XXXVII, fig. 8. The ventral bristles of this form are much stouter than in *Lætmatonice filicornis*.

This species is specially subject to the attacks of *Loxosoma*, which occurs abundantly on the ventral surface and cirri, on the feet, mouth, and other parts. Parasitic algæ often grow on the bristles and spines, with mud, sponge-spicules, and other débris entangled. A remarkable hydroid creeping along the bristles is also present. Hydroids and Polyzoa, indeed, are not uncommon.

In habit this species appears to correspond with *Aphrodita* and *Lætmatonice*.

Reproduction.—The ova were well advanced in July in those from Herm and other parts of the Channel Islands. Lo Bianco found the Neapolitan examples with developing ova in October, and increasing in size in November.

An interesting account of the development is given by Dr. R. von Drasche,[1] of Vienna, from observations made at the rich Marine Station of Trieste. He found the ripe forms in October and November, the latter month being probably that in which deposition of the eggs generally takes place. The egg measures 0·2 mm., and he watched it through all the stages of segmentation till the embryo moved within the capsule by aid of cilia. It then issued as a pear-shaped trochosphere, with an equatorial circlet of cilia and a tuft in front; while a solid mass of deutoplasm occurred in the middle of the body. The violet-coloured larva soon acquires another ring of shorter cilia behind the first or pre-oral, an anal ring of cilia appears, and it swims about actively. Two red eyes are developed in front. The anterior end becomes triangular, and a characteristic broad cellular collar lies behind the eyes—the mouth, with a tuft of cilia, opening towards (in front of) its posterior border ventrally. On the fourth day the larva has increased in size, and the yolk-mass has concentrated into a covering for the alimentary canal. On the under surface of the snout are five small papillæ—organs, however, not homologous with the cephalic processes of the adult. There are now three segments with bristles. On the sixth day it is still larger. The alimentary canal is complete. The equatorial belt is smaller. There are five segments. The feet show a large yellow spine and bristles, the latter having a structure conformable to the adult type, though the glochidiate forms

[1] 'Beitr. z. Entwickelung d. Polychaeten,' pp. 7—11, Taf. ii, f. 8—20; and Taf. iii, f. 1—4, 1885.

are not yet present. Besides the structures mentioned, the young *Hermione* has now three pairs of eyes, and a process (first foot) behind the collar.

Savigny (1820) first distinguished the species, though his description is by no means diagnostic.

Delle Chiaje (1823) refers to the condition of the alimentary system in speaking of the anatomy of *Pleurophyllidia*, and gives a figure of a moribund example in his 'Memorie.' He thought the papillæ of the proboscis were taste-organs. He shows the globules of the blood. In his 'Descrizione' he mentions its common occurrence at Naples, and reproduces the plate from the 'Memorie.'

The *Aphrodita hystrix* mentioned by Oersted [1] probably refers to *Lætmatonice*.

Kinberg (1858) followed De Quatrefages in making two species, viz. *H. hystrix* and *H. hystricella;* but so far as can be ascertained this distinction rests upon variation, and Claparède was of the same opinion.

De Quatrefages (Annelés) saw in a male *Hermione hystrix* the spermatozoa issue in the form of a white thread at the base of the inferior branch of the foot of the nineteenth segment. They probably escaped from the segmental papilla between the feet. This author distinguishes between his *H. fallax* and this species by the fact that the median antenna in *H. hystrix* is least, and that the bristles of the scale-bearing feet have the points unarmed, while those of the inferior feet are tridentate (instead of the tips straight and the inferior bristles bidentate as in *H. fallax*). The bristles of the ventral division have curved apices, whereas in *H. hystricella* from the Mediterranean, &c., these are straight, and Kinberg says so also.

Claparède [2] has already pointed out that De Quatrefages was wrong in thinking that absolute reliance was to be placed on the number of the denticles at the tip of the spines or of the ventral bristles, and he also showed the condition generally of the anterior feet in contrast with the posterior. He enters into the uses of the guard for the tips of the long dorsal spines, and demonstrates that a process also appears in the developing ventral bristles before they pierce the surface. He alludes to the granular bristles, which had previously been described by Johnston and Kinberg, and points out the nature of their tips, with the swollen part beneath the point, as shown in one of the present figures. He mentions having found in a single example a long, simple bristle in the ventral division of the foot, probably a pathological phenomenon. He speaks of the warts on the surface, already mentioned by Pallas, Johnston, and Kölliker. He likewise alludes to the structure of the peritoneum, and that of the dorsal cirri.

Grube (1874) says De Quatrefages relegated *Hermione hystrix* to the Mediterranean and *H. fallax* to the Atlantic.

Prof. Jourdain,[3] in his account of the histology of the integument and sensitive appendages of this species, describes the irregular polygons formed by the cells of the epithelial coat, the nerves which ramify in it, and the thinly distributed nerve-cells. On the ventral surface, the warts, of which Claparède had formerly given a figure, have a central pore, through which communication with the granular layer of the epidermis

[1] 'Annulat. Danic. Consp.,' p. 11, 1843.

[2] 'Ann. d. Golfe d. Nap.,' p. 50, 1868.

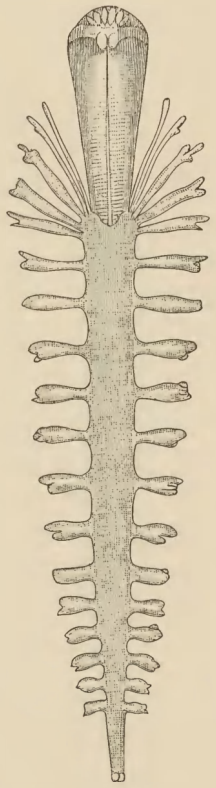
[3] 'Archives Zool. Expériment.' (2), vol. v, p. 91 (1887), pls. iii and iv.

occurs, and by which the nerve-supply to the cells and protoplasmic contents of the sensitive organs takes place. He also notes that the muscular fibres show no striæ, either transverse or longitudinal, and that the elytræ, after Haswell's description, have a double cuticle superiorly and inferiorly, two layers of cells, and an intermediate fibrous layer. They contain no cavity, but have a nervous plexus. They are evidently organs of considerable sensibility. Amongst other interesting points he refers to the nerve-supply of the palpi and dorsal cirri with their ganglia near the base of the terminal division, the nerve-trunk in each breaking up into a tuft of cells in this region.

Family III.—Polynoidæ.

Body more or less elongate; no facial tubercle, convex cephalic lobe; the base of the tentacle arising from the middle anteriorly; two lateral tentacles; four eyes; palpi elongate. Peristomium, bearing the first foot, with long dorsal and ventral cirri, and the ventral cirrus of the next segment long. Pharynx exsertile, muscular,

Fig. 19.

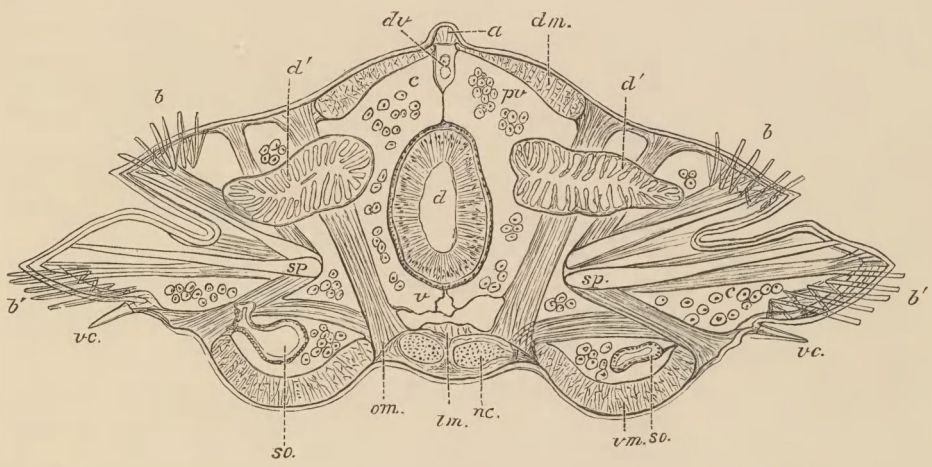


Alimentary apparatus of *Harmothoë imbricata*.—A. W.

cylindrical, with papillæ round the margin; horny jaws. Intestinal cæca shorter than in the *Aphroditidæ*, slightly branched; first foot bearing only a few minute bristles

conforming to the dorsal type. Scales twelve to thirty-five pairs or more; segments carrying these devoid of cirri. Segmental organs (nephridia) opening ventrally on a papilla near the bases of the feet; nerve-cords within the granular layer of the epiderm and between the oblique muscles. Dorsal bristles with more or less tapered simple tips; ventral bristles with simple or bifid hooked tips. Development by trochophores. The general arrangement of the body-wall in this family may best be understood by consulting the accompanying figure.

Fig. 20.



Section of body-wall of *Polynoë scolopendrina*, Sav., in the line of a median dorsal papilla (*a*), about the middle of the body. *b*, bases of dorsal bristles; *b'*, bases of ventral bristles; *c*, ova scattered in the various parts of the perivisceral (cœlomic) space (*pv*); *d*, intestine; *d'*, portions of intestinal cæca; *dm*, dorsal longitudinal muscles; *lm*, band of longitudinal muscular fibres above the nerve-area; *om*, oblique and nearly vertical muscles; *vm*, ventral longitudinal muscles; *nc*, nerve-cords; *dv*, dorsal vessel with mesenteries at side; *v*, ventral vessel with mesenteries; *vc*, ventral cirrus; *so*, segmental organs (nephridia). The dorsal cirrus is not shown, nor the perivisceral corpuscles. The drawing was made by Dr. Masterman from a somewhat contracted example.

Many authors, such as Audouin and Milne Edwards, Johnston, Œrsted, Grube, De Quatrefages, and Marenzeller, following Savigny, regarded the Polynoidæ as one or more genera of the family Aphroditidæ.

Kinberg, on the other hand, gave them the position of an independent family, or indeed two, if we include *Iphione*, with the characters indicated in the subsequent summary. In this he was followed by Malmgren and Théel. Claparède, again, varied the latter arrangement a little by making them his second Tribe, an equivalent position.

Savigny (1820) placed the Polynoidæ as a genus of his family Aphroditæ under the Nereids, the general characters being the oval or oblong body, with its elytra, which were typically a dozen pairs, branchiæ (which he says are easily recognised), head and its median unpaired, and external antennæ, four eyes, and armed papillose proboscis. With the exception of the remarks on the branchiæ his description is fairly good.

By Audouin and Milne Edwards (1834) the Polynoidæ were distinguished from the Aphroditidæ by the number of their antennæ, by the armature of the proboscis, and by the alternation of scales with cirri. Some have large scales completely covering the dorsum, others have them so minute as to leave the dorsum more or less bare, and in some cases they are vesiculate. The antennæ are five or rarely four; proboscis armed with large jaws. The simple branchiæ occur with the cirri. The first pair of feet terminate in long tentacular cirri; the appendages of the last segment form styles. They frequent banks

of oysters, and some construct mucous tubes with fragments of shells. Some are phosphorescent. They described thirteen species of the genus.

The Polynoidæ were included by Kinberg (1857) under his third family, Polynoina. His diagnosis was:—Elongated body; no facial tubercle; convex cephalic lobe with the base of the tentacle from the middle anteriorly; two antennæ; four eyes; palpi thick. Pharynx exsertile, cylindrical, without long papillæ; horny jaws. Scales twelve to thirty-five pairs. Segments bearing elytra devoid of cirri. He gave six genera, viz. *Lepidonotus*, *Halosydna*, *Antinoë*, *Harmothoë*, *Hermadion*, and *Polynoë*, the second, third, fourth, and fifth being new.

Michael Sars (1860) reviewed the condition of the Polynoidæ, as shown by Œrsted and the subsequent writers up to date, and gave a list of the northern examples with new species, viz. *P. nodosa*, *P. asperrina*, *P. rarispina*, and *P. scabriuscula*.

De Quatrefages (1865) described the Polynoidæ as having a very distinct head, furnished with three antennæ and four eyes. The buccal segment is characterised by the presence of two pairs of tentacles, the superior being bifurcate, the much longer and larger inferior, simple. The feet are more or less biramous, but the setigeous processes are united to a common base. Elytra alternating with superior cirri, and covering the back throughout. Proboscis armed with two pairs of horny jaws.

In his remarks on the tribe of the Polynoidæ Claparède (1868)[1] criticises the great increase in the genera caused by Kinberg and Malmgren. Thus the former subdivided the genus Polynoë of Savigny into six, taking as his basis of classification the position of the lateral antennæ; the number of the scales; the fact of their covering more or less of the dorsum; and the length of the body. Malmgren again augmented the number of the genera by nearly as many more as Kinberg, so that the original genus of Savigny was multiplied nearly twenty-fold. Claparède points out that the objections of Sars to the methods of Kinberg apply equally to those of Malmgren, because he not only employs the same elements in classification, but adds others of less value, such as the structure of the terminal parts of the ventral bristles. He shows that, for instance, the same species of *Syllis* presents features which would appear to subvert the reliance to be placed on this method, since the compound bristles are often replaced by simple bristles. There is, however, more in the systematic study of the bristles than Claparède imagined. Claparède grouped the Polynoidæ as one of the Tribes of his family Aphroditiens, Sav. (*sens str.*).

In his supplemental volume he correctly indicated, under *Hermadion fragile*, the position of the nephridia and their function as channels for the extrusion of the reproductive elements.

Grube, in his 'Annulata Semperiana,' gave the following description of the genus *Polynoë*. Body oblong or elongated, flattened and vermiform; segments more or less numerous, second, fourth, fifth, and every alternate segment to the twenty-third bearing elytra, the intermediate ones having cirri. The segments after the twenty-third have scales on every third foot or they are absent, rest bear cirri. Cephalic lobe rounded, more or less bipartite; two pairs of sessile eyes, three tentacles, two subtentacles (palpi). Buccal segment with two tentacular cirri, no setæ; two bundles of bristles and two cirri.

[1] Ann. Nap.

Ventral cirrus twice as long as pinna, setæ simple, two anal cirri. Elytra covering dorsum or leaving it bare. Pharynx with a crown of simple papillæ. Jaws horny, not denticulated. He grouped the species chiefly according to the arrangement of the tentacles, the number of the elytra and their structure, with a few additional particulars. The account is thus more detailed than that of 1874.

G. Darboux[1] fils distinguishes in the dorsal cirrus the cirrophore and the cirrostyle. The former is an evagination of the entire musculo-cutaneous envelope. The cirrostyle is inserted on the cirrophore by a delicate epidermic membrane. A secretion, he says, fills a glandular pocket at the insertion and causes a strain so that rupture ensues.

Whether as a family or a sub-family the Polynoidæ are sufficiently distinguished from the Aproditidæ by the shape of the body, the absence of a facial tubercle, the diminished size and the chitinous armature of the proboscis, the reduction in size of the alimentary cæca, and the position of the segmental (nephridial) papillæ.

They are cosmopolitan forms, yet each area has its characteristic species. Thus in Britain such as *Eupolynoë anticostiensis*, McI., *Melænis Loveni*, Mgrn., and *Eucranta villosa*, Mgrn., are absent, while they are found in more northern latitudes.

Commensalism is not uncommon in the group; thus Dr. Baird found *Harmothoë cirrata* (?) in the tubes of *Chætopterus*, *Gattyana cirrosa* is common in the tubes of *Amphitrite*, *Polynoë scolopendrina* in tubes of *Terebella nebulosa*. *Malmgrenia* and *Acholoë* occur on *Echini* and starfishes (*Astropecten*), and *Harmothoë* in *Euplectellæ*. Dr. Baird notes that Mr. Lord found at Vancouver's Island a *Lepidonotus* coiled under the foot of a *Fisurella*, and another on a starfish. Verrill,[2] again, mentions an orange-red *Polynoë* which occurs amongst the tentacles of the anemone, *Bolocera Tuediæ*, and another species with a dark purple proboscis and finely spinulose scales is very abundant among the branches of *Acanella Normani*. Dr. H. J. Johnson adds two species to the forms living as commensals, viz. *Polynoë reticulata*, in tubes of *Amphitrite* and *Thelepus*, and *P. gigas* in an *Amphitrite*, both from the Pacific coast of California.[3]

Genus VIII.—Lepidonotus[4] (*Leach*, 1816), char. emend.

Body short, more or less linear. Anterior part of the cephalic lobe produced into the bases of the median and lateral tentacles. Palpi smooth or with papillæ in five longitudinal rows. Three comparatively short alimentary cæca directed forwards into the peri-pharyngeal space. Elytra, twelve pairs, covering the dorsum entirely, and occurring in segments bearing feet thus: 1, 3, 4, 6, 8, and so on to 20, 22. Bristles of the superior lobe slender, serrate, shorter than the inferior, which have a smooth portion below the slightly hooked tip, and then a spinulose region beneath. Nerve-trunks in the granular layer of the epiderm, between the powerful oblique muscles.

[1] C. R., 126 (1878), pp. 257-8.

[2] 'Albatross' Explorations, 'U.S. Fisheries Report,' 1885, p. 525.

[3] 'Proceed. Calif. Acad. Sc.,' 1896, 3rd ser., vol. i, No. 5, p. 170, &c.

[4] Kinberg (op. cit., 1857) gives as a diagnosis of the genus:—"Anterior part of the cephalic lobe produced into the bases of the tentacle and antennæ; pharynx with papillæ; jaws; elytra covering the dorsum entirely; body short." Nothing special can be made out of his remarks on the jaws and tentacular cirri.

1. Lepidonotus squamatus, *Linnæus*, 1788. Plate XXV, fig. 1.

Specific Characters.—Lateral tentacles longer than the cephalic lobe, median tentacle, tentacular cirri, buccal and dorsal cirri inflated below the apex, smooth. Palpi elongated and tapering, but in spirit scarcely longer than the median tentacle, the basal part of which equals the length of the cephalic lobe. Scales ovate and reniform, studded with chitinous bosses and ciliated on the outer margin. Bristled segments twenty-six. Dorsal bristles long, tapering, and finely serrated, longer than those of *L. clava*. Ventral bristles stout, with a short series of spikes on the distal and slightly thickened portion of the shaft below the falcate apex. The distal row has two longer spines. Ventral nerve-cords comparatively small, lying within the dense cuticle and thin granular layer of the epiderm, and in the area between the attachments of the oblique muscles; only connective tissue internally.

Synonyms.

1766. *Aphrodita squamata,* Linn. Syst. Nat., 12th edit., p. 1084.
1788. „ „ „ „ (Gmelin) p. 3107.
1765. „ „ Baster. Opusc., subsec. ii, 2, p. 66, tab. vi, f. 5, A, B, C, D.
1766. „ „ Pallas. Misc. Zool., p. 91, tab. vii, f. 14 *a—d*.
1768. „ „ Pennant. Brit. Zool., iv, tab. xxiii, f. 26.
1776. „ *punctata,* O. F. Müller. Prod. Zool. Dan., p. 218, n. 2642.
1789. „ „ Abildgaard. Zool. Dan., iii, p. 25, tab. xcvi, f. 1—4.
1800. *Die gedüpfelte Aphrodite,* O. F. Müller. Naturges einiger Wurm-Arten, p. 170, tab. xiii.
1816—1830. *Aphrodita squamata,* Cuvier. Dict. des Sc. Nat., ii, p. 283.
1820. *Polynoë squamata,* Savigny. Syst., 22.
1828. *Eumolpe squamata,* Blainville. Dict. des Sc. Nat., lviii, p. 458, pl. ix, f. 2.
1834. *Polynoë squamata,* Aud. & Ed. Annél., p. 80, tab. i, f. 10—16.
1839. „ „ Johnston. Ann. Nat. Hist., ii, p. 432, tab. xxii, fig. 1.
1840. „ „ Grube. Actin. Echinod. u. Wür., p. 87.
1843. *Lepidonote punctata,* Œrsted. Annul. Danic. Conspect., p. 12, f. 2, 5, 39, 41, 47, 48.
„ *Lepidonotus squamatus,* H. Rathke. Beiträge z. Faun. Norweg., 149.
1851. *Polynoë squamata,* Maitland. Fauna Belg., p. 213.
1855. ? *Lepidonote armadillo,* Leidy. Mar. Invert. Rh. Is. & N. J., p. 16, pl. ii, f. 54.
1858. *Lepidonotus squamatus,* Kinberg. Freg. Eugen. Resa, p. 13, tab. iv, f. 15.
1860. *Polynoë squamata,* Sars. Vid.-Selsk., Forhandl. for 1860, p. 4 (sep. copy), 57 (original copy).
1865. *Lepidonotus squamatus,* Johnston. Cat. B. M., p. 109, pl. viii, f. 1.
„ „ Malmgren. Nord. Hafs. Ann., p. 56.
„ *Polynoë dasypus,* De Quatrefages. Hist. Ann., i, p. 266.
1873. *Lepidonotus squamatus,* Willemoes-Suhm. Zeitsch. f. w. Zool., xxiii, p. 347.
„ „ „ Verrill. Invert. An. Vin. S., Rept. U. S. Fish., i, p. 581, pl. x, f. 40, 41.
1874. „ „ Möbius. Untersuchung. d. Ostsee, p. 112.
„ „ „ McIntosh. Ann. Nat. Hist., April, 1874, p. 261.
1875. „ „ McIntosh. Invert. and Fishes St. And., p. 115.
1877. „ „ Huxley. Man. Invert., p. 227, &c.
1879. „ *squamata,* Webster. Annel. Chæt. Virgin., p. 4.
„ „ *squamatus,* Tauber. Ann. Danic., p. 79.

1883. *Lepidonotus squamatus,* Levinsen. Nord. Annulat., p. 194.
1884. „ „ Webster & Benedict. Ann. Mass., p. 699.
„ *Polynoë squamata,* A. G. Bourne. Trans. Linn. Soc., Zool., ii, p. 349, &c.
1886. *Lepidonotus squamatus,* Harvey-Gibson. Verm. Liverp., p. 150.
1888. *Polynoë squamata,* De Saint-Joseph. Ann. d. Sc. Nat. (7), v, p. 151.
1890. *Lepidonotus squamatus,* Malaquin. Ann. Boulon., p. 15.
1896. *Polynoë squamata,* H. F. Johnson. Pacific Annel., p. 166.

Habitat.—Everywhere round British shores, from Shetland to the Channel Islands, under stones between tide-marks, and stretching to the laminarian and coralline regions beyond, as well as to comparatively deep water (fifty fathoms), where it is partial to crevices in old shells, especially univalves covered with coils of Sepulæ, and the bottoms of stones. It is common in the stomachs of the cod and other fishes, and is frequently tossed on shore after storms along the east coast, as at St. Andrews. It extends across the Atlantic to the Canadian and American waters—from the St. Lawrence to Cape Cod, and passes as far south as the Azores, off which (Fayal) it was dredged at a depth of 450 fathoms in the 'Challenger.' In the north it ranges from Greenland to the Norwegian and Western European coasts, and Gould includes it in his list from the shores of Massachusetts.

Length about 25 mm.; more rarely 50 mm.

Head (Plate XXV, fig. 2) broadly ovate or rounded, bounded posteriorly by the fold of the nuchal plate, and anteriorly running into the bases of the median and lateral tentacles. It is smooth, iridescent, purplish pink, has a longitudinal median furrow, and bears on its dorso-lateral margins the four black eyes, the first and slightly larger pair of which are rather in front of the middle line, and the second towards the posterior border. Anteriorly the base of the median tentacle occupies the centre, and is distinguished from the smaller bases of the lateral tentacles, conjoined with it, by the arrangement of the dark pigment which forms a V with the point posteriorly. The median tentacle is considerably longer than the lateral, all having the bulbous and more deeply pigmented region below the pale filiform tip. Beyond the ceratophore the column is opaque, whitish, toned off gradually to the dark ring at the enlargement. The tentacular cirri are similar in structure but more slender. All these organs and the palpi are smooth. In life the latter (palpi) are longer than the median tentacle. Moreover, the first foot (basal process of the tentacular cirri) bears on its inner edge towards the front a tuft of six or seven slightly curved and tapered spinous bristles. These are shorter and thicker than the ordinary dorsal bristles. They are thus apparently more numerous than in *L. clava.* The small size of all the appendages of the head is a distinctive character when contrasted with the latter species.

Body of about twenty-six bristled segments. Dorsum smoothly rounded, with three or four bars in each segment, at the sides of which are soft elevations upon which the scales are placed, or which bear cirri at their external borders, the former being more prominent than the latter. The dorsum is pale, but between the elevations for the last pair of scales posteriorly a brown central patch occurs, while the segment behind presents a median, blunt, spear-head of brown, and a lateral ocellate arrangement, the whole being symmetrical. In the preparations the rigid contraction of the longitudinal

ventral muscles divides the surface into a median and two lateral regions, the former having the furrows of the segments from side to side, the latter only at the edges, as the muscular region is smooth. In some the dorsum is rendered dull ochreous by a deposit of this colour in the grooves, the ridges being pale, and the same ochreous coating is found on the under surface and inner edge of the scales. A solution of potash makes no change, but dilute hydrochloric acid slowly removes the deep orange colour and renders the granules invisible.

Posteriorly the body terminates in two symmetrical basal processes which bear cirri longer than on other parts of the body, but having the same structure and coloration. The anus is a small aperture (especially when contrasted with that of *L. clava*) opposite the posterior border of the penultimate pair of feet.

Proboscis.—The exserted proboscis shows a series of eighteen[1] papillæ around the margin. These vary somewhat in shape, being conical or hatchet-like in outline, with a terminal process and a beak, or in shape somewhat like a dactylozoid of Millepora. All have a trace of dark pigment in the centre. The horny teeth alternate, so that the upper go slightly to the right of the under pair. The horny ridge on each side of these organs will also subserve the functions of division of food.

Three cæca from the gut pass obliquely outward to the dorsal wall, the fourth being nearly transverse. They are larger and less alternate than those of *Harmothoë*, and of a darker yellow hue. They are richly glandular, with deep yellow granular cells or masses here and there, giving a minutely dotted aspect to the surface. Their tips present only a short lobe in addition to the terminal one. Their arrangement and aspect thus differ from those of *Harmothoë*.

The food in the intestine consists of sand-grains, fragments of crustaceans, and other débris.

Colour.—The dorsum is of an uniform brownish-grey hue in some, or with a lighter area on each scale, the inner edge of which has, moreover, a dark brownish spot. In others the central pale area has a nearly complete brownish ring encircling it. In those from the stomach of the cod the papillæ, especially on the anterior scales, retain their colour, so that they are conspicuous. Again, in examples from Guernsey and Shetland the larger bosses on the anterior scales were of a reddish amber hue, while some young specimens were mottled with reddish brown or madder brown. Those from the Gulf of St. Lawrence had bristles of a dusky golden hue, and the papillæ of the scales were also darker. Under surface iridescent, bluish pink anteriorly, and pinkish posteriorly. In some from Shetland (Bressay Sound) the bases of the posterior feet ventrally had a well-marked touch of blackish pigment situated between the nephridial processes and extending from the tail fully a dozen feet forward, and a series of dark touches in the median line in each segment, a pale longitudinal streak, however, cutting each into two.

Scales.—The first pair of scales are rounded, and, like the two or three following, have large horny tubercles, the darker colour in some specimens making them very prominent, and each is ciliated for more than half its circumference. The next pair are reniform, and the succeeding are more or less ovoid. The brownish horny tubercles or

[1] De Saint-Joseph says sixteen.

bosses project as blunt points from the surface in profile. The scales (Plate XXXII, fig. 1) increase in size posteriorly, the general shape being ovoid, though they are wider at the ciliated posterior border. The under surface is smooth and iridescent, and shows the pear-shaped scar for the attachment of the pedicle. In some, however, the surface presents the ends of fibres torn from the pedicle, and this sufficiently explains why some are readily removed, and others require separation with a knife. All the scales considerably overlap each other, and cover the dorsum entirely. The simple filiform cilia which occur on the edge appear to preserve the same relative length from the first to the last, and they are often coated with a muddy deposit, and have various microscopic growths. So far as can be observed, these cilia are simple and nearly cylindrical processes with a smoothly-rounded tip, and a median streak, as if from an axis of differentiated tissue. Under the action of potash the scale becomes coarsely granular or areolar, the areas of the bosses or blunt spines being characterised by a more regular arrangement of granular cells.

In young examples, barely 3 mm. in length, the scales have a few large tubercles, and the cilia are hirsute, with grains of various kinds, besides being proportionally larger than in the adult. De Saint-Joseph found that in a small example, 5 mm. long, the scales were covered with *Grammatophora marina*.

In general structure the scales have externally a more or less chitinised cuticular layer, with a cellular (columnar) coat beneath, a fibrous stroma passing between the dorsal and ventral layers, and finely-branched nerves, from the ganglionic mass at the scale tubercle, terminating in end-organs. The external surface has various chitinous tubercles or processes, and the edge has cilia.

The chitinous tubercles and spines are placed in the thick cuticular layer, and the larger are hollow in the centre, and the surface is roughened with small processes so that they look honeycombed. This is due to the minutely nodular condition on the surface, and not to scales, as Baron de Saint-Joseph[1] states. When the dark brownish (Algoid ?) coating begins to cover their surface, the "bosses" present a reticulated appearance, since the parasitic growth first invades the hollows between the minute tubercles. Pigment occurs in the cellular layer beneath. The scar has a complex series of muscles, some of which pass into the hollow of the organ. The majority of the muscular fibres are fixed to the scale-tubercle. As Prof. Haswell[2] says, they serve in the Polynoidæ for protection, for the production of phosphorescence, for sensation, and in certain forms for incubation.

The scales readily separate in ripe examples, and the under surface is as finely iridescent as in *Haliotis*. Captured specimens reproduce their scales. Thus in a month they reach about a third the size of the original organs, but are pale, and their translucent condition shows that the tips of the papillæ are minutely nodular.

Many parasitic structures occur on the scales, but none more beautiful than *Carchesium*, the long tufts of which resemble, under the lens, miniature zoophytes.

Occasionally examples occur with a deep orange coating on the under surface of the scales and the dorsum of the body. In structure it is minutely granular, as in the darker (blackish) coating on the bristles and other organs.

[1] 'Ann. des Sc. Nat.,' 8th sér., v, p. 231. [2] 'Ann. Nat. Hist.,' 8th sér., x, p. 241, 1882.

Feet.—The second foot has a small dorsal division, which projects anteriorly, and no dorsal cirrus. The dorsal bristles are tapering and spinous from the skin outwards, as in other parts of the body. On the other hand, the ventral division has more slender bristles, with longer and more tapered spinous tips than elsewhere. When seen antero-posteriorly they somewhat approach the pinnately spiked forms of the Aphroditidæ, though, of course, differing in character. The long tentacle-like ventral cirrus comes from the anterior and inner base of the foot, and is directed forwards, thus diverging both in size and relation to the parts of the foot from the subsequent organs.

The third has become more or less normal in structure, except that the ventral division has not attained the size of that in the fully-developed foot. The serrated dorsal bristles spring from an elevation on the upper and anterior border, the only representative of the dorsal division, if we except the elevated crest bearing the dorsal cirrus. The ventral bristles are stronger, the serrated tips somewhat shorter, and the points slightly hooked. The slender inferior series alone still resemble those in the second foot. The ventral cirrus has now the normal position and form.

The fourth foot, though smaller, is nearly typical, and the short curved dorsal bristles are also present. The ventral bristles have tips only a little longer than those of the central feet. The ventral cirrus is in the normal position, but the long papilla of the segmental organ does not appear till the eighth foot, and it continues to the penultimate one.

The typical foot (Plate XLII, fig. 25) is massive, and presents little differentiation of dorsal and ventral divisions other than the bristles and spines, for the main mass of the foot is formed by the ventral division. The dorsal bristles rise from a papilla placed far back on the dorsal edge and in the front of the cirrus, where that is present, and their tips, as a rule, extend little beyond the bases of the ventral bristles. In structure they consist of long, tapering, spinous bristles (Plate XXXVII, fig. 13), the spines being arranged in close rows from base to apex, a few on the dorsal edge being shorter and stouter, with coarser spikes (Plate XXXVII, fig. 12). The ventral bristles (Plate XXXVII, figs. 9 and 10) have slightly longer tips than in *L. clava*, and the two spines at the tip of the rows are characteristic.

The shape of the foot does not essentially alter posteriorly, and the ventral bristles of the last foot have tips only a little longer than in the centre of the body, a feature which almost disappears in that next in front.

The dorsal cirri spring from a dilated base (ceratophore) which has anteriorly and posteriorly an area in which a whitish granular amorphous substance is deposited. The deposit, indeed, marks the bulbous region on each side. The column is pale, but at the dilatation is a blackish band, while the filiform tip is pale.

The dorsal bristles are generally covered with fine mud and parasitic growths. The general hue of the ventral is golden, but it varies in intensity, some of the northern forms, *e. g.* from Norway and the Gulf of St. Lawrence, having darker bristles. In one large example from St. Abb's Head one side had golden bristles, while in the other all were of a pale colour. The same form had an enigmatical, hyaline, stalked structure, with numerous rootlets on a posterior scale. An occasional foraminifer and a small patch of *Lepralia* also are met with in large examples.

The large deep-water forms (forty fathoms off St. Abb's Head) seem to be softer than those between tide-marks, and have the scales more or less abraded.

Reproduction.—Large examples from the neighbourhood of St. Abb's Head were loaded with ova and ripe sperms on August 1st, 1884, and the Irish examples were so in July. At St. Andrews nearly ripe as well as ripe males and nearly ripe females occur from the beginning of May to the end of June, and it is probable that the spawning period is in June and July. The males are distinguished by their pale hue, whereas the ripe females are of a slate-grey. The spermatozoa have a globular or slightly ovoid head and a long tail, as in *Nereis*. No ova could be pressed out of the long segmental (nephridial) processes with their dilated and truncated ends, but they readily issued from ruptures of the parietes of the body. The segmental papillæ are alike in both sexes, of moderate length, and with a little dark pigment at the trumpet-like ends.

Young examples of about 3 mm. in length occur in July ('Irish Exped.,' 1886, to Gweedore). These show proportionally larger cilia, larger and fewer bosses on the scales, and the cirri have more elongate tips, with scarcely a trace of the enlargement below. The ventral bristles have proportionally longer tips.

When disturbed in their native haunts, their motions are comparatively slow and cautious, so different from the restless activity of *Harmothoë imbricata* or *Evarne*. They cling tenaciously, partly by aid of their bristles, to rough surfaces, so that, for instance, the tubes of *Filigrana* give way in extracting them, and it is difficult to pull them from grooves in shells and similar hollows. Fine examples are procured in rock-pools under large stones that have been little disturbed for many years, where, for instance, *Ægirus punctiluceus* and patches of *Alcyonium* occur. They are partial to hollows and crevices; thus one thrust itself into the tube of *Protula*, and being preserved therein has retained the cylindrical shape. Hitherto, however, they have not been found commensalistic in the tubes of other annelids, but occupy their sites independently under stones in rivulets and rock-pools near low-water mark, and for some distance landwards. In confinement, specimens of *Evarne* and *Harmothoë* will occasionally cling to the dorsum, and small examples may even insinuate themselves along the dorsum under the scales.

The crustacean parasite, *Sellius bilobus*, Kroyer,[1] is found on this species in northern waters, while *Perigonymus repens*[2] occurred in great beauty on the anterior scales of fine specimens trawled in thirty-five to forty fathoms off St. Abb's Head.

While they are not infrequently found in the stomach of the cod and other fishes, it is curious that young green cod in the tanks refused them and other Polynoidæ, such as *Harmothoë* and *Lagisca*, while they readily devoured *Nereis*, *Trophonia*, and *Cirratulus;* the mode in which the Polynoidæ curved themselves and kept the bristles prominent, showed that they were aware of the value of such protective organs. Taken into the mouth of the green cod they were at once rejected, and fell to the bottom of the tank, where they were engulfed by *Cottus*, but with a similar result, viz. immediate rejection.

O. F. Müller, in his 'Wurm-Arten,' calls this species "die gedüpfelte Aphrodite mit rauhen einfärbigen Schuppen."

[1] 'Naturhist. Tidskrift.,' 1ste R., i, 1837.

[2] This zoophyte recalls the loss lately sustained by science in the death of the Rev. Dr. T. Hincks, whose patient and accurate work amongst the Hydroids and Polyzoa will long be remembered.

Pallas ('Miscellanea Zoologica') mentions that Linnæus found it in deep water. It occurs also with pelagic Fuci, and amongst the latter and Sertularians at the bottom of the sea. He gives an account of the external appearance and arrangement of the scales, and a brief outline of its anatomy.

It is doubtfulif O. F. Müller's *Aphrodita punctata* refers entirely to this form, since he speaks of sub-crescentic bluish spots.

Audouin and Milne Edwards (1834) describe it as having twenty-seven segments, and reaching eighteen lines in length. They think that the *Polynoë punctata* of O. F. Müller comes near *P. squamata*, and so with the *Aphrodita clavigera* of M. Freminville;[1] but this cannot be, as M. Freminville found it phosphorescent.

It is difficult to say what H. Rathke's (1837) *Polynoë granulosa*[2] is. It may be this species in which a pair of scales has been lost.

Leidy's[3] *L. armadillo* appears to be allied to this species or to *L. clava*. His observation in regard to the unusual number of the tentacles is erroneous.

Kinberg[4] rested his specific characters on the comparative length of the tentacles, and the fact that the inferior bristles were serrated below the apex. He gave a correct account of the scales. De Quatrefages[5] adds nothing new to the foregoing, and he includes *Lepidonotus clava*, Mont., as a synonym, though with doubt. Subsequent French authors have corrected this error.

2. Lepidonotus clava, *Montagu*. Plate XXVI, fig. 1.

Specific Characters.—Head similar to that of *L. squamatus*. The large anterior eyes are in front of the middle line, and the respective pairs on each side are wider apart. Anteriorly the broad basal region of the median tentacle is more distinctly separated from the bases of the lateral tentacles than in *L. squamatus*, and the transverse diameter of the three processes is greater. Median and lateral tentacles thicker, and the bulbous region below the tip marked by a more distinct band of blackish pigment. Palpi with five rows of minute papillæ. Segments twenty-seven, characteristically marked with pigment on the dorsum; segmental (nephridial) papillæ large and thick. Scales more or less circular throughout, and do not quite cover the dorsum, more flexible than in *L. squamatus*, and, with the exception of the first four pairs, smooth. The first three have numerous small tubercles generally distributed, while the fourth pair have a smaller number. Papilla for the dorsal bristles more prominent than in *L. squamatus*. The dorsal bristles are shorter, thicker, less tapered and more curved than in *L. squamatus*, but have similar structure. The ventral bristles have shorter curved or falcate tips, with fewer rows of spikes, and the bare portion is shorter than in *L. squamatus*.

[1] 'Nouveau Bulletin de Sc. par la Soc. Philomat.,' iii, p. 253.
[2] 'Beitr. z. Fauna der Krym,' p. 408.
[3] 'Americ. Journ. Nat. Sc.,' p. 148, pl. xi, f. 54.
[4] Op. cit., 1857.
[5] Op. cit., 1865.

Synonyms.

1808. *Aphrodita clava,* Montagu. Trans. Linn. Soc., ix, p. 108, pl. vii, f. 3.
1824. *Lepidonotus clavatus,* Leach. Supp. Ency. Brit., i, p. 452.
1826. *Polinoë scutellata,* Risso. Hist. nat. Europ. mérid., iv, p. 414.
1828. *Eumolpe squamata,* Blainville. Dict. Sc. Nat., lvii, p. 458, Atlas, f. 2.
1829. *Eumolpe squamata,* D. Chiaje. Mem. sulla Storia, iv, p. 155, tab. lvii, f. 8 and 17.
1836. *Halithæa clava,* Templeton. Loud. Mag. N. Hist., ix, p. 234.
1838. *? Polynoë squamata,* Grube. Anat. u. Physiol. Kiemenw., p. 60, tab. ii, f. 13.
1840. *?* „ „ (Sav.), Grube. Act. Echin. u. Würmer, p. 87.
1860. „ *clypeata,* Grube. Arch. f. Naturges., Bd. xxvi, p. 71, taf. iii, f. 1.
1861. „ „ Grube. Ausflug n. Trieste, p. 138, taf. iii, f. 1.
1864. „ „ Grube. Insel Lussin, p. 77.
1865. *Lepidonotus clava,* Johnston. Cat. Brit. Mus., 111, pl. iv, f. 5 and 6.
„ *Polynoë modesta,* De Quatrefages. Hist. nat. Annel., i, p. 243.
1867. *Lepidonotus clava,* Malmgren. Ann. Polych., p. 130.
1870. *Polynoë grubiana,* Claparède. Suppl. Annel. Chétop., 9 (373), pl. i, f. 2.
1875. *Lepidonotus clava,* Marenzeller. Sitzb. der k. Akad., 1 Abth., Juli-Heft (sep. Abd.), p. 1.
1876. „ „ McIntosh. Trans. Z. S., ix, p. 374.
1880. „ „ Langerhans. Zeit. f. w. Zool., xxxiii, p. 273, taf. xiv, f. 2 ?
1881. *Polynoë clava,* Langerhans. Canar. Annel., Nova Acta, 42, iii, p. 108.
1884. „ „ A. G. Bourne. Trans. Linn. Soc. Zool., ii, pp. 347—356, pls. xxiv—xxvi.
„ *Lepidonatus clava,* Carus. Faun. Medit., p. 202.
1885. *Polynoë grubiana,* Jourdan. Zool. Anz., viii, p. 128, f. 1, 2.
1887. „ „ Jourdan. Arch. Zool. Expér., v, pp. 115—120, pl. iv, f. 11, 12, 16, 17.
1898. *Lepidonotus clava,* De Saint-Joseph. Ann. d. Sc. nat., 8 sér., v, p. 225.

Habitat.—This species is a southern and western form—ranging from Falmouth and the Devonshire coast to Gairloch, Ross-shire, and extending to Valencia Harbour in Ireland. None appear on the eastern shores. It is chiefly littoral, occurring under stones in tide-pools even near high-water mark, as in McNiel's Bay, Lochmaddy, as well as on oyster-beds under water. It is distributed along the shores of France to the Mediterranean, Adriatic, and perhaps to the Canaries (Langerhans).

Length about 30 mm.; breadth 8 mm.

Head (Plate XXXVII, fig. 4) similar in outline to that of *L. squamatus*, bounded posteriorly by the nuchal collar, which has the dark pigment of the dorsum on its edge. The surface is smooth and iridescent, as in the former species. The eyes are visible from the dorsum, the larger anterior pair in front of the middle line and wider apart, and two posteriorly. Anteriorly the broad basal region of the median tentacle is more distinctly separated from the bases of the lateral tentacles than in *L. squamatus*, and the transverse diameter of the three processes is greater than in the latter species, as might be expected from the larger size of all the appendages. The median and lateral tentacles are proportionally thicker, and the bulbous region below the tip better marked, especially as a band of blackish pigment occurs below the enlargement. A little brownish-black pigment also exists on the columns of these processes and of the tentacular cirri, all these organs being somewhat stouter and more boldly pigmented than in *L. squamatus*. The palpi are somewhat filiform at the tip, and, as shown by Grube, are marked by five rows

of elongated papillæ, which are conical and taper to a point. They are best developed towards the tip of the organ. Prof. Bourne describes each as furnished with a sensory hair.

Body.—The dorsum is marked in the median line by broad interrupted patches of blackish-brown pigment, three or four of the most prominent anterior touches having a pale area in the centre. These touches extend outward to the feet posteriorly; moreover, dorsally the bases of the feet have black pigment, which becomes strongly pronounced after the anterior third, the effect of the mottling of the feet and body posteriorly being somewhat like that on tortoise-shell.

The ventral surface has a similar arrangement of areas to that in *L. squamatus*, only the lateral are marked off from the bases of the feet posteriorly by a slightly elevated and pigmented border, which terminates at the bases of the caudal styles, and is connected with touches which extend a short way forward in the median line.

Posteriorly the body terminates in a grooved pedicle for the large symmetrical caudal styles, all these parts being better marked than in *L. squamatus*. The anus is situated dorsally at the base of the pedicle, to which it sends a ridge-like process.

The bristled segments are twenty-six.

Proboscis and Digestive System.—De Saint-Joseph found sixteen papillæ along the margin of the proboscis, but there are eighteen, as in *L. squamatus*, in all the examples examined. They are speckled with black pigment. In transverse section the organ is typical.

Only two cylindrical and rather massive cæca pass forwards into the peripharyngeal space, and their extremities appear to be devoid of any distinct differentiation. The stomachal region of the gut anteriorly is remarkably muscular, the fibres at the front end forming a row of separate dull orange lobes which clasp the proboscis, and which resemble a series of glands. Their tissue, however, is wholly muscular, the powerful fibres forming loops in the rounded lobes, which are sometimes made by rupture of the fibres from the proboscis.

Colour.—The dorsum is of a dull brownish hue speckled with white, and with dark touches on the scales. The under surface is pale, with some dark touches at the mouth and the sides of the tail. The segmental papilla has a dark column and a whitish tip in the posterior half of the body. At the reproductive season the males are pale under the scales, the females dark grey.

Scales.—The scales (Plate XXXII, fig. 2) of this species are more or less circular throughout, and do not quite cover the dorsum, or, as Marenzeller says, leave bare rhomboidal spaces. Some are firmly fixed, others easily separate from the pedicle as in *L. squamatus*. They are more flexible than in that species, and, with the exception of the first four pairs, show only minute tubercles. The first, second, and third have numerous small tubercles or blunt dumb-bell shaped papillæ, distributed generally over the surface, while the fourth has a smaller number, less distinctly raised above the surface. The edge of the scale throughout is smooth. They are fixed by the umbilicus, which is nearer the outer than the inner margin, this area being generally marked dorsally by a white patch bordered with black pigment. The scales give the dorsum generally a leaden hue, or in some a dusky brown, speckled with white. Besides the white patch, which posteriorly is sometimes reniform, at the umbilicus the scales are mottled with a

blackish or slightly glistening dull leaden hue, or with more numerous black specks, which posteriorly do not seem to be connected with papillæ. The under surface is smooth and iridescent, and has the opaque whitish patch of the umbilicus. In spirit the anterior scales generally show a fold from the umbilicus to the external margin.

The minute structure of the processes of the scales has been specially described and figured by De Saint-Joseph,[1] who states that the tip is "scaled" and spinous. His figure, indeed, is regularly and closely diced. So far as can be observed in the British specimens, it is the tip and neighbouring part of the capstan-like column of the process of the scale which is thus covered, as recently described and figured.[2]

Feet.—On the dorsum of the first foot is a minute tuft of tapered serrate bristles (Plate XXXVII, fig. 14), and a single large spine which penetrates the skin beneath the former. Prof. Bourne speaks of four bristles being borne by each division. This is probably a misprint, as his figure differs.

The second foot diverges from that of *L. squamatus* in having its comparatively large ventral cirrus directed more distinctly inwards and forwards, in the smoother foot and the more translucent bristles. Moreover, while the dorsal series more or less correspond at first sight, yet the character of the serrations slightly differs from those of *L. squamatus*, being somewhat shorter and finer, and the tips of the bristles are more tapered. The ventral bristles of *L. clava* again differ in having their long tips spinous to the apex, whereas in *L. squamatus* the spinous tips are shorter, the tip is bare, and in some slightly hooked.

In the third bristled foot (the second of some authors) the dorsal bristles are less gradually tapered than in *L. squamatus*, while the ventral series have longer spinous regions bare in the upper at the tip—which is more slender than in *L. squamatus;* indeed, the whole bristle is more slender than in the latter species, and the rows of spines longer. Both dorsal and ventral cirri, moreover, are different, being proportionally larger and more bulbous below the filiform extremity.

In the fully-formed foot (*e. g.* the tenth, Plate XLII, fig. 26) the papilla for the dorsal bristles is more prominent than in *L. squamatus*, and has a distinct black bar in front, and the bristles are somewhat shorter and more curved (Plate XXXVII, fig. 15). The tips of the ventral bristles are shorter, the curve more pronounced (Plate XXXVII, fig. 11), and the bare portion shorter. The stronger and larger hooked tip in *L. squamatus* is a characteristic feature. The segmental papilla is visible on the eighth bristled foot as in *L. squamatus*, and is continued to the last foot.

In the terminal foot the dorsal bristles are shorter and more curved than in *L. squamatus*, a feature present throughout the body. The ventral bristles have the curvature of the shorter tip more pronounced than in *L. squamatus*. In both species these bristles preserve great strength.

A marked difference between the species is the diminished size of the body and last feet in *L. squamatus*, contrasted with the comparatively large size of all the parts in this region in *L. clava*.

[1] Op. cit., Aug., 1898, p. 229, f. 4, &c.
[2] 'Ann. Nat. Hist.,' 1898, p. 108, pl. ii.

Reproduction.—Fine specimens from Gairloch, Ross-shire, were laden with ripe ova in February, and had a dull greyish hue from the tint of the eggs.

Habits.—It is a sluggish form.

This is one of the discoveries of the acute and sagacious Col. Montagu on the southern coast.

Like other Polynoidæ it is predaceous, masses of the bristles of *Harmothoë imbricata* being found in the intestine, with shreds of skin and other débris.

It is probable that Risso's *Polinoë scutellata*[1] is either this or *L. squamatus.*

Delle Chiaje's figures in the 'Memorie'[2] would appear to belong to this species; the first represents the entire animal, and the second the posterior end enlarged, though in the text it is termed the anterior end.

The statement by Audouin and Milne Edwards in their 'Annéles' that perhaps Montagu's *Aphrodita clava* approached their *Polynoë lævis,* is due to a misapprehension. The species much diverge.

Marenzeller,[3] in 1875, reviewed the literature of this species, and showed the identity of Risso's *P. scutellata,* Delle Chiaje's and Grube's *Eumolpe squamata,* and the *P. modesta* of De Quatrefages: he also linked on the *P. grubiana* of Claparède[4] with Montagu's form; but the palpi (Unterfuhler) of this species present a different appearance from those examined, since they are studded all over with papillæ, whereas those of *L. clava* have only rows of pointed papillæ, as indicated by Grube, in 1860, in the Mediterranean examples. Marenzeller procured British specimens from Cumbrae in the Clyde.

It is doubtful whether the form considered by Langerhans to be a young variety is this species, since the palpi are smooth and the bristles diverge.

Baron de Saint-Joseph includes the *Polynoë dorsalis* of De Quatrefages under this species, but this is doubtful, since *P. dorsalis* has cilia on the external margin of the scales. An examination of the specimen, however, may have shown that this is an error in description. He likewise places *Lepidonotus wahlbergi*, Kinberg, under the same head, but the foreign species differs, even under a lens, by the fact that the scales throughout, that is to the last, have numerous tubercles, those in front forming prominent spines; and, besides, the scales of *L. clava,* Montagu, are proportionally larger and, with the exception of first four pairs, are nearly smooth. Only in the old scales is there a belt of minute tubercles within the edge, and similar minute processes over the surface. These are, however, very different from those of *L. wahlbergi.* This distinction is clearly shown in the figure[5] in the 'Challenger' volume. Moreover, the dorsal bristles are much less tapered and acute than in *L. clava,* the reverse being the case with the ventral, which are proportionally more slender and elongate, and with a longer row of spines than in *L. clava.*[6]

[1] 'L'Europ. mérid.,' p. 414.

[2] Op. cit.

[3] "Zur Kenntniss der adriatischen Annel.," 'Wiener Akad. Ber.,' 1 Abth., Juli-Heft, 1875, p. 1, sep. Abd.

[4] A view still held by Dr. Benham, 'Camb. Nat. Hist.,' "Polychæt., &c.," p. 310, 1896.

[5] Pl. xi, f. 1.

[6] *Vide* McIntosh, 'Ann. Nat. Hist.,' ser. 7, vol. ii, p. 108, pl. ii, f. 12, 1898.

Genus IX.—Gattyana (Nychia,[1] *Malmgren*), McI.

Lateral tentacles arising below the base of the median, they and the cirri densely covered with long cilia. Palpi with numerous short clavate papillæ truncate at the tip. Scales fifteen pairs, minutely spinous, covering all the dorsum, and attached to segments 1, 3, 4, 6, 8, ... 22, 25, 28, 31. Bristles of the dorsal lobe ranging from stout, curved, and spinose inner forms to elongated ones with tapering, hair-like tips, finely spinous. Bristles of the inferior division stouter, with spinous distal regions and simple hooked tips.

Gattyana cirrosa, *Pallas*, 1766. Plate XXV, fig. 3.

Specific Characters.—Body of thirty-five to thirty-six bristled segments with a transverse impression in most. Head produced anteriorly into two pointed lobes. Tentacles and cirri densely covered with cilia. Scales, with the exception of the first pair, somewhat reniform, with long cilia on the posterior and external margins, smooth to the naked eye, but with many minute spines on the surface, the larger being external and posterior, with the tips often bifid, generally pale olive or buff, and frequently with a dark spot at the point of attachment. Dorsal bristles somewhat slender, with long tapering hair-like tips and rows of spines. Ventral bristles with simple hooked tips, beneath which is a spinous region which diminishes in length in the bristles from above downwards. Ventral cirrus short, with a few short clavate papillæ. Segmental process slightly tapered towards the tip, and of moderate length.

Synonyms.

1766. *Aphrodita cirrhosa*, Pallas. Miscell. Zool., p. 95, Tab. 8, figs. 3—6.
1780. „ *scabra*, Fabricius. Fauna Grœul., p. 311, n. 292.
„ „ *punctata*, Fabricius. Ibid., p. 311.
1792. „ *scabra*, Bruguiere, Encyc. Méthod., vers. i, p. 88.
1815. „ *viridis*, Montagu. Trans. Linn. Soc., vol. xi, p. 18, Tab. 4, fig. 1.
1820. „ *scabra*, Savigny. Syst. des An., 26.
„ „ *punctata*, Savigny. Ibid.
1828. *Eumolpe scabra*, De Blainville. Dict. d. Sci. Nat., vol. lvii, p. 459.
1834. *Polynoë scabra*, Aud. and Ed. Ann., 87.
1839. *Polynoë viridis*, Johnston. Ann. Nat. Hist., vol. ii, p. 437.
1843. *Lepidonotus assimilis*, Œrsted. Annulat. Danic. Consp., p. 13, figs. 3, 6, 14, 32, 33, 37, 38, 45, 46.
„ „ *scabra*, Ibid. Grönl. Ann. Dorsib., 164, pl. 1, figs. 2, 7, 10, 13, 17 and 18.
1850. *Lepidonote scabra*, Sars. Reise i Lof. og Finm., p. 209.
1851. *Polynoë scabra*, Grube. Fam. der Ann., 37 and 120.
1858. *Harmothoë scabra*, Kinberg. Eug. Resa, 21.

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[1] The title *Nychia* had already been used by Stål for one of the *Hemiptera*, so that Malmgren's name (1865) lapses. The term Gattyana may accordingly be appropriately substituted, after the generous founder of the New Marine Laboratory at St. Andrews.

1861. *Polynoë scabra,* Sars. Vid. Selsk. Förh., 1860, p. 58.
„ „ *scabriuscula,* Sars. Ibid., p. 61.
1864. *Lepidonotus cirratus,* var. *parasiticus,* Baird. Trans. Linn. Soc., 1864, p. 161.
1865. *Polynoë scabra,* De Quatrefages. Ann., vol. i, p. 235.
„ *Lepidonotus imbricatus,* Johnst. Cat. Brit. Annel., p. 118.
1867. *Nychia cirrosa,* Malmgren. Nord. Hafs-Ann., p. 58, Tab. viii, f. 1.
1871. „ „ Ehlers. Sitzunsb. phys.-med. Erlangen, 1871, p. 77.
1872. „ „ Sars. Nyt. Mag. f. Naturv., 19, p. 202.
1873. „ „ Sars. Bid. Christ. Faun., p. 2.
1874. „ „ Möbius. Die Zweite deutsche Nordpolarfahrt, ii, p. 253.
„ „ „ Malm. Göteborgs Kongl. Vet. o. Vitt. Samhälles Handl.; Ny Tidsföljd, Häft. xiv, p. 87.
1875. „ „ McIntosh. Invert. and Fishes, St. A., p. 115.
„ „ „ Ehlers. 'Porcupine' Annel., 1869, op. cit., 32.
1877. „ „ Marenzeller. Ost.-ung. Nordpol. Exp. (Deutsch. d. k. Akad. Wiss.), 39.
1879. „ „ Théel. Kongl. sv. Vet. Akad. Handl., 16, 3, p. 7.
„ „ „ Tauber. Ann. Danic., 79.
1883. „ „ Wirén. Chætop., 'Vega' Exped., 387.
„ „ „ Levinsen. Nord. Annulat., 195.
1884. „ „ Webster and Benedict. Ann. Mass., 700.
1886. „ „ Giard. Bullet. Sc. Nord., Nos. 9, 10, p. 338.
„ *Iphione muricata,* Harvey Gibson. Verm. Liverp., 150.
1890. *Nychia cirrosa,* var. *Chætopteri,* Malaquin. Ann. Boulon., 15, pl. 1, f. 7 *a*—7 *d*.
1891. „ „ Hornell. Trans. Liverpool Biol. Soc., v, p. 230.
„ „ Trautzsch. Polynoid. Spitzb., Jenaische Zeitsch., 24, 1 Heft, p. 75; and Arch. f. Naturges., 55 Jahrg., 1 Bd., 2 Hft., p. 143.
1896. „ „ Michaelsen. Polych. Faun. deutsch. Meere (Wiss. Meeresuntersuch., Bd. ii), p. 7.
1897. *Gattyana cirrosa,* McIntosh. Ann. Nat. Hist., ser. 6, vol. xx, p. 167.
1898. *Nychia cirrosa,* Michaelsen. Grönl. Annel., Bib. Zool., Heft 20, Lfg. 4, p. 120.

Habitat.—This species stretches from Greenland and the American waters to the shores of Northern Europe, but is numerically less abundant than many of the Polynoidæ. It occurs not infrequently in the deeper water off St. Andrews Bay, and is tossed on shore after storms. Specimens likewise come from Shetland (J. G. Jeffreys) in sixty fathoms, nine miles off Balta, from Southport Sands (Dr. Carrington), Hastings, between tide-marks, Channel Islands (Herm), Broadhaven Bay, Bantry Bay, and Berehaven Bay, in Ireland (A. G. More, Professor Haddon, and Dr. Scharff), the specimens found in the first-mentioned region being very large. Fine examples are not uncommon in the stomachs of cod and haddock at St. Andrews (E. M.). In Shetland it clings to the branched form of *Melobesia* in Bressay Sound. Malmgren pointed out that it was the form called by Baird *Lepidonotus parasiticus* in the tubes of *Chætopterus*, in the British Museum; and Hornell has confirmed this in the tubes of the same form, and in those of *Thelepus* in the Channel Islands, while at St. Andrews it is partial to the tubes of *Amphitrite figulus*, Dalyell.

It comes from the Gulf of St. Lawrence (Whiteaves), the Atlantic in 580—630 fathoms (Ehlers, 'Porcupine'), and Canon Norman frequently procured it in Norway and Finmark. Specimens also occur in Iceland.

Length.—A fine example from St. Andrews measured, exclusive of the processes, 47 mm.; and another, 42 mm. in spirit, comes from Broadhaven Bay, W. Ireland (A. G. More).

The *head* (Plate XXVII, fig. 5) differs from that in *Lepidonotus* in the relations of the median and lateral tentacles, since on each side of the median the head terminates in a pointed papilla (peak), the lateral tentacles being inferior. The outline of the head is somewhat ovate, and in life it is rose-red. A conspicuous pair of black eyes occur posteriorly on the dorsum, while a slightly larger pair are in front at the outer margin, and rather below the peak on each side of the tentacle. They are not well seen from the dorsum, and are fitted for anterior vision. The nuchal collar has a prominent boss or papilla in the centre. The median tentacle arises from a massive base, often of a slightly brownish tint, as a pale ciliated process about as long as the palpi in the spirit preparations, though of course the latter are much longer in life, and having a slight swelling below the filiform tip. The bases of the short lateral tentacles, which are beneath the massive base of the median, have a brownish bar. They are similarly ciliated, and have a slight enlargement below the filiform extremity. The cilia on the tentacles are elongate processes with a slightly bulbous tip, the centre of the latter and the column being granular.

The pale palpi have numerous small papillæ, which are shortly clavate in outline, with a truncated tip, which has a few minute papillæ. These are arranged in six rows—apparently two dorsal, two ventral, and a lateral on each side, the intervals between the rows being considerable. Malmgren simply says the surface is densely covered. They diminish in size towards the tip, and disappear from the filiform termination. Under a lens in life the organs appear to be smooth, but the minute papillæ are visible under a low power.

Body elongated, somewhat elliptical in transverse section, though more prominent dorsally than ventrally, gradually diminished in transverse diameter towards the head, and narrowed somewhat more abruptly towards the posterior end. Bristle-bearing segments 34—36, as Malmgren says for the Arctic forms. The dorsum is marked laterally by the papillæ for the scales, and the corresponding elevations in those feet bearing cirri. Moreover, each segment has a transverse bar, as it were, imprinted on its middle, the outer edge of the bar being especially depressed just as the surface of the segment rises towards the papillæ. These are continued to the fourth last segment posteriorly. On the other hand, the bulging of the body caused by the proboscis renders them less distinct anteriorly, though traceable in every segment. A tendency to separation of these bars at the anterior border of the segment is noticeable, while posteriorly the central half runs to the junction with the next segment. A median streak passes along the dorsum. Ventrally, the segments show a broader lateral band on each side, and a narrower median, which is opaque whitish in the centre. A little behind the line of each segment anteriorly an oblique streak passes to the nephridial process. The ventral surface of the body is iridescent, and in life it has a purplish sheen along the median region. In others the pinkish nerve-cords and ganglia form a well-marked moniliform median band, commencing behind the striated lower lip as a broad stripe. The feet are dull yellow.

The segmental papilla is directed between the feet, and is in the form of a slightly tapered process of some length. The northern forms agree with the British in regard to this structure.

Posteriorly, the body terminates in two elongated caudal styles, which have a similar structure to the cirri.

Proboscis.—When extruded, the organ shows on each edge nine terminal papillæ similar in shape to those of *Lepidonotus*. The horny jaws appear to resemble those of the genus named, and they are acutely pointed.

Two long, slender cæca pass forward into the peripharyngeal space.

Scales (Plate XXXI, fig. 1)—fifteen pairs. The first pair are somewhat circular and ciliated all round, the inner and anterior margins having short and somewhat clavate cilia, the rest being densely covered with similar cilia, which, as usual, are often thickened by parasitic growths. The surface has numerous small horny papillæ scattered over it, so that it is finely spinous. Such a scale, however, is in contrast with the Arctic examples or those from the Gulf of St. Lawrence, Norway, and Finmark, in which the sharp brown spines form prominent features in every scale of both large and small examples. Bifid tips also occur on many of the spines, as mentioned by Malmgren. It is not a question of size in regard to this difference between the British and the other examples, for in large representatives from the west of Ireland the same features are present as in the other British specimens. Moreover, the cilia are more prominent in the northern forms. These features, however, by no means indicate specific difference, for the general characters remain diagnostic.

The condition of the scales of the British examples is more like that of *Gattyana Amonsdeni*, Mrgn., though the spines are not so visible under a lens.

The scales of some have grains of sand and mud attached externally. Old and fine specimens have a dull olive hue on the dorsum, while the edges are flanked by the paler bristles and cirri, which are often, however, so coated with parasitic algæ and other structures, and grains of sand, that their normal hue is obscured. The scales of the large examples from the tubes of *Amphitrite* have a finely-streaked appearance from the dark growths on the spines.

Colour.—Dorsum of a pale yellowish-brown or sandy colour, the anterior scales being somewhat darker. In a considerable number (the majority of those tossed on shore at St. Andrews) a dark greyish-brown spot occurs at the point of attachment, and these form a somewhat regular row along each side. The prominent spines of the Arctic examples are brownish. The same dark spot at the point of attachment is present in some of these, and a dark touch at the inner border of each scale, so that an interrupted double band occurs along the middle of the dorsum. Tentacular processes pale. Head deep pinkish red, or only between the posterior eyes. In some the central process of the nuchal collar is bordered with dark pigment. Under surface pale, iridescent. Bristles pale yellow.

None of the British examples appear to show the dark median band of the dorsum from the nuchal fold backward, with fainter touches of colour in the median depressed parts of each segment to the tail, where darker pigment again appears, which characterises some Arctic examples (Godhaven Harbour). Flecks of pigment are also

seen along the mid-dorsal line even when no distinct band is present anteriorly and posteriorly.

Feet.—The tentacular cirri agree with the median tentacle. The basal region has the usual small tuft of serrated bristles (corresponding to the dorsal) with a spine. They are somewhat short and rather stout bristles, with rows of short spikes towards the tip.

In the second foot the dorsal bristles are shorter and more roughly spinous than in the typical foot. The latter is probably partly due to their shortness and greater curvature. On the other hand, the ventral bristles have much more elongated tapering tips than in the typical foot. The ventral cirrus has a few short clavate papillæ throughout the whole series.

The third foot presents a considerable change in the dorsal bristles, which now show the strong series with curved, serrated tips next the body, and the slender series with tapering tips adjoining the ventral division. The dorsal cirrus is somewhat shorter and thicker than in the fully developed foot. Both shafts and tips of the ventral bristles are still much more slender than in the average foot.

In the fourth foot a near approach to the condition in the typical foot occurs, though both dorsal and ventral bristles are more slender.

In the typical foot the dorsal division is bluntly rounded and turned upwards (Plate XLII, fig. 27), the spine, which is sheathed in skin, passing out as a slender process towards the inferior edge of the bristles. The dorsal bristles are rather slender (Plate XXXVII, fig. 18), have a long tapering tip, with rows of spines, the extremity being hair-like. The ventral division, on the other hand, has a somewhat triangular edge, the spine, which is sheathed at the base, and forms an independent process posteriorly, passing outward at the apex of the triangle. The ventral bristles show tips increasing in length from below upward, the superior bristles (Plate XXXVII, fig. 16) having more delicate tapering tips and more numerous rows of spines, while the tips are slightly hooked, the intermediate series (Plate XXXVII, fig. 17) often having a slight enlargement below the hooked tip. In large examples from deep water beyond St. Andrews Bay the smooth tips of the ventral bristles are somewhat shorter and broader. In contrasting these with the bristles of Arctic examples, the tips (that is, the region beyond the spines) of the latter are longer, and the bristles, both dorsal and ventral, are in some cases rather stouter. In the Arctic forms also the cilia on the cirri are somewhat longer.

In the posterior feet the tips of the ventral bristles again become elongated and the shafts more slender. In the last foot, indeed, the tips are so attenuate that, leaving the shafts out of sight, the curve of this region is almost the only distinction by which they can be recognised. The ventral cirri also are more elongate.

A curious ochreous appearance occurs in certain forms from Godhaven, Greenland, in which the tips of the dorsal bristles are covered with a minutely granular reddish-brown deposit, probably derived from their surroundings. The same structure coats the cilia of the cirri and scales.

The figure of the foot in Malmgren's paper does not show the upper spine, and in the ventral division the conical process for this structure is absent.

Parasites.—*Loxosoma* is not uncommon on the bristles and feet of the Arctic forms and those from the Gulf of St. Lawrence.

In a specimen from Godhaven Harbour (Disco Island) the body was dotted with rounded or ovoid whitish structures beneath the skin. They consisted of a mass of well-defined granules, generally of a somewhat ovoid shape and a double outline.

The parasitic crustacean, *Sellius bilobus*, occurs on the dorsum under the scales in northern forms, and seems to be a large parasite for so small an annelid.

Fine specimens are procured in the tubes of *Amphitrite figulus* (Dalyell) under large stones near low-water mark of spring tides at St. Andrews. They occupy the anterior end of the tube. All the examples were large, but the alimentary canal of those examined showed no recognisable food. The species probably finds in this and other tubes a safe refuge and sufficient food. It is, moreover, phosphorescent, irritation causing a very pale greenish or yellowish light to illuminate the scales. The phosphorescence is less vivid than in *Harmothoë imbricata* and *Polynoë scolopendrina*. As a rule, *Gattyana* occupies a position close to the mouth of the long tube of the *Amphitrite* beneath large stones, so that it is well protected from marauders, even supposing they were attracted by its light. In the same way its opportunities for alluring animals are curtailed, so that the remarks formerly made in this connection still hold.[1]

To sum up, the British species differs in the softer and much smoother scales, the horny papillæ being microscopic, and in the shorter, smooth tips of the ventral bristles, which tips are likewise more attenuate in the Arctic forms. The innermost bristles of the dorsal series appear also to be stouter and shorter in the Arctic forms.

Pallas (1776) was somewhat in doubt about this species, which had been sent him in a rather softened condition by Gronovius from the northern seas, and thought it might be an older form of his *Aphrodita lepidota*, though the structure of the feet differed. Both description and figures are imperfect, and in fig. 6, Plate VIII, the foot is inverted, but Malmgren is right in identifying it with this species. The general pallor struck Pallas. He mentions the "scabrous" condition of the posterior margin of the scales, and the elongated yellowish dorsal bristles. The description given by Fabricius (1780) is quite recognisable, and the dull greenish colour dorsally, the pale ventral surface, with the hispid scales, are characteristic. Savigny (1820) added nothing to the remarks of Fabricius.

Johnston (1839), both in this paper and in the subsequent remarks in the 'Catalogue,' gives only Montagu's description. Œrsted's figures (1843), rather than his description, show that this was the species to which he referred in both publications. He also gives its habitat as in the deeps of Greenland. Sars (1861), in his account of the Norwegian *Polynoidæ*, gave descriptions of both a *Polynoë scabra*, Fabr., and *P. scabriuscula*, n. s.; but Malmgren has rightly decided that these refer to the same species, considerable variation occurring between the Arctic and the more southern examples. De Quatrefages (1865) seems to have had no personal acquaintance with *G. cirrosa*, but mentions that Linnæus gave twenty pairs of scales to his form, and that it requires re-investigation.

This species was procured at a depth of 230 metres on mud during the Austrian North Polar Expedition. Möbius states that it occurs in Greenland in 4—12 fathoms. In the account of the annelids of Nova Zembla, Théel (1879) says that forms 45 mm. in length come from the Kara Sea. Verrill (1879) includes it in his list from Cape Cod

[1] 'Ann. Nat. Hist.,' 4th ser., ix, p. 1, January, 1872.

to the Gulf of St. Lawrence. Finally, Malaquin (1890) describes a variety found in the tubes of *Chætopterus* at Boulogne.

Genus X.—Eunoa, *Malmgren*, 1865.

Lateral tentacles arising under the median—below and slightly internal to the peaks of the head. Palpi with six rows of short cilia ; eyes large, visible from the dorsum. Three intestinal cæca directed forward into the peripharyngeal space, the ventral long and narrow, with two or more sacculations at its outer border inferiorly. The other two are clavate and short. Elytra, fifteen pairs, completely covering the dorsum, and occurring on the first foot, third, fourth, sixth, eighth, and so on to the twenty-second, twenty-fifth, twenty-eighth, and thirty-first. Dorsal bristles pointed at the tip (which is bare), then minutely spinulose in rows; ventral bristles somewhat longer, and resembling those of *Harmothoë*, with a smooth tip, which has a hook and transverse rows of spikes. External aperture of the segmental organ indicated by blackish pigment ; no papilla.

Note.—This genus approaches *Harmothoë*, but the peaks of the head in the latter are close to the median tentacle, whereas an interval exists in *Eunoa*. The eyes in *Harmothoë* are smaller and less visible, the anterior pair being under the point of the peak, whereas the anterior pair of *Eunoa* are situated some distance backwards, and are lateral in position—not ventral. The bristles of the first foot in *Eunoa* are very distinct. The remarkable *Eunoa hispanica*,[1] procured by the ' Porcupine ' in 1870 on the Channel slope, diverges from the other known forms by the great size of the eyes (with their corneal lens), which exceed by far those of any other example of the family, by the great length and smoothness of the palpi, and the great length of the ventral cirri and the foot. The dorsal cirri probably have no enlargement below the tip, if we may judge from a single lateral tentacle. *E. hispanica* is scarcely within the British area, but it is worthy of note in this connection, and may yet be found near the coasts.

1. Eunoa nodosa, *M. Sars*, 1860.

Specific Characters.—Body broad, flattened, slightly narrowed in front, but much more gradually and distinctly posteriorly ; bristled segments, 36 ; head about as broad as long, with a deep notch in front, from which the peaks are clearly marked off on each side ; eyes large, two anterior to the nuchal fold, and two just in front of the lateral projection of the head, and thus considerably behind the peaks ; tentacle ciliated, slightly dilated below the slender tip, longer than the palpi—in preservation ; lateral tentacles short, of similar shape ; palpi subulate, with six rows of minute papillæ ; tentacular cirri smaller than the tentacle, but of similar structure ; scales, 15 pairs, completely covering the dorsum, with the exception of the first pair, elongate reniform and somewhat thick, external margin densely ciliated, exposed surface rather thickly covered with

[1] ' Trans. Zool. Soc.,' ix, p. 396.

small tubercles and occasional parasitic growths, while a little within the posterior margin is a row of larger, isolated, rounded tubercles ; dorsal bristles distinctly shorter than the ventral. The dorsal cirri have the structure of the tentacular cirri, shorter than in *E. œrstedi ;* ventral cirri smooth. Segmental papilla cylindrical, passing from the posterior border of the foot, and directed upward between the feet. A dilated process occurs at the base of the dorsal cirrus.

Synonyms.

1860. *Polynoë nodosa,* Sars. Vid. selsk. Förhandl., 1860, p. 59.
1865. *Lepidonotus pharetratus,* Johnst. Cat. B. M., p. 113, pl. 3, f. 17—19.
1866. *Antinoë zetlandica,* Ray Lankester. Trans. Linn. Soc., xxv, p. 377, pl. 51, f. 13, 17, 18, 22, and 23.
1867. *Eunoa nodosa,* Malmgren. Nord. Hafs-Ann., p. 64, Tab. viii, f. 4, and Ann. Polych., p. 6.
,, *Antinoë pharetratus,* Parfitt. Cat. Ann., Devon, p. 18.
1872. *Eunoë nodosa,* Sars. Nyt. Mag. f. Naturvid., 19, p. 202.
1873. ,, ,, Sars. Bid. Christ. Fauna, p. 2.
1874. ,, ,, Malm. Göteborgs Kongl. Vet. o. Vitt. Samhälles Handl ; Ny. Tidsföljd, Häft. xiv, p. 74.
1876. *Eunoa nodosa,* McIntosh. Trans. Z. S., ix, 374, pl. 67, f. 4—8.
1879. *Polynoë scabra,* Théel. Annel. Nov. Zemb., 7.
,, *Eunoa nodosa,* Tauber. Ann. Danic., 81.
1883. ,, ,, Wirén. Chæt. Vega-Exped., 387.
,, *Harmothoë nodosa,* Levinsen. Nord. Annul., 193.
1884. *Eunoa nodosa,* Webster and Benedict. Ann. Mass., 700.
1886. *Eunoë scabra,* Marenzeller. Porif., &c., Jan Meyen, p. 11.

Habitat.—North Sea, Lieutenant Thomas; Zetlandic Sea, Dr. Gwyn Jeffreys; off Holy Island, Tynemouth, 25—30 fathoms, Professor G. S. Brady ; stomach of the cod, St. Andrews, E. M.

A fine example, from the collection of the late Dr. D. Robertson, comes from Cumbrae, on the west coast of Scotland, but none have yet been received from the coast of Ireland.

It ranges to 690 fathoms on the Channel Slope, 'Porcupine,' and 125 fathoms off Cape Rosier in the Gulf of St. Lawrence (Whiteaves), and thence to Cape Cod (Verrill). Malmgren gives the shores of Spitzbergen, Greenland, Finmark, and Scandinavia.

Length $1\frac{1}{2}$ in. to $2\frac{1}{4}$ in. (Clyde). Some of the foreign examples are about $2\frac{1}{2}$ in.

Head (Plate XXVII, fig. 9).—Nearly as broad as long, with a median sulcus in front, the sides trending to the peaks, which are free from the base of the median tentacle, the base of which extends outwards from the sulcus. No specimen had a tentacle, but Malmgren observes it resembles that of *E. œrstedi*, which is covered with long cilia with clavate tips. Moreover, towards the swollen distal region, below the filiform tip, a few large conical papillæ with bifid tips are present—probably as an abnormality. This, however, may differ considerably from the organ of *E. nodosa*—which may be less elongate, and have shorter cilia. The lateral tentacles are short, with small clavate cilia and a filiform tip. The tentacular cirri are similar to the median tentacle, but shorter. The eyes are comparatively large, two being situated in front of the posterior border towards the lateral region, and two just in front of the lateral projection of the head. The palpi

are subulate organs marked by six rows of conical papillæ, which become larger towards the tip of the organ.

Body large and broad, somewhat more rounded dorsally than ventrally, slightly tapered anteriorly, very gradually but much more tapered posteriorly. Dorsally, it is readily separated from other allied genera by the presence of the peculiar expansion at the base of the dorsal cirrus. The bristled segments are thirty-six in number. The shorter dorsal bristles at once distinguish the species when compared with *E. ærstedi*. Dorsally, the segments are generally marked by a transverse bar often dimpled at the outer edges, and by irregular papillæ internal to the scale-bearing process. Ventrally, the usual median groove marks the centre.

Posteriorly the body terminates in two caudal styles, which have a similar structure to the cirri.

None of the spirit preparations show colour along either dorsal or ventral surface, except a few touches on the area below the median and lateral tentacles; thus the species is in contrast with *E. ærstedi*. The only pigment visible consisted of a brownish hue on the lateral tentacles, and a brownish ring below the dilated region of all the cirri.

Proboscis.—No example of *E. nodosa* has an extruded proboscis. *E. ærstedi* shows nine dorsal papillæ and nine ventral, and the teeth are powerful. In *E. ærstedi* three gastric cæca pass forward to the dorso-lateral wall of the peripharyngeal space, the fourth being nearly transverse. The longest is the ventral, which forms a narrow tube anteriorly and extends to the fourth segment in front of the stomach. The posterior half, however, is widened by two or three sacculations at its outer edge. The second and third are shorter and wider clavate cæca, terminating in the corresponding spaces behind the first. The stomach, if we may so term the anterior dilated part of the intestine, has thick muscular walls, and its inner surface has a closely arranged transverse series of firm glandular lamellæ, interrupted at short intervals, so as to be crenate or papillose. These ridges become less and less distinct as we proceed backwards, until towards the vent the thin wall shows only the distinctly isolated papillæ as in *Halosydna gelatinosa*. It might be considered that the foregoing appearances of the stomach were due to the condition of the preparation, but such did not seem to be the case.

The external opening of the segmental organ has no papilla, but is marked in *E. ærstedi* by a blackish pigment-speck. In one example two specks were present on a posterior foot. The genus thus diverges from *Harmothoë*.

Scales.—The scales (Plate XXXII, fig. 3) of this form are distinguished from *E. ærstedi* by their more leathery consistence, by their characteristically reniform outline, by their longer and more abundant cilia on the outer edge, and by the divergent character of the tubercles, which are much more developed in *E. ærstedi*. The anterior scales, as usual, are rounded, but the typical scales are reniform with the free parts studded with small horny tubercles and a row of from six to nine much larger blunt horny tubercles, or short cones, some of which, a little within the posterior border, present a bluntly spinose condition at the tip. The anterior and inner margins are smooth, while along the posterior border a few isolated short cilia occur, gradually increasing in length till they terminate at the outer edge in the long cilia with the clavate tips. In

E. œrstedi, again, the anterior edge of the typical scale (anterior third) is smooth, but otherwise the entire margin has short clavate cilia scattered at intervals amongst the tubercles and spines, the outer edge having these no more prominent than the inner.

Considerable variation exists in regard to the size and distribution of the smaller spines over the surface. Thus in the figure from the specimen in the British Museum these are comparatively small both towards the inner border and along the anterior edge, but, on the general surface, the size increases while the number diminishes. The contrast between the outer and the inner borders is marked, the former having fewer and larger spines. The number of the large papillæ along the posterior edge is nine to eleven, which is more than usual, and some of them show spinous tips. The cilia are confined to the outer edge.[1] An increase in the size of all the spines takes place in an example from Spitzbergen, the larger forms on the general surface being proportionally few. Only five large tubercles are present, with traces of spines at the tip of one or two; some sparsely distributed cilia occur along the posterior border as well as the denser series of the outer edge. In fine specimens from the Gulf of St. Lawrence the proportions of the various spines agree rather with the British forms, but a few short cilia are found along the posterior border in addition to the longer outer series.

Colour.—No fresh example has been seen, so that all that can be said is that the scales are marked with reddish-brown or madder-brown touches, darkest in the anterior scales. Malmgren observes that the scales have a violet-brown hue, generally with a white spot in the middle.

Feet.—The first foot—bearing the tentacular cirri—has a few (about three) bristles which conform to the type of the dorsal, being stout, slightly curved, and spinous on the convex margin, with a short, smooth tip, which affords a contrast to the more elongate tip in *E. œrstedi*.

The second foot is distinguished, as usual, by its long ventral cirrus, and by the diminution and modification of its parts. The dorsal division has bristles of the ordinary type. The tip of these is short and smooth, and the curvature of the inner bristles is marked. The same foot in *E. œrstedi* has much longer and less curved bristles, and the smooth region at the tip is longer and has a different outline.

Ventrally is a group of much more slender bristles, with long spines on the distal region and a needle-like, smooth extremity (Plate XXXVII, fig. 20). The tip of the corresponding bristle in *E. œrstedi* is less elongate, and, instead of the finely-pointed tip, it has the outline of a narrow knife-blade (Plate XXXVII, fig. 21).

In the third foot the dorsal bristles are smaller than in the typical foot, but have the same structure. The ventral bristles, again, though slender, already show shorter tips, which, further, are less acute than in the first foot.

The changes in the bristles have considerably advanced in the fourth and fifth feet, so that the typical arrangement (Plate XLII, fig. 28), in which the longest dorsal bristles reach a little beyond the spine of the ventral, is soon reached. These bristles (Plate XXXVII, fig. 26) are shorter and more distinctly curved internally, the longer and

[1] A large Zetlandic example, the *Antinoë zetlandica* of Prof. Ray Lankester, corresponds in the main with the foregoing, though the large spines posteriorly extend along the outer border, and, like the former, the cilia are confined to the outer edge.

straighter forms being external, that is, next the ventral. The tips have the character shown in fig. 24, Plate XXXVII, viz. less tapered than in *E. ærstedi* (Plate XXXVII, fig. 25)—with a shorter smooth portion and more boldly marked spinous rows.

The ventral bristles (Plate XXXVII, figs. 22 and 27), on the other hand, have proportionately longer spinous regions superiorly than in *E. ærstedi;* the tips are more distinctly hooked, and the bare portion is broader on an average than in the species just mentioned (Plate XXXVII, fig. 23). The latter is not what might have been expected from the condition anteriorly. The ventral cirrus extends a little beyond the inferior border of the foot.

Posteriorly both dorsal and ventral bristles become more attenuate, as well as smaller, in conformity with the diminished feet, but they do not assume the elongate and slender condition observed anteriorly.

Two very large examples from the stomach of a cod agree with the fine Zetlandic specimen in having the smooth tips of the dorsal bristles somewhat shorter. On the other hand, young specimens (about ¼ of an inch) have longer tips to the dorsal and ventral bristles, and the scales are more rounded and have proportionally thicker cilia.

While the scales in the examples from Spitzbergen agree in shape and structure with those from the Gulf of St. Lawrence and Britain, the dorsal bristles have assumed a more elongated condition, so as to resemble those of *E. ærstedi*, being more tapered, and with a longer bare portion at the tip; yet the general curve of these bristles is more pronounced than in *E. ærstedi*. The tips of the ventral bristles are also proportionally longer than in the ordinary type. The typical characters of *E. nodosa* are seen in examples from the Arctic seas (Greenland), where the species attains a large size. The distinctions between the two forms are therefore evident, but whether two species should be formed may be to some an open question.

A parasitic sponge, with long processes, occurs on a scale of the example from Cumbrae.

Habits.—So far as can be ascertained, the present form is only found in deep water off the British shores, and that but rarely. It is more abundant in the northern seas of both Europe and America. *Loxosomæ* abound on the feet and bristles of those from the Gulf of St. Lawrence.

Reproduction.—The only example of the genus observed with fully developed reproductive elements is a large female of *E. ærstedi*, from Greenland, distended with ova, and probably procured in July.

This is one of the many forms that marine zoology owes to the industry and keen observation of the elder Sars, who patiently explored the shores of his native country for so many years and with such remarkable success.

It is difficult to know to what Sir J. Dalyell (1853)[1] refers under the name of *Aphrodita squamata*, from Shetland, unless it be this species. Théel (1879) noted that *Eunoa nodosa* and *E. ærstedi*, Malmgren, were the same species, viz. the *Lepidonotus scabra* of Œrsted, an opinion coinciding with the remarks made by myself many years previously. He procured large examples (70 mm.) at a depth of 90—200 metres in the Kara Sea (Nova

[1] 'Pow. Creat.,' ii, 166, pl. 24, f. 3, 4.

Zembla). The processes on the scales vary considerably in size, but he did not sufficiently discriminate between the forms.

The *Polynoë islandica* of Dr. Hansen (1882)[1] is probably either a variety of this species or *E. œrstedi*, in which the tentacles are smooth. His *P. arctica*[2] I would also be inclined to unite with the same form. Nor does any other conclusion seem to present itself with regard to his *P. assimilis*,[3] his *P. spinulosa*,[4] or his *P. foraminifera*.[5] From the inexperience of the artist, Dr. Hansen's figures are not reliable, the tentacular cirri, for instance, springing as a single trunk which becomes bifid, a condition which can only occur as an abnormality.

Wirén, in his account of the annelids of the 'Vega' Expedition, expresses the same view as Théel and the writer, and he gives notes on five varieties, with figures of three examples of scales, which differ considerably in regard to the papillæ.

2. Eunoa tritoni, *McIntosh.*

1898. *Eunoa Tritoni*, McIntosh. Ann. Nat. Hist., Aug., 1898.

Specific Characters.—Head somewhat pyriform, with the broad end posteriorly, a median furrow and two minute peaks close to the base of the median tentacle. Eyes equal, of moderate size, placed on each side of the lateral eminence. Lateral tentacles short and densely ciliated. Palpi with rows of minute clavate cilia. Body normal; segmental papillæ commence on the sixth foot and continue almost to the posterior end. Scales reniform in outline, densely fringed with long cilia on the outer edge. The surface of the scale has a series of capstan-like tubercles with a minutely nodular surface towards the posterior border, the general surface being studded with minute spines. Dorsal and ventral divisions of the foot have each a long process for the spine. The dorsal bristles are long, little tapered at the tip, which forms a short blunt cone invaded by the spinous rows so closely that the tip of the bristle is almost reached. Ventral bristles with slender shafts, spinous tips of the average length, and a long and rather broad terminal region, with a well-marked hook.

Trawled on board H.M.S. 'Triton,' at Station 8 (Faroë Channel?), 22nd August, 1882, in 640 fathoms.

A comparatively large species, about 34 mm. long.

Head.—Somewhat pyriform, with the broad end posteriorly, a median furrow in front, and two minute peaks close to the base of the median tentacle. Eyes of moderate size, equal, visible from the dorsum, placed on each side of the lateral eminence, and thus towards the middle of the region. The anterior pair look slightly forward and outward. Median tentacle absent. The lateral are comparatively short and densely ciliated. The palpi have rows of minute clavate cilia. Tentacular cirri absent.

[1] 'Norweg. N. Atlantic Exped.,' p. 24, pl. i, figs. 15—21.
[2] Ibid., p. 27, pl. iii, f. 1—5.
[3] Ibid., p. 27, pl. i, f. 22—26.
[4] Ibid., p. 28, pl. i, f. 6—10.
[5] Ibid., p. 29, pl. i, f. 11—14.

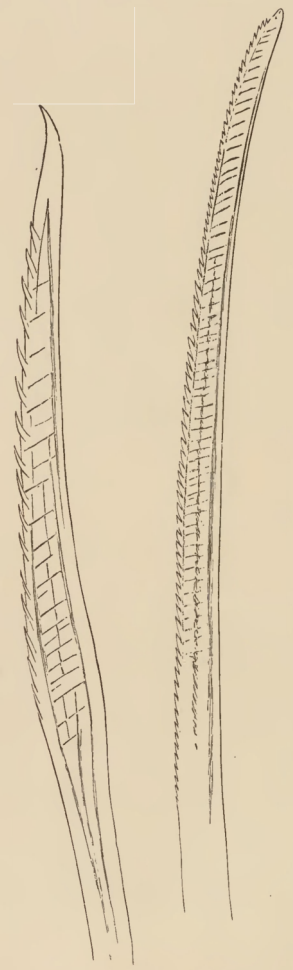
Body.—Convex dorsally, flattened ventrally, slightly tapered anteriorly, and more gradually posteriorly. Bristled segments about 40. The bases of the dorsal cirri show an expansion. The markings on the dorsum correspond with those of allied species. The segmental (nephridial) papillæ are visible on the sixth foot, and are directed upwards between the feet. They continue almost to the posterior end.

The scales are more nearly allied to those of *E. nodosa* than to those of *E. ærstedi*, being somewhat reniform in outline, densely fringed on the outer or narrower edge with long cilia ending in a probe-point (Fig. 21). Posteriorly these gradually diminish and run into

Fig. 21.

Outer edge of scale of *Eunoa tritoni*.

Fig. 22.



Eunoa tritoni.—Dorsal bristle to right and ventral to left.

the short cilia which occur at intervals along this border to the inner edge. Besides the cilia a series of eight or nine capstan-shaped tubercles, with a minutely nodular surface, project from the posterior border, besides others within it, and, in addition, two or sometimes three much larger tubercles of a similar shape are ranged a little within the posterior border. These larger tubercles are thus fewer in number and proportionally larger than in *E. nodosa*. Just within the densely ciliated outer border are a series of elongated papillæ, with trifid or multifid tips (Fig. 21). They

extend along the outer border, and also form a group in the neighbourhood—within the anterior edge. The anterior border of the scale is smooth, with the exception of an isolated group of one to five or more long cilia some distance from the outer edge. The entire surface of the scale is densely studded with minute spines, smallest in front and increasing in size posteriorly. The developing scales are of various degrees of smoothness, the youngest being quite smooth.

Both dorsal and ventral divisions of the foot bear a long pointed process for the spine. The dorsal division has characteristic bristles (right of Fig. 22), which somewhat approach those of *Harmothoë haliaëti*, though quite distinct. They are of considerable length, slightly curved, and not much tapered at the tip, which, indeed, ends in a short blunt cone, and in some shows a slight fold or differentiation on the spinous side. The short bare cone at the tip is much broader than that of *H. haliaëti*, and has a different character. The spinous rows so nearly approach the tips that they in some almost reach as far as the point of the bristle, and are as close as in the species just mentioned. The ventral bristles (left of Fig. 22) have somewhat slender shafts, spinous tips of the average length, and a long and rather broad terminal region with a well-marked hook. The ventral line of the smooth tip is slightly convex.

The dorsal cirri are of considerable length—with a filiform tip. They are densely covered with long cilia having probe-pointed tips. The ventral cirri have only a few scattered and very short clavate cilia.

This fine species appears to be confined to deep water.

Genus XI.—Lagisca, *Malmgren*, 1865.

Body rather narrow, attenuate posteriorly. Cephalic lobe produced into lateral peaks. Lateral tentacles attached below the median. Eyes four; two lateral just in front of the middle line, two in front of the nuchal border. Scales fifteen, covering the dorsum—except the last few. Bristles of the dorsal lobe with acute tips and finely serrated. Bristles of the ventral lobe simple superiorly and inferiorly, rest bidentate, and all with long spinous rows. Papillæ of proboscis $\frac{9}{9}$. Two slender cæca go forward into the peripharyngeal space. Segmental (nephridial) papilla commences as a minute process on the fifth foot, and extends nearly to the last foot. It is much smaller than in *Harmothoë*.

1. Lagisca floccosa, *Savigny*, 1820. Plate XXVI, fig. 2.

Specific Characters.—Body rather narrow throughout, slightly diminished anteriorly, and much more so posteriorly. Median and lateral tentacles, and the tentacular cirri rather short, densely ciliated and with filiform tips; little or no enlargement below the latter. Eyes large, posterior in front of the nuchal border; anterior lateral in position, and just in front of the middle line. First pair of scales rounded, the others reniform or somewhat ovate, mottled greyish brown, often with a white spot in the centre, densely

covered with minute spines (visible under the microscope), and having posteriorly a series of soft globular papillæ arranged at intervals just within the margin. Cilia on the outer border—very few and short. Dorsal bristles with acute tips and finely serrated ; ventral bristles with the tips simple superiorly and inferiorly, rest bidentate. Alternate spinous rows long, though the bristle-tip is proportionally short. Dorsal cirri with numerous and rather short cilia. Ventral cirrus smooth.

Synonyms.

1820. *Polynoë floccosa,* Savigny. Syst. Annel., pp. 22, 23, and 27.
1828. *Eumolpe floccosa,* Blainville. Dict. de Sc. Nat., vers., 459.
1834. *Polynoë floccosa,* Aud. and M. Edw. Ann., 88.
1851. ,, ,, Grube. Fam. d. Ann., 37 and 120.
1865. ,, ,, De Quatrefages. Ann., 236.
,, ,, *semisculptus,* Johnst. Cat. Brit. Mus., p. 116, pl. v, f. 1—11, and pl. vi, f. 4—6.
1867. *Lagisca propinqua,* Malmgren. Ann. Polych., p. 9, Tab. i, fig. 3.
1870. *Polynoë floccosa,* Grube. Archiv f. Naturges., 287.
1873. *Lagisca propinqua,* Sars. Bid. Christ. Fauna, p. 3.
1875. *Polynoë floccosa,* McIntosh. Invert. and Fish., St. A., p. 116.
,, ,, ,, McIntosh. Trans. Z. S., ix, 380, pl. 68, f. 6, 8, 10.
1876. *Lagisca propinqua,* McIntosh. Trans. Z. S., 375, pl. 67, f. 12—14.
1879. ,, ,, Tauber. Ann. Danic, 81.
1880. ,, ,, Langerhans. Die Wurmfauna Madeiras, Zeit. f. w. Zool., xxxiii, p. 274, Taf. xiv, fig. 3c.
1882. *Polynoë semisculpta,* Hansen. Norweg. N. Atl. Exped., 26, pl. iii, f. 16—20.
1883. *Harmothoë propinqua,* Levinsen. Nord. Annul., 192.
,, ,, *semisculptus,* Ibid.
1886. *Lagisca propinqua,* Harvey-Gibson. Verm. Liverpool, 148.
,, ,, ,, Langerhans. Zeit. f. w. Zool., xl, 251, Taf. 15, f. 6.
,, *Polynoë floccosa,* Harvey-Gibson. Verm. Liverp., 150.
1891. ,, (*Lagisca*) *propinqua,* Hornell. Op. cit., p. 234, pl. 13, f. 1, 7, 9.
1896. *Lagisca propinqua,* var. *abyssorum,* Roule. Camp. d. ' Caudan,' 444.
1898. *Harmothoë semisculptus,* Michaelsen. Grönland. Annel., Bib. Zool., Heft 20, Lfg. 4, p. 121.

Habitat.—Everywhere on the British shores from Shetland to the Channel Islands, where it is the chief form between tide-marks. It also ranges from 600 fathoms to low-water mark. It extends to the Gulf of St. Lawrence in Canada, as well as to Norway and Sweden. It was procured likewise during the ' Vega ' Expedition, and apparently also is found in Greenland.

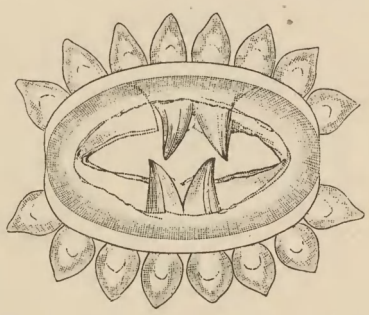
Length $1\frac{1}{2}$ inches, breadth about $\frac{1}{4}$ inch.

Head (Plate XXVII, fig. 14) with a median furrow anteriorly, which passes on each side of the base of the tentacle to the peaks. The black eyes are comparatively large, the posterior pair being dorsal in position and somewhat nearer each other than the anterior pair. The latter are more or less lateral in position just in front of the prominent median region. They are slightly larger than the posterior pair. Both pairs show in some specimens a cuticular lens, like a central speck. The median tentacle is rather short, with a long filiform tip and a slight swelling below the latter. It has short clavate cilia. The lateral tentacles are also short with similar cilia, and a long filiform tip. They have

a dark bar at the base, then a pale region with another bar below the filiform tip. If colour is to be relied on, the pale part would be homologous with the slightly swollen region in other forms. The tentacular cirri are similar to the median tentacle. All these cirri have the slightly enlarged part pale, with a brown band on each side, and the column below is brownish. The palpi show minute papillæ-like serrations along the sides under a high power, probably partly due to the rigid contraction. They thus differ materially from those of *Harmothoë imbricata* with the minute clavate cilia.

The *Body* is narrower than in *Harmothoë imbricata*, and the line of bristles on each side is straight and trim; moreover, it has a general firmness which is characteristic. The anterior end diminishes from the eighth or ninth bristled segment towards the head, while posteriorly the diminution, which is gradual, begins shortly behind the middle, and

FIG. 23.



Papillæ and teeth of the proboscis of *Lagisca floccosa*.

the body terminates in a process bearing the two caudal cirri beneath the vent. The number of bristled segments is about forty-two. Dorsally the latter are marked from the head backward by a median series of brownish touches, which posteriorly show a somewhat symmetrical arrangement in the centre of each segment, consisting of an anterior, narrow, curved bar, a fan-shaped region divided by a median streak and a short transverse bar posteriorly. A prominent dark patch also occurs on the papilla (homologue of scale-papilla) and a little pigment at the base of the dorsal bristles. The ventral surface is pale and iridescent; the nephridial papilla is smaller than in *Harmothoë imbricata*, and passes into the fissure between the feet. A considerable portion of the tail is devoid of scales, and it is this region which has the pigment on the dorsum best developed. The segmental (nephridial) papilla commences on the sixth foot, and extends to the posterior feet as a very minute process.

Proboscis.—The extruded proboscis (Fig. 23) has the usual teeth, the lower pair biting to the right of the upper, nine flattened conical papillæ dorsally, and nine ventrally at the margin. The skin-folds at the mouth are marked by brownish pigment. The pre-gastric cæca are short and small. The ventral alone is conspicuous in the preparations, for the second proceeds little beyond the stomach, and the third is nearly transverse.

Scales (Plate XXXII, fig. 5)—fifteen pairs. First pair rounded, the others reniform or ovate-reniform, the last pair being ovoid, of a brownish-red colour, or sometimes slightly purplish marbled with grey. They generally show a pale area over the scar for the pedicle, and from the depth of the colour this is best marked anteriorly, the pigment in the posterior scales being broken up into a series of touches and granules. The

entire surface, with the exception of a small area at the anterior and inner border, is densely covered with minute spines, which are longest towards the outer border. The posterior edge, again, has just within the margin a series of soft globular papillæ arranged at intervals and visible under a lens. Some are slightly clavate in outline, while the tip in others is truncate or slightly nodular. They are few in number on the last scales. A few short slender cilia occur at the outer or posterior margin. The under surface is iridescent, and the scar for the pedicle is near the hilus or indentation, where it is present, on the outer border. The first pair of scales have a few short cilia on the inner border, and a well-marked series of clavate cilia on the outer and anterior margin. The large globular papillæ on these are from four to six in number. A variety procured by the 'Knight Errant' at Station 2 (1882) is pale, with few and small tubercles on the posterior border of the scales.

Feet.—The first foot has two dorsal bristles, one curved and less pointed, the other straighter and more acute. The spinous rows are more distinct than in the typical foot. The tip in both is minute.

The second foot has a dense tuft of dorsal bristles, generally more curved and with more distinct spinous rows than in the typical foot, and the bare portion at the tip is proportionally broader and better marked. The slender ventral bristles have rows of long spines and simple tips, those at the ventral edge of the series approaching the pinnate type seen in other forms. They do not project beyond the dorsal bristles.

The third foot has the dorsal bristles less curved and the tips more acute. In the ventral division the bristles have increased in strength, and, while the upper and lower series have simple tips, the rest have the secondary spur. The tip of the smooth ventral cirrus is long and filiform.

In the fourth foot the ventral bristles have become more prominent by the increase of the fleshy part of the foot, and some simple tips still occur superiorly, and a more numerous series inferiorly. The spinous rows are long. The dorsal bristles are elongating, the long outer ones having acute tips, the inner broader smooth tips.

In the typical foot the dorsal division has long and very slightly curved bristles with gently tapered acute tips throughout, the sharpest tips as usual being external (on a slide next the ventral). They are thus easily distinguished from those of *Harmothoë imbricata*, and also by the much closer spinous rows. Bristles of the same length are decidedly more slender than in *H. imbricata*. One of the longer forms is represented in Plate XXXVIII, fig. 2. The tip tapers to a smooth, blunt point, and immediately below the latter very fine and close spinous rows occur. A glance at the latter in rapidly examining specimens is one of the most satisfactory points in discrimination. The ventral division bears superiorly a series (Plate XXXVIII, fig. 1) with long spinous extremities, more slender and with longer spinous rows than in *H. imbricata*. In a few the smooth tips have no secondary process. The next series has a small secondary process, and the spinous border gradually diminishes in length. The bifid tip differs from that of *H. imbricata*, especially in regard to the minute size of the secondary process. Inferiorly the tips are again simple. Posteriorly the structure of the dorsal bristles remains nearly the same, but the ventral become attenuate, the bifid tip being visible, but the secondary process is minute. The dorsal cirri have a dark bar above and below the

slight enlargement towards the tip, and the latter is attenuate. The cilia are numerous, rather short and clavate, and extend beyond the distal pigment-bar. They become more slender posteriorly, but have the same structure. In these translucent organs the areolæ of the hypoderm (epidermic granular layer) are very visible. The long first ventral cirrus is ciliated like one of the dorsal, and some of the succeeding ordinary forms show a few cilia. These gradually disappear and leave the cirrus smooth throughout the greater part of the body.

Some from Guernsey have the dorsal bristles covered with a reddish-brown or dull orange granular coating, from the surface of which minute algoid filaments project. Such would seem to be parasitic. A similar growth occurs on the dorsal bristles at St. Andrews.

In my notes of November, 1873, at St. Andrews, this species (and the preparation accompanies) is described as phosphorescent, but recent examination, both when laden with ova in January and in the warmer months, such as July, has not borne out this description. In the preparation the bristles, especially the dorsal, are covered with a parasitic granular growth.

Though this form is more plentiful in the south, the size of some dredged off Balta is quite as large as elsewhere.

In a specimen from Lochmaddy in which five of the posterior feet of the right side had been removed, long papillæ from the dorsal border (cirri?) and shorter papillæ from the ventral indicated regeneration.

Reproduction.—A specimen from St. Andrews in November was laden with ripe ova, so that the breeding season would seem to be in winter, as in the case of *Harmothoë*.

Variety.—A very distinct variety comes from the 'Porcupine,' 1869, 173 fathoms, on muddy sand, bottom temperature 49·6°; from 45 fathoms, eight miles N.W. of Cape Sagres, 'Porcupine,' 1870; off the Hebrides, 1866, Dr. Gwyn Jeffreys; West Sands, St. Andrews, 1867 (R. M.); and 90—25 fathoms, 30—50 miles west of Valencia, Ireland (Prof. Haddon). Abundant in various parts off Shetland, Dr. Gwyn Jeffreys, 1867–8.

The pigment on the scales is similar; that on the naked segments posteriorly, however, diverges, for it forms a single fan with a posterior bar only. Moreover, the papilla for the dorsal bristles has black pigment. No appreciable change is observable in the structure of the scales. The distinguishing feature is the condition of the dorsal bristles, which, instead of forming the elongated tip so characteristic of the typical form, end bluntly, so that the whole tip is broad, with a very short, bare portion at the tip. The spinous rows are as closely arranged as in the normal form. The ventral bristles and cirri do not differ from the typical example.

A form dredged by the 'Porcupine' in 173 fathoms, 1869, and in 160 fathoms, 17th August, 1870 (No. 42), differs from *Lagisca floccosa* and its variety in having no distinct bosses or globular papillæ on the scales posteriorly, while considerable papillæ occur anteriorly; the scales, moreover, having much larger spines, which show a tendency to be arranged in rows in the reniform scales, the largest being near the posterior border. In the first pair of scales the spines are larger, and the short cilia extend at intervals all round, while a few short cilia occur along the outer and posterior edge. The ventral cirri have a few clavate cilia. The bristles of the dorsal branch of the foot (Plate XXXVIII,

fig. 3, an average form) have the spinous rows much more distinct than in *L. floccosa* or its variety, and the smooth portion at the tip is small and acutely pointed. The ventral bristles do not much differ. The anterior pair of eyes are proportionately much larger than in *L. floccosa*.

The *Polynoë foliosa* of Savigny (1820) seems to come near this species.

De Quatrefages (1865) describes it as having a small head, almost quadrate, a long thick median antenna, the lateral small and slender. Segments 40—42. Scales large, much imbricated and decussate, rounded, smooth, not ciliated, caducous. He procured it, 42 mm. long, on the oyster-banks at St. Vaast. When living it is of a brownish-white colour (reddish brown ?), and thus is readily distinguished from its congeners.

Grube found a species at St. Vaast, where De Quatrefages had met with his, with only fifteen pairs of elytra, which, however, had cilia on their border ("Am Aussenrande gefranzte Elytren besitzt"). If such be so, then the species differs from *Lagisca floccosa*, in which no cilia are present on the scales.

Hornell says his specimens possess fifteen pairs of elytra, with only subglobular processes on the margin (whereas *P. floccosa* has clavate). He thinks Malmgren's artist exaggerated the spikes on the dorsal bristles, making them too coarse. His specimens agreed in colour with Malmgren's *L. propinqua*, but differed from mine. He figures one of the globular papillæ near the margin of the scale.

L. Roule found what he thinks a variety at depths ranging from 650 metres to 1700 metres in the Atlantic, with small eyes and pale scales. Its relationship to other closely allied forms has yet to be determined.

2. Lagisca Elisabethæ,[1] *McIntosh*, n. s.

Specific Characters.—This species has 30—35 segments, but a considerable portion of the tail is absent. Head curiously mottled with black. Eyes black, nearly equal; a pair at the anterior border, and the other on the lateral prominence of the head. Tentacles and tentacular cirri ciliated, and the ventral cirri have also short clavate cilia. Palpi with a dense series of minute papillæ with enlarged tips. Scales, probably fifteen pairs, scabrous, greyish mottled with black, densely spinous, with one or two large conical processes posteriorly, and the outer and posterior edge fringed with club-shaped cilia. Dorsal bristles with well-marked spinous rows, and a minute bare portion at the tip. Ventral bristles mostly bifid. Akin to *L. floccosa*.

Synonyms.

1875. *Lagisca propinqua*, McIntosh. Invert. and Fish., St. A., p. 115.
1876. „ „ Ibid. Trans. Zool. Soc., ix, p. 375, pl. lxvii, figs. 12—14.

Habitat.—Procured from the débris brought by fishing-boats from the off-shore waters, St. Andrews, 1870 (E. M.).

Head (Plate XXVII, fig. 3).—The head is curiously marked, for a pale band of considerable breadth occurs posteriorly—boldly defined by the blackish collar. A pale

[1] Named after the best benefactress in Marine Zoology my museum ever had.

belt runs from this forward in the median line to the base of the tentacle, which is blackish; and the anterior areas of the head thus mapped off are brownish red, with dark grains along the edges. The anterior pair of eyes are lateral, lying in front of the brownish-red border of the region. The posterior pair are large, black, widely separated, and situated on the pale band of the region. The median tentacle is absent. The lateral tentacles are short, brownish at the base, with a filiform tip, and furnished with long clavate cilia. The palpi have a dense series of minute papillæ, with enlarged tips. The tentacular cirri have a blackish patch at the base, a light brownish one in the slightly dilated portion near the tip, then a whitish ring, and lastly, a dark brownish one at the base of the filiform termination. They possess long cilia with globular ends.

Body.—The body is typical, that is, slightly narrowed in front, more so posteriorly, about 13 mm. in length, and mottled with blackish pigment on the dorsum in a remarkable way. The dorsum of the first four segments is mainly blackish, then each segment presents near the posterior border a median bar, which by-and-by becomes a speck. Symmetrical touches of pigment mark the lateral regions of each segment, and two blackish specks occur on the base of the foot. A well-marked median band of black characterises the dorsal lip; the ventral surface is otherwise pale. The pale scale-pedicles are very distinct, and proportionally large.

The dorsal cirri agree in colour with the tentacular cirri, and besides the longer cilia with globular ends on the column of the organ, shorter cilia proceed upwards rather beyond the lower third of the extremity. The ventral cirrus is subulate, with sparsely distributed and short clavate papillæ. The first has a dense coating of cilia, with large globular tips.

Scales (Plate XXXII, fig. 6) probably fifteen in number, though the last pair had disappeared in the specimen. The first pair are rounded, densely spinous, and ciliated almost entirely round; the cilia being longest externally, and with characteristic globular ends. The rest of the scales are more or less reniform, becoming ovate posteriorly. The general colour of the scales is dark greyish with a blackish patch in the centre, the pigment being broken into fragmentary portions. The outer and posterior edge is ciliated, as indeed is the greater part of the circumference. They commence as short, almost baccate processes, and towards the outer edge are more elongate, the extremities being nearly globular, the series again diminishing to terminate in short papillæ. With the exception of the covered portion of the scale the surface is densely covered with minute and rather blunt spines, a few of which towards the outer and posterior edge become larger acute processes, or bluntly conical papillæ. A considerable portion of the inner region of the scale is curiously reticulated, so that the spines are grouped in areas—a condition visible under the lens as well as the microscope over the greater part of the scale. The anterior and outer border has larger spines than those on the general surface, as shown in the figure. From the extreme roughness of the scale, mud and débris lodge in the crevices.

Feet.—The first foot has two curved bristles which correspond in structure to the dorsal type, though the smooth tips are somewhat broader.

The dorsal bristles of the second foot are nearly typical, except that the smooth tips are larger. The ventral are more slender than the subsequent forms, but show a bifid tip.

The dorsal division in the typical foot bears a somewhat dense mass of rather short pale bristles with a slight curvature. The tips are short and by no means acute (Plate XXXVIII, fig. 4, representing one of the longer forms). The spinous rows are much more distinct and longer than in *Lagisca floccosa*, and the shape of the bristle differs. The ventral division has translucent bristles with moderately long shafts. The tips of the superior series (Plate XXXVIII, fig. 5) are long and somewhat tapered, with rather distant rows of long spines, the smooth terminal region being minutely bifid. The tips gradually become shorter and stouter inferiorly (Plate XXXVIII, fig. 6), the strongly curved terminal hook and the secondary process with its characteristic angle of incidence being noteworthy. Some of the latter bristles show traces of an outward curve between the secondary process and the first row of spines. Towards the ventral border the secondary process diminishes with the general size of the bristle, but a minute trace occurs in almost all.

The dorsal bristles in most feet are densely coated with débris and minute filamentous algoid growths, and in some cases the tips of the ventral are likewise encrusted with a parasitic structure showing minute rods.

This species approaches the *Polynoë aspera* of Hansen [1] from the Norwegian North Atlantic Expedition, and of Théel,[2] from Nova Zembla, but differs in regard to the palpi, which are smooth in the northern form, and also in the shorter tips (bare) to the dorsal bristles. It may be that further examination will show they are identical.

3. Lagisca Jeffreysii,[3] n. s.

Specific Characters.—Length 16 mm. or more. Head more elongate than in *Lagisca floccosa*, with blunt anterior peaks. Posterior pair of eyes just in front of the collar, anterior pair somewhat further forward than in *L. floccosa*, and lateral in position. Median tentacle absent; lateral subulate, and slightly beneath the base of the former. Tentacular cirri slender, and with a series of clavate cilia which commence only when the basal third of the process is reached. Palpi have rows of minute papillæ with nodular tips. First scales rounded and minutely spinous, rest ovate-reniform, with a distinct fold from the scar of attachment to the hilus at the anterior border, speckled throughout the posterior half with pale specks as if variolated. The outer border has long cilia. Dorsal bristles of moderate length, with well-marked spinous rows, and a very short smooth tip. They are nearly straight. Ventral bristles with rather short spinous rows, and a short bare tip with a strongly curved hook at the end, and a secondary process—directed nearly straight—distally. Ventral cirrus with clavate cilia.

Habitat.—Dredged in sixty fathoms, nine miles off Balta, in 1868, by Dr. Gwyn Jeffreys.

[1] 'Nat. Mag. f. Naturvid.,' 24, p. 4, 1877, and 'Norsk. Nordh. Exped.,' vii, p. 5, pl. ii, f. 11—15, 1882.

[2] 'Annel. N. Zemb.,' p. 10, pl. i, f. 1—4, 1879.

[3] After the late Dr. Gwyn Jeffreys, a veteran explorer of the Zetlandic seas. The name was formerly given to the succeeding species—now associated with *P. extenuata*, Grube.

Length 16 mm., but the specimen had the posterior extremity regenerated, and therefore was probably considerably longer.

The head (Plate XXVII, fig. 10) is more elongate than in *L. floccosa*, and the peaks in front terminate bluntly. The posterior pair of eyes are of moderate size, and lie just in front of the collar; the anterior pair are somewhat further forward than in the species mentioned, are larger than the posterior pair, have a lens-like centre, and are more or less lateral in position. The median tentacle is absent. The lateral tentacles are short and subulate, being lateral in position, and only slightly beneath the bases of the former. They have a series of cilia with clavate tips. The tentacular, like the dorsal cirri, are rather slender, with a filiform tip and a series of clavate papillæ, which do not commence till the basal third of the process is reached, and extend within a short distance of the filiform tip. They are in moderate number, and diminish at each end of the series. The palpi are pale brown, and have rows of minute papillæ with expanded nodular tips. Two of these rows are dorsal.

The body is somewhat narrowed anteriorly, and posteriorly appears to have been recently regenerated after the twenty-fourth foot. The only colour exists in the dorsal fold of the mouth, which is brownish.

Scales (Plate XXXII, fig. 7).—The first pair of scales are rounded, and under a lens are minutely speckled as if variolated. This condition, however, is due to hypodermic structure, and does not affect the surface. The latter has a series of minute spines, which densely cover the outer and posterior part of the scale. Even in these scales a distinct fold occurs anteriorly, but no cilia on the edge. The other scales present are rather large, ovate-reniform in outline, and have a distinct fold from the scar of attachment to the hilus at the anterior border. They are faintly brownish in hue (in spirit), and on a dark surface—under a lens—are speckled throughout the posterior half with pale specks which simulate pustules. The outer border has a well-marked series of long cilia, which are not dilated at the tip. The smoothness of the edge of the scale, with this exception, is noteworthy.

Feet.—The second foot shows rather short and straight dorsal bristles, with distinct spinous rows as in *Lagisca floccosa*, var., from the 'Porcupine,'[1] with a very short smooth portion of a bluntly conical shape at the tip. The ventral bristles are slender, with elongate spinous regions and attenuate tips.

In the third foot the ventral bristles are stronger, and the bifid condition distinct in many—the secondary process passing nearly straight towards the tip.

In the typical foot the dorsal bristles (Plate XXXVIII, fig. 7) are of moderate length, with well-marked spinous rows and a very short smooth tip. They are nearly straight, with the exception of a few at the inner border of the tuft. *Loxosomæ* and algoid growths are common on these bristles. The ventral division has a dense group of pale bristles with elongated shafts, and, though the upper forms (Plate XXXVIII, fig. 8) have long tips, on the whole with rather short spinous regions, as shown in one from the middle of the foot (Plate XXXVIII, fig. 9). These bristles have very distinct spinous rows, a short bare tip with a strongly curved hook at the end, and in the majority a secondary process which is directed nearly straight distally, so that they differ quite from

[1] *Vide* p. 302.

those of *Lagisca floccosa*, which have longer spinous regions and a different curve at the tip. The ventral cirrus has well-marked clavate cilia. The segmental papilla is minute.

In the presence of the pale specks on the scales it resembles the rare *Polynoë nivea* of Sars,[1] but the absence of cilia in the latter species and other characters distinguish it.

4. Lagisca extenuata, *Grube*, 1840 (?).

Specific Characters.—Length about one and a quarter inches in spirit. Head with a deep median groove and two prominent peaks; eyes comparatively large, two in front of the nuchal collar, and two larger in front of the middle line, and lateral in position. Median tentacle somewhat long, scarcely dilated below the filiform tip, and with moderately long cilia. Lateral tentacles short, with attenuate tips. Tentacular cirri similar to the median tentacle. Palpi have rows of minute conical papillæ. Scales fifteen pairs, rounded in front, reniform posteriorly, densely covered with minute spines, and the free edge is profusely ciliated. Dorsal bristles strong, slightly curved, and closely spinous, with a smooth spear-shaped tip; ventral with a bifid tip and close rows of spines, the tips of some at the ventral edge being simple. Dorsal cirri somewhat slender, with numerous and slightly tapered cilia with bulbous tips. Ventral cirri stout, with short cilia. Segmental (nephridial) papilla scarcely distinct.

Synonyms.

1840. *Polynoë extenuata*, Grube. Actin., Echin., u. Würmer, p. 86 (?).
1861. „ *cirrata* (O. F. M.), Grube. Ausflug nach Triest., p. 81.
1865. *Lepidonotus Leachii*, De Quatrefages. Ann., p. 258?
„ „ *dumetosus*, Ibid. Annel., t. i, p. 259 (?).
1867. *Lagisca Ehlersii*, Malmgren. Ann. Polych., 9.
1868. *Polynoë extenuata*, Claparède. Ann. Nap., 70, pl. ii, fig. 2.
1870. „ „ Supp., p. 372.
1875. „ „ Marion and Bobretzky. Ann. Sc. Nat., 1875, p. 6.
„ *Lagisca extenuata*, Marenzeller. Zur Kennt. Adriat. Annel., p. 5, Taf. i, f. 1.
1876. „ *Jeffreysii*, McIntosh. Trans. Z. S., ix, p. 397, pl. lxxi, f. 8, 9, 11, and 12; pl. lxxiii, f. 17 and 18.
1884. „ *extenuata*, V. Carus. Fauna Medit., 202.
1888. „ „ De St. Joseph. Ann. d. Sc. Nat. (7), v, p. 180, pl. viii, f. 52—54.
1890. „ „ Malaquin. Ann. Boulon., 22.
1891. *Polynoë* (*Lagisca*) *extenuata*, Hornell. Op. cit., 12, pl. xiii, f. 4 and 8.
1898. *Lagisca extenuata*, De St. Joseph. Ann. d. Sc. Nat. (8), v, p. 237.

Habitat.—A common Mediterranean form procured in the 'Porcupine' Expedition of 1869, in the tube of an *Eunice*, in 173 fathoms off the west coast of Ireland, and also in a free condition on the same ground—muddy sand. Next year (1870) it was dredged at the depth of 690 fathoms in the Atlantic (Channel slope).

It is also a tidal form on the eastern border of the Irish Sea.

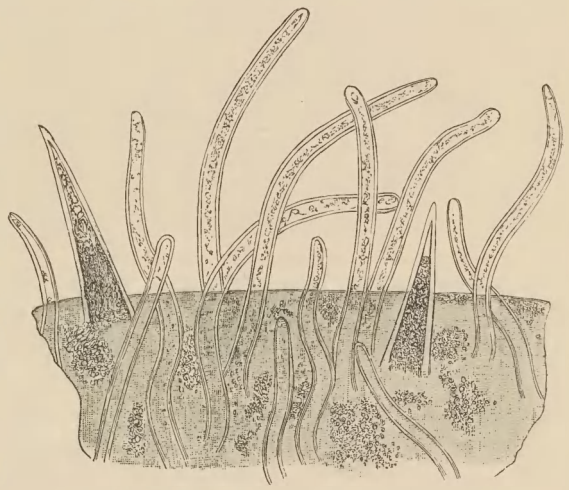
[1] 'Geol. og Zool. Reise,' 1862, p. 39.

Head somewhat hexagonal (Plate XXVIII, fig. 2), with a deep median groove at the base of the tentacle, and two prominent peaks, each of which is at a distance from the tentacles. The eyes are comparatively large, and, judging from the conditions of the largest example, increase with age and depth of water. Two slightly smaller are situated in front of the nuchal collar, and look dorsally, and two somewhat larger rather in front of the middle of the head, and lateral in position. In the example with the large eyes (from 690 fathoms) the anterior pair show traces of a corneal lens. The median tentacle is somewhat long, scarcely dilated below the filiform tip in the preparations, and covered with moderately long cilia having a slightly bulbous tip. The lateral tentacles are short, but also have attenuate tips. The tentacular cirri are similar to the median tentacle. None of these organs show any signs of pigment in the preparations. The palpi are of moderate length, and have rows of minute conical papillæ, as De St. Joseph also found, whereas Marenzeller observes that their upper surface is smooth. In the British forms one prominent papillose ridge occurs dorsally.

Body.—Somewhat narrow and elongated, slightly tapered towards the head, and very gradually towards the tail. Forty-five segments bear bristled feet, and the tail is not quite complete. Behind the distension caused by the included proboscis, the segments are boldly marked by the lozenge-shaped transverse bars which stretch between the bases of the scale-pedicles, or their homologues in the other feet. Each segment thus shows an anterior and posterior paler belt, and a median darker area. Traces of brownish pigment occur posteriorly at the bases of the feet and on the lozenge-shaped transverse bars. In some the brown pigment is broken into a number of symmetrically placed touches, two of which are on the bases of the feet, and the rest in interrupted bands across the segments. Ventrally traces of pigment occur on the lips, and the median iridescent depressed band is well marked. The conical segmental (nephridial) papillæ at the posterior border is directed upward between the feet. A considerable portion of the body posteriorly is uncovered by scales.

De St. Joseph states that there are only seventeen papillæ at the margin of the proboscis, but so far as can be seen there are nine in each half.

Fig. 24.



Edge of scale of *Lagisca extenuata*, Grube.

Scales (Plate XXXII, fig. 8) somewhat thin, in number fifteen pairs. They are rounded in front, reniform or irregularly rounded posteriorly, and of a uniform greyish hue in the preparations, though some are quite pale. Their surface is nearly smooth to the naked eye, but under a lens the whole is densely covered by a series of minute, pointed, slightly brownish spines, and the free portion of the edge is profusely ciliated (Fig. 24), the cilia being pellucid, tapering structures terminating in a bulbous tip. Marenzeller speaks of the network formed on the surface by the pigment; and Hornell mentions that the surface is mapped out into separate areas, each containing several spines. The under surface is iridescent, and the scar for attachment is situated near the outer and anterior border. Marenzeller shows, besides the spines on the edge of the scale, cylindrical papillæ, but these have not been observed in our specimens. The first scale is ciliated all round with the exception of the short covered portion.

De St. Joseph often found a white touch in the centre of the scales, which were marked with brown, grey, and whitish. Hornell's figure of the scale differs from the specimens referred to here.

Feet.—The base of first foot shows about two bristles, which conform to the type of dorsal tuft, though they are considerably smaller. In the next foot the dorsal bristles have attained great strength, though they are shorter than the typical forms, and much broader towards the tip, which is little tapered. The bristle is therefore proportionally more powerful than the typical form. They have a close series of spinous rows. The contrast between the massive dorsal and the slender ventral bristles is marked, and the tips of the longest of the latter extend only a very little beyond the extremities of the dorsal. Their tips seem to be brittle, and while the inferior are more elongated and slender, the upper forms present the characteristic short broad tips of the typical bristles.

In the third foot the size of the ventral bristles has largely increased, and they stand out nearly half their length beyond the dorsal. The tips now approach the normal, except that those of the inferior series are longer, and the upper slightly shorter.

In the typical foot (Plate XLII, fig. 30) the dorsal bristles form a powerful fan, the inner and outer borders of which have more slender forms, while the greater number consist of strong, slightly curved and tapered bristles, with somewhat closely arranged spinous rows, and a smooth spear-shaped tip (Plate XXXVIII, fig. 10), the latter having a tendency in some to follow the shape of the same region in the ventral bristles (Plate XXXVIII, fig. 11). Others, again, show a sharper tip, and at the inner border of the tuft are one or two with a slender tip. The ventral division commences with a series having very long spinous regions, and a short and characteristically shaped bare tip (Plate XXXVIII, fig. 12). The rows of spines are much finer and more dense than in *Harmothoë imbricata*—indeed, in this respect they approach *Acanthicolepis asperrima*. Those following the upper series show a distinct secondary process beneath the tips (Plate XXXVIII, fig. 13). The length of the spinous tips diminishes in the usual manner towards the ventral edge of the foot, the bare portion at the tip in several of the lowest showing no secondary process. The papilla above the spine is long and filiform, and the ventral cirrus extends beyond the bases of the adjoining bristles, and has sparsely distributed and short clavate cilia. All the bristles are of a pale yellowish hue.

Posteriorly the dorsal division diminishes in length, and disappears in some of the

terminal feet. At the tail the tips of the attenuate ventral bristles become much elongated, some, however, maintaining the typical outline.

The dorsal cirri spring from the posterior border of the foot, and in those feet without scales a well-marked papilla, the homologue of the scale-peduncle, occurs at the inner border of the basal process of the cirri. They are somewhat slender, and have numerous and slightly tapered cilia with a bulbous tip. The cilia are shorter inferiorly above the base, and again distally, and they cease about the middle of the filiform tip. Posteriorly the cirri become longer and more slender, and the cilia more attenuate. The caudal cirri are also slender. The long first ventral cirrus is stout, with a distinct enlargement below the tip, which is much less filiform than the dorsal. The cilia, which are considerably shorter and more uniform in length than those on the dorsal cirri, extend from the base beyond the middle of the terminal slender region. They are slender processes with a bulbous tip.

Loxosomæ occur at the bases of the bristles and algæ with other forms on them.

In Grube's original description of *Polynoë extenuata*[1] the scales are entered as smooth at the edge, and with minute warts. The inferior bristles are a fourth longer than the upper. Colour brownish grey above, bluish iridescent beneath. Elytra caducous. There is nothing to give certainty.

Baron de St. Joseph (1888) found one in the tube of *Serpula vermicularis*, but it may have simply crept there for temporary shelter. He is of opinion it is closely allied to *Lagisca floccosa*.

Hornell (1891) describes apparently the same form from the Liverpool district, though his figure of the dorsal bristles is rather indefinite. Its relation to *Evarne impar*, to which he refers, is less marked than to *Lagisca floccosa*. The figure of the scale given by this author differs from those procured by the 'Porcupine.'

This form would seem to be nearly allied to Grube's *P. extenuata* as described by Marenzeller in his 'Adriatic Annelida.'[2] He does not give the minute details nor describe the special condition in the tips of the upper bristles, which are longer in his figure and more distinctly bifid than in the British examples. On the whole the latter would seem to be a well-marked variety, in which the secondary process of the ventral bristles was less developed.

De St. Joseph (1878),[2] after Langerhans, would make *Lagisca rarispina* and *L. propinqua*, Malmgren, varieties of this species—a view which the preceding descriptions and figures will sufficiently criticise. He had the advantage of the specimens in the Parisian Museum in identifying *Lepidonotus Leachii* and *L. dumetosus*, both of De Quatrefages, with *Lagisca extenuata*.

[1] 'Actin., Echin., u. Wür.,' p. 86, 1840.

[2] Op. cit., 1898, p. 238.

Genus XII.—Acanthicolepis (*Norman* MS.);[1] Dasylepis, *Malmgren*, 1867.

Body elongate-oblong or sublinear. Head produced anteriorly into two pointed lobes on each side of the median tentacle, below the base of which the lateral tentacles spring. Eyes as in *Eunoa*. Scales eighteen pairs, coarsely spinous, overlapping each other and covering the entire dorsum. Dorsal bristles stronger than the ventral, tapering from the middle to the tip. Ventral bristles with short, bare, hooked tips, above the spinous rows, with a minute secondary process in some towards the upper third of the series. Segmental eminence distinct, papilla somewhat long and slender anteriorly, short posteriorly.

Acanthicolepis asperrima, *Sars*, 1860.

Specific Characters.—Body rather broad and thick, tapered slightly anteriorly, and still more posteriorly. Segments about forty-one. Eyes large, visible from the dorsum, two in front of the nuchal fold, and two somewhat lateral in position about the middle of the head, or perhaps a little anterior to it. Palpi of moderate length (in spirit), with minute cylindrical papillæ. The other appendages of the head have a slight enlargement below the long tapering tip, the region above and below the enlargement having long cilia. Tentacle and dorsal cirri similar. The ventral cirri are of moderate length, and have short cilia. Scales eighteen pairs; the first pair rounded, the rest more or less reniform, roughened, with long and strong horny spines, especially towards the free border. The tips of the spines are often bifid.

Habitat.—The only British locality seems to be the Frith of Clyde, where it was obtained by the veteran naturalist of that region, Dr. D. Robertson. It ranges to Norway, where it was procured by Sars, and lately by Canon Norman in his productive dredgings.

Synonyms.

1860. *Polynoë asperrima,* Sars. Forh. Vid. Selsk. Christ., 1860, p. 59.
1865. *Lepidonotus pharetratus?* Baird. Johnst. Cat., B. M. Suppl., p. 340.
1867. *Dasylepis asperrima,* Malmgren. Ann. Polych., p. 7.
1873. „ „ Sars. Bid. Christ. Faun., p. 2.
1876. „ „ McIntosh. Trans. Z. S., ix, p. 374, pl. lxvii, f. 9—11.
1879. „ „ Tauber. Ann. Danic., 82.
1883. „ „ Levinsen. Nord. Annul. Vidensk. Meddel. f. d. Nat. For. i Kiobenhavn, 188 and 195.

The length of the example in the British Museum is about an inch.

The *head* (Plate XXVII, fig. 6) is somewhat longer than broad, with a well-marked

[1] As the title *Dasylepis* has been pre-occupied by Pander for a Silurian Ganoid (1856), the name suggested by Canon Norman, viz. *Acanthicolepis*, may be substituted.

median groove, which trends outward in front to terminate in the peaks on each side of the median tentacle. The eyes are large and black, two being situated a little in front of the nuchal fold, and slightly lateral in position, and two in front of the lateral projection of the head, and also more or less lateral in position. Both pairs are thus only fully seen in side view. No example has a median tentacle. The lateral tentacles arise under its base, and are short organs with a trace of an enlargement below the slender tip, and somewhat closely ciliated. The palpi, which are of moderate length, show minute cylindrical papillæ in certain parts, but seem to be mostly smooth. Segmental papilla slender and somewhat long anteriorly, short posteriorly; directed upwards between the feet.

Body flattened and proportionally broad, slightly narrowed towards the head, and more distinctly posteriorly, where it is terminated by the two subanal cirri. The dorsum presents no feature of note. Ventrally the segmental papilla is slender and small, arising from an elevation close to the posterior border of each foot. These rounded elevations form a moniliform series along each side of the body. The cirri are comparatively slender and short.

The colour in the spirit-preparations has mostly disappeared, only one showing a few brownish transverse bars anteriorly on the dorsum, and a slightly brownish hue on the anterior folds of the mouth. The palpi have a curious greenish-grey colour, while a trace of brown remains on the cephalic appendages, the dorsal cirri, and the first (long) ventral cirrus. The anterior scales are brownish grey, with the brown spines standing prominently outward.

Scales (Plate XXXII, fig. 4).—The first pair are more or less rounded, and studded chiefly at the margin with the horny spines, the intervening spaces being often coated with mud and parasitic growths. The scales generally are by no means thick, but are covered with the chitinous papillæ or bosses, small towards the anterior edge, but rising into the long spinous processes posteriorly (Plate XXXIII, fig. 3). These processes terminate in a bifid, trifid, quadrifid, or quinquefid tip. . The central axis of each is cellulo-granular. From the inner to the outer margin also a few slender cilia with clavate tips are present. The majority of the scales are more or less reniform, but posteriorly the last pair become ovoid, with the same structure of spines and cilia. The under surface is smooth and iridescent, with the scar for attachment somewhat nearer the anterior than the posterior border, and more distant from the inner than the outer margin. The scales are easily removed.

Feet.—The first (with the tentacular cirri) has three bristles, which conform to the type of the dorsal bristles, only they are proportionally shorter and more curved.

In the second foot the dorsal bristles are stout and have boldly marked spinous rows which in lateral view follow slightly oblique lines across the shaft. They are formed by a thin chitinous plate split into the spines or teeth, somewhat after the fashion of the ctenidial rows in *Pleurobrachia*, and increase in size from the dorsal to the ventral surface of the bristle. The terminal region of the bristle is smooth. The ventral bristles are very slender, with long tips having alternate spinous rows, the extremities being slender and slightly hooked. The long ventral cirrus has moderately long clavate cilia.

The usual gradations occur till the typical foot is reached (Plate XLII, fig. 29).

It is characterised by the long and strong dorsal bristles (Plate XXXVII, fig. 28), which almost reach as far as the tips of the ventral. They are for the most part stiff, straight, and gently tapered bristles, those at the inner edge of the tuft being shorter and slightly curved. The spinous rows are well marked from a short distance above the free edge to the extremity, which is pointed and smooth. The ventral division of the foot is less acute than in front, the tip being almost fan-shaped, with the spine at the upper border. The bristles have long straight shafts, while the tips are slightly dilated at the commencement of the spinous region, have somewhat short bare tips of moderate breadth, a well-marked hook at the extremity, and in some, especially at the upper third of the series, a minute spur beneath (Plate XXXVII, figs. 29 and 30). The great density of the dorsal bristle-tufts gives the animal a woolly appearance, and in some they are tinted of a ferruginous hue from adherent growths. The ventral cirrus does not reach the tip of the fleshy part of the foot, and has short clavate cilia.

In the terminal feet a similar condition to that in front exists, though the dorsal bristles as a whole are more tapered. Their spinous rows are very distinct. The ventral bristles in the last foot are attenuate. Parasitic algæ are frequent on the bristles.

The segmental (nephridial) papilla becomes distinct about the sixth foot.

Reproduction.—One example (Canon Norman's) from Norway, in July, 1878, shows numerous ova in the perivisceral space.

The presence of a minute tooth below the tip of the ventral bristles shows the proximity of the present species to the genus *Harmothoë* and its allies. This spur had escaped the notice of Malmgren.

It is allied to *Harmothoë areolata*, Grube, but the latter differs in the more regular arrangement of the surface of the scale, the fewer though larger and less acute spines, the exquisite reticulation around them, and the much more numerous cilia of the outer and inner borders. It seems to be rare in Britain, though the example from the Clyde is of comparatively large size.

Acanthicolepis asperrima was first described by the elder Sars from specimens procured a few miles north of Bergen, a region which has been rendered classic to zoologists by his labours and by those of his successors. Recently no one has done more in collecting the annelids of the same region than Canon Norman.

Genus XIII.—HARMOTHOË (*Kinberg*, 1857),[1] char. em.

Body not much elongated. Lateral tentacles fixed below the median. Palpi with rows of minute truncate papillæ. Eyes four; two at the peaks in front, two posterior on the dorsum in front of the collar. Scales fifteen pairs, covering the whole of the

[1] Kinberg described the genus thus:—Cephalic lobe narrow anteriorly. Base of the tentacle occupying the fissure of the cephalic lobe. Bases of the antennæ fixed under the base of the tentacle. Pharynx with $\frac{9}{9}$ papillæ and jaws. Elytra fifteen, covering the dorsum to the end of the body. Body not long.

dorsum. Dorsal bristles strong, with well-marked spinous rows and a smooth portion at the tip. Ventral bristles with simple hooked tips, superiorly and inferiorly; rest with a well-marked secondary process. Segmental papilla long. Papillæ of proboscis $\frac{9}{9}$. Pre-gastric cæca long and slender.

1. Harmothoë imbricata, *L.*, 1767. Plate XXVI, fig. 3.

Specific Characters.—Body elongate-ovate, narrowing more distinctly posteriorly than anteriorly. Head somewhat ovate, with the median furrow in front, and terminating on each side in a blunt peak. The posterior pair of eyes are of moderate size, dorsal in position, and are alone visible from above. The anterior pair lie under the peaks in front, are somewhat larger, and look outward and forward. A trace of a cuticular lens is occasionally seen in these. Tentacle of moderate length, arising from an enlarged dark-coloured base (ceratophore); the proximal part of the column (ceratostyle) brownish with a dark belt below the pale enlarged region, to which the filiform tip is attached. A few rather short clavate cilia occur on its surface, the filiform tip being smooth. The lateral tentacles are beneath the former, and are about half their length, with a very slight swelling below the filiform tip. They have proportionally more numerous clavate cilia than the median tentacle. The tentacular and dorsal cirri agree with the latter in outline, and have a considerable number of clavate cilia. Palpi elongated and tapering, with rows of somewhat truncate clavate papillæ. Ventral cirrus of moderate length, with a few short clavate cilia. Segmental (nephridial) papilla comparatively long. Scales fifteen pairs, and, with the exception of the rounded first pair, ovate-reniform or obliquely ovate. Though smooth to the naked eye, they are minutely spinous under the microscope, and the outer margin has somewhat short cilia. Only in large specimens is there a row of brownish subglobular papillæ within the posterior margin. Dorsal bristles strong, with rather distinct spinous rows, and a well-marked smooth region at the tip. Ventral bristles with an elongated spinous region superiorly, a short spinous region inferiorly, and a simple smooth tip with a hook. All the rest have a well-marked secondary process beneath the hook.

Habitat.—Distributed between tide-marks and the adjacent region everywhere round the shores of Britain, from Shetland to the southern coast of England, but it is comparatively rare in the Channel Islands (Guernsey), where its place is occupied by *Lagisca floccosa*. It extends also to the depth of 75 to 96 fathoms ('Porcupine' Expedition, 1869) and to 125 fathoms off the west coast of Ireland. It ranges to Spitzbergen, Greenland, Iceland and Scandinavia, to the Adriatic and Mediterranean, as well as to other European shores, and is also found in America (Verrill) from Cape Cod to the St. Lawrence. According to Marenzeller it extends to Japan, and Grube records it from northern and eastern Siberia, and from Sitcha and the Sea of Okhotsk, and various other parts of the Arctic Sea.

It is common in the stomach of cod and haddock (E. M.). It has also been found in the tube of *Terebella nebulosa*, Bressay Sound, and beside *Polycirrus* in an old shell in the same region.

Length.—On each side of $1\frac{1}{2}$ inches, and reaching 2.

Synonyms.

1766. *Aphrodita lepidota,* Pallas. Miscell. Zool., p. 94, Tab. 7, fig. 15; Tab. 8, f. 1, 2.
„ „ *imbricata,* L. Syst. Nat., twelfth edit., vol. i, p. 1084.
1768. „ *violacea,* Ström. Kongel. Norsk. Vidensk. Selskabs. Skrifter, Deel iv, p. 366.
1776. „ *cirrata,* O. F. Müller. Prod. Zool. Dan., p. 218, n. 2644.
„ „ *violacea,* idem. Ibid., p. 218, n. 2645.
„ „ *lepidota,* idem. Ibid., p. 218, n. 2643.
„ *Die flache Aphrodite,* Martini. Allgem. Geschichte der Natur, iii, p. 132.
„ *Aphrodita imbricata* (Ziegelrücken Aphrodite), Martini. Ibid., iii, p. 151.
1780. „ *violacea,* Fabricius, O. Fauna Grönl., p. 308, n. 290, Tab. 1, fig. 7.
1792. „ „ Brugnière. Encycl. Méthod., vers. i, p. 89.
1800. *Die flache Aphrodite,* O. F. Müller. Naturges. einiger Wurm-Arten, p. 180, Tab. 14, figs. 1—5.
1820. *Polynoë cirrata,* Savigny. Syst. des Ann., 26.
1827. „ *violacea,* Bory de St. Vincent. Reproduced in Tableau Ency. Méthod., p. 135, pl. lxi, f. 30—33.
1828. *Eumolpe cirrata,* De Blainville. Dict. Sc. Nat., vol. lvii, p. 459.
1830. *Aphrodita cirrata,* Bosc. Hist. des Vers., 169, 2nd edit., 183.
1834. *Polynoë cirrata,* Audouin and Edwards. Annél., p. 86.
1840. „ „ Johnston. Ann. Nat. Hist., ii, p. 434, Tab. 22, f. 2.
1843. *Lepidonotus cirratus,* Œrsted. Grönl., Ann. Dors., p. 14, f. 1, 5, 6, 11, 14, 15.
„ „ „ idem. Annel. Dan. Consp., p. 13, fig. 43.
„ *Polynoë cirrata,* Rathke. Fauna Norweg., 150.
1851. „ „ Maitland. Fauna Belg., 214.
1853. *Aphrodita varians,* Dalyell. Pow. Creat., ii, 168, pl. xxiv, f. 11, 12.
1854. *Polynoë cirrata,* Thompson. Fauna, Ireland, 173.
1860. „ „ Sars. Vid. Selsk. Forhandl., 1860 (sep. copy, 5).
1865. „ „ De Quatrefages. Ann., i, p. 232.
„ *Lepidonotus cirrosus,* idem. Ibid., i, p. 261. (?)
„ *Polynoë cirratus,* Johnston. Cat. Brit. Mus., 114, pl. viii, fig. 2.
„ *Harmothoë imbricata,* Malmgren. Nord. Hafs.-Annul., p. 66, Tab. ix, fig. 8.
1867. „ „ idem. Ann. Polychæt. Spets., p. 154 (sep. copy, p. 9).
1871. „ „ Ehlers. Sitzb. phys.-med. Soc. Erlangen, Heft 3, p. 77.
1873. „ „ idem. Op. cit., Heft 5, p. 7.
„ „ „ Sars. Nyt. Mag. f. Naturvid., 19, p. 203.
„ „ „ idem. Bid. Christ. Fauna, iii, p. 3.
„ *Polynoë cirrata,* Möbius. Jahresb. Com., 1871, p. 111.
„ „ „ Kupffer. Ibid., p. 150.
1874. „ „ Möbius. Die Zweite deutsche Nordpolarfahrt, 1869, p. 253.
„ *Harmothoë imbricata,* Malm. Göteborgs Kongl. Vet. och Vitt. Samhalles Handl., Häftet 14, p. 74.
1875. „ „ Ehlers. Annel. 'Porcupine,' 1869, op. cit., p. 32.
„ „ „ McIntosh. Invert. and Fishes, St. A., p. 116.
„ *Polynoë cirrata,* Möbius. Jahresb. Com., 1872, p. 166.
1876. *Harmothoë imbricata,* McIntosh. Trans. Z. S., ix, p. 398.
1877. „ „ Hansen. Nyt. Mag. f. Naturvid., 24.
1878. „ „ Lenz. Jahresb. Com., 1874–6, Anhang., p. 12.
1879. „ „ Marenzeller. Südjapan. Annel. Denkschr. d. Kaiserl. Akad. Wiss. Wien, xli, p. 17, Taf. ii, f. 1.
„ „ „ Tauber. Ann. Danic., 80.

879. *Polynoë imbricata,* Théel. Kongl. sv. Vet. Akad. Handl., Bd. xvi, 3, p. 9.
1881. „ *cirrata,* Horst. Niederland. Archiv Zool., 1881, Suppl. Bd. i, p. 5.
„ „ „ Pelsener. Bull. Soc. Roy. Malacol. Belg., xiv, p. lxxxix.
1883. „ „ Kallenbach. Inaugur. Dissert. Eisenach, 1883.
„ *Harmothoë imbricata,* Levinsen. Nord. Annulat., 194.
„ *Polynoë imbricata,* L. Wirén. Chætop. 'Vega' Exped., &c., p. 389.
1884. „ *cirrata,* Carus. Fauna Medit., i, 201.
„ *Harmothoë imbricata,* Webster and Benedict. Ann. Mass., 701.
1886. „ „ Harvey Gibson. Verm. Liverp., 149.
1888. „ „ De St. Joseph. Ann. Sc. Nat., 1888, p. 161, pl. vii, f. 21.
1889. „ „ Trautzsch. Jenaische Zeitsch. f. Nat., xxiv, p. 66, and Arch. f. Naturges., 55 Jahr, Bd. i, Hft. 2, p. 136, pl. vii, f. 1.
1890. „ „ Malaquin. Ann. Boulon., 21.
1891. *Polynoë* (*Harmothoë*) *imbricata,* Hornell. Polychæta, Liverpool Dist., p. 231, pl. xiii, f. 2.
1896. *Harmothoë imbricata,* Michaelsen. Polych. Fauna, p. 11.
„ *Polynoë* (*Harmothoë*) *imbricata,* Roule. Camp. d. 'Caud.,' 443.
1897. *Harmothoë imbricata,* H. P. Johnston. Pacific Annel., Califor. Acad. Sc., 181, pl. vii, f. 37.
1898. „ „ Michaelsen. Grönl., Ann., p. 121.

The *head* (Plate XXV, fig. 6) is broader posteriorly than anteriorly, and shows only a single pair of eyes, which are of moderate size and just in front of the nuchal collar. The other and somewhat larger pair are placed under the anterior peaks, and present a trace of a cuticular lens. They look forward, outward, and slightly downward. Some specimens have the anterior eyes a little more lateral in position, so that they are partially seen from the dorsum, and occasionally an additional eye lies midway on one side, as in an example from the stomach of a haddock at St. Andrews and in another from Shetland (Fig. 25); while in a third from the latter region (Bressay Sound) the

Fig. 25.

Fig. 26.

Fig. 25.—Head of *Harmothoë imbricata* with an additional eye on the right, and the anterior pair more than usually evident.
Fig. 26.—Head of *Harmothoë imbricata* with three posterior eyes, while only one anterior is visible from the dorsum.

anterior eye on the left has moved backward, so as to resemble the position in *Lagisca floccosa* (Fig. 26), and in another from Lochmaddy the right anterior eye approaches the posterior even more closely. A still more remarkable variation exists in a young example from the same region in which both anterior eyes have moved backwards, so that they occupy the position of those in *Evarne*. The median tentacle is of moderate length, with a brownish column, a dark belt below and often encroaching on the whitish enlargement, and another dark belt beyond it at the base of the filiform process. The lateral tentacles are only slightly enlarged below the filiform tip, and have a few short clavate papillæ on the surface. The tentacular cirri are similar in shape and colour to the median tentacle. The palpi have rows of short and somewhat truncate clavate papillæ, the terminal surface showing in many minute processes.

The *body*, which consists of thirty-seven bristled segments, presents the normal outline, viz. narrowed somewhat abruptly anteriorly, but very gently posteriorly. The dorsum is often boldly pigmented from the first to the last segment with dark touches, which stretch across each segment between the pedicles of the scales or the corresponding papillæ in the other feet. In the anterior segments two of these touches occur, viz. a large one in the transverse "mark" of the segment, the pigment even invading the scale-pedicle, and a narrow one behind the former. In some a narrow belt in front of the larger bar is also present. A pale longitudinal line cuts the large median bar just mentioned into halves, but the smaller anterior and posterior pigment-belts remain entire except in a few posteriorly. The dorsum of the foot has also a sprinkling of dark pigment extending to the bases of the bristles. In some the pigment of the dorsum is much increased, so that the entire surface between the peduncles for the scales is blackish, enlivened only by the lines of the segment-junctions, and the pale lines around the transverse central pigment-bar, for no median longitudinal stripe occurs. The ventral surface is pale, with the exception of the anterior folds of the mouth, which have bands of dark pigment. The large terminal anal cirri are similar in structure to the dorsal, which, again, agree with the tentacle.

In the British specimens of *Harmothoë imbricata* the segmental papilla is so long as to merit the name of a cirrus throughout the greater part of the body, the process diminishing anteriorly towards the sixth foot, where it commences, and posteriorly in the terminal feet. So far as could be observed no sexual differentiation of the organ occurs either at the breeding season or subsequently. It is similar in both sexes. The segmental organs (nephridia) were clearly described in the Polynoidæ of Prof. Haswell, and shortly afterwards by Prof. A. G. Bourne.

Digestive System,—*Proboscis*.—Nine papillæ occur dorsally and ventrally in the extruded proboscis, the lower teeth of which bite to the right of the upper. The dorsal papillæ are slightly tinted with dark pigment, and the dorsal wall joining the organ to the mouth is similarly coloured.

The first (dorsal) gastric cæcum is a long slender tube which passes forward to the body-wall, and terminates in a bulbous region composed of two or three lobes. The narrow part of the canal is whitish like the wall of the gut, while the bulbous terminal portion is slightly yellowish or buff, like the glandular cæca of the gut, with which it agrees in structure. The second is nearly as slender. The two succeeding increase gradually in size. The next passes nearly transversely out, and begins the series of deep yellowish lateral glandular cæca.

The contents of the gut show sponge-spicules, foraminifera, star-fish plates, bristles of annelids, sand, and mud. Occasionally, however, portions of other annelids, such as *Nereis pelagica*, occupy the intestine. It is a voracious form.

Scales (Plate XXXII, fig. 10) fifteen pairs. The first pair are rounded, minutely dotted all over with short blunt spines, and have at the posterior border a series of somewhat clavate papillæ of variable number (six to twelve), which are visible under a lens. The outer and posterior margin bears short clavate cilia. The minute blunt spines increase in size at the outer and posterior borders. The rest of the scales are reniform or obliquely ovate, minutely spinous, the outer margin being furnished with short clavate cilia, and in certain specimens with large and small subglobose or

clavate papillæ. These papillæ were well marked in a series of comparatively small pale examples brought by Canon Norman from Finmark. The larger coloured specimens showed them less distinctly. The spines are larger in certain arctic examples, *e. g.* from Davis Strait. The cilia differ much in length even in large specimens. Some of the scales in spirit-preparations adhere with great tenacity; others separate readily. Their colour varies much, being, to take the order of Malmgren, bluish grey, greyish, brownish, or dark brown with a purplish or violet lustre, reddish brown (Vandyke brown), almost black, or greatly variegated. A striking variety has pale buff scales bordered with a narrow belt of dark brown. Others agree with the foregoing except that the scale is darker brown (Bismarck), with a small white patch in the centre and a few darker grains in front, the whole forming a beautiful series. Some have the outer half of the scales whitish, the inner blackish grey or brown, so that the animal has a broad blackish or brownish band down the centre. Occasionally the pale fawn-coloured scales are minutely and uniformly speckled with small brown touches. A few again are almost white. Some have a broad brownish-red belt, almost a third the breadth of the scale, curving within the posterior border, and as these are arranged symmetrically the effect is agreeable. A developing scale shows minute clavate cilia before the spines appear.

Development of the Scales.—These seem to be reproduced with considerable rapidity, forming miniature scales on the end of the peduncles, with a trace of brownish pigment over the scar. They consist of a superficial cuticle, which is quite smooth, and of a subjacent cellular layer within which the connective tissue rapidly proliferates.

Feet.—The first foot has often only a single bristle, conforming to the dorsal type.

The second foot has a short ventral lobe and a long ventral cirrus with clavate papillæ. The dorsal bristles are smaller, shorter, and more curved than usual, but are otherwise of the normal structure. The ventral are much more slender than the normal, and the spinous region is proportionally long and hispid, while the smooth tip is slender and simple.

The third foot has much stronger dorsal bristles than the second, and the ventral bristles have also increased in size. In these the upper and lower groups still have simple tips, while the median series have bifid tips, but the region is more slender than in the typical foot, and the secondary process small. The spinous rows are also more hispid (*i. e.* have longer spines) than in the typical foot.

As we proceed backward the characters of the typical foot are acquired (Plate XXX, fig. 1). It shows dorsally a strong series of somewhat straight or only slightly curved bristles with well-marked spinous rows, and a smooth spear-shaped tip of some length (Plate XXXVIII, fig. 14). In examples from Greenland the tips of these (dorsal) bristles are so elongated as to be almost sabre-shaped. In specimens from Cornwall, again, the spinous rows are finer, and the bare portion at the tip somewhat differs. In young examples the front edge is slightly bevelled. The ventral division bears a series of strong bristles, every one of which has a bifid tip. In the upper series the smooth portion at the tip is slightly curved outward, and the secondary process is short and sharp (Plate XXXVIII, fig. 15). The terminal hook is well marked. In those with

short tips from the middle of the foot (Plate XXXVIII, fig. 16) the same relations of the secondary process occur, and thus they are easily discriminated from the bristles of *Lagisca floccosa*. The ventral cirrus has a series of short clavate cilia.

In the terminal feet the dorsal bristles remain stout, but their tips are more tapered. The slender ventral bristles, on the other hand, have the spinous region greatly elongated, but the delicate tips in most cases retain the bifid condition, only one or two at the ventral border being simple.

Varieties.—A variety procured by Canon Norman in Norway has shorter bristles, but though the rows of spikes on the dorsal bristles are somewhat finer, in all other respects it corresponds. In another from Loch Portan, Lochmaddy, the dorsal bristles immediately above the ventral are slender, and in this form also the scales have more numerous and longer cilia. The colours are brighter, and the under surface and sides pinkish.

A pale variety, having somewhat rougher scales with longer cilia, occurred between tide-marks at Lochmaddy.

The large arctic examples, such as those of Dr. Walker, have a distinct tendency to elongation of the tips of the bristles, both dorsally and ventrally; while a variety from St. Andrews presents more elongated dorsal bristles than in the typical example.

Few annelids are more abundantly distributed, yet the structural variation of the individuals is not great.

Habits.—*H. imbricata* lurks under stones in pools and moist places between tide-marks, among sponges and in their crevices, in tubes of *Terebella* and *Chætopterus*, in empty acorn-shells, and in almost any convenient crevice. It is one of the most plentiful forms between tide-marks, and is also dredged abundantly in the laminarian region and beyond it, in the crevices of old shells, tangle-roots, and stones. It clings closely to such surfaces, and apparently tries to escape observation. Young examples have been found in old shells with *Polycirrus*. It is most active and restless when disturbed, and wriggles violently, leaving fragments of the body or separated scales in the hands of the captor.

It is a somewhat delicate animal in confinement. Thus it suffers rapidly in a bottle with other marine animals on the collecting ground; indeed, if the search be prolonged few are alive, while other marine forms survive. Sir J. Dalyell, however, retained them until the discarded scales were reproduced, being scarcely distinguishable from the original scales in about six weeks or two months. It swims with an undulatory motion in the water, but, like the loach, soon sinks to the bottom. As in allied species, it often strikes the glass vessels with its jaws, making sounds heard at a considerable distance.

It is brilliantly phosphorescent, discharging bright bluish-green or greenish scintillations from the point of attachment of each scale, and thus under irritation the flashes are arranged in pairs along the body or in a double moniliform line. The separated scales also continue to gleam for some time, chiefly at the scar for attachment, that is near the great ganglion of the region. If severely pinched it wriggles through the water, emitting sparks of greenish or bluish-green light from the foregoing points. The phos-

phorescence appears to be less vivid during severe weather and when confined for a night or two in shallow vessels—a feature probably due to nervous prostration, or it may be associated with approaching maturity. Specimens placed in a weak solution of picric acid in sea water are not luminous, and the scales are not at first thrown off.

Parasites.—The crustacean parasite *Herpyllobius arcticus*,[1] Stp. Ltk. (*Silenium Polynoës*, Kr.), occasionally occurs in arctic examples attached to the dorsum. Levinsen also found another crustacean parasite, viz. *Selioïdes Bolbroei*, Lev., on one from Greenland.[2]

On the dorsum, under the scales of a specimen from the tidal region at Balta Sound, Shetland, numerous examples of a fine *Loxosoma* in various stages of growth are found.

A peculiar warty growth appears on the tentacular cirrus of an example from the Gulf of St. Lawrence, and a series of minute whitish tubercles in an arctic example from Bessels Bay.

The bristles harbour many parasitic algæ, besides mud, foraminifera, and sponge-spicules. At St. Andrews a small *Sabella*, *Syllis*, and *Pholoë* have been found amongst the bristles, and young mussels occasionally fix themselves to the dorsal bristles.

A translucent *Ascaris*, fully half an inch in length, occurred in the peri-pharyngeal space of a female. The slightly truncated snout showed one or two blunt papillæ, while the pointed posterior end had a few acute papillæ. Though outside the gut it had free access to the perivisceral fluid, and, moreover, the long anterior cæca passed forward on each side of the space.

Development.—The broad outlines of the development of this species have been known for a considerable time, and it may therefore form the type for the group. Comparatively small species are occasionally found mature, or carrying ova under the scales.

Michael Sars,[3] as early as 1845, described the occurrence of ripe examples of *Harmothoë* in February and March. He noticed the mature females exhibited a change of colour, becoming pale rose behind the anterior fourth. This was due to the eggs which covered the dorsum. He thought that the ova passed out by a small aperture above the feet. He watched the development of the egg from early segmentation to the movement of the embryo by cilia, and its slightly greenish coloration. The larvæ (monotrochous trochophores) escape after two weeks, swim freely, and bear two eyes, with a pre-oral band of cilia. Max Müller, Desor, and others have also described the development. Desor, however, fell into the error of supposing that the larva escaped from a similar ciliated investment to that of *Lineus obscurus*.

Max Müller,[4] in the young of either this or an allied form, pointed out that new segments were interpolated posteriorly. He described the dimorphism of the bristles,

[1] 'Kgl. Danske vidensk. Selsk. Skrifter naturv.-mathem. afd.,' Bd. v, 1861; and Kröyer, 'Naturh. Zidskr.,' 3 die R., Bd. ii, 1863, &c.

[2] 'Videnskab. Med. fra den nat., &c.,' i Kiobenh., 1887.

[3] "Zur Entwicklung der Anneliden," 'Arch. f. Naturges.,' 11 Jahrg., v. 1, 1845; and 'Ann. Nat. Hist.,' 1845, p. 188 (vol. xvi).

[4] "Ueb. d. Entwicklung u. Metamorph. d. Polynoën," 'Müll. Archiv,' Jahrg. 1851.

the condition of the alimentary canal, and the development of the feet. His species had two pairs of eyes.

Claparède[1] gives the early stages of a *Polynoë* up to the formation of feet and bristles. His example had eleven pairs of feet.

Viguier[2] refers to a pelagic *Polynoë* of sixteen segments, but which, he says, showed no larval appearance. The feet and the ventral bristles are comparatively long. It is in all probability a post-larval *Polynoë* from the Bay of Algiers, as Marenzeller also thinks.

Dr. W. Michaelsen[3] describes a pelagic polynoid from Ceylon (*Drieschia pelagica*), in which the foot is simple, with very long hair-like bristles, and only a few shorter thicker forms. These apparently represent the ventral division of the foot, and only a single spine is present. The tentacular cirri and dorsal cirri are very long.

Marenzeller[4] gives an account of a pelagic form of twenty-four segments procured by the Prince of Monaco, in 48° 50′ lat. N., and 21° long. E. of Greenwich, under the name of *Nectochæta Grimaldii*. It is characterised by the great elongation of the inferior bristles. Scales absent, palpi and cirri smooth.

Fewkes[5] described a young *Polynoë* with only three pairs of feet.

Too little is yet known of the pelagic forms described by Michaelsen and Marenzeller to speak with certainty of their precise relationships. The presence of only a single spine and the simple nature of the foot in *Drieschia* are features which diverge from the ordinary types.

Prof. V. Häcker of Freiburg gave in 1896[6] the results of his studies of the larvæ of Polychæta at Naples. In the Aphroditidæ he describes three stages of a *Polynoë*, viz. the trochophore, metatrochophore, and nectochæte[7] stages. In the Aphroditaceans the trochophore moves at first by aid of its cilia, and then the bristles develop secondarily and enable the post-larval stage to assume great activity during its pelagic life. His species was probably *Polynoë reticulata*.

The ovaries of *Harmothoë imbricata* form a series of lobulated organs stretching from the seventh foot (which has a segmental [nephridial] papilla, as has also the sixth) to the posterior end. They are small anteriorly in the region of the proboscis, though as a rule they do not reach this part, but attain in January a considerable bulk throughout the rest of the body, again diminishing posteriorly.

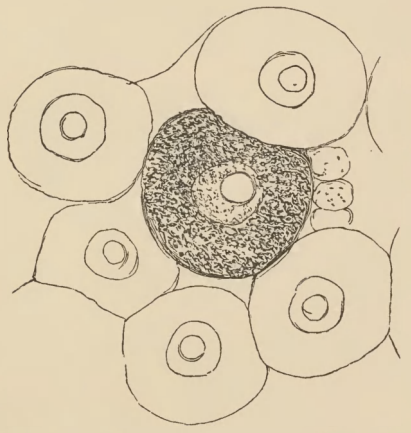
The eggs become prominent in November, being coarsely granular, with a distinct nucleus and nucleolus (Fig. 27). They seem to have a hyaline connecting substance, to which perivisceral corpuscles attach themselves. They vary in size, the smaller being

[1] 'Beobach.,' 1863, p.80, Taf. viii, f. 1—11.
[2] 'Archiv. de Zool. expér.,' vol. iv, 1886, p. 416.
[3] 'Jahrb. d. Hamburg. Wiss. Anstalt,' ix, 2, 1892, p. 6, figs. 15—18.
[4] 'Bullet. de la Soc. Zoolog. de France,' 1892, p. 173.
[5] 'Bull. Mus. Comp. Zool. Harv. Coll. Camb.,' v, 11, 1883–5.
[6] 'Zeitsch. f. w. Zool.,' Bd. lxii, pp. 74—168, Taf. iii—v.
[7] Νήχειν, swimming or pelagic; and χαίτη, bristle.

about an eighth the size of the larger,—the latter, however, being nearly equal, and their nuclei contain several nucleoli.

Some females retain a considerable number of ova till the middle of May, though the body is by no means distended. Many have been discharged.

Fig. 27.

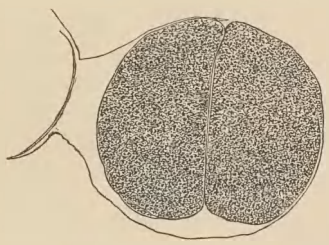


Developing ova of *Harmothoë imbricata*. × 280. November.

Besides the larger ova are many minute forms attached to the germinal tissue, so that the spawning period is prolonged, or the minute ova retained or absorbed.

About the middle of February specimens with masses of ova under the scales are common. The slightly pinkish eggs are attached to each other and the surface by a transparent mucous secretion, so that they do not readily fall off. They form a dense layer under the scales, and in some are almost invisible. The process would appear to be protective, giving them the shelter of the adult, and enabling them to escape the attacks of predatory crustaceans or other forms. They have a diameter of about ·56 to ·78 mm.; the zona is delicate and translucent, yet resists some pressure. In the perivitelline space are a few granular cells, such as those found in various eggs of fishes (*e. g.* the gurnard). In structure the yolk is minutely granular, the figure showing the

Fig. 28.



Segmenting ovum of *Harmothoë imbricata*.

egg cleft into two spheres (Fig. 28). The eggs are so opaque that section alone reveals the structure. In confinement the females carrying ova readily throw off their scales, a feature probably due to the absence of nourishment and the condition of the water.

The males have their spermatozoa fully developed at the end of January and beginning of February. These consist of simple tapering rods with a very attenuate filament from the broader end (Plate XXVI A, fig. 1). They thus differ in shape from

those of *Lepidonotus squamatus* (Plate XXVI A, fig. 2). When punctured the tissues of a ripe male heal in a day or two, and the animal regains activity.

In the first week of March the trochophores swarmed in the vessels containing the adults, congregating like the copepods and *Nauplii* at the margin next the light. The early trochophores (Fig. 29) present a less developed ring of cilia, but soon (Fig. 30)

FIG. 29.

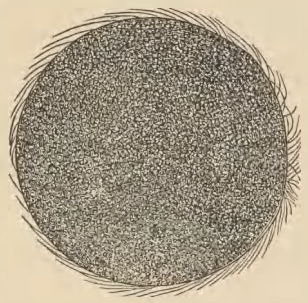


FIG. 30.

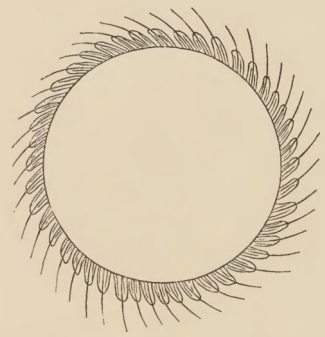


FIG. 29.—Early trochophore of *Harmothoë imbricata* viewed from the anterior end.

FIG. 30.—Trochophore of *Harmothoë imbricata* with fully developed pre-oral ring of longer cilia in rapid movement, viewed as in Fig. 29, from above.

these organs assume a characteristic appearance, and the larvæ are very active. They are bluntly conical at both ends, and devoid of eyes. When compressed under a cover the ring of cilia (pre-oral) (Plate XXVI A, fig. 3) has a very regular rotular aspect. Those captured by the bottom tow-net in the Bay at this time were somewhat larger.

On the 28th March the larvæ in confinement had for the most part gone to the bottom, and, moreover, had assumed a greenish appearance, as indicated in the figure. In the same plate (XXVI A) the older trochophores with a pair of eyes are shown in various positions in figs. 4, 5, and 6. In the first-mentioned figure the mouth forms a projection to the left.

On the 25th April the intermediate stages occur in the bottom tow-nets, viz. larger and more advanced forms having a bluntly rounded anterior end, a prominent ventral surface, and minute feet, with or without traces of bristles, the feet being marked only by crenations. The head is bluntly rounded, with two or three pairs of eyes, and the body is somewhat pear-shaped (Plate XXVI A, fig. 7). The digestive apparatus is indicated by the opaque granules in front and the paler posterior region.

Very soon (indeed, in the nets of the same date) the bristles make their appearance in the feet (Plate XXVI A, figs. 8 and 9), though the head still remains blunt. In the first-mentioned figure the foot-papillæ are minute, and project very little in lateral view, but as transparent objects they show traces of the bristles. The latter project by degrees from the ventral division of the foot, and present a somewhat broad spinous tip with distinct spinous rows and a well-marked terminal hook, but no secondary process. When they become more elongated, so that the shaft is clear for a considerable distance, a trace of a secondary process occurs below the hooked tip. Minute scales have also made their appearance. No anal papillæ (cirri) are yet visible, though in front the tentacular cirri are represented by papillæ. A line of pigment occurs at the ciliated ring, and the eyes present a rudimentary lens.

As shown in Plate XXVI A, fig. 9, the feet by-and-by assume a lobate form, and the bristles lengthen, while two rounded papillæ mark the anal cirri. The body is comparatively broad and short, and the anterior end truncated.

At a stage a little subsequent to the foregoing the head is better differentiated, and the lateral tentacles appear as two rounded papillæ on each side of the median dimple. There were ten feet in the example, and the scales were well formed. The tentacular cirri had a single large (the largest in the animal) curved dorsal bristle projecting at the base, with prominent rows of spines, and one or two smaller bristles just appearing beyond the surface. The organs themselves showed indications of developing cilia, as also did the dorsal cirri. Inferiorly the palpi formed two large rounded discs on each side of the head, projecting laterally, but not yet reaching the front. No trace of a median tentacle was observed in this specimen. The dorsal bristles were all curved, with prominent rows of spines, and the tips of the ventral had also very distinct spinous rows. The bristles project prominently (nectochæte stage). No caudal styles were present.

In Plate XXVI A, fig. 10, the next stage is represented. The head is less bluntly conical, and the two tentacular cirri are leaf-shaped, and soon the tip of the powerful dorsal bristle at their base projects nearly straight outward. The body is more elongated, the feet more prominent, and the bristles project more than half the diameter of the body on each side. The caudal cirri are now broadly lanceolate. Minute scales are present.

The dorsal bristles resemble the ventral more closely than in the adult. Moreover they approach those towards the posterior end of the adult rather than the median, a fact which may be connected with the growth of new segments between those adjoining the head and the tail. Thus it is that the anterior and posterior segments of the adult show the primitive condition of the bristles, the most modified and the most typical being those in the region between them.

In the stage shown in Plate XXVI A, fig. 11, the median tentacle (which may have been lost in the previous preparation) projects conspicuously in front, and the caudal cirri with tapered extremities are distinct.

In early stages, in which eight feet and four pairs of scales occur, the eyes on each side are nearer each other than subsequently, and a smaller third black speck is observed on each side in front of the rest on the under surface near the site of the adult eye, though the peaks are not yet formed.

In the stage figured in Plate XXVI A, fig. 12, the head is still further defined, the eyes being arranged obliquely on each side (the posterior pair nearer each other than the anterior). The median and lateral tentacles are distinct, and the palpi project prominently forward, with tapering extremities. Their margins are crenated, but distinct papillæ were not observed. The tentacular cirri show short clavate cilia. The scales are larger, and have short clavate papillæ projecting from the outer border, the last pair of scales having the largest cilia. The feet are deeply cleft and prominent, and the slender shafts of the bristles have become greatly elongated, so that they project far outwards on each side. There were nine bristled feet in the example. In this instance

the caudal cirri were absent (had fallen off), and a distinct papilla occupied the centre of the caudal region.

When fourteen feet are present a great advance has been made in regard to the head, cirri, and feet. The head shows a blunt peak on each side, and the median tentacle is proportionally large and long, while the palpi have not yet attained full development, though they show the rows of minute papillæ. Two large black eyes are situated posteriorly, and two occur on the mid-lateral region, and are well seen from the dorsum. A considerable interval occurs between the eyes of each side. All the cirri have large clavate cilia. The posterior scales show large clavate papillæ with palpocils at the tip. The bristles at this stage are long, but they do not show distinctive characters, though the attenuate condition of some of the dorsal suggests an approach to *Gattyana* (*Nychia*). The specific identity of those captured in the tow-nets could not, of course, be absolutely determined.

A different trochophore appears in the nets in June, characterised amongst other things by its black and brown pigment-belts at the ciliated ring, the former tint being in front of the latter (Plate XXVI A, fig. 15). This form closely approaches Dr. Häcker's species (Taf. iii, fig. 2) from Naples, though certain points of difference are present.

In this species the tips of the bristles seem to be less elongated, and the pre-oral lobe is curiously marbled with black pigment. When scales form, the body is marked in a somewhat tessellated manner, with transverse bars of reddish-brown pigment. At this stage also the anterior end (ventrally) has two rounded, pigmented, lateral regions, with a patch of black in the centre. A little later the black pigment bounds a median central region in front, and there are six eye-spots, two large rounded eyes on each side, and a black crescentic eye to the outer side of the anterior.

The body is shorter, the feet more closely arranged, and the scales more persistent. The latter have traces of low papillæ on their outer edge, and the surface is roughly areolated, probably from papillæ, as might occur in the young of *L. squamatus*. When the bristles are viewed from behind the spikes are alternate. The tips are much shorter than in the previous form, and the shafts stouter. Large diatoms often occur in the intestine.

In the stage (Plate XXVI A, fig. 18) with the developing palpi the head is rounded in front, and there are often three or four additional eye-spots besides the four normal. The single spine of the first foot is prominent, and also two curved bristles. A band of black pigment bounds the anterior border of the snout.

There are eight feet, the dorsal bristles of which present very fine serrations, and thus differ wholly from the previous forms. The ventral bristles have short tips with rather closely arranged spinous rows. The caudal end terminates in a pointed pygidium without cirri. In the early stages the bristles of the first foot are largely developed in proportion, and must be especially useful in protecting the head. The cirri in this form present a somewhat ovoid outline.

As soon as the palpi have developed (Plate XXVI A, fig. 19) the head shows a deep notch in the centre, the two large black eyes on each side being situated far back, the

anterior eye being behind the middle line. From the first foot three strong curved bristles project forwards at the side of the palpi. These bristles have well-marked spinous rows. The palpi have tapering extremities. The dorsal bristles are slender and tapering, with distinct rows of spines, which from the dorsum appear as opposite. The tips of the ventral bristles are simple, and the spinous region shorter than in the first species, and from the dorsum the spinous rows seem to show an alternate arrangement.

When eight pairs of feet are present, and the tentacles, palpi, and the anal cirri fairly formed, the dorsal bristles show a tendency to finer rows of spines, so that they approach the condition in such as *Lepidonotus* and *Gattyana*.

At the stage in which the two caudal cirri appear as two broad short processes there are at least four scales, and the tentacular cirri are present.

The head is truncated in front, and has a curious spectacle-mark ventrally (Plate XXVI A, fig. 16), a black spot being situated in each lateral dilatation. The spectacle-mark is outlined with black and touched with reddish brown, the rest of the head (in spirit) being pale. It is bounded by the black belt at the ciliated ring, while behind is the reddish-brown pigment, followed by streaks of black, which also occur at the segment-junctions. The caudal cirri are yellowish. On the dorsal surface (fig. 15), again, are two black eyes, obliquely situated on each side anteriorly, a long interval occurring between them and the black belt of the ciliated ring. Behind the black is a definite reddish line. The bristles project considerably on each side, so that the stage is a nectochæte one.

At a slightly later stage (Plate XXVI A, fig. 17) the palpus arises on each side at a black spot, which at first marks the budding organ. The growth of the various appendages, however, is irregular, since in this instance the caudal cirri were less advanced than in those without elevation of the area of the palpus. Coincident with the projection of the palpus is that of the median tentacle, which forms a rounded boss.

Pallas (1766) made his description of *Harmothoë imbricata* (his *Aphrodita lepidota*) from an incomplete and probably young specimen (as Malmgren says) with fourteen pairs of scales, the latter being partly ciliated, though in the description this is not alluded to, and the ventral view mistaken for the dorsal (pl. v, fig. 2). He thought it might readily be distinguished by its longitudinal black band on the dorsum. It occurs, he says, frequently in the North Sea, between Britain and Belgium.

The *Polynoë fulgurans* of Ehrenberg,[1] one third of a line long, may be the pelagic young of this or an allied form.

De Quatrefages considered the *Polynoë fasciculosa* and the *P. maculata* of Grube[2] as pertaining to this species, but the descriptions are so vague that doubt exists.

This was the only member of the group procured in the Siberian Expedition of Gerstfeldt, as described by Grube. De Quatrefages, in his work on the 'Annelés'

[1] 'Das Leuchten des Meeres,' 1835.

[2] 'Actin., Echin., u. Würm.,' p. 87, 1840.

(1865) says it has forty-two to forty-four segments, but adds nothing of interest. H. Lenz (1878) agrees with Möbius in considering that this form included *Lænilla glabra*, *Antinoë Sarsii*, and *Evarne impar;* but, as already mentioned, this was due to insufficient acquaintance with the group.

Théel (1879) observes that while it is common on the west of Nova Zembla, he found none in the Kara Sea. He also records his dissent from the view of Möbius and Lenz, who included under this species *Evarne impar*, *Antinoë Sarsii*, and *Lævilla glabra*, the second being supposed to be the young stage of *H. imbricata*. I have already alluded to this in the 'Challenger Report.'[1] The habits, for instance, of *Evarne impar* quite differ from those of *H. imbricata*, the former being much more irritable and active.

Kallenbach[2] gives an account of the minute structure of the scales of this species.

Hornell (1891) alludes to the varied coloration of *Harmothoë imbricata*, *e. g.* as striped with a median black band edged with pale border. He considers Théel is correct in stating that only the largest examples possess any notable rounded processes on the scales.

2. Harmothoë spinifera, *Ehlers*, 1864.

Specific Characters.—Body narrow and elongate. Head elongated from before backward, and the anterior peaks produced at the sides of the broad base of the median tentacle. The anterior pair of eyes lie under these peaks, but are also seen from the dorsum. Posterior eyes at the nuchal collar, dorsal, and nearer each other than the anterior pair, from which they are separated by almost the entire length of the head. Palpi of average length, brownish, with rows of small truncate papillæ, which are sometimes bifid at the tip. Median tentacle with a broad base (ceratophore), a brownish column (ceratostyle), a pale tip with little or no enlargement beneath, and numerous clavate papillæ. The lateral tentacles are inferior, subulate, and brownish. Tentacular and dorsal cirri (which are short) brownish, furnished with a few clavate papillæ, and slightly enlarged below the pale tip. Ventral cirrus with a few clavate papillæ. Scales fifteen pairs, almost smooth at the margin, only a few small clavate cilia occurring in some. A limited area towards the inner edge shows a series of spikes. First pair nearly circular, brownish; succeeding anterior scales reniform, blackish, with a metallic lustre; posterior scales mottled like granite. Bristles comparatively short, the dorsal slightly curved, finely serrated, and with a short broad tip like a paper-scraper; ventral bristles with short spinous regions, and the smooth terminal part boldly bifid.

Synonyms.

1864. *Polynoë spinifera*, Ehlers. Die Borstenwürmer, p. 96, Taf. iii, figs. 1—4 and 6.
1875. „ *crassipalpa*, Marenzeller (?). Sitzb. d. k. Akad., 1875, p. 6 (sep. Abdr.).
1876. *Harmothoë Sibbaldii*, McIntosh. Trans. Zool. Soc., ix, p. 378, pl. lxviii, f. 1—3.
1880. *Polynoë spinifera*, Langerhans. Zeit. f. w. Zool., xxxiii, p. 275.
1888. *Harmothoë spinifera*, De St. Joseph. Ann. des Sc. nat. (7), v, p. 171, Taf. xiv, f. 4.

[1] P. 58.
[2] 'Inaug. Dissert.,' Jena, 1883, p. 23.

Habitat.—Several examples were dredged in 6 to 10 fathoms, amongst tangle-roots, in Bressay Sound, Shetland, classic ground to marine zoologists since the days of Edward Forbes. A form apparently identical occurs in the British Museum, from chinks in the rocks, Polperro, Cornwall. The same form is found in the Adriatic.

Length about seven-tenths of an inch.

The *head* (Plate XXVIII, fig. 3) is elongated from before backward, and since the large anterior pair of eyes are carried outward, almost at the tips of the peaks, beneath which they are placed, and are visible from the dorsum, the condition is diagnostic. They are, moreover, wider apart than the posterior pair, and look forward and outward. The smaller posterior pair are dorsal, situated near each other, and almost touch the nuchal collar (in spirit). The two pairs of eyes are thus separated by a long antero-posterior interval. The median tentacle has a broad base, a brownish column, a pale tip with little or no enlargement beneath, and well-marked clavate cilia. The lateral tentacles are inferior in position, small, subulate, and with similar clavate cilia. The tentacular cirri are also brownish, furnished with numerous clavate cilia, and slightly enlarged below the filiform tip. The palpi are brownish, with rows of small blunt papillæ, which are sometimes bifid at the tip.

The *body*, which consists of thirty-seven segments, is comparatively short and of more uniform diameter than usual, being only a little narrowed anteriorly, and somewhat more posteriorly. Transverse markings occur on the dorsum between the scale-pedicles and their homologues. No pigment remained on the dorsum in the preparations, though it is probable traces of such were present during life. On the ventral surface traces of brownish pigment occur at the sides of the prominent fold in front of the mouth. The lateral prominences at the bases of the feet are well marked, but the segmental processes are minute.

Scales (Plate XXXIII, fig. 4), fifteen pairs. The first are small, nearly circular, and their light brownish colour contrasts strongly with the succeeding. The surface is studded with short blunt spines, which are especially distinct at the outer border, where there are also a few short clavate cilia. The rest of the margin is smooth. The second pair are reniform, the exposed parts being almost uniformly black, with a silky sheen and a smooth margin, except at the outer border, where five or six very short clavate cilia occur at intervals. The short blunt spines are distributed over the posterior two thirds of the surface. The third scales are also blackish with the same metallic sheen, but have a few minute pale points besides the microscopic blunt spines. The pale specks increase in size in the succeeding scales, and the pigment becomes paler, the posterior pair, indeed, being mottled like granite. The general shape of the posterior scales is irregularly rounded or ovoid, with the scar for attachment towards the anterior and outer border. The penultimate and last pairs are much elongated from before backwards. The number of the minute blunt spines diminishes posteriorly, so that they are chiefly confined to the outer border, where an occasional short clavate cilium is observed. The definite pale areas are due to the absence of pigment in the areolæ of the epiderm (hypoderm), while in the dark parts each areola is deeply pigmented. If the *P. spinifera* of Ehlers is the same form the scales had a greyish-violet sheen.

Feet.—The first foot shows dorsal bristles, which are little altered from the typical form.

The second foot has dorsally a series of short broad bristles, the tips especially being characteristic. Ventrally the shafts of the bristles of the region are stout, and the spinous tips well marked. The superior bristles have very short smooth tips, which are bifid. There is thus less change than usual in the foot.

In the typical foot the superior branch bears a short cirrus, the tip of which (in spirit) reaches the extremity of the bristles. It is almost cylindrical, except near the tip, where a gradual diminution occurs. The surface has rather numerous stout clavate cilia, which are best developed on and near the slight enlargement below the filiform tip. The ventral cirrus has an enlarged base, reaches a little further than the insertion of the inferior ventral bristles, and has a few stout clavate cilia.

The dorsal branch of the foot has comparatively short and not very stout bristles, slightly curved, and finely serrated. The smooth tips are peculiar, being fashioned like a blunt Esquimaux harpoon or paper-scraper, as represented in one of the larger examples (Plate XXXVIII, fig. 17). The spinous rows at the distal part project characteristically at a greater angle than usual, but are generally obscured by dense granular parasitic growths and mud.

The ventral bristles have comparatively stout shafts and short spinous regions. The smooth tip is also short. Every bristle is boldly bifid. The superior series (with longer spinous rows) have a very short smooth region (Plate XXXVIII, fig. 18), the longer terminal part being only diminished on its dorsal edge—not hooked, while the secondary process is stout and goes straight to a point, thus differing from the attenuated divisions of *Parmenis ljungmani*. The smooth tips of the middle and inferior bristles (Plate XXXVIII, fig. 19) are somewhat longer and have a slight hook, but the secondary process is straight. The spinous regions in these are proportionally short.

Reproduction.—The specimens procured in July had the ova well advanced, so that their spawning period would seem to be in autumn at latest. It is interesting that the examples of Ehlers and De Saint-Joseph also carried eggs. The latter found a specimen of 7 mm. in the same condition.

This species presents considerable differences from *Parmenis ljungmani*, Malmgren. The body is larger and broader, the segments thirty-seven instead of thirty-five or thirty-six; the head is more elongated, and the arrangement of the eyes different. Thus, for instance, the smaller anterior eyes in the northern form are situated at an incurved region of the head just in front of the middle. The dorsal bristles are thicker than the ventral, and have the peculiar tips indicated, whereas in *P. ljungmani* the tips are simply tapered. The ventral bristles have short spinous regions in both, but in the Zetlandic form the tip is less hooked, and the secondary process is short, stout, and straight. There are points of similarity between the forms, but there is no warrant for uniting them.

The *Polynoë spinifera* of Ehlers approaches this species very nearly, and he probably overlooked the papillæ on the palpi. It is possible the small size of his example (7 mm.) may have been the cause of certain variations. The figures and remarks of Langer-

hans[1] point to the same conclusion. In the southern forms the pallor of the first pair of scales is characteristic. The *Polynoë crassipalpa* of Marenzeller from the Adriatic is a very closely allied form, but, if the author's figures and descriptions are to be relied on, the British form is distinct, the tip of the dorsal bristles alone being characteristic. In Marenzeller's specimen also the large anterior eyes are not so near the tip of the peak as in the British form. Levinsen (1883) seems to think this closely approaches *Harmothoë ljungmani*, but the foregoing remarks demonstrate the differences.

3. Harmothoë zetlandica, *McIntosh*, 1876.

Specific Characters.—Body sublinear, narrowed anteriorly and posteriorly; bristle-bearing segments thirty-five to thirty-six. Head elongated from before backwards, with two acute peaks in front. Tentacles and cirri without apparent enlargement below the tip, and with sparsely distributed short clavate cilia; lateral tentacles inferior. Palpi minutely papillose. Eyes all visible from the dorsum, the larger anterior pair at the base of the peaks. Scales fifteen pairs, covering the dorsum, ovate or oval with the exception of the first pair, which are rounded, with few and indistinct papillæ. Dorsal bristles strongly curved, sharp-pointed, and with distinct rows of spines, the sharp tip being bare; ventral bristles with short spinous regions and smooth tips, the latter being hooked and having a long straight secondary process, which is parallel and closely applied to the other division,—that is, no gap is present.

Synonym.

1876. *Harmothoë zetlandica*, McIntosh. Trans. Zool. Soc., ix, p. 379, pl. lxviii, f. 4 and 5; pl. lxix, f. 1.

Habitat.—Dredged in 5 fathoms amongst the tangle-roots in Bressay Sound, Shetland, July, 1871.

The specimens are about half an inch in length.

Head (XXVIII, fig. 1) somewhat elongated from before backwards, terminating anteriorly in two pointed lobes on each side of the median tentacle. The eyes are all visible from the dorsum; the smaller posterior pair lie in front of the nuchal collar, while the larger anterior pair are situated at the base of the peaks and look laterally and dorsally. They are not so far forward as the anterior eyes of *Harmothoë spinifera*. The cephalic appendages are somewhat short. The median tentacle is not much, if at all, enlarged below the filiform tip, and is furnished with a few clavate cilia. In some it is deeply pigmented at the base. The lateral tentacles are short, enlarged at the base, but tapering at the tips after the manner of the ventral cirrus, and with sparse but distinct clavate cilia. The palpi are gently tapered from base to apex, and, while smooth or only wrinkled under a low power, show minute papillæ under a high power. The tentacular cirri taper from base to apex, have no enlargement below the latter, and have clavate cilia like those of the median tentacle.

[1] 'Zeit. f. w. Zool.,' xxxiii, p. 275.

Body elongate and somewhat narrow, consisting of about thirty-five bristle-bearing segments. The segments dorsally present no peculiarity, while inferiorly the depressed median region proceeds from the buccal fold to the tail. The segmental papillæ seem hardly to project beyond the elevation. The body is of a pale or dull straw-colour, the translucent scales showing only a few pale touches. Posteriorly the anus projects on a median process.

Proboscis.—The extruded organ presents nine papillæ along each edge, and the teeth are pale brown.

Scales (Plate XXXII, fig. 15).—The species was formerly stated to have fourteen pairs of scales, but a re-examination of the broken specimens points to the probability that fifteen pairs are present. They cover the dorsum, are rather thin, translucent, and soft, and seem to be smooth under a lens; but under a high power short clavate papillæ occur sparsely along the outer and posterior border, and over the usual area externally. The papillæ along the outer and posterior border are not to be confounded with the appearances found in the granular area of the epiderm. They are much more minute than those of allied species. Only a microscopic papilla here and there on the same border projects beyond the smooth outline. The first pair are small and round, the size increasing posteriorly to the twelfth, when a diminution again occurs in those behind. Only a few show a slightly reniform outline, the majority being more or less ovoid.

Feet.—The first foot shows bristles of the dorsal type.

In the second foot the dorsal bristles are curved, and have well-marked spinous rows. The ventral bristles, again, differ from the typical forms in the proportionally longer and more finely spinous regions, and in the simple tip, which is but little hooked.

The third foot has more or less become typical, except that the ventral bristles are more slender.

The typical foot (Plate XXX, fig. 2) presents dorsally a series of divergent, stout, sharp-pointed, and brittle bristles, with well-marked transverse spinous rows. The spinous region has a distinct curve. The smooth portion at the tip is of considerable length, has a slight bend, and tapers gently to the point (Plate XXXVIII, fig. 20, and front view, Plate XXXVIII, fig. 20 *a*). The ventral bristles (Plate XXXVIII, fig. 21) have superiorly a short spinous part of five or six rows, and a smooth terminal region which forms a well-marked hook. The secondary process is remarkably long, and passes straight outward parallel with the former, and in the upper bristles reaches as far as the terminal hook.

In the terminal feet the dorsal bristles alter little, except that they become smaller and the spinous rows more prominent. The ventral bristles, again, have shorter shafts and much more slender and elongate spinous regions and simple tips.

The bristles throughout are pale yellowish, and the dorsal are often loaded with algoid and other parasitic growths.

The dorsal cirri, like the tentacular cirri, taper from base to apex, which is filiform, and reaches the extremity of the ventral bristles (in spirit). Their surface has sparsely distributed short clavate cilia. The ventral cirri are tumid above the basal region, then taper to the extremity, and have a few clavate cilia.

When contrasted with the young of *Harmothoë imbricata* the head of this form is much more elongated antero-posteriorly, and the four eyes are visible from the dorsum, whereas in *H. imbricata* the posterior pair only are generally seen. The tentacles and other cephalic processes are different. The body is narrower and longer, and the bristles are much smaller, so as to alter the outline; and their structure, as well as that of the scales, is essentially different. From the *Parmenis ljungmani* of Malmgren,[1] to which it is allied, it differs in the structure of both dorsal and ventral bristles as well as in that of the scales.

Allied forms to both this and the succeeding species (*Parmenis ljungmani*) are the *Polynoë vasculosa* of Claparède,[2] and the *Polynoë crassipalpa* of Marenzeller.[3] They, however, differ in regard to the shape of the head and the structure of the bristles.

This species takes the place of the closely related *Parmenis ljungmani* of the Outer Hebrides, and the representatives of both appear to be few. It is probable that, like allied forms, it may be commensalistic.

4. Harmothoë ljungmani, *Malmgren*, 1867.

Specific Characters.—Body small, sublinear, bristled segments thirty-five to thirty-six. Head elongated antero-posteriorly, somewhat narrower in front, and with two short peaks. Eyes visible from the dorsum; two at the posterior border, and two larger at the side in front of the middle line. Tentacles and tentacular cirri short and tapering, with sparsely distributed clavate cilia. Palpi elongate, subulate, with minute papillæ. Tentacular and dorsal cirri alike. Ventral cirri enlarged at the base, similarly ciliated. Scales fifteen pairs; first pair suborbicular, the others obliquely ovate or ovoid, increasing in size till the two last pairs, with very few minute papillæ along the outer and posterior border, while the tubercles on the surface are larger and more numerous than in *H. zetlandica*. Dorsal bristles stouter than the ventral, rather short, curved and little tapered, with close rows of spines which extend to the tip. The ventral bristles have short spinous tips ending in a smooth and characteristically curved claw, while the secondary process leaves a gap between it and the base of the hook.

Synonyms.

1867. *Parmenis ljungmani*, Malmgren. Ann. Polychæta, p. 11, pl. i, fig. 2.
1875. *Harmothoë Macleodi*, McIntosh. Invert. and Fish., St. A., p. 116.
1876. ,, ,, Ibid. Trans. Zool. Soc., ix, p. 382, pl. lxix, f. 2, 3.
1888. ,, ,, De Saint Joseph. Ann. d. sc. nat. (7), v, p. 168, pl. vii, f. 37—40.

Habitat.—Between tide-marks under stones at Lochmaddy, North Uist, and in the stomach of the cod, St. Andrews (E. M.). Shores of France—Dinard.

Length about 14 mm.; breadth across bristles 3 mm.

[1] 'Annulat. Polychæt., &c.,' p. 11, pl. i, fig. 2, 1867.
[2] 'Annél. Chétop. Nap., Suppl.,' p. 12, pl. i, f. 4.
[3] "Zur Kenntniss d. Adriat. Annel.," 'Sitz. der k. Akad. Wissensch.,' April 1, 1874, p. 6, Taf. ii.

Head (Plate XXXVIII, fig. 4) elongated from before backward, terminating in two peaks anteriorly, and with eyes similarly placed to those in *H. zetlandica*, viz. a pair of smaller eyes on the dorsum in front of the nuchal collar, and a larger pair on the sides anteriorly in front of the middle line of the head, and at the base of the peaks. All are visible from the dorsum, though the main vision of the anterior eyes is lateral. The palpi have rows of minute papillæ, and are similar to those of *H. zetlandica*, as also are the tentacles and tentacular cirri—which have clavate cilia. All are comparatively short, and taper gently to the extremity without an evident enlargement below the tip (in spirit).

Body elongated, rather narrow, slightly tapered in front, more so posteriorly, and with comparatively short bristles, the segments bearing these being from thirty-five to thirty-six. In regard to external structure and coloration it agrees with the foregoing form.

Scales (Plate XXXII, fig. 14) amount to fifteen pairs, are thin and semi-translucent, have a very few minute cilia along the outer and posterior border, while the papillæ, which are generally scattered over the surface, are larger and more numerous than in *H. zetlandica*. Along the anterior edge somewhat smaller papillæ occur in rows. In shape they correspond with those of the latter, the first pair being circular, the rest more or less ovoid and increasing in size to the twelfth or thirteenth.

Feet.—In the first foot the upper division bears a few short dorsal bristles similar in type, though more curved than the succeeding.

In the second foot the dorsal bristles are already numerous and of considerable length. The curvature is well marked, especially at the tip, which shows no smooth portion, the spinous rows passing quite to the extremity. The bristles of the inferior division present superiorly almost the typical structure with the somewhat broad short tip, and the long secondary process. The bristles of the middle division have longer tips, very slightly bifid, while in the inferior series the tips are elongated, simple, and with long spinous rows, which in some views are more or less pinnate.

As we proceed backwards the bristles gradually assume the typical form, the dorsal becoming longer and stronger (Plate XXXVIII, fig. 22) as well as less curved. Moreover the tip is but slightly tapered, and the spinous rows pass to the extremity and are closely arranged, except in a few of the short forms next the body. The ventral division has boldly bifid bristles (Plate XXXVIII, fig. 23) throughout, the entire tip being rather broad and the spinous region short. The inner line of the hook forms a different angle from that in *H. spinifera*, and leaves a wider gap distally. The secondary process diminishes in length from the superior to the inferior series of bristles, so that in the latter it scarcely reaches to the middle of the peculiarly curved terminal hook. The spinous region of the tips of the inferior bristles is very short. The bristles generally are faintly yellowish, and the dorsal form a favourable site for the development of parasitic growths.

The dorsal cirri are comparatively short, and taper almost from the base to the slender tip. Sparsely distributed clavate cilia occur on the surface below the latter. The ventral cirri are enlarged at the base, and have also a few clavate cilia.

When the species was described in 1876 it was thought to differ from the *Parmenis ljungmani* of Malmgren, on the grounds of the proportional strength and structure of the

dorsal bristles, and in the pale semi-translucent scales, but the ventral bristles approached each other closely. A re-examination of all the characters and of Malmgren's description now inclines me to unite them, especially as in the generic characters he states that the dorsal bristles are shorter and thicker than the ventral, while in the specific he says they are much shorter and a little more slender than the inferior bristles. Moreover, if his figure of the dorsal bristle be supposed to be that next the ventral series (always the most slender and elongate), the distinctions more or less disappear. The only doubtful point is the possible existence of a species agreeing in all respects with that from Lochmaddy, but having more elongated dorsal bristles. Levinsen seems to be of the same opinion.

Few individuals of this form would seem to exist. Only a single example was obtained at Lochmaddy, and one in the stomach of a cod at St. Andrews. Baron de St. Joseph found one in the tube of *Lanice conchilega* at Dinard. With the two foregoing it forms a special series—closely approaching each other and such forms as the *Polynoë crassipalpa* of Marenzeller.

5. Harmothoë antilopis, *McIntosh*, 1876.

Specific Characters.—Length about three-quarters of an inch or a little more. Head broad behind, peaks truncated in front, two widely separated eyes posteriorly, and a larger pair laterally and below the short peaks, not visible from the dorsum. Median tentacle and tentacular and dorsal cirri moderately long, slightly enlarged below the filiform tip, and covered with numerous cilia with slightly bulbous tips. Lateral tentacles inferior. Palpi of average length—with clavate papillæ. Body, moderately elongated, of considerable breadth, bristled segments 33—35. Scales fifteen pairs, mostly reniform, entirely covering the dorsum, with long cilia externally and posteriorly and shorter on surface, which also has large horny papillæ ending in spines with hispid tips. Dorsal bristles elongated, with smooth tips and very distinct spinous rows (resembling the horns of an antelope), ventral with bifid tips, scarcely hooked, and in some the distal part of the spinous region is narrower than the smooth tip. Ventral cirri rather slender and tapering, with short clavate cilia. The segmental papillæ are but slightly marked.

Synonyms.

1876. *Harmothoë antilopis,* McIntosh. Trans. Zool. Soc., ix, p. 383, pl. lxix, f. 4—6.
1877. *Evarne mazeli,* Marion. Rev. des Sc. nat., April 15th, 1877.
1879. „ *antilopes,* Marion. Ann. des Sc. nat., 1879, p. 13, pl. xv, f. 1 to 1 *f.*
1884. *Polynoë antilopes,* Carus. Faun. Medit., p. 200.

Habitat.—First procured at Lochmaddy, North Uist, in 1865; off the Hebrides (J. G. J.); on muddy sand at 173 fathoms, 'Porcupine,' 1869; 'Porcupine,' 1870, 576 fathoms, on the Channel slope; 227 fathoms outside Gibraltar; and 358 fathoms in the Atlantic. It is included in the Mediterranean fauna also by Professors Marion and Carus.

Its range is thus extensive, but the numbers hitherto have been few, generally a single example at each station.

Length from three quarters to nearly an inch.

Head (Plate XXVIII, fig. 13) somewhat broad behind, with the anterior angles ending in very short peaks. Two comparatively large and somewhat widely separated eyes occur near the posterior border. The larger anterior pair are not visible from the dorsum, being situated laterally and below the truncated angles of the snout. In most specimens in spirit the pigment of the eyes has become very faint. The median tentacle is moderately long, slightly enlarged below the filiform extremity, and covered with numerous cilia with very slightly enlarged tips. The lateral tentacles are inferior, have a slight enlargement below the tip, and are also supplied with clavate cilia. The tentacular cirri are similar to the median tentacle, the cilia being continued about a third up the filiform termination. The palpi are of moderate length, with rows of minute clavate papillæ, which toward the termination are dilated and then constricted below the slightly granular tip.

The *body* is moderately elongated, of considerable breadth, not much tapered anteriorly and only a little more so posteriorly, and with the usual markings dorsally and ventrally. Bristled segments from thirty-three to thirty-five. The segmental papillæ do not appear to be produced as tubular processes, only the projecting "boss" or elevation indicating this structure.

The *scales* (Plate XXXII, fig. 16) amount to fifteen pairs, and entirely cover the dorsum. The first pair are more or less rounded, the rest reniform, the outer lobe being larger than the inner. They are fringed on the outer and posterior borders as well as studded over the surface with cilia, which become very long on the former border, and the tips are slightly bulbous. They are often coated with a granular parasitic growth. The horny papillæ or tubercles on the surface are large and boldly marked, the dilated tips forming blunt processes or spines truncated at the tip, which is hispid with sharp processes, and in favourable specimens they resemble a rosette of spikes. The appearance is thus characteristic. A pale brownish coloration occurs on the dorsal surface where the scales overlap, but otherwise they are pale with the exception of the minute brownish spines. The under surface is smooth and iridescent.

Feet.—The first foot has a few short bristles of the normal dorsal type, and very slightly curved. The second foot has a considerable tuft of short dorsal bristles, only the inner being curved, those next the spine being more or less straight, with the well-marked spinous rows from which the name of the species is derived. The ventral series of slender bristles has long spinous regions superiorly and shorter inferiorly. All have simple tapering tips. These bristles are proportionally shorter and stouter than the typical series. The bristles gradually elongate and the ventral series become bifid, so that in the typical foot (Plate XXIX, fig. 14) the dorsal division carries a conspicuously long and strong series, the inner bristles being shorter and more curved as well as more abruptly pointed at the tip, which has a short smooth portion; while the outer and inferior series are long, very gently tapered, and slightly curved, with a short, conical, bare portion terminally. All are distinctly marked by transverse spinous rows at rather wide intervals, whence the name of the species, from the resemblance of these organs to

the horns of certain antelopes, such as *Hippotragus oryx*. One of the larger bristles is represented in Plate XXXVIII, fig. 24. The ventral series again forms a dense tuft of fine and by no means long bristles, commencing superiorly with a group of about three, with elongate spinous regions, tapering to an acutely pointed simple tip. The adjacent series has also long, slender, spinous regions, but the tips are bifid, the part which is usually hooked having scarcely a trace of a curve, and the secondary process being closely applied (Plate XXXVIII, fig. 25). The tips become shorter and stouter inferiorly, and the secondary process more apparent. Though a slight curve is present the tip is scarcely hooked (Plate XXXVIII, fig. 26, representing one of the stoutest forms). The upper third of the spinous region is even narrower than the bifid part behind the hook at the tip, a peculiarity seldom seen. Inferiorly the simple tips as well as the bristles themselves become shorter.

Posteriorly (in the last feet) both dorsal and ventral bristles become much more slender as well as smaller. The dorsal, however, show even in the least developed the well-marked spinous rows. The ventral bristles have long and finely tapered spinous regions and simple tips.

The dorsal bristles are often loaded with parasitic growths, one of the most beautiful being a handsome stalked infusorian.

The dorsal cirri stretch beyond the bristles, and have a similar structure to the median tentacle. The ventral cirri are rather slender and elongate, with a filiform tip.

Reproduction.—All that can be said about the reproduction of the species is that in an example procured in early autumn (August) numerous ripe eggs occurred between the feet and on the dorsum under the scales. Though the body was ruptured it is probable these escaped, at least in some cases, naturally. A ripe form also was dredged in the Minch in July.

This species approaches *Evarne*, but a glance at the head and the arrangement of the eyes at once differentiates it, while the structure of the scales and the characters of the dorsal and ventral bristles still further emphasise the distinctions. The *Polynoë spinifera* of Ehlers is a closely allied form, but the anterior pair of eyes, if the figure is to be trusted, quite differ, since they are visible from the dorsum. The details of the bristles are not given. In the same way, while admitting the relationship between the species and *Evarne* as above mentioned, I do not think with my esteemed colleague, Prof. Marion, for the reasons indicated, that it should be placed in that genus. It is true that in the French naturalist's figure the anterior pair of eyes are dorsal, but such was not the case in the examples observed here. The character of the spinous rows of the dorsal bristles differs from that of either *Evarne impar* or *E. Johnstoni*.

6. Harmothoë Haliaëti, *McIntosh*, 1876.

Specific Characters.—No complete example has yet been found. The dorsal bristles are rather long, slender, and slightly curved, with conspicuous rows of spines, and a very short, bare portion at the tip. The ventral bristles have slightly hooked tips, and the secondary process is either straight or bends outward a little at the tip. The ventral

cirrus is somewhat enlarged at the base, filiform at the tip, and with rather long papillæ sparsely distributed.

Synonyms.

1876. *Harmothoë Haliaëti*, McIntosh. Trans. Zool. Soc., ix, p. 384, pl. lxix, f. 7—10.
1885. „ „ idem (partim). 'Challenger' Annel., p. 96.
1886. „ „ Harvey-Gibson. Verm. Liverp., 149.
1891. *Polynoë* (*Harmothoë*) *Haliaëti*, Hornell. Op. cit., 232, pl. xiii, f. 5.

Habitat.—The first specimen was procured in the Minch in July by Dr. Gwyn Jeffreys, who did so much in dredging examples of the British Annelids.

In a posterior foot the dorsal branch bears a series of rather long, slender, slightly curved bristles with conspicuous rows of spines (Plate XXXVIII, fig. 27). Such bristles, when viewed antero-posteriorly, present a much narrower aspect than when seen in profile. The arrangement of the spinous rows is alternate, as in the ventral bristles. Only a very small portion of the tip is smooth—a feature of moment when it is contrasted with the larger and longer tip of *H. Fraser-Thomsoni*. The dorsal bristles are often coated with a brownish granular substance and algoid growths. The superior ventral bristles have elongate spinous portions and slender tips (Plate XXXIX, fig. 1). At first the bifid tips are almost straight or very slightly curved, but they soon become more characteristic (Plate XXXIX, fig. 2). The *facies* of the tip is even more diagnostic in the inferior series (Plate XXXIX, fig. 3), where the spinous region is distinctly curved. In the superior group the secondary process is nearly straight, but in the others it bends outwards at the tip, which has a distinct hook.

The inferior cirrus is enlarged at the base, slender and filiform distally, and furnished with rather long papillæ sparsely distributed.

Hornell found an allied form at Port Erin, Isle of Man, in fifteen fathoms. He describes the scales as densely fimbriated round the border after the manner of *Lepidonotus squamatus*, so that there is need for further investigation as to the condition in this respect. Unfortunately this specimen could not be found in the collection at Liverpool, and the others are incomplete.

7. Harmothoë Fraser-Thomsoni,[1] *McIntosh*, 1896.

Specific Characters.—Head somewhat resembles that of *Lagisca*, having a pair of widely separated eyes posteriorly, and a larger pair on the lateral eminence. Median tentacle absent. Palpi of moderate length, with rows of minute papillæ. Body of considerable length and breadth; bristled segments thirty-nine to forty. Dorsum has touches of brown pigment posteriorly as in *Lagisca*. The lateral segmental eminences are prominent, but there is no process. Scales mottled brown, fifteen pairs, covering the dorsum; first small and rounded, rest more or less ovoid; border smooth, anterior

[1] Named after my early and valued friend, the late Dr. Fraser Thomson, of Perth.

and inner half studded with small horny papillæ, outer and posterior areas have sparsely distributed, large tubercles, with an interrupted row along the posterior border. Dorsal bristles stout, moderately long, and slightly curved, with closely arranged spinous rows and a short, smooth tip. Ventral bristles bifid, the secondary process coming off at an angle. Dorsal cirri appear to be fusiform—from the gradual nature of the dilatation and the long filiform tip, and have clavate cilia. Ventral cirri slender, with a few clavate cilia.

Synonyms.

1885. *Harmothoë Haliaëti* (partim), McIntosh. 'Challenger' Annel., p. 96.
1896. „ *Fraser-Thomsoni*, McIntosh. Sc. Proceed. R. Dub. Soc., vol. viii, n. s., p. 401.

Habitat.—Dredged in the 'Knight Errant' in 1880, in the Atlantic, at a depth of fifty-three fathoms, and procured by Prof. Haddon in the Royal Irish Academy's Expedition, July 15th, 1886, in ninety-three fathoms off the south-west coast of Ireland —along with *Malmgrenia castanea*, which occurred on *Spatangus raschii*.

The *head* (Plate XXVIII, fig. 7) somewhat resembles that of *Lagisca*, having a pair of well-marked and widely separated eyes posteriorly, and a larger pair still more widely separated on the anterior lateral prominence, looking laterally and dorsally. Both pairs are conspicuous from the dorsum. The head terminates anteriorly in sharp peaks on each side of the median tentacle. The lateral are brownish, subulate, and with a long filamentous tip. The palpi appear to be of moderate length, and to have rows of minute papillæ, but they had been dried.

The *body* is of moderate breadth and of considerable length, narrowed abruptly in front, but—from the middle—gradually diminishing posteriorly. The bristled segments seem to amount to thirty-nine or forty. The brownish pigment of the dorsum posteriorly is very prettily arranged in lozenges and touches, as often seen in species of *Lagisca*. The lateral eminences for the segmental apertures are well marked, and a small papilla projects between the feet.

The *scales* (Plate XXXII, fig. 11) number fifteen pairs, and are thin, translucent, and cover the dorsum. The first pair are small, rounded, and studded with minute spines and tubercles. Few seem to be reniform, the majority being ovoid. The border is smooth throughout. The anterior and inner half is densely covered with small horny papillæ or tubercles, while the outer area and that behind the scar for the pedicle have large tubercles sparsely distributed. The small tubercles are grouped with a few larger spines along the outer edge, while the posterior border is marked by about eight large blunt spines or tubercles. Some of the latter under pressure project a little beyond the posterior border, but no trace of cilia exists. Such scales thus differ quite from those mentioned by Mr. Hornell, so that two species are involved. The scales are mottled with brown, best marked round the scar for attachment.

Feet.—The first foot is not in a condition for description.

The second foot presents a dense tuft of short, strong, and very slightly curved dorsal bristles with smooth tips, and distinct though closely arranged spinous rows. Ventral cirri somewhat tumid at the base, and with a few comparatively long cilia.

The ventral bristles form two groups, a stronger upper series and a more slender inferior group, both with longer and more tapered tips than the typical. The tips of most of the upper series are spear-shaped, though in one or two a double contour is seen. The rows of spines are boldly marked. The inferior group has very long tapering tips, which are hair-like in their attenuation, and the spinous rows are finer than in the superior bristles.

In the third foot the dorsal bristles have increased in size and strength, and the terminal bare region is more distinct. While the upper and lower ventral bristles have simple tips, the median show bifid tips. The feet gradually assume the typical condition as we proceed backwards.

In the fully formed foot (Plate XXIX, fig. 15) the dorsal branch bears a series of moderately elongate and stout dorsal bristles with closely arranged spinous rows, only a short portion at the tip being smooth. The curvature is slight (Plate XXXIX, fig. 4). The ventral bristles are of average length, the upper series with long spinous regions and simple tips, the next with shorter spinous rows and bifid tips (Plate XXXIX, fig. 5). The tips in the stouter forms are slightly hooked, and the secondary process comes off at an angle. Only in the upper forms with the longer distal regions does the secondary process form a small angle. At the ventral edge of the series the spinous region becomes much shorter, but almost all are bifid.

These bristles differ from those of *Harmothoë Haliaëti*.

The dorsal cirri are somewhat slender and elongate, with a slight swelling—marked on each side by a brown bar below the long filamentous tip. They are sparsely covered with clavate cilia, the longest of which scarcely attain half the diameter of the thickest part of the cirrus. The posterior cirri are very slender throughout. The ventral cirri are rather small and slender, and have a few short clavate cilia.

Loxosomæ occur on the skin of the dorsal division of the feet, and also on some of the dorsal bristles (Plate XXXIX, fig. 6).

8. Harmothoë marphysæ, *McIntosh*, 1876.

Specific Characters.—Head elongated, rounded in front, widest posteriorly. Eyes small, the larger anterior pair further apart and situated laterally in front of the middle line. Posterior pair in front of the nuchal collar. Median tentacle short, with clavate cilia; lateral short, with filiform tips and a few clavate cilia. Palpi (in spirit) short and stout, with delicately tapered tips. The tentacular and dorsal cirri are comparatively short and slender, and the tips finely pointed. A few clavate cilia occur on the surface. Body somewhat elongate, about three quarters of an inch, and with thirty-two to thirty-three bristle-bearing segments. The feet increase in bulk after the twelfth (sexual). Scales thirteen or fourteen pairs (it may be fifteen), smooth under a lens, but under a high power showing widely separated horny papillæ. In shape they are rounded in front, reniform or ovoid posteriorly. Dorsal division of the foot little developed, and the tuft of bristles minute. Ventral bristles with short spinous regions and mostly with bifid

clavate cilia. Colour pale brownish inclining to buff, with a red patch on the head and a purplish hue over the proboscis. Under surface pinkish with a broad streak of carmine.

Synonyms.

1876. *Harmothoë marphysæ*, McIntosh. Trans. Zool. Soc., ix, p. 384, pl. lxix, f. 11—14, and pl. lxx, f. 7.
1890. „ „ Malaquin. Annel. Boulon., 21.

Habitat.—In the galleries of *Marphysa sanguinea* in Guernsey, and from chinks in the rocks, Polperro (British Museum).

Head (Plate XXVII, fig. 11) rather elongated from before backward, rounded in front instead of having the usual peaks, and with the widest part behind the middle. Eyes small; the larger anterior pair wider apart, and situated laterally in front of the middle line at the edge of the red patch on the head. The small posterior pair lie in front of the nuchal collar and behind the red patch. A slight median groove runs forward to the base of the median tentacle, the column of which is absent. The lateral tentacles are inferior (*i. e.* below the rounded anterior border of the head), short, with filiform tips, and have a few short clavate papillæ. The palpi are short and stout, with delicately tapered extremities. No papillæ were visible, but they may be present in section. The tentacular cirri are comparatively short and slender, with finely tapered points. On the surface are a few clavate cilia.

Body somewhat elongate, with the feet greatly developed posteriorly. Bristle-bearing segments thirty-two to thirty-three. The segments after the twenty-third (bristled), however, are in process of renewal. The markings on the dorsum are less distinct than usual, as the feet are separated by deep clefts. The feet increase in bulk after the twelfth bristled pair, becoming larger and longer, a feature which may be connected with reproduction. An elevated line occupies the middle of the dorsum in the preparation, while ventrally the median region has a depressed line at each side with a cushion-like ridge between. The segmental eminence is well marked, and a distinct conical process extends between the feet. The process is evident about the seventh foot, and continues almost to the posterior end.

The colour is pale brownish inclining to buff, with a red patch (from the ganglia) on the head, and a purplish hue just behind (due to the proboscis), while a faint median streak occurs on the dorsum. The cirri are pale brownish, pellucid, the two caudal styles being darkest. The under surface is pinkish, with a broad streak of carmine in the centre.

The *scales* (Plate XXXII, fig. 13) appear to be thirteen or fourteen pairs (possibly fifteen), covering the dorsum and easily separated, but the specimen is not in a condition to give accuracy in this respect. In front they are rounded, then reniform, and even somewhat quadrate posteriorly. They are rather thin, apparently smooth and pellucid, the anterior only having a pale brownish patch on a whitish portion. Under the microscope, however, a belt of small papillæ (spines) occurs within the anterior bay of the scale, in front of the scar. Other pale points which resemble these (by transmitted

light) are dotted over the lateral area, but they seem to be the end-organs in connection with the numerous nerves.

Feet.—The first foot has a strong spine and a bristle or two like the dorsal.

The second foot has a considerable number of short dorsal bristles, little tapered. In the ventral division is a group of comparatively short, strong bristles, with short spinous regions, and a somewhat elongated smooth portion at the tip which ends in a probe-point. The length of the spinous region diminishes in the usual manner from above downwards.

Gradually the feet assume the complete form, many of the ventral bristles, indeed, in the third foot being bifid, but the dorsal division, instead of becoming more prominent as in the majority of the Polynoidæ, increases very little.

In the fully formed foot (Plate XXIX, fig. 16) the dorsal division is marked by a long bluntly conical process bearing the spine, above which a short tuft of comparatively few bristles projects from a small eminence. These bristles (Plate XXXIX, fig. 7, one of the longer) are slightly curved, delicate, and translucent, with minute rows of spines. The ventral division consists of a somewhat long and obliquely truncated foot, the spine occurring at the upper angle in a pit between two fleshy lobes—a larger upper and a smaller inferior. The bristles have moderately long shafts and short spinous regions. The upper examples have more elongated spinous regions and simple tips (Plate XXXIX, fig. 8), while a distinct secondary process is observed in the succeeding forms (Plate XXXIX, figs. 9 and 10, the latter being seen from the front). Toward the ventral edge of the group the spinous regions become very short and the tip simple (Plate XXXIX, fig. 11). In large examples from Polperro the dorsal edge of this division of the foot is curiously wrinkled in the preparations. The spinous region of the ventral bristles is often coated with parasitic growths.

Posteriorly both dorsal and ventral bristles become more slender and elongate, the tips of the ventral forming long hair-like processes.

The dorsal cirri are pale brownish and pellucid, the caudal styles being darker. The cirri are simple tapering processes, with sparsely distributed clavate cilia, which are longest towards the base of the filiform tip. The ventral cirrus is somewhat tumid at the base, and has a very few comparatively long clavate cilia.

Reproduction.—The specimen procured in July at Guernsey carried nearly ripe ova.

Habits.—A single specimen occurred in each gallery of *Marphysa sanguinea*, and the examples from Polperro, "from the chinks of rocks," may have had a similar relationship. When placed in an open vessel beside *Marphysa* it clung to the body of the latter near the head.

Baron de Saint-Joseph procured his *Harmothoë picta*,[1] an allied species, in the tube of *Lanice conchilega* at Dinard, on the French coast. Another species (*H. arenicolæ*) he found clinging to a lobworm. It is curious that this also was a ripe female. His figures of the bristles are not so strictly drawn as is necessary for accurate diagnosis, but the species closely approaches *H. spinifera* and *H. ljungmani*. It is, however, larger, viz. 25 mm. long.

[1] 'Ann. d. Sc. nat.' (7), v, p. 172, 1888.

9. Harmothoë lunulata, *Delle Chiaje*, 1841.

Specific Characters.—The head approaches that of *Harmothoë marphysæ*, only it is less elongated and the eyes are larger. The tentacles and tentacular cirri are brownish; palpi smooth. Body about three quarters of an inch long; ventrally, with a series of brown spots, which, as a rule, commence as four rows somewhat behind the middle. Occasionally by union they form bars at the junction of each segment. A prominent segmental eminence and papilla. Scales fifteen pairs, smooth round the margin, but with a dense cluster of minute horny papillæ on an area in front of the scar. Brown pigment variously arranged—some having a ring of brown or a V-shaped pattern on the scale, while the outline of the pigment in others has the shape of the shell of *Pandora*. Dorsal bristles are better developed than in *H. marphysæ*, being long, tapering, slightly curved, and finely spinous. The ventral bristles, again, form a fan, and the tips of almost all have a secondary process. The dorsal cirri are comparatively short tapering organs, with sparsely distributed short clavate cilia. The ventral cirri have similar cilia, and are slender, their tips reaching beyond the base of the nearest bristles.

Synonyms.

1841. *Polynoë lunulata,* Delle Chiaje. Descriz. e not., vol. v, p. 57, pl. cxliv, f. 5, 6.
1865. „ *maculosa,* Carrington. Proceed. Lit. and Phil. Soc., Manchest., iv, p. 177.
1867. *Monocolea tessellata,* Costa. Ann. d. Mus. Zool. d. v. Univ. d. Napoli, i, p. 82.
1868. *Polynoë lunulata,* Claparède. Annél. Chét., Naples, p. 63, pl. ii, fig. 1.
1875. „ „ Panceri. Atti R. Accad. Napoli, vol. vii, p. 13, Tav., f. 1—3.
„ *Harmothoë lunulata,* McIntosh. Invert. and Fish., St. A., p. 116.
1876. „ „ idem. Tr. Z. S., vol. ix, p. 385, pl. lxix, f. 16—20.
1884. *Polynoë lunulata,* V. Carus. Faun. Medit., i, 200.
1886. *Harmothoë lunulata,* Harvey Gibson. Verm. Liverp., 148.
1891. *Polynoë* (*Harmothoë*) *lunulata,* Hornell. Op. cit., p. 236.

Habitat.—Very generally distributed throughout British waters—from Shetland to the Channel Islands, and from the west coast of Ireland to the east coast of Scotland. It ranges from the tidal rocks in the Channel Islands to 120 fathoms off the south-west coast of Ireland. It extends to the Mediterranean.

Head (Plate XXVII, fig. 8) resembles that of *H. marphysæ*, only it is less elongated and the eyes larger. The median tentacle is brownish, has a filiform tip and sparsely distributed clavate cilia. The lateral tentacles are subulate, with a filiform tip and clavate cilia. The tentacular cirri have the same form as the median tentacle, and also the same brownish colour. The palpi are smooth.

Body about three quarters of an inch in length, slightly tapered anteriorly, and much more so posteriorly. The chief feature of moment is the presence, in the majority, of a series of brown spots, which commence as four rows somewhat behind the middle. In some the sets are united so as to form two rows of bars at the junction of each segment; and this confluence sometimes occurs posteriorly even when the four rows are distinct in front. The segmental eminence is well marked, and a small cylindrical papilla projects between the feet.

Scales (Plate XXXII, fig. 12).—Fifteen pairs, somewhat thin, and entirely covering the dorsum. The first pair are rounded with a broad transverse bar of brown pigment in front. The succeeding are reniform, and the posterior more or less ovoid. They are finely veined, and as smooth under a lens as in *H. marphysæ*, but show a dense group of horny papillæ in front of the scar, that is, near the hollow of the reniform kinds. The coloration of these scales is varied. Thus some of the Zetlandic examples are faintly tinged with brown toward the posterior border; in others each scale has a brownish ring, or the brown pigment forms a bold border on the inner third, and sends a process, in some cases enlarged near the termination, toward the centre of the scale, so as to simulate a V. The spot or enlargement is at the scar. In the forms from St. Andrews the pigment assumes the shape of the shell of *Pandora*, with a spot (over the peduncle) corresponding to the hinge anteriorly. The colours are for the most part retained after immersion in spirit. The persistent attachment of the scales is not a feature characteristic of the Zetlandic forms, for they readily fall off.

Feet.—The first foot has the usual spine and a few bristles resembling the dorsal.

The dorsal division of the second foot bears a larger group of bristles than in *H. marphysæ*, with similar fine rows of spines, and the bristles are generally larger and stouter. The ventral series are fairly developed, the upper and lower with simple, the median with distinctly bifid tips, though the secondary process is slender.

In the third foot both dorsal and ventral bristles are longer and approach more nearly to the typical forms. They are also more numerous.

In the typical foot (Plate XXX, fig. 4) the dorsal division is more developed than in *H. marphysæ*, and the bristles attain a size never seen in that species, though it has to be borne in mind that the environment may have considerable influence in modifying these and other parts. They are long, tapering, slightly curved, and finely spinous bristles (Plate XXXIX, fig. 12, in profile, and Plate XXXIX, fig. 13, antero-posteriorly, so as to show the alternate disposition of the spines, both representing the longer and more tapering forms next the ventral). Some, however, are even more finely tapered than the forms shown. The spines proceed almost to the tip, a mere trace of a terminal smooth portion being present. Those next the body are much shorter and less tapered (Plate XXXIX, fig. 14). Parasitic infusoria and slender algæ are common on these bristles. The ventral division of the foot is somewhat less elongated than in *H. marphysæ*, and the bristles form a more regular fan. Superiorly the spinous region is longer, and the tips more finely tapered (Plate XXXIX, fig. 15); the secondary process, which appears to be present in all at this edge, being very closely applied to the larger division, which is scarcely hooked. In a variety from Guernsey some of these bristles have simple tips. The fissure between the divisions becomes more evident as the spinous region diminishes in length, but it again is less distinct ventrally, some at the extreme verge having a mere trace of this process. A bristle from the middle of the ventral group is drawn in Plate XXXIX, fig. 16. Their colour throughout is very pale yellow. Microscopic filamentous algæ occur on them.

The dorsal cirri are rather short, tapering organs, with scarcely a trace of an enlargement below the filiform tip, and the short clavate papillæ are sparsely distributed. The ventral cirri are comparatively slender, and the tips reach considerably

beyond the bases of the nearest bristles. They have the same sparsely distributed short cilia.

Habits.—*Harmothoë lunulata* is a very active species amongst the laminarian roots, and displays as much irritability as *Evarne impar*. It is also sometimes found as a commensalistic form in the tube of *Polycirrus*. It is brightly phosphorescent, glowing when irritated at the bases of the feet for a considerable time, and giving off flashes when immersed in spirit, as well as generally breaking in pieces.

The Zetlandic examples of the species are somewhat elongated, have longer feet, and longer and more delicate pale bristles; moreover the dorsal and ventral cirri are longer than in the southern forms.

It is evident that the species approaches *H. marphysæ* very closely, though the cirri of the latter are shorter and smoother, the bristles of the dorsal branch much shorter and less conspicuous, and those of the ventral division shorter and more slender. Moreover those of the superior ventral series have no bifurcation at the tip, the closest approach to the latter condition being in a variety of *H. lunulata* from St. Peter Port, Guernsey, which had an indistinctly bifid tip in one or two of its superior bristles.

I have united it, after Claparède, with Delle Chiaje's form, though in his original description of the species he gave it a single caudal style and fourteen pairs of scales—characters also illustrated in his somewhat stiff figure, which shows the middle line of the dorsum quite bare from end to end.

Claparède, who studied the species at Naples, correctly described it as having fifteen pairs of scales, and pointed out the pinkish hue of the ventral median line anteriorly—from the nerve-cord—on which he found no ganglia. He gives the total number of segments as thirty-seven, and shows that the last bears two large terminal cirri. At the bases of the feet are vibratile rosettes as described by Ehlers, and they are about four in number. In the preserved examples the two whitish masses he mentions on the feet are not visible. He also notes the apparent absence of blood-vessels, and describes the nerve-cord as having a median and two lateral bands corresponding to the nerve-cells, of which he gives some further details. He is of opinion that Costa's *P. tessellata* is the same species. He describes the scales as finely granular and without horny papillæ, but in his figure the greater part of the surface (all but the anterior third) shows such papillæ. This, therefore, is a point on which further evidence is required, especially as the distribution of these horny papillæ in the British examples is so well defined. Should the evidence prove that the Mediterranean form is different, then Dr. Carrington's name, *H. maculosa*, stands. He first found the species in this country stranded on Southport sands.

Prof. Panceri[1] experimented with this species and others in regard to luminosity, and came to the conclusion that it emanates entirely from the scales, and that it is connected with the remarkable terminations of the nerves in the subcuticular granular layer of the epiderm.

Grube's *P. maculata*[2] seems to be an allied form, but the description of the cirri differs.

[1] 'Atti R. Accad. di Napoli,' 1875, p. 13, Tav. 304.

[2] 'Actin., Echin., u. Würm.,' p. 87, 1840.

10. Harmothoë setosissima, *Savigny*, 1820. Plate XXV, fig. 4.

Specific Characters.—Head somewhat short and broad. The posterior eyes are nearer each other than in *H. imbricata,* while the anterior are larger and more visible from the dorsum. Median tentacle rather long, with just a trace of a dilatation below the filiform tip, and its surface has sparsely distributed short clavate cilia. Palpi apparently smooth, but show minute papillæ under a high power. Body somewhat elongated; segments thirty-eight, either pale or variegated rather prettily with brown. Segmental eminences and papillæ distinct. Scales somewhat adherent, thin, but fairly tough; first pair rounded, rest reniform-ovate, their surface densely covered with minute papillæ; colour pale or brownish, sometimes with a broad ring. Feet with a long acute process above the spine. Dorsal bristles long, gently tapered, with very close rows of short spines, and the point rather blunt except in the external forms. Ventral slender, with a long spinous region and a very short, smooth, bifid tip. Dorsal cirri elongated, tapering, and with sparsely distributed short clavate cilia; ventral slender and rather elongate, also with a few short clavate cilia.

Synonyms.

1820. *Polynoë setosissima,* Savigny. Syst. Annel., p. 25.
1828. *Eumolpe setosissima,* Blainville. Dict. de Sc. nat., lvii, p. 459.
1834. *Polynoë setosissima,* Audouin and Edwards. Annél., 90, pl. i, f. 18.
1836. „ „ De Quatrefages. Règ. an. illust., pl. xix, f. 2.
1863. „ *longisetis,* Grube. Archiv f. Naturges., xxix, p. 37, taf. iv, f. 1.
1864. „ „ idem. Die Insel Lussin, &c., p. 78.
1865. *Lænilla glabra,* Malmgren. Nord. Hafs-Ann., p. 73, Tab. ix, f. 5; and Ann. Polychæt., p. 136.
„ *Polynoë setosissima,* De Quatrefages. Ann. I, 229, pl. vi, f. 17.
„ *Antinoë semisculptus,* Baird (partim). Journ. Linn. Soc., viii, p. 192 (?).
1869. *Harmothoë Malmgreni,* Ray Lankester. Tr. Linn. Soc., xxv, p. 375, pl. li, f. 11, 25, 28.
„ *Polynoë longisetis,* McIntosh. Trans. R. S. E., xxv, p. 406, pl. xv, f. 3.
1870. „ *lævigata,* Claparède. Ann. Nap., Sup., p. 14, pl. i, f. 3 (?).
1875. *Lænilla glabra,* Ehlers. 'Porcupine,' 1869, op. cit., p. 32.
„ „ *setosissima,* McIntosh. Invert. and Fishes, St. A., p. 116.
1876. „ „ idem. Trans. Z. S., ix, p. 387.
1882. „ *glaberrima,* Hansen. Norweg. N. Atlantic Exp., 29, Tab. iii, f. 6—11.
1886. „ *setosissima,* Giard. Bullet. Sc. Nord, 339.
1890. „ „ Malaquin. Ann. Boulon., 23.
1891. *Polynoë* (*Lænilla*) *setosissima,* Hornell. Op. cit., 235.
1898. *Harmothoë longisetis,* De St.-Joseph. Ann. d. Sc. nat., viii, sér. v, 234, pl. xiii, f. 21.

Habitat.—Not uncommon between tide-marks, under stones at Herm, and also in the tubes of *Chætopterus;* tossed on shore amidst sponges, sea weeds, and corallines at the west sands, St. Andrews (E. and R. M.), in the stomach of the cod and haddock at the same place (E. M.), at Plymouth, Moray Frith, and various parts of the British coast. Ehlers found it ranging in the 'Porcupine' to 767 fathoms on *Holtenia*-ground with mud and globigerina-ooze. Extends to the Mediterranean.

Length one and a half to one and three quarters inches.

Head (Plate XXVIII, fig. 5) somewhat like that of *Harmothoë imbricata* in outline, only the anterior peaks are less acute and the widest region is further forward, so as to give the head a more distinctly ovate form. The posterior pair of eyes are nearer each other, and the larger anterior pair are more visible from the dorsum. The median tentacle is of moderate length, with just a trace of a dilatation below the filiform tip, and furnished with sparsely distributed short clavate cilia. The lateral tentacles are short and tapering, and have a very few of the same small clavate cilia. The palpi are smooth under a lens, but show very minute papillæ under a high power. The toughness and extensibility of these organs are well seen in this species. The tentacular cirri also show a trace of an enlargement below the filiform tip, and have sparsely distributed short clavate cilia. These and the tentacles are sometimes tinted brownish.

Body rather elongate, slightly tapered in front and more distinctly from the anterior third backward, and having thirty-eight bristled segments. In some the dorsum is pale, but in others, as in the drawing, it is barred with brown throughout, the pattern in each segment posteriorly being beautifully defined. The under surface is pale. The segmental prominence is distinct, and a considerable papilla projects between the feet. The body terminates in two long, tapering, caudal styles.

The pre-gastric cæca agree with those in *Harmothoë imbricata*.

Scales (Plate XXXIII, fig. 5) fifteen pairs, entirely covering the dorsum; the first pair rounded, the succeeding reniform-ovate. The anterior cling somewhat firmly to the pedicles. The surface is densely covered with minute chitinous papillæ (really minute spines), so that it appears like shagreen under the microscope. Towards the outer border a few short clavate cilia project from the edge and also appear on the neighbouring surface. The scales are comparatively thin, but of considerable toughness. They increase in size posteriorly. Their colour is often pale, but in some it is brownish, and in the coloured figure the papillæ of the scales and other organs are infested by a blackish parasitic growth which greatly alters the aspect.

In two fine examples procured after a storm on the west sands at St. Andrews (E. M.), the scales had a broad marginal belt in the exposed portions, leaving a large ovoid pale region in the middle. The dorsum besides was richly tinted with brown. Coloured examples, indeed, are more common in the north than in the south.

Many *Loxosomæ* occur on the scales of a specimen from the Moray Frith.

Feet.—The first foot has a very strong spine and a group of about four short bristles of the dorsal type.

In the second foot the dorsal bristles form a dense tuft, the closely arranged spinous rows and the rudimentary bare portion at the tip being diagnostic, though the bristles have not attained the length of the typical forms. The ventral division consists of a series of slender bristles with long, tapering, spinous regions, and simple slender tips. Moreover the shape of the foot is peculiar, the dorsal division in lateral view forming a high crest, while the ventral is distinguished by its long, acute cone projecting horizontally above the spine.

In the third foot the bifid condition of the ventral bristles is more evident, and the dorsal are longer. The conical process of the ventral division is larger. By easy stages

the typical foot (Plate XXX, fig. 12) is soon reached, showing a ventral division terminating superiorly in a long conical process above the spine. The dorsal bristles (Plate XL, fig. 5) spring from an oblique eminence, and are characterised by their great proportional length, slight curvature, and gently tapered extremities, those next the body having somewhat blunt tips, those next the ventral being more acute. The tips of the blunt forms scarcely show a bare portion, the rows of spines being continued to the tip, but the acute bristles next the ventral have a minute bare portion which sometimes presents a slight keel. The spines are short and the rows very close, so that the bristle is at once distinguished from that of *Harmothoë imbricata*, irrespective of the length of the tip. The ventral bristles are numerous, long, and slender, the spinous region of the upper forms being of great length, the rows closely arranged, and the spines rather short. The tips are bifid, the terminal hook is small, and the secondary process makes a very slight angle. Moreover the smooth region is remarkably short, the spines passing up to the fork (Plate XL, fig. 6). Both sets of bristles are of a lustrous pale yellow, almost like those of *Chloeia*, and thus afford a contrast with the dull straw-coloured organs of *Harmothoë imbricata*. In shape the ventral lobe of the foot is peculiarly pointed, the base being bevelled superiorly, and with a projecting fold inferiorly.

In the terminal feet the dorsal bristles are few in number, more slender and elongate, the tip pointed, and the rows of spines distinctly wider. The ventral are also few in number, slender, with long, tapering, spinous regions, and attenuate, simple tips.

The dorsal cirri present scarcely any enlargement below the filiform tip, are pale throughout, have short clavate cilia sparsely scattered over the surface, and they are longer distally than proximally. The ventral cirri are long subulate organs, the tip extending considerably beyond the bases of the bristles.

The dorsal bristles are the seat in some of a peculiar blackish fungoid growth, as indicated in the coloured figure. This minutely granular structure finds a suitable site on the spiny ridges of the dorsal bristles, and thus both shaft and tip are barred with black in a characteristic manner. This coating can readily be removed by pressure, and no evident change is apparent in the bristle. It is rendered brown by hydrochloric acid, while caustic potash does not seem to alter it much. This growth also affects the spinous region of a few of the ventral bristles.

Habits.—This is another example of the fact that species which frequent off-shore waters in the north are found between tide-marks in the south, as in the Channel Islands. It is a comparatively hardy form, and the example from which the coloured drawing was made lived for weeks in the centre of Perthshire, though towards the termination of the period many of the ventral bristles were shed.

After careful consideration this form has been associated with Savigny's *Polynoë setosissima*.

Audouin and Milne Edwards (1843) assigned forty segments to this species, and they and Savigny found their examples at Havre.

De Quatrefages (1865) included it under his fourth group, in which the body is more or less elongated, and covered by fifteen pairs of scales. He describes the species as provided with a simple triangular head; the median antenna large, about as long as the

tentacle. The lateral antennæ small. Forty segments. Scales whitish, obliquely ovoid; sometimes spotted, with the entire margin ciliated. He points out that Savigny and M. Edwards described individuals devoid of scales. Moreover he readily distinguished it by its pale colour; he thinks that Cuvier was wrong in saying Savigny found it at Havre.

Baird found it in tube of *Chætopterus insignis* from Beaumaris.

This species was carefully described by Grube[1] from specimens procured at the larger and smaller Lussins and at Crivizza. He noticed its relationship to *P. setosissima* of Savigny, but the latter had shorter palpi and two additional papillæ, viz. twenty, to the border of the proboscis. He[2] says the specimens so named in the Parisian Museum were *Lænilla glabra*, Mgrn., and *Evarne impar*.

Malmgren's artist represents the anterior pair of eyes on the dorsum, and of the same size as the posterior pair.

The *Polynoë lævigata* of Claparède, from Naples, approaches this form; indeed, there is little to differentiate it. Claparède considered the *P. tentaculata* of De Quatrefages as closely allied.

In Prof. Ray Lankester's early remarks on this species the essential points were omitted.

Ehlers alludes to the variations of the scales exhibited by the specimens from different depths in the 'Porcupine' Expedition of 1869.

Dr. Hansen's (1882) *P. glaberrima* appears to be this species. Unfortunately, while placing comparatively little weight on the minute structure of the bristles, the diagnostic characters relied on by this author would not appear to have been of much avail.

It is difficult to make out to what species Audouin and Milne Edwards' *Polynoë lævis* is to be referred. Malmgren includes it under his *Lænilla alba*. Prof. Giard (1886) considers that *Polynoë lævis* is not a variety of *Polynoë setosissima*, since the scales in the former are smooth, whereas in the latter De Quatrefages distinctly says they have a margin fimbriated all round, but he corrects himself in a subsequent communication.[3] He does not think the *P. lævigata* of Claparède is this species.

Hornell (1891) considers that it is the *Lænilla glabra*, Mgrn., and found it invariably present in the tube of *Chætopterus* in Herm.

Baron de Saint-Joseph[4] (1898) in a recent paper doubts if Prof. Giard and I are warranted in connecting this species with Savigny's form, which had lost its scales. The description given by MM. Audouin and Edwards, however, though imperfect, comes nearest this species. He also is doubtful about the inclusion of Claparède's *P. lævigata* as a synonym, but there is no valid reason for altering the view already expressed.

[1] "Beschreibung neuer oder wenig bekannter Anneliden," 'Arch. f. Naturges.,' 1863, p. 37.

[2] 'Arch. f. Naturges.,' 1870, p. 287.

[3] 'Bullet. Sc. Nord,' pp. 340, 341.

[4] Op. cit., 1898, p. 236.

11. Harmothoë areolata, *Grube*, 1860.

Specific Characters.—Body elongate, slightly tapered anteriorly, more so posteriorly, and terminating in two caudal cirri. Bristled segments 37 to 39. Head somewhat ovoid, with two elongated peaks in front, and clearly separated by an interval from the base of the median tentacle. Posterior pair of eyes on the dorsum and in front of the nuchal fold, while the anterior pair under the peaks are almost invisible from the dorsum. The median tentacle is of moderate length, gently tapered, little if at all dilated below the filiform tip, and densely ciliated. The lateral tentacles are short, and similar in structure. The tentacular cirri agree with the tentacle. Palpi of moderate length, gently tapered from base to near the apex, which is short and filiform. They have rows of short clavate papillæ, which diminish in size from base to tip, which is bare. Scales fifteen pairs, imbricate, covering the dorsum and extending over the bristles. They vary in shape from the rounded first pair to the reniform kinds, and the D-shaped posterior pair are studded with horny papillæ of various sizes, from the small rounded processes to the elongate forms which rise into bluntly conical spines posteriorly. Margin ciliated posteriorly from the inner to the outer border. Those on the outer border are densely grouped and long. Dorsal cirri of moderate length, tapered and densely ciliated almost to the tip. In many the distal half of the process is dilated, so that the organ is broadly spathulate, with the filiform tip projecting at the distal region. Feet have a dorsal tuft of curved bristles which are densely spinous, with a smooth tip, which has a streak as if a rudimentary tooth were present. The ventral bristles are rather slender, with tapering bifid tips and well-marked spinous rows. The ventral cirrus reaches beyond the base of the bristles, and has somewhat short clavate papillæ.

Synonyms.

1857. *Polynoë areolata,* O. G. Costa. Annel. Nap., Tav. ii, figs. 2—2*j*.
1860. „ „ Grube. Arch. f. Naturges., 1860, 72, pl. iii, f. 2.
1861. „ „ idem. Ein Ausflug n. Triest u. Quarnero., p. 139, Taf. iii, fig. 2.
1864. „ „ idem. Die Insel Lussin, p. 78.
1865. „ „ De Quatrefages. Ann., i, 232.
1866. *Antinoë nobilis,* Ray Lankester. Trans. Linn. Soc., xxv, p. 375, Tab. li, f. 1—9.
1868. *Polynoë areolata,* Claparède. Ann. Chét. Nap., 71, pl. ii, f. 5.
1876. *Harmothoë areolata,* McIntosh. Trans. Z. S., ix, 381, pl. lxviii, f. 3, 12, 14.
1884. *Polynoë areolata,* V. Carus. Fauna Medit., i, 200.
1886. *Evarne areolata,* Giard. Bullet. Sc. Nord, 341.
1888. *Harmothoë areolata,* De St.-Joseph. Ann. d. Sc. nat. (7), v, p. 169, pl. vii, f. 41—43.
1890. „ „ Malaquin. Ann. Boulon., 18, pl. i, f. 1, 2.

Habitat.—First found by O. G. Costa in the Mediterranean, afterwards by Prof. E. Grube in the same sea and the Adriatic, and in Britain by Prof. Ray Lankester close to and in the tubes of *Terebella nebulosa* in Herm, by Mr. Cooper in the tubes of *Chætopterus*, and by the author frequently under stones at Herm.

The *head* (Plate XXVII, fig. 15) of this species is distinguished by its somewhat ovoid outline and the prominent peaks in front. The eyes are of moderate size—two on the dorsum posteriorly in front of the nuchal fold and quite within the margin of the head, and two at the outer and under surface of the peaks, so that they look forward and slightly outward. The median tentacle is of moderate length, and tapers from the base towards the tip, which is filiform and densely covered with rather long cilia having slightly bulbous tips. Scarcely a perceptible swelling in the preparations occurs below the tip. The cilia diminish in length distally, but extend along part of the filiform tip. The lateral tentacles arise below and somewhat external to the median, are short, and taper from the base to the filiform extremity. Short cilia occur on the surface and on the filiform extremity as small papillæ.

The tentacular cirri are similar to the median tentacle. The palpi are of moderate length, gently tapered from the base to near the apex, which is filiform, though short. They have densely crowded rows of clavate papillæ—more slender than in *Harmothoë imbricata*, and which gradually diminish from below upwards.

The *body* presents the usual slight convexity dorsally with the transverse depression in each segment—especially marked behind the proboscidian region. Moreover much of the body is of uniform breadth. Ventrally a central depressed area occurs in spirit, with lateral elevations, from which the rather small segmental processes project between the feet. Posteriorly it terminates in the caudal cirri.

Proboscis.—The proboscis is less massively muscular than in *Lagisca* or *Harmothoë imbricata*, and the horny teeth are smaller; indeed, they may be called minute. The horny ridges are also less prominent. The terminal papillæ of the organ agree with those in *Harmothoë*.

In the peripharyngeal space only one short pregastric cæcum goes forward to the second segment in front of the stomach. The second is nearly transverse. The reduction of the cæca is thus a marked feature.

The *scales* (Plate XXXII, fig. 17) are somewhat stiff and leathery, especially in front. The first pair are more or less rounded, and thickened by the numerous large chitinous areas terminating in the blunt spines, which are minutely nodular with short chitinous spikes. The surface of the scale is further cut into definite areas by a series of chitinous reticulations which enclose the space occupied by each bluntly conical spine, and consequently in this (the first scale) irregular hexagons, pentagons, or similar figures occur in the central region round the large bosses, while the margin is cut into longer areas with intermediate small triangles—for spines—at the edge. Moreover the right or upper differs from the left or under scale, the former corresponding more particularly with the description, while the latter in the region overlapped by the former is thinner, and has numerous smaller reticulations enclosing a diminishing series of horny papillæ from the central region of larger spines to the edge. The latter is also smooth, but, with this exception, the edge has cilia all round, and of considerable length as well as more numerous at the outer margin. The right or upper first scale shows a continuous series of marginal cilia. The succeeding scales are more or less reniform or somewhat ovate, according to their position, while the last are almost D-shaped. Their general structure is similar, viz. the anterior and inner edge, that overlapped, being more

or less thin and smooth; then the small papillæ stud the surface, and gradually increase in size towards the posterior and outer edges. The border is formed of the long ridges terminating in the marginal, blunt, spinous papilla. The smaller rounded bases of the chitinous papillæ internally are so closely arranged that they resemble the shields in certain regions of an armadillo. Moreover, whereas in the first scales the chitinous lines which bifurcate to form the triangular areas of the margin are simple, in the rest they form a complex and continuous series of reticulations somewhat resembling those in the skins of holothurians (Plate XXXIII, fig. 3). The minutely nodular or cæspitose condition of the chitinous spines is a marked feature throughout. The posterior border has cilia of considerable length internally, then they diminish along the posterior edge, again elongating on approaching the outer border, where they form a long, dense fringe. The bulbous tip is minutely granular in its centre, and is continuous with the central axis of the cilium. The under surface of the scale is iridescent, with a well-marked scar for attachment somewhat nearer the outer than the inner border. The scales separate readily. Occasionally a small patch of *Cellepora* is found on a scale.

Colour.—The dorsum has a light brownish or amber hue from the scales, the posterior part of each of the latter being somewhat darker. The pinkish hue of the body occasionally shines through these. The cirri are pale. The under surface is iridescent bluish-pink, as in *Polynoë scolopendrina*. Ray Lankester speaks of the head as being violet, and the palps deep madder-brown. In spirit they are dark greyish, streaked with the lines of cilia. Towards the posterior end the dorsum has various transverse streaks of dark greyish (in spirit). In rather more than the posterior third also a dark touch occurs on each side of the base of the dorsal cirri, and there is a tendency for the elevations in a line with the tubercles for the scales to have a touch of the same colour. The pigment thus seems to be connected with the cirrigerous feet, and consequently is best developed behind the last scale-tubercle. On the ventral surface the posterior third presents dark pigment touches on the segmental eminences, and the tint increases in depth posteriorly, spreading outward on the bases of the feet. A touch or two of pigment also occur on the anterior folds of the mouth.

Feet.—The modified dorsal bristles of the first foot have smooth tips. The second foot is small, with a flipper- or paddle-shaped fleshy region dorsally, the inferior margin terminating in the long papilla for the spine. The bristles, though short, are typical in structure. The ventral division is somewhat conical, terminating in the pointed region for the spine, and from the tip of this process a long cutaneous papilla projects. The bristles are slender with elongated curved spinous tips.

The third foot shows a considerable increase in the size of both dorsal and ventral bristles. The ventral are still proportionally slender, but the majority have bifid tips, only the lower short forms having simple tips. The ventral cirrus has large clavate cilia. The papilla beyond the spine is present.

The fourth foot approaches the typical condition except that the number of simple bristles inferiorly is greater.

In the typical foot (Plate XXX, fig. 3) the superior division has a somewhat conspicuous tuft of elongate, slightly curved bristles externally, and shorter and more curved forms internally (Plate XXXIX, fig. 17). The spinous rows are dense. The tip has a

short smooth portion with, in many, a slight though distinct streak, best marked in the shorter bristles, in which it forms a groove at the extremity. The external bristles (those next the ventral division) form a contrast to the inner from their sharp tapering tips and slight curvature. In the older specimens these bristles are often densely coated with parasitic growths, such as algæ and infusorians, besides mud. The ventral branch has a series of rather elongate slender bristles with tapering tips, which, as usual, diminish in length from above downward. The tips superiorly are attenuate, and one or two show no secondary process, but this soon appears, again to disappear, in the shorter inferior forms. One of the attenuate superior bristles with a bifid tip is shown in Plate XXXIX, fig. 18. The spinous rows are rather prominent. A shorter bristle again, with a slightly abraded tip, is given in Plate XXXIX, fig. 19. Inferiorly the bristles have slender, short, spinous extremities with a minute secondary process, and, at the ventral edge of the series, the tips are simple. The nearly cylindrical papilla above the ventral spine is well marked; and the ventral cirrus reaches beyond the base of the bristles, and has somewhat slender clavate papillæ.

Comparatively little change ensues in the bristles of the terminal feet. The dorsal are more slender and proportionally longer, so that they extend almost to the tip of the longest of the ventral division. The ventral division has the same type of bristles as in front, except that they are more slender. The elongated forms usually found in this region were not observed, but the specimens may have been recently injured. The papilla above the ventral spine continues to the last foot.

The dorsal cirri are of two types, viz. those of the usual kind, with just a trace of a dilatation below the elongated filiform tip, and densely coated with cilia, which are long except at either end of the series; and secondly, those with a greatly enlarged distal half, so that the organ resembles a tennis-racket with the filiform tip appended to it, and coated with cilia as in the first form. This condition of the cirri was first noticed by Ray Lankester in specimens from Herm, for Grube's original ones had only the slender cirri. No connection between the sexual or other condition of the specimens and this state of the cirri has yet been observed. In one instance these enlarged cirri were found in the tubes of *Chætopterus*, and were forwarded as parasites.

Reproduction.—A specimen of good size from Herm carried ova at the end of July and beginning of August.

Habits.—Ray Lankester, who placed it as a new species under the genus *Antinoë*, thought it fed on *Terebella nebulosa*, and I found some procured in Herm had fed on *Eunice* and other forms. It would not always seem to be an inhabitant of tubes of other annelids, but occurs in a free condition under tidal stones. De Quatrefages gave this form a position near *Harmothoë imbricata*, but added nothing to Grube's remarks.

Giard (1886) includes it under the genus *Evarne* on account of the form of the head, and the presence of chitinous protuberances on, as well as on account of the structure of, the elytra. Yet the proboscis, the margin of the elytra, and the cirri present certain characters which are almost sufficient to give generic distinction.

De Saint Joseph (1888) seems to doubt my diagnosis in regard to Ray Lankester's *Antinoë nobilis*, but it rests on a careful examination of specimens kindly sent me by Lankester himself, and a survey of the same collecting grounds on the Channel Islands. There is no doubt on the subject.

Genus XIV.—Evarne, *Malmgren*, 1865.

Body rather small, ovate-oblong, attenuate posteriorly. Lateral tentacles fixed under the median, head deeply incised in front, and with prominent lateral peaks. Eyes four, generally large, the anterior pair on the projecting lateral region; the posterior in front of the nuchal collar and widely separated. Palpi densely covered with minute papillæ. Scales, fifteen pairs, spinulose, ciliated or smooth at the edge. Dorsal bristles shorter than the ventral, and with wide rows of spines; ventral bristles very long, with minutely bifid tips. Segmental papillæ well marked, but not long.

1. Evarne impar, *Johnston*, 1839. Plate XXVI, fig. 5.

Specific Characters.—Head wider than long, with prominent peaks anteriorly. Eyes large; posterior pair in front of nuchal collar, widely apart; anterior pair on projecting lateral region. Median tentacle strong and moderately long, densely ciliated, madder-brown, with a slightly dilated whitish region, marked off by bars, below the filiform tip. Lateral tentacles inferior, subulate and tapering, with short clavate cilia. Tentacular cirri similar to, but more slender than, the median tentacle. Palpi of average length, with tapered extremities, and densely covered with minute clavate papillæ. Body somewhat thin and flattened, broadest at the anterior third, thence tapering to the tail. Segments thirty-eight to forty, greenish-brown on the dorsum, darkest in front, the pigment forming somewhat regular bars and touches. Arch of pigment in the cirrigerous segments terminates laterally in two small touches of dark olive, besides other touches at base of cirri. Ventral surface pale or brownish. Segmental eminence and papilla well developed, commencing on the sixth bristled segment. Two long caudal styles. Scales, fifteen pairs, mottled with brownish pigment, often with a yellowish speck in the centre. First pair subcircular, rest reniform and then ovoid; external margin densely ciliated; surface mostly covered with small horny papillæ, with larger ones towards the outer and posterior borders, while along the latter are a few large pyriform or globular papillæ. Dorsal bristles translucent, rather acutely pointed, with wide rows of spines which cross the shaft at right angles; ventral bristles with elongate tapering spinous regions and minutely bifid tips; the latter diminish in length inferiorly, and some at the ventral edge have simple tips. Dorsal cirri like tentacular cirri; ventral cirri subulate, the slender tips reaching the ventral bristles, and with numerous short clavate cilia.

Synonyms.

1839. *Polynoë impar*, Johnston. Ann. Nat. Hist., ii, 436, pl. xxii, f. 3—9.
1840. *Lepidonote impar*, Oersted. Annul. Dan. Consp., 13.
„ „ „ Grube. Fam. Annel., 36.

1863. *Polynoë impar*, Claparède. Anat. u. Entwickel., 60.
1864. „ „ Kölliker. Kurz. Bericht., p. 15, pl. vi, f. 4—6.
1865. *Lepidonotus impar*, Johnst. Cat. B. M., 112, pl. viii, f. 3—9.
„ *Evarne impar*, Malmgren. Nord. Hafs-Ann., 71, Tab. 9, f. 7.
„ „ „ De Quatrefages. Annelés, 226.
1873. „ „ Sars. Bid. Christ. Fauna, p. 4.
1875. „ „ McIntosh. Invert. and Fishes, St. A., p. 116.
1876. „ „ idem. Trans. Zool. Soc., ix, 386, pl. lxx, f. 1—3; ibid., p. 398.
1879. „ „ Tauber. Ann. Danic., 81.
1886. „ „ Marenzeller. Porif., &c., Jan Meyen, p. 11.
„ „ „ Giard. Bullet. Sc. Nord, i, 16, with figs.
1888. *Harmothoë impar*, De St.-Joseph. Ann. d. sc. nat. (7), v, p. 162.
1890. „ „ Malaquin. Ann. Boulon., 18.
1891. *Polynoë* (*Evarne*) *impar*, Hornell. Op. cit., 232, pl. xiii, f. 3 and 6.
1896. *Harmothoë impar*, var. *Pagenstecheri*, Michaelsen. Polych. Fauna, p. 7, pl. i, f. 1.
1898. „ „ „ „ De St.-Joseph. Op. cit., 1898, 231, pl. xiii, f. 14—20.

Habitat.—Everywhere distributed round the British shores—from Shetland to the Channel Islands, and ranging into the Atlantic to the depth of 690 fathoms, as well as extending (*fide* Verrill) to the shores of America, from Cape Cod to the St. Lawrence. It occurs not only in purely salt water, but in such lochs as Loch Portan, Lochmaddy, which receive a stream of fresh water, small examples are likewise found.

Length about an inch. The finest examples in my collection are from the west coast of Ireland and the Irish Channel.

Head (Plate XXVII, fig. 13) somewhat wider than long, with the usual median groove, which widens out anteriorly to join the prominent lateral peaks. The eyes are large and visible from the dorsum, the posterior pair widely apart, and situated immediately in front of the nuchal collar; the anterior pair, which are scarcely larger than the posterior, being on the projecting lateral region, and thus little removed from the former, while they are separated by a considerable interval from the peaks. In an example from Whalsay, Shetland, the anterior pair of eyes were nearer the posterior than usual. In those from deep water the eyes are somewhat larger, but forms between tide-marks show considerable differences in this respect, some having large, others small eyes. Again, a young specimen 6 or 7 mm. long, procured on a thick mass of *Flustra* off Fermain Bay, Guernsey, had no eyes. The median tentacle is of considerable length and strength, generally of a madder-brown colour, and with a pale dilatation marked off by bars below the filiform tip. It is rather densely covered with clavate cilia, some of which equal in length the diameter of the process. The lateral tentacles are inferior, subulate and tapering, and have numerous short clavate cilia. The tentacular cirri are similar to, though smaller than, the median tentacle. Palpi of average length—with a tapered extremity, and densely covered with minute clavate papillæ, which occur from the base to the commencement of the filiform tip. These papillæ are proportionally large.

Body moderately elongate, somewhat thin and flattened, the broadest part being about the anterior third, and thence tapering to the tail. The hue of the dorsum is greenish-brown, darkest in front, and forming somewhat regular bars and touches along the back. Some, again, have the dorsum very prettily and symmetrically barred with

brown after the condition in *Lagisca*. In the cirrigerous segments the arch or band of pigment in the middle of the body terminates in two small touches of dark olive-green, and other touches occur at the base of the cirri. Nine or ten of the terminal segments show these specks on every foot. The proboscidian region is often deeply pigmented. The ventral surface is pale and iridescent, only a tinge of brown occurring on the ridge in front of the mouth. A variety from Bressay Sound, Shetland, has the ventral surface dull olive throughout, with lighter bars, while the dorsum is much variegated with brownish-olive and dark touches. Rarely the anterior half of the mouth is dark olive, and a double row of dark touches occurs at each side of the median depression, while the dorsum is pale madder-brown. In some large examples the elevated ridges posteriorly show pale olive pigment, which in each segment presents two transverse bars and a pale centre. The median longitudinal region is pale. In others similar pigment extends forward to the proboscidian region. The segmental papilla is evident on the sixth foot, and continues nearly to the posterior end. In size it is comparatively large, though it is not long, and points between the feet. The body terminates posteriorly in two long caudal styles, which are much larger than the adjoining dorsal cirri.

Proboscis.—The extruded proboscis shows a range of nine papillæ of the usual dactylozoid shape dorsally and ventrally. No pigment occurs in the centre of these organs. The pregastric and other cæca follow the arrangement in *Harmothoë*.

Scales (Plate XXXII, fig. 18) fifteen pairs, in the smaller thirteen to fourteen pairs, somewhat rough in aspect, mottled with brownish pigment and often with a yellowish speck in the centre, best marked posteriorly. The first pair are suborbicular, the succeeding reniform, and the posterior more or less ovoid, though angles are occasionally formed. The external margin is densely ciliated, the cilia having bulbous tips and varying in length. Moreover many occur on the neighbouring surface of the scale, and a few are scattered within the posterior margin. With the exception of the inner and anterior area the entire surface is covered with small horny papillæ, which often increase into small spines widely scattered towards the outer and posterior borders, while along the latter are the large pyriform or globular papillæ so characteristic of this species. Some of these occur even on the first scales. The summit of each is occasionally roughly papillose, or with a series of large conical spines. These large papillæ are sometimes absent,—as, for instance, in those from the tidal region at Lochmaddy, in an example from 690 fathoms (Station 1, 'Porcupine,' 1870), and in others from Station 6 and outside Gibraltar, while the cilia along the border are longer. Young specimens, as a rule, have smaller processes along the posterior border. Malmgren's figure shows the low rounded bosses very well. The scales are somewhat thin, and the under surface is smooth and glistening. The cilia on the scales are frequently overgrown with a granular parasitic structure.

In a large specimen dredged by Dr. Gwyn Jeffreys off Valencia the scales were devoid of tubercles. Considerable variation, indeed, exists, for some of those from Herm have shorter cilia with more distinctly globular heads, a feature accompanied by smaller dorsal bristles.

Feet.—The first has a few comparatively short dorsal bristles, slightly curved, and with closer and finer serrations than the typical form. A very short conical portion at the tip is smooth.

The second foot has a dense tuft of dorsal bristles which, though shorter than the typical forms, already show the chief characters in regard to the rows of spines. They have a more distinct curvature and less tapered tips than the succeeding forms. One or two at the inner side (next the body) have the finer rows and aspect of those at the base of the tentacular cirri. The ventral bristles have elongated spinous regions, the upper and middle with slender bifid tips, the lower with simple tips.

The foregoing, therefore, requires little change to assume the typical form (Plate XXX, fig. 7), which has dorsally a fan-like group of translucent bristles, springing from a prominent process, with rather acutely pointed tips, the bare portion being short. The smooth tip is formed like a knife, the dorsal edge being bevelled to the ventral (next the spines), and this shows in some a differentiation as in the figure. In lateral views the somewhat wide spinous rows pass nearly at right angles across the long axis and stand out prominently at the edge (Plate XXXIX, fig. 20), a condition probably due to the nearly opposite condition of the rows. The aspect is thus different from the more powerful bristles of *Harmothoë antilopis* with the curved and oblique spinous rows, which project very little at the edge. Such groups of bristles (dorsal) form a gradational series under pressure, those next the body being proportionally thicker and shorter—with more closely arranged spinous rows, the series rising to the much longer and more tapered central, and then declining to the more slender forms adjoining the ventral. Some of the latter are very slender—with finely tapered tips. Occasionally these bristles are more curved and less tapered than usual.

The ventral bristles are moderately elongate, and superiorly have a long, slender, tapering spinous region—the rows appearing as oblique bars—and a minutely bifid tip (Plate XXXIX, fig. 21). The spinous region becomes shorter and stouter, and the rows of spines more delicate, while the tip is more distinctly hooked, and the secondary process, which passes nearly straight out or with a very slight angle, is more evident (Plate XXXIX, fig. 22, representing one of the lower median). Inferiorly the bristles diminish in length, have a well-marked hook at the tip, and delicate oblique lines from the fine spinous rows. The bristles throughout are pale, with a faint straw-colour. The shape of the fleshy part of the foot is characterised by the length of both dorsal and ventral processes for the spines.

Posteriorly the bristles become shorter and more slender, the dorsal being proportionally long and nearly straight, with well-marked rows of spines which are nearly opposite, so as to differentiate these bristles from others. The ventral are also very slender, and the tips in the terminal feet are so attenuate that it is difficult to make out the bifid condition. Thecate infusoria are common on the dorsal bristles.

The dorsal cirri are finely tapered, and present a slight enlargement towards the filiform tip in life, whilst in spirit-preparations this is very evident, and more opaque than the rest; and they are densely covered with long cilia with bulbous extremities, visible under a lens. The ventral cirri are subulate, and also have a filiform tip which reaches the bases of the ventral bristles. They have numerous short clavate cilia on the surface.

A curious appearance occurs in both dorsal and ventral bristles of a specimen procured by Canon Norman in 1879 in Norway (Lervig Bay, three to twenty-five fathoms),

and is probably due to imperfect or peculiar preservation. Crystalline masses are present in the centre of the bristles, and in the case of the ventral distend in some the bases of the spinous region.

Reproduction.—Specimens procured in Norway in summer (Canon Norman states) bear large ova. Small examples (about 6 mm.) from Loch Portan, Lochmaddy, had advanced ova in August. A little larger example had advanced ova in Whalsay on July 17th. A ripe male again occurred at ninety fathoms off North Uist in July.

No ripe forms have been seen at St. Andrews, though numerous small ova are present in the middle of May.

Habits.—The haunts of this species are similar to those of other Polynoidæ. It occurs under stones between tide-marks, in the crevices of tangle-roots, and in the cavities of shells—both bivalve and univalve. It was also included in the annelids procured from holes in the telegraph cables in 1876, and which were thought by Dr. Carpenter to be borers in the gutta-percha. It is of course free from suspicion on this head.

It presents a rougher aspect than *Harmothoë imbricata*, from which it likewise differs in colour, and it is much more tapered posteriorly. It is also more lively, being active and irritable, as well as frequently breaking in pieces if molested. The movements are more graceful than usual in the group, and the long caudal styles are generally carried nearly in contact. It is likewise brilliantly phosphorescent. Like others of the family, it bears confinement well, and can be transmitted inland and kept for months in a small vessel of sea water.

In this, as in other forms, palpi and other appendages as well as the posterior part of the body are readily reproduced.

Parasites.—Levinsen mentions *Herphyllobius crassirostris*, Sars, as a Crustacean parasite fixed to the body of *Evarne impar* in Norway.

Dr. Johnston's *Lepidonotus pellucidus* may be a young example of *Evarne*.

Claparède (1863) drew special attention to the palpocils on the cilia of the cirri, and showed how general these organs were in the annelids.

De Quatrefages (1865) followed Johnston in assigning only thirteen pairs of scales to this species. Prof. Giard (1886) does not think that the *P. articulata* of Claparède is identical with this form, as I did in the 'Zoological Transactions.' He also says *P. spinifera*, Ehlers, is an allied but not identical form, since the position of the eyes is different, and the elytra are not fringed as in *E. impar*. Remarks on these forms are made elsewhere.

Hornell (1891) records examples from Southport of 33 mm. in length, and thirty-seven segments, whereas Malmgren gives only thirty-five and De St.-Joseph thirty-eight.

Varieties.—A variety from 358 fathoms in the 'Porcupine' of 1870 shows some shorter ventral bristles, the dorsal being pointed. It is a female.

In young specimens procured in the 'Triton' in 1883 by Dr. Gwyn Jeffreys only the intermediate horny papillæ occurred on the scales along with the cilia. The eyes were invisible in the preparations.

Dr. Michaelsen describes a variety from Heligoland, *Harmothoë impar*, var. *Pagenstecheri*, of which he gives a special description. By his courtesy a careful

examination of the microscopic preparations has been made. The form agrees with the typical British examples. Malmgren's artist had omitted the cilia on the ventral cirrus, while in the description they are not mentioned. Baron de St.-Joseph, in a recent publication,[1] alludes to the same form, and appears to agree with the original author in thinking it necessary to make a variety.

Another well-marked variety was procured between tide-marks, Herm, under a stone in August, 1868, and also at Lochmaddy, North Uist. While in regard to the general outline, the shape of the head, the position of the eyes, and the arrangement of the pigment on the dorsum, it agrees with the ordinary form, the dorsal bristles are shorter, though they do not deviate from the typical structure; and the same may be said of the ventral. The scales, however, vary, since the cilia on the outer border are shorter than usual, and have large ovate heads containing granular epidermic elements; some of these also occur within the posterior border, while along the whole of the latter is placed a short series of cilia with large globular heads and short stalks, the terminal ones only towards the inner border becoming ovoid instead of globular. The general surface of the scale is studded with larger tubercles; and few of the others, except towards the inner region, and one or two of those near the posterior border, assumed considerable proportions, while none were so large as usual. A similar variety in regard to scales was procured by Dr. Gwyn Jeffreys in 1868 in ninety fathoms off North Unst, Shetland, but the ventral bristles were more slender, both somewhat approaching those of *E. Johnstoni*, though the dorsal were more tapered towards the tip. The specimen was a male.

2. Evarne Johnstoni, *McIntosh*, 1876.

Specific Characters.—Distinguished from *E. impar* by the deep brownish hue of the dorsum, and the brownish-purple proboscis; eyes more minute, the anterior pair not visible from the dorsum. Scales with fewer and larger horny papillæ, longer, fewer, and more delicate cilia along the posterior and outer borders. Dorsal bristles more slender and less tapered distally; ventral more slender, and with longer bifid tips.

Synonym.

1876. *Evarne Johnstoni*, McIntosh. Trans. Z. S., ix, p. 398, pl. vii, f. 13—18.

Habitat.—Dredged at Station 3, 'Porcupine,' 1870, in 690 fathoms in the Atlantic; Station 115, West Ireland, August 20th, 1890 (Mus. R. Coll. Science, Dub.). Ranges to Norway.[2]

Length about 9 mm.

[1] 'Ann. d. sc. nat.,' viii sér., v, p. 231, 1898.

[2] Canon Norman, 1879, Stat. 30—34, 41 and 44.

The *head* (Plate XXVII, fig. 7, from a large example, and fig. 12, small example), has the same form as in *E. impar*, and is pale throughout in the preparations, the absence of pigment at the base of the tentacle being noteworthy. The eyes appear only as minute black points; two lie at the posterior border of the head, almost hidden by the collar; two laterally in front of these, as in the ordinary species. A variety dredged by the 'Porcupine' in 1870 at 690 fathoms has very large eyes (Plate XXVII, fig. 7), the anterior pair having a lens-like corneal thickening. Adult Norwegian examples show still further increase in these organs.

Body apparently similar in shape to *E. impar*, viz. abruptly diminished in front and gently narrowed from behind the anterior third. The dorsum has a deep brownish hue, with a tinge of purple in front—from the proboscis. Behind the latter the pigment is cut into bars by the pale belt at the junction of each segment. The ventral surface is pale, the margins of the oral aperture alone being deeply tinged with brown. The segmental eminence is distinct, but the papilla is minute.

In the examples the proboscis is more or less extruded, and the usual number of conical papillæ (nine) fringe each lip.

Scales.—A single reniform scale occurred in the vessel, and from what is observed in the examples from Norway it would seem to belong to the specimen. The surface, with the exception of the inner fifth, has rather large conical horny papillæ, often with blunt spinous tips, while the adjoining external and part of the posterior border have a few long and very slender cilia, with a somewhat fusiform tip. The contrast, therefore, with the more densely and minutely spinous scale of *E. impar* is marked; the cilia, moreover, on the outer edge of the scale of the latter are more numerous, larger and longer, and globose at the tip.

Feet.—As in *E. impar*, the second foot presents shorter dorsal bristles with less tapered tips, but otherwise they are of similar structure to the succeeding. The ventral bristles of this foot do not project more than the dorsal, and hence are short as well as slender, the long attenuated spinous region ending in a hair-like tip.

In the typical foot (Plate XXX, fig. 6) the dorsal division bears longer and more slender bristles than in *E. impar*, the slight tapering towards the tip being a noteworthy feature, and the rows of spines are even more distinctly marked. The smooth terminal portion is decidedly shorter than in the latter, and in some cases it presents a slight mucro at the extremity, then a shallow notch, and another elevation a little above the first row of spines. A long clear shaft projects beyond the foot before the rows of spikes appear, so that the bristles are comparatively long. One of the stronger bristles is represented in Plate XXXIX, fig. 23, while the tendency to differentiation of the tip is observed in fig. 24, Plate XXXIX. The superior ventral bristles have tips so attenuate that it is difficult to make out their structure; but the bifid condition is present, with the exception perhaps of the first. The next series have much longer and stronger distal regions, with extremely delicate and translucent bifid tips; the terminal hook is short and very slightly curved, and the secondary process is rather short and broad, and passes far up, while the rows of spines are distant and well marked. The tips of the succeeding (lower) bristles become broader and shorter, but the character of the termination remains the same. Toward the inferior edge the tip is simple, only a faintly developed

hook being present. All are very translucent and delicate. One of the elongated forms near the dorsal edge of the fascicle is shown in Plate XXXIX, fig. 25, and a more highly magnified tip in Fig. 27, the arrangement of the spines and the short bifid tip being characteristic. The bristles from the middle of the foot are exceedingly translucent and very faintly serrated (Plate XXXIX, fig. 26, and a tip more highly magnified in Plate XXXIX, fig. 28). In large examples from Norway the dorsal bristles show more acutely-tapered tips, but otherwise the characters closely approximate.

The dorsal cirri have a filiform tip without enlargement, and rather long clavate papillæ sparsely distributed. The ventral cirrus is slender and elongate with a finely tapered tip, which in the preparations ends in a slight enlargement. Short clavate papillæ—sparsely distributed—occur on the surface. The tip reaches considerably beyond the base of the lowest bristles.

The species is broadly distinguished from *E. impar* by the deep brownish hue of the dorsum and the brownish-purple proboscis, by the structure of the scales, which have only large horny papillæ and few and slender cilia, by the longer, more delicate, and less tapered dorsal bristles with shorter tips, and by the more slender ventral bristles with much more finely tapered tips.

The capture of a variety during the 'Porcupine' Expedition of 1870 at 690 fathoms, in which the eyes are large—especially the anterior pair, which have a lens-like corneal thickening—and still more the presence in Norwegian waters of a form closely resembling *Evarne Johnstoni* in colour, but differing in having very large eyes and in other minute particulars, raise the question as to how far such species vary with age, sexual conditions, and environment. The younger Norwegian forms agree with the description of *E. Johnstoni*, except that some have larger eyes (without a lens-like thickening). In the larger and older forms, however, the eyes still further increase in size, the lens-like corneal thickening of the anterior pair leaving only a rim of black pigment round the edge. The posterior pair are also provided with the central lens-like thickening. The dorsal bristles are broader, more acutely pointed, as well as somewhat more closely spinous; and the smooth portion at the tip is longer, so that it is dagger-shaped. In the ventral bristles the tips are bifid even to the ventral edge of the foot. Age, therefore, considerably alters the foregoing organs. The scales differ from those of *E. impar*, and agree with those of *E. Johnstoni*.

The prominent question therefore is, can *Evarne impar* pass insensibly—by epigamy, for instance—into *E. Johnstoni*, as in many other groups of annelids? So far as present observations go, a negative reply would seem to be most in harmony with the structure of the scales, the eyes, bristles, and the geographical range. Further knowledge may show the propriety of union, but at present it is better to leave the question as it is.

Prof. Giard (1886) finds a third and closely allied species of *Evarne* commensalistic on *Cucumaria pentactes* off Brittany and the neighbouring shores of France.

3. Evarne Hubrechti,[1] *McIntosh*, n. s.

Specific Characters.—Head comparatively small, and in the adult the eyes are very large; both pairs more or less lateral in position. Median tentacle long, tapering,

[1] Named after the distinguished Professor of Zoology at Utrecht.

smooth, and the tentacular and cirriform appendages are also smooth. The palpi are large, slightly tapered, and smooth. Body rather short and broad, about thirty-one bristled segments, much tapered posteriorly, and furnished with a caudal rudder in the shape of a thick style with a membranous flap, tapered from base to apex. In structure it is delicate and brittle, and is tinted of a deep madder-brown both dorsally and ventrally. Segmental eminence marked, but no distinct papilla is visible. Scales, fifteen pairs, thin but tough, rounded in front, rest large and ovate, completely covered with minute spines, but with a smooth edge; some cling firmly to the peduncles. Feet of considerable length, dorsal division rudimentary; bristles translucent, large, long, and acutely pointed, with wide rows of spines like an *Equisetum;* ventral division large, ovate at the tip, and having a broad fan of very long slender bristles with long spinous regions and acute tips, mostly bifid. Ventral cirrus comparatively long and slender.

Habitat.—Procured by the 'Triton' in August, 1882, at 600 fathoms; at Station 2, 500 fathoms; in the tow-net at 300 fathoms, and again at the surface.

Length about 14 mm.

Head (Plate XXVIII, fig. 6) comparatively small, broadly ovoid, with a median groove and two prominent anterior peaks. Both pairs of eyes are dorso-lateral in position, their largest surface in the preparation being lateral. Their large size and the limited area of the head leave little of the lateral region free, viz. a small portion at the peaks, the narrow line of separation between the pairs, and the brief space between the last and the nuchal collar. No distinct trace of a corneal opacity is present. From the contour of the head the anterior pair look forward and outward, the posterior outward and upward. Both pairs are partially seen from the dorsum. In young examples the eyes are considerably smaller. The long median tentacle is pale, slightly enlarged immediately above the basal region (in spirit), then it tapers to the filiform tip. Its surface is quite smooth, the median nerve-trunk being readily seen through its translucent granular layer. The lateral tentacles are pale, subulate, and small, with a filiform tip and a madder-brown basal region. They likewise are quite smooth. The palpi are smooth, of moderate length, and somewhat thick, with comparatively short tapering tips. They have a faint tinge of madder-brown at the base. The tentacular cirri, the upper of which is, as usual, larger than the lower, have a similar form to the median tentacle.

Body covered by the large scales; of about thirty-one bristled segments, and comparatively short and broad. It is slightly narrowed in front, and tapers somewhat rapidly posteriorly. The dorsum has a madder-brown hue, with transverse elliptical markings in the middle, paler on the feet. Posteriorly the segments have very beautiful patterns, the madder-brown ellipse being surrounded by a pale and somewhat crenate line. The entire under surface is madder-brown, with a pale median band, and iridescent, the darker region in front showing fine metallic lustre. The feet are also slightly tinted of the same brownish hue, the ventral cirrus being thus rendered conspicuous, and between its base and the body a pale transverse line occurs. The segmental eminence is marked, but no distinct papilla is visible—a feature perhaps associated with the pelagic habits of the species.

Posteriorly the body terminates in a single comparatively thick style, which arises beneath the anus and to the left. It remains nearly cylindrical from base to tip—which

is somewhat bluntly rounded. The remarkable feature about it, however, is the presence of a broad web or lamina attached to its lower surface, and which tapers from base to tip. The organ, therefore, forms an efficient rudder. The body is delicate and brittle, and the length of the bristles still further adds to the characteristic appearance.

Scales (Plate XXXIII, fig. 1), fifteen pairs, thin but tough, entirely covering the back, comparatively large and apparently smooth to the naked eye, but minutely granular under a lens. The first pair are rounded, the succeeding more or less ovate, and all with a smooth border. The entire surface is studded with minute horny spines, which increase in size from the inner to the outer border, and especially posteriorly. No part of the scale is free from them. It sometimes happens that a few of the larger conical spines project beyond the posterior border under examination, but otherwise the edge is smooth. In shape almost all the spines are acutely conical. The scales are pale, and the scar for the pedicle has an unusually large area behind it, from the great development of the posterior region. The scales, as a rule, adhere firmly. In a mounted scale a number of rounded bodies of various sizes, with a distinct capsule and granular contents, occurred, along with certain rectangular bodies composed of two halves, like Desmids. Their nature is enigmatical.

Feet.—The first bears a short, slightly curved bristle or two of the dorsal pattern, and resembling the shorter forms next the body in the typical foot.

The second foot presents a double ellipse—one for each division—with the projecting papilla for the spine, the inferior having in addition a fleshy digit-like process above the spine. A few of the inner bristles of the dorsal tuft are short and curved like those of the tentacular cirrus, each, however, having a smoothly pointed tip. The chief bristles are long, translucent, and tapering, with a long bare tip marked by wide and slightly oblique spinous rows, so that in some views it resembles an Equisetum of glass. The ventral bristles are slender and elongate, with long spinous regions tapering to a delicate tip, which is bare, and provided with a terminal hook. The filiform tip of the long ventral cirrus extends beyond the bristles.

The next foot leads to the typical shape, which is peculiar, since in a ventral view the tip is rounded. In profile, again (Plate XXX, fig. 10), the outline of the ventral division is comparatively deep and rounded, with the spine near the middle, and the bristles project as a broad fan. Dorsally the bristles (Plate XL, fig. 1) are remarkable for their great length, diaphanous nature, and brittleness—conditions pointing to a pelagic habit. The dorsal lobe itself forms only a small boss or eminence, and is thus in marked contrast with the same region in *Evarne impar*. From the inner side of this eminence spring a few short, slightly curved tapering bristles, with closer rows of spikes, next which are some shorter straight ones (Plate XL, fig. 3). The rest are large straight bristles (Plate XL, fig. 2), tapering almost from the base to the smooth and sharp tip. The spinous rows are short, slightly oblique, and very wide, as in an *Equisetum*, the appearance of the whole being diagnostic. The ventral series consist of elongated and slender bristles (Plate XL, fig. 4), with long and finely tapered spinous regions superiorly. They terminate in a long smooth tip, which is bifid and slightly hooked. The bifid condition, however, is difficult to detect in some, and inferiorly the tips are simple. The bristles can be followed in the diaphanous foot inwards to the muscular boss at the spine.

Posteriorly the dorsal eminence disappears, and the bristles become more slender, but still retain their characteristic structure. The tips of the slender ventral series are extremely elongate, but traces of the bifid condition are still to be found in many. The foot is thus practically formed of the ventral lobe.

In young examples the bristles, especially the ventral, are proportionally longer, and at this stage—5 to 6 mm.—two were pelagic at the surface.

In the development of these bristles the tip is practically complete on issuing from the foot, and additions are made posteriorly as it pushes out.

The dorsal cirri have the form of the tentacular cirri, and their filiform tips extend beyond the bristles. The ventral cirri are slightly brownish (madder), elongate, subulate organs, the slender tips of which extend beyond the fleshy part of the foot. They are perfectly smooth.

The delicacy of the body, the structure of the feet and bristles, as well as the rudder-like caudal style, show that this species has peculiar habits, probably more or less pelagic. What relation it may hold to other forms is unknown, and epigamy, or the epitocous condition, may yet be clearly demonstrated in the family.

4. Evarne atlantica, *McIntosh*, 1897.

Specific Characters.—Head like that of *Evarne impar*, but the cilia on the tentacles and the papillæ on the palpi seem to be smaller. The cirri generally are more slender. Dorsal bristles longer and less curved than in *E. impar*, and their rows of spines closer. Ventral bristles have longer tips than in *E. impar*.

Synonym.

1897. *Evarne atlantica*, McIntosh. Ann. Nat. Hist., ser. 6, xx, p. 168.

Habitat.—Dredged at Rockall (Station 3A) by the Royal Irish Academy's Expedition, June 15th, 1896.

A fragment of about fifteen segments of the anterior end.

The head resembles that of *E. impar*, Johnst., in general outline, but differs in having somewhat smaller eyes. The tentacles and palpi also are similar, though the cilia on the former and the minute papillæ on the latter are less bold. The cirri generally are a little more slender.

The *body* is thicker and more massive than in *E. impar* of the same size, and both dorsally and ventrally in the preparation has a pinkish skin-colour. The arrangement of the bristles at the side of the body is more trim. No segmental papilla is observable, though the eminence is distinct. In this respect it agrees with *E. impar* of the same size, in which the papilla only becomes noticeable about the twelfth bristled foot. In large examples it is evident on the seventh bristled foot.

Feet.—The first foot (bearing the tentacular cirri) has a few short bristles conforming to the dorsal type, though with somewhat closer rows of spines. In the second foot the dorsal bristles are longer and less curved than in *E. impar*, and while there may be room for doubt concerning the proportionate distances of the spinous rows, there can be none

about the length of the smooth portion at the tip, which is diagnostic of this form and also of *Evarne Normani*.[1] The present species differs from the latter, again, in the more tapering extremities of these bristles, and in the closer rows of spines. The spinous tips of the ventral series are somewhat longer than in *E. impar*, and in this respect approach *E. Normani*.

In the typical foot the lower lobe is more pointed and the ventral cirrus longer than in *E. impar*, so that it projects as far as the tip of the foot. The translucent dorsal bristles (Fig. 31) are considerably longer and less curved than in the typical species, and their rows of spines much closer, the latter character also distinguishing them from *E. Normani*. The ventral bristles (Fig. 32) approach those of the latter species more closely than those of *Evarne Johnstoni*, being somewhat shorter than those of *E. Normani*, which, again, have stronger tips than those of *E. Johnstoni*.

FIG. 31. FIG. 32.

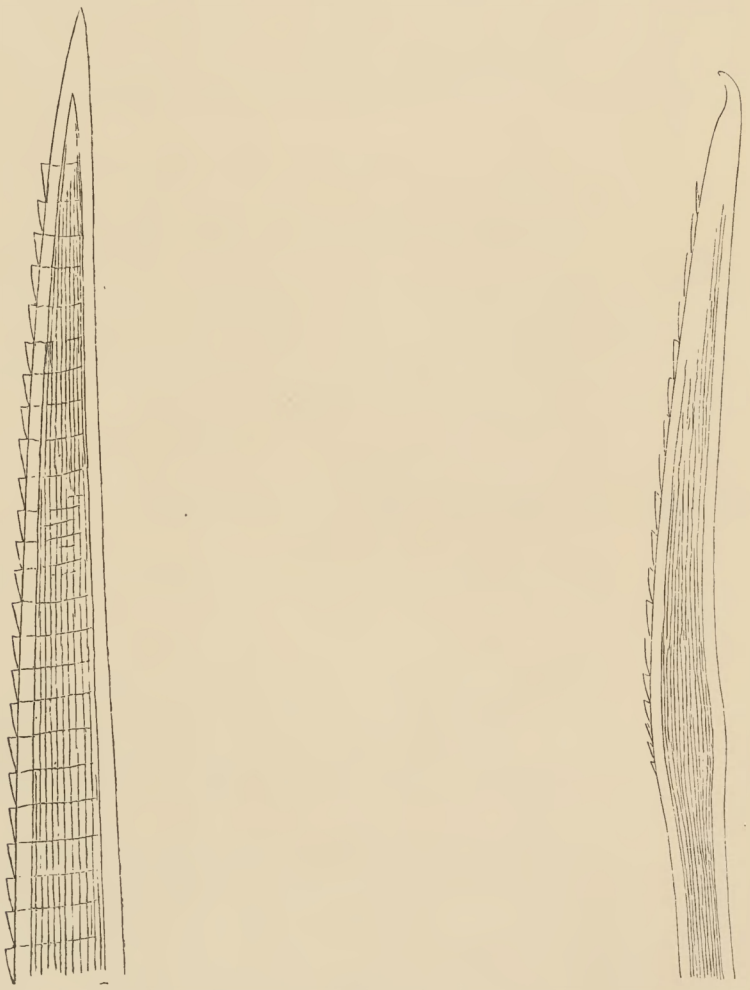


FIG. 31.—Tip of a dorsal bristle of *Evarne atlantica*. × 350.
FIG. 32.—Tip of a ventral bristle of *Evarne atlantica*. × 350.

No scales are present. In all probability they approach those of *E. Normani*.

By the lengthening of the tips of the ventral bristles and their general slenderness this species and *E. Johnstoni* come near *Antinoë* and allied forms.

[1] Op. cit., 173, pl. iii, fig. 13.

Genus XV.—Antinoë, *Kinberg*, 1857.

Lateral tentacles arising under the base of the median tentacle; cephalic lobe with lateral peaks anteriorly. Palpi subulate, densely covered with minute papillæ. Dorsal bristles long and tapering, with well-marked spinous rows. Ventral bristles long and slender, with elongated spinous regions and hair-like tips. Segmental papillæ distinct though not large.

This genus approaches *Harmothoë*.

1. Antinoë Sarsi (*Kinberg*), *Malmgren*, 1865.

Specific Characters.—Head about as long as broad, with two acute anterior peaks. Two posterior eyes, nearer each other and smaller than the anterior, which are situated within the dorsal margin of the widest part of the head, and considerably removed from the anterior peaks. Median tentacle brownish, tapering, with a long filiform tip and numerous long clavate cilia. Lateral tentacles with short clavate cilia. Palpi long and tapering, with minute clavate papillæ, often with processes on the blunt tips. Tentacular cirri with very long slender tips and numerous clavate cilia of moderate length. Body somewhat broad, most distinctly tapered posteriorly, segments thirty-eight; dorsally of a brownish hue—in various transverse belts posteriorly. Scales, fifteen pairs, ovoid or rounded, soft, rather opaque, and with cilia of moderate length on the outer and posterior borders, while some show minute conical spines on the surface. Dorsal division of the foot with a prominent spine, and rather long, slightly curved tapering bristles with well-marked spinous rows, which in profile occupy half the bristle, only a minute portion of the tip being bare. The ventral division has a very prominent spinigerous lobe, and a series of slender bristles—with long spinous regions and hair-like tips. Dorsal cirri long, tapering, with a filiform tip, and the surface has numerous short clavate cilia. The ventral cirrus is subulate, rather long, and with short clavate cilia. Segmental papilla begins on the fifth foot.

Synonyms.

1865. *Antinoë Sarsi* (Kbg.), Malmgren. Nord. Hafs-Ann., p. 75, tab. 9, fig. 6.
1871. „ „ Ehlers. Spitzb. Annel., Ann. Nat. Hist., 4th ser., viii, p. 53 (transl. from Sitzb. d. Phys.-med. Soc., Erlangen).
1873. „ „ Sars. Bid. Christ. Fauna, p. 5.
1874. „ „ McIntosh. Ann. Nat. Hist., April, 1874, p. 263.
1875. „ „ Ehlers. Annel. 'Porcup.,' 1869, p. 33, Taf. ii, f. 3 and 4 (Zeitsch. f. w. Zool., xxv, p. 53).
1879. *Polynoë Sarsi*, Théel. Annel. Nova Zemb., p. 16.
„ *Antinoë Sarsi*, Tauber. Ann. Danic., 80.
1886. „ „ Marenzeller. Porif., &c., Jan Meyen, p. 12.

Length of largest about $1\frac{3}{4}$ inches.

Habitat.—In the 'Porcupine' Expedition of 1869 it occurred at No. 28 (July 5th, 1869), in 1215 fathoms on mud.

It extends to various parts of the Arctic Sea, to the Gulf of St. Lawrence (where it is common), and to the shores of America (Verrill).

Head (Plate XXVIII, fig. 10) about as long as broad, with two acute peaks in front. The two posterior eyes are much nearer each other and smaller than the anterior pair—which are situated within the dorsal margin of the widest part of the head, and therefore considerably removed from the anterior peaks. These eyes in the Canadian forms are further forward, more lateral in position, and present in some a lens-like central thickening, and both they and the posterior pair are larger than in the European forms, which have eyes of moderate size. The median tentacle is brownish, with a slight swelling below the very long filiform tip. It has numerous long clavate cilia. The lateral tentacles are small and subulate with a tapering tip, and have short clavate cilia. The palpi are long and tapering, furnished with minute and somewhat clavate papillæ, which often have processes at the tip. A few of the papillæ occur on the tapering extremity. The tentacular cirri have very long slender tips and numerous clavate cilia of moderate length, a few shorter forms occurring on the filiform region distally. These organs are boldly areolar, and, like the tentacle, are tinted brownish.

Body.—Somewhat broad, tapered a little in front, and more distinctly so posteriorly; bristled segments thirty-eight. The colour is brownish dorsally, generally arranged in belts across the segments, which posteriorly show a broader belt in the middle and a narrow one in front and behind. The Canadian preparations are darker, the tubercle on the cirrigerous segments being dark olive, so that the tints are striking. As usual, the pigment is broken up in the terminal segments, and a pale band occupies the median line. The under surface is pale. The segmental elevations are well marked and project posteriorly as distinct processes, while the papillæ are directed nearly straight backward instead of between the feet. A marked feature ventrally is the prominence of the spinigerous lobe of the ventral division of the foot.

Proboscis.—The extended proboscis has nine conical papillæ dorsally and ventrally.

Scales (Plate XXXIII, fig. 17).—All the Norwegian examples show that the ovoid or rounded scales have their surface covered with small conical spines; indeed, in the Arctic examples these are visible under a lens. The spines in the posterior scales (those alone present) attain larger dimensions externally and anteriorly, and three or four larger conical processes are found on the posterior border. Cilia, of considerable length in the latter case, occur on the outer and posterior borders and invade the neighbouring surface. They are slender and translucent, with clavate tips.

On the other hand, the scales of the Canadian examples were more or less smooth, soft, somewhat reniform, and furnished with cilia of moderate length on the outer and posterior borders and on the neighbouring surface. The opacity of the scale, however, may hide the spines if they are few. At any rate, in the specimen from Barent's Sea numerous conical papillæ were present. Unfortunately many have no scales, and at best they are few in the preparations.

Feet.—The first foot bears a strong spine and about three bristles of the dorsal type, very slightly curved, and with boldly marked spinous rows. The spine forms a powerful projecting process in large specimens.

The second foot is also marked by the great prominence of the dorsal spine, and has a series of somewhat strong slightly curved bristles with well-marked spinous rows, which

in profile occupy only about half the bristle, the inferior half being thus smooth and translucent. Only a minute portion of the tip is bare. Ventrally are a series of slender bristles, with long spinous regions and capillary extremities.

In the typical foot (Plate XXXI, fig. 2) the dorsal spine is still very prominent, and the bristles are long, slightly curved, and with a moderately acute tip. The spinous rows are distinct, and leave only a very short portion of the tip bare (Plate XL, fig. 7). The ventral are slender, elongate, with long spinous regions and remarkably attenuate tips, which form long hair-like processes (Plate XL, fig. 8). The foot has a long process for the spine superiorly. In the terminal segments the character of the bristles alters little, except as regards size.

In the Canadian examples thecate Infusoria are common on the dorsal bristles, and, in some, *Loxosomæ*. Infusoria also frequent the British form, and a cluster occurs in one on the projecting spine of the ventral division of the foot.

The dorsal cirri are long and tapering, with a filiform tip, while the surface has numerous short clavate cilia. The ventral cirrus is subulate and rather long and tapering, with numerous short clavate cilia.

In certain respects, *e. g.* the slenderness of the ventral bristles in comparison with the dorsal, and in the clearly separated rows of spines, *Antinoë* approaches *Evarne*.

Reproduction.—None of the specimens give any light on this process.

Habits.—So far as present knowledge goes, this species would seem to frequent deep water only.

Ehlers (1871), in his account of the Spitzbergen annelids, gives a very interesting description of two well-marked colour-varieties of this species. The more abundant form presents the brown coloration which Malmgren states distinguishes the Spitzbergen from the Baltic form. In the other the scales are bordered with greenish-grey on the inner and posterior margins, with a darker spot at their junction, the ventral surface and feet being colourless. The dorsal surface of each segment is banded with greyish-green, the pigment being variously developed in different examples. This variety attains even larger dimensions than the first, viz. 46 mm. in length and 24 mm. in breadth, as against 35 mm. and 17 mm. He contrasts these two varieties with that now living in the Baltic, which is smaller, possesses a greenish dorsal coloration, and scales with brownish margins,—that is, it has an intermediate position. He is of opinion that it has retained, since the glacial period (when the Baltic was united with the Arctic Sea), the original coloration, from which the two races in the Spitzbergen Sea have been developed by differentiation.

Ehlers found a *Nucula* 8 mm. by 6 mm., and 4 mm. in thickness, in the intestine of one of the largest greyish-green varieties. The same author (1875) describes it from the 'Porcupine' Expedition of 1869 at 1215 fathoms, and gives good figures of the bristles. His specimens had respectively twenty-nine and thirty-five segments.

Hansen found it in the collection made by the Swedish Expedition of 1876.

Marenzeller (1877) includes this form also in the annelids of the Austrian North Polar Expedition from a depth of 240 metres on mud.

Verrill (1879) enters it in his list from Cape Cod to the St. Lawrence, where Mr. Whiteaves dredged it in 1873.

Several specimens occur along with *Evarne Johnstoni* in Norwegian collections (1870) by Dr. Merle Norman. Whether any relationship of an epitocous kind exists with this or other forms is unknown.

Möbius records it under the name of *Polynoë cirrata* on the authority of Théel, who gives *P. cirrata* as a synonym of the species, but the latter has since seen that there are no grounds for this arrangement.

2. Antinoë finmarchica, *Malmgren*, 1867; an. var. *A. Sarsi.*

Specific Characters.—Head as in *Antinoë Sarsi*, and the body has a similar outline, with thirty segments in the largest example (less than $\frac{1}{2}$ inch in spirit). Scales with short and sparse cilia on the outer and posterior borders, and the minute spinous papillæ are chiefly distributed on the anterior half of the scale as well as externally and internally. Feet similar to the foregoing in general structure, but the dorsal bristles have slightly narrower intervals between the rows than in *Antinoë Sarsi*, and they are longer, less curved, and more acutely tapered at the tip. The ventral bristles are decidedly stouter; the tips, instead of being capillary, have a long delicate portion of appreciable breadth, with a slightly curved point.

Synonyms.

1865. *Antinoë finmarchica*, Malmgren. Ann. Poly., p. 13.
1876. „ „ McIntosh. Trans. Z. S., ix, pp. 387 and 400, pl. lxxii, f. 1, 2.

Habitat.—Dredged off the west coast of Ireland (Donegal) during the 'Porcupine' Expedition of 1869 in 20 to 420 fathoms; and also by the Expedition of the Royal Irish Academy in 1886 at 93 fathoms.

Head differs from that of *A. Sarsi* in that the eyes are proportionally larger, and the anterior pair are more lateral in position. The other organs present no feature of moment in the preparations.

Body of similar outline to the foregoing species, and of thirty segments, but, as the largest specimen is under $\frac{1}{2}$ inch in spirit, it may be immature.

Scales (Plate XXXIII, fig. 8) show a definite structure in contrast with *A. Sarsi*, but changes may occur in course of growth. They have a similar outline, but the cilia on the outer and posterior borders are short and sparse, and the minute spinous papillæ are chiefly distributed in the anterior region in front of and on each side of the scar for the pedicle. The rest of the area posteriorly seems to have less distinct papillæ, but towards the posterior margin the cilia appear on the surface. Some of the papillæ have the summits curiously truncated. Small Norwegian examples of *A. Sarsi* show the same arrangement of the horny papillæ, so that the question is still open.

Feet.—The general structure of the fleshy part of the foot (Plate XXX, fig. 13) is the same as in the previous species. The dorsal bristles are long, translucent, sharply tapered from the commencement of the spinous portion to the tip, and with slightly narrower intervals between the spinous rows than in the former (Plate XL, fig. 9), the

latter figure representing one of the straighter forms next the ventral, while an outer curved one is given in Plate XL, fig. 10. In contrast with those of *A. Sarsi* they are longer, less curved, more acutely tapered at the tip, and with more closely arranged spinous rows, and this is the case whether we compare them with adult or with young of the same size. The ventral bristles, again, are decidedly stouter than in *A. Sarsi*, and superiorly, instead of those with capillary tips, are bristles with a very long and delicate portion of appreciable breadth, distinctly spinous, and ending in a slightly curved point. The spinous rows continue nearly to the latter. The tips gradually (Plate XL, fig. 11) diminish in length toward the inferior edge, and the spinous rows are closer. Some, *e. g.* those from the south-west coast of Ireland, show a tendency to have long spines at the tip as in *Antinoë mollis* (Plate XL, fig. 13), but the feature is indistinct. Young specimens of *A. Sarsi* of the same size show the fine hair-like tips of the adult.

The dorsal cirri have somewhat fewer cilia than in *Antinoë Sarsi*.

This form seems to frequent deep water. It is probable that further observations may show that it is only a variety of the foregoing, the points of difference between them, and it may be other forms, being due either to epigamy or other sexual variation. In the meantime the distinctive characters will ensure its ready identification.

3. Antinoë mollis, *G. O. Sars*, 1871.

Specific Characters.—Head somewhat broader than long (in spirit), with blunt anterior peaks. Eyes larger than in *A. finmarchica*, the anterior pair being situated laterally at the base of the peaks, and thus are not visible dorsally. The posterior pair are separated by a wide interval from the anterior pair. The palpi show minute papillæ under a high power. Lateral tentacles with short clavate cilia. First pair of scales rounded, rest ovoid; outer and posterior borders with slender clavate cilia, which are longest externally; entire surface closely covered with short, blunt, and rather soft spines. Dorsal bristles rather large, long, slightly curved, less acutely tapered than in *Antinoë finmarchica*, and with close rows of spines. Ventral cirri with short clavate cilia.

Synonyms.

1871. *Lænilla mollis*, G. O. Sars. Vidensk.-selsk. Forhandl., 1871, p. 406.
1873. „ „ idem. Bidrag Christ. Fauna, p. 7, pl. xiv.
1876. *Antinoë mollis*, McIntosh. Trans. Zool. Soc., ix, p. 400, pl. lxxii, f. 3, 4.
1879. *Lænilla mollis*, Tauber. Ann. Danic., 81.
1883. *Harmothoë mollis*, Levinsen. Nord. Annul., 191.

Habitat.—Dredged on a bottom of muddy sand at a depth of 20 fathoms off Donegal, and 370 and 420 fathoms at various points of the Irish coast in the 'Porcupine' Expedition of 1869. Dredged at 257 fathoms in the Expedition of 1870, in the Atlantic. A similar form occurs in Norwegian waters, and Verrill includes it in his American list.

Head (Plate XXVIII, fig. 14), in spirit, somewhat broader than long, with blunt anterior peaks. The eyes are larger than in the previous form, the anterior pair being situated at the base of the peaks laterally, and thus are not visible from the dorsum, as well as separated by a wide interval from the posterior pair, which are smaller,

and placed in front of the nuchal collar. The palpi appear to be smooth under a low power, but when magnified 350 diameters are minutely papillose. The median tentacle is absent. The lateral are small, somewhat enlarged at the base, and with a filiform tip. They have a few short clavate cilia. According to Sars the tentacular cirri also have a few clavate cilia.

Body has forty-three bristled segments (Sars). The only available British example is fragmentary. The segmental eminence is distinct, but the indifferent preparation showed no differentiated papillæ.

Scales have, so far as present, a somewhat ovoid outline (Plate XXXIII, fig. 9), with the exception of the first pair, which are rounded. The outer and posterior borders have slender clavate cilia, which are longest externally, becoming short and sparse as we proceed inward. Their entire surface is closely covered with short, blunt, and rather soft spines, and thus they differ in certain respects from the figure and description of Sars.

Feet.—The first foot has a sharp spine and a group of four small bristles conforming to the dorsal series.

The typical foot presents dorsally a series of rather large, long, yellowish bristles, which, though as conspicuous in size as those of *A. finmarchica*, are much less acutely tapered, and have closer rows of spines. They are slightly curved (Plate XL, fig. 12). The superior ventral bristles have somewhat shorter tips than in *A. finmarchica*, and the rows of spines are not so distinctly separated. The tip is similar, viz. slightly hooked; but the spines become so elongated towards the tip that they project on each side like a series of filaments (Plate XL, figs. 13 and 14).

No dorsal cirri are present, but the ventral cirri are long and filiform with short clavate cilia.

This form appears to present the following differences from the species described by Sars :—The anterior pair of eyes lie in front of the middle of the head, and are not visible from the dorsum, whereas in the Norwegian form they are situated on the median lateral eminence, and therefore considerably removed from the front. They are also seen from the dorsum. The posterior pair of eyes are less widely separated in the British form. It is difficult to compare the bristles, since some of the finer characters are lost in the kind of plate adopted by Professor Sars, but they closely approach each other. The scales, on the other hand, present certain divergences, *e. g.* in the presence of only minute cilia in the northern form.

Genus XVI.—Phyllantinoë, *McIntosh*, 1876.

Head short and broad; base (ceratophore) of the median tentacle passing far backward between the prominent anterior peaks. Anterior pair of eyes much larger than the posterior; pairs separated by a brief interval.

Dorsal bristles short, stout, translucent, with prominent and close rows of spines, and a short, acute, smooth tip. Ventral bristles extremely slender; spinous region long and tapering, tips simple.

In the absence of accurate information concerning the relations of such rare forms

to the epitocous condition of species perhaps elsewhere described, it has been deemed prudent to continue the generic distinctions. The large size of the eyes and the slenderness of the ventral bristles may be associated with sexual changes.

PHYLLANTINOË MOLLIS, *McIntosh*, 1876.

Specific Characters.—*Head* short and broad, the base of the median tentacle passing far backward between the prominent and acute anterior peaks. Eyes large, especially the anterior pair, the pigment in which is crescentic in the preparation, and placed on the median lateral prominence. The posterior pair are smaller, and lie in front of the nuchal collar. The pairs are separated by a brief interval. The fragmentary example has about forty bristled segments, the body being elongate, and tapering much posteriorly. The dorsum has brownish pigment, which posteriorly is regularly arranged in the segments. Segmental eminence prominent, but papilla minute. Dorsal bristles short, stout, translucent, considerably curved, with prominent and somewhat close rows of spines, the tip having a short, acute, smooth region. Ventral bristles translucent, extremely slender; the spinous region rather long and tapering, with a short smooth portion at the tip, which is simple and slightly bent. The spinous rows are distinct but somewhat close.

SYNONYM.

1876. *Phyllantinoë mollis*, McIntosh. Trans. Z. S., ix, vii, p. 401, pl. lxxii, f. 5 and 6.

Habitat.—Dredged in 539 fathoms in the Atlantic during the 'Porcupine' Expedition of 1870.

Length.—The fragmentary specimen measured about $\frac{3}{4}$ inch.

Head (Plate XXVII, fig. 18) in the preparation is shorter than broad, the base of the median tentacle passing a considerable distance backward between the prominent and acute anterior peaks. The four eyes are visible from the dorsum. The anterior pair are unusually large, crescentic in form, and situated on the median lateral prominence of the head. Their form would suggest the occurrence of a lens-like corneal thickening in the concavity in front, but the preparation is uncertain on this point. These eyes look forward, outward, and slightly upward. The posterior pair are smaller, but still of comparatively large size, and lie in front of the nuchal collar. They are more or less rounded, with traces of lenses. The pairs of eyes are separated by a brief interval, as in *Evarne*. All the cephalic appendages are absent.

Body.—The fragmentary example showed about forty segments, besides head and tail. It is characteristically elongated, and tapers much posteriorly. The whole body is soft and delicate, and the feet comparatively short. The dorsum has a brownish colour throughout, and the pigment posteriorly is somewhat regularly disposed in the segments. The segmental eminence is prominent, but so far as could be made out the papilla is short and small. The ventral surface has the usual pale iridescence.

No scales are present.

Feet.—The structure of the feet could not fully be made out, as the condition of the specimen was unfavourable, but they seem to have proportionally short fleshy lobes.

Anteriorly the pedicle for the scale is large, the ventral branch of the foot projecting further than the dorsal as a soft process. Few bristles occurred in any of the feet. The dorsal bristles (Plate XL, fig. 15) are short and stout, translucent, considerably curved, with prominent yet somewhat close rows of spines, and an acute, smooth portion at the tip. The ventral bristles (Plate XL, fig. 16) are translucent and extremely slender both as regards shaft and tip, the latter being long and tapering to the bare region at the point, which is simple, and in some is slightly bent. The spinous rows are distinct, but somewhat close.

So far as ascertained, no form approaches this species.

Genus XVII.—Scalisetosus, *McIntosh*, 1885.

Anterior border of the head smoothly rounded. Eyes placed close together on each side, while the right and left pairs are widely separated and placed far back. Palpi smooth. Proboscis somewhat thin. Body of moderate length. Scales cover the dorsum in front, but leave the centre bare posteriorly. Segmental eminence distinct, but the papilla is small. Bristles transparent as crystal; dorsal slightly curved, and with 5—8 very distinct rows of spines. Ventral bristles slender, elongate, with close spinous rows, and hooked and bifid tip. Longitudinal ventral muscles present a well-marked convexity in section. The ventral area is of considerable width, nerve-cords flattened and indefinite. Cuticle and subjacent granular layer attenuate. A strong band of fibres connects the insertions of the powerful oblique muscles, and thus bounds the cords internally.

Professor Giard [1] gave an amended description of Kinberg's genus *Hermadion* to suit the present forms, but the name *Scalisetosus* had already been published. It is perhaps well to remove them altogether from Kinberg's genus.

1. Scalisetosus communis, *Delle Chiaje*, 1841. Plate XXVI, fig. 6.

Specific Characters.—Head touched with yellowish or whitish pigment, anterior lobes smoothly rounded; eyes of each side placed close together, while the right and left pairs are widely separated and placed far back; anterior pair larger, and wider apart. Median tentacle long, slightly dilated below the filiform extremity, and with rather numerous short clavate cilia. Lateral tentacles long, with filamentous tips, and similarly coated with cilia. Palpi smooth. Tentacular cirri resemble the tentacles. Body $\frac{1}{2}$ to $\frac{3}{4}$ inch long; segments twenty-two to forty-two. Colour pale yellowish, faintly marked with brown towards the posterior end—especially between the feet; or speckled with brownish spots arranged transversely, and numerous yellowish or whitish specks. Occasionally the dorsum is blackish, interrupted by numerous transverse lines. The ventral surface is pale. Segmental eminence prominent, but papilla minute. Scales fifteen pairs, rounded or ovate, minutely dotted on the ventral surface, outer and posterior portions

[1] 'Bullet. scient.,' No. 1, 1886, p. 7.

dorsally studded with a series of small papillæ or short cilia, and, besides, with a smaller number of much larger clavate processes. The outer and posterior borders of the scale have a close series of short cilia with globular extremities. The transparent scales show the nerve-distribution minutely. They have numerous yellow patches, or are dotted with white specks, or are of a purplish-brown hue, especially at the inner border. The bristles are crystalline in their transparency. The dorsal bristles are slightly curved and not much tapered, have about eight rows of spines, and the tip is notched. The ventral bristles are slender and elongate, the shaft dilated superiorly, and with a spinous frill. From this the spinous region passes with a slight bend to the dorsum, and ends in a well-marked hook with a secondary process apart from its base. The dorsal cirri are rather long, with a slight dilatation beneath the long filiform tip. They have similar cilia to the median tentacle. The ventral cirrus is also rather long, but smooth.

Synonyms.

1841. *Lysidice communis,* Delle Chiaje. Discriz. e not., iii, p. 104, tab. 103, f. 1.
1853. *Aphrodita velox,* Dalyell. Pow. Creat., ii, 169, pl. xxiv, f. 13.
1864. *Polynoë pellucida,* Ehlers. Die Borst., p. 105, taf. iii, f. 5, 7—13; taf. iv, f. 1—3.
1868. *Hermadion fragile,* Claparède. Ann. Chét. Nap., 73, pl. v, f. 2.
1869. *Lepidonotus pellucidus,* McIntosh. Trans. R. S. E., xxv, p. 408, pl. xv, f. 2.
1870. *Hermadion fragile,* Claparède. Supplém., Ann. Chét. Nap., p. 16, pl. ii, fig. 2.
1875. „ *pellucidum,* McIntosh. Invert. and Fish., St. A., p. 117.
„ „ *fragile,* Marion and Brobretzky. Ann. sc. nat., 1875, p. 6.
„ „ *pellucidum,* Marenzeller. Sitz. der k. Akad. (sep. Abd.), 13.
1880. „ „ Langerhans. Z. f. w. Zool., xxxiii, p. 271.
1884. „ „ V. Carus. Fauna Medit., 203.
1886. „ „ Giard. Bullet. sc. Nord, i, p. 12.
1888. „ „ De St.-Joseph. Ann. d. sc. nat. (7), v, p. 177, pl. viii, f. 51.
1890. „ „ Malaquin. Ann. Boulon., 22.
1891. „ „ Hornell. Op. cit., p. 237.

Habitat.—Though not abundant it extends from Shetland to the Channel Islands in deep water, in the latter region between tide-marks, and on both the eastern and the western coasts. It ranges to the Mediterranean and Madeira. It is commensalistic on star-fishes (Hornell).

Head (Plate XXVII, fig. 12).—Yellowish in some, or with white pigment-specks posteriorly and at the eyes; somewhat trapezoidal, the anterior lobes being smoothly rounded instead of forming the usual peaks. The eyes of each side are placed close together, while the right and left pairs are widely separated and placed far back. The anterior pair are considerably larger than the posterior, and are wider apart. In the British examples no lenses are present in them, but Claparède shows such in the Neapolitan. The median tentacle is somewhat long, slightly dilated below the filiform tip, and with rather numerous short clavate cilia. The lateral tentacles are long with slender filamentous tips, and the column has the same short cilia. The palpi are smooth. The tentacular cirri resemble the median tentacle. The ganglia form two distinct ovoid masses in the head.

Body somewhat elongated, narrowed posteriorly, from ½ to ¾ inch in length, though sometimes longer. Segments from twenty-two to forty-two. Colour pale yellowish throughout, in some faintly marked with brown towards the posterior end, especially between the feet. In others the dorsum is speckled with brownish spots, arranged transversely, and numerous yellowish specks. The naked portion behind the scales (including the bases of the feet) is speckled with yellowish and whitish. In some Scotch examples the dorsum is of a blackish hue, interrupted by numerous fine transverse lines, most marked at the segment-junctions. In others a distinct band of dark pigment, interrupted by numerous pale striæ, most marked at the segment-junctions, passes along the dorsum. The ventral surface is pale. The segmental eminence is prominent, but the papilla is very small. Posteriorly the body terminates in two caudal styles.

Proboscis.—In extension this organ in the preparation shows apparently thinner walls than in the ordinary forms. A wide canal thus exists in the centre, and the teeth of the dorsal and ventral arches are widely separated. The usual nine papillæ occur on each arch. The teeth are pale brown (amber-coloured).

Scales (Plate XXXIII, fig. 7) cover the dorsum in front, but leave the centre bare posteriorly. The normal number seems to be eighteen pairs, but few examples are complete in this respect. They are more or less rounded or ovate translucent organs, so that their minute structure is readily shown. The entire scale is minutely dotted, and its areolæ so arranged that the whole has the aspect of a transparent plate. The dots, as Ehlers stated, appear to be in the cuticular layer of the under surface of the scale. The outer and posterior portions of the scale, moreover, are studded dorsally with a series of small papillæ (modifications of cilia) of a cylindrical or clavate outline, many of which run in the lines of the finely branched nerves. In life these structures have minute papillæ or palpocils at the top, so that they probably perform the function of special tactile organs, as indeed the able description of Ehlers would lead us to expect. Only a small portion at the anterior and inner area of the scale is devoid of them, and the nerves seem to terminate there in special end-organs. In addition, a series of much larger clavate processes occurs thinly scattered over the same region (outer and posterior), the largest sometimes projecting at the posterior border. They are readily seen under a lens, standing out like minute pillars from the surface of the scale. These receive nerve-twigs from the main branches, as shown by De St.-Joseph. The outer and posterior borders, further, are beset with a closely arranged series of short globular cilia, which also occur on the surface adjoining the edge. Many of these have microscopic papillæ (modifications of palpocils) at the tip, and all show a minutely granular central area—connected by the pedicle with the central connective tissue.

The nerve-supply of these organs is clearly outlined, as originally described by Ehlers, and subsequently by Langerhans. At the posterior border of the scar for the pedicle an enlargement (ganglionic) occurs, from which a main stem, rapidly breaking up into branches, proceeds posteriorly, giving off twigs in a somewhat dichotomous manner to the greater part of the scale, while a considerable branch goes forward, or obliquely forward and outward, to complete the distribution. The smooth pale area at the anterior and inner border has the smallest branch, probably because its functions are less prominent. The nerve-twigs terminate in peculiar granular swellings—men-

tioned by Ehlers. Every little papilla has its nerve-twig, and the granular enlargements are connected with the system like fruit on the tips of a much ramified wall-tree.

In life the scales are quite translucent, sometimes presenting towards their anterior and posterior borders numerous yellow patches at the papillæ, or, as in the figure, simply dotted with white specks. In others they have a faint purplish-brown tinge,[1] enlivened by orange and yellowish specks. The brownish tinge in some is towards the inner border.

This active and irritable annelid frequently throws off its scales, but, as in other cases, they are readily reproduced, an interesting account of their development having been given by Ehlers.

De St.-Joseph found a number of specimens of *Pedicellina belgica*, van Beneden, on the under surface of the scales.

Feet.—The first foot has a spine, but no bristles in the available specimens. De St.-Joseph thinks this is the normal condition, but it is uncertain.

The dorsal division of the foot (Plate XXX, fig. 9) forms a short and broad process bearing a series of translucent slightly curved bristles (Plate XL, fig. 17), which are not much tapered distally. The rows of spines (or frills), about eight in number, are wide apart inferiorly, while the tip of the bristle is notched as if from a minute claw or secondary process. So homogeneous are these bristles that the usual longitudinal striæ have disappeared, and they resemble crystalline structures. In the ventral division the spine forms the apex of a somewhat conical lobe, the upper slope, however, being the shorter. The bristles (Plate XL, fig. 18) are equally transparent, but are slender and elongate, the shaft terminating superiorly in a dilatation with a spinous frill, which, like those of the dorsal, seems to be continuous. From this part the spinous region passes with a slight bend towards the dorsum, and ends in a well-marked hook with a small secondary process—apart from its base beneath. The tip is flattened and not much tapered, while the oblique rows of spines are somewhat adpressed. Little change takes place in their structure in the posterior feet. The bristles seem to have few parasites.

The dorsal cirri (Plate XL, fig. 19) are comparatively long, with a slightly dilated portion beneath the long filiform tip. A yellowish belt, or in some a white ring, marks the dilated portion. A few minute clavate cilia occur on their surface, and to these nerve-twigs proceed. The nerve in the centre of the cilium appears to form an enlargement in the opaque region at the base of the filamentous tip, and then continues onward to the extremity. The posterior cirri are longer and more slender, and the dilatation below the filiform tip is distinct.

The ventral cirri are rather long, smooth and tapering, their tips extending beyond the bases of the bristles.

Reproduction.—Specimens procured in Bressay Sound in July showed ripe eggs, and they were extruded in masses on rupture of the body. A male captured off Peel, in the Irish Sea, bore ripe spermatozoa the same month.

Development.—A young form measuring a little over 1 mm. occurred amongst the

[1] De St.-Joseph calls it roseate.

débris from the haddock-hooks on the 16th September, 1889. The injured specimen had nine or ten bristled feet. The head showed two broad lobes in front, with a deep median notch. Only the ceratophore of the median tentacle remained. The lateral tentacles formed two short subulate organs. The palpi were fairly developed, with tapering tips. The tentacular cirri had long slender tips, readily distinguished from those of allied forms, and all these organs were smooth. A pair of black eyes—very widely separated—were situated at the posterior part of the head. The teeth of the proboscis were clearly visible as four hollow, pointed chitinous processes, with a small spur near the base, and with long horny limbs for the attachment of muscles. The dorsal bristles were recognised by their characteristic scalariform structure, from three to six or seven rows of spines being present. They were more slender than in the adult, and tapered to a delicate tip. The ventral bristles had the prominent basal spur, and the long slightly curved and more finely spinous tip. They projected considerably on each side, as became the nectochæte stage.

The *Aphrodita velox* of Dalyell (1853) is in all probability this form, its translucency, irritability, and general aspect being characteristic. His example was scarcely half an inch long.

Kinberg's *Hermadion* (1857) had the following characters :—Head broader posteriorly. Posterior eyes distant from the anterior. Elytra fifteen, not covering the posterior part of the body. Inferior bristles serrate below the apex. Foot elongate. There is little that is diagnostic in this, and certainly the present genus requires a more precise definition. His species were quite different from the British, and came from the Straits of Magellan.

Ehlers (1864) gave a long and careful description of the species from Quarneo in the Adriatic, detailing the essential characters, though his figures of the bristles and scales needed improvement. His specimens were small, only from 7 to 9 mm., and of twenty-two segments. The ciliated processes on the dorsum of the foot he considered the external part of the segmental organs; and as his examples bore reproductive elements (summer), he was the more certain of the function of these organs. Haswell and Bourne have both pointed out, in other species, the true segmental organs, which are on the ventral surface. Ehlers thought the species had relationship with Kinberg's genus *Hermadion*.

Claparède (1868) published a fairly accurate account of this species from Naples, pointing out the palpocils on the cilia of the cirri, and the ciliated cushions on the dorsum of the feet. He also describes the remarkable facility with which the distribution of the nerves can be followed. Its irritability struck him, and it cast off both scales and cirri. He, like Ehlers, placed it under Kinberg's genus *Hermadion* mainly because the scales only overlapped in the anterior region of the body.

In his supplement to the 'Annelids of Naples' (1870), the same author recognised that his *Hermadion fragile* was Delle Chiaje's *Lysidice communis*, which that author had represented with only the anterior pair of scales, and to which his artist had added a pair of cirri on every segment—of which the figure shows no less than about sixty. In this communication Claparède describes the segmental papilla at the inner border of the foot ventrally, and shows a membrane investing the

developing ova. He could not say that this membrane represented the wall of the segmental organ; indeed the absence of cilia inclined him to think it did not. He also drew attention to certain cell-masses, with yellowish concretions in the centre, in the intestinal diverticula—which he thought excrementitious. Prof. Giard agrees with me in considering the distinctions of this form and *S. communis* insignificant.

Marenzeller (1876) found *S. communis*—in the Bay of Muggia at Trieste at a depth of 18 metres, on *Ophiothrix alopecurus*—with thirty-three segments, and measuring 10 mm. His example had fourteen pairs of elytra. He also mentions the advantages of the species for the study of the nerves of the elytra, and alludes to the characteristic structure of the bristles.

Langerhans (1879) records large examples (2 cm.) from Madeira. In connection with the scales he discourses on tactile hairs and rudimentary organs of various animals.

Hornell (1891) found all his specimens as commensals on Echinoderms—one in the ambulacral groove of *Astropecten irregularis*, another on *Crossaster papposa*, and the third on *Ophiothrix rosula*. In one the pellucid scales had posteriorly a crescent of orange, while the first pair had an orange belt all round.

2. Scalisetosus assimilis, *McIntosh*, 1875.

Specific Characters.—Head similar to that of *S. communis*, the eyes occupying the same position, and the larger anterior pair having lenses. Median tentacle long, smooth, slightly dilated below the filiform tip; lateral tentacles short, also slightly dilated below the tip. Palpi smooth. Tentacular cirri similar to the median tentacle. Body narrow and elongated, with a brownish-black median band from the nuchal collar to the posterior end. It is widest at the posterior part of the proboscidian region, though even there less than a third of the breadth of the dorsum. Segmental eminence prominent, but a special papilla could not be made out. Scales even more delicate and transparent than in *S. communis*, minutely punctate on the under surface. The outer and posterior borders and neighbouring surface have short clavate cilia—less numerous than in the former species. The finely branched nerves and nerve-endings are similar. From the dorsum the tips of the feet are blunt, and viewed laterally the dorsal eminence for the bristles is large, while the spine has a broader border of granular epiderm. The dorsal bristles are smaller than in *S. communis*, slightly curved, the spinous rows being less prominent and covering a shorter region of the bristle. The tip is bluntly rounded, bearing a minute terminal claw and a small secondary process with a notch between. The ventral division shows a broad terminal lobe with a bluntly rounded margin in front of the tuft of bristles. The latter, as in *S. communis*, has the distal end of the shaft expanded, with a small spinous collar, and from this the spinous region, with a slight bend to the dorsum, tapers to the tip, which turns bluntly round to the spiked side and ends in a small hook; then, after an edge directed obliquely backward, a secondary process, lateral in position, occurs. The rows of spines are extremely fine. The dorsal cirri are apparently shorter than in the previous species, but of a similar shape—smooth, with a long filiform process at the tip. Only one was observed.

Synonyms.

1875. *Hermadion assimile,* McIntosh. Invert. and Fish., St. And., p. 117.
1876. „ „ idem. Trans. Zool. Soc., ix, 387 and 400, pl. lxx, f. 4—6.
1886. „ „ Harvey-Gibson. Verm. Liverp., 151 and 348.
1891. „ „ Hornell. Op. cit., 237.

Habitat.—First found at St. Andrews, by my sister; afterwards on the west coast of Ireland, in 80 fathoms, eighteen miles west of Skellig, by Dr. Gwyn Jeffreys; south of England and off the Spanish coast in the 'Porcupine' Expedition. Commensalistic on *Echinus esculentus* (Harvey-Gibson).

Head has a similar outline to that in the former species, and in the preparations is about as long as broad. The anterior lobes are smoothly rounded, and the eyes have the same position and proportions, the larger anterior pair showing lenses. Both are visible from the dorsum, and have a long portion of the head in front. The median tentacle arises between the rounded anterior lobes, is long, smooth, slightly dilated below the filiform tip, and minutely dotted under a low power, though this seems to disappear in the mounted preparations. The lateral tentacles are short (in spirit) and slightly enlarged below the filiform tip. The palpi are quite smooth. The tentacular cirri are also smooth, slightly enlarged below the extremity, and are shorter than those of *S. communis.*

Body somewhat narrow, about $\frac{3}{4}$ inch or upwards in length, very slightly tapered in front, and very gradually diminished posteriorly. It is distinguished by a brownish-black median band, which commences behind the head and continues to the tail. It is widest towards the posterior part of the proboscidian region, though even there occupying less than a third of the arch of the dorsum. In the preparations a darker band occurs at the segment-junction, and a pale belt just in front. The ventral surface is pale. The segmental eminences are prominent, but special papillæ could not be made out.

Attached to the ventral surface were several long Pedicellariæ, probably from an *Echinus*, and some were also fixed to the feet.

Proboscis.—The proboscis seemed to agree with the preceding in structure, but in the preparation the papillæ were somewhat clavate instead of acute.

Scales (Plate XXXIII, fig. 6), fifteen pairs, even more delicate and transparent than in the previous form, and similar in shape. The cuticle of the inferior surface is minutely dotted throughout as in *S. communis.* The outer and posterior borders have short clavate cilia, less numerous than in the latter, and they also occur on the neighbouring surface. The finely branched nerves arise from a similar ganglion at the posterior border of the scar.[1]

Feet.—In looking at the feet of the two species from the dorsum a decided difference is observed in the terminal region of the ventral division, which in *S. assimilis* (Plate XXX, fig. 15) is somewhat blunt and rounded, whereas it is acute in *S. communis.* In profile this divergence is more pronounced, since the fleshy part of the dorsal lobe is larger in *S. assimilis*, and the spine has a broader covering, and instead of the acute cone

[1] The thickenings observed in these scales do not appear to indicate papillæ in all cases.

in the ventral division of the other species, it is here a broad terminal flap or lobe with a bluntly rounded margin in front of the tuft of bristles.

The bristles are as translucent as in the former species, but are scarcely so long in proportion. The dorsal are smaller than in *S. communis*, and slightly curved, the spinous rows being less prominent, and covering a much shorter region of the bristle (Plate XL, figs. 20 and 21). About seven or eight are visible. The tip is bluntly rounded, with a minute terminal claw and a small secondary process—with a notch between.

The ventral division has a fan-shaped series of slender bristles, which, as in the former case, expand at the end of the shaft, where a small collar of spines occurs, the finely spinous region, with a slight bend to the dorsal edge, tapering to the tip, which turns bluntly round to the spiked side and ends in a small hook; then follows an edge directed obliquely backward between this and the secondary process, which is lateral (Plate XL, fig. 22). So fine are the spines on the terminal region that they are scarcely visible, but the oblique lines in lateral view are distinct. The whole bristle thus characteristically differs from that of *S. communis*.

Habits.—This is evidently a commensalistic form on an *Echinus*, for Pedicellariæ frequently adhere to the skin and processes.

What relationship the *Hermadion echini* of Professor Giard[1] has to this species remains to be seen. It is evidently a closely allied form, but the minute characters of the bristles are not given with that distinctness which is necessary for critical diagnosis. It is interesting in this respect, that *S. assimilis* was found by Harvey-Gibson near Port Erin, Isle of Man, coiled round the peristome of *Echinus esculentus*, protected by the peristomial spines. This author gives some interesting structural details. Hornell also (1891) found one on the spines of *Echinus esculentus* near Liverpool Bar.

Genus XVIII.—Malmgrenia, *McIntosh*, 1876.

Head somewhat pyriform, with the narrow end in front, devoid of peaks, the median and lateral tentacles springing from the front as in *Lepidonotus*. Eyes large, nearly forming a square. Palpi, tentacles, and cirri smooth. Body of moderate length and breadth. Segmental eminences fairly developed, but without papillæ. Scales, fifteen pairs, smooth with the exception of a small group of papillæ at the anterior curve. Dorsal bristles translucent, short, and with faint spinous rows. Ventral bristles translucent, with rather short distal regions and five rows of spines; the tip hooked, and a secondary process beneath.

1. Malmgrenia castanea, *McIntosh*, 1876.

Specific Characters.—Head somewhat pyriform with the narrow end in front, without peaks, the lateral and the median tentacles springing from the front as in *Lepidonotus*. Eyes large, nearly forming a square; anterior pair in front of lateral

[1] 'Bullet. sc. Nord,' i, 1886, p. 8.

prominence, posterior in front of collar. Median tentacle of moderate length, smooth, as are also the lateral tentacles, tentacular cirri and palpi, which are of moderate length. Body about $\frac{3}{4}$ inch long, of thirty-six to forty-one segments, with madder-brown pigment posteriorly on the dorsum, and more sparingly on the ventral surface. Segmental eminences fairly developed, but without evident papillæ. Scales, fifteen pairs, adherent, smooth, with the exception of a small and somewhat triangular group of papillæ at the anterior curve in those of a reniform shape; variously bordered with madder-brown. Dorsal bristles translucent, somewhat short, slightly curved, little tapered, and with a rather abrupt point; spinous rows faint. Ventral bristles translucent, with short spinous regions; fine rows of spines, a well-marked hook at the tip and a secondary process after an interval.

Synonyms.

1868. *Eunoa*. Report Brit. Assoc., 1868, p. 337.
1876. *Malmgrenia castanea*, McIntosh. Trans. Zool. Soc., ix, 376, pl. lxvii, f. 15—19.
1886. *Malmgrenia castanea*, Harvey-Gibson. Verm. Liverp., 149 and 345.
„ *Lænilla castanea*, Giard. Bull. Sc. Nord, i, 3.
1891. *Polynoë* (*Malmgrenia*) *castanea*, Hornell. Op. cit., p. 235.

Habitat.—Dredged by Dr. Gwyn Jeffreys off North Unst, Shetland, in 1867, in 90 and 96 fathoms, on *Spatangus purpureus*, and again in 1868, attached near the mouth of the same Echinoderm, living on a bottom of shell-sand in 85 fathoms, twenty-five miles north-north-east of Unst. The same veteran explorer of our seas found it in 80—125 fathoms, fifty miles west of Valencia, and in 110 fathoms, thirty miles west of the Blasquet, south-west Ireland, in 1870. It was also dredged off St. Peter Port, Guernsey, in 5—7 fathoms, in 1868. Mr. Hornell procured a few on the same host in the Liverpool district in 20—22 fathoms, and Professor Herdman at the Isle of Man. The Royal Irish Academy's Expedition of 1886 also procured a small example in 480 fathoms. Professor Giard found it on the shores of France on the same Echinoderm.

Head (Plate XXVIII, fig. 15) somewhat like that of *Lepidonotus* and *Halosydna* in so far as the anterior border of the head runs into the base of the lateral tentacles. The head is pyriform, broad and rounded behind, and narrowed in front. A pair of large eyes lie in front of the nuchal collar, and a still larger anterior pair in front of the lateral prominence, looking forward and outward. They are thus separated by a considerable interval, and in the preparations nearly occupy the corners of a square. A trace of a lens appears in the centre of the anterior pair, which are only partially visible from the dorsum. The smooth median tentacle is moderately developed, and has a slight swelling below the tapering tip (in spirit). The lateral tentacles are short and subulate, with brownish pigment above the base. The palpi are smooth and of moderate length. The tentacular cirri have a similar structure to the tentacle, most being somewhat fusiform in outline.

Body about $\frac{3}{4}$ inch in length, and having from thirty-six to forty-one bristled segments. In most of the preparations it is pale anteriorly, but marked with madder-brown pigment on the posterior segments. The colour varies considerably. The

under surface of the body is iridescent pinkish. In some a considerable amount of brown pigment occurs posteriorly on each side of the median groove, and on the segmental eminences, the site of the papilla being indicated by a darker speck. On the whole the body is rather firm and broad, tapering a little anteriorly and more so posteriorly. It terminates in two tapering caudal cirri, often of a deep brownish hue. The segmental eminences are fairly developed, but no distinct elongation of the papillæ occurs.

Scales (Plate XXXIII, fig. 10), fifteen pairs, covering the dorsum, only a brief portion of the tail being uncovered. The first pair are rounded, the succeeding reniform, then ovoid, while the large posterior scales are irregularly quadrate. They are smooth glistening organs under a lens. Under the microscope they present a somewhat triangular group of papillæ on the anterior concavity of the reniform scales, but in the posterior scales these almost disappear. They are surrounded by a madder-brown belt, with a tendency to the development of a denser portion in the anterior band. In addition to broader marginal belts, the posterior scales have a general sprinkling of the brown pigment. In some, especially those near the mouth of *Spatangus purpureus*, all the exposed portion of the scale is tinted of a deep madder-brown. The scales seem to adhere with considerable tenacity. The nerve-supply is similar to that in *Scalisetosus communis*, but it is considerably obscured by pigment.

Feet.—In those examined only a spine occurred in the first foot.

In the typical foot (Plate XXX, fig. 5) the dorsal lobe is not much developed, forming a small process from which the somewhat short bristles project. They are very slightly curved, and taper a little towards the tip, which ends in a short point (Plate XL, fig. 23). They are translucent, finely striated longitudinally, and with faint spinous rows which go almost to the point. The dorsal spine projects in its sheath only a short distance towards the lower edge of the bristle-bundle. The ventral bristles have slender translucent shafts with a median axis, and striæ distally as well as in the spinous region. The ordinary appearance of one of the superior ventral bristles is shown in Plate XL, fig. 24, scarcely a trace of the secondary process being visible below the well-marked hook at the tip, and it altogether disappears ventrally (Plate XL, fig. 25). In the developing form the secondary process is clearly indicated. The spinous rows are close, and leave only the short terminal region bare. In specimens from Valencia (south-west of Ireland) this process is very distinctly seen, for instance, when the bristle is slightly turned round (Plate XL, fig. 26). The secondary process is less marked in specimens from the Channel Islands and Shetland, though indications are present in all. In viewing the body from the ventral aspect the feet after the thirteenth become considerably larger, and continue so till the thirtieth. This, as in *Harmothoë marphysæ*, may be associated with reproduction.

The dorsal cirri are of moderate length, smooth, slightly enlarged towards the end of the column (in spirit), and with a filiform tip. They increase in length (as usual) posteriorly. The ventral cirri extend to the bases of the bristles, and are subulate and smooth.

In a small example dredged at 480 fathoms off the south-west coast of Ireland both dorsal and ventral bristles are shorter and proportionally thicker, the former being

little tapered, and the latter with shorter spinous regions. The structure of the scales corresponds with the typical form. The body is purplish throughout.

Habits.—They cling to the test near the mouth of *Spatangus purpureus*, and are thus commensalistic forms.

Prof. Harvey-Gibson and Mr. Hornell found them on *Astropecten irregularis*—between the rows of pedicels—at a depth of 20 fathoms in the Liverpool district.

The former gives an account of various structural features of this species.

2. Malmgrenia andreapolis, *McIntosh*, 1875.

Specific Characters.—Head less pyriform than in *M. castanea*, with anterior peaks more or less adnate. Eyes smaller than in *M. castanea;* anterior pair wider apart than the posterior. Median tentacle incomplete in all; lateral tentacles small and subulate, with two brown rings at the base. Palpi smooth. Tentacular cirri brownish, with a few clavate cilia. Body elongate. Scales, fifteen pairs (?); first pair rounded, rest reniform or irregularly rounded. Those after the second pair with a brown ring more or less complete, and at the sixth or seventh pair a V-shaped mark and a spot become distinct. A belt of small papillæ (microscopic) occurs along the central region of the anterior border and extends to the inner corner in the reniform scales. Tips of feet are blunt and bifid; dorsal division less developed than in *M. castanea;* bristles slender, slightly tapered, with a probe-like tip, and minute serrations on the edge. Ventral bristles long, translucent, with a tapering spinous region which is simple superiorly—ending in a distinct knob, the next series with a secondary process beneath the claw-like tip, and inferiorly a single knob. A few clavate cilia occur on the stout, brownish, and tapered dorsal cirri. The ventral cirri are slender and tapering, reaching only a little beyond the bases of the bristles, and have a few short clavate cilia.

Synonyms.

1875. *Malmgrenia andreapolis*, McIntosh. Invert. and Fishes, St. A., p. 117.
1876. „ „ idem. Trans. Zool. Soc., ix, p. 377, pl. lxvii, f. 20—23.

Habitat.—Not uncommon in the débris of the fishing-boats from the off-shore (E. and R.), on the west sands after storms (E. M.), and in the stomachs of cod and haddock at St. Andrews (E.).

Head (Plate XXVIII, fig. 8) tinted with brown on each side in the preparations, the pale median groove marking off the symmetrical coloured areas on each side. The anterior peaks are more or less adnate, but still visible at the origins of the lateral tentacles. The head is less pyriform than in *M. castanea*, the eyes are smaller, and the anterior pair are wider apart than the posterior pair. The anterior eyes look forward and outward. The median tentacle is incomplete in all. The lateral are small and subulate, with two brown rings at the base; they are not in a condition to show cilia if they are present. The palpi are smooth. The tentacular cirri are brownish, and have a few clavate papillæ. The pigment under the median tentacle is better marked than in the former species.

Body rather elongate, more than an inch in length, and having about 36—37 bristled segments. In some the posterior region (about a dozen segments) is prettily mottled in the preparations with dark brown pigment both dorsally and ventrally. Occasionally the brown bars, sometimes with a pale centre, are best marked on the ventral surface. Very little tapering of the body occurs anteriorly. The ventral surface is for the most part pale and finely iridescent. The segmental eminence is prominent, but a special papilla cannot be made out.

Scales (Plate XXXIII, fig. 11) probably fifteen pairs, but no specimen is complete. The first pair are rounded, with a broad belt of madder-brown round the edge and a spot in the centre, though in some the latter joins the outer portion of the ring. The rest are reniform or irregularly rounded. The second scale in some has a brown ring round the exposed part, and a patch near the outer border anteriorly, representing the spot in the centre of the first pair and that of the scales behind. Those after the second pair have a brown ring more or less complete, the broadest part being toward the inner margin, and the spot at the anterior leg of the V-shaped mark gradually becoming more evidently separated. About the sixth or seventh pair the V-shaped mark and the spot become distinct. Posteriorly a tendency to the obliteration of the ring is observed, and the spot becomes connected with the remnant of it at the inner border. In a few the pigment in the posterior scales occurs in detached specks.

The scales appear to be smooth under a lens, but under the microscope a belt of small papillæ occurs along the greater part of the anterior and outer borders (where the curve is). This belt is continued in the reniform scales round the anterior and inner corner.

Feet.—As in the former species, the specimens seem to have lost the bristles in the first foot.

In looking at the feet from the dorsum it is observed, in contrast with *M. castanea*, that the tips are blunt and somewhat bifid, though the posterior process is less prominent than the anterior flap. In profile, again (Plate XXXI, fig. 3), the foot has a greater depth from above downward in proportion to its length, and thus the terminal cone is shorter. The dorsal division is less developed than in the former species, and bears a series of slender, slightly tapered, inconspicuous, translucent bristles, with a peculiar tip, which forms a kind of rounded knob (Plate XL, fig. 27, representing one of the larger bristles), of much interest when contrasted with the ventral forms, since it demonstrates how closely the same type holds in both divisions. The serrations are minute, and leave only a short portion of the tip bare.

The superior bristles in the ventral branch are long and translucent, have a long, tapering, spinous region, with a distinct knob, like a probe-point, at the tip (Plate XL, fig. 28). The spinous region quickly shortens in the succeeding forms, which show a most interesting series of gradations from the first appearance of the secondary process, the shortening of the probe-point and its gradual modification into a claw and a knob-like tip with an oblique edge between it and the secondary process (Plate XL, fig. 29). The spinous region in these is comparatively broad and short. Then, as the spinous region diminishes inferiorly, the secondary process shortens and disappears, the bristles

at the ventral edge, with short spinous regions having a marked dorsal curve, presenting only a short knob, smoothly rounded, at the tip (Plate XL, fig. 30).

The dorsal cirri are stout, shorter than in *M. castanea*, brownish, and, in spirit, taper from base to tip, a few short clavate cilia occurring on the surface. The ventral cirri are slender and tapering, and only reach a little beyond the bases of the nearest bristles. A few short clavate cilia are present.

Habits.—This species is probably commensalistic on another form, probably an echinoderm, but hitherto it has occurred at St. Andrews only in the free condition, viz. as thrown on the beach after storms.

Genus XIX.—Halosydna, *Kinberg*, 1857.[1]

Body linear-oblong; head continuous anteriorly with the bases of the median and lateral tentacles. Eyes large. Palpi smooth. Nuchal collar with a prominent flap. Segmental eminences distinct and the papillæ long. Proboscis with twenty-two frilled papillæ along each border. Only two short, wide, and glandular gastric cæca pass forwards into the peripharyngeal space. Scales eighteen pairs, large, soft, and with a frilled outer border, not covering the dorsum. Dorsal division of the foot minute, with slender, simple, and finely spinous bristles. Ventral division rather long, with numerous somewhat slender bristles with tips of varying breadths.

Halosydna gelatinosa, *M. Sars*, 1860. Plate XXV, fig. 5.

Specific Characters.—Head ovoid, pinkish, running into the bases of the lateral tentacles. Transverse diameter greatest. Eyes large, furnished with lenses, close together, the larger anterior pair on the lateral prominence, and the posterior close behind. The median tentacle is long, smooth, and tapering, with a filiform tip, and the lateral tentacles are also long. The tentacular cirri agree with the median tentacle in length and structure. The palpi are of moderate length, and smooth. Most of these organs are tinted pale madder-brown. Body elongated, bristled segments forty-three, barred transversely with pale greyish-brown belts between the pedicles for the scales. The nuchal collar has a prominent flap, which covers the posterior part of the head. Segmental eminence distinct, and the papilla long. The proboscis is characterised by about twenty-two frilled papillæ along each border in extrusion, and a muscular fold at each side. Scales eighteen pairs, not covering the dorsum completely, large, soft, and rounded, with a folded or frilled outer border in spirit. The outer region is studded with minute trifid papillæ, but the margin is quite smooth throughout. The dorsal division of the foot is minute, with slender simple and finely spinous bristles. The

[1] Kinberg, in his description of the genus, gives little to discriminate it from *Lepidonotus* except the numerous elytra and the elongated body.

ventral division is rather long, and has a long cone for the spine superiorly. The bristles are somewhat slender, with the spinous region of varying breadth, the superior simple and long, the middle and inferior broad and bifid. Dorsal cirri rather long, slender, and smooth, with a slight swelling (and a dark belt) below the filiform tip. The ventral cirrus does not reach the adjoining tip of the fleshy part of the foot.

Synonyms.

1820. *Polynoë foliosa,* Savigny. Syst. des Ann., p. 23.
1826. *Polinoë* „ Risso. L'Europ. Mérid., 414.
1834. *Polynoë* „ Audouin and Edwards. Annél., 89.
1835. „ *gelatinosa,* Sars. Beskr. og Iagtt, p. 63, Tab. 9, fig. 25.
1851. „ *foliosa,* Grube. Fam. d. Ann., 37.
1853. *Aphrodita cirrosa,* Dalyell. Powers Creator, ii, 164, pl. xxiv, f. 1 and 2.
1858. *Halosydna gelatinosa,* Kinberg. Freg. Eugen. Resa, Zool., p. 19, Tab. 5, fig. 26.
1860. *Polynoë gelatinosa,* Sars. Christ. Vid. Selsk. Forhandl., 1860, p. 58.
1865. „ „ De Quatrefages. Ann., i, p. 249.
„ *Lepidonotus imbricatus,* Baird. Johnston's Cat. Brit. Mus., p. 340.
„ *Alentia gelatinosa,* Malmgren. Nord. Hafs.-Annul., 81.
1866. *Halosydna (Alentia) Jeffreysii,* Ray Lankester. Trans. Linn. Soc., 25, p. 377, pl. li, figs. 12, 19—21, 26, 27.
1867. *Alentia gelatinosa.* Malmgren. Ann. Polychæt., 14.
1869. *Halosydna gelatinosa,* McIntosh. Trans. R. S. E., 25, p. 408, pl. xv, f. 6.
1870. *Polynoë foliosa,* Grube. Archiv f. Naturges., 1870, p. 288.
1875. *Alentia gelatinosa,* Ehlers. Annel. 'Porcup.,' op. cit., p. 34.
„ *Halosydna gelatinosa,* McIntosh. Invert. and Fishes St. A., p. 117.
1876. „ „ idem. Trans. Z. S., ix, p. 388.
1879. „ „ Tauber. Ann. Danic., 82.
1883. *Alentia gelatinosa,* Levinsen. Nord. Annul., 196.
1886. „ „ Langerhans. Zeit. f. w. Zool., 40, p. 251, Taf. 15, f. 6.
1888. *Halosydna gelatinosa,* De St.-Joseph. Ann. d. sc. nat. (7), v, p. 154, pl. vi, f. 6—21.
1891. „ (*Alentia*) *gelatinosa,* Hornell. Op. cit., 237.

Habitat.—Everywhere distributed round British shores—from Shetland in the north to the Channel Islands in the south. It is generally found under stones and in crevices, in laminarian roots between tide-marks, or in the valves of old shells in deeper water. It ranges also to the Scandinavian coasts, as well as to Madeira. A small specimen, 13·5 mm. long, is described by Ehlers (1875) from the 'Porcupine' Expedition of 1869, from the great depth of 1366 fathoms, on a bottom of fine mud. This, so far as my experience goes, is a rare habitat, and no station or date is given—only the position of 54° 54′ N. and 10° 59′ W.

Head (Plate XXVIII, fig. 11) with the transverse exceeding the antero-posterior diameter, so that it forms an ovoid. Anteriorly the prominent base of the median tentacle takes origin between the lateral lobes, and thus well within the anterior margin, while the bases of the lateral tentacles are continuations of the head, no peaks being present. The eyes are proportionally large and prominent, and have lenses. The larger anterior pair occupy the projecting lateral region; the smaller posterior pair are situated

immediately behind, and, from the rapid narrowing of the region, are thus nearer each other. In an example of medium size from Bressay Sound in July the eyes were larger than usual, and those of each side in contact. The lenses were also larger. The reproductive elements did not appear to be much developed. Sir J. Dalyell mentions that a large one, also from Shetland, had apparently only two eyes, but it is possible they were confluent. In life the head is pinkish, and in the preparations iridescent. In the majority the head is prettily mapped out by a pale median belt running forward to the tentacle. The prominent lateral regions on which the eyes are situated are pale; while in front are two pinkish or brownish-pink smoothly rounded areas—indicating the brain. The median tentacle is somewhat long and tapering, with a filiform tip. In spirit it is slightly enlarged below the latter. The surface is quite smooth. The lateral tentacles, the bases of which are lower than the median, are remarkable for their length, being only a little shorter than the median,[1] and this is confirmatory of the nomenclature adopted in the group. They are tinted brownish. The tentacular cirri agree with the median tentacle in structure and length. The palpi are of moderate length, brownish, tapering, and quite smooth.

Body upwards of 2 inches, sometimes $3\frac{1}{2}$ inches in length, slightly tapered in front and much more distinctly tapered posteriorly; rounded dorsally and flattened ventrally. The dorsum is somewhat regularly banded across with greyish or greyish-brown granular belts, and occasionally touches of white occur in the middle line of the coloured belts. These alternate with a pale belt between the pedicles of the scales. Between each pale belt there is thus a central band bordered with pale lines—extending between the papillæ on the cirrigerous foot, and a belt in front and behind, each of which extends to the neighbouring segment. The segment-junction is, therefore, in the middle of each band. No pale band occurs opposite the first pair of pedicles, but the second and third, as well as the succeeding, have them. In some the pale belts are more or less invaded by pigment. The caudal region behind the scales is continuously grey. In front the nuchal collar forms a free flap, which is sometimes bifid and crenate, but it is not papillose. The under surface is pale or slightly yellowish and iridescent. The proboscis in many tints, the anterior region to about the sixth foot, the rest being iridescent bluish with a red line in the centre. The segmental eminence is distinct, and the papilla is evident at the fifth bristled foot, and continues to the posterior end of the body. It is longest and largest about the beginning of the posterior third.

The *proboscis* and *digestive system* differ from that of the previous genera in having a muscular fold at each side in extrusion immediately below the angle, and divisible into two halves, so that a doubly papillose aspect is given in certain views. Moreover all the papillæ at the tip of the extruded organ are more or less lobed. The six central are large, and when viewed from the exterior do not differ very much from the ordinary forms, except that they are more slender. On their inner aspect, however, they send off a frill sloping towards the aperture. The succeeding eight on each side form a diminishing series with frilled and lobed ends. The total number of papillæ is thus twenty-two. Each of the upper sharp horny jaws bites to the left of the corresponding ventral in

[1] Kinberg states that the antennæ are only about half the length of the palpi, and that the scales are rugose.

extrusion. Both are sharply ridged. A comparatively large number of the preparations, including those from the stomachs of fishes, have the proboscis extruded.

Only two gastric cæca, proportionally short and wide, pass forwards into the peri-pharyngeal space. They are glandular throughout. The tip seems to end in a series of diverging fibrous processes which fix it in the dorso-lateral space. The glandular lining of the stomach is arranged in a series of trumpet-like processes projecting inwards.

The alimentary canal is generally empty, but in some it contains muddy *débris* with spicules of sponges and other organic materials, together with the skin, bristles, and hooks of Terebellæ. De St.-Joseph says that it feeds on minute crustaceans. Sir J. Dalyell gave a graphic account of its rapacious habits.

The *scales* (Plate XXXIII, fig. 12) are eighteen pairs, large—but do not quite cover the dorsum, have a translucent greyish or slightly purplish aspect, or translucent brownish anteriorly, and dull bluish or greyish posteriorly. A pale spot in each marks the scar for attachment. In some of the anterior scales a few dark specks occur along the posterior border. They are soft and more or less irregularly rounded, the first pair having a marked fold at their outer and anterior border. They are devoid of cilia at the margin, and present a minutely cellular aspect by transmitted light. Moreover along the inner and anterior border the surface is densely studded with minute papillæ, which are short and broad—generally with a trifid end, two stronger spines laterally, and a smaller and more acute median, as Langerhans pointed out. They extend over a considerable surface of the region indicated. Most of the scales have frills or folds on their outer margin. The finely branched nerves radiate from the scar of attachment throughout the entire scale. They are highly sensitive, so much so that when irritated the annelid will sometimes turn on its back to avoid interference. The scales are fixed to the following bristled feet: 1, 3, 4, 6, 8, and so on to 22, 25, 28, 31, 34, 37, and 38.

A curious solid rounded body of minute size occurred in the substance of one scale. Its contents were granular. In some also minute opaque white specks were present behind the scar.

Feet.—The first foot has a spine, the tip of which projects beyond the region in a sheath of cuticle and granular epiderm. No trace of a bristle was present in any specimen examined, and in this it agrees with *Malmgrenia*.

In the second foot the dorsal division is marked chiefly by the tip of the spine, which projects a short distance from the dorsum of the long ventral division. Behind the spine is a small tuft of straight, slender, tapering bristles—finely spinous. The combined lobe is comparatively long, nearly cylindrical, and ends in a long conical process for the spine. The ventral bristles are short and slender, extending beyond the conical process at the tip of the foot. They are slightly enlarged at the commencement of the spinous region, and then taper to a hair-like extremity. Their tips, which have a dorsal curve, diminish in length from above downward. The ventral cirrus of this foot extends as far as the tips of the bristles.

In the third foot the dorsal division is marked only by the projection of the long process enclosing the tip of the spine, and a tuft of similar bristles to those in the previous foot, only the tips are less acute. The ventral division is proportionally shorter and thicker, and the upper border of the process for the spine is now continuous

with the dorsal margin of the foot. The bristles are somewhat stronger and the spinous regions shorter. The tips of the upper series are less acute, and those of the stouter inferior show traces of the expansion. The backward curve of the lower series is marked. The ventral cirrus reaches only to the tip of the adjoining fleshy part of the foot.

In the next (fourth) foot a slight elevation internal to the long sheath for the spine exists, as an indication of the dorsal division. The tips of the ventral bristles are now shorter and wider.

In the typical foot (Plate XXX, fig. 11) the dorsal division forms a small process on the upper and anterior border, and is best seen in the elytrophorous feet, since the enlarged base of the dorsal cirrus in the others obscures it. The inconspicuous tuft consists of slender translucent bristles with faint serrations, and tapering to a fine point (Plate XLI, fig. 1). The bristles of the ventral series are comparatively slender and translucent, while the tips are flattened out in varying degrees. The superior series (Plate XLI, fig. 2) have elongated spinous regions, and simple, slightly blunt tips ; while the broader middle series (Plate XLI, fig. 3) have a strong curved hook at the tip, with a secondary process immediately beneath. The flattened spinous region is marked by the oblique lines from the rows of spines as in *Malmgrenia*. Langerhans specially refers to the changes in the bifid tip of the ventral bristles. The ventral cirrus does not now reach the tip of the fleshy part of the foot.

Posteriorly the bristles become extremely slender, with a capillary tip. The ventral, however, retain a trace of the enlargement at the base of the spinous region. The bristles on the last foot are stout. The ventral cirrus extends almost as far as the tip of the inferior division of the foot.

Parasites on the bristles are rare.

The dorsal cirri are rather long, slender organs, with a filiform tip, and a dark belt at the slight swelling immediately below. Their surface is smooth. A considerable nerve passes up the centre of the organ nearly to the tip, giving off branches as it proceeds.

Habits.—This species is fond of clinging to the under surface of stones in pools near low-water mark, from the north of Scotland to the Channel Islands, and no marked difference in size is found on contrasting specimens from the extremes. In Bressay Sound it is very abundant in old bivalve shells, in crevices in the "roots" of the tangles, and on the surfaces of the valves of the "horse"-mussels bound together by the foregoing "roots." Sir J. Dalyell many years previously procured it from this region—under shells. He gives an interesting account of the rapacity of one in confinement which devoured its fellow, the teeth of the proboscis audibly striking the glass as it darted it out to conclude its meal. In various Polynoidæ this tapping on the glass occurs occasionally in confinement. Fishes seem to find it out readily in deep water, for large examples are frequent at St. Andrews in the stomach of the cod and haddock.

It is active and irritable, and frequently ruptures its body if held by the middle, or when put in spirit. Sir J. Dalyell found it timid and nocturnal, yet watchful for prey.

Reproduction.—Ripe males occur at St. Andrews towards the end of November. A

large female, again, was laden with fairly advanced ova in July in Herm, so that the period of deposition could not be distant, probably in autumn. They were somewhat less advanced in a large female during the same month in Shetland, no free ova occurring in either case. In August the condition of the ova was very similar to the last (*e. g.* in one sent from Arran by Dr. Howden). Sir J. Dalyell, again, found that in the middle of July a large specimen produced in confinement about 10,000 eggs, the mass having a reddish hue as it lay on the bottom of the vessel. De St.-Joseph found ripe specimens with the ova and sperms within a membrane, as shown by Claparède in *Hermadion fragile*, but he omits to mention the date.

De Quatrefages adds nothing new to the account of the species. Grube found that this author's *Polynoë foliosa* in the museum at Paris agreed with the present species, as Malmgren had hinted.

Ehlers gives a somewhat detailed description of the small specimen (13·5 mm.) from the 'Porcupine.'

Genus XX.—Polynoë, *Savigny*, 1820.

Head elongated antero-posteriorly, with a somewhat indistinct peak on each side, beneath which is the lateral tentacle. Anterior and posterior eyes widely separated. Palpi with dense rows of clavate papillæ. Body linear-elongate, with many segments (over 100). Segmental papillæ long. Scales fifteen pairs, with a broad belt of papillæ on the surface anteriorly. Dorsal division of the foot minute, with small spinous bristles truncated at the tip. Ventral division has a single strong hastate bristle superiorly, and, below, strong bifid bristles with short spinous regions.

The median area for the nerve-cords is comparatively wide, the oblique muscles having a broad attachment to its exterior border. A firm membrane bounds the area internally, and a symmetrical longitudinal muscle runs above it on each side of the median line.

Commensalistic.

Polynoë scolopendrina, *Savigny*, 1820. Plate XXV, fig. 7.

Specific Characters.—Head pinkish, with the long diameter antero-posterior; a somewhat indistinct peak on each side. A pair of distinct eyes in front of the nuchal collar, and a larger pair with lenses, scarcely visible from the dorsum, near the anterior part of the peak, and directed forward and slightly outward. Median tentacle larger than the palpi in spirit, with a slight enlargement below the filiform tip, and densely clothed with short clavate cilia having truncated tips. Lateral tentacles of moderate length. Palpi have dense rows of minute clavate papillæ. Body linear-elongate, 2 to 5 inches long, bristled segments from 80 to over 100, reddish brown, or brown on the dorsum, the pigment being arranged in various touches and bars. The posterior ventral region has also brown bars and touches, especially on the segmental eminences. The

papillæ of the latter are long. Scales fifteen pairs, dappled brownish, with a dark patch over the scar and surrounded by a pale ring. The larger examples have a dark metallic lustre from the pigment. They have a series of minute papillæ as a broad belt along the anterior region, and the outer edge shows very minute rounded or short clavate papillæ —the homologues of the cilia. The dorsal division of the foot is minute, and bears rather small, spinous, truncated bristles. Ventrally, as a rule, a single strong hastate bristle occurs superiorly, and, below, a series of strong bifid bristles with short spinous regions. The dorsal cirri are somewhat short, with a filiform tip, and with the same short cilia as on the median tentacle. The ventral cirri are short, ciliated, and tapering —not reaching the tip of the fleshy part of the foot in spirit. Commensalistic.

Synonyms.

1820. *Polynoë scolopendrina,* Savigny. Syst. des Ann., p. 350.
1834. „ „ Aud. and Ed. Annél., p. 92, pl. i, f. 17 and 19.
1840. „ „ Johnston. Ann. Nat. Hist., v, 307, Tab. 5, f. 1—9.
1851. „ „ Grube. Fam. Annel., 37.
„ „ „ Sars. Vid. Selsk. Förh., 1860, p. 62.
„ „ *variegata,* Grube. Annel. Oersted., 49.
1860. „ *scolopendrina,* Sars. Vidensk. Selskab. Christ., 1860, p. 62.
1865. „ „ Johnston. Cat. B. M., 119, pl. xi, f. 1—9.
„ „ „ Malmgren. Nord. Hafs-Ann., 82, Tab. 10, f. 11; and Ann. Polych., 15.
„ *Lepidonotus scolopendrinus,* De Quatrefages. Ann., i, p. 263.
1873. *Polynoë scolopendrina,* Marenzeller. Sitzb. der k. Akad., vol. lxix, p. 419.
„ „ *crassipalpa,* idem. Ibid., p. 412, pl. xi, f. 1.
„ „ *Johnstoni,* idem. Ibid., p. 420.
1874. „ „ idem. Sitzb. d. k. Akad., 69 (sep. Abd.), p. 14.
1875. „ *scolopendrina,* Grube. Jahrb. Schles. Gesells. (*fide* De St.-Joseph), 1875 Breslau, 1876, pp. 53 and 68.
1876. „ „ McIntosh. Trans. Z. S., ix, 389.
1879. „ „ Tauber. Ann. Danic., 82.
1883. „ „ Levinsen. Nord. Annul., 196.
1888. „ „ De St.-Joseph. Ann. d. sc. nat. (7), v, p. 183.
1891. „ „ Hornell. Op. cit., p. 235.

Habitat.—In the tubes of *Terebella nebulosa*, between tide-marks, Herm, and between the chinks of rocks (gneiss) in muddy sand in the burrows of *Lysidice*. The large race abounds on the eastern shores of North Uist in the tubes of *Terebella nebulosa* and other Terebellids attached to the under surfaces of stones close to low-water mark. Not uncommon also off the east and west coast of Ireland (Prof. Haddon and Dr. Scharff) and in the English Channel (Hornell). It extends to the shores of France and to the Mediterranean.

The pinkish *head* (Plate XXVIII, fig. 9) forms an ovoid, the long diameter being antero-posterior. A central groove terminates in front at the basal process (ceratophore) of the median tentacle, and on each side is a somewhat indistinct peak, which, however,

is differentiated from the lateral tentacle beneath. A pair of distinct eyes lie in front of the nuchal collar. The considerably larger anterior pair are scarcely visible from the dorsum, and are situated in the smaller southern forms on the outer border near the end of the peaks, a long interval thus existing between the anterior and the posterior pairs. In the large Hebridean examples these large eyes occupy almost the whole peak, and their direction is more forward than outward. The anterior eyes, as a rule, look forward and slightly outward, and are very conspicuous from the front. A minute lens, less distinct in the larger than in the smaller forms, appears in the centre of the anterior pair. In the preparations the brownish median tentacle is longer than the palpi, tapering from the base to the slight swelling below the filiform tip. It is somewhat densely clothed with short cilia, most of which have truncated tips, only a few being clavate—the latter shape being due to an ovate rather than a rounded tip. The lateral tentacles are of moderate length, and have a slight enlargement below the filiform tip. They are similarly clothed with truncated cilia. The palpi are of average length, and have rows of closely arranged clavate papillæ with truncated tips. These are longest and most cylindrical inferiorly, shorter and more markedly clavate superiorly. Smaller forms extend on the tapering extremity of the organ. The tentacular cirri resemble the median tentacle in regard to form and cilia.

Body linear-elongate, $1\frac{3}{4}$ to $4\frac{3}{4}$ inches or even more long, and having from 80 to 102 bristled segments. The iridescent dorsum in the larger examples is mottled with reddish brown, which, behind the proboscidean region, is somewhat regularly arranged between the lateral eminences, and by-and-by divided into two by the dark median tubercle which commences about the twentieth bristled foot. These three distinct sets of elevations (two lateral and a median) continue to the posterior end of the body. A ridge-like fold forms a buttress in front and another behind the lateral tubercle, and each bounds the seal-like brownish mottling. Brownish pigment also occurs on the elevations at the bases of the dorsal cirri. The median tubercle is situated towards the anterior part of the segment, the lateral towards the posterior part. In the large forms the reddish hue of the dorsum shines through the scales, and tints the entire region, relieved by the steel-like glitter of the darkly pigmented portions of the scales. In the smaller forms the dull yellowish back is minutely flecked with brown. Every alternate foot in front has a dark brown patch on the eminence for the cirrus. The ventral surface is iridescent, pale brown or dull yellowish in the specimens from the Channel Islands, and posteriorly marked by touches of brown—chiefly on the segmental eminences, which are distinct, and have a large and somewhat clavate papilla which projects backwards between the feet. The segmental papillæ become distinct on the sixth foot, and continue nearly to the posterior end. In the centre of the body is a reddish streak. In the large Hebridean forms the under surface and feet are of a dark orange—with the reddish central line—and iridescent. Moreover, in some, broad bars of pigment occur on the ventral surface throughout in more than the posterior half. Two races thus occur, the smaller yellowish-brown southern form, and the reddish-brown Hebridean.

The body terminates posteriorly in two anal styles, which, like the cirri, are proportionally short.

Digestive System.—The pre-gastric cæca are two in number, both being short and broadly club-shaped. The third is transverse. All go deeply into the intermuscular spaces at the feet. The movements of muscles and feet must thus have considerable effect on the contents of the cæca.

Scales (Plate XXXIII, figs. 13—small example, and 14—larger example) fifteen pairs. They vary in appearance according to the condition of the specimen; thus the smaller race from the Channel Islands has the anterior scales dappled brownish with a dark patch over the scar for attachment, and surrounded by a broad pale ring. In the larger specimens from the Hebrides they have a dark metallic (steel-like) iridescence. When removed they are translucent, pale anteriorly, marked by a dark belt, speckled with translucent spots round the inner three-fourths of their circumference, and with a pale centre. They vary, in any given specimen, in size according to state of development, covering the dorsum in some nearly as far as they extend, whereas in others with developing scales an interval occurs between the pairs. In the large forms the first five pairs cover the dorsum completely, the rest leave a space in the centre. The first pair are rounded—with minute cilia anteriorly, the succeeding somewhat reniform, and the rest more or less rounded ovoid. Though smooth under a lens they have a dense series of minute papillæ as a broad belt along the anterior region, and at the outer border a series of minute papillæ or cilia, and one or two also occur along the posterior border. Finely branched nerves ramify throughout the scale from the scar for the pedicle. In the small specimens from the Channel Islands the papillæ (spines) on the scales are proportionally large, as observed in the sketch.

Feet.—The dorsal division of the first foot presents a single small dorsal bristle with about seven or eight spinous rows, and a smooth tip.

The second foot has dorsally a group of somewhat tapered, short, slightly curved bristles with well-marked spinous rows. Ventrally the slender bristles are also short, the spinous regions being bent dorsally, and tapering to smooth bifid tips. The rows of spines are well marked,—that is, are at moderate distances from each other. The tips of one or two of the inferior bristles are simple. The large ventral cirrus of this foot has numerous cilia with clavate and truncate tips. The bristles in the succeeding feet gradually approach the typical form, which is found about the twelfth or thirteenth bristled foot. In shape the typical foot (Plate XXIX, fig. 17) presents dorsally the comparatively short tapering cirrus, then the eminence for the dorsal bristles. The inferior division is bifid, with a long anterior process and a shorter posterior cushion, the margin beneath having an inward slope from above downward. Even in the second foot the upper ventral bristle is stouter than the others, with strongly bifid tip and spinous rows. It increases in strength and becomes more boldly bifid as we proceed backward, attaining a large size in the fifth and sixth, and then becoming simple about the tenth bristled foot, while only traces of the spines remain. As a rule only one strong bristle occurs in the typical foot, which has below the dorsal cirrus the tuft of short, slightly curved, and little tapered dorsal bristles arising from a small eminence (Plate XLI, fig. 4). These bristles taper a little from the base, but end in a blunt tip (Plate XLI, fig. 7), which is curiously wrinkled so as to appear bifid. The spinous rows are somewhat close, yet fairly distinct. A careful examination of various specimens, however, shows that this condition of the

dorsal bristles is due to external influences, probably connected with commensalism. The tip has evidently been destroyed, so that only the lower part of the bristle remains. The stump, indeed, is often slightly thickened, and presents a furrow, giving the bifid appearance already adverted to. In an example dredged off the Hebrides by Dr. Gwyn Jeffreys the dorsal bristles are unusually complete, yet even in these the extreme tip has disappeared and a probe-pointed end remains. This specimen shows, however, that the normal condition of such a bristle is finely tapered to a filiform tip. The causes of this remarkable change, which does not seem to affect the ventral bristles, may be the secretions of the *Terebella*, or the friction of the bristles against the walls of the tube or tunnel, the latter the most probable.

The ventral division forms a short triangular lobe, the process for the spine being at the apex. In some a bar of dark pigment occurs near the tip of the foot, just at the base of the bifid region. Above the spine is the single large bristle, the shaft of which is about twice the diameter of those adjoining. The tip is hastate and the point acute (Plate XLI, fig. 5). As already indicated, this bristle is formed from a bifid one, the secondary process disappearing as we proceed backward, and likewise the spines—traces of which, however, even far backwards, are left in the faint transverse lines on the dilated region. The relative proportion of the two kinds of bristles is shown in figs. 4 and 5. All the bristles which follow are bifid, with short spinous regions and moderately stout shafts (Plate XLI, fig. 6, representing one of the superior forms with a longer tip, and fig. 8 showing the tip more highly magnified).

Toward the posterior end the large superior ventral bristle disappears. Before this change takes place, however, two strong bristles occur on the foot as in front. The dorsal tuft becomes minute posteriorly, and in the terminal feet the bristles are slender and tapered—with very distinct spinous rows.

The dorsal cirri, which in life are pale, extend in the preparations only a little beyond the bristles, and gently taper to the slight swelling below the filiform tip. They have numerous short cilia with clavate and truncate ends, and a few small cilia occur on the base of the slender extremity. The ventral cirri are small and tapering, with similar cilia. They do not reach the tip of the fleshy part of the foot. In some they are rendered conspicuous by dark pigment at the base.

Nerve-cords.—In transverse section nucleated cells are found externally and beneath the cords, especially at the ganglionic enlargements. Strands from the exterior fibrous layer also passed into the area of the cord in section, and in many such fibres seemed to join the nucleated cells lying in the median line below the cords.

Reproduction.—Females with well-developed eggs were found in the tube of *Terebella nebulosa* at Herm in July, 1868, and in the chinks of rocks in tracks of *Lysidice*. In the latter case males well advanced were also observed.

Habits.—This form is more sluggish in its habits than *Harmothoë imbricata* or other ordinary type. It is difficult also to conceive how the *Terebella* can be comfortable with such a large commensalistic form in its tube, especially when the powerful bristles of the *Polynoë* are considered. So far as observed it keeps its head towards the anterior end of the tube, and thus its ordinary position is in agreement with that of the *Terebella*. It is brittle, breaking into several pieces in lifting from one vessel to another.

Its food consists of cellular substances with a few sponge-spicules.

It is phosphorescent. On placing it in spirit luminous flashes were emitted from the bases of the feet, and the same emissions were caused by irritating the posterior end with the forceps.

The remarkable difference in size and coloration between the southern forms from the Channel Islands and those from the Outer Hebrides is an interesting feature, but one in the British Museum from Falmouth is between four and five inches, so that caution in making deductions is necessary.

The most marked variety is that from the chinks of the hard gneiss of the Channel Islands—in the burrows of *Lysidice*. It is less than two inches, very narrow, and there is a tendency to have dark brown pigment at the mouth and anterior ventral region. It thus approached in bulk *Lysidice* itself, and the tints anteriorly were not dissimilar.

The species was first found by d'Orbigny at La Rochelle, and by Savigny and Audouin and Edwards on the shores of the Channel. The latter authors state that it lodges in tubes of sand and shells agglutinated by a secretion, though they also found it in company with *Terebella*. No instance of its occurrence in an independent tube, manufactured by itself, is known in this country, and it is possible Audouin and Milne Edwards may have met with it only in an empty tube of *Terebella*.

De Quatrefages points out that Johnston's species diverges from that of Audouin and Milne Edwards, since it has 110 segments. . Further, that the appendages of the head differ in proportion. Thus the median antenna is much longer than the inferior tentacles, which are very large and conical; the lateral, again, are proportionally small. The superior tentacles differ correspondingly. For the rest, the figures of the bristles given by the respective authors diverge much. This author, however, laboured under a misapprehension on the subject.

Marenzeller in 1874 distinguished this from Savigny's species by the fact that the tentacle was longer than the palpi, while the tentacular cirri were shorter than the palpi: there are three rows of wart-like papillæ on the dorsum of the segments. Moreover, his *P. crassipalpa* comes near it, and may be the same form. I have not seen any reason to think that Savigny's species differed from Johnston's, though two varieties exist; and it is satisfactory to find that Baron de St.-Joseph agrees with me in this respect as well as with regard to the *P. crassipalpa* of the able naturalist of Vienna. Mr. Hornell observes that nearly every haul of the dredge off Anglesey brought up at least one specimen, and in one case it emerged from the tube of *Thelepus cincinnatus*.

In the recent remarks[1] of Dr. H. F. Johnson on the Pacific annelids it would have been very interesting to find the results of a comparison of such commensalistic species as *Polynoë reticulata*, sp. nov., or *P. gigas*, sp. nov., with the well-known *P. scolopendrina*.

[1] 'Annel. of the Pacific Coast,' Californ. Acad. Ser., 3rd ser., i, No. 5, 1896, p. 170 *et seq.*

Genus XXI.—ENIPO, *Malmgren*, 1865.

Head subcircular without peaks. Eyes rather small, two posterior, two median and lateral. Palpi thick, subulate, and, like all the tentacles, smooth.

Body much elongated (about 100 segments). Segmental papillæ distinct. All the segments have dorsal cirri.

Scales fifteen pairs, minute, smooth, subcircular, only occurring anteriorly.

Feet well marked and long. Dorsally is a minute tuft of slender serrate bristles. Ventrally are slender bristles with tapering, boldly spinous regions and a capillary tip, while a few are bifid.

ENIPO KINBERGI, *Malmgren*, 1865.

Specific Characters.—Head subcircular without peaks. Eyes rather small, two at the posterior border and two on the lateral prominence. Lateral tentacles subulate, short. Palpi thick, subulate. Tentacular cirri of moderate length. All these appendages are smooth. Body much elongated, of about 100 segments. Segmental papilla distinct. Scales fifteen pairs, minute, subcircular, pellucid, smooth, leaving the posterior part of the body uncovered. Feet well marked, long, bearing dorsally a minute tuft of slender serrate bristles. Ventral bristles mostly slender, with a tapering boldly spinous region ending in a capillary extremity, but a few have hooked tips with a secondary process. All the segments have dorsal cirri, which reach only a little further than the bristles. Ventral cirrus subulate, of moderate length—sparsely ciliated (*fide* Malmgren).

SYNONYMS.

1865. *Enipo Kinbergi*, Malmgren. Nord. Hafs-Ann., p. 83, Tab. x, f. 12.
1867. „ „ idem. Ann. Polych., p. 15 (sep. copy).
1873. „ „ Kupffer. Jahresb. der Com. der Deutsch. Meere, 1871, p. 150.
1875. „ „ McIntosh. Invert. and Fishes, St. A., p. 116.
1876. „ „ idem. Trans. Z. S., ix, 388, pl. lxx, f. 7—10.
1879. „ „ Tauber. Ann. Danic., 83.
1883. „ „ Levinsen. Nord. Annul., 196.

Habitat.—Deep water off St. Andrews Bay. The examples have occurred in the stomachs of cod and haddock (E. M.). It ranges to Christiania Fjord, to Drobäk, to Bahusia (Malmgren), and the Baltic.

Head.—The only British specimens hitherto procured have been from the stomachs of cod and haddock caught off St. Andrews Bay, and the head has been so injured that no description could be made. Malmgren observes that the head is subcircular, without anterior peaks, the base of the median tentacle occupying the region. Eyes apparently

rather small; two in front of the nuchal collar, and two on the lateral cephalic prominence. Lateral tentacles short, subulate. Palpi thick, subulate. Tentacular cirri about the length of the palpi in spirit. All these cephalic appendages are smooth.

Body.—Much elongated, narrow, of about 100 segments, and about 65 mm. long. Segmental papilla distinct (*fide* Malmgren).

Scales.—Fifteen pairs, minute, subcircular, pellucid, smooth, leaving the posterior region of the body uncovered (*fide* Malmgren).

Feet.—The feet are rather elongate, carrying dorsally a minute tuft of slender hairs, finely serrated (Plate XLI, fig. 9). The ventral bristles are described by Malmgren as of one kind only, but this form shows two kinds, viz. (1) that indicated by Malmgren, and represented in Plate XLI, fig. 10, the rows of spines in all the examples being apparently less numerous and wider apart than in Malmgren's figure; and (2) a few with characteristically hooked tips and a secondary process beneath (Plate XLI, fig. 11). The rows of spines in the first series are not opposite, but alternate—as observed in end views (Plate XLI, fig. 12). A slight enlargement occurs at the commencement of the spinous region.

All the bristled segments, as in *P. scolopendrina*, are furnished with smooth dorsal cirri, which extend only a little further than the bristles. Ventral cirrus subulate, of moderate length, sparsely ciliated.

The appearance of this northern form only in the stomachs of fishes shows how readily such may escape the various instruments of capture used by naturalists.

I have placed this under Malmgren's genus and species, supposing that he had overlooked the ventral bristles with the bifid tip. Should they be absent in his form, then the species from St. Andrews should bear the specific name of *Elisabethæ*, from its discoverer.

Kupffer (1873) shows that the antennæ are three-ringed in examples from the Baltic, but this and other features require careful re-investigation in connection with possible specific differences.

Genus XXII.—Acholoë,[1] *Claparède*, 1870.

Head elongated from before backward, and running into the bases of the tentacles. No peaks. Four large equidistant eyes. Palpi smooth and short. Body sublinear, flattened, segments numerous. A segmental eminence but no distinct papilla. Cirri on every foot, and a T-shaped branchial process. Scales numerous. Feet short. Dorsal division minute; bristles few and small, with a minute hook at the tip. Ventral division bearing bristles with long and strong shafts and short spinous regions having a sharp hook at the tip. The nerve-cords seem to be comparatively large, ovoid in section, and have the cuticle and granular epiderm externally. Internally a firm membrane separates them from a well-marked layer of longitudinal muscular fibres in the median line, as in *Polynoë scolopendrina*.

[1] One of the Harpies.

ACHOLOË ASTERICOLA, *Delle Chiaje*, 1823.

Specific Characters.—Head somewhat elongated from before backward, with four large equidistant eyes—all visible from the dorsum. Anterior peaks absent or indistinct, the head running into the bases of the lateral tentacles. Median tentacle of moderate length, subulate, with a very few clavate cilia. Similar cilia occur on the short lateral tentacles. The palpi are smooth and rather short. Body sublinear, flattened, segments numerous and of a peach-blossom or flesh colour. Segmental eminence, but no distinct papilla. Scales forty-five pairs, rounded or ovate, smooth, with a very few minute papillæ at the anterior and inner border. The feet are somewhat short, the dorsal division minute, the ventral bevelled from below upward. In the cirrigerous feet a T-shaped branchial process. Dorsal bristles few and small, gently curved and tapered, with a minute hook at the tip, which is smooth. The spinous region is short, and the spines minute. The ventral bristles have long and strong shafts, a slight dilatation at the commencement of the very short spinous region, and a smooth boldly marked sharp terminal hook. Dorsal cirri somewhat short, tapered, and with a very few clavate cilia. The ventral cirri are short, smooth, subulate, and tapering.

SYNONYMS.

1823. *Nereis squamosa,* Delle Chiaje. Mem. s. g. Anim., ii, pp. 368, 400, 425, Tav. 19, f. 7.
1841. *Polynoë astericola,* idem. Descriz. e notom., v, 57, 106, Tav. 129, f. 7.
1855. „ *malleata,* Grube. Archiv f. Naturges., Bd. xxi, 81, Taf. iii, f. 1.
1857. „ *astericola,* Sars. Bid. til Kundsk. om Middelhav. Littoral-Fauna, Christiania, p. 104.
1865. „ *asterinæ,* Carrington. Proceed. Lit. and Phil. Soc., Manchester, iv, p. 176.
1870. *Acholoë astericola,* Claparède. Suppl. Ann. Chét., Nap. (sep. copy), 18, pl. ii, f. 1.
1875. „ „ Marenzeller. Sitzb. der k. Akad. (sep. Abd.), 14.
„ „ „ Panceri. Atti Accad. Sc. Napoli, vol. vii, p. 13, Tav. 3, f. 3—5.
1876. „ „ McIntosh. Trans. Z. Soc., ix, 389, pl. lxx, f. 11, 12.
1884. „ „ V. Carus. Fauna Medit., 202.
1891. „ „ Hornell. Op. cit., p. 236.

Habitat.—It was first procured in Britain by the late Dr. Carrington on Southport Sands clinging to *Astropecten irregularis ;* while Prof. Percival Wright got it at Galway. Abroad it ranges to the Mediterranean, occurring on various star-fishes of the genus mentioned.

The *head* (Plate XXVII, fig. 17) is somewhat elongated from before backward in the softened preparations, of a roseate hue from the ganglia, and Claparède shows four large equidistant eyes—all visible from the dorsum.[1] The anterior peaks are absent or very indistinct, the head on each side running into the base of the lateral tentacles, while in front of the median groove is the base of the median tentacle. The trilobed processes

[1] The eyes had disappeared from the rather softened preparations which represented the species. For these I am indebted to the late Dr. Carrington, of Eccles, near Manchester.

alluded to by Claparède seem to be the result of compression. The tentacle is subulate, with a few clavate cilia. The lateral tentacles are short and subulate, with a few clavate cilia. The palpi are smooth, rather short (in spirit). The tentacular cirri are also short, with a few clavate cilia. Claparède observed that the dorsal base of the latter has a band of vibratile cilia on its upper surface, and he considered that such was the homologue of the branchial processes of the feet.

Body sublinear, flattened, and ranging from one to two inches in length. It is very little tapered in front—much more so posteriorly. The segmental eminence is distinct, but no papilla is visible in the preparations. Dr. Carrington describes the general aspect as peach-blossom or flesh coloured.

Scales (Plate XXXIII, fig. 15) are forty-five pairs (Claparède[1]), rounded or in front somewhat reniform, apparently smooth, but having a series of minute papillæ along the anterior and inner border, and with finely branched nerves. They are rather thin and translucent, and have a blackish belt round the border, the centre being pale. In some the blackish belt is confined to the posterior and outer border. On the anterior aspect of the pedicles for the scales is a band of vibratile cilia.

Feet.—Only the spine remains in the preparations in the first foot, and Claparède shows the same condition from life. In this respect it agrees with *Malmgrenia* and *Halosydna*.

The second foot has a few short dorsal bristles—slightly curved, and with a short spinous region, which does not quite reach the smooth and pointed tip. The ventral series are stout and somewhat short, with a distinct curvature at the upper part of the shaft, and a short spinous region tapering from a basal enlargement to an acute and slightly hooked tip. The spinous rows are well marked. The chief change in the third foot is the increase in the strength of the ventral bristles, and in the more distinct hook of the smooth extremity. A ciliated band occurs along the upper and anterior edge in this and other anterior feet without elytra.

The typical foot (Plate XXXI, fig. 4) in those segments which have cirri has a T-shaped branchial process on the dorsum—figured by Claparède from life, and showing a diverticulum of the intestine, and ova from the perivisceral chamber in the interior. Its inferior surface is richly ciliated. Such a process may fairly be called branchial. The foot is comparatively short, with a small dorsal papilla for the bristles, and a short ventral division sloping from below upward to the spine, and slightly bifid at the tip—when viewed from above. The dorsal bristles (Plate XLI, fig. 13) are short, somewhat curved, and little tapered distally below the bare region at the tip, which is acute and slightly hooked. The spinous rows are minute. The ventral bristles have long and strong shafts—the middle exceeding the superior and inferior in bulk, a slight dilatation at the commencement of the very short spinous region, and a smooth boldly marked sharp hook at the tip (Plate XLI, fig. 14). The spinous rows gradually diminish from below upwards, and no larger process occurs at the base of the hook, as in several forms.

The dorsal cirri are comparatively short, apparently devoid of an enlargement below the tips, and with a few clavate cilia. The ventral cirri are smooth, subulate, and

[1] Carrington says twenty pairs or more of white scales.

tapering. They do not reach the tip of the fleshy part of the foot (in spirit), though they pass beyond the bases of the bristles.

Nerve-cords.—At the sides of the nerve-cords are numerous nucleated cells, and the cords themselves in section present a peculiar areolar or reticulated appearance—a feature, however, which may be due to the mode of preparation. The granular epidermic layer seems to be largely developed.

Habits.—The late Dr. Carrington, of Eccles, found it at Southport in considerable numbers, along with *Harmothoë lunulata*, in the ambulacral grooves of *Astropecten irregularis*, his attention having been attracted by the bluish phosphorescence when the star-fishes were put in fresh water. It is very fragile, so that it is difficult to obtain an entire example ; yet it is sluggish. Claparède, again, procured it on the same star-fish at Naples in company with another Annelid, *Stephania flexuosa*.

Reproduction.—Dr. Carrington observed ova in his examples from Southport, but no date is given, though it is probable that they were obtained during the storms of winter. The ova were seen through the dorsal papillæ. M. Claparède procured those with ova and sperms at Naples in the winter of 1868–9.

Delle Chiaje first found this species in the ambulacral grooves of *Astropecten aurantiacus* and *pentacanthus* at Naples, and gives a figure of the entire animal, which is of a pinkish hue.

Amongst allied forms, Webster, in his 'Annelids of the Virginian Coast,' describes *Lepidametria commensalis* with scales extending the whole length of the body, viz. 50 to 90 mm., and living in the tube of *Amphitrite ornata* (Verrill). Moreover he also describes a minute form (which he terms "*Antinoë parasitica*") parasitic under the scales. It has peculiar hooks in the posterior segments (ventral series)—he thinks for holding on.

This species is apparently that referred to and figured by Delle Chiaje in 1823, but his reference to the previous note by Baster could not be verified. It has been thought best to retain the specific name *astericola* subsequently given to it by the Italian author, the original one of *squamosa* being less characteristic.

Family IV.—ACOETIDÆ, *Kinberg*, 1857.

Head without a facial tubercle. Median tentacle arising from the middle of the anterior lobe ; bases of the lateral tentacles covered by the ocular peduncles. Palpi long and tapering. Body elongate, flattened. Scales numerous. Scale-bearing segments alternating with those bearing cirri. Pharynx exsertile, with numerous papillæ on the margin—the median dorsal and ventral tentaculiform. No pregastric cæca. A segmental eminence, but no distinct papilla.

Genus XXIII.—Panthalis, *Kinberg*, 1857.

Scales smooth, flat, rounded or campanulate, covering the dorsum anteriorly, leaving the rest bare in the middle. Foot with a dorsal process in front, a trilobed median and a small ventral process. Dorsal bristles brush-like at the tip; median spinous on one side, and terminating in a long whip; ventral with curved tips—finely tapered and spinous.

Panthalis Œrstedi, *Kinberg*, 1857.

Specific Characters.—Head somewhat urn-shaped, with the rounded bosses for the eyes (ommatophores) in front, and the small median tentacle extending a little beyond them. Posteriorly it runs smoothly into the body. The median tentacle springs somewhat behind the bases of the pinkish ocular peduncles. The lateral tentacles arise close together beneath the ocular peduncles, and their tips extend further than the median. The palpi are long, flesh-coloured, and tapering, with minute conical papillæ towards the extremity. The tentacular cirri are longer and stronger than the median tentacle, and like the latter, smooth. Body 3½ inches in length, tapering in front and more distinctly posteriorly. The pearly white or flesh-coloured dorsum is finely streaked transversely. Inferiorly a ventral ridge and then a median groove stretch from the shield-shaped area behind the mouth. Proboscis cylindrical, with $\frac{1}{13}^{3}$ papillæ, the upper median forming a long smooth tentacle, the inferior a shorter process with an arch at its base. Maxillæ elongate, with a strong dorsal ridge ending in a hook, and a flattened blade with six to eight teeth. Scales thirty-nine pairs, rounded or campanulate, smooth, the first three pairs covering the dorsum, the rest leaving the centre bare. Foot with a dorsal process in front, a trilobed median and a small ventral process, and with two spines. The dorsal bristles are long and brush-like at the tip (bipennato-penicillate, Kinberg), the median stout and with short broad tips, spinous on one side, and terminating in a long whip (aristate, Kbg.), and ventrally a series of long slender bristles with curved tips finely tapered and spinous (subulato-serrate, Kbg.).

Synonyms.

1857. *Panthalis Œrstedi*, Kinberg. Eugen. Resa. Zool., ii, p. 25, Tab. vii, f. 34.
1859. „ „ Danielssen. Norske Vid. Selsk., Skrifter., Bd. iv, Hefte 2, p. 115.
1861. „ „ Sars. Nyt. Mag. Natur., xi, Hefte 3, p. 253.
„ „ „ idem. Forh. Skand. Naturf., viii, Kjöbenh., 1860, p. 625.
1863. „ „ „ Nyt. Mag. Naturv., xii, Hefte 3, p. 628.
1863. „ „ „ Geol. og Zool. Reise, 1862, p. 46.
1865. „ „ Malmgren. Nord. Hafs.-Ann., p. 85.
1867. „ „ idem. Ann. Poly., 16.
1869. „ „ McIntosh. Rept. Brit. Assoc., 1868, p. 338.

1876. *Panthalis Œrstedi,* McIntosh. Trans. Z. S., ix, 389, 404, 405.
1879. „ „ Tauber. Ann. Danic., 83.
1883. „ „ Levinsen. Nord. Annul., 197.
1893. „ „ Marenzeller. Polychæt. des Grundes, 5, Taf. 1, f. 2.
1895. „ „ Arnold Watson. Trans. Liverpool Biol. Soc., ix, 1895, 169, pls. ix and x.
„ „ *Lacazii,* Pruvot and Racovitza. Arch. Zool. expér., 3rd série, iii, 428, pl. xix, f. 84—104.
„ „ *Marenzelleri,* idem. Ibid., 442, pl. xix, f. 105; and pl. xx, f. 106—110.

Habitat.—First dredged in Britain by Dr. Gwyn Jeffreys in 78 fathoms, 35 miles off Skerries, Shetland, in 1868; 358 fathoms in the Atlantic (station 6) during the 'Porcupine' Expedition of 1870; by the 'Triton' at 516 fathoms; and recently in the Irish Sea by Prof. Herdman and Mr. Arnold Watson. It stretches to the Mediterranean, medium-sized examples having been procured in 40 to 80 fathoms off Jigeli in Algiers, in 40 to 80 fathoms during the 'Porcupine' Expedition of 1870; while Marenzeller obtained it in the eastern part of that sea off Jaffa. It is also found off Norway and Sweden. Its distribution is thus extensive.

The *head* (Plate XXVIII, fig. 16) is somewhat urn-shaped in the preparations, with the rounded bosses for the eyes in front laterally, and the median tentacle in the centre, then dilating from the bases of the former, and again narrowing posteriorly where it runs into the body, without a nuchal collar. The smoothly rounded tips of the ocular peduncles retain no pigment in the preparations; but in life, besides the ocular pigment, the peduncles are reddish. Pruvot and Racovitza consider them the homologues of the lateral peaks of the Polynoidæ—a supposition to which little objection can be taken, since they occupy the whole anterior region of the head. The median tentacle arises rather behind the bases of the ocular peduncles, and thus is behind the middle of the entire region (including the ocular peduncles). Its basal region is short, while the tentacle itself is a somewhat small subulate organ with a tapered tip which extends beyond the peduncles. The lateral tentacles arise close together beneath the ocular peduncles; and their tips reach a little further than that of the median. The palpi are flesh-coloured, long, tapering, and with minute conical papillæ which commence a little above the base and extend almost to the extremity, only a very short portion of the filamentous tip being bare. They are very minute inferiorly, but increase in size distally. Moreover each papilla has a basal granular region, and a clear tip like a jewel in its setting. The tentacular cirri are longer and stronger than the median tentacle, though much shorter than the palpi.

Body $3\frac{1}{2}$ inches and upwards in length, tapering a little in front and more distinctly posteriorly. The dorsum is pearly white in front, flesh-coloured posteriorly, the red dorsal blood-vessel enlivening the general hue of the finely and transversely striated integument. Inferiorly is the deep median furrow and two lateral ridges, the former terminating in front in a broad shield-shaped area. The ventral surface in life is opalescent, with a golden shade towards the sides. Mr. Arnold Watson describes the posterior extremity as being broadly forked from the backward direction of the last pair of feet. No complete specimen, perhaps, has been seen. Anteriorly the segmental eminence is very slightly indicated, but it forms a distinct elevation posteriorly. No papilla is visible.

Proboscis (Plate XXXIV, figs. 3 and 4) exsertile, cylindrical, furnished with $\frac{1}{1}\frac{3}{3}$ papillæ, the median—upper and lower—longer, especially the superior. In the British forms it projects from the mouth like a tentacle, and tapers from base to apex. The inferior, also conical, is much less, and has an inwardly projecting hood or arch at its base. The four maxillæ are elongate, brownish, strongly hooked at the tip, which is a process of the dorsal rib, and with an attached flat blade, the inner edge of which has six teeth (Kinberg says six to eight teeth, while Marenzeller shows in his figure traces of six).

No pregastric cæca occur, and in this respect it agrees with the Sigalionidæ. The stomach is very muscular. The lateral intestinal cæca are large and elliptical, with a narrow neck.

Scales (Plate XXXIV, fig. 5) thirty-nine pairs (Kinberg), in life pearly white, semi-transparent, the first three pairs flattened, covering the dorsum, the rest campanulate, and about one-third the breadth of the dorsum on either side, the centre being bare. "During life these do not rest upon the body, but in front are tilted up, so as to meet at an angle above the prostomium, the last few pairs of elytra also assuming a similar position. . . . A constant rising and falling of the elytra, as though to facilitate the passage of water for the purpose of respiration, was observable" (Arnold Watson). They are perfectly smooth, of fair thickness, and richly supplied with nerve-trunks, as in the Polynoidæ. Mr. Watson found in a living example that posteriorly the last two pairs only met in the middle line, whereas in a specimen in the British Museum, dredged by Sir John Murray in 44 fathoms, the last six pairs did so.

Feet.—The dorsal division of the first foot bears two long and rather slender spines, and several long slender bristles, finely spinous from a short distance above the base to their capillary extremities. The slenderness of these hairs is in contrast with the condition of the homologous organs in the Polynoidæ. The spines are minute.

The second foot is somewhat complex, and is specially interesting in connection with the action of the parts in the formation of the tube, as recently described by Mr. Arnold Watson. The foot is essentially bilobed,—that is, divided primarily into a dorsal and a ventral division, the latter, it is true, being again subdivided. The dorsal division has its spine, and forms an even ridge dorsally—terminating in a projecting globular or clavate knob—directed downwards and projecting as far as the ventral division. Beneath are a series of stiff bristles of the type seen in the foregoing process, but much stronger. They taper from the base to the slender apex, and the short but distinct spines begin a little above the former. The main ventral division is trilobed. The uppermost bristles spring rather above the lobe, point upwards and outwards, and have stout shafts ending in a spinous region dilated at the base and tapering to a slender tip. As we proceed downwards the spinous region becomes more slender and tapering—the enlargement at the base of the region gradually diminishing, and the shafts also becoming more slender. An accessory lobe (bract) occurs at the ventral border, and in it the bristles, though retaining the same type, become more slender, and the tapering spinous region shorter. The ventral cirrus of this foot agrees with the homologous organ in the Polynoidæ, and is apparently used in the same manner. Though certain modifications exist in this foot,

yet the general structure is so much in accordance with the type in others that the functions in all probability are not very diverse.

The third foot presents a short subulate dorsal cirrus and a somewhat clavate dorsal lobe, with finely serrated slender bristles. The ventral is a massive but short lobe, having superiorly a small group of bristles of the type of those in the foregoing foot, the spinous regions being slightly bent backward and downward, with prominent rows of spines at the commencement. Beneath are about six short and strong bristles with spear-shaped tips, slightly curved and quite smooth,—in short, the extremities of the typical series without the spines, but with the accessory process at the tip. These cover the main or central region of the foot, with intervals between. From the accessory process at the ventral edge of the foregoing lobe springs a group of more slender bristles of the type of the superior series, with well-marked alternate spines. In ordinary views (in spirit) the serrated concavity of these bristles is directed upward. As Pruvot and Racovitza observe, one or two simple serrated bristles occur at the inferior border of this foot. They probably indicate the original condition of the series. The subulate ventral cirrus extends beyond the fleshy part of the foot.

The fourth foot has the short slender dorsal bristles under the lobe superiorly. In the ventral division the bristles preserve the same type superiorly, but they have spread a little downward. The tips of the great spines beneath are somewhat longer, and the upper has a slender terminal whip. In like manner the slender inferior bristles have spread upward beyond the two lower strong bristles, their structure, however, showing no marked difference from those of the previous foot. The accessory ventral lobe is a mere notch.

The fifth foot exhibits no noteworthy change except the increased distinctness of the dorsal lobe, and the same may be said of the sixth.

The seventh foot agrees with the foregoing, and shows very well the series of globular warts or papillæ along the dorsal ridge above the cirrus. There are about eight of the stout median bristles with the enlarged tips and terminal brush.

The eighth foot inaugurates a change, for, superiorly, the slender bristles with the brush-like tips have appeared in the ventral lobe, while the dorsal division is only indicated by an elevation without bristles. There are about five of the strong median bristles with the filiform brush, while the inferior group of slender forms with the curved spinous tips remain as before. The glandular apparatus for the peculiar secretion commences in this foot.

The foot and bristles gradually assume the typical condition (Plate XXX, fig. 8), but the foot varies little from the foregoing, presenting a smaller superior and a larger inferior spine projecting in the centre of the median lobe, a rounded process superiorly, then the more prominent median lobe, and an inferior process. The brush-shaped bristles superiorly have very long slender shafts, which slightly dilate distally, then taper and terminate in a point. From the sides of the tapering part a series of long hair-like spines project like a brush (bipennato-penicillatæ, Kinberg), the enlarged region at the base having a shorter series (Plate XLI, fig. 15). The hair-like bristles either form a hair-pencil, as in the figure, or a broader brush at the tip. These bristles occupy about the upper third of the median lobe. Eight or nine strong aristate bristles then follow,

and their shafts are considerably longer than in front; they dilate in a spindle-shaped manner (in antero-posterior view, Plate XLI, fig. 16) at the end of the shaft, and then taper to a blunt point. In lateral view (Plate XLI, fig. 17) this region is somewhat spathulate in outline, the tip being broad, with the end of the shaft slightly bent backward, and finely striated. More than the distal half is covered with fine spines (pinnately arranged), which increase in length distally, and finally terminate at the dorsal edge in a long slender whip of such fibres, one being stronger and far longer than the others, and projecting from the midst of a basal series of large hairs (Plate XLI, fig. 17). These bristles (Grannenborsten of Marenzeller) appear to be capable of repair, one presenting two fractures below the tip, yet quite stiff and useful, the callus in each case being more coarsely striated than the normal bristle. In one small example from 358 fathoms in the Atlantic these bristles have shorter and more acutely tapered tips, and the spines cover three-fourths of the edge, commencing just above the base. Another and larger example from 516 fathoms (H.M.S. 'Triton') shows similar features. The terminal whip is a true prolongation of the shaft, with lateral spines.

At the ventral edge is a group of bristles with long shafts as slender as the superior brush-like forms, a well-marked shoulder or curve as in the anterior bristles (which they closely resemble), and a long tapering curved finely spinous tip (subulato-serratæ, Kinberg). The spinous rows of the curved region are prominent, while the long tapering region beyond has its spines somewhat longer just after its commencement, and thus in antero-posterior views presents a broader feathered arrangement (Plate XLI, fig. 18).

The feet retain the fundamentally bifid condition to the posterior end, both spines being present, though the dorsal lobe is only marked by a slight eminence (devoid of bristles), to which the spine goes. All the bristles are greatly elongated, but they preserve for the most part the characters seen in front. Thus the smoothly rounded ventral division has superiorly long slender bristles with the dilated and serrated tip. The shafts of the strong median series are also much elongated, and the dilated tips are densely spinous like a stiff brush, and closely akin to the condition of certain forms in *Aphrodita aculeata*. No filamentous terminal brush occurs, but the sides of the club-shaped tip are densely bristled, and the spikes project beyond the tip. The filamentous tip may have been abraded in these cases, but this is uncertain.

An elaborate account of the golden yellow fibrous secretion by the spinning glands in *Polyodontes maxillosus*, with numerous finely drawn figures, is given by Dr. Hugo Eisig in his beautiful 'Monograph on the Capitellidæ,'[1] and the arrangement seems to be very similar to that in *Panthalis*. Dr. Eisig considers the fibrous golden yellow secretion as homologous with the spines and bristles of these and other Annelids, and enters into a lengthened description of the structure of similar glandular secretions in both Vertebrates and Invertebrates. The glands are long tubular structures which pour their secretion externally by an aperture in the dorsal papilla above the foot. The threads thus secreted are mingled with mud in the formation of the tube, and Mr. Arnold Watson has described the mode by which the animal ruptures the anterior end, and, throwing it outward, adds layer upon layer in this manner, so as to constitute a massive tube.

[1] Naples, 1887.

Pruvot and Racovitza's view that the spinning glands are the homologues of the dorsal setigerous glands, forming the material for the tube instead of the dorsal bristles, is not free from doubt.

Reproduction.—In a large example procured in July, 1868, in Shetland (78 fathoms), a series of large ova occurred in the perivisceral chamber. The embryo must therefore attain considerable size before extrusion.

Habits.—Like others of the group, *Panthalis Œrstedi* inhabits a tube of mud, about 3½ inches long and about 1½ inches in diameter, with loose extensions of mucus at either end, thus concealing the entrances, and for an example of which I am indebted to Prof. Herdman. The estimated internal diameter of the tube is usually about ⅜ inch, while the thickness of the walls in the centre is about ¼ inch. The tube is composed of a number of layers of the thread-like secretion interspersed with mud, these layers not being parallel, but curving outwards, since, according to Mr. Arnold Watson, from whose interesting account[1] of the habits of the species the foregoing is taken, rupture of the anterior end frequently takes place.

The animal crawls along the surface of the ground, can reverse itself in its tube, and can also swim a little in the water.

The American *Euarche tubifex* described by Ehlers[2] makes a curiously ringed arrangement of the anterior end of the tube, probably due to the gradual narrowing of the calibre of the tube at this end.

Kinberg in 1857 described the species thus:—The cephalic lobe with the peduncles equal to a fifth part of the length of the palpi, tentacular cirri longer than the tentacle; bristles of three kinds, subulate, serrulate, bipennato-penicillate, bearded. No foot papillæ.

Marenzeller published an excellent account, with good figures, of the bristles, as well as pointed out the functions of the spinning-glands in regard to tube-making.

Pruvot and Racovitza give two new species of this genus from Banyuls with accurate and beautiful figures, viz. *P. Lacazii* and *P. Marenzelleri*. After a careful study of the first-mentioned as given in the authors' descriptions and figures, I have doubts as to the need for specific distinction from the British form, though there are a few minor variations, such as the increased size of the so-called branchial papillæ in front. It would also appear to be a question whether the French authors have not placed too much weight on the mere curvature of the ventral bristles of their *Panthalis Marenzelleri*,[3] especially as Kinberg's artist may have had a mounted preparation for illustration, and thus the curves would disappear. The twist or double curvature referred to is present in all the examples of *Panthalis Œrstedi* that have come under my observation, and the bristles of the first pair of feet (bearing the tentacular cirri) are likewise present. The comparative length of the tentacle is not always to be relied on, though in young specimens the tentacle seems to be about the same length. The same remarks apply to the median papilla of the proboscis. The absence of the ceratophore is remarkable. The bristles in young forms show the finer characters better than in the adults—in which

[1] Ibid., pp. 170, 183, &c.

[2] 'Annelida of the "Blake,"' &c., p. 54, Taf. 12, 13.

[3] "Faune des Annél. de Banyuls," 'Arch. Zool. expér.,' 1895, p. 451.

they have been subjected to considerable friction. The most noteworthy distinctions of the French authors are the condition of the second foot, which is exceptionally large, and the commencement of the spinning-glands on the ninth foot instead of the eighth. Further investigation will probably clear up the doubtful points. It has to be stated, however, that considerable variations exist in the common form (*P. Œrstedi*) in regard to the length and bulk of the second pair of feet. Thus, for instance, these were unusually large in an example procured by the 'Triton' in 516 fathoms; and the median tentacle was also much longer than usual, though it did not reach the tips of the lateral tentacles. The spinning-glands began in this on the eighth foot as in the ordinary examples.

Family V.—SIGALIONIDÆ,[1] *Kinberg*, 1857.

Cephalic lobe rounded, often with a nuchal collar posteriorly. No facial tubercle. Median tentacle, when present, generally long, produced from the median part of the cephalic lobe, and with ctenidia at the sides of the base (ceratophore). Lateral tentacles fused with the base of the tentacular cirri, the tips only emerging. Eyes four, occasionally only two, or absent. Palpi long, attenuate and smooth, with buccal ctenidia at the bases.

Body long and narrow. Pharynx with $\frac{9}{9}$ $\frac{11}{11}$ $\frac{13}{13}$ papillæ and teeth. No pregastric cæca. First pair of feet carried in front of the head. Dorsal bristles spinous and tapering. Ventral bristles compound, the terminal region being often long, multi-articulate and bifid. Ctenidia on all the feet. Elytra and cirriform gills alternate in the anterior segments up to the twenty-sixth; those of the middle and posterior part furnished with both elytra and cirriform gills.

Granular epidermic area for the nerve-cords deep, the upper arch being covered by the insertions of the vertical and oblique muscles, the latter attached below the former —on each side of the nerve-area—without intermingling to any extent.

The genus Sigalion was established by Audouin and M. Edwards in 1834, and adopted by Cuvier in the second edition of the 'Règne animal'[2] for two species, remarkable for their general organisation amongst the Aphroditaceans by the simultaneous presence of superior cirri and elytra on all the feet. They did not see eyes in the spirit-preparations, and no branchiæ, the fringes of the elytra perhaps taking the place of the latter. They grouped the Sigalionidæ under the *Aphrodisiens vermiformes* along with the Acoëtes.

Kinberg's fifth family of the Aphroditea is the *Sigalioninæ*, which he characterises as having a long narrow body, the cephalic lobe rounded, occasionally elongate. No facial tubercle. Tentacle not always present, and generally long, the basal region

[1] Dr. George Johnston observes, "Perhaps formed from σιγαλόεις, curiously or anomalously made; but *Sigalion* is a name of Harpocrates, the companion of Esculapius and Hygeia, by whom physicians were obliged to swear that they would observe a religious silence in their profession."

[2] T. iii, p. 207.

produced from the median part of the cephalic lobe. Antennæ, when present, arising from the anterior part of the cephalic lobe. Eyes four, occasionally only two or none. Near the base of the tentacle are two fossæ covered with a membrane—perhaps auditory organs. Palpi long, attenuate, smooth. Tentacular cirri furnished with many bristles. Pharynx with $\frac{9}{9}$ $\frac{11}{11}$ $\frac{13}{13}$ papillæ and teeth. Dorsal bristles serrate, ventral compound. Elytra and cirri alternate in anterior segments, those of the middle and posterior part furnished with both elytra and cirri. He gives four genera—*Sthenelais*, n., *Sigalion*, Aud. and Ed., *Leanira*, n., *Psammolyce*, n. He split up the old genus Sigalion into *Sthenelais* and *Sigalion*. *Sthenelais* he characterised as having a cephalic lobe rounded anteriorly, except where marked by the base of the tentacle. Antennæ short, affixed to the base of the tentacle. Dorsal and ventral divisions of the foot of equal length, the former with serrate bristles, the latter with superior subulate-serrate—occasionally bidentate, and with inferior articulate, the apex being bidentate or serrate. Elytra covering the entire dorsum.

Ehlers, in his 'Annelids of the United States Expeditions' (1887), follows Grube's arrangement of this group with Kinberg's subdivisions.

Genus XXIV.—Sthenelais, *Kinberg*.

Cephalic lobe rounded anteriorly, with a nuchal collar posteriorly in the preparations. A pair of ctenidia at the base (ceratophore) of the median tentacle; lateral tentacles fused with the first foot; tentacular cirri more or less separate. Palpi long, subulate and smooth, springing from the ventral surface of the cephalic lobe, but fusing with the first foot. A pair of scoop-shaped ctenidia at the base. Scales covering the dorsum; fringed. Dorsal and ventral divisions of the foot of equal length. Segmental eminence at the base of each foot, and a ciliated funnel-shaped process on the foot. A well-developed branchial process on every foot, and on the dorsal ridge beneath it three T-shaped ciliated organs. Dorsal bristles long, stiff, finely tapered, and spinous. Upper ventral bristles with simple tips—boldly spinous; next come compound bristles, at first with a terminal region of three segments, then with one joint, and at the ventral edge with one to four joints—all with bidentate tips. They are arranged in the foot after the outline of a horseshoe (in transverse section). Nerve-cords in a deep area, almond-shaped in section.

Grube, in the 'Annulata Semperiana,' defines the genus thus:—Body vermiform, segments more or less numerous, alternating. Elytra on the second, fourth, fifth, and on the unequal segments to the twenty-third, the intermediate segments bearing branchiæ, the rest furnished with both organs. Scales covering the entire dorsum. One frontal (median) tentacle. Two palpi (his subtentacula). First foot thrown forward with the cephalic lobe, and furnished with bristles and short tentacles. Other feet biramous and with ventral cirri. Superior bristles simple, barbed; inferior bristles compound or with other kinds. Elytra thin.[1]

[1] *Vide* previous brief description in 'Sitz. Schles. Gesell.,' 1874.

Carus in the 'Prodromus Faunæ Mediterraneæ' gives the following:—Head with median antenna and generally two short lobulated or fleshy-membranous organs at the base; maxillæ well developed; feet all furnished with branchiæ, and the anterior pair turned to the front, so that the cirri and setæ form part of the cephalic apparatus; body elongate, vermiform.

Pruvot and Racovitza[1] have recently drawn attention to the homologies of the head-processes in *Sthenelais*, and express the view that the subulate cirrus which springs from the inner side of the bristle-tuft of the first foot (bearing the tentacular cirri) is the lateral tentacle (their lateral antenna). In their descriptions they further point out the exact arrangement of the dorsal and the ventral bristles, the latter forming a horseshoe with the opening in front, and with a spur dorsally and ventrally, each of the latter being characterised by a change in the structure of the bristles.

1. Sthenelais boa, *Johnston*, 1833. Plate XXVI, figs. 7 and 8.

Specific Characters.—Head crimson, broadly ovate, bounded by a nuchal collar posteriorly. Median ridge passes in front into the broad basal process (ceratophore) of the median tentacle, which is short and subulate. Two flap-like organs (ctenidia) occur at each side, the anterior the longer. Two eyes on each side, the larger anterior pair almost hidden by the latter processes, and looking forward and outward. The posterior pair are on the dorsum, a little behind the bases of the processes. A truncated papilla at each side of the head posteriorly. Head fixed to the massive parts of the first feet, which bear externally two tapering cirri of considerable length. Behind the dorsal tentacle is a T-shaped ciliated process. To the inner side of the ventral cirrus of the first pair of feet is a sickle-shaped blunt appendage (ctenidium)—richly ciliated, and probably branchial. A short subulate cirrus (lateral tentacle) exists superiorly on the inner side of the bristle-tuft. The long, subulate, and smooth palpus springs from this basal process, which also carries a double series of long, tapering, slender, spinous bristles. Body elongated, little tapered anteriorly, but gradually diminishing posteriorly. It is rounded dorsally and flattened ventrally, greyish or bluish-green, the latter or flesh-colour characterising the iridescent ventral surface. Segmental eminence at the base of each foot, and a ciliated funnel-shaped process on the foot. Scales 156 pairs; mostly reniform, and with numerous minute papillæ, while the outer border bears a series of large simple papillæ. A well-developed branchial process exists above each foot, and on the dorsal ridge beneath it are three T-shaped ciliated organs (ctenidia). The dorsal bristles are long, somewhat stiff and finely tapered, as well as spinous from a little above the base to the apex. Upper set of the ventral bristles with simple tips, boldly spinous; then some with a tapering bifid appendage of about three joints, the end of the shaft having a few rows of spines. The main part of the division, forming the large curve of the horseshoe, has stout bristles with bevelled ends to the shafts, and a short beaked appendage of one segment. Inferiorly the lower spur of the horseshoe has

[1] 'Archives Zoolog. expér.,' p. 452, 3e Sér., iii, 1895.

more slender forms, with a few rows of spines on the slightly expanded distal regions of the shafts, and an appendage of one to four joints. A group of long papillæ occurs at the anterior edge of the superior division, one above the spine of the ventral division, and a ciliated or papillose frill is found at the base of the lowest slender bristles. Ventral cirrus elongate, subulate, barely reaching the tip of the fleshy part of the foot.

Synonyms.

1833. *Sigalion boa,* Johnston. Loud. Mag. Nat. Hist., vi, 322, f. 42.
1839. „ „ idem. Ann. Nat. Hist., ii, 439, pl. xxiii, f. 6—15.
1843. „ *Idunæ,* H. Rathke. Nova Act. Acad. Cæsar. Nat. Cur., xx, 150, Tab. ix, f. 1—8.
1851. „ „ Grube. Fam. Annel., p. 38.
„ „ *boa,* Williams. Rept. Brit. Assoc., 1851, p. 201.
„ „ *Idunæ,* Sars. Nyt. Mag. Natur., xi, 3, p. 254.
1861. „ „ idem. Vid. Selsk. Förh., 1861, p. 1 (sep. copy).
1865. „ „ Malmgren. Nord. Hafs.-Ann., p. 86.
„ *Sthenelais Idunæ* and *S. boa,* De Quatrefages. Ann., i, p. 276.
„ *Sigalion boa,* Johnston. Cat. Brit. Mus., 124, pl. 13, f. 6.
1867. „ „ Parfitt. Annel. Devon., p. 19.
1873. *Sthenelais Idunæ,* Sars. Bid. Christ. Faun., p. 14.
„ *Sigalion Idunæ,* Willemoes-Suhm. Zeit. f. w. Zool., xxii, p. 347.
1875. „ „ Ehlers. Annel. 'Porcupine,' 1869, op. cit., p. 18.
1876. *Sthenelais boa,* McIntosh. Trans. Zool. Soc., ix, p. 390.
1879. *Sigalion Idunæ,* Tauber. Ann. Danic., 83.
1880. *Sthenelais Idunæ,* Langerhans. Zeit. f. w. Zool., xxxiii, p. 276, Taf. xiv, f. 6.
1883. *Sigalion Idunæ,* Levinsen. Nord. Annul., 199.
1884. „ „ V. Carus. Faun. Medit., p. 205.
1888. *Sthenelais Idunæ,* De St.-Joseph. Ann. d. Sc. Nat. (7), v, p. 187, pl. viii, f. 55.
1890. *Sigalion Idunæ,* Malaquin. Ann. Boulon., p. 23.
1891. „ *boa,* Hornell. Op. cit., p. 238.

Habitat.—Ranges from Shetland to the Channel Islands, being procured by the dredge in the former and between tide-marks in the latter. It appears to be a generally distributed species, frequenting both shores of Ireland, and extending to Norway and Sweden. Ehlers gives a depth of 60 to 80 fathoms in the Minch during the 'Porcupine' Expedition of 1869. Shores of France.

Head (Plate XXIX, fig. 1) of a fine crimson hue, somewhat broadly ovate, and separated from the body by a nuchal collar. Anteriorly a median ridge terminates in the broad basal process for the pale median tentacle, which is comparatively short. At the sides of the basal process (ceratophore) are a pair of flap-like organs (ctenidia), the anterior being the longer, the posterior the shorter. Both are rather flattened, and move freely with the broad tentacular base (first foot) on the head—which is fixed. At their base externally on each side are the eyes, the anterior and larger pair of which are almost hidden under these processes—when viewed from the dorsum, especially as they are also placed on the front of the head so as to look forward and outward. The posterior pair lie a little behind their bases on the dorsum. At the posterior border on each side is a well-marked process or papilla with a truncated tip (one of the "organes nucaux"). The

head is fixed inferiorly to the massive bases of the tentacular cirri (first foot). Externally two tapering cirri of considerable length occur, one, the longer, from the dorsal edge, and another a little shorter from the ventral edge above the palpi. Behind the dorsal tentacle is a T-shaped ciliated process (ctenidium). To the inner side of the ventral cirrus is a sickle-shaped blunt appendage (cuilleron céphalique, or buccal ctenidium), richly ciliated and continuous with a well-marked ridge on the inner surface of the basal process. On the inner side of the bristle-tuft superiorly, again, is another short subulate cirrus, the homologue of the lateral tentacle (Pruvot and Racovitza). The long subulate and smooth palpus springs from the middle of the ventral face of the basal process, and has a scoop-shaped flap (ctenidium) ensheathing it internally. The first foot carries a double series of bristles directed forward and inward, and consisting of somewhat stiff, long, slender, curved bristles closely spinous towards the tip. The upper series of bristles had many-stalked infusoria like *Rhabdostyla*.

Body four to eight inches in length; elongate, not much tapered anteriorly, but gradually diminishing posteriorly; rounded dorsally and flattened ventrally, composed of 170 to 200 or more bristled segments. The dorsal surface is marked anteriorly by transverse lines, and the median region forms an elevated ridge, and sometimes has a bluish-green or ochreous colour. The post-cephalic ridge has at its sides small ciliated processes, which at first sight resemble parasites. The ventral surface is of an iridescent flesh-colour, or bluish-green (from eggs) marked by the red central vessel, and with a raised transverse line between the centres of the feet. Posteriorly the body terminates in two tapering caudal styles.[1] A segmental eminence occurs at the base of each foot, and on the adjoining region is a little funnel-shaped papilla, but apparently unconnected with the former. In the anterior feet the funnel is in the centre of the base of the foot, but it by-and-by moves forward, so that throughout the rest of the body it is near the anterior edge of the foot. The funnel-shaped papillæ are continued from the fourth bristled feet to near the top of the tail; about twenty segments, however, are devoid of them. In the males this funnel-shaped organ does not appear to be present, but the segmental eminences are very prominent, and have an oblique crest. In spirit the sperms sometimes form masses of a rope-like character externally, as if they had issued (on immersion in spirit) from a minute pore. The cuticle is considerably thickened over the nerve-area.

The *proboscis* has eleven papillæ on each half (dorsally and ventrally). These are large and somewhat conical, slightly constricted at the base, and with a projection internally about the middle. The teeth do not seem to bite alternately, as in the Polynoidæ, but the lower pass in front of the upper pair (Plate XXVI A, fig. 21).

No pregastric cæca are present, but short intestinal cæca occur laterally.

Scales (Plate XXXIII, fig. 16), 156 pairs, covering the entire dorsum, of a greyish hue, the anterior especially showing numerous dark brown grains; all however possess them, unless when recently reproduced. Towards the posterior end they have a broad band of dark grey or brownish grey along the posterior border internally, and occasionally externally a dappled condition or grains of the same dark grey colour. A

[1] Body terminated by four small cirri (De Saint-Joseph).

very pretty and symmetrically tinted arrangement thus pertains in this region. The first pair of scales are somewhat ovate, the rest more or less reniform, and they are tough,—adhering, moreover, with considerable tenacity to the tubercles. Their surface is entirely covered with minute papillæ, which are often tinted brownish, and along the anterior and neighbouring part of the outer border are a series of massive and simple cilia, somewhat constricted at the base, then dilating and tapering to a blunt tip. Some show a branch or knob near the base. In the other scales a portion of the outer and anterior region is devoid of the minute papillæ, whilst amongst the cilia of the outer border are numerous minute globular papillæ. Both extend here and there within the border. The inner or rounded anterior lobe of the scale has the papillæ up to its border. The scales occur on the first bristled foot, third, fourth, sixth, eighth to twenty-fourth, twenty-sixth, twenty-seventh, &c., to the end of the body. In the terminal region the small scales retain the same characters, though a patch devoid of papillæ occurs on the anterior part of the rounded inner lobe, and the cilia along the external border are smaller, more slender in proportion, and more numerous. The minute papillæ on the surface occasionally project beyond the border posteriorly in all the scales, and the gradual elongation of the cilia externally shows that they are modifications of the same organs. The largest papillæ occur on the exposed part of the scale. Finely branched nerves supply the entire organ. The scales often have a blackish or brownish deposit of granular matter on their surfaces. It seems to be the same as that which occurs in the Polynoidæ. In young examples the papillæ on the scales are proportionally large, and occasionally sand-grains adhere. The cilia also are somewhat larger.

Feet.—The second foot shows dorsally two ciliated lobes. It has two powerful spines. The dorsal division is indicated by the nature of the bristles and by the issue of the spine beneath them. The dorsal bristles consist of the same slender, elongated, finely spinose forms seen in the previous process, the tips of most being broken. They have the infusorial parasites formerly indicated and fine filaments of an alga. The ventral division bears much stronger bristles, the stout shafts of which merge into the distal spinous region without evident change. The slightly alternate rows of spines are prominent, and this region ends in a long, tapering, articulated appendage terminating in a bifid tip, the dorsal process being hooked. Just above the lower edge of the ventral region a series of large, lobate papillæ project, and below the bristles are a curved series of minute papillæ. The ventral cirrus, as in the previous groups, is large and tapering, its tip extending considerably beyond the fleshy part of the foot. The funnel-shaped papilla external to this organ is absent.

The third foot shows a T-shaped ctenidium dorsally. The dorsal division of the foot is more clearly indicated by a fissure, and its lower border is furnished with large clavate papillæ. The bristles curve upward and inward, their convexity being thus external. The bristles of the ventral division have already a tendency to form groups. Thus the upper six of the ventral series consist of moderately stout shafts with simple tapering tips which are coarsely spinous inferiorly and finely spinous distally, the tip being smooth. Then follow the stouter forms, as in the second foot, with spinous regions distally and a jointed, tapering, bifid appendage. Amongst these, however, are some with an unjointed terminal appendage, a powerfully hooked tip, and a strong

secondary process, so that the end is like a bird's beak. Those at the ventral edge again are much more slender, have a slightly dilated spinous region, and a five-jointed bifid appendage. Two groups of clavate papillæ occur on the edge of the foot above them and a row of smaller papillæ at their bases ventrally. The ventral cirrus extends fully as far as the fleshy part of the foot, and internal to it is a funnel-like, ciliated process.

The typical foot (Plate XXXI, fig. 5) presents dorsally a richly ciliated branchial process somewhat subulate in outline, and which is evident at the fourth foot. Beneath, on the dorsal curve, are three T-shaped ctenidia. Another ctenidium lies on the posterior border of the foot deeply placed in the interpedal fissure. In the middle of the body others occur on the dorsum of the foot and behind the elytrophore. Pruvot and Racovitza observe that they all have the same structure, viz. conical epidermic cells with their bases at the broad end and their points at the pedicle of the organ; they are richly ciliated distally. The dorsal lobe is considerably less than the ventral; the bristles (Plate XLI, fig. 19) are long, slender, and boldly spinous from a little above the base to the tip. Viewed from the side they form a beautiful fan directed laterally with the digit-like papillæ at the anterior border of the base. Though slender they are somewhat stiff and curved—with the concavity upward (Plate XLI, fig. 20). The spines form even transverse rows, thus differing from the alternate series so common in this group and in the Polynoidæ. The transverse arrangement, however, may render them more brittle. The dorsal lobe is separated from the ventral by a deep fissure, and has a series of long papillæ at its tip. The ventral lobe is massive, with a truncated extremity which bears the spine in its middle, and usually a single digit-like papilla. A fold of skin, arising at the upper part of the lobe, passes down posteriorly and curves to the front, separating the more slender ventral bristles from the stout series. In the posterior part of the body the commencement of this ridge of skin forms a free flap. The upper group of the ventral series consists of the moderately stout forms with the simple spinous tips (Plate XLI, fig. 21), and also a few with about three joints to the tapering, bifid appendage, the tip of the shaft having a few rows of spines. The centre of the foot is occupied by a series of stout shafts bevelled at the tip, and with a short appendage of one segment (Plate XLI, fig. 22), and the beak-like, bifid extremity. In some, transverse striæ indicate traces of spinous rows. Those of the upper series have longer and more slender appendages. Ventrally is a group of slender bristles forming a row directed forwards and outwards, then downwards and outwards, each with a few rows of spines on the expanded distal end of the shaft and appendages of one to four joints (Plate XLI, fig. 23). These spring from a notch at the ventral edge and within the tip of the foot, the inner border of the notch being marked by a series of small papillæ. In the region of the spine, which pierces the middle of the foot, is a long and somewhat fusiform papilla. So far as the structure of the bristles is concerned, the type remains the same in the terminal feet, though the bristles diminish in size. The median stout bristles have longer and more slender hooked appendages, and the backward curve of the end of the shaft is more marked. The papillæ are fewer. The ventral cirrus is subulate and tapering, extending to about the tip of the fleshy part of the foot. A spur or process occurs at its inner border above the basal segment. A well-marked ctenidium is placed a little

internal and anterior to the cirrus. The dorsal hairs are prone to deposits of mud, algoid growths, and stalked Infusoria, their colour thus being often brownish or greyish; while *Loxosomæ* abound on the feet, under the scales, and other parts.

Pruvot and Racovitza give a good figure,[1] showing the arrangement of the lobes, papillæ, and bristles in a typical foot. Dorsally the papillæ (stylodes) occupy the anterior region and pass beneath the division. Ventrally, the flaps, which they call parapodial bracts, envelop the foot above and beneath, as well as superiorly in front, the antero-inferior being scolloped, each process being terminated by a sensitive palpocil.

Reproduction.—Large specimens in the Channel Islands were laden in August with fairly advanced greenish eggs in enormous numbers. The males had also the peri-visceral chamber charged with sperms, which issued, after immersion in spirit, from the bases of the feet.

Development.—Larval forms occurred, towards the end of October, with bluish anterior digestive organs in the metatroch stage, with two kinds of bristles,—viz. long, curved, serrated bristles, somewhat like those of *Polynoë*, and shorter compound forms. Viewed from the front superiorly (Plate XXVIA, fig. 22), two eyes lie on each side. An oblique lateral view shows the feet of one side and the caudal cirri. The first and last bristle-tufts are simple and short, and about seven pairs of feet are visible. Only a single, long, and comparatively strong, swimming bristle occurs in each foot, the curved tip being distinctly and somewhat widely serrated on the convex edge. Such, therefore, would appear to be a modification of the serrate dorsal bristle, which is functional at this stage. The ventral bristles had dilated ends to the shafts—with the usual oblique termination and a distal region of two segments. It is uncertain whether these young forms pertained to this genus or to *Sigalion*.

Habits.—They are somewhat sluggish animals, usually lurking under stones between tide-marks, where they rest on a sandy bottom, though occasionally small examples are found in pure sand as at Southport. They form curious coils in vessels in confinement, and appear to be nocturnal. So far as my specimens go, the finest are those between tide-marks, Herm, while next to these, and only a very little less, are those between tide-marks at St. Andrews. Those procured in the sand of the Zetlandic voes are much smaller, and the same may be said of those from the outer Hebrides. Average examples come from the west coast of Ireland.

This species was introduced, in 1833, to science by Dr. G. Johnston, who found it in Berwick Bay under stones near low-water mark. He says it is somewhat sluggish, but burrows in sand with rapidity. Moreover that it is the Goliath of its race, and preys on its fellow-worms. It is probable that Rathke, in 1843, referred to this species under the title mentioned (*S. Idunæ*). The *Sthenelais Edwardsii* of De Quatrefages (1865) seems to be this species. He placed next the foregoing the *Sigalion Mathildæ* of Audouin and Edwards, for he thought they included two species under that title. He entered the *Sthenelais Idunæ* of Rathke, and the *S. boa* of Johnston as separate species.

Langerhans (1880) describes *Sthenelais Idunæ* from a depth of twenty fathoms off Madeira. He points out the reddish colour of the head (from the brain), the ringed base of

[1] Op. cit., p. 463, fig. 12.

the tentacle (his antenna), the ciliated rosette of the first segment, chitinous papillæ, and fringed scales (simple papillæ), and gives the detailed structure of the feet with figures. De Saint-Joseph (1888) observed many examples of *Halacarus olivaceus* on the body of one. He agrees with me in thinking that *S. Idunæ*, Rathke, is identical with *S. boa*, Johnst.

2. Sthenelais zetlandica, *McIntosh*, 1876.

Specific Characters.—Head absent, and body fragmentary. Scales somewhat reniform or irregularly rounded, densely covered with low flat papillæ, the outer and part of the posterior edge bearing a closely arranged series of minute clavate cilia. Dorsal lobe of the foot rather long, and obliquely bevelled from above downward, bearing a tuft of bristles that are longer and more finely spinous than in *S. boa*. Beneath the spine are a series of small papillæ with truncated and papillose extremities. Ventral lobe irregularly conical, with numerous papillæ, at the tip of which are the secondary processes or warts. Along the ventral border is a series of globose warts. The upper ventral bristles have proportionally strong shafts, with four or five rows of spines at the distal end, and a terminal bifid appendage usually of two joints. The slender inferior ventral have three divisions in the terminal appendage—all with a hooked tip, and a secondary process beneath.

Habitat.—Dredged off the Shetland Islands by Dr. Gwyn Jeffreys in 1867. Mr. Harvey-Gibson found a fragment (?) off Port Erin, Isle of Man.

Synonyms.

1876. *Sthenelais zetlandica,* McIntosh. Trans. Zool. Soc., ix, 390, pl. lxx, f. 15—17.
1886. „ „ Harvey-Gibson. Verm. Liver., p. 151.
1891. „ „ Hornell. Op. cit., p. 238.

Head.—Absent in the preparation, and the anterior end injured. The proboscis appears to have the ordinary structure—with the horny teeth, and the dorsal and ventral rows of conical papillæ.

Body.—About the size of *Sthenelais limicola*, and having a similar appearance. The *scales* are somewhat reniform, or irregularly rounded anteriorly, and the entire surface densely covered with flat papillæ, which on the folded edge of the scale form low, smooth warts, larger in proportion than in *Sthenelais boa*. The outer and part of the posterior edge again bear a somewhat closely arranged series of minute clavate cilia (Plate XLI, fig. 24), almost globular at the commencement on the posterior border, and with minute processes or palpocils on the summit, those on the outer edge being more slender than those on the posterior border.

The *feet* (Plate XXX, fig. 14) have dorsally a branchial process and three ciliated T-shaped organs beneath. The superior lobe is rather long, and obliquely bevelled from above downward. It bears beneath the spine a series of rather small papillæ, which have truncated extremities provided with several accessory papillæ. The superior bristles are longer in proportion than in *S. boa*, but do not form so broad a fan

when viewed laterally. They taper to a delicate extremity, and their rows of spines are distinctly marked, though somewhat finer than in *S. boa*. The inferior lobe is irregularly conical, and has numerous papillæ, the largest near the spine, and just above the inferior group of bristles. Moreover below the latter is a cluster of smaller papillæ furnished with the secondary processes or warts at the tip. After a brief interval, a series of globular warts occurs along the ventral border of the foot. The superior ventral bristles (Plate XLI, fig. 25, in calcium chloride, and with the basal part of the terminal appendage slightly folded) have comparatively strong shafts, with four or five rows of spines at the dilated distal extremity, visible, however, only at its edge. The terminal appendage as a rule consists of only two divisions, occasionally a more slender form at the upper border having three. In those with two the terminal portion is only one fifth the length of the basal. The claw at the tip is distinct and much curved, and the secondary process projects at a slight angle, the point often touching the tip of the claw. The basal joint is finely striated, as is likewise the dilated end of the shaft. As we proceed downwards these bristles become less robust, and the shaft has a more distinct dorsal curvature, but the terminal region of two divisions remains. Each of the more slender ventral groups, again, has three divisions in the terminal appendage (Plate XLI, fig. 26, which represents one of the larger forms). The bristles throughout are tinted of a light brownish hue.

The ventral cirrus is subulate, and it reaches nearly as far as the fleshy part of the foot (in spirit). The terminal region, which is elongate-ovoid, is marked from the succeeding by a distinct shoulder, as if articulated.

The absence of the head makes the generic relations of this species doubtful, but in the meantime it may be placed under *Sthenelais* until a more complete example is obtained. It is one of the many rare forms which the persevering explorations of Dr. Gwyn Jeffreys in the Zetlandic seas brought within our knowledge.

The *S. fuliginosa* of Claparède[1] is an allied form, and the *S. minor* of Pruvot and Racovitza[2] also approaches this species in regard to the structure of the papillæ and the general character of the bristles, but differs in the presence of papillæ along the ventral edge of the foot, and it has fewer papillæ on the scales than in the British form.

3. Sthenelais atlantica, *McIntosh*, 1876.

Specific Characters.—Head somewhat ovoid. Median tentacle subulate, and with a terminal joint. A pair of eyes close together on each side, near the base of the tentacle. Palpi long, smooth, and tapering. Tentacular cirri show a terminal differentiation, as in the median tentacle. Body as in *S. zetlandica*. Scales thin, rounded or ovoid in front, reniform throughout the rest of the fragment, covered with sparsely distributed but clavate cilia, and having a fringe of short clavate cilia, which are only absent from a portion of the inner and adjoining anterior margin. They are longer and more numerous than in *S. zetlandica*. Dorsal lobe of the feet bevelled from above

[1] 'Ann. Chét. Naples,' p. 94, pl. iv, f. 2.

[2] 'Archives Zool. expér.,' 1895, p. 465.

downward, and with papillæ like those of *S. zetlandica*. The bristles are similar, though in the smaller specimen finer. The ventral lobe is conical, with long papillæ,—as in *S. zetlandica*. The upper ventral bristles have about six rows of spines at the dilated distal region of the shaft, and the terminal process has three or four segments. The tips are slender and bifid, the secondary process having no appreciable angle to the axis. The next lower forms are stouter, with a beak-like extremity. The inferior bristles are slender, with about two rows of spines at the end of the shaft, and a tapering terminal appendage of two or four divisions, bifid at the tip. Apparently three ciliated pads (ctenidia) occur on the dorsum. The ventral cirrus is slender, and rather shorter than the fleshy part of the foot.

Synonym.

1876. *Sthenelais atlantica*, McIntosh. Trans. Zool. Soc., vol. ix, p. 405, pl. lxxii, f. 16, 17.

Habitat.—From the entrance of the British Channel to the Atlantic deeps in 305 fathoms, Station 2, 'Porcupine,' 1870. The ground seemed to have been sandy.

Head (Plate XXIX, fig. 2) somewhat ovoid in outline, a small subulate tentacle with a terminal joint in front, and a pair of eyes situated close together on each side near the base (ceratophore) of the organ. The palpi are very long, smooth, and tapering, and the tips of the tentacular cirri show a terminal joint as in the median tentacle.

Body.—Slightly narrowed in front, but as the feet project laterally and forward, the outline anteriorly is really broad and gently curved laterally. Only about 10 mm. of the body remain, and the specimen appears to be small.

Scales (Plate XLI, fig. 27) somewhat thin, rounded or ovoid in front, reniform throughout the rest of the fragment, covered with sparsely distributed but distinct clavate papillæ, and having a fringe of short clavate cilia, which are only absent from a portion of the inner and adjoining anterior margin. Four of the longest, indeed, occur on the outer lobe of the anterior margin near the hilus. They are longest anteriorly. The cilia (Plate XLI, fig. 27) are decidedly longer and more slender, as well as more numerous than in *S. zetlandica*, and palpocils occur frequently on the extremity.

Feet (Plate XXX, fig. 14) resemble those of *S. zetlandica*, having a projecting dorsal lobe bevelled from above downward, and the papillæ have similar dimensions. The bristles are somewhat finer, and the serrations or spinous rows closer, but the specimen is smaller. The ventral lobe is conical, with similar long papillæ, the secondary processes or warts at the tip of these being distinct. The superior ventral bristles (Plate XLI, fig. 28) have about six rows of spines at the dilated distal regions of the shaft; and the terminal appendage has three or four segments, the basal, in the case of those possessing four, being about as long as the three distal. The tips are slender and bifid, the secondary process having no appreciable angle to the axis, so that it lies close to the hook. The next lower series are stouter, with about four distinct spinous rows on the distal end of the shaft, and a terminal appendage of one or two segments, the tip resembling the beak of an eagle. The inferior are slender, with about two rows of spines at the dilated end of the shaft, a terminal appendage of two or four divisions, and a tapering, delicately bifid tip. The shafts of all the ventral bristles have a backward curve distally. A branchial process, and apparently three ciliated pads

(ctenidia) occur on the dorsum, but the specimen is not in a condition to speak decisively. The ventral cirrus is slender and rather short, the tip being shorter than the fleshy part of the foot. The preparations would seem to indicate a joint at the tip. In a former note it was mentioned that some minute warts appear along the ventral margin of the foot, but the preparations are now doubtful on this point.

The species comes near *S. zetlandica*, yet the points indicated seem to warrant separation. Both species approach Claparède's *S. ctenolepis* from the Mediterranean,[1] but yet are sufficiently distinct.

4. Sthenelais limicola, *Ehlers*, 1864.

Specific Characters.—Head ovoid with the long diameter transverse, and median space bounded by a brownish crescentic line on each side. Anterior and larger pair of eyes often scarcely visible from the dorsum, being situated under the lateral processes at the base (ceratophore) of the median tentacle, and looking forward. Posterior pair of considerable size, a little behind the base of the median tentacle. Both occasionally show a pale speck in the centre, as if from a lens. Base of the median tentacle (ceratophore) somewhat conical (in spirit); tentacle of moderate length, the filiform tip being slightly enlarged, and with a trace of an articulation. On each side of the base is a flattened spathulate process (ctenidium). First foot fused ventrally with the base of the long, tapering, smooth palpus, with a small sheath-like process (ctenidium) at its base internally; then come a filiform ventral tentacular cirrus and a much larger dorsal cirrus, and internally to the ventral cirrus a broad scimitar-shaped process (ctenidium). Above and behind the latter is the small terminal region of the lateral tentacle. Proboscis trumpet-shaped in extension, with eleven conical papillæ dorsally and ventrally. The teeth appear to bite as in *S. boa*. Body elongate, more than two inches long, and having about 128 segments. It tapers to a slender tail with two styles. Segmental eminence opposite each foot; no papilla. Scales smooth, translucent, brownish, covering the back. First pair rounded, each with short clavate cilia along its outer border, and a few larger digit-like forms at its anterior and outer margin. The others are more or less reniform, the outer margin thin, folded, and having irregular processes—simple, bifid, or irregularly divided. In the posterior scales the outer margin is bilobed, and in those near the caudal region a belt of large round vesicles occurs in the hypoderm in front of the scar: a touch of brown is present in some scales. Feet with branchial process, and three ciliated pads (ctenidia) dorsally. The dorsal lobe is prominent, somewhat clavate in outline, and has anteriorly four or five long papillæ (stylodes) from its upper end, the spine projecting inferiorly. The bristles are long, slender, tapering, and finely spinous. The ventral lobe is shorter and broader, somewhat conical at the tip, and bears one leaf-like lobe above the spine, and a smaller lobule at the ventral edge, a long papilla (stylode ?) likewise being attached to the former region. Upper bristles like those in *S. boa*, with simple spinous tips, only more slender. The next have slender shafts with long tapering tips of twelve or more segments, and minutely bifid. A

[1] 'Ann. Chét. Naples,' 88.

stouter series follows, also with long bifid tips, the shafts becoming more slender in the lower group. Lastly is a more delicate group at the ventral edge, having bifid distal appendages of from five to ten articulations. The ventral cirrus is long and tapering, with a terminal segment.

Synonyms.

1853. *Aphrodita arcta,* Dalyell. Pow. Creat., ii, p. 170, pl. xxiv, f. 14.
1864. *Sthenelais limicola,* Ehlers. Borstenw., 120, Taf. iv, f. 4—7; Taf. v.
1868. „ *leiolepis,* Claparède. Ann. Chét. Nap., 96, pl. iv, f. 3, and pl. vi, f. 1.
1869. „ *limicola,* McIntosh. Trans. R. S. E., xxv, 410.
1875. „ „ idem. Invert. and Fish., St. A., p. 118.
1876. „ „ idem. Trans. Z. S., ix, pp. 390, 476, pl. lxx, f. 13.
1884. „ „ V. Carus. Faun. Medit., p. 205.
1891. „ „ Hornell. Op. cit., p. 238.
1895. „ „ Pruvot and Racovitza. Arch. Zool. expér., p. 473, pl. xx, f. 122, 123.

Habitat.—First dredged by Dr. Gwyn Jeffreys in sixty to eighty fathoms off North Unst, in St. Magnus Bay, and the Outer Haaf, Skerries, in Shetland in 1867. It is very abundant off St. Andrews, probably in sand, and is tossed on shore in large numbers during certain storms. While it is not common in the dredge, the cod seems to find it readily, and so do the flounder and other fishes. In the 'Porcupine' Expedition of 1869 it occurred in 30 to 370 fathoms off the Irish coast, and a small eyeless variety in 420 fathoms. It ranges from Shetland to Cornwall, and has been found chiefly in water of some depth,—never, at any rate, between tide-marks. It extends likewise to Norway (Canon Norman), to Quarnero in the Adriatic, to the shores of Canada, and the United States of America.

Head (Plate XXIX, fig. 3) somewhat ovoid in outline, with the long diameter transverse. The median space is marked by a brownish crescentic line on each side, which Ehlers compares to an H. The posterior pair of eyes are situated a little behind the base of the median tentacle, are of considerable size, and sometimes show a pale speck in the centre, as if from a corneal lens. The anterior pair are scarcely visible from the dorsum (indeed, they escaped Ehlers), being situated under the lateral processes (ctenidia) at the base (ceratophore) of the median tentacle, and looking straight forward. They are somewhat larger than the posterior, and also occasionally show a pale speck in the centre. The ceratophore of the median tentacle is somewhat conical in spirit, but Ehlers says cylindrical in life, and from it a tapering tentacle (ceratostyle) of moderate length passes. The filiform region shows a slight enlargement at the tip in spirit, and a trace of an articulation at its commencement. On each side of the base is a flattened spatulate process (ctenidium) with long cilia. The frontal lobe carries ventrally the very long, tapering, smooth palpus, with a small sheath or membranous collar at its base internally, then a slender filiform ventral cirrus; dorsally a much larger dorsal cirrus, and internally to the ventral cirrus a broad scimitar-shaped process (cuilleron céphalique, Pruvot and Racovitza). A little behind and internal to the dorsal cirrus is the tip of the lateral tentacle, which Racovitza followed backward to its attachment to the head. In his description Ehlers omits the scoop-like process at the

base of the palpus. His view of the parts, indeed (Taf. iv, fig. 6), differs from what our specimens would have exhibited in life.

Proboscis.—The teeth are similar to those of *S. boa*, the lower pair apparently biting in front of the upper; but preparations are not always to be relied on in this respect. The number of conical papillæ dorsally and ventrally is eleven. It is curious that few or none eject the organ in spirit, whereas the gastric juice of the stomach of the cod causes full protrusion, the broad end of the trumpet-shaped structure being distal. Moreover a pair of oblique elevated ridges occur dorsally and ventrally near the tip.

Body.—The body is elongate, some of the imperfect specimens being nearly two inches in length. Ehlers gives 57 mm. and 128 segments, and one of the contracted perfect forms is larger than Ehlers' examples. Pruvot and Racovitza record a length of 95 mm., and a total breadth of 4 mm. It tapers posteriorly to a delicate tail which has two caudal cirri. The body is rounded dorsally, flattened ventrally. A segmental eminence occurs at the base of each foot, but no distinct papilla.

Scales numerous, translucent, rounded in front, irregularly ovate or somewhat reniform posteriorly, and cover the back. They are of a light brownish hue, best marked in front. They occur on segments 2, 4, 5, 7—25, and on all the others (Ehlers). The first scale, which has the scar for attachment behind its centre, presents a series of short clavate cilia along its outer border, and a few longer digit-like cilia at its anterior and outer margin.[1] Finely branched nerves pass from the scar throughout the scale. Its surface is quite smooth. The typical anterior scale (Plate XXXIV, fig. 9) has externally a thin folded margin possessing irregular processes, either simple, bifid, or divided into several flaps. The surface is smooth, though often crossed in the preparations by fine lines, probably creases or folds. Between the elytrophore and the anterior curvature, and stretching on each side beyond, is a series of rounded bodies like papillæ (the "petit tubercles irréguliers" of Pruvot and Racovitza), but they do not project from either surface of the scale, and appear therefore to be internal, as a reference to the condition in the posterior scales more clearly demonstrates.

The posterior scales (Plate XXXIV, fig. 10) are bilobed externally, each lobe forming a rounded process, which either approaches its fellow over the T-shaped fissure or slightly overlaps. Moreover in the terminal scale a belt of large vesicular organs occurs in the granular layer of the epiderm, in front of the scar for attachment. They consist of a large pale central region surrounded by a ring of smaller bodies. Each of the large circular vesicles has a cell with a nucleus and nucleolus, and the ring seems to be composed of nucleated granular cells. They indeed resemble papillæ with a ring of secondary processes at the tip, but they appear to be internal, and a further development of the structures noted anteriorly. These continue to the posterior extremity.

At Banyuls Pruvot and Racovitza found a large transverse touch of brown on the posterior region of the scales, and between the elytrophore and the anterior curve a few minute tubercles, best marked and most numerous in the posterior scales. As above mentioned, however, these structures project neither from the dorsal nor the ventral surface of the scale; they are vesicular and internal rather than tubercular and external.

[1] Neither Ehlers nor Pruvot and Racovitza mention these.

Feet.—The tufts of bristles from the first foot project somewhat outward dorsally, obliquely inward ventrally. They all appear to belong to the dorsal type, consisting of long, slender, finely serrated bristles with hair-like tips. The dorsal tuft is the longer; the inferior, moreover, presenting proportionally more of the smooth shaft at the base. The dorsal group alone possess a spine, and Pruvot and Racovitza consider the inferior group as representing the ventral tuft.

The second foot has its dorsal lobe only slightly separated from the ventral, but the spine has a special free papilla. Just above it three extremely elongated papillæ (stylodes) project from a common base. A long tuft of dorsal bristles—very finely serrated—arises from this lobe. They are directed forwards and inwards. The ventral division of the foot is bluntly rounded, extends further outward than the dorsal, and bears three groups of long papillæ, each springing from a basal process. The first arises from the tip above the spine, and has attached to it about four long papillæ, the longest of which projects further than the dorsal, since its basal process is carried out by the ventral division. The knob enclosing the spine gives attachment also to four, while a prominent peduncle just above the group of slender inferior bristles carries three. All these processes are somewhat translucent, granular, and with a cellulo-granular and almost transparent tip. The upper ventral bristles have tips of great length and tenuity, no less than about twenty divisions occurring in the terminal appendage, which is capillary at the tip, and, if fringed with minute algæ, it resembles a pinnate hair.

The feet gradually merge into the typical form (Plate XXXI, fig. 6), which dorsally below the branchial process shows three ciliated pads (ctenidia), and a few small clavate papillæ on the region between them and the bristles. This (dorsal) lobe is somewhat clavate in outline, and has four or five long papillæ (stylodes) from its upper terminal region, the spine passing out inferiorly. The bristles are slender, long, finely spinous, tapered, and form a fan directed upwards, outwards, and slightly backwards. Parasitic structures are common on these bristles.

The ventral division is shorter and broader than the superior, and is somewhat conical at the tip, while a large flattened and leaf-like lobule projects above the spine, and a smaller lobule at the ventral edge. The large lobule shows a process or papilla extending beyond it, and in its granular epidermic layer are large glandular areolæ. The superior ventral bristles have the type of those in *S. boa*, only more slender. They are simple tapering bristles with bold spinous rows at first, and then more minutely spinous towards the slender tip (Plate XLII, fig. 1). Beneath are a few with stout curved shafts, a short bifid terminal region, and a single articulation (Plate XLII, fig. 1), an arrangement which also occurs in the following three or four segments. The next are rather slender bristles with long tapering tips, having from nine to nearly twenty segments (Plate XLII, fig. 2) with a minute hook at the tip. Then follows a stouter series (Plate XLII, fig. 3) with long tips, also bifid, the shafts becoming more slender as we proceed downward; and lastly, a much more delicate group at the ventral edge, with from five to ten segments in the terminal region, which also has a minutely bifid tip.

The ventral cirrus is long and tapered, with a terminal segment (Plate XLII, fig. 4), or occasionally two.

In the posterior feet little change takes place in the dorsal lobe, except a diminution

in the number of papillæ. In the inferior division the flattened lobe becomes a much smaller rounded process above the spine, and has a large papilla attached to it superiorly. The simple spinous bristles of this lobe disappear, and a few bearing three rows of spines on the end of the shaft and a terminal division of three segments occur, the tip being simple. Others show four articulations. Above and below the spine are stouter bristles having tips of a single joint, or of two or three, strongly bifid, and this condition holds in front in certain Norwegian examples.

The slender inferior series show very delicate tips, with about four joints and simple hair-like extremities. The lobe beneath the spine in these feet does not diminish so much in proportion as that above it.

Reproduction.—Specimens tossed on the beach at St. Andrews in February had numerous large ova, so that the reproductive period would seem to be early spring.

Habits.—It appears to be a dweller in sand, and is somewhat sluggish in confinement. The finest specimens in my collection came from St. Andrews, but those from Shetland and Polperro are also of considerable size.

Dalyell's *Aphrodita arcta* may be this species, or an allied form. Unfortunately no distinctive feature is given.

The *Sthenelais leiolepis* of Claparède, from Naples, approaches this species in the form of the scale, as pointed out by the Swiss author. It is distinguished from it by the occurrence of only one ciliated mammilla below the branchia. Pruvot and Racovitza unite them, and consider the distinctions rested on imperfect observations.

5. Sthenelais Jeffreysii, *McIntosh*, 1876.

Specific Characters.—Head broadly ovate, with a median ridge running forward to the base of the tentacle, which is longer and thicker than in *S. limicola*. Lateral regions of the head form smooth ovoid lobes. No eyes in the preparation. The massive first foot carries dorsally the lateral tentacle internal to the bristle-bundle, and the dorsal cirrus externally, both extending beyond the tips of the bristles. Just beneath the former is the lamellar process, while ventrally is the shorter and more slender ventral cirrus. The long, smooth, tapering palpus, with its sheath-like lamella at the base—superiorly and internally—arises below the process. Body narrow, probably about two inches in length, and with numerous segments. Scales smooth, translucent, and devoid of pigment in the preparation; first pair probably rounded, rest reniform. On the external border are long, slightly tapered papillæ, perhaps more numerous in the anterior scales, and they may disappear posteriorly. The foot has a branchial process, and three ciliated pads (ctenidia) along the upper edge. The dorsal lobe is somewhat clavate, bevelled at the tip, with three long papillæ, and a tuft of tapering bristles bearing fine and rather closely set rows of spines. The ventral division has a conical tip, with one or two papillæ at the apex, and one on each of the lobes. The upper ventral bristles have four rows of spines on the distal end of the shaft, and a most delicate tapering terminal process of twelve to fifteen articulations ending in a hair-like tip. Below the spine the

shafts are stronger, and with less delicate and less numerously jointed tips. Some have one or two rows of spines at the distal end of the shaft, and a bifid tip, with a claw and secondary process, the joints ranging from one to three, the latter kind being inferior. The delicate inferior group (below the lobule) have also one or two rows of spines on the distal end of the shaft, a long tapering terminal process of six or seven joints, and a bifid tip. The subulate ventral cirrus extends nearly to the tip of the fleshy part of the foot.

Synonym.

1876. *Sthenelais Jeffreysii*, McIntosh. Trans. Zool. Soc., vol. ix, p. 406, pl. lxxii, f. 18, 19; pl. lxxiii, f. 1 and 2.

Habitat.—Dredged in the Atlantic off the west coast of Ireland (Galway) in lat. 53° 16′ N., and long. 12° 42′ W., in 165 fathoms, Station 9, 'Porcupine,' 1869.

Head (Plate XXIX, fig. 4) broadly ovate, with a median ridge running forward to the base of the tentacle, which is a tapering organ, longer and thicker than that of *S. limicola*. The lateral regions of the head form smooth ovoid lobes. No eyes are visible in the preparation. The first foot carries the following organs: dorsally the lateral tentacle (of some length) inside the bristle-bundle, and externally the dorsal cirrus, both reaching in spirit beyond the tips of the bristles. Just beneath the former is the lamellar process, while ventrally is the shorter and more slender ventral cirrus. The long, smooth, tapering palpus with the sheath-like lamella at the base—superiorly and internally—arises from the ventral aspect of the process. The structure of the parts thus diverges from that in *S. limicola*, and leans to those with more numerous processes, as for instance *S. boa*.

Body narrow, probably about two inches long, and with numerous segments.

Scales (Plate XXXIV, fig. 13).—First pair rounded, the rest more or less reniform, and all smooth, translucent, and devoid of pigment in the preparations. On the external border are long, slightly tapered papillæ, perhaps more numerous in the anterior scales, becoming fewer as we proceed backwards, and finally in the posterior scales disappearing altogether,—that is to say, if the first form agrees with the closely allied Norwegian species. The number of cilia (Plate XLII, fig. 5) on the external border thus varies, ten being a usual number anteriorly, and their great length is in contrast with those of *S. boa* (Plate XXXIII, fig. 16). In the latter the edge of the scale has been doubled, so as to show (somewhat out of focus) the smaller papillæ on the surface.

Feet (Plate XXXI, fig. 7).—Superiorly is the long branchial process, and three ciliated pads (ctenidia) along the dorsal edge. The dorsal lobe is somewhat clavate, bevelled at the tip superiorly, and bears three papillæ, one at its tip, one projecting from the upper bevelled region, and another near it—the two latter springing from the anterior aspect of the foot, and a tuft of the usual slender bristles with fine and rather closely set rows of spines. The ventral division is somewhat conical at the tip, and has one or two mammillary papillæ at the apex to which the spine goes, and one on each of the lobes—superiorly and inferiorly. These are generally constricted at the base. The superior ventral bristles are somewhat slender, have four rows of spines on the enlarged

distal ends of the shafts, and a most delicate tapering terminal process with a hair-like tip, and comprising fourteen or fifteen segments, the basal being much longer than the others (Plate XLII, fig. 6, which shows a bristle somewhat compressed by others). Below the spine are some with shafts considerably stronger, and with less delicate and less numerously jointed tips, which, however, end in a fine point. From the spine to the inferior lobule of the foot somewhat strong shafts of similar character are distributed, the inferior especially showing one or two rows of spines on the dilated distal region, while the terminal processes are of several kinds. The upper have a single terminal division consisting of a segment with a well-marked claw and secondary process which fills up the concavity. Just above the inferior lobule of the division are some with three segments in the terminal region, viz. a basal two thirds the entire length, and two short distal articulations, the last with a claw. A few have only two segments (Plate XLII, fig. 7). The inferior series, arising below the lower lobule, are delicate translucent bristles, having one or two rows of spines on the distal part of the shaft, and a long terminal process of six or seven articulations (Plate XLII, fig. 8), the secondary process filling up the hollow. Ventrally three series thus occur: (1) the stronger superior with tapering filiform tips; (2) the stout shafts with the short tips, of one, two, or three articulations; and (3) the slender inferior with long, tapering, bifid tips. All are very delicate and translucent, and the basal region of the terminal process is often wrinkled.

The necessity for carefully regarding the nature of the bristles is well illustrated in a very closely allied form brought by Canon Norman from Norway, and which in almost all its characters corresponded with the present species. A glance at the bristles of the Norwegian form showed that the dorsal series were much denser; the upper ventral series had nine or ten rows of spines at the distal end of the shaft, and a short acutely pointed terminal region of nearly a dozen segments. A series with more numerously jointed (eighteen to twenty articulations) and finely tapered tips followed, the shafts having two or three articulations in the upper examples, the rest being smooth; then a group with a single distal segment ending in a well-marked claw and secondary process; below was a group with similar shafts, but with tapering jointed terminal pieces ending in a hair-like tip; finally, the ventral series consisted of delicate bristles, with a slender terminal region of about five articulations and a bifid tip. The differentiation thus at every step was made clear.

The ventral cirrus is subulate, with an articulation at the tip, and extends nearly as far as the end of the fleshy part of the foot.

Habits.—Only a single example has been obtained, so that it would not seem to stretch to shallower waters. Where so much difficulty exists in capture and examination it is unsafe, however, to make statements on this head. The species is sufficiently defined, and should easily be identified. It probably frequents a sandy bottom.

This form clearly leads through *Eusthenelais* to *Leanira*.

6. Sthenelais ? sp.

Specific Characters.—Head unknown. Body long and narrow. Scales on every foot in the posterior region, large, covering the dorsum, reniform in outline, with a notch externally as well as at the hilus, perfectly smooth on surface and border. Branchial process unusually long and straight; three ciliated pads (ctenidia) beneath it along the dorsal curve. The dorsal lobe of the foot is clavate, with a long, slender papilla stretching from the apex. Dorsal bristles boldly spinous, and rather long. Ventral lobe forms an irregular spear-head, the longer slope being inferior. Above the spine is a prominent hump bearing a papilla. Inferiorly behind the lower bristles is another elevation. The superior bristles are slender, ends of shafts with eight or nine whorls of spikes and apparently simple tips, with many articulations. Some with stronger shafts and shorter tips occur below, others being slender with a minutely bifid tip. Ventrally are bristles with a few spines at the tip of the shaft, and long six- to eight-jointed tips. Ventral cirrus long and subulate, and reaching as far as the apex of the foot.

Synonyms.

1896. *Sthenelais*, n. s., McIntosh. Sc. Proceed. R. Dub. Soc., vol. viii, n. s., p. 403.

Habitat.—South-west Ireland, long. 45°, 325 fathoms (R. I. A. Exped., 1886).

Head absent.

Body seems to be long and narrow, with prominent feet. Only the posterior region remains.

Scales (Plate XXXIV, fig. 12) on every foot in the posterior fragment, large, covering the dorsum of the narrow body, and reniform in outline. They are perfectly smooth on surface and border, and thus differ from the other British species. A shallow notch occurs at the external margin, and a more acute one at the hilus. The distribution of the nerves is well seen.

Feet (Plate XXXI, fig. 8) with an unusually long straight branchial process dorsally, and three ciliated pads (ctenidia) beneath it on the dorsal curve. The dorsal lobe is clavate (narrower at the base), much bevelled dorsally at the tip, and with a long slender papilla stretching from the apex. The dorsal bristles form a long tuft of rather boldly serrated bristles superiorly, and they diminish towards the ventral edge. The ventral lobe resembles an irregular spear-head, the longer slope being inferior, and the apex from which the spine projects is prominent, and bears a papilla. Above the spine is a prominent hump, which also possesses a papilla. Inferiorly is another prominence behind the lower group of bristles. The superior ventral bristles are slender, the distal ends of the shafts having eight or nine whorls of spikes, the end apparently simple—in the form of a tapering acicular process, with a needle-like tip—a condition probably due to repair, since others show a many-jointed needle-like tip. Bristles with stronger shafts follow—with shorter simple tips, numerously jointed. Some of the more slender shafts at the ventral border of the stout series present many-jointed tips, with a minute

claw. Then follow a large fan-shaped group of most slender bristles, with a few spines at the tips of the slightly curved shafts, and long (six- to eight-) jointed hair-like tips.

The ventral cirrus is long and subulate, and its tapering tip reaches to the apex of the ventral lobe.

As far as can be observed this is the nearest approach to *Leanira*, only the more slender forms of the stouter series of bristles in the ventral division showing very finely bifid extremities. Unfortunately the condition of the single specimen leaves much to be desired.

Genus XXV.—Eusthenelais, *McIntosh*, 1876.

Characters as in *Sthenelais*, but the scales are unknown. Dorsal bristles slender, elongate, and finely spinous, tapering to a hair-like point. Upper ventral bristles slender, the distal end of the shaft having seven to nine whorls of spikes, and a terminal tapering process of fifteen to eighteen articulations ending in a hair-like tip. The stouter bristles at and below the spine have shorter divisions to the terminal whip. The slender group at the inferior edge has long (fifteen- to eighteen-) jointed terminal processes with a minutely bifid tip.

Eusthenelais hibernica, *McIntosh*, 1876.

Specific Characters.—Head broadly ovate, with a median region and two well-marked ovoid lobes at the sides. Eyeless in the preparations. Median tentacle similar to that of *Sthenelais Jeffreysii*, with a filiform tip. At its base are two small processes (ctenidia) which do not reach the tip of the ceratophore. The appendages springing from the first foot agree with those of the species mentioned. The dorsal cirrus proper (external) is slightly shorter than the median tentacle, and the tip is filiform. The shorter and more slender lateral tentacle lies to the inner border dorsally. Beneath are two processes; an inner, short, broad, and blunt (cuilleron); and an outer, slender, tapering, ventral cirrus, less than half the length of the dorsal. Palpi long, smooth, and tapering, with a scoop-shaped lamella at the base superiorly and internally. Body about two inches long, with numerous segments. Scales absent. Dorsal lobe of the foot somewhat clavate, and bevelled at the tip. It has three or four long papillæ. The bristles are slender, elongate, finely spinous, and tapered to a hair-like point. Ventral lobe conical, with a rounded lobule in front bearing a long papilla—stretching beyond the tip of the dorsal lobe. At the spine is another somewhat fusiform papilla, and on the inferior lobule a longer and more slender papilla. Upper ventral bristles with slender shafts, the distal region having from seven to nine whorls of spikes, while the terminal tapering process has from fifteen to eighteen articulations. Near the spine are bristles with stouter shafts, devoid of spines distally, and with shorter divisions in the terminal process. The slender inferior series have in some a few spines on the end of the shaft, and a numerously jointed (fifteen to eighteen) bifid tip. Ventral cirrus long and subulate, almost reaching the tip of the fleshy part of the foot.

Synonym.

1876. *Eusthenelais hibernica*, n. g. and s., McIntosh. Trans. Zool. Soc., vol. ix, p. 407, pl. lxxiii, ff. 4 and 5.

Habitat.—Dredged in the 'Porcupine' Expedition of 1869 at Station 8, off the west coast of Ireland (Galway) in 106 fathoms, and again in the Expedition of 1870 off Cape Sagres in the Mediterranean, in 45 fathoms.

Head (Plate XXIX, fig. 5) as in *Sthenelais Jeffreysii*, broadly ovate, with a median region and two well-marked ovoid lobes at the sides. Eyeless in the preparations. The median tentacle is similar to that of the species mentioned, and has a filiform tip. At its base are two small processes (ctenidia), which do not reach to the tip of the basal segment. The appendages springing from the first foot agree with those of *Sth. Jeffreysii*. The external process, corresponding to the dorsal cirrus, is slightly shorter than the median tentacle, and has a filiform tip. The shorter and more slender lateral tentacle lies to the inner border dorsally. Beneath are two processes,—an inner, short, broad, and blunt (cuilleron), with the flattened tip extending beyond the peduncle; and an outer, slender, tapering, ventral cirrus, which is not half the length of the dorsal. The palpi are long, smooth, and tapering, with a scoop-shaped lamella at the base superiorly and internally.

Body probably about two inches in length, and having numerous segments. It is rounded dorsally and flattened ventrally.

Scales absent. In all probability the scales will be found to present long papillæ on their external border—if we may judge from its close resemblance to *Sthenelais Jeffreysii* and its Norwegian ally, as well as to *Sth. fuliginosa*, Claparède.[1]

Feet.—The second foot bears a scale and a long ventral cirrus, and the third a dorsal cirrus of considerable length, while the fourth has a branchial process arising from the homologous base. The bristles in the second foot have already mapped themselves out more or less as they occur behind, though of course less distinctly. The branchia is short anteriorly, but gradually increases in length till about the middle of the body. A single large ciliated pad (ctenidium) exists on the dorsal edge of the foot, and three smaller in the curve below the cirrus. In the typical foot (Plate XXXI, fig. 9) the dorsal lobe is somewhat clavate, and bevelled at the tip superiorly. It bears three or four long papillæ. The dorsal bristles are slender, elongate, and tapered to a fine hair-like point. All are finely spinous, one series more distinctly, and another less distinctly so. The ventral lobe is conical at the tip, has a rounded lobule in front, bearing a very long papilla, which extends beyond the tip of the dorsal lobe. At the spine is another somewhat fusiform papilla, and on the inferior lobule a longer and more slender one. The superior ventral bristles have rather slender shafts, and the distal ends are furnished with from seven to nine whorls of spikes. The distal region is a slender tapering process of from fifteen to eighteen joints, ending in a capillary tip. These resemble the bristles of *Sthenelais* and *Sigalion* rather than those of *Leanira*, since the necklace-like canaliculi are absent. The figure (Plate XLII, fig. 9) represents a bristle adjoining the superior lobe, the spinous rows on the tip of the shaft being more numerous, while the jointed terminal region is shorter.

[1] 'Ann. Chæt. Nap.,' p. 94, pl. iv, fig. 2.

At and below the spine are a series of bristles having stouter shafts, without spines at the distal ends, and bearing shorter divisions to the terminal whip. The slender group at the ventral border of the foot, that is below the inferior lobule, have in some cases one or two spines at the end of the shaft, and long tapering and numerously (fifteen to sixteen) jointed terminal regions, with a minute claw and secondary process at the tip (Plate XLII, fig. 10). These bristles also lean to the two forms mentioned, and not to *Leanira*.

The ventral cirrus is long and subulate, reaching almost to the tip of the fleshy part of the foot. It has an articulation at the extremity.

Habits.—This species would seem to frequent sand in deep water, but it may yet be found inshore.

It is closely allied to Claparède's *Sthenelais fuliginosa*.

Genus XXVI.—Sigalion, *Audouin and M. Edwards*, 1830.

Head elongate from before backwards. Median tentacle absent; lateral tentacles short and papilliform, fixed to the anterior part of the cephalic lobe. Scales covering the dorsum; processes pinnate or with long papillæ from the axis. The feet resemble those of *Sthenelais*. Dorsal division clavate and furnished with a papilla. Bristles as in *Sthenelais*. Ventral division somewhat truncate, and with a papilla internal to the bristles, which are all bifid. Branchiæ on every foot[1] (in *S. Mathildæ*). Nerve-trunks rounded in section, and the granular epidermic area enclosing them is expanded inferiorly. Segmental eminence placed ventrally at the base of each foot.

1. Sigalion Mathildæ, *Audouin and M. Edwards*, 1834.

Specific Characters.—Head elongate from before backward, with a truncate anterior border, having a slight peak at each side. Behind the border are two pairs of small black eyes, the anterior nearer each other and larger. Body elongate (three to five inches), little tapered anteriorly, and gradually diminishing posteriorly. Segmental eminence situated ventrally at the base of each foot. Colour greyish-brown or pinkish. Proboscis with seventeen to eighteen papillæ on each lip. Scales about sixty-four pairs, adherent, somewhat quadrate or rhomboidal, with the posterior and inner corner rounded off. The processes along the external border are pinnate, with long cylindrical papillæ (about twenty on each side), and at the base these are irregularly distributed around the central axis. Foot with a club-shaped dorsal division, which has a single subulate papilla, and simple, tapering, finely spinous bristles—increasing in strength externally. The inferior

[1] Carus, in his 'Prod. Fauna Medit.,' states that in the anterior part of the body the branchiæ alternate with the elytra, but that posteriorly they occur on all the feet.

division is somewhat truncate, sloped from above downwards and inwards, and has a small papilla internal to the bristles, which superiorly are whorled, then finely serrate at the tip. Next follow larger bristles, with the distal end of the shaft curved and spinous. The distal region is segmented, and tapers to a fine bifid point (minute beak). Ventrally is a dense group of similar forms, but without spines at the end of the shafts. They are most slender at the ventral edge.

Synonyms.

1830. *Sigalion Mathildæ*, Cuvier. Règne An., 207.
„ „ „ Rathke. Fauna Norweg., 151.
1834. „ „ Aud. and Edwards. Annél., 105, pl. ii, ff. 1—10.
1840. „ „ Grube. Actin., Echinod., &c., p. 84.
1848. „ „ Gervais. D'Orbigny, Dict. d'Hist. Nat., xi, p. 601.
1851. „ „ Grube. Fam. d. Ann., p. 38.
1855. „ „ Peters. Archiv f. Naturges., vol. xxi, p. 38.
1857. „ „ Kinberg. Eugen. Resa, vol. ii, Zool., 2, p. 9.
1865. „ „ De Quatrefages. Ann., i, p. 279.
„ „ *Carringtonii*, Carrington. Proceed. Lit. and Philos. Soc. Manchest., vol. iv, p. 179.
1875. „ *Mathildæ*, McIntosh. Invert. and Fishes St. Andr., p. 118.
1876. „ „ idem. Trans. Zool. Soc., vol. ix, p. 408.
1884. „ „ V. Carus. Faun. Medit., p. 204.
1898. „ *squamatum*, De St.-Joseph. Ann. d. sc. nat., Zool. (8), vol. v, pp. 239, 241, pl. xiii, ff. 22—29.

Habitat.—Generally distributed round the British shores. Of large size and rather abundant between tide-marks in the Channel Islands and at St. Andrews, while those from Shetland are small. Most of the specimens are littoral, generally under stones, though occasionally small pale specimens occur in sand, as at Southport. It extends, however, to some depth in the adjoining waters. It is occasionally tossed on the sands at St. Andrews in considerable numbers after storms, and is also not uncommon in the stomachs of cod, haddock, and flounders (E. M.). The first two are especially partial to this species. They sometimes take refuge in tubes of *Terebella* when cast ashore. The species seems to be partial to sand. In the 'Porcupine' it occurred off the Algerian coast between Capes Falcon and Tenez.

Head (Plate XXIX, fig. 6) somewhat elongated from before backwards, oblong or cylindrical in outline. The anterior border is truncate, with a slight peak at each end. Behind the latter are two pairs of small black eyes, situated close together on each side of the middle line, the pairs not far apart. The anterior pair are nearer each other and also somewhat larger than the posterior pair. From the elevation of the head they look forward and upward. Posteriorly only a transverse furrow marks the boundary of the head. The head bends downward in front, and has soldered to it the two short and somewhat conical lobes of the first feet, which bear externally (dorsally and ventrally) short subulate cirri, and dorsally and internally a tuft of very slender, tapering bristles, most minutely serrated and directed upwards and inwards. Beneath is the long, tapering palpus, the tough cuticle of which is usually thrown into fine transverse

wrinkles, so that it resembles in a decayed specimen the trachea of an insect. The head is thus raised above these processes, and is confined to the dorsal region. A short conical process on the inner and upper border of the foot may indicate the lateral tentacle.

Body three to five inches in length, and with segments about as numerous as in *Sthenelais boa* (180), elongate, very little tapered anteriorly, so that in the preparations it is almost truncate, and gradually diminishing posteriorly, though terminating in by no means a slender tail, from the tip of which a remarkably long and slender caudal style or cirrus extends. The functions of this delicate appendage would appear to be sensory, and it is curious that the tail is often specially modified in sand-dwellers, such as *Nephthys*, certain *Opheliidæ*, and *Spionidæ*. The dorsal arch is slightly rounded laterally, flattened in the middle when the scales are present, the prominent papillæ for the latter occupying most of the surface, and in the ripe forms showing ova through the walls. The ventral surface is in life flattened, and in the preparations usually presents the aspect of a long riband with rounded edges. A segmental eminence occurs at the base of each foot, but no distinct papillæ could be made out.

In life the colour of the dorsum is greyish-brown with a central bluish-green mark, or dull greyish-white or pale pinkish in front with a dark grey stripe from the proboscis. In some a pale brown streak marks the inner margin of each scale. The ventral surface is iridescent, bluish-green or pale pinkish, with the red central vessel.

Proboscis.—The number of papillæ on each side (dorsally and ventrally) is about sixteen, though from overlapping one or two more may occur, *e. g.* seventeen or eighteen. The teeth bite alternately, the lower passing to the right of the upper.

Scales (Plate XXXIV, fig. 14) about sixty-four pairs, and of the hue already mentioned. They are firmly adherent. The surface is smooth, and they have the external border supplied with a series of pinnate processes. The first pair are smaller and somewhat triangular in outline, with a series of the typical pinnate processes along the outer border. Moreover at the bases of these are a few simple papillæ, and in some, instead of the pinnate process, a group of long, simple papillæ occur at one end of the series. The scales gradually assume a quadrate outline, the outer border bearing the papillæ being nearly straight, while the posterior and inner corner is rounded off. The processes[1] (Fig. 33) have a stout central stem, which tapers to a slender point. The axis is granular. The pinnæ or papillæ arise on the scale even below the process, and are continued on it somewhat irregularly at the base, but by-and-by assume a more uniformly pinnate arrangement. The papillæ are pale throughout. Occasionally one of the processes is bifid. In vertical section the dorsal and ventral coverings of the scale are joined by a close series of fibrous strands. Both surfaces are remarkably smooth. As we proceed backwards the scales become more elongated transversely, but again diminish posteriorly.

The first scale shows no branchial process, but all the rest are provided with such, the organ being long and sickle-shaped as well as richly ciliated.

Feet.—The second foot is bifid, presenting an elevated dorsal lobe with a tuft of simple, tapering, finely serrated bristles as in the first foot, the spine issuing at their

[1] 'Ann. Nat. Hist.,' August, 1898, pl. ii, f. 14.

lower border, and dorsally having a papilla for the scale. The inferior lobe is irregularly conical, the upper slope ending in a rounded process pierced by the spine, and the margin trending downward and slightly backward from this to the abrupt angle inferiorly. The upper bristles have slender shafts with slightly dilated extremities and an oblique edge, and present only traces of rough processes, the long tapering distal region having numerous

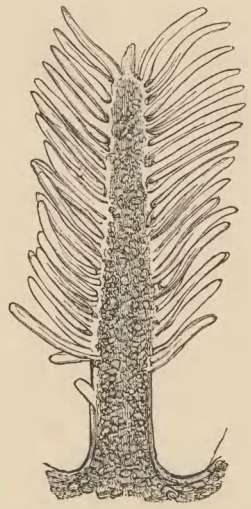


FIG. 33.—Papilla of scale of *Sigalion Mathildæ*, Aud. and Ed. × 280.

segments, the tip apparently being simple. The group below the spine is similar, except that the ventral series show a distinct spine or two towards the end of the shaft. The ventral cirrus is subulate, and projects beyond the tip of the fleshy part of the foot.

The third foot has a similar form, but papillæ occur dorsally (a conical upper and two boss-like inferior), and ventrally is a rounded papilla internal to the cirrus. The ventral bristles now present a claw at the tip.

A typical foot (Plate XXXI, fig. 10) shows dorsally three ciliated pads (ctenidia) along the dorsal edge. The dorsal lobe projects somewhat further outward than the ventral, is club-shaped, with a sinus superiorly, and a long, slightly tapered papilla a little below the dorsal bristles. The normal extremity of the division seems to be tilted upwards, the bristles standing obliquely upwards and backwards from the dorsal edge. Internally they commence as extremely fine hair-like forms, with very minute spikes. Towards the outer edge these simple bristles become much stronger, show slight longitudinal striations of the shaft, and a curvature where the spinous distal region commences. They then taper to a very slender extremity. De Saint-Joseph[1] states that these bristles end in a bifid point, an error of interpretation probably due to imperfect specimens. The minute spikes project upwards and outwards when the bristle is in position (Plate XLII, figs. 11 and 12). Fine transverse or oblique lines indicate the rows of spines. The spine passes out below the bristles and above the papilla.

The inferior division of the foot presents superiorly a small papilla internal to the bristles, a somewhat short series of bristles (Plate XLII, fig. 13), the tips having proximally a series of longer spines in whorls, five or six of which are very distinct, and

[1] Op. cit., 1898, p. 239.

a tapering tip with finer spines. The bristles below these have larger shafts—dilated and slightly curved towards the extremity (Plate XLII, fig. 14), with numerous rows of spines on the convex edge. The distal region is jointed, and terminates in a beak or claw. Then follows a dense tuft of similar compound bristles without spines at the tip of the shaft, and a long, jointed, tapering, terminal region with a minute claw (Plate XLII, fig. 15). They become more slender at the ventral margin (as in Plate XLII, fig. 16).

Besides these slender forms there are, below the spine, one or two somewhat stouter bristles, which show a single segment in the terminal bifid region (Plate XLII, fig. 17). The ventral cirrus is long and slender—reaching to the tip of the fleshy part of the foot —in spirit.

The foot at the posterior end retains much of the foregoing structure, both as regards the fleshy parts and the bristles. Those at and above the spine of the ventral division are somewhat stronger, and the ventral cirrus is proportionally longer than in front.

The branchiæ commence on the fourth foot, and occur apparently on every foot. The statement of Carus, therefore, that in *Sigalion* the branchiæ alternate with the scales anteriorly is not borne out in this species.

Reproduction.—A fragmentary specimen procured off the Algerian coast had well-developed ova on August 27th ('Porcupine,' 1870).

Habits.—In confinement its habits are similar to those of *Sthenelais boa*.

This Annelid, which formed the type of the family, was found by Audouin and Milne Edwards at the islands of Chausey, and measured about five inches long by three or four lines broad, and with 180 segments.

The scales of this species and the general characters approach very closely the *Sigalion squamatum* of Delle Chiaje, even closer than Claparède—the able interpreter of some of the more doubtful Annelids described by the Italian naturalist—supposed, especially since the difference in regard to the eyes has now been removed. Neither Delle Chiaje nor Claparède, however, show the ciliated mammillæ on the dorsal edge of the foot, so that this doubtful distinction alone remains. In his supplemental volume Claparède specially refers to the distribution of the nerves in the papillæ for the scales, and also in the periphery of these organs, thus giving them extreme sensibility. He mentions the occurrence of certain spicules or rod-like bodies on the pinnæ of the papillæ, probably of a parasitic nature; but such have not occurred in the British species. The males of *S. squamatum* were whitish, the females of a fine rosy hue—due to the eggs. Leidy's[1] *S. Mathildæ* from New Jersey is a *Sthenelais*.

2. Sigalion Buskii, *McIntosh*, 1869.

Specific Characters.—Head somewhat pear-shaped, broad in front and narrow posteriorly. Body stouter than in *S. Mathildæ*, pale greyish in spirit. Scales more or

[1] 'Marine Invert.,' &c., p. 148, pl. ii, f. 53.

less quadrate anteriorly, with the inner edge rounded. The straight external edge has a series of about sixteen pinnate processes, besides a few simple papillæ posteriorly. Each process has a granular stem, to which is attached a series of lanceolate granular lamellæ with a narrow papillary tip. In the typical foot the inferior lobe is shorter than in *S. Mathildæ*, broadly clavate, and with a single papilla on its tip. The bristles are attached to the whole tip (*i. e.* superiorly, terminally, and inferiorly), and are long and minutely spinous. The ventral lobe is devoid of the superior papilla seen in *S. Mathildæ*, and has a more prominent process for the spine. The compound bristles (with jointed tips —below the forms with the short tapering spike) have the terminal portion of the shaft covered with whorls of somewhat sparse spikes, which are more numerous than in *S. Mathildæ*, while the stouter bristles beneath have close rows of minute spines on the same portion of the shaft. One or two below the spine-papilla have short tips of one or two segments. The slender ventral series have only about two whorls of spikes on the end of the shaft, and the long jointed tips have, as in the upper series, minute beaks. The ventral cirrus is long, slender, and subulate, extending beyond the fleshy part of the foot.

Synonyms.

1869. *Sthenelais dendrolepis?* McIntosh. Trans. R. S. E., vol. xxv, p. 409, pl. xii, f. 12; pl. xv, f. 4, 5.

1876. *Sigalion Buskii*, McIntosh. Trans. Zool. Soc., vol. ix, p. 391, pl. lxx, f. 14.

Habitat.—Dredged in 90 fathoms off North Unst, Shetland, by Dr. Gwyn Jeffreys, in 1867.

Head (Plate XXIX, fig. 7) somewhat pear-shaped in outline, broad in front and narrow posteriorly, where it is only separated from the nuchal collar by a slight furrow. The anterior border is smoothly rounded, and abuts on the conical first foot. It is quite pale, no eye-specks being visible in the preparation. In the example a small and somewhat clavate papilla (tentacle) projected from the centre of the anterior border of the head—a remarkable condition in *Sigalion*.[1]

Body somewhat stouter than in *Sigalion Mathildæ*, and in this respect resembling *Sthenelais boa*, but having the same general shape both dorsally and ventrally. The example is incomplete, but it would seem to reach a similar length to the species first mentioned. The segmental eminences exist at the bases of the feet posteriorly, but no distinct papilla is visible. The general colour of the dorsum is pale greyish.

Scales.—The first pair of scales are almost ovoid, only the outer border is broader than the inner, and has eight pinnate processes besides a smooth projection in front, and some isolated papillæ posteriorly. Except at the latter part the margin is quite smooth. At the bases of the processes, however, isolated papillæ occur as in *S. Mathildæ*, one or two of which are attached to the central axis as in the species just

[1] The head had been injured, so that the question might be raised as to whether this was not one of the lateral tentacles pushed out of position. After careful examination, however, the view above mentioned was held.

mentioned. No branchial process occurs on the papilla supporting this scale,—indeed, it only appears on the papilla of the fourth scale on each side.

Passing backward the scales assume a somewhat quadrate outline, which in a typical example anteriorly has the inner end rounded, while the external border has about sixteen beautifully pinnate processes, besides a few simple papillæ at one end (Plate XXXIV, fig. 15). The pinnate processes have a tree-like figure—more robust than in *S. Mathildæ*, and the pinnæ, instead of being hyaline cylindrical processes, are lanceolate granular lamellæ with a narrowed papillary tip (Plate XXVI, fig. 9). The posterior scales are longer transversely, and have fewer pinnate processes, but the structure is essentially the same. The granular epiderm (hypoderm) of the curve between the processes is denser, more opaque, and in this condition extends up the stalk to the first pinnæ.

Feet.—The first pair project forward just beneath the head, and are bluntly conical with a single spine, which passes forward and upward near the dorsal cirrus—a slender and subulate organ, with a slightly dilated tip in the preparation. It springs from the outer and upper lateral region of the foot. The ventral cirrus arises from the lower part of the foot, somewhat internal to a vertical line from the former, to which it is similar in outline. The tuft of slender simple bristles is directed forwards and upwards; they are minutely spiked. The palpus is fused with the base of the foot inferiorly, and is shorter proportionally in the specimen than in *S. Mathildæ*. It is finely tapered and quite smooth. Only a blunt papilla occurs in the region of the lateral tentacle.

The second foot agreed with that in the former species, presenting a well-marked though short dorsal lobe, with a spine and a tuft of simple bristles, and a somewhat trifoliate ventral lobe with a series of bristles. These have long slender shafts with a few spikes on the dilated distal end, and a long jointed and finely tapered distal region, with a slight trace of a bifid (beak-like) tip.

In the typical foot (Plate XXXI, fig. 11) the superior lobe is shorter than in *S. Mathildæ*, and broadly clavate, the expansion of the tip in lateral view being greater than in the former species. It bears a brush of simple minutely spinous bristles, which spring from the superior and inferior borders as well as the tip. The stronger and longer forms arise above the spine; the more slender occur for the most part below it, and especially the inner group. The papilla at the tip of the superior lobe appears a short distance behind the front. Three ciliated pads (ctenidia) exist on the superior border between the branchial process and the tip. A stalked infusorian is present on the bristles.

The ventral division is devoid of the superior papilla observed in *S. Mathildæ*, and has a more prominent papilla for the spine. The ventral bristles are characterised, in contrast with *S. Mathildæ*, by having rather longer terminal processes with bifid tips. The superior series which adjoin the forms with the short tapering spinous region have the terminal portion of the shaft covered with whorls of somewhat sparse spikes (Plate XLII, fig. 18), which are much more numerous than in *S. Mathildæ*, while the stouter bristles below have close rows of minute spikes on the same portion of the shaft (Plate XLII, fig. 19, and in some the rows are closer than in the example figured). One or two below the spine-papilla have only a single articulation in the terminal region, while others have two, and the ends of the shafts in these are smooth, or in the former with only traces of spinous rows. The slender ventral bristles have generally about two

distinct whorls of spikes at the end of the shaft, and the basal division of the terminal process is broader than the latter.

The ventral cirrus is slender and subulate, and the tip extends beyond the fleshy part of the foot.

Reproduction.—The species is a female with a few ova, the majority probably having escaped either before or after capture in July.

This seems to be a deep-water species. It is named in honour of the late Prof. G. Busk, whose patient and accurate investigations in various groups are so well known, and whose genial interest in many a young worker in science will long be gratefully remembered.

An allied form is the *Sigalion Edwardsi* of Kinberg[1] (1858), from the Atlantic—off La Plata.

Genus XXVII.—Leanira, *Kinberg*, 1857.

Anterior border of the head fixed to the bases of the feet above the palpi, furnished with a somewhat slender median tentacle, usually with a short process at each side of the base; lateral tentacles minute; tentacular cirri unequal.

Scales not covering the dorsum anteriorly, smooth. Ciliated pads (ctenidia) along the dorsal arch above the feet. Dorsal lobe of the foot rather more prominent than the ventral, papillose, and with long spinous bristles. Inferior division has compound subulate bristles, with the tapering terminal region pectinate-canaliculate. Branchiæ commence in front, and are attached to the scale-peduncle on the dorsum of each foot. Nerve-cords somewhat flattened or ovoid in section, and the area covered by the oblique and vertical muscles. Segmental organs as in the group.

The genus was established by Kinberg in 1857, while Grube produced additional features in his 'Annulata Semperiana.'

V. Carus, again,[2] includes *Leanira* under *Sthenelais*, but does not allude to the condition of the bristles.

Leanira hystricis, *Ehlers*, 1874.

Specific Characters.—Head smoothly rounded. The awl-shaped median tentacle is remarkably short and small. No eyes in the preparations. The anterior border of the head is fixed to the bases of the feet above the palpi, which are long, tapering, and smooth, with scoop-shaped lamellæ at their bases. The foot above the palpus bears three processes: superiorly a tentacular cirrus about a fifth the length of the palpus; inferiorly a minute organ of the same nature, extending only a short distance beyond the peduncles; and a minute awl-shaped process (lateral tentacle) attached to the base of the peduncle superiorly. The body is small and slender, and between two and three inches in length. Scales rounded, translucent, and perfectly smooth in outline and

[1] Op. cit., p. 30, Taf. 9, f. 41, &c.

[2] 'Fauna Mediterraneæ' (1884).

surface. The foot presents a superior lobe rather more prominent than the ventral, and bears long, simple spinous bristles and two papillæ. The inferior division of the foot has two somewhat larger papillæ, and the characteristic bristles with the tapering extremities and moniliform markings. The branchial process begins as a minute organ on the twenty-fourth foot.

Synonyms.

1874. *Leanira hystricis,* Ehlers. Ann. Nat. Hist. (4), vol. xiii, p. 292.
1875. „ „ idem. Annel. 'Porcup.,' 1869, Zeitschr. f. wiss. Zool., xxv, p. 35, Taf. 2, f. 5—11.
1876. „ „ McIntosh. Trans. Zool. Soc., vol. ix, p. 408, pl. lxxiii, f. 6—8.
1885. „ „ idem. Ann. 'Chall.,' vol. xii, p. 155, pl. xxiii, f. 9.

Habitat.—Dredged in the 'Porcupine' Expedition of 1889, off the south-west of Ireland (Station 2), at a depth of 808 fathoms on a bottom of soft sticky mud; also at Stations 23, 87, and 20, the last at a depth of 1443 fathoms, generally on mud and Globigerina ooze. In the 'Challenger' it was got off the Azores at depths of 900 and 1000 fathoms, and in the 'Knight-errant' in 530 fathoms. Verrill enters it in his list from Cape Cod to the St. Lawrence.

Head (Plate XXVIII, fig. 17) smoothly rounded, little elevated, and slightly dusky from the presence of pigment along the anterior border. The median tentacle is remarkably short and small, shaped like the handle of an awl—narrow at the base, dilated in the middle, and tapering to a blunt tip. No eyes are visible in the preparations. The anterior border is fixed to the bases of the feet above the palpi, which arise close together on each side of the middle line inferiorly. They are long, tapering, and smooth, and at the base of each, towards the inner and ventral surface, is the scoop-shaped lamella. Immediately above and soldered with the base of the palpus is the first foot, bearing three processes, viz. superiorly a tentacular cirrus about a fifth the length of the palpus; inferiorly a minute organ of the same nature, and extending only a short distance beyond the peduncle; and a minute awl-shaped process (lateral tentacle) attached to the base of the peduncle superiorly. The latter is similar in form to the median tentacle near which it is placed. Inferiorly the oral aperture has prominent rugose lips, with a blunt papilla on each side of the median fissure in front. None showed traces of the bristles usually present in allied forms on the bases of the tentacular cirri.

Body comparatively small and slender, none of the incomplete specimens from the 'Porcupine' measuring more than an inch; but an example from the 'Challenger' reached about two inches, and was also incomplete. The external appearance of the body agrees with that in *Sthenelais*.

Scales.—The first and second scales are small and rounded. The rest are also more or less rounded, translucent, and perfectly smooth in outline and surface.

Feet.—The second foot is directed forward, its dorsal division being represented by a rounded process, which bears about a dozen digit-like papillæ and a series of fine bristles resembling those of the ordinary foot (Plate XLII, fig. 20). The ventral lobe has superiorly and inferiorly a papilla larger than those of the dorsal lobe. The bristles

have whorls of spikes on the distal region of the shaft and tapering extremities (Plate XLII, fig. 21), the stoutest being next the spine, and the more slender forms with spines at the distal end of the shaft occurring at the ventral border.

The superior lobe gradually increases in size until, in the typical foot (Plate XXXI, fig. 12), it projects about as far as the ventral, and the bristles become stronger and longer. A few smooth hairs occur in each bundle. The digit-like papillæ, however, diminish in number as a rule, only two occurring in each division of the foot in the middle of the body, those of the inferior lobe being the larger. Posteriorly (Plate XXXI, fig. 13) the superior division has three or four papillæ above the bristle-bundle, the inferior frequently only a single large, pedunculated, clavate process. The ventral cirrus is also reduced in size. The inferior bristles of the ventral series of the same region have a more distinct enlargement at the distal end of the shaft (Plate XLII, fig. 22).

No branchial process occurs until the twenty-fourth foot, and then it is minute. Posteriorly it gradually elongates, so as to extend outward as far as the tip of the foot.

The bristles are somewhat shorter and proportionally stouter than in *Leanira Yhleni*, Mgrn.; no ciliated pad exists on the dorsal edge of the foot, and the papillæ of the latter do not show the disparity in size characteristic of *L. Yhleni*. The ventral cirrus is also shorter, and in the preparation shows no process at the base.

The species diverges from *L. tetragona* in regard to the tentacle, bristles, and other parts.

Habits.—A deep-water species.

At the anterior end of a fragmentary specimen a crustacean parasite was fixed in the dorsal muscles.

Ehlers gives a detailed description[1] with figures of this species, his largest example being only 19 mm. long. He shows the tentacle of three segments, or at least it is thus figured and described. Eyes absent. He adds nothing novel to the description in the 'Transactions of the Zoological Society.' He observes that the species approaches the *L. Quatrefagesi* of Kinberg from the Atlantic, off the La Plata.[2] A more minute investigation of Kinberg's specimen, indeed, is necessary before all doubts as to the specific separation are removed. They closely agree in regard to the structure of the scales, bristles, and general condition of the head and its processes, and seem to differ chiefly in the structure of the feet and in the absence of eyes in the British form.

Genus XXVIII.—Pholoë,[3] *Johnston*, 1839.

Head furnished with a single short median tentacle. Two pairs of eyes, more or less connate. Body linear-oblong. Scales on alternate segments in the anterior part of

[1] 'Zeitsch. f. w. Zool.,' 1875.

[2] 'Freg. Eugen. Resa,' p. 30.

[3] Carus, in the 'Prodromus Faunæ Mediterraneæ,' includes this genus under the sub-family Sigalioninæ, *Phòloë* being characterised by having a linear-oblong body, elytra on alternate segments

the body; posteriorly a pair on each segment. First foot with two tentacular cirri; without bristles. Dorsal lobe of the foot with slender, tapering, spinous bristles. Inferior division with stout, falcate, compound bristles. Nerve-cords forming triangular flattened areas in section on each side of the median line, the oblique muscles passing to their insertion above them.

De Quatrefages (1865) gave the group three "antennæ," a facial tubercle, and two tentacles, the upper of which was bifid. Alternate scales anteriorly, while posteriorly all the segments had scales. No dorsal cirri. He thus had an imperfect acquaintance with the genus. Grube's account[1] was more accurate.

Pholoë minuta, *O. Fabricius*, 1780.

Specific Characters.—Head somewhat rounded, bearing a short subulate median tentacle, with a few papillæ on its surface. Two eyes on each side—connate, the anterior being the larger. There are two short tentacular cirri, also with a few small papillæ on their surface. Two prominent papillæ project behind the eyes, and sometimes overlap them. The palpi are somewhat massive, short, tapering organs, with a smooth surface. Body small, forty-five to seventy segments, and about three-quarters of an inch long as a maximum. It has two slender styles posteriorly. Scales ovate or reniform, with a series of cilia having moniliform tips along the outer border, and more sparsely along the posterior border; while the surface, especially at the inner region, is areolated. Dorsal lobe of the foot forms a prominent process with a convex margin externally for the dense tuft of bristles, which are slender, tapering, and spinous. Ventral lobe an oblique cone with numerous papillæ over the surface. The shafts of the bristles are stout, the distal convexity having numerous spikes. The terminal piece is short and falcate, and the edge is generally spinous. The ventral cirrus is short and tapering.

Synonyms.

1776. *Aphrodita longa*, O. F. Müller. Prod. Zool. Dan., p. 218, n. 2646.
1780. „ „ O. Fabricius. Fauna Grönl., p. 313, n. 293.
„ „ *minuta*, idem. Ibid., p. 314, n. 294.
1820. *Polynoë minuta*, Savigny. Syst. des An., p. 26.
1828. *Palmyra ocellata*, Johnston. Zool. Journ., vol. iii, p. 329.
1834. „ *minuta*, Aud. and Ed. Ann., p. 95.
1839. *Pholoë inornata*, Johnston. Ann. Nat. Hist., vol. ii, pp. 437, 438, Tab. xxiii, f. 1—5.
1843. „ *minuta*, Oersted. Grönl. Annal. Dorsib. (Danske vid. Selsk., Afh. x), p. 169, Tab. i, f. 3, 4, 8, 9, 16.
„ „ *baltica*, idem. Annul. Danic. Consp., p. 14, f. 21, 34—36, 40.

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in the anterior part of the body; posteriorly a pair on each segment; rami of the feet connate; superior bristles capillary, inferior falcate. He includes also *Sigalion*, *Psammolyce*, and *Sthenelais*, in the order given, under the Sigalioninæ.

[1] 'Sitz. d. Schleisch. Gesell.,' 1874.

1844. *Pholoë assimilis,* Oersted. Kroyer Nat. Tidskr. Anden Række, Bd. i, p. 404.
1851. „ *minuta,* Grube. Fam. d. An., 38.
1865. „ *inornata,* Johnston. Cat. B. M., p. 121, pl. xiii, f. 1—5; and Baird, p. 340.
„ „ *minuta,* Malmgren. Nord. Hafs-Ann., p. 89, Tab. xi, f. 13, and An. Poly., 17.
„ „ „ De Quatrefages. Hist. Nat. Annelés, vol. i, p. 188.
„ „ *inornata* and *baltica,* idem. Ibid., p. 190.
1873. „ *minuta,* Möbius. Jahresb. Com., 1871, p. 112.
„ „ „ Metzger. Ibid., p. 175.
„ „ „ Ehlers. Sitzungsb. Phys.-med. Soc., Erlangen, vol. v, p. 8.
1874. „ „ Malm. Göteborgs Kongl. vet. o Vitt. Samhalles Handl. Ny Tidsföljd, Häftet xiv, p. 76.
1875. „ „ Möbius. Jahresb. Com., 1872, p. 167.
1878. „ „ Lenz. Jahresb. Com. Anhang, 1874, p. 12.
1879. „ „ Théel. Annel. Nov. Zemb. Kongl. Sv. vet. Akad. Handl., vol. xvi, p. 24.
„ „ „ Tauber. Ann. Danic., p. 84.
1883. „ *inornata,* Levinsen. Nord. Annul., p. 199.
1884. „ „ Webster and Benedict. Ann. Mass., p. 701.
1886. „ „ Marenzeller. Porif., &c., Jan Meyen, p. 12.
1891. „ „ Hornell. Op. cit., p. 239.
1896. „ *eximia,* Michaelsen. Polych. Fauna, p. 12, pl. i, f. 2.
1897. „ *minuta,* McIntosh. Ann. Nat. Hist., ser. 6, vol. xx, p. 169.
1898. „ „ Michaelsen. Grönland. Ann., p. 122.

Habitat.—Everywhere on the shores of Britain from Shetland to the Channel Islands, where it attains the maximum size, and from the tidal region to the coralline ground. It lurks under stones between tide-marks, especially in pools. It is somewhat difficult to find, and perhaps is best obtained by placing suitable stones in vessels of sea water overnight, and then examining the water-line next day.

The variety *inornata* is more common on the eastern coast, whilst the variety *eximia* is more frequent in the west and south.

The species extends to Jan Meyen and to the shores of America (Verrill). Lenz found it in the grass-wrack region of the Baltic, and Michaelsen in the tubes of *Sabellaria spinulosa* at Heligoland.

Head (Plate XXIX, fig. 8) somewhat rounded and comparatively small, having anteriorly a rather short median tentacle with a few papillæ on the surface. The eyes are four in number; but as the pigment of the pairs touches on each side, they are connate.[1] Lateral tentacles absent. Two prominent papillæ project immediately behind the eyes. The palpi are somewhat massive, short, tapering organs, with a smooth surface. Two short, tapering, tentacular cirri occur on each side, with small papillæ sparsely distributed on the surface.

Body of forty-five to seventy segments, and about three-quarters of an inch as a maximum length, small, elongated (almost linear), but slightly more diminished posteriorly than anteriorly in young specimens. The dorsum is convex, the ventral surface flattened, with a median groove in the preparations. In life the dorsum is of a pale pinkish colour, slightly grained with brownish on some of the scales. A reddish mark occurs in front, with a dark greyish patch a little behind. Some, as Dr. Johnston

[1] Malmgren observed that in *P. minuta* the eyes were four, and approximated.

observes, are of a yellowish-brown colour, dusky along the sides. The centre of the dorsum is uncovered by the scales. Posteriorly are two slender, subulate styles.

Proboscis[1] forms a short muscular organ with teeth, as in the Sigalionidæ (biting to the left), and nine short but distinct papillæ along each arch. Moreover in extrusion, just behind the lateral furrow separating the dorsal and ventral arches, are two papillæ. A median and two lateral bosses (elevations) are also present in the basal segment when viewed from the dorsum.

Scales (Plate XXXIV, fig. 17).—The first pair in the variety *inornata* are somewhat rounded, as if an isosceles triangle had its angles smoothly removed. The scar for attachment is situated nearer the posterior than the anterior border. The latter has numerous short clavate cilia along its edge—to the number of about fifteen, while the posterior border has about nine longer cilia, somewhat moniliform in outline from constrictions. The surface of the scale anteriorly has also a row of cilia internal to that along the border, and a few are scattered in the area in front of the scar. All the cilia have traces of palpocils at the tip. Only the inner border of the scale is smooth.

In contrast with the first scale of *Pholoë minuta*, Fabr., from Greenland, the foregoing has fewer cilia. Thus there are upwards of forty along the anterior border of the arctic form, and twelve, proportionally shorter than in *P. inornata*, along the posterior edge. Moreover these organs are more numerous on the surface in front of the scar.

The shape in the second pair becomes transversely elongated with an anterior incurvation. The moniliform cilia along the posterior border are more numerous, while the smaller along the outer edge are fewer; and the same may be said of those on the surface.

The succeeding scales are irregularly rounded, with a somewhat even external border, which has moniliform cilia, while those along the posterior edge are few and widely separated. The scale is areolated, especially towards its inner border, which, along with the anterior, is smooth.

The posterior scales are more elongated transversely and have fewer cilia (about six of the large moniliform kind), both on the abbreviated external border and on the posterior edge. The scar is nearer the anterior than the posterior edge.

In comparing the larger broad anterior scales with those from Greenland and Canada (Plate XXXIV, fig. 18) comparatively little difference is observable, both having from eighteen to twenty-three moniliform cilia externally.

On the whole, therefore, the view that *P. minuta* and *P. inornata* are the same forms is borne out by the scales.

In the variety *eximia* the first pair of scales have a similar shape to those of the type, being irregularly rounded, and, from the size of the examples, smaller than in the latter. The outer border has a series of longer cilia, fewer in number but similar in structure. They encroach somewhat on the anterior border, or rather some of the isolated cilia scattered over the surface near the edge project beyond it, but none of the smaller clavate cilia so characteristic of the type *minuta* are present on this edge. These large isolated cilia occur both external and posterior to the scar for attachment.

[1] Described from an arctic example.

The second pair are elongated transversely as in the other form, but are distinguished by the great length of the cilia on the outer border. A few cilia also occur along the posterior edge.

The succeeding scales in the anterior third do not differ much in shape from those of *P. minuta*, but the cilia are much longer and stand stiffly out. They occur on the external margin and the outer half of the posterior edge. They are less numerous than in the large examples of the typical form, but agree with the smaller in this respect.

The posterior scales have about the same number of cilia, but they stand stiffly out like rays.

This form is distinguished from the preceding in spirit by an olive spot on the scale, with a pale centre at the scar for attachment. Occasionally, as in an example of this variety from Lochmaddy, the cilia on the scales are fewer and longer, being filiform tapering processes without the terminal enlargement.

In both varieties the areolæ, especially towards the inner edge, are well marked.

Feet.—The second foot is bifid, with two well-developed spines. The dorsal lobe forms a rounded eminence with a smooth surface. The bristles are comparatively short, slender, and taper to a very fine hair-like tip, minutely spinous. The inner forms taper more abruptly than the outer, and the tips are often bent nearly at right angles to the base. The ventral lobe is longer than the former, bluntly conical, and with numerous small papillæ on its surface. The ventral bristles have stout shafts dilated at the tip, and with numerous rows of spines on the convex margin, thus differing from those of the arctic examples (*P. minuta*, Fabr., typical), which have few. The distal region forms an elongated process—hooked at the tip, and with a series of spikes along the ventral edge. The tip in the arctic forms is more robust and proportionally shorter.

In the typical foot (Plate XXXI, fig. 14) the dorsal lobe presents a prominent process and a broad, slightly convex margin externally for the bristles, the spine piercing the apex of the convexity. The bristles (Plate XLII, fig. 23) form a dense tuft, directed outwards and downwards, and are slender and tapering, with well-marked spinous rows.

The ventral lobe has the shape of an oblique cone, with the spine issuing from the apex and with numerous papillæ over the surface. The shafts of the bristles (Plate XLII, fig. 24) are somewhat shorter and stouter than in the northern form (*P. minuta*, typical), and the convex edge of the tip has more numerous spikes. The falcate tip is shorter, more curved (the hook more pronounced), and the spines along the edge are often absent. Indications of these, however, are seen.

Posteriorly, the dorsal bristles have finer spikes, and the ventral have fewer rows of spines at the convex distal region of the shaft, while the terminal portion is more slender and proportionally longer. The papillæ on the ventral division are fewer and somewhat longer. The ventral cirrus is short and tapered.

In examples from Lochmaddy only three or four spikes occur on the distal end of the shafts of the ventral bristles. Some from Bressay Sound show more numerous though finer spikes at the distal end of the shafts, as in those from St. Andrews. In a small one from St. Magnus Bay they were too indistinct for determination, though they appeared to be smooth. In a small example from Herm no spikes were present

on the distal pieces of the ventral bristles. In specimens from the St. Lawrence, Canada, the bristles agreed more with the arctic forms, and one had a translucent granular deposit on them. The spikes at the end of the shaft were indistinct, but this also occasionally occurs in the British examples.

In considering the two varieties (*inornata* and *eximia*) it is clear that no reliable distinction can be drawn from the structure of the bristles, and this is probably more important than the condition of the cilia on the scales. It is true the end of the shaft is most spinous—that is, has a longer series of spines from above downwards—in var. *inornata*, and that the dorsal bristles are more distinctly spinous, and the ventral warts or papillæ more conspicuous, but the characters are not new, and only vary in degree, and are probably due to the surroundings, with which we are, perhaps, not fully acquainted. The steps from var. *eximia* to var. *inornata*, and thence to the typical *minuta* from the arctic seas, are easy, both as regards scales and bristles.

After a careful consideration of all the facts it has been thought best to unite the varieties into a single species.

Reproduction.—Male elements as minute granules occurred in August at Lochmaddy. At St. Andrews ripe males are common at the end of June, so that the breeding period would seem to be in July. The spermatozoa have globular heads and long tails, and resemble those of *Lepidonotus squamatus*, a species with the same breeding period. The examples of *P. minuta* from Greenland present ova in July.

Development.—Trochospheres, apparently of this species, occur near the bottom on September 12th, presenting only four crenations posteriorly to indicate the segments.

On September 10th the youngest stage has a bluntly conical prostomial region, which appears to occupy about half the bulk of the animal. Two small black specks are situated posteriorly. At each side are the short tentacular cirri. Four bristled feet follow, with stout bristles having the typical structure. Two spines occur on the dilated end of the shaft, the most prominent being inferior. Besides these stout bristles each foot has one or two much more slender forms, with a long, tapering, diaphanous terminal piece, evidently a larval ventral bristle. The dorsal bristles have the adult structure, being slender, tapering, hair-like, serrated bristles. The dorsal cirrus is much enlarged at the base, but with a slightly tapered tip.

What appear to be three pairs of scales have the aspect of globular organs on a pedicle, each with several large truncate papillæ projecting from the edge. These papillæ are out of all proportion to the condition in the adult. Viewed from below the ventral cirrus shows a basal swollen region (ceratophore) and a two-jointed cirrus, while some distance inwards is a globular papilla. The body, which is marked by transverse lines at this stage, terminates posteriorly in a broad pygidium.

In the next stage (which, however, is of the same date—September 10th, 1888) the snout is truncated, and the caudal process has a dimple in the middle. Then the head becomes defined as an oblong mass, rounded in front and flanked by the two tentacular cirri, which now are directed forward on each side. There are still only four bristled feet. The cilia on the scales are longer, and two short, broad, caudal cirri have appeared under the pygidium.

The bottom tow-net procured, on February 4th in four to five fathoms, a young example of *Pholoë* having thirteen feet on each side. The head bears in front two closely approximated median eyes, and two more widely separated towards the posterior border. Both pairs of eyes have a rounded, lens-like differentiation. The median tentacle is well developed and subulate, while three smaller and the stump of a fourth (making two tentacular cirri) project in front. These are minutely but sparsely papillose. The palpi have enlarged basal regions, and taper to a blunt point. The body is flattened and nearly of uniform diameter, though tapered a little in front and more distinctly posteriorly, where it terminates in a rounded "boss" on each side of the vent, the globular cirri of the last pair of feet generally projecting on each side a little in front. The proboscis is furnished with well-marked teeth.

The feet show dorsal and ventral divisions, each with a spine and the characteristic bristles, besides the cirri. At least four pairs of scales were present, most with five cilia on the outer border, though one (probably the first) had seven. Lines radiating from the centre of the scale to the base of the cilia probably indicated nerve-strands.

Habits.—They break, when lifted with the forceps, like the Polynoidæ, but are sluggish, lurking under stones between tide-marks. The best way to obtain them, indeed, is to chip fragments from the under surfaces of stones covered with various growths in pools near low water mark, and immerse them in sea water for a day or two. The Annelids either occur at the water-line of the vessel or are found by examining the débris at the bottom.

P. minuta was first found by Otho Fabricius on the shores of Greenland, and afterwards by Oersted in the same region.

Dr. Thomas Williams[1] (1858) credited this species with the only vascular system he had been able to see in the Aphroditaceans in the form of a vessel, carrying a colourless fluid in contact with the nerve-cord, and slowly undulating with pulsations.

The *Pholoë synophthalmica* of Claparède seems to be a closely allied if not identical form.[2] Marion and Bobretzky,[3] who agreed with this author as to the specific distinction of *P. synophthalmica*, point out the proper interpretation of the cephalic appendages, and that the first segment is fused with the cephalic, so that the first scale is borne on the second segment. De Saint-Joseph likewise follows Claparède in separating *P. synophthalmica*.

Marenzeller[4] (1893) describes a new species from the African shores of the Mediterranean (Santorin), in which the dorsum of the body is covered with papillæ, and the scales have more numerous cilia. The bristles seem to approach closely those of the common form.

Dr. Michaelsen lately (1897) regarded the variety *eximia* as a distinct species, but he relied chiefly on the divergence of the scales and other points already alluded to. It is sufficient to consider *eximia* a variety, and chiefly a smaller variety. He kindly sent me slides for examination, so that no dubiety might exist.

[1] 'Philos. Trans.,' 1858, p. 135.
[2] 'Annal. Chét. Naples,' 79, pl. iii, f. 1.
[3] 'Ann. Sc. Nat.,' 1875, pp. 8, 9.
[4] 'Polychäten des Grundes,' 1893, p. 6, pl. i, f. 3.

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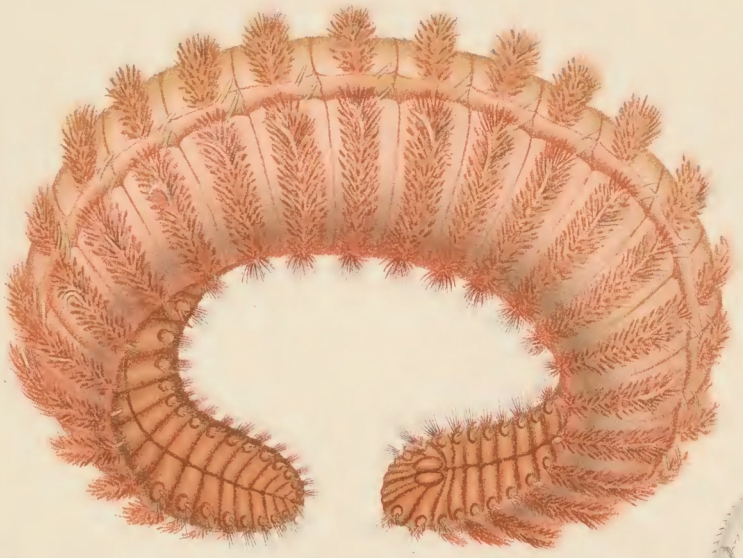

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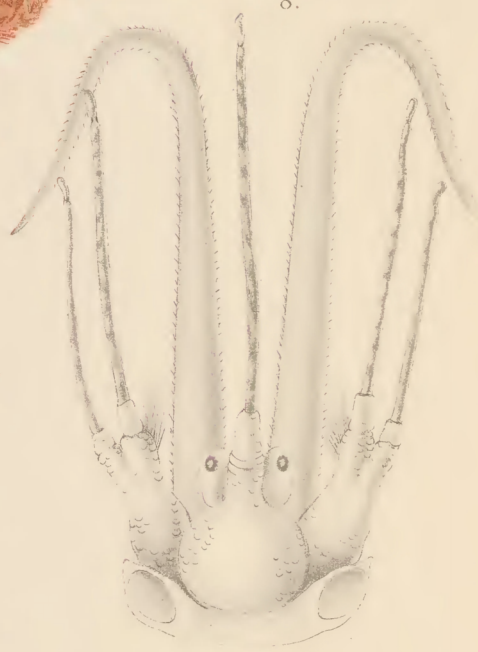

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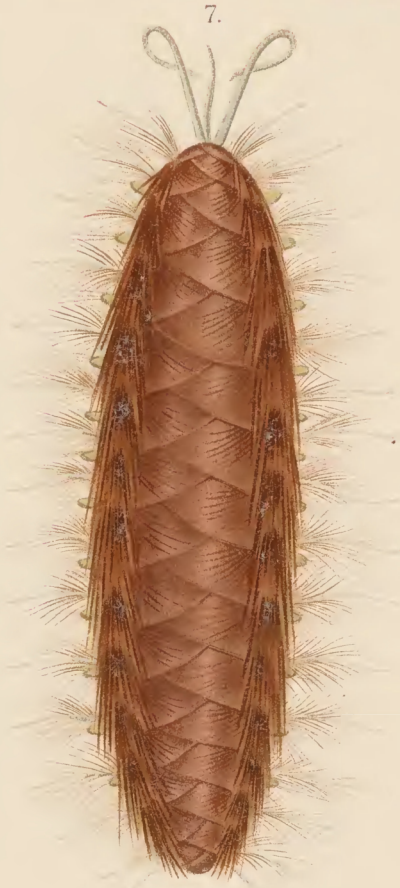

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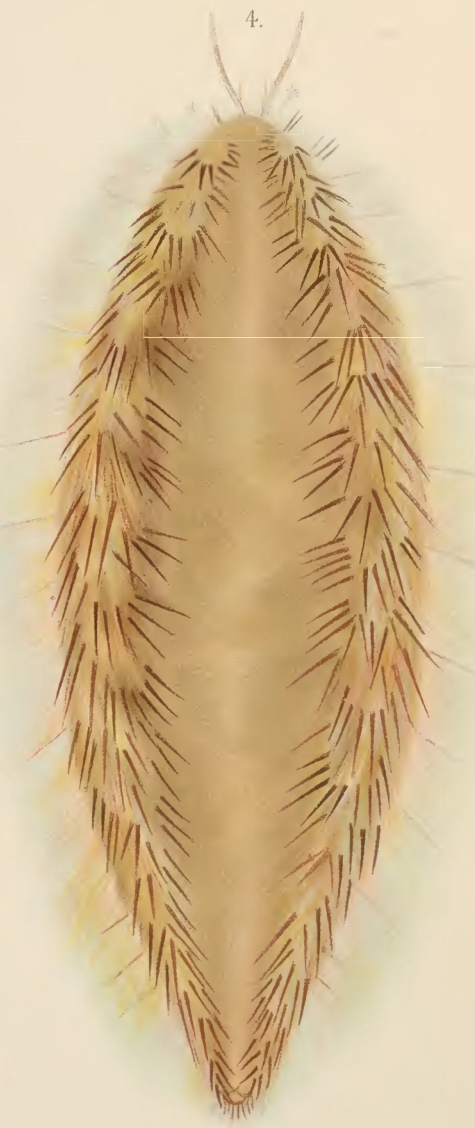

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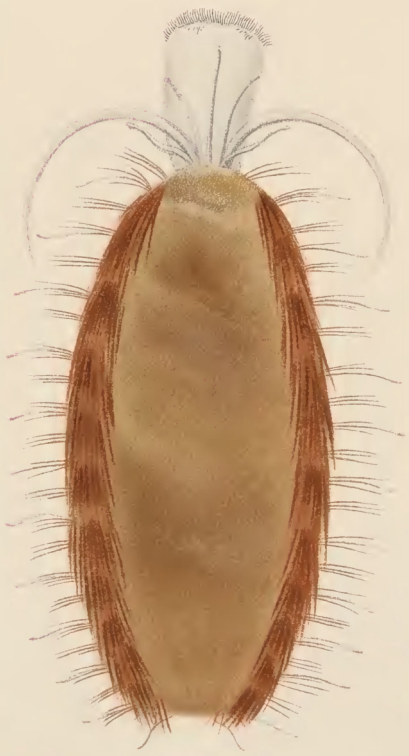

Figs. 1, 2, Nat. & not. Graff, 4, 5, J.M.A.
Fig. 3 R.M.& A.T.M.
Figs. 6-9 E.B.

Ltc. Werner & Winter, Frankfurt a/M.

PLATE XXIV.

FIG.

1. Dorsal surface of *Spinther miniaceus*, Gr. Enlarged.

2. Ventral surface of the same. Enlarged more highly.

3. View of a reddish example of *Euphrosyne foliosa*, Aud. and Ed., showing both dorsal and ventral surfaces. Enlarged.

4. *Aphrodita aculeata*, L., from the dorsum. Slightly enlarged.

5. Ventral view of the same. No median furrow occurs in this specimen.

6. Head and anterior region of the foregoing. Enlarged.

7. Dorsal view of a dark variety of *Hermione hystrix*, Aud. and Ed. Enlarged.

8. Cephalic region of the same. Enlarged.

9. Dorsal view of *Lætmatonice filicornis*, Kbg. Enlarged.

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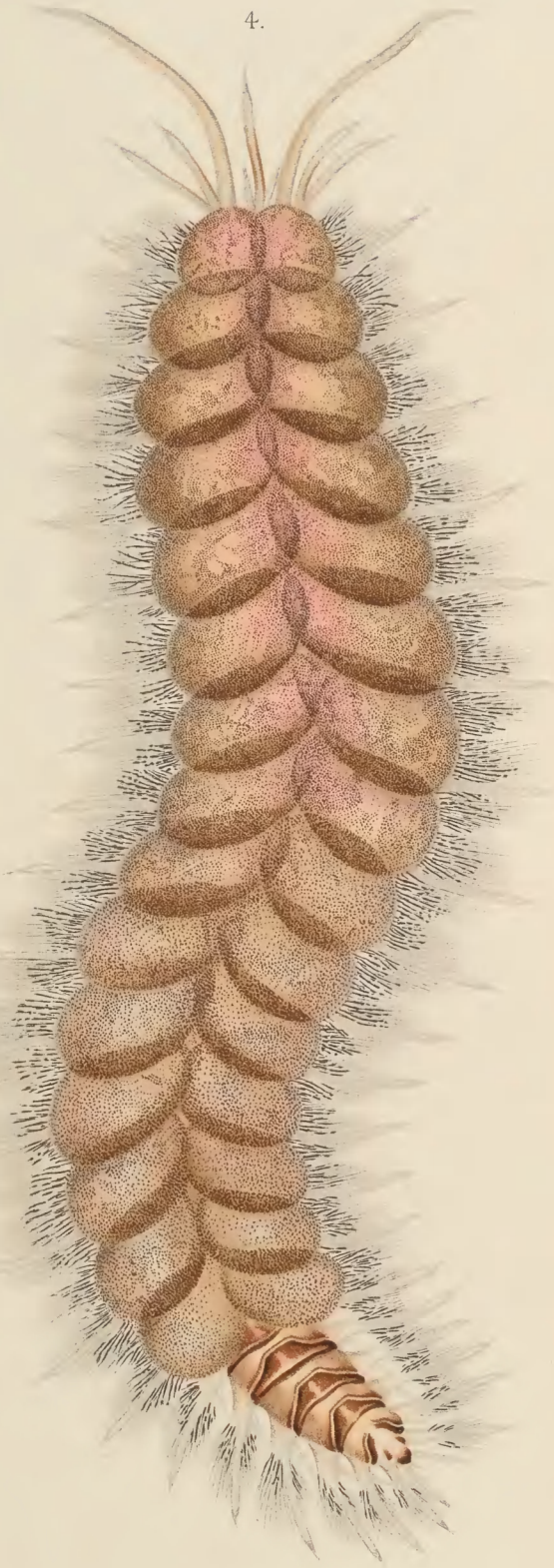

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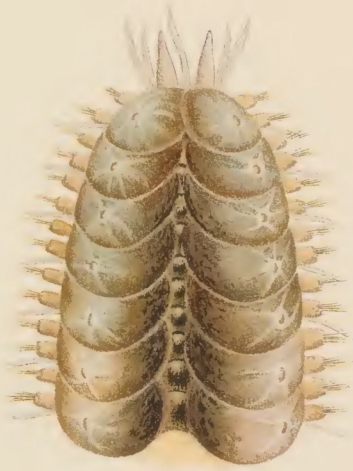

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Figs. 4&5 R.M.
» 1,3&7 A.W.
» 2&6 J.M.A.

Lith. Werner & Winter, Frankfort a/M.

PLATE XXV.

Fig.

1. *Lepidonotus squamatus*, L., from the dorsum. Enlarged.

2. Head of the foregoing in life. Enlarged.

3. A large specimen of *Gattyana* (*Nychia*) *cirrosa*, Pall., from the dorsum. Enlarged.

4. *Harmothoë longisetis*, from the dorsum. Enlarged.

5. Dorsum of a living example of *Halosydna gelatinosa*, Sars. Enlarged.

6. Head of *Harmothoë imbricata*, L. Enlarged.

7. Anterior end of a large example of *Polynoë scolopendrina*, Sav., from North Uist. Enlarged.

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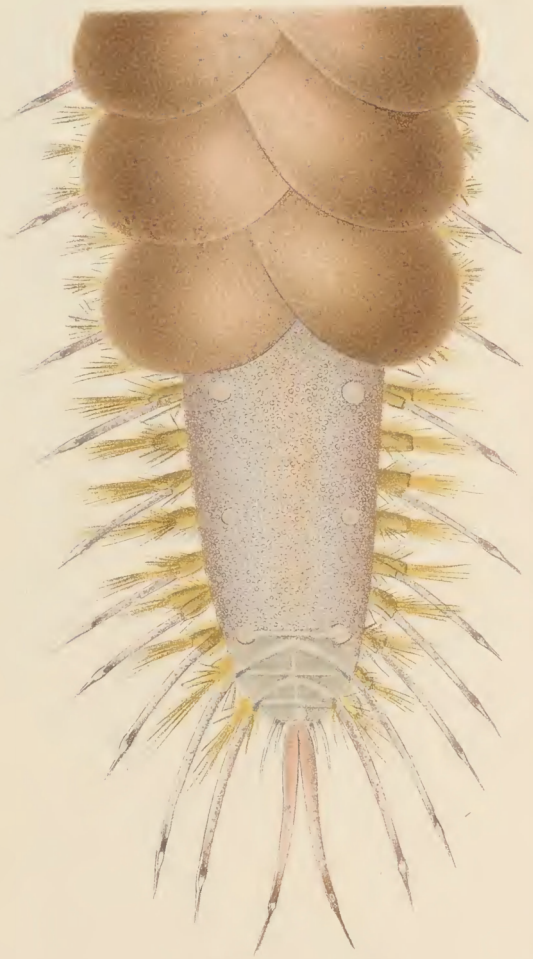

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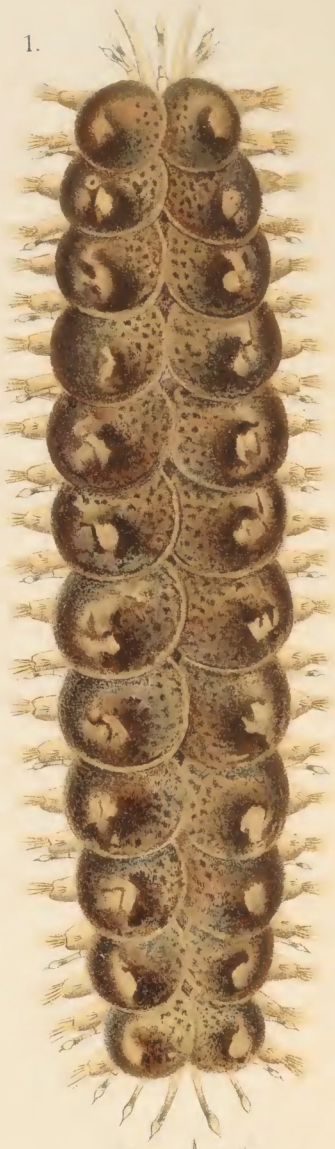

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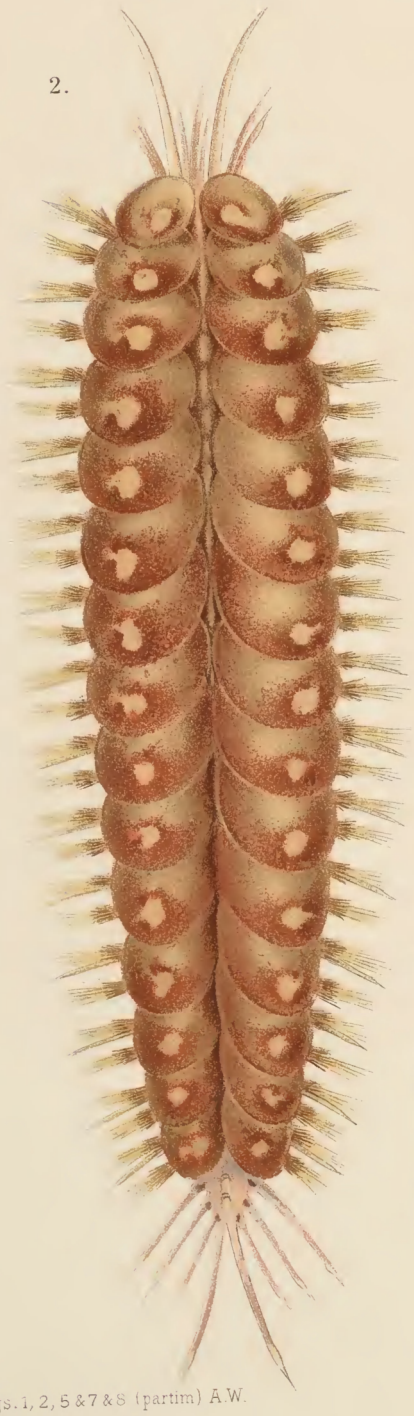

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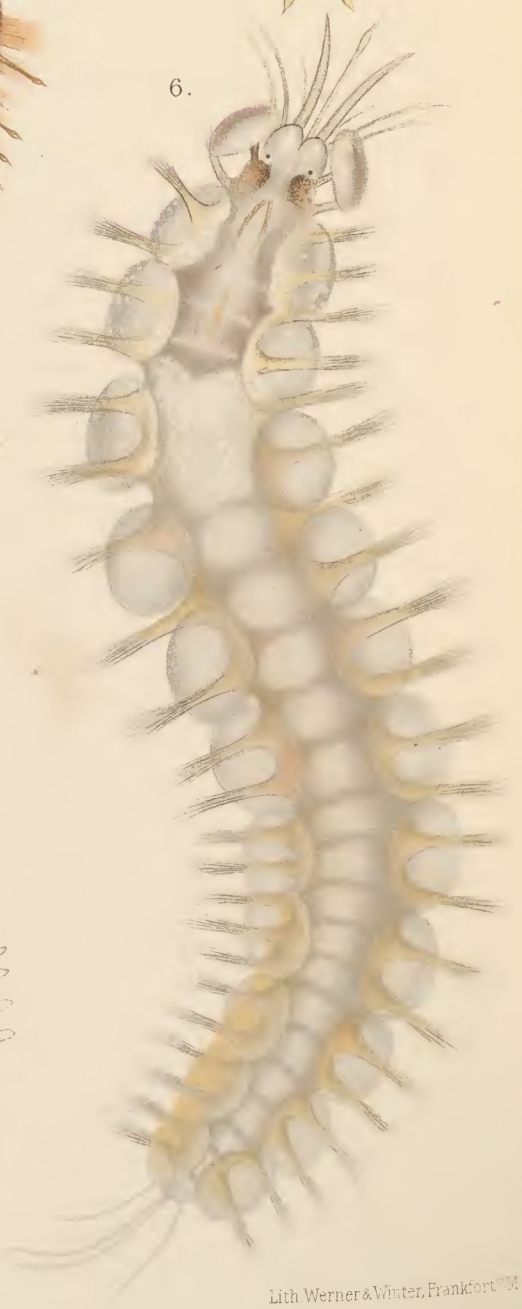

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Figs. 1, 2, 5 & 7 & 8 (partim) A.W.
„ 6, 7 & 8 R.M.
„ 3 E.L. 4 J.M.A.

Lith Werner & Winter, Frankfort a/M.

PLATE XXVI.

Fig.

1. *Lepidonotus clava*, Mont., from the dorsum. Enlarged.

2. *Lagisca floccosa*, Sav. (*propinqua*, Mgrn.), from the dorsum. Enlarged.

3. *Harmothoë imbricata*, L., from the dorsum. Enlarged.

4. Posterior end of an example of the same, from which three pairs of scales have been removed to show the ova on the dorsum. Enlarged.

5. *Evarne impar*, Johnst., from the dorsum. Enlarged. A very dark example.

6. *Scalisetosus pellucidus*, Ehlers, with regenerating scales; Channel Islands. Enlarged.

7. Anterior end of *Sthenelais boa*, Johnst. Enlarged.

8. Posterior end of the same. Enlarged.

9. Process from the edge of a scale of *Sthenelais Buskii*.

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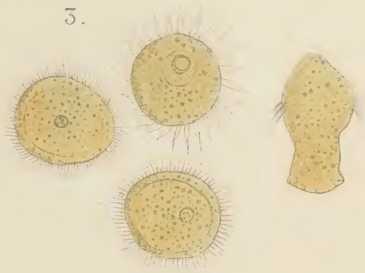

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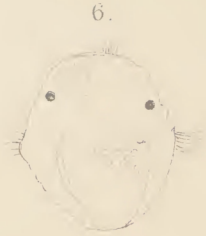

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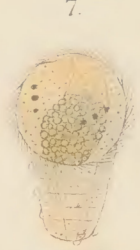

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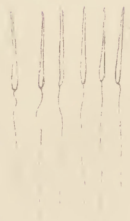

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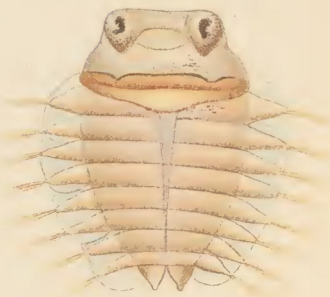

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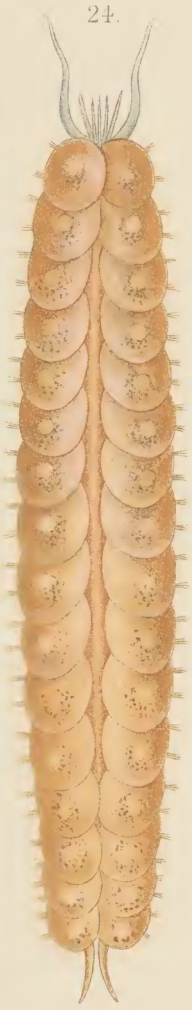

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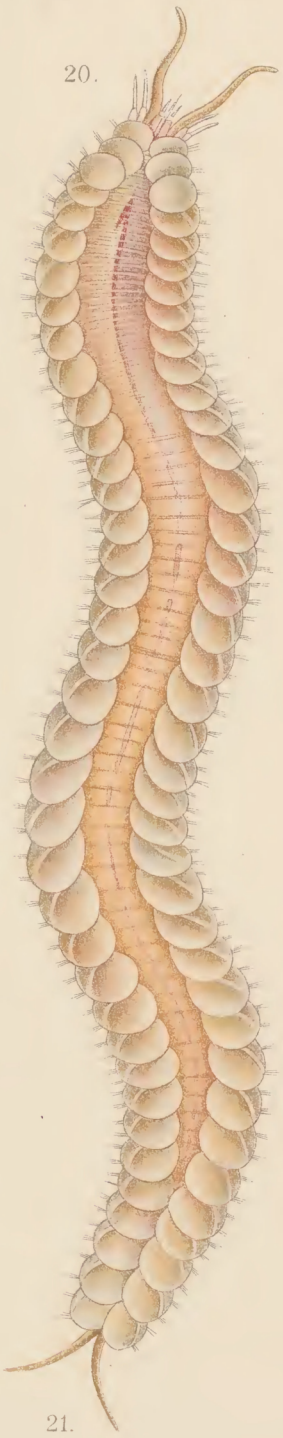

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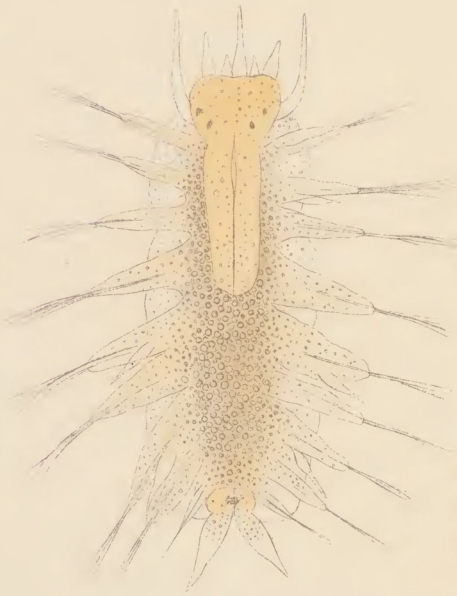

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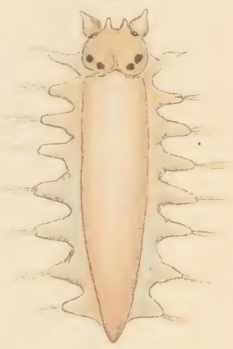

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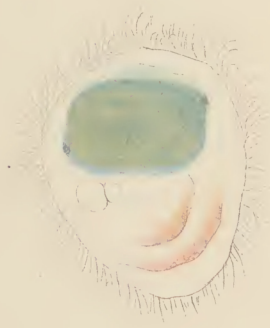

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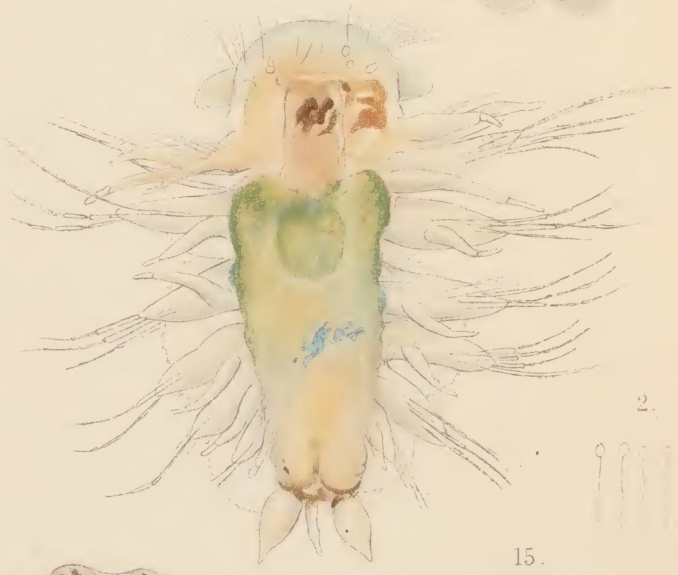

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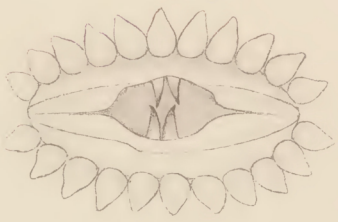

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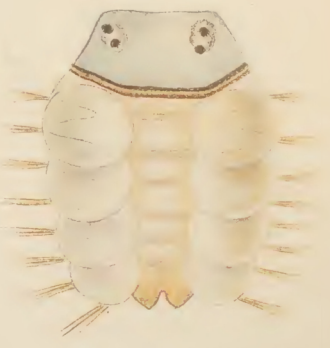


Engr. 3, 7, 10 & 12 J. M. A.
" 14, 21, 25 & 24 A. W.
Chester W. C. M.

Lith. Wenman & Whiter, Fore Ken.

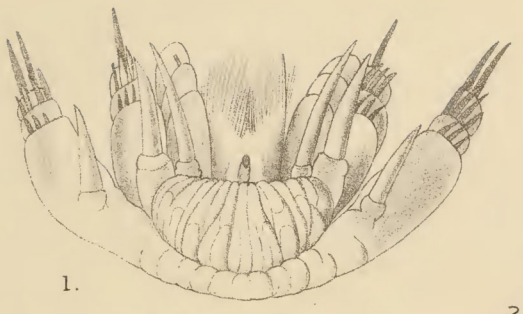
PLATE XXVIA.

Fig.

1. Spermatozoa of *Harmothoë imbricata*. × Zeiss, 1 oc., D obj.
2. Spermatozoa of *Lepidonotus squamatus*. × idem.
3. Trochospheres of *H. imbricata* assuming a greenish hue. Magnified.
4. View of a more advanced trochosphere of March 28th, with the projecting mouth to the left. × 116.

5 and 6. Lateral and dorsal views of other examples. × 52.

7. More advanced larva with traces of feet, but without bristles, or with such only indicated.
8. A further stage in which the feet have minute bristles. (June 26th.) × 82.
9. Larval *Polynoë* with well-marked feet and bristles, minute scales, and anal cirri. × 52.
10. Nectochæte stage of *Harmothoë*. (April 20th.) × 52.
11. Nectochæte stage of a Polynoid (June 28th), with median and lateral tentacles and anal cirri. × 52.
12. Nectochæte stage of *Harmothoë*, sp. (April 27th.) × 50.
13. Nectochæte stage of *Polynoë*, sp. (July 18th.) $\frac{1}{35}$ inch long. × 50.
14. More advanced nectochæte conditions in a form approaching *Lagisca* or *Evarne*. (October 25th.) × about 40.
15. Dorsal view (in spirit) of nectochæte stage of a form approaching *Lepidonotus squamatus*. (June.) × 40.
16. Ventral view of the foregoing. Similarly magnified.
17. A slightly later stage. Similarly enlarged.
18. Stage with developing palpi, and with additional eye-spots. Similarly magnified.
19. Stage of the same form with distinct palpi, median and lateral tentacles. × about 35.
20. Dorsal view of *Panthalis Œrstedi*, from a figure kindly sent by Mr. Arnold Watson.
21. Proboscis and jaws of *Sthenelais boa*. Enlarged under a lens.
22. Metatroch stage of *Sthenelais* or *Sigalion* seen from above. (October 22nd.) × 50.
23. Post-larval *Sigalion*, pelagic condition. (October 28th.) × 50.
24. Dorsal view of *Pholoë minuta*. Enlarged.
25. Spermatozoa of *Pholoë minuta*. (June 24th.) × 350.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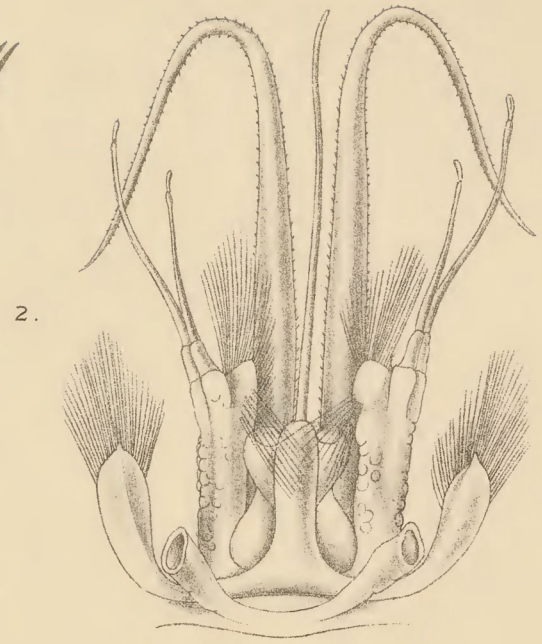
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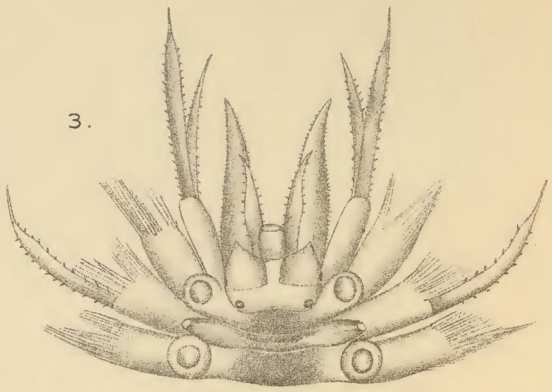
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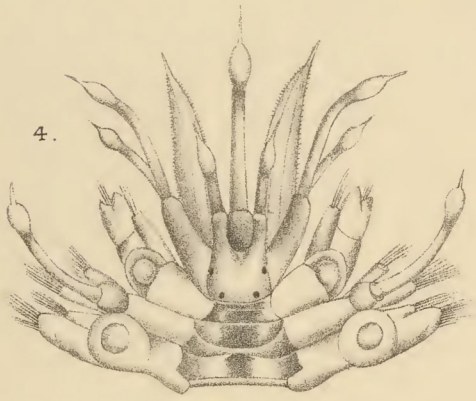
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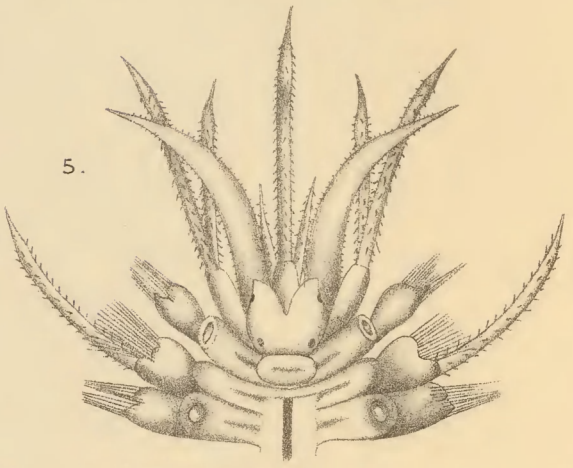
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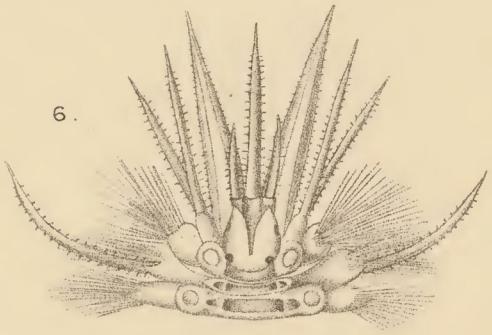
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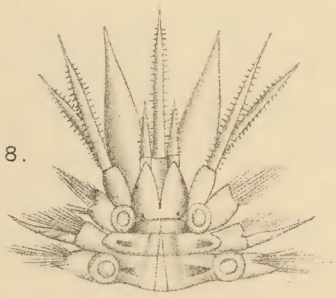
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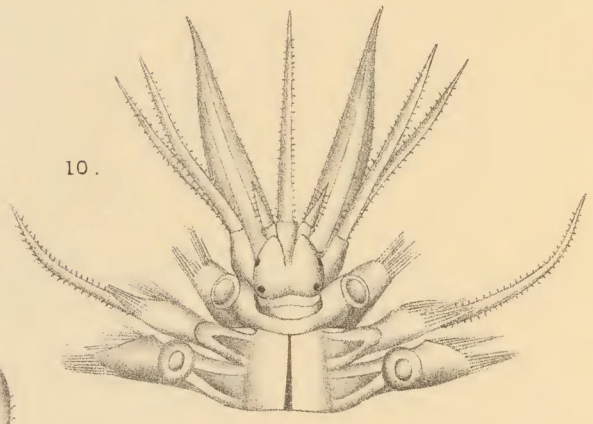
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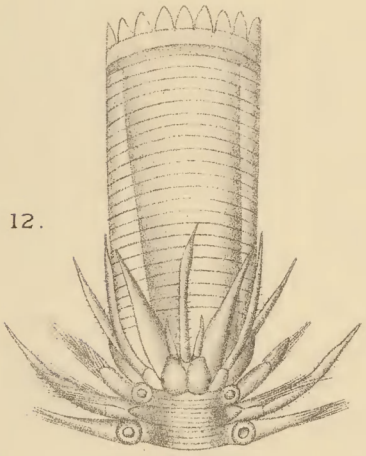
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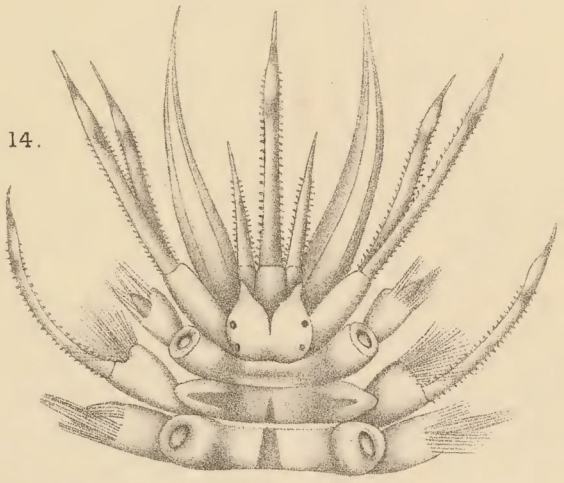
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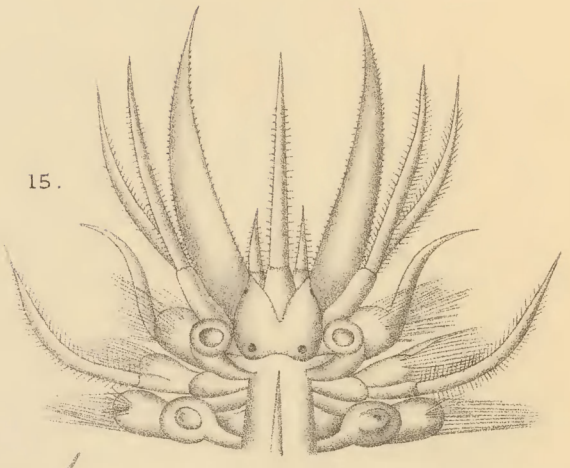
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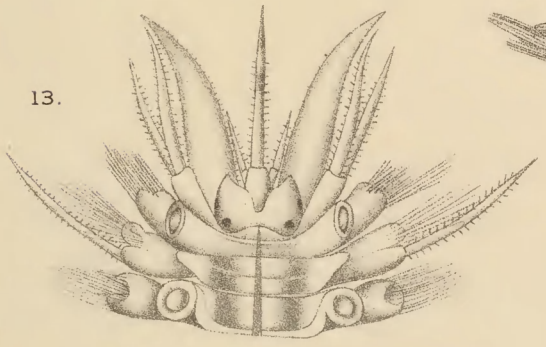
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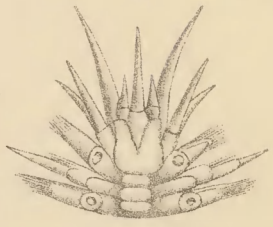
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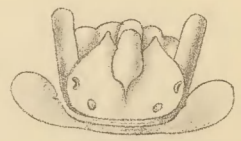
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A. Walker, del. Figs 1 2 7 18 E. Burnet.

F. Huth, Lith.r Edin.r

PLATE XXVII.

Fig.

1. Oral region of *Aphrodita aculeata*, L., in contraction and from the ventral surface. Enlarged.
2. Head of *Lætmatonice filicornis*, Kbg. Enlarged.
3. Head of *Lagisca Elisabethæ*, n. s. Enlarged.
4. Head of *Lepidonotus clava*, Mont. Enlarged.
5. Head of *Gattyana cirrosa*, Fabr. Enlarged.
6. Head of *Acanthicolepis asperrima*. Enlarged.
7. Head of *Evarne Johnstoni*, McI. (large example). Enlarged.
8. Head of *Harmothoë lunulata*, D. Chiaji. Enlarged.
9. Head of *Eunoa nodosa*, Sars. Enlarged.
10. Head of *Lagisca Jeffreysii*. Enlarged.
11. Head of *Harmothoë marphysæ*, McI. Enlarged.
12. Head of *Scalisetosus pellucidus*, Ehlers. Enlarged.
13. Head of *Evarne impar*, Johnst. Enlarged.
14. Head of *Lagisca floccosa*, Sav. Enlarged.
15. Head of *Harmothoë areolata*, Grube. Enlarged.
16. Anterior end of *Eurythoë borealis*, Sars, dorsal view. Enlarged.
17. Head of *Acholoë astericola*, D. Chiaji. Enlarged.
18. Head of *Phyllantinoë mollis*, McI. Enlarged.

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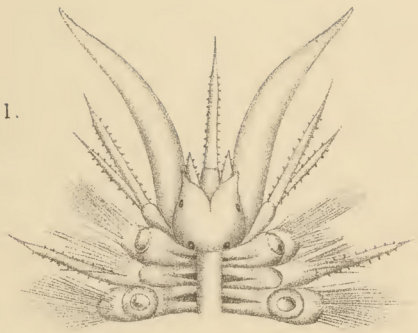

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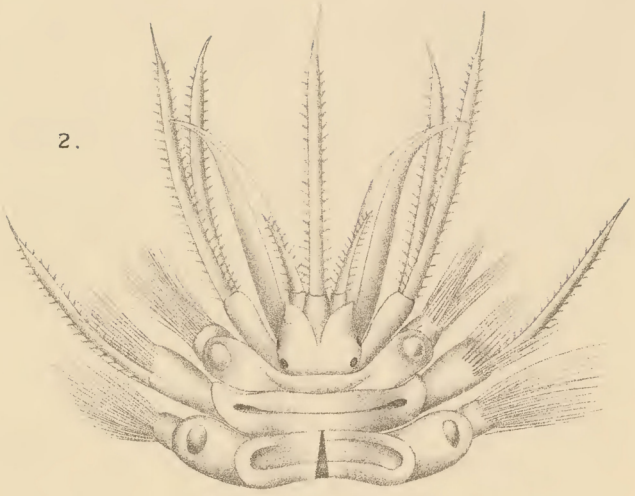

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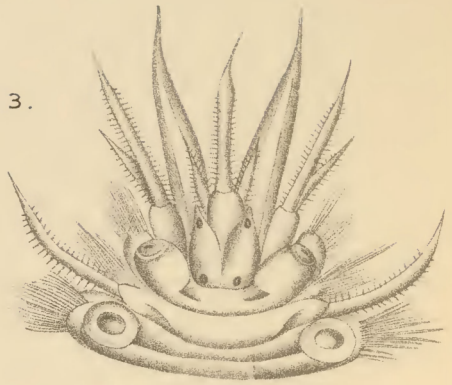

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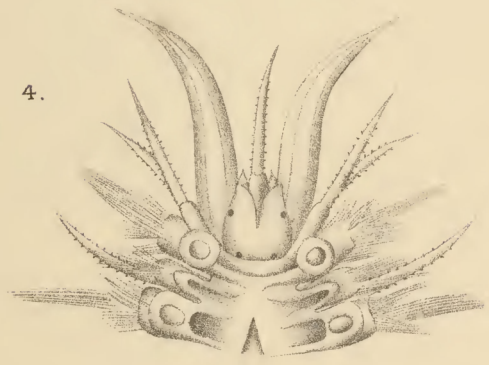

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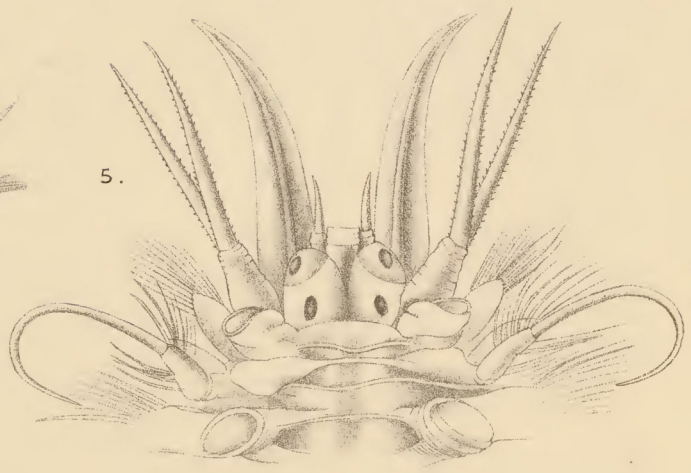

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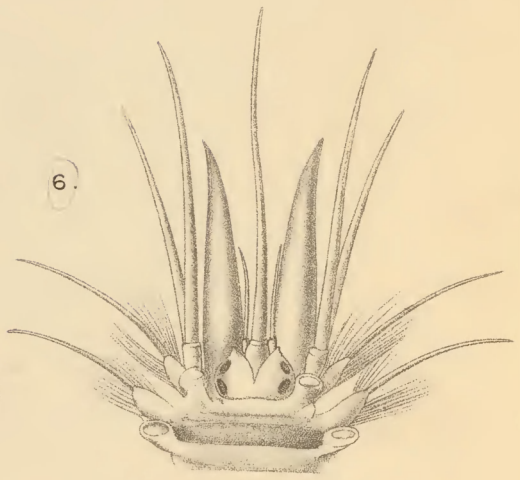

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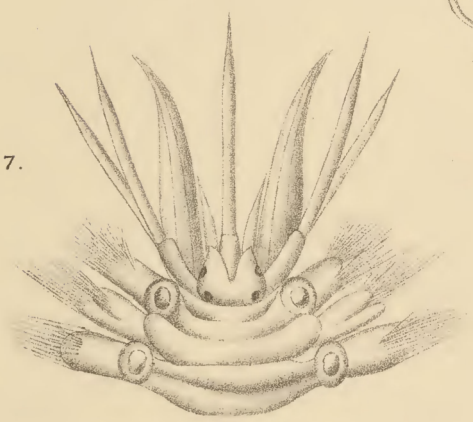

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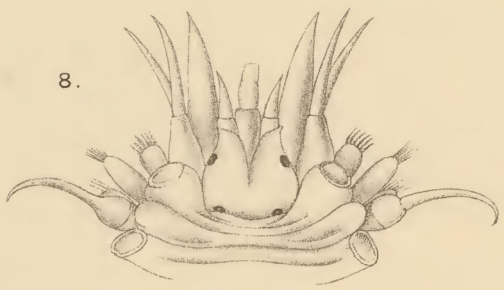

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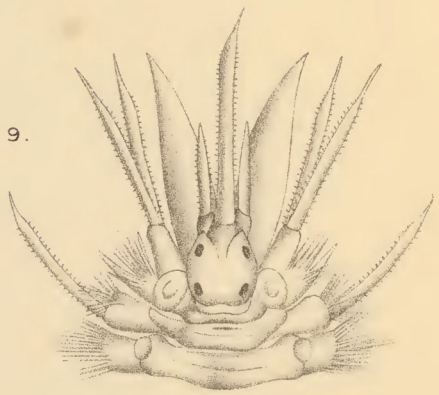

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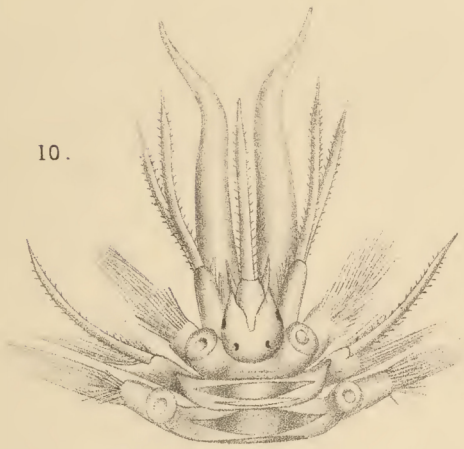

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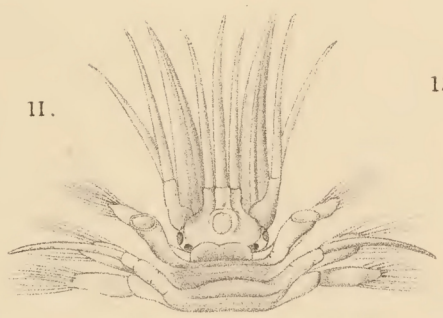

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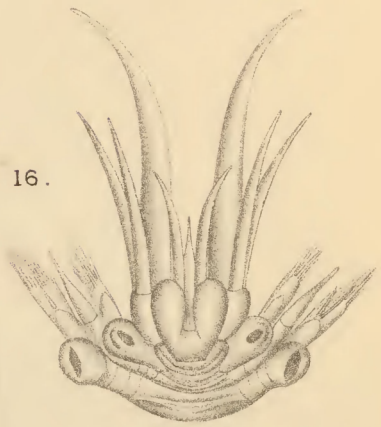

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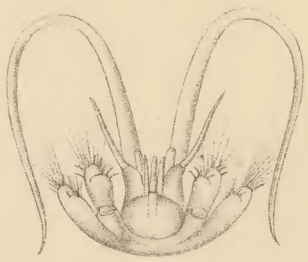

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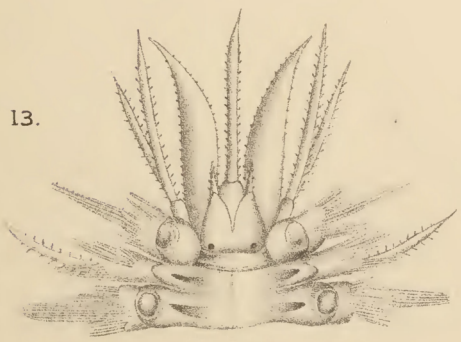

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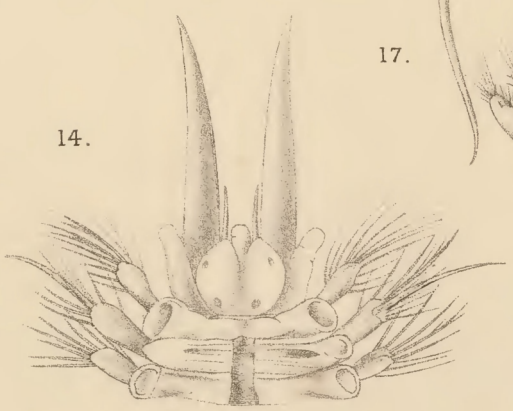

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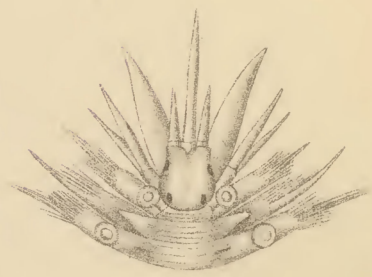


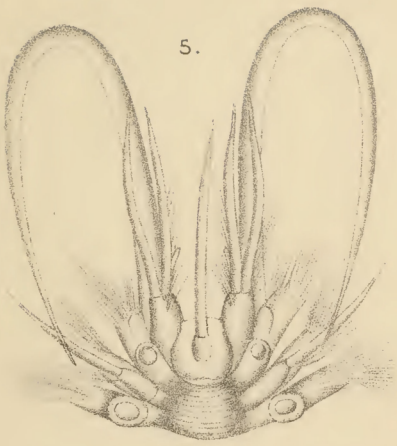
A. Walker del. Figs 5, 6, 8, 11, 12, 14, E. Burnet.

F. Huth, Lith. Edin.

PLATE XXVIII.

Fig.

1. Head of *Harmothoë zetlandica*, McI. Enlarged.
2. Head of *Lagisca extenuata*, Grube. Enlarged.
3. Head of *Harmothoë spinifera*, Ehlers (*olim Sibbaldii*). Enlarged.
4. Head of *Harmothoë Ljungmani* (= *H. Macleodi*). Enlarged.
5. Head of *Lænilla setosissima*, Sav. Enlarged.
6. Head of *Evarne Hubrechti*, McI. Enlarged.
7. Head of *Harmothoë Fraser-Thomsoni*, McI. Enlarged.
8. Head of *Malmgrenia andreapolis*, McI. The median tentacle is imperfect. Enlarged.
9. Head of *Polynoë scolopendrina*, Sav. Enlarged.
10. Head of *Antinoë Sarsii*, Mgrn. Enlarged.
11. Head of *Halosydna gelatinosa*, Sars. Enlarged.
12. Head of small example of *Evarne Johnstoni*, McI. Enlarged.
13. Head of *Harmothoë antilopis*, McI. Enlarged.
14. Head of *Antinoë mollis*, McI. Enlarged.
15. Head of *Malmgrenia castanea*, McI. Enlarged.
16. Head of *Panthalis Œrstedi*, Kbg. Enlarged.
17. Head of *Leanira hystricis*, Ehlers. Enlarged. The specimen was somewhat imperfect.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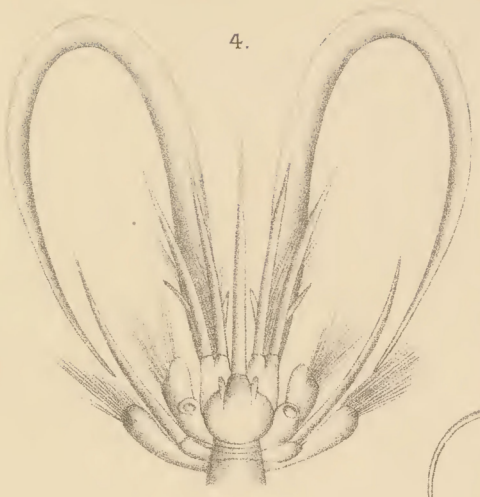
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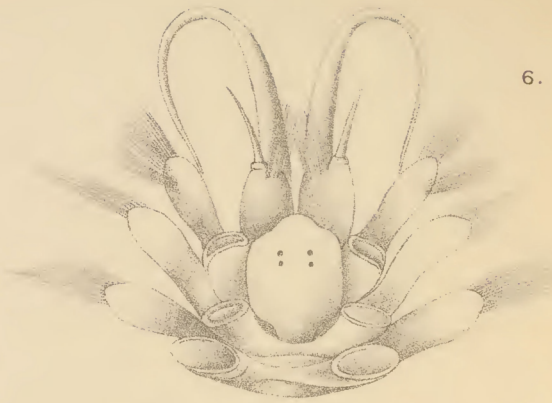
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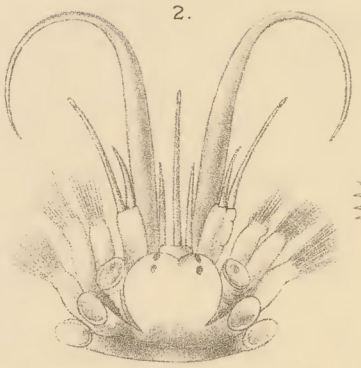
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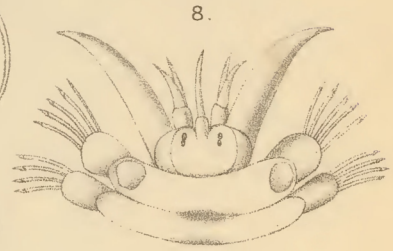
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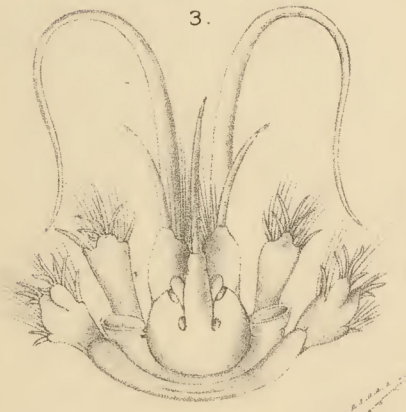
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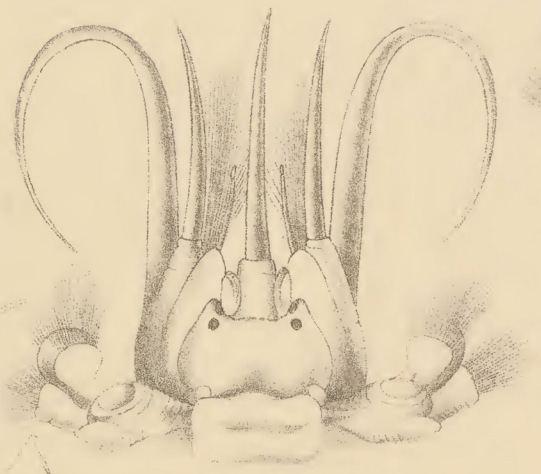
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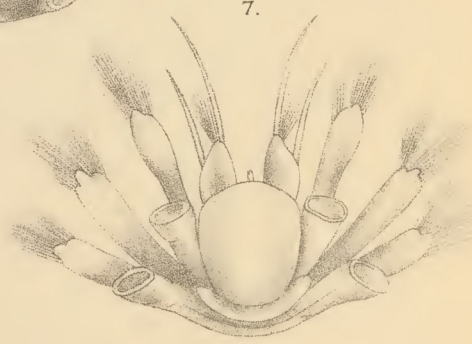
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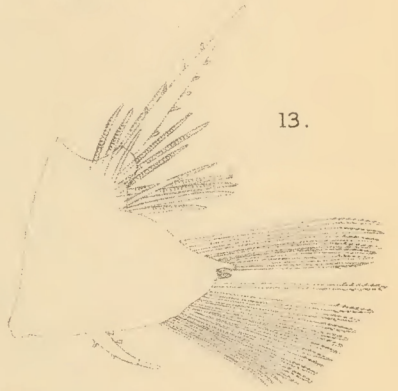
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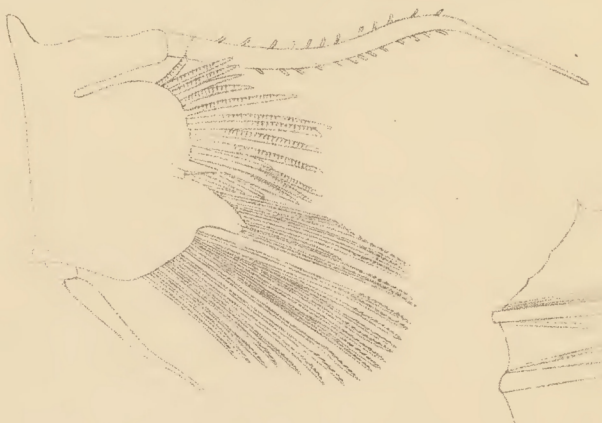
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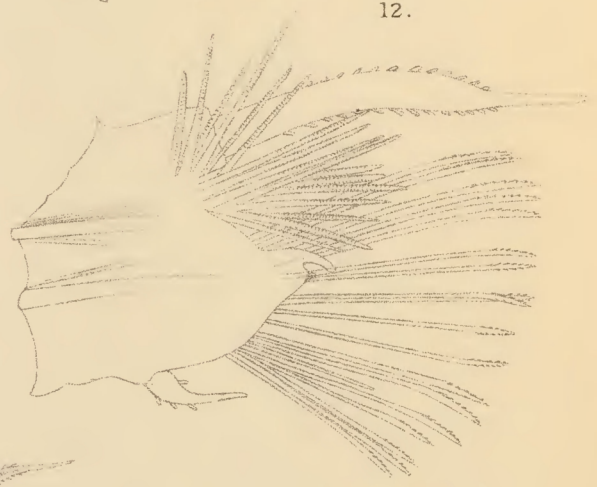
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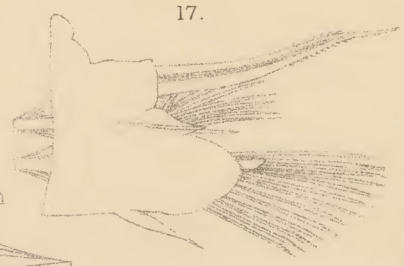
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16.

Figs 1-8. E.B. cætera W.C.M. del.

F. Huth, Lith.r Edin.r

PLATE XXIX.

Fig.

1. Head of *Sthenelais boa*, Johnst. Enlarged.
2. Head of *Sthenelais atlantica*, McI. Enlarged.
3. Head of *Sthenelais limicola*, Ehlers. Enlarged.
4. Head of *Sthenelais Jeffreysii*, McI. Enlarged.
5. Head of *Eusthenelais hibernica*, McI. Enlarged.
6. Head of *Sigalion Mathildæ*, Aud. and Ed. Enlarged.
7. Head of *Sigalion Buskii*, McI. Enlarged.
8. Head of *Pholoë minuta*, Fabr. Enlarged.
9. Anterior foot (about twelfth) of *Lagisca extenuata*, Grube. × 24.
10. Anterior foot of *Lagisca floccosa*, Sav. (= *propinqua*, Mgm.). × 24.
11. Twelfth foot of *Lagisca Elisabethæ*, McI. × 40.
12. Tenth foot of *Harmothoë spinifera*, Ehlers. × 24.
13. Anterior foot of *Harmothoë Ljungmani*, Mgrn. × 28.
14. Anterior foot of *Harmothoë antilopis*, McI. × 24.
15. Anterior foot of *Harmothoë Fraser-Thomsoni*. × 26.
16. Anterior foot of *Harmothoë marphysæ*, McI. × 40.
17. Anterior foot of a large example of *Polynoë scolopendrina*, Sav., from North Uist. × 15.

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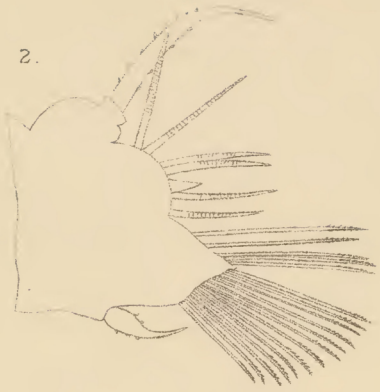

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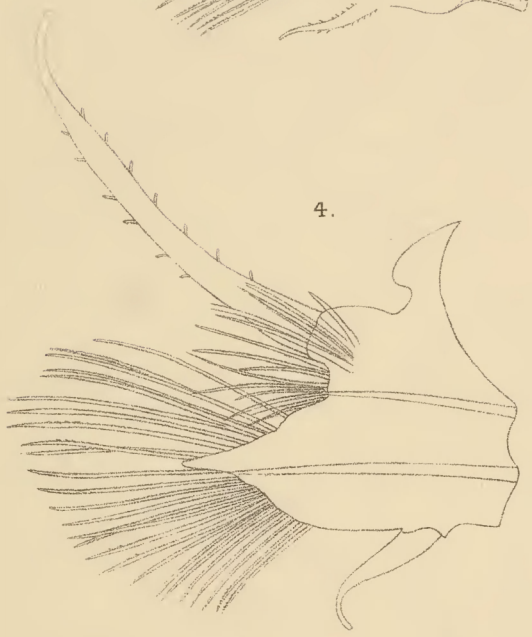

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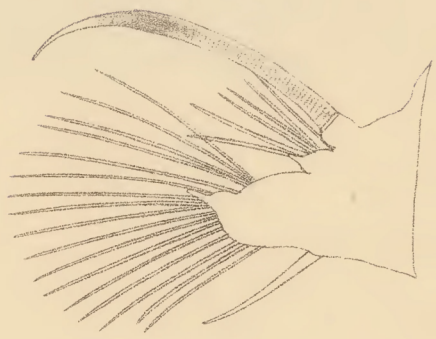

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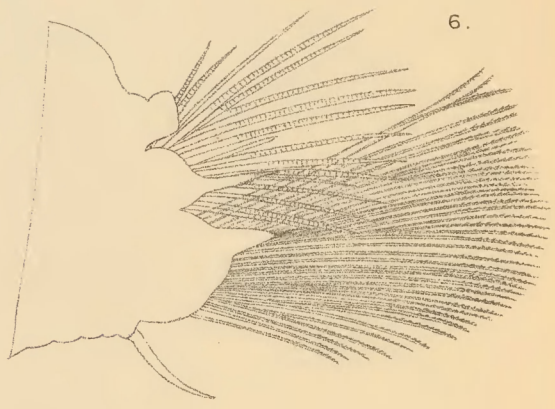

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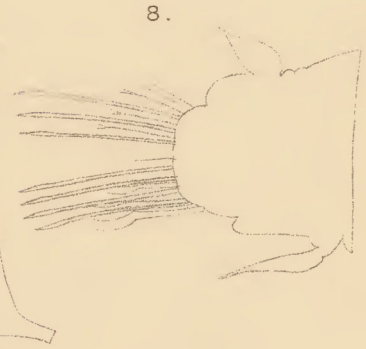

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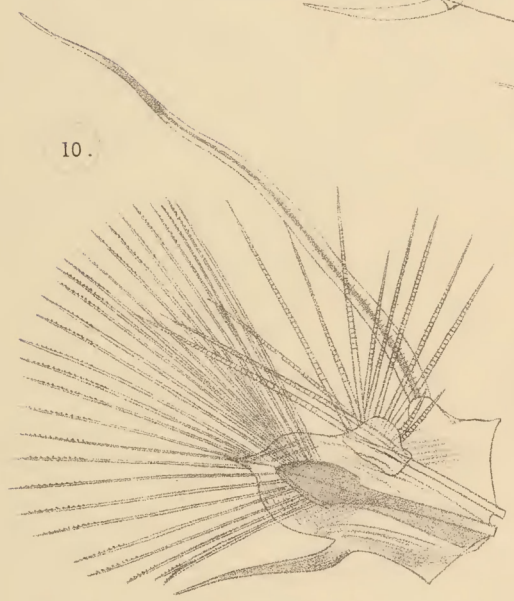

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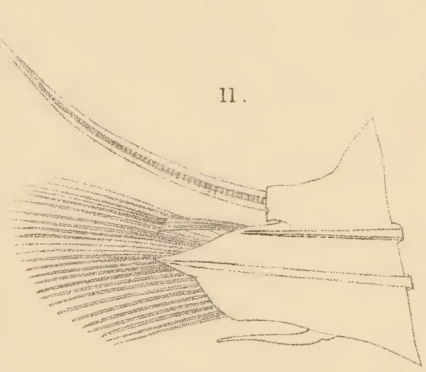

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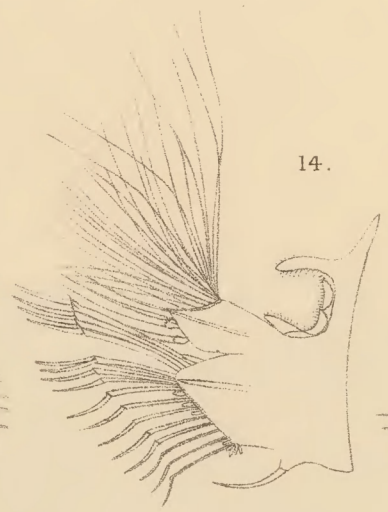

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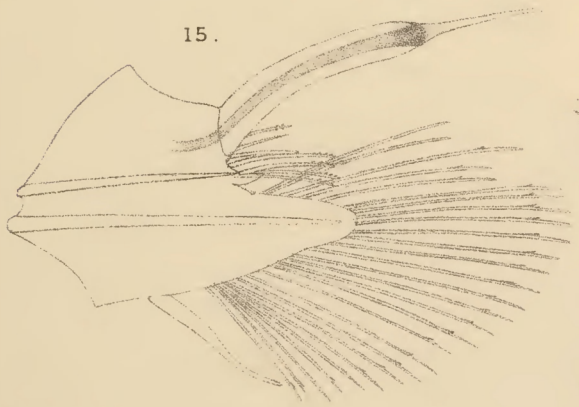

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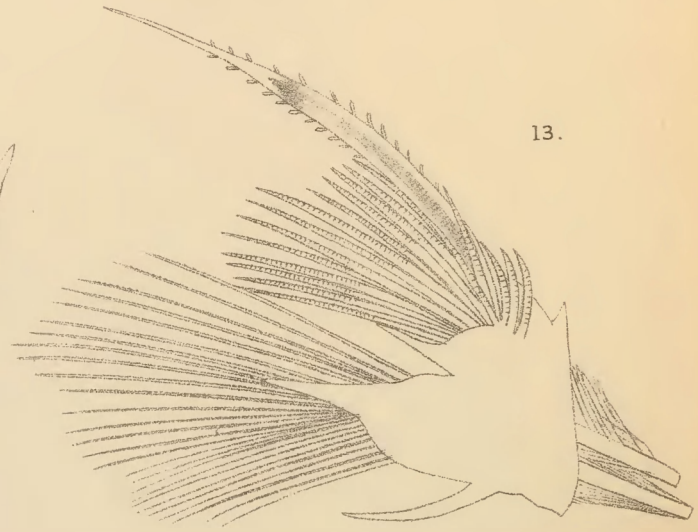

PLATE XXX.

FIG.

1. Foot (about twelfth left) of *Harmothoë imbricata*, L. × 12.

2. Anterior foot of *Harmothoë zetlandica*, McI. × 24.

3. Anterior foot of *Harmothoë areolata*, Grube. × 24.

4. Seventh foot of *Harmothoë lunulata*, D. Chiaje. × 40.

5. Anterior foot of *Malmgrenia castanea*, McI. × 24.

6. Anterior foot of *Evarne Johnstoni*, McI. × 20.

7. Anterior foot of *Evarne impar*, Johnst. × 30.

8. Foot of *Panthalis Œrstedi*, Kbg. × 15.

9. Foot of *Scalisetosus pellucidus*, Ehlers. × 40.

10. Anterior foot of *Evarne Hubrechti*, McI. × 20.

11. Anterior foot of *Halosydna gelatinosa*, Sars. × 18.

12. Anterior foot (about eleventh) of *Lœnilla setosissima*, Sav.

13. Anterior foot of *Antinoë finmarchica*, Mgrn. × 40.

14. Foot of *Sthenelais zetlandica*, McI. × 32.

15. Anterior foot of *Scalisetosus assimilis*, McI. × 40.

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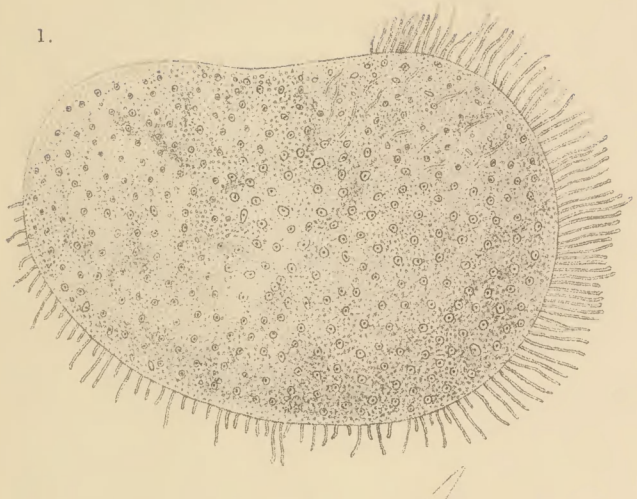

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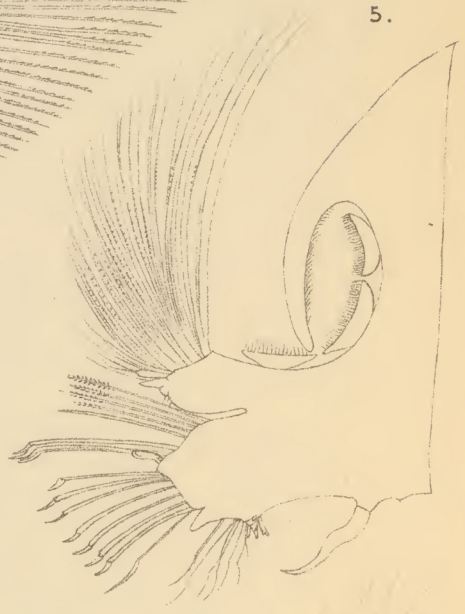

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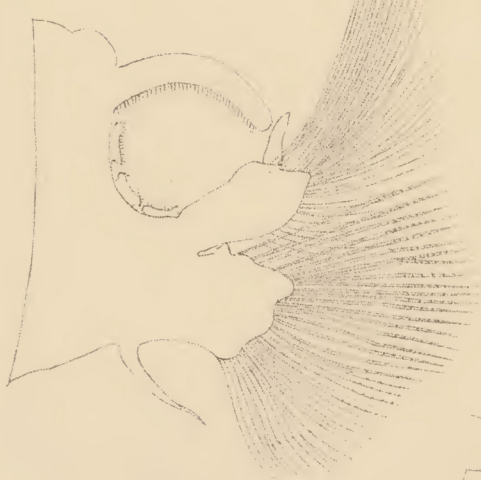

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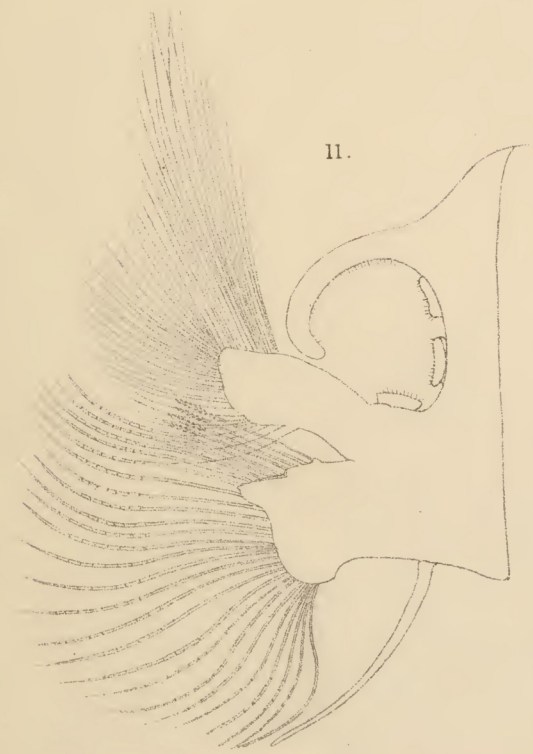

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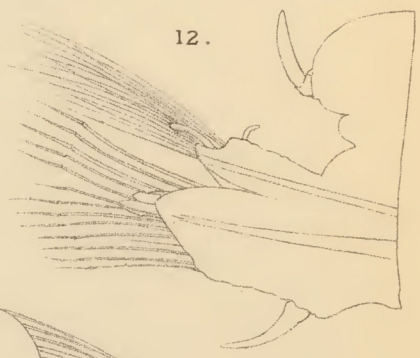

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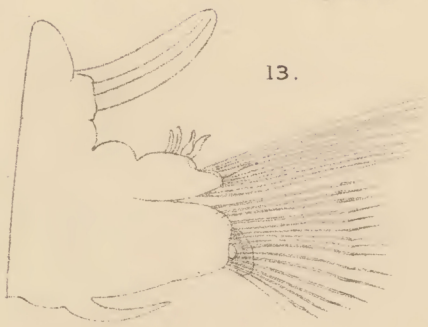

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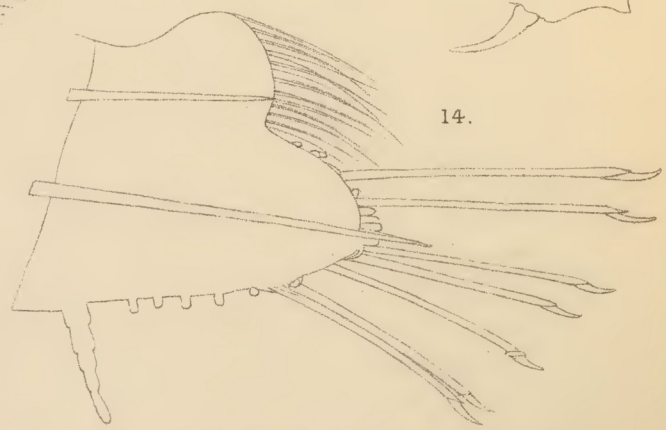

W.C.M. del. Fig 1, J.M.A.

F. Huth, Lith.r Edin.r

PLATE XXXI.

Fig.

1. Scale of *Gattyana cirrosa*, Pall., from St. Andrews. × 12.

2. Anterior foot of *Antinoë Sarsi*, Mgrn., "Knight-Errant," 558 fms. × 20.

3. Foot of *Malmgrenia andreapolis*, McI., St. Andrews. × 24.

4. Foot of *Acholoë astericola*, D. Ch. × 28.

5. Anterior foot of *Sthenelais boa*, Johnst. × about 15.

6. Anterior foot of *Sthenelais limicola*, Ehlers. × 30.

7. Anterior foot of *Sthenelais Jeffreysii*, McI. × 24.

8. Foot of *Sthenelais*, Z. × 30.

9. Foot of *Eusthenelais hibernica*, McI. (Imperfectly preserved.) × 24.

10. Anterior foot of *Sigalion Mathildæ*, Aud. and Ed. × 24.

11. Anterior foot of *Sigalion Buskii*, McI. × 24.

12. Anterior foot of *Leanira hystricis*, Ehlers. × 40.

13. Posterior foot of the same. × 40.

14. Foot of *Pholoë minuta*, Fabr., from St. Andrews. × 90.

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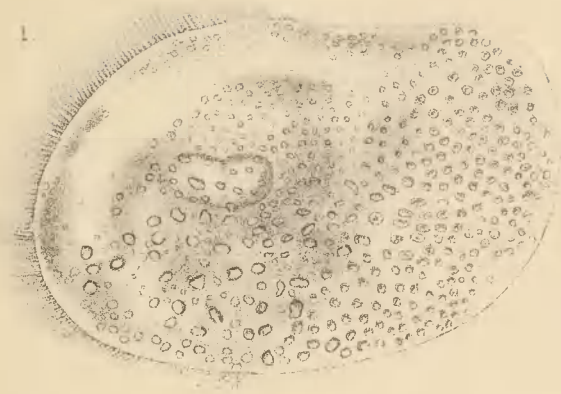

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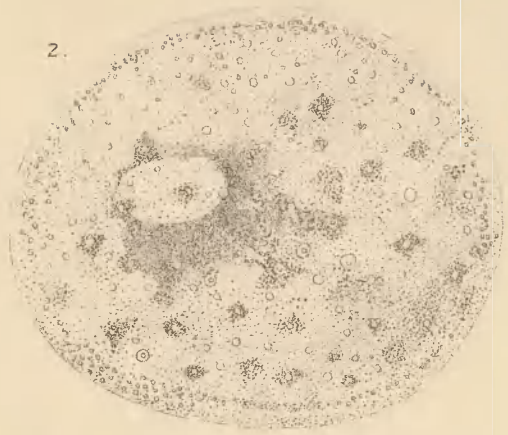

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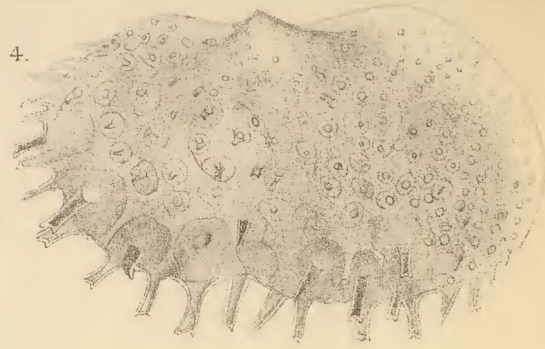

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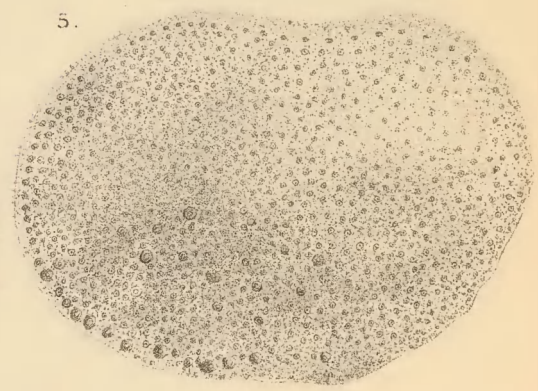

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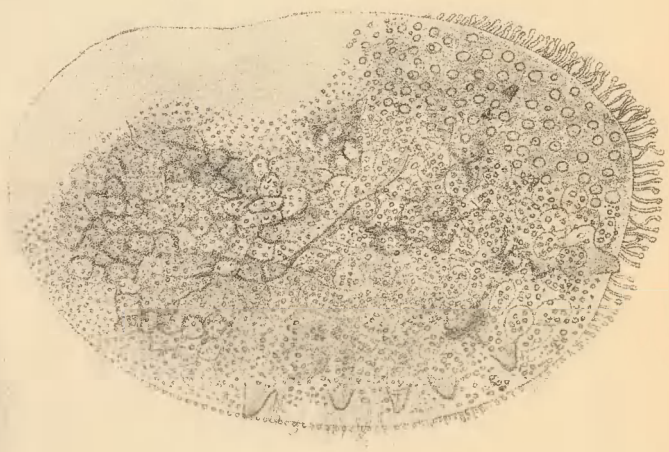

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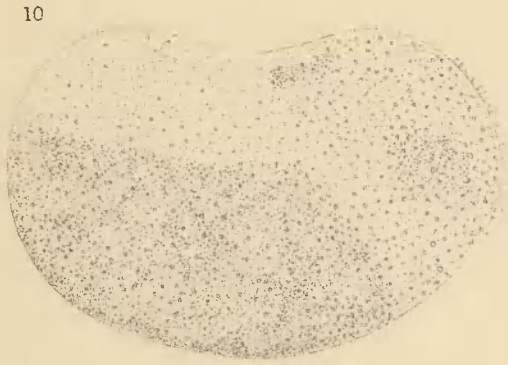

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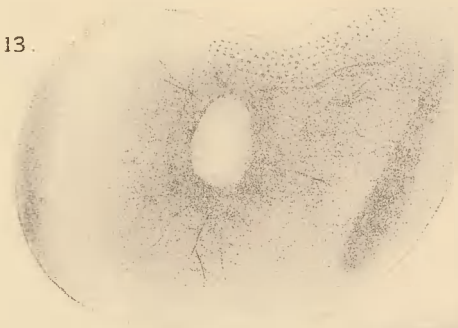

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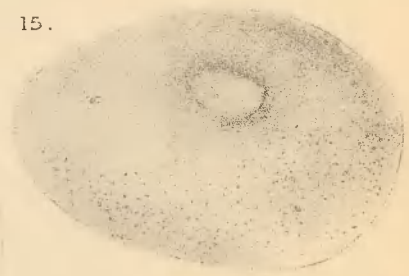

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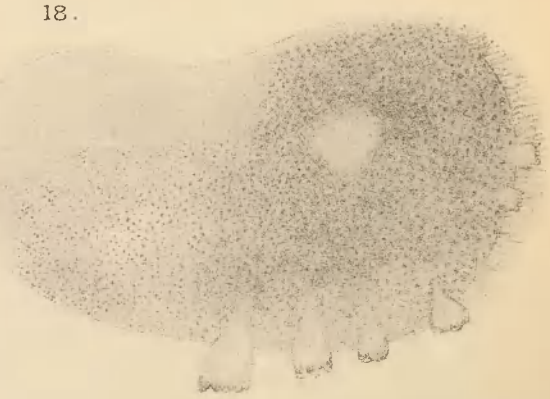


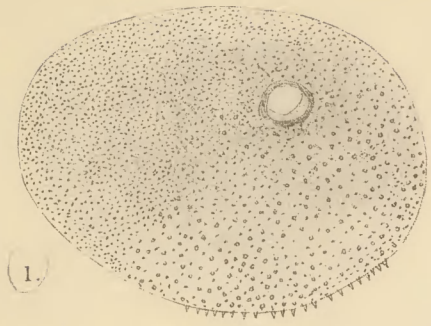
Figs. 1, 4, 8, 12 & 17, J.M.A cætera W.C.M. del.

T. Huth, Lith.r Edin.r

PLATE XXXII.

Fig.

1. Anterior scale of *Lepidonotus squamatus*, L. × 12.
2. Anterior scale of *Lepidonotus clava*, Mont. (spirit). × 12.
3. Scale of *Eunoa nodosa*, Sars (dried), British Museum. × 12.
4. Anterior scale of *Acanthicolepis asperrima*, Sars. × 12.
5. Eighth scale of *Lagisca floccosa*, Sav., from Baltic. The spines are rather distinct. × 20.
6. Anterior scale of *Lagisca Elisabethæ*, McI. × 40.
7. Anterior scale of *Lagisca Jeffreysii*, McI. × 20.
8. Anterior scale of *Lagisca extenuata*, from 680 fathoms in the "Porcupine." × 12.
9. Scale of *Lagisca floccosa*, var. "Porcupine," No. 42 (p. 302). × 40.
10. Anterior scale of *Harmothoë imbricata*, L. × 12.
11. Anterior scale of *Harmothoë Fraser-Thomsoni*, McI. × 24.
12. Anterior scale of *Harmothoë lunulata*, D. Ch. × 24.
13. Anterior scale of *Harmothoë marphysæ*, McI. × 44.
14. Anterior scale of *Harmothoë Ljungmani*, Mgrn. × 30.
15. Anterior scale of *Harmothoë zetlandica*, McI. × 24.
16. Anterior scale of *Harmothoë antilopis*, McI. × 28.
17. Anterior scale of *Harmothoë areolata*, Grube. × 12.
18. Anterior scale of *Evarne impar*, Johnst. × 20.
19. Anterior scale of *Evarne Johnstoni*, McI., from a Norwegian example. × 28.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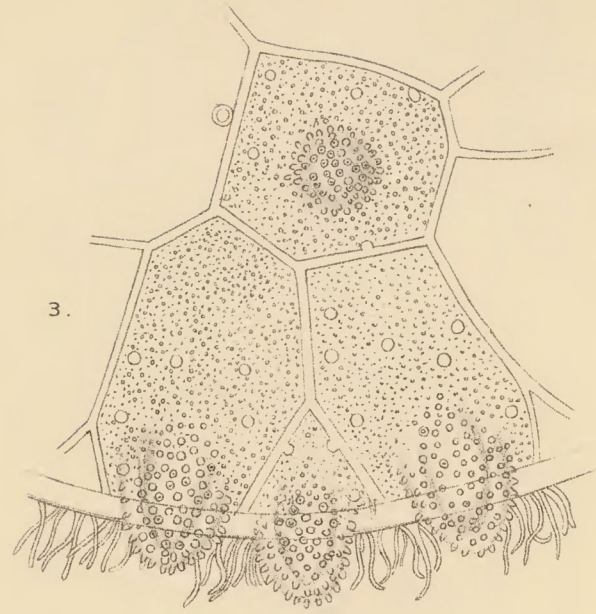
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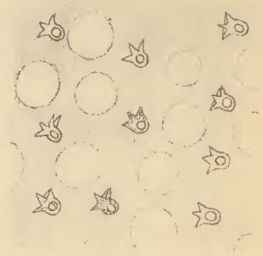
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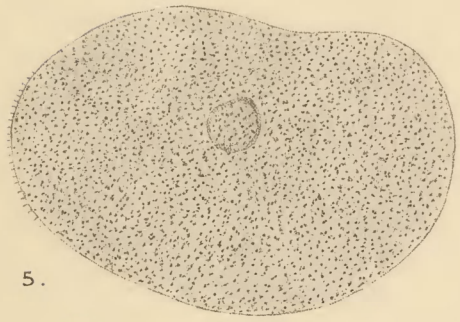
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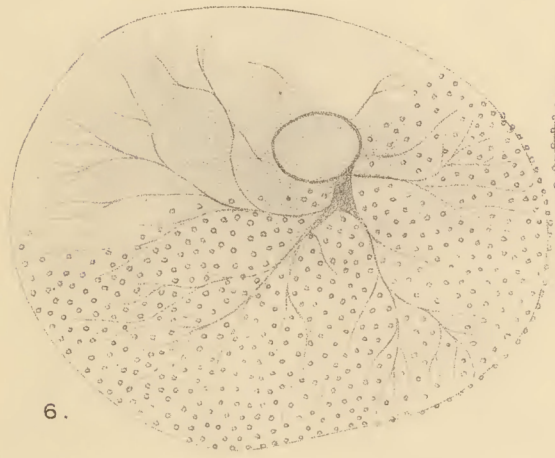
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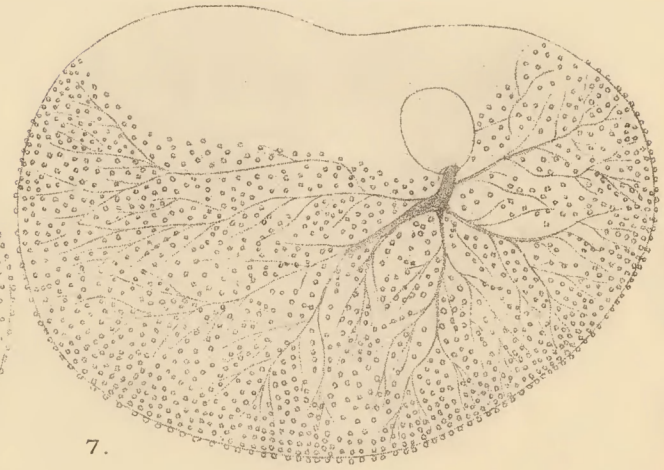
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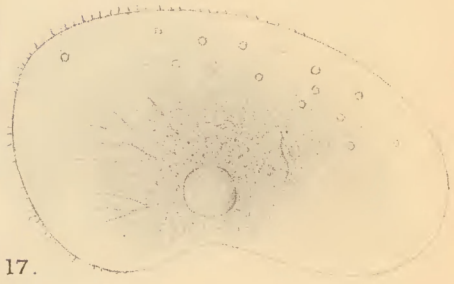
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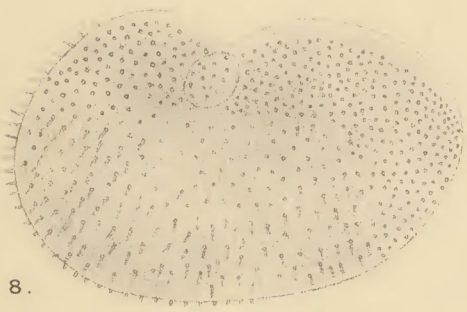
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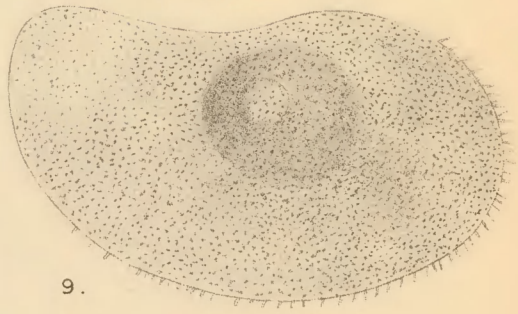
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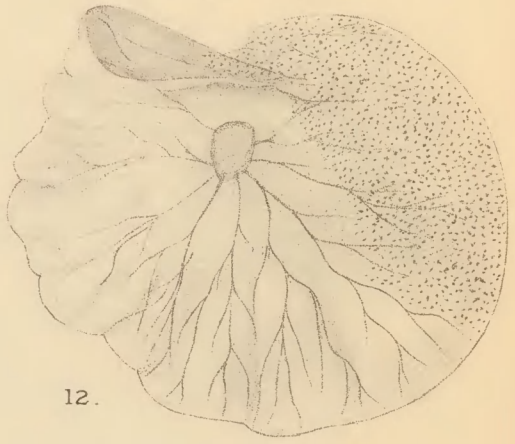
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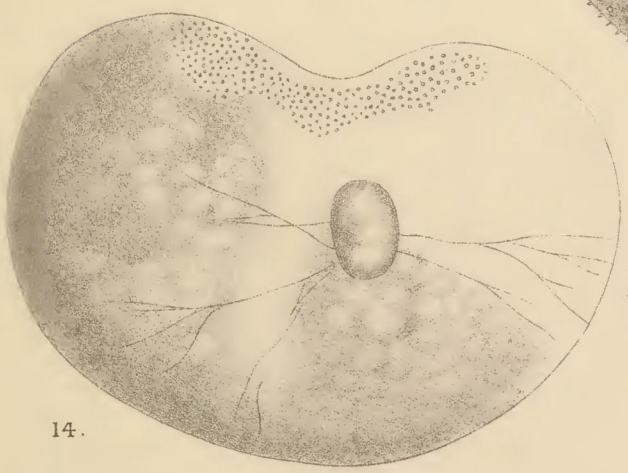
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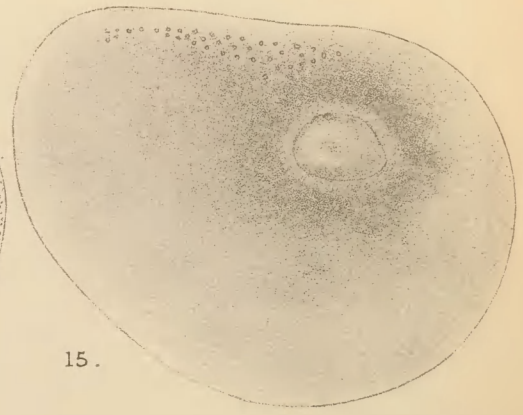
15.

W.C.M. del.

F. Huth, Lith^r Edin^r

PLATE XXXIII.

Fig.

1. Anterior scale of *Evarne Hubrechti*, McI. × 20.

2. Portion of the scale of a small example of *Halosydna gelatinosa*, Sars. × 210.

3. Portion of the inner edge of the first scale of *Harmothoë areolata*, Gr. × 90.

4. Anterior scale of *Harmothoë spinifera*, Ehlers. × 20.

5. Anterior scale of *Lœnilla setosissima*, Sav. × 20.

6. Anterior scale of *Scalisetosus assimilis*, McI. × 38.

7. Anterior scale of *Scalisetosus pellucidus*, Ehlers. × 45.

8. Anterior scale of *Antinoë finmarchica*, Mgrn. × 30.

9. Anterior scale of *Antinoë mollis*, McI. × 18.

10. Anterior scale of *Malmgrenia castanea*, McI. × 40.

11. Anterior scale of *Malmgrenia andreapolis*, McI. × 24.

12. Scale of a small example of *Halosydna gelatinosa*, Sars. × 15.

13. Scale of small example of *Polynoë scolopendrina*, Sav. (from Herm). × 40.

14. Scale of the large form of *Polynoë scolopendrina*, Sav. (from North Uist). × 24.

15. Scale of *Acholoë astericola*, D. Chiaje. × 28.

16. Tenth scale of *Sthenelais boa*, Johnst., from St. Andrews. × about 30.

17. Anterior scale of *Antinoë Sarsi*, Kbg. × 20.

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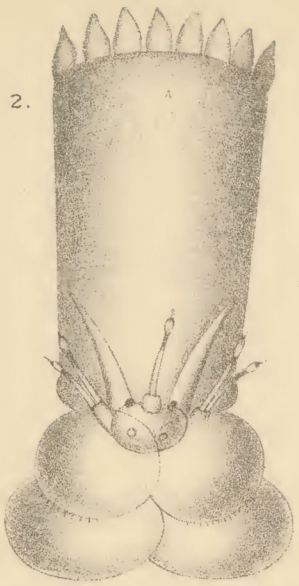
2.



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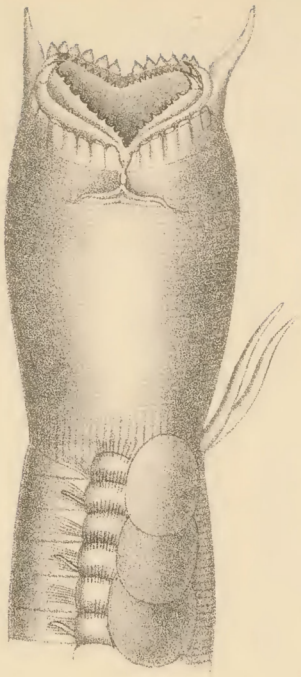

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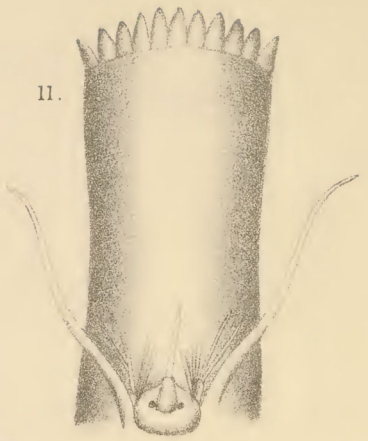

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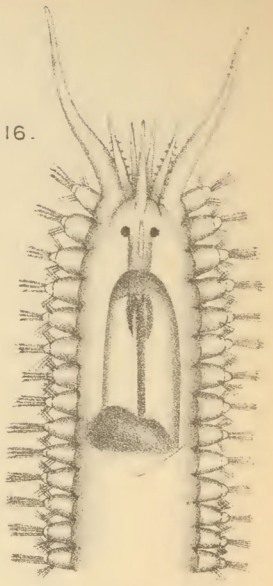

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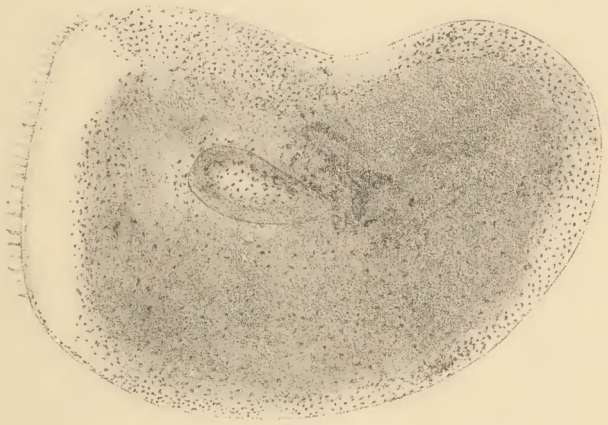

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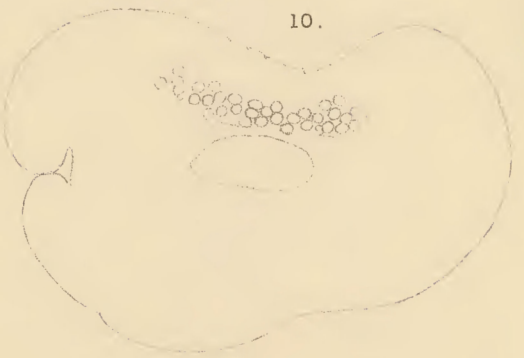

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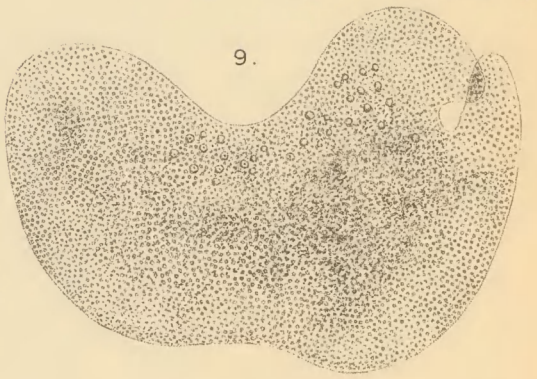

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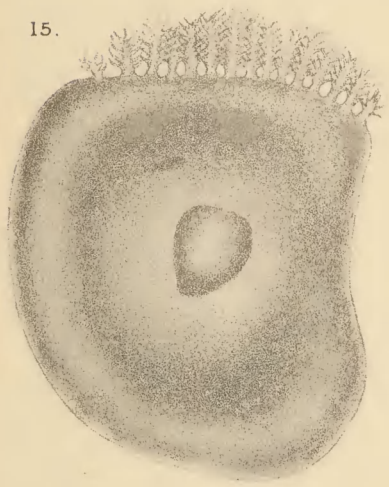

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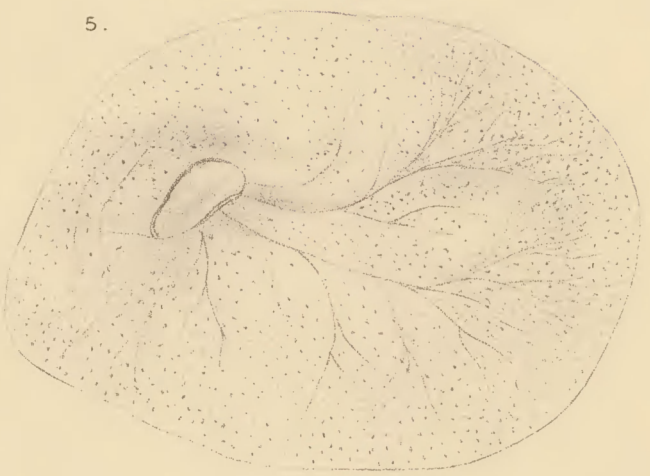

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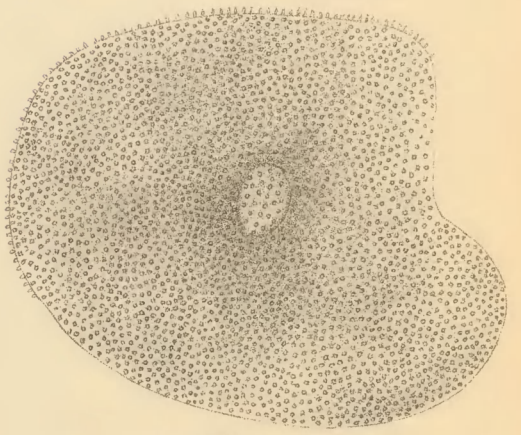

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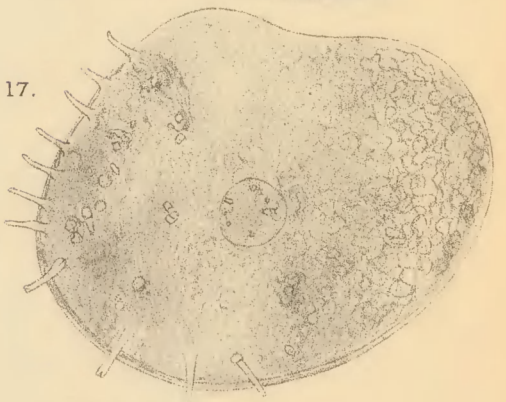

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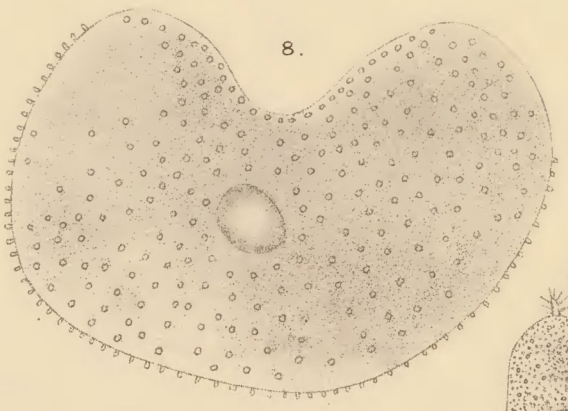

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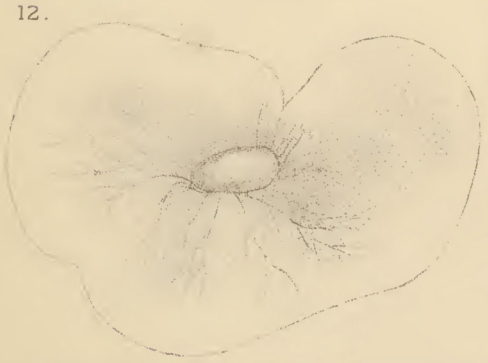

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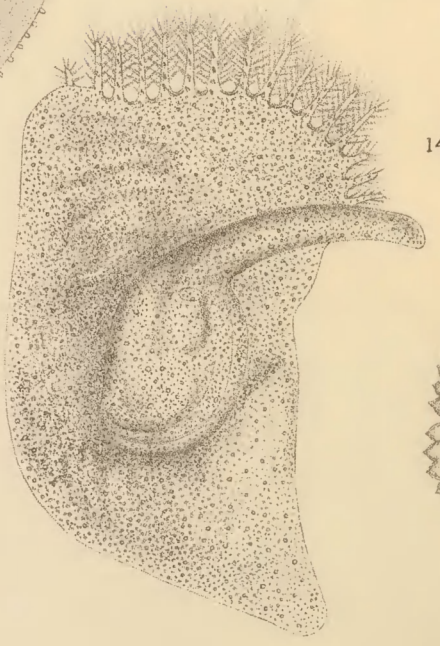

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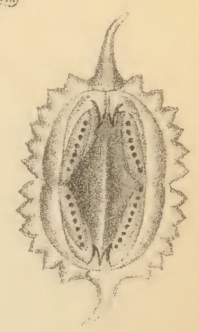

Fig. 15. R.M. Figs 1-4, 11 & 16. A.W. Figs 13 & 14, J.M.A. cætera. W.C.M. del.

F. Huth, Lith.r Edin.r

PLATE XXXIV.

Fig.

1. Proboscis of *Scalisetosus pellucidus*. × under a lens.
2. Proboscis of *Lagisca floccosa*. × under a lens.
3. Lateral view of the proboscis of *Panthalis Œrstedi*. × under a lens.
4. Antero-posterior view of the same. × under a lens.
5. Anterior scale of the same form ("Triton," 1882). × 24.
6. Anterior scale of *Sthenelais boa* (adult). × 17.
7. Scale of *Sthenelais zetlandica*. × 32.
8. Anterior scale of *Sthenelais atlantica*. × 55.
9. Scale from the anterior third of *Sthenelais limicola*. × 12.
10. Posterior scale of the foregoing. × 30.
11. Proboscis of *Sthenelais limicola*. × under a lens.
12. Scale of *Sthenelais*, Z. × 18.
13. Anterior scale of *Sthenelais Jeffreysii* ("Porcupine," off Ireland). × 17.
14. Anterior scale of *Sigalion Mathildæ* with branchial process. Enlarged.
15. Anterior scale of *Sigalion Buskii*. Enlarged.
16. Dorsal view of the anterior end of *Pholoë minuta*. × under a lens.
17. Anterior scale of *Pholoë minuta*, var. *inornata* (Lochmaddy). × 90.
18. Anterior scale of *Pholoë minuta*, var. (St. Lawrence, Canada). × 40.

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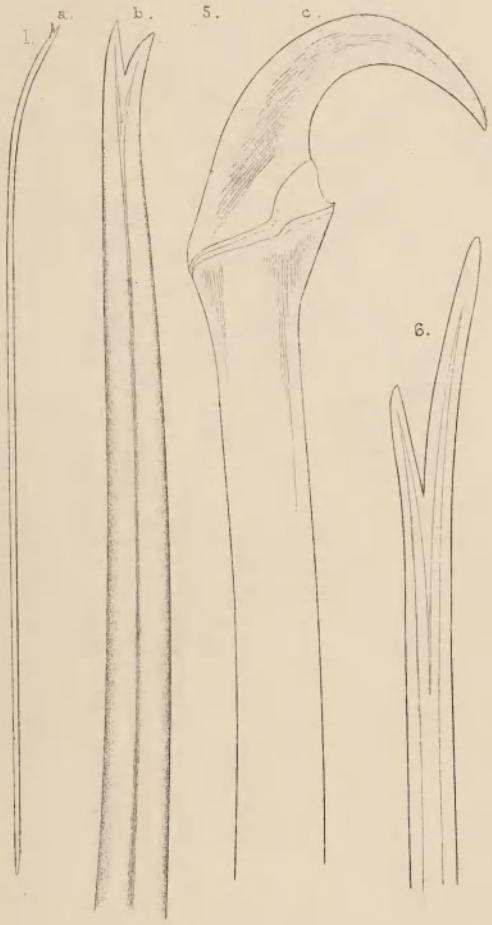
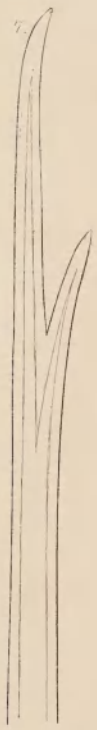

a. b. 5. c.

6.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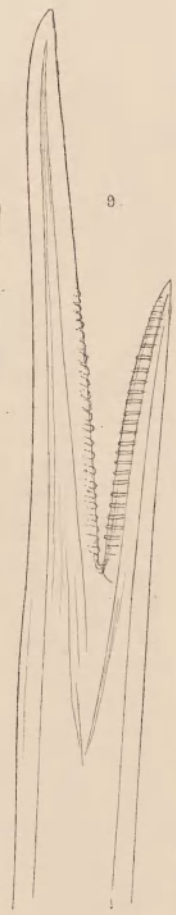
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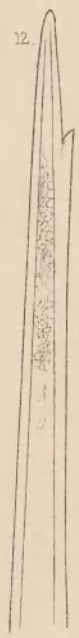
12.

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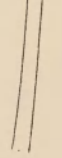
22 a.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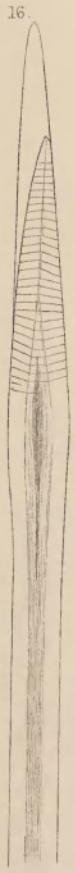
a. c. b.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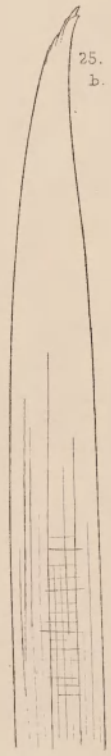

25. b.

20. c

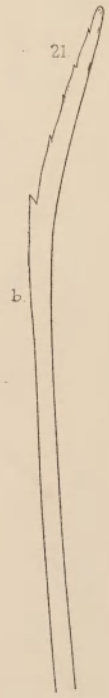
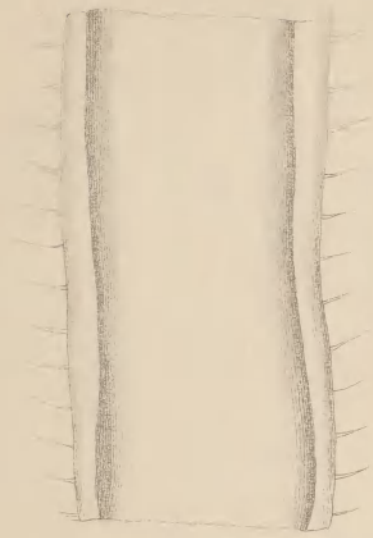
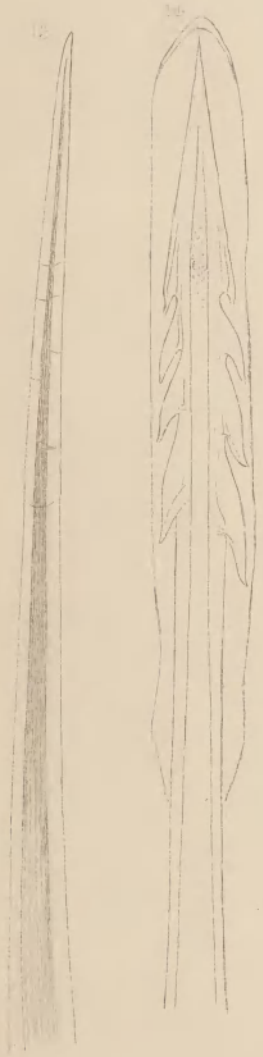

21. b.

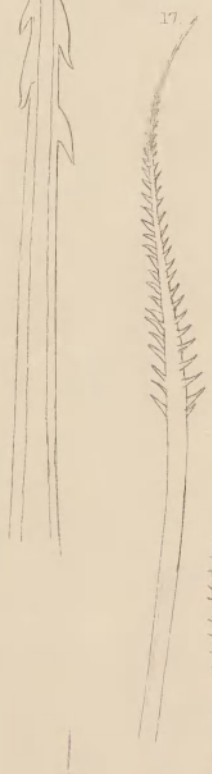
PLATE XXXV.

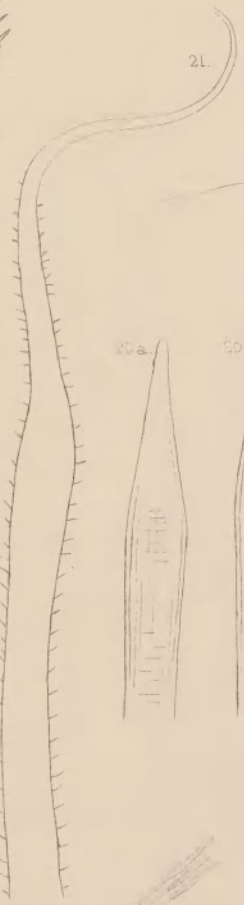
Fig.

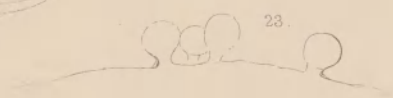
1. Dorsal cirrus of *Euphrosyne foliosa*. × 310.
2. Branchial processes of *Euphrosyne armadillo*.
3. Tips of branchial processes of *Euphrosyne foliosa*. × 236.
4. Tips of branchiæ of *Euphrosyne Robertsoni*, Frith of Clyde. × 90.
5. Bristles of *Spinther miniaceus*.
   a. Ventral bristle. × 90.
   b. Tip of a somewhat shorter and stouter form. × 350.
   c. Hook from the ventral region. × 350.
6. Upper bristle of *Euphrosyne Robertsoni*, n. s. (Clyde), with shorter tip. × 210.
7. Lower bristle of *Euphrosyne Robertsoni*, n. s. (Clyde), with longer tip. × 210.
8. Bristle of *Euphrosyne armadillo*. Oc. 1, obj. D, Zeiss.
9. Dorsal bristle of *Euphrosyne armadillo* (Norway). × 350.
10. One of the slender bristles of *Euphrosyne armadillo* (Norway). × 350.
11. The same. × 350.
12. The same. × 350.
13. Bristle of *Euphrosyne armadillo*. × 350.
14. Bristle of *Euphrosyne armadillo*. Zeiss, oc. 1, obj. D.
15. Dorsal bristle of *Euphrosyne foliosa*. × 236.
16. Bifid bristles of *Euphrosyne foliosa* (seen on edge). Zeiss, oc. 1, obj. D.
17. Slender serrated bifid bristle (dors.). Zeiss, oc. 1, obj. D.
18. Profile view of curved bifid bristle. Zeiss, oc. 1, obj. D.
19. Bristles of *Paramphinome pulchella*, *a*, from the inferior lobe; *b*, *c*, from the superior lobe. × 700.
20. Dorsal bristles of *Eurythoë borealis* from a posterior foot. × 350.
21. Bifid dorsal bristles of *Eurythoë borealis* (Channel Islands). × 350.
22. Slender bristles of *Eurythoë borealis* (Channel Islands). × 350.
23. Ventral bristle of *Eurythoë borealis* (Channel Islands). × 350.
24. Bristle of first ventral series of a typical foot of *Aphrodita aculeata*. × 55.
25. Bristle of the middle of the second row of the ventral series. × 55.
26. Tip of posterior hair (lower series) near last foot (*Aphrodita aculeata*). × 360.
27. Tip of dorsal hair forming felt (*Aphrodita aculeata*). × 350.
28. Bifid (serrated) dorsal bristle of *Euphrosyne Robertsoni*. × 300.

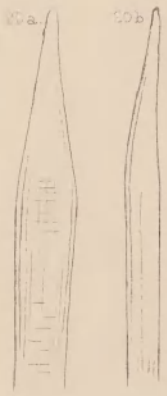


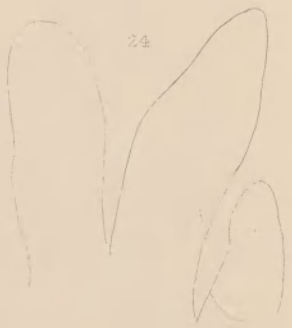












N.C.M. del. et lith.

Mintern Bros. imp.

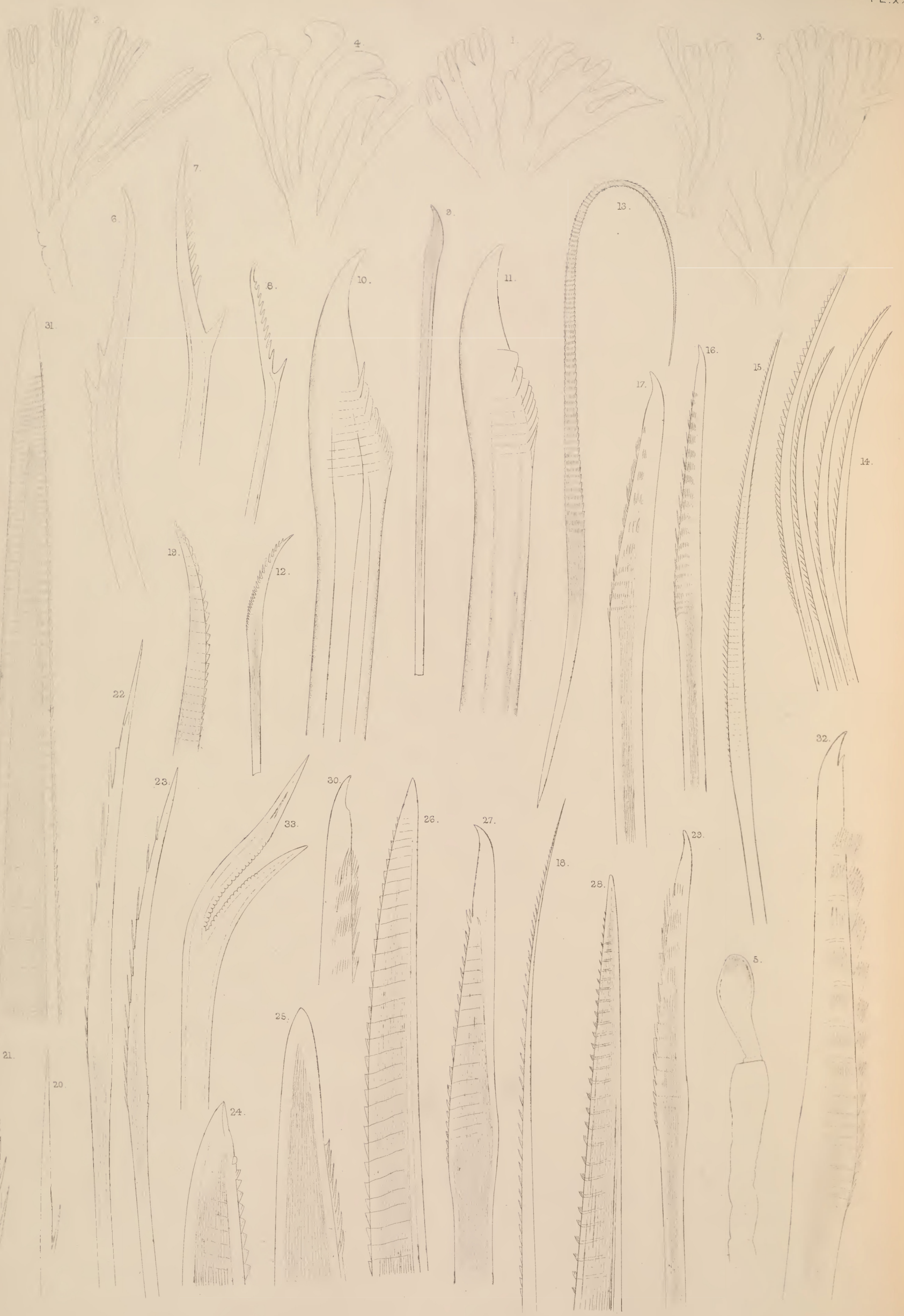
PLATE XXXVI.

Fig.

1. Palpus of *Lætmatonice filicornis*, a little beyond the middle. × 90.
2. Strong bristle from the upper (third) ventral series in the foot of *Aphrodita aculeata*. × 55.
3. Bristles from a posterior foot of *Aphrodita aculeata*. × 360.
4. Tip of a dorsal spine of a British *Lætmatonice producta*. × 55.
5. Ventral bristle of *Lætmatonice producta*, var. × 40.
6. Tip of dorsal spine of *Lætmatonice filicornis* with four hooks on one side. × 55.
7. Tip of ventral bristle of *Lætmatonice filicornis*. × 55.
8. Lateral view of a dorsal spine of *Lætmatonice filicornis*. × 55.
9. Tip of bristle on the dorsum of an anterior foot of *Hermione hystrix*. × 90.
10. Tenth foot (about) of *Aphrodita aculeata*, viewed from the ventral surface. Enlarged under a lens.
11. Tip of one of the attenuate spines on the dorsum of an anterior foot of *Hermione hystrix*. × 210.
12. Tip of dorsal spine of *Lætmatonice filicornis*. × 90.
13. Foot of *Hermione hystrix*. Enlarged under a lens.
14. Tip of dorsal spine of *Hermione hystrix* with shield. × 90.
15. Tip of spine of *Hermione hystrix* with shield removed, lateral view in balsam. × 90.
16. Foot of *Eurythoë borealis*, Channel Islands. × 90.
17. Pinnate ventral bristle of the second foot of *Aphrodita aculeata*. × 90.
18. Stout smooth bristles of *Aphrodita aculeata*. × 90.
19. Bristle (spinous) from the posterior end of *A. aculeata*. × 55.

20 *a* front, and 20 *b* lateral view of a bristle from the same region of *A. aculeata*. × 55.

21. Tip of the palpus of *Lætmatonice filicornis*. × 55.
22. Anterior foot of *Aphrodita aculeata*, from the posterior face. × under a lens.
23. Papillæ of the facial tubercle of *Aphrodita aculeata*. × 90.
24. Outline of three papillæ of the facial tubercle of *Lætmatonice filicornis*. × 90.



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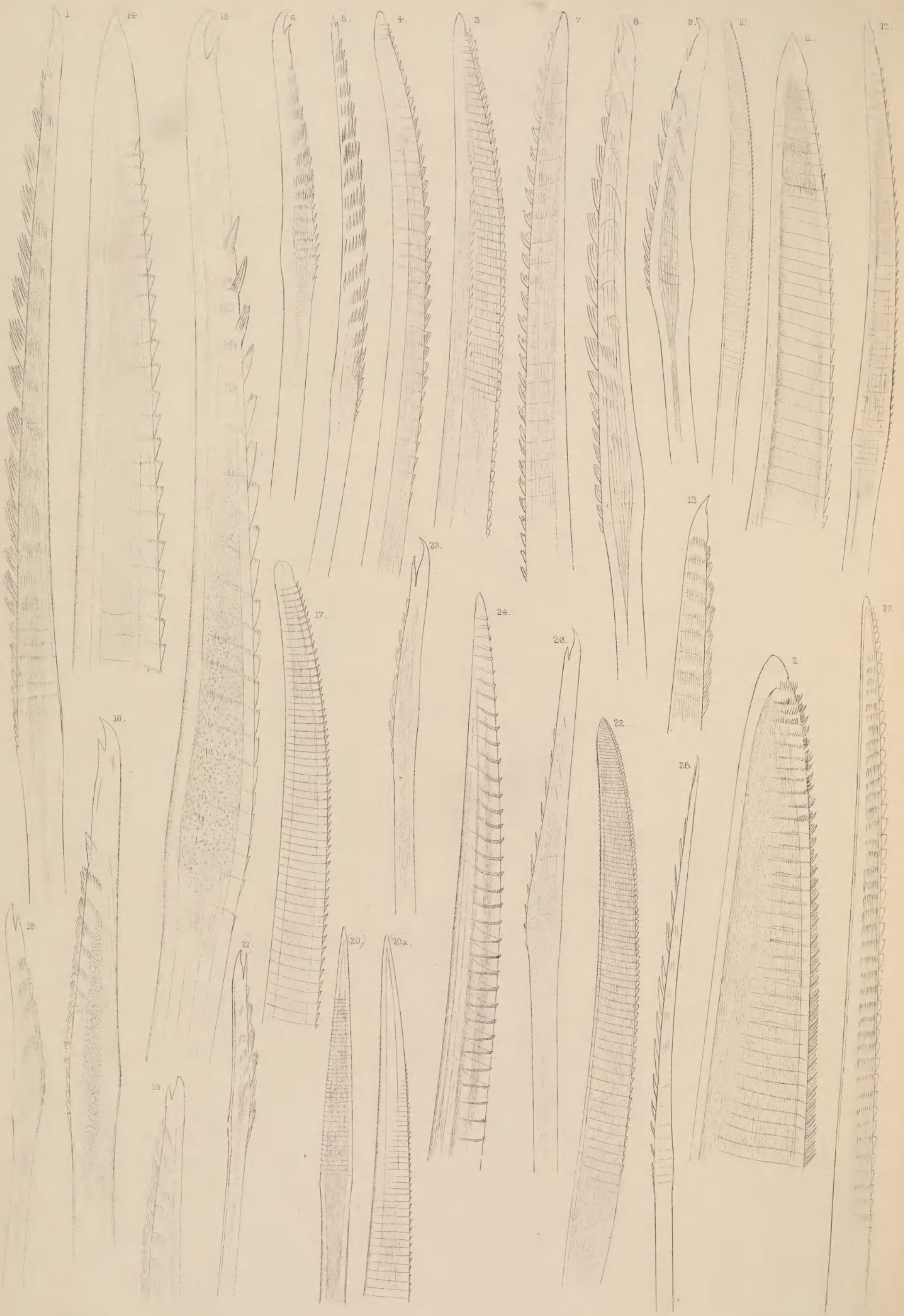
Kintern Bros. sc. et imp.

PLATE XXXVII.

Fig.

1. Papillæ of the tip of the proboscis in *Aphrodita aculeata.* × 55.
2. Papillæ of the proboscis of *Lætmatonice filicornis.* × 55.
3. Papillæ of the proboscis of *Lætmatonice producta.* × 40.
4. Papillæ of the proboscis of *Hermione hystrix.* × 55.
5. Tip of tentacle of *Hermione hystrix.* × 55.
6. Second bristle of the second foot of *Hermione hystrix.* × 90.
7. Ventral bristle (at ventral edge) of the same foot of *Hermione hystrix.* × 90.
8. Smaller bristle from the posterior foot of *Hermione hystrix.* × 90.
9. Ventral bristle of *Lepidonotus squamatus.* × 80.
10. Ventral bristle from the middle of the twelfth foot of *Lepidonotus squamatus.* × 210.
11. Ventral bristle from the middle of the twelfth foot of *Lepidonotus clava.* × 210.
12. One of the short dorsal bristles of *Lepidonotus squamatus.* × 180.
13. One of the longer bristles of *Lepidonotus squamatus.* × 280.
14. Group of bristles at the base of the tentacular cirri (first foot) of *Lepidonotus clava.* × 210.
15. Dorsal bristle of *Lepidonotus clava.* × 210.
16. Superior ventral bristle of *Gattyana cirrosa.* × 258.
17. Ventral bristle from the middle of the foot of *Gattyana cirrosa.* × 258.
18. Dorsal bristle of the middle of the foot of *Gattyana cirrosa.* × 210.
19. Bristle from the base of the tentacular cirri of *Gattyana cirrosa.* × 210.
20. Tip of upper bristle of the first foot of *Eunoa nodosa.* × 210.
21. Tip of the upper bristle of the first foot of *Eunoa Œrstedi.* × 210.
22. Ventral bristle of the first foot of *E. nodosa.* × 210.
23. One of the smaller ventral bristles of the first foot of *Eunoa Œrstedi.* ×210.
24. Tip of a dorsal bristle (average example) from an anterior foot of *Eunoa nodosa.* × 350.
25. Tip of a dorsal bristle (average example) from an anterior foot of *Eunoa Œrstedi.* × 350.
26. Dorsal bristle of *Eunoa nodosa* (coast of Durham). × 210.
27. Ventral bristle of *Eunoa nodosa* (coast of Durham). × 210.
28. Tip of a dorsal bristle of *Acanthicolepsis asperrima.* × 210.
29. Ventral bristle of *Acanthicolepsis asperrima.* × 210.
30. Tip of another example in *Acanthicolepsis asperrima,* showing minute process. × 350.
31. Tip of one of the longer dorsal bristles of *Lagisca floccosa.* × 350.
32. Tip of a median ventral bristle of the same. × 350.
33. Tip of a bifid dorsal bristle of *Euphrosyne Robertsoni.* × 350.

3f



Western Press

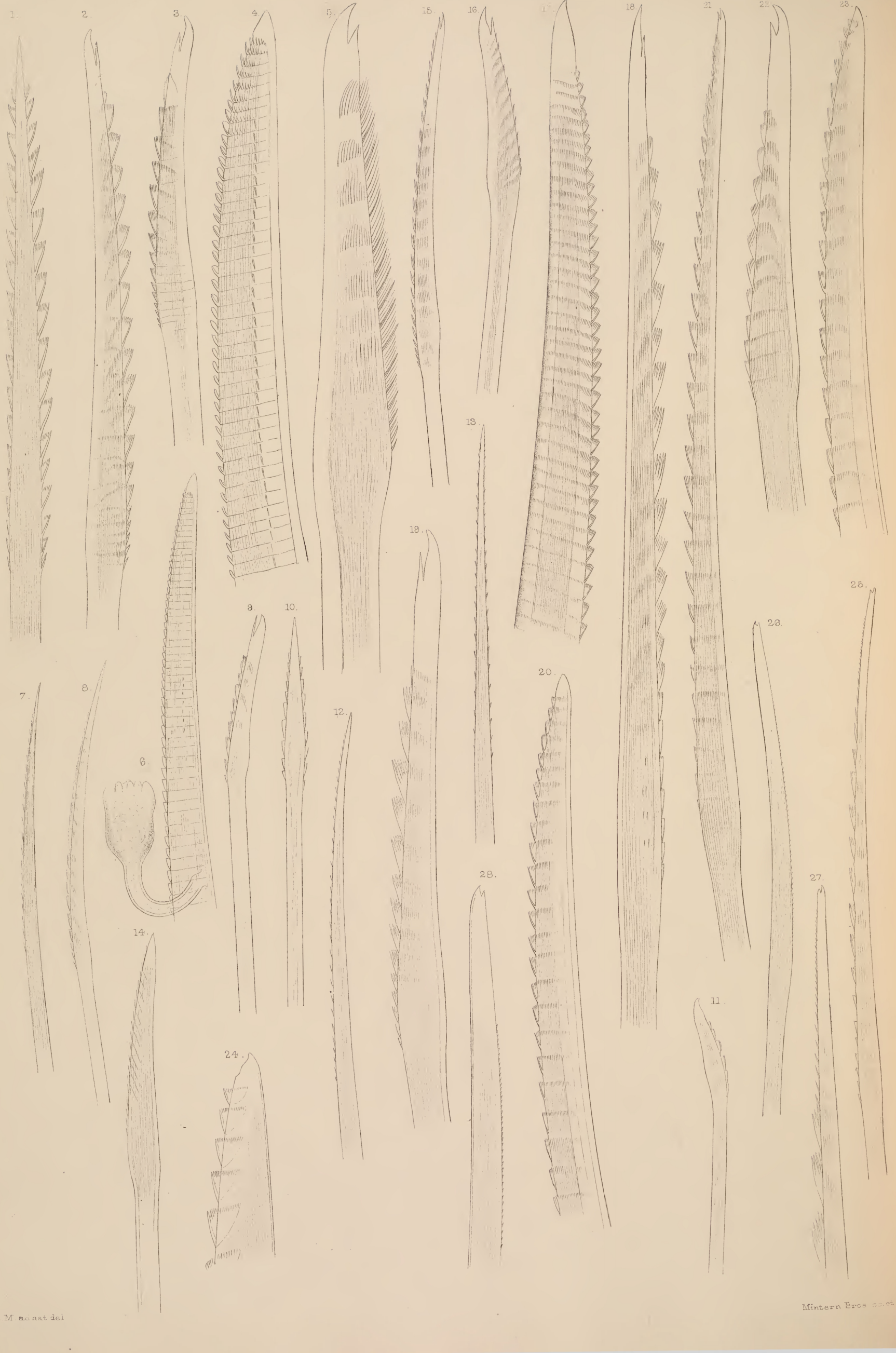
PLATE XXXVIII.

Fig.

1. Superior ventral bristle of *Lagisca floccosa*. × 350.
2. Dorsal bristle of variety of *Lagisca floccosa*. × 350.
3. Dorsal bristle of *Lagisca floccosa*, var. (p. 302). × 350.
4. One of the longer dorsal bristles of *Lagisca Elisabethæ*. × 350.
5. Superior ventral bristle of *Lagisca Elisabethæ*. × 350.
6. Inferior ventral bristle of *Lagisca Elisabethæ*. × 350.
7. Dorsal bristle of *Lagisca Jeffreysii*. × 350.
8. Superior ventral bristle of *Lagisca Jeffreysii*. × 350.
9. Bristle from the middle of the ventral series of *Lagisca Jeffreysii*. × 350.
10. Dorsal bristle of *Lagisca extenuata*, Gr. × 90.
11. Tip of the same bristle. × 350.
12. One of the longer (not longest) ventral bristles. × 210.
13. Tip of another ventral bristle, showing the secondary process. × 350.
14. Tip of a dorsal bristle from a large specimen of *Harmothoë imbricata*. × 350.
15. Superior ventral bristle of *Harmothoë imbricata*. × 350.
16. Median ventral bristle of *Harmothoë imbricata*. × 350.
17. Dorsal bristle of *Harmothoë spinifera*, Ehlers. × 350.
18. Tip of superior ventral bristle of *Harmothoë spinifera*, Ehlers. × 350.
19. Inferior ventral bristle of *Harmothoë spinifera*, Ehlers. × 350.
20. Front view of a dorsal bristle of *Harmothoë Zetlandica*. × 210.

20 *a*. Lateral view of the same. × 350.

21. Superior ventral bristle of *Harmothoë Zetlandica*. × 350.
22. Dorsal bristle of *Harmothoë Ljungmani*, Mgrn. (*olim H. Macleodi*). × 350.
23. Superior ventral bristle of *Harmothoë Ljungmani*. × 350.
24. One of the larger dorsal bristles of *Harmothoë antilopis*, McI. × 350.
25. Superior ventral bristle of *Harmothoë antilopis*. × 350.
26. One of the stouter ventral bristles from the neighbourhood of the spine. × 350.
27. Dorsal bristle of *Harmothoë haliaëti*, McI. × 350.



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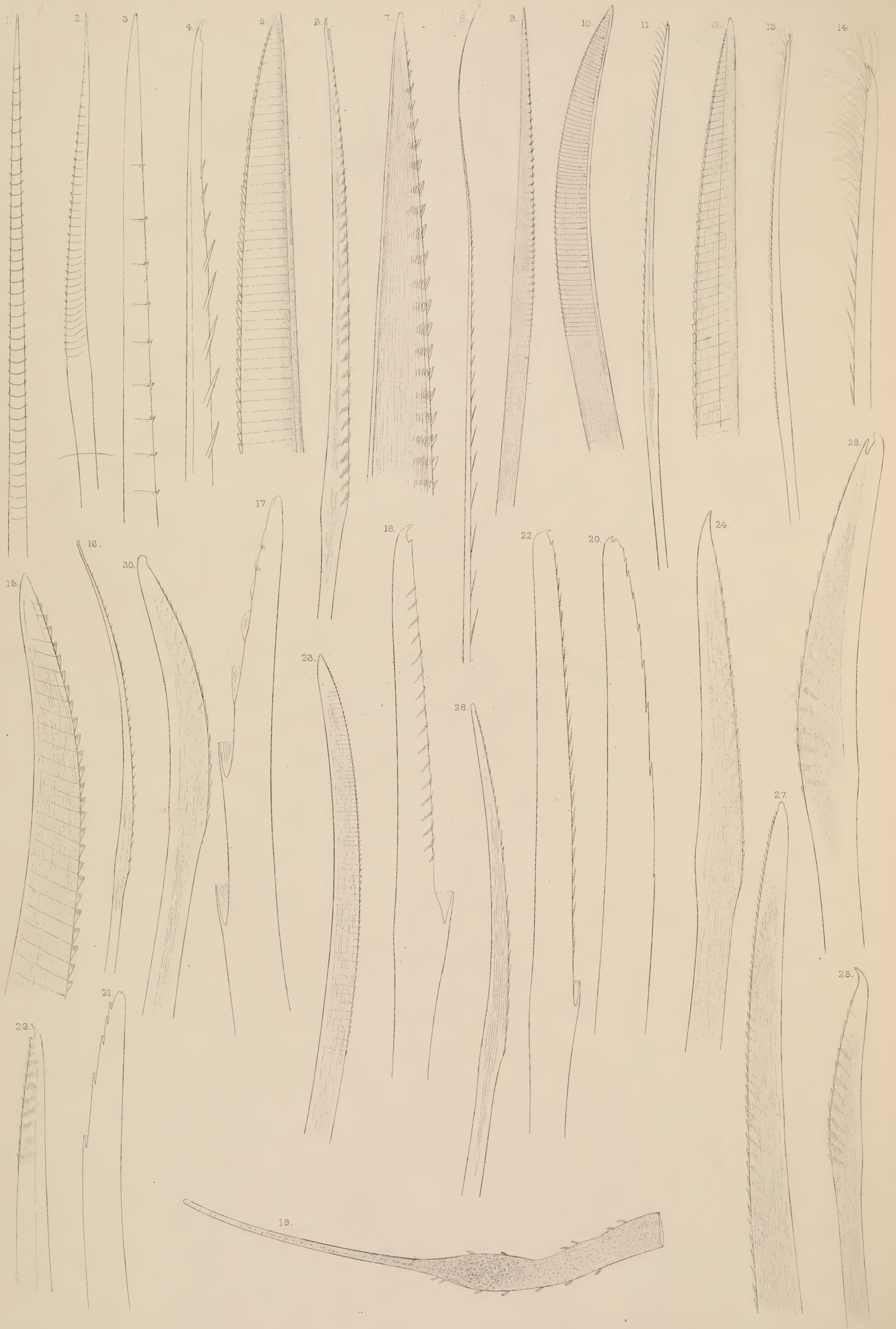
Mintern Bros. sc. et imp.

PLATE XXXIX.

Fig.

1. Superior ventral bristle of *Harmothoë haliaëti* viewed antero-posteriorly. × 350.
2. Another of the same form seen laterally. × 350.
3. Inferior ventral bristle. × 350.
4. Dorsal bristle of *Harmothoë Fraser-Thomsoni*. × 350.
5. Ventral bristle of *Harmothoë Fraser-Thomsoni*. × 350.
6. Dorsal bristle of *Harmothoë Fraser-Thomsoni* with parasitic *Loxosoma*. × 210.
7. One of the longer dorsal bristles of *Harmothoë marphysæ*. × 350.
8. Superior ventral bristle of *Harmothoë marphysæ*.
9. Median ventral bristle (in profile) of *Harmothoë marphysæ*. × 350.
10. Antero posterior view of one of the same. × 350.
11. Inferior ventral bristle. × 350.
12. Profile view of one of the longer dorsal bristles of *Harmothoë lunulata*, D. Ch. × 350.
13. Antero-posterior view of another dorsal bristle. × 350.
14. One of the shorter dorsal bristles. × 350.
15. Superior ventral bristle. × 350.
16. Median ventral bristle. × 350.
17. Tip of a dorsal bristle of *Harmothoë areolata*, Grube. × 350.
18. Superior ventral bristle. × 350.
19. One of the most characteristic median ventral bristles. × 350.
20. One of the stouter dorsal bristles of a large *Evarne impar*, from Herm. × 350.
21. Superior ventral bristle. × 350.
22. Lower median ventral bristle. × 350.
23. One of the stronger dorsal bristles of *Evarne Johnstoni*. × 350.
24. Tip of a dorsal bristle. × 700.
25. Superior ventral bristle. × 350.
26. Bristle from the middle of the ventral group. × 350.
27. Tip of a superior ventral bristle. × 700.
28. Tip of a bristle from the middle of the ventral series. × 700.



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Mintern Bros sc. et imp.

PLATE XL.

Fig.

1. Dorsal bristle of *Evarne Hubrechti.* × 60.
2. The same. × 60.
3. Tip of dorsal bristle. × 210.
4. Tip of ventral bristle. × 350.
5. Dorsal bristle (average) of *Lœnilla setosissima*, Sav. × 350.
6. Ventral bristle (average) of *Lœnilla setosissima*, Sav. × 350.
7. Tip of dorsal bristle of *Antinoë Sarsi.* × 200.
8. Tip of ventral bristle of *Antinoë Sarsi.* × 200.
9. A nearly straight dorsal bristle of *Antinoë finmarchica.* × 210.
10. An outer slightly curved bristle from the same group. × 210.
11. Median ventral bristle (South-west Ireland). × 210.
12. Dorsal bristle from posterior region of *Antinoë mollis.* × 210.
13. Median ventral bristle of *Antinoë mollis.* × 210.
14. The same. × 700.
15. One of the largest dorsal bristles of *Phyllantinoë mollis.* × 350.
16. Ventral bristle. × 350.
17. Dorsal bristle of *Scalisetosus pellucidus.* × 700.
18. Ventral bristle. × 700.
19. Distal region of a dorsal cirrus. × 90.
20. One of the larger dorsal bristles of *Scalisetosus assimilis.* × 350.
21. One of the shorter dorsal bristles. × 350.
22. Ventral bristle. × 350.
23. Dorsal bristle of *Malmgrenia castanea.* × 350.
24. Superior ventral bristle. × 350.
25. Inferior ventral bristle. × 350.
26. Tip of a ventral bristle from Valencia, showing secondary process. × 350.
27. One of the larger dorsal bristles of *Malmgrenia andreapolis.* × 700
28. Superior ventral bristle. × 350.
29. Median ventral bristle. × 700.
30. Inferior ventral bristle. × 700.

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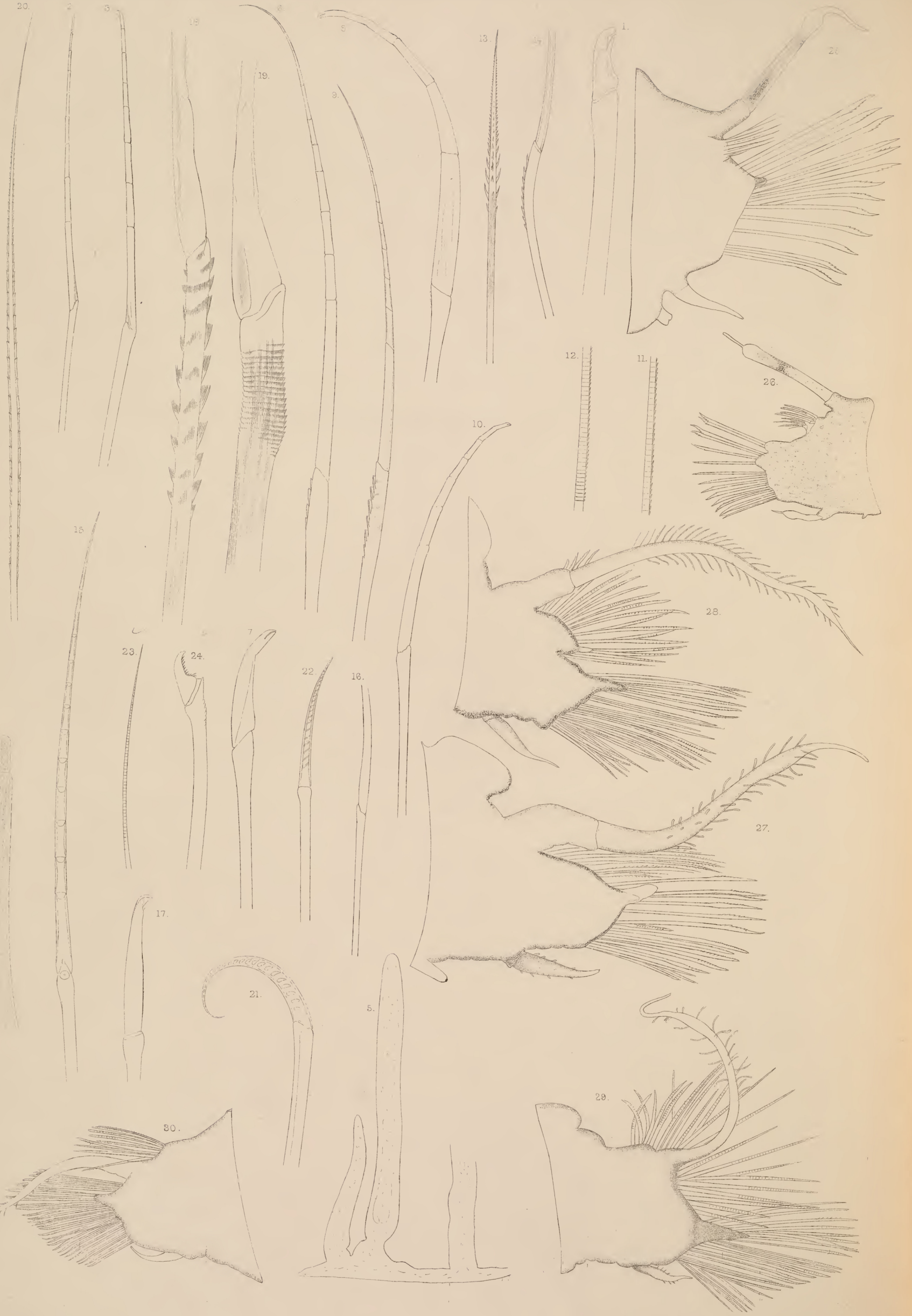
PLATE XLI.

Fig.

1. Dorsal bristle of *Halosydna gelatinosa*, Sars. × 180.
2. Superior ventral bristles. × 180.
3. Median ventral bristle. × 180.
4. Dorsal bristle of *Polynoë scolopendrina*. × 350.
5. Large bristle above the spine of the ventral division of the foot. × 90.
6. Bristle of the other series adjoining the spine. × 90.
7. Tip of a dorsal bristle. × 350.
8. Tip of one of the series represented in fig. 6. × 350.
9. Dorsal bristle of *Enipo Kinbergi*. × 350.
10. Ventral bristle with simple tip. × 350.
11. Bifid ventral bristle. × 350.
12. Antero-posterior view of a large ventral bristle with a simple tip. × 350.
13. Dorsal bristle of *Acholoë astericola*. × 350.
14. Ventral bristle. × 350.
15. Brush-shaped bristle from the superior border of the foot of *Panthalis Œrstedi*. × 350.
16. Antero-posterior view of a bristle from the upper third of the median lobe of the foot. × 210.
17. Lateral view of the same bristle. × 210.
18. Bristle from the ventral edge of the foot. × 210.
19. Dorsal bristle of *Sthenelais boa*. × 90.
20. Fragment of the former, showing spinous rows. × 350.
21. Superior ventral bristle with simple spinous tip × 350.
22. Stout bristle from the centre of the ventral division with a single appendage. × 350.
23. Bristle from the inferior series. × 350.
24. Portion of the edge of a scale of *Sthenelais Zetlandica*. × 350.
25. Superior ventral bristle in calcium chloride. × 350.
26. Inferior ventral bristle. × 350.
27. Edge of a scale of *Sthenelais atlantica*. × 350.
28. Superior ventral bristle. × 350.



W.C.M. ad nat. del. Fig. 26, J.M.A.

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PLATE XLII.

FIG.

1. Second series of ventral bristles with single terminal joint in foot of *Sthenelais limicola*. × 350.
2. Slender bristle beneath the former. × 210.
3. One of the stouter bristles following the preceding. × 210.
4. Tip of a ventral cirrus. × 210.
5. Papillæ on the edge of a scale of *Sthenelais Jeffreysii*. × 350.
6. Superior ventral bristle. × 350.
7. Bristle from the inferior lobule, with two divisions in the terminal process. × 350.
8. Bristle from the ventral edge of the group. × 350.
9. Superior ventral bristle of *Eusthenelais hibernica*. × 350.
10. One of the slender bristles at the ventral border of the foot. × 350.
11, 12. Portions of a dorsal bristle of *Sigalion Mathildæ*. × 280.
13. Superior ventral bristle. × 280.
14. One of the series below the former. × 280.
15. One of the next series without spines at the end of the shaft. × 280.
16. A more slender form at the ventral margin of the foot. × 280.
17. One of the stronger bristles of the ventral lobe, with a single terminal process. × 280.
18. Portion of the end of the shaft (with its whorls of spikes) of one of the superior bristles of *Sigalion Buskii*. × 350.
19. Similar region of one of the next series. × 350.
20. Dorsal bristle of *Leanira hystricis*. × 350.
21. Anterior ventral bristle. × 350.
22. Ventral bristle from the posterior region. × 350.
23. Dorsal bristle of *Pholoë minuta*. × 280.
24. Ventral bristle. × 280.
25. Foot of *Lepidonotus squamatus*. × 20.
26. Tenth foot of *Lepidonotus clava*. × 12.
27. Tenth foot of *Gattyana cirrosa*. × 40.
28. Foot of *Eunoa nodosa*. × 18.
29. Foot of *Acanthicolepis asperrima*—behind the middle of the body. × 24.
30. Anterior foot of *Lagisca Jeffreysii*. × 24.

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