Vol. 7. EIGHTH SERIES. No. 38.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY,
INCLUDING
ZOOLOGY, BOTANY, AND GEOLOGY.

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BEING A CONTINUATION OF THE "ANNALS" COMBINED WITH
MESSRS. LOUDON AND CHARLESWORTH'S "MAGAZINE OF NATURAL HISTORY."

WITH THREE PLATES.

Illustrative of Prof. M'Intosh's Notes from the Gatty Marine Laboratory, St. Andrews.

LONDON:
TAYLOR AND FRANCIS, RED LION COURT, FLEET STREET.
Sold by Simpkin, Marshall, Hamilton, Kent, & Co., Ld.; Baillière, Paris;
Hodges, Figgis, & Co., Dublin: and Asher, Berlin.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[EIGHTH SERIES.]

No. 38. FEBRUARY 1911.]

XVI.—*Notes from the Gatty Marine Laboratory, St. Andrews.*—No. XXXII. By Prof. M'Intosh, M.D., LL.D., F.R.S., &c.*

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1. *On the American* Syllides verrilli, *Percy Moore, from Woods Holl, Mass.*

An account of an interesting annelid, captured in the tow-net off the Marine Biological Laboratory at Woods Holl, United States of America, was lately given by an able investigator, Mr. J. Percy Moore †, under the name of *Syllides*

* In the last "Notes" *Polydora carazzi* on p. 172 appears to be identical with Mesnil's *P. caulleryi* (Bull. Sc. France et Belgique, t. xxx. p. 88, pl. iii. figs. 12–16. This paper had been overlooked).

† Proceed. Acad. Nat. Sci. Philadelphia, p. 488, text-figs. 1 & 2 (January 29, 1908).

verrilli, sp. n., and careful consideration of the description and the figures shows that besides the relationships mentioned by the author this minute form presents affinities with other types not mentioned by him.

The annelid is minute, viz. 2·5 to 3 mm., and its breadth is ·2 to ·3 mm. The prostomium is large, subquadrate, with rounded corners; eyes 3 pairs, reddish brown, the first pair evidently less important (as they are rudimentary) than the others, which lie behind, in the position usually found in Syllids, and, from the figure, the anterior pair of these has lenses. The tentacles are short, stout, and clavate, the median arising between the middle pair of eyes and the lateral near the anterior border of the prostomium. The palpi are "small, mammiliform, situated on the ventral face of the prostomium and directed downwards," nearly invisible from above. They have enlarged bases and short cirriform distal portions. Tentacular cirri of the shape of the tentacles, but they are supported by short cirrophores. The colourless body is slightly depressed, the segments increasing a little in width to the middle, the first seven (to the caudal end of the gizzard—eighth segment) being short, whilst the succeeding are longer and contain the gonads. The proboscis occupies the first three segments, is more or less cylindrical, with thick brownish chitinous lining, edentulous. The rim has a circle of ten soft papillæ. The pygidium is small and bears a median unjointed ventral style and a pair of very long unjointed cirri. The prominent foot is uniramous on all the segments in the immature worm and on the first seven of the sexually mature. The dorsal cirrus is of the same shape and size as the tentacular cirri on the first three segments. The succeeding are more slender and tapered, with the tip often differentiated as a more slender and subulate process, and they (cirri) increase in length toward the middle, again diminishing posteriorly, whilst they also become distinctly jointed or moniliform, though the author adds that there is great difference in this respect, some having the cirri much more distinctly moniliform than others, and "sometimes there is a slight but distinct alternation of longer and shorter cirri;" but these conditions are not constant. The setigerous lobe has a single spine, which ends in a rough flattened knob, is compressed and slopes inward from the salient dorsal angle. The ventral cirrus leaves the setigerous lobe near the tip, is comparatively long, and usually presents "irregular constrictions and a more slender, blunt, terminal piece." The setigerous process bears dorsally a single simple bristle, "curved and slightly thickened distally, finely toothed

along the convex side, and slightly enlarged and bifid at the end." Beneath this is a fan-like tuft of compound bristles with slightly curved shafts and somewhat long terminal pieces which are bifid at the end and with a serrated edge. Further, sexually mature examples have after segment viii. a tuft of delicate capillary bristles which spring from the posterior base of the setigerous process.

Mr. Moore refers the foregoing form to the Syllidæ, and thinks that it may be the species referred to by Verrill as having been taken at Woods Holl along with *S. setosa* *, and is perhaps the *S. longicirrata*, Œrsted, of Webster and Benedict, but is not that species as described by European authors. From typical species of the genus he points out that it differs in the small size and ventral position of the palpi.

Mr. Moore's careful description demonstrates the grounds on which the resemblances to the Syllids are based, yet there is another group with which it might be compared, viz. the Staurocephalidæ. The head (prostomium) is somewhat like that of *Autotylus* or *Myrianida*, with a median and two lateral tentacles, the eyes being arranged like those of the Syllids and *Staurocephalus*, the anterior rudimentary pair being, however, peculiar. The absence of a median tentacle in *Staurocephalus* is a divergence, but in some Staurocephalids the tentacles are more or less ringed. The body offers little that is diagnostic in general outline, but the caudal region has a pygidium with a short median style, as well as two long lateral cirri, features diverging from the Staurocephalids, which usually have only the lateral cirri. The structure of the foot is, perhaps, the most critical feature in the comparison. In Mr. Moore's form the foot is strictly uniramous on the first seven bristled segments in sexually mature forms and in all the segments in the immature annelids. In all ordinary Syllids the foot conforms to the uniramous type, having only a single spine and bristles of one character, the ventral cirrus often being fused with the lower border of the setigerous process, which usually has a different outline from that in *Syllides verrilli*. In the Staurocephalidæ the foot, on the other hand, though there is but one spine, shows a biramous tendency in so far as the bristles are in two tufts, and the upper dorsal bristles diverge in structure from the others, and, in all, the ventral cirrus is carried far out on the setigerous process.

To go more minutely into the structure of the foot of *Syllides verrilli*, the dorsal cirrus is proportionally massive

* Rep. U.S. Fish. Comm. for 1882 (1884), p. 664, footnote.

for a Syllid and ends in a conical tip, and, with the exception of the three anterior segments, the organ is more or less ringed. It therefore differs from that generally seen in the Staurocephalidæ, though obscure rings are occasionally present in these, while in the form of the conical tip it agrees with that group (Staurocephalidæ), as it also does in the absence of the tapering form so characteristic of the Syllids. The setigerous lobe again has a conical process superiorly more marked than in the majority of the Syllids, yet it is not always present in the Staurocephalids. The tip of the spine terminates in a large flattened and roughened knob, a condition approaching that observed in certain Syllids, such as *Odontosyllis ctenostoma*, *Syllis spongicola*, &c. A striking feature is the occurrence at the dorsal edge of the fascicle of bristles above the spine of a single simple bristle, which is curved, slightly thickened, and flattened distally, and with a blunt bifid tip. At first sight this bristle resembles that found in certain Staurocephalids, such as *Staurocephalus rubrovittatus*. Further, the fan of compound bristles which follows forms two groups in the text-figure, an arrangement observed in certain Staurocephalids, the large size of the terminal processes and their bifid tips also resembling those of the latter *. On the whole, therefore, the structure of the bristles would indicate relationship with the Staurocephalidæ as well as with the Syllidæ. In the sexually mature examples a tuft of long delicate capillary bristles arising from the dorsal and posterior face of the setigerous process occurs on each foot after the eighth. Such bristles occur in the sexual pelagic forms of both Syllids and Staurocephalids, and have no spine in either.

The ventral cirrus, from its proportionately great length and slightly crenate condition, diverges from that usually found in the Syllidæ or Staurocephalidæ, yet it agrees with both in being borne by the setigerous lobe, and, as a rule, well outward.

On the whole, then, Mr. Moore's form presents interesting features of relationship with both groups, the shape of the head, the peculiar palpi, the tentacles and the proboscis, the absence of a dental apparatus, and the pygidium leaning so far to the Syllids, whilst the structure of the foot and its bristles recall certain features observed in the Staurocephalids. More minute details of the structure of the foot and bristles by the author would be useful in enabling a more precise view of its relationships to be made.

* Fig. 2 *d*.

2. *On* Nevaya * whiteavesi, *a Form with certain Relationships to* Sclerocheilus, *Grube, from Canada.*

Dredged at Station 52, Gulf of St. Lawrence, Canada, 1873, by Dr. Whiteaves.

A fragment of the anterior region of a form (Pl. V. fig. 1) with a somewhat broad flattened body, a little tapered toward the front and rapidly narrowing behind the broad anterior region. The feet are deeply cut and have conspicuous bristles. Moreover, the second bristled segment has specially modified powerful golden bristles.

The head has anteriorly a somewhat slender prow (Pl. V. fig. 1 *a*), slightly blunt at the tip. From this a prominent and rather narrow median ridge (flattened vertically) passes backward to terminate in a small tentacle at the second bristled segment. The central region of the snout, indeed, is somewhat spindle-shaped when viewed from the dorsum, as a dilatation occurs in the middle, followed by the vertically flattened posterior portion. This condition recalls that in *Nerine*, especially as the lanceolate lateral processes resemble the branchiæ of that form. Part of the proboscis is extruded as a frilled organ. On each side of the median ridge anteriorly is an acutely lanceolate lamella (which may be branchial in function) pointing backward and outward, whilst from its inner border a tuft of slender glistening bristles (Pl. V. fig. 1 *d*) is directed upward, thus forming a remarkable arrangement in this region, and probably representing the dorsal division of the first pair of feet. Below is a small conical lamella, followed ventrally by a second of similar shape, a tuft of bristles projecting downward, outward, and forward in front and glistening with a brilliant metallic sheen. The ventral edge of this foot forms a long rounded elevation directed obliquely outward and forward from the median line and apparently clasping the buccal region. The ventral division carries a series of rather stout curved bristles (Pl. V. fig. 1 *b*), with a hook at the tip directed backward, but considerable differences exist amongst them, some being longer and more slender. At the posterior part of the cephalic median ridge another narrow lanceolate lamella projects on each side, the base being somewhat broader than that in front. In the preparation it slopes obliquely backward and outward. The arrangement of these lamellæ therefore recalls the condition in *Spiophanes*. Their relationship to the feet may not be quite free from doubt. The next

* Named after Nevay Park, on the Sidlaws, Forfarshire.

foot has in the ventral division four great flattened golden bristles with strong blunt points (Pl. V. fig. 1 *c*) attached to the massive setigerous region, a comparatively large lanceolate lamella occurring superiorly, whilst at the ventral edge is a small papilla. In the developing organs the points are, as usual, first formed. The dorsal bristles form a row superiorly, and consist of bristles similar to those in front, though shorter (Pl. V. fig. 1 *e*). They taper from the base to the tip, which is very attenuate, yet they make a somewhat rigid pencil or fan. Both they and the ventral bristles are encrusted with very small particles which obscure their minute structure.

The next segment is narrow and has a broad though narrow dorsal lamella which is lateral in position—that is, lies directly above the foot,—and its bristles are directed upward in front of it. No ventral bristles are present in the specimen.

The following three feet are similar, viz., each having a broad and vertically narrow dorsal lamella, with a bristle-tuft in front on the dorsum and a well-marked and increasingly massive ventral division, bearing a tuft of bristles the central series of which is often abruptly truncated below the tip. These bristles (Pl. V. fig. 1 *f*) are rather strong, straight, narrowed from the base distally, have a slight curvature below the tip, which is tapered to a fine point and feathered with a series of spikes. One of the stouter forms from this region is represented in fig. 1 *g*.

Behind the foregoing the dorsal lamella, which has the form of a vertical plate, moves further inward on the dorsum, and by-and-by considerably diminishes in size, as also do the feet at the posterior end of the fragment, from which the proboscis projects posteriorly. The dorsal bristles of this region (Pl. V. fig. 1 *h*) have long shafts and finely tapered tips.

The head in this form differs from that in *Sclerocheilus* in the absence of the anterior processes and in the absence of eyes. No protrusible and ciliated nuchal organs are visible at the base of the snout as in *Sclerocheilus*. The presence of the caruncle with the small tentacle behind it also separates *Nevaya* from *Sclerocheilus*, whilst in certain features it approaches *Nerine*. The buccal segment in the latter is achætous. The second segment in *Sclerocheilus* bears dorsally and ventrally capillary bristles, and a little below ("au-dessus") the ventral papilla five or six powerful golden hooks, which De St. Joseph * thinks enable the animal to

* Ann. Sc. Nat. 8e sér. xvii. p. 106.

make its tunnel in shells. In *Nevaya* a fully developed foot with lamellæ and bristles occurs in front of that with the four great golden bristles inserted in the massive setigerous region. Moreover, no bifid or fork-like bristles occur in *Nevaya* so far as the single example shows. Both *Sclerocheilus* and *Nevaya* present a remarkable development of certain anterior ventral bristles which must in some way be connected with their dwellings, whether in tubes or burrows; yet the divergences in the position and structure of these organs in each case indicate noteworthy differences in function. In *Polydora* the great hook-like bristles occur on the fifth segment, whereas homologous forms are on the third foot of *Disoma*. De St. Joseph after a careful survey of the structure of *Sclerocheilus* concludes that it belongs to the Scalibregmidæ.

3. *On the British* Cirratulidæ.

Four species representing the Cirratulidæ are given in Dr. Johnston's 'Catalogue of Worms in the British Museum,' viz. *Cirratulus tentaculatus*, Montagu, *Cirratulus cirratus*, O. F. Müller (under the name of *C. borealis*), *Aonis vittata*, Grube, and *Dodecaceria concharum*, Œrsted.

By De Quatrefages the Cirratulids were classified chiefly by the arrangement of their branchiæ, which either occurred throughout or were confined to the anterior segment; but subsequent authors took into consideration the structure of the bristles and hooks, as shown, for instance, by Langerhans, Levinsen, Claparède, and others. Thus two great divisions of the Cirratulids are made by De St. Joseph, viz.: (1) those devoid of large prehensile tentacles, and (2) those having such. Further, they may be grouped: (1) into those having capillary bristles in both divisions of the foot throughout, (2) those having only capillary bristles in the dorsal division and crotchets in a certain number of the ventral divisions, and (3) those having capillary bristles and crotchets in a certain number of both dorsal and ventral divisions. The majority of the British forms fall under the third group, such as *Cirratulus cirratus*, *C. tentaculatus*, *C. bioculatus*, *Dodecaceria concharum*, and *Chætozone*.

C. tentaculatus is everywhere distributed round our shores from Shetland to the Channel Islands, and is abundant under stones on muddy and sandy ground between tide-marks. Such muddy sand, indeed, is often furrowed by them and their trailing tentacles, which stretch as orange threads in every direction; and, besides, they are found in

various cracks and crevices of the rocks in the same region. The head (prostomium) is conical, and on each side, a short distance from the tip, an oblique depression slopes outward and backward, and from the point at which these converging grooves meet a ridge runs forward to the tip of the snout. Ventrally a deep groove leads backward to the mouth, which is bounded posteriorly by a thick transverse lip. In some specimens from Lochmaddy a little pigment occurs on the snout at the posterior and outer angle of the triangular anterior region, thus simulating eyes—indeed, the pigment is occasionally symmetrically arranged. In others from Guernsey and Herm a distinct band of ocular points passes from one side of the base of the snout to the other just in front of the constriction indicating the region. A variety with a blackish snout is met with at Herm, and Dr. Sowerby forwarded some in a similar condition from the estuary of the Orwell near Ipswich.

The body is from 6 to 9 inches in length, rounded on the dorsum, flattened ventrally, tapered anteriorly and more distinctly but gradually diminished posteriorly, where it ends in a pointed tail, the slit-like anus being dorsal, whilst in the mid-ventral line in some specimens is a small process like a rudimentary cirrus. Others show in lateral view a process above and a little in front of that just mentioned, and some present only a large terminal anus with a rim and no process. Such variations probably indicate injuries and reproduction. The number of segments ranges to 300 and upward in a large example. Vertical lines of dark pigment occur in the sulci at the segment-junctions—from the fourth segment backward for some distance.

On an elevated ridge which lies dorsally between the fifth and sixth bristled segments is a dense mass of tentacles on each side. The ridge is somewhat crescentic in front, straight behind, and the tentacles in the cluster number at least twenty. Each segment behind the foregoing has on each side its branchia situated behind and rather above the level of the upper bristle-tuft, and this throughout the whole anterior region, to the number of about one hundred in large examples. The branchiæ are more scattered in the middle and posterior regions, and cease altogether about the thirty-fifth or fortieth segment from the tip of the tail. After the seventh or eighth the bristled segments for a considerable distance are narrow, then become slightly wider, and again toward the tip of the tail are narrow. The remarkable spiral coils of the branchiæ constitute a feature of the species, and contact with sea-water is apparently less

congenial to the animal than with mud, which at least enables it to separate the long coiled filaments.

The peristomial segment is somewhat narrower than the two which follow, and each of which has various transverse creases or wrinkles. These are devoid of bristles, hooks, or other appendages. The first setigerous segment follows the foregoing and is broader than its successors. The foot is represented in the lateral region only by dorsal and ventral setigerous processes, which bear tufts of capillary bristles. Moreover, near the junction with the segment behind and nearly on a level with the upper bristles is a long coiled branchia. The capillary bristles have somewhat stout shafts and long, flattened, tapering tips, with a narrow border of spines directed distally. The four or five bristled segments which follow are broader than those next them, but all have the capillary bristles dorsally and ventrally. In the groove between the second and third bristled segment a second and smaller branchia occurs, the base arising a little above the level of the dorsal bristle-tuft. The same takes place in the groove between the third and fourth and between the fifth and sixth. The branchiæ and tentacles vary in size according to the degree of development, those in process of reproduction being small, whilst the older examples are thick. All are minutely ringed, probably from muscular fibres.

The strong hooks commence in the ventral series of the large examples from Plymouth at the sixty-second bristled segment, though they vary in this respect, some commencing at the forty-fifth, others at the sixtieth. The hooks are at first slender, but soon become robust, the neck curving backward and then forward at the tip, and probably they are the main agents in securing a firm hold of the burrow. Their appearance in the dorsal division is somewhat later, viz. between the ninety-first and ninety-fifth bristled segments. In both cases the foregoing figures differ from those of von Marenzeller and De St. Joseph. The former states that the first ventral hooks appear in *C. tentaculatus* between the thirty-third and forty-fifth segments, and the dorsal between the fortieth and forty-fourth; whereas in *Cirratulus chiajii* the ventral appear between the twenty-first and twenty-third and the dorsal between the fortieth and forty-fourth. The variation in regard to the appearance of these structures in British examples of *C. tentaculatus* would also, as De St. Joseph observes, lead to some doubt as to specific identity based on this feature.

An examination of two examples of *Cirratulus* (*Audouinia*) *filigerus* from Naples shows that in one the anterior tentacles

arise less definitely than in *C. tentaculatus*, it being difficult to say whether they are mainly opposite the sixth or the seventh bristles, whereas in the other they resemble more closely those of *C. tentaculatus* in transverse arrangement and they arise opposite the fifth pair of bristles. In both a branchia springs in front of the dorsal of the first series of bristles. The first ventral hooks occur on the thirtieth bristled segment on the right in the example first referred to, and the first dorsal hooks on the forty-first; whereas in the other specimen, with the groups of tentacles opposite the fifth bristles, the first ventral hook occurs on the nineteenth bristled segment and the first dorsal hook on the thirty-seventh. These hooks are slightly less curved toward the tip than those of the northern form, but otherwise are similar. The bristles are also proportionally larger.

A form approaching *Cirratulus filigerus*, D. Chiaje, from Malahide, Co. Dublin, obtained by the Royal Irish Academy's Expedition, is smaller than the foregoing species and presents certain differences. It is 3–4 inches in length, but of similar shape, the anus being dorsal, with a short cone beneath. Immediately behind and rather above the first bristled foot is a branchia, and so with the three following. On the dorsal sulcus between the fourth and fifth bristle-tufts is a group of four or five slender branchiæ. Behind the foregoing the branchiæ occur on each side and are sparsely distributed along the posterior region almost to the tip of the tail. The crotchets (hooks) appear in the ventral division about the twentieth bristled segment, whilst they occur in the dorsal division about the fortieth. Their curves are somewhat more pronounced than in *C. tentaculatus*, and in the posterior region the ventral are considerably larger and stronger than the dorsal.

The third form is *Cirratulus cirratus*, O. F. Müller, which is generally distributed round the shores of Britain between tide-marks. The head is broader than in *C. tentaculatus*, hoof-shaped, but with a slight notch in the centre, and with two well-marked bands of eyes sloping obliquely outward and backward. The body is 3 to 4 inches in length and has about 106 segments, more distinctly outlined than in *C. tentaculatus*, and their antero-posterior diameter is greater. It is rounded dorsally, somewhat flattened ventrally, where a deep groove runs from the first bristled segment backward to the tail, which ends in a point or papilla ventrally, with the

crenate anus above it. The colour varies from yellowish orange to deep madder-brown. Two achætous segments follow the prostomium. The fourth segment has a smaller sessile foot than the succeeding segments and bears two minute tufts of bristles which have the same structure as in *C. tentaculatus*. It also carries a series of proportionally large filiform branchial cirri arranged in two lateral tufts, each of seven or eight cirri of an orange colour, with contained blood-vessels. These coil and twist during the progress of the animal, and in proportion to the diameter of the body have a larger bulk than those of *C. tentaculatus*.

The following thirteen or fourteen segments bear branchial cirri, each arising above and slightly behind a line through the middle of the bristle-tuft. Some of these show a greater amount of blood than those in the dense anterior tufts. Here and there along the body a single cirrus springs from the dorsal arch considerably above the bristles, but the posterior region is devoid of them. On the whole, these cirri are much fewer in number than in *C. tentaculatus*, and do not show the remarkable spiral coils so characteristic of that species.

The feet differ from those of *C. tentaculatus* in so far as they are more prominent and the dorsal and ventral divisions considerably closer—indeed, in some, *e. g.* the first, the bases, fused with the body-wall, closely approach. The first twelve bristled segments have only the simple flattened tapering bristles, the points being extremely slender, and the ventral are distinguished from the dorsal by their shortness and in some by their proportionally broader tips. The dorsal slightly dilate from the base to the middle of the shaft, then taper gradually to the very fine hair-like tip. Parasitic structures, such as algæ, abound on them, and render them pinnate, besides winding round them. The front edge of each bristle is minutely and regularly spinous, the direction being distal. At the thirteenth foot a single crotchet appears on the ventral division. In structure the crotchets (hooks) dilate a little from the base to a point above the middle, where there is a slight forward curve, then a slight backward bend occurs, and again a forward curve to form the hook at the tip. This projects through a neatly rounded aperture in the cuticle, and is moderately acute in the uninjured forms. In the sixteenth foot three hooks are present, and four in the thirtieth. One or two bristles accompany the hooks. The crotchets commence in the dorsal division about the thirtieth foot, a slender sharp-pointed one appearing in the twenty-ninth, or perhaps earlier, along with the bristles, and they

continue to the posterior end, both divisions having a few slender tapering bristles, which are more conspicuous than in front. So far as observed, the hooks of the dorsal division posteriorly are slightly more slender and less curved than those in the ventral.

A small form (young ?), dredged off Shetland by Dr. Gwyn Jeffreys in 1867, presents the peculiarity of having only two eyes, and the head shows less of a basal constriction than is usual in examples of *C. cirratus* of the same size. The complete tentacles of the fourth segment are of very great length, probably reaching in life beyond the tip of the tail, which has a ventral papilla similar to that of *C. cirratus*. The tenth foot has dorsally a long slender tuft of finely tapered bristles, whilst the ventral bristles are much shorter —the flattened tips being expanded like a "bellied" knife, and then tapered to a fine point. The hooks by-and-by appear in both ventral and dorsal divisions, and their shape corresponds with that of the ordinary examples of *C. cirratus*. De St. Joseph * found that in the young of *C. tentaculatus* of 12 mm. the crotchets appeared in the tenth segment; but the structure of the bristles and hooks of this form differ from those of that species, not to allude to the structure of the head. Keferstein's *Cirratulus bioculatus* † differs in the shortness of its tentacles, in the structure of the hooks, and in the nature of the caudal region, which has two cirri. Too much reliance, however, cannot be placed on the representations of the minute structure of the bristles at that period.

Dodecaceria concharum, Œst., is common under the roots of tangles (*Laminaria digitata*), especially when these have a crust of *Lithothamnion* beneath them; occasionally in sandstone, as at the West Rocks, St. Andrews.

In this the dull greenish head is more attenuated than the rest of the body, the anterior border being rounded, though capable of various changes of form. The colour is brownish red anteriorly, greenish yellow posteriorly, and streaked longitudinally with the red blood-vessel, Some have touches of orange. They dye spirit green. The mouth opens a little behind the tip inferiorly as a Y-shaped slit in which the action of the cilia is marked, and with a considerable amount of dark pigment on the lips. The body is about an inch in

* Ann. Sc. Nat. 8^{e} sér. t. xvii. p. 50.
† Zeitschr. f. wiss. Zool. Bd. xii. p. 121, Taf. x. figs. 23–27.

length, slightly tapered toward the snout and distinctly diminished toward the tail and more or less rounded throughout. The segments are 60 or more, and when the body is extended the anterior region is nearly as narrow as the snout. The tentacles are 12 in number, six on each side, arise on the dorsal surface opposite each other, and the bases of the pairs approach quite as closely as in *Dodecaceria ater*. They commence on the anterior part of the second segment, the first pair being longer than the others. As a rule they are of a pale green colour, with darker pigment at the tip, but they may be dull orange. A coiled blood-vessel proceeds along the centre of each, and the edges of the tentacle are often crenated, and when extended frequently show a dilatation at the tip, but no cilia. When sickly the tentacles assume a dull brown hue.

The first seven bristled segments have on each side two fascicles of simple bristles which taper to very delicate tips. In the eighth segment the ventral division has a few of the peculiar bill-hook crotchets amongst the bristles, and at the tenth the latter only occur in the ventral series, whilst some show dorsally a few of the simple tapering bristles and about three stouter bristles, the tips of which have been abraded, so that an oblique surface remains. The typical crotchet or hook has a slightly curved shaft, which somewhat increases in diameter from the base to the distal third, then gently bends backward to the neck, where the dorsal line again has a backward curve, and then goes forward to the tip. The anterior curve, which at the neck is also slightly backward, is abruptly broken by a bold conical projection, from the apex of which the distal curve runs to the stout tip. It thus differs in all respects from the tip of the southern *Dodecaceria ater* of De Quatrefages.

In the posterior part of the body the dorsal setigerous cone bears a few of the long slender tapering bristles, and one or two stout hook-like bristles bevelled at the tip and representing a modified type of the ventral series, for they present no enlargement on the anterior face below the bevelled region. The ventral division likewise has a bristle or two of a shorter type than the dorsal, which are conspicuous in a lateral view from above, and one or two of the characteristic crotchets, the only peculiarities being their shortness and the more marked curve of the less robust hook at the tip. The conical projection at the anterior base of the curve of the tip is marked.

In a young example 3–4 mm. in length, procured along

with young *Arenicola*, the little boring *Sipunculus*, *Pholoë*, and swarms of *Polydora ciliata* at the East Rocks, St. Andrews, the body, in spirit, is rounded in front, but the posterior third is more or less flattened, as in *Heterocirrus*. The colour of the two regions also differs, that in front being pale greyish, whilst the posterior is brownish red. The bristled segments are about 35 in number. The snout is formed as in the adult, with the mouth considerably behind, and the tentacles and the branchiæ are well developed. The two rounded papillæ at the vent are more distinct than in the adult. The characteristic hooks show that whilst the flattened posterior region simulates that of *Heterocirrus ater*, the form is essentially different.

No feature in Guernsey and Herm is more interesting in the littoral region than the abundance of boring forms in the coating of *Lithothamnion* on the surface of the hard gneiss, especially at low water. Amongst them is the next form, viz. *Dodecaceria ater*, De Quatrefages (which is not a variety of *Dodecaceria concharum*, which also occurs in the fissures of the rocks in long galleries curved in various ways). Langerhans * and De St. Joseph consider this only a variety of *D. concharum*, but so marked a variety, especially in regard to the structure of the hooks, merits in the meantime special separation. It may be that Langerhans had not the present form before him, for his figure of the hooks of *D. concharum* is good. The head of this species is rather elongated, like that of *Phyllodoce*, slightly tapered and smoothly rounded in front, and with two dark patches of minute eyes in the median dorso-lateral region, the snout in front of these generally being pale in the preparations, whilst that behind is dark. The mouth opens ventrally a short distance behind the tip of the snout, as in other forms, and not at the tip as De Quatrefages observes.

The body is 1–2 inches long, rounded or slightly flattened in front, more distinctly flattened after the anterior third, and often forming a broad oar-like region posteriorly before abruptly narrowing toward the tip, which presents a papilla on each side of the vent. It is slightly tapered toward the snout and the segments throughout are distinctly marked, their antero-posterior diameter being larger in front than behind, though the first four or five bristled segments are narrow. The colour is of a very dark blackish green throughout, the tentacles being pale green, with a central

* Zeitschr. f. w. Zool. Bd. xxxiv. p. 96.

red streak (vessel). It tinges spirit green, giving out a dark green exudation like dark specimens of *Cirratulus*.

De Quatrefages thought that the buccal segment was in abeyance ("L'anneau buccal a presque entièrement disparu"), yet not only the mouth-parts, but the bases of the great tentacles are close to the peristomium. The large tentacles are prominent organs, with a deep groove on their ventral surface; and as the edges of these are crenated, they in all probability approach in function to those of *Polydora* and other Spionidæ. Above and behind the tentacles is a branchia, and, as a rule, three others follow, each on the dorsal arch of its segment, and with a diminishing distance transversely between the bases. They are of moderate length, and in some have a tendency to form curves and a few coils.

Behind the tentacles are indications of five segments, but whether the imperfect first of these should be regarded as an independent one may be an open question. The four following have dorsal and ventral bristles of a simple tapering kind, minutely serrated along the anterior edge. These and the next are all narrow segments, and differ in this respect from those which follow. The foot is represented by a dorsal and a ventral setigerous papilla, with a ridge between. The type of foot, however, changes at the seventh, where the characteristic crotchets occur dorsally and ventrally. On their first appearance these organs have a slight forward curve of the shaft as far as the distal third, where a backward curve takes place. The shaft shows only a slight dilatation from the base upward for a short distance, remaining nearly of the same diameter to the neck, where it bends backward and again forward at the tip (Pl. V. fig. 2 *a*). The latter in certain antero-posterior views presents a median rib and two lateral wing-like areas, but probably this appearance is due to the thicker tissue in the centre and the thinner and slightly expanded lateral regions. In lateral view the hollow of the distal hook appears to be scooped out like an old snuff-spoon, but there is no knob at the anterior base as in *D. concharum*. These hooks increase gradually in strength though not in length in both divisions of the foot posteriorly, and their number toward the tip of the tail diminishes, but they are of proportionally great size, and thus in contrast with those of *D. concharum*. Two occur in the dorsal and three in the ventral division just in front of the tail, but the number is variable. The alterations of the contour of the tips of the hooks would indicate that they have special functions in connexion with the tube, and

their gradual increase in length from before backward corroborates this view. In some, when seen antero-posteriorly, the tips are spatula-shaped, a slight constriction occurring at the neck. One or two capillary bristles, with a slight flattening of the tapered and serrated tip, accompany the dorsal hooks. Several procured at Guernsey and Herm in July and August had well-developed eggs. Moreover, an epitokous male more than 2 inches long occurred amongst the others. In this the anterior region of about twenty-two segments (exclusive of the head and six or seven segments) is modified, whilst the caudal of about thirty segments is not materially changed. The pigmented area of the eyes is perhaps a little larger, and the dorsal tuberosity of the head somewhat more prominent, whilst the tentacles and branchiæ are normal. The whole of the anterior and middle regions are enlarged and softer, and have long resplendent dorsal swimming-bristles which in length exceed the diameter of the body. They are smooth, simple, tapering bristles with very faint longitudinal lines, and of a pale yellow hue, best seen by transmitted light, and their tips are remarkably attenuate. The anterior dorsal bristles are little altered, but from the eighth to the thirty-first they form conspicuous tufts on each side. This bristled region, with the head, is probably thrown off and discharges the sexual elements, whilst the unchanged and flattened moiety of about thirty segments reproduces a head and anterior region. The fact that this example, which was not quite ripe, still occupied its tube in *Lithothamnion* would indicate that up to the period of "swarming" the oar-shaped posterior region and its series of powerful hooks would be of material service to the form, and, further, after the separation of the sexual region, if such is found to occur, the remnant would be ready for the emergencies of its life in the calcareous crusts and masses. The great size of the hooks or crotchets throughout, and especially in the posterior region, shows that the form is adult and that the shovel-shaped and abraded posterior hooks have been in constant use. In the dorsal division one or two of the tapering capillary bristles with the anterior edge of the tip serrated are present.

The great size of the hooks in *Dodecaceria ater* and their special structure at once attract attention, especially when contrasted with those of *D. concharum*.

A form (*Chætozone dunmanni*), which appears to be intermediate between *Cirratulus* and *Chætozone*, comes from

Dunmanus Bay. 11. 2. 92 in the collection of the Royal Irish Museum.

The snout forms a blunt cone, with slight lateral notches which may indicate sensory grooves, and the peristomial segment is devoid of bristles. The mouth opens ventrally as a large aperture, having a crescentic groove posteriorly and a median furrow between the two lateral lips anteriorly. From the peristomial segment the body gradually widens to the eighth or ninth bristled segment, and then rather abruptly dilates into an ovoid swelling including about ten segments, when it again contracts, such being doubtless due to the mode of preparation. The segments of the anterior region are distinctly marked and one-ringed, and the feet are represented by lateral ridges with dorsal and ventral setigerous processes and a minute flat intermediate papilla. Anteriorly the feet present, as at the sixth, a long dorsal tuft of capillary bristles and a shorter one ventrally. This arrangement continues toward the thirtieth foot, when a stouter series appear—at first simply modified ordinary bristles with a double curvature of the shaft and a finely tapered tip, the ventral series apparently preceding the dorsal. Finally, posteriorly both divisions have the elongated and characteristic hooks. These have long, straight, finely striated shafts, which at the upper part have a slight curve forward, then gently curve forward to the sharp tip. The striæ cease about the middle of the tip. They thus differ from the condition in *Chætozone* and approach that in *Cirratulus*.

A species (*Chætozone zetlandica*) dredged by Dr. Gwyn Jeffreys in 100 fathoms in St. Magnus Bay, Shetland, in July 1867, appears to differ from *Chætozone setosa*. It is a fragment about $\frac{1}{2}$ an inch in length of the middle and posterior regions, including more than sixty bristled segments, and is distinguished from *C. setosa* by the flattened body, the more hirsute lateral regions, the button-shaped anus, and the absence of the differentiated posterior region so characteristic of the species just mentioned. The broad flattened body has very distinct segments, with setigerous papillæ projecting as conical eminences on each side. The posterior end seems to have been reproduced, about fifteen segments being thus added with the large button-shaped pygidium; but the general structure of the feet remains as in front, and it differs from the condition in *C. setosa*, in which the modification of the crotchets in the posterior region is characteristic.

The feet at the anterior end of the fragment present dorsally a few very long and finely tapered capillary bristles and a series of broad flattened bristles, curved and faintly striated and with tapered extremities. They represent the intermediate forms ushering in the anterior crotchets of *C. setosa*. The ventral division consists of a few shorter capillary bristles and a shorter series of the same curved, flattened, faintly striated bristles, with tapering tips as in the dorsal division. In front of the reproduced tail the dorsal division has a few long, tapering, capillary bristles, the main series, however, consisting of long, stiff, curved, and striated forms, with a nearly cylindrical shaft inserted in the tissues, a constriction being evident before passing through the skin, after which it curves forward, and ends in the long, flattened, curved, and tapering tip. The ventral division, again, has shorter bristles of the same kind as the foregoing, besides a series of stouter crotchets, which have flattened shafts inserted in the tissues and slightly narrowed curved tips tapering to a blunt point.

This form, therefore, appears to pertain to De St. Joseph's second series, viz., those with capillary bristles in the dorsal throughout and crotchets in a certain number of the ventral divisions of the feet, but the absence of reliable figures makes its relationship to known forms uncertain.

4. *On the* Cirratulidæ *dredged by H.M.S. 'Porcupine' in* 1869 *and* 1870.

A Cirratulid (*Cirratulus tessellatus*) dredged in the 'Porcupine' Expedition of 1870 at Station 50, off the Algerine coast in 7–51 fathoms, appears to differ from any described. It was probably procured by the tangles attached to the dredge. The head forms a short cone with a large lateral eye on each side just in front of the posterior constriction and the collar of the next segment, which, however, is connected dorsally with the head by a bridge. The mouth opens ventrally as a comparatively small aperture in the snout in front of the collar. The body is about 2 inches in length and fusiform in outline, the greatest diameter occurring at the anterior third, from which it tapers to the snout and more gently to the tail. It is rounded dorsally, flattened ventrally, though posteriorly it is somewhat compressed on both surfaces. The segments are narrow and numerous. Anteriorly the rings are slightly tessellated, after the manner of *Scelibregma*, though to a less extent, and this condition probably occurs throughout in the fresh or well-preserved

animal. A median streak occupies the centre of the dorsum and another the mid-ventral line. Apparently three achætous segments follow the head, the third and broadest being tessellated or crenate ventrally as well as dorsally, the latter surface being so broad as to reach the area of the next segment toward the middle line, the lateral region being occupied by the elongated scar for the tentacles, only traces of which are present in the examples. The outer edge of each tentacular area abuts on the prominence of the dorsal division of the first bristled foot, which occupies a dorso-lateral position, the dorsal divisions of the succeeding feet forming a well-marked oblique ridge on each side and causing the body to appear as if sheathed in the anterior region (snout and achætous segments). This arrangement is due to the greater distance between the dorsal and ventral divisions of the first feet, the oblique region including about fifteen feet. Thereafter the dorsal and ventral divisions approach more closely, the space between them, however, remaining distinct to the posterior end. Each division of the foot carries a tuft of long, pale golden, capillary bristles (Pl. VI. fig. 3) issuing from a distinct setigerous process, and no change in the structure of these organs occurs from front to rear. The dorsal bristles, as a rule, are longer than the ventral and are curved outward and backward, the length being less than half the diameter of the body anteriorly. Each consists of a long basal region or shaft slightly narrowed proximally, remaining of the same diameter for some distance, and then gradually tapering to a fine point. Posteriorly one of the dorsal bristles in each tuft is considerably larger than the rest, the tip stretching outward as a long delicate hair. The tips of all, indeed, in this region are very fine. The ventral bristles are shorter and slightly broader, but also have delicately tapered tips. The ventral setigerous processes and tufts are really ventral in position, for in the preparations they are visible only in ventral and lateral views.

The structure of the bristles of this form distinguishes it from the *Chætozone macrophthalma* of Langerhans *, and, moreover, the skin of the species from Madeira is smooth. The *Heterocirrus marioni* of De St. Joseph † from Dinard has no crotchets, capillary bristles occurring throughout both divisions, but the ventral bristle is flattened at the tip and with a hair-like termination.

* Zeitschr. f. wiss. Zool. Bd. xxxiv. p 98, Taf. iv. fig 10.
† Ann. Sc. Nat. 8e sér. t. xvii. p. 56, pl. iii. figs. 62–64.

A *Heterocirrus* (*Heterocirrus gravieri*, sp. n.) dredged at Station 29 off Cadiz, to the west of the Straits of Gibraltar, in 227 fathoms, in the 'Porcupine' Expedition of 1870, appears to differ from any described. At this station, according to Dr. Gwyn Jeffreys, there was an admixture of northern and southern forms. The head is pointed in front and constricted posteriorly, so that from the dorsum it is almost cordate in outline. The mouth, as in allied forms, opens a little behind the tip of the snout. The body is about an inch in length, somewhat narrow and elongate, and slightly flattened from above downward throughout, the tail not being wider than the preceding region, and terminating in a pointed extremity with the anus above it. The colour in spirit is pale brown, darker at the tip of the tail. Anteriorly the dorsal bristles (Pl. VI. fig. 3) are longer than in allied forms with the exception of *Chætozone*, but they become shorter posteriorly. A pair of tentacles occurs in front and a pair of branchiæ on each side behind it. The tentacle is darker, longer, and thicker than the others, though apparently not differing in external structure. It arises immediately behind the head and may be the homologue of the grooved tentacle, *e. g.*, of *Dodecaceria ater*. A branchia springs just above it.

The first foot has a distinct dorsal setigerous papilla and a long tuft of simple tapering bristles which nearly equal the diameter of the body. The ventral division has a similar though shorter tuft. This arrangement continues for some distance and then the characteristic hooks appear in the ventral division. These (Pl. V. fig. 3 *a*) are comparatively long and slender, with a slight forward curve. The shaft dilates a little from the base to the distal third, where a slight backward curve and a diminution take place to the neck. The tip has an enlargement beyond the neck, then the posterior curve, in lateral view, forms a segment of a large circle and again points forward at the hooked tip. The anterior curve again is chiefly backward and then forward at the terminal hook. The length of the distal region in this hook is characteristic. A few bristles accompany the ventral hooks to the posterior end. By-and-by between the twentieth and thirtieth foot the hooks appear also in the dorsal division, one or two of these organs accompanying the bristles, which continue to the posterior end of the annelid.

This species inhabits a firm though thin calcareous tube strengthened externally by grains of sand, foraminifera, and fragments of shells. The interior of the tube is perfectly

smooth. At one point the tube had been broken and repaired, but an angle on each side indicates the union. The tube had also been fractured in capture, and the annelid had doubled itself into the largest fragment—the head and tentacles being completely protected, but the tip of the tail protruded.

This form has certain resemblances to the *Heterocirrus caput esocis* of De St. Joseph, but the absence of eyes and the structure of the anus and of the hooks indicate divergences.

Chætozone A.

A fragmentary form without snout or terminal region was dredged on the 3rd September, in the 'Porcupine' Expedition of 1870, in the Bay of Tunis. In all probability it adhered to the "tangles," which the naturalists then used, after the time-honoured practice of the coral-fishermen of the Mediterranean. The absence of the head and posterior region renders diagnosis and description imperfect, but externally it differs in certain respects from the northern *Chætozone setosa*. Thus the body is more rounded, presents no dorsal groove in the preparation, and the ventral groove is slightly marked, whereas both are usually distinct in *C. setosa*. The lateral bristles are much shorter, and though the specimen is a small one, the basal deep brown hue and the great breadth of the yellow tips, as at the tenth foot (for so all is termed beyond the bend at the end of the shaft), are diagnostic (Pl. VI. fig. 4). The broad terminal blade tapers to a long and fine point which is usually curved. Moreover, whilst they are somewhat brittle, they do not exhibit that proneness to split from the edge downward and backward as commonly seen in *C. setosa*. Accompanying the foregoing are a few narrow forms (Pl. VI. fig. 4 *a*). Although proportionally the crotchets should have been present in the portion of the posterior region attached, only bristles exist. The inserted basal region or shaft of the bristle is deep brown, curved and dilated from the somewhat narrow end upward, and is striated.

Two fragments of the anterior region of a *Chætozone* which does not appear to differ from *C. setosa*, Malmgren, were procured probably by the tangles in Bono Bay, on the coast of Algiers, in the 'Porcupine' Expedition of 1870. As no crotchets are present, a certain amount of doubt remains, especially as the bristles at the end of one fragment are

unusually long. The bristles are proportionally longer than in *C. setosa*, and their bases have a deep brown tinge.

Besides the foregoing, two fragmentary examples (×) apparently agreeing with *C. setosa* occur, but as only the anterior region is present in each, there is doubt. The snout in one is acutely conical, whereas in the other it is retracted into a blunt cone, and reddish-brown pigment marks the origin of each capillary bristle-bundle, both dorsally and ventrally.

Chætozone carpenteri *.

The anterior region of a form presenting characteristic features was dredged in the 'Porcupine' Expedition of 1870 in Bono Bay, on the coast of Algiers, in 25 fathoms. It also appeared off Cape Guardia, off Cape Finisterre, in the same Expedition. It is a somewhat larger and more rounded form and does not show the dorsal and ventral grooves of *C. setosa*. The snout (Pl. VI. fig. 5) is somewhat longer than in the common form and in one has a dark speck on each side at the posterior border of the prostomium, and these specks are best seen on the ventral surface, or from the front; the mouth opens on the ventral surface, a short distance behind them. The body has the usual fusiform shape, its largest diameter being about the anterior third. The bristles, which stretch from each side with an upward and backward curve, are proportionally longer than in *C. setosa*. They commence as considerable tufts in the first foot, the slightly yellow shaft being constricted about the level of the skin, and then the tip flattens out more in the shorter and less in the long forms, and finally tapers to a long hair-like curved extremity. The broader blades (Pl. VI. fig. 5 *a*) readily split in this region so as to make a brush-like appearance, the direction being downward and backward. The most characteristic feature, however, is the appearance about the tenth foot of crotchets in the dorsal and then in the ventral division (Pl. VI. fig. 5 *b*). In this foot (tenth) the bristles have attained great length, the dorsal being considerably longer than the ventral, the slight constriction below the long flattened blade being noteworthy, as well as the length of the attenuate tip. Those injured show the brush-like fractures already alluded to. The shorter forms have stouter shafts, and by a little modification the crotchets (Pl. VI. fig. 5 *c*), which are still

* Named after the late Dr. W. B. Carpenter.

thicker, are developed. The shaft dilates in its progress upward, then gradually diminishes to the slightly curved tip, which is rather blunt. At the twentieth bristled foot the bristles are still longer but more slender, and two crotchets are present ventrally, whilst dorsally there are four considerably stouter, and the bristles are very long, stretching far beyond the body. A considerable number of bristles occur ventrally between the hooks, whilst there are three dorsally. At the fortieth foot (Pl. VI. fig. 5 *d*) four large crotchets are present in each division—now closely approximated, the ventral being shaped like a scapel set in its handle, with a slight constriction and bend at the end of the handle ; both shaft and tip are longitudinally striated. The dorsal crotchets still are the stronger (Pl. VI. fig. 5 *e*) and the tip (or blade) is more distinctly curved. Four long bristles occur between the third and fourth (that is, toward the ventral edge) ; whilst ventrally two bristles lie between the first and second and two between the second and third.

These posterior crotchets differ from those of *C. setosa* in their great size and in the absence of longer intermediate forms, as well as in their occurrence anteriorly.

Chætozone Z.

A fragment of the posterior end of a form not hitherto seen, and having the shape of a gradually widening and spathulate tail with the broad end posteriorly. The posterior border is bluntly rounded, with a median ridge dorsally and ventrally, the former curving downward to terminate in the ventral anus which has a peak anteriorly. The region in front of the broad tail is considerably narrower, the dorsal surface being rounded and the ventral flattened. The segments are numerous and narrow, and have dorsal and ventral tufts of slender capillary bristles (Pl. VI. fig. 6 *a*) of a pale yellow colour and nearly straight. It was procurved in the 'Porcupine' Expedition of 1870, no locality being given.

A peculiar form, which may temporarily be termed *Cirratulispio*, was dredged in the 'Porcupine' Expedition of 1869 in 378 fathoms in sticky mud off the coast of Ireland. The mud contained fragments of foraminifera, coccoliths, and sandy débris.

The head (Pl. VI. fig. 7) is bluntly conical and the sides of the cone slightly hollowed. A pair of slender tentacles pass from the bristled segment immediately behind, and therefore apparently posterior to the buccal ring.

The body is filiform and elongated, probably 2–3 inches in length, apparently tubicolous, and it is imperfect posteriorly; but at least two regions are recognizable—namely, the anterior with nine pairs of well-marked pale golden bristles, and the succeeding division.

The first region agrees with the Chætopterids in the number of the segments (nine), and each foot has a dorsal and a ventral tuft of moderately long capillary, pale golden bristles (Pl. VII. fig. 7 *a*) which have a slight convergent curve—that is, the dorsal bending downward and the ventral upward. Both arise close together in the tissues, then slant from each other so that a flat cone in the middle of the foot lies between them. The dorsal tuft is considerably longer than the ventral, but the structure of the bristles is the same in both. Each bristle has a long cylindrical shaft not differentiated from the tip, and gradually tapering to a fine point from its middle, though in the shorter ventral forms there are differences in this respect.

No special differentiation separates the first region of the body from that which follows, and therein it differs from the Chætopterids; but the first segment of the succeeding region is three times broader (antero-posteriorly) than those in front, and its bristles are shorter and structurally different, whilst each of the two divisions carries a continuous row of stout curved crotchets without the differentiation between shaft and tip as observed in *Chætozone* (Pl. VII. fig. 7 *b* representing one from the tenth foot). Dorsally are two smooth capillary bristles, followed by five or six crotchets with the tips produced into slender processes, and then a series of the stout curved crotchets with slightly tapered tips ending in a stout though more or less pointed tip. The arrangement of these crotchets recalls the condition in *Chætozone setosa*, bristles being also interposed between the crotchets in the rows.

5. *On the* Cirratulidæ *dredged in the Gulf of St. Lawrence, Canada, by Dr. Whiteaves.*

Chætozone I.

A fragment of a *Chætozone* (?), apparently the posterior end of a large form, was dredged at Station A. 6, 1872, by Dr. Whiteaves. The total length is about an inch and a quarter. The segments are distinct though narrow throughout, and the body is somewhat dilated in front of the tail, and then gently tapers to the terminal anus, below which a process with a median groove projects posteriorly. The

body is rounded dorsally, slightly flattened ventrally, and the latter surface has a median groove. Both dorsal and ventral bristles (Pl. VII. fig. 8) are throughout capillary, and little difference exists between the most anterior and those at the tip of the tail. This, therefore, belongs to the first series of De St. Joseph, viz., those with capillary bristles throughout.

Chætozone setosa, var. *canadensis*. Stations 32–34—1873.

In this form, which has a general resemblance to *C. setosa*, though the body is more flattened posteriorly, the anterior bristles differ from those of *C. setosa*, for example at the tenth foot in having a distinct curve at the end of the shaft, and the long tip widens into a flat blade (Pl. VII. fig. 9), which then tapers to a fine tip; the whole, however, is considerably shorter than in the typical *C. setosa*. The general arrangement of the posterior hooks resembles that of *C. setosa*, though the crotchets (Pl. VII. fig. 9 *a*) are considerably larger and similarly alternate with a long capillary bristle (Pl. VII. fig. 9 *b*). It would be difficult to draw a specific distinction, however, from mere size.

Chætozone whiteavesi.

Dredged in the Gulf of St. Lawrence, Canada, by Dr. Whiteaves at Station A. 6 in 1872.

This species has much of the appearance anteriorly of *Chætozone setosa*, the snout being acutely pointed, and the tentacles and branchiæ being similar. The body is rounded dorsally in front, then is somewhat flattened, and again is rounded toward the tail, which is only a little tapered, and has a terminal anus with two small rounded papillæ ventrally. The ventral surface of the body is marked by a median groove from end to end, whilst the sides are flanked by tufts of long capillary bristles from the front to the middle of the body, and by shorter capillary bristles from the middle to the tip of the tail. This arrangement at once differentiates the species from *C. setosa* and allied forms, for their crotchets are conspicuous posteriorly. The gut shows through the integumentary layers in the region behind the middle—especially dorsally—the colour being dull pink.

The bristles throughout are capillary, the dorsal in front (Pl. VII. fig. 10) being considerably longer than the ventral and stronger than those in the succeeding region. Both dorsal and ventral tufts are shorter in the middle of the body, and the disproportion between dorsal and ventral is less marked, whilst posteriorly they are almost equal.

6. *On the* Cirratulidæ *dredged in Norway by Canon Norman, D.C.L., F.R.S.*

The northern form, *Chætozone setosa*, was first found in Finmark by Malmgren and in Sweden by Lovén, and it is abundant in the Fjords of Norway, where it was dredged by Canon Norman. The head is acutely pointed and somewhat triangular, with the mouth on the ventral surface a short distance from the tip. The body is about an inch in length, elongate-fusiform, tapering a little anteriorly and more gradually and distinctly posteriorly, where it terminates in a pointed extremity with the anus at the tip, which varies in acuteness according to the condition of regeneration, some being rather blunt after recent loss of segments. The thickest part of the body is about the end of the anterior third. It is more or less rounded throughout, with a tendency, however, to dorsal and ventral flattening. The segments number 70–90, and are narrow in front, but more evident posteriorly from the increased antero-posterior diameter. The surface is greyish in the preparations and is iridescent.

The long tentacles arise on the dorso-lateral region immediately behind the head, and seem to be rarely present in examples caught by the dredge. They have the ventral and probably ciliated groove of other forms.

The branchiæ occur in pairs, one on each side, probably from fourteen to twenty in succession, and then at intervals to the posterior third. They are slender filaments, those in front being long and sinuous. The first bristled foot occurs behind the tentacles and has a dorsal and a ventral tuft of pale golden capillary bristles,with a cylindrical shaft generally imbedded in the tissues, and a broader flattened serrated tip which tapers to a fine point. Little difference exists in the anterior region between the lengths of the dorsal and the ventral bristles, but after the twentieth, or thereabout, the dorsal elongate to about the diameter of the body, forming glistening tufts usually carried transversely in the preparations. Toward the posterior region stout, short, crotchet-like forms appear amongst the long bristles in the ventral and then in the dorsal division. They are more slender in the dorsal than in the ventral, and the dorsal bristles are fewer in number and more attenuate, only a brief flattened part occurring beyond the skin, the rest being hair-like. Moreover, the ventral bristles present intermediate forms, the shafts being three times the diameter of the ordinary

bristles, then a slight constriction takes place at the level of the cuticle, the tip being broad and more or less striated, but terminating in a long hair-like process. The perfect crotchet or hook is best seen in the posterior region of about fifteen segments, the shaft dilating a little from the soft base upward, then narrows about the level of the skin, from which a noticeable forward bend occurs, the long stout tip ending in a blunt point. The whole organ is striated to the point and somewhat resembles a miniature scalpel which has a curve backward (Pl. VII. fig. 11). The direction of these crotchets is at first slightly backward, but by-and-by they project transversely outward, and in four or five of the terminal segments they are directed forward—doubtless in connexion with their functions in mud or sandy mud.

Cirratulus norvegicus ?

A form dredged off Dröbak, Christiania Fjord, in 30–100 fathoms, in 1879, somewhat resembles *Cirratulus tessellatus* in so far as the dorsal divisions of the anterior feet approach each other dorsally, and in some are raised, so that the spaces between the lateral lines at the base of the feet are narrow in front and gradually widen in their course backward. Moreover, a considerable amount of dark pigment characterizes the anterior dorsal region and also occurs along the posterior lip of the gaping mouth.

The head has the form of a small blunt cone, sometimes constricted posteriorly, and when the button-shaped proboscis is extruded, as in the majority of the specimens, it projects upward and forward, or, in complete extrusion, upward.

The body is probably between 1 and 2 inches in length, flattened anteriorly, and somewhat rounded posteriorly. It is tapered rather abruptly anteriorly, but does not appear to be much tapered posteriorly, only a slight diminution taking place in the preparation; but such may be an incomplete specimen. It terminates posteriorly in a pouting button-shaped vent, which is produced ventrally into a process with a median fissure and a fillet on each side of it (Pl. VII. fig. 12). The ventral surface is flattened, sometimes with a median ridge and two lateral elevations, though in a few neither is visible. The buccal and two achætous segments follow the head, and in one example each has a dorso-lateral frill, it may be from imperfect preservation. Every example presents two short lappets (or, it may be, the bases of tentacles) interposed between the converging lateral lines of the feet nearly opposite the first bristle-bundles. A series of long

slender branchiæ project from the dorsal edge of more than twenty of the anterior feet, and traces appeared in some considerably behind these. The anterior segments are closely arranged, but posteriorly they are a little less so, and the number is probably from seventy to one hundred, though no specimen is complete.

Some had well-developed ova in July.

The structure of the feet throughout is the same, viz., a dorsal and a ventral setigerous process, each having a tuft of translucent pale yellow capillary bristles (Pl. VII. fig. 12 *a*), the tips being slightly flattened at the somewhat narrow base, and tapering to delicate hair-like extremities. The dorsal are the longer, and they increase in length toward the middle of the body, and remain of considerable length posteriorly, where the distinction between the more slender and longer dorsal and the shorter and proportionally broader ventral is maintained. A curious series of coiled tubes (?) occurs posteriorly.

EXPLANATION OF THE PLATES.

Plate V.

Fig. 1. View of *Nevaya whiteavesi* from the dorsum. The proboscis projects posteriorly from the ruptured end. Enlarged.
Fig. 1 *a*. Head and anterior region of the foregoing, still more enlarged.
Fig. 1 *b*. Strong hooked bristle of first foot. × Zeiss oc. 4, obj. A.
Fig. 1 *c*. Powerful hook of the second foot. × Zeiss oc. 4, obj. A+1 in. draw-tube.
Fig. 1 *d*. One of the first dorsal bristles. × Zeiss oc. 4, obj. D.
Fig. 1 *e*. Dorsal bristle of the second foot. × Zeiss oc. 4, obj. D.
Fig. 1 *f*. Bristle with curved and serrated tip from the ventral division of the fourth foot. × Zeiss oc. 4, obj. D.
Fig. 1 *g*. Stouter serrated bristle from the same region. × as above.
Fig. 1 *h*. Posterior dorsal bristle. × as before.
Fig. 2. Bristle of *Cirratulus tessellatus*. × Zeiss oc. 4, obj. D.
Fig. 3 *a*. Anterior hook of the foregoing. × Zeiss oc. 4, obj. D+1 in. draw-tube.

Plate VI.

Fig. 3. Simple anterior bristle of *Heterocirrus gravieri*, with minutely serrated anterior edge. × Zeiss oc. 4, obj. D+full draw-tube.
Fig. 4. Bristle of *Chætozone* A, showing entire outline. × Zeiss oc. 2, obj. D reduced.
Fig. 4 *a*. Tip of one of the foregoing of less breadth. × Zeiss oc. 4, obj. D, full draw-tube.
Fig. 5. Head and anterior region of *Chætozone carpenteri*. Enlarged.
Fig. 5 *a*. Bristle of the first foot of the foregoing. × Zeiss oc. 2, obj. D, full draw-tube.
Fig. 5 *b*. Tenth foot (dorsal division) of *Chætozone carpenteri*. Enlarged.

Fig. 5 *c.* Crotchet or hook of the foregoing. × Zeiss oc. 2, obj. D.
Fig. 5 *d.* Fortieth foot of the same. Enlarged.
Fig. 5 *e.* Dorsal crotchet of the fortieth foot. × Zeiss oc. 2, obj. D.
Fig. 6 *a.* Bristle of *Chætozone* Z. × Zeiss oc. 4, obj. D.
Fig. 7. Head and anterior region of *Cirratulispio.* Enlarged.

Plate VII.

Fig. 7 *a.* Bristle from the seventh foot of *Cirratulispio.* × Zeiss oc. 4 obj. D, with full draw-tube.
Fig. 7 *b.* Crotchet from the first segment of the second region of the foregoing. × Zeiss oc. 4, obj. D.
Fig. 8. Bristle of *Chætozone* I., Canada. × Zeiss oc. 4, obj. D.
Fig. 9. Anterior bristle of *Chætozone setosa*, var. *canadensis*, from the tenth foot. × Zeiss oc. 4, obj. D.
Fig. 9 *a.* Posterior hook (crotchet) of the same. × as above.
Fig. 9 *b.* Capillary bristle alternating with crotchets. × as above.
Fig. 10. Bristles of *Chætozone whiteavesi.* × Zeiss oc. 4, obj. D.
Fig. 11. Hook of *Chætozone setosa*, var., from Norway. × Zeiss oc. 4, obj. D.
Fig. 12. Tip of tail of *Cirratulus norvegicus*, unfortunately from a specimen not quite complete.
Fig. 12 *a.* Bristles of the foregoing. × as above.

XVII.—*New Species of Heterocera from Costa Rica.*—V.

By W. Schaus, F.Z.S.

Syntomidæ.

Isanthrene monticola, sp. n.

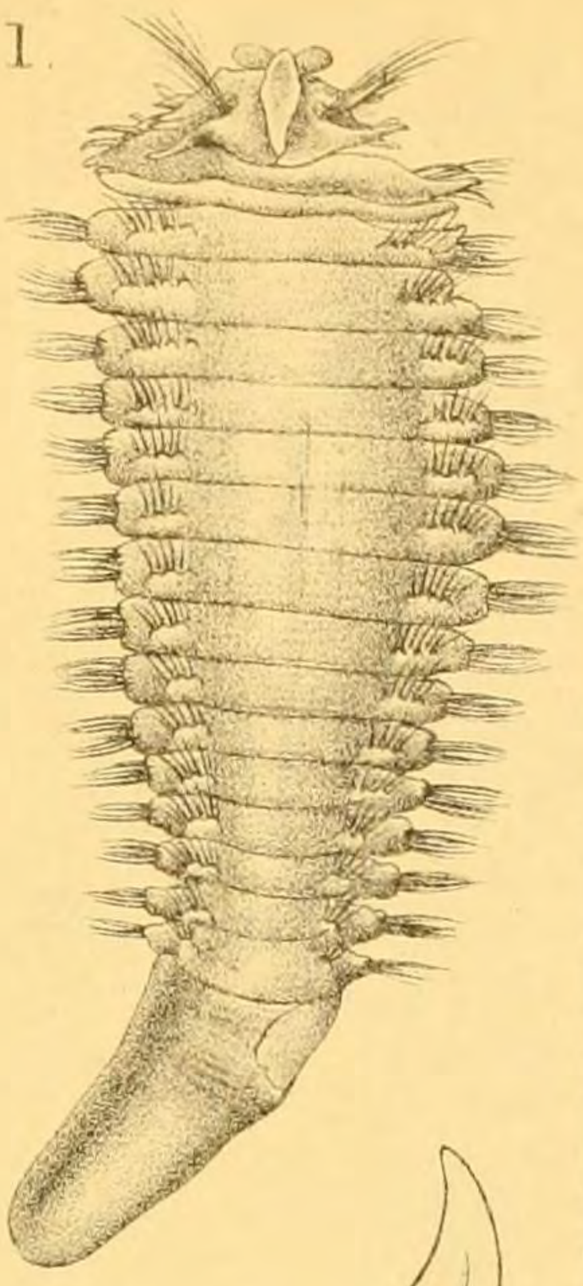
Antennæ with the shaft black on basal half and at tips, otherwise white. Body ochreous; palpi tipped with black; black spots on tegulæ, five on thorax; black line on shoulders; dorsal and lateral black spots on basal segment of abdomen, followed by black intersegmental spots on other segments. Wings hyaline, the margins ochreous. Fore wings: the veins ochreous, partly irrorated with black; black streaks at base of costal and subcostal veins; apex and tornus more broadly ochreous, inwardly edged with black. Hind wings: the veins and inner margin finely black.

Expanse 34 mm.

Hab. El Sitio.

Sarosa mora, sp. n.

Antennæ black tipped with rufous. Body black; some blue on frons; whitish-yellow spots on tegulæ outwardly



1.

1c

1d

1e

1f.

2.

1g

1h

1b.

3a.

1a.

A. H. Walker del.

J. Green lith.

3

4a.

4.

5a.

5d.

6a

5

5b.

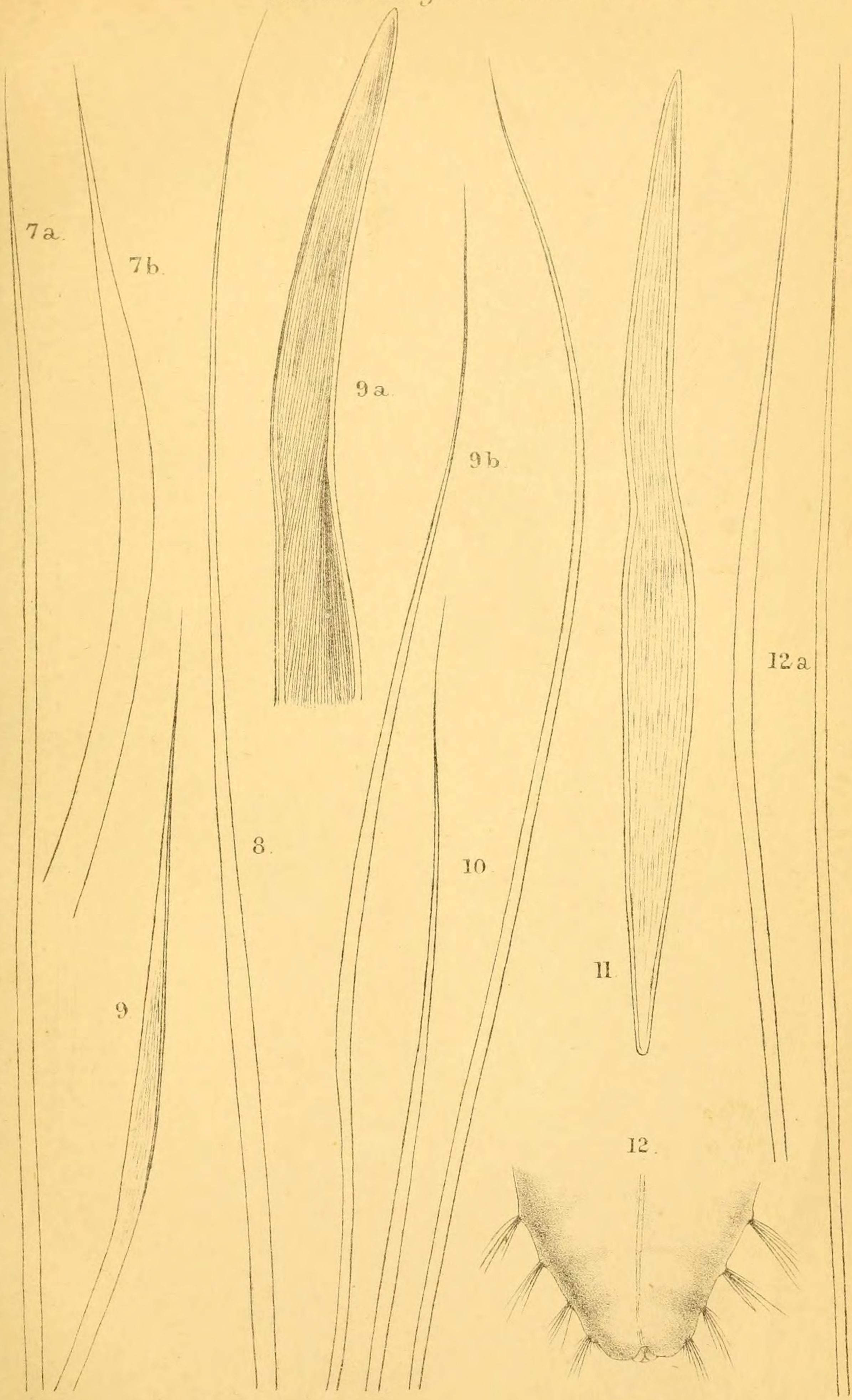
5e

5c.

7.

A. H. Walker del.

J. Green lith.



A. H. Walker del.

J. Green lith.

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