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I.—Notes from the Gatty Marine Laboratory, St. Andrews.—No. XXXVIII

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"..... per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hìc carpite flores:
Floribus et pictum. divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasi, Ecl. 1.

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

[Plates I.–IV.]

1. On the British *Sabellidæ*.
2. On the *Sabellidæ* dredged by H.M.S. 'Porcupine' in 1869 and 1870, and by H.M.S. 'Knight Errant' in 1882.
3. On the *Terebellidæ* and *Sabellidæ* dredged in the Gulf of St. Lawrence, Canada, by Dr. Whiteaves in 1871–73.
4. On the *Sabellidæ* dredged by Canon A. M. Norman off Norway and Finmark.

1. *On the British* Sabellidæ.

The British Sabellids number more than twenty, exclusive of some forms not yet fully investigated from lack of good material. In this respect, therefore, they compare favourably, in this preliminary notice, with those from other areas.

Thus, for example, Sars* in 1861 gave 10 species of Sabellids, including one of *Myxicola*, as occurring in the prolific Norwegian waters. De Quatrefages, in his 'Annelés,' mentions about a dozen of the forms which have been found in Britain, excluding double entries like *Sabella penicillus*

* Forhandl. Videnskabs-Selsk. Christiania, 1861, pp. 116–131.

and *S. pavonina, Sabella reniformis* and *S. saxicava,* and *Fabricia amphicora* and *F. johnstoni.* In Malmgren's 'Annulata Polychæta,' of Spitzbergen, Greenland, Iceland, and Scandinavia, nineteen Sabellids (including *Myxicola*) are entered, and some of these appear to be purely northern in distribution, and do not occur in our waters. Only six are entered by Dr. Johnston in the 'Catalogue of Worms in the British Museum' (1865), but two refer to the same form, viz., *Sabella penicillus,* and another (*S. savignii*) is uncertain.

Six species, including *Myxicola steenstrupi*, are recorded by Théel * (1879) from Nova Zembla. Langerhans (1880) found ten species at Madeira. About twenty-seven species of Sabellids occur in the laborious memoir of Miss Katherine Bush † from the vast area of the Pacific. Fifteen species occur in the careful 'Survey of Clare Island, on the rich West Coast of Ireland' by Mr. Southern (1914), several not having hitherto been found in Britain. Thirteen species of Sabellids are entered by Prof. Fauvel (1914) in his fine work on the Polychæta procured by the Prince of Monaco in his yachts 'Hirondelle' and 'Princess Alice.' In the recent (1915) list of the Polychæta procured at Plymouth by Dr. Allen, thirteen species are entered, and a few are exclusively southern forms. Comparatively few species (*e. g.*, from two to five) pertaining to this family, as a rule, occur in local catalogues in the British area. These will be elsewhere alluded to. Moreover, it is perhaps more difficult to separate the Sabellids by their bristles and hooks than, for instance, the Terebellids, and coloration disappears, as a rule, in spirit-specimens.

The first form is the widely distributed *Sabella penicillus*, I. When the branchiæ of this species are thrown off the cephalic region presents a truncated surface, in the centre of which is a frilled eminence, which, when carefully inspected, shows two lateral membranous wings, which unite in the middle line below and send a process ventrally between the two great ventral laminæ; whilst the upper edges pass above the mouth in a series of short frills. In the mid-dorsal line over the mouth is a triangular flap with an acute apex, the base of which is grooved dorsally, the whole resembling an epistome. Dorsally the cephalic plate is deeply grooved by the dorsal furrow, the firm and thick edge of the rim which carries the branchiæ being severed and neatly curved on

* Kongl. Sv. Vet.-Akad. Handl. Bd. 16, No. 3, p. 65.

† 'Harriman Expedition to Alaska' (New York, 1905).

each side; the rim, then passing ventrally to the base of the great flaps, is folded inward and upward, and is fused on each side with the firm median mass over the mouth. In the perfect condition with the branchiæ attached, the pedicle between the ventral flaps passes upward as a bifid process, then expands into a lateral flap or wing on each side, which, after a short progress, bends backward and upward, making a kind of frilled knee, and becomes continuous with the lining membrane of the branchiæ of its side, its outer border inferiorly passing into the basal semicircle of the branchiæ, to which it is fixed throughout. Such is the arrangement connected with the floor of the mouth and the lower lip. Dorsally the membrane forming the roof of the mouth splits, considerably in front of the median fissure of the lower lip, into two limbs, each of which at the base has an axis with a narrow ventral web, and a thinner and broader dorsal web which tapers distally and goes much further along the axis than the former, the axis finally tapering to a long delicate tip. The whole forms the so-called tentacle which in the preparations is concealed in each branchial semicircle. Viewed from the inner surface of each branchial fan the "tentacle" has the web on its dorsal edge connected with the dorsal edge of the fan, whilst its ventral web passes ventrally to the central region dorsad of the mouth. The inrush of water along the inner surface of the branchial fan would thus be swept toward the mouth, the tentacles and their webs probably aiding in this function and keeping the stream in each fan to its own side, as it rushes down the groove by the outer border of the smaller anterior web into the mouth.

The branchial fan arises on each side from the firm base formerly mentioned, a spiral twist being evident dorsally and more especially ventrally at its commencement. Each in preservation has the ventral edge curved inward, and a narrow membranous web passes from the frill of the inferior oral membrane for some distance along its edge. This ventral border is the thickest, and gives origin to the majority of the branchial stems, the rest springing from the middle and posterior parts of the basal semicircle. The number of these filaments varies, the two sides seldom being identical—thus, for instance, 38 may occur on the right and 41 on the left. The fan on each side is long and graceful, banded with regular markings of dull red and white. The circles of colour do not go evenly round the expanded fan, but slant from the ventral fissure. Dorsally a greenish hue occurs in some at the base of the fan. In

others green or purple predominate, and the fluid in which the animals lie is always tinged with green (Dalyell).

Each filament has an elastic chordoid and camerated axis, the cameræ being after the fashion of the bristles of *Nereis* or *Aricia*. They are united by a web inferiorly (about the level of the first pigment-band), but free throughout the rest of their extent, and are somewhat flattened processes with a smooth external edge, near which the axis lies; whilst its inner border is fringed with a dense series of slender pinnæ, which likewise have a translucent axis jointed at intervals like the bristles of the Chloræmidæ. The filaments and their translucent axis gradually diminish distally, but the axis can be traced almost to the extremity. Toward the tip of the filament the pinnæ gradually diminish in length, finally forming mere papillæ, and thereafter the tapering tip is smooth and of moderate length. When the branchiæ have lost their distal ends and regeneration has considerably advanced, the long filamentous processes projecting from the tips give a novel character to the organs.

Anteriorly the buccal segment occupies a hollow between the two pillars of the dorsal fan, a more or less separate fan-shaped lamella occurring on each side, tinted of a deep reddish brown. From this the marginal collar passes ventrally to expand into the prominent and generally reflexed lamella on each side of the median fissure, where it is distinctly thickened. A band on each side of the median oral process joins it to the fold a little higher.

The first shield on the ventral surface behind the collar is continuous from side to side, and is the largest of the series of glandular scutes. Though it is opposite the first bristle-bundle, that would seem to pertain to the segment behind it.

The mouth leads into a simple alimentary canal, which, when seen from the dorsum, forms a moniliform tract from end to end—wider anteriorly and narrower posteriorly. The septum in each segment retains it firmly in position. The contents can be seen through the transparent walls of the canal, and in one consisted anteriorly of pale granules and posteriorly of muddy sand.

The *body* shows little or no narrowing anteriorly, remains of similar diameter for a considerable distance, then in preservation may increase in breadth behind the anterior third, and thereafter gradually tapers to the tail, ending in the anus, which is often bilobed. In lateral view the margin of the vent slopes from above downward and backward, the ventral edge thus projecting considerably. From above the aperture is bifid inferiorly, and a triangular area

is differentiated on the dorsum in front of the aperture. Both dorsal and ventral surfaces are plano-convex, thus in transverse section being more or less elliptical, the dorsal, however, being generally more smoothly rounded, with a pale streak in the middle line from the dorsal vessel. The ventral surface has a continuous series of scutes from one end to the other, and, with the exception of the first, all are divided by the median groove, giving a right and a left scute to every segment. The number of segments varies from 200–270 or more.

The first region of the body (the so-called thoracic region) is distinguished by the direction of the bristle-tufts, which slope upward and backward, and by the presence of ventral rows of hooks. The setigerous processes of this region vary from seven to eleven pairs, one side occasionally having nine or ten and the other ten or eleven. The first setigerous process arises immediately behind the dorso-lateral lamella, and is smaller than those following; moreover, it has no row of hooks dorsally. The bristles are arranged in a rather dense group and show a longer and a shorter series. The longer forms have cylindrical striated shafts, slightly narrowed toward the origin of the wings, which are narrow, the bristle thereafter ending in a translucent and somewhat strong though flexible tip. No serrations on the edges of the wings have been seen in these, though striæ go to the edge. The bulk of the group of bristles is made up of these with shorter shafts and broader wings, the whole tip being rather broad until near its extremity, where it is somewhat abruptly tapered to a fine point. In the cluster of bristles in the tuft various stages occur in the developing bristles—some resembling a long narrow knife-blade, others a deep-bellied shorter blade. The succeeding tufts are of similar shape (that is, somewhat flattened), but they are longer and stronger, and the edges have distinct serrations. The anterior setigerous processes form a somewhat flattened cone, the base ventrally being prolonged into a prominent ridge, bearing the hooks which lie between two raised margins, constituting a narrow flap posteriorly in each segment. Moreover, a distinct papilla occurs on the anterior edge of the tip.

The setigerous processes of the second region form stiff narrow cones which project nearly straight outward, the bristles only being visible at the tip. A soft and rather swollen process bearing the hooks lies above their dorsal edges. The bristles form a kind of pillar, narrow at the base and enlarging at the tip to about double the diameter at the base of the wings, which give to the distal end a

characteristic lanceolate enlargement, from which the tapering tips slope slightly inward. These differ from the anterior groups in being all of one length, and appear to be ranged round a central papilla. The tips are comparatively short, with somewhat broad wings, which are obliquely striated and serrated along the wide or lower edge. The setigerous processes and bristle-tufts remain of the foregoing structure till near the posterior end, where longer and finer bristles project from the small processes. In these modified processes the bristles are fewer and of two kinds—viz., a long slender series without a visible wing, which have long, gently tapered, and slightly curved tips; and, secondly, a shorter series with rather longer tips than those in front and with striated wings.

The anterior hooks are typical avicularian forms with a marked forward curvature of the crown and a single acute main fang, the free edge of which is minutely serrated throughout the greater part of its extent, leaving little more than a third smooth, and the tip is often slightly turned up. The anterior outline has a wide gulf under the fang and a boldly rounded prow, whilst the posterior outline is convex, and the base is considerably prolonged in this direction and abruptly finished. Curved striæ occur at the throat, longitudinal striæ on the body, and horizontal striæ in the base of the hook. The hooks form a single row. Accompanying each hook in this region is a paddle-shaped bristle, the wings and tip of which are membranous and translucent. The hooks in the middle and posterior regions likewise form a single row, and have very much the same structure as those above-mentioned, except that the prolongation of the base posteriorly is less, and no paddle-shaped bristles occur. The posterior hooks, moreover, are considerably less.

In a small specimen, $\frac{4}{10}$ of an inch long, only three rows of ventral hooks were present, so that the number increases with age. Six brown pigment-specks occur behind the branchiæ. The tube of this example is leathery and brownish, with minute mud-particles on its surface and clear granules here and there. Another young form was in a tube projecting from a mass of *Alcyonidium parasiticum* growing on *Sertularia rugosa* and Ascidians tossed on shore at St. Andrews.

A young example procured on the West Sands, after an October storm, measured after preservation $\frac{8}{10}$ of an inch, and it had about 66 segments. The first two bristle-tufts are somewhat short, the third to the sixth are long, and

these corresponded to the first region of the body, consequently only five pairs of dorsal hook-rows are present. The seventh pair of bristle-tufts is slender and small, so that the outline is narrowed, the adjoining tufts being longer. Toward the tip of the tail elongated, slender, simple bristles occur as in the adult. The bristles correspond in arrangement and structure with those of the adult. The anterior hooks differ in having a shorter posterior basal process, but they are accompanied by the same paddle-shaped bristles.

The anal segment is bilobed, and has a peculiar series of dark pigment-specks. Four pairs of setigerous processes bearing short bristles occur behind the last hooks, which are small and only three in number. The bristles increase in length at the sixth from the tip. The opaque glandular tissue splits at the termination of the rows of dorsal hooks at the second ring from the latter, since the first has a bar obliquely bevelled at the lower edge. The splitting continues to the tip of the tail and gives a regular arrangement to the parts.

Both anteriorly and posteriorly the bristles commence before the hooks. Four pairs of bristles occur before hooks appear, the first hooks being between the fourth and fifth bristle-tufts, and their bases are undeveloped. The first five pairs of bristles are short, but the sixth are decidedly longer.

The tube may reach a length of 2 feet, and is fixed to a stone or other structure.

No form has attracted greater interest than the second species, viz., *Potamilla reniformis*, Leuckart, the *Sabella saxicava* of De Quatrefages—which abounds amongst calcareous formations, such as *Cellepora*, *Lithothamnion*, the *Balani* of the Gouliot caves of Sark and elsewhere, and is of special interest in connection with its power of perforating such structures.

The cephalic plate, when the branchiæ are shed, presents dorsally a bilobed collar or lamella, the deep dorsal furrow terminating in the centre. The outer edge of each flap is continued as a broad rim nearly to the mid-ventral line, where a notch separates the two sides, which curve forward. The truncated surface has a projecting transverse fold at the upper end of the ventral incurvation, and two folds meet above it—so as to make a triradiate aperture.

The branchiæ are about 10 or 11 in number on each side, and comparatively short, whilst the pinnæ are long. Each filament has the transversely barred or camerated chordoid

axis, and tapers to a short, slender, filiform tip, which, however, is usually enveloped by the long pinnæ or is in screw-like coils. The pinnæ have the translucent axis, as in *S. penicillus*, with long joints, and are richly ciliated. In life the branchiæ are of a pale green marked with white touches, so that they form a whitish ring around the collar within which they are attached. The pinnæ are variegated with pale greenish and white, and show vermiform movements when cast off. In some the branchiæ are of a pale buff hue, with a little yellow at the tips of the filaments. In contraction they are generally of a dull stone-colour. Leuckart's examples had whitish branchiæ with brownish touches, and De St. Joseph describes his examples as vinous-brown. Sars states that his specimens had yellowish-white branchiæ with four or five orange bands. Just above the whitish ring at the base most of the filaments, externally, have two boldly marked and elevated brown or reddish-brown ocular specks, separated by an interval from each other. De St. Joseph states that in his specimens each contained about thirty ovoid "crystallines" in a mass of brownish pigment. Moreover, the eyes of those from the Mediterranean are more numerous than those from the north, whilst Marion considered that those from deep water had fewer eyes than the littoral forms. They are absent in a few of the filaments. The longest filaments are dorsal, those at the ventral edge being considerably shorter and slightly reflexed. The ocular pigment in some fades in spirit. The tentacle is comparatively short, but its membranous web on each side appears to agree with that in *Sabella penicillus*.

The *body* is comparatively short—about $\frac{3}{4}$ of an inch in length—and has from 60 to 100 segments. It is rounded dorsally, slightly flattened ventrally, and marked by a groove which at the tenth segment bends from the side inward to the middle line and divides all the scutes which follow into two. The nine or ten scutes in front of these are split transversely. The ventral scutes are conspicuous by their whitish or pinkish colour, and are even visible through certain parts of the tube. Anteriorly the brownish dorsum is marked with dark brown pigment at the bases of eleven setigerous processes, the succeeding region of the dorsum being reddish brown. The body is paler in the median line dorsally and ventrally. It is slightly tapered posteriorly, and ends in a papillose anus, three papillæ being distinct, and the colour of the tip is orange rather than brown.

The setigerous processes are ranged along the lateral

regions from the second segment backward, a differentiation occurring anteriorly by the inflection of the groove which often passes behind the tenth bristle-tuft to the mid-ventral line, though in others it is further back. Each of the setigerous processes anteriorly has dorsally three longer bristles with straight shafts, tips bent backward, and moderate wings. The edges of the wings appear to be minutely serrated. Following these is a double series of comparatively stout bristles, with short and broad wings, making a spatulate tip with a filament in the centre. These bristles also have a dorsal curve, the filament trending in that direction, so that they would brush an opposing structure with the convex surface. From the nature of the parts, the shafts are somewhat abruptly tapered at the tip. Some of the bristles have modified tips, so that they resemble a short and broad knife-blade, as in certain forms in *Chætopterus*, the shaft not being continued along the centre as in the ordinary winged types.

In the posterior segments the bristles alter, being shorter, fewer in number, and with modified tips, which have moderately wide wings at the base, but they soon diminish, and the long central tapering tip projects far beyond them—thus performing the functions of the simple bristles of this region in other forms.

The anterior rows of hooks are below the setigerous processes, and consist of a long series of avicular forms, with serrated rows sloping to the sharp main fang, a rather long, slightly striated neck with straight sides, the anterior outline curving forward into the rounded prow and the posterior into the well-marked basal process. Accompanying each is a broad bristle, the shaft of which has a curvature toward the distal end, and the tip has a region with short wings so modified as to resemble a hook with a long shaft and a main fang. Two forms of accompanying bristles thus are present in this species, viz., those with broadly spatulate tips and those with a slightly enlarged posterior curve and a beak-like point anteriorly, nearly at right angles to the shaft. In a small example from Perelle Bay, the latter was large and with distinct wings. The hook has a larger space between the main fang and the prow than in *Sabella penicillus*.

The hooks behind the foregoing region are above the setigerous processes, and they become fewer and fewer, as well as smaller and with a longer base, in their progress toward the tail.

The tube is formed of a tough horny secretion of an olive

hue, and the exposed parts are covered with minute sand-particles.

An allied species (AB) occurred under stones between tide-marks both in Guernsey and Herm, with only five pairs of anterior bristles, and shows differences from both *Potamilla reniformis* and *P. torelli*. The cephalic plate has a narrower collar than in *P. reniformis*, a feature well marked in the small, pointed, ventral lobes. The edge is smooth at and near the mid-dorsal groove, then at each side is a lateral flap which trends to the lamellæ on the ventral surface. These lamellæ are smaller than in *Sabella pavonina*. Besides the small lamellæ which project ventrally, the margin is incurved at the middle line.

The body is comparatively small, about $\frac{3}{4}$ of an inch in length, and the number of segments is between sixty and seventy. It is rounded dorsally, with the exception of the region of the dorsal groove anteriorly, slightly flattened ventrally where a median furrow runs from the middle of the sixth scute backward to the tail. The anterior region is composed of five bristled segments and apparently the same number of uncinigerous rows. Posteriorly it tapers to a somewhat pointed tail. The branchiæ seem to be comparatively short—like those of *Potamilla reniformis*, and the pinnæ of moderate length or rather short, whilst the terminal filament is long, large, and is often in screw-coils, thus differing essentially from those of *P. reniformis*, *P. torelli*, and *P. neglecta*. Moreover, there are no ocelli on the filaments, and none on the first segment or on the tail.

The first region of the body has only five pairs of setigerous processes. Each bears a tuft of comparatively short bristles, the tips of which, unfortunately, had for the most part disappeared—probably from their brittle nature as well well as from rough usage. Those which are perfect have shafts which slightly dilate from the base to rather beyond the middle, then diminish at the neck and swell out at the origin of the wings, tapering thereafter to a somewhat long attenuate extremity. At the upper edge of the fascicle are the longer and more slender forms, the shafts of the others being thicker. No trace of spathulate tips is observable. The anterior hooks form a single row, and present a sharp main fang, the rest of the anterior face of the crown above it (about half the extent) being finely serrated in lateral view. As usual in such hooks, when the crown is examined from the front, this region is densely spinous. The posterior outline is more or less straight below the forward bend at the crown, whilst the anterior—also straight immediately

below the main fang—curves forward over the rounded prow. The projection of the base posteriorly is narrow, but somewhat shorter than in *Potamilla reniformis*. Each is accompanied by a short, broad, cuspidate or penniform bristle. The hooks behind the anterior region (in the fragmentary example) do not materially differ, though the neck is longer, the base somewhat stouter, and their size less.

The small number of the anterior segments, so unusual in the group (though this number has been found in *P. torelli*), raises the question as to its relationship to the latter, from which it differs in the terminal processes of the branchiæ and in the narrower web in the anterior bristles, but further investigations may clear up the divergencies. Like other Sabellids it is acid to litmus paper. In the example from St. Peter Port, Guernsey, the tube is composed of a translucent horny secretion, somewhat like that of *Potamilla reniformis*. Some examples have nearly ripe ova.

Potamilla torelli, the third form, is closely allied to the foregoing, and could scarcely be distinguished by the bristles and hooks. The general aspect of the cephalic plate, when the branchiæ are removed, agrees with that of its allies, and in the preserved examples some have a prominent **T**-shaped projection formed by the developing bases of the branchiæ—a condition not observed in other forms. The collar has a narrow slit dorsally, then it extends on each side laterally and ventrally with an even edge to the ventral lamellæ, which are reflected in protrusion and somewhat triangular in outline, and are separated from each other by a deep **V**-shaped notch. No eyes are visible in the spirit-preparations from Britain or from Canada.

The branchial filaments are of moderate length and are pale in the preparations. The structure of each filament is typical, and it ends in a short thick process distally. The pinnæ are of average length, and it is only at the tip of the organ that shorter forms occur, the last ten or twelve gradually diminishing to end in a short papilla-like rudiment at the base of the distal process. The number of the filaments appears to be from twelve to fourteen in each fan.

When the oral region is in a state of expansion a fold passes on each side from the ventral lamellæ upward, and its end fuses with the middle of each branchial fan, and, indeed, appears to be the only representative of the tentacle of other forms. Malmgren states that it is very short, broad, and subcircular. This fold is quite separate from the

ventral edge of the basal tissue of the branchiæ. On the other hand, a considerable portion of each dorsal edge of the base of the branchiæ is bordered by a free and mobile flap—the ventral edge adjoining the mouth.

The body is of small size in the examples from Plymouth, viz., about an inch in length and of the thickness of stout thread, whereas in the Canadian forms it is between 2 and 3 inches long and as thick as a crow-quill. De St. Joseph also found large examples at Rocher. It is grooved dorsally in the anterior region, rounded posteriorly; whereas the ventral surface is more or less flattened, and marked by the median groove from the anterior region backward. The first region has a variable number of segments, viz. five to eight (Langerhans, seven to nine). The posterior region has from thirty to fifty. Toward the tail it is flattened and tapered, and ends in the anus, which often presents a lateral projection on each side. De St. Joseph describes the body as brownish, with large spots of white. The first body-segment has two oval eye-spots (*Langerhans*). Fauvel * describes anal eyes, which are absent in the preserved examples from Plymouth †. The first bristle-bundle consists of simple bristles, with moderately tapered tips and distinct rings. The others in this region have two groups—an upper with longer shafts, more tapered and slightly curved tips with narrow wings, and a dense lower group of spatulate forms with a process at the tip. The bristles of the middle region form the usual bristle-pillar of rather short bristles with striated shafts, comparatively broad striated wings, and very finely tapered tips—two series, a longer and a shorter, being conspicuous. The shaft has a distinct curvature at the junction with the tip. The posterior bristles are fewer in number, and have wings distinctly striated and very attenuate tips. In glancing at small preserved specimens, it is found that most have the posterior bristles directed forward, and in several the anterior have the same direction. In the larger forms the anterior bristles are often directed upward, outward, and slightly backward. The anterior hooks, which occur on all the anterior segments except the first, are circular with a sharp main fang, and above it a series of minute teeth on the crown (Langerhans shows about twenty-four), and a moderately long base. Striæ pass from the neck to the base, after curving round the prow. These

* Campag. Sc. p. 315.

† Both are seen in small specimens kindly sent by Major Elwes from Babbacombe.

hooks are accompanied by the short bristles with the spatulate tips. The posterior hooks differ only in their smaller size and the brevity of the base. In comparing the larger with the smaller forms from Plymouth, the essential characters of the bristles and hooks are as well shown by the smaller as the larger.

The tube is composed of a tough internal lining, coated with fine sand-grains, the whole being firm and resistent, especially in the Canadian examples.

A form (BC), procured in numbers at Berehaven in 1886 by the Royal Irish Academy, appears to be a variety of *P. torelli,* though presenting certain features of its own. When the branchiæ are absent the cephalic region presents no deep fissure as in ordinary Sabellids, but the slight dorsal furrow ends in a solid mass which, with an incurvation in the middle, passes from side to side and then bounds the region laterally to the ventral surface. This rim forms a projecting base to the branchiæ. The collar commences as a narrow process on each side of the dorsal fissure, slopes obliquely forward and outward, and inclines laterally and ventrally into a deep though thin lamella, which attains its maximum in the mid-ventral line, where it is separated from its fellows by a fissure. The branchiæ preserve much of their reddish-brown coloration in spirit, and they are of considerable length. The pigment is arranged on the pinnæ so as to make a series of circular bands, as in *S. penicillus* and other forms, thus conferring great beauty on the expanded organs. In some cases, when mounted, the reddish-brown pigment is in isolated masses at intervals along the filament, and patches occur on the terminal process. There are about eleven filaments on each side, springing from the central region of the cephalic plate—a basal fissure, most distinct ventrally, occurring dorsally and ventrally. They are connected only at the base and are free throughout the rest of their extent, and are long tapering organs with proportionally short pinnæ, which, as they reach the tip, gradually diminish in length and end in a series of short papillæ at the base of the terminal strap-shaped tapering process. The chordoid skeleton is continued along the centre of the flattened tip and into each pinna. In young forms the pinnæ are short, but the flattened terminal strap is well developed. The *body* is comparatively small, elongated, and distinctly segmented from one end to the other—a feature characteristic of the species. Fifty-six segments, but the tail in the majority of the examples was in process of reproduction, so that the actual number of segments must

exceed the figure mentioned. The body is widest in front and gradually tapers behind the middle to the posterior end, where the rounded anus is terminal. The dorsal surface is more or less rounded, the ventral flattened and marked by the scutes from end to end. A slight depression occurs in the mid-dorsal line anteriorly, and, continuing to the right behind the sixth bristle-tuft, it crosses the seventh segment obliquely to the middle line, whence it passes to the tip of the tail—cutting the ventral scutes into two in each segment. Six bristled segments are present in the anterior region and five uncinigerous rows, but occasionally only five and four occur respectively. Other variations, apparently arising from lost parts in process of reproduction, show the ventral furrow running to the front or a diminished number of anterior ventral scutes. Moreover, the two anterior scutes may be split by a furrow—quite independently of the main ventral furrow. The first setigerous process is situated behind the collar, and is inconspicuous. It has a small tuft of simple bristles with acutely tapered tips and narrow wings, as in the dorsal group of the anterior region. The bristles of the succeeding segments of the anterior region (five in number) have dorsally translucent bristles with straight shafts and finely tapered tips with narrow wings—the upper having longer and more delicate tips and the lower narrow spatulate forms; the outline of the wings is more or less a long ellipse, the tapering shaft being continued as a fine process distally. Moreover, those with broader tips form a shorter row than those with more elongated tips. The outline of the tip of the latter bristles thus essentially differs from that in *Potamilla reniformis* and also from those of *P. torelli*. In the posterior region the bristles form a tulip-like fascicle, with a knee or curvature on each bristle toward the end of the shaft, the convexity with the wings being external: those with the longest and most delicate tips are dorsal, those with slightly broader wings are ventral, and the former are most conspicuous near the tip of the tail. In the anterior region five uncinigerous rows lie to the ventral edge of the setigerous processes, their inner ends impinging on the scutes opposite them. The first commences opposite the second bristle-tuft, and all are longer than those of the posterior region. The hooks are in a single row, with a main fang and a series of serrations above it, a neck of moderate length with striæ where it enlarges into the boldly convex prow, and an oblique tapered base (corresponding to the shaft). Moreover, a series of short modified bristles occurs with them, the tips

being short, bent at an angle, and with broad wings—the whole resembling a beak. The curved shafts dilate from the base to the neck, where a slight constriction occurs, then it bends forward and tapers to the short tip. In some views slight grooves appear on the enlarged basal part of the tip, so that they at first sight resemble the long hooks of *Terebellides* and other forms. The posterior hooks are smaller, their necks longer, and the bases more oblique. Some examples occur in a tube of tough secretion, with fine sand-grains attached, after the manner of the firm tubes of the Canadian examples of *P. torelli*.

Amongst the masses of the foregoing *Sabella*, BC, from Berehaven, are a few characterized by the striking madder-brown pigment-spots on the branchiæ, and without the general arrangement of the pigment characteristic of the former Sabellid. Yet in the disposition of the cephalic collar the two forms appear to be identical. It is true some of them show seven anterior segments with bristles, but others have the normal number—and some, which apparently have lost the cephalic plate and other parts, have fewer. Injury or abnormality also would explain the occurrence of the median ventral furrow from the first scute backward. The anterior hooks and their accompanying bristles and the posterior hooks are identical.

Potamilla incerta, which Dr. Allen procured by the dredge on Yealm ground, Plymouth, seems to be the young of *Potamilla torelli*, and in this Prof. Fauvel agrees. Indeed, it is difficult to find satisfactory distinctions between *Potamilla reniformis* and *P. torelli*, for the absence of ocular points on the branchial filaments may not be of capital importance.

A single example of *Laonome kröyeri*, Malmgren, the fifth form, was obtained by the dredge on a muddy bottom in Inishlyre Harbour by Mr. Southern, who kindly forwarded it for examination. The cephalic collar is somewhat low, being deepest ventrally where the edges overlap at the fissure. In the median line dorsally the gap is both wide and depressed in front, and the edges of the collar there are slightly reflected. The branchiæ are short in proportion to the length of the body and from fourteen to sixteen in number. The filaments have a chordoid axis with narrow transverse septa, and terminate in a slender tapering process. The pinnæ are short at the base, increase in length till near the tip, where they again diminish before reaching the base of the terminal filament. No pigment-specks were visible

in the spirit-preparation. Tentacles comparatively short, bluntly tapered distally.

The *body* is comparatively long and slender, and the example showed little diminution throughout its length, having apparently been preserved in its tube and then slit out. The segments are fairly distinct, those of the anterior region ranging from 8–12 (*Malmgren*). The ventral scutes of the region are distinct and undivided, and there is a dorsal groove, behind which a line marks the mid-dorsal region for some distance. The scutes are continued backward on the ventral surface as a somewhat narrow pale band, the central groove cutting the portion in each segment into two. In the preparation the bristles are inconspicuous. The anterior bristles are of two kinds—a series with slender elongate shafts and short tapering tips with narrow wings, and a larger number with stouter shafts and paddle-like tips with broad wings and a tapering process of the axis. The posterior bristles are of one kind only, viz., those with narrow but distinct wings and long tapering tips. The anterior hooks are avicular, with a characteristic short and stout outline and a high crown, a main fang of moderate size, and six or seven distinct spikes in lateral view above it. The anterior prow is large and bulging, the gulf between it and the great fang is small. The posterior outline is straight, and a small remnant of the base posteriorly is present. The posterior hooks agree in the general outline, but the process of the base is absent posteriorly. It is this hook which Malmgren shows in his figure, unless the Arctic species differs. The tube is composed of secretion and mud, very little of the latter constituent occurring on a third of the length at one end.

Branchiomma vesiculosum, Montagu, the sixth species, comes from various parts of the southern coasts.

Kölliker, in 1858 *, constituted the genus *Branchiomma* for those Sabellids having eyes on their branchiæ, and he gave as a type *Amphitrite bombyx*, Dalyell. Sars, a little later (1861) †, made the genus *Dasychone*, characterized by the dorsal pinnules on the branchiæ. Clarapède rightly restricts the term *Branchiomma* to those having subterminal eyes, such as *B. köllikeri*, the form which Kölliker probably studied. Dorsally, the cephalic plate presents a deep fissure between the firm basal pillars of the branchiæ. The somewhat deep collar arises from the outer edge of each pillar,

* Zeitschr. f. wiss. Zool. Bd. ix. p. 536.

† Vidensk. Selsk. Forhandl. 1861, pp. 28 & 33.

and slopes with an unbroken edge downward and forward to the mid-ventral line, where a fissure separates the two sides, each of which is produced into a prominent rounded edge which slightly overlaps its neighbour. The adjoining first scute is indented in the middle line, thus giving a character to the region. Whilst, therefore, the collar is largely developed ventrally, a considerable part of the dorsum is devoid of it. De St. Joseph found two pigment-spots (eyes) over the cephalic ganglia. An otocyst occurs on each side at the base of the branchiæ. The branchiæ are of moderate length ($\frac{1}{6}$ length of body), and their filaments are from eighteen to twenty-four in number. Each filament has the usual structure, and tapers distally, ending in a subulate whitish terminal process, into which the chordoid axis, which is remarkably attenuate towards the tip, does not go. The subulate terminal filament, where no eye is present, has a translucent thin margin, especially at the commencement of its inner edge. It is at this region (viz. the inner base) that the eye develops as a conspicuous dark brownish-violet organ, a stripe of the flattened translucent margin connecting its inner base with the line of the pinnæ; whereas the distal part of the process is slender. The pinnæ are of average length, and provided with a chordoid unjointed axis. When injured, these organs are readily reproduced from the filament, to which they give a feathery appearance when the animal projects itself from its tube. The branchiæ are gracefully spread like the flower of a *Convolvulus* (Claparède). De St. Joseph describes the exterior of the branchiæ as white, or as brownish violet, or alternately of these colours. Sometimes they are entirely "couleur de rouille ou gris de souris." In the examples from Plymouth the colour was pale olive throughout, only the exterior of the filament being marked by an interrupted band of white, which broke up distally into isolated touches. The remarkable delicacy of the pinnæ is characteristic, each branchial process thus resembling a feather with its delicate barbs. When viewed from without, the branchial fan had a slightly barred aspect from the arrangement of the white touches. The pinnæ are pale olive throughout. The eyes vary much in size on the same specimen, and in one case only a single large one was present, the rest being small in varying degrees. All are double, with the terminal process passing off between them.

The anterior region consists of nine segments (six to nine, *De St. Joseph*), eight of which bear pale golden bristle-tufts, which slope in the preparations upward and backward.

The first tuft springs from a setigerous process almost immersed in the tissues of the united first and buccal segments, but the posterior cirrus or process is distinct, though small. The bristles are small tapering forms with very narrow wings (some without evident wings), and in two series, viz., a larger series, more deeply tinted yellow by transmitted light and minutely dotted, and a more translucent smaller series. All have finely tapered and nearly straight tips. The rest of the setigerous processes of the region are characterized by an increasing prominence, and the posterior papilla is considerably larger. Each arises from a broad base, and is somewhat flattened, since its vertical exceeds its transverse diameter, and the distal end has three parts, viz., the posterior process or papilla (not to be confounded with either a dorsal or a ventral cirrus), which springs from the middle posteriorly, and two areas for the bristles. The papilla is short and nearly cylindrical in the preparations, and is directed backward. The upper bristles arise from a curved area above a papilla, so that the long axis of the row is antero-posterior and the convexity of the tip with the wings is turned ontward and their points directed backward. They have long shafts and finely-tapered slightly-curved tips with narrow wings. The inferior row of bristles, again, has its long axis vertical, and they have shorter and stouter striated shafts, stouter tips, and broader wings. The tip in all is finely pointed.

The body is somewhat elongate, a large example reaching 100 to 110 mm., with a breadth of 3–5 mm., flattened, and tapered toward the tail, in front of which some examples have the widest part of the body. At the tip is the crenate anus. The dorsum is rather more distinctly flattened than the ventral surface, and has a groove in front leading to the branchial fissure; whilst posteriorly it bends to the right between the eighth and ninth bristle-tufts, and slants to the posterior edge of the ninth bristled segment. The ventral surface has the somewhat prominent median region occupied by the scutes, the first of which, on the united buccal and first segment, is the largest, and characterized by a dimple in front. It is followed by eight others, each of which may have an even margin or a median incurvation. The last of the anterior scutes has posteriorly a median projection, to which the boundary-line from each side slopes. From this point the ventral median groove passes backward to the tail, cutting the succeeding scutes into two equal halves, which occupy a little more than a third the breadth of the body of the preserved specimens, except toward the tail,

where the scutes are somewhat broader and the median groove is wider. The anterior region has nine segments with a wider antero-posterior diameter than those which follow, whilst these, again, are wider than the caudal segments.

The colour of the body is dull orange or of a salmon hue, universally and minutely dotted with white grains. The dorsal collar is pale, and is also minutely dotted with white grains ventrally; the flaps are also pale with a brownish edge—well marked in the anterior dimple of the first shield. The ventral scutes are paler, but also minutely dotted with white, and the ventral groove is reddish. The cilia of the dorsal end carry loose bodies actively forward.

The bristles of the second region are arranged like the inferior group in front, viz. with the long diameter of the row vertical, and they spring from the tip in a double row—that is, on each side of a ridge of tissue. The wings of these are intermediate in character, being narrower than the lower series and wider than the upper series of the first region. Their tips, however, are long, especially the upper forms, and finely attenuate. The chief changes in the bristles toward the tip of the tail are the shortening of the shafts and the great elongation of the tips, which stretch from the side of the flattened body as finely-tapered hairs. A distinct curvature occurs at the commencement of the wings.

Neural canals occur from the second setigerous segment backward. The segmental organs are found in the first, second, and third setigerous segments, and they open by a common canal. The anterior rows of hooks occupy the summit of the rounded ridge, which begins close to the setigerous process and passes ventrally near the scute. Each hook is avicular in shape, with a marked forward curvature of the posterior outline at the crown, a powerful and sharp main fang with a series of very minute serrations above it, a neck of moderate length, and a long tapering base. Bold striæ pass from the crown to the base, into which they curve a little behind the prow. Each hook is accompanied by a short broad bristle, with a spatulate tip bent at an angle and ending in a point, or when seen obliquely the tip is hastate, or on edge a hook-like organ. In a specimen from South Devon in the British Museum, both these and the hooks had their "heads" tinted brown. The posterior hooks are smaller, with a shorter neck and shorter base, and more distinct serrations above the main fang. The tube is leathery, coated externally with coarse sand mingled with

fragments of shells, and the elastic anterior end closes when the branchiæ are withdrawn.

The absence of *Spirographis spallanzanii,* Viviani, from the British area, is noteworthy. It may yet be found in the Channel Islands or on the southern shores of England. It occurs on the opposite shores of France.

In *Bispira volutocornis,* Montagu, the seventh species, the general colour is of a yellowish brown, paler in front dorsally and on the ventral surface. The branchiæ are pale buff with a white (interrupted) border to the filaments, the tips being more or less white. Most of the filaments have a pair of eye-specks, but there is no regularity in their arrangement in the mass, and some have two pairs or an extra spot. Some of these specks are at the base of the white tip, others midway or above the basal insertion. Though not so brilliantly tinted as some species, the delicate shades of fawn and the pure white margins and tips, in addition to the eye-specks, give the branchial fans great elegance. The tips of many of the filaments appear to have been injured, and are in process of reproduction. In the living form the dorsal groove presents a white bar at the edge of the collar, whilst a brown fillet occurs at each side and passes under the large lateral brown flaps bordered with white, and the dorsal edges of which are continuous with a slight ridge on each side of the anterior region. Ventrally the deep purplish-brown collar with its border of pure white is stretched continuously across till it passes in front of the lateral flap. Dorsally and ventrally the anterior region is somewhat paler than the rest, the lateral region, however, being slightly darker—as, indeed, it is all the way backward till near the tip of the tail. Ventrally the scutes are buff (pale brownish) and marked by the coprogogne, which turns to the right at the posterior border of the anterior region and passes dorsally. In an example the segment in front ventrally was entire, but the one anterior to it was split as if it had a coprogogne of its own. Young forms are pale greenish, the branchiæ being pale, and only a little border of white and a few touches of brown are visible ventrally at the collar, which has a deep median fissure. Dorsally none of these hues are present, the rudimentary flaps being pale. The great development and pigmentation of these flaps is an adult feature.

When the branchiæ are removed from the cephalic plate, the dorsal groove abuts on two semicircles of firm tissue, which pass downward to the sides of the mouth. From the

groove a firm process of similar tissue passes straight downward and bifurcates after a short course, its summit giving origin to two short curved flaps like a bifid epistome overhanging the mouth, which appears as a triradiate fissure with two pouting membranous lobes inferiorly. By the sides of the dorsal groove are two thick firm ridges—apparently fused with the basal semicircles supporting the branchiæ. From the outer base of each of these the collar arises by a thick circular flap, from which the large lateral division passes forward and downward to end in a smaller thick attachment at the side of the anterior process of the ornamental (scalloped) first scute. This lateral flap is slightly tinted in the preparation, but in the living form is of the same deep violet-brown bordered with white. Overlapping the ventral edge of this lamella is the ventral plate, which curves downward and extends on each side of the middle line into a triangular reflected flap—the anterior surface of the whole being of a rich deep brownish purple, bordered with white. If the base of the separated branchial system be examined, a facet marks the dorsal end of each of the semicircles of firm tissue of attachment, and the facet fits on the firm pillars on each side of the dorsal furrow. The firm basal mass of each branchial fan is bridged on the ventral side of the facets by a narrow but firm band. From the ventral aspect the basal mass on each side curves forward and inward to end in a thick inrolled edge in the centre of the spire. In the middle line and attached by its basal webs to the bridge of connecting-tissue, on the one hand, and the dorsal edge of the base of the fan, on the other, is the tentacle on each side. These webs are of importance in the directing-currents, and the ventral is incurved. The tentacle is short, broad at the base, and tapered. The exterior of its base is tinted brown, and a ridge formed apparently by the prolongation backward of the thickened margin of the flap guarding the dorsal edge of the channel from the centre of the spire keeps the base of the tentacle stiff. From the firm spiral base the branchial filaments pass forward to the number of forty-five to eighty on each side, the number apparently increasing with age. They are united at the base by a short web, and are comparatively long. Each filament has the camerated axis which extends to the base of the terminal process, but does not seem to enter it, for only an opaque granular central region with a short web at each side is present. On the outer edge of many a pair of well-marked pigment-specks, and in some two or three, but their position is irregular; where three occur, the first is a

short distance above the base and the others at irregular distances. A considerable portion of the tip is always devoid of them. They are dense masses of blackish pigment apparently enclosed in some cases in a capsule. The pinnæ (barbules, *De St. Joseph*) are short, and form a dense double row along the inner edge of the filament, becoming shorter as they approach the tip, where they end abruptly. Their colour is brownish violet in young forms, with twenty branchiæ in each fan, and a pair of black ovoid eyes occurs on the dorsal filaments about a third from the end, whereas the specks are situated near the middle of the ventral filaments.

The *body* is of moderate length for a *Sabella*, varying from 2 to 6 inches (13 cm. long by 1 cm. broad, *De St. Joseph*), and the segments vary from eighty to ninety or more. It is rounded dorsally and flattened ventrally, the mid-ventral line being marked by the groove from the posterior edge of the anterior region to the tail. The body tapers from the posterior third (in spirit) to the tip of the tail, at which the anus is, whilst beneath the tip are two somewhat ovoid papillæ with pigment-dots. The anterior region has nine bristled segments, but the number, as De St. Joseph shows *, varies much (*e. g.*, from five to eleven), and the numbers on the respective sides may differ. The setigerous processes are large, and have the form of short blunt cones. In this region the bristles are directed upward and backward as conspicuous tufts, whilst the rows of hooks stretch on rounded elevations between them and the ventral scutes. The first segment is fused with the buccal, and bears the first bristle-tuft. The segments are deeply cut ventrally in this as in the succeeding region. The first ventral scute has two lunate depressions, upon which the ventral lappets of the collar apparently impinge, the glandular tissue having been absorbed or arrested in development on these areas. The next ten scutes in the example from Plymouth are undivided by the median line, though three show a white streak in the centre—two of these belonging to the posterior region. The scutes are continued to the posterior end as elongated plates on each side of the median groove. The bristles of the anterior region are characterized by their golden hue and their distinct separation into two groups—a longer dorsal row, the long axis of which is nearly horizontal or slightly oblique, and a mass of shorter bristles beneath them. The upper bristles have very long, straight, striated

* Ann. Sc. Nat. 8e sér. xvii. p. 288.

shafts, which taper a little as they approach the tip, which is finely tapered, distinctly curved, serrated, and furnished with narrow wings—these, indeed, in some being indistinct. These bristles, moreover, show a gradation posteriorly, where shorter forms with nearly straight tips and somewhat wider wings occur. The second series forms a dense brush considerably shorter than the foregoing, and, as in other forms, the two groups are moved by separate muscles, so that their special functions may be performed. The shafts of the longer bristles of this group are similar to those of the first series, but shorter and slightly stouter, and the shorter tapered tips have a trace of a curve, and have wider wings, but soon a tendency to form a tip like a knife-blade, in which the wings are fused, is apparent, and by-and-by all the shorter bristles have the translucent flattened tip. This blade varies in length and breadth, as well as in curvature, but the majority of the bristles in these tufts are of this formation. The peculiar flattening of the tips, which are thinnest distally, gives great flexibility to the organs, so that their function of smoothing and brushing is facilitated. All have strong, striated, golden shafts, which gradually dilate from their translucent bases to the distal third, when gentle narrowing again occurs to the origin of the flattened tip. When softened and compressed in glycerine, the various stages in the transformation of a winged form, with an elongated tapering tip and with bold striæ on the wings, to a form in which the tip is broad, flattened, and translucent with but a trace of minute striation, can be followed. With the change of feet in the second division of the body, a reversion to the normal type of bristle takes place, the fascicles consisting of smaller shorter bristles of nearly equal size, with finely-striated straight shafts, similar in formation to the preceding, but which have narrow wings gradually disappearing on the delicately-tapered tips, the minute serrations on the edges being continued far upward. These bristles are grouped in a tulip-like tuft, and each resembles the blade of a pointed scalpel, only a trace of a wing appearing toward the convex edge, which is serrated, the lines sloping outward and upward. De St. Joseph counted sixty long bristles and two hundred shorter in the sixth segment of an example 13 cm. long. In the posterior region the bristles form a cylindrical pencil, a slight swelling occurring distally where the wings project. Their tips are more finely tapered than in the first region, and there is a slight curvature at the commencement of the wings. The pencil springs from a distinct setigerous

papilla. The bristles of the flattened caudal region, again, while retaining the form of a pencil, have the tips of the majority greatly elongated, so that this region of the body is specially hirsute. No wings are visible in these much elongated forms, but in the shorter forms these are well marked and have serrated edges. The anterior hooks, which commence on the second bristled segment, are situated on long low flaps, eight in number, which stretch from the setigerous process almost to the ventral scute in each segment. They are in a single row, and are characterized by their somewhat long necks, from which the main fang arises at less than a right angle, and has eight or nine small teeth above it. The prow is rounded and prominent, but the base is short, for it abruptly tapers to a blunt point posteriorly. A series of bold striæ occupy the central region from the crown to the base, into which they curve. De St. Joseph found no less than one hundred and eight to one hundred and forty hooks in a single row in the anterior region. Each hook is accompanied by a short bristle with a thick shaft, a slight narrowing of the neck, then an enlargement of the base of the flattened tapered tip, which is bent backward at an angle, and according to position is either symmetrical or asymmetrical. The posterior hooks do not differ except in the length of neck and smaller size, and in the presence of short striæ on the neck at the base of the great fang. These may indicate a stage in the development of hook-like points on the region. De St. Joseph states that these have smaller and shorter bases, and he gives the numbers in several examples.

About two-thirds of the large tube is composed of a fairly firm, yet elastic secretion with little mud, and occasionally a shell is attached. The basal region, which appears to be fixed, is coated with greyish mud.

A young example occurred in the fissure of the rock a few inches from the adult. When alive, it appeared to be about half an inch in length. The anterior region has seven setigerous and six uncinigerous processes, whilst the posterior consisted of about thirty-nine segments, the tip of the tail apparently being incomplete. Nine scutes are in front of those split by the mid-ventral line, instead of eleven in the adult, showing that, whilst the two behind the anterior region are constant, the rest increase with age. The cephalic lamellæ and folds are similar. The branchial filaments are respectively eleven and twelve, and they have the beautiful white tints of the adult, and the same basal web. The "ocular" pigment-spots in the preparation, however,

are few and minute, since in all probability they have been bleached by the spirit. The structure of the anterior and posterior bristles and hooks at this stage correspond with that of the adult.

In another young example found under a stone at St. Peter Port, Guernsey, and which was about three-quarters of an inch in length, the reflected lamellæ of the collar were of a rich reddish-brown colour. The anterior region consists of ten bristled segments and nine long scutes, and the region which follows appears to have more than thirty segments. The body is comparatively short, grooved on the dorsum for a short distance behind the fissure of the collar, and rounded behind the anterior groove. The ventral surface is slightly flattened and marked by the median furrow from the tenth scute backward.

Amphicora fabricia, O. F. Müller, the eighth form, is abundant near low-water mark and amongst roots of sea-weeds. The cephalic region has a projecting, broadly conical, ventral median process, and dorsally the margin presents a median notch behind a small conical process connected with the mouth. There is thus an indication of a collar, and it and the next segment are narrower than those which succeed. Two eyes are situated a little behind the anterior border, and beneath are two pale red masses. In front of these, at the base of the tentacles, are two deep red spots—apparently in connection with the blood-vessels. The branchiæ are three in number on each side—that is, the dense series of pinnæ arise from three main stems on each side, and all are quite pale. The pinnæ are longest at the base of the filaments and shorter toward the tip, so that the general effect of the arrangement when the fan is closed is to have a fairly even series at the tip. They are ciliated internally. Internally at their base are two short and nearly cylindrical tentacles, ciliated like the branchiæ. A single vessel occurs in each pinna in the line of the cilia, and the surface has numerous palpocils. Moreover, at the base of the branchiæ are two vascular enlargements, which have been termed "hearts."

The body is rather more than an eighth of an inch (1–2 mm., *De St. Joseph*) in length, cylindrical throughout the greater part of its extent, then tapered toward the tail. The segments are thirteen in all, seven of which pertain to the anterior and six to the posterior region. It is more or less rounded in the preparation, but in life it is often flattened. The first or buccal segment has two black

eyes (*De St. Joseph*). The general colour is brownish or straw-colour. Posteriorly it terminates in a pygidium, which has two eye-specks. The alimentary canal is straw-yellow, is wide anteriorly, bulges here and there in its course, and then narrows posteriorly. On each side of it is a red blood-vessel. The body-cavity is filled with a vast number of granular cells about $\frac{1}{900}$ of an inch in diameter. In front of the eyes at the base of the branchial lobes is a blood-sinus (branchial heart of Ehrenberg and Claparède), and Langerhans counted 25 pulsations per minute. The blood is stated to be red by Meczynikow and Claparède, whereas De St. Joseph says it is green.

The first segment is devoid of bristles, but the second has a tuft on each side about the middle of the segment. The bristles are few, simple, translucent forms with straight shafts and finely tapered tips with narrow wings, and in some views the tip is bent at a slight angle to the shaft. Eleven segments are provided with them, the first and last having none. As usual in the family, the posterior bristles have the largest and most finely tapered tips. The minute anterior hooks are about six in number in each segment, have a comparatively large head, a constriction at the neck, then a well-marked shoulder, after which the long curved shaft tapers posteriorly. The main fang is large, and the crown behind it is flat with about four teeth. The organ is a miniature representative of that of *Chone*.

The last three bristled segments have, instead of the long hooks of those in front, peculiar forms, the posterior outline being incurved and the anterior slightly convex, whilst the crown is long and minutely toothed, no differentiation occurring between the lowest and the adjoining teeth. The base enlarges inferiorly, and is occasionally split, apparently from the pressure used in preparing.

Oria armandi is the ninth species, generally distributed in the south. Claparède (1864) describes a ventral cephalic collar to this species, apparently as distinguished from *Amphicora fabricia*, but so far as observed in the spirit-preparations there is not much difference in this respect—both presenting a conical ventral prolongation and a narrow rim to the dorsal fissure. Claparède states that below the collar is a row of vibratile cilia. Immediately in front of the termination of the collar on the latero-dorsal region is an eye-speck on each side. The second segment bears an "auditory" organ (statocyst) on each side, viz. a capsule with a statolith. The branchiæ are in two groups

of five (*Claparède*) and similar in general appearance. They are ciliated internally and have palpocils externally. The first ventral branchia is reduced to a simple filament without pinnæ. A single vessel occurs in each filament, and it ends blindly where the cilia cease.

The *body* of the examples from Sark is not larger than that of *Amphicora fabricia* from St. Andrews—the advantage in size, indeed, being with the northern form, which is also more translucent. The eyes had disappeared in the preparations (after preservation for 42 years), and yet, as Claparède shows, those of *A. fabricia* are permanent in spirit. The number of segments is at once diagnostic, for *Oria armandi* has fourteen bristled segments besides the first and last. Claparède, however, gives nineteen or twenty segments, though he found a ripe female with fewer than twelve segments. The first segment is achetous. At the tenth segment the bristles change to the ventral border and the shape differs.

The digestive system has a cylindrical colourless œsophagus, and from the third segment the gastro-intestinal canal proceeds backward as a brownish wide tube. A blood-vessel runs on each side of the canal with a transverse branch in each segment—indeed, the gut is surrounded by a vascular rete (*Claparède*). In the seventh segment a pair of folded tubular organs (segmental ?) occur.

Fourteen pairs of bristle-bundles characterize those from Sark. The anterior bristles have stouter shafts than those of *Amphicora fabricia,* and the tapering tip is shorter and has wider wings. Eight pairs belong to the anterior and six to the posterior region, the latter being distinguished by their slenderness and the tenuity of their hair-like tip, as well as by the absence of wings. Moreover, they are generally directed forward with a slight curvature, whilst the anterior bristles are directed backward. The anterior hooks have a similar shape to those of *Amphicora fabricia*—that is, have a curved shaft which tapers inferiorly, a shoulder above which is a somewhat narrower neck surmounted by a strong sharp main fang, which comes off at less than a right angle to the throat and with two or three strong teeth above it, the crown being, on the whole, more elevated than in *A. fabricia.* The neck of the hook is also slightly bent backward. The posterior hooks, which, as in *Amphicora fabricia*, occur in the last three bristled segments, differ, as Claparéde observed, from those of the species just mentioned in their shorter form, for the basal region is truncated and the posterior outline short and concave, the

conspicuous part of the hook being the long anterior face and crown, occupied by a small sharp main fang and numerous minute teeth above it. The anterior outline below the main fang bounds a small bay, the prow bending up to circumscribe it. The inferior outline is convex.

The otocysts in this species belong to the second group of Fauvel *, viz. to the closed series in which the otoliths are formed by concentric layers of secretion in the organ.

Amphiglena mediterranea, the tenth species, is a southern type from Plymouth and Torquay. The anterior region bears ten branchiæ each, pinnate, with a double row of barbules, the whole forming, in the preserved examples, a tuft about a third the length of the body. Each filament, according to De St. Joseph, consists of a double row of "cellules cartilagineuses," whereas the barbules have only a single row. The number of ciliated barbules appears to be about thirty, and they are shorter at the base and the tip than in the middle. The tip of the filament ends in a long and slightly tapered process with a narrow web at the base, and it has palpocils. Each branchial filament has a single vessel (*Claparède*).

Besides the two ciliated palps, De St. Joseph, after Claparède, shows a coiled process on each side, filled with brown pigment-granules, and which, after Meyer, he considers to be a fold of the upper lip, forming a superior lateral chamber on each side.

The body is about 8 mm. in length (but some may reach 18 mm., *Claparède*), usually little tapered anteriorly, but distinctly so posteriorly, and ends in a bluntly conical or rounded pygidium, which bears four to six pairs of eyes. The segments vary from 29–33. A pair of spherical statocysts, as mentioned by Claparède, exist in the second segment. They are ciliated internally and have statoliths. Claparède describes a dilatation of the œsophagus in the fourth segment. The circulatory system, according to the same author, consists of a contractile ventral vessel and two lateral trunks applied to the alimentary canal, but he could not detect the cœcal branches ordinarily seen in Sabellids.

The first achetous segment bears four eyes in two pairs; the second segment has two statocysts having a number of statoliths, besides two or three minute winged bristles dorsally; and the next seven segments have dorsal tufts of bristles, the upper having narrower wings, the lower

* Comp. Rend. Acad. Sc. Paris, Dec. 29, 1902.

resembling spatula from the breadth of the wings, gradations occurring between the the two—showing a long hair-like continuation of the shaft as well as the broad wings. The dorsal forms have a long shaft slightly curved backward toward the tip, which is finely tapered and furnished with wings of moderate breadth, which insensibly disappear below the hair-like tip. The inferior bristles of the same group—that is, those next the inferior hook-rows—have wings so short and broad as to make the tip spatulate and often with a slender hair-like continuation in the middle. Both types of bristles are frequent in the Sabellids. Similar bristles occur in the anterior "abdominal" region, but the last six at least are very long, attenuate, and project prominently outward, whilst scarcely a trace of a wing is visible, even in the most anterior long tuft.

A series of minute bristles with the spatulate tip bent at an angle accompany the anterior hooks, which commence on the second bristled segment. These occasionally project beyond the line of the great fangs of the hooks *in situ*. The hooks, of which there are about eleven in each row, themselves have a remarkably long main fang with three or four spines in lateral view above it, making a high crown, the posterior outline is much curved and runs to the basal process, whilst the gulf between the great fang and the prow is rather narrow. The posterior process is comparatively long. In the posterior hooks the spikes above the great fang are more numerous, as well as more evident. The great fang itself is powerful and slightly curved. The gulf anteriorly is as well marked as in the thoracic hooks, but the prow is proportionately broader and more blunt, and the posterior process considerably smaller and shorter. The number of the hooks anteriorly is similar to that found in the "thoracic" region, but posteriorly they diminish, so that in the antepenultimate there may be only one.

The change in the setigerous and uncinigerous processes occurs at the tenth segment, the posterior region having the hooks dorsal and the bristles ventral.

The eleventh species, *Dasychone argus*, Sars, a form not to be distinguished from *Subella lucullana*, D. Chiaje, is generally distributed throughout Britain. When the branchiæ have been shed by the annelid, the cephalic plate has the edge of the collar projecting beyond its surface, which shows at the dorsal inflection two small processes or folds, from which a pear-shaped area passes ventrally to end in the oral ridge. The entire surface is thus symmetrically mapped

out, whilst the margin is formed by the collar, which presents a lateral notch, in the form either of a slit or a shallow excavation, which divides the reflected and somewhat triangular ventral lobes from the rest of the rim, and they are separated from each other by a wider gap in the mid-ventral line. In large examples a dark speck occurs on each side of the surface external to the pear-shaped enlargement, and a dark speck on each side of the dorsal collar. A patch of dark brown pigment also is present in some on the edge of each reflected lobe. When the annelid withdraws itself into its tube the dorsal lamellæ are folded inward and slightly overlap, and the inner process is pressed flat.

The branchiæ are from 12–25 on each side and arise from a firm tissue which is continuous in each semicircle, and apparently formed by the fusion of the bases of the branchiæ, the individual elements being marked by a reddish-brown pigment-speck—linear in outline and interfilamentous in position. From each semicircle the finely coloured organs extend freely distally. The chordoid axis in each is more finely divided than in *Chone infundibuliformis*. The pinnæ, which are in a double row, become shorter at the tip and somewhat suddenly cease at the base of the short terminal process. Along the outer edge of each filament a series of clavate processes (about 18) are attached in pairs, and a pigment-spot occurs on each side just beyond the attachment of the processes, which in life are often curved downward. Sars calculated that there were from 1200 to 1400 eyes in this species, for each eye-speck is compound. As a transparent object the branchial filament shows the chordoid axis with its coating of hypoderm and cuticle, and the pinnæ with jointed chordoid axes (De St. Joseph calls them cartilaginous). In some from Guernsey the branchiæ were of a pale greenish hue, whilst the pinnæ were pale or whitish and the tentacles greenish. Zetlandic examples, again, had the branchiæ tinted dull orange with a tinge of green, whilst on each filament the pinnæ and the dorsal processes were marked with white grains. Others from St. Peter Port, Guernsey, had dull purplish-red branchiæ spotted with white. Four of the dorsal crenated processes also were white. In those from St. Andrews the branchiæ are often brownish purple, and the two tentacular groups are streaked longitudinally with white and purplish brown. The beautiful shades of white and purplish brown and the elegant form of these complicated organs almost baffle description. The general effect of the branchial coloration is striking, for three reddish-brown belts cross the branchiæ, the most

intense being inferior and which is toned down to the white collar. Two white belts separate the three brown bands and various white touches enliven the beautiful fan. Dalyell's specimens were variegated with different shades of brown and yellow, and he mentions one with snow-white plumes located inside an old oyster-shell.

The *body* is moderately elongated, but in contraction almost elliptical, and attains a length of $\frac{3}{4}$ to 2 inches, and has fifty-eight well-marked segments, of which 5–7 are anterior. It is rounded on the dorsal surface and devoid of any anterior groove, slightly flattened ventrally, and with a median groove from the posterior border of the ninth bristled segment to the tail, where the terminal anus has two slight lateral papillæ. The ventral surface from the collar backward has in each segment a glandular scute. These occupy the middle of the anterior region. The long rows of hooks occur at the sides, and they continue of similar breadth to the posterior end. After the ninth they are split in the mid-ventral line of the groove, and in some a faint line runs from the collar along the middle of the anterior segments. The body is of a madder-brown or dull red colour in some, with white specks both dorsally and ventrally (orpiment-orange, *Dalyell*). In others it is dull orange with only a few whitish grains on the collar, or of a light orange hue—rendered dark here and there by the intestine, whilst the lobes of the collar are speckled with minute dots of white, and two white papillæ occur at the anus, or a white patch in front of it. Young examples between tide-marks in Guernsey and Herm are yellowish green, with the dark specks at each foot. A bold dark brown speck occurs at the ventral edge of each setigerous process in the anterior region, the uncinigerous ridge commencing behind it. At the ninth bristled segment a smaller speck is situated rather behind the setigerous process dorsally, and at the commencement of the uncinigerous row, and so to the posterior end of the annelid. In one from Malahide the collar had many minute brown specks. The alimentary canal commences at the mouth as a wide, though translucent, membranous tube marked by transverse striæ. About the middle of the body it becomes narrower and thicker with powerful and rather coarse transverse fibres and some delicate longitudinal muscles. The dissepiments support the canal in every segment, and thus it assumes a moniliform aspect, or occasionally resembles a coiled spring.

The first setigerous processes are nearer each other than the succeeding, since the line of the bristles anteriorly

trends dorsally. The cervical process is smaller than the second, and bears a series of bristles with more slender winged tips than the succeeding. A typical tuft in the anterior region presents dorsal bristles with more elongated striated shafts and short, tapering, winged tips. The shaft slightly tapers toward the wings and again toward the root. Those at the edge of the series have somewhat broader wings, which are striated and serrated on the edges. A shorter series of bristles occurs at the base, the tips just projecting beyond the skin and having the same gradation as observed in the longer forms. The posterior bristles form a small tuft and are characterized by the great elongation of the tip, especially of the more slender forms, the wings in the preparation being scarcely visible. One or two bristles at the ventral edge have the wings considerably widened at the base, but the tips are attenuate. On examining the anterior tufts of bristles with a lens, the sharpest curve formed by the setigerous process is posterior and the concavities are dorsal. They are considerably stronger than the succeeding tufts. The ninth is less powerful and the dorsal bristles are proportionally longer. In transverse section they agree generally with the condition observed in *Chone infundibuliformis*.

The first bristle-tuft has no hooks on its ventral border, but the next seven have long ventral rows slightly diminishing in length from before backward, and the hooks occur in a single row. The ninth, which begins the posterior series, is dorsal, and is one-third less in breadth than the eighth. Throughout the entire series of rows the hooks maintain the same microscopic characters. The anterior hooks are avicular, have the posterior outline convex and the anterior concave, the great fang leaving the throat at a little less than a right angle, and a series of small teeth occur on the crown above it. The anterior outline, whilst concave at the neck, becomes boldly convex at the prow, which is smoothly rounded anteriorly and inferiorly—ending in a strap-like basal process which is usually bent a little downward posteriorly. The hooks diminish in size posteriorly, and the basal process is shorter.

In connection with this species, it is curious that Sir J. G. Dalyell (1853), in watching the development and reproduction of lost parts, made the following remarkable statement:—"Here we seem to reach a postulate, demanding the indefinite—the universal—diffusion of germs ready for development wherever the obstacles to it cease, or of some creature-power effecting a secretion of such matter as may produce

new organs in forms or substance." Something like Pangenesis was thus thought of before Darwin.

Euchone rubrocincta, Sars, the twelfth form, comes from St. Magnus Bay, Shetland, in 100 fathoms, where it was dredged by Dr. Gwyn Jeffreys. The collar dorsally has a curvature as it approaches the median fissure, whilst ventrally only a spout-like median fold occurs at the rim. The branchiæ are 15–16 on each side (twelve, *Sars*), connected by a web for half their length. The filaments have pinnæ which reach the base of the slender filiform tip, which is often so closely coiled as at first sight to represent a knob. A narrow hypodermic wing is attached to the axis along a considerable area of the pinnate region and to the base of the terminal process. "Five pairs of branched tentacles" (tentacular cirri) "and several unbranched, of which one long ventral pair is attached to the connecting membrane" of the branchiæ, "whilst the others are free" (*Southern*). These organs are in close proximity to the mouth, have an afferent and efferent blood-vessel, and are probably of importance in alimentation. The curve of the vessel is just within the hypodermic tip, which is slightly bulbous. The body is about three-quarters of an inch in spirit, of thirty-two or more segments, of which nine to eleven are included in the anal funnel, which has a furrowed process in front and a crenulated margin. It is somewhat rounded, though the ventral surface is more or less flattened, a little tapered in front, and more distinctly diminished in the caudal region. The segments are two-ringed, and a dorsal furrow runs from end to end, for it does not cease when the ordinary groove bends to the right and passes to the ventral surface between the eighth and ninth segments, and is continued to the anal funnel. The anterior scutes are divided by the transverse furrow of the segment; the posterior scutes are cut into four by the deep and broad ventral furrow.

The anterior bristles are borne on a setigerous process, are pale, and brittle. The first tuft, which arises a little more dorsal than the others and at the base of the collar, consists of a longer and shorter series of finely-tapered bristles with very narrow wings, those on the shorter series being almost invisible. The average anterior tuft has three sets of bristles, the larger having straight shafts, gently tapered and slightly curved tips; the next series has shorter tips with a distinct inclination backward and broader wings, but still their condition is in contrast with the broad spatulate tips of the corresponding series in such as *Euchone*

papillosa. The third series present narrower wings than the last, and the tips project little beyond the surface. So brittle are the tips that the tapered axis, or terminal region of the shaft, often snaps at the base of the wing, leaving a transparent web forming the wings projecting freely beyond it and on one side of the shaft. This is not common.

In his account of the species, Malmgren (1865) did not refer to other than the anterior hooks, which are rather large, have moderately long and boldly curved shafts, also as brittle as the bristles. These dilate from the base up to the shoulder, then are slightly narrowed at the neck. The main fang comes off nearly at a right angle, and in lateral view has eight or nine teeth above it, but the crown is flat, and thus differs from such as *E. papillosa*, in which the crown is more elevated. The *hooks* in the anterior part of the posterior region are avicular, have a main fang which leaves the neck at less than a right angle, a rather high crown with five or six teeth in lateral view, a convex posterior border, a prominent and massive prow, and a small basal process posteriorly. The terminal hooks, again, are considerably smaller, have a much higher crown and more numerous teeth in lateral view, and the posterior basal process is smaller. All the shafts of the bristles and long hooks are slightly brownish by transmitted light.

Euchone normani *, sp. n., the thirteenth form, is unfortunately fragmentary, and nothing is known of the branchiæ. The cephalic collar is fairly developed, with a deep fissure dorsally, the margin sloping thence downward and forward to the ventral process, a slight projection on each side of the middle line with a fissure between occurring there. The *body* appears to be comparatively short, and the anal funnel is short antero-posteriorly and wide, the margin being thin and deep anteriorly with a shallow median notch, whilst the sides are boldly and somewhat regularly crenate for more than the anterior half. The anterior bristles are of two kinds, a longer series dorsally with finely tapered and narrow wings, and those ventrally situated with broader wings and shorter tips. Posteriorly the tips of the bristles are greatly elongated, and the wings very narrow.

The anterior hooks have a long curved shaft tapering to the base, whilst the neck is narrowed above the shoulder and curved backward. The great fang comes off nearly at a right angle, and about four teeth are on the crown above it

* Canon Norman and Dr. Gwyn Jeffreys did much valuable work with the dredge in the Zetlandic seas.

in lateral view, whereas in *Euchone analis* the number of teeth is nearly doubled, and a differentiation of this region from that of the great fang is evident. The base is curiously diminished and narrowed posteriorly, but the prow is large and rounded. The posterior hooks are even more diagnostic than the anterior. The posterior outline is convex, with a slight inflection below the crown, and a short posterior curve at the base, which is small. The great fang is long and sharp, and on the crown above it are six or seven distinct teeth. The anterior outline begins at a little less than a right angle, gently curves forward to the prow, which inferiorly blends with the short truncate base. The lower part of the neck and body have curved striæ. In structure, therefore, these hooks differ from those of *E. analis*, Kröyer, and *E. papillosa*, Sars. Neither is figured by Malmgren.

The representatives of the genus *Chone* in northern waters seem to be in a somewhat confused condition, since the young of certain forms have been described as different species. At least five species, however, are clearly defined, viz. the characteristic *Chone infundibuliformis*, Kröyer, of the arctic seas, which appears to be rare in most collections, but was procured by the 'Valorous' in 1875. This form has often been confounded with another species, viz. *Chone duneri*, Malmgren—indeed, in a named collection from Greenland, procured in the sixties of last century, it is labelled *C. infundibuliformis*. Yet the form of the tips of the branchiæ in the latter, the structure of its hooks, especially the avicular posterior hooks, the bristles, and other features are diagnostic.

The original description of *C. infundibuliformis* by Kröyer*, although unfortunately he gives no figure, is clear in regard to the structure of the branchiæ, the collar, the size, and other features. He adds that it is not rare in Greenlandic seas, and that it inhabits a cuticular tube devoid of mud; yet modern naturalists seem to have seldom met with it. Its posterior hooks are so characteristic that no confusion with *C. duneri* need occur—even in young forms of each species. Of course, it may be a question what form Kröyer meant by his *C. infundibuliformis*, since both it and *C. duneri* are found in the arctic seas, but the typical *C. infundibuliformis* is chiefly arctic in distribution, whereas *C. duneri* has a much wider range. After careful consideration of Malmgren's views and various specimens, it has been deemed prudent to adhere to the diagnosis indicated above. It is, however, right to state that Prof. Fauvel and others hold

* Oversigt Kgl. danske Videnskab. Selskabs Forhandl. 1856–57, p. 33.

C. duneri to be Kröyer's *C. infundibuliformis*, and that the species held here to be *C. infundibuliformis* is only a variety of the former (*C. duneri*). This does not modify either the opinions or the figures in this paper.

Chone duneri has a very wide distribution, ranging from the British seas to Norway, Jan Meyen, Spitzbergen, Greenland, the Gulf of St. Lawrence, and Madeira. A species, which closely approaches *C. duneri*, extends along the eastern shores of Scotland, is thrown by storms on the sands at St. Andrews, is dredged in deep water off Montrose, and occurs in the stomachs of fishes, such as the cod and haddock. It has been termed *C. fauveli* in the meantime, since the processes at the tips of the branchiæ form a contrast with the long filiform processes in *C. duneri*, and its posterior hooks generally show a tooth more above the main fang. Further investigations may clear up certain doubtful points in connection with both forms. Wollebœk's* view that *C. duneri* is a synonym of *C. infundibuliformis* cannot be corroborated. In the fine volume on the Polychæts procured by the Prince of Monaco, Prof. Fauvel † describes and figures *C. duneri* as *C. infundibuliformis*, and it is possible that the rarity of the latter and the abundance of the former in northern waters has led to this misapprehension, which we in Britain equally shared. Prof. Fauvel's figures of the bristles and hooks in his account of the Polychæta from Jan Meyen are excellent. In all probability the species from the area of the Clyde ‡ is *Chone fauveli* and not *C. infundibuliformis*, which has not hitherto been met with in British waters. The species described by Miss Katherine Bush § as *Chone teres* appears to be closely allied to the last-mentioned species, especially in the structure of its posterior hooks. Besides the foregoing forms, *Chone reayi* extends from Shetland to the Channel Islands, and *Chone princei* occurs in the Gulf of St. Lawrence, Canada.

Chone fauveli ||, sp. n., the fourteenth species, is widely distributed in Britain.

The cephalic plate is surrounded by an ample and continuous collar, cleft, however, at the dorsal fissure, and it

* Akrift. Videnskap. Kristiania, 1911, 2 Bind, No. 18, p. 24.

† Campagnes Scient. fasc. xlvi. p. 319, pl. xxxi. figs. 10–18 (1914).

‡ Proc. Roy. Irish Acad. vol. xxxi. no. 47, p. 141.

§ Harriman Alaska Exped. Tubicol. Annel., New York, 1905, p. 215, pl. xxx. fig. 1, and pl. xxxvii. figs. 16–23.

|| Named after Prof. Fauvel, of the University of Angers, France, who has laboriously studied the Polychæta both of Europe and other regions.

ensheaths the base of the branchiæ. At the dorsal fissure the thickened edges, after the collar ceases, are carried downward, and end in a point above the inflection of the firm rim to which the branchiæ are attached, and which has the outline of a horse's hoof, the rounded ventral arch forming the front and the indented dorsal region the frog. After the branchiæ are shed, a small papilla is usually found in the mid-dorsal, and a larger in the mid-ventral line of the thickened inner rim. The mouth lies above the ventral papilla.

The body of this form is generally more rounded than in the Sabellids proper, reaches the length of 5–6 inches, and has the thickness of a strong goose-quill. The segments are from fifty to ninety. The outline is somewhat spindle-shaped, for, though the cephalic lobe is truncate, the body tapers to it, as well as more distinctly toward the tail, at the point of which is the anus, which in the younger examples sometimes shows two papillæ—a smaller dorsal and a more prominent ventral papilla. The deep dorsal fissure is continued to the second segment, where it is dilated, and from this the mid-dorsal groove passes backward to the anterior border of the eighth segment, where it inclines to the right, cutting off in its course ventralward a narrow portion of the ninth segment, and, reaching the mid-ventral line in this segment, thereafter proceeding to the tip of the tail, the last part of its course being generally more deeply grooved in the preparations. The body of the fresh specimen is pale pinkish, and in the newly-preserved form is of a pale skin-colour.

The branchiæ vary from twelve to thirty-six on each side, and are connected together almost to the tip by a membrane, the dorsal fissure, however, causing a gap in the funnel. In preserved examples the filaments are often slightly spiral and the tips are incurved. The filament is stiffened by a chordoid camerated axis as in *Sabella*, but it is not less in diameter. The tip of each process is characteristically formed with a broad wing at the base and tapering to a fine tip. A slender axis, apparently from the chordoid skeleton, passes along the centre of the bare flattened tip almost to its extremity. The pinnæ are long, even to the base of the flattened terminal process, and have a central (chordoid) axis, the tip being smoothly rounded or occasionally slightly enlarged. The pinnæ at the bases of the filaments (that is, near the mouth) are elongated, the last one or two being so long as to resemble tentacles. When a suitable example is observed the slender tentacles arise at each side of the mouth,

and are quite free from the branchiæ. Six or more occur on each side as delicate filaments little tapered toward the tip. In the centre are two or three folded lobes, apparently in connection with the oral aperture, and near the dorsal fissure is an oblique fold of some length, the distal end of which is split into filaments. What appeared to be the two tentacles proper are on the inner border of each ventral fold, and they terminate in a tapering filament. The mechanism of the entire elaborate apparatus is complex. The length and degree to which the tip is webbed vary considerably, and in the arctic form it is more elongate.

The cutis is smooth, has a finely iridescent or nacreous lustre, and, when removed, has a bluish aspect. In intimate structure it is crossed by fine lines, which give it a fibrous appearance, but at the segment-junctions white bands occur, and these are tesselated. A series of powerful circular fibres occur beneath the skin and its basement-tissue, whilst the longitudinal bands conform to the type of the family.

The collar runs smoothly into the first segment, which is of considerable antero-posterior diameter and uniformly rounded. It has on each side, a little in front of the segment-junction, a small tuft of bristles and a pale spine. The bristles are simple winged forms with tapering tips, the edges of the wings being serrated. They slant dorsally forward. Some of these long anterior bristles present a peculiar twist below the wings, but whether this is artificial or otherwise is unknown. The succeeding seven pairs, which issue just in front of the median ring, have modified tufts, consisting of a dorsal series of bristles with tapering tips, like those of the first series, with serrated edges and a ventral series of bristles of spatulate form, the slope of both being obliquely upward and forward. The spatulate bristle is smallest at the base, and gradually enlarges into a finely-serrated shaft, which remains cylindrical until the wings appear, and then tapers to a blunt point. The wings rapidly widen on each side, and soon end in a blunt tip, are obliquely striated, and have serrated edges laterally. Moreover, the tip often presents a slight marginal fold. When the tip of the shaft is broken, the transparent web connecting the wings is evident and the margins of the wings are stiffened by incurvation and slight thickening. There is little difference between the first tuft and the last, except that the posterior are rather more obtuse at the tip. In transverse section the exterior of the bristle is hyaline, the centre granular from the fibres. On examining the bristle-tufts of this region with a lens, a

double series of black dots appears—caused by the central stalk of each spatulate bristle.

The anterior tufts of simple bristles (at and after the ninth) are characteristic when contrasted with the northern *Chone infundibuliformis* from Greenland; for in lateral view the shafts are curved, constricted as they approach the wings, and the tip leaves the shaft at an angle, whilst it is finely tempered and bordered with the narrow wings. In antero-posterior view the constriction at the upper end of the shaft is distinct, the base of the tip (continuation of the shaft) being considerably broader. On the other hand, the bristles of the Greenlandic species are much more slender, the tips longer and more attenuate, and the wings just visible. The constriction of the shaft below and its dilation above the commencement of the tip scarcely attract notice.

A change occurs at the ninth bristle-bundle, which is now ventral to the row of hooks, for all have tapering tips with the serrate wings, and slant upward and backward. The succeeding tufts are equally powerful, and have the same direction till the posterior fifth is reached, and there the bristles gradually assume an opposite direction—that is, downward and forward. These posterior bristles are longer and smoother, presenting no serrations, and the terminal wings narrower, so that the shaft is more conspicuous. The free portion of the bristle increases disproportionately, the shaft being little more than a quarter of the length. Further, whilst the bristles of the anterior region are in front of the median ring of the segment and the hooks behind it, the posterior bristles are more nearly in a line, though still anterior to the row of hooks. Generally speaking, the anterior bristles have most of their shaft below the skin and a shorter tip, whilst the posterior have a short shaft under cover and a long tip—conditions doubtless connected with their functions.

The rows of hooks commence on the second bristled segment to the ventral side of the bristles, and the first seven—that is, those of the anterior region—are longer and more boldly marked than the succeeding, appearing like minutely dotted dark lines under a lens. The hooks are arranged alternately in a double row, but toward the ends of the row, especially ventrally, appear to form a single series. Each presents a long, curved, striated shaft, deeply inserted into the muscular coats, and tapering from the well-marked shoulder to the base. The neck is translucent, finely striated, especially superiorly, narrowed above the shoulder, and again slightly dilated as it approaches the

head, which has a powerful main fang extending from the throat at more than a right angle, and with five or more smaller teeth on the crown in lateral view, and they extend to the downward curve of the crown posteriorly. In contrasting these with the hooks of *C. infundibuliformis*, the curvature is less, the neck shorter, and the crown somewhat flatter. Moreover, whilst the body of the arctic specimen is larger, the hooks are proportionally smaller. The hooks in the seven rows maintain the same structure, the posterior, perhaps, being slightly stronger. In transverse section of the shaft of the hooks the centre is fibrous, and at the shoulder it is somewhat flattened, with an indentation of the fibrous area, a condition which explains the peculiar blank always seen on one side of the shaft. At the ninth segment the hooks change to the dorsal side of the bristles, and they maintain that position to the posterior end of the body. These hooks are avicularian, and form a single row, diminishing in size from the dorsal to the ventral end adjoining the bristles. There are about thirty-six hooks in each row anteriorly. Moreover, the hooks at the upper end of the row have a larger base than those next the bristles, for in the last hooks the base is in a line with the neck and devoid of the anterior prow. In the upper hooks the main fang is large and sharp, the anterior outline below it deeply concave to the prow, after which it is nearly straight. Four distinct teeth occur above the main fang. The posterior outline is irregular, a slight hollow occurring at the neck, then a convexity from which a straight line runs to the angle at the upper part of the base, another straight line joining that bounding the free end. The base and neck are boldly striated, the former transversely, the latter longitudinally. At the lower end of the row the posterior outline of the hook is nearly straight, only a slight elevation occurring in the middle; whilst the anterior outline of the base is prolonged downward with a slight posterior inclination, so that the hook has a base elongated in the line of the neck. In some large forms from St. Andrews these hooks were of a deep brown hue.

In *Chone infundibuliformis* the hook in the middle of the body considerably diverges from that of *C. fauveli*, since the base is more massive; the prow has a slight process projecting downward, and the gulf below the acute main fang, instead of having a nearly uniform outline on its inner edge, has a distinct indentation, marking off, as it were, the region of the prow. But the most divergent feature is the crown, which is flatttened and provided at its

posterior edge only with five or six small teeth in lateral view (and which do not affect the straight outline of the crown) in contrast with the four large teeth of the British form, which project well over the main fang, and the striæ from which occupy a considerable portion of the neck; and the striæ adjoining these (in front) are parallel, whereas in the arctic hook the long striæ from the smaller hooks on the crown are indistinct, the striæ in front being alone conspicuous. The posterior outline in the two hooks likewise differs, the arctic form being evenly convex till near the base, where it is truncated, the British having this portion of the posterior edge concave.

The distinctions noted continue posteriorly. Thus the bristles near the tip of the tail in the British form, while they have greatly elongated tips, retain the marked constriction of the shaft below the tip and the dilatation beyond it. On the other hand, the extremely slender tips of *C. infundibuliformis* have only a trace of wings, and the slight constriction of the shaft below and dilatation above the commencement of the wings would not at first sight be noticed. The terminal hooks in the British form have a more regular posterior outline, but otherwise keep to the type seen in front, the main fang and the teeth above it being especially distinct. On the other hand, those of *C. infundibuliformis* retain all the distinctive features already mentioned, the minute teeth at the back of the flattened crown being so indistinct as to suggest fusion.

When the digestive tract is exposed, it presents anteriorly prominent oral papillæ and glandular organs on each side. The anterior region of the tract is brownish in colour, chitinous, and very friable, and after a short course it merges into a rounded and more distinctly moniliform portion, which, gradually diminishing in calibre, ends in a small anus. The contents of the gut showed many diatoms, fragments of the spicula of sponges, fragments of minute crustacea, amidst muddy sand. A large and firm glandular body is attached to the intestine, and above the intestine lies the dorsal blood-vessel, which has in the preparation a brownish barred aspect.

The anterior half of the intestine is of a pale brownish hue and somewhat firm, as if chitinous, and in minute structure is finely striated transversely, and hence the readiness with which the gut ruptures. Few muscular fibres occur in the anterior region of the gut, but at the point where it becomes moniliform a layer of muscular fibres lies beneath the chitinous coat, which becomes thin

and translucent posteriorly, whilst the muscular fibres increase in bulk and power. A complex reticulation of blood-vessels covers the wall of the canal anteriorly. Strong fibres from the body-wall cross the canal, but are not attached to it. The intestine is coated throughout with the brownish digestive gland, which is deeply tinged with yellow pigment. It ceases within a quarter of an inch of the vent.

Chone duneri, Malmgren, the fifteenth, a widely-distributed species, extends from British waters to Spitzbergen and the Gulf of St. Lawrence, Canada. The cephalic collar forms a considerable web dorso-laterally, passing backward to the line of the second bristle-tuft, and doubling forward along the edge of the dorsal fissure on each side so as to make conspicuous parallel edges to the fissure, as far as the base of the pedicle for the branchiæ. The pedicle, after removal of the branchiæ, does not project beyond the rim of the collar. The branchiæ are distinguished by their comparative length and the long slender terminal processes. The structure of the filaments is typical, and they slightly taper distally, ending in a remarkably long winged process, which tapers to a delicate tip and has a slender continuation of the chordoid axis in the centre. The number of filaments ranges from six to twenty-two on each side according to size, the latter being the number in a fine example from Jan Meyen, kindly sent by Prof. Fauvel, and they are united by membrane throughout the greater part of their length, the tip being free. The pinnæ are of considerable length, each having the jointed chordoid axis. They continue long till near the basal web of the terminal process, when a few shorter occur.

The body in all the examples observed is considerably smaller than that of *C. fauveli*, and is nearly of the same diameter throughout the anterior three-fourths, though a little tapered in front. It then diminishes gently to the tail, which is by no means acute. It is somewhat flattened and grooved anteriorly on the dorsum, and grooved ventrally from the ninth scute backward. A papilla marks the anus at the tip. The number of segments would appear to be about fifty, and they are distinctly marked, with the exception of the minute caudal rings. The anterior bristles are in two groups—an upper, with longer shafts and tapering winged tips, and a lower, of spatulate form, with a short tapering process at the tip. The tufts are fewer and smaller than in *C. fauveli*. Posteriorly in front of the tail the tips

of the bristles are greatly elongated, and they slope forward rather than backward, projecting on each side as a fine fringe.

The anterior hooks are similar to those of *Chone fauveli*, though smaller, the posterior part of the crown is less rounded, and the three or four teeth above it very sharp. The posterior hooks, while generally resembling those of the common species, have somewhat higher crowns, five to six teeth being clearly visible above the great fang. The posterior part of the crown is also less rounded, as is the posterior outline. The main fang is proportionally shorter, since its point does not project beyond the line of the prow. Another feature is that the crown with its small teeth is on a level with the outer surface of the main fang, whereas in *C. fauveli* the four large teeth above the main fang fit into a convex outline. The figure of Langerhaus *, though poor, clearly indicates the species.

Chone reayi †, sp. n., the sixteenth form, comes from Shetland, off the coast of Ireland, and from the Channel Islands.

The cephalic plate has a thinner but fuller collar than in *Chone fauveli*, and its edges are turned in dorsally, sloped inward and backward to be fixed to the first segment on each side of the middle line and to the sides of the groove in front; but its anterior margin is well behind the free edge of the collar above, and no continuation of this part occurs in front—a distinctive feature with such as *Chone duneri* and others. As in the former species, the fissure presents a pouch at the attachment of the collar posteriorly. The collar passes with a slightly crenate margin nearly straight to the ventral surface, but from attachment the free rim is there narrow. The pedicle of the branchiæ does not project beyond its edge. In this species the bases to which the branchiæ are attached are different, for they form two semi-circular soft grooved lobes, which do not project beyond the margin of the collar in lateral view. To the inner (median) or straight edges the tentacles are attached, and the whole base is constricted posteriorly, so that it is mushroom-like. There is no bifid process of the lip-membrane as described by Southern in *Chone filicaudata*.

Each branchial filament has a large camerated chordoid

* Zeitsch. f. w. Zool. Bd. xxxiv. p. 114, Taf. vi. fig. 34.

† Named after Lord Reay, K.T., who has so long taken an interest in the marine work at St. Andrews, and who auspiciously opened the Gatty Marine Laboratory in 1896.

axis, which extends into the elongated terminal process as a fine thread. The long pinnæ arise in a double row, and continue to the base of the terminal group, the sides of which have a series of short pinnæ, giving a character to the organ, and which gradually diminish, leaving a smooth subulate filament—much shorter than in *Chone duneri* and of a different character—at the end of the branchia. As a transparent object the filament presents a series of rounded areas inside the chordoid axis, which probably represent the bases of the pinnæ. Few species show a more distinct structure of these organs.

The body is shorter and smaller than in *C. fauveli*, the largest example being fully an inch in spirit and having about fifty-five segments, of which eight bristled are anterior. It is rounded throughout the greater part of its extent, especially dorsally, and only at the posterior third is the ventral surface flattened as it tapers to the tail, the tip of which projects as a special process with an oblique end, the slope of the anus being from above downward and forward. A little pigment occurs dorsally and ventrally at the tip, which in a small example had a minute filiform process, so that *C. filicaudata* is not the only form so provided. From the dorsal fissure at the collar a groove runs backward in the middle line to the end of the seventh bristled segment, then slants to the right across the eighth dorsally and the ninth ventrally to the middle line at its posterior border, and thence backward to the tip of the tail. The segments show a few transverse markings, but only a few of the anterior ventrally are distinctly divided into two rings. The anterior region has eight bristle-tufts and seven uncinigerous rows.

The first bristle-tuft consists of simple bristles, but the second and those following in the anterior region consist of two kinds—viz., a dorsal series of translucent bristles, with a pale golden sheen when viewed under a lens, and long tapering tips with very narrow wings, which disappear before reaching the extremity, and of a spatulate ventral series with cylindrical shafts, the tips of which project little from the surface and end in a delicate filament. The wings are at first narrow, expand into a spathulate region, then gradually cease as a narrow rim on the base of the terminal filament. The prolongation at the tip distinguishes this bristle from the corresponding one found in *C. fauveli*. The succeeding region of the body has only the narrow winged tapering bristles, which, as in front, have a distinct curvature. Toward the posterior end the bristles elongate, and are

directed downward and backward, or just in front of the tail downward and forward. In these elongated bristles the wings are indistinguishable. A few shorter bristles, probably in process of development, occur in these tufts.

The striated shafts of the long anterior hooks are even more tapered at the insertion than in *C. fauveli*, and they increase in diameter upward to the shoulder, which gently diminishes to the stout neck. The great fang leaves the throat nearly at a right angle, and on the crown above it in lateral view are five or six teeth. The neck and shoulder of these hooks have a forward curve, so that the head is carried backward. The posterior hooks have a convex anterior and a concave posterior outline, but the base is not bent backward as in the ordinary avicularian forms. The main fang leaves the throat at somewhat less than a right angle, and is strong and sharp. Above it is a series of four or five or more small but distinct teeth. The slightly-curved neck dilates a little as it merges into the stunted shaft or base, which has a slight flexure backward, the character of the hook being thus diagnostic, and so different from those of species of *Chone* hitherto described. In a variety from Finmark the bases of these hooks are tapered into shaft-like processes, and the whole series constitute in each foot an elegant fan. They form a single row.

Chone filicaudata, Southern, from Clew Bay, Ireland, is the seventeenth species, and differs from *Chone duneri*, Malmgren, which it approaches in the presence of a bifid process of the lip-membrane, in the form of the posterior hooks, which have a higher crown and more numerous teeth above the great fang in lateral view. It also has a conical anal appendage. The terminal process of the branchial filament has a central axis and a web on each side. It is the rule, however, for the posterior hooks in most species of this genus to have higher crowns. The occurrence of a caudal filament on *Chone duneri* in certain cases, however, makes the distinction less evident, yet the posterior hooks diverge.

Jasmineira elegans, De St. Joseph, a southern form, is the eighteenth species. The cephalic lobe, when the branchiæ are removed, presents a mushroom-shaped basal region—that is, it is constricted proximally and dilated distally, and has a median cleft. It is marked externally by longitudinal lines or grooves. From the ventral edge of each half three or four slender smooth tentacles (four to six, *De St. Joseph*)

project. A well-marked collar is present, with a dorsal fissure as in *Chone* and an entire ventral margin. De St. Joseph describes linear eyes on the fused buccal and first segment, but these were not observable in the spirit-specimens. The number of the branchiæ is from eight to twelve on each side, and they show two chordoid cells in transverse section. They have a double row of ciliated barbules, and terminate in a naked process with a thickened base.

De St. Joseph observes that the foregoing fused segments have, besides the eyes, two branchial heads, two red thoracic organs debouching by a common canal at the base of the branchiæ dorsally, and two otocysts with trembling otoliths. Fauvel*, however, states that in the closed otocysts, to which group those of *Jasmineira* belong, the "trembling" is due to Brownian movement only, as there are no cilia.

The body, which in spirit is about an inch in length, has the outline of *Chone*, and is little tapered till the posterior third. It ends in a slender tip, with a conical papilla above the anus. The anterior region consists of nine segments, the posterior of twenty-four or twenty-five segments, or even more (De St. Joseph gives a total of forty). The ventral groove cuts through the right edge of the eighth ventral shield in its progress to the dorsum. The ventral shields commence anteriorly by two small ones, and the next seven, which are entire, rather increase from before backward. The scutes of the posterior region are in pairs, being distinctly separated by the broad ventral groove. Diminishing in size, they become invisible on the minute terminal segments. The first bristle-tuft is small and occurs near the posterior border of the united buccal and first segments. It consists of simple but by no means feeble bristles, the shaft a little diminished at the neck, so that the slightly curved tip with its narrow wings and acute point is clearly differentiated. Nine bristle-tufts occur anteriorly. The bristles of the anterior region generally consist of two kinds, viz., winged capillary bristles with the slightly curved and acutely tapered tips, and spatulate forms the wings of which rapidly dilate, terminate abruptly, and have a short median process, often bent. The bristles of the posterior region, which are below the hooks, are of one kind only (viz., the simple, winged, tapering form), but the tips have, even in the first part of the region, a tendency to elongation, and toward the end of the tail the tips of the bristles are extremely elongated, so as to resemble fine hairs, though the narrow wings

* *Op. cit.*

can generally be noticed at the end of the shaft. The distinctions in this respect had not been observed by De St. Joseph.

The anterior crotchets have long curved shafts, commencing as narrow bases, but gradually dilating to the shoulder, which continues the curve and is narrower than the adjoining part of the shaft. The neck is not constricted and the main fang leaves it nearly at a right angle, whilst on the crown are numerous small teeth. The whole crotchet has the curvature of a bow. De St. Joseph speaks of nine crotchets only, but occasionally about twenty are present; and since their narrow bases occupy a comparatively small area, the group has the form of a fan, the broad tips requiring more space for the action of their armature. The hooks of the posterior region differ from those of *Chone* and *Euchone*, and more resemble the type of the Sabellidæ. They are characteristically **S**-shaped, the base being smoothly curved anteriorly, convex inferiorly, and turned upward posteriorly. A slight constriction occurs at the neck, from which the main fang comes off at less than a right angle, and is long and sharp, whilst on the crown above are numerous minute teeth. The posterior outline bends forward at the crown, then backward, and has a bold forward curve in the main part of the body.

The differences between this species and *J. caudata*, Langerhans, which Mr. Southern procured in Clew Bay, seem to be slight—mainly the elongated caudal process, as in the form procured at Madeira by Langerhans.

Jasmineira caudata, Langerhans, 1880, is the nineteenth representative, and it appears to differ from *J. elegans* only in the presence of a filiform anal appendage. Mr. Southern states that the structures of the bristles and hooks agree, but that the number of "abdominal" segments is twenty (seventeen, *Langerhans*), whilst *J. elegans* had from twenty-eight to thirty-two. The collar of *J. caudata* appears to be somewhat higher than, and not so oblique as, that of *J. elegans*. Mature specimens occurred in May. Dredged in 17 fathoms in Clew Bay.

The twentieth species is *Haplobranchus æstuarius*, A. G. Bourne, a minute aberrant Sabellid from the estuaries of southern rivers and also from the mouth of the Liffey, Dublin (*Southern*).

The twenty-first form is *Myxicola infundibulum*, Montagu,

in which the cephalic region differs from that of a Sabellid in the absence of a collar, for the first segment is smoothly rounded on each side to the base of the branchial fans, whilst ventrally a triangular process passes forward in the middle line below the division between the branchial fans, and dorsally a slight projection also points between the fans from the anterior end of the groove. Montagu describes the mouth as purple, whilst the lips are bordered with chestnut. Dalyell found no tentacles, and Malmgren's tentacles refer to the frilled processes on each side of the mouth.

The branchial fans appear to cling more tenaciously to their bases than in ordinary Sabellids, and comparatively few of the preparations are devoid of them. The filaments range from twenty-one in each fan (Shetland) to thirty-seven (South Devon), and they are connected by a web (which Claparède states is ciliated externally) almost to the tip, as in *Chone*. In structure each filament agrees in the main with that in *Sabella*, the camerated chordoid axis passing along its entire length, and a slender continuation of it reaching to the tip of the terminal process, which has a tapering web on each side, and is often deeply tinted purple. The pinnæ are comparatively long, and likewise have a chordoid axis (not distinctly camerated), and they taper a little from base to apex. Toward the tip of the filament the rows of pinnæ terminate in a double series of papillæ, which, like the pinnæ, are alternate. The branchial plumes or fans are of a rich dark chocolate-brown in life, the brown being chiefly confined to the filament externally, and the pinnæ, which are capable of independent motion, are of a rich purplish red. The bases externally, however, are of the colour of the body, viz., a dull orange hue. The two branchial fans are often separated to their bases during the movements of the animal. Montagu describes them as singularly beautiful and of a purple colour, darkest at the tips of the rays, and the pinnæ of a chestnut colour, shaded to purple near the centre. In the Zetlandic specimens, 2 or $2\frac{1}{2}$ inches long, the body had the diameter of an ordinary quill, the branchial fan measured about $\frac{1}{2}$ inch antero-posteriorly, but when the fans were flatly extended laterally their diameter was about an inch.

The body in the preparations is somewhat fusiform, for, besides the distinct tapering posteriorly, it is narrowed in front, and in life it sometimes assumes the same outline. It is rounded throughout except anteriorly, where, on the dorsal surface, a groove passes backward in the middle line

to the eighth segment, which it cuts obliquely as it goes to the right, and ends ventrally about the middle of the ninth. In some, traces of the median groove are found behind the slope to the right in the eighth segment. It is of a dull orange hue throughout, or in some pale, though in the Zetlandic specimens a distinct white ring went entirely round the body in front of the third segment-junction. Montagu mentions that the body is "of an orange colour annulated with whitish." The number of segments varies, for Montagu gives the large southern form of 8 or 10 inches in length no less than one hundred and fifty to one hundred and sixty segments, whereas the smaller Zetlandic examples (of 2 or $2\frac{1}{2}$ inches) had but forty-five to fifty-two. The segments are distinct, but little differentiated dorsally and ventrally, and therein differing from the ordinary Sabellids, but they often show one or more rings—especially one ventrally near the posterior border, and in some examples a slight peak occurs at the posterior border of each near the posterior third. The segments become narrow at the tapering posterior end, and terminate in a median anus at the somewhat blunt tip.

The vascular system contains greenish blood, and is similar in arrangement to that of the Sabellids (*Claparède*). This author holds that a contractile sinus envelops the intestine, and he is probably right. Contrary to the view of De Quatrefages, Claparède states that the nerve-cords, double in front, are not separated behind, but form a single cord with a large neural canal (his "fibre tubulaire"), and in certain sections that canal has a larger area than the nerve-tissue, which would seem to show that the term "neural canal" (1879) is not out of place.

The anterior region has eight bundles of bristles, which are of uniform structure, viz., they have long, straight, slender, cylindrical shafts, and finely tapered though rather short tips slightly bent backward, and with narrow wings. In rear of the fascicles of bristles Claparède (1870) mentions the occurrence of minute ocular spots, formed of a crystalline body surrounded by pigment. This has not been observed in the preparations. Posteriorly the translucent bristles are both more minute and more slender, and the shafts are tapered toward the tip, which has a curvature as in front and a trace of a wing on each side. The forward projection of the prow approaches that of the Polycinids, but the great size of the secondary tooth differs.

The anterior region ventrally has groups of about eight long crotchets, which in general outline somewhat resemble

those of Oligochæts. The shaft is long, gently curved, tapered inferiorly, dilating at its distal third into an indistinct shoulder, from which it is gently tapered to the throat below the main fang. The neck is stout and nearly straight, and the main fang, which arises at a wide angle to the neck, is blunt, whilst on the crown, which slopes downward in lateral view, are a few small teeth. Under pressure the hook often lies so as to give an antero-posterior outline, which is hastate, a constriction occurring behind the great fang, from which a gradual enlargement occurs to the shoulder, beneath which it again tapers to the base. The usually acute Claparède had overlooked these organs. The terminal hook of the row shows a more simple form, without spikes in the crown. The posterior hooks are large and avicular, are identical with the type as figured by Malmgren, have a base much produced anteriorly, the anterior outline of the neck curving from the main fang in a convex manner downward to a blunt prow, the inferior outline being slightly concave, as also is the posterior outline. The main fang is long and sharp, and above it is a comparatively large secondary tooth.

This is, in all probability, the *Myxicola steenstrupi* of Kröyer *, though the description is so lax that it is difficult to be certain. He did not observe the hooks.

A *Myxicola* procured between tide-marks, Herm, in 1868, offers certain peculiarities distinguishing it from *M. infundibulum* and *M. viridis*, as well as *M. dinardensis* of De St. Joseph, though the absence of anterior hooks leaves a margin of doubt in relation to the last-mentioned. It is a small form, measuring about $\frac{3}{4}$ inch in total length, and having the typical condition of the cephalic region and collar. The branchiæ are of moderate length, and have broader wings and less tapered tips on the distal processes of the filaments than in *M. infundibulum*.

The anterior region seems to be short, as in *M. dinardensis*, which has only three segments, and in the specimen from Herm the long crotchets appeared to have only a single tooth above the main fang, as in *M. viridis*. The posterior hooks came far forward, and in structure they differed from those of their allies, for the main fang is proportionally larger and the tooth above it is only about half its length, and thus contrasts with the condition in other forms. The basal region has a nearly straight inferior border, to which the prow curves downward.

* Oversigt Kgl. danske Vidensk. Selsk. Forhandl. 1856, p. 35.

Whether this is an example with the anterior region in course of reproduction or a variety is uncertain, but its features are worthy of note.

Myxicola viridis, Milne-Edwards, the twenty-second species, occurred in the mud of a mass of *Filograna* procured off the Bell Rock, St. Andrews Bay. The cephalic region seems to agree with that of *M. infundibulum* both in the absence of a collar and in other respects.

The branchiæ form a rich green spiral mass in repose, a position often assumed in its sheath under examination; but when it protrudes, the anterior end of the branchiæ spread out as a double fan of nine or ten filaments, which have a chordoid axis and a terminal process, which differs from the tapering elongated one of *M. infundibulum* in maintaining its strap-like breadth till near the tip, where a short tapered region occurs. The body is capable of considerable elongation, and the total number of segments is about forty-seven, eight anterior and thirty-nine posterior. A well-marked papilla at the anus terminates the body posteriorly. The colour is a rich green, the central interspace being darker. The first pair of bristle-tufts has a different direction from those which follow, being directed obliquely forward and outward. The anterior bristles are the most conspicuous—indeed, in a specimen so minute the posterior at first escape notice. The typical anterior bristle has a slender translucent shaft and finely tapered tip and narrow wings. The posterior bristles are more minute and the wings less distinct. Many present a curvature at the commencement of the tip.

The anterior hooks are in groups of five or six, and are long *f*-shaped structures which resemble somewhat those of Oligochæts. The wide region or shoulder is in front of the middle, the shaft tapering posteriorly to the base and anteriorly to the long neck, which is almost straight. The main fang leaves the neck nearly at a right angle, and is short and sharp, and on the crown above is a single prominent tooth. The whole organ thus characteristically differs from that of *M. infundibulum*. The posterior hooks are minute, having a long sharp main fang, and another above it almost as long, a nearly straight posterior outline, and a short base directed forward. The annelid secretes a transparent gelatinous tube in captivity.

At least two species of *Myxicola* thus inhabit British waters; but, in regard to the green example, it may be a question whether it is not a marked variety, with more transparent branchiæ, of the type with the minute bifid

anterior hooks. Fresh investigations are necessary. Only a single specimen has hitherto been obtained.

A *Myxicola* from Plymouth, while agreeing generally with *M. infundibulum*, differs in the structure of the anterior hooks, for they are rather slender, with a slight enlargement at the shoulder, and the distal end is curved like a shepherd's crook with a sharp point (main fang). It is a question how far this is due to the age and size of the specimen, but it was a feature in every hook observed. It is curious that no example of this genus was procured by the 'Challenger,' its representatives, perhaps, being chiefly littoral or confined to comparatively shallow water.

Dr. Allen includes *Myxicola æsthetica*, Claparède, in the fauna of Plymouth, but the distinctions indicated by the Swiss author are uncertain, and he overlooked the long crotchets in the anterior region of *Myxicola infundibulum*.

2. *On the* Sabellidæ *dredged by H.M.S. 'Porcupine' in* 1869 *and* 1870, *and by H.M.S. 'Knight Errant' in* 1882.

In the 'Porcupine' Expedition of 1869 *Sabella penicillus* came from various parts of the west coast of Ireland, and *Potamilla reniformis* in 90–100 fathoms on "Porcupine Bank" off Ireland. In the Expeditions of 1870 *Sabella penicillus* was dredged in 30–40 fathoms off Dingle Bay, and again at Station 50, lat. 36° 14′ N., long. 17° 30′ E., in 7–51 fathoms, on sand and muddy sand. *Sabella hystricis*, sp. n., was procured at No. 27 in 322 fathoms, in fine grey mud, bottom-temperature 51°; *Chone duneri* at No. 29, in 227 fathoms, bottom-temperature 55°. *Branchiomma kollikeri*? was brought up on the sounding-lead in 64 fathoms in Setubal Bay. A fragment of a *Sabella* occurred 9 miles off Cape Finisterre in 81 fathoms, on a hard bottom with sandy mud, bottom-temperature 53°; and another from Ras el Amoud in 45 fathoms. In the 'Knight Errant' *Sabella southerni*, sp. n., was met with at Station 8, in 540 fathoms; *Sabella murrayi*, sp. n., in 555 fathoms at Station 11; and *Chone duneri* in 53 fathoms at Station 3.

Sabella hystricis, sp. n.

Dredged in the 'Porcupine' Expedition of 1870 at Station 27 in 322 fathoms, in fine grey mud. The single example appears to have been dried, but, so far as can be observed, the branchiæ and the general surface are pale. The collar shows a wide dorsal gap in the middle line, and

the wide lateral flap is separated from the ventral flaps by a notch, and the frilled flaps themselves almost touch in the middle line. The number of the branchiæ in each fan is not less than twenty, the filaments are of moderate length and appear to have a terminal process of considerable length, but the specimen is not in a condition to be certain on this point. The specimen is incomplete, only the injured anterior region adhering to its tube remaining; but the rounded dorsal surface shows no trace of a groove, whilst the slightly flattened ventral surface has a pale median streak with a dotted line on each side, as if a nerve-cord were indicated.

The segments of the anterior region are narrow (anteroposteriorly) and the ventral scutes are indistinct. Above the closely arranged bristle-tufts of the region is a small dark speck. The anterior bristles are in three groups, the longer upper series (Pl. IV. fig. 1) having straight shafts and slightly curved, finely tapered tips, without distinct traces of wings. The next series is only a little shorter, but the tips are diminished and the wings broader (Pl. IV. fig. 2). The third series projects little beyond the surface of the setigerous lobe, and their tips have fully broader wings than the second series. The little pigment-speck near the commencement of the row of hooks is somewhat conical in outline, since it is pointed internally and appears to be composed of granules of dark pigment. The anterior hooks are avicular and characterized by the distinctness of the teeth above the main fang (Pl. IV. fig. 3), about six being visible in lateral view. The main fang leaves the neck at considerably less than a right angle, the posterior outline curves forward at the crown, so that the region is convex, the prow projects almost as far as the tip of the main fang, and the posterior process is short and slightly tapered distally, and in contrast with such hooks as those of *Potamilla reniformis* it would appear to be rudimentary. Only faint striation occurs at the curvature between neck and base. No accessory short bristles accompany the hooks. The tube is composed of tough secretion coated at one end with fine mud.

Sabella southerni *, sp. n., was dredged by the 'Knight Errant' at Station No. 8, 17th August, 1882, at 540 fathoms, along with a sponge. The fragmentary specimens appear to

* Named after Mr. R. Southern, B.Sc., of the Irish Fisheries Department, who has done so much good work on the Annelids and other marine forms on the western and other coasts of Ireland.

belong to a small species about an inch or a little more in length. Thus the cephalic plate and collar were so injured that all that can be said is that the ventral edge of the collar was rather full and the two sides separated only by a narrow fissure; but no reflection seemed to occur. The lateral regions appeared to be entire up to the dorsal edge. Dorsally in every instance the parts adhered to the tube, and the collar seemed to be rudimentary. Behind the ventral collar were two inner curved ridges surmounted by the bases of the branchiæ. The branchiæ in the preparation were pale and about ten in number in each fan, the pinnæ being of moderate length and continuing nearly to the tip, which in some was blunt, in others with a short subulate process; but the preparation was unsatisfactory, the tips being incurved and adherent to the tube. The anterior bristles are pale golden and in two groups—a dorsal longer series, few in number, with straight shafts and finely tapered winged tips (Pl. II. fig. 1), and a more numerous series, with oar-like tips from the breadth of the wings (Pl. II. fig. 3), some having and others not having a slender median prolongation of the axis at the tip. The tips of the small posterior bristles are much elongated, especially dorsally, and have a distinct curve. Narrow wings occur in the longer and broader in the shorter forms (Pl. II. fig. 2). The anterior hooks (Pl. I. fig. 10) have a rather high crown, which is often indicated by a transverse line, a long neck, and a wide gulf anteriorly, whilst the posterior outline is nearly straight except the forward curve at the crown. The base forms a wide angle with the posterior outline, and the prow is only moderately prominent. The base is comparatively short. Numerous small teeth occur above the main fang. These hooks are accompanied by a series of short bristles, the tips of which in certain views looked like an elephant's foot from the thickness of the shaft, though in most views the tip ended in a point (Pl. I. fig. 11). The posterior hooks are smaller, but retain the characteristic features of the anterior.

The tube is composed of fine grains of sand mixed with a number of minute Foraminifera.

Sabella murrayi, sp. n.*

Hab. Dredged at Station 11 by the 'Knight Errant' on 23rd August, 1882, at a depth of 555 fathoms.

* Named in honour of the late Sir John Murray, whose career, from the time of his being sent in 1871, by Sir Wyville Thomson, to Murthly

The cephalic region dorsally has a wide collar which passed inward and forward in the median furrow to which it was attached. Thus the collar participated in the groove and thinned off at its anterior end. Moreover, the frilled edge passed backward to the anterior border of the second bristled segment, and, forming a V, coursed forward again to join the lateral rim of the collar. The edges of the V were free, and thus greatly contributed to the extension of the collar. Laterally the collar was apparently unbroken, and continued to the large ventral recurved lappets which were fixed at their inner edge to the cephalic plate, the free lamella on each side covering much of the first scute. From the inner edge of each lappet a conspicuous membrane stretched forward to be attached to the edge of the branchial fan, thus extending about a fourth of the total length of the branchiæ. The basal region of this peculiar web was expanded into a wide disk or lamella, the edges of which were more or less curved (Pl. I. figs. 1 & 2), so that from the ventral surface a large semicircular plate flanked the vertical ridge at each side. The function of this remarkable apparatus was probably connected with alimentation in its abyssal habitat, an unusually powerful and extensive current being thus directed forward between the lamellæ to the region of the mouth. The whole arrangement of the collar is, so far as known, unique, and carries further the condition indicated by those of *Chone duneri* and to a less degree by those of *C. infundibuliformis*. In front of the groove with the fixed anterior folds of the collar, the branchiæ dorsally presented a solid base, whereas ventrally a wide groove ran forward between the fans, and over the mouth lay a mass of débris rich in Foraminifera, fragments of Echinoderms, and other organic structures. The anterior edge of the ventral membranous ridge was fixed to the base of the lower edge of the branchial fan of its side, and to this were attached five or six short and slender branchial filaments, the rest being much larger, the total number being about fifteen in each fan. The branchial filaments were softened and injured, but they seemed to have the normal structure, only a single filament having a tip more

(to be initiated into the preservation of marine animals) to his successful conclusion of the 'Challenger' publications, has been watched with interest. Sir Wyville then thought he would attend to the preservation of the contents of the dredges and trawls as well as to the skins of birds. He afterwards had much work with the tow-nets, and was anxious to describe the Radiolarians, but these went to Prof. Haeckel. To Sir John was assigned the bottom-deposits.

or less complete. In this the stout filament tapered distally, the pinnæ diminishing to small papillæ, then a free process from the tip of which a very long thread-like appendage projected. If such is the normal condition in this curious species, it is little wonder no others were perfect. The body is about $1\frac{1}{2}$ inches long, the branchial region being fully $\frac{1}{2}$ inch more, and the segments are about fifty-eight. It is flattened both dorsally and ventrally with the exception of the anterior region of the scutes, a median groove running the entire length dorsally and from behind the anterior region ventrally. The tail especially is flattened and oar- or spatula-shaped, the diminution at the tip being slight. The anal slit is ventral, and on each side is a rounded papilla (or cirrus) on a short stalk. The flattening throughout the greater part of the body is characteristic; and the constriction in front of the spatulate tail is well-marked. The anterior bristles follow the normal condition in the genus, viz., a longer and a shorter series. The longer bristles (Pl. I. fig. 3) have cylindrical golden shafts with a marked slant backward after the commencement of the narrow wings and a finely tapered tip. The shorter forms (Pl. I. fig. 4) have a broad paddle-shaped tip with a distal median process—the continuation of the tapering shaft. Whilst the latter presents no striæ, the broad wings which form the paddle are striated longitudinally. Posteriorly the tips of the longer bristles become more and more elongated and the wings narrower, until toward the end of the tail they are invisible on the hair-like extremities of the attenuated bristles. The shorter forms, again, undergo a similar change, the tips elongating and the wings becoming narrower, though they always retain a much broader and shorter tip than the foregoing. Indeed, in the caudal region the bristles increase much in strength while diminishing in number, and a tendency to assume the knife-blade outline is noticeable, a constriction of the shaft occurring below the tip. These stout caudal bristles evidently have special functions.

The anterior hooks (Pl. I. fig. 6) are remarkable for their high crowns and for the great proportional length of the base, which in this species appears to be of a tougher nature—in fact, they simulate the condition in such forms as *Pista*, *Terebellides*, and *Chone*. The main fang makes a small angle with the neck, and its base is differentiated almost to the posterior outline of the hook, whilst above it the elevated and bluntly conical crown shows in lateral view five distinct teeth and several indistinct upper ones. The

nearly straight posterior outline presents a hump above the base; the prow is rounded in front, and the elongated base is gradually tapered backward and curved, so that, mingled with the largely developed bristles which accompany them, the structure of the hook-row is noteworthy, and it is often difficult to distinguish the shaft of the bristle from the long basal pedicle of the hook. The cuspidate bristles (Pl. I. figs. 7 & 8) which accompany the hooks have long curved shafts, narrowed at the basal extremity, and also constricted below the spear-shaped tip, which is bent at an angle to the shaft and tapered to a fine point—longer in some, shorter in others. So far as observed, no other species has similar bristles, the majority showing the short paddle-like forms. The posterior hooks (Pl. I. fig. 9) are sharply defined from the anterior by the truncate base and the anterior projection or prow. They have the high crown with the boldly marked teeth, and the absence of a prow makes the neck long. The bases vary in length, that represented being an average example.

Branchiomma kollikeri, Claparède*, var. of *B. vesiculosum*?.

Procured during the 'Porcupine' Expedition of 1870, in 64 fathoms, in Setubal Bay. It was brought up on the cup-lead. In general outline this somewhat resembles *Chone*, though readily distinguished by the large eyes at the tips of the branchial filaments and the number of the anterior scutes. Dorsally the collar presents a deep median furrow, with an eminence or boss on each side covered by a rounded flap. A little behind this is the origin of the collar proper, which springs from the dorsum of the second segment, passes downward and forward, and ends in a rounded edge on the ventral surface, but as the example had been injured it was difficult to compare it with *B. vesiculosum*.

Half of the branchial funnel seemed to be present, viz. about thirty-one filaments, the first dorsal of each side being much larger than the others. The filaments generally are stiffer than those of *Sabella*, and in the preparation are slightly coiled and the tips incurved. Each consists of a stem flattened laterally and externally, the former having the larger diameter and diminishing toward the tip, which ends in a pair of compound eyes and a median process or tentacle (Pl. IV. fig. 7), a slender tapering process. The pinnæ are of great length and slenderness, forming a delicate fringe to the inner edge of each filament, and they

* Annél. Chétop. Nap. p. 423, pl. xxii. fig. 4.

are especially long a short distance from the tip; then diminishing in length, they end rather abruptly a short distance within the ocular region, which is somewhat clavate with the tapering tentacle projecting distally. The filament has a similar chordoid skeleton to that of *Sabella* and a jointed axis continued into each pinna. The whole apparatus is stiffer than in the ordinary *Sabellæ*, and the pinnæ finer and more thread-like. Some of the filaments have no eyes, the diminished tip ending in a long slender tentacle with a chordoid axis in the centre. Moreover, the pinnæ in these do not terminate abruptly, but gradually becoming shorter end in a series of short papillæ (rudimentary pinnæ), from which the long tentacular process projects. A series of short tentacular filaments project from each side of the oral fissure. No large tentacle occurred in this injured example. As Claparède observes, the eyes are confined to the dorsal half of the fan.

The body is of considerable length—probably, when complete, having a length of 4–5 inches. It is flattened anteriorly on the dorsum, as well as grooved for some distance from the collar backward. The ventral surface is rounded anteriorly, the first region having eleven scutes which have their long diameter transverse, whereas the median furrow splits the succeeding scutes, the long diameter of which is longitudinal. The specimen is imperfect posteriorly.

The anterior region has eleven setigerous processes, the first being small, but all the bristles have the same structure, viz. straight striated shafts with tapered bases, and tapering tips with moderate rings, obliquely striated and with serrated edges. The same structure characterizes the posterior bristles, except that the tips are more elongated. The most posterior, however, are absent. All the bristles are deeply immersed in the tissues. Ten rows of hooks in single series occur on each side in the anterior region, and these are longer than those in the next division. The anterior hooks (Pl. III. fig. 10) are avicular, being distinguished by their moderate necks and greatly elongated tapering bases. The main fang has a series of very fine teeth above it, and these are so fine that in preparations which have been long mounted they are difficult to see. The crown has a forward curvature, but thereafter the posterior outline is straight till it reaches the base. As the great fang leaves the neck at less than a right angle, and as the prow is prominent, the anterior outline is deeply concave. The somewhat tapered prolongation of the base is marked, and the neck and base are striated. These hooks

are accompanied by short flattened bristles with spatulate or beaked tips and pennant-like flaps. The posterior hooks do not differ from the foregoing, except in size and in the shorter bases (Pl. III. fig. 11). The tube of the example is fully 10 inches in length and thicker than a goose-quill. It is composed internally of tough secretion—tinted at one end of an ochreous hue, and coated externally with minute pebbles or coarse sand-particles, fitted neatly together, and with an occasional fragment of shell.

Claparède separated *B. kollikeri* from *B. vesiculosum* by the presence of the two eyes on the tips of the branchial filaments, but the British species has the same arrangement, and, unfortunately, he does not figure the hooks of each, so that certain features still require elucidation. So far as can be observed, the bristles and hooks in each case are practically identical, and so with the smaller flag-bristles which accompany the anterior hooks. The terminal process of the branchial filament is longer in the large 'Porcupine' form, but such may be the effect of age. On the whole, it would appear to be a variety of *B. vesiculosum*.

3. *On the* Terebellidæ *and* Sabellidæ *dredged in the Gulf of St. Lawrence, Canada, by Dr. Whiteaves in* 1871–73.

Amongst the Terebellidæ procured were *Amphitrite grœnlandica*, off Port Hood, Cape Breton, the widely distributed *Amphitrite cirrata*, O. F. Müller, off Cape Rosier Lighthouse; *Sabella*, AB, from the same locality. *Pista cristata* was not uncommon at Station A 1, 1872; between Cape Rosier and Cape Gaspé, in 75–80 fathoms, on stony ground, No. 2, 1872; and in 210 fathoms, S.W. point of Anticosti. In the first-mentioned the tube was composed of hard secretion, minute stones, and mud. The ubiquitous *Thelepus cincinnatus*, O. Fabr., abounded in various localities, such as near Orphan Bank, off Anticosti, and off Cape Rosier Lighthouse. Many of the tubes were smaller than the British representatives, and attached on one side, but made of similar materials. The curious *Lanassa nordenskioldi*, Mgrn, was dredged off Nova Scotia at Station No. 6, 1872, and Nos. 35 and 36, 1873, whilst the equally interesting *Artacama proboscidea*, Mgrn., occurred in Gaspé Bay in 30 fathoms. Fragments, apparently of *Erentho smitti*, Mgrn., again, were found in 170 fathoms off Caribou Island, and between Cape Rosier and Cape Gaspé. No form was more abundant than *Terebellides strœmi*, Sars, which seemed to range over the whole area, from 100 to 220 fathoms. The

widely distributed *Sabella penicillus*, L., was procured at Station No. 10, 1872, and Nos. 35 and 36, 1873, besides being dredged in 220 fathoms between Anticosti and the shore. *Potamilla reniformis*, O. F. M., occurred between Pictou Island and Cape Bear, Nos. 46–48, 1873, in firm sandy tubes. *Potamilla torelli*, Malmgren, was common at Stations Nos. 46–48, 1873, and between Pictou Island and Cape Bear, No. 56, 1873. *Chone duneri*, Malmgren, along with a fragmentary *Euchone*, occurred at Station No. 2, 1872, and *Chone princei*, sp. n., at various Stations in the Gulf of St. Lawrence; whilst further north, in Godhavn Harbour, Disco, a form approaching *Chone fauveli*, occurs.

Euchone (?) *lawrencii*, sp. n.

Dredged in the Gulf of St. Lawrence at Station 2, 1872.

Only a fragment of the anterior end without the branchiæ is present along with *Chone princei*. The collar, which is rather full, runs from the ventral surface, where it is entire, with a very slight slope backward to the dorsal surface, where its edge turns in to be attached to the middle line as far forward as the base of the pillar for the branchiæ, which does not project so far as the rim of the collar. Eight segments are bristled anteriorly, and the dorsal furrow passes downward between the eighth and ninth segments, cutting the ninth obliquely to the median line, along which it is continued. The species seems to be a large one, the body being about 3 mm. in diameter anteriorly. The bristles were absent. The lower anterior hooks (Pl. II. fig. 11) had stout curved shafts, in which a long enlargement below the indistinct shoulder and a short neck occurred, the bold striæ of the shaft passing upward almost to the main fang, which forms a little more than a right angle with the shaft, and there were several (three or four) small teeth above it. The posterior hooks differ from those of *Chone*, and more nearly approach those of *Euchone*, having a nearly straight and long posterior outline (Pl. II. fig. 12), an almost straight anterior outline, and a truncated base, the neck being finely striated.

Chone princei *, sp. n.

Dredged at Stations 2, 6, 9, 11, 1872, and Stations 35 and 36, 1873, in the Gulf of St. Lawrence, by Dr. Whiteaves.

When the branchiæ are removed, the cephalic region (Pl. III. figs. 3 & 4) differs from *Chone reayi* in having

* Named after my early student, fellow-worker, and friend, Prof. E. E. Prince, now Dominion Commissioner of Fisheries for Canada.

the branchial basal region or pedicle more prominent and the tentacles on each side of the fissure well developed. Moreover, the collar is narrower, and it slopes from below upward and backward to the dorsal surface, where it ends in a broad, free, **V**-shaped pocket on each side—separated by a central fissure. Instead of the high fold on each side of the dorsal fissure the narrow collar makes a **W** of a characteristic form, since the inner margins run forward to the median groove of the pedicle, and the whole facies of the anterior end differs. A glandular or tubular organ is visible in each space of the **W**, for the cephalic plate is largely exposed in a dorsal view; ventrally the mouth appears as a longitudinal slit with thickened edges below the basal pillars of the branchiæ, and in some the thin buccal membrane is distended with mud. Moreover, the ventral margin of the collar is symmetrically sinuous, being prominent at the sides, and then passing with a curve to the central dimple. A distinctive feature is the prominence of the bases of the branchiæ, and their separation anteriorly,

The body, which is about 2 inches long and $\frac{1}{8}$ inch in diameter, is somewhat flattened anteriorly, more rounded posteriorly, and the segments appear to range from sixty to seventy. From the mid-dorsal fissure a groove passes backward to the posterior border of the eighth bristled segment, runs in the furrow between the eighth and ninth, then ventrally crosses the ninth obliquely to the middle line, and then passes to the posterior end. The segments are distinctly marked, those of the anterior region presenting a two-ringed condition ventrally. It tapers gently posteriorly, and then rather abruptly ends in a point with the anus at the tip, the segments being numerous and crowded in this region.

The branchiæ are of considerable length, are devoid of a web, and have a regularly camerated axis continued as a slender central process in the very long, tapering, terminal process, which has a few short pinnæ or papillæ at its base, the longer pinnæ gradually diminishing and ceasing at the base of the process. The number of the branchiæ would appear to be about a dozen on each side, and, besides the filiform cirri, two short, flattened, tapering tentacles occur dorsally.

The anterior segments have a median prominence in the form of a flattened cone laterally, and thus the bristles are unusually conspicuous, especially as a distinct setigerous process is present. The first tuft is composed only of

bristles with tapering tips and well-marked wings which are obliquely striated and probably minutely serrated at the edges, though this was not clearly seen in the spirit-preparations. The tips are slightly curved backward, and the shafts faintly striated. The tips of a shorter series, probably for replacement, project from the edge of the setigerous process. The succeeding bristles of the anterior region are arranged in two series—an upper with long straight shafts and shorter more finely tapered tips (Pl. IV. fig. 14), with proportionally broader wings than in the first series, the backward curvature occurring beyond the commencement of the wings, and a lower with spatulate tips terminated by a median filament (Pl. III. fig. 8). In the developing bristle various degrees of enlargement of the spatulate tips are observed, and the wings are more or less longitudinally striated. These bristles form a group moved by distinct muscles, as might be anticipated from their functions. The posterior bristles are longer and more slender, the shafts, however, being comparatively short, whilst the tips are of great length and finely tapered, with but slight curvature. The wings are so narrow as to be almost indistinguishable, though in the developing bristles with a portion of the tip protruding they are more easily recognized. These posterior tufts do not show a shorter series.

The anterior hooks (Pl. III. figs. 5, 6) have long curved shafts, which dilate from the base (proximal end) to the shoulder, where a slight constriction marks the commencement of the short neck, which again expands a little distally as it runs into the main fang in front and the rounded crown posteriorly. When inverted these organs simulate the human foot and leg. The main fang leaves the neck at rather more than a right angle, but the crown is quite flat except at the rounded posterior "keel." Numerous small teeth occur on the crown behind the main fang. The posterior hooks (Pl. III. fig. 7) lean to the type of *Chone reayi*, though quite different, for the shaft ends abruptly after only a slight curvature, so that no proper prow is formed and the neck is little differentiated. The main fang leaves the neck at an angle of 45°, the posterior outline curves forward to the somewhat high crown which has numerous minute teeth above the great fang.

Reproduction. A male had nearly ripe sperms in August.

Tube. The tube is a smoothly rounded firm structure of mud, which coats the internal chitinous lining. It is friable.

A *Chone* resembling *C. fauveli* comes from Godhavn Harbour, Disco, where it was dredged by H.M.S. 'Valorous,'

in 5–20 fathoms in 1875. The collar is deep all round like that of *C. reayi*, but the single example does not show the pedicle for the branchiæ (which are absent) on a level with the margin as in that species. Eight bristled segments occur anteriorly, the dorsal tufts having moderately elongated tapering tips with distinct, though rather narrow, wings and with a slight curve. The lower bristles are spatulate, with stout shafts which remain nearly cylindrical to the wings, then slightly diminish to a blunt tip, and the web is somewhat short with a smoothly rounded end. The bristles of the second region have shafts which are constricted distally, the tip thereafter making an angle with the shaft, the winged tip then tapering to a fine point. The bristles are of moderate length and rather stout, one in each tuft especially surpassing the others in size. They become longer and more slender toward the tail. The anterior hooks have stout curved shafts, which increase from the root or base to the shoulder and are striated and yellowish by transmitted light. The neck is translucent, stout, and the main fang, which leaves the neck at an obtuse angle, is short and strong, and has about four distinct teeth above it, the crown posteriorly projecting a little. The posterior hooks (Pl. III. fig. 9) approach those of *Chone fauveli*, but show only three teeth above the main fang instead of four in the British form, the base is less massive and the striation differs, yet there is a close resemblance, which is interesting in forms so divergent in habitat. As mentioned, this is the type of hook Prof. Fauvel associated with *Chone infundibuliformis*, Kröyer, but it is essentially different, as are likewise the bristles.

4. *On the* Sabellidæ *dredged by Canon A. M. Norman off Norway and Finmark.*

Besides *Sabella nordenskiöldi* and *Chone normani* described subsequently, *Sabella penicillus*, L., was obtained at several stations along with *Potamilla reniformis*, Kr., *Amphicora fabricii*, O. F. M., and *Chone duneri*, Mgrn.

Sabella nordenskiöldi *, sp. n.

A Sabellid which at first sight resembled *Sabella crassicornis* from its finely coloured branchiæ and the disposition of the collar, and nearly 2 inches long, was dredged by Canon Norman off Finmark. The collar

* Named after Dr. Erik Nordenskiöld, of the University of Helsingfors, a former worker in the Gatty Marine Laboratory, St. Andrews.

(Pl. III. figs. 12 & 13) arises as a somewhat thick process on each side of the dorsal fissure—leaving, however, a considerable portion of the centre bone (where the two ridges pass forward, one on each side of the deep central fissure). It then passes laterally and is separated by a notch from the ventral border, which has two median flaps. This collar has certain resemblances to that of *Branchiomma*. In the centre in front of these is the symmetrical process formed by the lips. The branchiæ are comparatively short, are richly banded with purple and white, and number about fourteen or fifteen on each side, terminating in a short slightly-tapered process, flattened and grooved internally. The pinnæ are rather thick and short, diminish toward the tip of the filament, and end somewhat abruptly at the base of the terminal process. Each bears three or four pairs of eyes externally, the distal pair apparently being most differentiated. Each eye is elevated above the filament and is composed of a series of somewhat regularly arranged pigment-cells with a clear corneal surface, the whole being only less differentiated than the larger eyes of *Branchiomma*. The tentacles are somewhat short, flattened at the base, and tapered distally. They are not quite one-third the length of the branchiæ. The anterior region consists of nine segments, the dorsum being very slightly hollowed at the fissure, whilst the rest is more or less rounded. The ventral surface is flattened, nine entire scutes being in front, and thereafter each is bisected by the median furrow which passes to the tail. The body appears to be rather short and stout, tapering gently to the posterior end. Nine pairs of bristles are found anteriorly, the upper bristles (Pl. IV. fig. 4) having longer striated shafts and tapering tips with narrow wings and serrated edges. The tips of the inferior bristles (Pl. IV. fig. 5) just project beyond the skin, and these are shorter and have wider wings, the shafts also having striæ which are continued into the tips, and the shafts are slightly narrowed below the wings. The posterior bristles are shorter and fewer in number in each tuft, but the length and slenderness of the tips increase toward the tail. The constriction of the neck below the wings and the projection of the base of the winged region give a character to each tuft posteriorly, so that it is tulip-like, and the tips are comparatively short. The anterior hooks (Pl. IV. fig. 6) have a somewhat short and sharp main fang, which leaves the neck at less than a right angle. The crown above it is high with numerous minute teeth. The dorsal outline is convex and

bends forward at the crown and backward over the somewhat short base. A little behind the long row of teeth on the crown is a shorter row at the end of the striæ which pass up the neck. The anterior outline is smoothly curved below the great fang, then gently extends forward to the prow and below the short basal process, which is striated. The chief features are the depth of the crown, the short and sharp main fang, the minuteness of the serrations above it, the narrowness of the neck, and the comparatively short base. The posterior hooks differ from the anterior chiefly in size, but the lateral row of teeth on the crown is more distinct than in front. The tube is chiefly composed of a horny secretion which clings tenaciously to the body of the annelid in the preparation. Few grains of sand or other extraneous structures are present.

In the brilliant coloration of the branchiæ this form approaches *Sabella crassicornis*, Sars, procured during the 'Valorous' Expedition in 1875, and its collar is also similar, but the presence of well-formed paired eyes differs from the bold pigment-touches of the arctic species. Moreover, the branchial filaments of *S. nordenskiöldi* are short and stout, and the pinnæ rather short, whereas the filaments of *S. crassicornis* are longer and more slender, and so with the pinnæ. The terminal processes are also longer and more slender. The rich coloration of the branchiæ in both species is noteworthy—Sars * describing those of *S. crassicornis* as banded with white and red, or often wholly red, and having four or five intensely red oval spots equally distant.

Chone normani †, sp. n., was dredged by Canon Norman off Finmark, and is distinguished by the great length of the branchiæ, which are not much shorter than the body, the terminal processes especially being greatly developed, so that each resembles a linear lanceolate leaf (Pl. III. fig. 14) with a slender midrib. The filaments bear very slender pinnæ which are of considerable length, and the edge of each is also webbed for a considerable distance, the membrane connecting the filaments with each other occurring only below it. The body is about an inch in length, very little tapered in front, but diminishing gradually to the tail, rounded generally, though slightly flattened ventrally

* Nyt. Mag. 6 Bd. p. 202 (1851).

† Named after Canon Norman, who, for many years, has so richly added to the fauna of the British and neighbouring seas, and to whose courtesy with specimens I have long been indebted.

after the median groove appears. The collar has a deep dorsal fissure, and is formed much after the shape of that of *Chone reayi*, viz., slopes a little forward from the dorsal groove, and preserves an even outline throughout the rest of its extent. It differs, however, in so far as the collar forms a free edge dorsally on each side as far back as the posterior border of the first segment. From the point of attachment a prominent ridge goes forward on each side to the pedicle of the branchiæ, which does not project so far forward as the collar. The edge of the collar throughout is entire. The segments of the body are two-ringed, and there are about sixty of them.

The anterior region consists apparently of eight bristled segments, but the bristles are inconspicuous, and the dorsal furrow passes ventrally between the eighth and ninth segments. Behind the collar is a single ring, then the following segments are two-ringed. The anterior bristles consist of an upper series (Pl. II. fig. 13) with winged tips finely tapered and a ventral series of spatulate forms (Pl. II. fig. 14), the shafts of which are stouter and only slightly tapered distally, the tip often having a filiform process.

The anterior hooks are comparatively short, have a somewhat long main fang (Pl. II. fig. 15), and six or seven teeth on the crown behind it. The neck is short and distinctly striated longitudinally, and the curve of the shaft is marked as it tapers to the basal region. The posterior hooks (Pl. III. fig. 15) have a main fang with a nearly straight upper outline, and the six or seven teeth on the crown behind it are slightly prominent. The posterior curve is not quite straight superiorly, then bends nearly at a right angle to the base. The anterior curve has a slight prow and the outline of the base is sinuous. The tube is formed chiefly of a firm, though brittle, secretion, with a Foraminifer studded here and there on the surface. It resembled that of *Potamilla reniformis*, but was less tough.

It was at first thought probable that this was a northern variety of *Chone duneri* or an allied form, but a consideration of all the features negatived such a view. Though it is known that the posterior (avicular) hooks of such forms vary somewhat in the number of visible teeth on the crown above the main fang, yet the outline in each species has certain limits in this respect. The peculiar structure of the branchiæ and the terminal processes in the present form are also factors of importance. A fragmentary form procured by the 'Valorous' in 1875 in the Arctic seas, has a

posterior hook almost identical with the foregoing, so that its distribution may be extensive, though the absence of branchiæ and other parts in the Arctic fragment leave a margin of doubt.

EXPLANATION OF THE PLATES *.

Plate I.

Fig. 1. Dorsal aspect of the region of the collar and the branchial base in *Sabella murrayi*, sp. n., from H.M.S. 'Knight Errant.' Enlarged under a lens.
Fig. 2. Lateral view of the same region.
Fig. 3. Slightly winged dorsal bristle of the longer type. × Zeiss oc. 4, obj. D.
Fig. 4. Spatulate bristle with filament at the tip. Ditto.
Fig. 5. Posterior bristle.
Fig. 6. Remarkable anterior hook with a differentiation of the posterior border behind the prow and a greatly elongated shaft. × oc. 4, obj. D.
Figs. 7, 8. Minute bristles accompanying the long anterior hooks. × 450 diam.
Fig. 9. Posterior hook of the same. × oc. 2, obj. F.
Fig. 10. Anterior hook of *Sabella southerni*, sp. n., with long basal process. × oc. 4, obj. D, with 2-in. draw-tube.
Fig. 11. Posterior hook of the foregoing with abbreviated base. × oc. 4, obj. D, with 1-in. draw-tube.

Plate II.

Fig. 1. Anterior winged bristle of *Sabella southerni*, 'Knight Errant.' × oc. 4, obj. D, with 1-in. draw-tube.
Fig. 2. Posterior bristle with longer tip. Ditto.
Fig. 3. Spatulate bristle of the same. × oc. 4, obj. D, with 1-in. draw-tube.
Fig. 4. Anterior winged bristle of *Chone duneri*, Malmgren. × oc. 4, obj. D, with 1½-in. draw-tube.
Fig. 5. Spatulate bristle of the foregoing. × oc. 4, obj. F.
Fig. 6. Anterior hook. × oc. 4, obj. D.
Fig. 7. Posterior hook. × oc. 4, obj. F.
Fig. 8. Posterior hook of *Chone fauveli*, St. Andrews (? marked variety of *C. duneri*).
Fig. 9. Posterior hook of typical *Chone infundibuliformis*, Kr., from Greenland. × oc. 4, obj. D.
Fig. 10. Posterior hook of *Chone reayi*, sp. n. × oc. 4, obj. F.
Fig. 11. Anterior hook of *Euchone lawrencii*, sp. n.? × 500 diam.
Fig. 12. Posterior hook. × 500 diam.
Fig. 13. Longer winged bristle of *Sabella nordenskiöldi*, sp. n. × 450 diam.
Fig. 14. Spatulate bristle. × 450 diam.
Fig. 15. Anterior hook of the same. × 450 diam.

Plate III.

Figs. 1, 2. Minute cuspidate bristles accompanying the anterior hooks of *Sabella southerni*. × oc. 4, obj. D, with draw-tube.

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* I am indebted to the Carnegie Trust for the majority of these figures.

Fig. 3. Dorsal view of the collar-region of *Chone princei*, sp. n. Gulf of St. Lawrence, Canada. Enlarged under a lens.
Fig. 4. Ventral aspect of the foregoing. Similarly magnified.
Figs. 5, 6. Anterior hooks. × oc. 4, obj. D, with full draw-tube.
Fig. 7. Posterior hook. × 800 diam.
Fig. 8. Spatulate bristle of the anterior region. × oc. 4, obj. D.
Fig. 9. Posterior hook of a *Chone* (p. 63) from the Arctic Expedition of 1875–76. × about 800 diam.
Fig. 10. Anterior hook of *Branchiomma kollikeri*, Claparède, or var. *B. vesiculosum*, 'Porcupine' Expedition, 1870. × oc. 4, obj. D.
Fig. 11. Posterior hook of the same. Ditto.
Fig. 12. Dorsal view of the collar-region of *Sabella nordenskiöldi*, sp. n. Enlarged under a lens.
Fig. 13. Ventral view of the same. Similarly magnified.
Fig. 14. Linear lanceolate process at the tip of a branchial filament. × 60 diam.
Fig. 15. Posterior hook of the foregoing. × 700 diam.

PLATE IV.

Fig. 1. Longer dorsal bristle of *Sabella hystricis*, sp. n., from the 'Porcupine' Expedition of 1870. × oc. 4, obj. D, with 1-in. draw-tube.
Fig. 2. Shorter form with more distinct wings. Ditto.
Fig. 3. Anterior hook. × oc. 4, obj. D, with 2-in. draw-tube.
Fig. 4. Longer dorsal bristle of *Sabella nordenskiöldi*, sp. n., from Finmark. × oc. 4, obj. D, with 1-in. draw-tube.
Fig. 5. Shorter bristle with broad wings. Ditto.
Fig. 6. Anterior hook. Ditto.
Fig. 7. Branchial eyes of *Branchiomma kollikeri*, Claparède, or var. of *B. vesiculosum*. × oc. 2, obj. A.
Fig. 8. Long dorsal bristle (anterior) of *Chone reayi*, sp. n. × oc. 2, obj. D, with draw-tube.
Fig. 9. Intermediate bristle with wide wings. × oc. 4, obj. D.
Fig. 10. Paddle-like form with filament at the tip. × oc. 4, obj. D, with draw-tube.
Fig. 11. Anterior hook. × 450 diam.
Fig. 12. Dorsal view of the collar and pedicle of the branchiæ. Enlarged under a lens.
Fig. 13. Ventral view of the foregoing.
Fig. 14. Winged bristle of *Chone princei*. × oc. 4, obj. D.

II.—*New Lepidoptera from Dutch New Guinea.* By J. J. JOICEY, F.L.S., F.Z.S., F.E.S., and G. TALBOT, F.E.S.

[Plates V.–VIII.]

THE forty-four species herein described were obtained by Messrs. A., C., and F. Pratt in November 1914 during their expedition to the district of Geelvink Bay, North Dutch New Guinea.

The species from the Coast District, Geelvink Bay, were