

ADDITIONAL NEW SPECIES OF POLYCHÆTA FROM THE NORTH PACIFIC.

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In the following pages are described a number of new species of Polychæta, belonging to several families, from the collections of the Alaskan Salmon Commission of 1903. Three papers noticing other novelties in these collections have already been published in these *Proceedings* with the approval of the Commissioner of Fisheries, through whose kindness the material was placed in my hands for study. The full report on all of the species represented will appear in the Bureau of Fisheries *Bulletin*.

Notophyllum imbricatum sp. nov. Plate X, figs. 1-3.

The two examples upon which this species is founded bear a remarkable resemblance in proportions and general aspect to a *Polynoe*. The body is depressed and the large, scale-like notopodial cirri are imbricated and, except for a short space near the anterior end, completely conceal the back from above.

The type and larger specimen is a trifle over 30 mm. long, and the greatest width between tips of the parapodia a little anterior to the middle of the body is 6.5 mm. The small individual is 12 mm. long and 1.8 mm. wide, and the back is concealed by the clytra even more completely than in the larger one.

The prostomium is flattened and wedge-shaped, with the slightly concave or straight base about two-thirds of the length, and the angles rounded. A slight emargination of the anterior portion of the sides is filled by an irregular low tubercle from which the frontal cirri arise. A pair of large brown eyes occupy the greater part of the posterior region of the prostomium laterad of the median tentacle (fig. 1).

The frontal tentacles arise in lateral and ventral pairs, the latter slightly in advance, from the slight emargination above mentioned. They nearly equal the prostomium in length, are stout and somewhat swollen above the base, and taper to fine tips. The median tentacle arises between the eyes and nearly fills this space. It is one and one-half times as long as the prostomium, stout and somewhat enlarged

above the base and tapers to a slender end. From behind its base a low ridge runs to the posterior margin of the prostomium. In both specimens the proboscis is retracted and the large mouth is bounded by a rather prominent lip, formed by the union of the peristomium with the succeeding somite.

The peristomium and two succeeding segments are much crowded forward so that the tentacular cirri arise beneath the head. The first or peristomial cirrus is a ventral cirrus and arises from the forwardly directed portion of the peristomium beneath the eye. It resembles the median cephalic tentacle in form and size, but is a trifle longer and arises from a distinct basal article. Arising from beneath the posterior dorsal margin of the prostomium, apparently from the peristomium, are three somewhat flattened appendages on each side, the outermost of which is the longest and connected with the corresponding tentacular cirrus by a slight web. The middle one is nearly as long, and the inner one is minute (fig. 1).

Somite II bears two pairs of tentacular cirri, a dorsal and a ventral one, separated by a considerable interval in which arises a small papilla probably representing a parapodium. The ventral cirrus occupies a position below the peristomial cirrus, which it resembles, but which it exceeds decidedly in both length and thickness. The dorsal cirrus of this somite arises at a higher level than any others in the body from beneath the postero-lateral angle of the prostomium, and its rather stout but long and tapering style reaches to IX or X. Somite III bears a dorsal tentacular cirrus only, which, with the complete parapodium to which it belongs, is depressed to a position more ventral than usual, in marked contrast to the dorsal cirrus of II. It arises from beneath and slightly behind the latter, which it resembles in form and size (fig. 1).

As stated before, the first three somites are carried well forward, the peristomium and II being coalesced ventrally but distinct, though very short, above. Remaining somites are well differentiated and obscurely biannular, the anterior and decidedly larger annulus bearing the parapodia. There are about 78 somites, the posterior end of the body being in a state of regeneration and the somites of that region as a consequence very small and tapered to a minute pygidium.

The body, excluding the parapodia, is slender, about two-fifths of the total width, and of nearly uniform diameter, except near the tapering ends. It is somewhat arched dorsally; flattened and with a shallow neural groove below.

Parapodia (fig. 2) are prominent and well developed throughout.

In the middle region they exceed one-fourth of the entire width. They consist of a broad base, a somewhat flattened, tongue-shaped neuropodium, slightly cleft at the tip and bearing a rounded and swollen prominence on the ventral side of its base, and a minute papilliform notopodium, which diverges dorsally from the neuropodium. Each division is supported by a single aciculus, the notopodial being very slender and curved, the neuropodial stouter and straight.

Along the posterior face of the base of the neuropodium above the papilla mentioned arises a flange-like ceratophore bearing a large, foliaceous palette-shaped ventral cirrus which curves upward behind the neuropodium and completely conceals both it and its setæ from behind. The notopodial ceratophore is very large, causing the notopodium itself to appear as a mere appendage. At its dorsal side the free distal border is prominently produced, thus prolonging the surface of attachment of the notopodial cirrus. The cirrus itself is very prominent, of a somewhat irregular reniform outline and attached by the marginal sinus. All of the notopodial cirri are turned nearly horizontally and overlap on the back in an imbricate fashion, closely similar to the elytra of the *Polynoidæ*. Anteriorly the dorsal cirri diminish in size so that they fail to cover the back completely and their ceratophores become more slender and elevated. The ventral cirri also become smaller, but remain prominent as far forward as III without essential change of form or position. A minute neuropodial tubercle exists on II, but it is uncertain if setæ are present thereon.

The eyes are purplish brown and the general color of the body a distinct dull greenish olive. Little pigment remains in any part of the body, but the notopodial cirri are more or less marked with dusky streaks and spots. A few small ova float free in the body cavity.

The notopodium usually bears but a single slender, curved and simple seta, and even this appears to be absent from several of the anterior parapodia. Neuropodial setæ are numerous, upwards of 20 to 30 occurring in the subacicular and 12 to 18 in the supraacicular groups. They are colorless and transparent, compound, with the stem gently curved and slightly enlarged at the end, where each side of the socket is provided with 6 to 8 very long, slender teeth and several shorter ones. The blade is slightly curved and tapers to an acute tip, and is striated and provided with minute marginal denticulations (fig. 3).

The only specimens are the two from Station 4,269, Afoqnak Bay, 14 to 19 fathoms, hard gray sand and rocks.

Eulalia quadrioculata sp. nov. Plate X, figs. 4-6.

This description is based upon a single much contracted entire specimen (type) and a fragment of the anterior end of another in every way similar.

The type is 27 mm. long, the protruded proboscis 2 mm. additional, the width without parapodia 2 mm., with parapodia 3 mm., the diameter of the distal end of the proboscis 2.5 mm., and the number of segments 106.

The evidently much contracted prostomium (fig. 4) is about two-thirds as long as wide, scarcely emarginated in the median line posteriorly, rather tumid in the posterior lateral part and then slightly concave to a small truncate median anterior lobe. The usual pair of eyes are transversely elliptical, situated on the dorsal surface of the prostomium about three times their diameter apart, nearly twice their diameter from the lateral margins of the head and not more than their diameter from the posterior margin. They have distinct lenses. In nearly the same transverse line or very slightly in advance and half way between the dorsal eyes and the margin, or just within the nuchal organs, is a second pair of eye-like spots of black pigment, but lenseless and smaller and more irregular than the dorsal eyes.

The four frontal tentacles are subequal, about as long as the head, and rather thick, with acute tips. The ventral pair project somewhat downwards, the dorsal directly outwards. From the middle of the small lobe lying between the frontal tentacles a shallow longitudinal groove passes to the median tentacle, which arises from a point just anterior to the eyes. It equals the frontal tentacles in length, but is slightly more slender in its distal part. The four tentacular cirri arise in the positions usual in the genus from somites I, II and III, and are short and subequal, being about twice the length of the prostomium.

The segments are all well differentiated and dorsally are strongly arched; anteriorly they are strictly simple smooth rings, but in the posterior third become biannulate. Ventrally the body is marked by a neural groove and lateral ridges bearing glandular areas ventral to the parapodia. On this surface the biannulation extends nearly to the anterior end. The anterior segments are contracted and extremely short, farther back they become relatively longer, and toward the posterior end the body is distinctly flattened. The pygidium, which is provided with a thickened welt-like rim surrounding the anus, bears on the ventral side a pair of prominent acuminate cirri resembling the ventral cirri in size.

Parapodia are located at the level of the ventral surface. That on

II, related to the second tentacular cirrus, is rudimentary and achæitous; that on III is larger, perfectly formed and bears setæ. The others have the form shown in fig. 5 and bear foliaceous dorsal cirri. When fully developed they are sharply marked off from the ventral glandular swellings by distinct lateral grooves. The notopodium is of course wanting, and the neuropodium is a small somewhat flattened process divided distally into a very small postsetal and a decidedly longer presetal lobe, from between which the single vertical series of setæ projects. Each lobe is notched on the edge at the point where the single straight slender aciculum reaches the surface. The neuropodial cirrus is prominent from III back and is a short, rather thick process attached to the posterior side of the base of the neuropodium. In the middle region it is somewhat foliaceous and reaches to the tip of the neuropodium; in form it is triangular with the broad, somewhat convex base ventral and the apex dorsal, while the attachment is by one of the short sides. Posteriorly they become more slender and project distinctly beyond the end of the neuropodium.

The dorsal cirri (fig. 5) are prominent and foliaceous throughout. They arise from stout bases situated a short distance dorsal to the neuropodia, which they in most cases exceed in size. All of the cirri have their fibrous and glandular structures arranged pinnately along an axial core. Anteriorly the cirri are rather broadly lanceolate with acuminate, somewhat recurved tips; posteriorly they become more slender and elongated; and finally are very narrowly lanceolate and of a length exceeding the diameter of the body. At the same time their foliaceous character is gradually lost.

About thirty setæ, equally divided between the supraacicular and subacicular groups, form the vertical fan-like fascicle. They are of the usual compound form (fig. 6) with the transparent, colorless stems rather stouter than those of *E. longicornuta*, the thickened and nearly truncate end furnished on each side with seven or eight slender teeth, one of which is much larger than the others. The blades are short, broad at the base, and rather conspicuously striated and fringed.

The type specimen, a female filled with large eggs, retains a dull olive color throughout the body, becoming brown on the dorsal cirri. Besides the black pigment in the eyes, there is a diffuse spot near the tip of each dorsal cirrus, and a very minute spot beneath each ganglion of the ventral chain. The cotype shows some indications of a faint transverse band across the dorsum of each segment.

The type and cotype are from Quarantine Rock, Port Townsend, Washington, June 27, 1903.

Eulalia longicornuta sp. nov. Plate X, figs. 7, 8.

A complete example, much contracted, measures 15 mm. in length, with a body width of 1.5 mm. at the widest part, and a total of 73 segments.

The broad prostomium is very slightly cordate, about as wide as long, and has no distinct concavity or constriction behind the frontal tentacles. The latter arise from the extreme anterior end of the prostomium, are slightly longer than the head and very slender. The median tentacle arises immediately in front of a line connecting the anterior border of the eyes or very close to the centre of the prostomium. It is $1\frac{3}{4}$ times as long as the head, very slender, and tapers regularly from the base to the tip.

The single pair of eyes are circular, black, situated nearly their diameter from the posterior margin of the prostomium and twice their diameter from each other. Both specimens have the proboscis retracted, in which condition the mouth is bounded below by a somewhat swollen, longitudinally furrowed lip. The peristomial somite appears on the dorsum as a slightly elevated lenticular area overlapping the prostomium. The first ventral tentacular cirrus arises directly beneath the eye, the second one from somite II; both are slender and subulate and reach back to somite VII or to a length $2\frac{1}{2}$ times the head. The two dorsal tentacular cirri arise from II and III respectively, and are about twice the length of the ventral cirrus, very slender and regularly tapered to a delicate tip.

Dorsally the body is strongly arched above, below flattened and slightly grooved. It is widest at the middle and tapers regularly and nearly equally both ways. The segments are well marked throughout and show scarcely a trace of biannulation, even posteriorly. The anal cirri are missing from both type and cotype.

Although the specimens are smaller, the parapodia (fig. 7) are even more prominent than in *E. quadrioculata*, owing to the projecting character of the dorsal angle of the presetal lobe, but otherwise they are similar. The dorsal cirri are, however, very different from those of that species, being folded against the sides of the body instead of held erect. They are strongly foliaceous throughout, the anterior and middle ones having a broadly pyriform outline, and those of the latter region being especially broad; the posterior ones are more slender and rather cuneate-ovate. Moreover, the central area is always broad and thick and the gland ducts and other markings radiate from it in all directions and not in a pinnate manner. The ventral cirrus is also prominent and projects beyond the dorsal lobe of the parapodium.

There are about 10 supraacicular and 12 subacicular setæ in all, but fewer on the extreme anterior and posterior parapodia and, except for the usual variations in relative length of the blade, all have the form exhibited in fig. 8. The slender stem ends in an acutely oblique enlargement with 7 to 9 nearly equal, closely appressed teeth on each side. The blades are slender, flexible and very acute, with very fine marginal fringe.

In both specimens the color has faded to a nearly uniform olive with some brown striations on the dorsal cirri. The type is a female filled with eggs. These specimens were found among serpulid tubes taken at the Quarantine Station dock near Port Townsend, Washington, on June 27, 1903.

Pionosyllis magnifica sp. nov. Plate X, figs. 9-11.

This large syllid is described from two specimens, one of which (the type) measures 48 mm. long and nearly 2 mm. wide, exclusive of cirri and setæ, in the middle of the body. The form is much depressed, especially in the widened middle region, from which it tapers to the very small head and pygidium.

As just indicated the prostomium is small, its width little exceeding three-fifths of the width of the second segment and one-fifth of the maximum breadth of the body. It is depressed, somewhat quadrangular in form, widest anteriorly where the width is about double the length. The somewhat flattened palpi project forward and somewhat downward and are very slightly connate at the base (fig. 9).

All three of the cephalic cirri are decidedly slender and arise in a transverse row from almost the extreme anterior margin of the prostomium. In one specimen they are subequal and about three times the length of the prostomium. In the other the median one is three and one-half times, the lateral about twice the prostomial length. The ends may be partly sloughed away.

The eyes, though small, are very conspicuous and nearly black, the anterior slightly the larger. Together they form a quadrate figure conforming to the outline of the head and about two-thirds as large.

Dorsally the peristomium is very short, but ventrally it projects as a prominent lip surrounding the large mouth. A fragment of the anterior end of an example of this species from Station 4,235 has the proboscis protruded as a short bell-shaped structure, bearing ten prominent papillæ at the end and just behind them a conical, dorsal median tooth which appears to be quite soft. On the roof of the pharynx just behind the everted portion there appears to be, however, a hardened, horny elliptical area. This specimen also has the eyes

larger than the others and nearly connate, but no swimming setæ exist on any of the small number of anterior segments present.

Of the tentacular cirri (fig. 9) the dorsal peristomial is about four times as long as the prostomium, that of somite II is slightly longer and of III as much shorter; the ventral peristomial cirrus is about two and one-half times the prostomial length. All of the tentacular cirri resemble the cephalic cirri in being slender, delicate, and not moniliform, or with indistinct irregular furrows only.

After the second, the segments increase very gradually in length and more rapidly in width and soon assume the depressed form characterizing the middle region where they are five or six times as wide as long. The type specimen has about 150 somites, the cotype only 110. Posteriorly the body becomes slender and ends in a minute annular pygidium, bearing on its ventral side a pair of very slender caudal cirri equalling the last twelve segments and exceeding any of the cephalic appendages.

The parapodia are of the form usual in Syllidæ and project prominently from the sides at a low level. Although there is no distinct notopodium, a slender notopodial aciculus is always present just beneath the notopodial cirrophore (fig. 10). The well-developed neuropodium terminates in a broadly rounded, more dorsal, postsetal process and a longer, rather prominent, and more ventral presetal process. The three or four aciculi terminate at the upper outer angle of the former. Ventral cirri are always short, stout and bluntly rounded, with oblique bases passing into the ventral surface of the body, and in size about equal the neuropodia. Notopodial cirri arise from very large and prominent cirrophores. Except for their slightly larger size anteriorly, where they are about three times the length of the prostomium, the notopodial styles are similar throughout. They are probably somewhat contracted and in life would be longer and more slender. In the middle of the body they are scarcely one-half of the total width. As shown in the figure they are rather stout and coarse, and, though more or less deeply marked with irregular transverse furrows, are never regularly articulated or moniliform. The only variation in the parapodia is that they become more prominent in all their parts posteriorly.

Notopodial aciculi are slender, curved and acutely pointed; the neuropodial are stouter, nearly straight and knobbed at the end. All setæ (fig. 11) are compound and all are subacicular in position. In middle parapodia they are numerous, arranged in about ten horizontal rows of three to five each, or about forty in all. They are colorless,

with long, slender, curved shafts, the ends of which are rather abruptly enlarged and not very oblique, and are provided with only a few small teeth at the apex. The appendages or blades are strongly hooked and bifid at the end and distinctly fringed. The shortest posterior ones have a length of about one and one-third times the diameter of the end of the shaft, the longest about four and one-half times that diameter.

Both specimens are entirely colorless and the large one is filled with masses of sperm.

The type comes from Admiralty Inlet, near Port Townsend, Washington, Station 4,219, 16 to 26 fathoms, on a bottom of green mud with sand and broken shells. A fragment was taken at Yes Bay, Behm Canal, 130 to 193 fathoms, bottom of gray mud.

Stauronereis annulatus sp. nov. Plate X, figs. 12, 13, and Plate XI, figs. 18-22.

The larger example (much contracted) is 13 mm. long and about 1 mm. wide exclusive of the setæ, and has 72 segments. The other is 9 mm. long with 62 segments.

The prostomium (fig. 12) consists of a broad shovel-like anterior process and two short segments, each bearing a pair of tentacles and a pair of eyes. Although these two divisions or rings are about equal, both the eyes and tentacles of the anterior one are much the larger. The anterior tentacles (palpi) arise from the ventro-lateral region of the first annulus. Each consists of a large and very stout basal piece strongly curved backwards by the sides of the head and bearing on its end a very small ellipsoidal terminal article. Just above the base of each, on the dorso-lateral region of the head, is a large very dark brown eye. Immediately behind and slightly above the large eyes the second pair of tentacles are borne on the second annulus. They are about as long but not so stout as the anterior ones, are cylindrical in form and consist of six or seven nearly spherical articles. The second pair of eyes are minute dark brown spots about one-fifth the diameter of the anterior pair, and are situated on the dorsum of the second annulus about half as far apart as the anterior pair. The mouth is small and bounded behind by the second somite, and from it project the ends of the jaws (fig. 18). Owing to the retracted state of the proboscis the jaw apparatus is not all visible. A specimen cleared in glycerine shows on the dorsal side a lenticular area having a very dark brown border and a paler interior enclosing a small central space. In ventral view are seen the pair of dark brown mandibles (fig. 18) with slender bowed bases and curved, divergent, tapering end-plates bearing about seven strong teeth along the medial margin.

The prostomium and somite II are apodous, short simple rings. All others bear parapodia, but are not otherwise more complicated in structure. Up to about the fifteenth they increase in size, but remain uniannular throughout. The body is strongly arched above and nearly flat below, and terminates in a simple ring-like pygidium bearing a pair of small ventral anal cirri as long as the diameter of the pygidium.

Parapodia are small, slender and strictly lateral in position. Except that they correspond in size with the segment bearing them and are consequently largest at the middle of the body, they are quite similar throughout. The neuropodium (fig. 13) is slender, nearly cylindrical and slightly enlarged distally, where it terminates in a presetal lobe divided into a larger ventral and a minute acicular process, and a postsetal lobe which begins just below the aciculum and runs to a rather prominent dorsal angle. Its dorsal surface bears a group of long cilia. The neuropodial cirrus is a simple finger-like papilla arising in or near the distal third of the ventro-posterior surface of the neuropodium and reaching nearly to the end of the latter.

The dorsal cirrus arises immediately above the base of the neuropodium and consists of a slender, elongated cirrophore nearly as long as the latter and slightly diverging from it. Usually but not always it is slightly constricted about the middle and the end is a little thickened. Probably it represents the notopodium, as what appears to be a slender aciculus penetrates about half of its length. A tuft of long cilia resembling that on the dorsal surface of the neuropodium is usually present on its ventral and sometimes on its dorsal surface also. On the end of this basal piece is borne a terminal style of about half its length and of a slender, conical form. The first parapodium altogether lacks a dorsal cirrus.

Setæ are numerous and of four forms, all very delicate, transparent and colorless. They are arranged in well differentiated supra- and subacicular fascicles, each comprising two kinds, and all of which occur throughout the body, except perhaps in a few anterior segments, where the long compound setæ have not been found.

All of the supraciclar setæ are simple; those most numerous being very delicate but stiff capillary bristles, tapered to very acute tips, slightly curved and rather strongly serrated in an antrorse manner along one side (fig. 20). Their exposed parts are fully three times as long as the entire neuropodium. The other form has generally stouter stems, straight and tapering until near the end (fig. 19), where they present a gentle ventral curvature and at the same time become

broadened and end in two divergent, slightly curved points, the ventral of which is the longer; while below the dorsal is a serrated sheath, the rather coarse teeth of which are directed outward. Seldom more than three or four of the latter form occur in a parapodium along with ten or fifteen of the former.

Subacicular setæ are all compound. The most numerous kind occur to the number of about fifteen. They have moderately stout, rather strongly curved stems, the end being very unequally and obliquely bifurcated to form a socket, the dorsal border of which is provided with a few teeth (fig. 20), while the blades are comparatively short, but increase in length from the ventral to the dorsal margin of the bundle, and have one border fringed and the end terminated by a pair of distinct but not widely separated and nearly parallel teeth. The second kind of compound setæ (fig. 22) seldom exceeds three in number. They have the same construction as the more numerous form but are much more slender and delicate in all their parts, and the blade often equals the entire length of the neuropodium or about three times the length of the longest blades of the other type. On the most anterior segments the two forms appear to grade into each other. The setæ of this species differ decidedly from those of typical members of the genus and are more nearly like those of *Prionognathus ciliatus* Keferstein.

These worms are quite colorless and their form and histological structure indicates that they may be pelagic in habit.

The type and a somewhat smaller cotype were obtained at Quarantine Rock, Port Townsend, Washington, June 27, 1903.

Notomastus giganteus. Plate X, figs. 24, 25.

The only complete specimen measures 140 mm. in length and 7 mm. in maximum diameter in the thoracic region, but a second incomplete example is much larger. Even taking into account the contracted state of the specimens, this species is much stouter than usual for the genus. The body is nearly terete or slightly depressed and for the first fifteen or twenty millimeters increases in diameter, and then falls off to the posterior end which is two millimeters in diameter within ten segments of the anus.

The prostomium is a small rounded lobe bearing a minute conical palpo and is completely retracted within the peristomium, which, except in being slightly longer, resembles the immediately following segments. The protruded and collapsed proboscis forms a discoid, wrinkled structure fully 8 mm. in diameter. All of the thoracic seg-

ments are strongly biannulate, the anterior annulus being slightly shorter than the posterior. Each annulus is marked out in irregular areas, of which there is generally but one series to each annulus, though on somites IV to VII inclusive they become arranged irregularly in two rows. Behind VII the thoracic segments become smooth and more glandular and decrease in length, though even the last is fully one-half longer than the first abdominal.

Beginning with II, each thoracic segment bears small notopodial and neuropodial tufts of very delicate, narrowly winged capillary setae in the usual positions, but neither the lateral sense organs nor the genital pores can be detected in surface views of these specimens.

The abdominal segments, of which there are 190, are very short, with shallow, ill-defined furrows, and are either simple rings or anteriorly obscurely biannulate. The surface is smooth, and the integument provided with a thick glandular coat on the anterior and a much thinner coat on the posterior segments.

The notopodial tori are very long, but not at all elevated above the surface in these specimens, and bear a great number of uncini. The notopodial torus is much more elevated and prominent, especially on posterior segments, but is much shorter and contains a much smaller number of uncini. The gills are low, rather long, inconspicuous folds. The pygidium forms a narrow circumanal welt bearing two longer prominently protruding ventral cirri and four much smaller ones in two pairs more dorsally placed.

The uncini (figs. 24, 25) are numerous and very delicate crochets of a peculiar form. They are f-shaped with the densely fibrillated core exhibiting a slight spiral turn, and the tip provided with a single bent terminal process, somewhat flattened and at the base swollen and over-arched by a depressed hood, the margin of which is denticulated with eight or ten teeth.

The type comes from Station 4,264, off Freshwater Bay, in Chatham Strait, at a depth of 282-293 fathoms, and on a bottom of green mud; the larger but incomplete cotype was taken at Station 4,197, in the Gulf of Georgia, at a depth of 31 to 90 fathoms, on a bottom of sticky green mud and fine sand.

Travisia pupa sp. nov. Plate XI, fig. 23.

This is a thick, stout, grub-shaped worm tapering nearly equally both ways but having the anterior end rather blunter and thicker. The considerable number of examples in the collection measure from 24 mm. to 82 mm. in length, with corresponding diameters at the middle of from 8 mm. to 32 mm. Exclusive of the pygidium there are thirty

one or thirty-two somites, but the number is not correlated with the size of the worm, the largest two having thirty-one and the smallest thirty-two.

The prostomium is a minute conical organ, thin-skinned, weak-walled and hollow, and apparently capable of distention by internal fluid. It is followed by a short, uniannular segment continuing the general conical form of the anterior end. Dorsally this segment is crenulated on its posterior margin; below it is flattened and slightly grooved in the middle of the posterior part; and on each side it is provided with a dorso-lateral groove which terminates anteriorly in a deep sensory pit at the posterior margin of the prostomium. The next segment is biannular, with the anterior ring distinctly larger. Below it forms the upper lip and is thrown into a number of deep longitudinal folds and furrows which pass into the mouth. On each side, above a rather prominent swelling, is a quadrangular area opposite the groove on the first segment and itself bounded by a longitudinal groove above and another below, both of which cut the segment for its entire length. This area bears the small tufts of notopodial and neuropodial setæ and between them an elliptical clear spot or pit. Dorsally each ring is marked by longitudinal grooves which effect a peculiar lobed and crenulated arrangement of the posterior margin. The third somite is triannulate, but the anterior two rings are somewhat united and on the ventral surface the first enters the sides of the mouth and the second forms the longitudinally grooved lower lip. At the sides this segment is constructed like the second, except that the posterior third of the quadrate area is depressed and smooth and that a cirrus is borne on each side immediately above and behind the notopodial setæ. Above the same longitudinal sulcation and posterior lobing appear. The next twelve segments are formed of three equal rings completely separated by continuous furrows, except for the short interruptions at the setigerous areas on each side. Dorsal longitudinal sulcations are wanting and a second sensory pit, which first appears on the middle of the second ring below the setigerous area of somite IV, becomes very conspicuous on the posterior segments of this region, and on every specimen finally ceases on XV. Somites XVI, XVII and XVIII each consist of a large posterior and a small anterior ring, the furrow separating which becomes successively more and more restricted to the dorsal and ventral regions. Traces of a short anterior ring, differentiated only dorsally and ventrally, still continue on XIX and XX, but all remaining somites are strictly uniannulate with prominent overlapping posterior margins, which finally become telescopic. Somite

XIV, which is exactly at the middle of the body, is the longest; but the reduction in both length and diameter of the segments is slight until near the ends, where it becomes more rapid. The pygidium is a short squarely truncated tube marked externally by longitudinal grooves which correspond with the clefts between the nine to twelve uneven lobes into which its margin is divided.

The surface of the body is vesiculated or finely pustular in the following manner: Generally over the posterior half of the body, in all of the intersegmental furrows and on all except the most anterior setigerous areas, the pustules are very small and, though numerous, not crowded. In macerated specimens they are collapsed and appear as punctations. From the middle of the body they gradually increase in size forward. Each annulus of anterior somites is provided on its highest part with an irregular transverse series of very large vesicles which usually lie nearer to the posterior margin and overlap the succeeding ring, when the worm is contracted, as a rough and irregular fold interrupted in the median dorsal region. These folds and their vesicles are usually best marked on the middle ring of each somite, on which they increase in prominence from the median break laterally to the setigerous areas, below and even more above which they form rough lobes overlapping the third ring. The ventral lobe bears the ventral sensory pit referred to above. Anteriorly the transverse series of enlarged vesicles tends to form several rows and all of the vesicles to increase in size. The first three segments bounding and anterior to the mouth are covered nearly uniformly with vesicles of moderate size; and similar ones cover the anterior two-thirds of the setigerous areas of the first ten or twelve segments. The prostomium is perfectly smooth and lacks surface vesicles altogether. Posteriorly the ridges of enlarged vesicles and the lateral lappets become gradually flattened out and the entire surface much smoother. The lappets above and below the setigerous areas remain, however, and may become even more prominent on the last few segments, where, however, they are not vesicular.

Neuropodial cirri appear on III and continue on every segment to near the posterior end, ceasing on from XXIV to XXVII in different specimens. They arise at the dorsal margin of the setigerous area, chiefly from the third annulus but in part from the second also. At the base their diameter nearly equals the length of the third annulus, but they quickly become slender. The surface is strongly wrinkled transversely, much like the contracted tentacle of a jelly-fish, and doubtless they are in life capable of great extension; but in the preserved speci-

mens, even where longest (in the middle of the body), they barely equal one-half or one-third of the body diameter. Toward the ends they are reduced to one-third or even one-fourth of this length.

Lateral sense organs appear as a pair between the prostomium and peristomium and occur between the setæ tufts of every succeeding segment, except that they are occasionally absent from XXXI or XXXII. In shape they are elliptical with the long axis vertical. Ventral sensory pits appear on IV and continue without exception to XV in the position indicated above. At first very small, they increase rapidly until they exceed the lateral organs, unlike which they are always circular.

Small notopodial and neuropodial tufts of setæ occur on all somites from II caudad at the junction of the second and third rings. Both tufts are retractile into pits and the notopodial setæ are somewhat longer than the neuropodial. All setæ are very slender, flexible and thread-like, of various lengths in each tuft, and have each margin provided with a fringe of appressed hairs.

Many of the specimens are enclosed in a very tough mucous membrane more or less coated with silt, and often inhabited by small nematodes.

This species bears much resemblance to *Travisia olens* Ehlers, which has only thirty segments and rather distinct parapodial papillæ.

It is apparently an abundant worm, conspicuous from its large size, and widespread on muddy bottoms. Specimens were collected from the following stations: 4,192, Gulf of Georgia, 18 to 23 fathoms, green mud and fine sand; 4,194, Gulf of Georgia (type locality), 111 to 170 fathoms, soft green mud; 4,197, Gulf of Georgia, 31 to 90 fathoms, sticky green mud and fine sand; 4,230, Behm Canal, 108 to 240 fathoms, rocky; 4,235, Behm Canal, 130 to 193 fathoms, gray mud; 4,237, Behm Canal, 192 fathoms, green mud; 4,246, Kasaan Bay, Prince of Wales Island, 101 to 123 fathoms, gray and green mud, coarse sand and shells.

***Brada pilosa* sp. nov.** Plate X, figs. 14-17.

This well-marked species is represented by about a dozen specimens varying in length from 15 to 30 mm., the largest having a maximum diameter of 5 mm. With the prostomium and tentacles retracted, which is the condition of all of the specimens, the form of the body is slender clavate, bluntly rounded at the anterior end and gradually thickening to about XI or XII, from which point it tapers into the rather slender, gracefully formed caudal region.

The exact form of the prostomium and mouth is not apparent, inasmuch as this region is retracted, leaving a conspicuous trifid opening which has been sometimes indicated in descriptions of other species as the true mouth. In this condition the peristomium is trilobate. All of the segments are simple rings, separated from one another by clearly defined but not conspicuous intersegmental furrows which become more distinct posteriorly. The segments pass regularly into one another without any conspicuous breaks in contour, and increase in length, as they do in diameter, to about XII, then undergo little change to the middle of the body, behind which they become again gradually shorter. Toward the posterior end they diminish to a minute pygidium which contains a small, vertical, slit-like anus, but appears to lack cirri or other appendages.

The number of segments varies from 31 to 33, the latter number being present in the type. All, including the peristomium, bear both notopodial and neuropodial setæ in tufts upon minute tubercles.

The chief characteristic of the species is the richness of its papillation. The entire dorsal surface is thickly covered with filiform papillæ especially numerous toward the ends, where they are so densely arranged that they actually touch and crowd one another. On the middle segments they are more widely separated, but are still so numerous that where *Brada villosa* bears 3 or 4 in the length of a somite, this species bears 8 to 12. They are not disposed in regular rows, but are arranged more or less irregularly at nearly equal intervals in all directions. The intersegmental furrows lack papillæ and appear as smooth lines, like narrow avenues through a grass field. Just anterior to each parapodium the papillæ become few or nearly disappear, leaving a wider open space at this point. Those papillæ remaining in this region are collected about the setigerous tubercles, but instead of becoming enlarged and forming rosettes they are actually smaller than the dorsal ones.

All of the papillæ (fig. 14) are slender, elongated and filiform with a small terminal knob. Many of them collect a thick girdle of sediment in a zone near the base, which gives the appearance of a bulbous enlargement. They differ considerably in length and toward the anterior end of the body exceed the length of the segment bearing them, so that this region has the appearance of being thickly coated with fine hairs. At the level of the ventral margin of the neuropodial tubercles the dorsal papillation ceases abruptly, and is replaced by the much smaller papillæ (fig. 15) which cover this surface. Although their number is nearly as great, these papillæ are so much smaller than

those found on the dorsal surface that to the naked eye they appear merely as a fine granulation.

Every somite, including the peristomium, bears both notopodial and neuropodial setæ in small lateral tufts. The setæ of both fascicles have the same character, all being slender and transversely jointed, except at the acutely pointed tip. The former (fig. 16) are very slender and delicate and the internodes increase in length toward the tip. The latter (fig. 17) are more deeply colored, much stouter, distinctly curved and the much shorter joints decrease in length toward the tip. In both tufts the number of setæ is small, about eight notopodials and eight or ten neuropodials being the rule. On the peristomium the notopodials are very long, equalling four or five segments, and they project forward far beyond the mouth. On succeeding segments they project outward and upward and decrease in length until they are about equal to the segment bearing them. The neuropodials are rudimentary on I, but increase in both length and thickness on succeeding anterior segments, those at the posterior end becoming again more slender but without diminution in length.

As stated above the prostomium is in all cases retracted. A dissection shows that the tentacles are fine and very numerous, numbering upwards of thirty on each side. They are borne on a pair of bosses which are about twice as wide dorsally as ventrally, where they curve around the mouth and nearly meet. The palpi are very short and broad and marked by a longitudinal groove and transverse wrinkles on the ventral side, the dorsal surface being smooth. The skin is gray, but the papillæ impart to the dorsal surface a buffy yellow color.

Brada pilosa very closely resembles *Trophonia hirsuta* Theel, but is distinguished by the reduction in size and number of the papillæ forming the setal rosettes and by the unjointed tip and other peculiarities of the setæ.

The species is not uncommon northward. Examples occur from the following stations: Station 4,251 (type locality), Stephens Passage, 198 fathoms, rocky bottom; 4,235, Yes Bay, Behm Canal, 130 to 193 fathoms, gray mud; 4,252, Stephens Passage, 198 to 201 fathoms, gray mud; 4,258, Lynn Canal, 300 to 313 fathoms, mud.

Maldane similis sp. nov. Plate XI, figs. 26-30.

The type and largest example is 56 mm. long and 2.5 mm. wide, the latter being nearly constant throughout the entire length.

This species belongs to the *M. biceps* group in having the cephalic and caudal plates of nearly the same form and size. The cephalic plate

is very broadly elliptical in outline, the margin little limbate, the posterior two-fifths separated by a deep notch on each side from the anterior three-fifths, the former erect and with its margin finely denticulated with from twenty to twenty-five teeth. One-fourth of the remaining margin anterior to the notch forms on each side a rather thick, narrow, spreading rim, the margin of which is quite entire or merely slightly crenulated, not conspicuously toothed as in *M. biceps*. Anteriorly the cephalic rim is separated from the postero-lateral margins of the palpode by a pair of distinct radial furrows. The palpode is very large and contributes easily three-tenths of the entire margin. It is very broad and flat, with a smoothly curved anterior border and rather more than one-third of the middle of its posterior border produced backward on to the head plate as a slightly elevated median welt scarcely rising to the height of a ridge. On each side of this, forming its lateral boundaries and the posterior boundary of the lateral portions of the palpode are the deep sensory slits, U-shaped or hooked, with the lateral limb the shorter. No furrows or other markings occur on the surface of the cephalic plate.

The mouth is large and the lips prominent and pouting. A short distance behind it is a transverse groove encircling the ventral half of the peristomium and joining a conspicuous longitudinal groove which begins at the lateral notch in the cephalic margin and passes along the side of the peristomium, to end posteriorly in the circular furrow which separates a complete narrow ring from the hinder part of the segment. Inasmuch as the posterior part of the peristomium is retracted within the anterior margin of II, this ring is completely concealed ventrally by the prominent half-collar developed in that position on the latter segment.

The next segment (II) is very short, its length not more than one-half of its diameter; the posterior third is completely separated as a distinct ring; and the anterior margin is somewhat produced into a collar, the ventral half of which springs into especial prominence abruptly at the level of the setæ. Somite III is about one-third longer than II and similarly biannulated, but its anterior margin is not collared. Thus far the skin is entirely glandularly thickened.

The following six segments (IV to IX) are decidedly longer, about equalling their own diameter, and the secondary furrow, while always present, is in a more anterior position not far behind the middle. While the three anterior segments are glandular throughout, the ones under discussion have the glandular area confined to the ventral half of the body and especially to the anterior ring in the vicinity of the

tori. Somites IX and X are indistinguishable, and on the latter the now prominent tori have shifted to the posterior end of the segment.

From this point the segments continue to lengthen to XIV, which is about three times as long as thick, after which they again decrease. Throughout the middle region the integuments are soft and translucent, except for the swollen, oval, glandular areas surrounding each torus. Somites XVIII, XIX and XX are again much thicker than long and the tori are correspondingly large and prominent: XX is about one-fourth as long as thick with a prominent pair of achæitous tori much below the usual level and meeting ventrally.

The pygidium consists of a very short basal ring bearing a pair of coalesced glandular thickenings corresponding to the tori of XX. The anus is conspicuous and in a dorsal position at the base of the dorsal membrane. The limbate margin of the pygidium bears a remarkable resemblance to the cephalic plate, but is oblique in a reverse direction. Its ventral two-fifths are separated from the dorsal three-fifths by a deep rounded notch, with thickened margins which nearly meet externally and constrict its opening. The ventral portion has its margin marked by four very broad, shallow crenulations and a pair of prominent triangular lateral lobes. The dorsal plate is more prominent and flaring, with a smooth and regular margin marked only by a broad and extremely shallow median emargination.

Somites I and II and the pygidium are achæitous; II bears strictly lateral setæ only, arranged in a vertical tuft just above the dorsal ends of the ventral collar; III and IV bear similar setæ tufts and very short series of uncini disposed in the same plane and both strictly lateral and sessile. On succeeding segments the setæ tufts have short, slightly oblique bases placed a little in advance of the uncini, which form lines five or six times as long as those on the preceding somites, more ventral in position, and elevated upon distinct tori. Proceeding caudad the uncinal lines increase slightly in length and become more ventral in position. The number of uncini in a torus is about 8 on III, 13 on V, 28 on X, 32 on XV and 35 on XIX.

The small tuft on II contains setæ of two kinds, the one small with a rather wide wing and abruptly tapered stem terminating in a slender tip; the other very much longer, with the stem conspicuously striated the tips rigid and less slender and the wing very narrow (fig. 26). On following somites the number of setæ increases to 10 or 12 pairs, the larger ones become stouter and the smaller more slender. By somite XV the number is further reduced; the small setæ exhibit only minute pointed tips and the ends of the larger ones are elongated and

provided with ensheathing awns which appear to be disposed in symmetrical pairs.

Anterior uncini (on III) (fig. 27) have the head little enlarged and somewhat thrown back, the stout, blunt, nearly straight beak somewhat elevated, the crest composed of a single large tooth with a cluster of small ones surrounding its base, and the guard rudimentary or absent (fig. 28). In a succeeding tori there is a gradual transition to the typical form which appears at about VI. Such uncini (fig. 29) have a distinct shoulder, well-defined neck and head, and a stout, tapering, hooked beak with an acute, slightly recurved tip. The crest is well developed and formed of two transverse rows of numerous teeth which are largest at the vertex and become rapidly reduced laterally. The guard is strong and arising well below the beak sweeps boldly beyond and above its tip (fig. 30).

The type and one other specimen were taken at Station 4,264, off Freshwater Bay, Chatham Strait, 282 to 293 fathoms, on a bottom of green mud.

***Maldanella robusta* sp. nov.** Plate XI, figs. 31, 32.

No complete specimen of this species occurs in the collection, but fortunately there are several heads and one posterior end and it is possible to so fit the fragments together as to secure a complete description.

The worm thus reconstructed is a fine large one, measuring about 195 mm. long and 7.5 mm. in diameter at the middle part. Excluding the pygidium there is twenty-one segments, of which the peristomium and first preanal segment are achartous, II bears setæ only, XX setæ only on one side, and III to XIX inclusive both setæ and uncini.

The prostomium and peristomium are completely coalesced and exhibit no trace of a dividing furrow or suture. The cephalic plate meets the dorsal profile of the peristomium at an angle of approximately 135° to 150° , so that the ventral length of the head is nearly or quite twice the dorsal. The cephalic plate has a nearly regular ellipsoidal outline, with a length of about twice the width. Its thin margin is elevated all round, highest and most erect behind, thence slightly diminishing in height to a point anterior to the middle where it is folded and sometimes slightly notched. Anterior to this point it again becomes higher and more flaring until it curves into the base of the palpod, from which it is separated by a slight cleft. Except for a faint crenulation, the margin is entire. The median ridge is rather broad and low, but extends through the anterior half or less only of the

cephalic plate, ending abruptly behind; anteriorly it widens slightly and passes partly into the marginal rim, partly into the palpode. On each side of the ridge are deep sensory slits which anteriorly bend somewhat sharply outward and backward, and continue along the base of the lateral fold nearly as far as the posterior end of the median limb.

From near the posterior end of the median ridge to the lateral fold or notch in the marginal membrane passes a strictly transverse furrow on each side, leaving an extensive area in the posterior region of the head marked only by a few crescentic furrows parallel with the posterior margin. The palpode is a short, broadly rounded, rather thick, tongue-like structure which is continued backward on the ventral side as a broad welt to the mouth, within which it bifurcates to form a pair of ridges separated by a deep cleft. The mouth is relatively small and bounded by a nearly circular fold, elevated and furrowed somewhat like a piece of rope and which is open only anteriorly to admit the posterior extension of the palpode.

As before mentioned there is absolutely no visible line of separation between prostomium and peristomium, but the two together constitute a continuous head, shaped somewhat like a horse's hoof; that is, it spreads anteriorly, where it is truncated obliquely by the cephalic plate. The seven somites next following are cylindrical, with a nearly uniform diameter about equalling the posterior diameter of the peristomium, and a length but little greater. All have traces of anterior collars, which are best developed on IV to VII, on which also the glandular layer of the skin is thick and extensive. The skin of the head and somites II to IV is very smooth, iridescent and marked by fine furrows crossing in various directions, like those on the human skin. Somites V to VIII are of a dull, opaque, non-iridescent white. Following this the body is distinctly depressed and the segments elongated to two or three times their diameter. They bear prominent tori situated along broad elevated longitudinal muscle bands. While the greater part of the surface of the segments is smooth and has a conspicuous bluish iridescence, the longitudinal muscle ridges are vertically furrowed and, when the segments are much contracted, these furrows are extended nearly around the segment. With the exception of $\frac{IX}{X}$, the segments bounding which are continuous and the place of transition of the parapodia from an anterior to a posterior position, all of the furrows are well developed. Somite IX is the last exhibiting a distinct glandular region, which is confined to a narrow anterior zone. For nearly the entire length of the worm there appears in the median ventral line a neural cleft in the muscles, having

the aspect of a clear, translucent, bluish line. There is no diminution in the length of the posterior setigerous segments, but the achæitous segments are considerably reduced in both length and diameter. They are terete, about twice as long as thick, have the surface deeply wrinkled transversely and bear rather prominent tori in the posterior one-third. Following these is the campanulate pygidium which has a narrow ringed base and a deep cup-shaped body, the margin of which is divided into thirty-nine very regular bluntly rounded teeth, the four ventralmost of which are considerably broader than the others, while at three other points one of the latter has been replaced by two smaller ones. Both without and within the surface of the cup is longitudinally fluted, and in the deeper part of the interior numerous fine ribs, usually two to each marginal tooth, pass to the margin of the very large anus.

Somite II bears capillary setæ only, which arise as a narrow vertical tuft from a slit-like cleft into which they are retractile. Succeeding segments, to XIX inclusive, bear both setæ and uncini which are strictly lateral in position, the dorsal interval between the setæ scarcely exceeding the ventral interval between the uncini. As far as somite VIII the setæ continue to occur in the form of vertical tufts retractile within slit-like pockets; and the uncini, which begin immediately below the setæ and lie in the same plane, form strictly linear series sessile or even depressed below the surface. On IX and all subsequent segments the setæ are situated on rather prominent wart-like papillæ in the form of crescentic tufts open below; and the uncini are elevated on the crests of swollen tori. On II, III and IV the parapodia are situated in the anterior one-third; on V and VI they are but little anterior to the middle; on VII, VIII and IX they are again near the anterior end; on X they shift abruptly to the posterior one-third and so remain to the last. The posterior tori are especially prominent. Whether XX is normally setigerous cannot of course be determined until additional specimens are known.

The number of uncini increases toward the posterior end, the counts being 22 to 26 on III, 35 to 42 on V, 45 to 50 on X, 53 to 57 on XV and 60 on XIX.

The setæ are numerous and form dense tufts. On II those of one series are shorter and about three times as thick as the others and have well-developed wings. Those in the other series are slender and nearly wingless. On succeeding somites all of the setæ become much more elongated and more slender, but do not differ otherwise, and apparently lack altogether any lateral hairs or awns.

As indicated above uncini (fig. 31) are numerous on all segments;

and are stout, striated, and of a deep yellow color throughout. They differ very little in form on the different segments, the only noticeable distinction being that the extreme anterior ones have the crest teeth less well developed and the guard hairs fewer. The rather long, slender, curved stem has a distinct but tapering shoulder, a rather long, erect neck and an enlarged head, below which is a very prominent square guard process (fig. 32). The beak is stout and hooked, the crest teeth three or four, the lowermost very large, the upper small or obsolete; sometimes, especially on anterior uncini, a pair of small but distinct lateral teeth is present. The guard is strong and consists of about sixteen stiff hairs which arise from a scale-like base ensheathing the front of the guard process, and spread regularly in an even curve around the end of the beak, above which they arise convergingly to a considerable height.

The body of the alcoholics is generally colorless or pale yellow, but the cuticle has a strong bluish iridescence throughout.

A portion of a tube is soft and flexible, consisting of a thick mucoid substance covered with a stratum of moderate thickness of soft grayish brown silt.

This species is evidently related to the three species of *Maldanella* described by McIntosh from the deep waters of the oceans of the Southern hemisphere. The Japanese maldanid *Clymene harai* Izuka (= *Axiothea campanulata* Moore) also belongs to this genus.

The sources of the examples of *M. robusta* are Station 4,197, Gulf of Georgia, 31 to 90 fathoms, bottom of sticky green mud and fine sand; Station 4,230, Behm Canal, 108 to 240 fathoms, rocky bottom; and Station 4,246, the type locality, Kasaan Bay, Prince of Wales Island, 101 to 123 fathoms, bottom of green mud with coarse sand and shell fragments.

Clymenella tentaculata sp. nov. Plate XI, figs. 33-35.

This very interesting species is unfortunately imperfectly known, the following description being based upon one anterior and one posterior piece which may be parts of the same individual and which together represent nearly an entire worm.

The former measures 22 mm. long and 2 mm. wide at IX and consists of the prostomium and nine segments; the latter is much twisted and the five setigerous segments, four achaetous preanal segments and pygidium measure about 20 mm. long.

The cephalic plate is very much expanded and flares widely at the margin. Its outline is very broadly oval. The hinder third of the rim is separated from the anterior two-thirds by a pair of small lateral

incisions, behind which it is more erect and diminishes in height to a minute median posterior notch. Anterior to the lateral incisions the rather abruptly widened and flaring margins continue undiminished almost to the palpode which they join on each side. The cephalic margin is everywhere smooth and its margin entire. A pair of conspicuous sensory slits divide the central disk of the head for about the anterior five-sixths of its length into three narrow longitudinal areas of equal width which are united behind. The central one is somewhat ridged and widens almost imperceptibly as it passes into the palpode anteriorly. The palpode consists of a short rounded base bearing a slender, elongated finger-like process on its median anterior margin.

The cephalic plate forms a dorsal angle of about 120° or less with the peristomium, which is indistinguishably coalesced with the prostomium. It is little more than one-half as long as the cephalic plate and its surface is slightly granulated but unwrinkled. Owing to the protrusion of the proboscis, which has a depressed acorn-shape, with the basal division thickly papillated, the mouth is invisible.

Somite II (the first setigerous) has a length about equalling the width at the anterior end, from which it gradually diminishes in diameter caudad. The next two segments are narrower, after which the diameter increases gradually to VIII, though the length remains nearly constant; IX has the same diameter, but if complete is scarcely half as long as VIII. All of these segments are transversely wrinkled superficially and are provided with a distinct, raised neural line. No prominent collars but merely a low free rim, most distinct on V, are developed on their anterior ends.

Owing to the much coiled and twisted condition the real proportions of the distorted posterior segments cannot be easily ascertained. They are evidently three or four times as long as wide, slender and thin-skinned, except posteriorly where the prominent, swollen and glandular parapodia are developed. There are no especially developed glandular zones or muscular ridges and the neural line is elevated throughout. The last six or seven segments decrease in length and the entire region tapers to the pygidium. The first of the posterior achæitous segments is about one and one-half times as long as wide and of a shape similar to those preceding it, having fully developed but naked tori on the posterior end. The next three are simple rings without tori and of rapidly decreasing length. Terminating the body is a remarkably small, top-shaped pygidium lacking any limbate margin. Instead there arises around the base of the anal papilla, which con-

stitutes its greater part, a circle of twenty-three separate and distinct cirri, all of which are slender, regular and equal, and not, as in many species of the genus, alternately longer and shorter. Apparently they increase slightly in size from the dorsal to the ventral side; and the median ventral one is much elongated, its length equalling that of the four achæitous segments combined or about ten times the length of the other marginal papillæ, and it is very slender distally.

On the first three setigerous somites (II to IV) about thirty setæ occur in each group and are disposed in small vertical tufts just above the lateral line and about one-third of the length of the somite from its anterior end. The small number of uncini (3 to 5) are sessile in short, transverse lines just below the setæ. On succeeding segments the setæ are more numerous and project upward and outward in tufts from small tubercles. The uncini are more numerous (13 on V, 20 on IX, and still more posteriorly) and form longer lines widely separated below by a space of twice or more their own length. The tori have become prominent swellings. On IX they have become transferred to the posterior end, although the boundary between this segment and VIII is not clearly defined. This condition of the tori continues throughout the body, though they become even more prominent posteriorly and are united across the dorsum of each segment by a glandular band. The dorsal interval between the setæ is about equal to the ventral interval between the uncini. The first achæitous segment at the posterior end bears a pair of perfectly normal tori, but no setæ or uncini.

The setæ are often imperfect and their distribution is worked out only incompletely. Anterior segments have them all slightly curved, delicate and narrowly winged, with very slender, tapering tips. They occur in two series, one of finer, the other of coarser setæ. Farther back these two kinds become further differentiated. Both become longer and the slender ones provided with short basal wings, beyond which is a delicate capillary tip doubly fringed with strongly divergent, very fine hairs.

All uncini are yellow and have the stems longitudinally striated. Those of somites II to IV, in which the number is small, have the form shown in fig. 33. The stems are slender, slightly curved, regularly enlarged, but with no distinct nodule, then slightly constricted to a neck, bearing a scarcely enlarged head (fig. 34), with a simple, tapering unhooked beak, a small crest of three minute teeth and apparently no guards. These uncini increase regularly to the dorsalmost, which

also has by far the most prominent beak. On the remaining somites the uncini differ decidedly in the form of the head (fig. 35) which is much enlarged backward. The smaller beak is more curved and hooked, the crest high and prominent, with five or sometimes six non-fibrous, imbricated teeth of diminishing size. The guard consists of several (about 8) fine tapering hairs, which arise from a plate just beneath the beak, the inferior outline of which they follow to the tip, above which they then rise as curled inarched filaments.

The alcoholic specimen is colorless, but the greatly developed parapodial plexuses of bloodvessels indicate red bands during life.

Some fragments of tubes are 3 mm. in diameter. Their flexible walls are composed of a soft mucoid membrane covered with a thin coating of very fine neatly deposited sand.

This species presents interesting resemblances to *Praxilla gracilis* (Sars) Malmgren in the form of the head and tentaculiform palpo, to *Chlymenella catenata* (Malmgren) in the number of achæteous preanal somites, and to *C. rubrocincta* Johnson in the elongated median ventral pygidial cirrus.

It is known only from Station 4,264, off Freshwater Bay, Chatham Strait, July 25, 1903, 282 to 293 fathoms, bottom of green mud.

Nicomache carinata sp. nov. Plate XI, figs 36-39, and Plate XII, figs. 43 and 44.

A well-preserved but somewhat contracted specimen (the type) is 65 mm. long and 3 mm. in diameter at the thickest part. Another incomplete but more fully extended example must have exceeded twice this length when complete.

The prostomium and peristomium are coalesced, forming a continuous head about $1\frac{3}{4}$ times as long as wide. The prostomial region is nearly vertical with about its medial $\frac{1}{2}$ formed by a ridge, which forms a prominent profile, somewhat arched above and ending below and anteriorly in a transverse crescent, separated by a slight groove from the short, somewhat thickened palpo. The latter is continuous with the similarly thickened lateral margins of the head, within which is a pair of shallow longitudinal depressions, while within these again and close to the median ridge are the distinct longitudinal sensory slits or nuchal organs.

The dorsal peristomial region is somewhat tumid anteriorly, with a nearly straight profile posteriorly, but strongly arched transversely throughout. From the prostomium it is slightly distinguished by a faint transverse groove which passes laterally into the depression mentioned above and the groove which continues the latter posteriorly to the end of this segment. The mouth is a large elliptical opening sur-

rounded by a rugous, furrowed lip. Just behind this lip is a shallow transverse ventral groove, while near its posterior end this segment is completely encircled by another faint furrow which, like the groove mentioned, is met by the longitudinal furrow on each side.

Besides the pygidium the type has 24 segments, while the only other complete specimen in the collection has 25. The peristomium is achæitous, and somites II to XXII (or XXIII) inclusive are setigerous, leaving two preanal achæitous segments, as in *N. lumbricalis*. Somite II is as long as the head; the next seven or eight segments are successively of slightly increased length, the last named being nearly twice as long as the first. Behind IX several segments remain nearly equal in length, then the length diminishes, at first slowly, then rapidly to the last, the last three setigerous segments each equalling III in length and the two achæitous preanal segments together barely exceeding the last setigerous. Somites II, III and IV are of much greater diameter anteriorly, and slope to the posterior end which is inserted slightly into the next succeeding segment. The next five segments (V to IX) are more nearly cylindrical, but bear slightly produced glandular collars at their anterior ends. The last four are simple short rings. At the two ends of the body the intersegmental furrows are deep and distinct, but in the middle region they are obscure.

The pygidium is funnel-form, but little widened, regular and somewhat longer than the last two segments combined. On the type its margin is divided into twenty-one equal and regular triangular teeth each with a minute cirriform tip. The only other anal funnel present has but sixteen marginal teeth and cirri. The anus is central and very large, and is surrounded by about ten regular lobes separated by as many radiating furrows. At about somite VIII the neural groove begins to be distinct between the lateral muscle ridges and continues to XXIV, from which point a faint neural line continues across the pygidium to end in the median marginal tooth which is narrower than the others. The other anal funnel has the three median ventral teeth smaller and the nerve cord terminating between two of them.

No distinctly elevated tori or setigerous tubercles exist anterior to XIII, on which the latter are midway between dorsum and venter, and the ridge-like tori extend from just below them through the centre of the broad glandular zone nearly to the neural line. On succeeding segments they are even more prominent, and behind XV have shifted with the glandular zone to the posterior end of the segment. Toward the posterior end as the thin-walled portion of the segment diminishes in length they become more central, and finally on XXI and XXII the

swollen glandular tori form the entire length of the segment and bear the uncini along the middle. Although XXII and XXIV are achætous they are similarly constituted.

The head and first four segments are very smooth, iridescent and of a uniform deep purple color above. The next three segments are smooth and dull yellowish throughout; those of the middle region have pale anterior glandular zones, the rest being yellowish and roughened, while posterior segments are pale throughout and thin-walled, except for the ventral longitudinal bands and posterior glandular zones.

The peristomium and two preanal segments are achætous. Somites II, III and IV have a single stout spine situated at about the end of the anterior one-third of the segment and about twice as far from the dorsal as from the ventral median line. A little above and in front of this is a short vertical series of capillary setæ. On the remaining segments the setæ form more prominent tufts arranged in vertical series midway on the sides of the body and in the middle of the glandular area which lies on the anterior end of the somites as far as about XV, then for some segments on the posterior end, and finally, with the disappearance of the non-glandular region, occupies the entire segment. Uncini occur on all segments from V to XXII inclusive. They are in all cases arranged in a single series in the same plane as the setæ, and extend in a line, for a greater or less distance according to their number, on to the ventral surface. On the anterior segments they are slightly larger and fewer, the number counted in the type being 7 to 9 on V, 16 to 19 on X and 10 to 12 on XXII.

The single ventral spines on II, III and IV are stout, fibrous and yellow, tapering to a slightly curved, blunt, hard point. On the same segments the notopodial tufts contain about six longer, stouter setæ (fig. 44) with longitudinally striated stems tapering to stiff, straight, acute tips and provided with a broad and extensive wing on one side and a very narrow one on the other; also a corresponding number, arranged in a parallel row, of much shorter, more delicate setæ (fig. 43) with nearly wingless stems tapering to a long hair-like and very delicate, flexible tip provided on each side with minute cilia-like hairs. The latter are so minute that they are visible under high powers only. Except for a slight increase in number the stouter setæ remain unchanged throughout, but the more delicate ones become considerably modified. By about the tenth segment they have become more numerous; some of them (fig. 43) are only moderately elongated (about as much or only slightly more than those of the preceding segments), but the lateral processes have become much larger, ensheathing and awn-

like, and may be arranged spirally (fig. 43a); others are very greatly elongated, thread-like, openly spiral, tapered very gently to acute tips, and have the lateral processes reduced to minute appressed scales (fig. 36). The latter spring in a group from the ventral side of the bundle.

Typical crochets (figs. 38 and 39) have rather slender, strongly curved stems with an asymmetrical nodulus near the middle, the head very little enlarged and provided with a stout, rather long, moderately acute, strongly hooked, and slightly recurved rostrum, above which is a prominent crest consisting of five, or sometimes of four, depressed, overlapping, diminishing teeth. There are no lateral teeth, but the striations end in several groups of conspicuous markings just below the principal teeth. The guard arises close beneath the rostrum, but separated from the latter by a distinct space. There is no distinct guard process or shoulder, but the guard arises as a distinct transverse plate, soon becoming divided into about twelve slender, tapering filaments, which spread around the end of the rostrum or overarch it. The stem, neck and posterior part of the head are strongly striated. Posteriorly the stems of the uncini increase in length. On somite V all of the uncini have the form shown in fig. 37. The stem is straighter, beak less hooked and the teeth of the crest fewer and more erect. The guard is rudimentary.

The head and succeeding three or four segments are very smooth, iridescent and of a uniform deep purple or reddish-brown color above, not at all spotted or blotched; the next three segments are smooth and yellowish throughout; those of the middle region have pale anterior glandular zones, the remaining parts being yellowish and roughened; while posterior segments are pale throughout and thin-walled, except in the position of the longitudinal muscles and glandular zones.

The tubes are stout, thick-walled, hard but fragile structures, composed of fine sand grains, sponge spicules and bits of rock cemented together firmly and lined by a thin mucoid layer. Several tubes are sometimes coherent side by side.

Fragments of this species occur in the collections from the Gulf of Georgia, Station 4,197, 31 to 90 fathoms, on a bottom of sticky green mud and fine sand, and Station 4,198, 157 to 230 fathoms, on a soft green mud bottom. The type locality is Station 4,227, in the vicinity of Naha Bay, Behm Canal, 62 to 65 fathoms, dark green mud and fine sand.

Nicomache carinata is easily distinguished from *N. personata* Johnson by the possession of two achæitous preanal segments, while the latter has but one. In this respect it resembles *N. lumbricales* Malmg.,

but differs from that species in color, the form of the uncini and spines and the greater number of marginal divisions of the pygidium.

Lumbricymene pacifica sp. nov. Plate XII, figs. 40-42.

The type and largest complete specimen, which is unduly elongated through maceration of the middle region, is 103 mm. long and 2 mm. in diameter.

The head (composed of prostomium and peristomium) is slightly compressed laterally and very short, the length only very slightly exceeding the depth. It totally lacks a cephalic plate and has a nearly straight dorsal profile, meeting the vertical and convex anterior profile at nearly a right angle. There is just the faintest indication of a palpode and of the anterior end of the median ridge. About midway on the side of the head a longitudinal furrow extends from the furrow $\frac{1}{II}$ to a point just over the mouth, and just anterior to the ends of these furrows are the nuchal organs—a pair of small round depressions. A few faint short furrows run from near the end of the longitudinal furrow toward the mouth, and behind the latter the longitudinal furrow is cut by a transverse furrow which is very strongly developed on the dorsal side but fades out ventrally. From the posterior end of the peristomium a short re-entering half-ring is cut off ventrally by a rather distinct furrow which ends dorsally at the longitudinal furrow. The mouth is a rather conspicuous transverse slit situated about opposite the middle of the head and bounded both anteriorly and posteriorly by rather prominent lips, the former of which is marked by a short but deep longitudinal furrow.

Somite II is slightly shorter than the head. Behind it the segments increase regularly in length to IX at least, which is about three times as long as the head. Behind this several segments are probably still longer, but owing to their much softened state the exact length is uncertain. At the posterior end XVI is about as long as VI or VII and succeeding segments diminish rapidly, XIX and XX together only about equalling V in length. The two achæitous preanal segments are again much reduced.

Except that at the extreme posterior end a few are provided with prominent tori, all somites appear to be perfectly cylindrical. Somites II, III and IV bear setæ about the middle and just behind them is a faint furrow. The next five bear them near the anterior end just behind the glandular girdle. Posterior somites have their large swollen tori situated near their posterior ends and bearing the small tufts of setæ above and moderately long lines of crochets below. The two

preanal segments have two tubercles on each side, one above the other, in the position of the tori, but without setæ or uncini.

In the type the pygidium is very short—less than the two preanal segments—and is terminated squarely by a simple slightly convex plate of broadly elliptical outline. Another specimen has the pygidium more extended and nearly twice as long (on the dorsal side) as the two preceding segments, and the terminal plate is oblique at about 45° . In both specimens the plate is margined by a just evident fold, continuous except on the median ventral region. Just anterior to this margin dorsally is the anus.

The color is well preserved at the anterior end in a sharply contrasted pattern of reddish brown and white. On the head the former color occurs as follows: over the entire frontal surface, a half-ring on the dorsum of the posterior end of the prostomium, and a broad ring which occupies most of the peristomium and which is much more deeply colored dorsal to the longitudinal furrow than below it. The white areas are a broad band occupying the sides and dorsum of the prostomium above the mouth, and a very narrow ring on the anterior end of the peristomium. On several succeeding segments the arrangement is in a narrow anterior red ring, then a white ring occupying most of the glandular zone, and succeeding this an extensive red area occupying all of the rest of the segment. These colors are best developed on the dorsum, and gradually fade until by about somite VII only a nearly uniform dull yellow prevails. The glandular areas are, however, always whiter and more opaque than the remainder of the segment.

The peristomium and two preanal somites are achætous, II to V bear small tufts of dorsal capillary bristles, and immediately below them two stout straight spines. Remaining somites have dorsal setæ tufts, and below them ventral series of crochets occupying from one-eighth to one-sixth of the circumference of the segment.

The anterior spines (fig. 40) are deep yellow, with opaque fibrous centres and straight blunt ends. In each tuft the setæ number from fourteen to twenty in two ranks. On the proximal part of the exposed portion is a rather wide wing, obliquely striated and often frayed and fringed on the free margin. Just below this the shaft is usually constricted, and beyond it tapers to a capillary tip which is short on the anterior and very long and delicate on the posterior segments, but always, so far as determined, quite devoid of hairs or awns.

Crochets are always few in number, never more than nine to fourteen occurring in each torus. They (fig. 41) are similar on all segments and

have well-differentiated shoulder, neck and head. The latter (fig. 42) bears a stout, strongly hooked beak, above which are four stout profile teeth of diminishing size, flanked by a few small lateral teeth. The guard arises well below the beak and consists of about twelve coarse fibres which spread in front of and above the apex of the latter. The internal fibrous structure is strongly developed.

Several tubes of this species occur in the collection and are interesting in structure. They measure 70 to 80 mm. long and 2.5 mm. in diameter, and occur either singly or attached in groups or to foreign bodies. Their walls are thin but hard and very brittle and are composed chiefly of small sand grains and sponge spicules, the latter of which are so attached that their pointed ends project freely toward the mouth of the tube. Various kinds of foraminifera and other foreign bodies are attached to the tubes, which are always dark-colored at the distal end and clean and pale elsewhere.

Two complete worms and a fragment together with four or five tubes were taken at Station 4,264, off Freshwater Bay, Chatham Strait, 282 to 293 fathoms, bottom of green mud.

Sabellaria cementarium sp. nov. Plate XII, figs. 45-51.

The fine species which represents the genus *Sabellaria* along the Pacific coast from Washington to Alaska is represented by a number of specimens, but unfortunately only one of these is complete, the others having lost the posterior end either through an attempt to remove the living worm from their tubes or by maceration in the tubes.

The type and only perfect specimen is 81 mm. long, of which the very slender fecal tube contributes 28 mm. The operculum has a diameter of 4.5 mm., the thorax a width of 6 mm., from which thickness the abdomen tapers regularly to about 2 mm. at the posterior end and then suddenly contracts to the 1 to 1.5 mm. of the fecal tube.

Counting the peristomium there are five thoracic segments exhibiting three distinct types of setation, then follow forty ordinary abdominal segments and about forty-six segments in the reduced fecal tube; finally the pygidium is a tubular structure 1.5 mm. long and .6 mm. in diameter with its posterior end serrate with about twenty minute teeth.

The prostomium is minute and completely concealed beneath the enormously developed peristomium. The small slit-like mouth is enclosed between a pair of closely appressed longitudinal folds, bounded laterally and somewhat enfolded ventrally by the enlarged palps, which are completely connate with the peristomium.

The peristomium is greatly enlarged and in the type measures 6.5

mm. long and 4.5 mm. wide. Dorsally it is completely closed, over-arching and concealing the prostomium and mouth. Together with the palpi which it bears below it forms a broad flat plate, of which the palps form the margins and are rolled inward and nearly touch ventrally. At its distal end the peristomium bears the operculum—a circular or somewhat elliptical disk directed slightly dorsad and composed of three whorls of stout, stiff, hard spines or peristomial setæ, so fitted together that they form a flexible and at the same time close-fitting and impenetrable plug to the tube. There are some indications in one specimen that this region may be regenerated when lost. The paleoli of the three rows differ in form and number as indicated below. Just external to and below the operculum is a circle of rather prominent conical opercular papillæ, which probably represent the much subdivided dorsal cirri of the peristomium. They are clearly divided in two symmetrical halves like the opercular paleoli, and number 16 to 20 on each side.

The palps may be opened from the ventral side and spread, together with the peristomium, as a flattened plate deeply pigmented below and bearing the branchial folds on the lateral thirds. Anteriorly the two palps are conjoined in the operculum, the branchiæ also meeting in the middle line below and behind the operculum. From 12 to 18 of these branchial folds or ridges occur on each side, the usual number in full-grown specimens being 18 pairs. They are prominent ridges running transversely across the free ventral margin of the palps and diminishing in size from behind forward. Owing to the medial bending of the anterior end of the palps, the anterior six pairs of branchiæ are arranged in the form of an arch and several of them lie in a nearly antero-posterior plane. Each gill consists of a stiff plate or ridge, with a serrate free margin behind which the filaments are borne. Except the very last, which usually bears but 10 filaments, the posterior gill ridges have about 20, the number decreasing regularly to the most anterior. All gill filaments are very slender and thread-like and the longest posterior ones equal the width of the peristomium.

At the base of the branchial region is a pair of short rounded lobes having much the aspect of the branchial plates, but shorter and thicker than they and coming in contact across the mouth slit. Continuing from this dorsally is a sloping ridge bearing a pointed conical cirrus longer than the rounded lobe, and above this again a small tubercle carrying a fan-shaped tuft of slender setæ.

Somite II is a short, simple ring partly fused with I and III ventrally to form the first ventral gland plate. Laterally it bears three conical

cirri, the ventral about as long as the segment, the middle about two-thirds as long, and the dorsal more than twice as long, slender distally and resembling the branchiæ, with which it stands as the first of a series.

The remaining three thoracic segments are a little longer and IV and V bear distinct ventral glandular plates. Their neuropodial setæ are stouter than those on I and II, but have no associated cirri and arise from the anterior margin of the segment on a level about midway between the neuropodial tufts of I and II. Each of these segments bears a dorsal cirrus or gill similar to that on II and in line with it, leaving a broad, naked area on the dorsum. Unlike II these somites bear no middle cirrus, but in place of it a prominent vertically elongated notopodial tubercle bearing a vertical series of large, coarse, paddle-shaped setæ.

Abdominal segments are somewhat flattened and only obscurely separated. As indicated above they decrease gradually in both length and diameter to the caudal appendage. Dorsally they present a somewhat arched area between the rows of gills and ventrally are excavated by a deep groove for the fecal tube, which is held in place by the tufts of slender neuropodial setæ crossing from side to side beneath it.

The body walls are exceedingly thin and delicate in the dorsal median area and permit the intestine to show through distinctly; the sides and ventral parts are decidedly thicker and more muscular. The abdominal gills have the same general form and position as the thoracic but are more perfect in structure, having larger blood-vessels, thinner walls and more numerous and prominent transverse ciliated ridges along their medial aspect. The first five or six are also much longer and have a length equal to the width of the interbranchial area. From this point they decrease in size very gradually and are totally absent from the last five or six segments.

On the first abdominal segment the parapodia are very extensively developed and the notopodial uncinigerous tori occupy the entire side of the segment from the branchia nearly to the ventral median line. Ventrally they become higher and terminate in a small free lobe, from beneath which arises a delicate ventral cirrus, and below this again the small neuropodial tubercle with its tuft of setæ. The tori decrease in length chiefly from the dorsal end, at first very slowly, then rapidly and at the same time become more sharply defined as distinct, thin, outstanding lobes bearing the uncini on their margins. Toward the posterior end they become merely small prominent pro-

cesses with somewhat constricted stalks standing midway between the branchiæ and the neuropodial setæ tuft. After the first abdominal segment the neuropodial cirrus quickly becomes reduced and in four or five segments has become quite rudimentary or totally absent.

The caudal or fecal tube has already been partly described. It is very delicate and thin-walled and bears no trace whatever of parapodia. Along its ventral side, however, what appear to be nerve ganglia can be distinctly seen and counted through the body wall, and delicate lines running in pairs from their neighborhood dorsad and cephalad have the same metameric arrangement.

The type specimen is richly colored. The outer whorl of paleoli are a warm golden, the inner a golden brown. The thoracic region is a rich sienna brown, especially deep on the dorsal interbranchial region of the peristomium as well as of succeeding segments, and on the sides of the latter and the first ventral plate. The ventral post-branchial lobe of I and the dorsal branchiæ are also well colored, but other cirri are pale. The gill filaments are pale purple, each with a deep brown basal spot. This specimen is a male, and the abdomen is colored pale cream from the contained sperm. Except for delicate lines formed of minute dots of reddish brown, which begin at the ventral setæ tufts and then pass dorsad along the anterior margin of the segment and in most cases continue on to the antero-lateral margin of the gill, there is no pigment in this region. The intestine is filled with a greenish-gray matter that colors the fecal tube. Most of the other specimens are paler, but one has the anterior brown parts of a deep chocolate. The genital products escape by means of a pair of openings through the body walls behind the parapodia of each segment and in several cases from large masses within the tubes.

The opercular paleoli vary from bright yellow to the more usual deep golden brown. They are all very stout, hard and rigid, and of peculiar irregular forms difficult of accurate description. All have slender, elongated stems, smooth superficially but striated longitudinally at the core, bearing very heavy and strong external blades, the great part of whose surface is roughened by numerous fine wavy parallel ridges which are slightly imbricated with their edges directed outward. The markings are not shown in the figures.

The outer whorl of normal opercula contains from 39 to 64, according to the size of the worm, between 50 and 60 being the most usual number. They are arranged in two symmetrical groups, though there appears to be a decided tendency for the right half to include one or two more than the left. Exclusive of the stem they (fig. 45o) consist

of a massive irregularly twisted base, from which arises a tongue-like piece the end of which is strongly flattened at right angles to the greatest thickness of the base and terminates in a fringed tip, from the central cleft of which arises a slender, densely hairy process (fig. 46). These paleoli are so arranged that they present a spreading rim, in which their twisted form causes the basal portions to be somewhat imbricated from below dorsalwards.

The middle paleoli number from 14 to 25, usually about 20, in symmetrical halves. They (fig. 45*m*) also have a thickened base, from which arises a very prominent upright spine, gracefully curved and tapered to an acute tip. The inner circle of paleoli contains from 14 to 22, but in nearly all cases they equal and alternate with those of the middle row. They (fig. 45*i*) have abruptly widened cleaver-shaped ends bearing a knife-like edge and strengthened on the opposite side by a thickened rim which ends in a short triangular beak. They are disposed somewhat obliquely to the middle line and converge ventrally.

Somite II bears a small tuft of strongly doubly-fringed, feather-like neuropodial setæ (figs. 49 and 50). On III the neuropodial setæ are partly of a short, more brush-like form and partly very small and of a slender, slightly fringed form. On the remaining thoracic segments they all become more sparsely fringed. The notopodials (fig. 47) on III, IV and V form a single vertical series of stout setæ, shaped like an Indian paddle with the end much split and frayed. At the base of each of these is a minute spatulate hairy setæ, with the end entire and somewhat produced in the middle, and the blade bent flatways.

Abdominal setæ are all very long and slender, but owing to different states of development appear of unequal length. Their shafts (fig. 48) are provided with numerous whorls of hairs united at the base into collars and much produced on one side.

The uncini (fig. 51) are very numerous and vary from 100 to 200 or even more on a torus. They are nearly colorless, delicate and inconspicuous, and consist of narrow elongated bodies provided with from 7 to 9 (seldom the former) very acute, appressed, overlapping teeth which are arranged in one series and diminish in size toward both ends. Each bears a stiff and rather brittle tendon at each end, the upper one being short and expanded distally into a small plate, while the lower bifurcates immediately into a shorter, irregularly thickened, more ventral branch and a slender uniform branch greatly elongated to many times the length of the uncini.

This species is probably rather common and occurs in the collections from the following stations: 4,220 (type), Admiralty Inlet, near Port

Townsend, Washington, 16-31 fathoms, green mud, sand and broken shells; 4,247, Prince of Wales Island, 89-114 fathoms, green mud with sand and broken shells; 4,274 (eotypes), Kadiak Island, 35-41 fathoms, green mud and fine sand.

Samytha bioculata sp. nov. Plate XII, figs. 52, 53.

The anterior prostomial lobe is quadrate, broader than long, its anterior border wider than the posterior, slightly concave and its lateral angles somewhat produced. Immediately behind and separated from it by a distinct transverse furrow is a second small quadrate lobe, with a rather prominent eye or close aggregation of several pigment specks at each antero-lateral angle. Behind this lobe the peristomium forms a broad, smooth, slightly convex area reaching to the branchiæ. Ventrally there is a very broad truncate under lip with a glandular margin. In the two known specimens only four to six very short clavate tentacles exist on each side.

The considerably enlarged peristomium projects ventrally as a broad lobe enveloping the lower lip and is marked by a narrow transverse line of gland cells. Elsewhere it is a simple smooth convex ring. The second somite is about two-thirds as long and marked by a broader glandular half-ring. The third (first setigerous) somite is very short, but succeeding ones increase in length rapidly and by about VIII equal the peristomium. All of the thoracic segments, of which there are nineteen, the last seventeen of which are setigerous, are somewhat muscicularly thickened on the ventral half and provided with a narrow presetal half-girdle of glands. The entire dorsum between the setæ tufts is thin-walled and smooth throughout.

Fourteen segments in the type and larger specimen, and thirteen in the smaller eotype, form the abdomen. In the former this region comprises about one-third of the entire length; in the eotype not more than one-fourth. Owing to the projection of the parapodia from the angles this region is decidedly quadrate, but somewhat arched dorsally and marked ventrally by a narrow neural groove. The somites diminish regularly in all dimensions from before backward and the entire region tapers to the pygidium, which forms a ring surrounding the large anus and bears a pair of slender, prominently projecting cirri about equal to half the diameter of the body at the posterior end.

The four pairs of branchiæ are so much crowded antero-posteriorly that they appear to form a single series extending quite across the dorsal area of II and III. Closer study shows that two are anterior and slightly more lateral and two posterior and more median. They are all similar, slightly flattened, slender and elongated, their length

being about three times the diameter of the region of the body from which they spring.

Setæ begin on III as a pair of minute tufts arising from an elevated position just beneath the gills. The tufts on IV are also small and placed nearly as high. On succeeding somites the setæ become larger and more numerous and the tufts gradually assume a low station on the sides of the body as the abdomen is approached. They continue to XIX.

Uncinial tori begin on VI, or the fourth setigerous somite. Throughout the thoracic region they are low, but freely projecting, compressed folds which arise immediately ventral and slightly posterior to the setæ tufts and end ventrally in a freely hanging lobe or process. On abdominal segments the notopodia are distinctly separated from the neuropodia and project as small papillæ from the dorsal angles of the body. The neuropodia are small, compressed lappets constricted at the base and bearing the uncini along the free margin; apparently they lack cirri.

Setæ are all of one kind, slender, tapered and narrowly winged on both sides of the free portion nearly to the very acute tip. The uncini form a close single rank in which they are quite numerous (108 on X). From dorsal to ventral end of each series they decrease in length. They (fig. 52) are roughly triangular with a nearly square but sometimes projecting upper ligament process, above which the tooth-bearing margin rises but slightly. The inferior process varies in form, but is usually more or less incurved. Those of the type specimen almost constantly bear four long, slender, acute, overlapping teeth, the ventralmost of which is the stoutest, the two middle the longest and the upper the most slender. On the cotype a fifth smaller and sometimes minute tooth exists at the upper end of nearly all uncini (fig. 52a). Abdominal uncini (fig. 53) have the same form, but are much fewer in number.

This species is founded on two much macerated specimens, of which the larger and type is 30 mm. long and filled with large ova. The smaller example is 16 mm. long.

A nearly complete tube is 65 mm. long. Its basal third is soft, thin-walled and membranous. Beyond this the walls gradually thicken by the accumulation of silty material until they attain a diameter of about 5 mm. This entire region of the tube is supported and protected by siliceous sponge spicules, the ends of which project in all directions and produce a very firm and bristling structure.

Both specimens come from Station 4,197, Gulf of Georgia, 31 to 90 fathoms, sticky green mud and fine sand.

Amphicteis scaphobranchiata sp. nov. Plate XII, figs. 54-61.

A single well-preserved specimen represents this noteworthy species. The length without branchiæ is 32 mm., the branchiæ 7 mm., and the maximum width in the anterior part of the thorax 2.8 mm.

The anterior lobe of the prostomium (fig. 54) is almost completely divided by a longitudinal furrow into a pair of somewhat slender tentacle-like divisions which are somewhat divergent anteriorly. A narrow transverse welt passes across the base of this region and is partly concealed by the much larger and more prominent sensory folds which lie behind it. These pass from the lateral borders of the head nearly transversely to the middle line, where they meet in a wide angle. Laterally they are continuous with the lateral lobes or folds which join the frontal lobe beneath. The tentacular membrane lies below the frontal and lateral lobes and is partly embraced by the peristomium. It bears from twelve to fifteen tentacles on each side, the lateral ones being very short and the middle ones as much as two-thirds the width of the thorax. All and especially the shorter ones are more or less clavate.

The prostomium passes without any clear demarkation into the peristomium, which reaches as a smooth unbroken convex surface to the branchial segment. Dorsally it is remarkable for its extent, smoothness and absence of furrows. Its length and breadth are each equal to about two-thirds of the width of the branchial segment. In the middle line it reaches to the interbranchial shield, but its postero-lateral angles are cut off by the paleolar tubercles and lateral portions of somite II. Ventrally the peristomium forms a large, broadly truncated lower lip, slightly inserted into II and embraced laterally by the paleolar tubercles.

The second somite is more than half as long ventrally as the peristomium, but except for the narrow strip extending dorsally beneath the branchiæ it ends abruptly at the enlarged paleolar tubercles. Somite III is very short and IV slightly longer, the two combined just equalling the length of II. Behind this region the segments again diminish in both length and diameter to the pygidium. With the exception of the last three or four, the thoracic segments are ill defined on the ventral and not at all on the dorsal side. Up to the level of the setæ tufts, where a lateral shelf-like ridge is formed, the body walls are rather thick and firm, with slight anterior glandular bands and obscure ventral plates. Dorsal to the setæ the body for the entire length is

perfectly smooth and unsegmented. The last three or four thoracic segments are transitional in character to the abdominal. The latter are more distinctly differentiated, owing in part to their more prominent parapodia and in part to the greater depth of the ventral furrows. The last few segments are separated by obvious furrows even on the dorsal side. Owing to its being crushed the pygidium cannot be described further than to refer to the pair of prominent, slender and stiff cirri which it bears. A distinct neural groove extends throughout the abdominal region and even on to several of the posterior thoracic segments. A remarkable smoothness and peculiar dull iridescence characterizes the entire cuticle of this worm.

If normally formed in this specimen the branchiæ are highly characteristic. All four pairs are large and stout and arise in the usual manner, two pairs anterior and more lateral from II and III and two more posterior and median from IV, those of each side being completely coalesced at the base. A small shield-shaped area separates them in the middle line, but otherwise they cover the entire width of the dorsum. Viewed from above they cover and conceal the entire head and curve downward in front of the prostomium and beneath the tentacles. All are very broad and flat at the base, especially the two inner ones on each side. In the case of three of them the outer one-third is less flattened and tapers to a blunt point. The anterior median of both sides, however, expands into a broad flat plate (fig. 56) somewhat lobed on the margins and terminated by a tapering process bent sharply on itself into a hook. This process is complete on one side only, having been broken off of the other. Probably all of the branchiæ are straight in life, but they are peculiarly stiff and rigid and their cuticular covering is thick and marked by fine transverse striæ, but otherwise smooth.

Thoracic parapodia consist of simple setigerous tubercles arising from the lateral muscular shelf and short auriculate tori with both dorsal and ventral angles produced somewhat freely. Abdominal parapodia (fig. 57) consist of prominently projecting hatchet-shaped ventral tori, each bearing a minute cirriform process, and sharply bent, clavate dorsal cirri which replace the setigerous tubercles of the thoracic region. Parapodia of successive somites are united by a beaded muscular ridge which passes along the side of the abdomen between the torus and cirrus. The worm consists of thirty-two segments, of which II bears the paleoli, III to XIX ordinary setæ, and VI to XXXII uncini.

The paleoli (fig. 58) are of a clear, bright glistening straw color and

are arranged in a half tubular figure at the base, from which they diverge and spread distally in a fan-shaped fascicle. In each tuft the shortest one (at the inner end of the posterior limb) is about twice as stout as the longest. Distally they all taper regularly and rather rapidly to very long, slender, acute and stiff tips. Except for these tips they are striated conspicuously in both the longitudinal and transverse direction.

The ordinary setæ (fig. 59) are few in number and form rather small close tufts. They are apparently similar on all segments, being rather slender with tapering stems and acute, tapering tips, striated somewhat obliquely, and provided on one side with a wing of moderate width marked with distinct oblique striæ.

The uncini are numerous on the thoracic segments (135 on X). They have the form shown in figs. 60 and 60a, being roughly triangular, with large bases, a prominent superior ligament process, a projecting rounded lower angle and long tooth-bearing border with five or six strong acute teeth, the lowermost of which is peculiarly bevelled and covers a short inferior ligament process which nearly touches its lower surface. Abdominal uncini (fig. 61) are fewer in number (78 on XXV), much smaller, and formed quite differently. They have small bases and high outstanding tooth-bearing rami, and apparently lack the inferior ligament process.

Several thick-walled mud tubes in the same bottle were probably fashioned by this species.

Type locality, Queen Charlotte Sound, off Fort Rupert, Vancouver Island, B. C., Station 4,201, 138 to 145 fathoms, soft green mud, sand and broken shells.

Chone gracilis sp. nov. Plate XII, figs. 62-66.

A very pretty small species resembling *Chone duneri* Malmgren in proportions, but differing from that species in the short, and broadly winged, barbless tips of the branchiæ. From *C. teres* Bush this species is easily distinguished by its much longer branchiæ, small number of abdominal segments and the more elongated form of the abdominal uncini.

The type specimen has a total length of 32 mm., of which the branchiæ make 12 mm. and the thorax 5 mm., the diameter for nearly the entire length being about 2 mm.

The branchial bases are simple and very low, being completely concealed by the high collar. Ten pairs of delicate branchiæ extend equally to a length of more than one-half of the body. The stems are united by a very delicate membrane for three-fifths of their length and

the remainder is broadly winged on both sides. The barbs are very delicate and are absent from an acute foliaceous tip about 2 mm. long. Eyes are totally wanting.

A collar of the form typical of the genus rises to a height of two and one-half times the length of the segment which follows it. The dorsal ends are refolded into the dorsal sinus and a slight notch occurs in a median ventral position; otherwise it is quite simple. The very small tentacles are shorter than the diameter of the body.

Nine segments, 8 of which are setigerous, form the thorax and 51 segments the abdomen. For nearly its entire length the body is cylindrical and of almost uniform diameter, but in the posterior fourth becomes somewhat broader and depressed before tapering rapidly to the caudal end. No distinct glandular ventral plates are developed, but all of the thoracic and the anterior three or four abdominal segments are completely encircled by a thick glandular layer. The thoracic and a few anterior abdominal segments are strongly biannulate, the middle abdominal are simple and half as long as wide, while the posterior are much shorter and more crowded. The fecal groove is distinct on the caudal fourth of the abdomen, and conspicuous on a few anterior abdominal segments, also where it passes obliquely around the right side of the first abdominal segment and on the dorsum of the thorax; elsewhere it is faint or absent. A few small ova are present in the coelom. Every portion of this worm is white, without a trace of pigment anywhere.

All setæ tufts are short but rather prominent; uncinigerous tori are also short and nearly uniform, diminishing only slowly and regularly from the first to the last. The setæ and uncini are all delicate and colorless. The collar fascicle consists of a small number of narrowly winged, acute, capillary setæ. Remaining thoracic somites have a larger number of partly capillary, partly spatulate setæ placed between two small lappet-like processes. The former consist of a dorsal row of acute tapering setæ with one moderately wide and one just perceptible wing and a small number of very small and inconspicuous crooked setæ (fig. 62) with rudimentary wings found below the spatulate setæ. The spatulate setæ (fig. 64) are arranged in two rows of about ten each; they have delicate, striated, usually symmetrical, obovate blades, and long very slender mucronate processes. The abdominal setæ (fig. 63) are also in one series, few in number, rather coarser than the thoracic and with the two wings narrow and about equally developed. Thoracic uncini contain a single series of erect crochets or hooked setæ (fig. 65) with striated stems and the slightly enlarged head thrown back, a large coarsely divided crest and stout,

blunt beak. On somite V there are 13 in a torus, on somite VIII 11. The abdominal tori contain uncini of the form shown in fig. 66, with quadrate bases and heads of much the form of the thoracic crochets but strongly recurved on the base. They are more numerous than the thoracic crochets, somite XXI containing 17.

The tube is nearly transparent, little tortuous and almost free from sand.

The single specimen comes from Station 4,274, Alitak Bay, Kadiak Island, 35 to 41 fathoms, on a bottom of green mud and fine sand. A smaller specimen was taken at Station 4,253, Stephens Passage, 131 to 188 fathoms, rocks and broken shells.

EXPLANATION OF PLATES X, XI AND XII.

PLATE X.—*Natophyllum imbricatum*—figs. 1-3.

Fig. 1.—Dorsal view of head of type. $\times 13$.

Fig. 2.—Outline of parapodium of middle region, seen from in front, $\times 13$.

Fig. 3.—Distal end of a neuropodial seta of average length. $\times 600$.

Eulalia quadriaculata—figs. 4-6.

Fig. 4.—Dorsal view of anterior end of type. $\times 24$.

Fig. 5.—Posterior view of parapodium from somite XXV. $\times 32$.

Fig. 6.—End of an average seta from somite X. $\times 600$.

Eulalia longicornuta—figs. 7 and 8.

Fig. 7.—Posterior view of parapodium from somite XXV of type. $\times 32$.

Fig. 8.—End of a seta from somite X. $\times 600$. Some of the setæ have even longer appendages.

Pionosyllis magnifica—figs. 9-11.

Fig. 9.—Dorsal view of anterior end of type. $\times 32$.

Fig. 10.—Anterior view of parapodium of somite XXV. $\times 32$.

Fig. 11.—End of a seta from the middle of a fascicle on XXV. $\times 600$.

Stauronereis annulatus—figs. 12 and 13.

Fig. 12.—Anterior end of cotype from above. $\times 82$.

Fig. 13.—A parapodium from somite XXV, anterior view. $\times 82$.

Brada pilosa—figs. 14-17.

Fig. 14.—A medium-sized extended papilla from the dorsum of the middle region, showing ring of adhering silt. $\times 113$.

Fig. 15.—An extended papilla from the ventral surface. $\times 113$.

Fig. 16.—A portion of the middle of a notopodial seta from XV. $\times 250$.

Fig. 17.—Exposed portion of neuropodial seta from XV. $\times 98$. a, portion of middle of the same. $\times 250$.

PLATE XI.—*Stauronereis annulatus*—figs. 18-22.

Fig. 18.—Distal portion of jaw from below. $\times 130$.

Fig. 19.—Forked seta from middle of notopodial fascicle of somite XXV; a, another of the same slightly rotated and foreshortened. $\times 800$.

Fig. 20.—Portion of the middle of a capillary neuropodial seta from somite XXV. $\times 800$.

Fig. 21.—A short-bladed compound neuropodial seta from the middle of the fascicle of XXV. $\times 800$.

Fig. 22.—A long-bladed compound seta from the same somite. $\times 800$.

Travisia pupa—fig. 23.

Fig. 23.—A small portion from near the distal end of a notopodial seta from the middle region. $\times 800$.

Notomastus giganteus—figs. 24 and 25.

Fig. 24.—An entire crochet from the middle of the body. $\times 333$.

Fig. 25.—Profile view, and a face view, of the end of one of the same. $\times 800$.

Maldane similis—figs. 26–30.

Fig. 26.—Slightly winged seta from II. $\times 333$.

Fig. 27.—Hispid capillary seta from somite XV. $\times 480$.

Fig. 28.—End of crochet from somite III. $\times 480$.

Fig. 29.—Entire crochet from X. $\times 110$.

Fig. 30.—Distal end of the same. $\times 480$.

Maldanella robusta—figs. 31 and 32.

Fig. 31.—Two entire crochets from somite XV. $\times 110$.

Fig. 32.—The end of one of the same. $\times 480$.

Clymenella tentaculata—figs. 33–35.

Fig. 33.—Middle crochet from somite II, entire. $\times 110$.

Fig. 34.—End of the same. $\times 480$.

Fig. 35.—End of a middle crochet from V. $\times 480$.

Nicomache coronata—figs. 36–39.

Fig. 36.—Small portion of a fiber seta from somite X. $\times 800$.

Fig. 37.—End of a crochet from somite V. $\times 480$.

Fig. 38.—An entire crochet from somite XV. $\times 110$.

Fig. 39.—End of the same. $\times 480$.

PLATE XII.—*Lumbrichymene pacifica*—figs. 40–42.

Fig. 40.—End of a spine from II. $\times 98$.

Fig. 41.—An entire crochet from somite X. $\times 83$.

Fig. 42.—End of the same. $\times 440$.

Nicomache coronata—figs. 43 and 44.

Fig. 43.—Small seta from somite X. $\times 360$; *a*, small portion of the same. $\times 600$.

Fig. 44.—Large seta from somite X. $\times 360$.

Sabellaria cementarium—figs. 45–51.

Fig. 45.—Three spines forming a middle segment of the operculum, shown in profile in as nearly as possible their natural relations; *i* inner, *m* middle, and *o* outer spines. $\times 32$.

Fig. 46.—A face view of the end of an outer spine. $\times 32$.

Fig. 47.—Middle notopodial seta from somite III. $\times 32$.

Fig. 48.—Portion of an ensheathed capillary notopodial seta from somite XX. $\times 440$.

Fig. 49.—Bipinniform neuropodial seta from II. $\times 98$.

Fig. 50.—A portion of the middle of the same. $\times 440$.

Fig. 51.—Middle abdominal uncinus. $\times 440$.

Samytha bioculata—figs. 52 and 53.

Fig. 52.—Uncinus from somite X of type. $\times 600$; 52, the same from somite X of the cotype, somewhat foreshortened. $\times 600$.

Fig. 53.—Uncinus from somite XXV. $\times 600$.

Amphicteis scaphobranchiata—figs. 54–61.

Fig. 54.—Dorsal aspect of anterior end of type, with branchiæ cut away and separated to show the prostomium. $\times 9$.

Fig. 55.—Ventral aspect of the same with the branchiæ in place. $\times 9$.

Fig. 56.—Distal portion of one of the anterior middle branchiæ. $\times 9$.

Fig. 57.—One of the abdominal parapodia. $\times 24$.

Fig. 58.—A paleolus from the middle of the fasciculus. $\times 83$.

Fig. 59.—A seta from somite X. $\times 250$.

Fig. 60.—Two forms of uncini from somite XII, the five-toothed one *i* somewhat foreshortened. $\times 600$.

Fig. 61.—An uncinus from XXV. $\times 600$.

Chone gracilis—figs. 62–66.

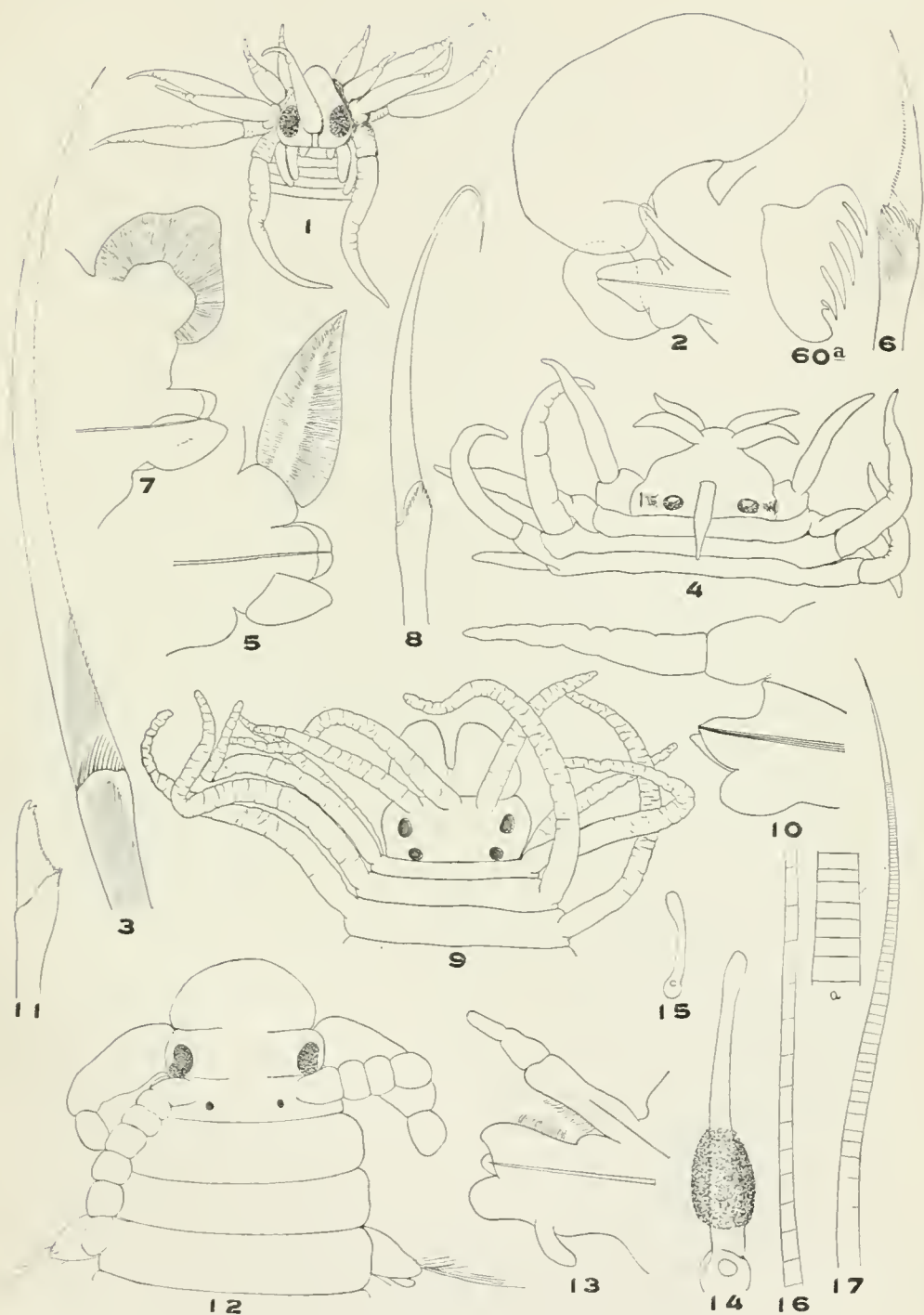
Fig. 62.—A small bent seta from somite V. $\times 360$.

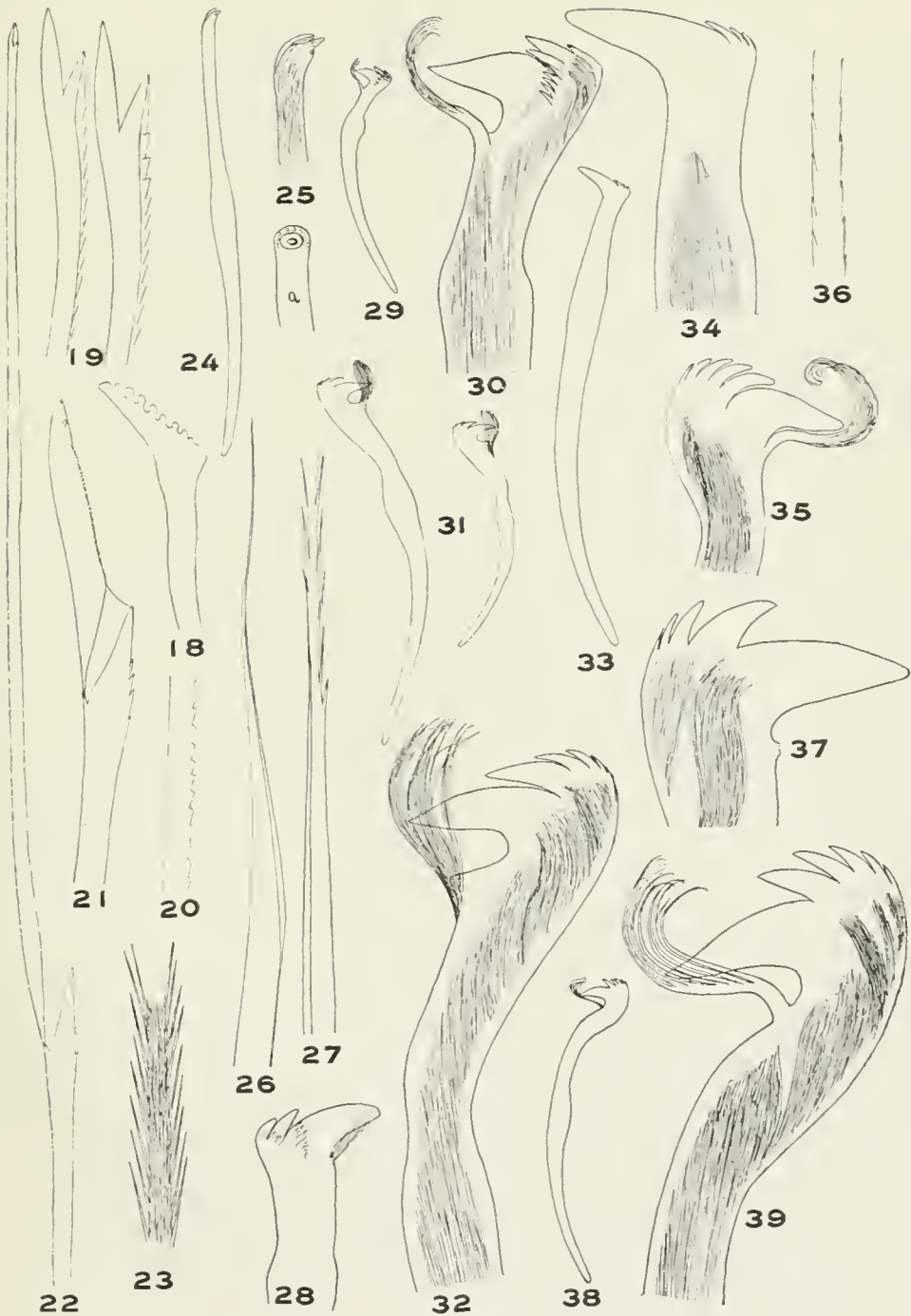
Fig. 63.—A winged seta from XXI. $\times 250$.

Fig. 64.—A spatulate and mucronate seta from VI. $\times 360$.

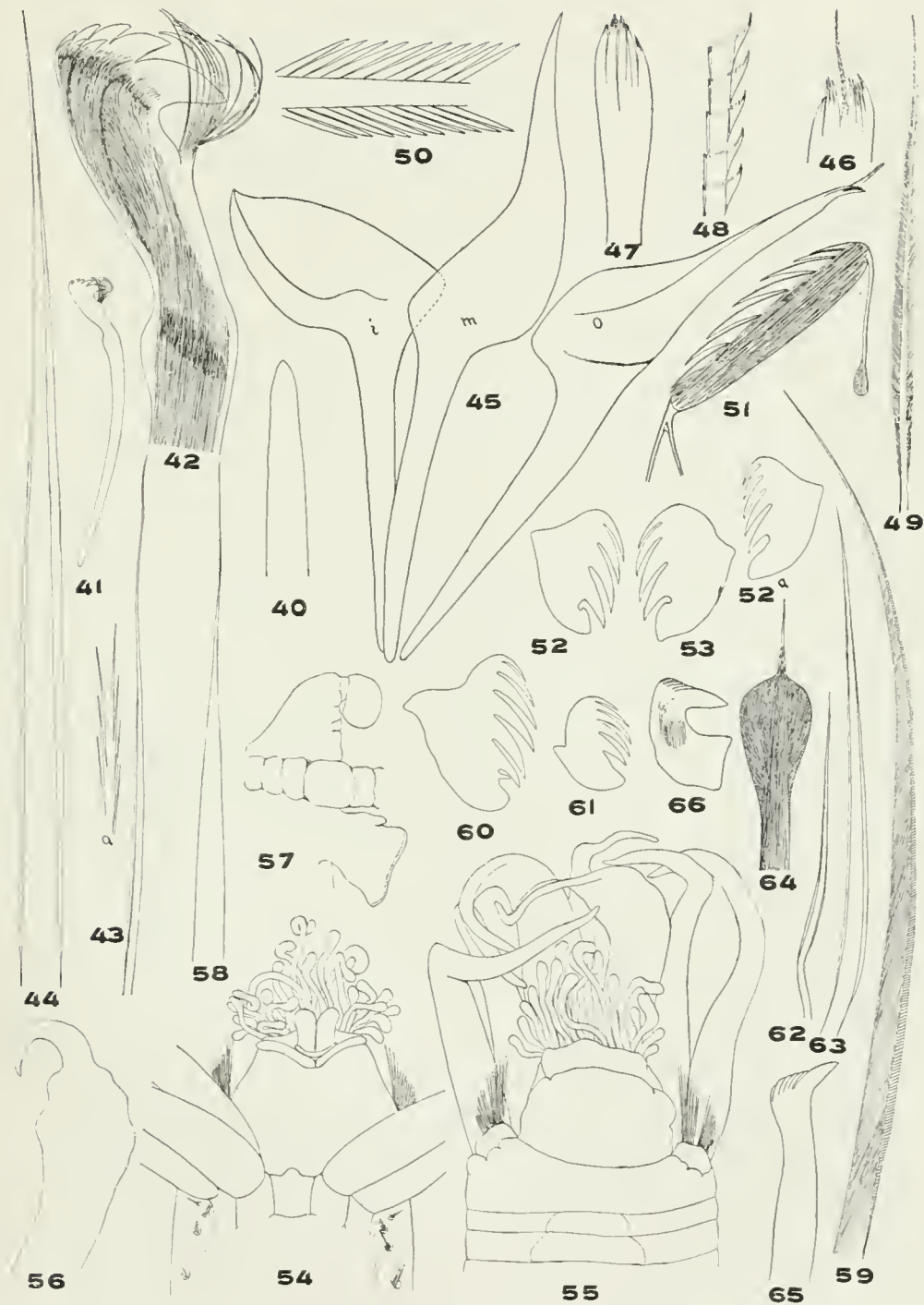
Fig. 65.—A crochet from VI. $\times 360$.

Fig. 66.—An uncinus from XXI. $\times 360$.





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