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# THE POLYCHAETA OF THE PUGET SOUND REGION.

By Herbert Parlin Johnson.

With nineteen plates.

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August, 1901.

No. 18.— *The Polychaeta of the Puget Sound Region.*

By Herbert Parlin Johnson.

The following account of the Polychaeta of Puget Sound and neighboring waters is primarily based upon a collection made by Nathan R. Harrington, lately deceased, a member of the Columbia University Zoological Expedition to that region in the summer of 1896. The collection, comprising thirty-four species belonging to seventeen families, was sent to me in January, 1898. Preliminary examination showed that the collection, although meagre, in part poorly preserved, and almost destitute of data, contained much of interest. It seemed best, however, to defer any publication of results until more and better material could be obtained. Thanks to the good efforts of several collectors, notably Prof. William E. Ritter and Miss Alice Robertson, both of the University of California, very substantial additions have been made to the original collection. These, together with two species from Victoria, B. C., kindly contributed by Prof. William A. Herdman, raise the total number of species to fifty-one, distributed in thirty-four genera and twenty-six families (see Table, p. 384) — practically all the Polychaeta known to occur in the Puget Sound region.[1] They cannot reasonably be supposed to represent more than a fourth or even a fifth of the actual Polychaete fauna. Nearly all the collecting thus far has been between tide-marks. Dredging has been small in amount and limited to very moderate depths (not over thirty fathoms); and the entire absence of pelagic forms — with the possible exception of *Aricideopsis megalops* — would indicate but slight use of the tow-net.

[1] Ehlers ('68) describes eight species from the Pacific Coast; five of these (*Nereis agassizi*, *N. procera*, *N. vexillosa*, *N. virens* and *Nephthys coeca*) have been found in Puget Sound or vicinity.

Baird ('63) describes nine species, all from Esquimalt Harbor, Vancouver Island. Four of these, *Polynoe* (*Lepidonotus*) *insignis*, *lordi*, *fragilis*, and *Nereis foliata* (= *N. virens* Sars) have been identified, and an account is given of them. *Lepidonotus grubei* is in all probability the same as *Polynoe insignis*. There remain unidentified only four of Baird's species (*Harmothoe unicolor*, *Nereis bicanaliculata*, *Glycera corrugata*, and *Sabellaria saxicava*). These it is practically impossible to identify with certainty from Baird's descriptions.

Although comparison has been carefully made with the descriptions of Japanese Polychaeta given by Grube ('77) and by von Marenzeller ('79 and '84), no species, with the sole exception of the widely ranging *Harmothoe imbricata*, has been found to inhabit both sides of the Pacific. This is not surprising when we consider that nearly all of the sixty-two species of Grube's and Marenzeller's lists are from the southern portions of Japan, and therefore belong to the Indo-Pacific fauna, not to the circumboreal. But, on the other hand, comparison of Puget Sound Annelids with those of Bering Sea (Wirén, '83; Marenzeller, '90) also shows absolute dissimilarity. So far as known, the Polychaeta of the more northern parts of Bering Sea — the only ones of that region dealt with by Wirén and von Marenzeller—are practically those of the Arctic and North Atlantic (*i. e.*, are circumboreal) with very little admixture of forms peculiar to the North Pacific. In Wirén's list of twenty-nine species there is not one which can be regarded as belonging distinctively to the North Pacific. Von Marenzeller's list of twenty-four (exclusive of eight previously given by Wirén) affords only two new species; the others are well-known inhabitants of the shores of Scandinavia, Iceland, Greenland, or northeastern America. The data as yet available are wholly insufficient to justify even a rough estimate of what proportion of the Puget Sound Annelids range far to the northward and eastward along the Aleutian chain. From such a category should of course be excluded purely circumboreal and North-Atlantic species (*e. g.*, *Polynoe* (*Lepidonotus*) *squamata*, *Harmothoe imbricata*, *Nereis virens*), as these are no more characteristic of the Pacific than of the Atlantic. When the extensive series of Polychaeta collected by Professor Ritter and Dr. Coe during the Harriman Alaskan Expedition of 1899 shall have been worked up it will doubtless be found to contain many species which range southward to Puget Sound and beyond.

Descriptions of localities where collecting was done by the Columbia Expedition have already been given in the general reports by members of the Expedition ('97, '97a); and the topography of the region, with indication of collecting stations, is shown in a map published with the first of these reports. In many instances the authors mention the occurrence of Annelids; but it is not always possible to determine accurately what species is meant. Moreover, several species are mentioned — by generic name at least — that are not represented in the collections.

In the summers of '97, '98, and '99 Miss Robertson collected in the vicinity of Seattle, a region much further up the Sound than that investigated by the Columbia University Expedition. About Seattle the shores are generally beaches of muddy sand, but sometimes clean sand, as is the case between Duwanish Head and Alki Point. Alki Point itself is rocky, and in 1898 numerous Annelids were found between and under the stones. Under the bluff on the north shore of Port Orchard Channel (stretching westward from the Sound) extends Pleasant Beach, composed of muddy sand. Numerous burrowing forms are from this locality. On this beach Professor Ritter collected several species of Polychaeta in 1899.

Following is a list of the species represented in the various collections, which shows, so far as known, the local and the geographical distribution of each species. For convenience' sake, the two districts explored by the Columbia University Expedition are designated "Port Townsend Region" (including Sequim Bay, Discovery Bay, Scow Bay, and Hood's Canal), and "Neah Bay" (at the entrance of Straits of Juan de Fuca); while that portion of Puget Sound investigated by Miss Robertson and Professor Ritter is indicated as "Seattle Region" and comprises not only the immediate vicinity of Seattle but also Port Orchard Channel and its shores — Orchard Point, Mud Bay, "Port Orchard," Pleasant Beach, and Channel Rocks. A + indicates occurrence of a species in any given region.

Two species (*Northia iridescens* sp. nov. and *Sternaspis fossor* (?) Stimpson) were dredged by Prof. W. A. Herdman at Victoria, Vancouver Island, B. C.

| | | Neah Bay. | Port Townsend Region. | Seattle Region. | Geographical Distribution. |
|---|---|---|---|---|---|
| | POLYNOIDAE. | | | | |
| 1. | Polynoe (Lepidonotus) squamata (L.) Aud. and M. -Edwards. | | + | | Circumboreal; Cal. coast to Santa Monica. |
| 2. | P. insignis (Baird) | | + | + | Bering Sea to San Diego. |
| 3. | P. lordi (Baird) | + | | + | Northward (?); Cal. coast to San Francisco. |
| 4. | P. pulchra Johnson | + | | | Cal. coast to Pacific Grove. |
| 5. | P. fragilis (Baird) | + | + | + | " " " San Francisco. |
| 6. | Harmothoe imbricata (L.) Malmgren. | | + | + | Circumboreal; Japan; Cal. coast. |
| 7. | H. iphionelloides sp. nov. | | | + | Northward. |
| 8. | H. complanata sp. nov. | | + | | Cal. coast (San Diego). |
| 9. | H. pacifica sp. nov. | | + | | |
| 10. | H. tuta (Grube) | | + | + | Northward; Sitka (Grube). |
| | SIGALIONIDAE. | | | | |
| 11. | Sthenelais fusca Johnson | | | + | Cal. coast to San Pedro. |
| | HESIONIDAE. | | | | |
| 12. | Podarke pugettensis sp. nov. | | | + | Cal. coast (Pacific Grove). |
| | NEREIDAE. | | | | |
| 13. | Nereis virens M. Sars | | + | + | Northern Europe & N. E. coast of N. A.; Cal. coast to Bolinas. |
| 14. | N. vexillosa Grube | + | + | + | Bering Sea to Santa Barbara. |
| 15. | N. agassizi Ehlers | | + | + | Southward to Santa Barbara. |
| 16. | N. cyclurus Harrington | | + | | |
| 17. | N. procera Ehlers | | + | | Gulf of Georgia (Ehlers). |
| | NEPHTHYDIDAE. | | | | |
| 18. | Nephthys coeca (Fab.) Oerst. | | + | + | Circumboreal; Alaska to Tomales Bay, Cal. |
| | EUPHROSYNIDAE. | | | | |
| 19. | Euphrosyne heterobranchia sp. nov. | | + | | |
| | SYLLIDAE. | | | | |
| 20. | Pionosyllis elongata sp. nov. | | | + | Southward to Monterey Bay. |
| 21. | Trypanosyllis gemmipara sp. nov. | | + | | " " " " |
| | ONUPHIDIDAE. | | | | |
| 22. | Northia elegans sp. nov. | | + | | |
| 23. | N. iridescens sp. nov. | | | | Victoria, B. C. (Herdman). |
| | LUMBRICONEREIDAE. | | | | |
| 24. | Lumbriconereis zonata sp. nov. | | | + | |
| | GLYCERIDAE. | | | | |
| 25. | Glycera rugosa sp. nov. | + | + | + | |
| 26. | G. nana sp. nov. | | + | + | |
| 27. | Hemipodia borealis sp. nov. | | + | | |
| | ARICIIDAE. | | | | |
| 28. | Scoloplos elongata sp. nov. | | + | + | Southward; Cal. coast to Tomales Bay. |

| | | Neah Bay. | Port Townsend Region. | Seattle Region. | Geographical Distribution. |
|---|---|---|---|---|---|
| | LEVINSENIIDAE. | | | | |
| 29. | Aricideopsis megalops gen. et sp. nov. | | | + | |
| | MAGELONIDAE. | | | | |
| 30. | Magelona longicornis sp. nov. | | | + | |
| | CAPITELLIDAE. | | | | |
| 31. | Capitella dizonata sp. nov. | | | + | |
| | CHLORAEMIDAE. | | | | |
| 32. | Trophonia papillata sp. nov. | | | + | Southward; Shelter Cove, Cal. |
| 33. | Flabelligera infundibularis sp. nov. | | + | | |
| | STERNASPIDAE. | | | | |
| 34. | Sternaspis fossor (?) Stimp. | | + | | Victoria, B. C. (Herdman); Bering Sea, Japan (Marenzeller); N. E. coast North America. |
| | MALDANIDAE. | | | | |
| 35. | Clymenella rubrocincta sp. nov. | | + | + | Southward to San Pedro, Cal. |
| 36. | Nicomache personata sp. nov. | | | + | |
| | AMMOCHARIDAE. | | | | |
| 37. | Ammochares occidentalis sp. nov. | | | + | |
| | ARENICOLIDAE. | | | | |
| 38. | Arenicola claparedei Lev. | | + | + | Mediterranean. |
| | CIRRATULIDAE. | | | | |
| 39. | Cirratulus cingulatus sp. nov. | | + | + | |
| 40. | C. robustus sp. nov. | + | | + | |
| | AMPHICTENIDAE. | | | | |
| 41. | Pectinaria brevicoma sp. nov. | | + | | |
| | AMPHARETIDAE. | | | | |
| 42. | Sabellides anops sp. nov. | | + | | |
| | TEREBELLIDAE. | | | | |
| 43. | Amphitrite robusta sp. nov. | | + | + | |
| 44. | A. spiralis sp. nov. | | | + | |
| 45. | Lanice heterobranchia sp. nov. | | | | |
| 46. | Thelepus crispus sp. nov. | | + | | Southward to San Francisco. |
| | SABELLIDAE. | | | | |
| 47. | Bispira polymorpha sp. nov. | + | + | + | Southward to Monterey Bay. |
| 48. | Megachone aurantiaca gen. et sp. nov. | | | + | |
| | ERIOGRAPHIDAE. | | | | |
| 49. | Myxicola pacifica sp. nov. | | | + | |
| | SERPULIDAE. | | | | |
| 50. | Serpula columbiana sp. nov. | | + | + | Southward to San Francisco. |
| 51. | Serpula zygophora sp. nov. | | | + | Northward (?). |

The entire absence of Phyllodocidae and Opheliidae from a collection of this size and representative character is remarkable. The Eunicidae and Chaetopteridae are represented, the former by several headless fragments of some large species, and the latter by numerous long, annulated, empty tubes.

For any zoologist devoted to the study of living animals, the examination and description of a collection of preserved specimens, gathered by others in a region he has never visited, is likely to prove an irksome and unprofitable task. In the present instance, however, the task has been enlivened by the discovery of several very interesting forms. First and foremost should be mentioned *Trypanosyllis gemmipara*, a Syllidian with alternation of generations in which the sexual zooids, instead of forming a linear series, arise by collateral budding near the posterior extremity. *Harmothoe tuta*, with its great number of asymmetrical somites, also deserves notice; and as regards zoogeography, the discovery of a Pacific species of *Magelona*, the finding of a genuine *Hemipodia* in the Northern Hemisphere, and the confirmation of Gamble and Ashworth's (:00) statement regarding the occurrence of *Arenicola claparedei* on the west coast of America, are worthy of note.

I gladly avail myself of this opportunity to express my sincere and hearty thanks to Prof. C. O. Whitman, who generously placed at my disposal an investigator's room at the Marine Biological Laboratory during the latter part of the summer of 1900; to Prof. E. L. Mark, of Harvard, to whom I am indebted for laboratory privileges at the Museum of Comparative Zoology; and to Dr. Wm. M. Woodworth for permission to make use of the Polychaete collections of the same institution.

## Polynoidae.

1. **Polynoe squamata** (L.) Aud. and M.-Edwards.

*Lepidonotus squamatus* Leach. Zoological miscellany, London, 1816.

This well-known circumboreal species is represented by three specimens, probably from the vicinity of Port Townsend.

*P. squamata* occurs on the California coast as far south as Santa Monica, where a specimen was obtained for me by Mr. J. J. Rivers, the well-known entomologist. At Pacific Grove it is frequent in

dredgings at twelve fathoms and over, but I have never obtained it there between tide-marks. I have collected it just above low-water mark at Point Cavallo, on the northern shore of the Golden Gate, and even higher on the beach near Black Point, Sonoma County, about one hundred miles north of San Francisco. The specimens from Puget Sound are larger than any as yet collected from the California coast, but are inferior in size to New England specimens. It is probable that this species will be found to have a wide distribution along the eastern and western shores of the North Pacific, comparable to its dispersal on both sides of the North Atlantic.

2. **Polynoe insignis** (Baird).

*Lepidonotus insignis* Baird. Proc. zool. soc. London, Apr., 1863, p. 106.

*Halosydna insignis* Baird. Journ. Linn. soc. London, vol. 8. (Zoology), 1865, p. 188.

*Polynoe brevisetosa* (Kinberg) Johnson. Proc. Cal. acad. sciences, 3d ser., Zoology, vol. 1, 1897, p. 167. Figs. 24, 31, 40, 40a, 46, 46a.

This, the commonest Polynoid of the western coast of North America, is represented in the Puget Sound collections by several slender, darkly pigmented specimens commensal with *Thelepus crispus*, and a single specimen with remarkably thick and tuberculated elytra, obtained by the Columbia University Expedition; also by four specimens collected by Miss Robertson at Alki Point.

With the exception of *Harmothoe imbricata* this species has the widest known distribution along our western sea-board of any of its family, ranging from San Diego to Kadiak.[1] South of Point Concepcion it is rare, at least inshore, being almost wholly replaced by *P. californica*.[2] Its remarkable variations according to habitat have been described elsewhere (*vide* Johnson, '97, p. 167).

The identification of this species with the *Halosydna brevisetosa* of Kinberg ('55; '58, p. 18), as given by me in the "Preliminary Account" ('97), was undoubtedly characterized by too little confidence in the accuracy of Kinberg's figures and too much influenced by his statement that *Halosydna brevisetosa* was collected in Sansalito Bay, near San Francisco. As *P. insignis* is the only Poly-

[1] A small collection of Polychaeta from Kadiak Island, including a single *P. insignis*, was gathered by Mr. Cloudsley Rutter, and kindly loaned to me for examination and description by Stanford University.

[2] Name changed from *P. reticulata* Johnson ('97) as the latter name is preoccupied.

noid with eighteen pairs of elytra I have ever seen from that portion of the coast, it is highly probable that Kinberg's species came from another part of the world. *P. insignis* was described by Baird in 1863 from specimens collected by J. K. Lord at Esquimalt, Vancouver Island. His *Lepidonotus grubei*, described at the same time (and subsequently) with the foregoing, is in all probability a mere color variety of *P. insignis*.

3. **Polynoe lordi** (Baird).

*Lepidonotus lordi* Baird. Proc. zool. soc. London, Apr., 1863.

*Halosydna lordi* Baird. Journ. Linn. soc. London, vol. 8 (Zoology), 1865, p. 190.

*Polynoe lordi* Johnson. Proc. Cal. acad. sciences, 3d ser., Zoology, vol. 1, 1897, p. 175. Figs. 35, 44, 51.

As in the case of *P. insignis* and *P. fragilis*, the Puget Sound region may be regarded as the type locality of the present species. All three were collected by J. K. Lord at Esquimalt, Vancouver Island. For an instructive and entertaining account of this curious Polynoid's habits and habitat, the reader is referred to Lord's "Naturalist in Vancouver Island and British Columbia," vol. 2, page 9 ('66). As this somewhat rare work is doubtless inaccessible to many, I quote somewhat at length from Lord's account. Speaking of *Fissurella cratitia*, the host of *P. lordi*, he says: "I had found him at last and at home, so pounced upon him as a lawful and legitimate prize. Knife and hammer soon severed his close attachment to the rocks; and turning him up, to take a peep at his powerful ring of muscle and strangely-formed breathing apparatus, I spied a worm evidently very uneasy, about three inches long, brown, and in shape like an ancient dagger blade. He appeared to me to be wriggling out from betwixt the folds of the foot or the mantle, and apparently most anxious to escape .... In displacing other shells, I found in nearly every one a similar tenant: the secret was discovered, the worm was a parasite, that lived in peace and good-fellowship with the Keyhole.... That the parasite worm does no harm is clearly proved by the healthy state of the mollusc in whose shell it takes up its abode .... On more carefully examining the position of the worm I found it was invariably coiled away in a semi-circle under the foot, like a ribbon on its edge, never flat. This seems to me a wise provision; for the pressure of the muscles when the limpet grips the rock would crush a soft-bodied worm to death, if flat; but by being edge on, which is the position

chosen, all risk of harm is avoided, as it fits in a cleft between two layers of soft material. . . . At least four out of every six contained a parasite, and, what is rather strange, the worms were nearly all of one size."

Later collectors have found it not uncommon in that region. The Columbia University collection contains four specimens, probably from Neah Bay, as the species is mentioned by Harrington and Griffin ('97) as having been found there "on *Fissurella*." Miss Robertson's collections afford only a single fragmentary specimen from Alki Point. I have several from Anacortes, collected by Miss Louise M. Carpenter, of Berkeley, Cal. These last occurred under the mantle of specimens of *Glyphis aspera*, preserved with the Annelids. This Gastropod is undoubtedly the usual host, but I have found it also in the gill-groove of *Cryptochiton stelleri*, and once on the Leather Star (*Dermasterias imbricata*), crawling on the aboral surface. The southern limit, so far as known, is Point San Pedro, about twelve miles south of San Francisco. Two specimens were found at that locality by Prof. W. J. Raymond of the University of California, who kindly placed them at my disposal. Although about eighteen specimens of *Glyphis aspera* were examined, only these two specimens of *P. lordi* were obtained. Like *Polynoe fragilis*, this species becomes more abundant northward. Every specimen of *Glyphis aspera* brought from Anacortes by Miss Carpenter had one or two examples of *P. lordi* under its mantle; and Lord states the proportion to be "at least four out of every six."

Two of the Columbia University specimens have almost no pigment. Even the brown zone on the ninth somite, so constant a feature of this species, cannot be made out in one specimen. This example is remarkable also for its size, having 83 somites and 41 pairs of elytra.

*P. lordi*, like *Lepidametria commensalis* (Webster, '79), *Polynoe gigas* Johnson, and *Harmothoe tuta* (Grube) often has asymmetrical somites in the posterior portion of the body. In one of the specimens from Anacortes the thirty-first somite is asymmetrical (cirriferous on the right side, elytrophorous on the left). In a specimen from Dillon's Beach, Sonoma Co., Cal., there are as many as nine asymmetrical somites, and yet there are the same number of elytra (27) on both sides. The elytra on the right side are borne on somites 2, 4, 5, 7 . . . . 23, 26, 28, 29, 31, 33, 35, 37, **38, 40, 42,**

44, **46**, 48, 50, 52; and on the left side on somites 2, 4, 5 .... 23, 26, 28, 29, 31, 33, 35, 37, **39**, **41**, **43**, 44, **45**, **47**, 48, 50. The asymmetrical somites are printed in heavier type.

4. **Polynoe pulchra** Johnson.

*Polynoe pulchra* Johnson. Proc. Cal. acad. sciences, 3d ser., Zoology, vol. 1, 1897, p. 177. Figs. 34, 43, 43a, 50, 50a, 50b.

The species of scaly annelid referred to by Harrington and Griffin ('97) as occurring on *Holothuria californica* is without much doubt *P. pulchra*, as I have found it a frequent commensal or parasite of that Holothurian. It is well represented in the Columbia collection. None of the specimens exhibits dark brown or black markings on the elytra, but all appear to have had the protective reddish or flesh tints characteristic of the individuals found on *Holothuria californica*.

5. **Polynoe fragilis** (Baird). Pl. 1, fig. 1.

*Lepidonotus fragilis* Baird. Proc. zool. soc. London, Apr., 1863.

*Halosydna fragilis* Baird. Journ. Linn. soc. London, vol. 8 (Zoology), 1865, p. 190.

*Polynoe fragilis* Johnson. Proc. Cal. acad. sciences, 3d ser., Zoology, vol. 1, 1897, p. 179. Figs. 36, 45, 52, 52a, 52b.

Numerous specimens from all three districts of the Puget Sound region. As stated in the "Preliminary Account" (Johnson, '97, p. 180) this species is much more plentiful in the Puget Sound region than on the California coast, where I have collected it only in San Francisco Bay, and only three or four specimens in as many years. Its great abundance at Port Orchard is noted by Miss Robertson as follows: "Twenty specimens were taken from twenty-seven or twenty-eight Star-fishes. Several times two and in one instance three, were found on a single Star-fish."

The frequent absence of ventral cirri is a striking peculiarity. Even when present, the ventral cirrus is very diminutive; but, on the other hand, its absence on all the parapodia seems to be a rare occurrence. Of the twenty-nine examples at my command, only one (and an imperfect specimen at that) is entirely destitute of ventral cirri. In not a single individual, however, is every parapodium provided with a ventral cirrus.

6. **Harmothoe imbricata** (L.) Malmgren.

This ubiquitous species was collected by the Columbia Expedition, also by Miss Robertson at Alki Point and at other places. Most of the specimens are of the usual greenish gray tint with

mottled, iron-gray elytra. One of the largest specimens obtained at Alki Point has numerous undeveloped ova attached to the dorsal setae and in the intersegmental furrows. These bunches of ova are only partially covered by the elytra.

7. **Harmothoe iphionelloides** sp. nov. Pl. 1, figs. 2–7.

*Form* short, broad, and flattened; width, including elytra, two fifths of length; dorsum and prostomium completely covered by elytra, which overlap extensively; somites, 36; elytra, 15 pairs, borne on somites 2, 4, 5, 7 .... 23, 26, 29, 32.

*Prostomium* (Fig. 2) broad, transverse diameter exceeding the longitudinal; distinctly bilobed with median sulcus; the lobes ovoid, rounded in front. Palpi stout, fusiform, minutely papillated, transversely ringed with grooves, acuminate. Tentacle with immense basal joint, nearly one half its length; terminal segment slightly papillate, subulate, unpigmented. Antennae with basal joints about as long as tentacle, slightly bulbous near tip, with subterminal dark band; slightly papillated. Eyes large, black, the posterior pair smaller and nearer together than the anterior pair.

*Peristomial cirri* (Fig. 2) much stouter than antennae, and about twice as long; with filiform papillae near tips; basal joints very long; subterminal bulbous enlargement, with dark pigment-zone.

*Elytra* thick, with large, rough, irregularly polygonal, flattened tubercles (Fig. 3), forming a pattern like alligator skin; tubercles increase in size from the concave (protected) side of elytron towards the convex and exposed portion; elytra become larger towards middle of series, and diminish again towards posterior end; ciliate on outer margin; except first pair, all elytra more or less strongly reniform, the concave edge of each embracing the preceding elytrophore.

*Parapodia* (Fig. 4) rather long, thick, biramous; each ramus ending in a finger-like prolongation, into which the acicula extends. Dorsal cirrus extends beyond the setae; basal joint nearly one fifth its length with pin-head-like papillae towards the incrassated tip. Ventral cirrus subulate, slightly papillate. Ventral setae straw-colored, hardly extending beyond the longest dorsal (Fig. 4, *below* the dorsal cirrus), and only slightly stouter than the uppermost dorsal (*cf.* Figs. 5 and 6); slightly hooked at tip, with 12–20 "frills" of usual form. Dorsal setae white, forming a graduated series from uppermost stout, short, strongly-curved ones (Figs. 4 and 6) to the lower elongated slender ones (Figs. 7 *a*, *b*). The fine serrations extend nearly one half the length of seta, whether it be long or short.

*Nephridial papillæ* very short, cylindrical, length and diameter about equal; begin at 8th and extend to 30th somite.

*Length* (approximately) 23 mm.; width, including setae, 10.5 mm.; dorso-ventral thickness, 3.5 mm.; proboscis, 4 mm.

A single specimen from Pleasant Beach, near Seattle, collected by Professor Ritter. It is chiefly notable for its great, overlapping elytra, with tuberculation resembling the areolae of *Harmothoe hirsuta*, or of *Iphionella*.

8. **Harmothoe complanata** sp. nov. Pl. 2, figs. 8–13.

*Form* of moderate length, flattened dorso-ventrally; breadth, including setae, two sevenths of length; number of somites, 36–38; elytra, 15 pairs, borne on somites 2, 4, 5, 7 .... 23, 26, 29, 32.

*Prostomium* (Fig. 8) approximately six-sided, width and length equal, deeply incised for reception of basal joint of tentacle, indistinctly bilobed. Eyes four, minute, posterior pair dorsal, anterior pair dorso-lateral, and further apart than the posterior. Tentacle with short basal joint, which extends a little beyond the "peaks" of the prostomium, terminal portion nearly twice the length of the prostomium. Antennae very short, inserted below level of tentacle, two-jointed, less than one half the length of the prostomium. Palpi very thick at base, terete, gradually and uniformly tapering to an acute tip, barely papillate, as long as peristomial cirri.

*Peristomial cirri* long and slender, gradually and uniformly tapered, without subterminal dark band, slightly papillate.

*Elytra* (Fig. 10) thin, oval, translucent, with minute, scattered conical tubercles.

*Parapodia* (Fig. 9) long, rami distinct, finger-like tips long and slender. Dorsal cirrus like peristomial, long and slender, extending far beyond tips of setae, papillate. Ventral cirrus long, evenly tapered, papillate. Dorsal setae of two sorts: (*a*) a supra-acicular fascicle of very stout, minutely serrated setae (Fig. 11) which are the thickest in the foot; they are arranged in a whorl, the shortest being the uppermost and most anterior; (*b*) a smaller tuft of very slender, elongated, serrulate setae (Fig. 12) inserted in the finger-like process; these are considerably longer than the preceding, and much fewer (4–5 in number). The ventral setae (Fig. 9) are arranged in a graduated series of which the uppermost closely resembles in length, slenderness, and serrulation the dorsal setae of fascicle *b*; the middle and lower ones are of the more usual type (Fig. 13), with a series of "frills" near tip, beginning with very

minute ones and gradually increasing in size towards proximal end of seta.

*Nephridial papillae* begin at the 6th somite and extend to 36th; with acuminate tips.

*Length* of largest specimen, 21 mm.; width, including setae, 6 mm.

This species is represented by two imperfect specimens, one from Puget Sound, collected by Harrington, the other from Coronado, Cal., collected by me in July, 1895. Its living color is stated in my notes to be "orange-yellow," but the alcoholic specimen is pale brown. Elytra and dorsal cirri are easily detached. The occurrence of the species at localities so widely separated, and, so far as known, at no intermediate point, is certainly remarkable.

9. **Harmothoe pacifica** sp. nov. Pl. 2, figs. 14–17.

*Form* rather flattened, diminishing towards both head and posterior end; breadth, including setae, about four ninths of length. Somites, 37; elytra (wanting in specimen), 15 pairs, borne on somites 2, 4, 5 .... 23, 26, 29, 32.

*Prostomium* very strongly bilobed, nearly twice as broad as long; "peaks" short and blunt, divaricate; lobes of prostomium separated by a wide, shallow groove. Basal joint of tentacle very thick, about the length of the prostomium. Antennae slender, considerably longer than prostomium, inserted below the level of tentacle; ciliate, their basal joints projecting beyond the peaks of the prostomium. Anterior pair of eyes laterally directed; just in front of the bulge of the prostomium; posterior pair dorsal, near base of prostomium, slightly nearer together than the anterior.

*Peristomial cirri* villous, without bulbous enlargement near tip. *Dorsal cirri* (Fig. 14) very similar. Dorsal ramus short and stubby without finger-like process, bearing setae of two different forms (Figs. 15, 16) which grade into each other. The short curved ones are the more dorsal. All the dorsal setae are much more slender than the ventral. Ventral setae (Fig. 17) stout, hastate, with straight or slightly curved tips, and from two to twelve serrations. Ventral cirrus fusiform, papillate.

*Length*, 26.5 mm.; width across middle, including setae, 11.5 mm.

This species is represented by a single specimen, unfortunately without elytra and imperfect in other respects. It was collected by the Columbia Expedition. The species is probably scarce, as all efforts to obtain more specimens have thus far failed.

10. **Harmothoe tuta** (Grube). Pl. 2, figs. 18, 19. Pl. 3, figs. 20–22.

*Polynoe tuta* Grube. Arch. f. naturgesch., jahrg. 21, bd. 1, 1855, p. 82.

*Halosydna tuta* Baird. Journ. Linn. soc. London, vol. 8 (Zoology), 1865, p. 188.

*Form* elongated, of nearly uniform width throughout anterior two thirds, gradually tapering in posterior third to extremity; somites numerous and variable in number (77–83); elytra not all paired, 35–38 on each side; borne on somites 2, 4, 5, 7 .... 23, 26, 29, 32 ....; general color of formalin specimens, very pale brown; a transverse band of darker brown on every somite of anterior half, and a median dark stripe.

*Prostomium* (Fig. 18) distinctly bilobed, median furrow extending to its base; lobes rounded anteriorly, widely sundered by the thick napiform basal joint of tentacle; eyes placed well forward, medium-sized, black; the anterior pair laterally, the posterior pair upwardly, directed. Basal joints of antennae inserted below the basal joint of tentacle, on underside of prostomium; distal segments of antennae and tentacle very short, nearly equal, not exceeding length of prostomium. Palpi also short, rapidly tapered to subulate tips; constricted at intervals in contraction; all cephalic appendages, like tentacular and dorsal cirri, sparsely beset with minute papillae.

*Tentacular cirri* considerably longer and more slender than tentacle; subterminal enlargement very slight.

*Elytra* slightly variable in shape, nearly orbicular (Fig. 20), some broadly reniform, strongly imbricated, meeting across median line; with very few microscopic tubercles, thin and translucent, suffused with smoky brown.

*Parapodia* (Figs. 18, 19) elongate, nearly or quite equal to width of dorsum between elytrophores; dorsal setae rather numerous, much shorter and more slender than the ventral (Fig. 19), divaricate, slightly curved, rather coarsely serrated along convex border near tip (Fig. 21). Ventral setae numerous (over twenty), with about twelve "frills" near the slightly expanded tip. Point nearly straight, acute. Dorsal ramus short for this genus, with decided finger-like process, to tip of which the acicula extends. Ventral ramus stout, fleshy, with thick, stumpy, finger-like process which does not receive tip of acicula. Ventral cirrus short, abruptly tapering to a fine point.

*Nephridial papillae* extraordinarily long in large specimen, fully equal to ventral cirri; begin on the sixth somite and extend to the eighty-first in the larger, and to the seventy-fourth in the smaller specimen.

*Length* of larger specimen, 82 mm.; width, including parapodia and setae, 12 mm.; without setae, 10 mm.; without parapodia, 5 mm. Length of smaller specimen, 61 mm.; width, including parapodia and setae, 8 mm.; without setae, 6 mm.; without parapodia, 2 mm.

This interesting Polynoid is represented by two specimens in the collections, one obtained by Harrington and stated by him to be commensal in the tube of the largest species of "*Amphitrite*" found by the Expedition, — undoubtedly *Thelepus crispus* (see p. 428); the other collected by Miss Robertson at Alki Point. The latter is smaller and evidently younger than the former. The dimensions given in the diagnostic description show clearly the difference in the proportions of young and old.

The nearly colorless condition, as well as the great length of the body and the thin, translucent, smooth elytra, indicates plainly its constantly commensal habit. Forms like *P. insignis*, *P. californica*,[1] and *Harmothoe imbricata*, which are sometimes free-living, sometimes commensal, retain the pigment, often in heightened intensity, when they have either temporarily or permanently adopted the latter mode of life.

In spite of the excessive number of somites and elytra, the true relationship of this form is with the species grouped under the genus *Harmothoe* (*sensu extensiori*), and not with *Polynoe*, where numerous somites are much more frequent. The relationship with *Harmothoe* is shown (1) by the structure of the prostomium, (2) by the finger-like processes of the rami of the parapodia, and (3) by the sequence of the elytra from the 23d to the 32d somite (23, 26, 29, 32). A fourth character of less importance is the sparse papillation of the cirri — a feature almost invariably present in *Harmothoe*, and absent in *Polynoe*. The excessive number of somites and pairs of elytra possessed by not a few commensalistic or parasitic Polynoids is no doubt correlated with their mode of life; hence the unusual length attained by the commensal *Harmothoe tuta* need not surprise us, although such a length, and elytra in excess of 15 pairs, seem to be as rare in this genus as they are common in *Polynoe*.

[1] Synonym for *P. reticulata* Johnson which name is preoccupied by *P. reticulata* Claparède.

It is not unlikely that such highly modified forms as *Polynoe lordi*, *P. pulchra*, and *P. fragilis* have descended from *Harmothoe* stock and do not rightly belong in the genus *Polynoe*. The characters are a *mélange* of those of *Harmothoe* and *Polynoe* (*sensu ext.*). This may be taken to indicate that these commensals retain characters of the Polynoid ancestor from which typical *Polynoe* and *Harmothoe* have both descended. The structure of the prostomium, especially the presence of basal joints to the antennae, recalls *Harmothoe*; while the structure of the foot is more like that of *Polynoe*. The sequence of the elytra differs from that of both genera. These species certainly do not belong in the genus *Lepidasthenia*, where Darboux ('99) has placed them.

The asymmetrical somites (dorsal cirrus on one side, elytra on the other) constitute the most striking peculiarity of this species, and one which, so far as present knowledge goes, it shares only with *Polynoe gigas* Johnson ('97, p. 174), *Lepidametria commensalis* Webster ('79, p. 210), and *Polynoe lordi* (Baird). In *Polynoe gigas*, I have found at most two unsymmetrical somites; in *P. lordi*, from one to nine; for *Lepidametria* the number is not stated. In two specimens of *Harmothoe tuta* I have found, respectively, 15 and 16 asymmetrical somites! As in *P. gigas*, they are confined to the posterior part of the body (back of the 32d somite) whence the sequence of the elytra differs in different individuals. In the older specimen (Columbia University collection) there are 38 elytra on the right side and 35 on the left. In the younger specimen (No. 963) there are 38 elytra on the right side, 36 on the left. The asymmetrical somites of the former are: 38, 41, 43, 56, 57, 60, 61, 65, 69, 71, 77, 80, 81, 82, 83 — a total of 15; those of No. 963 are: 33, 37, 38, 39, 40, 41, 43, 45, 60, 62, 64, 66, 68, 70, 72, 74 — 16 in all.

The identification of the specimens from Puget Sound with the *Polynoe tuta* of Grube ('55), described from specimens collected at Sitka, seems reasonably safe, although his description takes no account of the diagnostically important structures of the head. The sequence of the elytra up to the thirty-second somite is precisely as stated by Grube. Beyond that point it differs in every different individual — a fact not perceived by Grube.

In no Polynoid has a normal asymmetrical somite been found in front of the 32d.

SIGALIONIDAE.

11. **Sthenelais fusca** Johnson.

*Sthenelais fusca* Johnson. Proc. Cal. acad. sciences, 3d ser., Zoology, vol. 1, 1897, p. 185. Figs. 60, 61, 64.

A single imperfect specimen of huge dimensions, including prostomium and 74 somites, was collected by Miss Robertson at Pleasant Beach in July, 1898. It is far larger than any specimen yet taken on the California coast. It measures 107 mm. in length (the entire worm must have been over twice as long) and 12 mm. in transverse diameter. The exposed surface of the elytra is rusty, with the exception of the first six pairs and scattered ones along the body, which are unpigmented and translucent.

HESIONIDAE.

12. **Podarke pugettensis** sp. nov. Pl. 3, figs. 23–25.

*Body* gradually tapering towards both ends; somites 50–54, the anterior three or four (Fig. 23) much shortened; the rest about four times broader than long.

*Prostomium* twice as broad as long, three-lobed in front, the lobes bearing the tentacle and dorsal pair of antennae (Fig. 23). No palpi; antennae 4, the ventral pair considerably stouter than the dorsal, and provided with a thick basal segment. Tentacle small, subulate, less than length of head. Eyes 4, contiguous, anterior pair slightly larger and farther apart than the posterior; both pairs with lens; retinal pigment brown.

*Tentacular cirri* on first three segments, two pairs to each, with distinct basal joints; dorsal cirri of 2d and 3d somites equal and longest.

*Parapodia* elongated (Fig. 24), exceeding half the width of dorsum; dorsal ramus and basal joint of dorsal cirrus fused; ventral ramus much longer, terminating in a conical, achaetous tip; 2 aciculae in each ramus. Dorsal cirrus notably longer than the parapod and setae; gradually tapered; ventral cirrus extending obliquely backward, somewhat beyond acute tip of ventral ramus.

*Setae* of two sorts, simple and compound, the former confined to the dorsal ramus; very few (Fig. 24) ventral setae, some with elongated appendages (Fig. 25) and some with short appendages — otherwise alike in form. They are arranged in a supra- and an infra-

acicular fascicle, from 13 to 20 setae in each. Anal cirri wanting in all the specimens.

*Length* of largest specimen, 25 mm.; width, 3.8 mm.

A few specimens from Alki Point, collected by Miss Robertson, Aug. 3, 1898. None are perfect, the tentacular and dorsal cirri, in particular, being very caducous. The species occurs also at Pacific Grove.

NEREIDAE.

13. **Nereis virens** M. Sars. Pl. 3, figs. 26–30.

*Nereis virens* Grube. Middendorff's Reise in den äussersten norden und osten Siberiens, bd. 2, Zool., th. 1, 1851, p. 6. Taf. 1, figs. 2–6.

*Alitta brandti* Malmgren. Öfversigt af k. vet. akad. förhandlingar, Stockholm, 1865, p. 183.

*N. foliata* Baird. Appendix to John Keast Lord's "Naturalist in Vancouver Island and British Columbia," vol. 2, 1866, p. 347.

*N. brandti* Ehlers. Die borstenwürmer, 1868, p. 563.

I cannot agree with Ehlers ('68) and Malmgren ('65) that this North Pacific Nereid is distinct from *N. virens* of the coasts of Northeast America and of Northern Europe. I have compared specimens from the two oceans, and fail to find any differences that can be considered of specific value. It is apparently an interesting instance of discontinuous distribution, since the species seems not to attain high northern latitudes. The coast of Norway, the Gulf of St. Lawrence, and the Sea of Ochotsk (Grube) are the northern limits of its known distribution. It is likely to be found, however, on the more southern shores of Alaska. I have not found it on the California coast further south than Bolinas, about ten miles north of San Francisco.

The species attains a much greater size in the Pacific than in the Atlantic. Whereas an Atlantic *N. virens* of a length of 26 cm. in the contracted condition would be considered large, a length of 50 cm. and a diameter of 25 mm. under the same conditions are not infrequent dimensions on the western shores of North America (Fig. 26).

The Heteronereis of this species I have not seen, but as usual among Nereids, individuals attain sexual maturity in the ordinary or "atokous" form.

14. **Nereis vexillosa** Grube. Pls. 3 and 4, figs. 31–38.

*Nereis vexillosa* Grube. Middendorff's Reise, etc., bd. 2, Zool., th. 1, 1851, p. 4. Taf. 2, figs. 1, 5, 6.

*N. arctica* Grube. Ibid., p. 11. Taf. 1, fig. 7.

*Heteronereis middendorffii* Malmgren. Öfversigt af k. vet. akad. förhandlingar, Stockholm, 1865, p. 109.

This species, described and figured a half century ago by Grube, and subsequently by Ehlers ('68, p. 573), is one of the commonest Annelids all along the coast, from the Pribylof Islands to Santa Barbara. It apparently abounds in Puget Sound, judging from the fact that it occurs in all the collections from that region, and numerously in that of the Columbia Expedition. It is known to fishermen as the "pile-worm," on account of its habitat amongst the mussels and barnacles which cluster thickly upon the piles of wharves and bridges, and is in much requisition for bait. Upon the piles it seldom attains a length greater than 20 cm. and a diameter of 12 mm.; but in gravelly beaches, where it lives in company with *N. virens*, it grows to a somewhat larger size. Olive-green is its usual color in life, but this changes to a bright emerald-green or bluish green in alcohol. Tints of brown are very frequent in the more posterior parts, and sometimes the entire worm is brown or dusky.

The great dorsal lobe of the feet of the posterior portion of the body, carrying at its distal end the dorsal cirrus, increases notably in length with age, as may be seen by comparing Figs. 34 and 35, Pl. 4. The former represents a foot of a young female; the latter, the foot of a large, sexually-mature female. This great increase in length is probably not correlated with the advent of sexual maturity, as some individuals of very diminutive size have the dorsal lobes of considerable length. In passing caudad the dorsal lobes lengthen so gradually it is impossible to find a demarcation-point between long and short lobes. In the anterior region in front of the 12th foot the feet are of the form shown in Fig. 31, Pl. 3 (tenth foot).

The Heteronereis (epitokous form of Ehlers) is not uncommon (Figs. 32, 33). This condition is by no means confined to full-grown worms, but occurs in individuals having a length of 56 mm. and upward. The species also arrives at sexual maturity without becoming heteronereized, as I have noted in many instances.

15. **Nereis agassizi** Ehlers. Pl. 4, figs. 39–45.

*Nereis agassizi* Ehlers. Die borstenwürmer, 1868, p. 542. Pl. 23, fig. 1.

This beautiful Nereid is a tube-dweller. The secretion is furnished by the large glands opening on the dorsal aspect of the upper lobes of the feet (Figs. 44, 45*g*, Pl. 4), and is poured out so rapidly and copiously that a new tube is formed in a very few minutes when a worm is removed from its tube and placed in a jar of clean sea-water. The tube is rather tough and leathery, but very flexible and translucent, especially when newly secreted. The worms are gregarious, and great tangled ropy bunches of "eel-grass" (*Phyllospadix*) are often found, held together by the powerfully-adhesive secretion of a colony of *N. agassizi*. The species attains sexual maturity at the latitude of San Francisco in February and March. I have rarely seen the Heteronereis of this species.

*N. agassizi* does not attain a large size. The largest I have collected measures 63 mm. in length and 5 mm. in diameter, including parapodia and setae. Several small specimens have been brought from Puget Sound, and I have collected it at various points along the California coast as far south as Santa Barbara.

16. **Nereis cyclurus** Harrington. Pl. 4, fig. 46. Pl. 5, figs. 48–52.

*Nereis cyclurus* Harrington. Trans. N. Y. acad. sciences, vol. 16, 1897, p. 214. Pls. 16–18.

This remarkable species has been ably described by Harrington ('97), and its extraordinary commensalistic relations with the Hermit crab (*Eupagurus armatus* Dana) are discussed. The scanty material at command does not enable me to add anything of value. One of the striking features of this Nereid is the immense size and cup-like form of the peristomium (Figs. 46–48). This is undoubtedly for the protection of the prostomium, which when retracted is partially concealed within the concavity of the peristomium.

17. **Nereis procera** Ehlers. Pl. 4, fig. 47. Pl. 5, figs. 53–59.

*Nereis procera* Ehlers. Die borstenwürmer, 1868, p. 557. Pl. 23, fig. 2.

A very slender Nereid obtained by the Columbia Expedition undoubtedly belongs to this species. There are several specimens, none of which is complete. The species does not occur in the other collections from the Sound. There are no data as to depth or locality.

It is highly probable that this is the species of *Nereis* mentioned by Harrington and Griffin ('97a, p. 156) as dwelling in the tubes of a Chaetopterid. The extremely attenuated form of the body and

great number of somites suggest such a habitat; and the stout dorsal seta shown in Pl. 5, Fig. 59, is such as would properly belong to a tube-dwelling Nereid. These setae remind one of the "hooded crotchets" of *Nereis agassizi* (Pl. 4, Fig. 43), which is also a tube-dweller, but they are in fact compound setae with a much reduced appendage deeply sunk within the tip of the shaft. These setae are not found in the most anterior parapodia, but begin about the 40th foot. A seta of this form would be especially useful in clambering within the tube. These stout setae are only one or two in number in each foot (Figs. 54, 55, 56), and occur only in the dorsal ramus. There are no setae of the ordinary form in the dorsal ramus where these setae are present, except in two or three parapodia where the change is taking place (Fig. 54).

Ehlers's description of this species is based upon a single specimen collected by Alexander Agassiz in the Gulf of Georgia in 1859. This type, now deposited in the Museum of Comparative Zoology, I have had an opportunity to examine, and I find it of the same species as the specimens above mentioned.

None of the specimens is complete. Ehlers's example had a length of 125 mm. and 179 somites; a nearly perfect specimen in the Columbian collection measures 146 mm. and has 260 somites. It is evidently not full grown, for its greatest transverse diameter, including parapodia, does not exceed 3 mm., whereas Ehlers's specimen, which is the largest I have seen, has a diameter of 4 mm.

### Nephthydidae.

18. **Nephthys coeca** (Fabricius) Örsted.

Numerous examples from various localities — Neah Bay, Salmon Bay, and Pleasant Beach. The largest specimens measure 20 cm. and over in length, and 15 mm. across the thickest portion, including the parapodia. The species occurs northward along the Alaskan shores, in Bering Sea (Marenzeller, '90) and along the northern coast of Siberia (Wirén, '83). It extends southward along the California coast as far at least as San Francisco Bay, but the California specimens are pygmies as compared with those from Puget Sound and Alaska.

The species was long ago collected by Alex. Agassiz in the Gulf of Georgia and identified by Ehlers ("Die borstenwürmer," p. 588) as identical with *Nephthys coeca* of European waters. I have com

pared the Puget Sound specimens with some in the Museum of Comparative Zoology from Massachusetts Bay, and find them identical in every respect.

### EUPHROSYNIDAE.

19. **Euphrosyne heterobranchia** sp. nov. Pl. 6, figs. 60–66 *a–c*.

*Form* elliptical, robust, slightly more tapering towards the posterior than towards the anterior extremity. Dorsal bare stripe narrow, less than one fourth the width of body. Somites, 34.

*Caruncle* (Fig. 60) low, bilobed dorso-ventrally, the lobes of equal length, reaching sixth somite. It has eight longitudinal ridges, two pairs in the upper, and two in the lower lobe, extending the entire length of the caruncle. Median tentacle short and awl-shaped, its filiform tip nearly as long as the thick basal portion; at its base the two posterior or "dorsal" eye-spots. The anterior or "ventral" eye-spots confluent, flanked on each side by a very minute antenna.

*Palpi* rather broad and flat, separated by a slight furrow from first and second somites, divided by a conspicuous median cleft. The mouth bordered posteriorly by the 5th somite.

*Parapodia* of usual form in this genus. A short ventral cirrus at posterior edge, adjacent to the intersegmental furrow; a lateral cirrus between the fourth and fifth gill-trunks, counting from the uppermost of the series; a stout, fusiform dorsal cirrus, not exceeding the branchiae. Branchiae ten on each side, some simply forked, others ramose, branching twice (Figs. 66 *a–c*). Setae all with hard, glistening tips; the bifid ones of dorsal series often have a very minute lateral tooth (Fig. 63); lateral tooth of ventral series also small (Fig. 65); cleft setae both serrate and non-serrate (Figs. 61–62*a*), the latter form the more common; serrations sometimes very few.

*Length*, 13 mm.; width, not including setae, 4.5 mm.; dorso-ventral thickness, 33 mm.; median base stripe, 1 mm.

A single specimen in the Columbia collection. The species is interesting for its resemblance to *E. borealis* of the North Atlantic, as to the heterogeneous character and large number of its branchiae, but differs from it in the shape and multiform nature of its setae, and in the larger number of somites. It is sufficiently distinct from all other known species of our Pacific coast, although its superficial resemblance to *Euphrosyne arctia* is rather striking.

As regards the so-called "branchiae" of *Euphrosyne*, it was long ago pointed out by Claparède ('68, p. 420) that functionally these are no branchiae, but probably glands, which furnish the slime with which the animal is more or less coated. I have recently had an opportunity to examine these structures in a young specimen of *E. aurantiaca* and compare them with the functional branchiae of *Eurythoe californica*, both *in situ* and freshly abcised from the living animal. While the branchiae of *Eurythoe* are richly vascular, the organs of *Euphrosyne* show not the slightest trace of blood-vessels, although almost as transparent as those of *Eurythoe*. On the other hand, these gill-like structures are richly beset with glandular cells, and there cannot be much doubt that they furnish a part or the whole of the mucus with which the setae are usually enslimed. The relationship of *Euphrosyne* to *Eurythoe* is undoubtedly close; many authorities place them in the same family. We may therefore legitimately conclude that here we have homologous structures that have undergone a change of function; and the term "branchia," applied in a morphologic sense, is not a misnomer, although perhaps liable to be misleading.

Study of sections of specimens of *Euphrosyne aurantiaca* and *Eurythoe californica*, fixed in aceto-sublimate and stained with haemalum, shows less difference in the structure of the gills than would appear to exist from examination of the structures in the living or fresh condition. Both, indeed, contain blood-vessels or structures functioning as such. In *Eurythoe* the presence of a vascular loop is very evident, but in *Euphrosyne* I have not been able to detect a loop, or in fact anything more than a cleft in the tissue sometimes empty, sometimes filled with coagulum. This seems to be a lymph space connected with the body cavity. In both species the walls of the gills are thick, but thicker in *Euphrosyne* than in *Eurythoe*. The branchiae of *Euphrosyne* contain an axial strand of muscle fibres. Their surface is ciliated.

### Syllidae.

20. **Pionosyllis elongata** sp. nov. Pl. 6, figs. 67–70. Pl. 7, fig. 71.

*Form* slender, becoming much elongated with age; 140–200 somites; diameter nearly uniform the entire length, tapered slightly towards head and tail; intersegmental furrows are deeply incised; somites average two and one half times as broad as long.

*Prostomium* (Fig. 67) about one and one half times as broad as long, in front obtuse, convex, the base nearly full width of peristomium. Palpi fused for nearly half their length. Antennae and median cirrus moniliform, similar to peristomial and dorsal cirri. Eyes four, the anterior pair twice the size of the posterior, and considerably further apart.

*Peristomium* with dorsal and ventral cirri, without parapodia or setae.

*Parapodia* (Figs. 67, 69) uniramous, with double aciculae; setae few; ventral cirri short, plain; dorsal cirri moniliform, gradually tapered from the base; slightly exceeding in length the diameter of the worm. Articulations 10–15 in antennae and peristomial cirri, increase to 16–18 (in some specimens, 18–20) in dorsal cirri of the anterior region, then diminish to 14–15 in more posterior somites.

*Pygidium* (Fig. 68) hemispherical; anus on its dorsal side; anal cirri longer than the dorsal cirri, cylindrical, 16–17 jointed.

*Alimentary canal* (Fig. 71) of usual form; proboscis with a circlet of thirteen conical papillae (*pap.*) at its orifice, and armed with a single tooth (*t.*) near anterior edge of chitinized lining; proboscis frequently found everted in preserved specimens. Oesophagus (*oes.*) elongated, extending through about twelve somites; its posterior third thick-walled and glandular. The proventriculus or "gizzard" (*prov.*) of the usual structure, extending through eight to ten somites, according to degree of contraction of body; cylindrical, rounded at the ends, lumen very narrow. Ventricular coeca (*c.*) much elongated, extending through four somites, frequently curved or bent double and opening into digestive tube just back of the proventriculus.

*Sexes* distinct; no stolonization; genital products develop only in posterior somites (163d to 194th in a female specimen with 198 somites), which become much enlarged in consequence.

*Color*, in life, nearly white, translucent; ova rich yellow.

*Length* of full-grown female (198 somites) 58.5 mm.; transverse diameter, including parapodia, 1.1 mm.

A single specimen was collected by Miss Robertson at Port Orchard in July, 1899. It is immature, measures 31 mm. in length, and has but 146 somites.

This species occurs within tide-marks as far south as Pacific Grove, Cal., where I have taken sexually mature specimens in December. I have also collected, in the month of February, sexually

mature specimens of exceptionally large size at Point Cavallo, on the northern shore of the Golden Gate, where it occurs in small numbers on the underside of stones, inside of dead shells, etc. The much-swollen caudal segments, turgid with ripe ova, are very conspicuous.

I have examined the radial muscle-columns in the proventriculus, and find the structure as regards the central core of granular, undifferentiated protoplasm, in which the nuclei are located, and as regards the peripheral layer of muscle tissues, in harmony with the statements of Haswell ('86) and Malaquin ('93); I have not, however, been able to discern striations in the muscular part, but this may be due to the fact that the material was not preserved with a view to histological study.

21. **Trypanosyllis gemmipara** sp. nov. Pl. 7, figs. 72–76.

*Form* elongated, much flattened dorso-ventrally, tapered towards both ends, abruptly towards the head, gradually towards the pygidium; somites very short; parapodia less than one sixth the width of the trunk in its widest portion; somites very numerous (300 or more).

*Prostomium* (Fig. 72) comparatively small, broadest in front, distinctly bilobed, the lobes separated by a median furrow; eyes four, the anterior pair larger and very slightly further apart than the posterior. Median cirrus nearly twice as long as the antennae; these, as also the peristomial cirri and all the dorsal cirri, moniliform, with numerous short articulations, diminishing in size towards the tip. Entire surface of cirri covered with dark brown, easily detached, bud-like bodies (Figs. 72 and 74). Palpi (*p.*) reniform, elongated, projecting far in front of the prostomium, widely separated their whole length.

*Peristomium* extremely short, embracing the prostomium on its two sides; bearing at its anterior corners two pairs of forwardly directed peristomial cirri, of which the dorsals are twice the length of the ventrals. The arrangement of prostomium and peristomium, together with their appendages, closely resembles the collocation of these parts in the Polynoids.

*Parapodia* (Fig. 74) not prominent, ventral ramus fairly developed, pointed at tip, with 7–9 setae of the form shown in Fig. 75; a small separate lobe covers the tips of the double aciculae. Ventral cirrus (*v. c.*) short, often curved, blunt at tip, non-moniliform. Dorsal cirrus very long, either straight or circinate at tip; in the

latter case incurved over the dorsum, in the former extending nearly at right angles to longitudinal axis of the body.

*Digestive system* exhibits a well-developed trepan (Fig. 73) of ten teeth; these are surrounded by a circlet of elongated papillae (*pap.*). Oesophagus of moderate length (extending through 22 somites), strongly chitinized; proventriculus cylindrical, of uniform diameter throughout; two well-defined lateral raphes; radial muscle-columns very large. Alimentary canal back of proventriculus with extensive, segmental, paired diverticula.

*Dorsal surface* elegantly marked with fine transverse dark lines which indicate the boundaries of the segments.

*Posterior extremity* capable of producing successive crops of collateral, sexual buds or zooids (Fig. 76), which possess every external structure of the parent except mouth and anus. They lack, however, an alimentary canal and nephridia.

*Length*, 68 mm.; transverse diameter, 3 mm.; dorso-ventral diameter, 1 mm.

A single specimen was collected by the Columbia University expedition, probably in the vicinity of Port Townsend. Unfortunately, no data accompany it. This individual possesses the remarkable sexual zooids, over fifty in number, presenting all stages of development. They arise as collateral buds from a proliferating somite near the posterior extremity (Fig. 76). At full maturity they evidently separate from the asexual stock and become free-swimming sexual zooids, provided with parapodia, antennae, eyes, and central nervous system, but destitute of an alimentary canal. They will be fully described in volume 2 of the Biological Bulletin.

### Onuphididae.

22. **Northia elegans** sp. nov. Pl. 8, figs. 77–85.

*Form* stout, flattened dorso-ventrally, tapering towards head; except in most anterior region, dorsal contour flattened and ventral convex; branchiae simple, filiform, upraised, and slightly incurved over the back.

*Prostomium* (Fig. 77) small, conical, considerably broader than long, and its surface monopolized by its large appendages; three pairs of antennae; most anterior pair short, ovoid; second pair with annulate basal joints and acute terminal joints about one half the

length of the basal joints; third pair three-jointed, the middle joint much the shortest, and the distal twice as long as the proximal; this pair more than twice as long as the second pair, and reaching the sixth somite. Basal joints of second and third pairs of antennae with nine or ten obscure annulations. Median cirrus likewise three-jointed, one half as long as third pair of antennae, and with long terminal stylode; its basal joint five-annulate. Palpi large, globose, approximate (Fig. 78, *p.*). Eyes four, small, at bases of third pair of antennae, one pair directed forward, the other laterally (Fig. 78).

*Peristomium* (Fig. 77, 78) shorter and narrower than the other somites, having on its antero-dorsal border a pair of small, slender, peristomial cirri (Fig. 78, *p. c.*).

*Somites*: first four or five back of peristomium longer and narrower than the succeeding ones, with parapodia (Figs. 77, 80) of different form from the rest, characterized by an elongated ventral ramus, with acute achaetous terminal portion, a large fusiform ventral cirrus (*v. c.*), a dorsal cirrus (*d. c.*) of similar form and dimensions, and a cirriform gill (*br.*), likewise of similar aspect. The transition to the typical somite and foot is gradual (*cf.* Fig. 81, 28th foot).

*Branchiae* unbranched throughout, tapered to an acute tip, increasing in length caudad, until they exceed half the transverse diameter of the trunk. The setae of the 4–5 anterior parapodia are different from those of the succeeding feet, and are of two forms, "hooded crotchets" and capillary bristles (Figs. 82, 83). Setae of dorsal rami throughout the series are buried in the foot; at most, their tips protrude (Fig. 85). Setae of ventral rami beyond fifth foot are (1) bordered capillary (Fig. 84), (2) a pair of stout, two-pronged uncini with flabellar expansions at tip — in all respects like uncini of succeeding species (Fig. 90).

*Upper jaws* (Fig. 79) asymmetrical, six pieces on right, seven on the left.

*Length* of 85 somites, 66 mm.; transverse diameter, 6 mm.

The antero-dorsal portion of the trunk elegantly marked with paired umber-brown spots placed near the posterior border of each somite; these tend to coalesce across the median line (Fig. 77).

Three or four specimens of this fine *Northia* occur in the Columbia University collection. Unfortunately, all lack the posterior portion of the trunk. There are no data as to depth or exact locality. The tubes also are lacking.

23. **Northia iridescens** sp. nov. Pl. 8, figs. 86, 87. Pl. 9, figs. 88–92.

*Form* slender and nearly cylindrical, of almost uniform diameter in anterior region; highly iridescent; branchiae curved over dorsum, not reaching median line; slender, filiform, translucent (Fig. 88).

*Prostomium* (Figs. 86, 88) small, hemispherical; first or "accessory" antennae elongate ovate, constricted at base; second pair of antennae two-jointed, basal joint slightly the longer, twelve-ringed; third pair of antennae three-jointed, with 11–13 annulations; this pair nearly four times as long as the second pair. Median cirrus a little shorter than third pair of antennae; nine-ringed. Eyes wanting. Palpi (Fig. 86) globose, pedunculate, spreading.

*Peristomium* much broader than prostomium, with a pair of minute peristomial cirri (Fig. 88) projecting from its anterior border.

*Jaws* (Fig. 87) very similar to those of *N. elegans*, but with more teeth on the dental plates and more slender maxillae.

*Somites*: four following the peristomium with modified parapodia (Fig. 88), similar to the same somites in *N. elegans*; the succeeding ones with filiform gills and dorsal cirri, but no ventral cirri (Fig. 89).

*Hooded crotchets* (Fig. 91) of ventral fascicles of first four somites very similar to those of preceding species. Two stout, wing-tipped uncini (Fig. 90) in ventral fascicles of parapodia further back. Capillary setae with striated border (Fig. 92).

*Length* of 52 somites, 38 mm.; transverse diameter, 3 mm.

This species is represented by a single specimen, dredged by Prof. W. A. Herdman at Victoria, B. C., in the summer of 1897, and by him kindly placed in my hands for description. Unfortunately, all the posterior portion of the specimen is lacking. The tube is of parchment-like material, opaque-white, flexible, and with adherent sand-grains.

### LUMBRICONEREIDAE.

24. **Lumbriconereis zonata** sp. nov. Pl. 9, figs. 93–100.

*Form* cylindrical, slightly tapered towards anterior end; parapodia placed a little below the mid-lateral line; somites three times as broad as long, each marked with a sharply-defined brown zone

which extends around the trunk, widening on each side, above and below, as it approaches the parapodium. Middle of each band marked by a sharp dark line (Figs. 93, 95, 96).

*Prostomium* (Fig. 93) acorn-shaped, of a lighter tint than the trunk; perfectly smooth and glistening.

*Peristomium* (Fig. 93) tapered to the diameter of the base of the prostomium which is less than three fourths the diameter of the third somite. Second somite about one half the average length of the somites.

*Jaws* as shown in Fig. 94.

*Parapodia* (Figs. 97, 98) less than one half diameter of body, bi-lobed at tip, posterior lobe the longer. Setae inserted between the lobes. Setae, as usual, of two forms: winged capillary (Fig. 99) in anterior portion of body and "hooded crochets" (Fig. 100) in the posterior portion.

*Length* of 200 somites, 167 mm.; diameter, including parapodia, 4.5 mm.; without parapodia, 3 mm.

A single imperfect specimen lacking the posterior region, was collected by Professor Ritter at Salmon Bay, Puget Sound, May 29, 1899. This specimen is remarkable for the possession of abnormal segmentation in as many as five places. In two instances the somites are spiral in the way shown in Figs. 95, 96, representing respectively the dorsal and ventral sides. In another place, the spiral extends through nine somites, with a forked somite at each extremity. The other two instances are partially-divided somites without a spiral arrangement — in one case with the parapodium displaced towards the ventral side. The asymmetrical somites are not confined to any limited region, but are scattered for a long distance through the middle region of the body.

### Glyceridae.

25. **Glycera rugosa** sp. nov. Pl. 10, figs. 101, 102.

*Form* stout, terete, thickest about one third the distance from head to posterior extremity, tapering slightly cephalad; much more, though gradually, caudad. Number of somites 200–300, distinctly two-ringed, all setigerous except the pygidium. The rings are nearly equal, but the anterior one, which bears the parapodia, is often raised like a welt, giving the body a corrugated aspect.

*Prostomium* conical, tapering, 2–3 mm. long, length exceeding its breadth, obscurely twelve-ringed; four minute tentacles at tip. Basal portion not sharply set off from the peristomium. Palpi (?) retracted.

*Pygidium* small, globose, bearing a pair of slender subulate anal cirri. Anus minute, on dorsal side of pygidium.

*Parapodia* (Fig. 101) stout, of nearly equal height and length, the largest equal to width of dorsum in its widest part; except the two most anterior pairs, four-lobed, the two anterior lobes slightly longer than the posterior, but all lobes of nearly same form except in most anterior parapodia. Anterior dorsal lobe sometimes bifid. All the lobes more or less conical and pointed; their tips darkly pigmented; simple capillary setae inserted between the dorsal lobes; the compound setae between the ventral. Ventral cirrus (*v. c.*) large, conical, strongly resembling the lobes; dorsal cirrus (*d. c.*) smaller, globose, much constricted at the point of attachment, placed high, at the base of the parapod.

*Branchiae* (Fig. 101) begin at the 16th or 17th parapod and extend to the 22d from the pygidium; they consist of eight or nine finger-like, thin-walled lobes, sometimes bifurcated; completely retractible into body-wall; at sexual maturity crowded with reproductive cells (Fig. 101). *All branchiae are on posterior aspect of the parapodium*; the most anterior and most posterior of the series are single, sausage-shaped processes.

*Proboscis* extremely variable in length (12 to 35 mm. or more), club-shaped, thicker than anterior portion of body, beset with minute papillae of two forms, conical and ovate. Jaws (Fig. 102) strongly hooked; each bears a triangular appendage (*ap.*) with long falcate process.

*Color* of alcoholic and formalin specimens variable, from tawny or buff to olive-brown. The color is due to abundant yellowish brown pigment grains in the hypodermis. These are often aggregated towards tips of the lobes of the parapodia.

*Length* of large specimen (much contracted), 170 mm.; transverse diameter, including parapodia, 9 mm.

This species is probably abundant in the Puget Sound region, as it occurs in all the collections. It has been taken at Neah Bay, and at Salmon Bay (near Seattle); and there are a considerable number in the Columbia collection (probably from the vicinity of Port Townsend) for which no locality is given. A Glycerid col-

lected by J. K. Lord at Esquimalt and described under the name *Glycera corrugata* by Baird ('63) is probably identical with *G. rugosa*, but the description is too meager to admit of positive determination. Many of the larger specimens are females with ripe or nearly ripe ova; but I have seen no specimen which has undergone the atrophy of the proboscis incidental to sexual maturity mentioned by Arwidsson ('98, p. 6).

As the Glyceridae are destitute of a vascular system, the gills are merely reversible pouches of the body-wall, into which the caelomic fluid passes. Reproductive cells also enter these thin-walled pouches.

26. **Glycera nana** sp. nov. Pl. 10, figs. 103, 103a.

*Form* short, thick, somites comparatively few (about 140 in one specimen); diameter nearly uniform for greater portion of length; somites two-ringed; the posterior ring slightly raised above the level.

*Prostomium* conical, ten-ringed, four minute tentacles at tip. Proboscis short, club-shaped, beset with conical papillae. Jaw-appendage as shown in Fig. 103a.

*Parapodia* (Fig. 103) rather slender, anterior lobes two, the ventral one the longer, both conical; posterior lobe single, rounded; ventral cirrus (*v. c.*) similar in shape to upper anterior lobe; dorsal cirrus a rounded tubercle placed high above the foot on the side of body; no gills.

*Setae* elongate, of the usual two forms, capillary dorsal, and compound ventral.

*Length* of larger specimen, 64 mm.; greatest transverse diameter, 6 mm.; without parapodia, 4 mm.

The species is present in the Columbia collection and also in Miss Robertson's; she obtained it at Port Orchard in July, 1898. The exact locality is not recorded for the other specimen. In both examples the posterior portion is regenerating, so it is impossible to give accurately the normal number of somites. It probably lies between 180 and 200.

27. **Hemipodia borealis** sp. nov. Pl. 10, figs. 104, 104a.

*Form* terete, moderately long and slender, of nearly uniform thickness for the greater portion of the length, but tapered posteriorly; somites three-ringed, 126 in number; two minute anal cirri.

*Prostomium* with conical, ringed process, tipped with four (?) tentacles. Proboscis beset with minute, ovate papillae. Jaws with notch near base; jaw-appendage (Fig. 104a) a simple rod.

*Parapodia* (Fig. 104), as invariably in this genus, with only the lower ramus, a single acicula, and no simple setae. The dorsal cirrus (*d. c.*) near the foot, ovate; no gills. Parapodia consisting of an anterior, elongated lobe and a posterior, short, rounded one.

*Length*, 72 mm.; transverse diameter, including parapodia, 3 mm.

Only a single female specimen of this very interesting species occurs in the Puget Sound collections. It was gathered by the Columbia University Expedition — exact locality not known. It contains large eggs, and is evidently mature.

The genus *Hemipodia* was established in 1865 by Quatrefages for the reception of a peculiar Glycerid from Chile, which he named *H. roseus*. The same year another species from the Straits of Magellan was described under the name *H. patagonica* by Kinberg ('65, p. 245). Until the present, no genuine species of *Hemipodia* has been added to the two original ones, although two species of Glyceridae — *Hemipodia* (?) *magellanica* M'Intosh ('85, p. 349) and *H. septentrionalis* Roule ('96, p. 452) — have been erroneously attributed to this genus (*vide* Arwidsson '98, p. 28).

ARICIDAE.

28. **Scoloplos elongata** sp. nov. Pl. 10, figs. 105–110.

*Form* long and slender, somites short and very numerous (293 in one specimen); flattened anteriorly; broadest between 9th and 17th somites; thence narrowing gradually to a uniform diameter which is kept about as far as the 200th somite, thence gradually and uniformly diminishing to the slightly expanded, hemispherical pygidium. Dorsum plane, but apparently concave on account of the upward direction of the parapodia. Ventral aspect convex, flattest in the widened anterior region, where dorsal and ventral surfaces are nearly alike and the parapodia are laterally directed.

*Prostomium* small, tipped by a conical, acutely-pointed palpode (Fig. 105, *pp.*); without eyes.

*Peristomium* increasing rapidly in width towards the second somite, which is the first to bear setae. Pharynx eversible, with leaf-shaped lobes (Fig. 106).

*Parapodia* at anterior end (Fig. 107) with dorsal and ventral setae, and simple branchiae. Setae closely serrated (Fig. 109). Parapodia back of the anterior region (Fig. 108) with larger, ciliated

branchiae and dorsal cirri. Dorsal and ventral setae in small fascicles. Ventral ramus of foot continued ventrad as a leaf-like expansion, but not extending below the medio-lateral line. Anus on dorsal side of pygidium; anal cirri long and slender.

*Length*, 192 mm.; width of thorax, 3 mm.; width of abdomen (including parapodia), 2 mm.

This species burrows in sandy shores, near low-water mark, whereas the much commoner and more widely distributed species of *Aricia* found on the Californian coast has its habitat among the rhizomes of *Phyllospadix*. The present species is represented in the material from Puget Sound by a number of incomplete specimens collected by the Columbia University Expedition and by Miss Robertson.

### Levinseniidae.

**Aricideopsis** gen. nov.

Characters of *Aricidea* Benedict and Webster, but differs from it in having well-developed parapodia and setae on the peristomium, and no ventral cirri. Eyes very large, compound. Anal cirri, two.

29. **Aricideopsis megalops** sp. nov. Pl. 10, figs. 111, 112. Pl. 11, figs. 113, 114.

*Form* of moderate length, gradually tapering from the anterior to the posterior extremity, color of preserved specimen pale yellow, the dark intestine showing through in the posterior portion. Parapodia with distinct rami flattened into foliaceous expansions, much the largest dorsally, and in the anterior half of the body; setae in both rami; uncini and capillary setae in all ventral rami (except the last two or three, which are achaetous) back of the 18th.

*Prostomium* (Fig. 111), the full breadth of trunk, rounded anteriorly, elevated in a median thickening at base, which is bilobed anteriorly, and bears the median cirrus and the large crescentic eyes.

*Parapodia* (Figs. 112, 113) with dorsal rami expanded into leaf-like form on somites 2–24 and beyond, gradually becoming smaller and more rounded; towards end of series the upper lobe becomes minute; ventral lobe rounded, always smaller than the dorsal; a filiform gill (*br.*) on somites 2–27, often with lanceolate tip. Setae (Figs. 112, 113, 114) of two sorts: capillary and "hooded crotchets"; both kinds occur in the ventral rami back of the 17th somite; at

first only one or two uncini (Fig. 114) among the capillary bristles, gradually increasing to five, while the capillary bristles decrease *pari passu*. Anal cirri two, short and stumpy.

The present species undoubtedly belongs to the family Levinseniidae recently established by Mesnil and Caullery ('98) for the reception of a small group of peculiar little Polychaetes which show affinities to the Spionidae on the one hand, and to the Ariciidae on the other. The species under consideration most nearly resembles *Aricidea*, of which two species have been described from the Atlantic coast by Webster and Benedict ('87). It differs enough however from *Aricidea* to deserve generic distinction. The presence of parapodia and setae on the peristomium probably indicates a more primitive character than the allied genus exhibits. The large size of the eyes is also remarkable, and would seem to indicate a pelagic habit.

The foregoing description is based upon a single specimen from Port Orchard, collected by Miss Robertson in June, 1899.

### Magelonidae.

30. **Magelona longicornis** sp. nov. Pl. 11, figs. 115–118.

*Form* cylindrical, rather stout, of nearly uniform diameter, divided into two regions: (1) the *anterior*, in front of ninth somite, with capillary, double-bordered setae (Figs. 115-117) in both fascicles; (2) the *posterior*, back of and including the ninth somite, with uncini (Fig. 118) both above and below. Ninth somite (Fig. 116) shorter than the others, and marked by a deeper constriction, with a pair of comb-like fascicles of short, stiff, capillary setae.

*Prostomium* (Fig. 115) flattened, grooved in median dorsal line, anterior tip expanded; no eyes. Peristomium bears a pair of enormously long, flexile, tentacular cirri, beset with numerous capitate papillae on exterior aspect; showing rings of contraction near its base (Fig. 115). Proboscis (*pr.*) rounded, without corrugations or surface differentiation; extensible as far as tip of prostomium.

*Parapodia* (Figs. 115, 116) of anterior region slightly developed; dorsal and ventral cirri small; a small branchia between them; dorsal and ventral setae (Fig. 117) of same form, double-bordered capillary. In posterior region, branchiae and cirri are larger; uncini (Fig. 118) in form of "hooded crotchets" bidentate at tip, in transverse rows of ten or eleven, rising high upon dorsal side.

*Length* of head and anterior region, 7 mm.; length of first 12 somites of abdomen, 8 mm.; greatest transverse diameter, 1.5 mm.; length of tentacular cirri, about 14 mm.

Two imperfect specimens, consisting of only a few anterior somites, represent this interesting species. It was collected by Miss Robertson at West Seattle, June 23, 1899.

*Magelona papillicornis*, originally described by Fritz Müller ('58) from the Island of Santa Catharina off the coast of Brazil, has since been found on both sides of the North Atlantic (*vide* Andrews, '91). Its anatomy, both external and internal, has been carefully studied by M'Intosh ('78) and its remarkable blood has been investigated by Benham ('96). Hitherto it has remained a unique and isolated form, most closely related to the Spionidae but, as M'Intosh pointed out, having affinities also with the Chaetopteridae. The present species differs from *M. papillicornis* (1) in its much greater size, (2) in the greater length of its tentacular cirri and longer papillate areas of same, (3) in the comparative shortness of the prostomium, and (4) in the smoothness of the proboscis.

### Capitellidae.

31. **Capitella dizonata** sp. nov. Pl. 11, figs. 119–121.

*Thorax* thickest in region of 5th and 6th somites; smallest at 8th and 9th (Fig. 119), most of the thoracic somites two-ringed; abdominal somites three- to twelve-ringed; intersegmental constrictions pronounced, especially in thorax.

*Prostomium* short, conical, at base slightly more than one half the diameter of the peristomium; nuchal organs not discovered.

*Peristomium* setigerous; somites of thorax over three times as broad as long in the contracted state; the 4th and 5th each with a dark brown band passing around it in front of the fascicles. Female genital pore between the 7th and 8th somites (♀, Fig. 119).

*Abdominal somites* notably longer than the thoracic, beginning at the 10th, which differs but slightly from the 8th and 9th of the thorax; increase caudad in length and number of rings. Uncinigerous tori placed near the posterior boundary of each segment; the ventral the first to appear, and larger than the dorsal throughout anterior region of abdomen.

*Capillary setae* (Fig. 120) alone present in first seven segments; obtusely angled, with striated limb on convex border, arranged in dorsal and ventral widely separated fascicles; persist in dorsal fascicles as far as 10th somite; beyond this point replaced entirely by uncini.

*Uncini* (Fig 121) begin in ventral fascicles at 8th somite; in dorsal fascicles at the 10th; hooded, with four minute teeth above rostrum; shaft strongly geniculate.

*Length* of 39 anterior somites, 36 mm.; greatest transverse diameter of thorax, 1.5 mm.

This species is represented in the collection by a single incomplete specimen, lacking the posterior portion. It is an immature female, and was collected by Miss Robertson at Port Orchard, July 2, 1898. The dorsal setae of the 8th and 9th somites appear to be entirely wanting.

CHLORAEMIDAE.

32. **Trophonia papillata** sp. nov. Pl. 12, figs. 122, 123.

*Form* rather long and slender, slightly tapered, thickest anteriorly, abruptly diminishing toward mouth; subcylindrical; intersegmental constrictions distinct, but not noticeably deepened caudad; entire surface papillate, slightly rough to the touch, but without adherent sand-grains; dorso-ventral differentiation slight, mainly expressed in differences between dorsal and ventral setae, and in the closer papillation of dorsum.

*Oral tentacles* (Fig. 122) eight, of moderate length, pointed at tip; palpi (*p.*) thicker and blunter, grooved on ventral aspect, distinctly constricted at regular intervals.

*Setae* of second, third, and fourth somites, both dorsal and ventral, elongated, flexible, capillary bristles, forwardly directed (Fig. 122), exhibiting the usual transversely-striate structure. Dorsal setae of remaining somites, capillary, three or four to each fascicle; ventral setae (uncini), to the same number; stouter than dorsal setae, blackish, hooked (Fig. 123).

*Somites* of only complete specimen, 89 in number; those in the anterior region twice as broad as long; posteriorly, length and breadth gradually becoming equal.

*Length*, 88 mm.; greatest transverse diameter, 4 mm.

Two specimens, one incomplete, were collected at Port Orchard, July 2, 1898, by Miss Robertson.

33. **Flabelligera infundibularis** sp. nov. Pl. 12, figs. 124–127.

*Form* (Fig. 124) rather stout, squarish, dorsal aspect more flattened than the ventral; enclosed in clear mucus; tapered in posterior third to a minute caudal extremity; oral region (2d somite?) flared, with an almost complete circle of setae on the margin, formed by two broad fan-shaped fascicles; intersegmental constrictions deep; parapodia (Figs. 124, 126) well developed, distinctly biramous, on every somite from the third.

*Peristomium* within the oral funnel; bears numerous slender tentacles and two stout, lobulated palpi (*p.*).

*Dorsal setae* (Figs. 125, 126) longest and most numerous on second somite, where they form the funnel; on the other somites, more slender, delicately curved, completely imbedded in the jelly, transversely striate. Ventral setae (Fig. 126) begin on third somite, one or two in each ventral ramus, in form of long hooks, transversely striate, blackish towards tip. Numerous sensory papillae (Fig. 127) are borne at the tips of long varicose pedicels.

*Somites* in four specimens are 42, 50, 56, and 71, increasing in number with size of animal. In contraction, somites are at least four times as broad as long.

*Length* of specimen with 56 somites (about average size), 55 mm.; greatest transverse diameter, 5 mm.

According to the statements of Harrington and Griffin ('97, p. 162), this species is enormously abundant in Scow Bay, where it covers the muddy bottom over an area about half an acre in extent. The depth given for one lot of specimens is six fathoms. It does not appear in any of the littoral collections from the region of Seattle.

The extraordinary elongation of the dermal sensory papillae in species of this genus is well exemplified in the present form. The thick coating of mucus which envelops every part of the animal except the anterior and posterior extremities (Fig. 124) (the funnel formed by the broad flabellate oral tentacles makes a passage to the mouth) apparently renders necessary this method of putting the animal in communication with the outer world.

### STERNASPIDAE.

34. **Sternaspis fossor** (?) Stimpson.

Three specimens, apparently of this species, were collected at Victoria, Vancouver Island, by Prof. W. A. Herdman. The specimens are not sufficiently well preserved to admit of thorough and critical study; but comparison of the ventral shields with those of a specimen of *S. fossor* from the Atlantic coast, and also with Marenzeller's ('90) figures, makes it reasonably certain that the above identification is correct. Specimens from Puget Sound collected by the naturalists of the Northwest Boundary Commission were doubtfully described by Stimpson ('64) as a new species, which he named *Sternaspis affinis*.

### MALDANIDAE.

35. **Clymenella**[1] **rubrocincta** sp. nov. Pl. 13, figs. 128–133.

*Form* considerably elongated, cylindrical, narrowed in region of third and fourth somites, gradually enlarging to maximum diameter in region of somites 10–12, thence narrowing to somites 15–17, which are the longest and slenderest of the body; the remaining somites (18–22) slightly thicker and progressively shorter; the 21st the shortest of the body.

*Cephalic plate* (Figs. 128, 129) oval, concave on dorsal side, nearly bisected longitudinally by a median ridge continued back from the ovate palpode; a distinct raised margin, and well-developed longitudinal nuchal organs (Fig. 129, *n. o.*). Mouth with thickened corrugated lower lip and crescentic outline.

*Peristomium* achaetous; capillary setae and uncini begin on second somite (Fig. 128), the latter with scarcely perceptible tori at first; tori become distinct in fourth somite; dorsal setae from wart-like papillae.

*Somites* gradually increasing in length from fifth onward; fifth to eighth marked with a broad indian-red band back of the setae and uncini, accentuated by a narrower whitish band in front.

[1] *Axiothea* and *Clymenella* cover species too nearly alike to require generic distinction. As recently pointed out by Verrill (:00, p. 657), the name *Axiothea* being preoccupied, *Clymenella* (*sensu ext.*) should cover the species formerly included under *Axiothea*.

Tori much enlarged in somites 12–21. Last 3 somites (including pygidium) achaetous; pygidium funnel-shaped with cirrose border. Perianal cirri (Fig. 130) 18–30 in number, alternately long and short; the mid-ventral one much elongated, and containing prolongation of the ventral nerve-cord; tips of all the longer cirri recurved. Anal rosette with alternate sectors raised, corresponding in position with the longer cirri.

*Capillary setae* of two forms, bordered and serrated, the latter much the more slender (Fig. 133). Both kinds in same fascicle; begin at second somite. Uncini (Figs. 131, 132) with five or six teeth, including rostrum, graduated in size; bristles at base of rostrum lateral in position.

*Length* of large specimen, 162 mm.; greatest transverse diameter, 3.5 mm.

This fine species comes near *Axiothea catenata* Malmgren, a form of wide distribution in the North Atlantic and Arctic, and reported from Bering Sea by Marenzeller ('90). The present species, however, differs from it in the form of the serrated setae and of the uncini. In *A. catenata* there are four preanal achaetous somites, in the present species only two; *C. rubrocincta* has 22 segments; *A. catenata*, 24.

The present species was collected both by the Columbia University Expedition and by Miss Robertson. I have found it in abundance at the entrance of Tomales Bay, and at San Pedro, California. It forms a tube of coarse sand, which is lined by a peculiarly tough, opaque, whitish membrane.

36. **Nicomache personata** sp. nov. Pl. 13, figs. 134–139.

*Size* small; 25 somites, of which all except the peristomium and the last two are setigerous; no cephalic plate; prostomium and peristomium united to form a hood-shaped head (Fig. 134); mouth large, overhung by projecting upper lip; a distinct crease in peristomium back of mouth.

*Somites* increasing in length back of second; longest from the 8th to the 17th; those at the end very short; pygidium (Fig. 135) funnel-shaped, with a zone of 16–18 cirri on margin, quite uniform in length. Dorsal and lateral surfaces of head and first four or five somites beautifully mottled with chocolate-brown; ground-color, white; somites 2–5 with contrasting white and brown bands; on the head these bands have the aspect of a grotesque face.

*Setae* of five kinds: (1) capillary double-bordered setae in all

somites from second to twenty-third; (2) smaller serrated setae together with (1) in dorsal rami; (3) ventral setae in first three setigerous somites in form of a stout, acute spine (Figs. 134, 136); (4) very long, filamentous, spiral setae in dorsal rami beginning at 7th to 11th somites and continuing to 23d somite (Fig. 138); (5) uncini (Fig. 137) of the usual form in this family, in all setigerous somites back of the 4th.

*Length* of much-contracted specimen (impossible to measure accurately on account of twists and flexures), 50 mm.; diameter through thickest portion, largest specimen, 1.75 mm.

The only specimens of this odd little species were collected by Miss Robertson at Alki Point, Aug. 3, 1898. The species bears a close superficial resemblance to *Nicomache lumbricalis* (Sars) Malmgren, but has one achaetous somite in front of the pygidium instead of two.

The long, silky, spiral filaments shown in Fig. 138 have not, I believe, been hitherto described in any Maldanid. Whether they are permanent structures peculiar to this species, or "nuptial setae" (Pubitätsborsten) which develop only at sexual maturity, is an interesting question. Filamentous nuptial setae of a similar form have been described by Michaelsen ('92, p. 6) in a Polynoid (*Drieschia pelagica*).

### Ammocharidae.

37. **Ammochares occidentalis** sp. nov. Pl. 14, figs. 140–142.

*Form* cylindrical, tapering towards posterior end; 23 (?) somites, of which 20 are setigerous.

*Peristomium* produced into ten thick, bluntly-ramose "tentacles" (Fig. 140) which rise to a level, giving anterior end of body a truncated appearance. Capillary setae in fascicles placed high on dorsal surface (Fig. 142), very slender, acutely pointed, silvery by reflected light, serrated. Uncini very minute, two-hooked (Figs. 141 *a*, *b*), 16–18 horizontal rows in each band (6th somite), extending three quarters of the way around the body; begin at 4th somite.

Second and third *somites* (Fig. 140) very short, third twice the length of the second, both with rudimentary parapodia (?). Somites 4, 5, 6, 7 the longest of the body; from the 7th diminishing gradually to end of series.

*Length*, 22.5 mm.; greatest transverse diameter, 1 mm.

No species of *Ammochares* has hitherto been reported as having chelate or bifid uncini. This character in fact has been considered so diagnostic of the allied genus *Myriochele* that M'Intosh did not hesitate to describe a species in the "Challenger" collection as *Myriochele pacifica* from a fragmentary specimen lacking both anterior and posterior extremities — basing his diagnosis entirely on the structure of the uncini.

The two specimens upon which the foregoing description is based were collected by Miss Robertson at Port Orchard, July 2, 1898. Each was enclosed in a tube composed of sand-grains and minute particles of shell. The color of the formalin preserved specimens is nearly black.

### Arenicolidae.

38. **Arenicola claparedei** Levinsen. Pl. 14, figs. 143, 144.

In the excellent memoir of Gamble and Ashworth (:00) upon the Arenicolidae, the Mediterranean species, originally described by Claparède ('70, p. 300) as *Arenicola marina*, but afterwards erected as a separate species by Levinsen ('83, p. 137, footnote) under the name of *A. claparedei*, is attributed to the Pacific coast. After a careful examination of the Puget Sound *Arenicolae* at my disposal, and comparison with specimens of *A. claparedei* from Naples, I am convinced that Messrs. Gamble and Ashworth are correct in their determination. The only notable points of difference between the Puget Sound specimens and those from Naples are the vastly greater size — at least eight times as great — of the former, and the smaller number of oesophageal coeca or "pouches" in the latter. Of the four specimens of *A. claparedei* from Naples which I have examined, three have four pairs of pouches, and one only three pairs; whereas, out of eight specimens from Puget Sound in four there are six pairs, in two fifteen pairs, in one sixteen pairs; and in one there are sixteen coeca on the right and eighteen on the left!

In the Arenicolidae there are as a rule only two oesophageal coeca or "pouches," but in *A. claparedei* they are not only numerous (as many as 32 in one instance, Fig. 144) but highly variable as to number and arrangement, and probably even differ as to function, if it is permissible to draw such an inference from the great size and thin-walled character of the most anterior pair (Figs. 143, 144).

As, however, the whole question of the structure and function of the oesophageal pouches of *Arenicola* is still unsolved, this problem must be deferred for the present.

The discovery of this Mediterranean form upon the Pacific coast of North America, and at no intermediate point, is certainly one of the most remarkable cases of discontinuous geographical distribution ever recorded.

With exception of a single specimen collected by Miss Robertson, I am indebted to Dr. C. M. Child of the University of Chicago for all the Puget Sound *Arenicolae* I have. The specimens were collected by the Columbia University Expedition — exact locality not stated.

While, as von Marenzeller has suggested, it is probable that Murdoch's ('84) *Arenicola glacialis* from arctic Alaska is none other than the circumboreal and widely-ranging *A. marina*, it is not at all certain that the latter species occurs so far south as Puget Sound, although it has been reported from Vancouver Island by von Marenzeller ('87).

### Cirratulidae.

39. **Cirratulus cingulatus** sp. nov. Pl. 14, figs. 145–148.

*Form* stout, size moderate, tapered at both extremities, decidedly flattened on ventral aspect; dorsum rounded; seven anterior somites without setae or cirri; two clusters of 17–18 tentacular filaments (Fig. 145, *t. f.*) each, on dorsal aspect of 8th (the first setigerous) somite; when removed, an oval transverse scar is left; a series of similar cirri along each side, in the anterior and middle portions of body inserted low (Fig. 146), gradually rising to a higher level in the posterior region.

*Somites* very short, three-ringed above the dorsal setae, the middle ring raised welt-like above the level (Fig. 146).

*Prostomium* (Fig. 145) acute, concave on ventral side towards mouth, which usually exhibits a partially everted pharynx; eye-spots five or six, either in a group or transverse row.

*Parapodia* slightly developed (Figs. 145, 146), both dorsal and ventral rami with slender, serrated setae (Fig. 147); these alone are present for 30 setigerous somites back of the head; the uncini appear in the ventral rami (Fig. 148) at this point, and in the dorsal rami a few somites caudad; they continue to end of series.

Cirri, especially those of the first cirriferous somite ("tentacular filaments") of great length, frequently forming a tangled mass nearly as long as the entire body. Anus in pygidium, minute.

*Length* of large specimen, 100 mm.; greatest transverse diameter, 5 mm.

There are several specimens in the Columbia University collection, obtained "between tides." I have not found this species on the California coast.

40. **Cirratulus robustus** sp. nov. Pl. 14, figs. 149, 150.

*Form* short and thick; ventral aspect broadly flattened, concave anteriorly and posteriorly; dorsum rounded, tapered about equally towards both ends; 112 somites in one specimen, *not divided into rings* (Fig. 150).

*Prostomium* (Fig. 149) shorter and thicker than in preceding species; eye-spots in two oblique rows. First three somites achaetous, fully twice the length of the rest; fourth with two clusters of tentacular filaments and with dorsal and ventral setae (Fig. 149, *t. f.*).

*Parapodia* (Figs. 149, 150) slightly developed; anteriorly with capillary setae alone; at the 19th or 20th somite the ventral uncini begin, and two or three somites further back, the dorsal; cirri inserted low in anterior somites (Fig. 149), gradually rising to mid-lateral line (Fig. 150) towards middle of length, then in posterior region gradually approaching the dorsal setae. Anus terminal.

*Length*, 59 mm.; greatest transverse diameter, 5 mm.

Only two mature and one young specimen of this species are available for description. One adult specimen was obtained at Neah Bay by the Columbia University Expedition; the other at Port Orchard by Miss Robertson. Both lack the cirri. The setae and uncini of this species are practically identical with those of *Cirratulus cingulatus*.

### Amphictenidae.

41. **Pectinaria brevicoma** sp. nov. Pl. 15, figs. 151–156.

*Form* conical, gradually widening towards anterior end; cephalic disc nearly flat, plane, its edge entire; scapha broadly ovate, not wider transversely than posterior end of thorax. Total number of somites, about 27; 21 in thorax (of which 17 are setigerous, and 13 are uncinigerous), and 6 (?) in scapha.

*Prostomium* expanded into a large velum (Fig. 151) with 33 fimbriae on edge.

*Peristomium* with a pair of subulate, moniliform cirri and numerous club-shaped tentacles (much contracted in preserved specimens). Paleolae short, stout, arranged in two distinct groups, 10–12 in each; highly iridescent, either blunt or acutely pointed (lateral ones), strongly sloped towards ventral aspect. *Second somite* with a pair of cirri in all respects like the peristomial.

*Branchiae* pectinate, borne on third and fourth somites.

*Setae* broadly limbed and twisted near tip (Fig. 152) with serrations beyond the twist, or straight and without serrations (Fig. 153). The latter are not so numerous. They diminish in size towards anterior and posterior extremities of thorax. Uncini with 4 teeth (Fig. 154) or occasionally five (Fig. 155); the latter begin about the 11th somite; none were found in front of this. Spines on scapha (Fig. 156) with a stout, laterally-bent hook at tip.

*Tube* composed of coarse sand-grains, curved.

*Length* of largest specimen, 28 mm.; diameter of disc, 5 mm.

Several specimens were dredged by the Columbia University Expedition at a depth of 10 fathoms.

This species comes nearest to *P.* (*Cistenides*) *granulata* (Malmgren), which has been found in Bering Sea (Marenzeller, '90), and was collected at Kadiak by Mr. Cloudsley Rutter, differing from it only in the shortness of the paleolae and in the form of the setae and uncini. Upon examination of more abundant material, this form may prove to be identical with *granulata*, which is a wide-ranging, circumboreal species, and may therefore prove to be variable. While the uncini afford, on the whole, the surest diagnostic characters, they should be used with caution, as their variability in the present species clearly indicates.

### Ampharetidae.

42. **Sabellides anops** sp. nov. Pl. 15, figs. 157–161. Pl. 16, figs. 162–163.

*Form* stout, curved, thickest about midway of thorax, abdomen rather rapidly tapered, convex on dorsal, flat on ventral aspect (Fig. 157). Thirty to thirty-one somites, sixteen in thorax, fourteen to fifteen in abdomen; fourteen setigerous somites in thorax;

setae begin at third somite and cease at sixteenth. Uncini begin at sixth somite (the third setigerous somite), and extend to the pygidium. Dorsal rami of all abdominal parapodia destitute of setae and uncini.

*Prostomium* (Figs. 158, 162, 163) broadly truncated with two antero-lateral lobes; no eyes; a pair of transverse slits containing the nuchal organs at its base.

*Peristomium* (Figs. 158, 162, I) forming, with second somite, a region destitute of parapodia and branchiae. The club-shaped tentacles, about fifteen in number, arise from the inner border of the peristomium; they are destitute of papillae, but in contracted state are wrinkled (Fig. 163).

*Branchiae*, four on each side, smooth, terete, subulate, arise from dorsal aspect of the third, fourth, and fifth somites; in length about twice the diameter of the body (Figs. 158, 162).

Ventral *rami* or *tori* (Fig. 157) spatulate, increasing from the fourth somite to the sixteenth, thence diminishing to end of body. Each bears a single row of pectinate, six-toothed uncini (Fig. 161). Dorsal thoracic rami contain fascicles of single and double-bordered, straight and slightly-curved setae (Figs. 159, 160); dorsal rami achaetous throughout the abdomen.

*Length* of largest specimen, 27 mm.; greatest transverse diameter of same, 5 mm.

Several specimens are in the Columbia University collection, without data as to depth and locality. No tubes were preserved.

This species comes close to *Sabellides* (*Amage*) *auricula* (Malmgren) but differs from it in having longer branchiae, attached to three somites, shorter tentacles, and differently shaped uncini. *Sabellides auricula*, however, has been reported from Japan by Marenzeller ('85), and its occurrence in any part of the North Pacific would therefore not be surprising.

I follow Théel ('79) in discarding Malmgren's genus *Amage*, as not being sufficiently distinct from *Sabellides*.

### Terebellidae.

43. **Amphitrite robusta** sp. nov. Pl. 16, figs. 164–168.

*Form* short, robust, thickest anteriorly in region between 5th and 12th somites, gradually and almost uniformly tapering thence to

posterior end. Total number of somites, 63–90; in thorax, 20, of which 17 (4th to the 20th inclusive) are setigerous. Uncini begin at 5th somite and extend to the penultimate. Uncini uniserial anterior to the 11th somite, and posterior to the 20th; biserial on thoracic somites 11–20 (Fig. 167).

*Prostomium* with dorsal ridge and small lateral lobes formed by its continuation to the sides; no eyes. Peristomium bearing a semicircle of tentacles, rather thick in formalin specimens, decidedly grooved, spirally coiled in contracted state, and about one half the length of the thorax. Peristomium forms a thick prominent ventral lip, opposible to thin ventral edge of prostomium.

*Branchiae* (Fig. 164), three pairs, on somites 2–4, densely ramose, di- and tri-chotomously branched; the main stems short and thick, ultimate branches subulate, slightly moniliform. Branchiae all nearly alike in form and size; anterior pair slightly the largest; all variable as to size and amount of branching.

*Setigerous lobes* moderate, increasing in size from the first to the seventeenth (on 20th somite). Uncinigerous tori of nearly uniform length from 5th to 18th somites; thence gradually diminishing to end of body.

*Setae* with striated limb on each side and curved, serrated tip (Fig. 165). Uncini avicular, with from 5 to 7 rows of teeth above the rostrum (Figs. 166–168).

*Nephridial papillae* twelve pairs, on somites 4 to 15; first pair considerably the largest; the rest of nearly uniform size; placed ventrad, and a little posterior to setigerous lobes.

*Length* of larger specimen, 75 mm.; greatest transverse diameter of thorax, 11 mm.; average transverse diameter of abdomen, 4 mm.

Several specimens, collected both by the Columbia University Expedition and by Miss Robertson. The species is doubtless common. No tubes were preserved. The absence of eyes in this species and in the preceding is remarkable. They are evidently wholly lacking, as I was unable to find them even in serial sections.

44. **Amphitrite spiralis** sp. nov. Pl. 16, figs. 169–171c.

*Form* greatly elongated, abdomen slender, terete, and spirally coiled when out of the tube; dorsal aspect of thorax high-arched; ventral slightly convex. This condition is enhanced in anterior portion of abdomen, where the somites are decidedly thicker on the dorsal than on the ventral aspect, producing thereby the spiral

coiling. Number of somites approximately 170; those of posterior portion of abdomen two-ringed. Thoracic somites, 43, of which 41 are setigerous and 39 uncinigerous.

*Prostomium* with dorsal crescentic groove separating a dorsal ridge from the ventral flap; no eyes visible on surface.

*Peristomium* with deep ventral groove, and dorsal semicircle of cirri.

*Branchiae* two pairs, on third and fourth somites; moderate; anterior pair considerably the larger and more richly branched; main branches arising near the base; beyond the first ramification, the branching is dichotomous (Fig. 169).

*Setigerous lobes* begin on fourth somite, increase slightly in size towards middle of thorax, then diminish; the last few pairs very small. Setae of form usual in this genus (Fig. 170).

*Uncinigerous tori* begin at fifth somite; first six pairs shorter than the rest; gradually increasing in length to the seventh where they attain the maximum length, and retain it to the 16th or 17th, at which point they gradually diminish, becoming flattened and almost indistinguishable on the abdomen. Uncini small, avicular, with five rows of teeth above the rostrum (Fig. 171 *c*). They are uniserial on somites 5 to 10, and on 35 to end of series; biserial, on somites 11 to 34.

*Length*, 160 mm.; greatest transverse diameter of thorax, 5 mm.; average of abdomen, 2 mm.; dorso-ventral diameter of thorax, 4.5 mm.

A single individual of this species was collected by Miss Robertson near Seattle.

45. **Lanice heterobranchia** sp. nov. Pl. 17, figs. 172–174.

*Thorax* of 20 somites, 17 (?) setigerous.

*Prostomium* of usual form; no eyes.

*Branchiae* three pairs, borne on somites 2–4; first pair (Fig. 172) much the largest and longest, with elongated main stem dendritically branched; ramifying branches very compact. Gills of second and third pairs short, without main stem.

*Setae* (Fig. 173) with striated limb on each side; tip entire, from fourth (?) somite onward. Uncini from fifth somite, uniserial, alternating ("rangée alterne," Claparède), avicular, with three teeth in front of beak (Fig. 174).

A single specimen in the Columbia University collection, too imperfect for complete description. The worm was enclosed in a mud tube. The difference in the size of the branchiae of different pairs is the most striking character.

46. **Thelepus crispus** sp. nov. Pl. 17, figs. 175–178*b*.

*Form* rather stout, not greatly tapered posteriorly; thorax passing gradually into abdomen; tapered considerably towards prostomium from tenth somite. Number of somites 88–147.

*Prostomium* with ample dorsal flap, transversely corrugated on dorsal surface; no eyes.

*Peristomium* with circlet of strongly grooved tentacles.

*Branchiae* (Fig. 175) three pairs, branching from the base in numerous, slender, spirally curled filaments; borne on somites 2–4.

*Setae* begin at third somite and extend to penultimate in young specimens; to fourteenth from pygidium in older ones; with striated limb on each side; sometimes slightly bent (Figs. 176, 177).

*Uncinigerous tori* begin at fourth somite; uncini absent from extreme end of body. Uncini (Figs. 178 *a*, *b*) single-ranked from fourth to seventh somites, inclusive, and gradually returning to this condition towards end of series; in flattened rings from eighth somite ("rangée parabolique," Claparède) onward. Tori attain their greatest length between the twelfth and twenty-fourth somites; thence diminish very gradually to end of body; those of the abdomen rounded and wart-like.

*Length* of large female specimen, 270 mm.; greatest transverse diameter (at sixteenth somite), 13 mm.; dorso-ventral diameter, 12 mm.

This fine Terebellid is represented in the Columbia University collection by a single large female turgid with eggs. It occurs on the California coast as far south at least as San Francisco, and is abundant at Bolinas, Marin County. Its tube is formed of coarse sand or gravel. It frequently harbors commensal individuals of *Polynoe insignis*, and northward, probably also *Harmothoe tuta* (see p. 394).

### Sabellidae.

47. **Bispira polymorpha** sp. nov. Pl. 17, figs. 179–183. Pl. 18, figs. 184, 185.

*Form* nearly terete, dorsum flattened in adult specimens; in young specimens, form slender; tapered gradually at posterior end to a minute pygidium; anus terminal. Somites, 170 or more.

*Thorax* (Fig. 179) of nine somites, one sixteenth to one ninth of entire length (exclusive of branchiae) according to degree of contraction and probably also the age of the specimen.

*Branchiae* (Fig. 179) about as long as thorax, dichotomously branched twice or thrice in some specimens, in others unbranched; pinnate, radioles slender; 16–30 branchiae on each side, forming a spiral of 2–3 turns; each rachis with 2–10 black eye-spots (Fig. 184).

*Tentacles* flattened, lanceolate, about one fifth the length of branchiae.

*Fecal groove* extending forward along mid-dorsal line of abdomen to thorax; at posterior boundary of thorax passing on the left side to mid-ventral line of same, and thence to oral region.

*Peristomium* with raised anterior border or "collarette," deeply notched in mid-dorsal line, and produced into two pointed processes adjoining the ventral sulcus.

*Thoracic setae* (Figs. 180, 181) begin on second somite; of two forms, winged-capillary and mucronate-spatulate; the latter more numerous, forming a close series towards the torus.

*Uncinigerous tori* of thorax dorsal to setigerous tubercles; begin on third somite; separated by full width of dorsum; uncini biserial, of two sorts (Fig. 182), avicular and dilated-cuspidate; both kinds with long manubria; the points directed cephalad. Abdominal setae all of one kind (Fig. 185) arising from smaller tubercles, which are placed dorsad to the uncinigerous tori. Uncini (Fig. 183) uniserial, all avicular, with a shorter manubrium than the thoracic uncini; rostra directed anteriorly.

*Tube* cartilaginous, translucent, adherent to rocks, piles, etc.

*Length* of average specimen (exclusive of branchiae), 95 mm.; greatest transverse diameter, 6 mm. Greatest transverse diameter of largest specimen at hand, 12 mm.

Numerous specimens from the Puget Sound region, collected at Neah Bay and in the Port Townsend district by the Columbia University Expedition, and at Alki Point and Port Orchard by Miss Robertson. It occurs also on the California coast as far south as Pacific Grove.

This species is remarkable for the highly variable aspect which it presents, owing to the diverse coloration of the branchiae and the differences of shape caused by different states of contraction in which it has been killed. If killed within the tube, it is almost perfectly cylindrical and often of great length, owing to the impossibility of expansion within the rigid and tightly fitting tube. The longest specimen thus killed (posterior somites lacking) measures not less than 150 mm. in length and only 5 mm. in greatest trans-

verse diameter. Even more striking, although not always perceptible to the naked eye, is the variable character of the branchiae, which are in some specimens dichotomously branched, and in others entirely unbranched.

The coloration of the branchiae shows two distinct phases — purple or wine-color and whitish or tawny. Either color may be present to the exclusion of the other, or the two may be in alternate, transverse bands. The eye-spots may be few or many, but I have found no specimen without them. Although a lens is absent, the eye-spot produces a wart-like elevation of the cuticula which covers it (Fig. 184). The eye-spots are of various sizes, the largest being over twice the diameter of the smallest. They are scattered at irregular intervals along the rachis, but are more numerous towards the base than towards the tip. None are found near the tip and very rarely any on the branches.

The tube is adhesive, and is usually affixed by its lower extremity or by its side to a stone or pile. At Pacific Grove the species attains a large size and is abundant on rocky bottoms from low-water mark to a depth of several fathoms.

**Megachone** gen. nov.

*Form* terete; no ventral shields; collarette flaring, interrupted only at ventral notch; branchiae connected by a web; no spatulate thoracic setae; thoracic uncini with long manubrium, of one kind only; abdominal uncini short avicular plates; no ventral fissure at posterior end.

48. **Megachone aurantiaca** sp. nov. Pl. 18, figs. 186–192.

*Form* subcylindrical, spiral in contraction, thickest in posterior portion; anterior end truncated; collarette broad (Figs. 186, 187); body narrowed in region of thorax and enlarged in abdomen; posterior extremity abruptly tapered to a minute tip, which is curved dorsad; anus terminal. Somites 75 in number.

*Branchiae* 20 on each side, unbranched (Figs. 187, 188), closely appressed, tips pointing ventrad; radioles invisible until branchiae are raised.

*Thorax* (Fig. 186) of eight somites; peristomium, with collarette, one and one half times the length of the other thoracic somites; bears a small tuft of setae, but no uncini; a slight indication of two rings; the biannulate condition more strongly marked in the other thoracic and abdominal somites.

*Fecal groove* extending forward along mid-dorsal line to ninth

somite, there passing on the left side to mid-ventral line, and thence to oral notch. Setigerous tubercles small.

*Capillary setae* (Fig. 189) of thorax single or double-bordered; uncinigerous tori (Fig. 186) short, small; uncini avicular, with very long manubria, uniserial, or incompletely biserial (Fig. 190); setae of the abdomen very similar to those of thorax; uncini of abdomen (Figs. 191, 192) with much elongated rostra.

*Length*, 87 mm.; transverse diameter of collar, 5 mm.; greatest transverse diameter of abdomen, 4.5 mm.

This species is represented by a single specimen, collected by Miss Robertson at Port Orchard, on July 4, 1898. The specimen was preserved in formalin and the color when first received (no doubt nearly that of the living worm) was a bright orange. The worm is undoubtedly a tube-dweller, but there are no data concerning a tube or the precise habitat.

As suggested to me by Professor Verrill, the branchiae of this specimen are in all probability in process of regeneration.

### Eriographidae.

49. **Myxicola pacifica** sp. nov. Pl. 19, figs. 193–198.

*Body* fusiform, terete; tapered slightly towards anterior, much more, and gradually, towards posterior extremity; somites 67–97 in number, short, biannulate; no collarette; two fleshy processes (tentacles?) on first somite, adjacent to mouth; thorax hardly distinguishable from abdomen and composed of nine somites.

*Branchiae* (Fig. 193) 14 on each side, connected by a web (*w.*) as far as radioles extend, *i. e.*, within 3 mm. of tip; radioles slender, biserial; tips of branchiae spirally coiled in retraction.

*Thoracic setae* of two forms: (1) double-bordered capillary (Fig. 194), very slender, often twisted; and (2) blunt, spinous setae (Fig. 195) with conical tips, much fewer in number; both kinds occur together in tufted fascicles. Uncini of thorax with long manubria (Fig. 197), strong rostra, and minute teeth; uniserial. Abdominal setae (Fig. 195) slender, minute, very broadly double-bordered; abdominal uncini (Fig. 198) very minute, avicular, 2–3 teeth above rostrum; arranged in tori which nearly encircle the body, being interrupted only by the setigerous papillae and a median stripe on dorsum; uniserial.

*Length* of large specimen (not including branchiae), 60 mm.; greatest transverse diameter of same, 9 mm.; length of retracted branchiae, 21 mm.

This species is represented by two female specimens, one collected by Miss Robertson at Port Orchard in June, 1899, the other by Professor Ritter at Pleasant Beach in May of the same year. Although exhibiting great difference as to size — one being more than twice the length of the other — they both contain nearly ripe ova, indicating sexual maturity.

The transparent mucous envelope so characteristic of this genus was preserved with both specimens.

### SERPULIDAE.

50. **Serpula columbiana** sp. nov. Pl. 19, figs. 199–204.

*Form* subterete; somewhat flattened dorso-ventrally; gradually tapered towards posterior extremity; fecal groove distinct, dorsal as far as thorax, there branching and passing to the ventral side under the thoracic membrane.

*Thorax* with seven setigerous somites, well-developed collarette, and thoracic membrane, the latter reaching to the tips of the setae. Abdominal somites, 250 or more.

*Branchial filaments* 54 on each side, arranged in two spirals ascending from the ventral edges, each making a complete turn, then extending mesad and meeting each other just over the mouth. Branchiae whitish, beautifully banded with scarlet or crimson; distribution of color variable but usually a broad red band at or near base, followed by two narrow bands, and branchiae broadly tipped with the same. Operculum (Fig. 199) on right side, its mate on the left very short and rudimentary; funnel-shaped, with about 100 ribs which form a notched border; deep, funnel-shaped cavity; pedicle geniculate just below the operculum.

*Bayonet-setae* of first setigerous somite as in Fig. 200; the other thoracic setae broadly striate-bordered (Fig. 201). Uncini of thorax and abdomen similar in shape, 6–8 toothed; the tip of largest tooth often turned outward (Figs. 202, 203). Chisel-shaped setae of abdomen as shown in Fig. 204.

*Tube* white, calcareous, more or less coiled; anterior portion of old tubes often free from the substratum to which tube is attached.

*Length* of large specimen, 55 mm.; greatest transverse diameter of thorax, 7 mm.; of abdomen, 6 mm.

This beautiful Serpulid is abundant in Puget Sound. Harrington and Griffin ('97, p. 103) mention a handsome *Serpula*, probably this species, which forms "hard white tubes" on the rocky bottom of Hood's Canal; and also as "whitening the rocks with its calcareous tubes," along the beaches near Port Townsend. It was collected at Alki Point by Miss Robertson. It occurs also on the California coast at Bolinas (Duxbury Reef), and at Lime Point and Point Cavallo, on the northern shore of the Golden Gate. Its favorite habitat is the under side of a stone where the water flows freely. If not in a tide-pool, it is near extreme low-water mark.

The uncini show considerable variation on the same individual, and even on the same torus. The number of teeth ranges from six to eight; the upper border is high-arched or nearly straight. The tip of the large tooth may or may not be recurved.

The coloration of the branchiae is also variable, both as to tint and distribution. It is either scarlet or damask-red, and it may involve nearly the whole of the branchiae and operculum, or may be more restricted, so that the white predominates. If formalin specimens are not exposed to direct sunlight the color is retained for years in almost its original brightness.

This may possibly be identical with *Serpula jukesii* Baird, described by Grube ('77) from North Japan. His description is too brief, however, to put the question of identity beyond doubt.

51. **Serpula zygophora** sp. nov. Pl. 19, figs. 205–208.

*Form* nearly cylindrical; abdomen strongly grooved on dorsal aspect, the somites marked on each side by transverse ridges; seven thoracic setigerous somites.

*Branchiae* spiral, thirty filaments on each side; carmine-red at base, and broadly barred with the same; operculum (Fig. 205) on right side, funnel-shaped, moderately cupped, 26-ribbed, the ribs extending to the center of the concavity; base yoke-shaped; pedicle long and curved, geniculate just below the operculum; corresponding filament of left side club-shaped. Operculum and pedicle variegated with red.

First *setigerous somite* with bayonet-setae (Fig. 206). Thoracic uncini six-toothed (Fig. 207); abdominal uncini (Fig. 208) five- or six-toothed. Chisel-shaped abdominal setae almost identical with those of *Serpula columbiana*. Transverse diameter of thorax, 3.5 mm.; of abdomen, 3 mm. Tube lacking.

This species is represented by a single imperfect specimen (lacking posterior portions), collected by Miss Robertson at Alki Point. As it has never been collected, so far as known, on the California coast, it may be inferred that its distribution is northward.

## LITERATURE.

Andrews, E. A.
'91. The distribution of Magelona. Johns Hopkins univ. circulars, vol. 10, no. 88, p. 96.
Arwidsson, Ivar.
'98. Studien über die familien Glyceridae und Goniadidae. Bergens museums aarbog, no. 11, pp. 1–69, 4 taf.
Benham, W. B.
'96. The blood of Magelona. Quart. journ. micros. sci., vol. 39, pp. 1–17, 1 pl.
Claparède, Ed.
'68–'70. Les Annélides Chétopodes du Golfe de Naples. Mém. de la soc. de phys. et d' hist. nat. de Genève, t. 19, pp. 313–584, 16 pls.; 1ere part., pp. 1–225, 15 pls.; 2e part., pp. 365–542.
Darboux, J. G.
'99. Recherches sur les Aphroditiens. Travaux de l'institut de zoologie de l'université de Montpellier, etc., nouv. sér., mém. no. 6, 276 pp., 83 figs.
Dean, B., N. R. Harrington, G. N. Calkins, & B. B. Griffin.
'97. The Columbia University zoological expedition of 1896, etc. Trans. N. Y. acad. sciences, vol. 16, pp. 33–42 (with map of Puget Sound).
Ehlers, Ernst.
'64–'68. Die borstenwürmer (Annelida Chaetopoda), bd. 1, Nereidea, 4to, 748 pp., 24 taf.
Gamble, F. W., & J. H. Ashworth.
:00. The anatomy and classification of the Arenicolidae, with some observations on their post-larval stages. Quart. journ. micros. sci., vol. 43, pp. 419–569, 8 pls.
Grube, Ed.
'51. Middendorff's Reise in den äussersten norden und osten Siberiens, bd. 2 (Zool.), th. 1. (Annelida.)
'55. Beschreibung neuer oder wenig bekannter Anneliden. Arch. für naturgesch., jahrg. 21 (1855), bd. 1, pp. 81–136, 3 taf.
'77. Neue Anneliden aus Japan. 55 Jahresber. der Schles. gesellsch. für vaterl. cultur, pp. 104–106.
Harrington, N. R.
'97. On Nereids commensal with Hermit Crabs. Trans. N. Y. acad. sciences, vol. 16, pp. 214–221, 3 pls.
Harrington, N. R., & B. B. Griffin.
'97. Notes upon the distribution and habits of some Puget Sound invertebrates. Trans. N. Y. acad. sciences, vol. 16, pp. 152–165.
Haswell, W. A.
'86. On the structure of the so-called glandular ventricle (drüsenmagen) of Syllis. Quart. journ. micros. sci., vol. 26, pp. 471–480, 1 pl.

Johnson, H. P.

'97. A preliminary account of the marine Annelids of the Pacific coast, with descriptions of new species. Proc. Cal. acad. sciences, 3d ser., (Zoology), vol. 1, pp. 153–198, 6 pls.

Kinberg, J. G. H.

'55. Nya slägten och arter af Annelider. 1. Aphroditea. Öfversigt kongl. vetenskaps-akad. förhandl. Stockholm, 12, pp. 381–388.

'58. Kongliga svenska fregatten Eugenies resa omkring jorden. Zool., 1, pp. 1–32, 8 pls. Stockholm.

'65. Annulata nova. Öfversigt kongl. vetenskaps-akad. förhandl. Stockholm, pp. 22, 167–179, 239–258.

Lord, J. K.

'66. The naturalist in Vancouver Island and British Columbia. 2 vols., 8vo. London.

M'Intosh, W. C.

'78. Beiträge zur anatomie von Magelona. Zeitsch. für wissensch. zool., bd. 31, pp. 401–472, 10 taf.

'85. Report on the Annelida. Polychaeta. Voyage of H. M. S. "Challenger," Zoology, vol. 12, pp. 36+554, 94 pls., and map.

Malaquin, A.

'93. Recherches sur les Syllidiens. Morphologie, anatomie, reproduction, développement. 477 pp., 14 pls. Lille: L. Danel.

Malmgren, A. J.

'65. Nordiska Hafs-Annulater. Öfversigt kongl. vetenskaps-akad. förhandl. Stockholm, 22, pp. 51–110, 181–192, 355–410, 8 tafl.

v. Marenzeller, E.

'79. Südjapanische Anneliden, 1. Denkschr. k. akad. wissensch. Wien, math.-naturwissensch. classe, bd. 41, pp. 109–154, 6 taf.

'84. Südjapanische Anneliden, 2. Denkschr. k. akad. wissensch. Wien, math.-naturwissensch. classe, bd. 49, pp. 197–224.

'87. Polychäten der Angra Pequena Bucht. Zool. jahrb., abth. für systematik, bd. 3, pp. 1–24, 1 taf.

'90. Annulaten des Berings-Meeres. Ann des. k. k. naturhist. Hofmuseums, t. 5, pp. 1–8, 1 taf. Wien.

Mesnil, F., & M. Caullery.

'98. Études de morphologie externe chez les Annélides. 4. La famille nouvelle des Levinséniens, etc. Bull. scient. de la France et de la Belgique, t. 31, pp. 125–150, 1 pl.

Michaelsen, W.

'92. Polychaeten von Ceylon. Jahrb. der Hamburg wissensch. anstalten, bd. 9, pp. 91–113, 1 taf.

Müller, Fr.

'58. Einiges über die Anneliden-fauna der Insel Santa Catharina an der brasilianischen küste. Arch. für naturgesch., jahrg. 24 (1858), pp. 211–220, 1 taf.

Murdoch, J.

'84. Description of seven new species of Crustacea and one new worm [*Arenicola glacialis*] from arctic Alaska. Proc. U. S. nat. mus., vol. 7, pp. 518–522.

Roule, L.

'96. Résultats scientifiques de la Campagne du "Caudan"—1895. Annélides, Géphyriens. Ann. de l'univ. de Lyon, pp. 439–474, 7 pls. Paris: Masson et Cie.

Stimpson, Wm.

'64. Descriptions of new species of marine Invertebrata from Puget Sound, collected by naturalists of the Northwest Boundary Commission. Proc. acad. nat. sciences Phila., 1864, pp. 153–161.

Verrill, A. E.

:00. Additions to the Turbellaria, Nemertina, and Annelida of the Bermudas, etc. Trans. Conn. acad. arts and sciences, vol. 10, pp. 595–672, 1 pl.

Webster, H. E.

'79. On the Annelida Chaetopoda of the Virginian coast. Trans. Albany institute, vol. 9, pp. 202–272, 11 pls.

Webster, H. E., & J. E. Benedict.

'87. The Annelida Chaetopoda from Eastport, Maine. Report U. S. comm. fish and fisheries for 1885–87, pp. 707–755, 8 pls.

Wirén, A.

'83. Chaetopoder från Sibiriska Ishafvet och Berings haf, insamlade under Vega-expeditionen, 1878–79. Vega-expedit. vetensk. jakttagelser, bd. 2, pp. 381–428, 6 taf.

*Printed, August, 1901.*

## PLATE 1.[1]

Fig. 1. Anterior extremity, dorsal aspect, of *Polynoe fragilis*. The elytra have fallen off. × 8.5.

Figs. 2–7. *Harmothoe iphionelloides*.

Fig. 2. Anterior extremity, dorsal aspect; proboscis exserted; anterior elytra removed. × 8.5.

Fig. 3. Fifth elytron, right side. × 8.5.

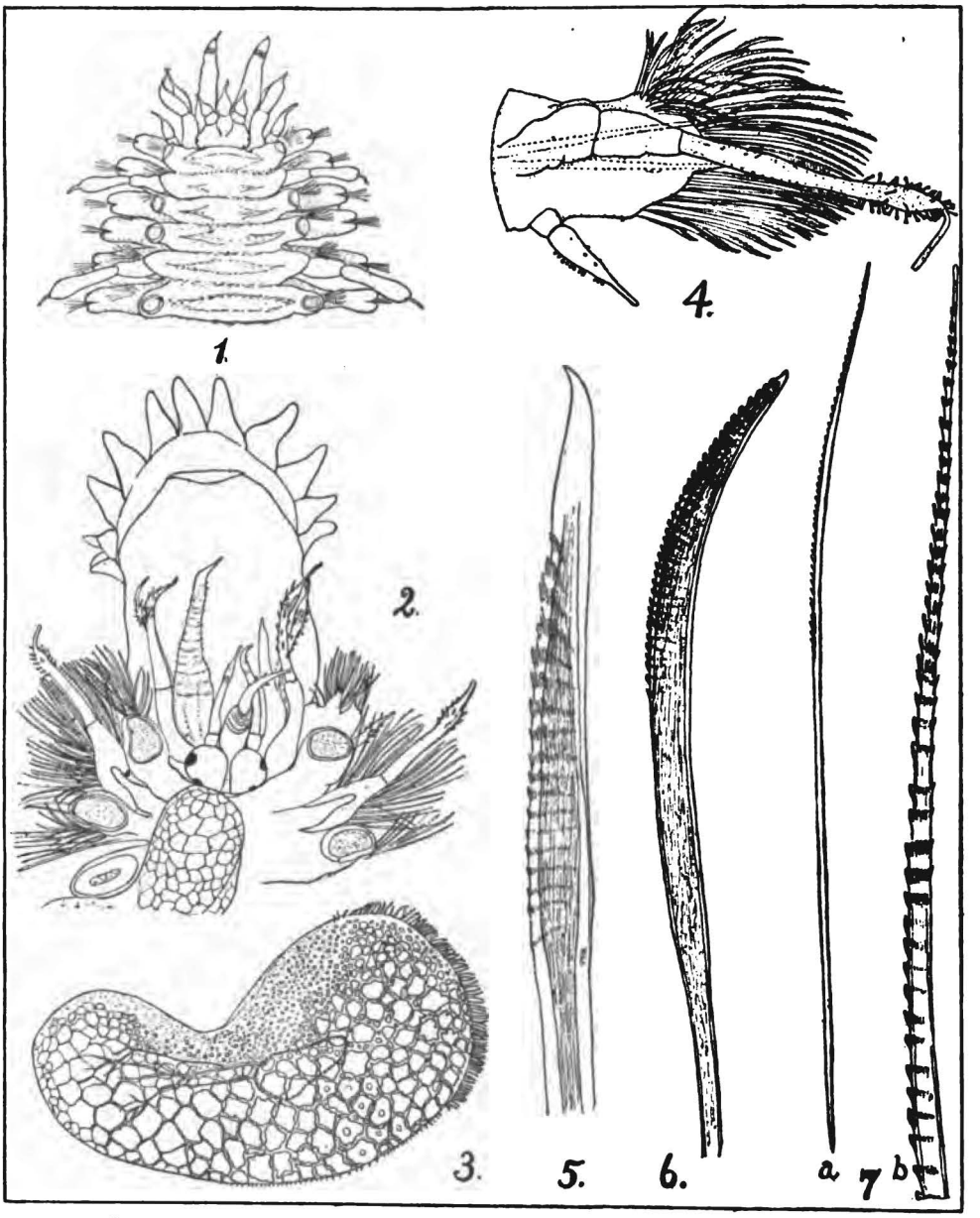
Fig. 4. Third foot from right side, dorsal aspect. The setae above the dorsal cirrus all belong to the dorsal fascicle. × 23.

Fig. 5. Ventral seta-tip, profile. × 200.

Fig. 6. Stout, curved, dorsal seta. × 200.

Fig. 7. *a*. Slender dorsal seta. × 53.
*b*. Tip of same, more magnified. × 200.

[1] With very few exceptions (in each instance, stated), the figures are from camera drawings. In all the plates the drawings have been reduced one-half, and the magnification, as given with the explanation of each figure, has been corrected accordingly.




H.P.J. & L.H.J. del.

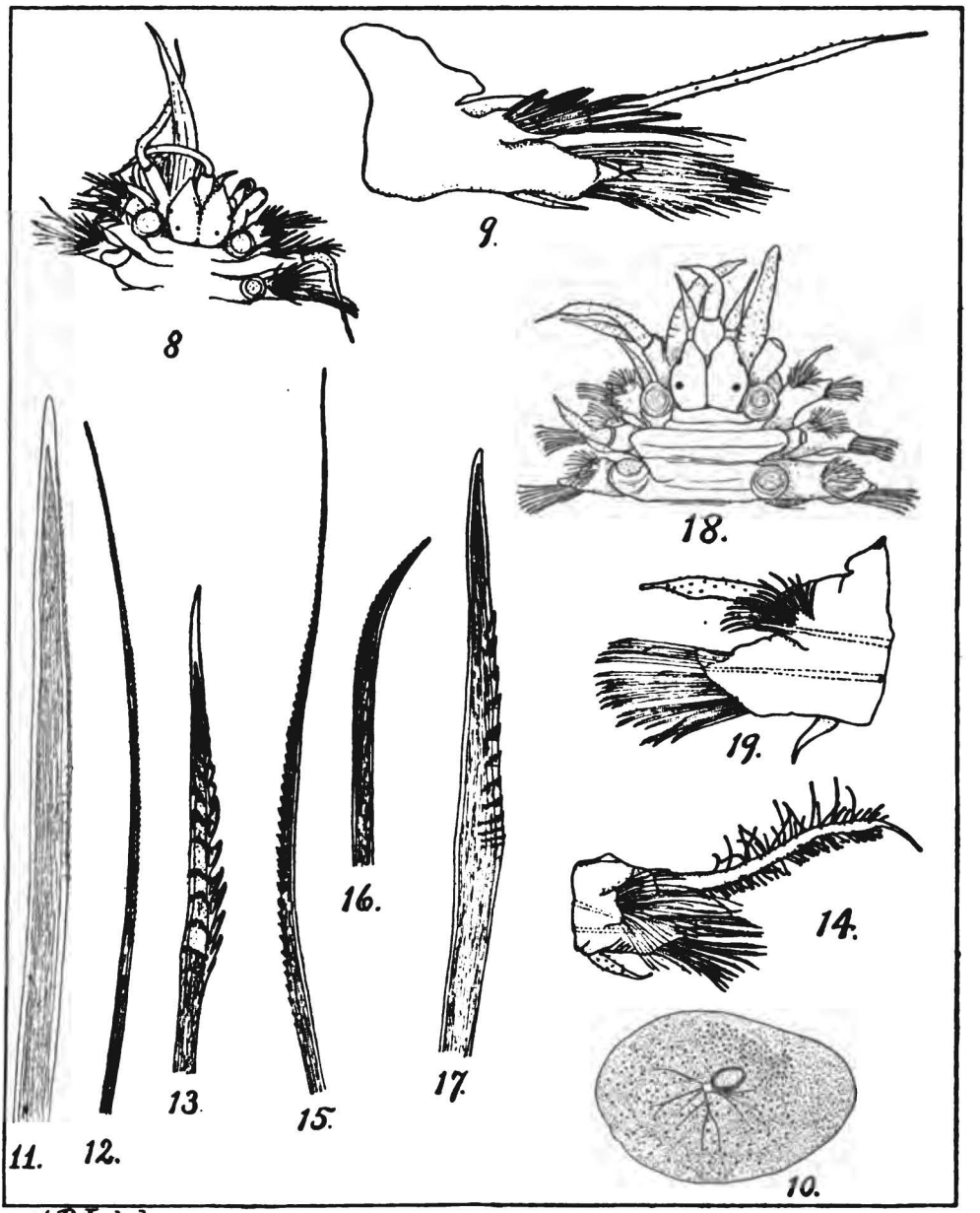
## PLATE 2.

Figs. 8–13. *Harmothoe complanata.*

Fig. 8. Anterior extremity, dorsal aspect. × 13.
Fig. 9. Twenty-first foot, anterior aspect. × 23.
Fig. 10. Elytron from left side; the nerves radiating from the elytrophore are distinctly seen. × 13.
Fig. 11. Tip of stout dorsal seta. × 200.
Fig. 12. Top of slender dorsal seta. × 100.
Fig. 13. Tip of ventral seta. × 200.

Figs. 14–17. *Harmothoe pacifica.*

Fig. 14. Anterior aspect of second foot. × 13.
Fig. 15. Tip of slender, slightly curved dorsal seta. × 100.
Fig. 16. Tip of strongly-curved dorsal seta. × 100.
Fig. 17. Tip of ventral seta. × 100.
Fig. 18. *Harmothoe luta*; anterior extremity, after removal of elytra. × 8.5.
Fig. 19. Seventeenth parapod of the same. Anterior aspect. × 17.



## PLATE 3.

Figs. 20–22. *Harmothoe tuta.*

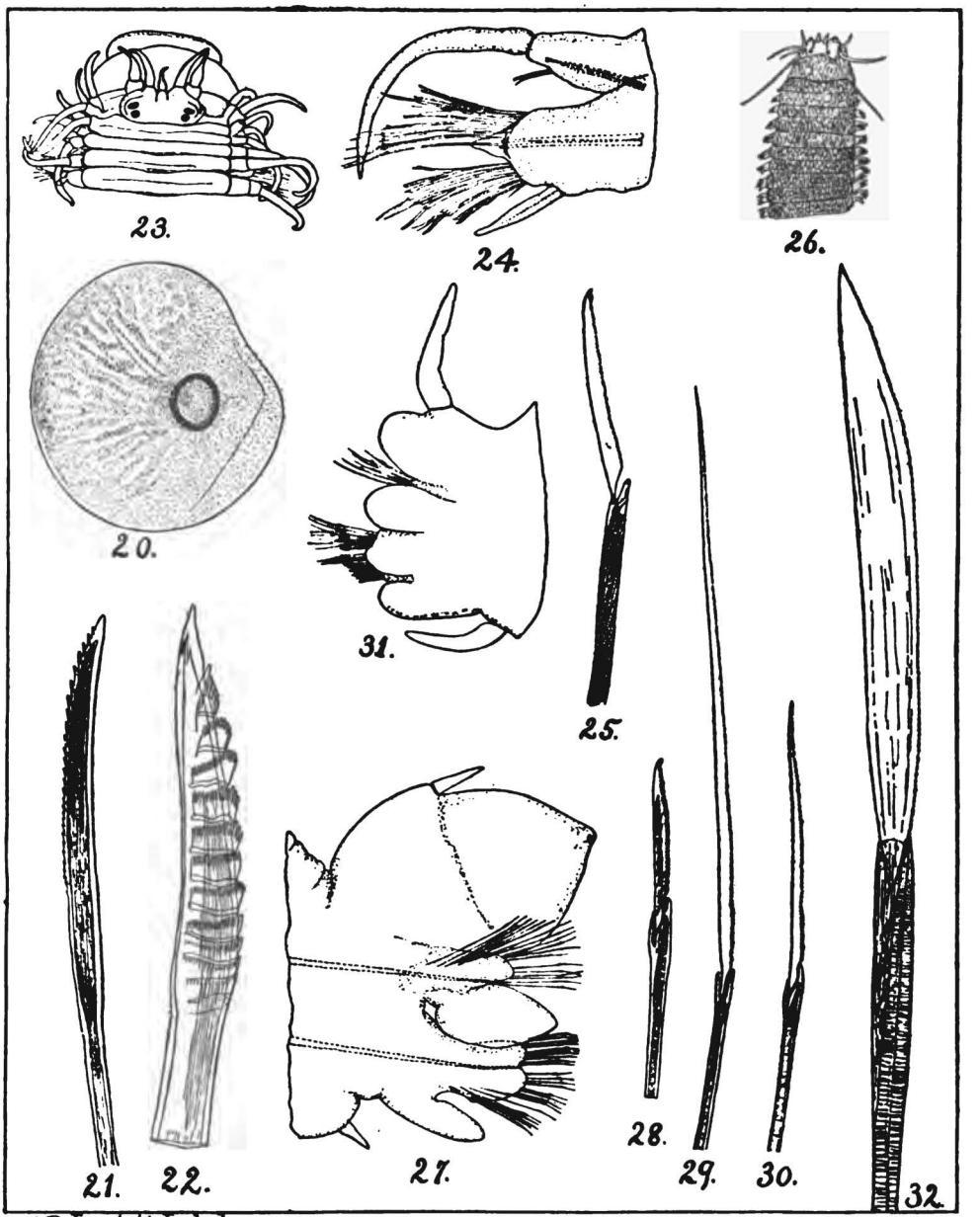
Fig. 20. Elytron from left side. × 6.5.
Fig. 21. Dorsal seta from eighteenth foot. × 200.
Fig. 22. Ventral seta-tip from eighteenth foot. × 200.

Figs. 23–25. *Podarke pugettensis.*

Fig. 23. Anterior extremity, proboscis exserted. × 16.
Fig. 24. Parapod from middle of the body. × 32.5.
Fig. 25. Tip of a ventral (compound) seta. × 200.

Figs. 26–30. *Nereis virens.*

Fig. 26. Anterior extremity, dorsal aspect, of large specimen. × 0.5.
Fig. 27. Foot from middle of body, anterior aspect. × 8.5.
Figs. 28–30. Tips of setae from ventral fascicle, showing graduation in length of appendage. × 150.
Fig. 31. Tenth foot of *Nereis vexillosa*, posterior aspect. × 23.5.
Fig. 32. Natatory seta, female Heteronereis of *N. vexillosa.* × 200.



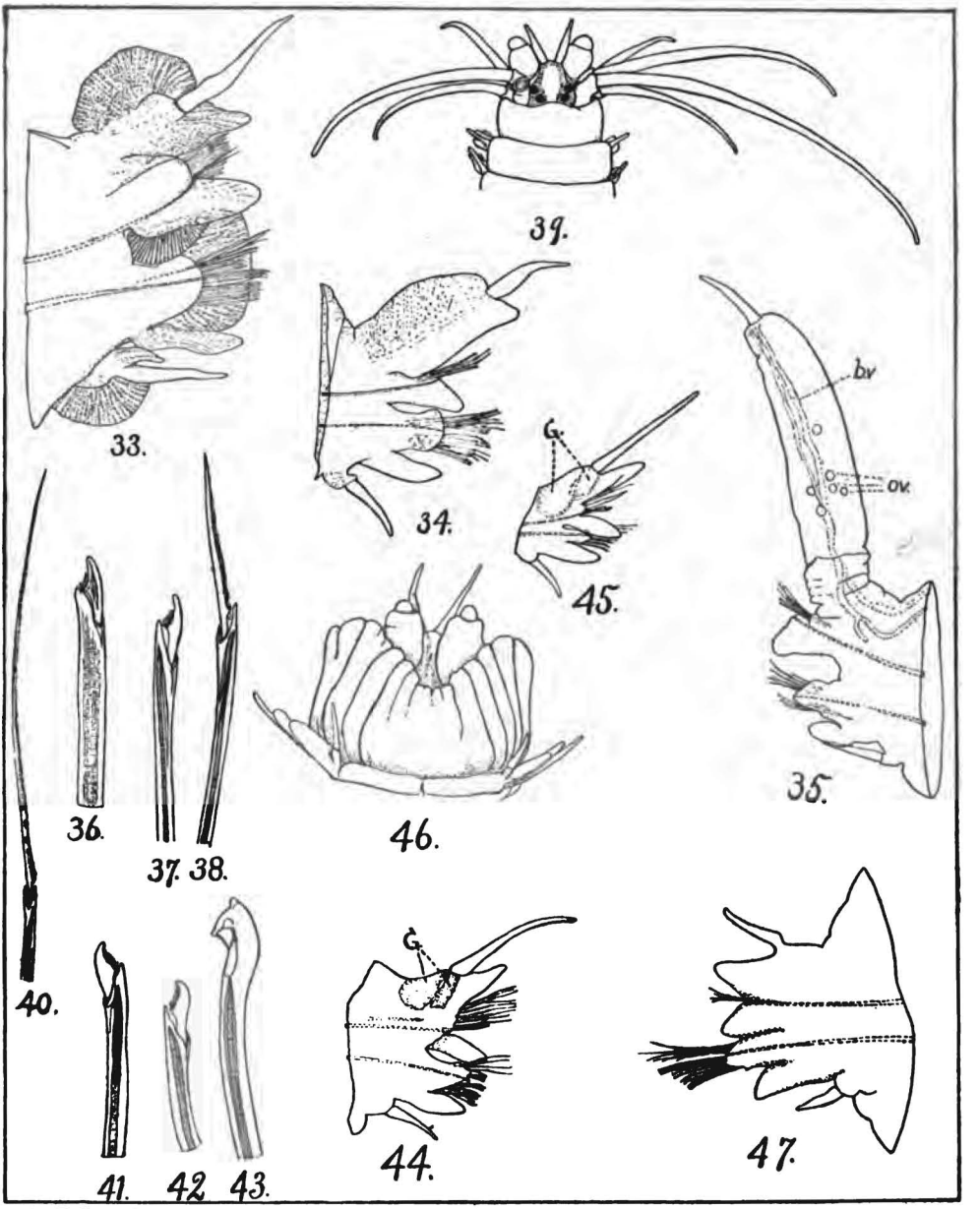
## PLATE 4.

Figs. 33–38. *Nereis vexillosa.*

Fig. 33. Anterior aspect of heteronereized foot. × 8.5.
Fig. 34. Foot from posterior portion of body of young female. × 8.5.
Fig. 35. Foot from posterior region of large adult female, with much elongated dorsal lobe. *b. v.* Blood-vessel. *ov.* Ova lying within coelomic space. × 8.5.
Fig. 36. Stout sickle-shaped seta from dorsal ramus. × 150.
Figs. 37, 38. Sickle-shaped and "fish-bone" setae from ventral ramus. × 150.

Figs. 39–45. *Nereis agassizi.*

Fig. 39. Anterior extremity. × 8.5.
Fig. 40. "Fish-bone" seta from dorsal ramus. × 200.
Figs. 41, 42. Sickle-shaped setae from ventral ramus. × 200.
Fig. 43. Hooked seta from dorsal ramus. × 200.
Fig. 44. Foot from middle of series. The glands (*g.*) at base of upper lobe are shown. × 23.
Fig. 45. Foot from posterior portion of body. × 23.
Fig. 46. Anterior, ventral aspect of a young *Nereis cyclurus*. The prostomium is partially withdrawn into the large, collar-like peristomium. × 8.5.
Fig. 47. *Nereis procera*; foot from anterior portion of body. × 23.5.

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## PLATE 5.

Figs. 48–52. *Nereis cyclurus.*

Fig. 48. Anterior extremity, dorsal aspect, showing large, collariform peristomium, within which the prostomium is partially withdrawn. Young specimen. × 8.5.

Fig. 49. Tenth foot, anterior aspect. × 13.

Fig. 50. Falcate seta from lower fascicle, ventral ramus, of foot from anterior region of body. × 200.

Fig. 51. Falcate seta from upper fascicle of ventral ramus. × 200.

Fig. 52. "Fish-bone" seta, upper fascicle, ventral ramus. × 200.

Figs. 53–59. *Nereis procera.*

Fig. 53. Anterior extremity, dorsal aspect. × 8.5.

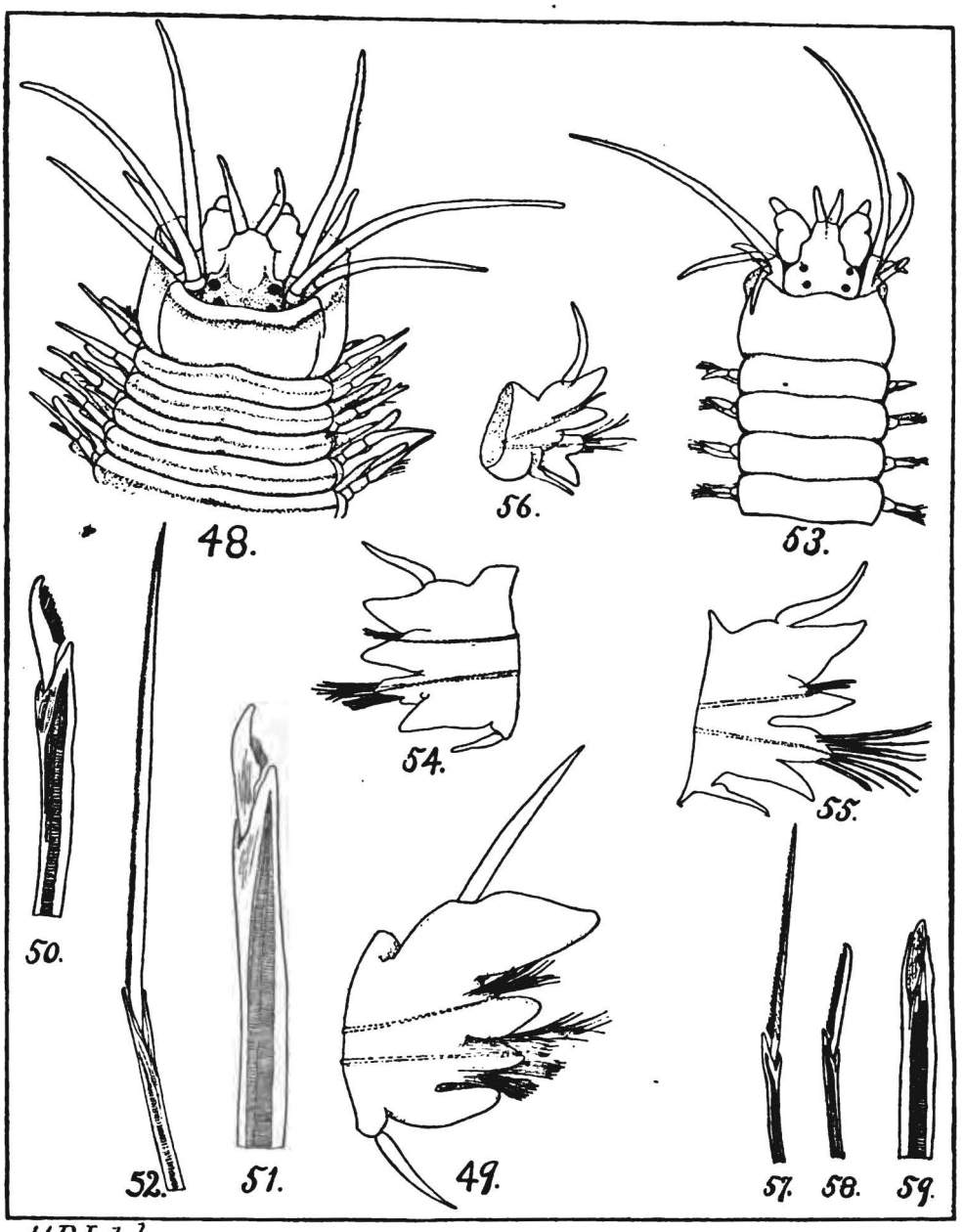
Fig. 54. Forty-first foot, showing stout, dorsal seta and three slender ones. × 23.

Fig. 55. Foot further back; slender dorsal setae no longer present. × 23.

Fig. 56. Foot from posterior region, near pygidium. × 23.

Figs. 57, 58. "Fish-bone" and falcate setae from ventral ramus. × 200.

Fig. 59. Stout dorsal seta. × 200.




H.P.J, del.

## PLATE 6.

Figs. 60–66. *Euphrosyne heterobranchia.*

Fig. 60. The prostomium, dorsal aspect, showing the antennae, the tentacle, the dorsal eyes, and the caruncle. × 40.

Fig. 61. Tip of one of the unserrated, cleft, dorsal setae. × 200.

Fig. 62. Tip of serrated, cleft, dorsal seta. The serrations are almost restricted to the lower fork. × 200.

*a*. Tip of another seta of same kind, fully serrated. × 200.

Figs. 63, 64. Bifid, dorsal setae of two forms. × 200.

Fig. 65. Ventral seta of the usual form. × 200.

Fig. 66 *a*, *b*, *c*. Various forms of branchiae. × 32.

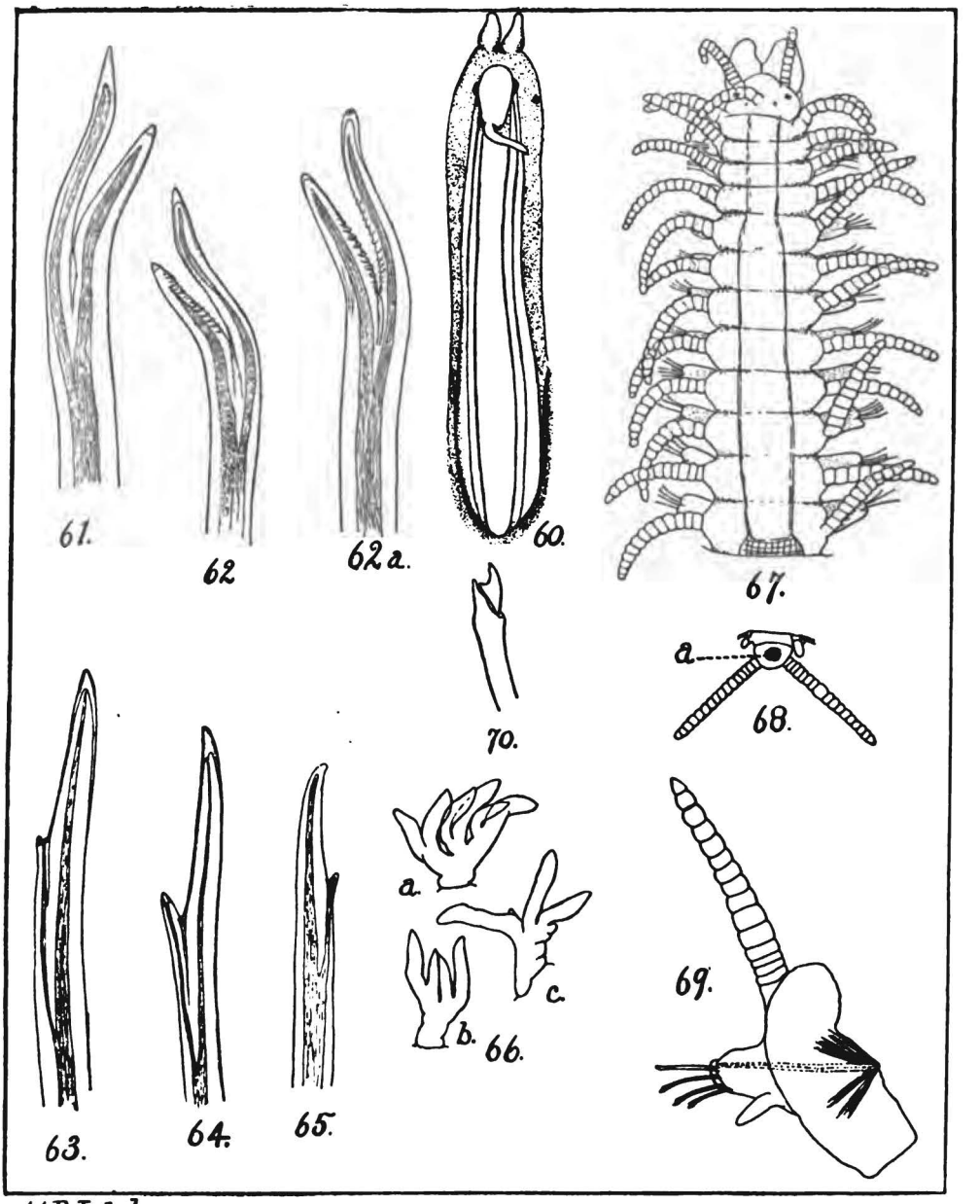
Figs. 67–70. *Pionosyllis elongata.*

Fig. 67. Anterior portion of immature specimen (146 somites). × 32.

Fig. 68. Posterior extremity, showing pygidium, anus (*a*.), and anal cirri. × 32.

Fig. 69. Foot from middle of body. × 52.

Fig. 70. Seta tip. Minute serrations sometimes present on concave side of falcate appendage. × 275.

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## PLATE 7.

Fig. 71. *Pionosyllis elongata*; outline of anterior portion seen on the ventral side, showing alimentary canal *in situ*. The dorsal cirri and the setae are omitted. *pa.* Papillae. *t.* Tooth. *oes.* Oesophagus. *prov.* Proventriculus, or "gizzard." *c.* Coeca. × 23.5.

Figs. 72–76. *Trypanosyllis gemmipara.*

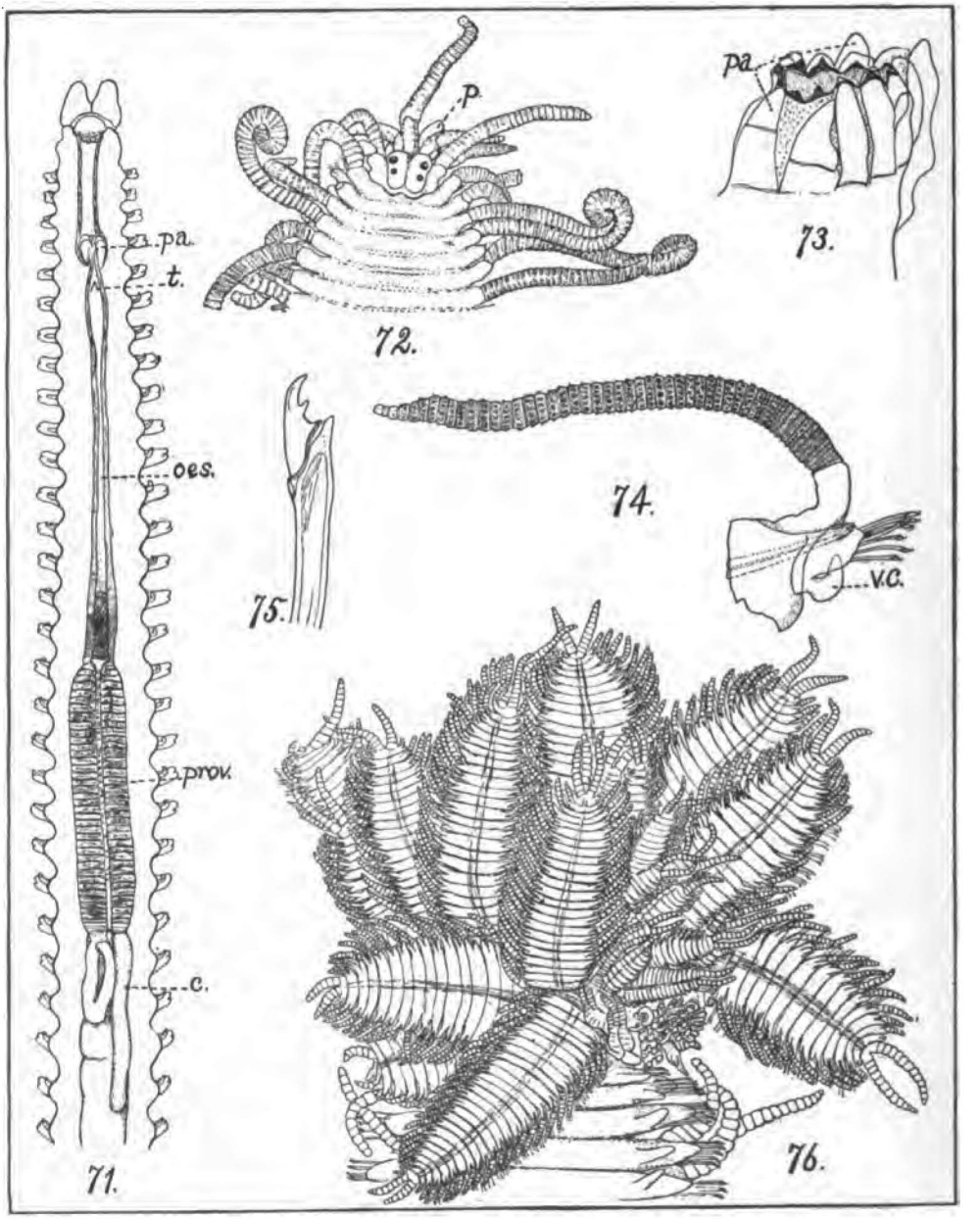
Fig. 72. Anterior extremity, dorsal aspect. *p.* Palpus. × 13.

Fig. 73. Proboscis dissected out, showing chitinous teeth and surrounding fleshy papillae (*pa.*). × 23.5.

Fig. 74. Foot from anterior region of body. The moniliform character of the dorsal cirrus is too strongly indicated. *v. c.* Ventral cirrus. × 22.5.

Fig. 75. Seta-tip, profile. In glycerine. × 237.

Fig. 76. Caudal buds, seen from ventral aspect. The center of proliferation is on the right, where a cluster of young buds is seen. × 23.



## PLATE 8.

Figs. 77–85. *Northia elegans.*

Fig. 77. Anterior extremity, dorsal aspect. × 6.

Fig. 78. Anterior extremity, specimen lying obliquely on right side. The minute eyes are visible at base of left articulated antenna. *p. c.* Peristomial cirri. *p.* Palpus. × 8.5.

Fig. 79. Maxillae, somewhat spread apart, and the right edentate maxilla folded back, to show underlying toothed jaw. × 16.

Fig. 80. Anterior aspect of second foot. *br.* Gill. *d. c.* Dorsal cirrus. *v. c.* Ventral cirrus. × 13.

Fig. 81. Twenty-eighth foot, profile view. (Lettering as in Fig. 80.) × 13.

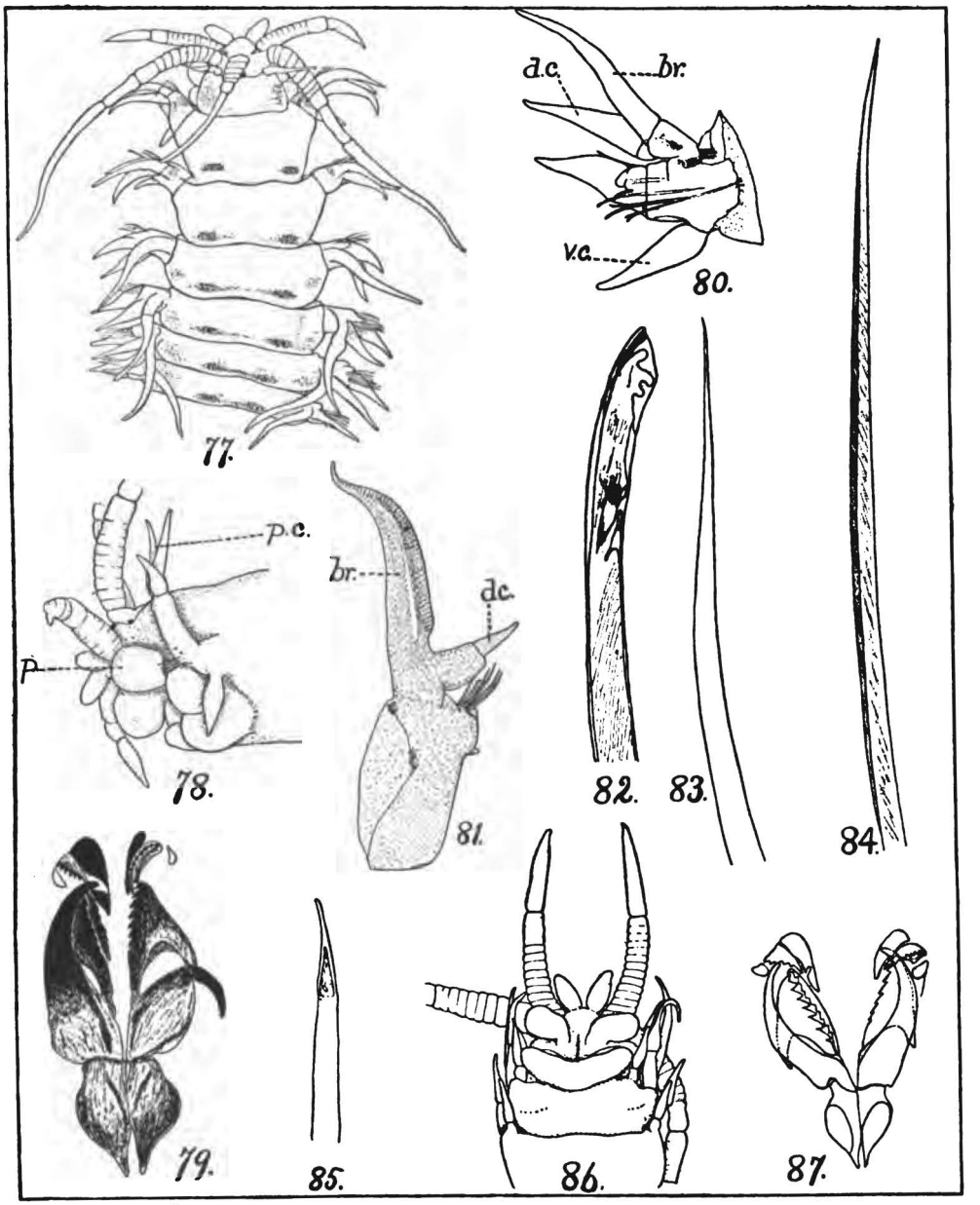
Figs. 82, 83. Uncinus or "hooded crotchet," and capillary subulate seta, both from ventral fascicle of third parapod. × 200.

Fig. 84. Capillary seta with striated border, ventral fascicle of thirty-first foot. × 200.

Fig. 85. Concave seta (buried in foot) from dorsal fascicle of thirty-first foot. × 200.

Fig. 86. Anterior extremity, ventral aspect, of *Northia iridescens.* × 8.5.

Fig. 87. Maxillae of the same, spread widely apart, and seen from dorsal aspect. × 16.

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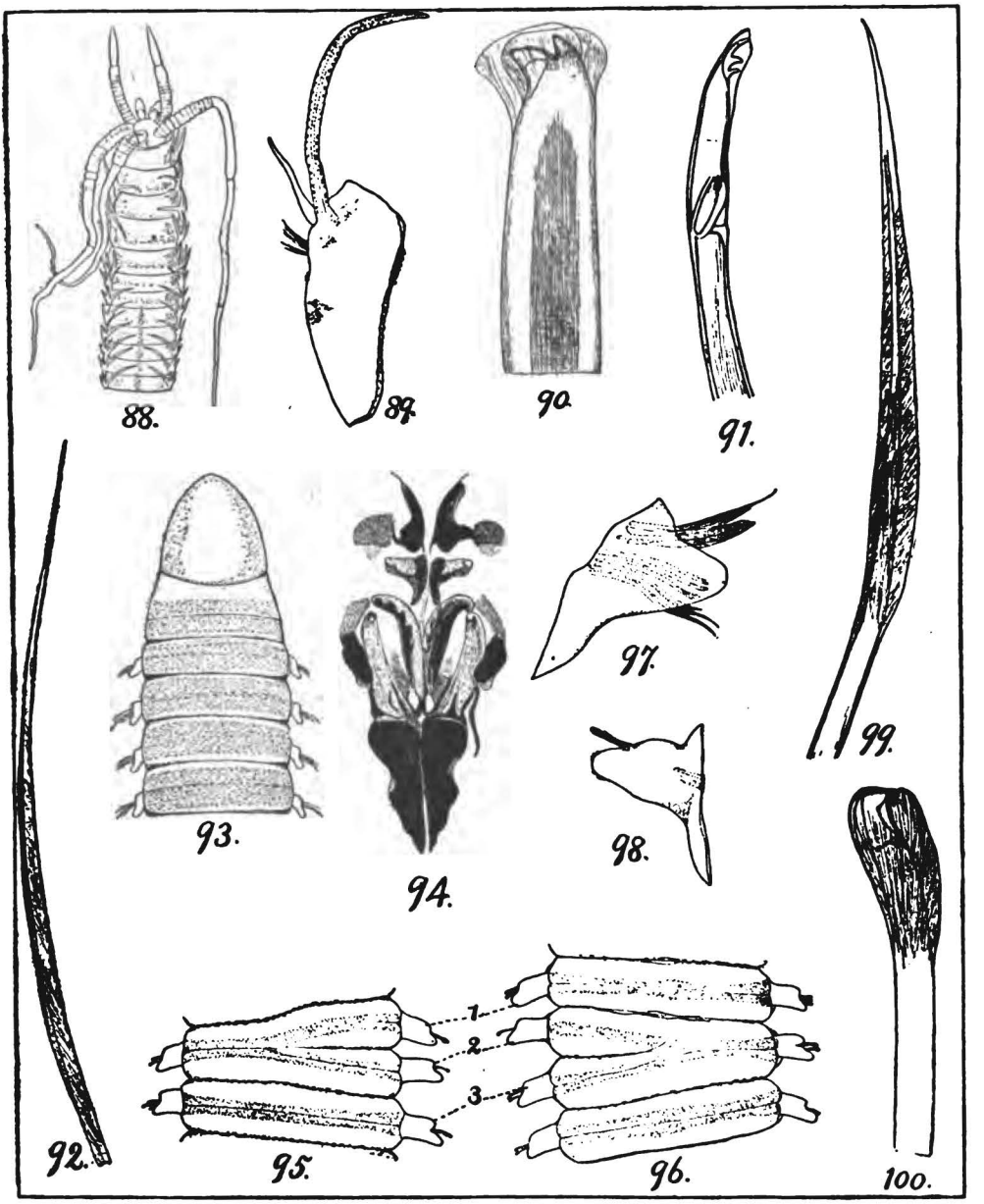
## PLATE 9.

Figs. 88–92. *Northia iridescens.*

Fig. 88. Anterior extremity, dorsal aspect. Free-hand drawing. × 3.
Fig. 89. Foot from middle of series, showing the filiform gill and subulate dorsal cirrus. × 23.5.
Fig. 90. Wing-tipped uncinus, from a middle parapod. × 200.
Fig. 91. Hooded crotchet from ventral fascicle of third foot. × 190.
Fig. 92. Capillary seta with striated border. × 200.

Figs. 93–100. *Lumbriconereis zonata.*

Fig. 93. Anterior extremity, dorsal aspect. × 8.5.
Fig. 94. Maxillae, somewhat spread apart, and seen from the dorsal side. × 23.5.
Figs. 95, 96. A "spiral" somite from posterior region of body, seen from the dorsal (Fig. 95) and from the ventral aspect (Fig. 96); 1, 2, 3, the somites involved. × 8.5.
Fig. 97. Fifteenth foot, posterior aspect. × 40.
Fig. 98. Foot from middle of series, posterior aspect. Uncini only are present. × 23.5.
Fig. 99. Double-bordered seta from an anterior foot. × 237.
Fig. 100. "Hooded crotchet" from a posterior foot. × 237.

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## PLATE 10.

Fig. 101. Posterior aspect of foot of *Glycera rugosa*, from middle of body showing 6-lobed gill, and dorsal cirrus (*d. c.*) seen by transparency through uppermost lobe of gill (the tip of which has been cut off). The minute ova have entered the gills. *v. c.* Ventral cirrus. × 23.5.

Fig. 102. Jaw and jaw-appendage (*ap.*) of the same. × 13.

Fig. 103. Posterior aspect of foot of *Glycera nana*. Dorsal cirrus is not shown. *v. c.* Ventral cirrus. × 23.

Fig. 103*a*. Jaw-appendage of the same. × 40.

Fig. 104. Posterior aspect of a foot from middle of series of *Hemipodia borealis*. Setae are all compound, and several are almost entirely withdrawn within the foot. The single acicula is indicated by dotted lines. *d. c.* Dorsal cirrus. *v. c.* Ventral cirrus. × 75.

Fig. 104*a*. Jaw-appendage of the same. The attached end is somewhat expanded. × 75.

Figs. 105–110. *Scoloplos elongata*.

Fig. 105. Anterior extremity, dorsal aspect. *pp.* Palpode. × 13.

Fig. 106. Anterior extremity, ventral aspect, with proboscis everted, showing foliaceous expansions. × 13.

Fig. 107. Profile of seventeenth foot, anterior aspect. × 23.5.

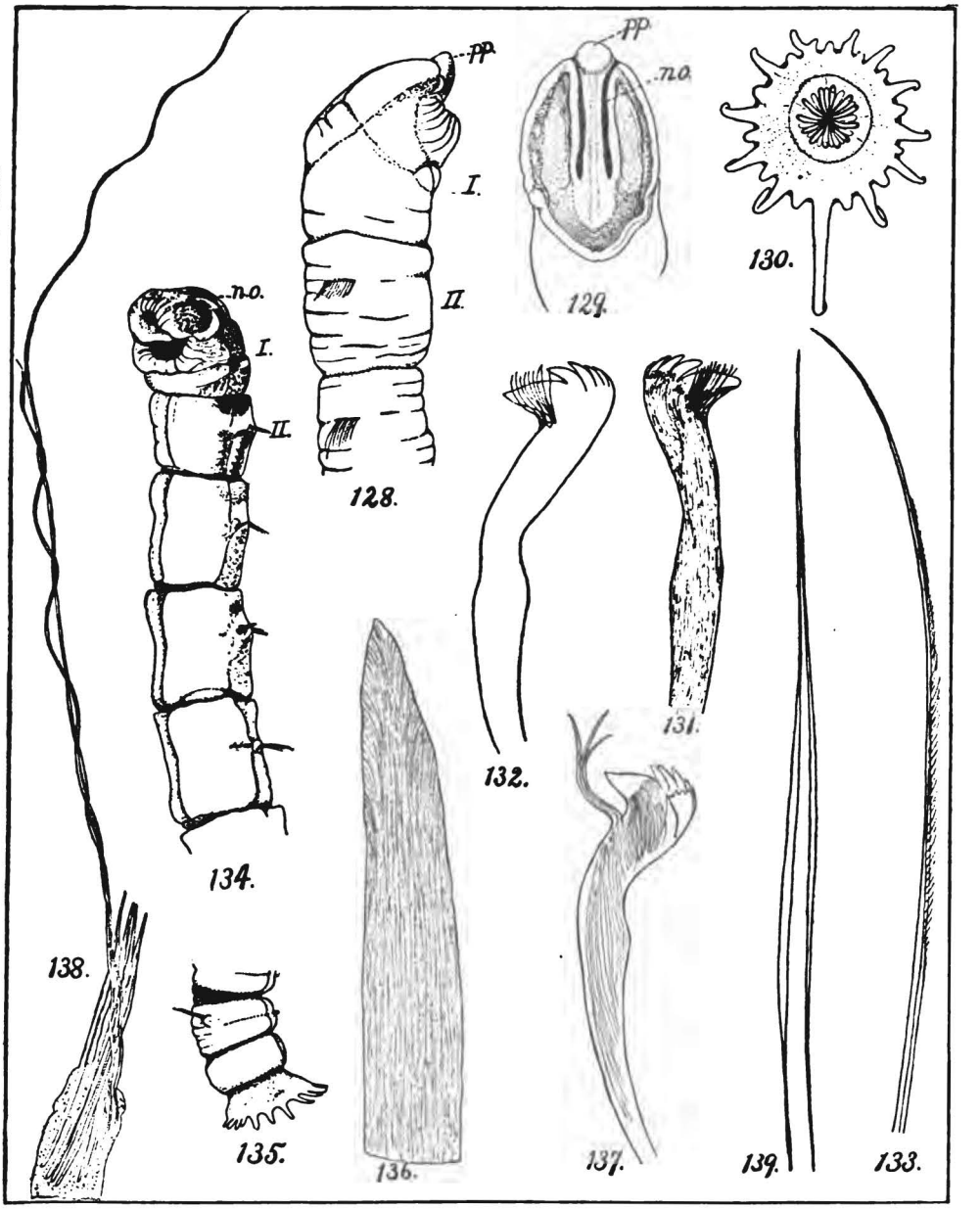
Fig. 108. Vertical section of foot from middle of length, showing the dorsally-directed parts. *br.* Gill. × 52.5.

Fig. 109. Portion of one of the deeply-serrated, anterior setae. × 340.

Fig. 110. Portion of a ventral seta. × 340.

Fig. 111. Anterior extremity of *Aricideopsis megalops*. × 39.

Fig. 112. The same. Foot from posterior portion. × 39.



## PLATE 14.

Figs. 140–142. *Ammochares occidentalis*.

Fig. 140. Anterior portion, ventral aspect. The tori are represented, but the uncini are invisible at this magnification. × 13.

Figs. 141 *a*, *b*. Uncini, frontal aspect and profile. When *in situ*, only the portion distal to the constriction is exposed. × 600.

Fig. 142. Seta, showing double serration. × 450.

Fig. 143. Portion of digestive tract of *Arenicola claparedei*, showing lower section of oesophagus (*oes.*); oesophageal coeca of two kinds (*c*, *c'*), and the anterior extremity of the chlorogogous tract (*ch.*). The most anterior pair of coeca (*c.*) are always much larger than the rest, thin-walled and highly vascular. The other coeca (*c'.*) are thick-walled and the surface is striated. They are not always paired, and the number is highly variable (ten in the present instance, which is about the minimum). Free-hand drawing. × 2.

Fig. 144. Oesophageal coeca of another specimen, showing the thin-walled, vascular pair (*c.*) in a much-contracted condition. The smaller coeca (*c'.*) number fifteen on each side (with one exception the highest number hitherto observed) and are quite uniform as to size. Several are attached at or near the median line. Free-hand drawing. × 2.

Figs. 145–148. *Cirratulus cingulatus*.

Fig. 145. Anterior portion, showing tentacular filament (*t. f.*) and three most anterior pairs of cirri, all cut short. × 9.

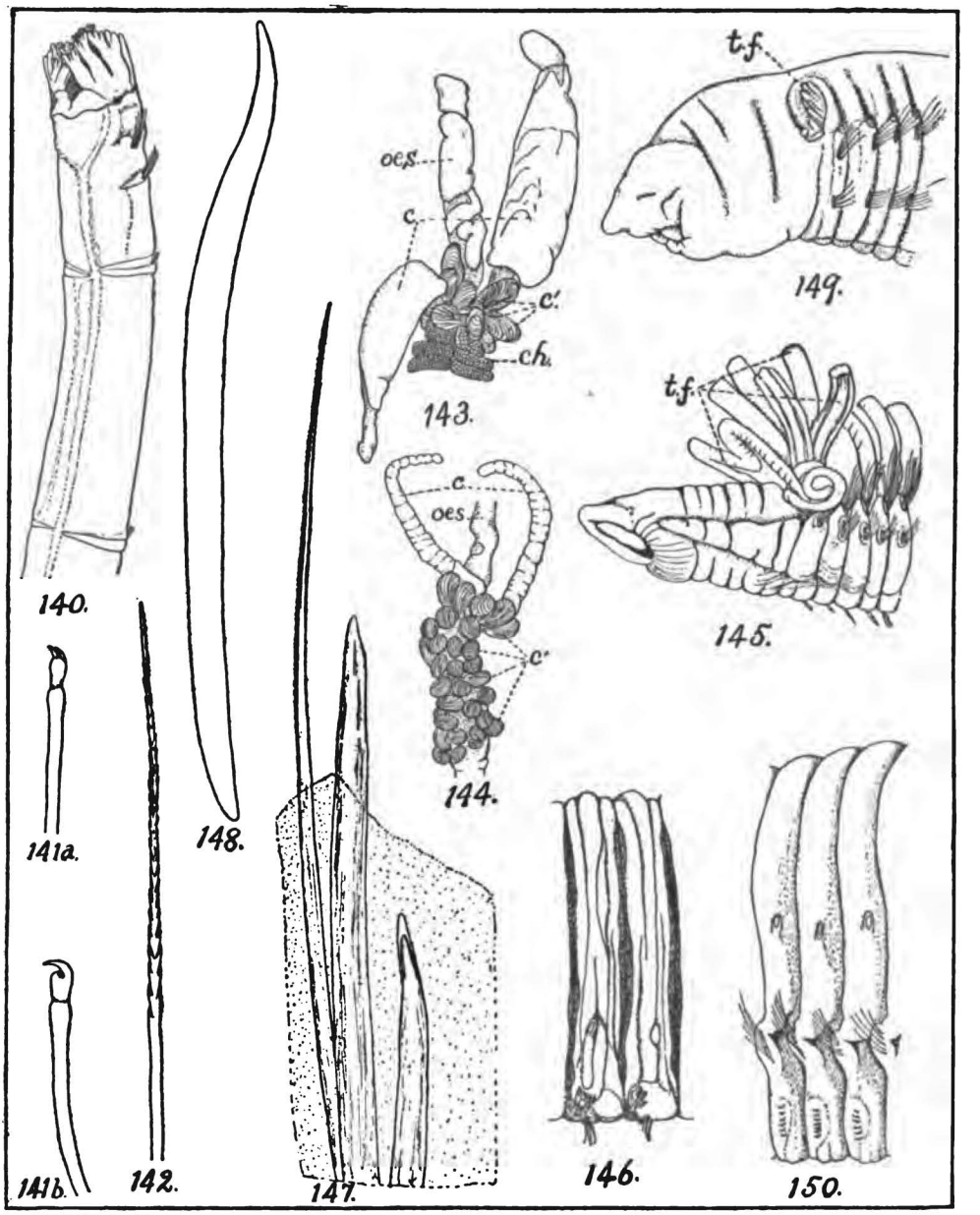
Fig. 146. Two somites from middle of body. The dorsal cirri are broken off, but the points of attachment are shown. × 13.

Fig. 147. Ventral setae, and two uncini *in situ*. × 187.

Fig. 148. Ventral hook, middle region. × 150.

Fig. 149. Anterior portion of *Cirratulus robustus*. The tentacular filament (*t. f.*) and dorsal cirri are broken off at point of attachment. × 9.

Fig. 150. Somites 36–38 (anterior third of body), left side of the same. Points of attachment of cirri are distinctly shown. × 13.




PROC. BOST. SOC. NAT. HIST. VOL. 29.

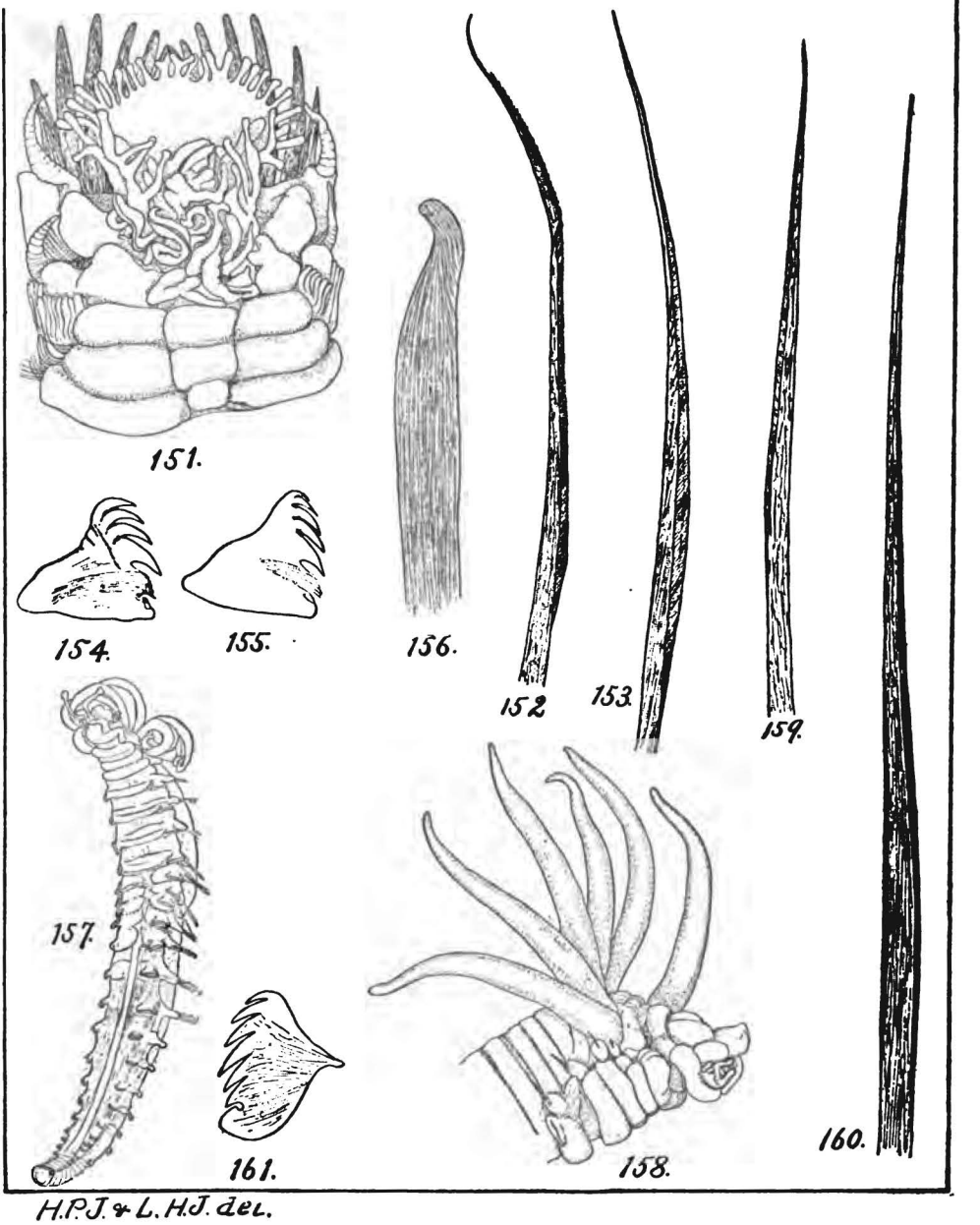
## PLATE 15.

Figs. 151–156. *Pectinaria brevicoma.*

Fig. 151. Anterior end, ventral aspect. × 9.
Fig. 152. Seta from ninth somite, with striated border; slightly twisted. × 100.
Fig. 153. Seta with striated border; not twisted. × 150.
Fig. 154. Usual form of uncinus; from seventh somite. × 321.
Fig. 155. Occasional form of uncinus; from twelfth somite. × 321.
Fig. 156. Scapha-hook, showing laterally-bent tip. × 150.

Figs. 157–161. *Sabellides unops.*

Fig. 157. Entire animal, ventro-lateral aspect. Posterior extremity wanting, as are also most of the tentacles. Free-hand drawing. × 2.5.
Fig. 158. Anterior extremity, right side, tentacles retracted. Two of the branchiae have been removed from the left side. × 6.
Fig. 159. Single-bordered capillary thoracic seta. × 187.
Fig. 160. Double-bordered capillary thoracic seta. × 321.
Fig. 161. Uncinus, lateral aspect. × 321.




H.P.J. & L.H.J. del.

## PLATE 16.

Fig. 162. Anterior extremity of *Sabellides anops*, dorsal aspect. Branchiae on right side have been cut off at the base. The somites 1–5 are numbered. × 9.

Fig. 163. Prostomium and tentacles of the same, dorsal aspect. × 15.

Figs. 164–168. *Amphitrite robusta*.

Fig. 164. Gill, mounted in glycerine. × 6.

Fig. 165. Seta from thorax. × 187.

Fig. 166. Uncinus from eighteenth somite, in profile. × 321.

Fig. 167. Biserial arrangement of uncini, thoracic region. × 321.

Fig. 168. Uncinus from near posterior end. × 321.

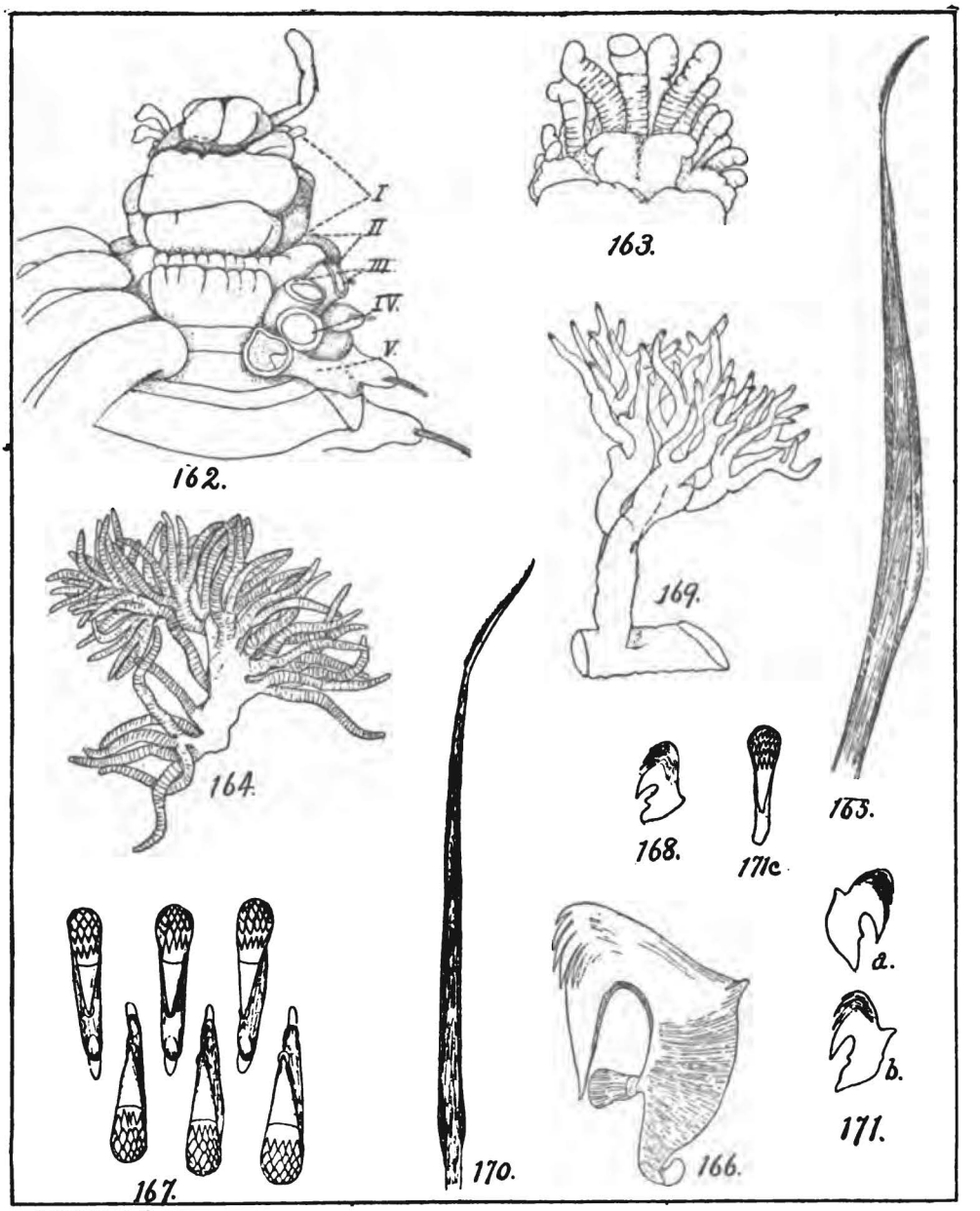
Figs. 169–171. *Amphitrite spiralis*.

Fig. 169. One of the main branches of a gill. × 15.

Fig. 170. Seta from eighteenth (thoracic) somite. × 321.

Fig. 171 *a*, *b*. Uncini from eighteenth somite, profile. × 321.

Fig. 171 *c*. Uncinus, anterior aspect, showing five rows of teeth above rostrum. × 350.



## PLATE 17.

Figs. 172–174. *Lanice hetcrobranchia.*

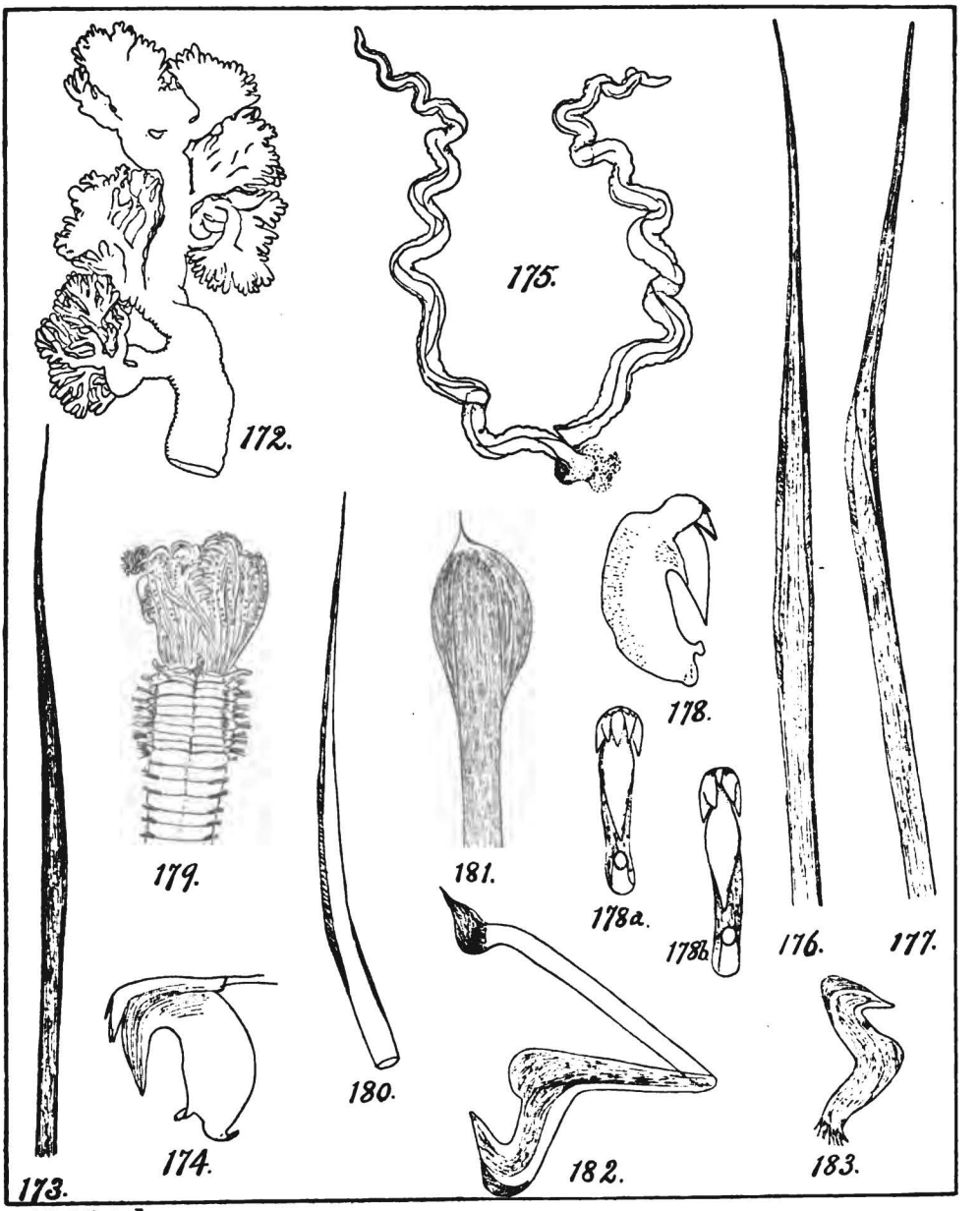
Fig. 172. One of the first pair of gills ; only one branch is given in detail. × 9.
Fig. 173. Capillary, double-bordered thoracic seta. × 187.
Fig. 174. Uncinus from nineteenth (thoracic) somite. × 321.

Figs. 175–178. *Thelepus crispus.*

Fig. 175. Two gill-filaments, showing place of attachment to body. In glycerine. The blood-vessels show through the translucent walls. × 9.
Figs. 176, 177. Two capillary double-bordered setae of differing form. × 150.
Fig. 178. Uncinus from thirty-second (thoracic) somite, profile view. × 321.
Fig. 178 *a*, *b*. Two thoracic uncini of slightly different form. × 350.

Figs. 179–183. *Bispira polymorpha.*

Fig. 179. Anterior portion, ventral aspect, including thorax and first six somites of abdomen. Free-hand drawing. × 2 (*circa*).
Fig. 180. Winged seta from dorsal portion of sixth fascicle. × 150.
Fig. 181. Spatulo-mucronate seta-tip from ventral portion of sixth fascicle. × 275.
Fig. 182. Avicular and mucronate uncini from sixth torus, in their normal relation to each other. × 150.
Fig. 183. Avicular uncinus from abdominal region (twentieth torus). × 150.



## PLATE 18.

Fig. 184. Portion of gill of *Bispira polymorpha*, near base, showing gill-filaments and two eyes. × 39.

Fig. 185. Double-bordered, capillary seta from abdominal region. × 150.

Figs. 186–192. *Megachone aurantiaca.*

Fig. 186. Thorax, and first somite of abdomen, right side. Collar is clearly indicated. × 6.

Fig. 187. Anterior extremity in end-view, showing regenerating (?) branchiae, appressed upon the disc ; their tips point ventrad. × 9.

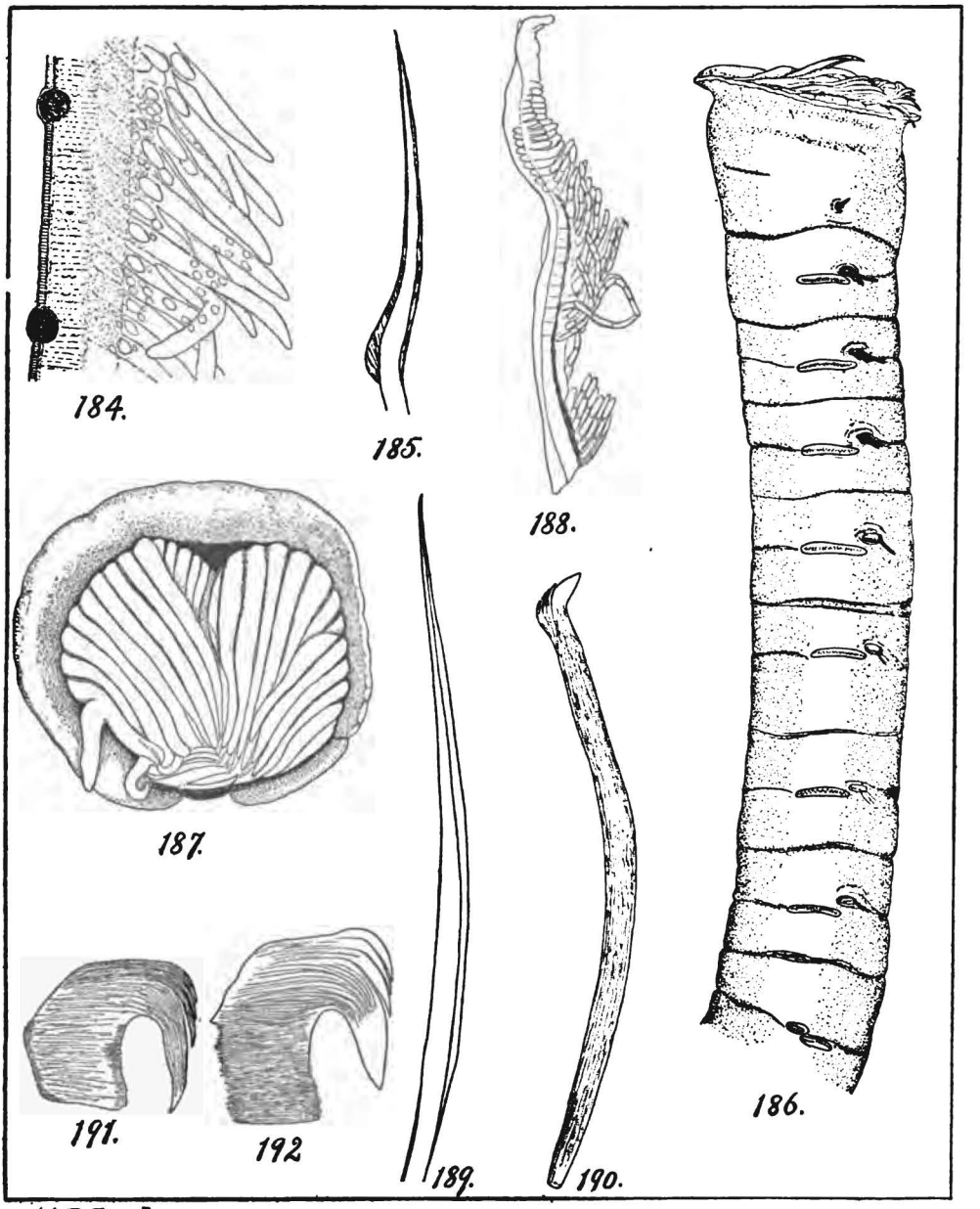
Fig. 188. Gill showing filaments, the blood-vessels of which contain oval blood-clots. × 26.

Fig. 189. Bordered seta, from thorax. × 187.

Fig. 190. Uncinus from sixth torus. × 150.

Fig. 191. Uncinus from nineteenth torus. × 275.

Fig. 192. Uncinus near posterior extremity. × 275.

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## PLATE 19.

Figs. 193–198. *Myxicola pacifica.*

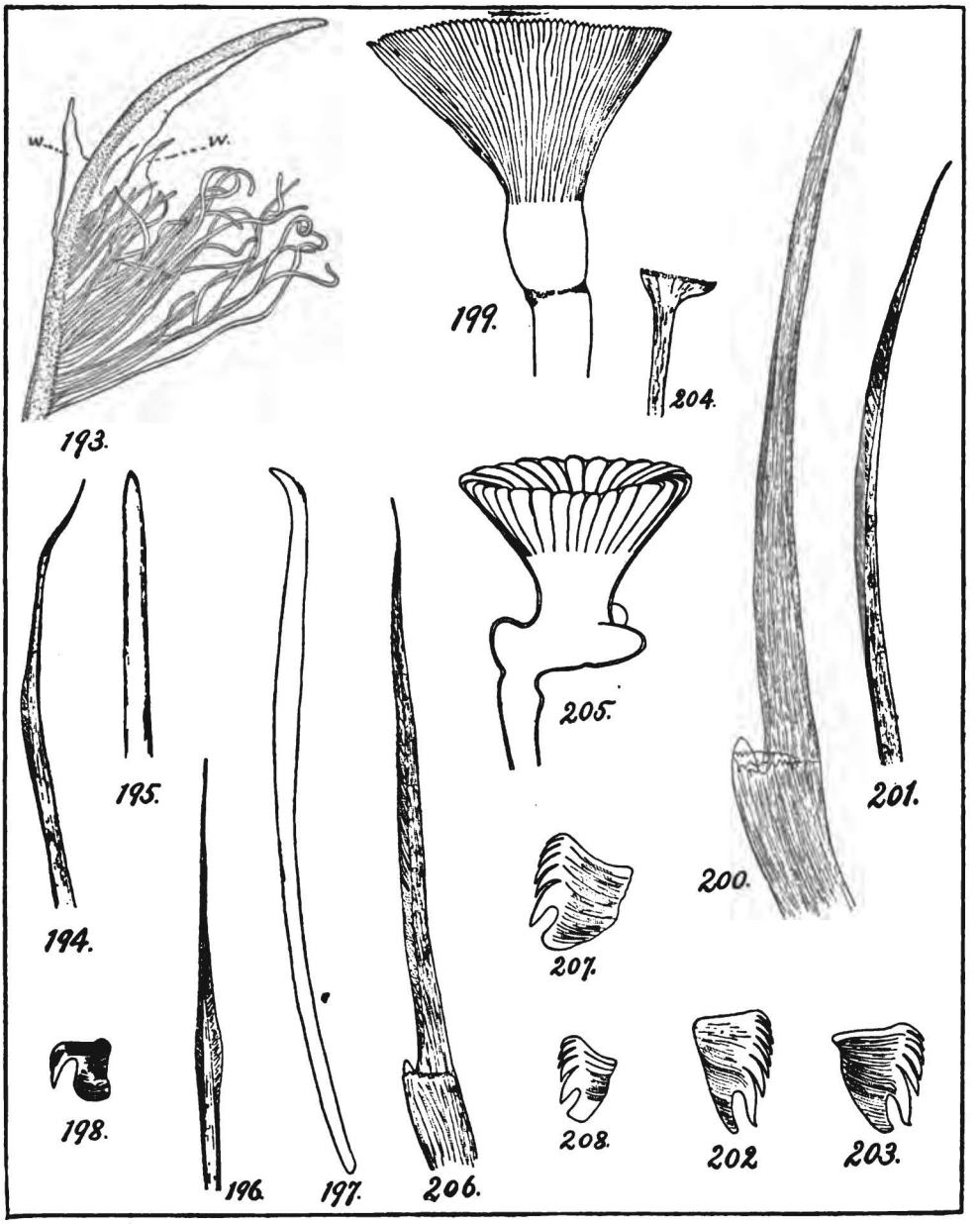
Fig. 193. Tip of branchia. The web connecting the branchiae is shown as a border on the right side, and as ruptured tips at *w*. *w*. × 12.5.
Fig. 194. Double-bordered, thoracic seta. × 450.
Fig. 195. Stout, straight seta from thorax. × 450.
Fig. 196. Abdominal seta. × 450.
Fig. 197. Thoracic uncinus. × 321.
Fig. 198. Abdominal uncinus. × 321.

Figs. 199–203. *Serpula columbiana.*

Fig. 199. Profile view of operculum. × 6.
Fig. 200. "Bayonet" seta from first fascicle. × 187.
Fig. 201. Thoracic seta with striated border. × 187.
Fig. 202. Thoracic uncinus (many are 6- or 7-toothed). × 275.
Fig. 203. Abdominal uncinus. × 275.

Figs. 204–208. *Serpula zygophora.*

Fig. 204. Chisel-shaped, abdominal seta. × 321.
Fig. 205. Profile view of operculum. × 9.
Fig. 206. "Bayonet" seta from first fascicle. × 187.
Fig. 207. Thoracic uncinus (6-toothed). × 321.
Fig. 208. Abdominal uncinus (usually 6-toothed). × 321.

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