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PAPERS FROM THE HARRIMAN ALASKA EXPEDITION.

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THE NEMERTEANS.

BY

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YALE UNIVERSITY.

WASHINGTON, D. C.

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CONTENTS:

THE Harriman Alaska Expedition, during the months of June and July, 1899, afforded exceptional advantages for the investigation and collection of the marine invertebrate fauna of the Alaska coast south of Bering Sea.

During the course of the expedition collections of Nemerteans were made at Victoria (Vancouver Island) and Lowe Inlet in British Columbia; at New Metlakahtla (Annette Island), Cape Fox, Wrangell, Farragut Bay, Taku Harbor, Juneau, Skagway, Glacier Bay, Sitka, and Hot Springs on the islands and mainland of southeastern Alaska; at Russell Fiord and Yakutat Bay; at Orca and Virgin Bay in Prince William Sound; at Kadiak; at Popof Island, Shumagin group; at Kukak Bay on the Alaska Peninsula; and at Dutch Harbor, Unalaska.

Stops were made also on St. Paul, St. Matthew, and Hall Islands in Bering Sea; at Plover Bay, Siberia, and at Port Clarence, Alaska, just south of Bering Strait. At these latter localities, however, the shores are surrounded in winter by pack ice, which prevents the existence of any considerable amount of life between tides. No Nemerteans were found here between tides in the limited time at our command, though it is not unlikely that in deeper water an abundance of these worms could have been obtained by the dredge. South of Bering Sea, on the other hand, the shores are densely covered nearly to high water mark with a luxuriant growth of nearly all classes of invertebrates.

All along that part of the coast which borders the North Pacific Ocean—from Dixon Entrance to the Aleutian Islands—with the exception of areas subject to local disturbing elements, such as the proximity of rivers and glaciers, invertebrates occur in remarkable abundance. Not only is there an enormous number of individuals, but also a great variety of species. And, furthermore, the unusually large size which many of the species attain is quite as striking as the wealth of species and individuals. The purity of the water, its freedom from contamination from muddy streams, and the great rise and fall of the tides with their consequent swift currents, which continuously provide a rapidly changing supply of pure water, furnish conditions especially favorable to the growth of marine invertebrate animals.

Exceptions to these favorable conditions were found at Juneau, where the water is of slightly less than normal density, and contains a considerable amount of sediment. At Skagway these unfavorable conditions are still more pronounced, and here very few Nemerteans could be found between tides. In Russell Fiord the water was decidedly brackish, there was little tide, and almost no shore collecting could be done. Localities in the vicinity of glacier fronts were extremely barren of marine life, as was to be expected.

Perhaps the locality which proved the most fruitful was Dutch Harbor, Unalaska, although the stations in Prince William Sound were but little inferior, and Sitka was found to possess an extremely rich littoral fauna.

Of the abundance of Nemerteans collected, colored drawings were made of most of the species, and many specimens were carefully preserved for anatomical study, and have proved most interesting. Serial sections of most of the species have been prepared, and details of their anatomy will be found on subsequent pages.

Two other members of the expedition, Prof. William E. Ritter, of the University of California, and Prof. Trevor Kincaid, of the University of Washington, have generously submitted to me the Nemerteans collected by them.

SPECIES PREVIOUSLY RECORDED.

The Nemertean fauna of the northwest coast of North America up to the present time has been almost entirely neglected. Several small collections have been made, but the only literature relating to the group in this region seems to be a paper by Stimpson. This author[1] gives brief Latin diagnoses of the following species from the west coast of North America:

Emplectonema viride Stimpson [= *Nemertes gracilis* Johnston = *Emplectonema gracilis* Verrill]. Found by Stimpson under stones between tides in San Francisco harbor. This species occurs abundantly along the whole Pacific coast of Alaska.

Cosmocephala beringiana Stimpson [= *Amphiporus angulatus*]. Found in Bering Strait in five fathoms. This species also is abundant along the whole Pacific coast of Alaska.

Cerebratulus impressus Stimpson [= *Micrura impressa*]. Found in twenty fathoms in Bering Strait. This species was not met with by the Harriman Expedition.

The investigation of the systematic position and anatomy of this group of worms has been rendered much less difficult since the publication of Bürger's excellent monograph on the Nemerteans of the Gulf of Naples.[2] Bürger's classification is found to be admirable, and his nomenclature has been closely followed in the present work. It will be impossible, however, to retain the generic names *Eunemertes* and *Eupolia* which Bürger adopts, for the reason that they have been antedated by Stimpson. In

[1] Proc. Acad. Nat. Sci. Philadelphia, pp. 159–165, 1857.

[2] Fauna und Flora des Golfes von Neapel. Monogr., 22, 1895.

1857 Stimpson[1] published brief, though accurate, diagnoses of these same genera under the names *Emplectonema* and *Tæniosoma*. Moreover, Stimpson gives as the type of *Emplectonema*, *E. camillea* [= *Borlasia camillea* Quatr. (1846) = *Amphiporus neesii* Oersted (1844) = *Eunemertes neesii* Vaillant (1890)]. Not only this species, but also Stimpson's other species, *Emplectonema viride* [= *Nemertes gracilis* Johnston, 1837], is a typical member of the genus named by Vaillant more than thirty years later. With these facts in mind it is obvious, as has been already pointed out by Verrill,[2] that Stimpson's name must be retained.

The status in regard to *Eupolia* Hubrecht (1887) is similar. Stimpson named *Borlasia quinquelineata* Quoy et Gaimard (1833) as belonging to his new genus *Tæniosoma*, and described as new species *T. septemlineatum* and *T. æquale*, which is probably identical with *quinquelineatum* Quoy et Gaimard. But both of these species are typical of *Eupolia* Hubrecht. There can be no doubt, therefore, about the identity of the two genera[3] and, as in the case of *Emplectonema*, Stimpson's name, *Tæniosoma*, must hold.

The brevity of some of Stimpson's *generic* diagnoses, as mentioned above, is justified by the citation of well known typical species of those genera, and in such cases their validity cannot be questioned. Of his *specific* descriptions, on the other hand, it is more than likely that some will prove insufficient for an indisputable determination of the species.

In the preservation of the Nemerteans, I found a 2- to 5-per-cent solution of formalin in sea-water to yield most satisfactory results. Most forms die well-extended if a few drops of formalin are added to the water in the vessel in which the living worms are contained. The formalin solution preserves the general anatomical and some of the histological features excellently, and sharp nuclear stains are easily secured, especially with the epithelial structures. This solution, however, works

[1] Proc. Acad. Nat. Sci. Philadelphia, 1857.

[2] Trans. Connecticut Acad., VIII, p. 413, 1892; ibid., IX, p. 146, 1895.

[3] Bürger states distinctly in his great Monograph (p. 26) that "*Tæniosoma* deckt sich mit *Eupolia*," but, for some reason, does not consider Stimpson's diagnoses valid.

havoc with the nervous elements and with the connective tissues. Specimens killed in strong alcohol proved valuable adjuncts to the formalin preparations. In most cases the formalin specimens have been eventually transferred to alcohol for permanent preservation. Corrosive sublimate-acetic, Gilson's fluid, and, for nervous elements, Flemming's solution are always to be recommended.

For serial sections no stains have given more happy results than Delafield's hæmatoxylin, followed by Orange G.

In the limited time at our disposal it was naturally impossible to make an exhaustive collection or study of the Nemertean fauna. Some thirty-two species were collected, however, and of these twenty-seven proved to be new to science, and only two of the remaining species have been recorded from the Pacific.

LIST OF SPECIES HERE RECOGNIZED.

Following is a list of the species recognized, with brief notes on their general distribution so far as our collections go:

PROTONEMERTEA.

1. *Carinella speciosa* sp. nov. Along the whole Pacific coast of Alaska. Vancouver Island (Shearer). Not uncommon.
2. *C. dinema* sp. nov. Victoria, B. C.; Sitka. Uncommon.
3. *C. capistrata* sp. nov. Prince William Sound. Common.

MESONEMERTEA.

4. *Cephalothrix linearis* (Rathke) Oersted. Pacific coast. Abundant.
5. *Carinoma griffini* sp. nov. Collected by Mr. Creswell Shearer at Albert Head, Vancouver Island.

METANEMERTEA.

6. *Emplectonema gracile* (Johnston) Verrill. Pacific coast. Abundant. San Francisco (Stimpson).
7. *E. bürgeri* sp. nov. Glacier Bay; Sitka. Not common.
8. *Zygonemertes thalassina* sp. nov. Sitka. Not uncommon.
9. *Z. albida* sp. nov. Victoria, B. C. Uncommon.
10. *Paranemertes peregrina* gen. et sp. nov. Pacific coast. Vancouver Island (Shearer). Abundant.
11. *P. pallida* sp. nov. Yakutat Bay; Popof Island. Uncommon.

12. *P. carnea* sp. nov. Pacific coast. Vancouver Island (Shearer). Common.

13. *Amphiporus angulatus* (Fabricius) Verrill. Pacific coast. Abundant.

14. *A. bimaculatus* sp. nov. Southeast coast. Uncommon. Puget Sound (T. Kincaid).

15. *A. tigrinus* sp. nov. Farragut Bay. Uncommon.

16. *A. nebulosus* sp. nov. Kukak Bay, Alaska Peninsula. Uncommon.

17. *A. leuciodus* sp. nov. Southeast coast. Common.

18. *A. exilis* sp. nov. Pacific coast. Abundant.

19. *Tetrastemma bicolor* sp. nov. Kadiak. Not common.

20. *T. aberrans* sp. nov. Glacier Bay; Prince William Sound. Uncommon.

21. *T. cæcum* sp. nov. Dredged by Dr. Ritter at Kadiak. Common.

HETERONEMERTEA.

22. *Tæniosoma princeps* sp. nov. Southeast coast. Uncommon.

23. *Lineus viridis* (Fabricius) Verrill. Annette Island. Common.

24. *L. torquatus* sp. nov. Prince William Sound. Common.

25. *Micrura verrilli* sp. nov. Prince William Sound. Not uncommon.

26. *M. alaskensis* sp. nov. Southeast coast. Common.

27. *Cerebratulus herculeus* sp. nov. Sitka. Not uncommon.

28. *C. marginatus* Renier. Sitka. Not uncommon.

29. *C. occidentalis* sp. nov. Yakutat; Prince William Sound. Vancouver Island (Shearer). Abundant.

30. *C. longiceps* sp. nov. Yakutat. Uncommon.

31. *C. montgomeryi* sp. nov. Puget Sound to Unalaska Island. Common.

32. *C. albifrons* sp. nov. Near Sitka. One specimen.

It must be remembered that the above list represents but a few weeks' collecting, and sometimes with only a few hours at a locality; too much confidence therefore should not be placed on the distribution or comparative abundance of the various species. Further research will undoubtedly add greatly to the number of species, and judging from the number found in so short a time it seems not unlikely that the list may eventually be more than doubled.

General considerations in regard to the anatomical peculiarities of the Nemerteans described below are reserved for a future paper. My reason for postponing this important duty in connection with the study of the collection is that since this article was written, extensive collections of Nemerteans from the west and northwest coasts of America and the Pacific Ocean have been placed in my hands. These collections will doubtless include other forms than those collected on the Harriman Expedition, and it seems desirable that as many as possible be studied before drawing any general conclusions in regard to the anatomical peculiarities presented by the Alaska forms.

KEYS TO GROUPS AND SPECIES.

For convenience in determination, the species at present known from the northwest coast of America may be arranged in the following analytical table, based mainly on superficial and easily distinguishable characters.

A. Proboscis without stylets. Mouth posterior to brain. Intestinal cæcum absent.

a. Lateral nerves external to musculature of body walls. PROTONEMERTEA.

aa. Lateral nerves imbedded in or between muscular layers of body walls .....b.

b. Musculature of body walls in two main layers, to which an inner circular layer is sometimes added in the esophagal region. Cerebral sense-organs absent.....MESONEMERTEA.

bb. Musculature of body walls in three main layers, of which the inner is longitudinal. Cerebral sense-organs present. HETERONEMERTEA.

AA. Proboscis with stylets. Mouth in front of brain, usually opening with proboscis in a single terminal or subterminal pore. Intestinal cæcum present. Lateral nerves internal to muscular layers of body walls.....METANEMERTEA.

ORDER PROTONEMERTEA.

Body remarkably long, soft, and fragile. Head distinctly marked off from body, usually broader than neck, often flattened dorso-ventrally..... *Carinella*, p. 11.

1. Body very soft, attaining a length of upwards of 2 meters, deep red or bright vermilion..... *C. speciosa*, p. 11

2. Color brown or chocolate with numerous narrow, transverse white rings and five parallel, longitudinal white lines, of which one is in the dorso-median line, and two on each lateral surface.....*C. dinema*, p. 15.
3. Color brown with numerous narrow transverse rings and three parallel, longitudinal white lines of which one is in the dorso-median line and one just below each lateral margin.....*C. capistrata*, p. 16.

Order MESONEMERTEA.

A. Body musculature consists of a thin outer circular layer and a strong inner longitudinal layer—an inner circular layer is usually wanting entirely, or, if present, is much reduced. Body long and filiform, often coiled in a close spiral. Head sharply pointed. Mouth placed very far behind the brain. Nephridia not discovered .....*Cephalothrix*, p. 19.

1. Slender, filiform, pale yellow, sometimes with reddish, grayish or greenish tinge. No ocelli in adult.....*C. linearis*, p. 19.

AA. Body musculature consists of a thin outer circular layer, a diagonal layer, a longitudinal layer, and, in the esophagal region, an additional, enormously developed inner circular layer. Head broader than neck. Nephridia well developed.

Carinoma, p. 20.

1. Body rather stout, flattened posteriorly. Mouth close behind brain. Milk-white with grayish or brownish mottlings, and darker intestinal lobes. *C. griffini*, p. 20.

Order METANEMERTEA.

A. Body long and slender. Proboscis sheath usually less than half the length of body. Proboscis small; central stylet usually small.....*Emplectonema*, p. 23.

1. Stylets slender, curved. Dark green or pale green above, and whitish or very pale greenish below.....*E. gracile*, p. 23.
2. Stylets straight and short, with swollen bases. Basis of central stylet swollen and rounded posteriorly. Dark brown above, flesh-color beneath.....*E. bürgeri*, p. 25.

AA. Body moderately elongated. Proboscis sheath about ½ to ¾ the length of body. Central stylet well developed.

Paranemertes, p. 32.

1. Two or 4 pouches of accessory stylets. Color purplish brown, dark-brown, or orange-brown above, on sides, and on lateral margins of ventral surface; rest of ventral surface (often only the median third) white or yellowish white.....*P. peregrina*, p. 33.
2. Four pouches of accessory stylets. Opaque white.....*P. pallida*, p. 36.

3. Six to 12 pouches of accessory stylets. Whitish, pinkish or flesh-color..... *P. carnea*, p. 37.

AAA. Body commonly rather short and thick. Proboscis sheath usually reaches nearly or quite to posterior end of body. Proboscis large; central stylet well developed.....a

a. Ocelli numerous, extending along the lateral nerves beyond the brain. Basis of central stylet massive, with truncate or concave posterior end..... *Zygonemertes*, p. 28.

1. Each of the 2 pouches of accessory stylets contains about 5 stubby stylets. Olive green above and below..... *Z. thalassina*, p. 29.
2. Each pouch of accessory stylets contains 2 or 3 moderately slender stylets. White..... *Z. albida*, p. 31.

aa. Ocelli do not extend posteriorly beyond the brain. Basis of central stylet usually rounded posteriorly .....b.

b. Body not very small. Ocelli usually numerous. *Amphiporus*, p. 40.

1. Short and broad. Usually two pouches of accessory stylets with 5 to 7 rather slender stylets each. Dark purplish or chocolate-brown above, with a triangular white spot on each side of the head; ventral surface pinkish or flesh-color..... *A. angulatus*, p. 41.
2. Basis of central stylet but half as long as the slender stylet itself. Usually 4 pouches of accessory stylets. Dorsal surface deep brownish orange with 2 conspicuous oval or dark brown spots on head; ventral surface pale orange or flesh-color..... *A. bimaculatus*, p. 44.
3. Body rounded. Color of females yellowish orange, obscured in intestinal region (in breeding season) by dark-green ova. Males yellowish, with white flecks..... *A. tigrinus*, p. 46.
4. Body rather broad and flat. Whitish, thickly mottled with dark brown blotches and dots; ventral surface whitish..... *A. nebulosus*, p. 48.
5. Body slender, rather small. Ocelli usually 15–40. Usually 3 pouches of accessory stylets, with 2 or 3 stylets each. White. *A. leuciodus*, p. 51.
6. Body extremely elongated for the genus. Ocelli usually 60–250, or more. Usually 6 to 12 (most commonly 8) pouches of accessory stylets, with 1 or 2 stylets each..... *A. exilis*, p. 54.

bb. Body very small. Ocelli few; usually 4 well-developed ocelli arranged in a rectangle; but sometimes these 4 eyes are double or are fragmented into 4 groups of ocelli; occasionally ocelli are wanting..... *Tetrastemma*, p. 57.

1. Ocelli 4. Brownish-red above, with median, white stripe; ventral surface white..... *T. bicolor*, p. 57.
2. Ocelli of 4 groups, each consisting of several pigment spots of irregular size. Pale yellow..... *T. aberrans*, p. 58.
3. Ocelli wanting. Hermaphroditic. Whitish..... *T. cæcum*, p. 59.

Order HETERONEMERTEA.

A. Head without deep lateral, longitudinal furrows. Proboscis musculature of two layers..... *Tæniosoma*, p. 61.

1. Of very large size, reaching a length of 2 meters and a diameter of 18 mm. Deep yellow, thickly sprinkled with small irregular, dark red spots. *T. princeps*, p. 62.

AA. Head with deep, horizontal furrows. Proboscis usually with three muscular layers and muscular crossings.

a. Caudal cirrus absent. Body long and slender, rounded or flattened; very contractile..... *Lineus*, p. 64.

1. A single row of 4–6 (or sometimes 8) ocelli on each side of head. Dusky, or brownish green, dark brown, or reddish brown; commonly paler beneath..... *L. viridis*, p. 65.
2. No ocelli in adult. Dark, reddish brown or purple, with a narrow transverse white band connecting posterior ends of cephalic furrows across dorsal surface of neck..... *L. torquatus*, p. 66.

aa. Caudal cirrus present. Body rather firm; incapable of swimming..... *Micrura*, p. 68.

1. Dorsal surface deep purple or wine-color with 15–40 sharp, pure white, transverse lines; tip of snout with triangular, bright orange spot; ventral surface of body pure white..... *M. verrilli*, p. 68.
2. Body flattened, grayish brown above with narrow, colorless, transverse lines; with a small, flesh-colored, sub-truncate head, much narrower than body, and with minute gray spots near antero-lateral margins. *M. impressa*,[1] p. 70.
3. Salmon or flesh-color (more rarely light brownish); lighter, with tinges of brighter red, or nearly colorless anteriorly. Intestinal lobes more deeply colored, sometimes chestnut-brown. A cream-colored stripe is conspicuous in the ventral median line..... *M. alaskensis*, p. 71.

aaa. Caudal cirrus present in perfect specimens, but often missing. Body long and flat, with thin lateral margins. Swims readily. Dorso-ventral and diagonal muscles well developed. Eyes usually absent..... *Cerebratulus*, p. 74.

1. Very large and stout, becoming 2 meters or more in length, and 25 mm. in width. Dark, reddish brown..... *C. herculeus*, p. 75.
2. Large and ribbon-like. Slaty brown to grayish green, with thin, white, lateral margins..... *C. marginatus*, p. 75.
3. Rather short. Chestnut-brown or reddish brown in esophagal region, chocolate-brown in intestinal region above; brownish flesh-color to dark brown beneath, with a median longitudinal ochre stripe along ventral surface..... *C. occidentalis*, p. 76.

[1] Known only from Stimpson's original description—Proc. Acad. Nat. Sci., Philadelphia, p. 160, 1857.

4. Head and anterior portions of body narrow and slender, with remarkably long and deep cephalic furrows. Dark brown or purplish, paler on borders of cephalic slits and tip of snout.....*C. longiceps*, p. 77.
5. Very long and ribbon-like, becoming 2 meters or more in length. Deep blood-red except tip of snout, which is yellowish white both above and below .....*C. montgomeryi*, p. 80.
6. Reddish purple except head which is white on both dorsal and ventral surfaces back to anterior border of mouth.....*C. albifrons*, p. 82.

SYSTEMATIC DISCUSSION OF GENERA AND SPECIES.

CARINELLA Johnston.

Mag. Nat. Hist. London, VI, p. 232, 1833.

The species belonging to this genus are characterized by a slender, soft, rounded body, capable of extending and contracting to a remarkable degree. Head distinctly marked off from body, usually much broader than parts immediately following, often flattened dorso-ventrally, and disk-like.

On each side of body a transverse furrow separates the head from the esophagal region. Proboscis opening subterminal; mouth a small round opening on ventral surface just back of lateral transverse furrows. The lateral nerves lie outside the muscular layers of the body, and just beneath the basement layer of the integument. The body walls are made up of a very thick outer epithelium with abundant glands, a basement layer, a circular muscular layer, and a longitudinal muscular layer in the order named from without inwards. In addition to these there is, in the esophagal region, an inner circular muscular layer which often forms a dorsal, and sometimes a ventral crossing with the fibers of the outer circular muscular layer.

Proboscis sheath usually not more than ⅓ the length of body. Proboscis small and short. Ocelli wanting. Cerebral sense organs usually represented simply by a pair of sensory pits in the epithelium, although some species (cf. *C. speciosa*) possess a pair of well-developed sense organs with ciliated canal, ganglion cells and glands. A pair of peculiar lateral sense organs is usually situated well back in the esophagal region. Some of the species show elaborate markings of fine white lines on a brownish body, others are homogeneous in color. Most species are colored in some shade of brown or red; some are bright vermilion.

1. CARINELLA SPECIOSA sp. nov.

Pl. III, fig. 6; Pl. IX, figs. 1-3; Pl. X, figs. 1, 2.

Body large, very long, flattened below, rounded above, and remarkably soft and pliable. This beautiful Nemertean closely resembles *C.*

polymorpha in external appearance, but is more brightly colored, and shows conspicuous peculiarities in its internal anatomy. The body is even softer than that of *C. polymorpha*, and more distensible; and the species is easily distinguished by the presence of enormously developed cephalic glands, by having very highly specialized and sharply defined cerebral sense organs (with ciliated canal, lined with glandular and sensory cells), by the peculiarities in the nephridia, and by many other details of structure.

Head rounded in front, broader than parts immediately following, from which it is marked off by lateral, transverse furrows. Proboscis opening and mouth as in other species of the genus. Body variable in thickness in its different portions according to state of contraction of the particular part, but usually flattened below and rounded above, with well-rounded lateral faces; posterior portion of body much more slender than anterior.

The worms are very sluggish. When coiled together the turns of the body are irregular and angular.

Color.—This is the most brilliantly colored and unquestionably the most striking Nemertean encountered on the expedition. The color of the whole body was a deep, rich vermilion, becoming somewhat paler and more yellowish towards the posterior end. In formalin or alcohol the natural color quickly disappears, although a characteristic marking still remains. This feature is peculiar to *C. polymorpha* as well. About 25 to 40 mm. back from the tip of the head (in a large specimen) is a broad band of dark brown color reaching entirely around the body. This band is commonly 10 to 30 mm. in width, is very sharply marked off anteriorly, but fades out gradually behind. All the rest of the body, both in front and behind, is yellowish or grayish. This marking remains after imbedding in paraffin, and even after sectioning and staining in hæmatoxylin there is a sharp line of distinction at the anterior end of the dark band. A single section, cut obliquely, shows the line of demarkation perfectly. The difference lies wholly in the integument and does not affect any of the layers beneath. In the integument the dark band is characterized not only by the presence of an abundance of minute pigment granules, but by a decided change in the staining qualities of the closely packed gland cells.

Size.—The body is very long, one specimen measuring—when suspended by its middle portion, and therefore well extended—fully three meters in length, and about 5 mm. in width. Most specimens, however, were not more than ¼ as long.

The epithelium of the body is very thick, and filled with closely packed gland cells. The two circular muscular layers in the esophagal region show almost no indication of a mutual crossing of fibers either above or below, although, as indicated in PL. IX, fig. 3, a few fibers of connective tissue and fine nerve fibers pass at intervals from the region of the median dorsal nerve to the internal circular muscles.

Proboscis.—Attached to tissues of head just opposite the mouth, and therefore a considerable distance back of the brain commisures. Its posterior attachment is in the region of the efferent nephridial ducts. The muscular layers are as in other species of the genus. Two large nerves enter the latero-ventral portion of the proboscis at its attachment, and pass backwards on opposite sides just internal to the circular muscular layer.

The *proboscis sheath* shows a homogeneous basement layer beneath its internal lining of flattened epithelium. The musculature consists wholly of circular fibers, except that there is a distinct layer of longitudinal muscles between the circular muscles of the proboscis sheath and the epithelium of the esophagus. Lying on the muscles of the proboscis sheath is a small median dorsal nerve which runs parallel with the median nerve outside the circular body-muscles and corresponds to the inner median nerve of other species.

The esophagus is provided with a pair of nerves continuous with the unusually large buccal nerves. The cerebral ganglia are situated wide apart, as in other species. The anterior portion of the head receives a considerable number of remarkably large nerves (PL. IX, fig. 1).

Cerebral sense organs.—These organs deserve special attention because of their high degree of development. They are each provided with a narrow but distinct canal leading outward to the lateral surface of the integument. The sense organs lie immediately external to the dorsal ganglia, from which they are separated only by a few fibers of connective tissue which here represent the integumental basement membrane (PL. X, fig. 2). In size, position and structure these organs are closely similar to those of *C. annulata*, as figured by Bürger.[1] Each consists of a large, rounded mass of nerve cells and connective tissue surrounding a narrow, central canal lined with ciliated and specialized sensory epithelium (PL. IX, fig. 2). Peripherally there is an abundance of peculiar glandular cells, and the whole is separated from the surrounding integumental cells by a thin

[1] Fauna und Flora des Golfes von Neapel, Monogr. 22, PL. XII, fig. 5.

sheath of connective tissue. The central canal leads ventrally and outwards to open through the epithelium of the lateral margin of the head. The sense organs are innervated by several large nerves from the adjacent dorsal ganglion (Pl. x, fig. 2).

Cephalic glands.—Enormously developed, making up a large portion of tissues of snout (Pl. ix, fig. 1). These glands are closely packed throughout the tissues internal to the integument, and form thick layers around the cephalic blood lacunæ and the rhynchodæum. Nearer the brain region they become more scattered, and disappear just in front of the ganglia, those about the rhynchodæum reaching back a little farther than those situated external to the blood lacunæ. The secretion from the glands stains most intensely with hæmatoxylin. Most of the anterior glands pour out their secretion on the tip of the snout; those farther back open along the whole circumference of the body, but most abundantly near the lateral margins (Pl. ix, fig. 1). Still farther back all the glands open laterally.

Nephridia.—Situated mainly in, and a little behind, middle third of esophagal region. There is a single large longitudinal canal on each side, lying in close contact with the dorsal walls of the large, lateral blood lacunæ (Pl. ix, fig. 3). The nephridial canals reach forward about as far as the anterior end of the broad band mentioned above as becoming darkly colored in alcohol. Near its posterior end each canal exhibits a peculiar relation with the outer integument. At several points in each canal the dorsal wall of the canal becomes discontinued and the inner ends of the integumental cells reach inward into the lumen of the canal (Pl. x, fig. 1). Sometimes this infolding of the integumental cells occupies a large part of the lumen of the nephridial canal. Superficially these areas always show one or more openings in the outer layers of the integument, but such openings do not penetrate the nephridial canal. At the posterior end of each nephridial canal there is one, or sometimes two, efferent ducts (Pl. ix, fig. 3) which lead to the dorso-lateral surface of the body, as in other species.

Habitat.—The species was found at Hot Springs (near Sitka), Virgin Bay in Prince William Sound, and at Dutch Harbor, Unalaska.[1] Individuals were occasionally seen crawling about on the bottom beneath the water, and in such instances were extremely conspicuous, because of their large size and brilliant vermilion color. They were more commonly found under stones near low-water mark, but were nowhere abundant.

[1] Collected also by Mr. Shearer at Vancouver Island, B. C.

2. CARINELLA DINEMA sp. nov.

Pl. 1, figs. 2, 3.

This species somewhat closely resembles *C. superba* in general color of body and the thread-like markings thereon. It differs from this and allied species in many details, and especially in having *two* lateral longitudinal white lines on each side—hence the specific name.

Body long and slender, largest in esophagal region, rounded anteriorly, somewhat flattened on ventral surface posteriorly. Head broad, flat, often emarginate in front; lateral, transverse furrows back of head deep and conspicuous. Proboscis-pore subterminal. Mouth rather large for the genus, elongated and situated slightly in front of second white ring.

Color.—General color dark brown with a more or less pronounced yellowish tone, becoming more nearly yellow posteriorly. The markings of fine longitudinal and transverse white lines on this ground color are very characteristic and stable. Five parallel, longitudinal lines run nearly the whole of the length of the body, and there are a great number of transverse lines. Of the five longitudinal lines, one lies in the middle of the dorsal surface and extends from the most anterior transverse ring to the posterior end of the body. The other four lie symmetrically on the sides—two almost on the lateral margins; the other two much nearer the ventral surface. Seen in section, the distance between the dorsal median line and the upper of the two lateral lines on each side is 90°. Two lateral lines on either side are separated by about 45°, while the remaining 90° lies between the two lower lateral lines. All the four lateral lines extend from the second transverse line to about ¾ the distance towards the posterior end of the body. Here they become interrupted, and back of this they are usually indicated only by short segments and scattered dots, though their course may be traced nearly to the end of the body. The five longitudinal lines are all very fine and sometimes consist of rows of fine white dots closely placed together. In addition to these five longitudinal lines some individuals show an indication of a median ventral longitudinal line in the form of a row of isolated fine white dots extending from behind the mouth nearly to the fifth white ring.

The first transverse white marking lies near the tip of the snout. It is somewhat wavy in outline and does not reach below the lateral margin. The second white marking is broader than the first, but is likewise limited to the dorsal surface. It is indicated, however, on the lateral surface by two narrow and inconspicuous spots. The third

marking is not represented on the lateral surfaces, but is sharp on the dorsal surface, and is indicated on the ventral surface by a few scattered white dots. The fourth marking is very sharp and extends as a ring completely around the body. The fifth is broader than any of the other rings. The sixth is usually merely indicated by a series of fine dots. Posterior to the sixth, there are commonly as many as 150 more or less distinct and perfect rings, arranged at fairly regular intervals throughout the length of the body. They are much more conspicuous on the dorsal than on the ventral surface. In fact a large number of them are interrupted on the ventral surface and represented only by isolated dots. When the rings are well developed each consists of two very fine white rings lying side by side, with a fine brown ring between them. Over the greater portion of the body are alternating wider and narrower white rings, or double and single rings, but there are always exceptions to the regularity of arrangement. The white lines, both longitudinal and transverse, appear as if formed by a coating of fine white particles on the surface of the body.

The region of the proboscis-pore is very pale. Extending outward and backward on each side from a point just above the proboscis-pore is a shallow, horizontal groove. Each of the grooves is marked by a black line, and each extends backward as far as the first transverse white line. They do not quite meet in front however. The borders of the mouth are pale in color. The sides of the brain region are dark reddish.

In alcohol the body is grayish as far back as the fourth white ring. Here it abruptly changes to black, which fades into dark brown throughout the remainder of the body. The markings are well preserved.

The '*side organs*' are indicated as a pair of rounded pits lying just anterior to the fifth white ring and immediately below the dorsal of the two white, lateral, longitudinal lines on each side.

Habitat.—This species was found on the piles of a wharf at Victoria, B. C., and was also found among hydroids, etc. at Sitka. The worms were from 300 to 500 mm. long in extension, with a diameter of about 2 to 3 mm. They inhabited grayish, fragile, parchment-like tubes, which were commonly much twisted and coiled. But few specimens were met with.

3. CARINELLA CAPISTRATA sp. nov.

Pl. 1, fig. 1.

This, like the preceding species, resembles *C. superba* (Kölliker) Bürger somewhat closely in color and general appearance. A careful

examination of a number of individuals, however, shows that the markings on the body present such constant differences that the two species must be considered distinct. *C. capistrata* is likewise different from any of the other related and described species. It may at once be distinguished from *C. superba* by lacking all indications of a median ventral white line. The markings on the head and the arrangement of the anterior transverse white lines distinguish it easily from *C. annulata* and *C. nothus* Bürger; from *C. dinema* it may be separated by the presence of but one pair of lateral white lines, instead of the two pairs found in *C. dinema*.

C. capistrata is a very large species, attaining a length of more than a meter with a diameter of about 5 mm. near the anterior end, and of 2 to 3 mm. farther back. The worms are therefore extremely long and slender, and the diameter in the esophagal region is twice as great as it is farther back. The body is strongly rounded on the dorsal surface throughout its whole length; the posterior end is very slender and easily broken.

Head broad, flattened dorso-ventrally, rounded or emarginate in front, sharply marked off from succeeding portions by a pair of deep, lateral, transverse constrictions, or furrows. Proboscis-pore minute, subterminal, bounded on each side by a shallow horizontal groove. Mouth small, slightly elongated, situated immediately behind the lateral furrows.

Color.—General color of body rich, deep brown, sometimes varying towards grayish black; posteriorly becoming lighter, and of a yellowish brown. On this ground color is a series of conspicuous, but fine, longitudinal and transverse white lines (PL. 1, fig. 1). The longitudinal lines are three in number and parallel—one in the middle of the dorsal surface, the others just ventral to the lateral margins. The dorsal line extends without interruption from near the tip of the head to the posterior end of the body. The lateral lines, on the other hand, are much broken up in the anterior portions of the body, and in the esophagal region are only indicated at intervals, though their course can be followed nearly to the head; throughout all the rest of the length of the body they are sharp and distinct.

The transverse white lines, excepting the most anterior one, completely encircle the body. This first transverse line appears as a sharp V-shaped marking a little back of the head. Its angle is directed backward and its extremities reach but little below the lateral margins. The median dorsal line passes through the angle of this V-shaped marking, and at the point of intersection the white area is somewhat

enlarged to form a small oval spot. The second transverse marking is situated some 20 to 30 mm. (in large individuals) from the first, and completely encircles the body. This ring is always sharp and conspicuous, and in alcoholic specimens is still more distinct in that it separates a paler anterior portion from the much darker succeeding parts. The third transverse ring is also complete, and is commonly separated from the second by about half the distance that this is separated from the first. The fourth and fifth rings are sometimes interrupted below, but are more usually complete, and are much nearer together than the second and third. Back of the fourth or fifth ring we find a regular succession of complete rings to the end of the body. It is common to find as many as 200 such rings arranged at fairly regular intervals and separated from each other, when the worm is contracted, by an average distance of about the diameter of the body. Some of the rings are wider than others, but nearly all are as narrow as fine threads; a few are more or less interrupted.

The anterior and lateral margins of the head are bordered by a narrow band of light color, as in several other species, but this is mainly visible from the ventral surface.

The '*side organs*' are indicated by a pair of small pits situated in the third transverse white ring and just dorsal to the position of the lateral lines. Their position is about the same, therefore, as in *C. superba*.

In alcoholic specimens the arrangement of the white longitudinal and circular lines is still distinguishable, except near the anterior end of the body, which, back to the second transverse marking (first complete ring), is pale or grayish brown. Back of this the color abruptly changes to very dark brown or black, which reaches posteriorly 50 to 75 mm. (in large individuals) and then gradually fades out into light brown, which continues to the end of the body. The color is usually paler on the ventral than on the dorsal surface.

Habitat.—This species was found in abundance under stones near low-water mark at Orca and Virgin Bay in Prince William Sound, but was not met with elsewhere. The worms lived in long, fragile, grayish, paper-like tubes of about the same diameter as the body. These tubes were usually twisted about horizontally beneath the stones under which the animals live. They were also frequently occupied by a species of polychætous annelid (*Nereis*), which was often associated with the Nemertean. The worms are sluggish in their movements, and break up posteriorly if roughly handled.

CEPHALOTHRIX Oersted.

Entwurf der Plattwürmer, Kopenhagen, 1844.

This genus includes very long, slender, filiform species which show a tendency to coil in a close spiral. Brain situated well behind tip of snout; mouth several times as far posteriorly. Head sharply pointed in extension; proboscis-pore on ventral side a little back of its extremity. Inner circular muscular layer very much reduced, or (commonly) entirely absent, the body musculature consisting of a thin outer circular muscular layer and a strong inner longitudinal layer; lateral nerves situated in the longitudinal muscular layer; cerebral sense organs and cephalic furrows wanting. These worms resemble in external appearance some of the slender Nematodes.

4. CEPHALOTHRIX LINEARIS (Rathke) Oersted.

Planaria linearis RATHKE, Skrivter af Naturhist. Selsk. Kjöbenhavn, v, p. 84, 1799.
Cephalothrix linearis OERSTED, Entwurf der Plattwürmer, p. 82, Kopenhagen, 1844.

A very slender thread-like species capable of great extension and contraction. Individuals may be extended till they resemble a very fine thread, but when disturbed commonly coil themselves into a closely wound spiral. Body commonly rather thicker in the middle and tapering toward both extremities. Head very long, acutely pointed when extended. Proboscis-pore situated ventrally, some little distance back from tip of snout. Mouth very far back; commonly distant from tip of snout 10 to 12 times the diameter of body; or it is perhaps 4 to 5 times as far back as is the brain.

The length is subject to the greatest variation. Alaska specimens commonly extended themselves 3 to 6 inches or more, but could contract to a small fraction of this length.

Ocelli.—Wanting in adults although the embryos are provided with a single pair soon after leaving the egg.

Color.—Usually pale yellow throughout, but some specimens had a distinct reddish tinge, and some were gray, greenish, or pale green. A median paler line, due to the proboscis sheath, appears on the dorsal surface in the esophagal region.

Habitat.—The species is very common well up toward high-water mark under stones in muddy places, among decaying mussels, etc. The worms were commonly found where the mud was black, slimy, and very foul. Scores of specimens were sometimes found under a single stone. They were often associated with slender red-

dish Nematodes. Very abundant at New Metlakahtla, Glacier Bay, Sitka, Orca and at other places. The species is also common on the coast of New England, and is likewise found along the shores of northern Europe and in the Mediterranean.

CARINOMA Oudemans.

Circulatory and Nephridial Apparatus of the Nemertea, Quart. Journ. Micr. Sci., xxv, Suppl., pp. 1–80, 1885.

Body usually slender, often thickened and rounded anteriorly, flattened in intestinal region; head usually wider than parts immediately following; mouth situated immediately behind the brain; proboscis pore subterminal. Lateral slits, cephalic groves, and cerebral sense organs wanting. Intestine with paired, lateral diverticula.

Body musculature composed of two muscular layers throughout length of body, and of localized supplementary layers. These consist of a thick internal longitudinal layer and a thin external circular layer, but in the esophagal region a second circular layer lies internal to the longitudinal muscles, and just in front of the nephridial region becomes enormously thickened. In the anterior portions of the esophagal region a double set of distinct diagonal muscles lies just internal to the outer circular muscular layer.

The lateral nerves are situated within the longitudinal muscular layer.

In the anterior portions of the esophagal region are three pairs of longitudinal blood vessels, of which one pair represents the main lateral vessels and lies beside the esophagus. a second pair lies beside the proboscis sheath, and the third pair is situated internal to the ventral wall of the proboscis sheath and projects freely into the rhynchocœl.

5. CARINOMA GRIFFINI sp. nov.

Two[1] species of this interesting genus are already known from other parts of the world — *C. armandi* Oudemans, which is found

[1] Miss C. B. Thompson has very recently added a third species, *C. tremaphoros* (Zool. Anz., Vol. xxiii, No. 631, pp. 627–630, Dec., 1900, from a single specimen collected at Woods Hole, Mass. I have found this species rather abundantly in a large pond at Falmouth, Mass., connected with Vineyard Sound by a very narrow outlet, and consequently but little affected by the tides. The species must be unusually hardy, for the worms lived just on the edge of the pond in sand much blackened by decaying organic matter. They have moreover to endure great changes in the salinity of the water due to irregularity in rainfall and evaporation. Further notes in regard to the anatomy of this species will be published later, together with colored figures of the living worms.

occasionally on the shores of England, and *C. patagonica* Bürger, of which a single specimen has been collected from the Straits of Magellan.

This new species was found by Mr. Creswell Shearer at Albert Head on Vancouver Island. It attains a length of upwards of 600 mm. and a diameter of 3–5 mm. Anterior portions of body cylindrical; intestinal region much flattened. Head broader than neck, and pointed, rounded or emarginate in front according to the state of contraction (figs. 1 and 2).

No ocelli were found.

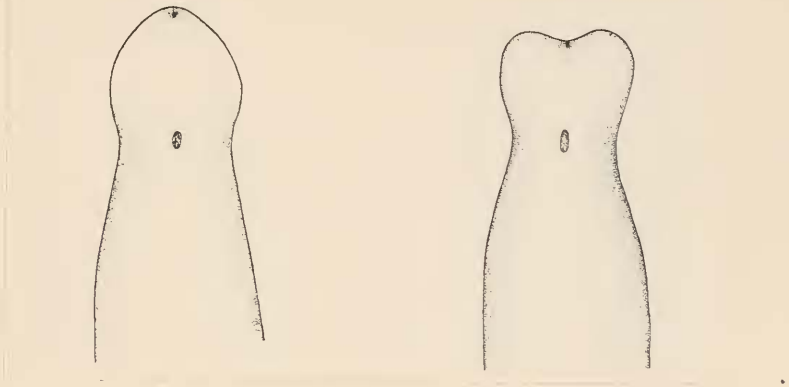

FIG. 1. FIG. 2.

FIGS. 1 and 2. *Carinoma griffini* sp. nov. Anterior part of ventral surface. 1. Head extended and pointed. 2. Head contracted and emarginate. ×8.

Color.—General color milk-white anteriorly, with brownish mottlings farther back; intestinal lobes darker. After preservation the color is completely lost, and the body becomes nearly cylindrical throughout.

Body walls.—In internal organization this species agrees closely with the descriptions which Bürger gives of *C. armandi*[1] and of *C. patagonica*,[2] but presents a number of peculiarities, which may be stated briefly as follows: Outer integument divided into a superficial and a deeper layer of epithelial cells, separated by a network of connective tissue fibers. Basement layer in esophagal region about equal in thickness to the integument itself, but is much thinner farther back. Beneath basement layer in esophagal region is a loose sheet of circular muscles, and beneath this a double set of diagonal muscular fibers.

[1] Fauna u. Flora des Golfes von Neapel, Monogr. 22, Nemertinen, 1895.
[2] Zeits. f. wiss. Zool., Vol. LXI, pp. 19–20, pl. 3, figs. 1–9, 1896.

The main longitudinal muscular layer in most regions of the body equals in thickness that of all the other muscular layers combined. The lateral nerve cords lie imbedded in this layer. Internal to the longitudinal muscles lies a small amount of gelatinous tissue or parenchyma of the body cavity. The inner circular muscular layer extends from the mouth to the posterior end of the esophagal region. Its fibers are continuous with those of the proboscis sheath. Anteriorly, it is even thinner than the outer circular muscular layer, but towards the posterior end of the esophagal region it increases so greatly in massiveness that for a short distance it exceeds in thickness the other muscular layers combined. Having reached its maximum development (near the efferent nephridial ducts), it suddenly disappears entirely, its dorsal portion remaining for a few sections as a semicircular arch above the proboscis sheath.

Proboscis sheath.—This organ is more strongly developed than in the other species of the genus, and possesses a single muscular layer composed of circular fibers interlaced with longitudinal fibers in small groups.

Proboscis.—The anterior end of the proboscis is attached to the tistues of the head at about the middle of the brain region. It walls consist of a thin outer fibrous layer, on which rest the superficial flattened epithelial cells bathed in the fluid of the rhynchocœl. Beneath is the thick layer of longitudinal muscles comprising nearly the whole of the musculature. Internal to these are a few scattered circular fibers, then a thin basement membrane, and, finally, the internal layer of columnar epithelial cells. This inner epithelium is composed of a simple layer of very long and closely pressed cells, a portion of which contain rod-like masses of secretion. Their nuclei are closely packed together peripherally, and comprise several layers as is usual in much crowded columnar cells.

A pair of rather large nerves extend throughout the length of the proboscis just internal to the circular muscular layer. These nerves originate from the ventral commissure of the brain very much as in *Carinella*. They arise from the anterior border of the commissure near its origin from the ganglia, and pass dorsally to the point where the proboscis is attached to the tissues of the head. They then enter the proboscis, and take up lateral positions in its walls corresponding to those of the lateral nerves in the walls of the body.

Nephridia.—The condition of the nephridial system is in many respects intermediate between that of *C. patagonica* and *C. armandi*, the mass of tubules constituting the so-called nephridial glands not ex-

tending into the cavity of the blood space nearly so far as in the former, but are much more profusely branched than in the latter species. The single pair of efferent ducts lies in the same region as the posterior ends of the series of 'nephridial glands.' Posteriorly to this point a single unbranched duct of large size runs backward on each side for a considerable distance, and then bends sharply and runs forward to the efferent duct, always lying close beside, and just external to that limb of the duct which is passing backward. The efferent ducts open on the dorso-lateral surfaces of the body at the posterior end of the enormously thickened internal circular muscular layer.

The blood vascular system, brain, buccal nerves, lateral nerves, and dorsal and ventral median nerves are much as in *C. patagonica*.

Specimens collected in August had just discharged their sexual products. In one individual a very few genital sacks still retained their mature ova.

EMPLECTONEMA Stimpson.

Emplectonema STIMPSON, Proc. Philadelphia Acad., p. 163, 1857.
Nemertes MCINTOSH, British Annelids, Part I, Nemerteans, Ray Society, 1872–1873.
Eunemertes VAILLANT, Hist. Nat. des Annelés, Tome 3, Paris, 1890.

Body very long and slender, varying greatly in thickness according to state of contraction, but most commonly considerably flattened; often sharply bent and folded into an irregular mass; integument provided with an unusual abundance of mucous secretion; proboscis and mouth opening together on subterminal portion of snout; proboscis sheath limited to anterior third of body; proboscis slender and very short, often not more than 1/6 the length of body; a large number of minute eyes usually present; cerebral sense organs situated well in front of brain, and usually very small. The species are of sluggish movement, and many of them are found very near high water mark among mussels, barnacles, rockweeds, etc.

Of the genus *Emplectonema* two species, of which only one (*E. gracile*) had previously been described, were found on the Harriman expedition.

6. EMPLECTONEMA GRACILE (Johnston) Verrill.

PL. VIII, fig. 3.

Nemertes gracilis JOHNSTON, Mag. Zool. and Bot. London, vol. 1, 1837–38.
Emplectonema viride STIMPSON, Proc. Philadelphia Acad., p. 163, 1857.
Eunemertes gracilis VAILLANT, Hist. Nat. des Annelés, Tome 3. Paris, 1890.
Eunemertes gracilis BÜRGER, Fauna u. Flora des Golfes von Neapel, Monogr. 22, Nemertinen, p. 543, 1895.
Emplectonema gracilis VERRILL, Trans. Connecticut Acad., VIII, p. 413, 1892; IX, p. 146, 1895.

Body very long and slender, somewhat flattened below, irregular and ungraceful in form, and sluggish in movement. Head slightly broader than rest of body; snout blunt, posterior extremity of body tapering gradually to a point.

The common opening of the mouth and proboscis lies ventrally, a little back from the tip of the snout. The cerebral sense organs lie far in front of the brain, and each communicates with the exterior by a canal which opens on the ventro-lateral margin near the tip of the snout.

Color.—Uniform dark green above and nearly white below; sometimes grayish or yellowish green above, and very pale yellowish green below. The color of Alaska specimens is as a rule paler and more grayish green than in Mediterranean specimens. The head is bordered with a narrow band of white, uniform with that of the lower surface. Back of the head is an inconspicuous transverse band paler than the rest of the dorsal surface. The pigment resides wholly in the integument, the muscular layers and other organs of the body being practically colorless.

Ocelli.—The eyes (fig. 3) are characteristically arranged in two groups on each side of the head. The anterior group on each side usually consists of 8 to 10 pigment-cups arranged in a single row near the antero-lateral border of the head. These lie deeply imbedded in the tissues of the head, and are much more conspicuous from the ventral surface owing to the presence of much pigment on the dorsal surface above them in ordinary states of contraction. Each posterior group lies nearly above the brain and consists of 10 to 20 ocelli in an irregular cluster. The eyes of the posterior groups are visible only from the dorsal surface, and are smaller in size than those of the anterior groups. The integument may be scraped off so as to expose the eyes clearly.

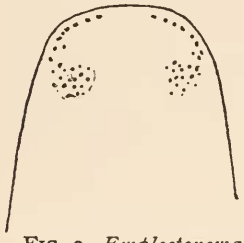

FIG. 3. *Emplectonema gracile.* Dorsal view of head to show arrangement of ocelli. × 12.

Proboscis.—The stylet apparatus is especially characteristic of the species. The basis of the central stylet is very long and slender, and is twice to three times as long as the stylet itself. The posterior end is sharply swollen into a flattened knob (PL. VIII, fig. 3). In front of the knob the basis decreases in diameter evenly towards the anterior end, except for a slight constriction which occurs at about ⅓ the distance from the posterior end. The anterior portion is slightly

curved. The central stylet is slender, extremely sharply pointed, and gracefully curved like a sabre or scythe. There are two accessory stylet pouches, and each commonly contains 5 to 7 slender stylets curved like the central one, and of approximately the same size (PL. VIII, fig. 3).

Habitat.—This species was found in the greatest abundance at nearly all the collecting stations between Victoria, B. C., and Dutch Harbor, Unalaska. It occurred everywhere along the shore, and was most plentiful near high water mark, crawling over the thick growth of mussels and seaweeds. Often a number of individuals were found coiled together in a single slimy mass, and on being disturbed would crawl apart and move sluggishly about, but usually made no effort at concealment. Similar masses were met with under stones in very muddy localities, and often where the water was very brackish. This is probably the most abundant species of Nemertean on the Alaska coast, and is found nearer high water mark and in more brackish water than almost any other species.

The species has previously been recorded from the coasts of England, the northern shores of Germany and France, the Mediterranean, and Madeira. It was also found by Stimpson under stones between tides in San Francisco harbor and described as *E. viride.*

An excellent and detailed account of the minute anatomy of this species is given in Bürger's Monograph of the Nemerteans of the Gulf of Naples.[1]

Specimens collected in Alaska in June and July were filled with nearly mature genital products, in closely packed, but irregularly arranged pouches. The genital glands were often noticeable from the exterior because of their pale color.

7. EMPLECTONEMA BÜRGERI sp. nov.

PL. II, figs. 1, 2; PL. VIII, fig. 1; PL. XII, fig. 3.

Body long, flattened both above and below, ribbon-like, as thick near the edges as in the median line; head usually narrower than the parts immediately following; posterior extremity slender. The rhynchodæum opens on the ventral side of the tip of the snout; a pair of shallow lateral slits occur just in front of the mouth.

The worms attain a length of more than a meter, and are 5 mm. or more in width. Like other species of the genus the integument is furnished with a vast amount of mucus.

[1] Fauna u. Flora des Golfes von Neapel. Monogr. 22, 1895.

Color.—The color varies considerably, as will be seen from the two color varieties on PL. II, figs. 1 and 2. The commonest form is dark velvety-brown above, with a paler median line, much paler and slightly yellowish in front, and flesh-colored or creamy white below. Other individuals have the whole dorsal and lateral surfaces of a mottled reddish brown color, with a tinge of purple, while the ventral surface is pale yellow or flesh-colored. Sometimes the head is nearly colorless. The dorsal surface almost always has an appearance suggestive of velvet. This color is superficial, and is easily removed by rough handling.

Proboscis.—Proboscis small, very short and delicate, sometimes scarcely more than $\frac{1}{10}$ the length of body. The proboscis sheath reaches well toward middle of body, but is very small toward its posterior end; in esophagal region it is well developed, with a thick outer layer of circular muscles, and a thin, inner, longitudinal muscular layer. The rhynchodæum passes backward a considerable distance before the intestinal canal is separated from the proboscis opening.

The armature of the proboscis consists of a weak central stylet, and a pair of pouches of accessory stylets (PL. VIII, fig. 1). The basis of the central stylet is rather slender in front, slightly contracted near its posterior third, from which point it swells out suddenly into a large spherical bulb. The central stylet is slightly shorter than its basis. Each of the reserve pouches usually contains three small stylets with swollen bases. The posterior chamber of the proboscis is narrow. The proboscis is provided with 11 distinct nerves.

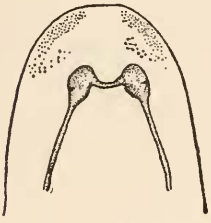

FIG. 4. *Emplectonema bürgeri.* Dorsal view of head to show arrangement of ocelli. ×8.

Ocelli.—The ocelli are very numerous. On each side of the tip of the snout is an elongated cluster of minute eyes, all situated near the dorsal surface, and without regularity of arrangement. Their number is commonly 60 or more on each side (fig. 4). Back of these are a few other eyes, likewise very minute, situated deep in the tissues of the body, and seen only with difficulty. They are scattered irregularly from near the lateral borders in front of the brain inward towards the median line (fig. 4).

Cerebral sense organs.—Unusually large. They lie lateral to the rhynchodæum, and slightly in front of the brain. The ducts by which they communicate with the exterior pass forward to open latero-ventrally.

The pair of *blood lacunæ* in the head are rather small, and pass backward in numerous branches. The dorsal vessel in the proboscis sheath has several communications with the lateral vessels in the esophagal region.

In the region of the brain a great abundance of *sub-muscular glands* appears, occupying the whole lateral aspects of the body and reaching far backward. As usual, they are multicellular. Their ducts pierce the muscles and integument of the body wall to open on the sides of the body in enormous numbers. Farther back they are restricted to a narrow region in each section just lateral to the nerve cords, and open somewhat ventrally from the lateral edge. They continue in diminished numbers, but of large size, backward beyond the point where the esophagus opens into the intestine (Pl. XII, fig. 3).

Alimentary canal.—A pair of remarkably narrow intestinal cæca reach forward well toward the brain. Their diameter for a long distance back is insignificant compared with that of the esophagus. They occupy positions ventro-laterally to the proboscis sheath and above the esophagus. Occasional pouches are sent off laterally into the tissues above the nerve cords. Farther back they become larger and extend laterally beyond the ventrally placed nerve cords. Towards the middle of the esophagal region the pouches become paired with considerable regularity. A well developed network of muscular fibers and connective tissue reaches between the pouches from the muscular layer above to that below the alimentary canal. The pouches lie close together still farther back, and near the posterior end of the esophagal region extend on each side below the esophagus and open together from opposite sides. The two intestinal cæca are thus connected together. From this point backward the esophagus decreases rapidly in size, the cæcum becomes large and is divided into numerous pouches by fibrous partitions extending between the muscular layers above and below, and eventually the esophagus opens into the intestine by a narrow slit in its dorsal wall (Pl. XII, fig. 3).

Reproductive organs.—Far in front of the opening of the esophagus into the intestine the reproductive glands make their first appearance. The anterior pouches are scattered, and lie above the intestinal cæca well towards the sides of the body. These open directly on the dorso-lateral surfaces. Farther back similar ones appear below the intestinal canal, and these open ventrally (Pl. XII, fig. 3). In the intestinal region the glands are very numerous and are scattered just inside the muscular layers all over the body—dorsally, ventrally and laterally. As many as 20 to 30 glands in a male are met with in a single section.

Their ducts lead directly to the surface of the body, and consequently open at any point instead of in certain definite regions as in many species.

Both lateral nerves and blood vessels join above the hind gut as in most other Nemerteans—the union of the nerves lying ventral to that of the blood vessels.

This species is named in honor of Prof. Dr. Otto Bürger, of Göttingen, whose monograph on the Nemerteans of the Gulf of Naples forms by far the most important contribution which has yet appeared relating to this group of worms.

Habitat.—Several individuals are often found knotted together in a seemingly inextricable mass. The body lies coiled in a mass, and is bent and folded in sharp angles.

The species was found under mussels on rocks between tides at Glacier Bay (W. E. Ritter) and at Sitka.

ZYGONEMERTES Montgomery.

Zool. Jahrb., x, p. 2, 1897.

A species of Nemertean was found at Sitka which agrees very closely with Verrill's description of *Amphiporus virescens*.[1] The detailed anatomical description given by Montgomery,[2] however, shows at once that the Alaska Nemertean is a distinct species. Montgomery has created a new genus for *A. virescens* Verrill based on its anatomical peculiarities, especially the structure of the proboscis and proboscis sheath. This genus he named *Zygonemertes*, with the following characters as its chief peculiarities:

(1) The proboscis sheath reaches to the end of the body, while (2) the thickened proboscis is but half as long; (3) basis of central stylet large, elongated; flattened or slightly concave posteriorly; (4) central stylet massive, not half the length of its basis: (5) ten or eleven proboscidial nerves; (6) body contractile, shape like *Amphiporus*, not as elongate as in *Emplectonema;* (7) ocelli numerous and small, extending along the nerve cords posterior to the brain.

While I am of the opinion that these characters are mainly of specific rather than of generic rank, yet I am convinced that because of the large number of species already in the genus *Amphiporus* the establishment of this new genus will be of great practical convenience. The most tangible characters of the group are: (1) the eyes extend posteriorly beyond the brain along the lateral nerve cords, and (2) the

[1] Trans. Connecticut Acad., VIII, p. 20, 1892.

[2] Zool. Jahrb., X, p. 2 to 4, 12, 1897.

basis of the central stylet is massive and has a concave or a truncated posterior end, while the stylet itself is comparatively weak. Of course the number of nerves in the proboscis cannot be considered a generic character. There are two Alaska species, then, which may be placed in the genus—*Z. thalassina*, which is closely allied to the type species, and *Z. albida*, which is a minute, white form.

8. ZYGONEMERTES THALASSINA sp. nov.

Pl. II, fig. 5; Pl. VII, fig. 1; Pl. XIII, fig. 2.

Zygonemertes thalassina differs from *Z. virescens* chiefly in the following peculiarities: Color of former species much darker; eyes more numerous; shape of basis and central stylet of proboscis different; usually 5 stubby stylets in each lateral pouch, and 12 nerves in proboscis. There are minor differences in other anatomical details.

Zygonemertes thalassina has a slender, somewhat flattened body; head broad, not sharply marked off from body; one or two pairs of very inconspicuous oblique furrows on sides of head. The worms are active, and are restless in confinement.

Ocelli.—Ocelli very numerous; arranged in two or three longitudinal rows along sides of head, and extending backward along lateral nerve cords far behind brain. They are smaller posteriorly than in front and are more widely scattered. In front of the brain there are sometimes 40 or more ocelli arranged in two or three irregular rows (fig. 5) which follow the general outline of the lateral margin of the head. Immediately in front of the brain about a half dozen much smaller eyes are seen, and lateral to the brain are commonly 10 to 12 ocelli of moderate size. Behind these are usually 8 to 15 small ocelli scattered along the nerve cords at irregular intervals. These commonly reach nearly as far behind the brain as the distance from the brain to the tip of the snout in moderate extension. In sections (Pl. XIII, fig. 2) they are found to lie quite internal to the body musculature and almost directly upon the lateral nerves.

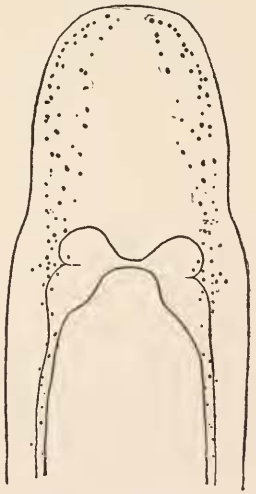

Fig. 5. *Zygonemertes thalassina*. Dorsal view of head showing outline of brain and lateral nerves, and arrangement of ocelli. × 12.

Size and color.—The specimens obtained were from 30 to 60 mm.

in length in moderate extension, and ratner slender. The color was olive-green both above and below. A coating of brown particles was sometimes scattered over the dorsal surface. The proboscis is pale.

Proboscis.—The proboscis sheath extends to posterior end of body; the proboscis extends only about half way to posterior extremity. The central stylet is remarkably short and blunt. Its basis (PL. VII, fig. 1) is at least twice, and often three times, as long as the stylet itself, and is massive in proportions. Its diameter is nearly constant throughout its length, although it is narrowed in front and constricted slightly at about three-fourths the distance towards its posterior end. The posterior extremity is sharply truncate or concave and often shows serrated edges (PL. VII, fig. 1). There are two lateral pouches of accessory stylets, and each usually contains five stylets similar in size and shape to the central stylet. The character of these remarkably stubby stylets is shown in PL. VII, figures 1*a* and 1*b*.

The lateral stylet pouches are imbedded in a thickened glandular wreath, yellowish in color, which lies around the circumference of the proboscis in front of the stylet. The mass of muscular tissue surrounding the basis of the central stylet is unusually thickened, and this necessitates an unusually long canal leading from the posterior chamber to the stylet region. In each of the two specimens sectioned the proboscis was provided with 12 nerves.

Cerebral sense organs.—Situated immediately in front of brain, but in the ventral portion of the head. The canals leading to the exterior pass obliquely forward and downward, and open on the antero-ventral surface near the tip of the snout.

Nephridia.—The nephridia extend from a point immediately in front of the brain backward throughout nearly the whole length of the esophagal region. There is a single pair of efferent ducts situated in the region of the brain, and opening to the exterior on the ventro-lateral aspects of the body. In the specimens examined one of these ducts lay as far forward as the ventral commissure of the brain, while the other was situated opposite the posterior end of the ventral brain-lobe.

Montgomery[1] mentions for *Z. virescens* that the superficial epithelium of the body contains numerous yellowish, sickle-shaped bodies situated among the epithelial cells. These also occur in *Z. thalassina*, but here they are of various sizes, and differ greatly in shape. Some are sickle-shaped, others are rod-like or irregular in form, and have every appearance of having been formed in the gland cells of the epithelium.

[1] Zool. Jahrb., x, p. 2, 1897.

Somewhat similar bodies may be found in various other Metanemerteans, notably in *Amphiporus bimaculatus* and *A. leuciodus*. Here too they appear to originate as secretions in the glandular cells of the epithelium.

The lateral nerve cords unite above the posterior end of the alimentary canal as usual.

The tissues of the head in front of the brain contain large numbers of sub-muscular glands which open mainly on the anterior extremity, although a portion of them open directly outwards. These sub-muscular glands do not extend back into the esophagal region as they do in many other species.

The intestinal cæcum is paired from its origin. Its two branches extend forward on each side of the esophagus until they reach nearly to the brain. Here they bend dorsally (pl. xiii, fig. 2) and terminate by abutting closely against the posterior ends of the dorsal brain-lobes.

The ova are large and opaque. They appeared to be fully mature in June.

Habitat.—This species was found only at Sitka, where it was not uncommon among hydroids, broken shells, etc., in clear water.

9. ZYGONEMERTES ALBIDA sp. nov.

pl. iii, fig. 2; pl. viii, fig. 5.

This is a small, moderately slender species, very active in habits. It was met with only at Victoria, B. C., on the piles of a wharf. Sexually mature individuals were not more than 25 mm. in length. It was associated with *Amphiporus leuciodus*, which it somewhat resembles.

Color.—There are no markings on the body, the color being white with a tinge of yellow both above and below.

Ocelli.—This species may be easily recognized from other described forms by the arrangement of the eyes (fig. 6). These are scattered somewhat irregularly on the head in front of the brain, and extend backward as a single row on each side along the lateral nerves for about two-fifths the length of the esophagal region. The ocelli on the head are roughly arranged in two irregular rows on each side. There is an outer row

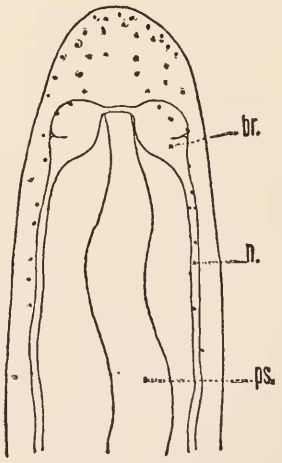

Fig. 6. *Zygonemertes albida*. Outline of anterior portion of body to show arrangement of ocelli. *br*, brain; *n*, lateral nerve; *ps*, proboscis sheath. × 12.

of 9 to 12 eyes near each lateral border of the snout, and another row inside and somewhat posterior to the latter, containing about 6 small ocelli on each side, and of these 3 commonly lie nearly above the brain. Back of the brain 7 to 10 ocelli occur at widely separated intervals above the lateral nerve on each side.

Proboscis.—Proboscis comparatively large; central stylet moderately slender; basis dark, moderately elongated, of nearly uniform diameter throughout, and sharply truncated posteriorly (PL. VIII, fig. 5). Accessory stylet pouches two in number, each commonly containing two or three moderately slender stylets.

Cerebral sense organs.—Large, and situated immediately in front of brain.

The eggs of these worms are few in number, but are fully ⅓ the diameter of the body in size; consequently there can be but a single row on each side. The sexual products are mature in June.

PARANEMERTES gen. nov.

Body of large size, rather stout, usually much rounded in the esophagal region but flattened posteriorly. Head not marked off from body, of variable form, in some states of contraction often emarginate in front. There is commonly a pair of inconspicuous oblique furrows back of head. The nerve cords and blood vessels join on the dorsal side of the posterior end of the intestine.

The mouth opens into the rhynchodæum. The proboscis sheath commonly reaches but little beyond the middle of the body—in *P. peregrina* to ¾ the distance towards the posterior extremity. The proboscis is small (*P. pallida*), of medium size (*P. peregrina*), or large (*P. carnea*). There is a single central stylet in the proboscis, and usually four or more pouches of accessory stylets. Some individuals of *P. peregrina*, however, have but two. Ocelli are numerous and minute. The cerebral sense organs are rather small and lie in front of the brain. Sub-muscular glands are usually well developed.

The species of this new genus show considerable resemblance to those of *Emplectonema* Stimpson. They differ, however, in general shape and appearance of body, never being very long or slender, and individuals do not coil their bodies into a mass as those of *Emplectonema* are so prone to do. The proboscis is much larger and the central stylet is always well developed. The proboscis sheath is also much longer. In many respects the genus resembles *Amphiporus*. The body is much longer, however, and not nearly so contractile, the proboscis is not nearly so large, and the proboscis sheath is not so long.

The armature of the proboscis resembles that in some species of *Amphiporus*.

Paranemertes is represented on the coast of Alaska by at least three species.

10. PARANEMERTES PEREGRINA sp. nov.

PL. II, fig. 6; PL. III, fig. 5; PL. VII, fig. 7.

Body moderately elongated, flattened below, rounded on dorsal surface; anterior portion slightly more slender than middle region; posterior tapering gradually to extremity.

Head very variable in shape, commonly wider than the portion of body immediately following; flattened, sometimes sharply demarcated by lateral constrictions. Tip of snout pointed, rounded, or emarginate according to the state of contraction. On each side of the head is an inconspicuous V-shaped furrow, with the ends pointing obliquely forward above and below. The upper limb of the furrow reaches into the dark color of the dorsal surface, where it is sometimes conspicuous from its light color.

Color.—The color varies considerably as may be seen from a comparison of PL. II, fig. 6, and PL. III, fig. 5, but is commonly homogeneous dark brown, orange brown, or purplish brown above and on the sides, while the ventral surface is opaque white or whitish yellow. In most specimens the dark purple of the dorsal surface encroaches considerably on the ventral surface, shading gradually into whitish or yellowish. Seen from the ventral surface therefore the worms appear dull white or yellowish white, with a wide border of dark purple. Oftentimes the whitish color occupies scarcely more than the median third of the ventral surface. Anteriorly the whitish color covers the whole ventral surface, and on the head it covers also the sides and front. The head is dark purplish brown above, bordered in front and laterally by the light color of the ventral surface. At the posterior border of the head is a small angular spot on each side corresponding in color with that of the ventral surface. Behind the head is a narrow, V-shaped, dorsal marking, usually of lighter color, with its ends pointing forward and outward. In paler individuals the pinkish color of the brain lobes can be distinguished. The natural color of the body is well retained in formalin or alcohol.

Size.—Individuals of all sizes from 20 to 400 mm. were met with, but the most common size was about 150 mm. in extension. The width was commonly about 5 mm.

Ocelli.—Numerous minute eyes are arranged in two groups on each side (fig. 7). Of these, an anterior group of 12 or more small pigment spots are scattered along each side of the antero-lateral margin, while about as many more occupy an irregular cluster on each side just in front of the brain. These latter ocelli are usually well separated from the anterior, or marginal groups.

FIG. 7. *Paranemertes peregrina* Outline of anterior portion of body to show the arrangement of ocelli. Dorsal surface. × 6.

Proboscis.—Proboscis of medium size (as in *Amphiporus*), slightly yellowish, and usually everted when the animal is killed. The extruded proboscis is short and thick with an unusually slender posterior chamber. The armature (PL. VII, fig. 7) consists of a small, slender, sharply pointed central stylet, and with either 2 or 4 pouches of reserve stylets. The basis of the central stylet is very small and slightly enlarged posteriorly; the reserve stylets are slender and sharp like the central one, and commonly number from 6 to 10 in each pouch. When four pouches are present the number of stylets in each is as great as when there are only two pouches.

The mouth and proboscis open together, but the rhynchodæum is short. The proboscis sheath reaches about three-fourths the length of the body, or sometimes more than three-fourths. In each of four specimens sectioned there were 14 conspicuous nerves in the proboscis. The proboscis has a remarkably narrow ring of gland cells on the periphery near the posterior end of the basis of the central stylet.

A crowded mass of multicellular glands occupies the anterior portion of the head. The anterior ones open on the tip of the snout. In the brain region they open mostly on the lateral surfaces of the body, while farther back, and in the esophagal region, they assume the character of sub-muscular glands. No difference in appearance is noticeable between the cephalic glands and those in the esophagal region. They are present in the esophagal region only about as far back as the openings of the nephridia. Throughout their course they open to the exterior (by innumerable ducts which pass through the muscular and basement layers) on the ventro-lateral aspects of the body.

Alimentary canal.—A pair of slender branches of the intestinal cæcum reach forward nearly to the brain commissures and lie well above the lateral nerve cords. At about the point of the nephridial openings these branches pass ventrally and occupy a position beneath the esophagus. Another pair, coming forward from behind, take

their places. The ventral branches join to form the main median cæcum, from which short branches pass obliquely forward and dorsally at intervals. In cross section two pairs of branches are usually seen besides the main cæcum. One pair of these lies above and one below the lateral nerves. They are disposed in such a way that one pair ends at about the point where the second pair anteriorly originates. The branches are only irregularly arranged in pairs. The esophagus opens into the dorsal wall of the main cæcum.

Nephridia.—The nephridia occupy the anterior ⅔ of the esophagal region. They are large, with numerous branches lying above the lateral nerves, and frequently passing internally to the nerves and beneath the esophagus. They reach forward nearly to the brain. At about ⅓ of their distance posteriorly the main nephridial tubes, lying above the lateral nerves increase greatly in size and a pair of remarkably large efferent ducts pass externally to the lateral nerves to open on the lateral aspects of the body slightly below the lateral margins. The main duct reaching posteriorly from this point is larger than that in front.

Blood vessels.—There is a pair of large blood lacunæ in the head as usual; they join anteriorly by a broad anastomosis. The three longitudinal vessels are well developed to the end of the body where they anastomose above the anus. Sometimes the dorsal vessel lies beside or even above the proboscis sheath throughout a portion of its course, instead of below the sheath as usual.

Nervous system and sense organs.—The cerebral sense organs lie well in front of the brain, and external to the blood lacunæ. They open into a slight furrow on the lateral aspects of the head a little anterior to their own position. The lateral nerves form a commissure above the anus as usual.

Reproductive organs.—The sexual products were nearly mature in June and July. They are formed in numerous pouches which surround the intestinal canal on all sides. In a male as many as twenty sexual pouches were seen in a single section. They open directly to the exterior, whatever be their position.

Habitat.—This is a restless Nemertean, and on cloudy days was frequently met with crawling about over the stones on the beach between tides—which peculiarity has suggested its specific name. It was found abundantly at nearly all the collecting stations from Victoria, B. C., to Unalaska Island, and is one of the commonest Nemerteans of the coast. It occurs from low tide well up toward high water mark in every variety of location—under stones, among seaweeds, barnacles, mus-

sels, etc. The individuals are very voracious feeders, and were taken not infrequently with partially swallowed Chætopods. Their tenacity of life is remarkable—they will live for days in a small quantity of filthy water.

11. PARANEMERTES PALLIDA sp. nov.

Pl. VII, fig. 3; Pl. XII, fig. 1.

Body rather large, stout, rounded, and almost cylindrical anteriorly, somewhat flattened behind when extended; head variable in shape, not sharply marked off from portions immediately following, at certain states of contraction emarginate in front. A pair of inconspicuous oblique furrows back of head. When contracted the worms are nearly cylindrical and of about the same diameter throughout, except at the extremities, both of which are pointed.

Color.—The whole body, both above and below, is commonly uniform opaque white, sometimes showing traces of yellowish or reddish tints, especially in the anterior portions.

Ocelli.—Ocelli minute and numerous. In ordinary states of contraction they are arranged in a pair of elongated, irregular clusters on the antero-lateral margins of the head. The number of such ocelli is sometimes 30 or more in each of the two clusters.

Proboscis.—Small, short, and unusually slender (Pl. XII, fig. 1). Its armature consists of a moderately slender central stylet and usually 4 pouches of accessory stylets. The basis of the central stylet is moderately slender, slightly constricted near its middle portion, rounded behind, and of approximately equal length with the stylet (Pl. VII, fig. 3). There are commonly two accessory stylets in each of the 4 pouches. The chambers posterior to the stylet apparatus are remarkably narrow.

The mouth opens into the rhynchodæum. The proboscis sheath extends but little beyond the middle of the body, and sometimes not so far as the middle. One specimen had 9 nerves in the proboscis; another had 10. These nerves do not all enter the proboscis from the ventral side, as they do in *Amphiporus angulatus*, but those supplying the dorsal portion enter direct from that side.

Closely packed *sub-muscular glands* are present on the right and left sides of the body, and extend well inward towards the median line. Their ducts pierce the musculature and other layers of the body walls mainly on the latero-ventral aspects of the body. Twenty or more are frequently met with in a single section. These glands occupy also the region in front of the brain, and extend backward in decreasing

numbers to the commencement of the intestinal region. In front of the brain is a large and irregular cluster of glands, which open anteriorly on the tip of the snout.

Cerebral sense organs.—Situated in front of brain, and near lateroventral margins of head. The ducts which place them in communication with the exterior run obliquely forward and downward, and open immediately on the surface.

Nephridia.—The nephridial canals extend from near the brain throughout almost the entire esophagal region. The main trunks lie above the lateral nerve cords, and send off numerous branches both ventral and dorsal to the nerves. There is a single pair of remarkably large efferent ducts opening just below the lateral margins of the body, and slightly anterior to the middle of the esophagal region. In one series of sections these ducts are so precisely paired that both appear in a single section (PL. XII, fig. 1). The efferent ducts pass from above obliquely downwards and external to the nerve cords.

The blood-vascular system consists of cephalic lacunæ, and anastomosing longitudinal vessels, as in related genera.

The intestinal cæcum does not reach forward nearly to the brain. There are comparatively few lateral diverticula (PL. XII, fig. 1).

The lateral nerve cords unite above the posterior end of the intestine.

Paranemertes pallida was found only at Yakutat and at Sand Point on Popof Island, and few specimens were obtained. These were about 150 mm. to 250 mm. in length, and perhaps 5 mm. in width. They were found between tides under stones covered with algæ.

12. PARANEMERTES CARNEA sp. nov.

PL. III, figs. 3, 4; PL. VII, fig. 4; PL. VIII, fig. 7.

This species was found to be extremely variable in size, shape of body, and head, and especially in the armature of the proboscis. As shown in PL. III, figs. 3 and 4, the body is rather stout, rounded in the esophagal region, flattened both above and below posteriorly, and ending rather abruptly behind. The head is very variable in shape, being pointed, rounded, broadened, or emarginate in front, according to its state of contraction. It is most commonly a little broader than the parts immediately following, and is not distinctly marked off, although a slight oblique furrow on each side is sometimes seen behind the brain. From the dorsal surface the furrows of the two sides give the appearance of a very faint V-shaped marking with the angle projecting backward in the median line. A little farther forward, as seen in PL. VIII, fig. 7, a pair of shallow furrows occupies the sides of

the head. These are also V-shaped with the angle projecting backward on the lateral margins. The ventral limb of each V-shaped furrow reaches nearly to the opening of the rhynchodæum; on the dorsal surface the ends of the dorsal limbs are separated by about ⅓ the diameter of the body in ordinary states of contraction (fig. 8).

In microscopic sections the V-shaped grooves on each side of the head are conspicuous, because of their differentiated epithelium. In these shallow depressions the epithelial cells are of smaller size, more slender in form, and seem to partake more of the nature of sensory cells. In these grooves the ordinary glandular cells are wanting. In the ventral limb of each V-shaped groove opens the tube which places the cerebral sense organs in communication with the exterior.

Ocelli.—There are commonly 20 to 32 eyes on the head arranged in 4 more or less distinct clusters, though their relative positions change with the contraction of the head. The two anterior clusters contain about 4 to 6 eyes each, and occupy the antero-lateral margins of the head (figs. 8, 9). The posterior clusters lie directly back of these,

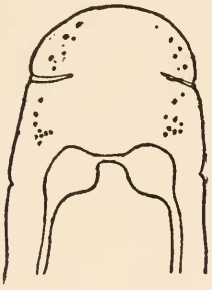

FIG. 8.

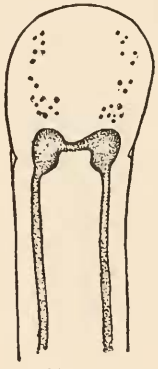

FIG. 9.

FIGS. 8 and 9. *Paranemertes carnea.* 8. Outline of head from dorsal surface showing arrangement of ocelli. The two pairs of lateral indentations indicate the lateral and dorsal furrows. × 8. 9. Outline of the head when extended. Dorsal surface, showing arrangement of ocelli. × 6.

and immediately in front of the brain. Each of these clusters contains 8 to 12 scattered ocelli. An individual from Taku Harbor had 6 ocelli in each anterior cluster, and 10 in each posterior one. Another specimen had only 3 or 4 eyes in each of the four clusters, but in this case the ocelli were larger. A specimen from Popof Island had 3 large eyes in each anterior, and 6 to 8 in each posterior cluster; one from Virgin Bay had 6 in each anterior, and 7 in each of the others,

and had 3 single eyes between the anterior and posterior clusters, while one from Yakutat had 3 large ocelli in a row on the anterior margin of the head, and a pair of scattered clusters of 8 to 12 eyes each in front of the brain. When the head is contracted so that it is emarginate in front, the arrangement of the eyes into clusters disappears, and they are then all scattered irregularly on the antero-lateral margins. Figs. 8 and 9 show the general arrangement of the eyes.

Color.—The whole body, both above and below, is a homogeneous, very pale red or flesh-color (PL. III, figs. 3, 4), and is entirely without markings except for a longitudinal median line of deeper red, showing the position of the proboscis sheath, and the deeper color of the intestinal lobes. In some specimens the reddish color was more pronounced anteriorly, and some were very pale. The intestinal lobes are seen through the clear tissues of the body walls as narrow, transverse markings, slightly darker than the rest of the body. The reddish color of the brain and lateral nerves is often conspicuous from the dorsal surface (PL. III, fig. 3).

Size.—Individuals were seen which were 500 mm. long in greatest extension, although the majority were less than half this length.

Proboscis.—Mouth and proboscis open together through a subterminal pore. The proboscis is large (PL. VIII, fig. 7) and of moderate length. The short proboscis sheath does not reach far beyond the middle of the body. The armature of the proboscis shows marked variations. The size and shape of the central stylet and its basis, however, remain fairly constant. The central stylet is of the regular *Amphiporus* type, is moderately slender, and rests on a moderately slender basis. The basis is slightly narrower in front and is rounded behind (PL. VII, fig. 4). The number of pouches of accessory stylets is commonly from 6 to 12. One specimen had 12 of these pouches, each with one or two slender stylets; each of two others had six pouches with two stylets in each pouch. Three specimens had each twelve nerves in the proboscis, while a fourth specimen had but eleven.

Cerebral sense-organs.—Unusually small and situated some distance in front of brain-lobes. They occupy positions very close to the ventro-lateral borders of the head, and beneath the cephalic blood lacunæ.

Nephridia profusely branched, and extending throughout the greater portion of esophagal region, though they do not reach the brain. Their numerous branches ramify both above and below the lateral nerve-cords, and several efferent ducts of small size lead to the exterior from both the dorsal and ventral branches. There may be about five

pairs of efferent ducts, all of which open in the immediate vicinity of the lateral nerves. In one series of sections a small efferent duct from one of the branches above the lateral nerve was followed only two sections farther back by a similar, though larger, duct from a branch below the lateral nerve on the same side. The nephridia end posteriorly near the point where the esophagus opens into the intestine.

Sub-muscular glands of limited number lie between the musculature and the intestine and proboscis sheath. These glands are closely packed together in the head in front of the brain; back of this point they become widely scattered, although they do not cease entirely until back of the esophagal region.

A short intestinal cæcum with a few wide lateral diverticula extends forward beneath the esophagus. This cæcum is shorter than in most species of the genus, and does not reach nearly to the brain. The esophagus also is short and opens directly into the dorsal wall of the intestine.

A pair of large blood lacunæ occupies the anterior portion of the head as usual.

The lateral nerves and longitudinal blood vessels join above the posterior end of the alimentary canal, as in most species.

Reproductive glands in both male and female are very numerous, and are situated both above and below the intestine. They open directly to the surface, as could be determined from their rudimentary ducts, although the sexual products were very immature in June and July.

Habitat.—This species is conspicuous because of its clear, rosy or flesh-like color, which is all the more striking in contrast with the black mud in which it is usually found. It occurs between tides in muddy locations over a large portion of the southern Alaska coast. It was collected at Taku Harbor, Sitka, Yakutat, Prince William Sound, and Popof Island, although only a few were found at each locality. Usually but one or two specimens were found in several hours' digging.

AMPHIPORUS Ehrenberg.

Symbolæ Physicæ, Berlin, 1831.

This is by far the most common genus on the Alaska coast, and to it belong six of the thirty species of Nemerteans collected.

The genus *Amphiporus* includes mostly rather stout, solid, often flattened forms, usually of considerable size, which are capable of an almost incredible amount of extension and contraction. A few forms, however, are long and cylindrical, even when contracted, but others

can contract until the body becomes almost barrel-shaped. The worms can neither swim nor roll up spirally.

Proboscis.—Provided with a single, well-developed central stylet, with a cartridge-shaped basis, and with two or more pouches of accessory stylets. The proboscis sheath usually reaches nearly or quite to the end of the body.

Ocelli.—Usually present in very considerable numbers. A few forms are without eyes, and a few others have but a single pair—there are never 4. The eyes do not extend far behind the brain.

Cerebral sense organs.—Usually well developed. Their position is most commonly in front of the brain, but they are sometimes beside or even behind the ganglia.

13. AMPHIPORUS ANGULATUS (Fabr.) Verrill.

Pl. VI, fig. 4; Pl. VII, figs. 2, 2*a*; Pl. XI, fig. 2; Pl. XIII, fig. 3.

Fasciola angulata O. Fabricius, Müller's Verm. Terrest. et Fluv., I, p. 58, 1774.

Omatoplea stimpsonii Girard, in Stimpson, Invert. of Grand Manan, Smithsonian Contributions to Knowledge, p. 28, 1853.

Nareda superba (?) Girard, loc. cit.

Cosmocephala beringiana Stimpson, Proc. Acad. Nat. Sci. Philadelphia, p. 165, 1857.

Amphiporus angulatus (Fabr.) Verrill, Marine Nemerteans of New England, Trans. Conn. Acad., p, 10, 1892.

"This large and conspicuous species is generally easily recognized by its clear dark purplish or chocolate-brown color above, with pale margins and a trapezoidal or triangular white spot on each side of the head and usually with a narrow white line across the neck; and by the pinkish or flesh-colored lower surface. Ocelli in two or more rows in an elongated groove on each antero-lateral margin of the head, and a pair of small sub-dorsal clusters on the transverse white nuchal band." (Verrill, loc. cit.) The arrangement of the eyes and markings on the head of the Alaska specimens are shown in fig. 10 and in Pl. VI, fig. 4. In ordinary state of contraction the body is rather short and stout. When disturbed it can become so greatly thickened anteriorly that its transverse diameter is fully ⅓ as great as its length. In extension the body is but moderately elongated, and is relatively broad and flat. It contracts very much as does a leech.

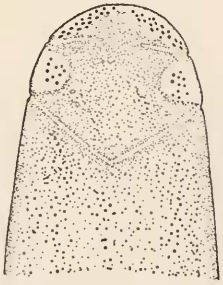

Fig. 10. *Amphiporus angulatus.* Dorsal view of anterior portion of body showing markings on the head and the arrangement of ocelli. × 8.

The Alaska specimens are commonly larger than have been recorded elsewhere, often measuring 200 mm. or more in length and 10 mm. in width.

Proboscis.—The proboscis is large, thick, and pale reddish or salmon in color. The smallest specimen collected had 17 nerves in the proboscis; four other specimens examined had each 18 proboscidial nerves, one had 19 nerves, and two others had 20 each.[1] This shows more strikingly than has previously been pointed out that the number of nerves in the proboscis is variable to a very considerable extent. Bürger[2] has shown that *Drepanoporus crassus* may have 19 or 20 nerves, and *D. spectabilis* 24 or 26. Nevertheless in the other Alaska species the number has been found surprisingly constant. The number of nerves in any particular proboscis remains perfectly constant so far as I have observed from the anterior end back as far as the stylet region. Here they break up into a plexus and lose their identity. The nerves in *A. angulatus* enter the proboscis at its anterior attachment and in its ventral portion (pl. xi, fig. 2). They then divide into their definite number of branches (usually 18) which pass obliquely dorsally and arrange themselves symmetrically on the periphery. The proboscis sheath extends within a few sections of the posterior end of the body.

The armature of the proboscis is made up of a moderately slender central stylet, and (usually) two pouches of accessory stylets. The basis of the central stylet is about as long as the stylet itself. It is moderately slender, constricted near its middle (pl. vii, figs. 2, 2*a*), enlarged and rounded posteriorly. Each reserve pouch commonly contains 5 to 7 rather slender stylets, similar in size and shape to the central stylet.

Ocelli.—Numerous and characteristic in arrangement. The dark pigment on the head, however, often renders them difficult of accurate determination. Girard[3] states for *Omatoplea stimpsonii* that there are six or more minute eyes "situated in an oblique, simple row, on either side of the head anteriorly." The same author (loc. cit.) describes

[1] Of eight specimens of this species from Eastport, Maine, one had but 17 nerves in the proboscis, six had 18 each, and one had 19 or 20. Other anatomical details in the eastern form agree perfectly with those of specimens from Alaska. I have recently examined a number from the original locality of Stimpson's *C. beringiana* (Bering Strait), and have no doubt as to the specific identity of this form with that from southern Alaska and from Eastport, Maine.

[2] Fauna u. Flora des Golfes von Neapel. Monogr. 22, Nemertinen, p. 372, 1895.

[3] Marine Invert. Grand Manan, Smithsonian Contr. to Knowledge, p. 28, 1853.

Nareda superba as having but a single pair of rounded ocelli situated wide apart on the transverse white band of the neck. It seems highly probable, as Verrill suggests,[1] that both of the species are identical; in the one case only the marginal eyes were seen, while in the other the cerebral clusters were supposed to represent single eyes and the marginal ones were overlooked. Verrill[1] describes the eyes correctly, and his diagnosis of the species is so full and accurate that it is necessary to describe here the internal anatomy only. A pair of elongated clusters of ocelli lies on the antero-lateral margins of the head, and another smaller cluster on, or near, the angular white spot on each side of the head. As shown in fig. 10, each of the anterior clusters may contain upwards of 20 ocelli arranged in two or more irregular rows nearly parallel with the antero-lateral margin of the head, while the posterior groups may consist of 8 to 15 similar ocelli. The posterior groups are situated deep in the tissues of the head. Of course the number of ocelli varies greatly in different individuals.

Cerebral sense organs.—Well developed. They lie a little in front of the brain, beside the esophagus, and below the cephalic blood lacunæ. Each *sense organ* has a wide canal which leads a short distance anteriorly and opens to the exterior on the latero-ventral aspect of the body. The brain itself is of large size, with a thick ventral and narrow dorsal commissure (pl. xi, fig. 2).

Nephridia.—The nephridia extend from near the brain (pl. xi, fig. 2) well backward in the esophagal region. In one specimen there were two pairs of efferent ducts opening on the latero-ventral aspect of the body; in another only one pair.

Cephalic glands.—The cephalic glands open on the tip of the snout and are well developed. Sub-muscular glands, likewise, are remarkably abundant. They reach from the brain region well back towards the end of the esophagus. They are multicellular, each one being composed of upwards of a score of large, vacuolated cells with small nuclei situated on the side farthest from the lumen. Each gland has a twisted duct leading through the muscular layers, basement membrane, and integument, and opening to the exterior on the ventro-lateral aspects of the body (pl. xi, fig. 2).

Beneath the esophagus a broad cæcal appendage of the intestine stretches forward well toward the brain region. This cæcum consists of a large median canal with pouch-like diverticula extending dorsally above the lateral nerve cords.

There is the usual anastomosis of the three longitudinal vessels, and

[1] Marine Nemerteans of New England, Trans. Conn. Acad., viii, p. 12, 1892.

of the pair of lateral nerve cords (Pl. XIII, fig. 3), above the hind gut and slightly in front of the anus. As seen from the figure, the union of the blood vessels is directly dorsal to that of the nerve cords.

The reproductive glands occur both above and below the alimentary canal. Sexual products were not nearly mature in June and July.

Habitat.—The species is extremely abundant along the whole Alaska coast as far west as Unalaska Island, and Stimpson records it from Bering Strait. It is found under stones between tides in all sorts of situations. Stimpson's specimens came from a depth of five fathoms. The species is found on the Atlantic coast of North America from Massachusetts Bay to Greenland (Verrill, *loc. cit.*).

14. AMPHIPORUS BIMACULATUS.

Pl. I, fig. 4; Pl. V, fig. 10; Pl. VIII, fig. 2; Pl. XII, fig. 2.

Body rather short, broad, and flattened both above and below. Head narrower than parts immediately following. Body of about the same width and thickness throughout esophagal and intestinal regions. Posterior extremity tapers rather abruptly to the pointed or rounded end. Opening of rhynchodæum situated on subterminal portion of snout. From near this opening a pair of slits pass obliquely backward and upward behind the eyes to the brain region.

Color.—The color of this species is very striking. The whole dorsal surface back of the head is deep brownish orange, somewhat paler behind. The head is without color, or of a very much paler color than the rest of the dorsal surface, and in the center of this pale area two oval, black or very dark brown spots lie side by side. These are very characteristic, and are conspicuous even in alcoholic specimens. The black spots sometimes occupy a considerable portion of the pale area, and are sometimes sharply angular in front (Pl. I, fig. 4). In the median line of the body the color is slightly paler than elsewhere and in the center of this paler stripe is a dark, but inconspicuous, longitudinal line. The pale stripe and dark line both fade out at a point about ⅓ the distance towards the posterior end of the body. The brain lobes appear as pinkish bodies just posterior to the black cephalic spots. The whole ventral surface is of a homogeneous, pale orange or flesh color, with the exception of pinkish spots marking the position of the brain, and a slightly paler stripe below the anterior portion of the proboscis sheath.

Ocelli.—The eyes are rather large, and number 25 to 30 or upwards on each side (fig. 11). The majority lie in an irregular marginal row beside and in front of each of the black cephalic spots. At

the posterior end of each marginal cluster the ocelli are more closely and more irregularly placed, and often occupy several rows. In addition to these marginal clusters a closely set group of about a half dozen smaller ocelli is situated in the light area lateral to the posterior end of each of the dark cephalic spots. These ocelli lie deeper in the tissues of the head, and near the brain (Pl. I, fig. 4).

Proboscis.—The proboscis is remarkably large, and its constituent layers are very sharply defined (Pl. XII, fig. 2). The proboscis sheath has a correspondingly massive development, and reaches to the very extremity of the body. The stylet apparatus of the proboscis is very characteristic of the species, because of the extreme minuteness of the basis of the central stylet. The central stylet itself is very long and slender, while the length of its basis is but half as great. The basis is constricted in the middle, and is ⅔ as wide as long (Pl. VIII, fig. 2). There are usually four pouches of accessory stylets. These pouches are not evenly distributed on the circumference, for two lie close together on one side of the proboscis, the other two on the opposite side. There are usually five to seven slender stylets in each of the four pouches. Most of the stylets are much smaller than the central stylet. Measurements of the stylets of one individual about 100 mm. long are: central stylet .12 mm. long, .015 mm. wide near base; basis of central stylet, .06 mm. long, .04 mm. wide; largest accessory stylet, less than .1 mm. long. The proboscis is provided with 16 large nerves (Pl. XII, fig. 2).

FIG. 11. *Amphiporus bimaculatus.* Outline of head to show position of markings and arrangement of ocelli. ×8.

The mouth and proboscis open together. There are three large communicating blood lacunæ in the head, one on the right, one on the left, and one dorsal to the rhynchodæum.

Cerebral sense organs.—Remarkable for their large size, being fully as large as either of the brain lobes. They lie lateral to the brain, slightly *behind* the commissures, and in the angle between the dorsal and ventral lobes. A large process from the posterior end of the dorsal lobe furnishes the sense organs of the same side with an abundant innervation. Their posterior ends extend backwards beyond the dorsal brain lobes, against the posterior faces of which they are closely pressed. Behind the dorsal brain lobe the sense organs lie directly dorsal to the lateral nerve-cords and are bathed on their internal borders by large blood lacunæ. A section through this point is not very different from a corresponding section of a Heteronemer-

tean. Of the Alaska Metanemerteans here recorded this is the only one in which the cerebral sense organs lie posterior to the brain commissures. The canal by which each sense organ communicates with the exterior is of large size, runs anteriorly in front of the brain, and opens on the ventro-lateral aspect of the head.

Nephridia.—The nephridia reach forward close to the posterior ends of the cerebral sense organs. Anteriorly there is a tangle of small vessels, but farther back these unite into a single large, branched canal which runs close beside the blood vessels above the lateral nerve on each side. From these canals a pair of large efferent ducts pass above the lateral nerve cord, and open to the exterior of the body just below the lateral margin.

Sub-muscular glands.—Present along anterior portion of esophagal region, but not very abundant.

A broad and profusely branched *intestinal cæcum* runs forward from the intestine well toward the brain region. The cæcum lies well beneath the esophagus and sends off numerous pouch-like branches dorsally above the lateral nerve cords.

Reproductive glands.—These occur both above and below the intestinal canal. Although the sexual products were very immature in one of the specimens sectioned, yet the efferent ducts of the glands were formed as far outward as the basement layer of the cutis. Here each duct ended in a swollen chamber lined with cylindrical epithelial cells.

Size.—The individuals of this species varied from 40 to 150 mm. in length. The largest were about 6 mm. wide and 2 mm. thick.

Habitat.—The species was collected at Victoria, B. C., on the piles of the wharf; at Sitka among hydroids, etc., near low water (W. E. Ritter), and a finely preserved specimen from Puget Sound, State of Washington, was given me by Prof. Trevor Kincaid.

15. AMPHIPORUS TIGRINUS sp. nov.

PL. IV, figs. 5–8; PL. VIII, fig. 4; PL. X, figs. 3, 4.

Body moderately slender, rounded throughout, head not marked off from parts immediately following, rather narrow and pointed in front; posterior extremity of body narrow. On each side of the head is a shallow, inconspicuous, oblique groove.

Color.—In June, at the time the specimens were collected, the sexual products were fully mature, and the species showed marked sexual color varieties. The prevailing color of the females was yellowish orange both above and below, but except in the esophagal region, this color was to a great extent obscured by the dark olive green

color of the mature ova. These ova developed in large pouches on each side of the body, and each pouch with its contents appeared as a dark green spot. In many cases several adjacent pouches lie nearly in contact, giving the external appearance of dark green blotches. Seen directly from the dorsal surface the green spots appear on each side in more or less regular pairs, those of the two sides being separated by an interrupted, narrow, longitudinal, median band of yellow. From the sides the ovaries appear as irregular transverse stripes of dark green alternating with the yellow color of the body—hence the specific name, *tigrinus*. The males are much less deeply colored. They are pale yellowish with a slight tinge of green, and the spermaries appear as innumerable cream-colored specks. Both males and females have a narrow, longitudinal, median band of brownish on the anterior dorsal portion of the body. After preservation in alcohol both sexes assume a greenish color, which is retained even after mounting in balsam.

Ocelli.—The eyes are numerous, and are arranged in two irregular, and scarcely separated, clusters on each side of the head in front of the brain. The individual ocelli are so irregular in shape, so variable in size, and so closely massed together, that it is difficult to determine their precise number. Many of them appear as ragged pigment masses. Commonly, however, there are a dozen or more of such ocelli in each of the anterior clusters, and perhaps 8 to 10 in each of the posterior ones. The ocelli of the anterior clusters are scattered through the tissues of the head from the dorsal to the ventral surface. Some of the ocelli are three times as large as are others. In contraction all the eyes of the same side form a single confused cluster. Because of their variability of position no drawing is given of their arrangement.

Proboscis.—The long and well developed proboscis is provided with a remarkably weak armature. This consists of a small central stylet and two pouches of accessory stylets. The central stylet is small and short, but is acutely pointed. Its massive basis, double the length of the central stylet itself, is short, thickened, and rounded behind (Pl. VIII, fig. 4). In a worm 75 mm. long, the central stylet measured about .075 mm. in length; the basis was .15 mm. long and .075 mm. in average diameter. The accessory stylets are, like the central stylet, short, broad at the base, but sharply pointed. They usually number about five to each pouch. The glandular wreath about the stylet is well developed, and in the specimens examined is deep green in color even after mounting in balsam. The proboscis sheath reaches nearly to the posterior end of the body.

Cerebral sense organs.—Smaller than in most species of the genus. They are situated slightly in front of the brain, but are well separated from it because they lie near the ventro-lateral border of the head. The canals placing them in communication with the exterior are, consequently, extremely short. Each canal opens into the shallow, oblique furrow on the side of the head. The posterior ends of the sense organs lie beneath the anterior borders of the ganglia, but much nearer the ventral surface. A pair of large nerves given off from the dorsal ganglia opposite their commissure connect with the sense organs. The lateral nerve cords unite above the posterior end of the intestine as usual.

The body cavity in the esophagal region is filled with an unusually large amount of gelatinous tissue, which occupies the considerable space between the muscular layers and the esophagus and proboscis sheath (Pl. x, fig. 4). In this gelatinous tissue the lateral nerves are situated, and through it a complex system of blood vessels and nephridial canals ramifies.

The intestinal cæcum is very broad and has but short lateral diverticula. It lies wholly beneath the esophagus, and the branches do not extend above the lateral nerves. The cæcum ends anteriorly far behind the brain region. The esophagus becomes very small before it empties into the dorsal wall of the broad intestine.

The attachment of the proboscis to the tissues of the head, the position of the rhynchodæum and its openings into the esophagus and proboscidial cavity, the position of the dorsal and ventral brain commissures, the cephalic glands and other organs are shown in Pl. x, fig. 4.

The sexual products are mature in June. The whole body becomes distended with the pouches of sexual elements, and the cavity of the alimentary canal is much reduced in consequence. The ova are large and deep olive-green.

The length of the specimens obtained, both males and females, was about 75 to 100 mm. in extension.

Habitat.—This species was met with only at Farragut Bay, where it occurred under stones in muddy locations at about half tide.

16. AMPHIPORUS NEBULOSUS sp. nov.

Pl. iv, fig. 1; Pl. viii, fig. 6; Pl. xi, fig. 1.

Body short, rather broad, and much flattened; narrower anteriorly than in the intestinal region, and tapering gradually posteriorly. Mouth sub-terminal; head pointed or expanded in front, according to

state of contraction. A V-shaped furrow is present on each side of the head near the tip; the angles of these furrows point obliquely forward above and below.

Color.—Dull white or pale yellowish on dorsal surface; very thickly mottled with confluent dark brown blotches and dots which largely obscure the ground color. Margins of the head without spots. There are faint indications of a pair of transverse lines without color—one near the tip of the snout and the other near the brain region, the latter sometimes becoming a shallow, irregular, V-shaped furrow. Ventral surface dull white or yellowish, without markings other than deeper yellow spots which indicate the positions of the genital sacs, and the darker color of the intestinal canal.

FIG. 12. *Amphiporus nebulosus.* Outline of the head to show arrangement of ocelli. Dorsal surface. × 7.

Ocelli.—On each side of the head are from 18 to 25 ocelli, arranged in three irregular groups (fig. 12). Close to the anterior border of the snout are 4 or 5 large cup-shaped ocelli on each side. Behind these and bordering each lateral margin are about 8 much smaller eyes in an irregular group, while 3 or 4 small eyes are scattered between these and the anterior group. Behind each lateral group, and not far in front of the brain, about 7 to 10 small ocelli lie in an irregular cluster deeper in the substance of the head, and are therefore less easily visible.

Size.—The specimens obtained measured 100 to 150 mm. in length, and 5 mm. in width. The esophagal region is short, rounded above, flattened below, and thicker than the intestinal region.

Proboscis.—The proboscis sheath reaches nearly to the extreme end of the body. Proboscis thick, fairly large, and white. It is provided with 17 nerves. Basis of central stylet very much broadened posteriorly (PL. VIII, fig. 6), flat or even emarginate behind, narrow in front. Central stylet as long as the basis, slender, acutely pointed. Accessory stylets in two pouches; similar to central stylet, but sometimes very slightly curved; commonly 3 in each pouch. The pouches lie well behind the central stylet in ordinary extension (PL. VIII, fig. 6). Wreath of gland-cells surrounding basis of central stylet moderately broad.

In the brain region (PL. XI, fig. 1) and for some distance posteriorly an abundance of large multicellular glands are thickly placed in the ventro-lateral aspects of the body, and are mostly situated among the fibers of the longitudinal muscular layer. Behind the brain these submuscular glands become so closely packed together that the muscular

layer is divided into an outer and an inner portion in the region where the glands are situated. The ducts from the glands (Pl. XI, fig. 1, *smg*) pass through the muscular layers and basement membrane to open to the exterior among the epithelial cells of the integument. These glands become smaller and more scattered near the region of the nephridial openings, but do not disappear entirely until near the end of the esophagal region.

Alimentary canal.—The mouth and proboscis open together into the rather long rhynchodæum. The esophagus is as usual in the genus. A single pair of small intestinal cæca reach forward well toward the brain region. They lie immediately below the esophagus, and near the middle line. Farther back they join a median, broad, unpaired cæcum. This has wide, paired, lateral outgrowths which, still farther back, alternate with clusters of reproductive glands. These lateral appendages of the cæcum lie mostly above the reproductive glands, as well as alternate with them. Much farther back the esophagus decreases greatly in size and opens into the intestine by a longitudinal slit in the dorsal wall of the latter. The intestinal pouches are rather deep; the anus is subterminal.

Nephridia.—The nephridial canals reach anteriorly nearly to the region of the brain, where there is a single branched longitudinal vessel on each side. Throughout the greater part of its length, this main canal lies above the lateral nerve cord, but sometimes lies internal to it or above it. In the anterior third of the esophagal region the main canal becomes very large; here an efferent duct branches off, passes outside the lateral nerve, and bends downward to open on the exterior of the body on the ventro-lateral aspect. There is but one efferent duct on each side, and the two are sometimes exactly paired. Back of the efferent ducts, the nephridial canals decrease rapidly in size, and disappear far in front of the anterior end of the intestinal region.

A pair of large blood lacunæ lie in the anterior portion of the head as usual. In the brain region they divide into numerous smaller vessels (Pl. XI, fig. 1). The lateral vessels form a broad anastomosis with the dorsal vessel above the anus.

Nervous system and sense organs.—The dorsal ganglia are closely fused with the ventral. They are without distinct posterior lobes, and sink gradually into the ventral ganglia (Pl. XI, fig. 1). The cerebral sense organs are well developed. They lie in front of the brain, some distance ventrally from the dorsal ganglia, and communicate with the exterior by a canal which opens ventro-laterally. Each sense organ is lobulated posteriorly and provided with a large nerve (*son*,

PL. XI, fig. 1) which arises from the ventral side of the dorsal ganglion near the ventral commissure. The union of the lateral nerve cords above the anus lies in the same section as the anastomosis of the three longitudinal blood vessels. A pair of small nerves from the lateral cords continues backward beyond the commissure to the end of the body.

Reproductive organs.—The sexual glands first make their appearance in the esophagal region at the point where the unpaired intestinal cæcum receives its pair of anterior branches. Those sexual glands which are situated most anteriorly lie below the alimentary canal, internal to the lateral nerves, and open on the ventral surface of the body. Farther back are commonly four or five reproductive pouches in a single section. These lie mainly below the intestine, but no matter what their position they all open to the surface of the body *below* the lateral margins. Those lying farthest from the middle line and above the lateral nerves open ventrally between the nerve cords and the lateral margins. Sexual products appear to be fully mature in July.

Habitat.—Beneath stones near low water at Kukak Bay, Alaska Peninsula (T. Kincaid).

17. AMPHIPORUS LEUCIODUS sp. nov.

PL. VII, fig. 6.

Body usually not more than 50 to 75 mm. in length, slender, elongated, flattened posteriorly, not capable of great contraction. Head narrower than parts immediately following. An inconspicuous V-shaped furrow on dorsal surface back of head, seen only under favorable conditions.

This species resembles young individuals of *A. exilis*, with which it is often associated. It is likewise similar in many respects to *A. lactifloreus* (Johnston) McIntosh, from which it differs widely in the armature of the proboscis and in many other anatomical features.

Color.—Opaque white, sometimes with a pale reddish or yellowish tinge. This color is commonly uniform throughout, though it is somewhat influenced by the internal organs which show through the body walls. The brain is pinkish, the intestine often brownish.

Ocelli.—There are four irregular, but usually distinct groups of minute ocelli on the anterior portion of the head. Bordering each antero-lateral margin of the tip of the snout is an elongated cluster of about 8 to 12 ocelli (fig. 13). Posterior to these marginal clusters,

and somewhat nearer the median line is a pair of clusters, each of which likewise contains 8 to 12 ocelli. These posterior groups lie immediately above the brain. Smaller and evidently younger individuals have but 4 to 6 eyes in each of the four groups. There is considerable variation in the size of the ocelli.

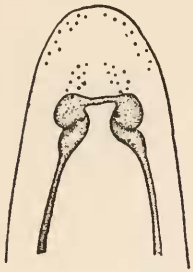

FIG. 13. *Amphiporus leuciodus*. Outline of anterior portion of the body showing brain and arrangement of the ocelli. × 12.

Proboscis.—The proboscis sheath reaches nearly to the posterior end of the body. The proboscis is rather slender but may be contracted so that its diameter is equal to more than half that of the body itself. The proboscis is commonly attached to the proboscis sheath at a point situated from ⅓ to ¼ the distance towards the posterior end of the body. The armature is weaker than in *A. exilis*. The central stylet is moderately slender and acutely pointed. Its basis is somewhat conical in shape, contracted slightly toward its middle portion (PL. VII, fig. 6), and is rounded at its larger, posterior end. It is slightly longer than the stylet itself. The number of pouches of accessory stylets is commonly three, although there are sometimes only two, and occasionally a specimen is found which has four. There are usually two or three stylets in each pouch. In a few instances, however, four and five were observed. Where three pouches are present, as is usual, they are situated at nearly equal distances on the circumference of the proboscis (PL. VII, fig. 6).

Cerebral sense organs.—Moderately small and situated well in front of brain and on ventral side of head. They communicate with the exterior by means of a pair of canals which open on the latero-ventral margins of the tip of the head.

Nephridia.—The nephridia reach forward to the brain region. There are several pairs of efferent ducts, some of which open on the ventral, and some on the dorsal surface of the body. In one of the specimens sectioned the first pair of efferent ducts extended from the internal side of the lateral nerve cords and opened directly to the latero-ventral aspect of the body after passing on the *ventral* side of the nerve cords. A little farther back in the esophagal region were two efferent ducts on one side and one on the other which passed above, and externally to the nerve cords to open likewise below the lateral margins. In the remainder of the esophagal region were three more efferent ducts on each side. With one exception all of these passed above the lateral nerves and opened on the dorso-lateral surfaces of the

body as in *A. exilis*. Another specimen had 7 efferent ducts on the left side and 8 on the right. Of those opening on the left side the four anterior ones passed dorsally to the nerve cord and then bent ventrally to open on the ventro-lateral aspect of the body; the fifth one opened very near the lateral margin, and the last two opened on the dorso-lateral surface. On the right side the four anterior ducts opened ventro-laterally, and the four posterior ones opened on the dorso-lateral surface. The nephridia extend backward beyond the first few pairs of reproductive glands. Here, then, we find the connecting links between the typical *Amphiporus* nephridium (which passes above and external to the lateral nerve and then bends downward to open on the ventro-lateral aspect of the body), and the type of nephridium which is characteristic of *A. exilis* and the Heteronemerteans, and which opens directly on the dorso-lateral aspect of the body.

Sub-muscular glands are closely packed together in front of the brain and in the brain region. They are not found farther posteriorly, and in this respect the species differs markedly from *A. exilis*.

The *intestinal cæcum* reaches forward well toward the anterior end of the esophagal region. The main cæcal cavity, which lies directly beneath the esophagus, sends off numerous lateral pouches above the lateral nerves, and at its anterior end branches into lateral diverticula which extend forward on each side as far as the brain region.

Reproductive glands.—The genital products mature in June in the region of Victoria, B. C. The ova develop in sacs which are regularly arranged, and extend from the posterior third of the esophagal region to the posterior end of the body. The ovaries, in all cases noticed, were situated immediately above the lateral nerves. In the intestinal region they alternate with the intestinal lobes with a great deal of regularity. Their efferent ducts occupy positions on the latero-dorsal aspects of the body exactly corresponding to those of the posterior efferent nephridial ducts. The ducts from the ovaries, however, pierced only the longitudinal muscular layer, and did not penetrate the circular muscular layer of the body wall. These rudimentary genital ducts are further distinguished from the nephridial ducts by lacking a conspicuous epithelial lining.

Habitat.—These slender whitish worms were found in great abundance beneath barnacles and other growths on the piles of the wharf at Victoria, B. C. They were found less abundantly under stones between tides at New Metlakahtla and in Glacier Bay, but were not noticed farther northwest.

18. AMPHIPORUS EXILIS sp. nov.

Pl. III, fig. 1; Pl. VII, fig. 5; Pl. XI, fig. 3.

Body extremely elongated for the genus, rounded throughout; not capable of the great contraction which characterizes many species of the genus; only moderately flattened; posterior extremity slender. Head usually narrower than esophagal region. The general shape of the body resembles that of *Emplectonema*. In shape of body, as well as in color and habits, this species, like the last, recalls *A. lactifloreus* (Johnston) McIntosh. Its anatomical structures are, however, very different, as will be seen from the following description.

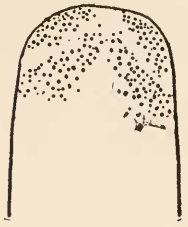

FIG. 14. *Amphiporus exilis*. Dorsal view of head to show arrangement of ocelli. ×8.

Ocelli.—Exceedingly numerous and minute. They are arranged on the head in four elongated clusters (fig. 14). Two of these clusters lie on each antero-lateral margin of the head, while the two other groups lie more posteriorly (just in front of the brain), and extend from near the middle line obliquely outward and backward. Sometimes the two posterior clusters are united in front into a continuous V-shaped group. The number and distribution of these eyes is indicated by the following table, which shows the numbers found in ten individuals:

	No. of ocelli in anterior clusters.		No. in posterior clusters.	
	Right.	Left.	Right.	Left.
1.	12	11	15	17
2.	16	17	26	28
3.	18	19	33	30
4.	23	23	32	31
5.	25	24	40	42
6.	25	26	52	46
7.	28	26	45	46
8.	35	37	54	45
9.	35	35	51	53
10.	60	56	71	73

In the specimens examined, therefore, the number of ocelli in the front clusters varied from 11 to 60, that in the posterior clusters from 15 to 73. The average in the 10 individuals is about 28 in each anterior cluster, and 41 in each posterior group.

All the ocelli are minute, but nevertheless very irregular in size, some being several times as large as others. From the ventral surface the anterior marginal clusters only are seen.

Proboscis.—The proboscis sheath is long and slender. Even in this elongated species it reaches within a few millimeters of the posterior end of the body. The proboscis also is slender, though of moderately large size. It reaches well backward in the body. The armature of the proboscis is especially remarkable. The central stylet is moderately slender, rather small, and rests on a moderately heavy basis. The basis is somewhat conical in form, and rounded posteriorly (PL. VII, fig. 5). In addition to the central stylet there are usually 8 pouches of accessory stylets (PL. VII, fig. 5), though the number varies from 6 to 12. In each pouch are one or two slender stylets. Often there is a single fully developed stylet, and a second, immature stylet in most of the pouches. The proboscis is usually extruded when the animal is killed.

Cerebral sense organs.—Situated far in front of brain—nearly at end of snout when the head is contracted—and fairly well developed. Their canals open on antero-lateral borders of tip of snout.

The blood-vascular system resembles that in other species of the genus.

Nephridia.—The nephridial system shows peculiar deviations from the arrangement usually found in the Metanemerteans. A pair of main canals with numerous branches runs longitudinally above the lateral nerve cords, as in other species. These reach forward well toward the brain and extend posteriorly far into the intestinal region. Their branches ramify both above and below the lateral nerve cords. The number and position of the efferent ducts is remarkable—there are commonly 20 or more on each side. The first is near the anterior end of the main nephridial canal, and sometimes opens on the ventro-lateral aspect of the body, as in other species of the genus. Back of this, however, were counted nine other efferent ducts on each side in the esophagal region, and at least as many more were present on each side in the intestinal region. These ducts were mostly small and opened on the *dorsal* aspect of the body, as in many Heteronemerteans. The positions of the efferent ducts were sometimes immediately above the lateral nerves, and sometimes but a little laterally from the proboscis sheath. Most commonly, however, the ducts occupied positions between these two extremes, so that the majority of the nephridiopores were situated on the dorsal surface about half way between the lateral margin and the median line (PL. XI, fig. 3). As noted on page 52, an approach to this condition is found in *A. leuciodus*. These appear to be the only species of the genus, and indeed the only Metanemerteans, in which the nephridiopores are situated on the dorsal surface of the body.

The *intestinal cæcum* is enormously developed. Its diverticula reach forward on each side even to the anterior end of the brain. In the brain region each of the cæcal diverticula appears as a rounded lobe on either side directly above, and closely approximating to, the dorsal brain-lobe. Back of the brain there are several rather slender lobes on each side. These lie mainly above the lateral nerves, but send off branches below the nerves at frequent intervals. Somewhat farther back in the esophagal region these lateral lobes join the main, unpaired cæcum, which lies immediately below the esophagus. This cæcum, throughout its course to the intestine proper, gives off numerous lateral diverticula on each side, and these branch upward above the lateral nerve cords (PL. XI, fig. 3).

Sub-muscular glands.—These occur abundantly in the brain region, and are still more closely packed together in the anterior portion of the esophagal region. They occupy positions, as in other species, in the connective tissues beneath the musculature in the latero-ventral regions of the body. Each gland is composed of a number of cells, and each has a duct leading through the layers of the body wall to the exterior on the latero-ventral aspect. A much smaller number open on the dorsal surface. In the posterior end of the esophagal region these glands have almost entirely disappeared, although a few are met with in the anterior portion of the intestinal region.

Color.—The color of the individuals of this species is commonly a homogeneous, opaque white, very pale flesh color, or pale yellowish-white. This color is continuous throughout the length of the body, both above and below, except where the internal organs show through. The smaller specimens are pale, while the larger ones almost always exhibit a brownish color, which indicates the position of the intestine. Sometimes minute reddish-brown specks are distributed over the dorsal surface. Occasionally a worm of this species is met with in which the intestinal lobes are pale orange. The brain is plainly distinguishable in the living worm because of its pinkish coloration.

Habitat.—Amphiporus exilis is one of the most common, as well as the most widely distributed species of nemerteans met with on the expedition. It occurred abundantly at nearly all the collecting stations from Victoria, B. C., to Dutch Harbor, Unalaska. The worms are restless and are often seen crawling over stones between tides. They live among barnacles, mussels, etc., from low water well up to high water mark, and are found abundantly under stones in almost all sorts of locations. The species is especially hardy.

TETRASTEMMA Ehrenberg.

Symbolæ Physicæ, Berlin, 1831.

This genus includes a group of very small, slender worms, seldom more than 20 to 30 mm. long, with slightly flattened body, and usually with four well-developed ocelli, which form a quadrangle on the head. In a few species (cf. *T. aberrans*) these ocelli are each replaced by a group of two or three smaller ones, and in other species ocelli are wanting entirely. The anatomical structures are very similar to those of *Amphiporus*, and the distinctions between the two genera are not clearly defined. The mouth and proboscis open together. The cerebral sense organs lie close in front of the brain. The proboscis sheath extends to the posterior end of the body, and the proboscis is well developed, armed with central stylet and pouches with accessory stylets, and usually provided with ten nerves.

Only three species of the genus were met with on the expedition, although it seems probable that a number of other forms of these minute worms will be found later.

19. TETRASTEMMA BICOLOR sp. nov.

pl. 1, fig. 6.

Body moderately slender, rounded both above and below; much larger and longer than most species of the genus, sometimes becoming 50 to 60 mm. in length in extension.

Color.—This species is bright brownish-red or orange the whole length of the dorsal surface; the whole ventral surface is pale gray or whitish. The anterior border and lateral margins of the head, as well as the lateral margins of the body for a short distance back of the head, have the same whitish color as the ventral surface. A narrow, median, white stripe, sharply marked off from the reddish color of the dorsal surface, extends from the white, anterior border of the head nearly to the posterior end of the body. Posteriorly the stripe becomes more irregular and is usually lost near the posterior extremity.

Ocelli.—Four, rather large, rounded, arranged nearly in the form of a square.

Proboscis.—Proboscis sheath and proboscis as in typical species of the genus. Proboscis provided with a moderately heavy central stylet about .075 mm. in length. Basis of central stylet somewhat conical in shape, swollen behind, and about 1½ times as long as the stylet itself. There are two pouches of accessory stylets, with usually three or four stylets in each pouch.

The blood is dark red, and the blood vessels may be traced in the living worm the whole length of the body.

Habitat.—The species was found only at Kadiak, where it was dredged in about three fathoms. It slightly resembles some varieties of *T. vermiculus* Quatrefages, but the longitudinal bands of dark pigment between the two ocelli of the same side are lacking, and the median white line is sharply demarkated, so that the two species are undoubtedly specifically distinct.

20. TETRASTEMMA ABERRANS sp. nov.

This is a minute Nemertean, the specimens found not exceeding 12 mm. in length in greatest extension. Body moderately slender, slightly flattened. A pair of slight vertical slits on sides of head.

Color.—Pale yellow throughout, both above and below.

Ocelli.—Of moderate size, or rather small, arranged in four groups which form a rectangle, as do the single eyes of typical species of the genus. Each of the four groups is composed of three to five ocelli of variable size. The two anterior groups lie well toward the tip of the snout, while the two posterior groups lie above or slightly in front of the brain (fig. 15). The appearance of the eyes is such as to give at once an impression that the multiple nature of each group has arisen from the fragmentation of single ocelli. This I consider to be the case. At least one other species of *Tetrastemma* (*T. cruciatum* Bürger) is known in which the four ocelli are double, and I have often noticed other species of the genus—notably the fresh water *T. rubrum* (Leidy)—which showed almost conclusively that one or more of the six or seven eyes present had been derived from a splitting of the primary ocelli. In one instance the fragmentation had been carried so far that no fewer than 20 to 30 pigment spots were present.

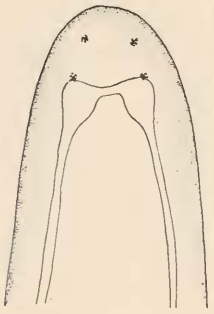

FIG. 15. *Tetrastemma aberrans*. Dorsal view of anterior portion of body, showing outline of brain and arrangement of the four groups of ocelli. ×25.

Proboscis sheath and proboscis as in other species of the genus. Mouth and proboscis open together; proboscis sheath reaches the posterior end of the body. Proboscis provided with a rather slender central stylet and basis; the two accessory stylet pouches each with two or three stylets of typical form. The proboscis possesses twelve nerves, and in this respect again shows a departure from the typical *Tetrastemma*, where there are usually but ten proboscidial nerves.

Nephridia.—The nephridial canals are short, and reach forward to the brain. Anteriorly each nephridium lies above the lateral nerve, but farther back the branches ramify both above and below the nerve. Near the anterior end of each of the main canals a large efferent duct passes outside of the lateral nerve, and bends downward and outward to open to the exterior on the lateral margin of the body. In one instance a double efferent canal was observed.

The head is provided with large cephalic glands which open on the tip of the snout. The *cerebral sense organs* are large. They lie mainly in front of the brain, although their posterior ends extend backward beside and lateral to the brain lobes. Each connects with the exterior by a canal which runs anteriorly to open on the lateral margin of the head.

A broad *intestinal cæcum* reaches into the anterior fourth of the esophagal region. It lies below the esophagus, and sends off a few wide lobes on each side, but these reach dorsally only a little above the lateral nerve. The esophagus opens into the cæcum far behind the anterior sexual glands, and nearly as far back as the middle of the body. The reproductive pouches lie both above and below the intestine.

As will be seen from the above description, this species agrees closely with the typical species of *Tetrastemma* in size, general appearance, and in the details of the internal anatomy. It differs from known species of the genus only in the fragmented nature of its eyes and in the number of nerves in the proboscis. It seems extremely probable, however, that when more of the described species have been examined in this regard, some of them will be found to contain more or less than ten proboscidial nerves. The eyes certainly resemble those of *Tetrastemma* more closely than they do those of any described species of *Amphiporus*.

Habitat.—Found among hydroids in about four fathoms in Glacier Bay, and between tides at Orca, Prince William Sound. Not common.

21. TETRASTEMMA CÆCUM sp. nov.

A small species which I shall refer provisionally to this genus was found by Ritter in considerable numbers at Kadiak. The species is especially remarkable, and quite aberrant from most other species of *Tetrastemma*, both in lacking ocelli and in being hermaphroditic. The body is rounded and of almost even diameter throughout. The head has a pair of inconspicuous, oblique, lateral furrows.

Color.—The worms are very pale, whitish or pale yellowish in color, with dark intestinal lobes.

Size.—Very small, not usually more than 5 to 10 mm. long and 0.5 to 1 mm. in diameter when sexually mature.

Ocelli.—Wanting.

Proboscis.—The proboscis sheath reaches nearly to the end of the body. The proboscis is remarkable for its enormous size as compared with the size of the body—when everted its diameter is practically equal to that of the body itself, although it is then comparatively short. Its armature consists of a central stylet with rather slender basis, and of two pouches of accessory stylets. The basis of the central stylet is slightly swollen and somewhat sharply truncated posteriorly. Each pouch contains 2 or 3 long, slender and delicate accessory stylets.

In cross section of the proboscis the inner and outer circular muscular layers appear as usual. The intervening layer of longitudinal muscles, however, is divided into two secondary layers separated by a thick sheet of nerves and connective tissue. The nerves appear to be more or less confluent, and not separated into a definite number of longitudinal cords as in most other species of *Tetrastemma*. This appearance may be partially due, however, to the action of the formalin in which the worms were preserved.

Sense Organs.—The cerebral sense organs are very well developed, and unusually voluminous as compared with the other organs of the head. They lie in front of the brain, and extend posteriorly on the ventral side of the brain lobes as far as the ventral commissure. Each sense organ communicates with the exterior by a small canal passing obliquely forward to open on the lateral margin of the head.

The *brain* is of small diameter, but its extent antero-posteriorly is comparatively great.

Reproductive organs.—The individuals are hermaphroditic, and probably to some extent protandric although there is considerable variation in this respect. One of the individuals sectioned was filled with ripe spermaries only, but all the others possessed enormous ova, with the spermaries disposed irregularly. The mature ova were fully two-thirds the diameter of the body, and hence were arranged at irregular intervals in a single row. Where the ova were mature the spermaries were smaller and contained much fewer spermatozoa than in those individuals which were without large ova. Many of the spermaries had ducts which pierced the muscular layers to reach the dorso-lateral surfaces of the body. In some cases where these ducts were fully formed, and the spermatozoa therefore mature, the ova in the same individual were but half grown. The sexual products were mature in July.

TÆNIOSOMA Stimpson.

Tæniosoma STIMPSON, Proc. Acad. Nat. Sci. Philadelphia, p. 162, 1857.
Polia DELLE CHIAJE, Mem. sulla storia e notomia degli anamali senza vertebre del regno di Napoli, Naples, 1823–28.
Eupolia HUBRECHT, Report of Challenger Exped. Zoöl., XIX, 1887.
Eupolia BÜRGER, Fauna u. Flora von Neapel, Monogr. 22, p. 598, 1895.

For the reasons given on page 4, it seems absolutely necessary to adopt for this genus the name given by Stimpson in 1857 rather than accept that of Hubrecht of 30 years later, even though most European writers have ignored Stimpson's brief, but careful, diagnoses.

The species belonging to this genus show a remarkable specific variation in the general shape and size of the body. Some are characterized by extremely long, slender, flattened, and much twisted bodies, while others are short, thick, and cylindrical. In all the species, however, the head in life is rounded in front and is sharply marked off from the parts immediately following by lateral constrictions. Horizontal furrows are wanting, but small, oblique or transverse grooves may be present on the head. In strong contraction the esophagal region becomes greatly swollen, the head is drawn in (PL. II, fig. 4), so that the anterior end of the body is large and shortly truncated.

Proboscis sheath and proboscis short, seldom reaching more than one-third the length of body. Proboscis opening subterminal, minute. Mouth a small round opening on the ventral surface immediately behind the ganglia.

Muscular layers of body composed of a thick outer longitudinal, a circular, and a less thickened inner longitudinal layer. Outside the muscular layers is a well developed cutis, composed of a thick inner layer of connective tissue, and an outer layer of glandular tissue. The external epithelium is thin, as compared with the other layers of the body, though the fibrous layer separating it from the cutis is well developed. The musculature of the proboscis consists of an inner longitudinal, and an outer circular muscular layer. Consequently there can be no muscular crosses.

The cephalic glands are enormously developed. They stretch backward on all sides beyond the brain, and even reach some distance into the esophagal region.

The lateral nerves lie immediately outside the circular muscular layer. There are three longitudinal blood vessels.

Ocelli are usually present in great numbers, though very small.

The worms are sluggish in their habits, are unable to swim, and usually show great irregularities in the diameter of the body. They

are prone to twist themselves in sharp coils, or in knots, and often lie in lumps. They are usually capable of contracting and extending their bodies to a remarkable degree.

22. TÆNIOSOMA PRINCEPS sp. nov.

Pl. II, figs. 3, 4.

Body of very large size, long, thick, largest in the esophagal region, cylindrical in anterior portion, flattened on ventral surface posteriorly; in contraction nearly cylindrical throughout. Head sharply marked off from body in extension, rounded in front, flattened dorso-ventrally; in contraction drawn almost entirely into the parts immediately following, so that the anterior portion of the body is greatly swollen and sharply truncated in front. In contraction the anterior end of the body is thrown into massive folds, and the whole body is remarkably short and thick (Pl. II, fig. 4). A pair of inconspicuous, oblique grooves lies on the antero-ventral surfaces of the head; into these the canals leading from the cerebral sense organs open. The esophagal region is scarcely more than one-twelfth the length of the body. In alcoholic specimens there is usually a median ridge on the dorsal surface running the length of the body, except in the head and esophagal regions.

Color.—The dorsal surface is deep ochre yellow, sometimes inclining to orange, and sometimes to brownish, and thickly strewn with minute irregular dark red spots. The reddish markings are most conspicuous near the anterior end of the body, and in the dorsal, median line. In many places a large number of the reddish dots become confluent, and form an irregular patch of deeper color. These patches commonly occur as broken longitudinal lines. Such lines are most abundant on the middle of the dorsal surface where they form a median longitudinal band of reddish-brown. The ventral surface is paler and the reddish markings are wanting. Along the median line the color is brighter yellow than elsewhere on the ventral surface. This is apparently due to the absence in this position of the opaque intestinal lobes. The ventral surface often exhibits a greenish tinge to the yellow ground color. The posterior extremity is pointed and much paler than the rest of the body.

Size.—*T. princeps* grows to a size greater than has previously been described for any species of the genus. The individuals found were from half a meter to two meters in length when extended; when contracted, but a small fraction of this length, and proportionately thick (Pl. II, fig. 4). After long standing in alcohol a section of the

body of one specimen still measured 15 × 18 mm. It is one of the largest Nemerteans of the coast.

Ocelli.—There are many minute ocelli arranged in an irregular group on each side of the tip of the head. The number of such ocelli is commonly 40 or more in each of the two groups.

The *mouth* is a small rounded pore, and is situated several millimeters back from the tip of the head in large individuals. The proboscis-pore is also minute, and is situated subterminally as usual.

Proboscis.—The proboscis sheath reaches some distance into the esophagal region, but is very short when compared with the length of the body. The proboscis is short and weak. Its muscular and epithelial layers are as in other species of the genus.

The *cephalic glands* are enormously developed. They occupy a large proportion of the area in the anterior portion of the head, surround the brain on all sides, and extend still further backwards into the anterior end of the esophagal region. Here they lie in the outer longitudinal muscular layer around the whole circumference of the body.

Body walls.—The outer longitudinal muscular layer about equals in thickness the other two muscular layers combined. In the intestinal region the inner longitudinal muscular layer becomes extremely thin on the lateral aspects of the body, and is much reduced dorsally. It is only on the ventral side that this layer retains its comparative thickness. The cutis is thinner than in most species of the genus, and especially is this true of its inner, fibrous layer. This layer is, throughout most of the body, reduced nearly to the condition of a thin membrane. It is commonly not much thicker than the muscular layer beneath the body epithelium. The epithelium itself is thin in comparison with the massive muscular layers of the body.

The *blood lacunæ* in the head lie directly above the brain, as in other species of the genus. They are, however, remarkably large, and are crossed in various directions by numerous bundles of muscular tissue, which tend to subdivide the lacunæ into numerous smaller spaces. The longitudinal blood vessels are as usual. The dorsal vessel passes out of the proboscis sheath early in its course.

Nephridia.—Situated in anterior and middle portions of esophagal region. Several efferent ducts on each side. These are small in diameter and pass above the nerve cords, opening on the lateral aspects of the body dorsal to the lateral margins.

Cerebral sense organs.—The dorsal lobes of the brain greatly exceed the ventral lobes in size, and lie somewhat lateral as well as above them. The cerebral sense organs are voluminous. They extend for-

ward on each side, external and ventral to the dorsal brain lobes, nearly as far as the ventral commissure. Here, at the anterior extremity of each sense organ, a canal passes obliquely downward and outward to open into a shallow oblique furrow on the ventro-lateral aspect of the head. The sense organs are closely united with the posterior ends of the dorsal brain lobes. In the middle region of the brain, the anterior ends of sense organs are triangular in section, and lie external and between the dorsal and ventral ganglia. Farther back a glandular appendage of the sense organ pushes itself in between the internal faces of the brain lobes. This appendage fuses with the ventral portion of the sense organ more posteriorly. The brain lies deeply buried in the tissues of the head and nearly in the median line, but the lateral nerves while still in the region of the cephalic sense organs bend sharply outward, and occupy throughout the remainder of their course positions immediately external to the circular muscular layer of the body wall.

The *genital products* were nearly mature in July. The oviducts were in many instances preformed, and opened on the dorso-lateral aspects of the body.

Habitat.—Only four individuals of this species came under my observation. One was collected at Cape Fox (Kincaid), two at Yakutat, and the fourth at Orca in Prince William Sound. All were found under stones in rather hard mud at low water. The individuals contract strongly when handled, throwing the surface of the body into wrinkles, and often coil the posterior portion of the body into a close spiral, much as does *Cephalothrix*.

LINEUS Sowerby.

The British Miscellany, London, p. 15, 1806.

Representatives of this genus are characterized by a slender, sometimes thread-like body, usually rounded throughout. The body is commonly twisted and coiled into an irregular mass. The movements are sluggish. The animals creep over objects and readily move about on the surface of the water, but they are unable to swim. The body is extremely contractile; the head is often slightly wider than the body, of oval shape, and is usually provided with numerous minute ocelli, often arranged in a single row on each side of the head. A caudal papilla or cirrus, a diagonal muscular layer, and neurochord cells are all wanting. The proboscis sheath is often short in comparison with the length of the body.

23. LINEUS VIRIDIS (Fabr.) Johnston.

Planaria viridis O. Fabricius in O. F. Müller, Zool. Dan. Prod., 1776; Fauna Grœnlandica, p. 324, 1780.
Planaria gesserensis Müller, Zool. Danica, II, p. 32, 1788.
Nemertes obscura Desor, Boston Journ. Nat. Hist., VI, pp. 1 to 12, 1848.
Lineus viridis Johnston, Catalogue British Non-parasitical Worms, pp. 27, 296, London, 1865.

As stated by Verrill,[1] there seems little doubt that the description of this species sent by Fabricius to Müller and published by him in the Zoologica Danica, is entitled to retain priority in nomenclature instead of Müller's *gesserensis* of later date, which has been adopted by most recent European writers.

Characteristic individuals of this species were found under stones at low water at New Metlakahtla, on Annette Island.

Body moderately slender, rounded throughout, but slightly flattened posteriorly; head slightly wider than the parts immediately following; cephalic slits long and deep, with pale margins above and below, reaching anteriorly close to the proboscis pore. The anterior end of the mouth does not reach quite so far forward as the posterior end of the cephalic slits. Length usually 100 to 200 mm.

On each side of the head in front of the brain and close to the lateral borders is a single row of minute ocelli (fig. 16). The number of these is commonly from four to six on each side, though some individuals have as many as eight, and very young specimens but a single pair.

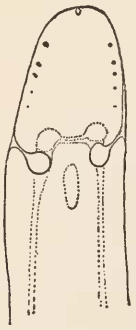

Fig. 16. Outline of anterior portion of body of *Lineus viridis* showing arrangement of the ocelli, and position of brain, cephalic sense organs and mouth. ×8.

Color.—The Alaska specimens were dusky or brownish green, becoming dark brown anteriorly, and commonly paler on the ventral surface, especially posteriorly. The head is very pale on lateral margins and in front. The brain is large, reddish, and shows distinctly through the pigment of the body. Cerebral sense organs paler but easily distinguished in life, with conspicuous canals leading to the posterior ends of the cephalic slits (fig. 16).

Habitat.—This species, besides being found in Alaska, is widely distributed in northern waters. On the east coast of America it occurs from Long Island Sound to Greenland. It is found on nearly all the coasts of northern Europe. It has also been found in the Medi-

[1] Trans. Connecticut Acad., VIII, p. 421, 1892.

terranean, though it is there comparatively rare and small. It is usually found between tides under stones in muddy localities.

24. LINEUS TORQUATUS sp. nov.

pl. v, figs. 8, 9.

Body rather thick and stout for the genus, somewhat flattened throughout, but especially posteriorly and on the ventral surface. Head short, pointed in front, somewhat narrowed behind, slightly flattened. A slight annular constriction commonly marks off the head region from that immediately following. Sometimes this constriction is very conspicuous, and the head much narrower behind. Esophagal region rounded above, flattened below. Intestinal region commonly well flattened but without narrow margins. Posterior end slender.

Cephalic furrows rather short. In alcohol or formalin they join the terminal proboscis pore in front, but in life they are separated from it.

Ocelli.—Absent, at least in mature individuals. Mouth a minute pore or a large slit, according to state of contraction; situated a little behind posterior end of cephalic furrows.

Color.—The color is usually dark, reddish-brown, chocolate, or purple above; paler and commonly more reddish beneath. The dorsal surface is often flecked with irregular minute, inconspicuous whitish specks. A narrow transverse white band passes across the dorsal surface at the posterior ends of the cephalic furrows. This characteristic marking reaches only to the lateral edges, and is not seen from the ventral surface. The cephalic furrows are sometimes, but not always, bordered above and below by a narrow band of white. Furthermore a minute white spot occupies the region of the proboscis pore. The white borders of the cephalic furrows commonly connect this white spot with the white transverse dorsal band on the posterior portion of the head. On the extreme tip of the snout—in the white area around the proboscis pore—a pair of small pigment spots is sometimes present, one on each side of the proboscis pore.

Size.—Length usually 200 to 400 mm. in extension, width about 5 mm.

Proboscis.—The proboscis is moderately slender and of medium size. It is without color. The inner longitudinal muscular layer is almost entirely wanting; the crosses between the circular layers are distinct, and the nervous plexus is exceptionally well developed. A single pair of large nerves enters the proboscis at its point of attachment at its anterior end. They originate from the ventral commissure of the brain near the ventral ganglia, enter the proboscis from the ven-

tral side, pass backward for some distance on the right and left sides respectively, and later spread out into a cylindrical plexus immediately internal to the muscular layer, and separated from the inner epithelium only by a few longitudinal muscular and connective tissue fibers.

Glands.—The cephalic glands are very well developed, and occupy a large portion of the region of the head in front of the brain, both above and below the rhynchodæum. They do not extend posteriorly quite so far as the brain.

Nerves.—The nervous system is far more easily made out than in any of the related species with which I am acquainted. The individual nerves are large and are sharply defined in all cases. The nerves extending from the brain toward the tip of the snout are numerous and are all of large size. The esophagal nerves are also surprisingly large and quite conspicuous. They have several transverse connecting branches after their origin from the ventral ganglia. The most posterior of these connecting branches occurs just in front of the mouth. In the mouth region they communicate in several instances with the lateral nerves by means of branches which pass through the nervous plexus outside the circular muscular layer. These branches from the lateral nerves follow the nervous plexus to the vicinity of the esophagal nerves, which they join by passing directly through the circular muscular layer. I do not know that such an anastomosis between the lateral nerve cords and the esophagal nerves has been previously noted in any species.

The median dorsal nerve, situated just outside the circular muscular layer, is unusually conspicuous, and throughout a considerable portion of the intestinal region is supplemented by a second median nerve lying directly beneath the first, but in the midst of the internal longitudinal muscular layer. Branches connect these two nerves at frequent intervals.

Cerebral sense organs.—Voluminous. The canals leading to the exterior open on the summit of a broad papilla situated at the posterior, widened end of each of the cephalic slits.

Nephridia.—The nephridial canals are of much greater diameter than I have observed in any other Nemertean. The canal on either side is, throughout a portion of its length, equal to the lateral nerve cord in cross section. The nephridia extend through the anterior half of the esophagal region. The main tubule has a few very large branches, and these lie in the walls of the blood spaces about the esophagus. Anteriorly the branches lie mainly dorsal to the lateral nerves, but towards the posterior ends of the nephridia the branches

ramify more towards the ventral side of the esophagus. There is a single pair of efferent ducts which are of enormous size as compared with those of other species. These ducts are situated at about two-thirds the distance towards the posterior ends of the nephridia, and open on the dorso-lateral aspects of the body as usual.

Habitat.—This species is common in mud and under stones in muddy localities at Orca and Virgin Bay in Prince William Sound, but was not met with elsewhere on the expedition. The individuals are hardy and of sluggish movements. They do not break up nor contract excessively when thrown into killing fluid, and the proboscis is not usually everted when the animal is killed. Some, especially the smaller ones, when preserved are nearly cylindrical, but most individuals are flattened ventrally. The color is fairly permanent in formalin, and even in alcohol for some months.

MICRURA Ehrenberg.

Symbolæ Physicæ, Berlin, 1831.

This genus includes mostly moderately small, slender forms, generally less rounded posteriorly, and of rather more active habits than *Lineus*. Its most marked distinction from the latter genus is that the posterior extremity of the body is provided with a slender, usually colorless, muscular caudal cirrus. This is formed of a continuation of the muscular tissues and integument beyond the posterior end of the alimentary canal.

The species of *Micrura* are generally, though not always, more brightly colored and have more distinct markings than those of *Lineus*. The vast majority of the species are provided with numerous ocelli, though some are blind. The head is slender, and not distinctly separated from the rest of the body. The lateral faces of the body are not provided with thin edges as in *Cerebratulus*, the intestinal region is not so much flattened, neurochord cells are not present in those species which have been studied, and none of the species are able to swim as do all species of *Cerebratulus*. The mouth is usually smaller than in *Cerebratulus*, and the intestinal lobes are not so deep.

The proboscis is usually slender and comparatively weak; the proboscis sheath is sometimes considerably shorter than the body.

25. MICRURA VERRILLI sp. nov.

Pl. v, figs. 1, 2, 3.

Body moderately elongated, widest anteriorly, tapering to an acute anterior extremity; much more slender posteriorly. Ventral surface

flattened; dorsal surface rounded. Head narrow in front. Cephalic furrows long and deep; at their posterior ends each is met by an oblique, shallow depression above and below. Proboscis-pore exactly terminal; anterior ends of cephalic furrows well separated from proboscis pore. Mouth small, situated as far back as posterior ends of cephalic furrows. Caudal cirrus small, slender, easily broken off.

Color.—This is one of the handsomest and most striking of all the described species of Nemerteans. The color of the dorsal surface is deep purple or wine-color; that of the ventral surface is purest white.

On the dorsal surface are usually 15 to 40 very sharp, pure white, transverse bands or lines connecting with the white color of the ventral surface. These transverse bands are nearly as narrow as pencil marks, and are situated at fairly regular intervals throughout the length of the body. They are sometimes more or less interrupted, but always sharp and distinct. On the dorsal surface of the tip of the snout is a small triangular marking, always very conspicuous because of its bright orange color. Following behind this is a narrow transverse white band, followed by broad purple and narrow white bands in succession. The cephalic furrows lie within the white color of the ventral surface, and are bordered above with a very narrow margin of white. They reach posteriorly as far as the second white band.

After preservation in formalin or alcohol the worms are strongly rounded below as well as above, and the color of the dorsal surface changes from purple to red, while the orange spot on the tip of the snout disappears.

Ocelli.—None were found.

Proboscis.—Colorless, and shorter than in many species of the genus. Its microscopic structure shows distinctly the three muscular layers and the muscular crosses characteristic of the family. The inner circular muscular layer is very thin. The nervous plexus inside the circular layer is usually well developed.

Nervous system.—The dorsal ganglion of the brain is divided posteriorly into two distinct lobes, of which the smaller, dorsal lobe ends shortly, while the larger, ventral lobe continues into the cerebral sense organ. Each of these sense organs is of about the same size as one of the ventral ganglia, but considerably smaller than either dorsal ganglion. The duct lying on the external border of each of the pair of cerebral sense organs communicates, as usual, with the enlarged posterior end of the cephalic furrow by means of a wide duct opening directly outwards. The dorsal median nerve, lying just outside the circular muscular layer, is remarkably conspicuous throughout the whole length of the body.

A section through the esophagal region shows that the outer longitudinal muscular layer of the body wall is particularly thick, and that the esophagus is unusually small. The other layers are as in most species of the genus.

The lateral blood lacunæ break up in the esophagal region into numerous thin-walled vessels, or spaces, which surround the lateral and ventral walls of the esophagus.

Nephridia.—The nephridia extend through the anterior ⅔ of the esophagal region, as a single profusely branched tubule on each side. All the branches of the main canal are small, and lie in close connection with the walls of the blood spaces about the esophagus. The efferent ducts are very numerous, but minute. They open on the dorso-lateral aspects of the body, usually not far above the lateral margins. In a single instance one of the efferent ducts was found to open beneath the lateral margin, but this must be looked upon as abnormal. In several instances two efferent ducts lay close together on the same side, but in such cases one originated much nearer the ventral side of the esophagus than did the other. The actual number of efferent ducts counted in one medium-sized individual was 17 on one side, and 24 on the other.

Reproductive organs.—The pouches containing the sexual products when mature become so voluminous as to occupy more than half the entire space within the body walls. In July, when the genital products are fully ripe, the ducts leading to the exterior are completely formed some little time before the elements are discharged. Each pouch has a single duct opening into a funnel-shaped depression through the epithelium on the dorso-lateral aspect of the body. The opening into the cavity of the ovary is on the surface of a broad papilla formed of long columnar cells, a portion of which bend inward to guard the opening. The ducts often have a somewhat tortuous course, and are likely to broaden out considerably in passing through the circular muscular layer.

Size.—The length of the largest individual observed was about 300 mm., and its width 6 mm.

The species is named in honor of Prof. A. E. Verrill, of Yale University, who, more than any one else, has helped to bring the American species of Nemerteans into orderly arrangement.

Stimpson[1] briefly describes from Bering Strait a species of *Cerebratulus* (*C. impressus* = *Micrura impressa*) which bears a superficial resemblance to the above. Stimpson's species, however, was flattened,

[1] Proc. Philadelphia Acad. Nat. Sci., p. 160, 1857.

of a dusky gray color above, with narrow, colorless, transverse lines, and with a flesh-colored subtruncate head, much narrower than the body. The same author describes a somewhat similar species (*C. bellus* = *Micrura bella*) from Yezo Island, Japan. This had 10 bluish-white, narrow transverse lines across the ashy-gray dorsal surface, and a white ventral surface. The head was short, and of a vermilion color. Both these species should be referred to the genus *Micrura* as here defined.

Habitat.—This species was found only at Virgin Bay, in Prince William Sound. Here it was not uncommon under stones at low water, and was frequently met with in the parchment like tubes of *Carinella capistrata*, with which it was associated.

26. MICRURA ALASKENSIS sp. nov.

Pl. IV, fig. 2; Pl. XIII, fig. 1.

Body long and slender, rounded in esophagal region, flattened throughout the whole intestinal region. Head remarkably slender, elongated, and sharply pointed; cephalic furrows correspondingly long, but their anterior ends do not reach the proboscis pore. Mouth small, and well back from tip of snout; its anterior end reaches about as far forward as posterior ends of cephalic furrows.

No ocelli are present. The brain is reddish in color, and shows conspicuously through the tissues external to it.

The esophagal region is well rounded, and narrower than the succeeding portion of the body. The intestinal region is much flattened both above and below; its lateral margins are rounded, however. After preservation in alcohol the intestinal region is flattened or even hollowed ventrally, while the dorsal surface is very convex. Posteriorly the body tapers gradually, and at its pointed extremity an unusually long caudal cirrus is present. This is quite colorless, and contracts after preservation to but a fraction of its original size and length.

Color.—Two color varieties were met with. Most commonly the general color was a salmon or flesh-color. The esophagal region was pale salmon with tinges of brighter red, becoming lighter anteriorly; the head pale or nearly colorless; the brain region distinctly red; the intestinal region pale salmon, with much more deeply colored intestinal lobes. Running the whole length of the ventral side of the body—from near the mouth to the caudal cirrus—is a characteristic, narrow, cream or flesh-colored stripe in the median line. This stripe is conspicuous only in the intestinal region, though it may be traced forward to the mouth, as stated. In alcoholic specimens it can still be detected

in the intestinal region, though the natural color of the body has mostly disappeared. A similar, though much less conspicuously marked, median stripe occurs on the dorsal surface.

The second color variety had chestnut brown intestinal lobes, brownish esophagal region, slightly paler below; snout and margins of head colorless; brain red. The paler, ventral, median stripe was even more conspicuous than in the other variety.

Serial sections show that, while the cephalic furrows are unusually long, yet they are not really as deep as in many related species. The brain is very large; the posterior end of each dorsal ganglion is bilobed, the dorsal lobe ending freely, while the ventral lobe continues directly into the cerebral sense organ. The canals from the sense organs open into the very posterior ends of the cephalic furrows. The buccal, or esophagal, nerves are larger than in most species.

Accessory buccal glands.—On each side of the mouth, and extending a short distance into the esophagal region, is a series of peculiar glands—accessory buccal glands, they may be called. These glands are similar in their nature to, and apparently supplement, the ordinary buccal glands which line the mouth cavity. In the present instance, however, these accessory glands lie imbedded in the outer longitudinal muscular layer ventral to the lateral nerves. Here they greatly encroach upon the domain of the muscles, and occupy a large portion of the space between the circular muscular layer and the cutis (PL. XIII, fig. 1). The gland cells are large, and are distended with a clear, granular secretion. These accessory glands appear to have originated from ordinary buccal glands which have passed outward and taken up a position outside the two inner muscular layers (PL. XIII, fig. 1). They are arranged in clusters, and discharge their contents by irregular ducts leading through the two inner muscular layers to the epithelium of the buccal cavity and adjacent esophagal wall. A short distance back of the mouth the two lateral series of these accessory buccal glands unite beneath the esophagus, and are not found further posteriorly. The ordinary buccal glands are present as in related species.

Alimentary canal.—The *esophagus* is large in comparison with the thickness of the body wall. The histological difference between the epithelium lining its anterior portion and that of its posterior half is much more marked than in most related species. The delicate layer of circular and longitudinal muscular fibers which surrounds the epithelial lining of the esophagus in most of the Heteronemerteans becomes remarkably developed in this species. At the very posterior end of the esophagus—just anterior to the first intestinal pouches—

the circular muscles of the esophagus increase so greatly in number that they form a most conspicuous layer. In the region of its maximum development this layer becomes nearly half as thick as the circular layer of the body walls in the same section. In no other species of the *Lineidæ* has this muscle been found of even approximately this thickness. Its fibers connect in part with the circular layer of the body walls, and to a lesser degree with the circular muscles of the proboscis sheath. But few fibers lie on the dorsal wall of the esophagus, so that this organ is largely bound up with the proboscis sheath in a continuous layer of muscles, and one cannot fail to see the striking resemblance between this circular layer and the inner circular muscles that are so highly developed in precisely the same region in *Carinoma* (p. 22).

Body walls.—The external longitudinal muscular layer of the body walls is especially weak when compared with the same layer in related species. This is partly shown by the fact that the cutis glands extend ¾ or more of the distance from the exterior to the circular muscular layer. Nearer the intestinal region the muscular layers are thicker, and the esophagus occupies correspondingly less space.

The three longitudinal blood vessels are very conspicuous throughout their length. The dorsal vessel leaves the proboscis sheath near the posterior ends of the nephridia, or at about ⅔ the distance towards the posterior end of the esophagal region.

Nephridia.—The nephridial system consists of a pair of unusually large, longitudinal canals, which lie in the dorsal walls of the lateral blood lacunæ beside the esophagus. The nephridial canals send off very few branches, except near their anterior ends, where they divide into smaller branches. The main canals extend through about the middle third of the esophagal region. Each of the pair of longitudinal canals terminates posteriorly in a single, remarkably large efferent duct which opens on the dorso-lateral aspect of the body. The ducts sometimes lie exactly opposite, but in other specimens one lies some distance farther back than the other. In such cases, of course, one of the nephridia extends a corresponding distance farther posteriorly than the other. Each of the efferent ducts spreads out as it passes through the circular muscular layer into a broad sieve-like or filter-like structure with scores of small, nucleated cells. From this point a straight and comparatively narrow duct leads directly to the surface.

Reproductive glands.—The sexual elements are fully mature in the month of June, and the genital ducts at this time are fully formed. In the females each duct communicates directly with the cavity of the ovary by a funnel-shaped opening, and a similar funnel-shaped open-

ing lies at the outer end of the oviduct on the dorso-lateral aspect of the body. The bodies of many of these worms were so distended with sexual products that they were very easily ruptured and could consequently be preserved intact only with great care.

Size.—The length of this species is commonly about 150 mm. in extension, although several individuals were found which were more than 300 mm. long.

Habitat.—The species was found under stones between tides in rather muddy localities at New Metlakahtla on Annette Island, at Glacier Bay, Sitka, Yakutat, and at Orca and Virgin Bay in Prince William Sound. At the four last-named localities the worms were abundant. Nearly 50 individuals, some of them nearly 300 mm. long, were found at Sitka massed together in a single cavity in coarse gravel mixed with mud. All were filled with fully mature sexual products, and the bodies of nearly all were in contact in a tangled mass.

CEREBRATULUS Renier.

Prospetto della Classe dei Vermi (t. Bürger), 1804.

The species of this genus are distinguished by long, flattened bodies, the lateral margins of which are thin, adapted for swimming. Most species are very active, swim readily with undulatory motion, can roll up spirally and become twisted, but are only moderately contractile in length, and do not draw together into a tangled mass. The dorso-ventral musculature is highly developed, as are likewise the longitudinal and oblique muscles.

Head usually pointed anteriorly, but very changeable in shape; lateral slits long and deep; proboscis pore terminal; mouth large, and situated behind the ganglia; esophagal region mostly rounded; intestinal region broad and flat with thin lateral margins; the posterior end extremely flattened and provided with a delicate caudal cirrus, which extends beyond the opening of the intestine, and in most species is easily broken off and lost. Eyes usually wanting; body commonly of a nearly homogeneous color without distinct markings (such as longitudinal and circular bands and rings).

Proboscis sheath reaches to posterior end of body; proboscis very long and strong. Intestinal pouches deep and mostly forked peripherally; central intestinal canal narrow. Neurochord cells probably commonly present in brain and lateral nerve cords, though they have as yet been found in but few species.

27. CEREBRATULUS HERCULEUS sp. nov.

Pl. 1, fig. 5.

Body very large, stout, thick, broad, attaining a length of 2 meters or more, and a breadth of more than 25 mm.; remarkably broad when contracted, the body somewhat resembling that of a leech. One specimen, preserved in alcohol and strongly contracted, now measures 300 mm. in length, 25 mm. in width in intestinal region; 18 mm. in width and 15 mm. in thickness in esophagal region. The length of the esophagal region in this specimen is only about 55 mm. after preservation.

Head very short, thick, and bluntly pointed. Cephalic slits short, separated in front, reaching back in the alcoholic specimen but 7 mm. Mouth large, situated as far back as the posterior end of the cephalic furrows.

Esophagal region short and thick; intestinal region very broad and flat, with thin, wavy margins in life. Posterior extremity provided with a pale caudal cirrus of comparatively small size. Proboscis large, colorless, fully equal in size to that of a large specimen of *C. marginatus*. No ocelli.

Color.—Color very dark brown or reddish brown throughout the whole dorsal surface, rather paler and less bright ventrally.

This gigantic Nemertean is not clumsy in its movements, but is active, and swims rapidly and gracefully. It was met with only at Sitka, where it occurred in considerable numbers in mud at low water mark, associated with *C. marginatus*. The worms are fragile, and break spontaneously unless carefully handled.

28. CEREBRATULUS MARGINATUS Renier.

Cerebratulus marginatus Renier, Prospetto della Classe dei Vermi (t. Bürger), 1804.
C. angulatus McIntosh, British Annelids; Pt. 1, Nemerteans, p. 195, Ray Society, 1872–73.
C. fuscus Verrill, Trans. Connecticut Acad., viii, p. 438, 1892.

This large and active Nemertean was found in several localities about Sitka, but not in great numbers. The individuals there found possess the typical color of the species, with which they agree externally in every detail except the shape of the body. All the Alaska specimens are much shorter and comparatively broader than those I have seen in Naples, although careful study of microscopic sections revealed no essential anatomical differences. It is therefore probable that this is but a local peculiarity of a single widely distributed species.

The worms were found near low water mark living in soft black mud beneath a considerable growth of 'eel grass.' The mud contained a great quantity of decomposed vegetable matter, and was saturated with sulphuretted hydrogen. The worms are excellent swimmers, and are very rapid in their movements in their underground burrows.

The specimens obtained measured up to 500 mm. or more in length, and about 15 mm. in width.

The color above was slaty-brown, dark gray, or greenish-gray, with white or colorless margins.

The species has been previously recorded from the Mediterranean, the coasts of Great Britain, Madeira, the northeastern coast of America, Greenland, and from other localities.

29. CEREBRATULUS OCCIDENTALIS sp. nov.

PL. VI, FIG. 3.

Body 300 mm. or more in length in moderate extension; rather slender, rounded in front, flattened behind, and with very thin margins in the intestinal region, as in other species of the genus. Head changeable in shape, either rounded or acutely pointed, according to state of contraction. Cephalic furrows rather short.

Color.—Individuals vary considerably in the general color of body, but are most commonly chestnut brown or dull reddish anteriorly, and light chocolate brown in the intestinal region. The ventral surface is brownish flesh-colored, with a median, ochre ventral stripe. Sometimes the ventral surface is nearly chocolate throughout its entire length. A darker median dorsal stripe is indicated.

Proboscis.—Remarkably small and slender, being many times smaller than in most related species of equal size. It is colorless, and is usually everted when the animal is killed.

In internal anatomy but few points need special mention. The cephalic glands are unusually well developed, and continue backward as the cutis glands. The brain is remarkably voluminous, the dorsal ganglion bilobed, the lower lobe continuing into the cerebral sense organ.

The mouth is very large, and is provided with an unusual abundance of buccal glands. There are many diagonal fibers between the proboscis sheath and the body musculature.

Nephridia.—The nephridia are of moderate length, and occupy the middle third of the esophagal region. The main tubules lie in the angles between the esophagus and the proboscis sheath. They are profusely branched towards their anterior ends, each branch lying in

the wall of one of the esophagal blood lacunæ. Farther back the branches unite into a single tubule on each side. Their main canal continues backward for a considerable distance in the wall of a lateral blood lacuna, and is without branches. At its posterior extremity the efferent duct bends to the dorso-lateral surface of the body, as usual.

The sexual products are fully mature in July.

Habitat.—This is a very active species. It was found in abundance at Wrangell, Yakutat, Orca, and Virgin Bay. It inhabits the shore at half tide and below, in muddy places and under stones. The small size of the proboscis will distinguish it from related species.

30. CEREBRATULUS LONGICEPS sp. nov.

PL. V, figs. 4, 5, 6, 7 .

Body much flattened throughout its whole length; anterior portion remarkably narrow and slender, becoming wider posteriorly. Head much narrower, more slender, and longer than in most species of the genus, acutely pointed in front, much flattened dorso-ventrally, and with the tip of the snout often slightly curved upward. A section through the head is often concave both above and below, showing that the head is thicker laterally than in the median line. The head is directly continuous with succeeding portions of the body. Frontal sense organs very highly developed.

Cephalic furrows very long, and remarkably deep and wide. Anteriorly they do not reach quite to tip of snout. They are, consequently, well separated from the proboscis pore, which is situated subterminally. The mouth is situated as far back as the posterior end of the cephalic furrows.

From the narrow, pointed head the esophagal region gradually widens as it passes backward, but it remains unusually flat throughout; the intestinal region is not sharply marked off from the esophagal region, but widens gradually toward the posterior third of the body, and narrows toward the posterior extremity. The intestinal region is even flatter than the more anterior portion of the body. The caudal cirrus was not observed.

Proboscis.—The proboscis sheath is reduced to a frail tubule in the posterior third of the intestinal region. The proboscis is slender and colorless; it has the three muscular layers and the muscular crosses, as usual in the genus.

Color.—Dorsal surface dark brownish-black or purplish, much paler on tip of snout, and on borders of cephalic furrows. This paler border is wider on the ventral than on the dorsal borders of the furrows. It

is sometimes so much increased that it covers the whole ventral surface in the region of the mouth, and gradually becomes darker toward the tip of the snout, as well as posteriorly. The color of the ventral surface is similar to that of the dorsal surface, but is commonly slightly paler, especially anteriorly, and has a grayish tinge.

No eyes were found.

Size.—Length of largest specimens collected about 300 mm.; width in intestinal region 6 mm.

The body is fragile, and the specimens are often broken in killing. After preservation in formalin or alcohol the body tapers gradually toward the narrow head, is widest in the posterior third or near the posterior end, and greatly flattened throughout. The head retains its long, pointed appearance, the tip is recurved, and the cephalic furrows in most specimens are deep and widely open.

Frontal sense organs.—On the exact tip of the head are three rather deep and wide pits, easily overlooked in the entire animal, but very conspicuous in sections. These are undoubtedly sensory in their nature, and are lined with slender rod-like cells with especially large cilia. Bürger has described in detail such sense organs in *Micrura* and *Cerebratulus*, and somewhat similar ones in other genera. These 'frontal organs,' as they are called, lie above the proboscis pore; one of them is situated in the median line and the other two are placed symmetrically on the antero-lateral margins.

The *brain* is remarkably large, and the dorsal ganglia are much larger than the ventral. The posterior ends of the long lateral furrows are greatly expanded.

Cerebral sense organs.—These also are very voluminous and are continuous with the posterior ends of the dorsal ganglia. The canals leading to the exterior are large, and open into the posterior ends of the cephalic furrows. Internally each canal passes directly beneath the dorsal ganglion to its internal ventral border, and then bends dorso-laterally to the external border of the sense organ. These canals leave the cephalic furrows far back of the cerebral commissure, and at about the point where the ventral ganglia merge into the lateral cords.

Nephridia.—The nephridial system presents remarkable deviations from the type usually found in the genus. The nephridial canals extend throughout the whole length of the esophagal region, and communicate with the exterior by upwards of *sixty* efferent ducts on each side. In the region of the mouth, or directly behind it, are one or two nephridial tubules on each side, quite independent of the rest of the system. Each of these tubules consists of a coil of fine canals lying

on the dorsal side of the lateral blood lacunæ, and projecting freely into the cavity of the lacuna. From each coiled tubule an efferent duct leads directly to the dorsal surface of the body. Back of these anterior, isolated nephridia a continuous richly branched and much coiled canal extends posteriorly on each side as far as the end of the esophagal region. The branches of these canals are limited to the dorsal and lateral surfaces of the lateral blood spaces, which occupy the angles between the esophagus and the proboscis sheath. The coiled tubules project freely into the blood spaces, and encroach considerably upon their area. The very numerous efferent ducts, which are given off from these tubules, pass directly outwards to the surface of the body. Those which pass out from the most lateral of the nephridial tubules, open on the dorsal surface near the lateral margins of the body, while those which leave the tubules nearest to the proboscis sheath open on the dorsal surface not far from the median line. The greater portion of the nephridiopores, however, lie rather nearer to the lateral margins than to the median dorsal line. Although there are practically the same number of efferent ducts on each side, this does not signify that these ducts are paired, but rather that the average number on each side is identical. In several instances an unusually large efferent duct on one side was accompanied by one of similar size nearly opposite. These ducts vary greatly in size, some being several times as large as others. Great irregularity likewise exists as to their distribution along the course of the nephridial canal. In the anterior third of the esophagal region they are well separated, but more posteriorly, portions of two or three sometimes appear on the same side in a single section.

Sexual glands.—The reproductive glands appear immediately behind the nephridia, and in both sexes alternate with the intestinal pouches. The sexual products were fully mature in July, and in both sexes the genital ducts were fully formed. They were lined with a special flattened epithelium, and opened on the dorso-lateral aspects of the body in both sexes. The ova when immature are attached by a narrow stalk to the wall of the ovary, and later break off and fall into the ovarian cavity. The spermatozoa have short, oval heads instead of the slender, pointed ones so common in the genus.

Habitat.—Yakutat; under stones at low water; not common.

31. CEREBRATULUS MONTGOMERYI sp. nov.

Pl. VI, figs. 1 and 2.

Body large, very long and ribbon-like when fully grown, and much flattened, except in esophagal region. Head variable in shape, according to state of contraction; sometimes rounded and obtuse, at other times much elongated, pear-shaped, and flattened dorso-ventrally. The anterior portion of the body, back as far as the intestinal region, is narrower and thicker than the posterior portions, and has rounded margins; in the intestinal region the body is very flat, and the lateral margins are extended to very thin edges. In partial contraction the dorso-ventral muscles, situated a little distance from the outer edge of the margins, contract so strongly as to produce a lateral ridge on each side both above and below the lateral edge. A transverse section consequently shows that the lateral margin is thicker distally than it is nearer the median line. These lateral ridges are often seen in specimens preserved in alcohol or formalin. Posteriorly the body becomes still thinner, and is narrower toward the extremity. The posterior end is either obtuse or sharply pointed, according to the state of contraction. The posterior opening of the intestine is subterminal. In none of the many specimens obtained was the caudal cirrus present, though such an appendage is probably present in uninjured worms.

The cephalic slits are moderately elongated, and extend backward as far as the anterior end of the mouth. Their posterior ends are wide and deep, and in life their margins are thin and widely separated. Anteriorly they do not reach quite to the proboscis pore, except when the animal is strongly contracted.

Color.—In life the whole body, both above and below, except the tip of the head, is bright blood red. The anterior extremity is tipped with a narrow band of white or yellowish-white. This white tip extends both above and below, and is not usually more than a few millimeters wide. The proboscis is light red in color.

Size.—Individuals were most commonly from one to two meters in length, and 8 to 10 mm. in width in the intestinal region. A few of the specimens obtained measured as much as two and a half meters when extended.

The individuals are generally hardy, and are not so prone to break spontaneously into fragments as are those of many other species of the genus. They contract much less violently than most other Nemerteans when killed, and may consequently be easily preserved entire by killing in a dilute solution of formalin in sea water.

Proboscis.—The proboscis is pale red, and of moderate size for the genus. Its musculature consists of an inner circular, a longitudinal, and a very thin outer circular muscular layer. It is, therefore, different from those of nearly all the species of the family *Lineidæ*, in that the inner longitudinal muscular layer is wanting. There are fibers passing between the inner circular layer and the thin outer circular layer, but these fibers do not form such distinct crosses as are characteristic of most of the members of the family. The internal epithelium is thick and highly glandular. The nerve plexus beneath this layer is unusually conspicuous, and lies directly internal to the circular muscular layer. The proboscis is very often retained in place after the animal has been killed. The muscular layers of the proboscis sheath are rather thick, and the circular muscular fibers often cross into the circular muscles of the body in the median line.

In the anterior portion of the head a rich growth of glands penetrates the other tissue nearly to the central proboscis sheath. These glands mostly open directly outward on the whole circumference of the head, although a few open on the tip of the snout. Back of the lateral slits the glands are restricted to the cutis. In the region of the mouth the cutis glands are separated from the outer epithelium by a layer of interlaced fibers of connective tissue, forming a basement layer of double the thickness of the epithelium. In the intestinal region the cutis glands are much reduced, and scattered. The outer muscular layer of the body is about as thick as the two inner muscular layers combined.

The mouth is much elongated, and its anterior end reaches forward as far as the posterior ends of the cephalic slits. The intestinal pouches are deep and narrow, and are forked distally.

Nephridia.—The nephridial canals are profusely branched, and lie in contact with the blood spaces around the esophagus in front of the middle esophagal region. Their extent longitudinally, however, is short. The main nephridial canals lie in the angles between the esophagus and the proboscis. Near their posterior extremities a large efferent duct passes obliquely upward on each side and opens on the latero-dorsal aspect of the body. As described by Bürger[1] in *C. marginatus*, one of the efferent ducts often lies far behind the other. Posterior to the efferent ducts the nephridial canals are smaller, and their branches end a short distance farther back. The blood lacunæ in the head in the specimens sectioned were very much reduced in size.

[1] Fauna u. Flora Neapel, Monogr. 22, p. 622.

The brain lobes are large, and the ventral commissure enormously thick. The well developed cerebral sense organs abut closely against the posterior ends of the dorsal ganglia. Their ciliated canals pass obliquely inward from the posterior ends of the cephalic slits. In their course these canals pass external and ventral to the dorsal ganglia. The median dorsal nerve, lying just outside the circular muscular layer of the body, is large and conspicuous throughout nearly the whole length of the animal.

Ocelli are wanting in the adult worm.

In specimens collected in June and July the genital products had evidently been recently discharged.

This species is named in honor of Dr. T. H. Montgomery, Jr., of the University of Pennsylvania, whose studies on the Nemerteans form most valuable contributions to the knowledge of the group.

Habitat.—This magnificent Nemertean was found abundantly under stones in muddy places near low water mark at most of the collecting stations between Sitka and Unalaska. At Orca and Virgin Bay, in Prince William Sound, and at Dutch Harbor, Unalaska, it proved to be one of the commonest species. Professor Kincaid has sent me a large specimen from Puget Sound, in the State of Washington, where it is said to be not uncommon. This would indicate that the species may be found locally along the whole northwestern coast of North America south of Bering Sea.

32. CEREBRATULUS ALBIFRONS sp. nov.

PL. IV, figs. 3, 4.

Body elongated, ribbon-like, flattened behind, rounded in front as in typical species of the genus. Margins of intestinal region pale and thin. Cephalic slits unusually long and deep, reaching well beyond posterior end of mouth.

Color.—General color of body brownish purple. Anterior end of head white, including both dorsal and ventral surfaces, and extending backward about as far as anterior end of mouth, and sometimes reaching along borders of cephalic slits to their ends. The esophagal region is dark smoky purple on dorsal surface; the ventral surface is similar but paler; the intestinal region inclines more to reddish. A darker line runs along the middle of the dorsal surface and the intestinal lobes appear more opaque.

Habitat.—Only a single specimen of this pretty species was secured, and this, unfortunately, had its posterior extremity missing. The specimen was about 150 mm. in length and of moderate propor-

tions. It was restless in confinement, and an active swimmer. It was found under a stone near low water mark at Hot Springs, near Sitka.

EXPLANATION OF PLATES.

The colored plates (I to VI) are reduced from colored sketches made, with a few exceptions, from the living animal. They were completed after the return of the expedition and have been retouched, and in some instances entirely redrawn, by Mr. A. H. Verrill. Every effort has been made to make the colors and the form of the body as natural as possible.

In the figures on the plates the following reference letters are used:

ap, attachment of proboscis.
bg, buccal glands.
bg', accessory buccal glands.
bl, blood lacuna.
ble, epithelium of same.
bm, basement layer.
br, brain.
bv, blood vessel.
bva, anastomosis of lateral vessels.
cc, ciliated canal of cerebral sense organ.
cgl, cephalic glands.
cm, circular muscular layer.
cso, cerebral sense organ.
ct, connective tissue.
cugl, cutis glands.
dc, dorsal commissure of brain.
dg, dorsal ganglion.
dgl, secretion of cephalic glands.
dn, median dorsal nerve.
e, esophagus.
eep, epithelium of same.
f, fibrous layer of cutis.
gc, glandular cells of cerebral sense organ.
gl, integumental glands.
gp, genital pouch.
i, integument.
ic, intestinal cæcum.
icm, inner circular muscular layer.
ifl, inner fibrous layer.
ilm, inner longitudinal muscles.
in, intestine.
lm, longitudinal muscles.
ln, lateral nerve-cord.
m, mouth.
mep, epithelium of same.
nc, nerve commissure.
nd, efferent nephridial duct.
nep, nephridial canal.
np, nerve plexus.
nv, nerve.
oc, ocellus.
ocm, outer circular muscles.
oep, outer epithelium of proboscis.
olm, outer longitudinal muscles.
ov, ova.
pcm, circular muscles of proboscis.
plm, longitudinal muscles of proboscis.
pn, proboscis nerve.
ps, proboscis.
psh, proboscis sheath or its cavity.
rh, rhynchodæum.
ro, opening of same.
smg, submuscular glands.
sn, nerve to cerebral sense organ.
sop, opening of ciliated canal of sense organ.
vc, ventral commissure of brain.
vg, ventral ganglion.

INDEX TO GENERA AND SPECIES.

New genera and species are in black face type; synonyms are in italics; pages on which generic or specific decriptions occur are in black face type.

PLATE I.

FIG. 1. *Carinella capistrata* sp. nov. A large individual about natural size. Virgin Bay, Prince William Sound.

2. *Carinella dinema* sp. nov. Victoria, B. C. Enlarged 2½ times.

3. Head of same species. Side view. Enlarged 4 times.

4. *Amphiporus bimaculatus* sp. nov. Dorsal view of head. Glacier Bay. Enlarged 12 times.

5. *Cerebratulus herculeus* sp. nov. A large individual. Sitka. Half natural size.

6. *Tetrastemma bicolor* sp. nov. Kadiak. Three times natural size.

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PLATE II.

FIG. 1. *Emplectonema bürgeri* sp. nov. Anterior portion of an individual of the pale variety. Glacier Bay. ⅔ natural size.

2. *E. bürgeri.* A large individual of the dark variety. Glacier Bay. ¾ natural size.

3. *Tæniosoma princeps* sp. nov. Large individual. Yakutat. ½ natural size.

4. *T. princeps.* A contracted specimen in formalin. Cape Fox. Natural size.

5. *Zygonemertes thalassina* sp. nov. Sitka. Twice natural size.

6. *Paranemertes peregrina* sp. nov. Brown variety. Victoria, B. C. A small specimen. Natural size. Compare pl. III, fig. 5.

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PLATE III.

FIG. 1. *Amphiporus exilis* sp. nov. Glacier Bay. Slightly enlarged.
2. *Zygonemertes albida* sp. nov. Victoria, B. C. Enlarged 1½ times.
3. *Paranemertes carnea* sp. nov. Taku Harbor. Anterior portion of body with emarginate head. Natural size.
4. *P. carnea*. Sitka. ⅔ natural size.
5. *Paranemertes peregrina* sp. nov. Virgin Bay, Prince William Sound. ⅔ natural size.
6. *Carinella speciosa* sp. nov. Hot Springs, near Sitka. ½ natural size.

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PLATE IV.

FIG. 1. *Amphiporus nebulosus* sp. nov. Kukak Bay, Alaska Peninsula. Natural size.

2. *Micrura alaskensis* sp. nov. Sitka. Enlarged 1½ times.

3. *Cerebratulus albifrons* sp. nov. Near Sitka. Twice natural size.

4. Side view of head of same individual.

5. *Amphiporus tigrinus* sp. nov. Farragut Bay. Mature male specimen, slightly enlarged.

6. *A. tigrinus*. Head of male; dorsal view. Twice natural size.

7. *A. tigrinus*. Farragut Bay. Female with ripe ova. Slightly enlarged.

8. Head of female of same species. Dorsal view. Twice natural size.

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PLATE V.

FIG. 1. *Micrura verrilli* sp. nov. Virgin Bay, Prince William Sound. Natural size.

2. Side view of head of same species.

3. The same; contracted.

4. *Cerebratulus longiceps* sp. nov. Yakutat. Enlarged 1½ times.

5, 6, 7. Heads of same species, from lateral, dorsal, and ventral aspects respectively.

8. *Lineus torquatus* sp. nov. Orca, Prince William Sound. Natural size.

9. *L. torquatus*. Side view of head.

10. *Amphiporus bimaculatus* sp. nov. Victoria, B. C. Natural size.

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PLATE VI.

FIG. 1. *Cerebratulus montgomeryi* sp. nov. Dutch Harbor, Unalaska. Natural size.

2. Head of same species from ventral surface.

3. *Cerebratulus occidentalis* sp. nov. Yakutat. Natural size.

4. *Amphiporus angulatus* (Fabr.) Verrill. Kadiak. Natural size of large specimen.

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B. Meisel in Boston

PLATE VII.

FIG. 1. *Zygonemertes thalassina*. Outline of stylet apparatus of proboscis (× 50). 1*a*, 1*b*, several accessory stylets from two individuals (× 225). Sitka.

2. *Amphiporus angulatus*. Central portion of proboscis (× 40). Taku Harbor. 2*a*, central stylet and basis of another specimen (× 80).

3. *Paranemertes pallida*. Outline of middle region of proboscis (× 60).

4. *P. carnea*. Extremity of everted proboscis, with six pouches of accessory stylets, of which but four are shown (× 35). Sitka.

5. *Amphiporus exilis*. Middle portion of proboscis, indicating, besides central stylet and basis, eight pouches of accessory stylets (× 40). Yakutat.

6. *Amphiporus leuciodus*. Stylet apparatus of proboscis showing the three accessory stylet pouches (× 60). Victoria, B. C.

7. *Paranemertes peregrina*. Outline of middle portion of proboscis (× 50). Virgin Bay.

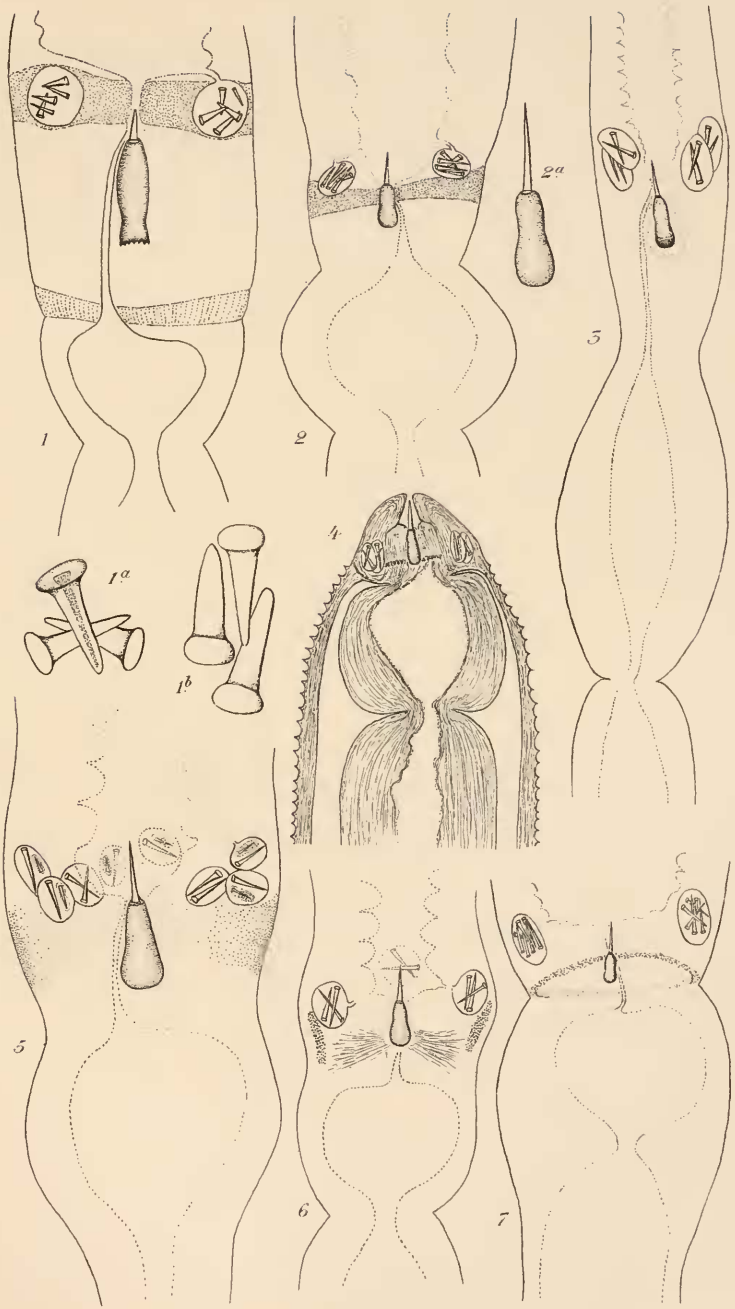

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PLATE VIII.

FIG. 1. *Emplectonema bürgeri*. Outline of stylet apparatus (× 35). Glacier Bay.

2. *Amphiporus bimaculatus*. Middle portion of proboscis, with four pouches of accessory stylets (× 35). Glacier Bay.

3. *Emplectonema gracile*. Stylet apparatus of proboscis (× 50). Popof Island.

4. *Amphiporus tigrinus*. Middle region of proboscis (× 60). Farragut Bay. The deeply stained wreath of glands is indicated only in section.

5. *Zygonemertes albida*. Middle portion of proboscis (× 40). Victoria, B. C.

6. *Amphiporus nebulosus*. Outline of stylet apparatus of proboscis (× 50). Kukak Bay.

7. *Paranemertes carnea*. Side view of head, with partially everted proboscis. The position of the lateral oblique furrows, and the arrangement of the ocelli are indicated (× 5). Taku Harbor.

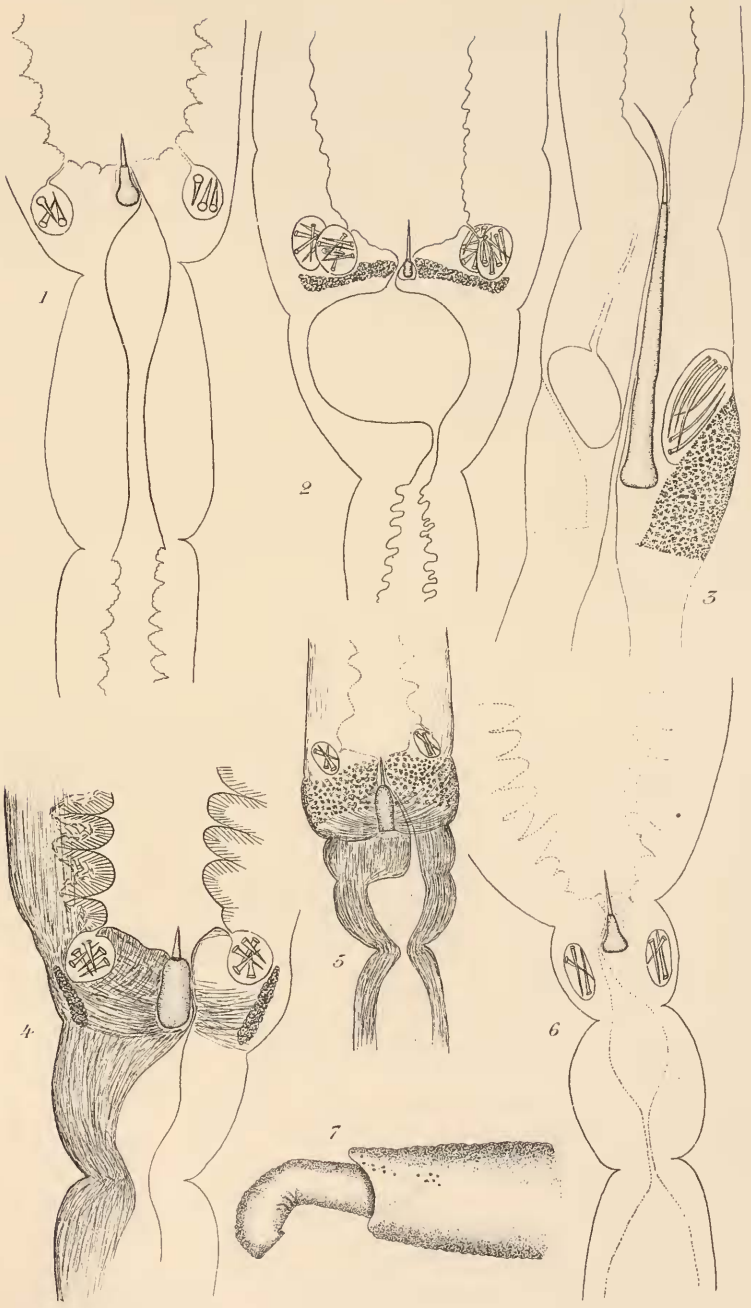

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PLATE IX.

FIG. 1. *Carinella speciosa.* Transverse section through head in front of brain showing, particularly, position of enormously developed cephalic glands (*cgl*) and arrangement of cephalic nerves (*nv*). The cephalic glands are thickly placed both above and below the cephalic blood lacunæ (*bl*), as well as around the rhynchodæum (*rh*). The secretion from many of these glands is discharged near the lateral margins as indicated (*dgl*). Between the longitudinal and oblique muscles (*lm*), which lie in the deeper parts of the head, and the circular fibrous layer (*cm*), composed of muscles and connective tissue fibers underlying the integument (*i*), are numerous and very massive nerves (*nv*) which supply the head regions in front of the brain. The broad indentation on the ventral margin has no relation to the mouth, which lies much farther back. Other reference letters are explained above (p. 83). A small individual. (×45).

2. *Carinella speciosa.* Transverse, but somewhat oblique, section through head in region of brain. On the right of the section the brain (*dg* and *vg*) lies directly beneath the circular fibers (*cm*). External to the brain, and lying among the bases of the integumental cells, is the highly specialized cerebral sense organ (*cso*), connected with the dorsal ganglion (*dg*) by several small nerves (*sn*). The cerebral sense organ shows a conspicuous central canal. The rhynchodæum (*rh*) has lost its fringe of gland cells, these being limited to the regions anterior to it. The outer portion of the circular layer (*cm*) constitutes the basement membrane of the integument. In the region of the brain the circular layer splits into two sheets, one passing external to the brain and the other (*ifl*) internal. Other reference letters as above. A large specimen. (×25).

3. *Carinella speciosa.* Transverse section through nephridial region showing positions, and one of the openings, of the nephridial canals. The lateral blood lacuna (*bv*) and the nephridial canal (*nep*) lie embedded in a band of loose connective tissue on each side. The opening of one of the efferent nephridial ducts (*nd*) is seen on the right of the drawing. Other reference letters as indicated above. (×25).

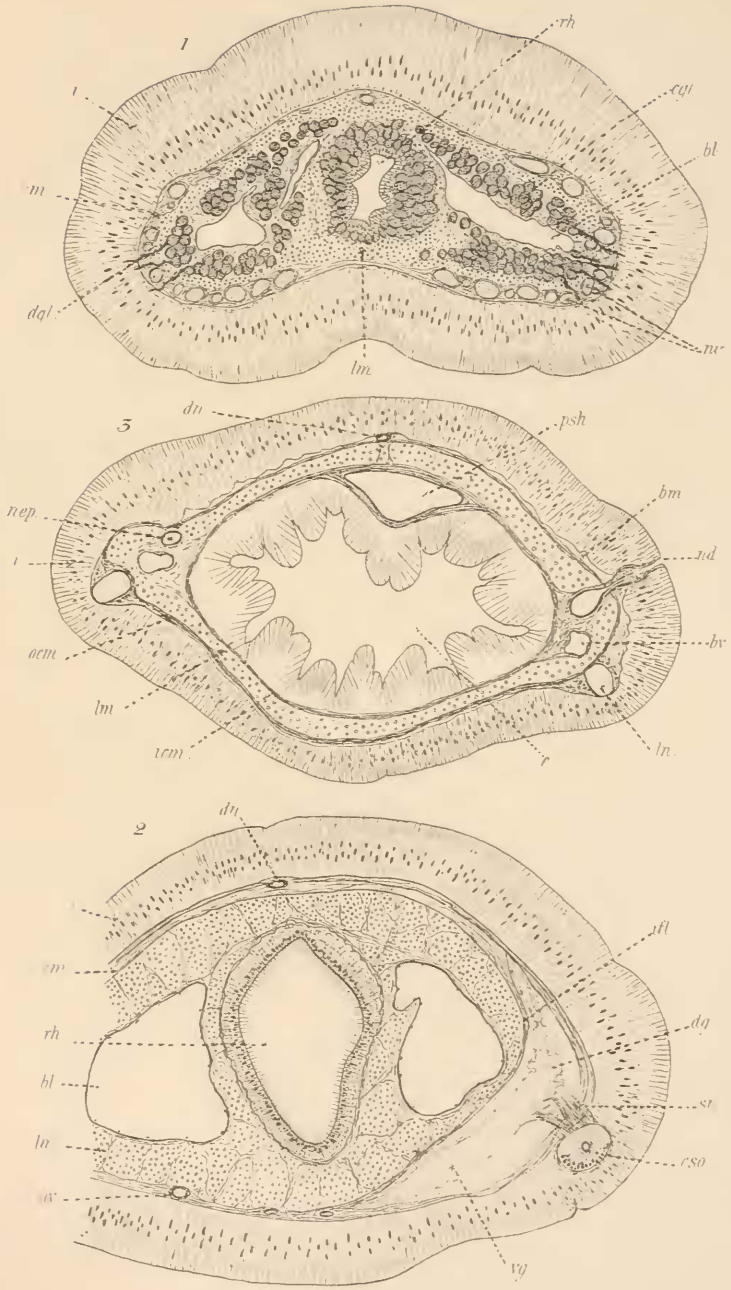

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PLATE X.

FIG. 1. *Carinella speciosa.* Portion of transverse section through nephridial region. The ciliated nephridial canal (*nep*) shows the peculiar infolding of the integumental cells on its dorsal border. These integumental cells are here loosely arranged, and show several deep infoldings (*op*) which, under certain circumstances, may possibly have a more or less distinct communication with the nephridial canal. But a small portion of the closely packed gland cells in the integument are indicated. Reference letters are explained on p. 83. (×75).

2. *Carinella speciosa.* Portion of a transverse section through the brain region. The relation of the dorsal ganglion (*dg*) with the highly specialized cerebral sense organ (*cso*) is indicated. The ciliated canal (*cc*) of the sense organ connects directly with the exterior by a narrow tube (*sop*)—shown in dotted lines in the drawing, because it lies mainly in another section—opening on the lateral margin of the head. Several nerves (*sn*) are seen to pass from the dorsal ganglion to the sense organ. Other reference letters as above. Only a small portion of the integumental gland cells are shown. (×75).

3. *Amphiporus tigrinus.* Dorsal view of anterior portion of body, cleared in cedar oil. In front of the brain the arrangement of the ocelli is shown, and farther back the position of the ovaries (*ov*). The intestinal cæca are not indicated. Farragut Bay. (×8).

4. *Amphiporus tigrinus.* Median sagittal section through the anterior portion of the body. The cephalic glands (*cgl*) lie above the opening of the rhyncodæum (*ro*). The mouth (*m*) separates from the proboscis opening a little way back. The attachment (*ap*) of the proboscis to the tissues of the head is seen to be well in front of the brain commissures (*dc* and *vc*). The section shows the comparative size and arrangement of the proboscis, blood vessels, esophagus, and other organs. Reference letters as above. (×30).

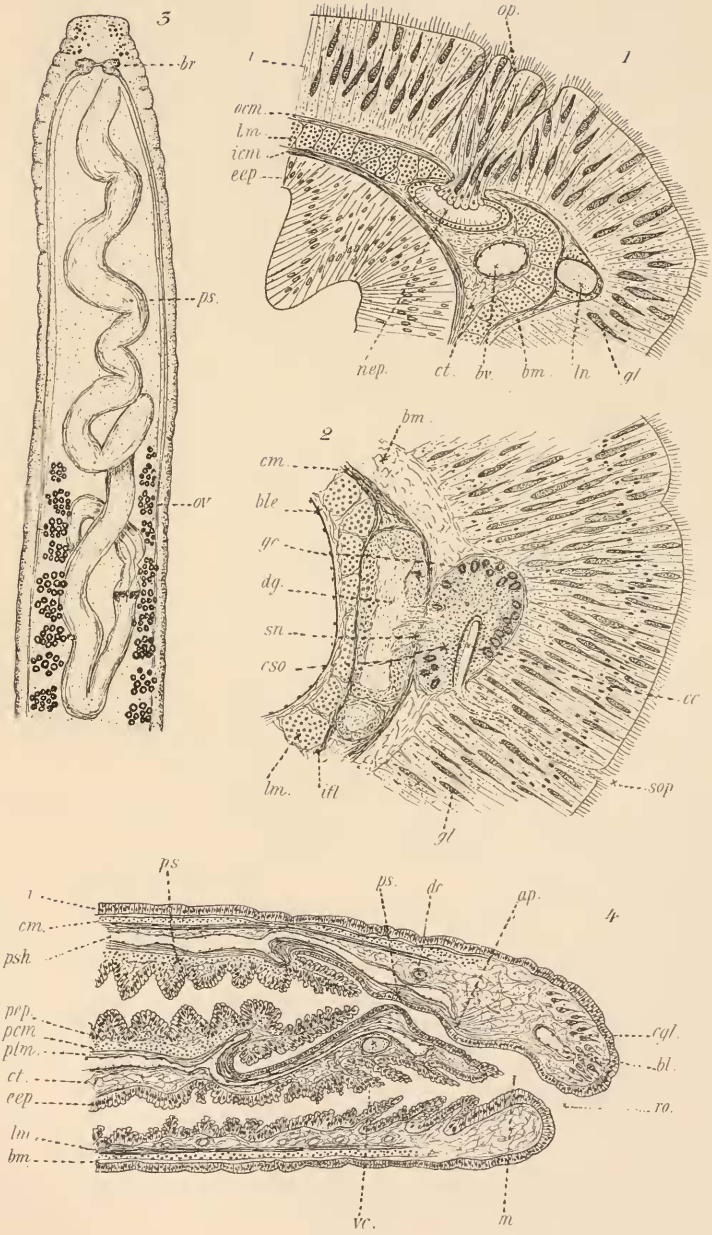

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PLATE XI.

FIG. 1. *Amphiporus nebulosus.* Transverse section through posterior portion of ventral commissure of brain. The submuscular glands (*smg*) fill up a large portion of the tissues of the ventral half of the head. The pair of nerves leading forward to the cerebral sense organs is seen to originate (*son*) from the ventral side of the dorsal ganglia. Other reference letters are explained on p. 83. (×26).

2. *Amphiporus angulatus.* Transverse section through ventral commissure of brain. The dorsal attachment of the proboscis to the tissues of the head is shown. The proboscis nerves (*pn*) enter the ventral side of the proboscis, and divide into a definite number of branches (usually 18), which farther back arrange themselves symmetrically about the periphery. The roots of the dorsal brain commissure (*rdc*) are indicated. In the right half of the section the anterior ends of the nephridial tubules (*nep*) are seen. Submuscular glands (*smg*) are not as numerous as in *A. nebulosus*. Other reference letters as above. (×26).

3. *Amphiporus exilis.* Transverse section through nephridial region to show efferent nephridial ducts (*nep*) opening on dorso-lateral aspects of body. This condition is extremely rare in Metanemerteans. Several diverticula of the intestinal cæcum (*inc*) are represented. Other reference letters as above. (×32).

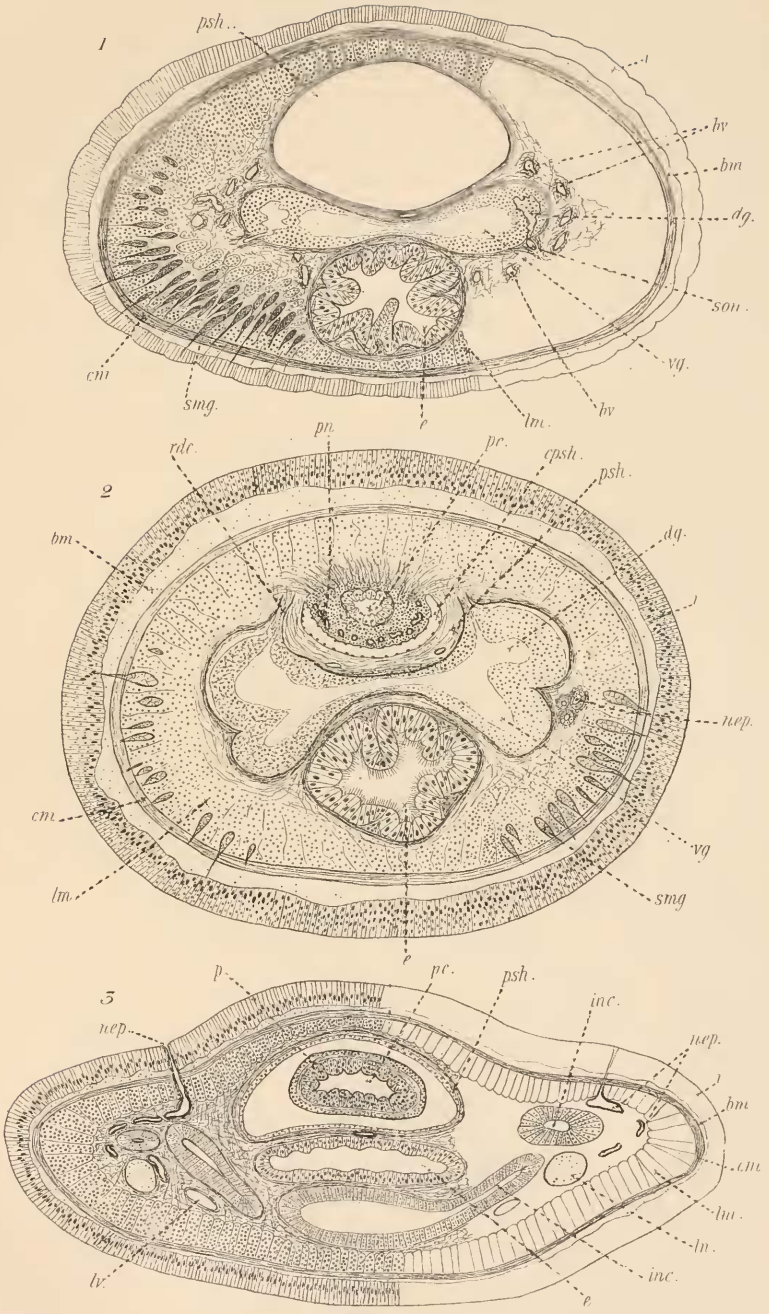

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PLATE XII.

FIG. 1. *Paranemertes pallida.* Transverse section through nephridial region. In this case the single pair of efferent nephridial ducts (*nep*) was so symmetrically placed that both were cut in a single section. The very small size of the proboscis (*ps*) in the large proboscis sheath (*psh*) is remarkable. The intestinal cæcum (*ic*) shows lateral diverticula above the lateral nerve cords. (× 18).

2. *Amphiporus bimaculatus.* Transverse section of proboscis. The 16 proboscis nerves (*pn*) are very sharply defined. The cylindrical plexus (*np*) of nerve fibers and connective tissue serves to connect the nerves, and divides the thick longitudinal muscular band into an inner (*plm*) and an outer (*plm'*) layer. The inner longitudinal muscular layer, found in most related species, is wanting—the basement layer (*bm*) of the internal epithelium (*pep*) lying immediately beneath the circular muscular layer. (× 66).

3. *Emplectonema bürgeri.* Transverse section through body, showing manner in which the esophagus (*e*) opens into dorsal wall of intestine (*in*). This section also shows the genital pouches (*gp*) lying both above and below the intestinal lobes, and indicating that they open respectively on the dorsal and ventral surfaces of the body. Of the submuscular glands (*smg*), which extend throughout the esophagal region in great abundance but a few remain as far back as the position of the section figured. (× 20).

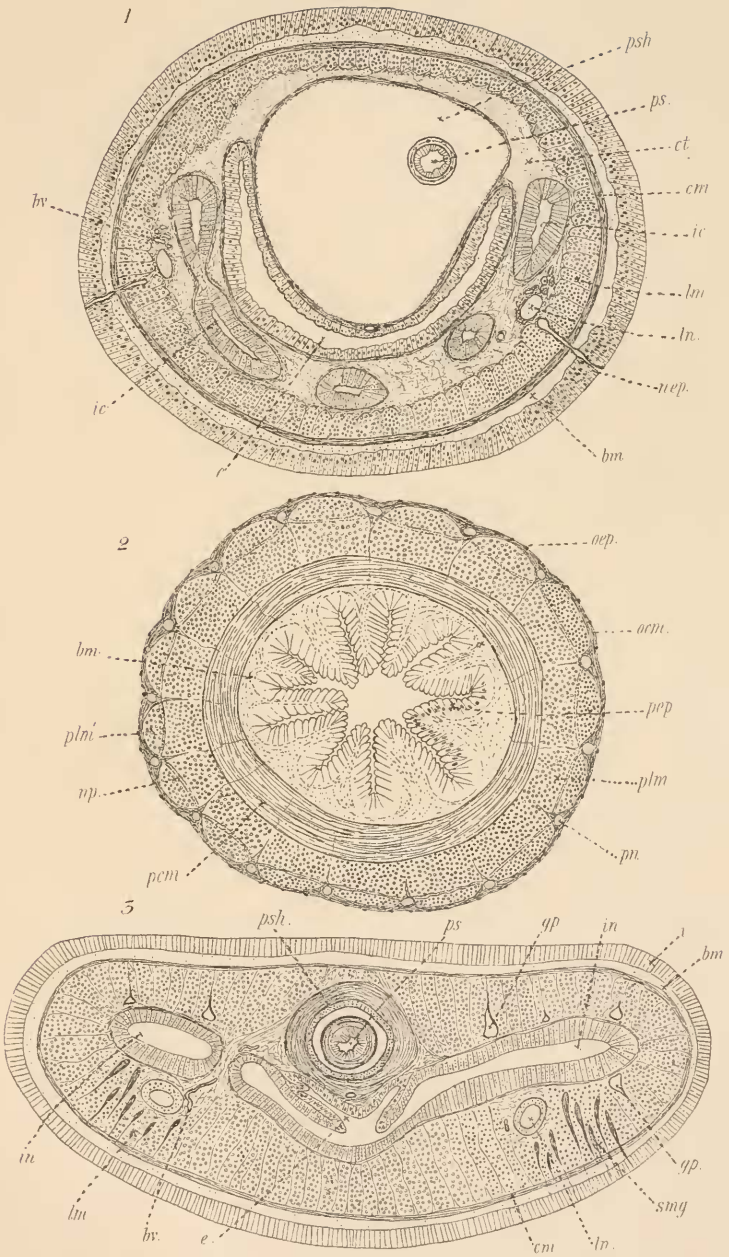

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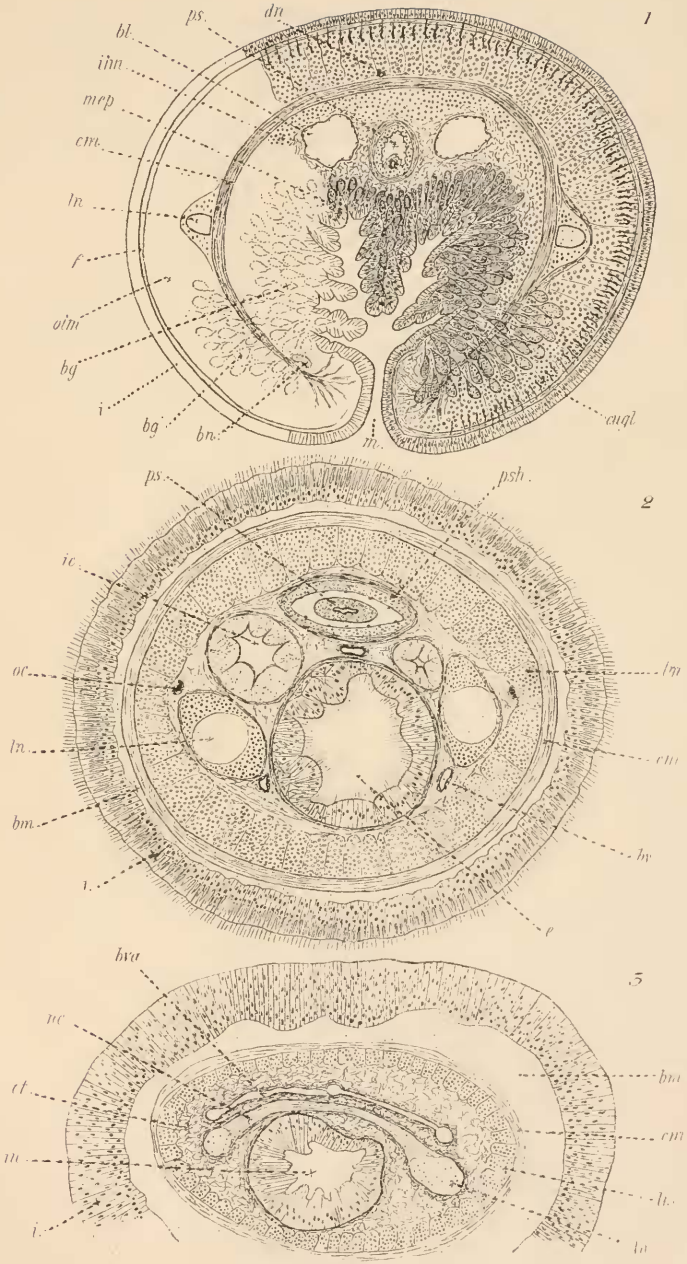
PLATE XIII.

FIG. 1. *Micrura alaskensis*. Transverse section through mouth region. The peculiar accessory buccal glands (*bg'*) are seen to lie outside the circular muscular layer (*cm*), and amongst the fibers of the outer longitudinal muscular layer (*olm*). Their secretion passes through the layer of circular muscles, and mixes with that of the true buccal glands (*bg*), which lie immediately beneath the epithelium of the mouth (*mep*). The buccal nerves (*bn*) lie on the lateral borders of the mouth as usual. Other reference letters are explained on p. 83. (× 30).

2. *Zygonemertes thalassina*. Transverse section immediately back of the brain. The intestinal cæca (*ic*) reach forward to abut against the dorsal ganglia. The ocelli (*oc*) extend back of the brain, and occupy positions, as shown, immediately above and external to the lateral nerve cords (*ln*). (× 100).

3. *Amphiporus angulatus*. Transverse section through posterior end of body. The drawing is slightly diagrammatic, as it contains portions of the two adjacent sections. The anastomosis of the three longitudinal blood vessels (*bva*) is seen to lie immediately dorsal to the commissure (*nc*) of the lateral nerves (*ln*); the basement layer (*bm*) is remarkably thick in this region. The posterior end of the intestine (*in*) opens ventrally a few sections farther back. Other reference letters are explained above. (× 80).



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