

THE POLYCHÆTOUS ANNELIDS DREDGED BY THE U. S. S. "ALBATROSS" OFF  
THE COAST OF SOUTHERN CALIFORNIA IN 1904. I. SYLLIDÆ,  
SPHÆRODORIDÆ, HESIONIDÆ AND PHYLLODOCIDÆ.

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Until in 1904 the U. S. Bureau of Fisheries, the University of California, and Stanford University joined forces in initiating an investigation of the marine biology of California upon a comprehensive scale, most of the faunal work done on the invertebrates of that region had been limited to the littoral zone, and much of it had been of a local or desultory character.

Early in that year the Fisheries steamer "Albatross" was detailed to investigate the deeper waters off the coast of the southern half of the State. From March 1 to April 15 collections and physical observations were made at 139 dredging stations in the region south of Point Conception, chiefly in the vicinity of San Diego and among the Santa Catalina and Santa Barbara Islands. Between May 10 and June 15, 128 dredging stations were established in Monterey Bay, making 267 in all. The full data relating to these stations have been compiled and published as Fisheries Document No. 604, Washington, 1906.

Among the material gathered is a rich but rather indifferently preserved collection of Polychæta which was submitted to the writer for study, especially through the interest of Prof. Charles H. Gilbert, of Stanford University. Coming from the deeper waters, this collection admirably supplements the shore collections from the vicinity of San Diego and Monterey Bay contained in the Stanford University Museum and already reported upon in these PROCEEDINGS. It had been expected that the bulk of the collections would be made up of known shore forms, but the large number of undescribed species encountered in the families already studied has dispelled that anticipation. Types of new species are to be deposited in the National Museum, and sets of cotypes and duplicates, as far as possible, also in the coöperating Universities and this Academy.

SYLLIDÆ.

*Syllis alternata* Moore.

This species is the most common syllid in the collection and occurs

at depths of from 33 fathoms to 1,400 fathoms and chiefly among the Santa Catalina and Santa Barbara Islands. The largest and best preserved specimens are 40–44 mm. long and have 125 to 137 segments, but some are only 12–20 mm. long. In some the eyes, and particularly the posterior pair, are enlarged until those on each side nearly meet. There are indications that this condition may be correlated with bathymetrical distribution, the approximation being most marked in the examples from the greatest depth and least in those from more shallow waters.

When contracted the notocirri exhibit a distinct thickening above the base, when extended they taper nearly uniformly from the base, but in all cases the alternation in length is obvious. Some examples have the anterior twenty or so segments each marked by a dusky band, not narrow and sharply defined as in *S. armillaris*, but broad and ill defined. The accessory tooth of the seta appendages is frequently much worn or nearly obsolete, causing the tips to appear simple. In no case do the appendages exhibit any tendency to unite with the stems, as in *Pionosyllis elongata* Johnson and other species of the *Synsyllis* group.

The chitinous lining of the pharynx terminates in a thickened, somewhat crenulated border, behind which is a circle of soft papillæ and dorsally a large, blunt, conical tooth. In the retracted state the tooth lies in somite III, the gizzard in XI–XXVII, the œsophageal loop in XVIII and the cæca in XVII and XVIII.

*S. californica* Kinberg may be this species, but no certainty can be reached from the brief diagnosis. The *Eusyllis tubifex* Gosse reported by Treadwell from near Monterey Bay is very probably this species. *S. violaceo-flava* Grube is another related species from the Philippines.

Stations 4,326, off Point La Jolla, near San Diego, March 8, 280 fathoms, green mud; 4,400, between San Diego and San Clemente Island, April 8, 500 fathoms, green mud; 4,420, off San Nicolas Island, April 12, 33 fathoms, fine gray sand; 4,427, off Santa Cruz Island, April 14, 447 fathoms, black mud and stones; 4,430, off Santa Cruz Island, April 14, 197 fathoms, black sand and pebbles; 4,574, off Cape Colnett, Lower California, October 8, 1,400 fathoms.

*Syllis* (*Ehlersia*) *heterochæta* sp. nov. Pl. XV, figs. 1–4.

Described from the type only, a small complete specimen 9 mm. long, with a width, in the region of the gizzard, of body of .4 mm. and between tips of parapodia of .7 mm. Segments 80.

Prostomium (Pl. XV, fig. 1) pentagonal, with very unequal sides, the posterior longest and nearly straight, the lateral shortest and

convex, the anterior meeting in a rounded apex; about twice as wide as long. Eyes three pairs, forming a triangular group on each side; the middle pair with distinct lenses and much the largest, but not more than one-ninth the width of the prostomium and situated about their diameter from its lateral border; the posterior also with lenses, directed dorso-caudad, about one-fourth the diameter of the middle pair and situated medio-caudad of them; the anterior<sup>1</sup> mere specks of pigment without lenses situated in line with the posterior pair and equally distant from the middle pair. Behind the posterior pair is a large black blotch on each side. Palps prominent, projecting straight forward, separate to the base, about one and one-half times as long as the prostomium, broad at the base where they equal one-half the width of the prostomium, thence diverging slightly and tapering to the rather slender, bluntly rounded tips. Median tentacle arising posterior to middle of prostomium between middle pair of eyes, lateral tentacles close to base of palps laterad of anterior eyes; both slender, little tapered, subequal, reaching about one-fifth of their length beyond palps, strongly moniliform except at base, with twenty to twenty-two joints.

Peristomium (Pl. XV, fig. 1) a short but distinct ring bearing two pairs of tentacular cirri similar to cephalic tentacles but with distinct ceratophores, similar to the cephalic tentacles; the dorsal equal to the latter and with twenty or twenty-one joints, the ventral two-thirds as long with fourteen or fifteen joints. Segments all distinct, short, uniannulate, slightly depressed, increasing in width to near the middle. Pygidium a broadly expanded, furrowed ring whose cirri have been lost.

Parapodia (Pl. XV, fig. 2) of a length generally about one-third the width of their segments. Neuropodia thick, little compressed and little tapered, divided distally into a low postsetal lip which curves over and encloses the ends of the acicula, and a slightly longer presetal lip, the supraacicular portion of which is a small, blunt, projecting lobe forming the dorso-distal angle of the neuropodium. Posteriorly this lobe is much reduced and the postsetal lip becomes longer and more pointed. Neurocirri nearly free from base of neuropodia; their cirrophores small and indistinct; styles slender, tapered, blunt, longer than neuropodium and with a swelling on the dorsal side above the base. Posteriorly they become more slender. Notocirri strongly moniliform and very distinctly jointed (though the joints become cylindrical rather than spheroidal or ellipsoidal) even to the caudal

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<sup>1</sup> Omitted from the figure.

end; cirrophores short but generally distinct. Those on II and V are the longest, about one and one-half times the dorsal tentacular cirrus and exceeding the greatest width of the body; they have twenty-four to twenty-seven joints; III and IV are slightly longer than the dorsal of I and have nineteen to twenty-two segments. The remaining notocirri are more or less regularly alternately longer and shorter even to the caudal end, the longer in general equalling about three-fourths the width of their segments and the shorter about three-fifths their width. Those in the middle of the body have about sixteen or seventeen (fig. 2) and eleven to thirteen (fig. 2*a*) joints respectively.

Acicula (Pl. XV, fig. 2) of anterior parapodia in a row of six or seven, the ends of which appear in a groove at the dorso-distal angle of the neuropodia. They are pale yellow, rather stout, tapered and end in blunt points, slightly knobbed and variously slightly bent or even hooked; middle neuropodia have three or four and posterior only two.

Setæ in rough, irregular subacicular fascicles of about seven rows of three or four each. They are colorless with rather long, curved shafts slightly enlarged at the distal end (Pl. XV, fig. 3) to form simple, oblique articulations roughened by a few minute points. Appendages of all except the setæ of the dorsal row comparatively short (fig. 3), two to four times the length of the oblique end of shaft, scarcely curved and not hooked at the tip, which is a simple point below which is sometimes an obscure accessory tooth; margin strongly toothed. Setæ of dorsal series and sometimes one or two of the next row more slender (Pl. XV, fig. 4) with very long, slender, straight appendages usually about four times the longest of the lower rows, with blunt ends (fig. 4*b*) and finer marginal denticulation (fig. 4*a*). Such setæ continue to the caudal end and are similar on all segments. Many of the posterior parapodia also bear a single stout, nearly straight, spine-like simple seta, as long as the shafts of the others, in the dorsal part of the bundle; it is probably to be regarded as a prolonged aciculum.

Proboscis (Pl. XV, fig. 1) protruded about one-third of its length beyond palps, broad cylindroid, diameter exceeding prostomium, cuticle thick, smooth and entire at orifice; dorsal tooth stout and blunt, probably from wear; behind this is a circular fold bearing eight (or nine?) distant, soft, rounded papillæ. Gizzard reaches from IX to XXI and has thirty-seven rings. Colorless in alcohol.

The only specimen was taken at Station 4,423, off San Nicolas Island, April 13, 339 fathoms, gray sand, black pebbles, shells.

*Syllis (Ehlersia) anops* Ehlers, from the Straits of Magellan, is a much more elongated species with the anterior and posterior dorsal

setæ appendages differing in form. *S. singulisetis* Grube, from the Philippines, also belongs to the subgenus *Ehlersia*, but has only four eyes.

***Pionosyllis typica*** sp. nov. Pl. XV, figs. 5-7.

Form moderately slender, widest in the region of the gizzard, from which it tapers regularly to the caudal end. The well-extended and complete type has 96 segments and is 31 mm. long and 1.2 mm. in diameter at XXV.

Prostomium small, somewhat sunken into peristomium, about one and two-thirds times as wide as long, the greatest width posterior, the sides and front broadly and regularly rounded. Eyes two pairs, dark brown, small, anterior pair close to lateral border and about midway of length of prostomium; posterior pair little more than one-half diameter of anterior and slightly behind and within them. A pair of faint ridges run from the posterior eyes to the posterior border of the prostomium, nearly completing with the eyes a V-shaped figure.

Palps completely separated to base, bent somewhat ventrad, broadly triangular with rounded angles, about as long as prostomium and basal width about two-thirds length. Median tentacle arising between posterior eyes, about one and one-fourth times as long as prostomium and palps, slender and slightly tapered, divided into about twenty-four articles, distinct distally but obscure toward the base, not strongly moniliform. Lateral tentacles similar, arising from a slight depression just anterior to anterior eyes, nearly three-fourths as long as median and reaching nearly as far, divided into nineteen or twenty joints. Mouth rather large with prominent crenulated lips.

Peristomium short and partly crowded beneath prostomium, but visible for entire width of dorsum. Tentacular cirri similar to tentacles, the dorsal slightly exceeding median tentacle in length, with about twenty-six joints; the ventral somewhat shorter, with twenty joints. Body segments nearly terete, remarkably regular but separated by shallow, inconspicuous furrows; except for a few short anterior ones they are half as long as wide or more. From the maximum width at the end of the first fourth they taper regularly to the pygidium, which is a small ring and bears one of a pair of cirri as long as the last nine segments and resembling the posterior neurocirri in being scarcely articulated.

Parapodia (Pl. XV, fig. 5) situated at ventral level of body, well separated throughout, slender, rather conspicuous in ventral view but largely concealed from the dorsum. The neuropodia are slightly compressed and taper slightly to the bluntly rounded and rather abruptly contracted end, which is divided into two small lips separated by a

deep cleft, from which the setæ arise and into which the tips of the acicula enter. Neurocirri arise obliquely from basal half of neuropodium, cylindrical or slightly tapered to blunt tips reaching well beyond end of neuropodium, especially on anterior segments. Notocirri arise from rather prominent but indistinct cirrophores immediately above base of neuropodia and all at same level. Styles all approximately of one length, about two-thirds width of body, the anterior and alternate ones scarcely longer than the others, but the alternate ones carried erect. Anterior notocirri are somewhat articulated, similarly to the tentacles, but this character becomes more obscure toward the base and on more caudal cirri; most of them are rather stout, rather quickly tapered and more or less transversely wrinkled, rather than jointed. Near the caudal end they become much reduced in size.

Acicula number from five or six anteriorly to two or three posteriorly; pale yellow, tapered, the ends blunt and very slightly knobbed (Pl. XV, fig. 6).

Setæ generally about twelve or fifteen, in oblique, spreading, fan-shaped tufts; colorless, the stems long, slender, curved, the ends (Pl. XV, fig. 7) slightly enlarged, oblique, with four or five just perceptible teeth on the convexity of the front face and a slight shoulder behind. Appendages moderately long, varying from three times diameter of distal end of stem in ventral to five times its diameter in dorsal setæ, except at the posterior end, where all are shorter. They (fig. 7) are of peculiar form with very oblique base, beyond which the width remains nearly uniform; distally abruptly truncated and ending in a stout oblique spur, above which is a delicate curved tooth often nearly worn away; a very fine marginal fringe ending in a more prominent tuft of hairs.

This species stands closer to the type species than any of the three already described from the Pacific coast of North America. Johnson's species, *P. elongata*, appears to be more properly referred to *Synsyllis* Verrill. Much confusion in the usage of the genus exists among authors.

Station 4,430, off Santa Cruz Island, April 14, 197 fathoms, black sand and pebbles. Two specimens.

***Pionosyllis gigantea* Moore.**

About forty anterior segments of a specimen of this large species from an unknown locality. As noted above it is doubtful if this species really belongs to *Pionosyllis*.

***Trypanosyllis intermedia* Moore.**

Owing to the deficiencies of the type the original description of this species is incomplete and may be added to here.

A complete specimen with 230 much contracted segments is 60 mm. long, with a maximum body width of 3.2 mm. at XXX. Prostomium subquadrate, slightly wider than long; with a deep postero-medial dorsal incision and furrow. Palps completely separated to base, slightly longer than prostomium, somewhat divided into basal and terminal portions; the former somewhat swollen and the latter slender and abruptly bent ventrad. Median tentacle five or six times length of prostomium and composed of fifty-six very short joints; lateral tentacles about one-half as long, with thirty-five to thirty-eight joints. Eyes on each side nearly or quite coalesced. Tentacular cirri arising beneath prostomium, the dorsal nearly equal to median tentacle, with fifty joints; the ventral slightly shorter than lateral tentacle, with about thirty-five joints. Notocirrus of II the longest, about one-third more than the median tentacle, with sixty-four to seventy joints; that of III scarcely shorter and of IV two-thirds as long as II. Following this the notocirrophores of odd-numbered segments are at a slightly higher level and bear slender styles as long as the width of their segments and with as many as sixty or seventy very short joints; those of even-numbered segments have styles about two-thirds as long. Pygidium a tapered ring bearing a pair of slender cirri as long as its diameter and with twenty-five to thirty joints.

A pharynx dissected had the circle of teeth in somite VIII; there are eighteen to twenty slender compressed soft papillæ and apparently as many teeth, but the latter are so much broken that this cannot be determined with certainty. Gizzard in XVIII to XXIX with thirty-five distinct and seven or eight indistinct rings.

The anterior thirty-five or forty segments are reddish-brown above with pale intersegmental lines.

One specimen each from stations 4,417, off Santa Barbara Island, April 12, 29 fathoms, fine yellow sand, rock and coralline; and 4,420, off San Nicolas Island, April 12, 291 fathoms, gray mud and rock.

*Odontosyllis phosphorea* sp. nov. Pl. XV, figs. 8-10.

Epitokous, sexually mature examples, unfortunately much distorted and broken. The type and largest specimen lacks some of the caudal segments and measures 23 mm. long, 2.5 mm. in maximum width between tips of parapodia and 1.5 mm. in width of body only. The anterior region of twenty-three segments is 4.6 mm. long, the middle of fifty-one segments provided with swimming notopodial setæ is 17 mm., and only four segments of the posterior region remain, making seventy-eight segments in all. A smaller, more extended and

posteriorly complete cotype is 18 mm. long, the anterior region being 5 mm. and the posterior 5.5 mm. Segments  $23 + 26 + 31 = 80$ .

Form rather short and stout, widest at the middle, the ventral surface flat, the dorsal more or less arched, most so in the anterior region, which is nearly as high as wide; the middle and posterior regions depressed.

Prostomium small, short, bent downward, subprismatic with rounded angles, about two-thirds as long as wide and deeper than long, the front abruptly vertical, somewhat excavated for the tentacles. Eyes two pairs, moderately large with large lenses, brown, occupying sides of prostomium, the anterior pair directed chiefly forward, the posterior upward. Though themselves distinct they are enveloped in an irregular curved, broad band of black pigment which occupies most of the lateral and posterior dorsal part of the prostomium. The three tentacles arise close together, the median more dorsal, from a depression in the middle of the frontal face, small, slender, unjointed, subequal, somewhat exceeding length of prostomium. Palpi directed ventrad, thick, fleshy separated knobs.

Peristomium achæitous, largely concealed by prostomium, only a very short dorsal ring and larger lateral prominences showing. Two pairs of tentacular cirri, unjointed but transversely wrinkled, the ventral about as long as width of prostomium, the dorsal about one and one-half times as long. The nuchal fold arises from the dorsum of II and is a prominent, semicircular, deeply pigmented, free, membranous flap, with a basal width equal to one-half the segment and covering the posterior part of the prostomium as far as the anterior eyes. Somite II and remaining setigerous segments are uniannular and well marked by irregular furrows, differing in the several regions as indicated above. Pygidium a small, low, dome-shaped ring having a pair of short, thick fusiform cirri.

Parapodia, owing partly to the contraction of the specimens, very little prominent, those of the anterior and posterior regions uniramous (Pl. XV, fig. 8), of the middle region biramous (fig. 9). Neuropodia short, stout, with blunt ends, terminating in two short, thick, rounded lips, of which the postsetal is usually slightly the longer; both terminating dorsally at the acicula, which lie slightly below the dorsal border of the neuropodia. In the middle region the neuropodia (Pl. XV, fig. 9) are somewhat longer than in the anterior region, but otherwise similar. The notopodia are low, flattened protuberances pushed out anterior to the seta tuft into a pointed, conical acicular process. In the posterior region the parapodia are neuropodial only and are gradually



reduced in size. Neurocirri arise from beneath the base and rather on the posterior face of the neuropodia, and have somewhat swollen bases and a small, slightly distinct distal piece reaching about as far as the end of the neuropodium. They are similar on all parapodia. Notocirri arising from low swellings (but not distinct cirrophores) on the dorsum well above the parapodia. Styles rather long, slender and unjointed, but more or less wrinkled. The first (on II) is longer than the others, about twice the dorsal peristomial cirrus and about one and one-third the width of the segment; that of III is less than two-fifths, of IV about three-fifths and of V about seven-eighths of that of II; remaining notocirri are alternately longer and shorter, those in the middle region being respectively about equal to three-fifths and one-third the width of their segments.

Neuropodial acicula generally two in anterior, three in middle region, moderately stout, straight, tapered, the ends slightly knobbed. Notopodial aciculum single, slender, gently tapered and curved, the distal end slightly knobbed and often bent at the end. Neuropodial setæ entirely subacicular, in dense fascicles of several ranks, rather numerous, usually ten or eleven ranks of three or four each. They are colorless, rather stout, with curved stems becoming thicker distally and ending obliquely in a blunt, slightly roughened point (Pl. XV, fig. 10). Appendages short broad blades varying in length only from once to twice the width of the distal end of the stem, the longest occurring in anterior parapodia and the ventral part of the bundles, terminating in a prominent hook, well below which is a stout spur. In the posterior region a solitary slender, curved simple seta also occurs in each fascicle, but has not been detected elsewhere.

A dissected proboscis exhibits the characteristic thick bow and fold of the chitinous rim, but the number and character of the teeth is not evident. The gizzard of the same specimen has sixty-seven annulations.

Color pale yellow with a conspicuous spot on the prostomium, the nuchal fold and narrow intersegmental transverse lines black; in the middle and posterior regions every fourth one of the latter is much wider and denser, and at these deeply pigmented furrows the frequent fractures of the body-walls always occur; appendages colorless; eyes brown.

The label reads: "Phosphorescent annelids caught at surface, Avalon Bay, Catalina Island, evening, April 11, 1904, Albatross." Professor William S. Ritter writes that a phosphorescent annelid swarms at the surface of San Diego Bay. Doubtless this is the species here described. It is a frequent characteristic of species of this genus to be luminiferous.

**Syllid** gen. et sp.?

A small syllid, probably a true *Syllis* or *Eusyllis*, from an unknown station, cannot be identified, and its characters are put on record for the use of a future describer.

Length 11 mm., segments 72.

Prostomium nearly twice as wide as long, rounded laterally, slightly convex anteriorly and nearly straight posteriorly. Eyes very imperfect (probably abnormal), represented by a minute speck of pigment close to the base of the palp on one side, and a larger but still very small eye with a lens on the other side. No trace of tentacles remains, but it seems very improbable that they should be normally absent in a syllid of this type. Palps projecting forward and curved downward pistally, free, broad, subelliptical, flattened, their length nearly equal to width of prostomium, and their combined width exceeding that of prostomium.

Peristomium very short above, swelling to a broad lip at the sides and below. An incomplete, strongly moniliform, dorsal tentacular cirrus with seventeen joints remaining exists on one side, but the others are lost.

Body strongly arched anteriorly, but more flattened behind. First twelve segments very short and separated by deep furrows, the others becoming longer until in the middle region they are one-fourth as long as wide. Pygidium a very short ring with a slight median lobe, bearing a pair of very long, slender, moniliform cirri as long as the last twelve segments and consisting of more than forty joints; in addition there is a very minute unjointed median cirrus.

Parapodia small, the neuropodia cylindroid, little compressed, truncate, the distal end divided into nearly equal, short, thick, rounded presetal and postsetal lips. Neurocirri rather slender, tapered, unjointed, blunt, reaching slightly beyond end of neurocirri. Notocirri arising from prominent swellings and small cirrophores well above neuropodia; very long, flexible, very strongly moniliform, alternately longer (on odd-numbered segments) and shorter (even-numbered segments). At the anterior end mostly lost; on middle segments the short ones exceed the width of their segments and have thirty-five or forty joints, the long ones are twice the width of their segments and have fifty to fifty-five joints. Even near the caudal end they are not much shorter, the longest having forty or more joints and the short ones twenty-five or thirty.

Acicula three or four in a row ending at the dorso-lateral angle, pale yellow, tapered to blunt, slightly knobbed tips. Setæ few, seldom

exceeding ten or twelve and oftener fewer, colorless, transparent, with rather stout, curved stems, terminating in enlarged, oblique ends which appear to be quite smooth. Appendages usually about twice as long as the oblique end of stem, with straight, simple points and strongly developed marginal fringe. Parapodia of the last thirty segments at least bear a single simple spine which projects prominently from the dorsal part of the bundle. It has about twice the thickness of the compound setæ, is very slightly curved and ends in a blunt point. The most posterior project very prominently to quite the length of the compound setæ; further forward they are less conspicuous, and anterior to XL none can be detected.

Proboscis retracted and on account of the opacity and pigmentation of the anterior end difficult to see. It appears, however, to have a smooth margin. Gizzard in XV to XXII, with thirty-four rings.

Color anteriorly pale brown owing to numerous granules in the integument, passing through yellow into a nearly colorless posterior end.

**Autolytus** sp.?

A single example of a stock regenerating behind and incomplete from the loss of many of the appendages. Length 16 mm., width between tips of parapodia 1.4 mm.; segments 85 with a narrow regenerating bud of 13 segments.

Prostomium broadly ellipsoid, anterior and posterior borders nearly straight, sides prominently convex; with the palps as seen from above the outline nearly circular. Eyes two pairs with lenses, the anterior nearly black, diameter about one-fifth width of prostomium, located midway of the length of prostomium at its lateral borders, looking outward and a little downward and forward; posterior brown, about one-half diameter of anterior, with which they are in contact on the dorso-postero-median side. Palps completely coalesced to tips, but having a depressed median line and barely perceptible distal emargination. Median tentacle lost, but one lateral tentacle present, arising just above base of palp nearly in line with anterior eye, coarse, little tapered, its length six or seven times prostomium and palps, but much twisted and probably incomplete.

Peristomium bearing large cirrophores, but only the ventral style of one side remaining, this being one-half the length of the lateral tentacle. Anterior segments imperfectly separated, the furrows shallow; width increasing for about twenty segments to the gizzard region and then nearly uniform to the end. A wedge-shaped median elevation with apex at the peristomium extends over the first six or

seven segments, and is bounded by the divergent epaulettes which extend caudad from the peristomium and have pigmented borders. The regenerating region is quite small, barely a mm. in length and about one-fourth that in width, and ends in an unsegmented blunt pygidium without cirri.

Parapodia, as usual in the genus, short, thick, ventral in position, lacking free neurocirri which become coalesced with the neuropodia to form opaque ventral swellings; neuropodia terminating in short, thick, presetal and postsetal lips. Notocirri with large cirrophores, often as large as the neuropodia; styles unjointed, coarse and similar to the tentacle, very easily detached and many missing. That of II very long, about twice the lateral tentacle and reaching to about XX; that of III about one-half as long; the others much shorter, the longest about one-half III or about width of body.

Aicula four (on one parapodium studied), tapered to blunt points. Setæ forming rather dense tufts, colorless, the shafts rather stout, strongly curved, distally enlarged and near the articulation denticulated on both faces. Appendages little longer than oblique end of shaft, triangular with bidentate ends, the anterior tooth larger and somewhat hooked.

No teeth visible at end of retracted proboscis, œsophagus scarcely looped; gizzard in XX-XXVIII, apparently about thirty-three rings. No color.

The single specimen comes from an unknown station.

#### SPHÆRODORIDÆ.

Although at least five generic names have been applied to the few known species of this very small family, it seems that the forms possessing compound setæ still lack proper generic designation. Indeed, if the synonymies published by European authors be correct, all of these names are based upon a single type species. As each was originally proposed for a single species, there is no difficulty about fixing the types. Three names were proposed in 1843: *Ephesia* Rathke for *E. gracilis* Rathke (n. sp.), *Sphærodorum* Oersted for *S. flavum* Oersted (n. sp.) and *Bebryce* Johnston for *P. peripatus* Johnston (n. sp.). *Ephesia* was previously used by Hübner in 1816 for a genus of Lepidoptera, and *Bebryce* is preoccupied by *Bebryce* Philippi, 1842. Nothing in the descriptions of the types serves to differentiate them; they all certainly have simple setæ and lack spherical organs other than those directly related to the parapodia. Two years later Johnston, discovering the earlier use of *Bebryce*, substituted *Pollicita*, but admits the prob-

able identity of his type species with *Sphærodorum flavum* Oersted. Perrier in 1897 proposed *Hypephesia* for species with simple setæ, naming *H. gracilis* as the type.

Levinsen employs *Ephesia* to include both typical species with simple setæ like *E. gracilis* Rathke and forms with compound setæ like *E. peripatus* Claparède (non Johnston), while *Sphærodorum* is retained for those species which bear several series of spherical appendages with granular contents and which have the setæ compound, like *S. clapedii* Greeff. St. Joseph, on the other hand, prefers to separate the genera on the basis of setæ characters, ranging under *Ephesia* species with simple setæ and under *Sphærodorum* those with the setæ compound. Finally Perrier recognizes the three generic types apparent in the family, retains Levinsen's application of *Sphærodorum* but divides his *Ephesia*, unfortunately applying that name to the *E. peripatus* group and giving a new name (*Hypephesia*) to the typical *E. gracilis* with simple setæ.

It is evident, therefore, that *Sphærodorum* is the proper name for the papillated forms with simple setæ only, and, so far as I am aware, no distinct tenable generic names are in existence for the two types with compound setæ.

The present collection includes a species of each of the three types known in the family, but all are provisionally placed in the genus *Sphærodorum*, a proceeding that may be justified because the known number of species is so small that no confusion will result from placing all in a single genus, because increased knowledge of the species of the family may make known forms possessing intermediate characters, and because the relationships of the Sphærodoridæ have been so variously conceived that it is possible that other generic names have been overlooked.

***Sphærodorum papillifer*** sp. nov. Pl. XV, figs. 11, 12.

Moderately slender, tapering both ways, the greatest width nearer the anterior end, subterete, but somewhat depressed and flattened below. Length of type 30 mm.; maximum diameter at end of anterior two-fifths 1 mm.; segments 102. Other specimens one or two millimeters shorter.

Anterior end blunt, the prostomium and peristomium retracted and difficult to distinguish, the former a very short, simple, slightly domed lobe studded with papillæ and without definite appendages, though three papillæ longer than the others may represent the tentacles and a pair of mammilliform papillæ the palps. Peristomium a simple, not clearly differentiated ring surrounding the mouth and bearing a pair

of small globoid cirri. On the dorsum is a <-shaped group of conspicuous black eye-spots which extend on to somite II. Typically there seem to be two pairs, but frequently there is an additional pair of spots or a median spot anteriorly.

Segments short and uniamular or slightly and irregularly annulated, mobile and irregularly contracted in the different regions; posteriorly becoming very small and tapering into a minute pygidium which bear a pair of spherical cirri with small apical papillæ and in addition a minute median cirrus or papilla. Surface, particularly toward the ends of the body, bearing numerous small, pointed or somewhat clavate retractile papillæ which are evidently of a sensory nature and become larger in the neighborhood of the parapodia.

Parapodia (Pl. XV, fig. 11) rather inconspicuous, lateral, probably uniramous. They consist of a slender, conical setigerous neuropodium roughened with small, conical, sensory papillæ becoming longer towards its distal end, which terminates in an especially prominent one or postsetal lobe. A much stouter process arising from the postero-ventral region of the neuropodium, having nearly the structure of the sensory papillæ, is undoubtedly the neurocirrus. Quite distinct from and well dorsad of the neuropodium is a spherical prominence (notopodium?) bearing on the middle of the distal face a small clavate cirrus. The spherical body is largest and most conspicuous on middle segments, but the distal cirrus is larger, both relatively and absolutely, at the ends. These organs are enveloped in a thick cuticle and the interior is filled with a snarl of slender, elongated bodies and opaque brownish granules, giving to the entire organ its characteristic opacity. A short distance farther dorsad is a clavate papillæ similar to that borne by the spherical body but more slender and elongated, especially on middle segments.

Neuropodial aciculum single—a rather stout, yellowish, tapered spine ending in a simple, blunt, somewhat projecting point. Setæ few, about four to six, projecting unequal distances in an irregular fascicle in each neuropodium (fig. 11). All are simple, colorless, rather stout, the shafts straight or nearly so, the ends expanded into a blade-like extremity with a knife-like edge rising into a slightly curved point and passing at the base into a slightly differentiated lateral spur. They exhibit little variety in shape or proportions (Pl. XV, fig. 12).

Proboscis unknown. Color nearly uniform pale yellow, faded, the eye-spots deep brown.

Six specimens from station 4,400, off San Diego, April 8, 500 fathoms green mud.

One is a female filled with large eggs distinctly visible to the naked eye; the others, including the type, appear to be males.

**Sphærodorum brevicapitis** sp. nov. Pl. XV, figs. 13, 14.

Although considerably larger this species closely resembles *S. papillifer* in general appearance. The type and only specimen, much contracted and distorted, is 39 mm. long, with a maximum diameter without parapodia of 1.6 mm., and has 96 segments.

Owing to the partial protrusion of the proboscis as a soft bulbous structure the prostomium is crowded dorsad. It appears as a very slight, scarcely distinguishable lobe, bearing scattered papillæ, of which five, though still small, are larger than the others; three of these are very close together near the anterior margin of the lip; the others are separated by a considerable interval on each side.

Peristomium likewise indistinct—a short achætous ring bearing a minute mammilliform papilla on each side. A pair of rather large, widely separated pigment spots, the remains of a pair of eyes, lies partly on this segment but chiefly on III. Owing to the condition of the specimen little can be determined about the normal appearance of the segments. The cutaneous papillæ, however, are less numerous and smaller than in *S. papillifer*. They are scattered fairly uniformly over the surface, becoming more numerous on the parapodia. Pygidium a minute ring bearing a pair of low, broad, mammilliform papillæ, besides at least two small, simple papillæ.

Parapodia (Pl. XV, fig. 13) in general similar to those of *S. papillifer*, but the parts more widely separated and the neuropodia more slender and cylindrical with a conical apex, rather than simply conical, and ending in a small postacicular lobe. Neurocirri small, subconical processes arising from the posterior ventral side of the neuropodia just at the base of the terminal cone. Spherical organ prominent, with a thinner cuticle than in *S. papillifer*, and the papilla borne on the ventral side of the base instead of on the outer surface. Dorsal papilla (notocirrus) well above spherical organ, small, claviform, with a widened base.

Aciculum single, rather more slender than that of *S. papillifer*, but similar in form, colorless, the blunt-pointed tip projecting freely. Setæ in irregular fascicles of usually eight or nine, rather prominent, all compound or semi-compound, becoming widened and flattened distally and then tapering into a hooked tip or appendage which is articulated to the stem by an oblique joint, the absence of which would leave these setæ very similar to those of *S. papillifer* (Pl. XV, fig. 14).

Proboscis—see above. Color slightly yellowish; opaque from presence of sperm-balls with which cœlom is packed.

Type only, from station 4,395, off Santa Catalina Islands, March 31, 2,045 fathoms, blue-gray mud.

**Sphærodorum sphærulifer** sp. nov.

Fragment of caudal end of a species related to *S. clapedii* Greeff, but with the large spherical bodies more numerous. It is dark brown and very opaque. Each segment bears on the dorsum two or three pairs of large, and alternating with them smaller, spheroidal bodies, all partially united at their bases into a somewhat irregular transverse ridge. The smaller numbers are at the posterior end, and they increase regularly as far as the piece extends to the middle segments. Several similar but smaller bodies occur on the venter. Neuropodia generally similar to those of *S. brevicapitis*, but the very extensile neurocirri and postacicular lobes are much larger, a papilla appears to be absent from the notopodial organ and the first (a smaller one) of the transverse series of dorsal appendages may be the notocirrus of each segment. Setæ compound, similar to those of *S. brevicapitis*, but with the joint more distinct and the appendage somewhat longer.

The single specimen, included among some invertebrates presented to the Academy by Professor Harold Heath, was taken from a deep-sea fish-line in Monterey Bay on July 16, 1902.

**HESIONIDÆ.**

**Podarke pugettensis** Johnson.

About a dozen specimens with up to fifty-eight segments and except for the eyes devoid of pigment. One is regenerating the caudal end. Many have the proboscis, which has not been described, protruded. It measures about 1.5 mm. long and half as wide, the basal two-thirds swollen, bulbous and smooth, the distal portion subcylindrical or truncated conical and more or less compressed; terminal orifice a vertical slit surrounded by eight or ten faintly marked small papillæ.

The first mention of this species in literature is under the name of *Ophiodromus* by Harrington and Griffin as a parasite on *Asterias* in Puget Sound.

San Diego Bay, Beacon No. 3 Shoal, March 1, 1904.

**PHYLLODOCIDÆ.**

**Phyllodoce mucosa** Oersted.

This species, already recorded from the North Pacific, appears to be common off southern California. Most of the specimens are well



preserved and agree closely with typical examples of the species taken in the North Atlantic at Labrador and Greenland, as well as with the figures of Malmgren and other European authors. The only apparent difference is that the Pacific examples may have one or two more papillæ in some of the rows on the proboscis, most of them having 11 or 12 in the upper and lower and 13 or 14 or rarely 15 in the middle rows. None shows any trace of a median dorsal series, but the other papillæ are prominent and generally have a conspicuous brown spot on the posterior face. The form of the prostomium is very changeable and may be pyramidal, ovate or deeply cordate, but is always more or less emarginate posteriorly. The nuchal papilla is minute and inconspicuous. Several specimens are regenerating lost caudal ends and one is filled with eggs.

Seven specimens from station 4,399, off San Diego, April 7, 245 fathoms, fine gray sand and rock; and one from each of the following: 4,445, Monterey Bay, May 11, 66 fathoms, green mud; 4,476, same, May 16, 39 fathoms, soft green mud; 4,482, same, May 17, 43 fathoms, soft green mud; 4,485, same, 108 fathoms, soft green mud and sand; 4,519, same, May 26, 35 fathoms, hard gray sand; 4,548, same, June 7, 46 fathoms, coarse sand, shells and rock.

***Phyllodoce medipapillata* Moore.**

The median dorsal series of proboscival papillæ is always well developed and quite as conspicuous as the others. Besides this character this species is distinguished from the related *P. mucosa* by having the setæ appendages much shorter and the notocirri ovate-lanceolate instead of truncated as in that species. The large specimen is just 100 mm. long with 201 segments.

A single example was collected at each of the following stations: 4,420, off San Nicolas Island, April 12, 33 fathoms, fine gray sand; 4,460, Monterey Bay, May 12, 55 fathoms, green mud, gravel; 4,558, Monterey Bay, June 9, 40 fathoms, rock.

***Phyllodoce ferruginea* sp. nov. Pl. XV, figs. 15-18.**

Two complete specimens of nearly equal size. The type measures 46 mm. long, .7 mm. in maximum width of body and 1.2 mm. between tips of parapodia; 148 segments. Very slender, nearly linear, widest about end of anterior third, somewhat depressed.

Prostomium (Pl. XV, fig. 15) regularly elliptical, about five-sixths as wide as long, slightly depressed, slightly truncated at both ends and with a very slight posterior median emargination, strongly convex above. Eyes one pair, brown, very large with prominent lenses,

their diameter nearly one-third width of prostomium, situated just posterior to middle of length close to posterior borders of prostomium and looking dorso-laterad. Frontal tentacles arising by restricted bases, widely separated on antero-lateral borders of prostomium, long, slender and subulate, tapered regularly from above base to slender tip; the dorsal one and one-half times or more the length of prostomium, the ventral about as long as prostomium. Study of additional material may modify the last statement, as some of the tentacles of both specimens have evidently suffered injury and one (type) has two, the cotype one, in regeneration as small knob-like buds. The cells of the prostomium form a small rosette-like radiation anterior to the eyes, but there is no indication of a median tentacle.

Peristomium completely crowded beneath prostomium, projecting as lateral lobes merely, from the upper part of which arise the two pairs of tentacular cirri. No nuchal papilla. Posterior lip prominent. Somites II and III very short but distinct, except that ventrally the former coalesces with the prostomium to form the lower lip. Tentacular cirri (fig. 15) all unusually long and slender, regularly tapered, with well-developed cirrophores. The peristomial arises at about the level of the foliaceous notocirri and reaches to about XII; the dorsal of II is at a higher level and reaches XVII; ventral of II at a very low level and equals peristomial; that of III at nearly the level of succeeding notocirri and reaches XIV. Three or four small setæ arise from a small tubercle between the cirri of II and a fully developed neuropodium occurs on III. Anterior segments all very short and distinctly biannulate; farther back they become nearly half as long as wide. Pygidium a rather long ring, but cirri wanting.

Parapodia (Pl. XV, fig. 16) unusually small, projecting very little from side of body, the neuropodium flattened, with postsetal lip obsolete and presetal lip large and broadly rounded distally with a very slight notch, from which the point of the aciculum projects (fig. 17). Neurocirrus very strongly foliaceous, broadly subovate, several times larger than neuropodium on all somites, completely concealing them from behind and bending dorsad until on most somites it meets the notocirrus; arrangement of veins radial. Notocirrophores prominent, somewhat flattened domes, two or three times as large as the neuropodia on middle segments. Strongly foliaceous, thin, imbricated but covering only a small part of the sides of the body, of moderate size but very large in comparison with the neuropodia, broadly cordate with apex bluntly rounded (usually broader at the end than the one figured) and base deeply excavated, with deep yellow-brown veins forming a dense bipinnate figure; rather easily detached.

Aciculum single, nearly colorless, straight, tapered to a point like a sharpened pencil which projects slightly beyond the acicular notch (fig. 17). Setæ rather numerous, in broad, fan-shaped fascicles only obscurely divided into supra- and subacicular groups; 8 + 11 on somite X, 9 + 12 on XXV and L, 7 + 9 on C of type. They are colorless with moderately long stems scarcely reaching beyond the border of the neurocirri of middle segments, slender and gently curved, rather conspicuously inflated at the ends (Pl. XV, fig. 18) to form a socket bounded by lateral ranks of slender teeth connected anteriorly by a row of much smaller teeth. Appendages rather long, equalling or generally exceeding depth of neuropodia, very delicate with striations and marginal denticulations not visible under the magnification shown.

Color generally rusty, the body pale with little color, the cephalic appendages and neurocirri deeper and the notocirri very brilliant yellowish brown which contrasts strongly with the paler body and gives the worm its conspicuous coloring. Proboscis unknown.

Station 4,550, Monterey Bay, June 7, 50 fathoms, green mud, rock.

In form of the prostomium and other features this species approaches *P. citrina* Malmgren.

**Phyllodoce (Carobia) castanea** Marenzeller.

A small example 26 mm. long with 106 segments. Like the specimen previously reported from Monterey Bay this one has notocirri somewhat more elongated than those of Marenzeller's Japanese types. The color is paler and more yellowish than in the specimen above mentioned, though, like it, this is a female with eggs. There is no trace of a nuchal papilla and the flattening of the tentacular cirri is very obvious.

*Phyllodoce polyphylla* Ehlers, from South Georgia, is probably closely related to this species, though Ehler's figure exhibits no setigerous lobe on II, which is very obvious in this specimen. The minute dorsal tentacles shown by the type of *P. polyphylla* are probably merely the result of these being in process of regeneration after having been lost, as I have seen precisely similar conditions in several species.

Station 4,496, Monterey Bay, May 19, 10 fathoms, fine gray sand and rock.

**Anaitis polynoides** sp. nov. Pl. XVI, figs. 19-21.

Owing to the closely imbricated manner in which the large notocirri overlap the slender body this species bears a superficial resemblance to an elongated *Polynoë* or even more to a *Sthenelais*. The single specimen is complete, but the posterior one-fourth of the body has evidently

been recently regenerated—being abruptly unpigmented and of smaller size.

Form slender, depressed, the segments scarcely exceeding one-third of total width between margins of notocirri or tips of parapodia. From the maximum width at the end of the anterior fourth the extreme outline tapers slightly forward and regularly and continuously caudad. Length 44 mm.; maximum width of segments 1.6 mm.; total width 3.8 mm. Segments 88.

Prostomium very short, broad and depressed, decidedly bent downward. In the figure (Pl. XVI, fig. 19) the prostomium is represented as pressed upward somewhat, but in the position in which it naturally rests the anterior outline is regularly semicircular and the length (exclusive of the posterior prolongation) about one-half the width. From the slightly convex posterior margin a median prolongation fits into a deep depression in the peristomium and bears a knob-like nuchal cirrus having a diameter about equal to the eyes. Eyes one pair, conspicuous, circular, brown, about one-ninth or one-eighth the width of the prostomium and widely separated by an interval of about five times their diameter, close to the posterior margin of the prostomium. Frontal tentacles very short, subconical with small terminal appendages, very widely separated and somewhat reflexed on sides of prostomium; the dorsal about as long as one-third width of prostomium and separated by about twice their length; the ventral somewhat longer, nearer together and reflexed so that they are concealed in dorsal views.

Peristomium somewhat tumid laterally, but excavated dorso-medially for the nuchal projection and papilla, almost indistinguishably coalesced with II which is similarly tumid laterally but lacks a median depression.

Tentacular cirri four pairs, rather short, thick, blunt, and stiff. The first (or peristomial) pair scarcely longer than width of prostomium and not reaching beyond IV; dorsal of II with a much larger ceratophore and reaching VII; ventral of II equal to peristomial and that of III (notocirrus) similar to dorsal of II and reaching VIII.

Podous segments well defined, very regular, the anterior very short, but soon becoming one-third as long as wide, slightly convex above, flat below, with a shallow neural groove. Posteriorly the segments taper to a very minute pygidium bearing a pair of relatively stout, cylindroid anal cirri, the combined width of which equals that of the pygidium and the length the last five or six segments.

Parapodia (Pl. XVI, fig. 20) begin on III, strictly lateral, prominent, their length exceeding one-half width of body, toward the ends becom-

ing smaller but otherwise unmodified. Strictly uniramal, the neuropodia compressed, with obsolete postsetal lip and prominent, foliaceous presetal lip divided by an acicular notch into a larger, broadly-rounded, supra-acicular lobe and a somewhat shorter subacicular lobe obliquely tapered to a blunt point.

Notocirrophores large, those of all except most anterior segments flattened and auriculate (fig. 20), Notocirrostyles beginning with IV, thin and membranous; typically broadly lunate-reniform, the external border squarish, very regularly, closely and broadly imbricated, covering and concealing the parapodia and posteriorly the entire dorsum, but leaving the middle of the segments exposed anteriorly. Toward the anterior end the styles approach a circular form and become gradually smaller until practically the entire dorsum is left uncovered. The notocirrus of III is the last tentacular cirrus, while the neurocirrus of the same segment differs in no respect from those following. Neurocirrophores prominent swellings at base of ventral side of neuropodia. Neurostyles (fig. 20) oblong elliptical, with the broad distal end subtruncate, foliaceous, about equalling the neuropodia in size and reaching to or, on anterior parapodia, beyond their ends.

Aciculum single, stout, pale yellow, gently curved, with simple bluntly pointed tip. Setæ (Pl. XVI, fig. 21) colorless, numerous (about 30, equally divided between supra- and subacicular groups on middle segments), in a broad, fan-shaped fascicle. Shafts slender, slightly curved, slightly enlarged at the end; the very asymmetrical socket prolonged on one side into a great spine with a few small teeth on its base; the other side bearing a shoulder for articulation of the appendage which is supported by a thin, scale-like process slightly fimbriated at the end. Appendages long, about equal to the depth of the neuropodia, slender and delicate with the margin very finely but distinctly denticulated. The form of the articulation resembles the *Eteone* type.

Color generally, including prostomium and four anterior segments, under parts, parapodia, lateral parts of notocirri and posterior fourth of body, pale yellowish or yellowish ashy; exposed part of dorsum rich purplish-red with a fine blue-green iridescence. Inner thirds of notocirri rich brown, together forming a pair of broad stripes extending continuously for the anterior three-fourths and becoming darker anteriorly. Tentacular cirri except colorless tips, largely of a somewhat darker brown. Eyes dark brown.

Proboscis unknown. The type is a female containing half-grown ova which largely fill the cœlom and enter the cavities of the parapodia and notocirrophores.

Station 4,548, Monterey Bay, June 7, 46 fathoms, coarse sand, shells and rock.

*Eumida tubiformis* sp. nov. Pl. XVI, figs. 22, 23.

All of the specimens are contracted and in this state are depressed and stout, with the segments much crowded, particularly at the anterior end. The type, a female with 137 segments, is 67 mm. long, with a maximum body width of 3.1 mm. and a width between tips of parapodia of 4.5 mm. A male with 104 segments is 37 mm. long, and a small portion of the anterior end of a very large example measures 7 mm. between the tips of the setae.

Prostomium in the several specimens varying in degree of contraction and proportions, in the type and most of the others being nearly twice as wide as long, subelliptical, slightly concave posteriorly and with a tentaculiferous prominence in front, the prominent lateral ocular lobes resting upon the peristomium. One specimen has the prostomium subtriangular and only about one-fourth wider than long. In life it would probably be broadly cordate. Eyes one pair, very large, about one-fourth, or somewhat less, the width of the prostomium, with large lenses looking upward. Immediately behind and below them are the small nuchal sense organs.

Frontal tentacles arising close together on front of prostomium separated by a distance of about one-fourth width of prostomium, all subulate with basal half thickened and beyond that abruptly tapered to very slender tips, subequal or the ventral pair somewhat longer, slightly exceeding one-half width of prostomium. Median tentacle arising from a slight depression between lenses of eyes, not abruptly thickened at base, more slender and slightly longer than frontal tentacles.

Peristomium much shortened, crowded beneath prostomium, not visible as a distinct segment from above; somites II and III also much shortened and crowded. Tentacular cirri with well-developed cirrophores and large stout subulate styles shaped like the median tentacle but very much larger. Dorsal and ventral of II widely separated, the ventral being at nearly the level of the notocirri of succeeding somites. The single pairs of I and III lie opposite the interval between those of II, the peristomial being at the higher level. That of I reaches VI, ventral of II reaches VIII and dorsals of II and III reach IX.

Body of very uniform diameter, being perhaps widest at about XL, thence tapered very gradually and regularly caudad. Owing to the manner in which the notocirri are imbricated an aspect of rather strong depression results, but the body is really very little depressed. Seg-

ments arched above, flattened below with a slight neural ridge, distinctly biannulate dorsally with small intersegmental rings. Pygidium a very small, slightly thickened and rugose ring.

Normal setigerous parapodia (Pl. XVI, fig. 22) begin on III, but a small tubercle bearing a few setæ lies between the cirri of II. They arise at the ventral level of the segments and are prominent, being from more than one-third to one-half the width of their segments. Neuropodium somewhat compressed, supported by a single aciculum, the postsetal lobe nearly obsolete, presetal well developed, divided by an acicular notch into a supra- and a subacicular lobe, both rounded on anterior but bluntly pointed on posterior parapodia.

Neurocirri broadly foliaceous, ovate with bluntly pointed tip and oblique base attached to a low cirrophore, reaching to or beyond end of neuropodium which they exceed in width and overlap and conceal from behind. They are relatively much larger on anterior somites where they equal one-half the notocirri, diminishing to one-fourth the notocirri posteriorly. Notocirrophores low and broad. Notocirrostyles (Pl. XVI, fig. 22) of moderate size, broadly foliaceous and imbricated over bases of parapodia, leaving most of the dorsum of body exposed. They are broadly cordate with blunt apex and nearly symmetrical base, the anterior ones broader, often wider than long and blunter, the posterior tending to more acute, euncate, longer, less cordate forms, with the length as much as one and one-third times the width.

Aciculum single, yellow, stout, tapered, straight or slightly curved and ending in a simple blunt point at the acicular notch. Setæ in a single vertical series spreading fanwise and only very slightly separated at the acicular notch into supra- and subacicular groups. On the type they are distributed as follows: somite X, 13 supra- and 21 subacicular; XXV, 14 and 25; L, 11 and 24; LXXV, 11 and 17; and C, 8 and 14.

They are nearly colorless, with slender slightly curved stems scarcely enlarged at the ends (Pl. XVI, fig. 23) to form an imperfect asymmetrical socket, the best developed side of which is broadly rounded and provided with a uniform series of slender teeth. Appendages of moderate length, very uniformly about one-half depth of neuropodium, rather broad at base but tapering to a slender tip with scarcely discernible marginal denticulation.

Color uniform dark brown, yellowish brown or pale yellow with a few irregularly scattered dusky or black blotches, one of which may be on the prostomium.

Proboscis of type 8.5 mm. long, 2.4 mm. in diameter at orifice; of largest specimen 16 mm. long, 3 mm. in diameter at base and 4 mm. at orifice. It is somewhat trumpet-shaped, gradually widening to the somewhat flaring distal end which is surrounded by a circle of 18 to 20 low, rounded, soft papillæ more or less incised at the base and in some cases cleft in two. When protruded the proboscis has a slight spiral twist and is marked by three narrow, raised longitudinal lines on each side, the dorsal and ventral intervals between those of the two sides being one-third more than the lateral intervals between those of the same side. The general surface is marked with fine irregular wrinkles and usually, but not always, with minute granulations which are slightly more conspicuous along the raised lines.

Stations 4,430, off Santa Cruz Island, April 14, 197 fathoms, black sand and pebbles, six specimens, two of which (including the type, a female filled with large ova) are mature; 4,423, off San Nicolas Island, April 13, 339 fathoms, gray sand, black pebbles, shells, one young specimen, in which the longest (second dorsal) tentacular cirri each bears a symmetrical swelling on its anterior face near the middle.

*Eulalia nigrimaculata* sp. nov. Pl. XVI, figs. 24-26.

Two complete specimens considerably contracted have the following measurements: Type 33 mm. long; maximum width near middle body only 1.5 mm., extreme width between tips of parapodia 3 mm.; number of segments 89; female with eggs. Cotype 36 mm. long with 90 segments.

Prostomium subglobose, slightly depressed, nearly circular in outline as seen from above; profile strongly convex, sloping downward anteriorly; sharply differentiated from peristomium. Eyes one pair, brown, with well-developed lenses, large, nearly one-fourth width of prostomium, midway of the length and close to the lateral margins of which they are situated. On the type the right eye is enormously and abnormally enlarged and occupies the most of that side, to the displacement of the dorsal right tentacle. Frontal tentacles widely separated, the dorsal just outside of line of lateral border of eyes, the ventral slightly nearer together; length of dorsal equal to prostomial width, with swollen fusiform basal half and abruptly contracted filamentous distal half; ventral similar but with much shorter terminal filament. Median tentacle (present in type only) arising between eyes, slightly longer than frontal tentacles, with less swollen base and regularly tapered.

Peristomium and II coalesced, forming a short distinct ring above, crowded forward beneath the prostomium, at the sides of which the peristomium appears. Mouth large, bounded by a nearly smooth



posterior lip. Tentacular cirri much crowded, the peristomial and that of III (notocirrus) arising almost between the dorsal and ventral cirri of II, the former at the higher level. All have short but distinct ceratophores and prominent, regularly acuminate styles with slender tips. They are slightly flattened in the type, much more strongly flattened, apparently as a result of accidental pressure, in the cotype. The longest (dorsal of II) reaches to XII, those of I and III reach to IX and the ventral of II to VI. A conspicuous tuft of neuropodial setæ occurs between the two cirri of II.

Setigerous segments sharply defined by deep furrows; very short anteriorly but increasing until in the middle region they are at least one-third as long as wide. Slightly depressed and little more convex above than below. Behind the middle they gradually diminish in size to the pygidium, which is a very short and small ring, the cirri of which have been lost.

Parapodia rather short, scarcely exceeding one-third width of their segments but with conspicuous spreading tufts of setæ which begin on II. Neuropodia (Pl. XVI, fig. 24) strongly compressed, subovate; postsetal lip rudimentary; presetal lip well developed, foliaceous, symmetrical, terminating in a blunt point but altogether lacking a notch, though there is a slight posterior groove in which the end of the aciculum rests (fig. 25). Neurocirri (fig. 24) rather thick, very large, especially anteriorly where they have an area of about four times the neuropodium, but diminishing to twice the neuropodium posteriorly. They are narrowly palette-shaped, the excavated portion attached to low cirrophores on the ventral base of the neuropodia, the broad end outward and bent dorsad behind and extending far beyond the neuropodia, which they completely conceal from behind and serve the purpose of postsetal lobes. They are crowded with deep-brown or on the margins often nearly black glands. Notocirrophores (fig. 24) large and prominent, erect, more or less dome-like with a restricted area for attachment of the styles. Styles thin and membranous, easily detached, somewhat imbricated and concealing the parapodia; anteriorly ovate with rounded ends, on middle segments broadly ovate-cuneate with pointed ends and posteriorly becoming elongated; the base oblique and asymmetrical with a shallow sinus for attachment. Internal structure finely reticular with slightly developed veins and glands.

Aciculum single, colorless, tapered, ending in a rather acute point. Setæ forming a very broad undivided, fan-shaped fascicle, very numerous for the genus (30 on X, 48 on XXV, 40 on L and 36 on LXXV).

projecting about one-fourth of their length beyond the neurocirri. Stems colorless, of moderate length, nearly straight, little enlarged at the distal end (Pl. XVI, fig. 26) where they terminate in a small shoulder and a socket bounded on each side by a fringe of long delicate teeth. Appendages very delicate, about as long as depth of neuropodium with barely discernible marginal teeth.

Proboscis (only partially protruded) cylindrical, 5.5 mm. long and .6 mm. in diameter, surface thickly covered with small, blunt, flattened, slightly retrorse papillæ, separated by considerably more than their length.

Color gray-blue or bluish-plumbeous with a metallic blue iridescence and brownish suffusions and marked with a few conspicuous gradrate black spots, especially on the ventral surface, either widely scattered singly or aggregated in groups. Notocirri uniform orange yellow. Neurocirri yellowish with dark brown or blackish margin.

Station 4,454, Monterey Bay, May 12, 71 fathoms, green mud and sand.

***Eulalia levicornuta*** sp. nov. Pl. XVI, figs. 27-30.

Only one small specimen measuring 43 mm. long is complete, with 221 segments. The type is much larger, being 70 mm. long for 172 segments and lacking perhaps the caudal one-third and 100 segments; its maximum width of body at C-CXX is 1.2 mm., between tips of parapodia 1.8 mm. Another very much macerated and incomplete specimen referred here somewhat doubtfully has 240 segments and is 94 mm. long, and less than 1 mm. wide, having therefore nearly the proportions of a slender lumbriconereid.

Form very slender and elongated, nearly linear, but tapering gently both ways from about the end of the anterior third.

Prostomium (Pl. XVI, fig. 27) about as wide as long, moderately depressed, semioval with truncate ends or subtriangular with rounded basal angles and truncated apex, usually sharply differentiated from the peristomium, but in one specimen almost continuous with it dorsally. Eyes one pair, small, about one-seventh of posterior width of prostomium, close to its postero-lateral angles, separated by three to three and one-half times their diameter, dark brown, with small lenses. Frontal tentacles situated on the sides of a distinctly separated anterior segment of the prostomium, subconical, their length about one-half prostomium. Median tentacle a minute, slender, conical papilla situated on line between anterior border of eyes and having a length of from one to one and one-half times their diameter.

Peristomium a complete ring entirely posterior to the prostomium

and usually free from it all round, scarcely wider than prostomium, dorsally elevated into a convex platform-like area which in one case overlaps the prostomium and partly covers the eyes. Mouth small with nearly smooth posterior lip. Somites II and III similarly well differentiated with similarly elevated dorsum. Tentacular cirri arising from large cirrophores, the styles rather stout, tapered and short; the peristomial pair about as long as prostomium and reaching to III; ventral of II equal to peristomial and above its base a tubercle bearing a small tuft of setæ; dorsal of II about twice as long and reaching VI or VII. Somite III bears a fully developed setigerous parapodium and its tentacular notocirrus is equal to that of II.

Anterior somites are uniannulate and very distinct, becoming less well differentiated farther back as small interpodal annuli appear. The raised dorsal field gradually merges with the general convexity of the back. The venter is flat. They very gradually increase in size to or beyond C, and taper thence caudad.

Pygidium a dome-shaped ring about twice as long as the last setigerous segment, bearing a pair of somewhat flattened, subcylindrical cirri resembling the posterior notocirri but rather larger than they, together with a minute median cirrus (described from one specimen, station 4,431).

Parapodia (Pl. XVI, figs. 28, 29) small, little prominent and scarcely exceeding one-fourth the width of their segments, but becoming relatively longer and more prominent posteriorly. Setigerous neuropodia begin on II; they are slender, only slightly compressed, and little tapered to a bluntly rounded presetal lip divided by a slight acicular notch into two equally rounded lobes, of which the subacicular is usually somewhat longer; postsetal lip scarcely developed.

Neurocirrophores broad and low, the styles (Pl. XVII, figs. 28, 29) subelliptical, little excavated for attachment, thick, more or less foliaceous, broadest and relatively largest on anterior parapodia, where they considerably exceed the neuropodia and extend somewhat beyond them. Posteriorly they are relatively smaller and narrower, but often so much longer that fully one-fourth of their length projects beyond the neuropodia, but they always tend to diverge from the latter and not to bend dorsad behind them. Notocirrophores (Pl. XVI, figs. 28, 29) of anterior somites rather small, of middle somites low but nearly as wide as the length of the neuropodia. Styles generally foliaceous but comparatively small, carried nearly erect, little imbricated and covering but a small part of the sides of the parapodia. On anterior somites (fig. 28) they are regularly ovate with broadly

rounded distal end and scarcely excavated base; on middle segments larger, more broadly ovate, with bluntly pointed tips and nearly straight symmetrical bases; while posteriorly they become again smaller and tend toward a cuneate form. They all exhibit strongly marked internal striations arranged in a partly bipinnate, partly radiate pattern. On some specimens the styles are contracted and much thicker, the anterior ones being nearly cylindrical, and all are opaque and of a more or less deep brown color. Greatly extended specimens have the notocirri all erect and widely separated.

Aciculum single, rather slender, of the form usual in the genus, with the bluntly pointed tip projecting slightly from the notch. Setæ (Pl. XVI, fig. 30) arranged in the usual fan-shaped vertical fascicles of one series, of a rather small number, as follows in the type: on X 7 supra- and 5 subacicular, on XXV 5 + 11, on L 9 + 11, on LXXXV 11 + 12, on C 7 + 14 and on CLXX 14 in all. They have remarkably long, slender shafts with slightly enlarged symmetrically cleft ends forming the socket, each side of which is prolonged obliquely into a prominent elongated tooth flanked on each side by a fringe of delicate spinules. Appendages (fig. 30) rather short, usually one-third to one-half depth of neuropodium, but on one specimen (station 4,431) rather longer, broad at base and tapered and gently curved to a delicate tip, the marginal denticulations and oblique striations fine but distinct.

Proboscis of a cotype protruded 2.5 mm., .4 mm. in diameter at distal end, terete, gradually increasing in diameter distally, the entire surface covered so thickly that they touch each other with crowded, granulated, slightly flattened, rounded papillæ, at least three irregular circles of which at the distal end are of much larger size.

Color of type (female filled with eggs) faded to a uniform pale greenish drab or light olive. Another specimen is nearly uniform brown and still another pale yellow with a thin brown line of granules across each segment and the head, tentacular cirri and parapodial cirri deep brown with aggregations of similar granules.

One specimen from each of the following stations: 4,418, off Santa Barbara Island, April 12, 238 fathoms, gray sand; 4,420, off San Nicolas Island, April 12, 291 fathoms, gray mud, rocks; 4,430 (type), off Santa Cruz Island, April 14, 197 fathoms, black sand and pebbles; 4,433, off Santa Rosa Island, April 15, 265 fathoms, gray mud.

This species belongs to the *bilineata-gracilis* group and, with the exception of the Hawaiian species *E. naraica* Kinberg, appears to be the first of that group to be described from the Pacific. As is the case with *E. gracilis* Verrill, specimens in different states of contraction differ considerably in appearance.

*Eulalia* (*Sige*) *bifoliata* sp. nov. Pl. XVI, figs. 31-34.

Described from a single imperfect anterior end consisting of the head and 57 segments, having a length of 18 mm. and a maximum diameter between tips of parapodia of nearly 2 mm. Contracted and rather stout, strongly arched above, flat below and little tapered in the length of the piece.

Prostomium (Pl. XVI, fig. 31) about three-fourths as long as wide, somewhat depressed, subpyramidal with a straight, inclined profile, greatest width in posterior half, posterior border nearly straight, entire, bounded by a deep furrow separating the peristomium. No anterior furrow behind tentacles. Eyes circular with prominent lenses, brown, large, about one-fourth width of prostomium and situated at its greatest width, about one-half their diameter anterior to posterior border and close to lateral border. Frontal tentacles situated rather close together at the truncated apex of prostomium, separated by little more than one and one-half times their diameter, somewhat macerated and imperfect, but their length approximately one-half prostomium or slightly less. Median tentacle situated between anterior border of eyes at centre of prostomium, much smaller than frontal tentacle, but macerated so that the exact size is not certain. Immediately behind each eye is a faint brown spot.

Peristomium scarcely visible above, forming a swollen lower lip and small lobes beneath eyes. Remaining segments short, uniannulate. Tentacular cirri with distinct cirrophores, all styles lost except the ventral of II on one side, which is rather short and stout, conical, about one and one-half times length of prostomium and reaching to V. A small tuft of setæ on II.

Parapodia (Pl. XVI, figs. 32, 33) small and little prominent, their length about one-fourth width of somites on anterior and one-half on posterior (middle) somites, but strongly compressed and deep. Postsetal lip obsolete; presetal greatly developed and foliaceous, divided by a deep acicular notch into a much smaller subacicular lobe, rounded at the end, and a larger supra-acicular lobe prolonged into an acuminate but blunt tip frequently much longer and more slender than those figured. Neurocirrophores (figs. 32, 33) rounded swellings at base of neuropodia; styles strongly foliaceous, thin, quadrant-shaped, with the dorsal angle prolonged similarly to the supra-acicular lobe, but usually extended far beyond the latter. Though of large size they do not exceed the neuropodia of middle segments, the subsetal lobes of which they completely cover from behind, reaching slightly dorsad of the acicular notch, their nearly straight dorsal border being parallel

to the axis of the supra-acicular lobe and serving as a postsetal support to the setæ. Notocirrophores (fig. 33) low and flat, moderate in size, immediately above notopodium. Three or four only of the notostyles remain. They are strongly foliaceous but rather small, scarcely or not longer than the neurostyles and about one and one-half times as wide as they, broad ovate or suborbicular with nearly straight, truncate, scarcely excavated base, opaque brown with granules chiefly arranged in radial lines.

Aciculum single, pale yellowish, with colorless base, straight, regularly tapered to a simple point, which enters but does not project beyond the acicular notch. Setæ (Pl. XVI, fig. 34) numerous (18 supra- and 27 subacicular on XXV), forming a broad, spreading, fan-shaped fascicle, the shafts colorless, long, with about one-third of their length projecting beyond the margin of the neurocirrus, slightly curved, little enlarged at the end, where they terminate in a prominent shoulder and a pair of high, tapered processes finely denticulated at the ends which bound the socket. The only perfect appendage seen has a length of about three-fifths the depth of the neuropodium and is slender and finely denticulated.

Proboscis (dissected) tubular with smooth non-papillated lining; orifice surrounded by a circle of apparently eighteen soft papillæ.

This species has the smooth proboscis, prolonged neuropodia and neuropodial cirri and form of setæ characteristic of the subgenus *Sige*, features which appear in the descriptions of no known *Eulalia* from the North Pacific or the west coast of South America.

Type from station 4,522, Monterey Bay, May 26, 149 fathoms, gray sand and shells.

#### EXPLANATION OF PLATES XV AND XVI.

PLATE XV.—*Syllis heterocheta*—figs. 1-4.

Fig. 1.—Anterior end,  $\times 56$ .

Fig. 2.—Parapodium XXV with one long and one short seta in place; *a*, short notocirrus from XXVI,  $\times 56$ .

Fig. 3.—End of short seta from XXV,  $\times 600$ .

Fig. 4.—Same of long seta,  $\times 250$ ; *a* and *b*, articulation and tip of appendage of same,  $\times 600$ .

*Pionosyllis typica*—figs. 5-7.

Fig. 5.—Parapodium with dorsalmost and ventralmost setæ represented,  $\times 24$ .

Fig. 6.—Tips of two acicula,  $\times 400$ .

Fig. 7.—End of a seta from XXV,  $\times 600$ .

*Odontosyllis phosphorea*—figs. 8-10.

Fig. 8.—Parapodium X without setæ, 56.

Fig. 9.—Parapodium L with bases of notopodial setæ only,  $\times 56$ .

Fig. 10.—Distal end of middle seta from L,  $\times 600$ .

*Sphaerodorum papillifer*—figs. 11, 12.

Fig. 11.—Parapodium X with setæ,  $\times 98$ .

Fig. 12.—Seta from X,  $\times 440$ .

*Sphaerodorum brevicapitis*—figs. 13, 14.

Fig. 13.—Parapodium X (the parts may be abnormally separated owing to distention of body walls) without setæ,  $\times 56$

Fig. 14.—Average seta from somite X,  $\times 440$ .

*Phyllodoce ferruginea*—figs. 15–18.

Fig. 15.—Anterior end,  $\times 56$ .

Fig. 16.—Parapodium XXV with dorsalmost and ventralmost seta shown,  $\times 56$ .

Fig. 17.—End of neuropodium showing tip of aciculum,  $\times 500$ .

Fig. 18.—Profile and front view of region of articulation of seta from XXV,  $\times 440$ .

PLATE XVI.—*Anaitis polynoides*—figs. 19–21.

Fig. 19.—Anterior end, from the dorsum,  $\times 24$

Fig. 20.—Parapodium of XXV, anterior view, dorsalmost and ventralmost setæ shown,  $\times 24$ .

Fig. 21.—Profile and rear views of articular region of two setæ from somite X,  $\times 360$ .

*Eumidia tubiformis*—figs. 22, 23.

Fig. 22.—Anterior aspect of parapodium L, showing dorsalmost and ventralmost setæ in place,  $\times 24$ .

Fig. 23.—A seta from somite XXV,  $\times 360$ .

*Eulalia nigrimaculata*—figs. 24–26.

Fig. 24.—Anterior aspect of parapodium L, with dorsalmost and ventralmost setæ in place,  $\times 24$ .

Fig. 25.—Outline of neuropodium showing tip of aciculum,  $\times 56$ .

Fig. 26.—Two views of articular region of seta from X,  $\times 440$ .

*Eulalia levicornuta*—figs. 27–30.

Fig. 27.—Anterior end,  $\times 24$ .

Fig. 28.—Anterior aspect of parapodium XXV,  $\times 56$ .

Fig. 29.—Same of parapodium LXXV, with dorsalmost and ventralmost setæ in place,  $\times 24$ .

Fig. 30.—A seta from XXV; a, front view of articulation of same,  $\times 440$ .

*Eulalia bifoliata*—figs. 31–34.

Fig. 31.—Head from dorsum,  $\times 24$ .

Fig. 32.—Posterior view of parapodium XXXIII, without notostyle or setæ,  $\times 56$ .

Fig. 33.—Anterior view of parapodium XXXIX, without setæ,  $\times 56$ .

Fig. 34.—Profile and rear views of articulation of seta from XXXIII,  $\times 440$ .