NOTES ON THE NUDIBRANCHIATE MOLLUSCA FROM THE VANCOUVER ISLAND REGION

III. RECORDS OF SPECIES AND DISTRIBUTION

By Chas. H. O'Donoghue, D.Sc., F.Z.S.
Professor of Zoology, University of Manitoba

In 1921 the writer published a list of Nudibranchiate Mollusca from the Vancouver Island Region (8) which gave the classification, diagnostic characters and the structure of the radula of all the species then known to occur in that area and was based upon an examination and dissection of each one. The present paper is based upon extensive collecting during the months of May, June, July and August, 1921, and is intended to supplement the previous one in two ways: firstly, to place on record in a similar manner the further species that have been procured and examined, and secondly, to give additional new data on the size and distribution of the species included in the former list. All the material dealt with, was obtained while living and the measurements and colour notes made on it before preservation with the exception of *Tritonia tetraquetra*, of which a very large specimen in the Provincial Museum at Victoria was examined. This is only the second individual of this species to be recorded from the Pacific Coast of North America.

Dr. C. MacLean Fraser, Curator of the Biological Station at Nanaimo, B.C., in his usual courteous manner, has done all he could to assist in the collection of the material. My thanks are due to him and to the Biological Board of Canada for permission to work at their station.

No attempt has been made to enter into a discussion of the classification of the group which, like that of most groups, is open to revision, but the classification put forward by Eliot in "British Nudibranchiate Mollusca Pt. VIII" Supplementary, 1910, has been adopted here, as in the previous list, since this excellent work forms a convenient and readily accessible basis upon which to work.

This paper, as just noted, falls into two parts: A., Species not included in the previous list, and B, Notes on species previously listed and this, together with two other notes in this series, *i.e.*, I. Colour Variations (9) and II., The Spawn of Certain Species (10), help to fill some of the noticeable gaps in our knowledge of the Nudibranchiate Mollusca of this region.

A. SPECIES NOT INCLUDED IN THE PREVIOUS LIST

The following species are here recorded:

I. HOLOHEPATICA	II. CLADOHEPATICA
Tritonia tetraquetra	*Coryphella longicaudata* sp. nov.
Doris echinata sp. nov.	*Galvina olivacea* sp. nov.
Discodoris heathi	*Amphorina columbiana* sp. nov.
Rostanga pulchra	*Cuthona concinna*
Cadlina flavomaculata	

DESCRIPTION OF THE SPECIES

Tribe I. HOLOHEPATICA

Nudibranchs, in which the liver forms a compact mass, neither branched nor divided; usually accompanied by the following characters. Almost complete external symmetry; vent usually on the mid dorsal line and surrounded by a circle of branchial plumes; radula of moderate or considerable width and not known to be reduced in any genus; mandibles are rare; hermaphrodite gland not a separate mass but spread over the liver as a layer; as a rule the genital ducts are triaulic and there are two receptacula seminis.

Family TRITONIIDAE

Branchiae consisting of tufts set along the mantle margin or accasionally altogether absent.

Genus TRITONIA (Cuvier)

Alder and Hancock, Mon. Brit. Nud. Moll., Pt. VII, 1855, p. 46. Bergh, Proc. Ac. Nat. Sci. Philadelphia, Pt. I, 1879, p. 95. Malacol. Untersuch., Vol. III, Heft 15, 1884. Bull. Mus. Comp. Zool., Harvard, Vol. XXV, No. 10, 1894, p. 146. Eliot Brit. Nud. Moll., Pt. VIII, 1910, p. 145.

"The body is limaciform but somewhat rectangular in outline, except at the end where it tapers to a short tail. The foot is broad. Over the mouth is an oral veil bearing two grooved tentacles at the end, and in the middle tubercles or processes. The rhinophores are retractile into raised sheaths; not perfoliate but surrounded by a few plumes. The dorsal margin is slightly prominent and bears a single row of branchial tufts which are more or less arborescent. Anal and renal openings on the right side. Jaws large with several rows of denticles or prominences

near the edge. The radula varies greatly in size in the different species, but always consists of a broadish central tooth with a moderate or large number of laterals which are usually simply hamate. The first lateral is usually larger and lower than the others and somewhat clumsily shaped. The liver is not divided and sends off no branches to the gills. There is no armature either in the stomach or on the genitalia. The hermaphrodite gland forms a layer spread over the liver." (Eliot 1. c.).

TRITONIA TETRAQUETRA Pallas

Bergh, Proc. Acad. Nat. Sci. Philadelphia, Pt. I, 1879, p. 98.

Body.—The body is an elongated oval, broader at the front end and narrowing behind; a typical Tritonia but somewhat more stoutly built. The dorsum is but slightly arched and plentifully covered with conspicuous mammilated tubercles. The mantle is thick and fleshy, extending well beyond the foot all round. At the front end is a very well-developed semi-circular oral veil which is not bilobed as in *T. hombergii* and is tuberculate.

Colour.—This animal has not been examined alive but the following description is based upon a painting of the living form in the possession of the Provincial Museum at Victoria. The general body colour is of a dull brick-red passing off to a lighter shade at the edge where there is also a sprinkling of brown specks. The tubercles are of a dingy yellow colour with white spots on them so that the entire animal bears a somewhat mottled appearance. Thus it does not agree with the "ashy grey" of Bergh's description (2).

Dimensions.—Bergh's specimen was 75.0 mm. long and 37.5 mm. wide and 26.0 mm. high but he states (2, 1880, p. 99) that Pallas says his specimens were larger than his figure which measures 7-8 centimetres. The preserved specimen measured 200 mm. long x 120 mm. wide and 85 mm. high, but it was measured alive and stated to be nearly 12 in. long, *i.e.*, about 290 mm. and the other measurements were, of course, in proportion. Thus it was a very large animal exceeding in size the large *Dendronotus giganteus* previously described from this coast (8).

Head.—The head is quite broad, not sharply marked off from the body but distinct from the foot. The mouth appears as a longitudinal slit with thickish lips. It is covered by the large well-developed oral veil.

Foot.—The foot is broad and flat and the same length as the dorsum. Its posterior end is bluntly pointed and the anterior end much broader and abruptly rounded and bilabiate with the two lips equally developed.

Rhinophores.—The rhinophores are widely separated as in *T. hombergii* and were retracted within well-marked sheaths with much tuber-

culated margins and not much detail could be made out. The description here given is adapted from Bergh (2). The stalk is short, the clavus cylindrical with its central portion lowered. The periphery of the club is divided into about ten large bi- or tripinnate plumes, each often divided into a median and two lateral plumes. The hindermost plumes are largest and the stem produced into a thick papilla projecting over the other plumes.

Branchiae.—Bergh states that there are numerous gills all along the margin of the dorsum. They formed a close uninterrupted series from just behind the rhinophores back to near the posterior end and were of two sizes as in *T. hombergii.* They were relatively smaller than in *T. hombergii* and more numerous, appearing in the preserved condition as a fringe along the edge of the dorsum.

Radula—The radula is very large and well developed and of a bright brown colour containing in all about 57 rows of teeth. The median tooth has the form of a very irregular compressed pyramid but wider in the middle than at either end. The anterior margin is decidedly notched and the posterior roughly round. The bluntly rounded apex projects upwards but does not project beyond the front margin of the base. The first lateral tooth is more elongated, much less notched in front and more rounded behind; it also has a bluntly rounded apex. The second lateral tooth is to be regarded as the first of the true pleurals and is intermediate between the first laterals and a typical pleural. The apex is much more developed, so forming a distinct spine, and the base is reduced. A short distance out the typical tooth is a simple hook with a somewhat enlarged base. The extreme lateral teeth are small with a thin irregular spine. The number of lateral teeth was about 232 so that the formula is 232.1.1.1.232.

Jaws.—The jaws are extremely thick and strong and occupy the entire front of the powerful pharynx and measured 30 mm. long by 31 mm. wide. The processus masticatorius is not so well developed as Bergh figures. The inner margin is dark brown, much thickened and quite sharp so that it forms a very efficient cutting organ.

The glans penis is conical, long, slender and unarmed.

This species was first described by Pallas from the Kuril Islands where, according to that author, it is known to the natives as Tochni and eaten by them either raw or cooked. Bergh (2) described a specimen from Unalaska, Aleutian Islands, found on reef at low water, and gives a good account of its internal anatomy.

Habitat.—Three large specimens of this species were taken in the neighbourhood of Victoria, B.C., some years ago, probably dredged in 15 fathoms on Brotchie Ledge. One of them is mounted in the Pro-

vincial Museum and there is also a painting of the animal in life. I wish to thank the Director, Mr. F. Kermode, for his kindness in allowing me to examine this splendid specimen and giving me information concerning it.

Family DORIDIDAE CRYPTOBRANCHIATAE

Branchiae retractile into permanent pocket. Two spermathecas.

Genus DORIS Linnaeus

Eliot, Mon. Brit. Nud. Moll., Pt. VIII, 1910, pp. 95 and 147.

Animals not hard, flattish, but the back is usually moderately arched. The dorsal surface is covered with tubercles or warts which are sometimes specially developed round the openings of the branchiae and rhinophores. Tentacles often thick grooved projections. Foot broad. Mantle margin not narrow. Radula broad and composed of simply hamate teeth. No armature on the labial cuticle or the male genitalia.

DORIS ECHINATA sp. nov.

Body.—The body forms a regular ellipse with bluntly rounded ends. The dorsum is arched and somewhat flattened and covered with numerous well-marked bluntly conical papillae, which gives it a superficial resemblance to *Acanthodoris pilosa,* but the sides of the papillae are strengthened by numerous spicules. The dorsum is somewhat gritty to feel from the presence in it of large numbers of spicules which have the form of elongated wavy needles. They are arranged in interlacing bundles all over the dorsum and the bundles, passing up the sides of the papillae, project freely above the surface.

The mantle is very wide and thick and extends well beyond the foot all round save at the posterior end which is just visible when the animal is crawling actively.

Colour.—The general colour of the whole animal is an opaque white with from a dozen to forty small spots of a warm brown colour scattered irregularly over the dorsal surface, the smaller ones situated towards the margin in one case but not in others. Very minute specks of the same colour cover the dorsum but not the papillae.

Dimensions.—The measurements of the largest animal when alive were 12 mm. long, 5.5 mm. wide and 3 mm. high.

Head.—The head is small with a small longitudinal slit-like mouth with small blunt tentacles, which are apparently not grooved. Both the sides of the head and the tentacles bear scattered spicules.

Foot.—The foot is elongated and much narrower than the body. The hinder end is bluntly pointed while the anterior is abruptly rounded

and widely and deeply bilabiate, the anterior lip being notched in the middle line.

Rhinophores.—The rhinophores are fully retractile into deep sheaths whose margins are beset with papillae furnished with spines. The clavus, borne on a slightly conical stalk, is perfoliate with 10 or 11 leaves and about twice as long as the stalk.

Branchiae.—The branchial plumes are 6 in number and arranged in an almost complete circle with a tendency to union at their bases; the anterior four are simply pinnate while the posterior pair are bipinnate. They can be completely withdrawn into a deep sheath with a papillated margin. When expanded the margin of the sheath also expands, leaving a sort of gutter all round. The anal papilla lies within the branchiae and the renal pore is just in front of it on the right side.

Radula.—The radula is pale yellow, relatively larger, short and broad. There is no median tooth and the pleural teeth number from 13-15 on each side. They are simply hamate reaching their maximum about the third or fourth tooth out and decreasing towards the outside. The total number of rows varies from 16-18.

Glans penis unarmed?

This obviously belongs to the Doridiidae Cryptobranchiatae as is indicated by its general form, the fact that the branchiae are completely retractile, the two spermathecas and the characteristic radula.

The classification of this family is by no means satisfactorily established and such authorities as Bergh (2) and Eliot (3) differ in their nomenclature. To settle this point it would be necessary to investigate critically a large series of forms and would be beyond the scope of the present paper but until it is done it is almost impossible to avoid introducing names that may later have to be discarded. If I may venture a criticism it is that while on the one hand Eliot may tend to retain too many forms in the genus *Doris*, Bergh certainly goes to the other extreme and raises to generic rank forms that appear so closely related that they should be included in the same genus. He further goes to the length of dismembering the genus Doris and not even retaining the name for one of its component genera—a procedure not generally adopted without ample justification.

The present form would fall within the genus *Doris* as defined by Eliot (vide supra).

While a number of Dorids possess a spiculate dorsum the present species has the spicules developed to a remarkable degree and projecting as spines so that I propose, therefore, to name it *Doris echinata*. Should this and its associated characters prove sufficient to merit generic rank the genus might well be termed Echinodoris.

Habitat.—The specimens were obtained under loose stones at False Narrows at the low tide limit on June 12th, at Rocky Bay at low tide on June 20th, and at low tide at Lock Bay, Gabriola Island, on June 21st.

Genus DISCODORIS (Bergh)

Discodoris, Bergh, Jahrbücher der deutsch. Malacol. Gesselsch., IV, 1877, p. 61; Malacol. Unters., XII, 1877, p. 518; Supp. I, 1880, p. 47; II, 1881, p. 108; XV, 1884, p. 658; XVI, I, 1888, p. 805; XVII, 1890, p. 895; Report on Nudibr. Challenger Repts., X, 1884, p. 92; Syst. der Nudibr. Gasterop., 1892, p. 102.

Body.—Rather soft, rounded or oval in outline; the branchial aperture slightly crenulate, stellate, or bilabiate; anterior margin of the foot bilabiate, the upper lip more or less notched. Prostate gland large.

DISCODORIS HEATHI (MacFarland)

Discodoris heathi, MacFarland, Proc. Biol. Soc. Washington, XVIII, Feb., 1905, p. 39; Bull. Bureau Fisheries, Washington, Vol. XXV, 1905, p. 118, pl. XXIII.

Body.—The body is eliptical, broad and flattened with equally rounded ends. The dorsum is covered with tiny tubercles but practically smooth. The mantle is fairly thick and extends beyond the foot save at the posterior end. In the skin are a large number of closely packed spicules, slightly curved and bluntly pointed at each end.

Colour.—The general colour is a pale sandy yellow getting darker in the mid-dorsal region. Scattered upon it are a number of small spots, some dark brown, others brownish red; they are more plentiful in the mid-dorsal region. The rhinophores are slightly darker.

Dimensions.—The specimen measured 24 mm. long, 13.3 mm. wide and 5 mm. high.

Head.—The head is completely hidden by the mantle and is quite small. The elongated cylindrical oral tentacles pass from the posterior region of the head and curve forwards and outwards.

Foot.—The foot is eliptical, narrow and wider at the front end than at the hinder end. Its anterior end is blunt and bilabiate with a median notch in the upper lip.

Rhinophores.—The rhinophores are completely retractile within deep sheaths with a wavy slightly projecting margin. The stalk is cylindrico-conical and the bluntly pointed clavus is perfoliate with 12 or 13 leaves.

Branchiae.—The nine branchial plumes are tripinnate, rather small and when expanded cover about $\frac{1}{3}$ of the width of the animal. They are arranged in a fairly complete circle, almost confluent at their bases,

and are completely retractile within a sheath with a wavy margin. Within them, at the posterior ends, lies the anus on a low papilla.

Radula.—The radula is about twice as long as wide and with a shallow median groove. The teeth are colourless and arranged in 20 rows of from 38-41 on each side. The inner 20-24 of each row being moderately stout teeth while the 15-18 are much thinner and packed close together. The inside pleural teeth are fairly stout, slightly sigmoid rods with bluntly pointed recurved tips and their inner border bears a shelf-like flange. The middle pleural teeth have a longer, more curved spine and practically no flange. The outer pleural teeth are very slender and curved into a sickle shape.

Labial armature.—The labial region is covered with a thin eliptical disc of chitinous material. This bears a lamella on each side of the upper half of the mouth opening. The lamella is pale yellow in colour and composed of a large number of tiny little rods with almost square ends tightly packed together over a nearly rectangular area with one posterior corner carried down into a point. Genitalia unarmed and the everted penis is blunt and conical. This species was recorded by MacFarland (6 and 7) from the rock tide pools from Point Pinos to Monterey principally during July and August, but stated to be rather rare.

Habitat.—The single specimen obtained was taken from the vertical north shore of Jesse Island at the end of May and is the only one so far recorded from this locality.

GENUS ROSTANGA Bergh

Rostanga, Bergh, Gatt. nordischer Doriden Arch. f. Naturgesch., XLV, I., 1879, p. 353; Malacol. Unters. Sup. H.H., 1881, p. 99; System der Nudibr. Gasterop., 1892, p. 105.

Notaeum covered with minute hispid papillae; branchiae of simply pinnate leaves. Rachis of radula naked; inner pleural teeth strong, with large body and small hook; the remaining ones less strong, erect, the body smaller, the hook elongated and more slender, the apices of the outer pleurae with slender denticles.

ROSTANGA PULCHRA MacFarland

Rostanga pulchra, MacFarland, Proc. Biol. Soc. Washington, XVIII, 1905, p. 40; Bull. Bureau Fisheries, Washington, XXV, 1906, p. 118.

Body.—The body is somewhat elliptical but wider and blunter at the front end. The dorsum is only slightly arched and closely covered with small but well-marked papillae, which are strengthened with numerous spicules. These spicules diverge so that the top of the papilla is wider

than the base and they also project as a series of tiny points. The mantle is wide, covering all but the extreme tip of the foot when the animal is crawling actively.

Colour.—The whole of the animal, including the rhinophores and branchiae, is a deep orange-red, practically scarlet, and the foot is somewhat lighter and more translucent while the tip of the clavus is yellowish. There was no trace of the brown and black spots between the papillae stated by MacFarland to be present in some specimens.

Dimensions.—The largest specimen measured 13 mm. long, 9 mm. wide and 5 mm. high.

Head.—The head is of moderate size and wide with a longitudinal slit-like mouth and bears a pair of long, slender oral tentacles.

Foot.—The posterior end of the foot is bluntly pointed and the sides pass forwards almost parallel so that the foot is considerably narrower than the body. Its front end is abruptly rounded and deeply bilabiate with the upper lip slightly notched in the middle line and projecting beyond the lower.

Rhinophores.—The upright rhinophores are of a characteristic shape. The stalk is cylindrical and bears the somewhat expanded frill-like clavus with 11 leaves (10-12) on each side and it terminates as a free finger-like process on the posterior border which bends forwards slightly. They are completely retractile within sheaths with a papillated margin.

Branchiae.—The ten branchial plumes are simply pinnate and arranged in a circle within which the anus opens on a low papilla, in front and to the right of which is the tiny renal pore. The branchiae are held almost upright and not spread out over the back and are completely retractile within a sheath whose margin bears papillae similar to those on the back.

Radula.—The pale radula is broad and contains 67-79 teeth. The first pleural tooth has a stout, somewhat diamond-shaped base from the antero-lateral corner of which a stout hook-like process passes backwards and bears upon its median edge a series of 7-11 sharp pointed spines. The succeeding ten teeth are in the form of a strong spine on the base of which is a curved flange-like expansion. The hook becomes increasingly slender in the more lateral teeth, finally it is transformed into a long slender spine upon a small oblong base. Right at the outside the end part of the spine becomes divided up into 2, 3 or 6 slender thread-like spines so that the lateral border of the ribbon is brush-like in appearance.

Labial Armature.—The labial aperture is guarded by an almost circular, thin, chitinous disc with an aperture in the form of an inverted T.

The lower borders of this opening are provided with a band of flattened plates directed forwards and slightly decreasing in size as they pass backwards.

The penis is short, blunt and cylindrical and is unarmed. This species was first described by MacFarland (6 and 7) from Monterey, California, where he states that it is common upon a bright red encrusting sponge. He has given an account of its internal anatomy, to which I have nothing to add, and a good coloured figure.

Habitat.—The specimens were obtained at Round Island and at Cardale Point early in July and while none were actually found on the red sponge there is plenty of this encrusting the rocks in the vicinity.

Genus CADLINA (Bergh)

Cadlina Bergh, Proc. Phila. Acad. Nat. Sci., 1879, p. 114; Bull. Mus. Comp. Zool., Harvard, XXV, p. 168; System der Nudibr. Gasteropoden, 1892, p. 108; Malacol. Unters., XVIII, 1892, p. 100.

Dorsal surface, as a rule, granulate or bearing small tubercles. Rhinophores short, broad and flat. Foot broad. Labial cuticle armed with a plate or band composed of minute hooks. The rachis of the radula bears a median denticulate tooth; the lateral teeth are hamate and denticulate. In most species (but not in *C. clarae*) the verge is armed with rows of minute hooks. Glans penis armed with a series of hooks.

CADLINA FLAVOMACULATA (MacFarland)

Cadlina flavomaculata MacFarland, Proc. Biol. Soc. Washington, XVIII, 1905, p. 43; Bull. Bur. Fisheries, Washington, 1905, p. 126.

Body.—The body is oval, about one and one-half times as long, as wide, and practically equally rounded at both ends. The notaeum is covered with blunt papillae. The mantle is thick, papillate above but smooth below and very wide, extending well beyond the body all round save that the end of the foot projects very slightly during locomotion.

Colour.—The general body colour is a dull cream, appearing slightly darker towards the mid-dorsal region, where the underlying viscera give more body to the colour. Along the sides of the body are a series of bright opaque lemon-yellow spots. MacFarland (6) figures 5 of these on one side and 6 on the other, and states that the first is behind the rhinophore. In addition to these, however, there were 9 or 10 slightly smaller spots on each side so that the total number is higher than the 7-10 on each side as given by MacFarland. However, one

could not fail to recognize the animal from his figures. The clavus of the rhinophore was of a pale brown colour with flecks of the lemon yellow at the tip.

Dimensions.—The largest specimen measured in the living condition 22 mm. long, 14 mm. wide, 4 mm. high.

Head.—The head is quite small with a longitudinal slit-like mouth and fits into the under surface of the mantle. It bears a pair of short, blunt, somewhat flattened tentacles with a groove on their outer margin.

Foot.—The foot is very narrow and elongated with the margins parallel for greater part of their length; it is bluntly rounded posteriorly and more abruptly rounded in front, where it is bilabiate.

Rhinopores.—The rhinopores project slightly forwards and outwards and are completely retractile into a sheath with a slightly tuberculate margin. The stalk is quite short and the clavus, occupying about $\frac{4}{5}$ the total length, is perfoliate with 11 leaves.

Branchiae.—The branchial plumes are 10 in number, simply pinnate, and they are retratile within a sheath with a very small margin.

Radula.—The radula is relatively small with a shallow median groove and contains 68 rows of teeth. The median, or rachidial tooth, is of a peculiar shape not unlike a hand with short fingers and a thumb on each side. The first pleural teeth bear a high pointed cusp on the inside of which are one or two smaller side cusps overlapping the rachidial tooth and on the inside three to six cusps. The lateral teeth have one long curved spine with 12-15 denticles on one side and as they pass outwards they become more and more saw-like, reaching a maximum about the middle of the row and becoming very slender on the outside. T total number of lateral teeth varies from 22-25, so that the formula is (22-25)-1-(22-25). This species was first described by MacFarland (6) 1905, and again more fully later (7), when he gave a full account of its internal anatomy.

Habitat.—This form is not uncommon in the vicinity of the Station and was found on the Algae (*Laminaria* sp?) on the north shores of various places, and also under stones exposed at very low tides. It was taken during the end of June and beginning of July, when it was spawning at Brandon Island; Lock Bay, Gabriola Island; Duke Point Lagoon; Round Island and Ballenac Islands.

Tribe II. CLADOHEPATICA

The liver does not form a single mass but is divided, and in the majority of families ramified. In a number of families the radula is not ascoglossan, and jaws are invariably present.

Family AEOLIDIDAE

Limaciform animals bearing unbranched cerata on the dorsal surface. The liver is represented by the diverticula which these cerata contain and does not, as in *Dendronotidae*, etc., form masses in the body cavity. Rhinophores simple or perfoliate, but never with sheaths. Radula uniseriate or triseriate. Cnidocysts usually present.

α TRISERIATAE

Each transverse row of the radula contains three teeth.

Genus CORYPHELLA (Gray)

Coryphella Bergh, Malacol. Zool. Blatter, 11, 1875, etc.; Alder and Hancock, Monog. Brit. Nudibr. Moll., Pt. VII, 1855, p. 45; Vaysiere. Anal. Musee d'Hist. Nat. de Marseille Zool., Vol. III, 1866-1889; Eliot, Notes on Some British Nudibranchs Jour. Mar. Biol. Assoc., Vol. VII, No. 3, 1906, pp. 334-382; Brit. Nud. Moll., Pt. VIII, 1910, p. 168.

Form elongate and slender; corners of foot produced; rhinophores usually smooth and wrinkled but may be perfoliate; jaws with several rows of denticles.

CORYPHELLA LONGICAUDATA sp. nov.

Body.—The body is very slender, elongated and limaciform. It is not sharply marked off from the foot. The front end is higher and broader than elsewhere and it passes off posteriorly into a long slender tail, which is one of the striking characteristics of this species and even in preserved specimens often projects a considerable way, almost one-third of the total length of the animal beyond the end of the body and the cerata. The dorsum is smooth and bears along its sides series of cerata arranged in groups. The cerata are cylindrico-conical and quite long. The first group of cerata on each side is composed of from 14-16 and lies to the side of and just behind the rhinophore. This is followed by an area free from cerata that even shows quite plainly in some shrunken preserved specimens. The second group of cerata consists of 26-32 on each side not regularly arranged in rows. It passes backwards and inwards and the groups of the two sides merge in the mid-dorsal line.

Colour.—The general body colour is translucent white or slightly greyish white. The cores of the cerata are of a vermillion red, and around the top of the cerata are circular bands of bright orange.

Dimensions.—The largest specimen collected near Departure Bay measured 17 mm. long by 4.5 mm. wide and 4.5 mm. high, but on a visit to Friday Harbour, San Juan Islands, U.S.A., Mr. Kjerschow-Agersborg gave me a living specimen measuring 21.5 mm. long by 5.5 mm. wide and 5.25 mm. high.

Head.—The head is large, broad and oval with a transverse slit-like mouth. Its antero-lateral corners are produced into a very long cylindrico-conical oral tentacles which project outwards and upwards during locomotion and are nearly as prominent as the rhinopores.

Foot.—The foot is elongated and not sharply marked off from the body save by the flange along its margin. It is wide and rounded at the front end, which is also bilabiate with two equally developed lips, and it passes backwards, narrowing as it does so to be continued along the long tail. The antero-lateral margins of the foot project to some extent, but are not produced into such marked processes as in *Coryphella fusca.*

Rhinophores.—The rhinophore is long, cylindrico-conical and about two-thirds of it is occupied by the perfoliate clavus which bears 14-16 shallow and somewhat irregular leaves.

Radula.—The radula is short, of equal width throughout and contains 14-16 rows of yellow teeth. The median tooth is strongly built and has a base of an elongated horse-shoe shape. It terminates in a very sharply pointed, long conical spine. On each side it bears six short, fairly stout curved denticles. The hinder portion of the base is hollowed in the middle line to allow for the median spine of the succeeding tooth. The lateral tooth is triangular with almost a right angle at the postero-median corner. The hypotenuse is slightly curved. On the median side are a series of from 6-8 curved, fairly stout denticles and in front of these a series of 2-3 tiny points. The apex is formed by a strong spine. The base is bent inwards and the side bearing the denticles is more thickened than the rest of the tooth.

Jaws.—The jaws are well developed and of an oval hollow shell-shape and pale yellow in colour. The cristae connectivae are strongly developed and bound together by a tough membrane. The masticatory edge is thickened and brown and passes off into a well-developed *processus masticatorius* along the margin of which is a row of pointed spine-like denticles.

Habitat.—This species does not appear to be common in this district. Small specimens have been obtained at low tide at Round Island early in May and at Lock Bay, Gabriola Island, towards the end of May. It appears to be more common in the neighbourhood of Friday Harbour, San Juan Islands, for when visiting there about the middle of August

Mr. Kjerschow-Agersborg had a number collected near the Biological Station which were then spawning. From its radula, the possession of pedal tentacles and oral tentacles and its general structure it is undoubtedly a *Coryphella*, but does not appear to have been described. In some ways it recalls *C. rufibranchialis* (Johnston) (1, 1848. Pt. IV, Fam. 3, pl. 14) from which, however, it differs in the radula and the possession of orange bands at the tops of the cerata, in having fewer cerata and the posterior ones only forming one large group and also in the greater length of the slender tail. To call attention to this last point I propose to call it *Coryphella longicaudata*.

Genus GALVINA Alder and Hancock

Alder and Hancock, Mon. British Nudibr. Moll., Pt. VII, 1855, p. XXII; Eliot, Mon. British Niudbr. Moll., Pt. VIII, 1910, p. 169.

GALVINA OLIVACEA sp. nov.

Body.—The body is aeolidiform and much elongated, passing back into quite a noticeable tail. The back is well rounded and at the side marked off from the foot by a slight flange. The cerata are relatively large and fewer than in most of the other forms of Aeolididae, apparently reaching about 18 in number, although they are caducous and the highest number counted in any one individual was 15. The first group consists of 4-6, about one quarter of the way from the front end of the animal and those behind this are disposed alternately. No head shield is present.

Colour.—The whole of the body and foot is of a pale translucent yellowish green, through which the internal organs are faintly discernable. Over the back there is a delicate tracery of light brown lines. There is a fairly broad, wavy band of deep olive green colour along the back and a core of the same colour in the cerata thus giving a deep green colouration to the animal as a whole. At the tip of the cerata are a number of tiny spots of opaque white. A similar patch of white spots is found around the end of the rhinophores. The animals were always found on a colony of the Hydroid *Obelia longissima* upon which they were apparently feeding. The Hydroid was growing upon the logs of the Station float, or more frequently upon the blades of Zostera marina, and it was obvious that the colouring was protective.

Dimensions.—The largest specimen measured 11 mm. long by 1.5 mm. high and 1.5 mm. wide and the largest cerata stood up about 1.8 mm. above the dorsum.

Head.—The head is relatively large and sub-globular and the mouth is widely open. It bears at its side two long cylindrical oral tentacles.

Foot.—The foot is long and narrow, passing off at the posterior end into a sharp tail and rounded in front but not possessing antero-lateral processes as in *Coryphella.*—It is quite muscular and by its means the animal is able to cling quite tightly and crawl readily on the under side of the surface film.

Rhinophores.—The rhinophores are long and non-retractile. They lie well in front of the first cerata and are not perfoliate.

Cerata.—The cerata are large in proportion to the animal. They swell out a short distance up and then gradually diminish in diameter until near the tip, where they finish in a low, somewhat pointed cone as in *Galvina exigua.*

Radula.—The non-tapering radula is triseriate and contains 32-33 rows. The median tooth consists of a somewhat rectangular horse-shoe-shaped base with a projection in front upon which is borne a long median spine. On each side of this are six fairly stout lateral denticles, the three anterior and the three posterior ones pointing in slightly different directions. Sometimes also a seventh smaller denticle occurs at the lateral end of the series. The lateral teeth have the form of quite thin plates with a slightly curved posterior margin. At the antero-median corner is a fairly long, sharp projection and at the antero-lateral is a much shorter and blunter one.

Jaws.—The jaws have the form of two thin, hollow shells which are strengthened along their cutting edge by an increase in thickness and a row of tiny chitinous points. They are firmly attached at the crista connectiva and also again at the opposite edge.

The genital aperture lies on the right side just in front of and below the first cerata.

Habitat.—The first specimens obtained were upon a piece of floating *Zostera marina* covered with *Obelia longissima,* near the north shore of Jesse Island, and they would have been undoubtedly overlooked had it not been for the fact that the small egg masses were quite conspicuous and when they were examined closely the animals were found near them. A large number of specimens were obtained from near Jesse Island, near Brandon Island, and particularly from the Obelia on the Station float and the *Zostera* bed near it.

It is undoubtedly a member of the Genus *Galvina,* and in habit and radula approaches most closely *Calvina exigua* (1, Part V, Fam. 3, pl. 36), but differs from it in certain points. In general appearance and colour

it more clearly recalls *Tergipes despectus* (1, 1844, Pt. I, Fam. 3, Pl. 36). As far as I can find it is undescribed and so I suggest the name *Galvina olivacea* on account of its deep olive colouration.

Family AEOLIDIDAE

UNISERIATAE

The radula consists of a single longitudinal row of teeth.

Genus AMPHORINA (Quatrefages)

Amphorina Bergh, Verhandl. der k.h. zool-bot Gessels. in Wien, VII, 1882, pp. 7-74 and VIII, 1885, pp. 1-60; Eliot, Jour. Mar. Biol. Assoc., Vol. VII, 1900, pp. 334-382; Mon. Brit. Nud. Moll., Vol. VIII, 1910, p. 172.

Cerata somewhat inflated. Jaws with a row of minute denticles. Radula long (50-80) and tapering. The denticles, especially the median cusp, arise far back and hence appear elevated.

Penis armed with a spine.

AMPHORINA COLUMBIANA sp. nov.

Body.—The body is slender, but otherwise typically Aeolidiform and it passes back to a short slender tail. The sides of the body are moderately marked off from the foot by the interposition of a wide undulating flange. The dorsum is fairly high and smooth. On each side are from 17-20 cerata roughly arranged in transverse rows of 2-3 and falling into two ill-defined groups but they are not so distinct as, for example, in *Coryphella longicaudata.* The cerata are extremely long and cylindrical, terminate in a blunt end and are slightly constricted where they join the dorsum.

Colour.—The colour of the body and foot was of a more or less opaque white. The cores of the cerata were of a light vermillion and the outside translucent pale grey. The cerata are so large that they almost hide the animal when viewed from above so that it appears bright pink.

Dimensions.—The largest specimen measured was 4.5 mm. long by 1.25 mm. high and 1.5 mm. wide, while the longest cerata projected to a height of 3 mm. above the dorsum and even after fixation were quite long.

Head.—The head is rounded and broad with a transverse slit-like mouth. At the antero-lateral corners it bears two cylindrical tentacles of moderate length.

Foot.—The foot is elongated and narrow, wider and rounder at the front, where it is slightly bilobed and tapering off to a point at the hinder end.

Rhinophores.—The rhinophores are cylindrico-conical and of a moderate length. They are not perfoliate, but the last two-thirds of them are somewhat wrinkled.

Cerata.—The cerata are, as noted, very long and tend to be arranged in groups and the larger of them are situated near the dorsal side.

Radula.—The radula is uniseriate, narrow, very long and tapering. There are in all 65-69 rows of pale yellow teeth of which the last few are not fully formed and separated by considerable spaces. The tooth is composed of a basal plate in the form of a broad inverted U. At the hinder border of the middle of the front end arises the stout median cusp in a manner characteristic of the genus. To each side of this, near the front border, arise two large conical spines. Between the outer and inner of these are a number (usually 3) of tiny spines and between the inner and the median cusp another group, usually 4. Just outside the lateral spine is a deep notch and groove into which the two posterior end of the tooth in front fit.

Jaws.—The jaw is very thin and pale coloured and of an elongated oval shell shape. It is thickened and yellow coloured along the anterior edge. The crista connectiva is moderately developed, the masticatory edge is thick and there is a fairly well developed *processus masticatorius* bearing a row of sharply pointed denticles.

The penis is blunt and cylindrical and bears a small somewhat flattened spine.

Habitat.—The specimens were dredged in 7-12 fms in Gabriola Pass at the end of June. Its radula and general structure show it to be a member of the Genus *Amphorina*, and perhaps its nearest ally is *A. aurantica* (1, 1851, Fam. 3, Pl. 27). From this it differs slightly in general shape, number and length of the cerata and considerably in the details of the form of the tooth. It appears to be undescribed and I have suggested the name *Galvina columbiana*.

Genus (CUTHONA (Alder and Hancock)

Cuthona Alder and Hancock, Brit. Nud. Moll., Pt. VII, 1885, p. xxii; Eliot, Brit. Nud. Moll., Pt. VIII, 1910, p. 173.

Foot rounded in front. Rhinophores not perfoliate, Cerata fairly numerous. Radula usually short and not markedly tapering, with a few, rarely more than ten, denticles on each side of the central cusp. No armature on the genitalia as a rule.

CUTHONA CONCINNA (Alder and Hancock)

Eolis concinna Alder and Hancock, Brit. Nud. Moll., Pt. I, 1844, Fam. 3, Pl. 24.

Cuthona concinna Eliot, Brit. Nud. Moll., Pt. VIII, 1910, p. 173.

Body.—The body is elongated and typically Aeolidiform with a long pointed tail. It is not sharply marked off from the foot but the latter possesses quite a distinct flange. The cerata are fairly numerous, elongated and somewhat inflated. They are arranged approximately in 9-10 rows with 3-5 in each row and fall into three groups, one posterior and two antero-lateral. The hindermost group lies on the two sides and at the end passes up practically to the mid-dorsal line; it contains 22 cerata. On the right side this is separated from the anterior lateral group by the anal aperture in front of which there are 14 cerata. There is a slight break in the arrangement of the cerata on the left side level with that on the right and in front of it there are 13 cerata. The total number of cerata is 49. The cerata at the front end and hinder end are small while they are largest in the mid-dorsal region. The first cerata are on a level with the base of the rhinophore.

Colour.—The general body colour is a translucent white tinged with yellow. The cores of the cerata are of a dark brown, practically black (this is somewhat darker than described by Alder and Hancock), and the envelope is transparent faintly tinged with blue. Nearly all of them are tipped with a ring of closely opaque white spots which generally forms a complete cap, but in some cases leaves the actual point clear. The clavus of the rhinophore and ends of the oral tentacles are also white but not so intense.

Dimensions.—The single specimen examined measured 9.6 mm. long, 2.0 mm. wide and 3.6 mm. high (including the cerata). This agrees closely with Alder and Hancock's measurement of "nearly half an inch long."

Head.—Somewhat globose with a mouth in the form of a longitudinal slit. The anterior end is rounded with no sign of a median point like that in *Coryphella fusca*. It bears two quite long oral tentacles unlike those of *C. trilineata*, but more like those of *C. fusca*, and they are about half the length of the rhinophores.

Foot.—The foot is fairly narrow and the front end is rounded but appears distinctly incurved when the head is extruded. It spreads out into two broad, flat, blunt tentacles which are hardly noticeable when the foot contracts. At the hindermost end it passes off into a long sharply pointed tail which extends well beyond the last cerata.

Rhinophores.—The rhinophores have no sheath, are non-retractile, and quite long. They lie just inside and level with the most anterior cerata. The clavus is less than half their length and is not perfoliate, but when contracted it becomes wrinkled.

The anus is about half way back on the right side and the genital aperture forward on the right side near the most anterior cerata. As far as could be seen the genitalia are unarmed.

Radula.—The practically colourless radula contains a single row of teeth, 25 in number. Each tooth is of a deep angular horse-shoe shape with a small flange at the inner ends of the two bases. It bears a fairly prominent median spine flanked by smaller lateral spines which number five on each side, as stated by Alder and Hancock (1), in the newly formed teeth but in the older ones there are only four.

This is, beyoud doubt, the same species as that described by Alder and Hancock from the British coast in 1844, and it agrees closely with the type. It has not been previously recorded from the Pacific coast of North America and indeed so far no other member of the genus has been found.

Habitat.—The single specimen was found on a frond of *Ulva* sp. on the almost vertical north shore of Brandon Island, just at the limit of a moderately low tide on the 14th May, 1921. As no other specimens have been found it is probably a rare form.

B. NOTES ON SPECIES PREVIOUSLY LISTED

I. HOLOHEPATICA

Archodoris montereyensis.—In addition to the localities previously noted this species has been collected at Lock Bay and Rocky Bay, both on Gabriola Island, at the end of June; Duke Point Lagoon, Round Island and Cardale Point early in July; and at Friday Harbour, San Juan Islands, in the middle of August.

Anisodoris nobilis.—Additional localities: Lock Bay and Rocky Bay, both on Gabiorla Island, at the end of June; Duke Point Lagoon, Round Island and Cardale Point early in July; and at Friday Harbour, San Juan Islands, in the middle of August.

Diaulula sandiegensis.—Additional localities: Lock Bay, on Gabriola Island, at the end of June; Duke Point Lagoon, Round Island, Cardale Point, and the Ballenac Islands early in July and dredged in 15-18 fms. in Northumberland Channel towards the middle of July. The specimens from Round Island and Cardale Point were light while those from

Lock Bay were all very dark. One of the latter was the largest I have yet measured alive, being 49 mm. long by 25 mm. wide and 9.5 mm. high.

Cadlina marginata. Additional localities: Duke Point Lagoon, Round Island and Cardale Point early in July, dredged in 15-18 fathoms in Northumberland Channel towards the middle of July, and in 25-35 fathoms off Snake Island early in August. This species spawned plentifully on the north shore of Brandon Island during the end of May and beginning of June.

Laila cockerelli.—Additional localities: Round Island and Cardale Point early in July. The animals were spawning at the latter place.

**Triopha elioti.*—Additional localities: North shore of Brandon Island middle of May, False Narrows Reef early in June, Degnan's Bay at the end of June, Round Island early in July, and dredged in 25-35 fathoms off Snake Island early in August. The specimens form Round Island included one very much larger than any obtained previously and measured 97.0 mm. long by 22.0 mm. wide and 18.5 mm. high.

Acanthodoris pillosa var albescens.—Additional localities: From the north shore of Brandon Island during the middle and end of May and Duke Point Lagoon, Round Island and Cardale Point at the beginning of July.

Acanthodoris hudsoni.—Additional localities: False Narrows early in June and Cardale Point early in July.

Acanthodoris nanaimoensis.—Additional localities: The Lagoon at Hammond Bay early in June, Duke Point Lagoon, Cardale Point and Ballenac Islands early in July, and off the Station float at the end of July. The specimens from Cardale Point were spawning.

II. CLADOHEPATICA

Dirona albolineata.—Additional localities: North shore of Brandon Island in the middle of May and numerous nidosomes were seen in Degnan's Bay at the end of June. One specimen taken from the usual place on Jesse Island was very large, measuring 109 mm. long by 32 mm. wide and 30 mm. high, and the cerata were 43.5 mm. long when fully extended.

Dendronotus giganteus.—Additional localities: Dredged in 12-15 fathoms between the Station wharf and Brandon Island and in 15-20 fathoms off North Bay, Thetis Island, early in August. One of the specimens from the former place was fairly large, measuring 165 mm. long by 52 mm. high and 36 mm. wide.

*Really *Triopha aurantiaca.*

Dendronotus rufus.—Additional localities: Dredged in 10-12 fathoms off Horswell Bluff early in June in 15-18 fathoms in Northumberland Channel in the middle of July.

‡*Chioraera leonina.*—Small specimens were taken at Cardale Point early in July and in Haro Sound, San Juan Channel, and Friday Harbour, San Juan Islands, in the middle of August. Some of the specimens taken off the *Zostera* bed near the float were larger than any measured previously. The largest was 135 mm. long, including its cowl which was 64 mm., so that it was larger than those originally described by Gould (4), which were 5 inches long and about the same size as reported by Kjerschow-Agersborg (5).

Aeolidia papillosa.—Additional locality: False Narrows early in June.

θ*Hermissenda opalescens.*—Additional localities: Lock Bay, Cardale Point, Degnan's Bay at the end of June, Cardale Point early in July, and Friday Harbour, San Juan Islands, in the middle of August. It was also dredged in 8-12 fathoms in Gabriola Pass early in July. A specimen from the north shore of Jesse Island was the largest I have yet obtained measuring 55 mm. long by 14 mm. wide and 9.5 mm. high. It was also noticeable in that it was a very dark form with the cores of the cerata almost black and the band at their tip deep orange.

SUMMARY

The foregoing list of Nudibranchiate Mollusca includes the following four which are apparently new species:

Doris echinata, Coryphella longicaudata, Galvina olivacea and *Amphorina columbiana.* The following genera are also reported from the Pacific coast of North America for the first time: *Doris, Galvina, Amphorina* and *Cuthona.* The following species have previously only been recorded from California, and hence their range is extended considerably northwards: *Discodoris heathi, Rostanga pulchra* and *Cadlina flavomaculata.*

Tritonia tetraquetra has previously been recorded from a single specimen from Alaska and so its range is extended considerably to the south.

A number of additional localities have been given for specimens previously listed and in some cases measurements of individuals larger than were taken before.

---

‡Better *Melibe leonina.*
θBetter *Hermissenda crassicornis.*

LIST OF REFERENCES

1. Alder and Hancock, "A Monograph of the British Nudribanchiate Mollusca." Parts I-VII, London, 1844-1855.
2. Bergh," R., On the Nudibranchiate Gasteropod Mollusca of the North Pacific Ocean, with special reference to those of Alaska, Part I." Proc. Ac. Nat. Sci. Philadelphia, Pt. I, 1880, also published in "Scientific Results of the Exploration of Alaska," Vol. I, Art. V.

   "Die Opisthobranchien" from "Reports on the Dredging Operations of the West Coast of Mexico, and in the Gulf of California, in charge of Alexander Agassiz, carried on by the U.S. Fish Commission Steamer 'Albatross' during 1891." Bull. Mus. Comp. Zool., Harvard, Vol. XXV, No. 10, Oct., 1894.
3. Eliot, C., "A Monograph of the British Nudibranchiate Mollusca." Part VIII, Supplementary, London, 1910.
4. Gould, United States Exploring Exp. Mollusca, Vol. 12, 1852.
5. Kjerschow-Agersborg, "Notes on Melibe leonina (Gould)." Pub. Puget Sound Biol. Station, Vol. 2, 1919.
6. MacFarland, F. M., "A Preliminary Account of the Doridídae of Monterey Bay, California." Proc. Biol. Soc., Washington, Vol. XVIII, Feb., 1905.
7. Ibid., "Opisthobranchiate Mollusca from Monterey Bay, California and Vicinity." Bull. Bureau of Fisheries, Washington, Vol. XXV, 1906.
8. O'Donoghue, "Nudibranchiate Mollusca from the Vancouver Island Region." Trans. Roy. Canadian Inst., Vol. XIII, 1921.
9. Ibid., "Notes on the Nudibranchiate Mollusca from the Vancouver Island Region, I. Colour Variations." Ibid 1922.
10. O'Donoghue, C. H. and O'Donoghue, E., "Notes on the Nudibranchiate Mollusca from the Vancouver Island Region. II. The Spawn of certain Species." Ibid 1922.

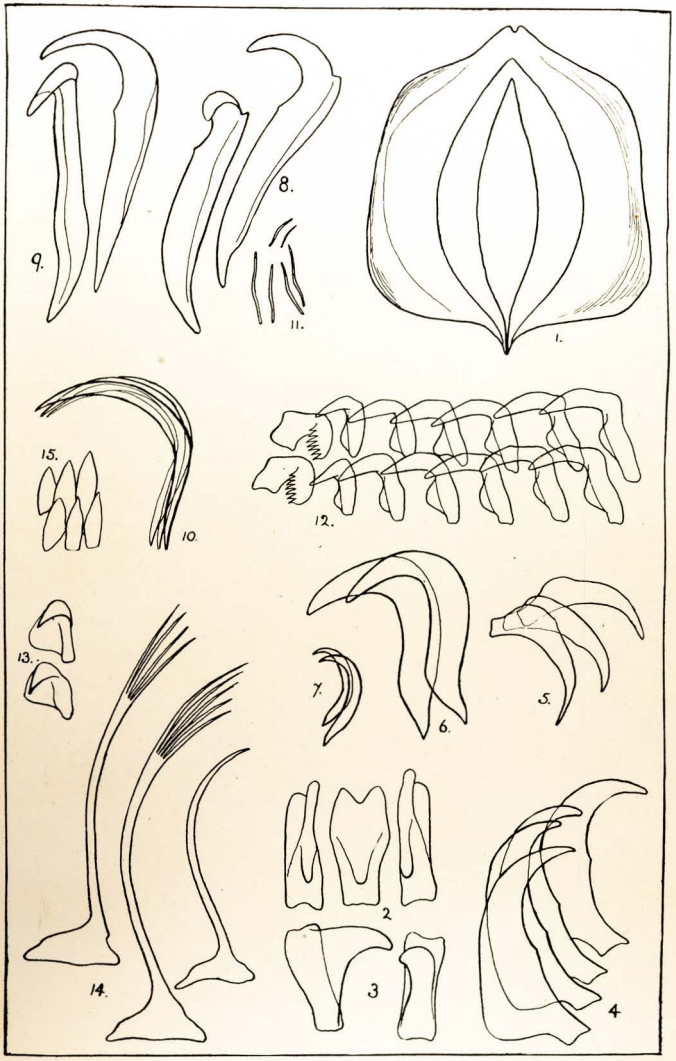
EXPLANATION OF THE PLATES.

PLATE V.

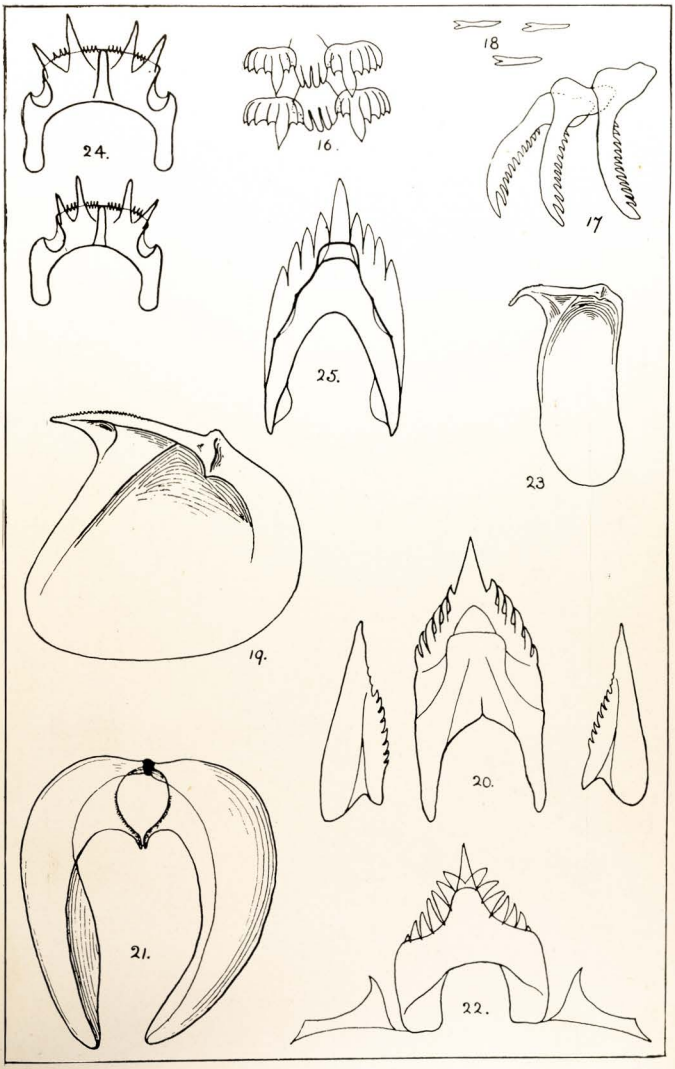
Fig. 1. *Tritonia tetraquetra* jaws anterior view×1½.
Fig. 2. *T. tetraquetra* the median and first pleural teeth×91.
Fig. 3. *T. tetraquetra* the second pleural tooth upper and lateral views ×91.
Fig. 4. *T. tetraquetra* four typical pleural teeth × 91.
Fig. 5. *T. tetraquetra* three outer pleural teeth×91.
Fig. 6. *Doris echinata* sp. nov. two innermost teeth×214.
Fig. 7. *D. echinata* sp. nov. two outermost pleural teeth×214.
Fig. 8. *Discodoris heathi* two of the innermost pleural teeth, one viewed slightly from the side×200.
Fig. 9. *D. heathi* Two median pleural teeth×200.
Fig. 10. *D. heathi* three outermost pleural teeth×200.
Fig. 11. *D. heathi* group of spicules×200.
Fig. 12. *Rostanga pulchra* two rows of the seven innermost pleural teeth ×494.
Fig. 13. *R. pulchra* the fourth pleural teeth seen from above×494.
Fig. 14. *R. pulchra* three of the lateral pleural teeth×494.
Fig. 15. *R. pulchra* plates from the labial armature×494.

PLATE VI.

Fig. 16. *Cadlina flavomaculata* the median and first lateral tooth on each side×400.
Fig. 17. *C. flavomaculata* three pleural teeth×400.
Fig. 18. *C. flavomaculata* three denticles from labial armature×400.
Fig. 19. *Coryphella longicaudata* sp. nov. jaw internal view×40.
Fig. 20. *C. longicaudata* sp. nov. one row of the radula×490.
Fig. 21. *Galvina olivacea* sp, nov. jaws antero-lateral view×66.
Fig. 22. *G. olivacea* sp. nov. one row of the radula×490.
Fig. 23. *Amphorina columbiana* sp. nov. jaw internal view×95.
Fig. 24. *A. columbiana* sp. nov. two teeth, one from the end and one from the middle of the radula×560.
Fig. 25. *Cuthona concinna* tooth. A tooth from the end of the row with only 4 lateral spines, those further back having 5 spines×320.



O'DONOGHUE ON NUDIBRANCHIATE MOLLUSCA III.



O'DONOGHUE ON NUDIBRANCHIATE MOLLUSCA III.