## NOTES ON TECTIBRANCHS AND NAKED MOLLUSKS FROM SAMOA.

BY C. ELIOT.

Between the middle of May and the end of July, 1899, I collected a number of mollusks on the coasts of the Samoan islands, chiefly on the reef at Apia. Some of the Tectibranchs and Nudibranchs which I obtained seem to me to be undescribed species, and few of them have been examined in the living condition by more than one or two observers. I therefore submit the following notes, to those who are interested in this group of animals. My best thanks are due to the authorities of the Smithsonian Institution at Washington and the Academy of Natural Sciences of Philadelphia, especially to Mr. Pilsbry, for assistance, and to Dr. Nolan for access to the Library of the Academy, without which the specimens collected could not have been identified.

**Cryptophthalmus cylindricus** Pease. Amer. Jour. of Conch., IV, p 74.

Pease's description and figure are accurate. I obtained several specimens of this animal at Apia. It is about an inch or an inch and a quarter long and generally black, but two specimens of apparently the same species are grayish white. The form is elongated and cylindrical, the epipodia being closely applied to the back, but the living animal sometimes contracts into a ball, and all my alcoholic specimens have assumed this shape. The shell is on the hinder part of the body, white, transparent, and nearly a quarter of an inch long. It is external and not covered by the mantle, though like all the dorsal region it is hidden under the epipodia. Branchia on right posterior side of body adjacent to the shell, but not covered by it.

All my specimens were found in the interior of a closely growing, bushlike seaweed.

**Doridium (Aglaia) Pilsbryi** n. sp. Pl. XIX, fig. 1*a*, 1*b*.

Body oblong. Two dorsal shields, of which the anterior has free margins all round and the posterior a free margin only behind,

where it is bifid and covers a large branchial plume, which does not come out between the lobes and is not visible from the upper surface. No tentacles. Foot wide; sides recurved and extended into small epipodia. Color rather bright green, changing to fawn color at the edges; foot and branchial plume dark green. On the anterior shield is a vivid black pattern like a large figure of 8, on the posterior shield a somewhat similar pattern, but the lower circle of the 8 is not complete. The edges of the epipodia are irregularly marked in black and there are five black spots on the foot. An alcoholic specimen measures 33 mm. long.

I obtained a single specimen of this animal under seaweed on the Apia reef. In captivity it was very sluggish in its movements.

I have been unable to find any description corresponding to this species, which is clearly distinguished from other Doridia by its coloration and markings. Should I be right in supposing it to be new, I propose to call it *Doridium* (*Aglaia*) *Pilsbryi*.

**Aplysia (Tethys) nigrocincta** Martens.

I captured three specimens at Apia July 19, which seem referable to this species, though it is not very fully described, and recorded from Mauritius.

The animals are about an inch and a half long, but are apt to contract themselves into a ball, in which condition they become much smaller. The color is light brown, with multitudes of minute white spots, some of which are arranged in clusters so that they appear like one large gray spot. The edges of the foot, mantle opening, rhinophores, tentacles and siphon are marked with a fine but very distinct black border. The epipodia are ample but thin, united behind the large siphon, but widely separate in front. The mantle opening is very large and displays the shell, which is large, convex and white, not yellow, as stated in the descriptions of *Aplysia nigrocincta*.

The whole animal reminds one of *Aplysia parva*, which I have seen alive at Key West.

**Aplysia (Tethys) Benedicti**, n. sp. Pl. XIX, figs. 2*a*, 2*b*.

From July 19 to 21, I caught several examples of a species of *Aplysia*, which was abundant in Apia harbor during this period, on shallow sandy spots, and then vanished as suddenly as it had appeared.

The animals were singularly beautiful and very active, creeping and swimming rapidly, the latter movement somewhat resembling the flight of an insect. The body is plump and prolonged backward into a short tail, the tentacles and rhinophores large and leaflike. The epipodia are ample and winglike. They arise from each side of the neck at a moderate distance from the rhinophores with a clear space between them, but are united posteriorly. The ground color is bright pale green, with a border of lilac or pale blue around the edge of the epipodia. The outside of the epipodia, the head, neck, sides of the foot and upper surface of the mantle are marked with black reticulations, to which are added black eye-like spots on the three regions first-mentioned. The inside of the epipodia is marked with large irregular blotches of vivid black, which, in some specimens, almost form a network pattern. The lower surface of the mantle is black, and there is a distinct black spot at the end of the tail on the upper surface. The skin is smooth; there are no warts or filaments, but the edges of the epipodia are wrinkled. The spermatic groove, proceeding from the right oral tentacle, is very distinct. The mantle communicates with the shell cavity through a small tube. The shell is of a fair size, but very thin, and almost entirely membranous, with only a slight calcareous deposit. There is a large greenish ctenidium, which is not entirely covered by the mantle and shell. In front of it is the genital orifice. The opening of the opaline gland is single. The anal siphon is large. The sides of the stomach are set with 12–16 closely packed, brownish, horny plates. The jaws are long and leathery, and each divided lengthways into two halves, one blackish brown, the other white. The radula is composed of numerous teeth, the rows and the individual teeth being both very close together. The central tooth (fig. 2*b*, right side) consists of a basal plate with three cusps, of which the median is the largest; the lateral teeth (fig. 2*b*, left side) of a basal plate with a simple long inner cusp and shorter outer cusp, without accessory denticles along the margin. This form is retained even in the marginal teeth, the two outermost only becoming vestigial. The length of the specimen figured (in alcohol) is 75 mm.

This species corresponds in many ways with Pease's description of his *Siphonota viridescens*, but is much smaller and not at all like his figure, particularly in the shape of the head. The coloration

also seems to be different. *Aplysia pulmonica* var. *Tryoniana* Pilsbry appears to be closely allied, and is recorded from Upolu, but has a starlike pore in the mantle, a much more solid shell, and no ocelli, and, to judge from the figure, differs in its general shape. Another species with points of resemblance is *Aplysia dactylomela*, from Bermuda and the Cape Verde Islands, of which I have examined a specimen. But it differs in having ocelli with a yellow centre, a longer interval between the epipodia and rhinophores, the epipodia not united posteriorly, the tail not black and another form of teeth. The central tooth is unicuspid and the laterals also have only an inner and not an outer cusp.

My specimens, therefore, appear to me not to coincide with any described species of *Aplysia*, and, if this proves correct, I would propose to call them *Aplysia Benedicti*.

**Dolabella Hasseltii** Ferussac. Pl. XIX, fig. 3.

There is found in abundance at Apia, a species of *Dolabella*, which is eaten by the natives, and which seems to be identical with *Dolabella Hasseltii*, and particularly with the variety described and figured by Quoy and Gaimard (*Voy. de l'Astrolabe*, Vol. II, p. 306), though, if so, the coloring of their plate is not good.

The animal, which is heavy and sluggish in its movements, is generally found among seaweed growing on sand. When annoyed it excretes a copious purple fluid. The body is about six inches long and much broader behind than in front. The posterior disk is very large and distinctly marked off. It is fringed with ragged processes. The epipodial lobes are concrescent in front, the line of junction forming a spermatic groove, and touch one another, though they are not concrescent, in the region above the mantle, where they form a dorsal slit with two wider openings, one anterior above the ctenidium and one posterior above the excurrent siphon. Color olive-green with dark brown and sandy patches admirably imitating a mass of old seaweed. Though the animal is a conspicuous object if put in a basin, it is, thanks to its protective coloration, almost invisible in its native haunts. The foot is dark orange. The cavity surrounding the shell and mantle is large. The mantle greenish and only partly covering the shell and the large pale flesh-colored ctenidium. The shell is large and strong, hatchet-shaped, the edge of the blade membranous, but the spire

heavily callous, and in its natural position on the back of the animal lower than the membranous portion. The part exposed is greenish brown, the part covered by the mantle white. The oral tentacles are auriform and directed forward, the rhinophores stout and canaliculate. Length of the figured specimen (in alcohol) 11 cm.

The walls of the stomach are set with about ten large horny plates. The genital opening is beneath the gill, about the middle, not at the posterior extremity. The purple gland is very large.

The jaws are subtriangular, horny and brownish. The radula consists of numerous close-set teeth, but the rows are somewhat wide apart. Each tooth consists of a narrow basal plate with one long thin cusp. No central tooth or central space is distinguishable.

I am inclined to think that *D. Hasseltii* Fér., *D. variegata* Pease and *D. Teremidi* Rang are all one species. The last named differs chiefly in having the mantle sky-blue, but in animals with protective coloration environment might produce such variations.

**Dolabrifera** Gray.

*D. Tahitensis* Pse. is common on all the islands under stones at low-water mark. I obtained it at Apia, Manono and Tutuila. Pease's description and plate (*Amer. Jour. of Conchology*, 1868, p. 77, Plate VIII, fig. 5) are quite accurate. In many specimens the bright blue eyes are very large and conspicuous, but there was some variety in this respect, as also in color. Perhaps the distinction between *D. Tahitensis* and *D. olivacea* is not very marked, and the two species may be connected by intermediate forms. I also obtained one specimen of *D. fusca* at Apia, but have nothing to add to Pease's description.

**Notarchus Indicus** Cuvier.

Three specimens obtained at Apia in June seem referable to this species, though smaller than the recorded size. The animal is capable of assuming two forms of exceedingly different aspect, one globular, and one sluglike and elongated. It is active in its movements and in captivity seemed to prefer swimming to creeping. As it moves, water is taken in through the dorsal opening between the epipodia in the anterior part of the body, and expelled from it rhythmically. The integument is transparent and allows the intestines to be seen distinctly.

**Pleurobranchus delicatus** Pse.

Three specimens from Safotu, Savaii, in July. The animal agrees with Pease's description (*Amer. Jour. of Conchology*, 1868, p. 79), but is not very like his plate, being smaller and of a much brighter orange except on the back, where the black viscera can be seen through the skin. Branchia and orifices very prominent.

**Platydoris** Bergh.

Two species of this genus (*scabra* and *arrogans*) are common under stones on Apia reef. They both grow to a length of about three inches, and are characterized by their flattened form, wide mantle, with irregularly indented edges, and a peculiar hard and leathery texture, which distinguishes them at once from all other Dorids which I have seen. They are sluggish in their movements and do not appear to be protected by their coloration. *P. scabra* (= *Doris scabra* Q. and G.) grows to be about three inches long. The outline is an irregular oval, the edge of the ample mantle being wavy. The color is white, with irregular blotches of brown produced by aggregations of small spots. The branchial rosette is yellowish, sixfold and very voluminous and delicate. Edge of foot brown, but sole and under surface of mantle white. Labial tentacles small, white and tapering. The branchial aperture is clearly defined and starlike. *Platydoris arrogans* Bgh. (= *Doris cruenta* Q. and G.) has the same external characters as *Pl. scabra*, but the markings are formed, not by minute spots, but by fine lines. In addition to them there are on the back four or five splashes of vivid red, looking like red ink, which disappear in alcohol.

**Discodoris fragilis** (A. and H.), Bergh.

*Doris fragilis* Alder and Hancock, Trans. Zool. Soc., Vol. 5, 1864, pp. 117, 38. From east coast of India.

This animal is common on Apia reef. In life it is brownish green, mottled with darker shades of the same color, the foot and under surface of the mantle being similarly marked. The rhinophores and branchial rosette are brownish and the labial tentacles white and pointed. The whole body is flat and oval, and the length from two to three and a half inches.

The creature is remarkable for its extraordinary powers of self-mutilation. When handled, it throws off part or the whole of

the mantle edge, in some cases leaving behind it a complete ring of mantle more than a quarter of an inch wide, while the central part crawls away, apparently none the worse for the loss. The animal can hardly be described as "brittle," for it is gelatinous to the touch and secretes an abundant mucus. The process of amputation is not rapid, and would not protect the *Discodoris* against a fish or any quick-moving animal, but might perhaps enable it to escape the attacks of a carnivorous mollusk. I did not succeed in discovering what its enemy may be.

**Chromodoris scurra** Bergh.

This brilliantly colored species is common on the coasts of all the Samoan islands, and, though rarely an inch long, is conspicuous owing to its ornamentation, which must be warning. The back is striped with lines of white, violet and bright orange. The large rhinophores and the branchial rosette are violet at the tips and orange in the lower parts. Bergh's Plate XXXIII (in Semper's *Reisen*, II, 2) hardly does justice to the vivid coloration of the living animal.

**Chromodoris inornata** Pse.

Common on Apia reef. I do not know why Pease distinguished this beautiful animal by so inappropriate an epithet as "unadorned." The back and foot are white, subpellucid and spotted with purple. The mantle, but not the foot, which projects considerably behind, is bordered with a line of bright orange. The sevenfold branchial star is grayish yellow, and the upper part of the large rhinophores bright orange. The labial tentacles, which are of moderate size, are faintly tinged with the same color. The foot is long and narrow, and the length of the whole animal rather more than an inch.

**Chromodoris** sp.

Very dark green, edge of mantle bluish, shape very variable. Mantle edge indented or not at will of animal. Rhinophores dark green, tipped with white. Branchial rosette dark green, rather large. Labial tentacles very small. Foot light gray. Viscera visible from under surface. Tail much longer than mantle. One specimen at Manono.

**Trippa areolata** (A. and H.) Bergh.

This animal affords an extraordinary example of mimicry. It so exactly resembles a shell or old stone overgrown with green and blue seaweeds and with sponge that it is absolutely invisible when crawling on such objects. When the specimen which I caught was placed in a basin with shells it took up a position on an old Strombus, and could not be distinguished from the growths and accretions by which it was surrounded.

The body is deeply indented with cavities like those made by worms in stones. The rhinophores and branchial rosette are grayish brown, and in spite of their size, inconspicuous.

This animal is described by Alder and Hancock (*Trans. Zool. Soc.*, Vol. V, 1864) as *Doris areolata*, and recorded from the east coast of India. Bergh refers it, with a query, to his genus *Trippa*. The dentition shows that it undoubtedly belongs to this genus. There are no jaws, but the radula resembles that of *T. ornata* Bgh. There is no central tooth, but about forty laterals on each side. The innermost teeth are very small, but increase in size up to the fifteenth, after which they become equal, except the two or three outermost, which are reduced. The transverse rows are nearly straight at the sides, but bend downward in the middle.

**Doris setosa** Pse.

Bergh, in Semper's *Reisen*, II, 2, supplement Plate G, gives a figure of *Doris setosa* from Pease. *Proc. Zool. Soc.*, XVIII, 1860, p. 26, which he seems unable to assign to any of his genera. Last July I captured at Mulifanua, Upolu, three specimens of an animal which, except in color, appears to agree with Pease's plate. The largest specimens were an inch long. The upper surface, branchial rosette and rhinophores were brownish yellow with darker brown spots. The under surface of foot and mantle whitish. The branchial star was ten plumed and protected by two lateral lobes; the anal tube prominent. The whole dorsal surface covered with villous projections, which contain spicules, and can be scraped off, leaving a smooth surface. The radula consists of five rows of simple hamate teeth. There is no central tooth and the formula is 19 (or 18) 0. 19 (or 18). Jaws are absent.

**Doridopsis herpetica** Bergh.

*Doris compta* Pse.

Beautiful pearl gray, with spots of same color, but darker. Rhinophores and sixfold branchial rosette with faint yellowish tinge. Foot and under surface of mantle pearl gray with small spots. Labial tentacles small, whitish. Body slightly transparent, showing reddish intestines. Pharynx long, cylindrical; no jaws; no radula.

Pease's plate (*Doris compta, Amer. Jour. of Conch.*, 1871–72, Pl. 4, fig. 1) is fairly like the living animal, but he is mistaken in supposing that the mantle edge is permanently and regularly indented. The animal is sluggish in its movements, but constantly alters its shape; it is sometimes elongated and sometimes oval, and can wrinkle and undulate the edge of the mantle at will.

**Trevelyana citrina** Bergh.

One specimen obtained at Apia in July. It corresponds accurately in color and other external characters with Bergh's description and plate in Semper's *Reisen*[1] (II, 2, Pl. XLI).

With regard to this and all other tropical *Polyceridæ* which I have seen, I would observe that the expression non-retractile, applied to the rhinophores and branchiæ, is only comparatively true. In *Doridida* the branchiæ, when touched, disappear entirely, reëmerge slowly, and are, as a rule, invisible in alcoholic specimens. In the *Polyceridæ* they generally remain outside in alcoholic specimens, but when touched in the living animal, retract themselves into a pocket, though perhaps less thoroughly, and for a shorter time than in *Doridida*. But to say that a genus or family is characterized by non-retractile branchiæ may lead an observer into error.

**Cyerce nigra** Bergh.

This beautiful animal appears to be common, as I captured numerous specimens at Apia and Manono. It crawls rapidly, but I have not seen it swim. When it is walking its many cerata are agitated with a motion similar to that of a field of corn under the wind.

[1] By an oversight corrected in another part of Bergh's work the animal figured in the plate is called *Nembrotha*.

**Placobranchus gracilis** Pease.

One specimen. Apia reef. June, under a stone. Buff-colored, with green eye-like spots, surrounded with bright black rims. Epipodia reflected over the back and striped internally with longitudinal bright green ridges. Edges of epipodia and frontal veil and tentacles violet colored. On a prominence between the tentacles are two distinct black eyes.

**Bornella** Gray.

I obtained two species of this genus at Apia. The first is *B. arborescens*, described by Pease in the *Amer. Jour. of Conch.*, 1870–71, p. 302). I have nothing to add to his account except that the red coloring is rather brighter than in his figure. The second I somewhat doubtfully identify with *B. Hancockana* (Kelaart, in *Annals and Magazine of Nat. History*, 1859, Vol. IV). In life the body was subpellucid, and the back mottled with yellow. Over the mouth are two stellate processes with about ten rays each. The rhinophores are greenish and retractile into four-fingered sheaths. There are five pairs of cerata, four containing hepatic diverticula, and all bearing branchiæ. The three anterior cerata are trifid, the two posterior bifid. There are two black eyes under the skin just in front of the rhinophores. The animal is very active and crawls and swims rapidly.

**Elysia nigropunctata** Pse.

A single specimen captured at Apia seems midway between the species called by Pease *Pterogastron* (= *Elysia*) *marginatus* and *Pterogastron nigropunctatus*. The body was greenish, with black and white spots, as in his figure of the latter (*Amer. Jour. of Conch.*, 1870–71, p. 304), but the lateral lobes are edged with a single line of orange, somewhat less conspicuous than in his figure of the former. On the whole, I think the animal should be called *Elysia nigropunctata*.

**Elysia Hendersoni** n. sp. Pl. XIX, fig. 4.

In July I found twelve specimens of an *Elysia* on green seaweed at Manono, which do not appear to me to be referable to any species of which I have seen the description. The outer surface of the animal is greenish, with yellowish markings, and resembles a piece of seaweed sprinkled with sand. The interior of the

epipodia is bright green and striated with numerous fine veins. The epipodia are indented at their edges, and united behind in a very ample dorsal expansion. On the back, a little behind the two tentacles, is an elongated, bladder-like projection, containing the heart, which pulsates regularly and rapidly. From this arise three main trunk veins, each of which is numerously subdivided. This arrangement seems to distinguish the animal from *Elysia viridis*, and the coloration is unlike that of the other species described. If it proves to be a distinct species, I would propose to call it *Elysia Hendersoni*. Length, in alcohol, 17 mm.

**Onchidium Tonganum** Quoy and Gaimard.

*Peronia tongana.*

This curious animal is very common on the Apia reef at low-water mark. It is oval in shape, and attains a length of nearly three inches. The mantle is of a dirty olive green, thick and covered with processes and warts, on some of which are eyes. The tentacles are short, but the labial palps enormous.

Though an ungainly looking creature, *Onchidium* displays greater activity and intelligence in its movements than any mollusk except Cephalopods which I have seen. It may almost be said to run, and if placed in a vessel at the bottom of a boat will make a determined effort to climb over the sides and reach the sea. As it moves, the large posterior pulmonary orifice opens widely and contracts. It must be capable of living under water, as it frequents reefs which are submerged except at low tide, but in captivity, when placed in sea water, it invariably came out and wandered on the balcony, but specimens placed under a heap of wet seaweed remained quiet. It has been stated that *Onchidium* has dorsal eyes only in those regions where *Periophthalmus* is found, and that they assist it to escape the attacks of the fish. I cannot support this statement from my own observation, for, though *Periophthalmus* is common in Samoa, it frequents mud flats and mangrove swamps, and I have never seen it on the edges of coral reefs which are the habitat of *Onchidium*.

It will be noticed that the majority of the Nudibranchs described belong to the *Doridid*æ or *Elysioidea*, and that the *Æolid*æ and allied families are entirely absent. As Pease, who collected chiefly in the Society and Hawaiian islands, also describes no Æolids, it looks as if the group was not numerous in the central

Pacific, though on the shores of California it is very abundant. Many of the less-known species which I found have evidently a wide distribution. Thus *Trippa areolata* had previously been reported from the coast of Madras, *Dolabella Hasseltii* from Java and Mauritius, and *Aplysia nigrocincta* from the latter locality. Though the coast of Samoa is exceedingly rich in marine life, I observe that many species are smaller than those described from other places.

*Cyerce nigra*, *Aplysia Benedicti* and *Elysia Hendersoni* were found in small flocks or families of from ten to fifteen individuals; *Dolabella* and the *Doridid*æ mostly in pairs.

## EXPLANATION OF PLATE XIX.

1*a*. *Doridium Pilsbryi*, n. sp., dorsal aspect.

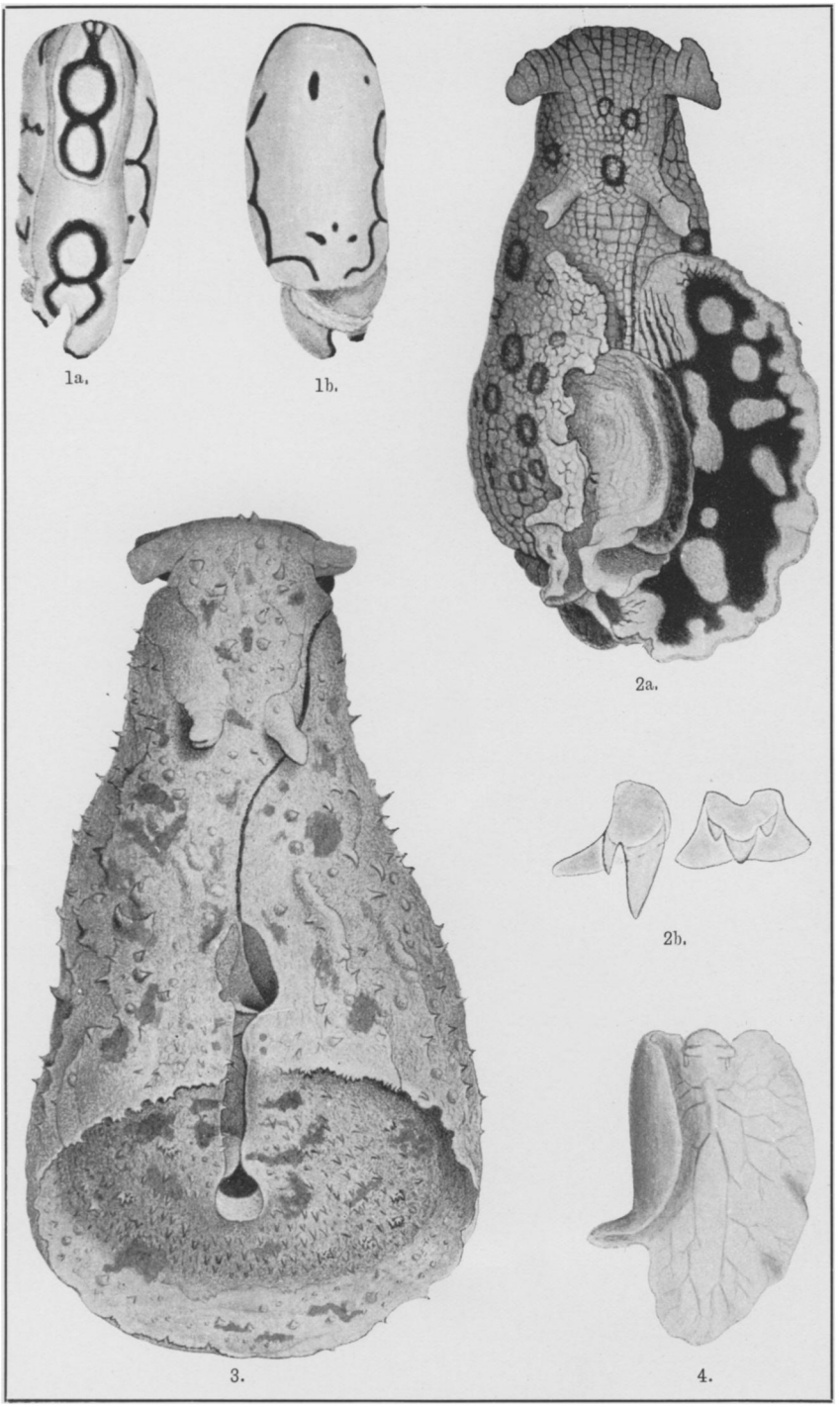
1*b*. *Doridium Pilsbryi*, n. sp., ventral aspect.

2*a*. *Aplysia Benedicti*, n. sp.

2*b*. *Aplysia Benedicti*, n. sp., central and lateral teeth.

3. *Dolabella Hasselti* Fér.

4. *Elysia Hendersoni*, n. sp.




ELIOT. MOLLUSKS OF SAMOA.