

A monograph of the British nudibranchiate mollusca / By Joshua Alder and Albany Hancock ... with a supplement by Sir Charles Eliot.

Contributors

Alder, Joshua, 1792-1867.

Hancock, Albany, 1806-1873.

Eliot, Charles, 1862-1931.

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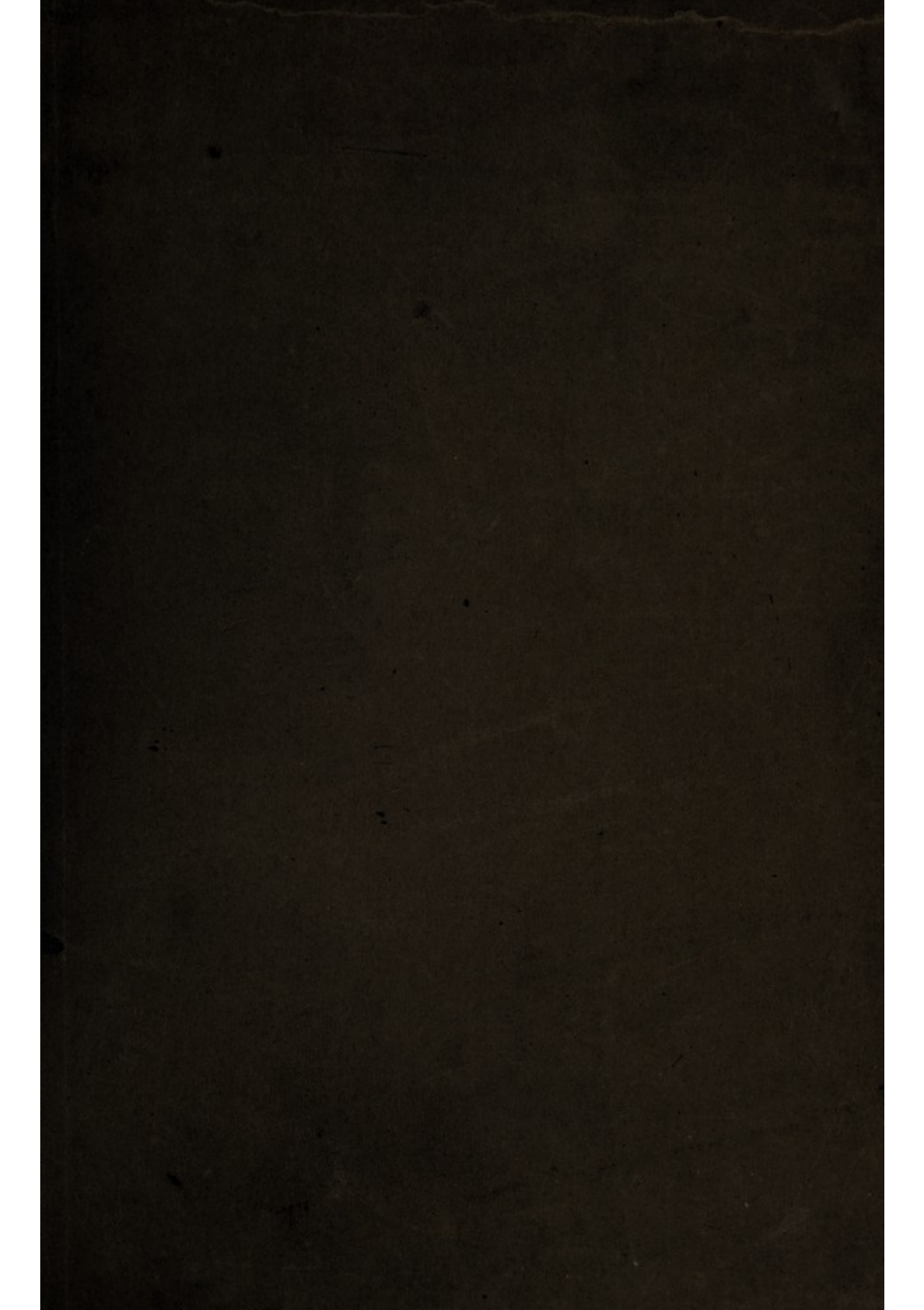
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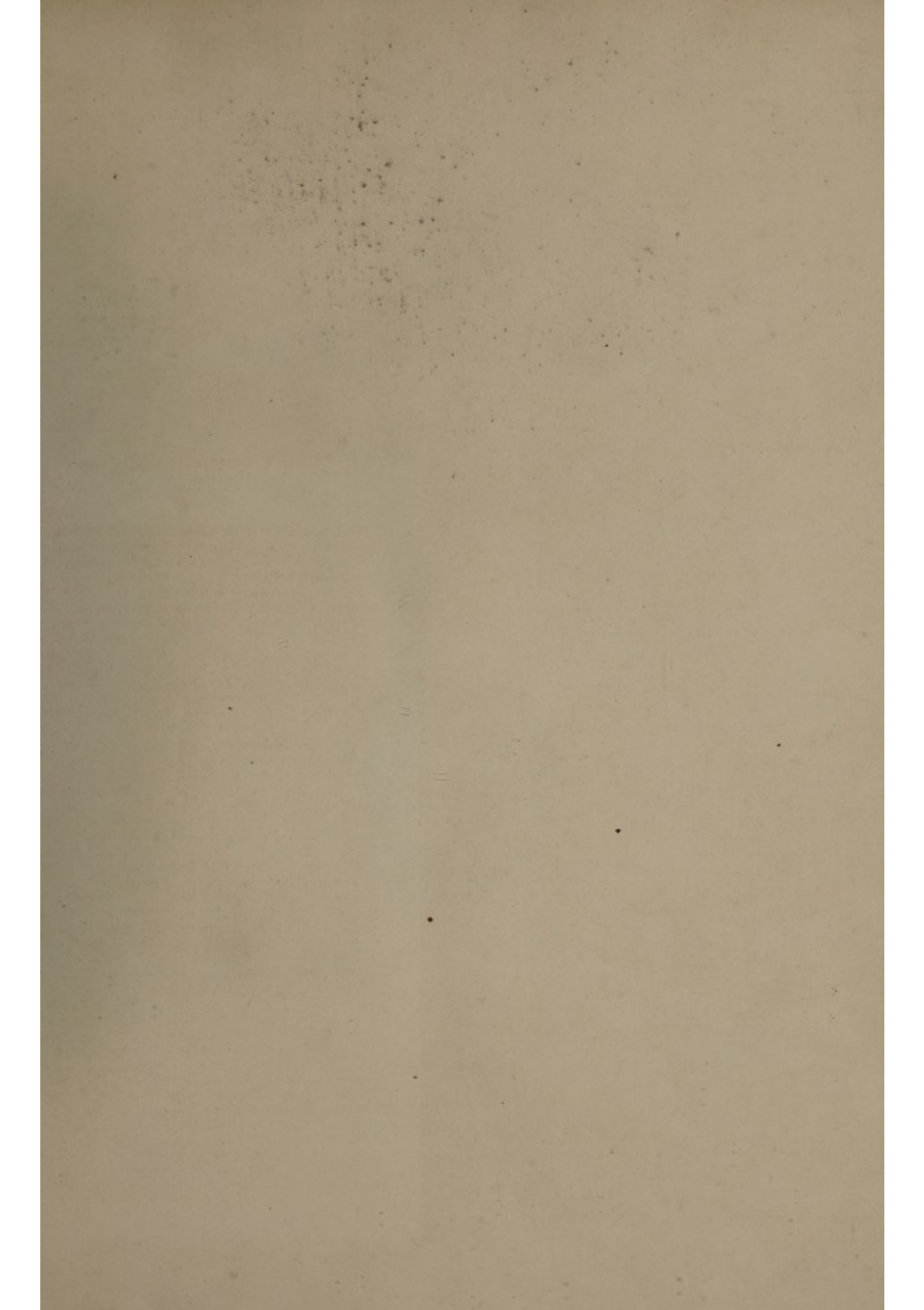
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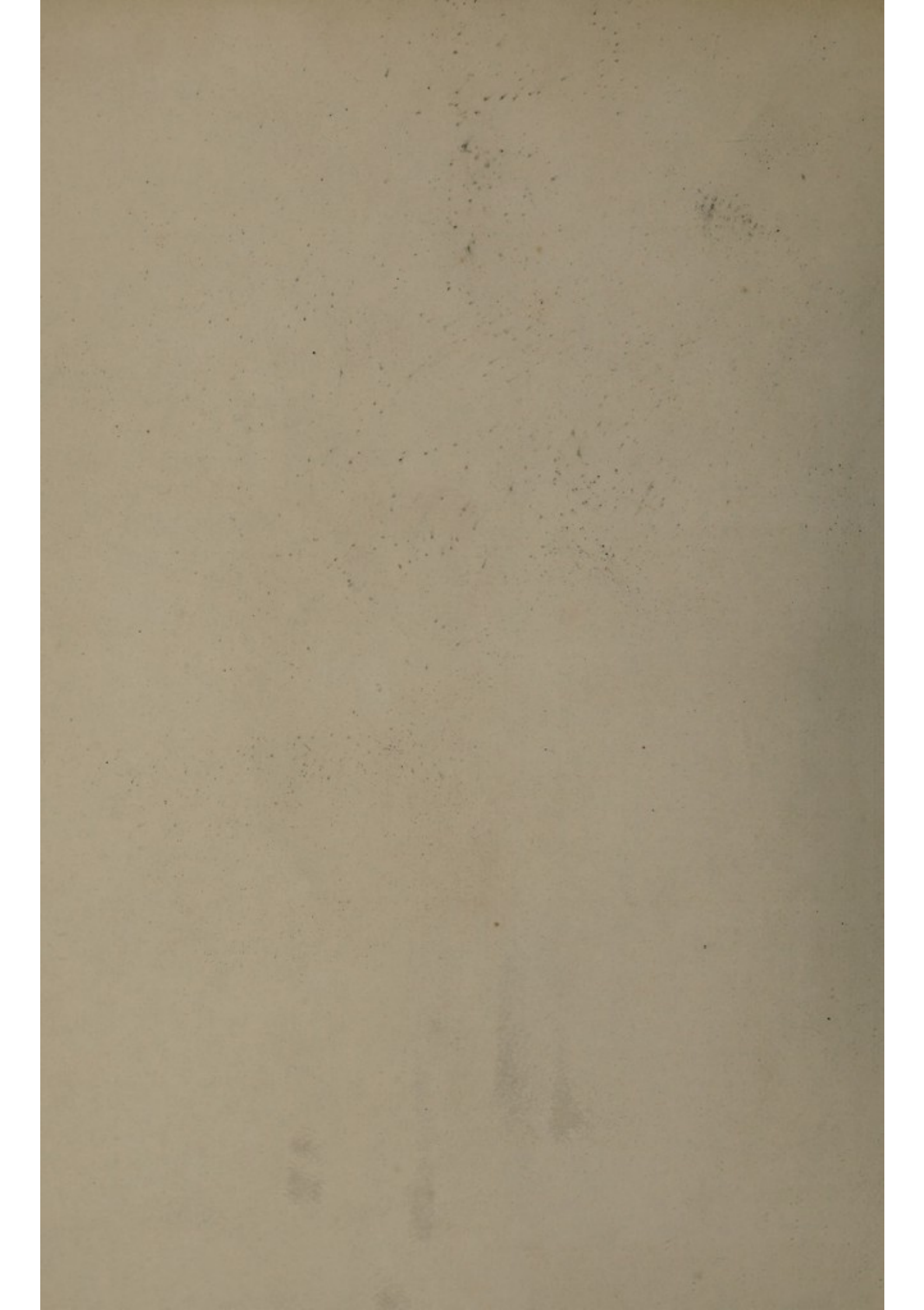


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1870

A
M O N O G R A P H
OF THE
BRITISH NUDIBRANCHIATE MOLLUSCA:

WITH
Figures of all the Species.

BY
JOSHUA ALDER AND ALBANY HANCOCK.

LONDON:
PRINTED FOR THE RAY SOCIETY.

MDCCCXLV.



PRINTED BY C. AND J. ADLARD, BARTHOLOMEW CLOSE.

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It is intended in the present work to give, as far as possible, a complete history of the British species of Mollusca included in the order *Nudibranchiata* of Cuvier, together with careful and detailed drawings of each. The latter are the more necessary on account of the perishable nature of these animals and the impossibility of preserving them with their proper forms and colours in museums.

From the difficulties attending their study on this account, many authors, in treating of the Mollusca, have entirely omitted the *Nudibranchiata*, and have confined themselves to a description of the testaceous Mollusca alone, thus leaving a gap in the chain of affinities inconsistent with a proper knowledge of this sub-kingdom of nature as a whole.

The authors of the present work confidently hope that they will be able, as far as the British species are concerned, to supply this deficiency, and to give such full delineations and descriptions of most of the species as may prevent any difficulty in their recognition by future observers. By the kind assistance of their friends, added to their own researches, they have been enabled to accumulate a large store of materials, but there are still several species described by other naturalists which they have not met with. As the Society to whom they are indebted for the publication of this Monograph have determined to bring it out in Parts, extending over a period of four or five years, the authors hope yet to obtain many of these species before its completion.

For the purpose, therefore, of affording an opportunity of adding drawings and descriptions of these from the living animals, it has been thought advisable to publish the species promiscuously, adopting such a plan as will allow of their being arranged systematically on the completion of the volume.

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As the philosophical study of these animals is yet in a state of progression, and has lately received much attention from physiologists, the authors have also determined to defer their general views on the Order till near the completion of the work, so that they may be brought up to the knowledge then attained.

In the meantime they have given a Synopsis of the genera into which the British species may be divided, with a list of the species at present known. This will allow the reader at once to refer each species, as it appears, to its proper place, and to understand the characters of those genera, the detailed account of which may not appear until a subsequent part of the work. This synopsis will afterwards be superseded by a more complete systematic arrangement.

The authors have pleasure in stating that, in making out the anatomical details, they have had the able assistance of their friend Dr. DENIS EMBLETON, Lecturer on Anatomy in the Newcastle School of Medicine. The plates are accurate transcripts of their original drawings. They have been executed by Mrs. HOLMES, an accomplished artist in Lithotint, an invention of Mr. HULLMANDEL, admirably adapted for portraying the delicacy and beauty of these fragile inhabitants of the sea.

NEWCASTLE; *June* 1845.

BRITISH NUDIBRANCHIATE MOLLUSCA.

SYNOPSIS.

Sub-Kingdom. *Mollusca*.

Class. *Gasteropoda*.

Order. NUDIBRANCHIATA.

Fam. 1, DORIDIDÆ. Branchial plumes surrounding the vent on the medio-dorsal line.

Sub-Family, *Doridinæ*. With a cloak.

Gen. 1. *Doris*, Linnæus. Tentacles clavate or conical, retractile within cavities, sometimes slightly sheathed: cloak large, covering the head and foot; without appendages.

*Body depressed: plumes retractile within a single cavity.

- D. tuberculata*, Cuv.
- D. flammea*, A. & H.
- D. Johnstoni*, A. & H. (*D. obvelata*, Johns.)
- D. coccinea*, For.
- D. repanda*, A. & H.
- D. mera*, A. & H.

**Body depressed: plumes retractile within separate cavities.

- D. Ulidiana*, Thomp.
- D. muricata*, Mull.
- D. aspera*, A. & H.
- D. bilamellata*, Linn.
- D. affinis*, Thomp.
- D. depressa*, A. & H.

***Body convex: plumes non-retractile.

- D. pilosa*, Mull.
- D. similis*, A. & H.
- D. lævis*, Mull.
- D. sublævis*, Thomp.

Gen. 2. *Goniodoris*, Forbes. Tentacles clavate, non-retractile, without sheaths: cloak small, exposing the head and foot: without appendages.

G. nodosa, Mont.

- vars. *G. Barvicensis*, Johns.
- G. marginata*, Mont.
- G. emarginata*, For.
- G. elongata*, Thomp.

SYNOPSIS.

Gen. 3. *Triopa*, Johnston. Tentacles clavate, retractile within sheaths: cloak margined with filaments.

T. clavigera, Mull.

var. *T. plumosa*, Thomp.

Sub-Family, *Polycerinae*. Without distinct cloak.

Gen. 4. *Ægires*, Loven. Tentacles linear, retractile within sheaths: body covered with very large tubercles.

Æ. Maura, For.

Æ. punctilucens, D'Orb.

Gen. 5. *Thecacera*, Fleming. Tentacles clavate, with sheaths: head bilobed: branchiæ with two or more lateral appendages.

T. pennigera, Mont.

Gen. 6. *Polycera*, Cuvier. Tentacles clavate, non-retractile: without sheaths: a veil over the head bordered with tubercles or tentacular points: branchiæ with two or more lateral appendages.

P. quadrilineata, Mull.

var. *D. flava*, Mont.

P. typica, Thomp.

P. ocellata, A. & H.

var. *Triopa Nothus*, Johns.?

P. Lessonii, D'Orb. (*P. citrina*, Ald.)

Gen. 7. *Idalia*, Leuckart. Tentacles clavate or linear, with filaments at their base: head slightly lobed at the sides: back with numerous branchial appendages.

I. elegans, Leuck.

I. aspersa, A. & H.

I. quadricornis, Mont.

I. cristata, Ald.

Fam. 2. *TRITONIADÆ*. Branchiæ laminated, plumose, or papillose, arranged down the sides of the back: stomach simple.

Gen. 8. *Tritonia*, Cuvier. Tentacles 2, with branched filaments, retractile within sheaths: veil tuberculated or digitated: branchiæ plumose, arranged in a single series on a ridge down each side of the back.

T. Hombergii, Cuv.

T. plebeia, Johns.

var. *T. pulchra*, Johns.

Fam. 3. *EOLIDIDÆ*. Branchiæ papillose or branched, arranged on the sides of the back: stomach branched.

Sub-Family, *Melibæinae*. Tentacles 2, with sheaths.

Gen. 9. *Dendronotus*, Ald. & Hanc. Tentacles clavate, laminated, retractile within sheaths: front of the head with branched appendages: branchiæ branched, arranged in a single series down each side of the back.

D. arborescens, Mull.

var. *Tr. lactea*, Thomp.

Tr. pulchella, A. & H.

D. felina, A. & H.?

SYNOPSIS.

Gen. 10. *Doto*, Oken. Tentacles linear, retractile within sheaths: veil small, simple: branchiæ ovate-muricate, arranged in a single series down each side of the back.

D. fragilis, For. (*Melibæa pinnitifida*, Johns.)

D. coronatus, Gm.

var. *M. ornata*, A. & H.

D. pinnitifidus, Mont.

D. maculatus, Mont.

Sub-Family, *Eolidinæ*. Tentacles without sheaths, linear, 2, 4, or none.

Gen. 11. *Eolis*, Cuvier. Tentacles 4: branchiæ papillose, arranged in rows on the sides of the back: anus lateral.

*Branchial papillæ numerous, depressed, and imbricated.

E. papillosa, Linn.

E. Zetlandica, For.

E. rosea, A. & H.

E. obtusalis, A. & H.

E. stipata, A. & H.

**Branchial papillæ clustered. (*Flabellina*, Cuv.)

E. coronata, For.

E. Drummondi, Thomp.

E. curta, A. & H.

E. pedata, Mont.

E. Cuvieri, Johns.

E. rufibranchialis, Johns.

E. pellucida, A. & H.

E. gracilis, A. & H.

E. alba, A. & H.

***Branchial papillæ in transverse, rather distant, rows. (*Cavolina*, Brug.)

E. angulata, A. & H.

E. nana, A. & H.

E. concinna, A. & H.

E. aurantiaca, A. & H.

E. olivacea, A. & H.

E. cingulata, A. & H. (*Hystrix*, A. & H.)

E. vittata, A. & H.

E. Northumbrica, A. & H.

E. viridis, For.

E. longicornis, Mont.

E. arenicola, For.

E. purpurescens, Flem.

E. cœrulea, Mont.

E. foliata, For.

E. pallida, A. & H.

E. tricolor, For.

E. Farrani, A. & H.

****Branchial papillæ in a single row on each side. (*Tegipes*, Cuv.)

E. despecta, Johns.

E. plumosa, Flem.

SYNOPSIS.

Gen. 12. *Pterochilus*, Ald. & Hanc. Tentacles 2, simple; head with lateral lobes: branchiae papillose, arranged down the sides of the back: anus lateral.

P. pulcher, A. & H.

P. minimus, For.

Gen. 13. *Hermæa*, Loven. Tentacles 2, longitudinally folded: head without lobes: branchiae papillose, arranged down the sides of the back: anus dorsal or sublateral.

H. bifida, Mont.

H. dendritica, A. & H.

Gen. 14. *Alderia*, Allman, M. S. Without tentacles: head lobed at the sides: branchiae papillose, arranged down the sides of the back: anus dorsal.

A. modesta, Loven.

Gen. 15. *Proctonotus*, Ald. & Hanc. Tentacles 4: a veil over the head: branchiae papillose, arranged on a ridge down the sides of the back and round the head in front: anus dorsal.

P. mucroniferus, A. & H.



Fam. 1, Plate 4.

DORIS FLAMMEA, ALDER and HANCOCK.

D. coccinea, aliquando purpureo-maculata: pallio tuberculis inequalibus, parvisculis: branchiis 9, tripinnatis, coccineis, non effusis, intra foramen retractilibus.

Doris flammea, Ald. and Hanc. in Ann. Nat. Hist. v. 14, p. 330.

Hab. Dredged up on *Pecten opercularis* in shallow water, Rothesay Bay.

Body about an inch long, and one half as broad, ovate, rounded at both ends, rather depressed, of a bright orange scarlet, occasionally blotched with purple. Cloak rather ample, covered with smallish, unequal, rounded, spiculose tubercles, becoming smaller towards the margin. Under side of the cloak minutely freckled with opake yellow. *Dorsal tentacles* rather large, tapering, orange, with ten or eleven scarlet laminae and intermediate smaller ones. The orifices strongly tuberculated at the edges. *Branchiae* not much spreading, but turned gracefully over, rather paler than the body, composed of nine scarlet plumes imperfectly three times pinnate, the posterior ones bilobed; retractile within a single cavity. *Head* small, with the sides produced into very short, obtuse, angular tentacles. *Foot* deep scarlet, rather darker than the body, rounded and slit transversely in front, rarely extending beyond the body behind; the sides nearly parallel.

This animal lived with us several days. It did not possess much activity. When at rest the cloak was occasionally much spread, giving it a rounded contour.

Of two specimens obtained, one was of a uniform scarlet; the other had a few blotches of purple, with an edging of that colour round the branchial plumes.

Doris flammea is very nearly allied to *D. tuberculata*; but, besides the difference in colour, the tubercles and branchiae are smaller, and the dorsal tentacles larger and more numerously laminated.

Fig. 1, 2, 3. *Doris flammea*, different views.

- | | |
|--------------------------|--------------------------|
| 4. Portion of the cloak, | } more highly magnified. |
| 5, 6. Dorsal tentacles, | |
| 7. A branchial plume, | |

THEORY OF THE EARTH AND ITS HISTORY

It is a well-known fact that the earth is a sphere, and that it is covered by a layer of water. The water is not a uniform layer, but it is divided into oceans, seas, and lakes. The oceans are the largest bodies of water, and they cover most of the earth's surface. The seas are smaller bodies of water, and they are usually found near the coasts of continents. The lakes are the smallest bodies of water, and they are usually found in the interior of continents.

The earth is also covered by a layer of land. The land is not a uniform layer, but it is divided into continents, islands, and peninsulas. The continents are the largest landmasses, and they cover most of the earth's surface. The islands are smaller landmasses, and they are usually found in the oceans. The peninsulas are landmasses that are almost completely surrounded by water. The land is not a uniform layer, but it is divided into mountains, hills, and valleys. The mountains are the highest landmasses, and they are usually found in the interior of continents. The hills are smaller landmasses, and they are usually found near the coasts of continents. The valleys are the lowest landmasses, and they are usually found in the interior of continents.

The earth is also covered by a layer of air. The air is not a uniform layer, but it is divided into the atmosphere, the stratosphere, and the mesosphere. The atmosphere is the layer of air closest to the earth's surface, and it is the layer of air that we breathe. The stratosphere is the layer of air above the atmosphere, and it is the layer of air that contains the ozone layer. The mesosphere is the layer of air above the stratosphere, and it is the layer of air that contains the aurora borealis.

The earth is also covered by a layer of fire. The fire is not a uniform layer, but it is divided into the crust, the mantle, and the core. The crust is the layer of fire closest to the earth's surface, and it is the layer of fire that we walk on. The mantle is the layer of fire above the crust, and it is the layer of fire that contains the magma. The core is the layer of fire above the mantle, and it is the layer of fire that contains the iron.

The earth is also covered by a layer of ice. The ice is not a uniform layer, but it is divided into glaciers, icebergs, and ice sheets. The glaciers are the largest ice masses, and they are usually found in the interior of continents. The icebergs are smaller ice masses, and they are usually found in the oceans. The ice sheets are the smallest ice masses, and they are usually found near the coasts of continents.





Fam. 1, Plate 5.

DORIS JOHNSTONI, ALDER and HANCOCK.

D. flavescens, interdum maculis fuscis: pallio granulis minutis confertis: branchiis 15, tripinnatis, apum formâ calicis cingentibus, intra foramen retractilibus: tentaculis brevibus, crassis, fusco-maculatis.

Doris obvelata, Johns. in Ann. Nat. Hist. vol. 1, p. 52.

Hab. Among rocks near low-water mark. Berwick Bay, Cullercoats, and Newbiggin, Northumberland. Rothesay, Isle of Bute. Skerries, off the Dublin Coast, G. C. Hyndman, Esq. Scarborough, J. S. Bowerbank, Esq. Torbay.

Body an inch and a half or two inches long, ovate when at rest, but capable of great extension, rather convex on the back and depressed towards the sides, generally yellowish white or pale cream-coloured, occasionally of a buffish orange or lemon yellow. *Cloak* ample, closely covered with very minute, equal, linear, and spiculose tubercles, scarcely visible to the naked eye, and giving the cloak a granular appearance. It is blotched with pale brownish patches, and sometimes with a few small dark chocolate-brown or blackish spots, arranged in two or three longitudinal rows. The under side is smooth or very slightly granulated. *Dorsal tentacles* short, broad, and much rounded above, the apex projecting in a small nipple-like point; lamellated with 10 to 15 close-set plates, and covered with numerous dark brown spots; without sheaths, but having the margins of the cavity slightly raised and minutely tuberculated. *Branchial plumes* 15, tripinnate, yellowish white or sometimes pure white, encircling the brown tubular anus, and forming a beautiful blossom-like cup. They are retractile within a single cavity, the margin of which, when the plumes are extended, rises into a distinct rim; the plumes issuing from this, when viewed in profile, have a peculiarly elegant appearance. *Mouth* slightly probosciform, with two long, linear oral tentacles. *Foot* elliptical, yellowish, deeply grooved in front, the upper portion divided into two lobes below the mouth. It projects a little behind the cloak when the animal is in progression.

This species appears to be pretty generally diffused on our coasts, but nowhere common. It may, however, have been sometimes overlooked in consequence of its general resemblance, on a superficial view, to *D. tuberculata*. It was first described by Dr. Johnston from a small specimen found by one of the authors of this work while exploring with him the rocks in Berwick Bay. Dr. Johnston referred it to *D. obvelata* of Muller; but as we cannot agree with our friend in this opinion, we gladly dedicate the species to its talented describer, to whom we attribute the impulse that first led our studies in this direction. Muller describes his *Doris obvelata* to be covered with unequal convex papillæ, and the cloak veined beneath; the branchiæ he calls a confused serrated lobe, and the oral tentacles auriform lobes. Now in this species the tubercles are equal, nearly linear, close, and much smaller than those of

DORIS JOHNSTONI.

D. obvelata, if we may judge from the figure; the under side of the cloak is never veined: one of its chief peculiarities is the beautiful and regular cup formed by the branchial plumes; and the oral tentacles are slender and linear, more so indeed than in any other species with which we are acquainted.

The spawn of *Doris Johnstoni* is smaller and more waved at the margins than that of *D. tuberculata*. It is of the same buff or yellowish colour. The cup formed by it has four coils, and the ova are placed rather irregularly. It is deposited in the months of May and June on the under side of stones near low-water mark.

Fig. 1, 2, 3. *Doris Johnstoni*, different views.

4. Portion of the cloak more highly magnified.
5. A branchial plume.
6. Dorsal tentacle.
7. Spawn.
8. A small portion of the same, showing the ova.





A. H. del.

C. Hollnagel's Parent Lithogr.

IDALIA ASPERSA

Fam. 1, Plate 26.

IDALIA ASPERSA, ALDER and HANCOCK.

I. flavida, fulvo et brunneo aspersa: appendicibus tentacularibus longis, ad basin utrique tentaculi 2, filamentis linearibus utrinque dorsi 4; branchiis 12, parvis, stellatis.

Hab. On a dead shell of *Fusus antiquus* from the fishing boats, Cullercoats.

Body half an inch long, thick, broadly elliptical, rounded in front, and abruptly tapering to a point behind; of a yellowish hue, blotched and spotted above with reddish brown and orange, which dies out towards the margin of the foot. The sides are sprinkled with opake white. *Tentacles* two, placed upon the back a little less than one third of the length of the animal from the anterior end; long, tapering, nearly linear, and much inclined backwards; of a fawn colour, freckled with brown and white. They are delicately laminated behind from the top almost to the base; the front is smooth. At the base of the tentacles, and nearly of the same length and thickness with them, are four linear, tapering, tentacular filaments, one in front and another at the side of each tentacle. These appendages rest upon a slight ridge, which is continued round the front of the tentacles and along the sides of the back past the branchiæ, terminating behind them. Upon this ridge, and about half way from the tentacles, arise on each side four small linear filaments, the posterior ones longest and situated at the sides of the branchiæ. *Branchiæ* consisting of 12 short, stiff, simply pinnate plumes with a broad mid rib, forming a complete circle round the vent, and non-retractile. They are of a pale fawn colour, speckled with a darker shade of the same, and with a large white patch near their apices. Behind these the back slopes rather abruptly down towards the tail. *Head* broad and obtuse, slightly lobed, but not produced, at the sides. The mouth is inferior; the margins of the lips as they pass off to the sides are thickened in a peculiar manner, forming an arch at each side. *Foot* broad, rounded and slightly arched in front, straightish at the sides, and abruptly brought to a sharp point behind. It is nearly colourless, the liver appearing through of a reddish salmon-colour.

A single specimen of this interesting addition to our fauna was obtained at Cullercoats in October, 1844. It did not possess much activity, but, while moving about, its tentacular filaments were kept perpetually in action. They waved with considerable grace, generally from above downwards, and then, just tipping the ground, were flung up again as if to ascertain the approach of danger. These might therefore be considered the true tentacles, did not uniformity of nomenclature oblige us thus to designate the lamellated organs generally considered so by naturalists. We have elsewhere endeavoured to show that the latter perform a different function, yet perhaps not incompatible with their being also employed as organs of touch.

In consequence of the position of the tentacles behind the cerebral ganglions, the eyes in this species appear before the tentacles, and not in their usual position, behind them.

IDALIA ASPERSA.

The little animal spawned while in confinement. The spawn is of a rosy hue, and has the character of that of a *Doris*. It is about twice coiled, and forms a moderately deep, elegant cup, a little more than a quarter of an inch wide. The ova are small, numerous, and much crowded. We have twice before met with the same spawn on corallines from deep water brought in by the fishing boats. At Newbiggin it occurred in June. Our individual spawned in October.

The shape of this *Idalia* varies much at different times. Sometimes it draws itself up into a conical form; at other times it spreads itself out into a flattish disc; but usually the back is much elevated, especially towards the oval area formed by the slight ridge which includes the tentacles in front and the branchiæ behind. Under the microscope cilia were detected on the branchiæ and tentacles, but nowhere else. The skin was observed to contain spicula of a peculiar character. They are rather stout, pointed at the ends, and bent in the centre where there is a circle of largish nodules; there are also a few more imperfect circles of small nodules towards the ends. The spicula are not numerous, and are placed without any apparent order.

The species of *Idalia* approaching most nearly to this are, *I. lacunosa* of Philippi, and *I. (Doris) quadricornis* of Montagu, but both of these have only two tentacular appendages. *I. cirrigera*, Phil. appears to have four, but it differs from this species in many respects.

Fig. 1, 2, 3. *Idalia aspersa*, different views.

4, 5. Front and side of a branchial plume.

6, 7. Back and front view of a dorsal tentacle.

8. Spicula.

9. Spawn.

10. A portion of the same more highly magnified.





A. H. del.

C. Hallmandel's Patent Lithotint.

DENDRONOTUS ARBORESCENS

Fam. 3, Plate 3.

DENDRONOTUS ARBORESCENS, MULLER.

D. rufescens, brunneo marmoratus : velo fasciculis ramosis 4 ornato : branchiis arborescentibus 6-7 utrinque dorsi dispositis.

Doris arborescens, Mull. Zool. Dan. Prod. 229. Fab. Faun. Grœnl. 346. Gmel. v. 1, p. 3107, No. 25.

Doris cervina? Gmel. v. 1, p. 3105. No. 12.

Tritonia arborescens, Cuv. in Ann. du Mus. v. 6, p. 434, pl. 61, f. 8, 9, 10. Lam. An. s. Vert. 2d Ed. v. 7, p. 454. Flem. Brit. Anim. p. 284; Johns. in Ann. Nat. Hist. v. 1, p. 115; Gould. Inv. Massach, p. 5.

Tritonia Reynoldsii, Couthouy in Bost. Journ. Nat. Hist. v. 2, p. 74. Pl. 2, f. 1-4.

Var. a. Hyaline white. (Fide Gould.)

Tritonia lactea, Thomp. in Ann. Nat. Hist. v. 5, p. 88, pl. 2, f. 3.

Var. b. Pink, with opaque yellow tubercles.

Tritonia pulchella, Ald. and Hanc. in Ann. Nat. Hist. v. 9, p. 33.

Hab. In crevices of rocks, under stones, and upon sea-weeds and corallines, between tide marks, and in shallow water; not uncommon in the north. Loch Broom, Ross-shire, and Zetland Islands, Rev. Dr. Fleming. Aberdeen, Professor Macgillivray. Oban Bay, Argyshire, J. A. Frith of Forth, Dr. Grant. Isle of Man, Professor E. Forbes. Lough Strangford, W. Thompson, Esq. Dublin Bay, and Malahide, Ireland. Whitly and Cullercoats, Northumberland. Torbay.

Body nearly two inches long, linear oblong, rather higher than broad, rounded above, and compressed at the sides; variable in colour, but generally of a reddish hue, streaked and marbled with brown, and with small opaque white or yellow tubercular spots. The most usual variety has reddish brown markings on a yellowish ground. It is, however, not unfrequently of a cold sepia colour. The markings are somewhat symmetrically placed on the sides of the head and shoulders, and along each side of the back between the branchial processes, and there are also two narrow interrupted streaks down the centre of the back. *Tentacular sheaths* nearly as long as the branchial tufts, and set rather apart from each other. They are divided for about half their length into four, or sometimes five, branches: these branches are generally subdivided, and there is also a small branch on the outside of the sheath about half way down. *Tentacles* clavate, strongly and broadly laminated on the upper part, with five or six large plates, and intermediate smaller ones, of a pale yellowish brown. They are aptly compared by Fabricius to a panicle of hops. *Veil* very short, with four principal branched appendages and smaller ones between them. Beneath, on the upper surface of the lips, there are a few small simple appendages of a similar character, and on each side of them a slight tentacular prolongation. *Branchiæ* beautifully arborescent; the stem nearly cylindrical, and rising gradually from the back. They are delicately transparent, of the same colour as the body, with dark and opaque yellow or white spots, the latter slightly tubercular. In most individuals the colour of the central vessel is seen through.

DENDRONOTUS ARBORESCENS.

There are six or seven pairs diminishing in size towards the tail, which does not extend far beyond them. In fine old specimens there are also smaller intermediate tufts. The anterior pairs have four or five principal branches, which are divided and subdivided into numerous delicate points. The posterior ones are less branched. *Foot* very narrow, linear, rounded in front, the sides thin, and adapted for clasping. The heart forms a large swelling between the first and second pairs of branchial tufts. It pulsates about seventy-six times in a minute. The eyes are placed on the sides a little below the tentacular sheaths, and are very small.

The young are very pale, and the spots exceedingly delicate: in this state the digestive system is distinctly seen extending nearly the whole length of the body, and giving off branches into the arborescent tufts and tentacles.

When fully developed this is a splendid animal. It is subject to much variation in colour, which has given rise to some spurious species. Occasionally we have met with an individual perfectly white and transparent, showing the coloured viscera within. This we take to be the *Tritonia lactea* of Mr. Thompson. Another beautiful variety, which we formerly described under the name of *Trit. pulchella*, is much smaller, and of a uniform pale rose-pink, with yellow tubercles. The *Trit. felina*, also described by us in the 'Annals of Natural History,' may possibly be another variety, but as there are some little differences of form and consistence, we prefer keeping it apart at present.

These molluscs crawl but slowly on a plain surface, but on corallines they move with graceful facility, their tree-like plumes waving at every turn. Frequently, clasping the coralline with only a small portion of the foot, they will remain suspended by it, moving their bodies about in all directions.

Dr. Grant has given a curious account of sounds emitted by these animals, which he conceives to proceed from the action of the jaws. Though we have frequently kept them alive for several days together, we could never succeed in detecting any sound. It may possibly only be produced under peculiar circumstances.

Dendronotus arborescens appears to have a wide range in the northern seas, extending from Greenland to the shores of the English channel; and it is again met with on the north-east coast of America.

Its spawn is deposited in the spring months, at which period large individuals may usually be found among the rocks between tide marks. The young, however, occur all the year round. The spawn is of a pale yellow or rosy colour, and is about twice coiled; the ova are arranged in a small cord doubling upon itself as in the spawn of *Eolis papillosa*, which this greatly resembles, but is not quite so large.

Fig. 1. *D. arborescens*, usual appearance.

2. Light red variety.

3. White variety, (*Tritonia lactea*, Thomp.)

(The figures in this Plate have been inadvertently reversed.)





A. Edel

C. Hullmandel & Farent Lithofint

EOLIS ALBA.

Fam. 3, Plate 21.

EOLIS ALBA, ALDER and HANCOCK.

E. gracilis, alba ; branchiis oblongis, sub-linearibus, albis, apicibus interdum fusco-cinctis, in fasciculis 5-6 digestis ; tentaculis dorsalibus fuscis, superne in bulbo expansis ; angulis anterioribus pedis valdè dilatis.

Eolis alba, Ald. and Hanc. in Ann. Nat. Hist. v. 13, p. 164.

Hab. On sponge from shallow water, Malahide, near Dublin. Under stones at low-water mark, Rothesay Bay.

Body half an inch long, very slender, and tapering to a fine point behind ; pellucid white with a yellowish tinge from the viscera shining through. A broad patch of opake white runs along the head to the dorsal tentacles, passes in a narrow band between them, and is divided behind into two branches extending to the first branchial papillæ, where they again unite, forming a triangle or lozenge-shaped patch, which is continued backwards, and assumes an elliptical form over the heart ; it then contracts and passes in a single interrupted line down the back to the tail. *Dorsal tentacles* rather long, smooth, approximating at the base, tapering slightly for about three fourths of their height, when they swell into a bulb or button-like expansion, above which they become more slender and taper to an abrupt point. They are of a dark olive brown approaching to black below the bulb, and white above it. *Oral tentacles* long, nearly linear, swelling a little at the base, and tapering at the point, which is opake white, the rest transparent. They arise from the sides of the head, the form of which they determine. They are usually held in a gracefully curved position. *Head* rather narrow. *Branchiæ* arranged in five or six clusters on each side of the back, four of which are very distinct and well defined, the opposite ones approaching each other in the centre more nearly than usual, and having a ruff-like appearance. The first and second clumps which are at a considerable distance from each other, are composed of two transverse rows each, six or seven papillæ in each row ; the others are in single series, and decrease towards the tail. The papillæ are of moderate length, linear oblong, and slightly flattened at the base, where they are pellucid and tinged with yellow from the central vessel appearing through ; the rest is of an opaque white, excepting, in some specimens, a dark olive coloured circle near their termination, above which is another band of opake white ; the apices are pellucid. *Foot* narrow, nearly linear, and perfectly transparent, terminating behind in a very fine point, extending considerably beyond the branchiæ. The anterior angles are produced into long, slender, tentacular processes, curved backwards. A deep groove extends across the front of the foot to their points ; the central portion is curved inwards, giving the whole of this part a bow-like outline. The eyes are conspicuous and placed as usual behind the dorsal tentacles.

EOLIS ALBA.

The elegant and graceful form of this little animal renders it extremely attractive. The dorsal tentacles are peculiar.

It was first found in Malahide Bay, where we dredged up two specimens in about four fathoms water, in August, 1843. They were adhering to the common sponge, (*Halichondria panicea*), which is very abundant in this locality, and grows to a larger size than we have elsewhere seen. It probably constitutes the chief food of this and numerous other nudibranchs that were found upon it. That this species, however, is not very scrupulous in adhering to such diet we have reason to know. The two individuals after travelling three hundred miles by post, lived with us two or three weeks. They were very active, and glided rather quickly through the water. The dorsal tentacles were generally inclined forwards and spread much apart, the oral ones were arched gracefully backwards, and kept in constant motion. The papillæ usually lay rather close to the body, but frequently they were spread out and curved in a very graceful manner. Finding that they had devoured the spawn of another *Eolis* kept in the same glass with them, they were afterwards fed with the spawn of a *Polycera*, which they always laid hold of with great avidity; another proof, if any were wanting, of the carnivorous habits of this genus. They were always most active at nights. Their spawn was deposited in a slender gelatinous flattened thread forming a delicate spiral coil of seven or eight volutions; the eggs are oval, and lie three or four abreast through the whole length of the thread.

Fig. 1, 2, 3. *Eolis alba*, in different positions.

4. Two of the papillæ more highly magnified.

5. Spawn.

6. A portion of the same, showing the ova.

(The figures in this Plate have inadvertently been reversed.)





A. H. del.

EOLIS CONCINNA

C. Hallenstedt & F. Parent-Laborer

Fam. 3, Plate 24.

EOLIS CONCINNA, ALDER and HANCOCK.

E. albida; branchiis purpureo-fuscis, sub-nitentibus, in seriebus 9-10 digestis; tentaculis lævibus: angulis anterioribus pedis paululum extensis.

Eolis concinna, Ald. and Hanc., in Ann. Nat. Hist. v. 12, p. 234,

Hab. Under stones, between tide marks. Whitley, Northumberland.

Body nearly half an inch long, sub-linear, pellucid white, tinged with buff or yellow. *Dorsal tentacles* rather longish, linear, tapering, transparent, with opaque white tips; set near together at the base, spreading apart above, and generally inclined forwards. There is a dark cruciform mark on the head in front of them, produced by the jaws appearing through. *Oral tentacles* about one third shorter than the dorsal ones, linear, arising from the upper surface of the lips. *Branchi* oblong, sub-conical, purplish brown in the centre, and granulated; the external envelope transparent and tinged with blue, giving the whole a metallic hue; the apices strongly tipped with white. They are placed in 9 or 10 transverse rows of 5 papillæ each in the sides, leaving a wide space down the centre of the back. The rows are set a little apart, and diminish posteriorly. *Foot* nearly linear, pellucid, stained with buff, extending considerably beyond the branchiæ behind; the front transversely grooved, and produced at the sides into obtuse points. The eyes are immediately behind the dorsal tentacles, and are well developed.

Though less brilliantly coloured than many others of the genus, the silvery hue of the papillæ, when in motion, gives the species a very pretty appearance.

Four specimens were obtained in a pool at low-water mark, on the under side of a stone, crawling on *Sertularia argentea*. Some of the coralline was removed along with them, and placed in the same glass. On this one or two individuals deposited their spawn. The ova were contained in a broadish transparent strap or belt, which was deposited without apparent order. The departure from the usual spiral form in this instance may have been accidental, arising from the deficient support afforded by the coralline in its detached state.

Fig. 1, 2, 3. *Eolis concinna*, different views.

4. Papillæ, more highly magnified.

5. Spawn.





Fam. 3, Plate 26.

EOLIS OLIVACEA, ALDER and HANCOCK.

E. flavido-alba, maculis albis; branchiis paucis, crassiusculis, cylindraccis, olivaceis, seriebus 6-8 digestis; tentaculis levibus; angulis anterioribus pedis brevibus, obtusis.

Eolis olivacea, Ald. and Hanc. in Ann. Nat. Hist. v. 9, p. 35.

Hab. Under stones between tide-marks, Whitley and Cullercoats, Northumberland, not uncommon. Whitburn, Durham. Rothesay Bay, Isle of Bute.

Body about half an inch long, pale yellow or yellowish white, sprinkled with minute spots of opaque white. *Dorsal tentacles* rather short, nearly linear, obtuse, approximating at the base, yellow speckled with white, and having a more or less distinct orange-red band in the centre. *Oral tentacles* not so long as the dorsal ones, linear and obtuse, arising from the upper surface of the lips. A streak of orange or rose-red extends on each side of the head between the oral and dorsal tentacles, curving inwards, and is continued behind the latter a short way down the back; in some brilliantly coloured varieties there is a large sub-triangular blotch of rose-red behind these on the centre of the back, and one on each side below the dorsal tentacles. *Branchiæ* rather few, thickish, elliptic-oblong, nearly cylindrical, of a yellowish olive-brown, with numerous belts composed of granulated spots of dark olive, sometimes indistinct. The apices pale; the whole of the external surface covered with patches composed of opaque whitish spots. The branchiæ are set along the sides in 6 to 8 rows of 3 or 4 papillæ each: their size is nearly equal throughout. *Foot* watery white, tapering to a fine point behind; the anterior extremity widened and rounded. Eyes small, placed close behind the dorsal tentacles.

We know of no species with which this can be readily confounded. It is subject to some slight variation in colour. Sometimes a specimen is found with the branchiæ of a richer hue, approaching to reddish brown, and sometimes of a much darker or lighter tint, but the modest olive generally prevails. In a specimen found in Rothesay Bay, the papillæ showed indications of a brown ring at the apex. The spawn, which is deposited in the months of May and June, forms a broad semicircular coil, attached to the under sides of stones. In the simple form of the spawn and the single otolite of the auditory capsule, this species indicates the peculiarities of the section of *Eolis* to which it belongs.

- Fig. 1, 3, 5. *Eolis olivacea* of the usual colour.
2. The same, rich brown variety.
3. The same, dark, full-coloured variety.
6, & 7. Papillæ, more highly magnified.
8. Spawn.

(The figures in this Plate have inadvertently been reversed.)

COLLEGE OF AGRICULTURE

The following report was made by the students of the College of Agriculture, during the year 1910, in connection with the work of the Department of Agriculture, and is published for the information of the public.

The first part of the report deals with the work of the Department of Agriculture, and is divided into two sections, the first of which deals with the work of the Department of Agriculture, and the second with the work of the Department of Agriculture. The second part of the report deals with the work of the Department of Agriculture, and is divided into two sections, the first of which deals with the work of the Department of Agriculture, and the second with the work of the Department of Agriculture. The third part of the report deals with the work of the Department of Agriculture, and is divided into two sections, the first of which deals with the work of the Department of Agriculture, and the second with the work of the Department of Agriculture. The fourth part of the report deals with the work of the Department of Agriculture, and is divided into two sections, the first of which deals with the work of the Department of Agriculture, and the second with the work of the Department of Agriculture. The fifth part of the report deals with the work of the Department of Agriculture, and is divided into two sections, the first of which deals with the work of the Department of Agriculture, and the second with the work of the Department of Agriculture. The sixth part of the report deals with the work of the Department of Agriculture, and is divided into two sections, the first of which deals with the work of the Department of Agriculture, and the second with the work of the Department of Agriculture. The seventh part of the report deals with the work of the Department of Agriculture, and is divided into two sections, the first of which deals with the work of the Department of Agriculture, and the second with the work of the Department of Agriculture. The eighth part of the report deals with the work of the Department of Agriculture, and is divided into two sections, the first of which deals with the work of the Department of Agriculture, and the second with the work of the Department of Agriculture. The ninth part of the report deals with the work of the Department of Agriculture, and is divided into two sections, the first of which deals with the work of the Department of Agriculture, and the second with the work of the Department of Agriculture. The tenth part of the report deals with the work of the Department of Agriculture, and is divided into two sections, the first of which deals with the work of the Department of Agriculture, and the second with the work of the Department of Agriculture.

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Fam. 3, Plate 34.

EOLIS TRICOLOR, FORBES.

E. ovato-oblonga, pallidè flavida; branchiis elliptico-oblongis, inflatis, albis, lineâ centrali violaceâ, apicibus flavo-annulatis, in seriebus 13-14 digestis: tentaculis fulvis; lateribus pedis anterioribus rotundatis.

Eubbranchus tricolor, Forbes, Mal. Mon. p. 5.

Eolis violacea, Ald. and Hanc., in Ann. Nat. Hist. v. 13, p. 166.

Hab. On corallines from deep water (15 to 20 fathoms). Ballaugh, Isle of Man, and coast of Anglesea, Professor E. Forbes. Belfast Lough, W. Thompson, Esq. Cullercoats, Northumberland.

Body above an inch long, ovate-oblong, rather broad, and not much produced behind, of a pale buffish yellow, tinged on the head with orange or fawn-colour. *Dorsal tentacles* fawn-coloured, long and rather stout, tapering to an obtuse point. *Oral tentacles* much shorter and smaller, inserted into the upper surface of the lips, and faintly tinged with fawn colour. *Branchiæ* large, elliptical, inflated, pellucid, yellowish white with the central gland linear and of a deep violet colour, fading off to brownish orange below: an opaque ring of brilliant golden yellow encircles the apex. They are set in 13 or 14 transverse rows, leaving only a small space uncovered on the centre of the back. There are 3 to 5 papillæ in a row on each side, those next the back large and inflated, diminishing towards the sides, and very small near the foot. A few papillæ run along the sides as far as the dorsal tentacles. *Foot* rather broad, pellucid, terminating rather abruptly in a point not much behind the branchiæ. The front margin is grooved transversely and rounded at the sides.

This delightful species was first discovered by Professor E. Forbes on the coast of the Isle of Man, and published in his *Malacologia Monensis*, under the name of *Eubbranchus tricolor*. Subsequent observations, however, have shown that it really belongs to the genus *Eolis*, and that the individual first observed had been in a young and imperfect state. We met with a single specimen at Cullercoats, in October 1843, which, not recognizing its identity with *Eubbranchus tricolor*, we published under the name of *E. violacea*. Since then we have had a specimen sent us from Belfast Lough, by Mr. Thompson, and Professor Forbes procured several splendid specimens by dredging on the Anglesea coast, some of which he has kindly presented to us.

Mr. Forbes remarks, in his manuscript notes with which we have been favoured, that this animal when teased rolls itself up into a ball; a habit which we had not observed.

The eyes may very readily be seen in good specimens. The auditory capsule contains only a single otolite.

Fig. 1, 2, 3. *Eolis tricolor*, different views.
4. Papillæ more highly magnified.





A. H&el

EOLIS FARRANI

C. Billmeyer's Ternat. Lichonot.

Fam. 3, Plate 35.

EOLIS FARRANI, ALDER and HANCOCK.

E. alba; branchiis flavido-albis, inflatis, extremitatibus aurantio-annulatis, in seriebus 9-10, digestis: tentaculis supernè aurantiacis: lateribus pedis anterioribus rotundatis.

Eolis Farrani, Ald. and Hanc. in Ann. Nat. Hist. v. 13, p. 164.

Hab. One specimen brought up by the dredge in Malahide Bay, near Dublin.

Body three-eighths of an inch long, slender, tapering to a fine point behind, pellucid white, with a delicate tinge of yellow. There are a few spots of bright orange immediately before and behind the dorsal tentacles, and on the medial line of the back extending towards the tail, at the extreme point of which is a blotch of the same colour. *Dorsal tentacles* rather long, smooth, nearly linear, swelling slightly towards the base, where they approximate. The lower portion is transparent white; the upper portion orange, excepting the tips which are whitish. *Oral tentacles* about half the length of the dorsal ones, and of the same colour; rather slender, linear, inserted into the upper surface of the lips. *Head* rather narrow and roundish, the lips not much spreading at the sides. *Branchiæ* elliptical, inflated, pellucid white, with the central vessel of a pale straw colour, giving the whole a yellowish white appearance. They are terminated by a broad ring of bright orange, with occasionally a few dusky freckles; the apex transparent. They are set in nine or ten transverse rows of three or four papillæ each, on the sides of the back, nearly approaching in the centre, where they are large and inflated; those next the sides small. The first row, containing two papillæ, approaches very close to the dorsal tentacles. *Foot* linear, tapering gradually to a fine point posteriorly; pellucid; the spawn and viscera appearing through; anterior portion not much extended laterally, but rounded and slightly bilobed in the centre.

We have named this pretty species after Dr. Farran of Dublin, a gentleman well known for his love of natural history, and for his fine collection of Irish shells. To him we are indebted for the opportunity of procuring this and two other new species of Irish Nudibranchs dredged during a little excursion to Malahide in August 1843.

The single specimen captured, lived with us a considerable time, and was almost constantly in motion. The spawn is in form of a broad gelatinous riband, attached by its edge, and coiled openly one and a half times.

This species is very nearly allied to *E. tricolor*, but is much more slender, and has the head narrower and more elegantly formed; the branchiæ are rather shorter; their central

EOLIS FARRANI.

vessel, in this species, is of a pale straw colour, elliptical and deeply sacculated, while in *E. tricolor*, the same vessel is violet-coloured and nearly linear.

The little animal for which M. de Quatrefages has instituted his genus *Amphorina*, looks very like the young of this species.

Fig. 1, 2, 3. *Eolis Farrani*, different views.

4. Spawn.

5. Papillæ more highly magnified.





EOLIS DESPECTA

Fam. 3, Plate 36.

EOLIS DESPECTA, JOHNSTON.

E. alba, lineâ olivaceâ undatâ in medio dorsi; branchiis amplis, ovatis, in serie unicâ utrinque digestis: tentaculis dorsalibus longis, lateribus pedis anterioribus non productis.

Eolidia despecta, Johns. in Mag. Nat. Hist. vol. 8, p. 378, fig. 35e: idem in Ann. Nat. Hist. vol. 1, p. 123.

Hab. On corallines at or beyond low-water mark. Berwick Bay, Dr. Johnston. Whitley, Northumberland. Oban, Argyleshire.

Body two or three lines long, slender, tapering gradually to a point behind; transparent white with a slight greenish tinge in the centre from the viscera shining through. Two reddish streaks pass backwards from the dorsal tentacles towards the first branchial papillæ, and two fainter ones also pass forward to the oral tentacles; besides these there is a streak of pale red on each side of the body below the branchiæ. These reddish markings are, however, sometimes wanting. *Dorsal tentacles* long, tapering, smooth, and stout, approximating at their bases, but generally spread much apart and inclined forwards; pellucid, with the red streak of the head and shoulders passing a little way upwards. The oral pair short, not above one third the length of the dorsal ones, linear and pellucid. *Branchiæ* large, oblong-ovate, pointed, forming a single line of four papillæ on each side of the back. The first pair are opposite each other, the rest alternating. The central part of each papilla is of a pale olive green or yellowish brown, coarsely and irregularly granulated with a much darker shade of the same colour; the outside rim whitish and transparent; the tips opaque white, with sometimes a reddish band. A dark vessel of the same colour as the branchiæ, and similarly granulated, is seen passing down the centre of the back in a zig-zag line sending off a branch into one of the papillæ on each side alternately at the angles. *Foot* very narrow, tapering to a point behind, and extending considerably beyond the papillæ; the front is rounded and not produced at the sides. The eyes are small.

The specimen from which Dr. Johnston's description of this pretty little species was taken had only three papillæ on each side, and was probably a young one. It is subject to a little variation in colour and markings; some individuals being very pale, while others have the red or olive markings more or less conspicuous. The very large and undulating central branch of the digestive system is lined with coloured granules, and has in all probability the same function to perform as the glands of the papillæ. It may therefore be considered a portion of the hepatic organ. In this peculiarity, as well as in its general aspect, this little creature shows a departure from the type of *Eolis*. It appears nearly allied to the *Limax tergipes* of Forskal, upon which Cuvier founded his genus *Tergipes*; but that eminent naturalist was, we think, led into an error by relying upon the structure and func-

EOLIS DESPECTA.

tion attributed to the branchial papillæ, the chief character on which his genus rests. Forskal's statement we conceive to have originated in a mistake. More than one naturalist has been deceived by the transparent tips of the papillæ in *Eolis*, which being generally surrounded by an opaque ring, have the appearance, when looked down upon, of being hollow.

Eolis despecta is a gregarious animal; 18 or 20 specimens were found under the same stone at Whitley rocks. They had deposited their spawn on a small coralline (*Laomedea gelatinosa*) that covered the under side of the stone. In Oban Bay they were met with in yet greater numbers on *Laomedea geniculata* attached to the large fronds of *Laminaria saccharina* dredged up in five or six fathoms water. In the latter place we should think a hundred specimens might readily have been obtained in a short time: they were also spawning. The spawn, which in both cases was met with in the month of June, is a small kidney-shaped mass; the ova inclosed in a thick transparent envelope. Its form differs from that of any other species we have met with.

A few individuals kept for several days we found to be very active and restless in their habits, and fond of swimming inverted on the surface of the water. The vibratile cilia on the body of this species are larger than usual.

Fig. 1, 2. *Eolis despecta*.

3. The same, dark variety, with the papillæ encircled with red.

4, 5. Papillæ more highly magnified.

6. Spawn.

(The figures in this Plate have inadvertently been reversed.)

