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On Some Eolidacean Nudibranchiate Molluscs from South Africa.

By

William Macnae,
Rhodes University, Grahamstown.

With Plates I and II and 32 Text-figures.

INTRODUCTION AND ACKNOWLEDGMENTS.

HITHERTO the South African representatives of the tribe of Nudibranch Molluscs known as the Eolidacea has received scant notice. Dr. K. H. Barnard (1927) brought together all the records of Nudibranchs published before that date, and described several new species. Although he lists six species in his family Æolidiidæ only five are members of the tribe Eolidacea as now understood; the remaining one (*Janolus capensis*) belongs to the tribe Arminacea. The present paper, which is the first of a series to describe South African Opisthobranchs, amplifies the diagnoses of four of the five species listed and described by Barnard and adds seven new species.

With the exception of one species (*Facelina faurei*), all the specimens on which the account which follows is based were collected by myself, and I have to acknowledge the assistance given me by the Staff Research Funds of the University of Cape Town and Rhodes University, without which the extensive collecting trips could not have been made. I also acknowledge, gratefully, the assistance given me by Dr. K. H. Barnard of the South African Museum, and the encouragement given me by Professors J. H. Day and J. Omer-Cooper, in whose Departments at the University of Cape Town and Rhodes University all my work has been done. Professor Dr. Nils Odhner of Stockholm has read my manuscript and given me much helpful criticism and advice, which have been greatly appreciated. I must also thank my wife, Mrs. M. M. Macnae, to whose skill the coloured plates accompanying this paper are due. Lastly I thank the South African Council for Scientific and Industrial Research for their generosity in making available a substantial grant towards the cost of publishing these coloured plates.

THE CLASSIFICATION OF THE NUDIBRANCHS.

Since the issue of Barnard's paper the classification of the Nudibranchs has been considerably and thoroughly revised. The basis of classification has always been the form of the liver system. This was first used by Alder and Hancock (1845–1855) in their famous treatise on British Nudibranchs, and later Bergh in a long series of studies on Nudibranchs from all parts of the world made it the basis of his Holohepatica and Cladohepatica. Thiele (1931) retained Bergh's two groups but gave them different names, Doridacea (= Holohepatica) and Æolidiacea (= Cladohepatica). This twofold divison was not alto-

gether satisfactory and was responsible for many anomalies. Two familes, otherwise closely similar to one another, would be separated into different sub-orders merely because of the form of the liver. This applies to several families in the modern sub-orders of the Dendronotacea and Arminacea. Odhner (1934) suggested the division of the order into the four sub-orders, Doridacea, Dendronotacea, Arminacea and Eolidacea. While the form of the liver system is used as the primary basis of division, other internal features are used in addition. His key published in 1934 and again in 1939 is convenient and easy to use.

Odhner (1939) has also clarified the classification of the Eolidacea, by splitting the sub-order into the following three tribes on the basis of the relationships between the position of the anus and the ramifications of the liver system or digestive gland :

(i) the Pleuroprocta, which have a lateral anus unrelated to the ramifications of the liver system ;

(ii) the Acleioprocta, in which the anus lies more dorsally and within the interhepatic space ;

(iii) the Cleioprocta, in which the anus lies within or just behind the first posterior group of the left liver, forming the second liver group on the right side.

This system is a considerable improvement on the earlier classifications, in which it is often difficult to see the true relationships between different genera.

In the original citation of many genera no definite statement was made about the form of the liver branching, nor of the arrangement of the organs which constitute the genital mass. Both of these systems must be considered when fitting an Eolid into its proper place in the system of classification. The position of the anus in relation to the branching of the digestive gland indicates, as we have seen, to which tribe the species belongs. The position of the nephroproct and the arrangement of the organs which constitute the genital mass are useful in determining to which family a species belongs. For example Odhner (1939) has shown that all members of the family Cuthonidæ possess a large gland or sac associated with the penis, and this gland is not found in closely related families. Again, the Facelinidæ all resemble one another in the general simplicity of the genital mass and the usually short duct of the spermatheca, which leads into the oviduct near its origin from the division of the hermaphrodite duct. As further study is made of the different genera and species of the whole order of the Nudibranchia it is now realized that the form of the genital mass is an important systematic criterion which most of the older workers completely neglected to mention or describe.

While the radula and its teeth and the jaws and their armature have been much used in the past as specific, generic and even familial characteristics, it

is only in a few exceptional cases that they can be validly used. In so many cases the form of the radula tooth is purely a result of convergence. There is, for example, a strong resemblance between the radula teeth of some of the genera of the two families Cuthonidæ and Facelinidæ, which fall into separate tribes. In fact the radula teeth can only be considered as a satisfactory diagnostic feature when they are unique as are those of the genus *Catriona* (cf. fig. 2). Similarly the jaws and their armature are also features which show convergence.

Lack of definition in relation to these points has led to the inclusion in certain genera of species which differ from the type species of the genus in the position of the anus, and in the arrangement of both the digestive gland and the genital mass, although they have borne considerable resemblance to the type species in the shape of the radula teeth and jaw armature, and this resemblance has been the sole justification for their inclusion. Also lack of definition has led to the inclusion of genera in families, to the other members of which they bear only a superficial resemblance. As opportunity arises for the re-examination of such species and genera it will be necessary to transfer them to their rightful place, and it may be necessary to create new genera for the reception of such stray species.

Family CUTHONIDÆ.

There seems to be some confusion as to the proper name of this family. Thiele (1931) and following him Baba (1937, 1949) designate the family Tergipedidæ. Certainly *Tergipes* Cuvier, 1805, is the oldest genus in the family, but it is an extreme form and does not, from a taxonomic viewpoint, occupy a central position in the family. Odhner has consistently called the family Cuthonidæ, and the genus *Cuthona* Alder and Hancock, 1835, is a typical and centrally placed form. It is more convenient, therefore, and more practical to retain the name Cuthonidae for this family-group, and a request has been passed to the International Commission for Zoological Nomenclature that the name Tergipedidae be suppressed and the name Cuthonidae be adopted for the family group.

Genus *Catriona** Winckworth, 1941, p. 148 ; Odhner, 1943, p. 22.

This name was established to include certain species previously included in the genus *Cratena* Bergh 1864. As Winckworth (1941) pointed out, the name *Cratena* was given to the species *Doris* or *Cavolina peregrina* Gmelin, 1790, which was chosen by Trinchese (1877) as the type of the genus *Rizzolia*, with which *Cratena* must be considered a synonym, and over which it will

* Mme. Pruvot-Fol (1951) considers that von Jhering's (1879) genus *Trinchesia* is synonymous. I cannot agree with this view.

have preference. Bergh himself and other authors have confused the issue by giving the name *Cratena* to forms to which the diagnosis given below applies as well as to forms more rightly included within the genus. It is to these forms of the genus *Cratena* as usually understood that the new genus *Catriona* was proposed by Winckworth.

His diagnosis of this genus is as follows : " Acleioproct Eolidacea ; with uniseriate radula in which the teeth are arched with a central cusp shorter than or not markedly longer than the lateral denticles : with simple rhinophores : having simple liver canals each with a single row of papillæ : having the anterior corners of the foot rounded and the jaw process denticulate. Type species, *Catriona aurantia* = *Eolis aurantia* Alder and Hancock."

Catriona speciosa n. sp. Text-figs. 1–3 ; Pl. I, fig. 1.

Two specimens of this pretty little species were found in January, 1949, on the shores of False Bay ; one was crawling among Corallines in a rock pool about a mile south of Kalk Bay harbour, and the other was clinging amongst barnacles at Dalebrook, the two localities being just over one mile apart.

The dimensions of the specimens when alive were 14 mm. long by 4 mm. broad, and 12 mm. by 3 mm.

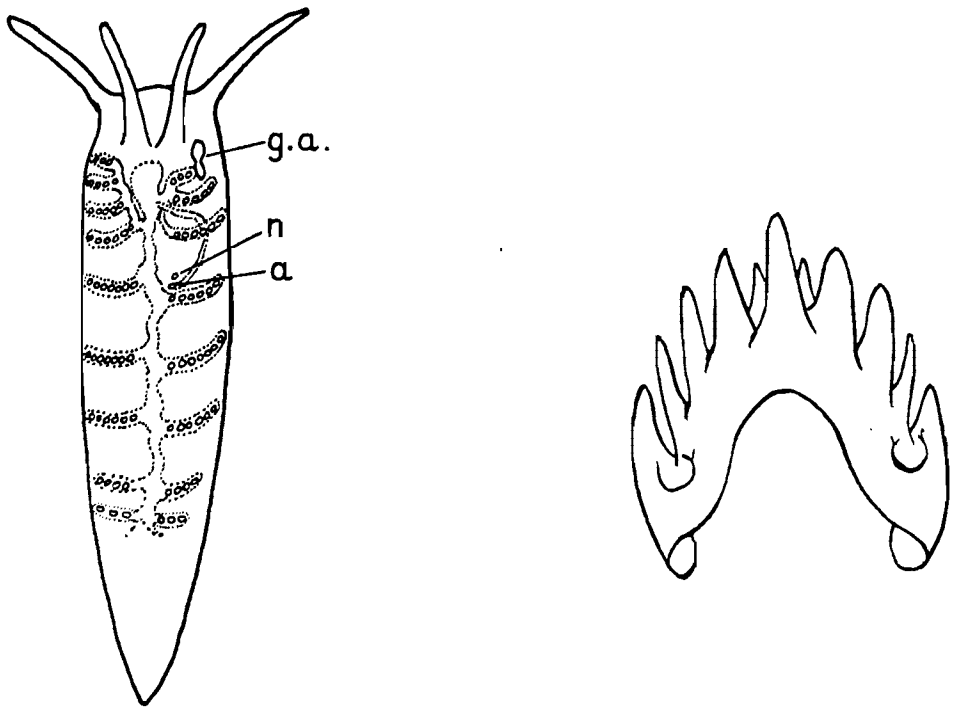
While alive the anterior edges of the foot were very slightly produced into tentacular processes, but these do not show in the preserved specimens, in which the anterior corners of the foot are rounded. The oral tentacles are slender, the rhinophores a little longer, stouter and quite smooth. The tail is short and broad. The foot is a little wider than the body. The cerata are spindle-shaped and arranged singly in rows. On the right side the rows contain, in succession, 3, 5, 6, 7, 7, 6, 4 and 3 cerata. The right lobe of the liver bears three rows of cerata ; of these the first row is very short and lies just behind the rhinophores and immediately above the genital apertures. Four rows of cerata of the left lobe correspond to the right lobe. The posterior branches are symmetrical and diminish abruptly in length towards the tail. The anus is acleioproct and lies just in front of or immediately above the most dorsal ceras of the first posterior row on the right, and the nephroproct lies just in front of the anus.

The colour of the body (Pl. I, fig. 1) is a bright translucent lemon-yellow. An orange line runs round the edge of the foot, but this line fades to the general body colour after a few days in a finger-bowl. The tentacles and the rhinophores are both chrome yellow overlaid by a pink flush. A pink flush paler than that on the rhinophores and tentacles also extends over the dorsal surface of the body and tail. In one specimen the pink colour was present on the dorsal surface of the head between the bases of the rhinophores and tentacles, but in the other it did not extend so far forwards. Each ceras is iridescent blue and lilac with an orange tip. The dark greenish branch of the digestive

gland can be seen entering the base of each ceras, but its colour is masked in the cerata themselves.

The radula has 37 teeth, each arched and broadly horseshoe-shaped. The median cusp (see text-fig. 2) is not markedly longer than the four larger lateral denticles ; there may be a small lateral denticle on either side of the cusp,

TEXT-FIGS. 1, 2.



Catriona speciosa n. sp. 1, " liver " system ; 2, radula tooth.

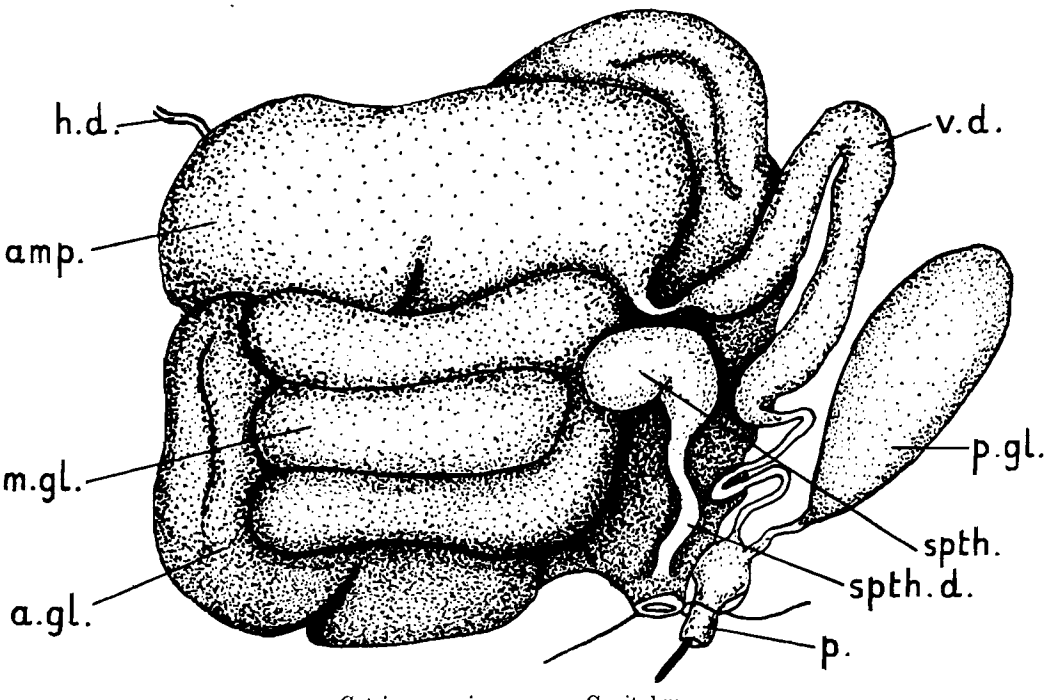
but this little denticle is not present in all the teeth of the radula. The masticatory process of the jaw has a few widely separated blunt denticles. The jaws are not particularly large.

The genital organs (text-fig. 3) follow the pattern characteristic of the Cuthonidæ, and are similar to those described by Odhner for *Catriona aurantia* (Odhner, 1939, p. 74, fig. 41). The penis is short and conical, and its tip is provided with a chitinous arming tube which is quite straight and approximately equal in length to the penis itself. The vas deferens is comparatively short and has muscular and prostatic portions more or less equal in length. There is a large ovoid penis sac or gland connected by a short uncoiled duct to the base of the penis closely adjacent to but separately from the vas deferens. The ampulla of the hermaphrodite gland is inflated and only slightly coiled.

The spermatheca is ovoid and connected to the vagina by a short, almost straight duct. Both the ampulla and the spermatheca lie between the mucous and albumen glands and the former has to be displaced to some extent to see them.

That these specimens belong to the genus *Catriona* is obvious from the above description, and above all the position of the anus and nephroproct, the form of the radula teeth, the armature of the penis and the presence of a penis

TEXT-FIG. 3.



Catriona speciosa n. sp. Genital mass.

sac or gland are characteristic of the genus. Both specimens have a marked resemblance to Vayssière's illustration of *C. cœrulea* (Vayssière, 1888, pl. 1, fig. 5), but differ markedly from Alder's and Hancock's figure published by Eliot (1910, pl. vi, figs. 6, 7 and 8). The radula teeth also bear a close resemblance to those of the Atlantic and Mediterranean species, but the 37 teeth of the South African specimen is a very much smaller number than the 70–80 quoted by Vayssière. The recently described *C. venusta* Baba, 1949, is very similar in general appearance to both *C. cœrulea* and to my South African specimens, particularly in coloration, form of the radula teeth and in the shape and armature of the jaw, but differs in possessing a number of teeth (55–60)

intermediate between these two species. No descriptions are extant of the other internal features of these two species, and so one cannot with any certainty identify the South African specimens with either of them. It seems wise, therefore, to distinguish the South African specimens as a new species with the name *C. speciosa* in allusion to the showy colouring of the animals.

Family Facelinidæ.

This family name was first used by Vayssière (1888), but most authors have included its members in the family Æolidiidæ with the rank of a sub-family. Several of the genera which Vayssière included have to be transferred to other families, and some which he did not recognize as members are now included. When one accepts Odhner's classification one cannot include this group of genera in the Aeolidiidæ as is done by Thiele (1931), for the two families differ on several points. In all the genera of the Facelinidæ with the exception of the genus *Moridilla* Bergh, 1888, the anus lies within the second group of cerata on the right side, while in the Æolidiidæ it lies further back, behind the second group of cerata. This position is also occupied by the anus of *Moridilla*, in which according to Bergh (1888) the anus lies just outside the anterior papilla of the third liver group, its other features are, however, definitely Facelinid. Also in the Facelinids the nephroproct is situated in the interhepatic space either on the same level as the anus or towards the ventral end of the first adanal row. Among the Æolidiidæ, on the other hand, it has followed the anus backward, and is either adjacent to it or at least behind the first posterior group of cerata.

The family contains two sub-families : (i) the Facelininæ, in which the right liver has a number of parallel branches each bearing a single series of cerata ; and (ii) the Favorininæ, in which the right liver is in the form of an arch, or, exceptionally, is simple.

To the first sub-family belong the genera *Facelina* Alder and Hancock, 1855, *Acanthopsole* Trinchese, 1874, *Learchis* Bergh, 1896, *Moridilla* Bergh, 1888, and possibly some others. The first two genera have frequently been fused, but they seem to be distinct. The descriptions given by Trinchese (1874, 1879) and Vayssière (1888) indicate that the branching of the digestive gland of *Acanthopsole rubrovittata* is of a form different from any *Facelina*. While the right liver is three-branched the posterior liver groups are in the form of horseshoes or simple, but in all species of *Facelina* which have so far been described several of the posterior groups have more than two branches. This difference in arrangement seems to be generic. On the other hand, the differences which were stressed by Trinchese are not so significant, yet they may serve as useful additional recognition marks. One of the three species of *Facelina* to be described below has annulated and not perfoliate rhinophores, and this Trinchese holds is characteristic of *Acanthopsole*. The armature of

the penis may, however, be generic. *A. rubrovittata* has a long finger-line penis, round the glans of which is an armature of a single row of quite strong hooks ; this series becomes multiple at the extreme ends. Several species of *Facelina* have an armed penis, but in all cases the armature is in the form of several series of tiny spines or tiny hooks, and these are quite likely to be overlooked in some of the species which possess them. It is chiefly on the evidence of Bergh (1877, 1882 and 1885) that the genus *Acanthopsole* has been regarded as synonymous with *Facelina*, but Bergh never appreciated the importance of the finer divisions of the liver groups, and never used them in classifying the Eolids. Odhner is also of my opinion (*in litt.*), and says, " I have long held this group as a distinct genus."

To the second sub-family, in addition to certain exotic genera, some of which are rather scantily described, belong the other genera to be described below. These genera may be distinguished as follows :

Key to the South African Genera of Favorininæ.

1. Radula teeth with prominent central cusp and no or only inconspicuous lateral denticles ; penis short, conical and unarmed . . . . . *Favorinus*
— Radula teeth with prominent lateral denticles ; penis neither short nor conical . . 2
2. Liver horse-shoes with more than one row of cerata in each limb 3
— Liver horse-shoes with a single row of cerata in each limb 4
3. Rhinophores smooth or wrinkled, but never perfoliate nor annulate ; penis elongate, armed with a terminal hook or unarmed . . . . . *Godiva*
— Rhinophores annulate ; penis armed with a multiplicity of small spines . *Echinopsole*
4. Penis unarmed ; rhinophores smooth . . . . . *Cratena*
— Penis armed ; rhinophores annulate . . . . . *Amanda*

Before going on to discuss certain trends which are obvious in the family *Facelinidæ* it seems appropriate to consider the status of the generic name *Hervia* Bergh, 1871. This generic name has been loosely used in the past, and has been given an assemblage of species of considerable divergence in form. Not having at that time ready access to the original citation of the genus I communicated my difficulty to Dr. Odhner, who sent me (1952, *in litt.*) the following comments on the name *Hervia* :

" Nobody seems to have observed the meaning of this genus name. It was established by Bergh in 1871 (brief diagnosis only ; a description followed in 1874). The type was *modesta* n. sp. from the Kattegat (northern waters), likewise briefly characterized in 1871. In 1874 Bergh described it satisfactorily enough for enabling its identification. He says : ' Die Papillen etwas wie bei den Facelinen gestellt. Die Papillenkissen nur unbedeutend hervortretend, langgestreckt, mit kurzen Schrägreihen von Papillen besetzt. Die erste Papillenkissen weit vorwartz reichend, zählte 6 Reihen, von denen die zwei hinteren hufeisenformig vereint waren. Die nächste Kissen zählte 5 Reihen, von denen die zwei hintersten wieder in der erwahnten Weise vereinigt waren und in ihrem Bogen die Analpapille aufnahmen.' From these words it is evident that the arrangement of papillæ and anus is the one characteristic of

Facelina; *Hervia* consequently is a synonym of *Facelina*, and further comparison with the description will reveal as probable that *H. modesta* is an abnormal modification of *F. drummondi*."

Species ascribed to *Hervia* by many subsequent authors and even by Bergh himself cannot always be referred to *Facelina*, and each must be studied on its own merits. Without careful study of specimens of many of the species concerned it is impossible to make a definite decision as to which genus they really belong, but the following comments may well be made:

Apart from the type species no others seem to be a *Facelina*. Because of the fact that the right liver is in the form of a horseshoe, the majority of the species ascribed to the genus *Hervia* have to be included in the sub-family Favorininæ, and these seem to fall into two groups. Some have the right liver in the form of a simple horse-shoe, and the posterior branches may have the form of horse-shoes or may be single. This group includes *H. lineata* Eliot, 1904, and *H. serrata* Baba, 1949 (this may well be a *Favorinus* (Odhner, 1952, *in litt.*)), and possibly *H. berghii*[1] Vayssière, 1888, although his description does not make clear the shape of the anterior liver groups. These species are similar to *Cratena peregrina*, and no doubt should be included in this genus.

The second group includes five species: *H. rosea* Bergh, 1888, *H. ceylonica* Farran, 1905, *H. japonica* Baba, 1937 (= *Rizzolia modesta* Bergh, 1880), *H. emurai* Baba, 1937, and *H. quadricolor* Barnard, 1927. In all of these most of the liver groups except one or two of the most posterior have the form of horse-shoes; and further, in all of them the cerata are inserted in the horse-shoes in more than one series. *H. quadricolor* differs from all the others in having six or eight series of cerata, while the others have two series. This species also has a strong terminal hook on the glans penis—a feature shown by neither *H. rosea* nor *H. japonica*; descriptions of the penial armature of the others are not given by Baba in any of his accounts of them. A new genus, *Godiva*, is proposed below for the species *H. quadricolor*, and it is suggested that the other four species should be included in it provisionally, until further study will establish whether the differences between these and the South African form are really generic.

Two other species ascribed to *Hervia* are in fact species of *Catriona*. These are *H. sibogæ* Bergh, 1905, and *H. ornata* Baba, 1927. *H. sibogæ* has an acleioproct anus and four rows in the right liver, and in addition has the typical arched radula teeth without a prominent central cusp. *H. ornata* is described as being similar to *H. sibogæ* with the anus acleioproct between the fourth and fifth rows, and the text-figure shows a radula tooth of typical *Catriona*-type. Hence these two species should be renamed *Catriona sibogæ* (Bergh) and *C. ornata* (Baba) respectively.

Throughout the family of the Facelinidæ there is a trend towards a simplification of the branching of the liver system. In the genus *Facelina* and some

[1] Mme. Pruvot-Fol (1951) considers that *H. berghii* is the juvenile of *Acanthopsole rubrovittata*.

others closely related to it, all the branches of the liver except the most posterior ones are highly branched. In *Acanthopsole* the number of branches is considerably reduced, and while the most anterior pair retain more than two branches, the posterior branches are either arched or simple. In most of the Favorininæ the anterior branches have also the form of horse-shoes and the posterior groups are either arched or simple. In the genus *Herviella* Baba, 1949, even the anterior branches have become simple. The single or simple rows may be drived from horse-shoes by postulating the disappearance of the posterior limb of the horse-shoe—a condition forecast in several species of *Favorinus* and *Cratena*, in which the posterior limb of the arch is much shorter than the anterior one. This development is paralleled in the family Cuthonidæ, as has been shown by Odhner (1939).

The genital mass of all members of the family are alike in essentials, and especially in the simplicity of the ducts. In all forms the spermatheca has a comparatively short or very short duct, which leads into the oviduct quite close to the origin from the division of the hermaphrodite duct. The vas deferens is glandular throughout its length and in all species to be described below is quite long, longer than is suggested by Odhner's (1939) description of Norwegian forms. The shape and armature of the penis and whether it be provided with accessory glands or not would appear to be criteria diagnostic of genera and of species within genera.

Genus *Facelina* Alder and Hancock, 1855.

Facelina : Alder, J., and Hancock, A., 1855, appendix, p. xxii ; Bergh, R., 1864, p. 210 ; *Hervia* : Bergh, R., in Morch, O. A. L., f. 1871, 1872 ; Bergh, R., 1874, p. 409 ; *Facelina* : Bergh, R., 1875, p. 399 ; 1876, p. 752 ; 1877, p. 824 ; Trinchese, S., 1881, p. 31 ; Bergh, R., 1882, p. 24 ; 1885, p. 41 ; Vayssière, A., 1888, p. 33 ; Eliot, C., 1910, p. 171 ; Thiele, J., 1931, p. 458 ; Odhner, N. H., 1939, pp. 53, 77–80.

This genus is distinguished from most other genera in the family by the much branched right liver. The nephroproct lies in front of, and usually close to the ventral end of the anterior branch of the adanal group. The penis may be either unarmed, or armed with a belt of tiny spines round the glans. In many species there are a large number of accessory glands associated with the penis.

F. auriculata described and figured by Odhner (1939) has an elongated tongue-shaped penis with no associated glands, but with an armature of a belt of tiny chitinous hooks around the glans. Vayssière (1888) described the penis of *F. marioni* and gives an illustration (pl. iii, fig. 24). In this case the penis is unarmed but there are some strange associated glands. In two of the species to be described below there is a long tongue-shaped penis with a narrow belt of tiny chitinous hooks round the glans, and one of them has five and the other one accessory gland at the base of the penis. The third, *F. faurei*, has a penis of most bizarre appearance. It is short, unarmed, but provided with a large number of associated glands, some arranged round the edge of the glans and

others at the base of the penis. It seems to take to an extreme the condition illustrated by Vayssière for *F. marioni*.[1]

Facelina olivacea n. sp. Text-figs. 4–6, Pl. I, fig. 2.

Two specimens were taken on a raft in Table Bay harbour in May, 1949, and several specimens were collected among hydroids on weed at Saldanha in October, 1949.

The animals are stout and not markedly depressed. Fully extended a specimen may reach 25 mm. long by 8 mm. broad but the average is much smaller; the average length of several specimens was 15 mm. The oral tentacles are very long and highly mobile. The rhinophores are perfoliate with a large number of more or less complete rings. The anterior edges of the foot are prolonged into a pair of tentacular processes, which are often held close to the sides of the body and so escape notice. The tail is of medium length. The foot is narrower than the body. The genital openings lie ventro-laterally in the interhepatic space.

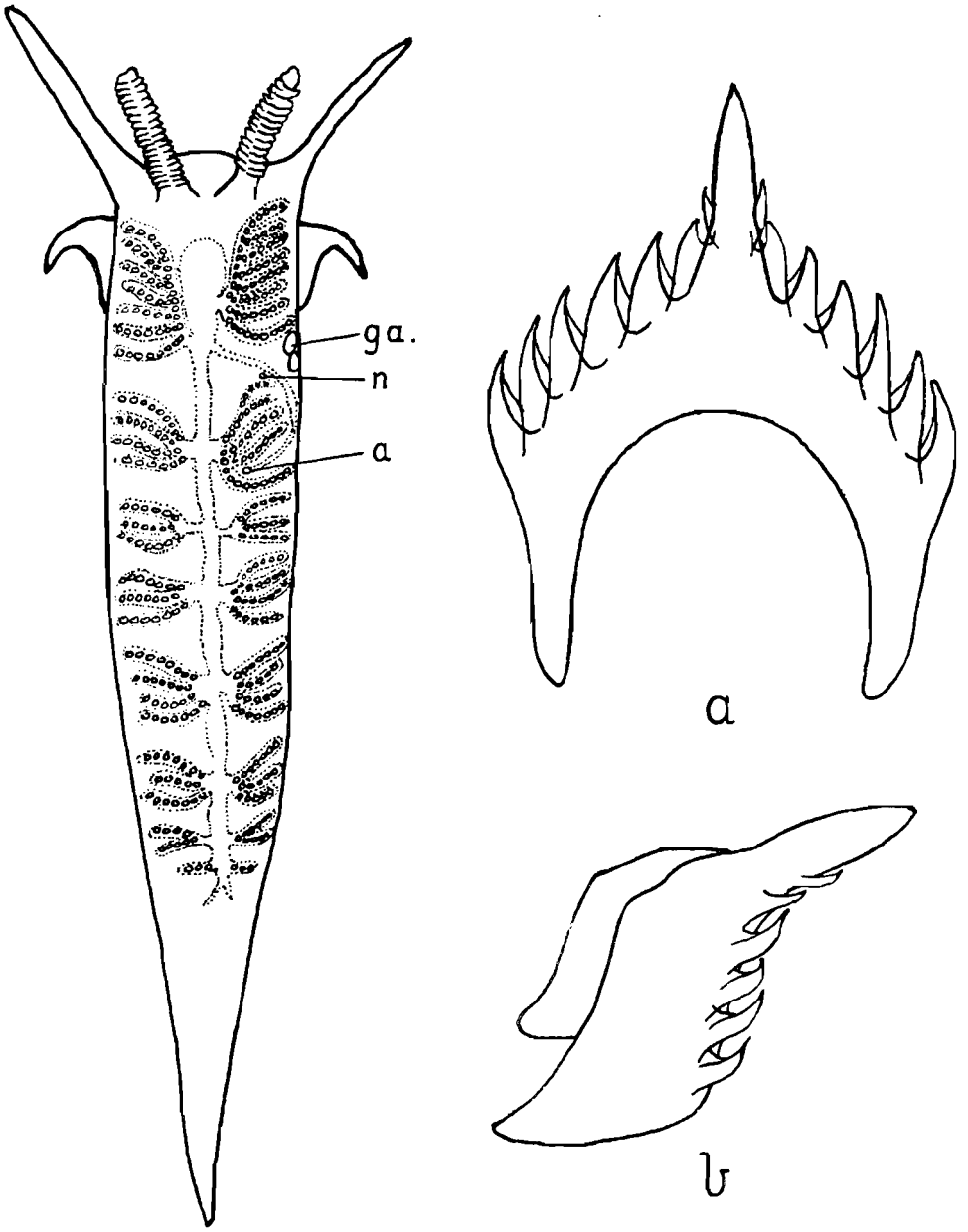
The colour of the body (see Pl. I, fig. 2) is translucent white, with spots and patches of opaque white on the back of the body and on the dorsal surface of the head between the rhinophores. In most but not all specimens there is a pair of pinkish or orange spots on the surface of the head between the bases of the rhinophores, and a pink flush may extend forward to the anterior edge of the upper lip. Over the general dorsal surface between the bunches of cerata there spreads an olivaceous suffusion. The cerata are translucent white and olivaceous with the brownish or greenish contents of the digestive glands showing through.

Both lobes of the digestive gland (text-fig. 4) are highly branched and of the typical *Facelina* form. The right lobe has 6–8 branches directed obliquely forward or backward according to the state of expansion of the specimen. A similar number of branches in the anterior group of the left liver balances the right lobe. The posterior groups are all subdivided and the number of branches in each group diminishes posteriorly. The cerata are set singly in each branch. The anus lies deeply within the first posterior group of the left liver on the right side; it lies just in front of the most posterior branch of the group. The nephroproct lies in front of this group and close to the distal end of the most anterior branch. The genital openings lie beneath and immediately behind the branches of the right liver.

The radula has 13 to 15 teeth, each (text-fig. 5) broadly horse-shoe-shaped with a prominent central cusp. The cusp itself bears two tiny lateral denticles on each side, and there are in addition 5 lateral denticles. The jaws are not

[1] Mme. Pruvot-Fol (1951) has established the genus *Facelinella* (a name which is preoccupied by Baba (1949)) for the species *F. marioni*; and the genus *Rolandia* for *R. hispanica* n. sp., a form with a penis resembling that of *F. faurei*. The descriptions of *Rolandia* are elaborated by her in a later work (1953). For reasons expressed here and on p. 17 I consider that these genera are unnecessary though useful as sub-generic categories.

TEXT-FIGS. 4, 5.

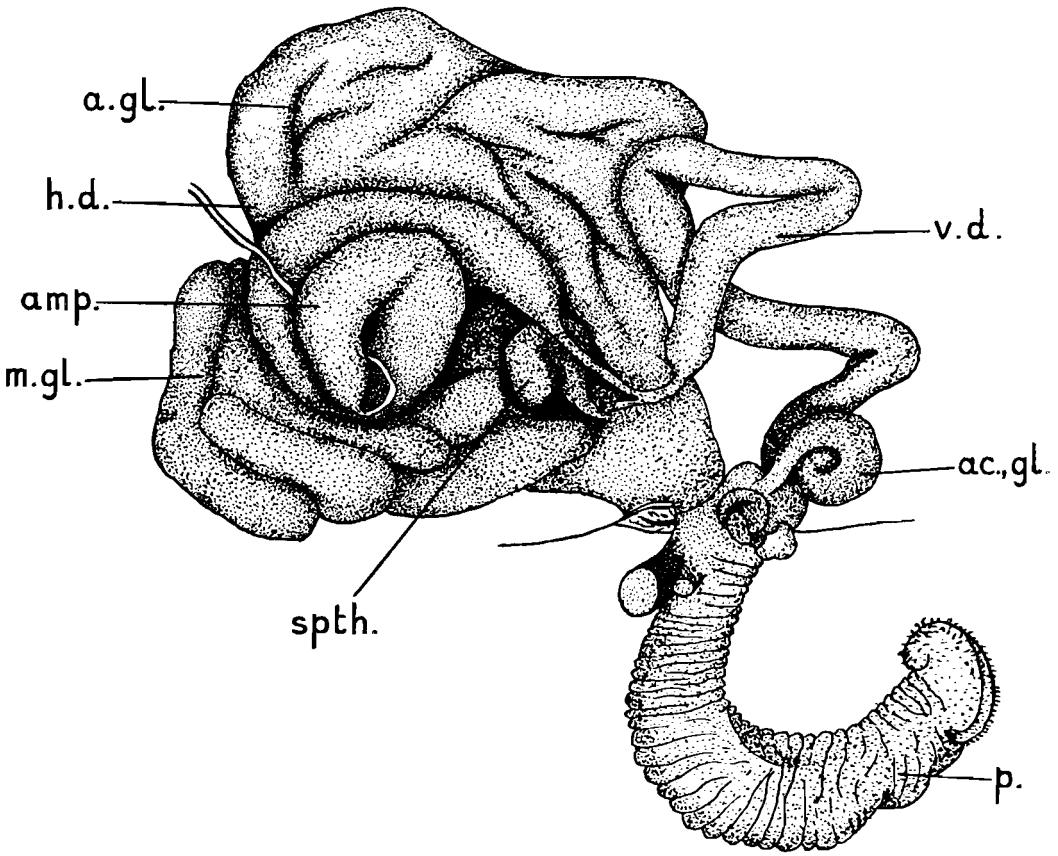


Facelina olivacea n. sp. 4, " liver " system ; 5, radula tooth, *a* from above *b* from the side.

strong, and the masticatory process bears a single series of about 40 irregularly spaced, rather blunt teeth.

The reproductive organs (text-fig. 6) have the typical Facelinid facies. The ampulla of the hermaphrodite duct is long and coiled. Its narrow distal portion is short. The vas deferens has a short, narrow, proximal portion and

TEXT-FIG. 6.



Facelina olivacea n. sp. Genital mass.

then widens and is glandular throughout its length. It is very long and has to be pushed aside to see the organs lying beneath it. The penis is long and tongue-shaped, and round the glans there is a narrow belt of numerous tiny chitinous hooks. A group of five accessory glands of various sizes and shapes are present round its base and these are exserted when the penis is fully erected. When the penis is withdrawn its proximal portion forms a sheath for the distal portion. The spermatheca is club-shaped and bent on itself and is connected

by a short duct to the oviduct. It lies beneath the distal portion of the ampulla and closely attached to the albumen gland.

Facelina annulata n. sp. Text-fig. 7 ; Pl. I, fig. 3.

One specimen was taken in June, 1952, on the shore about one mile south-west of the mouth of the Kowie River at Port Alfred in the eastern Cape Province.

The animal is stout and not markedly depressed. Fully extended it is 14 mm. long by 6 broad. The oral tentacles are very long and highly mobile. The rhinophores are comparatively short and annulated, not perfoliate. They are girdled by eight incomplete rings. This condition is peculiar and different from most other members of the genus, for usually the rhinophores are perfoliate. The anterior corners of the foot are extended into a pair of tentacular processes which are short and stout. The tail is short and broad. The genital opening lies beneath the last limb of the right liver.

The colour of the body (Pl. I, fig. 3) is translucent white. Opaque white spots form a saddle over the dorsal surface of the head just in front of the rhinophores. A slightly narrower belt runs forward and expands to cover the entire surface between the base of the oral tentacles. A line of opaque white spots runs between the rhinophores and stops just behind them. A scattering of such spots occurs on the surface of the back between the cerata, and they become organized into a line again on the tail. A peppering of opaque lemon-yellow spots is present in the middle section of the rhinophores ; the lower two annulations and the tip are clear translucent white. There is an iridescent sheen on the cerata, which are translucent white in colour with a peppering of opaque white spots and through which the brownish-yellow contents of the digestive gland shine to give the predominant brownish-yellow appearance to the animal. There is a pale pink suffusion over the lips. A pink spot between the rhinophores is due to the dorsal suface of the buccal mass, which is pink in colour, shining through.

The branching of the digestive gland is simpler than is usual within the genus. The right liver and its left partner with their five branches are quite typical. Only the most anterior of the posterior branches are divided. The adanal group has three branches, and the anus lies between the second and third and deep within the bay between them. Its left partner is also three-branched. Behind this are five simple undivided branches. The nephroproct lies in the interhepatic space in front of the second ceras from the upper end of the first adanal row.

The form of the radula is similar to the previous species except that there may be three small denticles on the central cusp, though these are not present on all teeth of the radula. The jaws are also similar to those of that species.

The organs of the genital mass have the normal Facelinid facies. The penis is long and tongue-shaped, and round the glans is a horse-shoe-shaped

belt of tiny spines and hooks. Two small accessory glands are present at the base of the penis.

This species is of interest as it possesses the annulate rhinophores which Trinchese stressed as being characteristic of *Acanthopsole*, and though it has an armed penis the armature is not of the *Acanthopsole* type, but is of a form typical of several species of *Facelina*. The fact that the adanal liver group is three-branched and not arched definitely makes this a *Facelina* and not an *Acanthopsole*. The trivial name has reference to the annulations on the rhinophores.

Facelina faurei Barnard, 1927. Text-figs. 8–10.

Facelina faurei : Barnard, K. H., 1927, p. 205, fig. 4, 5.

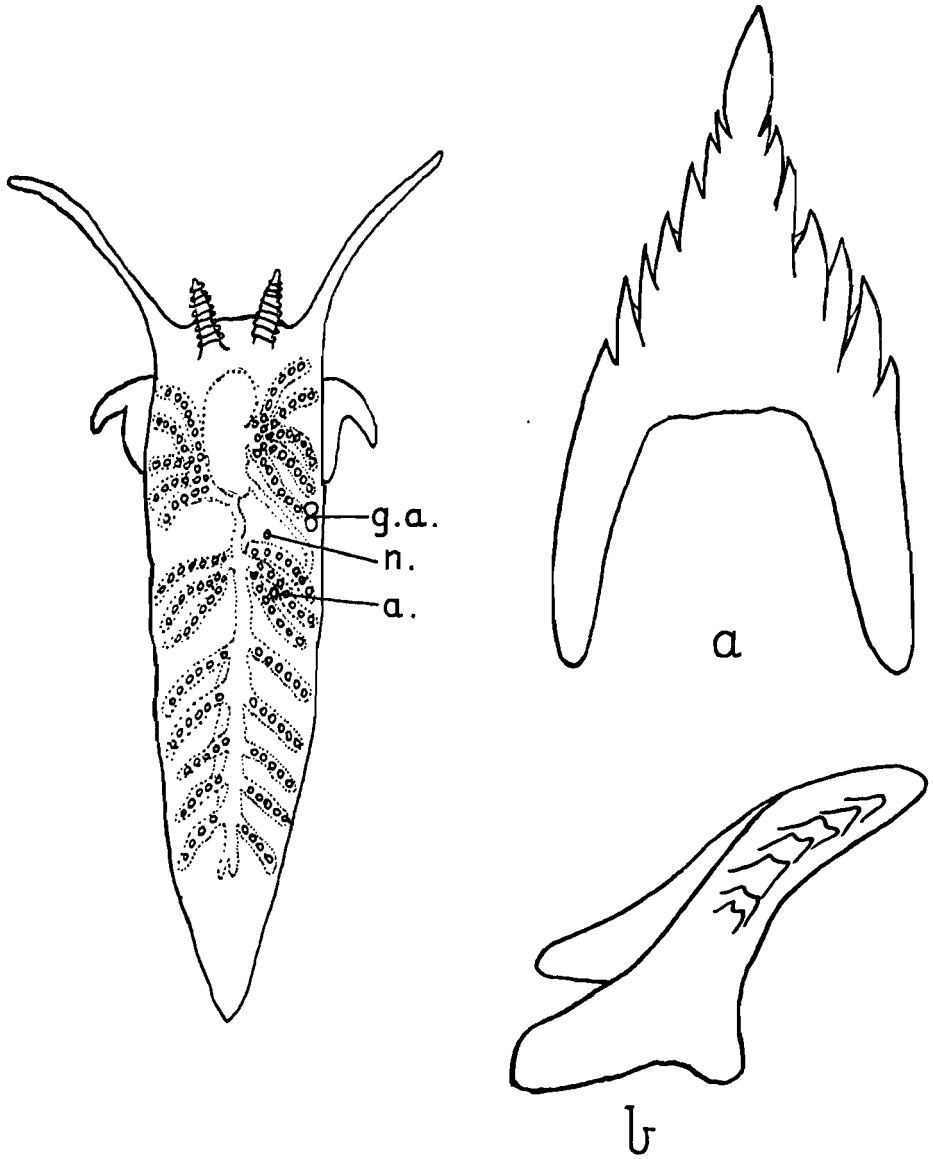
The following description amplifies Barnard's original citation. I have to thank Dr. Barnard for putting at my disposal two specimens from the original type material, and for permitting me to dissect them. The species has not been found since the type material was collected off Saldanha Bay and on the shore of Dassen Island early this century.

The general appearance of the animals is that of a typical *Facelina*. The oral tentacles are long and the rhinophores are perfoliate with a large number of leaf-like expansions more or less incomplete behind. The anterior edges of the foot are prolonged into tentaculiform processes, each of which is grooved along its ventral surface. The foot is broad, as broad as the body in the preserved specimens. The tail is short and broad.

There are numerous rows in the right liver, 14 in one specimen and 15 in the other ; they are directed obliquely backward in the preserved specimens. The anterior branch of the left liver has a similar number of rows and balances the right liver. The posterior branch of the left liver bears a large number of groups with thickly arranged cerata. There are 7 rows in the adanal group, 9 in that next behind, and the remaining 16 or so rows emerge singly from the central canal. All these posterior rows are directed obliquely backward, and all are inserted on cushions slightly elevated above the general body surface, but this may be an accident of preservation. The anus lies between the fourth and fifth rows of the adanal group, and is deep whithin this bay. The nephroproct lies in front of the adanal group near the ventral end of the first row. The genital openings are in the interhepatic space, just behind the last row of the right liver. In both specimens available the penis was exserted, a condition also shown in Barnard's figure.

The radula bears 30 teeth, each of which (text-fig. 8) is narrow and horseshoe-shaped and high in proportion to its width. There are 7–9 lateral denticles on either side of the prominent cusp. Many of the teeth show a marked asymmetry, this is shown by both Barnard's and my figures. The jaws show no peculiarities.

TEXT-FIGS. 7, 8.



Facelina annulata n. sp. 7, " liver " system ; *Facelina faurei* Barnard, 8, *a* radula tooth from above, *b* from the side.

The arrangement of the organs in the genital mass (text-fig. 9) is typically *Facelinid* in its simplicity. The ampulla is of moderate length and coiled in a circle. The distal portion of the hermaphrodite duct is longer than usual and bent at right angles just before it divides. The vas deferens has a narrow proximal portion and a very much longer glandular portion which leads directly to the penis. The spermatheca is club-shaped, bent on itself, and has a short duct leading into the oviduct.

The penis (text-fig. 10) is most bizarre. It is very short and has a large foliaceous and scoop-shaped glans, the handle of the scoop being round the opening of the vas deferens. The edge of the scoop bears a number of flask-shaped glands which extend without interruption all round the edge. Each opens by a pore at the tip. Two groups of longer sausage-shaped glands are associated with the penis and spring from its base. In one specimen there are two in the anterior group and five in the posterior group ; in the other there are one in the anterior group and six in the posterior group, and these six are inserted finger-like along a ridge of tissue alongside the glans. Each of these, also, has a pore at the tip. On first examination it was thought that one of the largest of these might be the true penis, but on dissection it was found that a guarded bristle which was passed into the vas deferens emerged through an opening at the base of the scoop-like glans. The whole of this remarkable arrangement is quite low, and the actual opening of the vas deferens is scarcely if at all elevated above the general body surface. The seven long glands are approximately as long as the longer cerata, as will be seen if reference be made to Barnard's figure.

The opening of the vagina lies immediately beneath the opening of the vas deferens and is separated from it by a fold of skin.

In spite of the peculiarity of its penis there seems to be no doubt that this is a *Facelina*, and in fact the form of the penis seems to take to an extreme the condition described by Vayssière (1888) for *F. marioni*. (*cf.* footnote p. 11.)

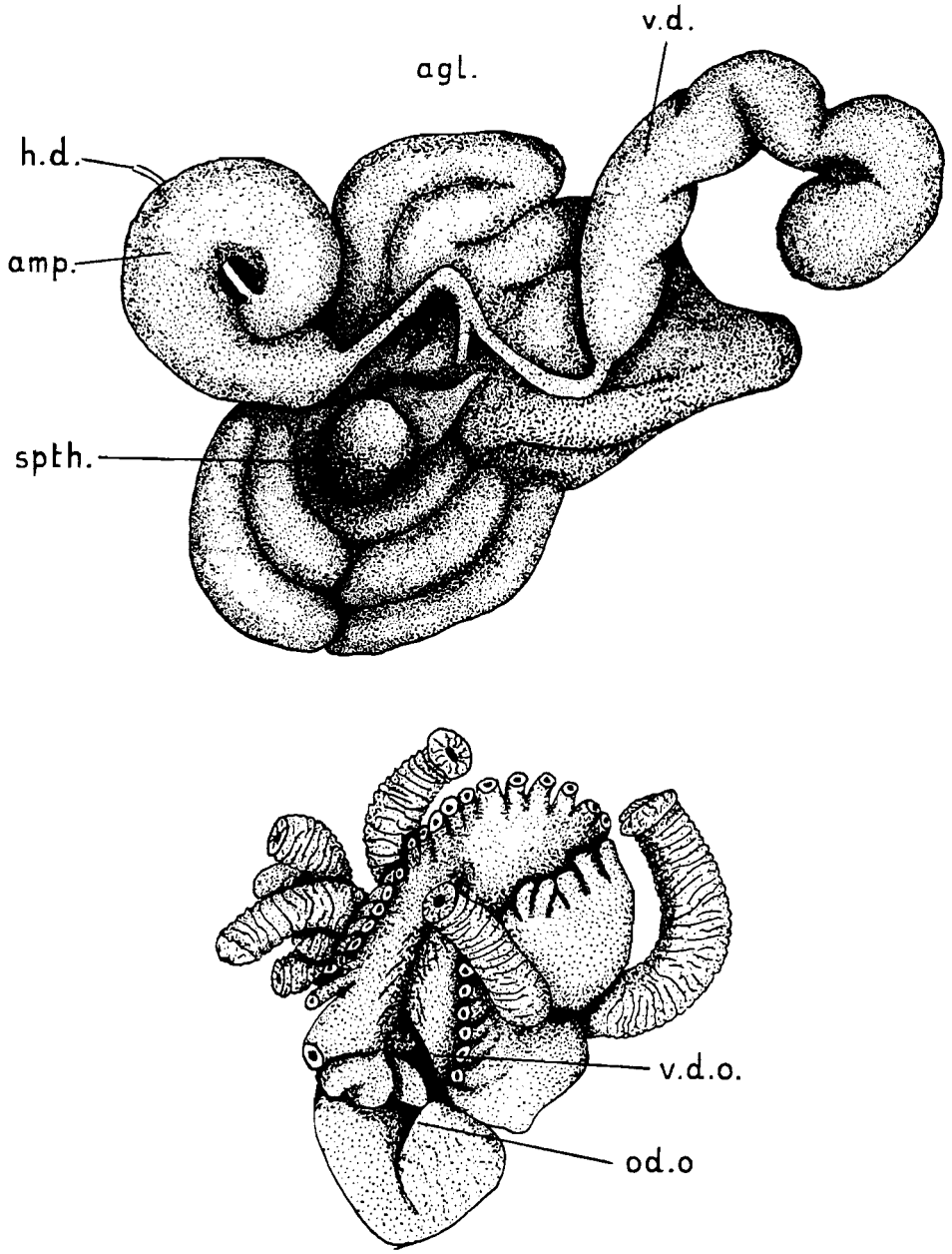
Genus *Favorinus* M. E. Gray, 1850.

Favorinus : Gray, M. E., 1850, vol. 4, p. 109 ; Alder, J., and Hancock, A., 1855, supplement p. xxii ; Bergh, R., 1876, p. 640 ; Trinchese, S., 1881, p. 67 ; Bergh, R., 1878, p. 822 ; Bergh, R., 1879, p. 565 ; Bergh, R., 1882, p. 49 ; Bergh, R., 1885, p. 39 ; Vayssière, A., 1888, p. 75 ; Eliot, C., 1910, p. 172 ; Thiele, J., 1931, p. 457 ; Odhner, N. H., 1939, pp. 53, 77.

Although the original citation of this generic name is rather scanty and refers to no character which would be recognized as generic to-day, yet the name has validity because a well-known species was designated as type. This is *Eolis alba* of Alder and Hancock, a species which Iredale and O'Donoghue (1923) renamed *F. albidus*, and which Odhner (1939) has identified with the species *Doris branchialis* Muller, 1806 ('Zool. Dan.,' ed. 3, vol. 4, 1806, p. 33).

I have to thank Dr. W. J. Rees of the British Museum (Natural History) for looking up the original citation for me. Mrs. Gray characterized the genus

TEXT-FIGS. 9, 10.



Facelina faurei Barnard. 9, genital mass ; 10, penis and associated structures.

as possessing " tentacula with a single sub-terminal fold ; labial feelers elongate ; gills in tufts ; front of foot subulate." These points are not sufficient to define the genus exactly. Alder and Hancock add to this definition a comment that the anterior groups of cerata are in double rows, and that the teeth possess a single smooth spine. Neither Bergh in any of his several papers nor Eliot (1910) add to this definition. Odhner (1939), while comparing the genus with *Facelina*, points out the chief generic characters, which may be stated as follows :

The members of this genus are cleioproct forms with the right liver and the more anterior branches of the left liver in the form of arches ; with usually smooth rhinophores ; with the anterior corners of the foot produced into tentaculiform processes ; with the radula uniseriate, each tooth with a central cusp which is very prominent and has tiny serrations along its edges and no lateral denticles ; with a short conical, unarmed penis ; with the nephroproct dorsal in front of the anterior limb of the adanal liver group.

From *Godiva* this genus may be distinguished by the form of the radula teeth and by the form of the penis. From *Cratena* it may be distinguished by the form of the radula teeth and by the generally simpler form of the liver branching shown by *Cratena*.

Favorinus horridus n. sp. Text-figs. 11–13 ; Pl. I, fig. 4.

This species is common crawling over weed and rocks just below low water mark on the shores of False Bay some half mile south of Kalk Bay harbour. Several specimens have also been found crawling on the tests of *Pyura* dredged in the mouth of Fish Hoek Bay. One specimen was found on the shores of Algoa Bay at " Flat Rocks " about a mile beyond Humewood.

They are large and rather stout animals. When fully extended a large specimen may reach 40 mm., but the usual length is 25–35 mm. The tail is quite long and strongly prehensile. The oral tentacles are long and slender, and the rhinophores a little shorter and quite smooth with rounded tips. The anterior edges of the foot are prolonged into tentaculiform processes, which may be short or quite long and slender. The foot is narrower than the body. The cerata are very long and slender, sub-cylindrical and slightly tapering towards the tips. When the animals are disturbed the cerata bristle and are directed forward over the head. The specific name *horridus*, is given in allusion to this habit. The cerata are grouped in 8–9 bunches, all except the most posterior being arched. The cerata are cast off on the slightest disturbance and writhe for some time after separation from the animal. The genital openings lie beneath and slightly in front of the anterior limb of the right liver arch.

The general body colour (Pl. I, fig. 4) is translucent white. An opaque bluish-white line runs down the middle of the back from between the oral

tentacles to the tip of the tail. A pink flush extends over the surface of the back, and behind the pericardium it becomes intensified to a deep reddish pink, which extends to the end of the back but does not pass on to the surface of the tail. A small crescent of the same colour lies on either side of the dorsal surface of the head just in front of the rhinophores. The cerata are iridescent blue and lilac and contain a chocolate-coloured extension of the digestive gland, which shining through the blue and lilac gives a reddish-purple appearance to the cerata. The oral tentacles and rhinophores have the same translucent white colour possessed by the rest of the body, and are unadorned by any other colour. There is some variation in depth of colour and pale specimens are not uncommon.

The liver system (text-fig. 11) is typical of this genus (cf. Odhner, 1939, p. 78). The branches of the right liver form an arch in which the cerata are inserted in two rows, the cerata of one row alternating with those of the other. A similar arch of the left liver balances the right liver. The posterior section of the left liver bears 6–8 branches, but only the more anterior ones are regularly arched. Towards the rear the posterior limb of each arch may become shorter, giving an irregular arch, and the most posterior branches are simple and unarched. The anus lies deeply within the first posterior arch of the left liver on the right side, and the nephroproct lies just in front of this group about the level of the middle of the anterior limb of the arch.

The radula has 19–23 teeth, each of which (text-fig. 12) is narrow and highly arched. The median cusp is strong and has a number of small serrations along its upper (and outer) edges, but there are no lateral denticles. The jaws are not strongly developed and the masticatory process is smooth.

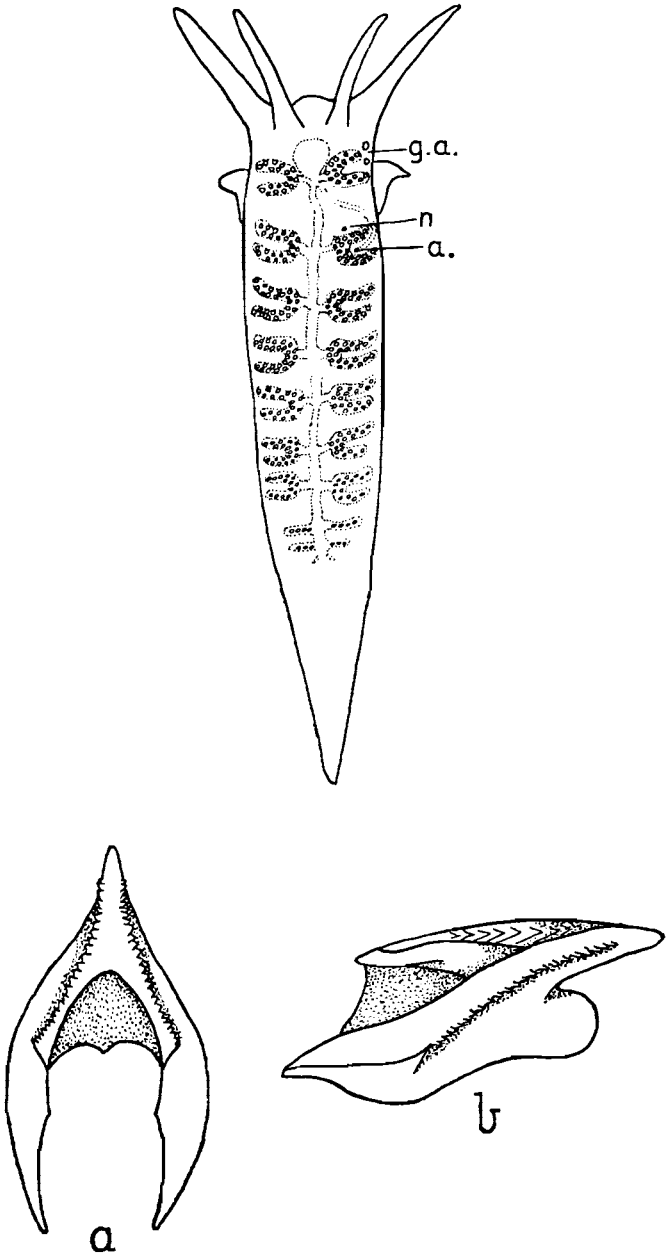
The genital organs (text-fig. 13) have the typical Facelinid facies. The hermaphrodite duct is rather longer than usual and coils within the genital mass before swelling into the ampulla, which is long and coiled. The distal portion of the hermaphrodite duct is very short. The vas deferens is glandular throughout its length. The penis is short and conical and has no associated glands. The spermatheca has a moderately long duct which enters the oviduct near its origin. The spermatheca lies partially beneath the ampulla, and both lie between the mucous and albumen glands ; the former has to be displaced to display them.

The egg ribbon is flattened, and attached along its edge and roughly in a spiral. Each pocket in the ribbon contains up to three eggs. More than this were never found, although counts were made on several occasions. The eggs are quite large.

Genus *Godiva* n. genus.

As I have already mentioned this genus is proposed to include those species, formerly included in the genus *Hervia*, which have two or more rows of cerata in each arch of the liver. These are : *H. rosea* Bergh, 1888, *H. ceylonica*

TEXT-FIGS. 11, 12.

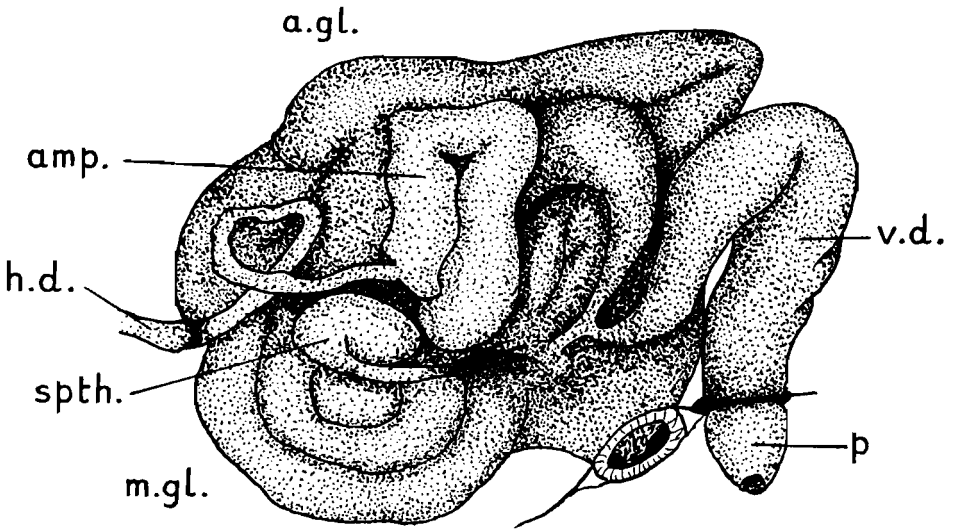


Favorinus horridus n. sp. 11, " liver " system ; 12, radula tooth, *a* from above, *b* from the side.

Farran, 1905, *H. japonica* Baba, 1937 (= *Rizzolia modesta* Bergh, 1880), *H. emurai* Baba, 1927, and *H. quadricolor* Barnard, 1927. Reasons have been given why these species are distinct from *Facelina* with which *Hervia* is synonymous, and from *Cratena* to which some other species of *Hervia* belong. The species *H. japonica* Baba will revert to its original specific name after inclusion in the new genus ; it will then become *Godiva modesta* (Bergh).

The complexity of the arrangement of the liver arches and the shape of the rhinophores, which are either simple or wrinkled, neither distinctly annulate nor perfoliate, are characteristics which distinguish this genus from the other

TEXT-FIG. 13.



Favorinus horridus n. sp. Genital mass.

genera of the Favorininæ. The genus *Echinopsole* proposed below seems to be closely allied ; the form of the liver horse shoes is similar in the two genera, but *Echinopsole* has annulated rhinophores and a peculiar and characteristic armature of the glans penis.

The species designated as type of the genus is *Godiva quadricolor* (Barnard, 1927). The others are included provisionally until further examination decides whether the differences which separate them from the type are generic or merely specific. The definition of the new genus is as follows :

Cleioproct Eolidacea with the majority of the liver branches in the form of horse-shoes or arches, in which the cerata are inserted in two or more series : with smooth rhinophores and with the anterior corners of the foot produced into tentaculiform processes ; with the radula uniseriate, of which the

teeth have a prominent cusp and strong lateral denticles ; with the penis of moderate length, armed with a single terminal hook or unarmed.

Godiva quadricolor (Barnard). Text-figs. 14–16.

Hervia quadricolor Barnard, 1927, p. 203, pl. xx, figs, 9 and 10.

Specimens of this species are very common in Kalk Bay swimming-pool and have been found there at all seasons. They have also been found under stones on the shores of False Bay at several localities between St. James and Millers Point, and they have been dredged among *Pyura* in the entrance to Fish Hoek Bay. Two specimens have been found near Port Elizabeth, one of normal colour at Schoenmakers Kop, and one very pale specimen among *Zostera* in the Zwartkops River estuary. Specimens have also been found at Richmond on the coast of the Alexandria Division of the Eastern Cape.

The colour of the animals is more variable than Barnard's description would suggest, but the variation is not so much in the colours themselves as in their extent, and this is particularly so on the cerata. The four bands of colour, which give the animal its name, are very variable in distribution, and one or more of them may be reduced to a vestige or absent altogether. As mentioned above, one very pale specimen was found, but apart from its coloration it did not differ in any other way from typical specimens.

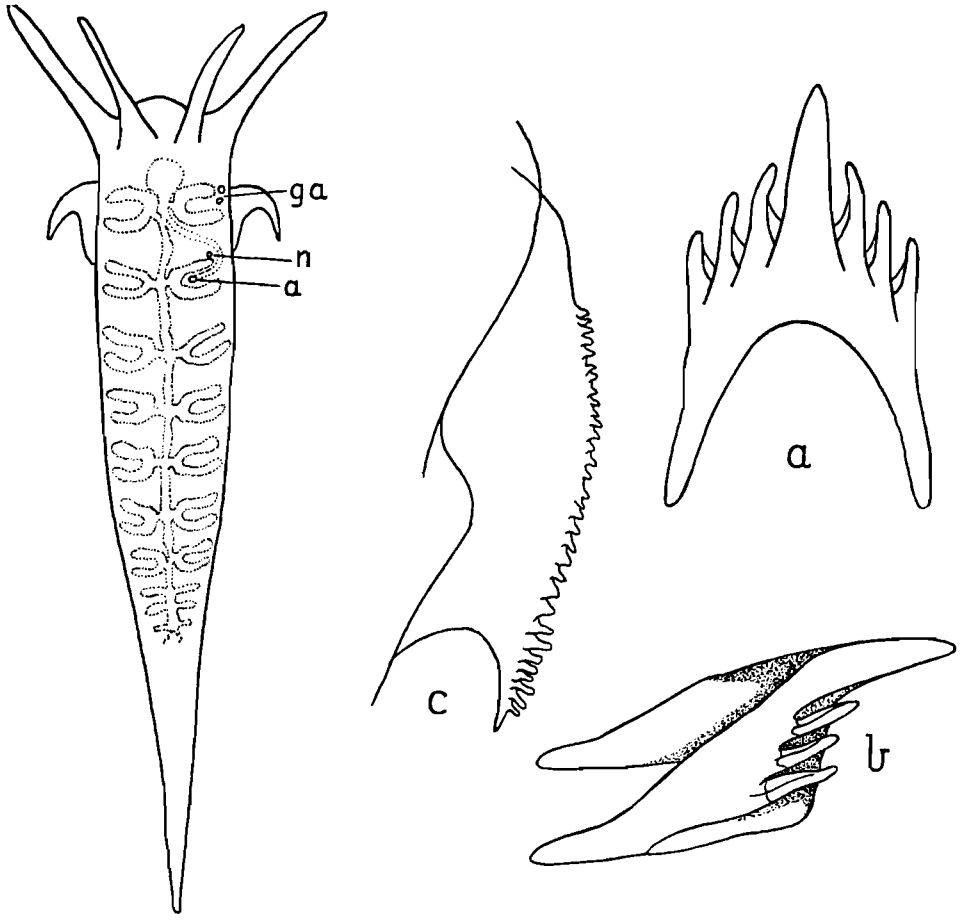
The branches of the digestive gland (text-fig. 14) are all more or less symmetrically arched, but as is usual in such forms the posterior groups are simple. The cerata are thickly clustered in each group, and in the anterior groups there may be as many as six or eight rows in each limb of the arch. The more dorsally inserted cerata are long and slender and slightly club-shaped ; they are shed freely on disturbance. The more ventrally placed cerata are more abundant than those more dorsally placed, and much smaller—they are closer to the region of proliferation. The anus lies in the cleioproct position and the nephroproct lies just in front of the adanal group towards its ventral edge.

The radula has 26–30 teeth. Each (text-fig. 15) is horse-shoe shaped with a strong and prominent cusp and three or occasionally four lateral denticles. The jaw is well developed and strong, with a long masticatory edge which bears 26–46 teeth of variable size, spacing and form. The text-figure 15c shows one with a small number of denticulations.

The genital mass (text-fig. 16) shows the typical Facelinid facies. The ampulla of the hermaphrodite duct is long and coiled proximally, with a straight distal portion which runs directly between the mucous and albumen glands to the division at the base of the vas deferens. There is only a very short, narrow distal portion of the hermaphrodite duct. The vas deferens is short, thick and glandular throughout its length. The penis is of moderate length, rather almond-shaped with a clear golden chitinous spine sheathing its tip, and at the base of this spine the vas deferens opens. The spermatheca

is bulbous, connected by a long and very narrow duct to the oviduct near its origin from the hermaphrodite duct. Most of the ampulla and all of the spermatheca are hidden beneath the mucous gland, which has to be displaced

TEXT-FIGS. 14, 15.



Godiva quadricolor (Barnard). 14, " liver " system ; 15, radula tooth, *a* from above, *b* from the side, *c* masticating edge of the jaw.

to see their relations. The genital openings lie beneath and slightly behind the anterior limb of the right liver arch.

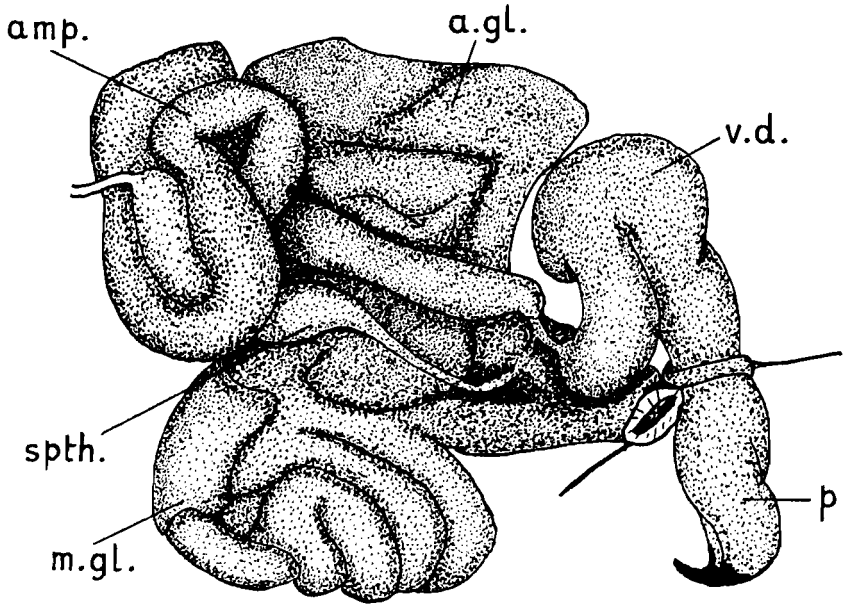
As Barnard points out, there is very close agreement between this species and the description of *Rizzolia australis* Bergh, 1884, from Port Jackson, New South Wales. Barnard mentions the close resemblance of the radula teeth and jaw plates, but there is also agreement in the thickly clustered

cerata in the arches, in the clear golden tip to the penis and in the position of the genital apertures. These are certainly congeneric and may well be conspecific, but until another specimen of *G. australis* turns up it may be wisest to retain them as separate species.

Genus *Echinopsole* n. genus.

When the specimen on which this genus is based was first examined it was thought that it should be included in the genus *Acanthopsole* Trinchese, 1874. It cannot, however, be included in this genus, which has a right liver con-

TEXT-FIG. 16.



Godiva quadricolor (Barnard). Genital mass.

taining three or more branches, because its right liver is arched. Thus while *Acanthopsole* falls within the sub-family Facelininæ, my specimen falls within the scope of the Favorininæ. The armature of the penis is also distinct from that of *Acanthopsole* ; this genus has a single row of strong hooks round the glans, while in the South African specimen the glans is beset with a multiplicity of tiny spines. No genus of the Favorininæ which has yet been described possesses such a penial armature, nor do any others possess a similar set of glands associated with the penis.

This specimen will, then, form the type of a new genus, characterized as follows : Cleioproct Eolidacea with the right liver and the more anterior

branches of the left liver in the form of arches in which the cerata are inserted in more than one row ; with annulated rhinophores, and with the anterior corners of the foot produced into tentaculiform processes ; with the radula uniseriate, each tooth with a prominent central cusp and lateral denticles ; with an elongated finger-like penis, the glans of which is irregularly beset with a multiplicity of tiny spines.

This genus has a form of liver branching similar to that shown by *Godiva*. From this genus it may be distinguished by the annulated rhinophores and by the peculiar armature of the penis. It is highly unlikely that it would be confused with any other genus.

Echinopsole fulvus n. sp. Text-figs. 17–19 ; Pl. II, fig. 1.

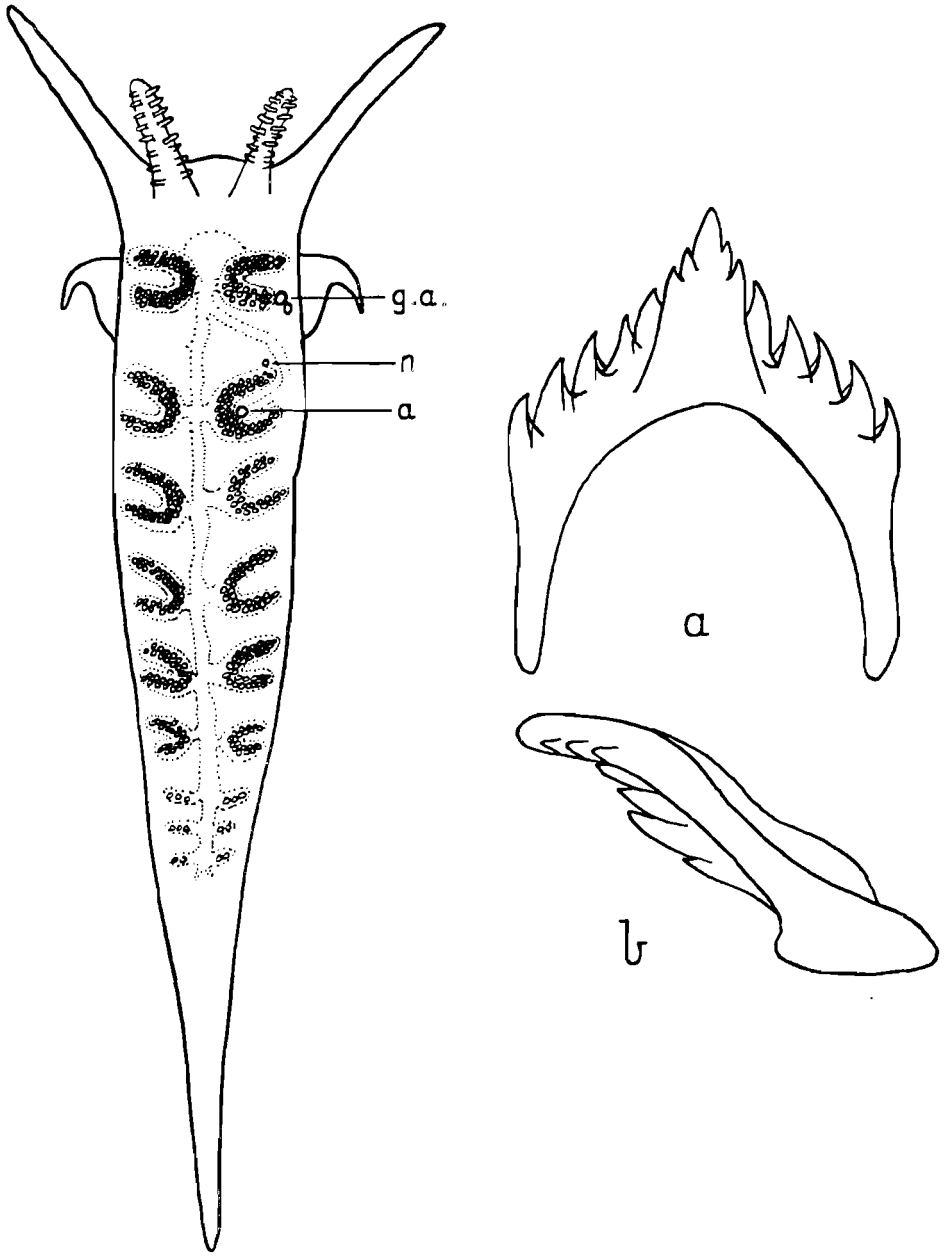
A single specimen was found under a stone below the swimming pool at Dalebrook, False Bay, Cape Peninsula, in February, 1951.

The body is elongate and slender (14 mm. long by 3 mm. broad by 3 mm. high ; of the length 4 mm. is tail). The oral tentacles are long and highly mobile ; the rhinophores are short, stoutish, tapering and annulate, girdled by eight rings incomplete posteriorly. The anterior edges of the foot are very slightly produced into tentaculform processes. The cerata are long, spindle-shaped, and arranged in multiple series in arches. When the animal was disturbed the cerata were bunched up, directed forwards and kept in shivering motion for a few seconds. The genital openings lie immediately below the posterior limb of the arch of the right liver. The anus is cleioproct, and lies deep within the arch of the adanal group of cerata. The nephroproct lies just outside this group at its lowest tip. The branches of the digestive gland (text-fig. 17) are evenly arched, except towards the rear, where they are simple. Within each group the cerata are thickly clustered in up to four series.

The general body colour (Pl. II, fig. 1) is a translucent creamy white with patches of ochreous yellow, overlaid by dots of opaque white. The dorsal surface of the head between the bases of the oral tentacles is pale cream, intensified in front to the ochreous yellow, which covers the back. Just dorsally to the bases of the rhinophores lie a pair of deeper ochreous patches and these are separated by a cream-coloured line. An interrupted line of opaque white runs along the axis of the tail. The cerata are translucent white overlain with ochreous yellow, and the dark greenish-brown contents of the digestive gland shine through, giving them a drab look. There is a marked resemblance in colour to *Facelina olivacea*.

The radula is short, and bears 13 teeth of a peculiar and characteristic appearance. Each tooth (text-fig. 18) is broadly horse-shoe-shaped. There is a prominent central cusp which bears three denticles on each side, and in addition there are four quite strong lateral denticles. The jaws are simple, and the masticatory edge bears a series of about 20 irregularly spaced teeth,

TEXT-FIGS. 17, 18.

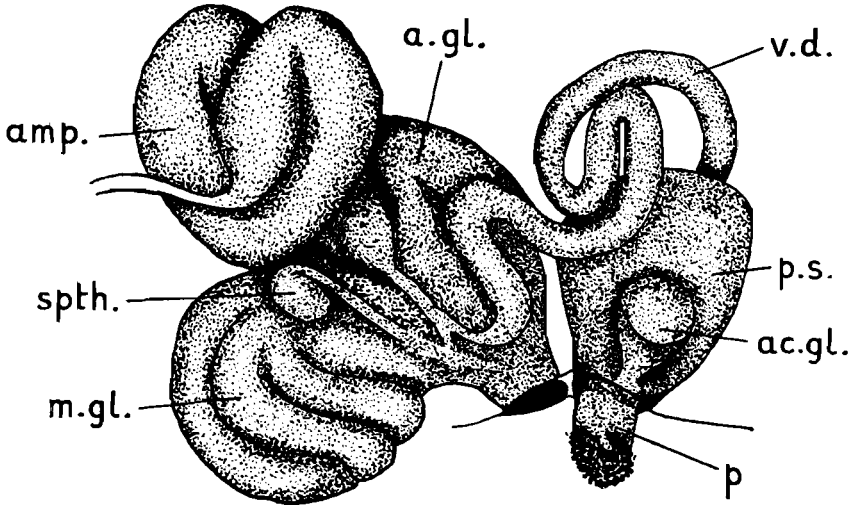


Echinopsole fulvus n. sp. 17, " liver " system ; 18, radula tooth, *a* from above, *b* from the side.

of which the more distal ones are longer and narrower than the more proximal ones.

The reproductive organs (text-fig. 19) have the typical Facelinid facies. The ampulla of the hermaphrodite duct is long and coiled, and its distal portion lies embedded between the mucous and albumen glands. Its connection with the vas deferens and oviduct is straight, narrow and of moderate length. The vas deferens is glandular throughout its length, but is narrower in comparison

TEXT-FIG. 19.



Echinopsole fulvus n. sp. Genital mass.

with several other Facelinids. The penis is long, but not so long as in *Facelina olivacea* described above. The penis sheath is bulbous, and a single accessory gland enters it just within the external opening. The glans penis is armed with a broad band of tiny chitinous spines arranged like a belt round the mouth of the vas deferens. The spermatheca is small and partially hidden beneath the ampulla ; it has a fairly short duct leading directly to the oviduct.

Genus *Cratena* Bergh, 1864.

Cratena : Bergh, R., 1864, p. 198, 213 ; *Rizzolia :* Trinchese, S., 1877, p. 1 ; *Cratena :* Bergh, 1864 ; Winckworth, R., 1941, p. 146 ; Odhner, N. H., 1943, p. 22.

As has been pointed out by Winckworth (1941), this generic name has precedence over *Rizzolia* Trinchese, 1877, for the same species was designated as type species of the two genera. Eliot (1904) commented that he could see no difference between the genera *Hervia* Bergh, 1871, and *Rizzolia*, and Barnard (1927) united the two genera but gives no reasons for so doing. Baba

(1937) also united the two genera but made them sub-genera of *Cuthona*—a mistake which he has since corrected (1949). I agree that there is no reason for keeping separate from *Cratena* some of the species of *Hervia*, but as has been shown above, this name has frequently been mis-applied. Those species which seem to me to fall within the scope of *Cratena* have been mentioned above, and they are listed here without comment. They are: *C. lineata* (Eliot, 1904), and *C. berghii* (Vayssière, 1888). Also as pointed out above, *H. serrata* Baba, 1949, may be a *Favorinus* or it may be included here; in order to be certain one would have to know the form and structure of the penis, which Baba neglects to mention.

As mentioned above, I do not consider that all the forms previously inclu ded in the genus *Hervia* which are members of the Favorininæ can be included in the genus *Cratena*, for in order to include them the definition of this genus would have to be very wide and allow of considerable variation. Similarly not all species included within *Rizzolia* can be identified with *Cratena*. Mention has already been made of *R. australis* Bergh, 1884, which is a *Godiva*. For these reasons a definition of the genus *Cratena* as restricted to the type species and those listed above, and including the species *C. capensis* Barnard, 1927, will read: Cleioproct Eolidacea with the anterior liver groups in the form of arches; with the nephroproct in front of the adanal group of cerata; with smooth tentacles and usually smooth rhinophores; with the anterior corners of the foot rounded or produced into tentaculiform processes; having a uniseriate radula of which the teeth are horse-shoe-shaped with a prominent central cusp and strong lateral denticles; having the penis unarmed and with associated glands.

Cratena capensis Barnard, 1927. Text-figs. 20–22; Pl. II, fig. 2.

Cratena capensis: Barnard, K. H., 1927, p. 204, pl. xx, fig. 8.

The description which follows amplifies Barnard's original description.

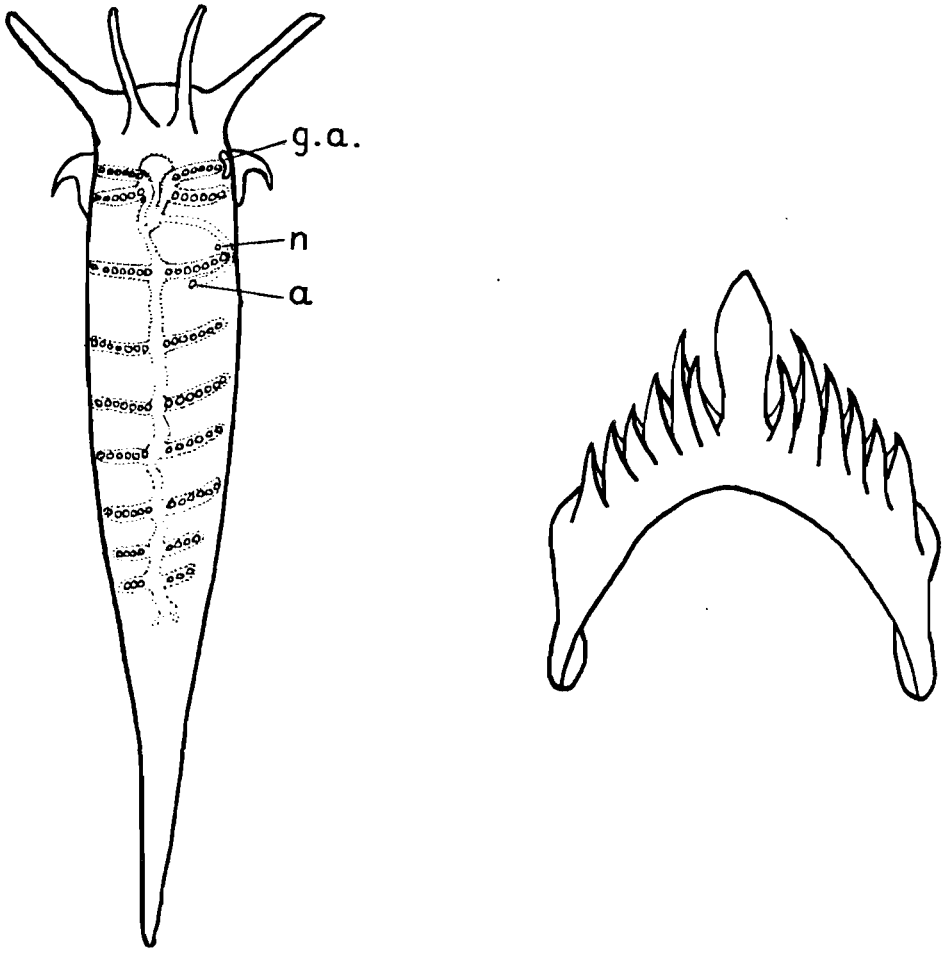
Specimens have been collected at Saldanha Bay, on both shores of the Cape Peninsula, at Hermanus, at Port Elizabeth and at Kleinemonde some 10 miles east of Port Alfred.

When large specimens are fully extended their length may reach 30 mm., although the average is much less. Of this length fully one-third is tail. The animals are very slender in proportion to their length. The oral tentacles are long, simple and highly mobile. The rhinophores are smooth, shorter and stouter than the tentacles. The eyes are conspicuous as black dots at the base of the rhinophores. The anterior edges of the foot may or may not be very slightly produced but are never extended into tentaculiform processes. The foot is narrower than the body.

The general body colouring is a translucent white. In specimens from Kleinemonde there is a peppering of dark brown spots along the mid-dorsal line and

sides, over the entire surface of the tail and extending up the rhinophores and oral tentacles, almost to the tips, which remain unspotted (Pl. II, fig. 2). This peppering is much less heavy on specimens from the Cape Peninsula and Saldanha Bay, and is completely absent from several specimens, including one

TEXT-FIGS. 20, 21.



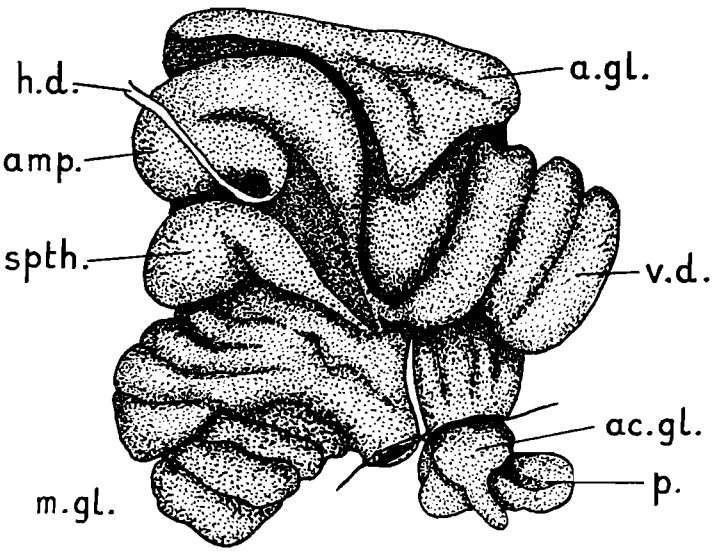
Cratena capensis Barnard. 20, " liver " system ; 21, radula tooth.

from near Port Elizabeth. Opaque white spots are peppered more lightly over the oral tentacles, rhinophores and cerata, and often very thickly toward the tips of the cerata. There is an orange-yellow patch of variable extent and depth of colour on each side between the tentacles and rhinophores, and in specimens from Kleinemonde this patch is edged dorsally by a zone of dark

brown spots. Barnard suggests that this patch may be due to the jaws shining through, but this is not so. The cerata are a dull brick red or indian red (Barnard's description) with opaque white spots and usually clear white tips, above a zone of thickly peppered opaque white spots.

The right lobe of the digestive gland is arched (text-fig. 20), with equal limbs and 6–12 cerata in a single row in each limb. The most anterior branch of the left liver is also arched and has a similar number of cerata in it. The remaining posterior branches of the left liver are all simple and bear single

TEXT-FIG. 22.



Cratena capensis Barnard. Genital mass.

rows of cerata, decreasing in number posteriorly. The most anterior branch of the posterior liver on both sides of the body has a tiny diverticulum, which in the largest specimens examined and dissected bears one or two cerata and thus represents the posterior limb of the arch. The genital openings lie immediately beneath the most anterior row on the right. The anus lies immediately behind the third ceras from the dorsal end of the adanal row, which may be bent forward a little to accommodate the anus. The nephroproct lies in front of the base of the adanal row.

The radula has usually 23–25 teeth, though only 15 were present in Barnard's type specimen. Each tooth is arched with a prominent cusp and 5–7 lateral denticles (text-fig. 21). The masticatory process of the jaw has a single row of denticles irregularly spaced along its inner margin.

The arrangement of the genital organs (text-fig. 22) is of the simple Face-

linid facies. The vas deferens is much coiled, of moderate length and glandular throughout. The penis is short and unarmed, and when exserted a small club-shaped gland is exserted also at its base. The head of the club is attached to the base of the penis and the handle of the club is free. The spermatheca is moderately large and club-shaped with a short duct leading to the oviduct.

Genus *Amanda* n. genus.

The specimens to be described below differ from all other members of the Favorininæ in so many particulars that they cannot be fitted into any of the known genera. It is proposed to create the genus *Amanda* to include them. The diagnosis of the genus is as follows : Cleioproct Eolidacea with the nephroproct in front of the adanal liver group, in which the radula is uniseriate with teeth which are broadly horse-shoe-shaped with a very prominent cusp and strong lateral denticles ; having the jaw process denticulated ; with annulated rhinophores and the anterior corners of the foot rounded ; having most of the liver branches in the form of arches ; having the penis long, without associated glands and with the glans armed with a single ring of strong hooks.

The form of the liver indicates that the genus is close to *Favorinus* and *Cratena*, but it can be distinguished from both of these by the annulated rhinophores and by the peculiar armature of the penis. The bulbous form of the vagina may also be generic. The genus *Zatteria* Eliot, 1902, has rhinophores with similar widely spaced annulations and a similar arrangement of liver horse-shoes. However, nothing is known about the form of the genital organs, and so it is not possible to identify the South African specimens with the East African genus.

Amanda armata n. sp. Text-figs. 23–26 ; Pl. II, fig. 3.

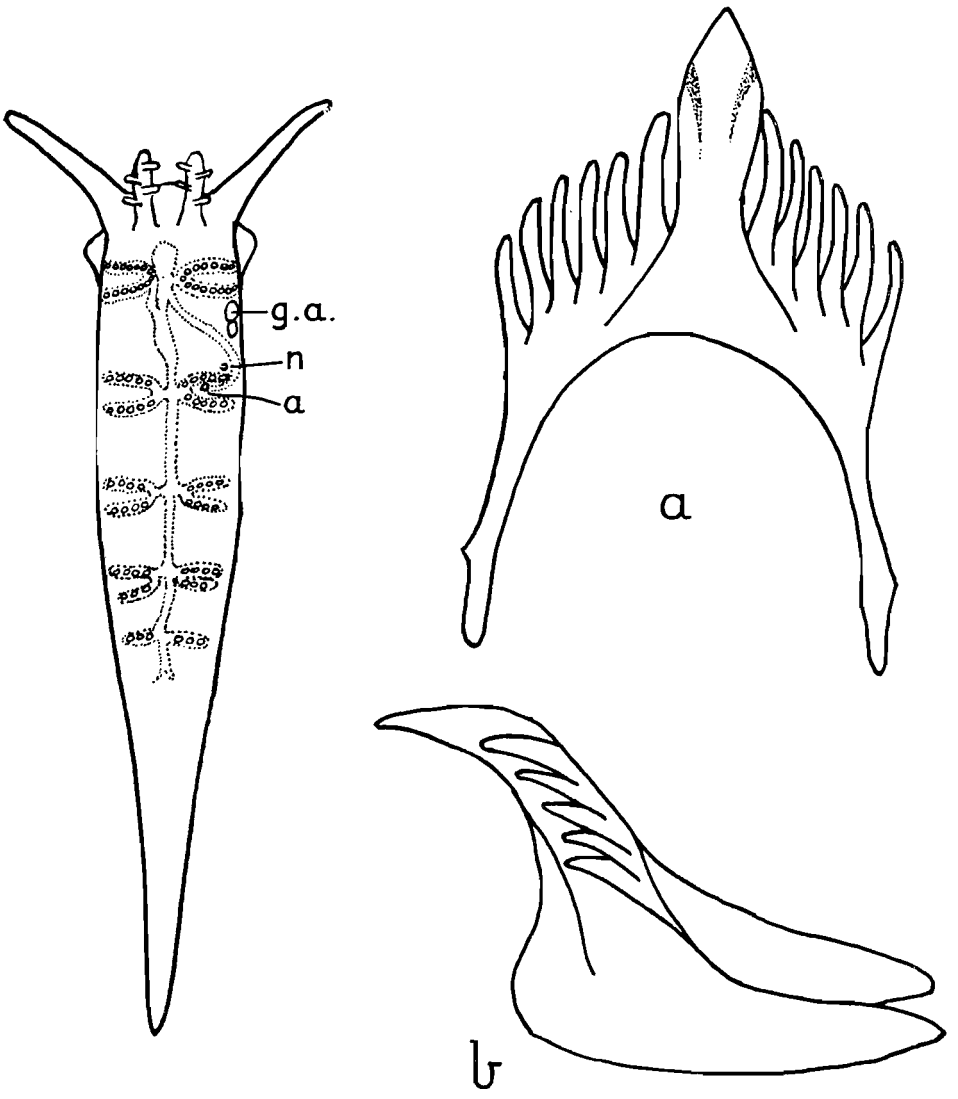
Numerous specimens have been collected on several occasions and at all seasons between May, 1949, and January, 1951, in a rock pool some half mile south of Kalk Bay Harbour and more rarely at other localities on the shores of False Bay.

The animals are very slender with a long tapering tail. When fully extended a large specimen may reach 30 mm., of which rather more than one-third is tail. The width of such a specimen will be about 5 mm. ; its height also is inconsiderable when compared with the length. The foot is much narrower than the body.

The tentacles are long and slender and the rhinophores shorter and quite stout, each girdled by three incomplete rings. The anterior corners of the foot are rounded. With the exception of the most posterior groups all the cerata are regularly arched (text-fig. 23). The right lobe bears one arched group

with 7 cerata in each limb. This group lies in front of the genital openings, which are in the interhepatic space, laterally rather than ventro-laterally. A similar arch occurs on the left. The posterior groups borne by the left liver are symmetrical, three groups are arched, and one, the most posterior, is

TEXT-FIGS. 23, 24.

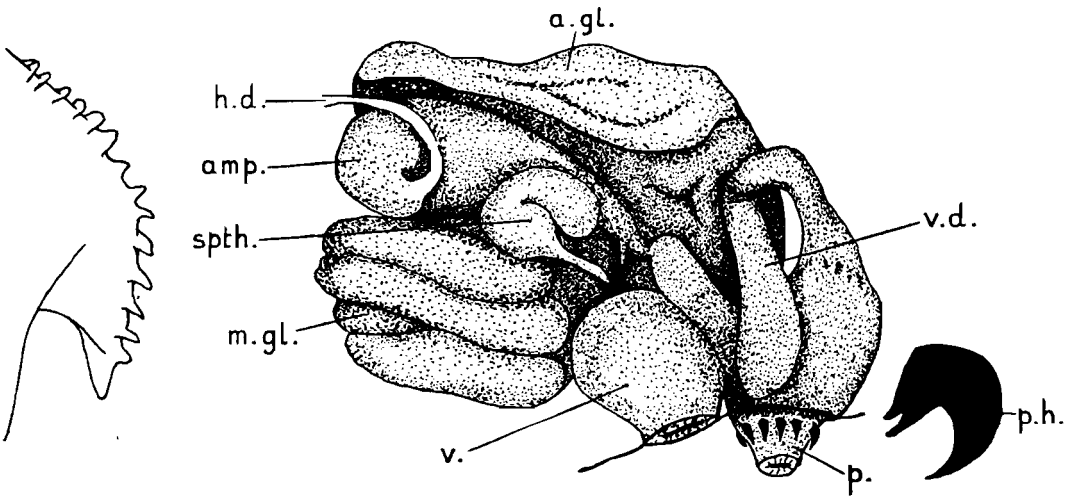


Amanda armata n. sp. 23, " liver " system ; 24, radula tooth. *a* from above, *b* from the side.

single. The number of cerata in each group decreases posteriorly. Such numbers are variable, varying with the size of the specimen. The groups are rather widely spaced. The anus lies within the first posterior arch on the right, and the nephroproct lies just outside it in front of the lower tip of the anterior limb of the arch.

The colour of the body (Pl. II, fig. 3) is translucent creamy white, with a suffusion of pale chocolate over the back which deepens between the bunches of cerata. A number of small black dots lie between, in front of and just behind the rhinophores, and there is a scattering of opaque white spots over the entire body surface. Each ceras is chestnut to chocolate in colour with opaque white spots.

TEXT-FIGS. 25, 26.



Amanda armata n. sp. 25, masticating edge of jaw ; 26, genital mass.

The radula has 16 or 17 teeth each (text-fig. 24) with a prominent cusp and five or six lateral denticles. The jaws are comparatively large, and there is a single row of widely spaced denticles along the masticatory edge (text-fig. 25).

The genital mass has the typical Facelinid facies (text-fig. 26). The ampulla is inflated, slightly coiled and quite short ; there is no narrow distal portion. The vas deferens is quite short and glandular throughout its length ; it gradually widens to pass into the penis without any abrupt change in diameter. The spermatheca is elongate, bent on itself, and has a fairly short duct which passes between the mucous and albumen glands and the former has to be lifted away to uncover the spermatheca and duct. The penis is conical and fairly long. The glans has a ring of 10 strong hooks round its middle. The vagina

is bulbous and highly muscular, perhaps a development to fit the peculiarly armed penis. This bulbous vagina may be a characteristic of the genus.

Family ÆOLIDIIDÆ.

The members of this family can be distinguished from the members of the family Facelinidæ on the basis of two characteristics: the radula teeth are pectinate, contrasting with the horse-shoe-shaped teeth of the Facelinidæ; and the anus is situated behind the first posterior liver group on the right, a position which lies further back than that occupied by the anus of Facelinids. The family Spurillidæ also possesses pectinate teeth, but they have the cerata arranged in secondarily arched rows, and also an adanal nephroproct. In the Æolidiidæ the nephroproct is usually abanal. Baba (1949) has recently described the anus as adanal in *Æ. takanosimensis*, but this would appear to be an exception to the general rule.

Odhner (1939) derives the liver system of the Æolidiids from the type of branching shown by the genus *Facelina*. He visualizes that the compound liver branches of the Facelina type have split into individual branches which have acquired direct connections with the central liver canal. This is essentially achieved in the genus *Æolidia*, and the genus *Æolidiella* shows various intermediate stages in the process. In some the right liver shows the Facelina type of branching and in others the right liver is a simple horse-shoe, although in some of these the ends of the horse-shoe may show a tendency to split into short finger-like extensions.

The family Æolidiidæ comprises three genera: *Æolidia* Cuvier, 1797, *Æolidiella* Bergh, 1867, and *Cerberilla* Bergh, 1873. These three genera can be distinguished from one another as follows:

Radula teeth regularly arched with regularly graded denticles; nephroproct postanal *Æolidia*
Radula teeth emarginated medially with regularly graded denticles; nephroproct preanal . . . . . *Æolidiella*
Radula teeth with denticles dissimilar in size and not graded . . . . *Cerberilla*

(This key is partly after Odhner (1939).)

Genus *Æolidiella* Bergh, 1867.

Bergh, R., 1867, p. 99, footnote; 1874, p. 396; Trinchese, S., 1881, p. 23; Bergh, R., 1882, p. 7; 1885, p. 22; Vayssière, A., 1888, p. 107; Bergh, R., 1892, p. 1019: 1905, p. 222; Eliot, C., 1910, p. 174; *Eolidina* Quartefages, 1843, Iredale, T., and O'Donoghue, C. H.; 1923, p. 201; *Æolidiella* Bergh, 1867, Engel, H., 1925, p. 4; Rishec, J., 1928, pp. 230, 260; *Eolidina* Quatrefages, 1843, Thiele, J., 1931, p. 459; *Æolidiella* Bergh, 1867, Odhner, N. H., 1939, p. 53, 81.

In the past there has been considerable discussion about the validity of this name, but Odhner (1939) has shown that there are very sound reasons why the name *Æolidiella* has preference over *Eolidina*.

In a revision of the genus Engel (1925) lists seven species which he considers

valid. Since that time two others have been added. The list of species is as follows :

Æolidiella glauca (Alder and Hancock, 1845).
Æ. drusilla Bergh, 1900.
Æ. faustina Bergh, 1904.
Æ. occidentalis Bergh, 1867.
Æ. indica Bergh, 1890.
Æ. orientalis Bergh, 1888.
Æ. japonica Eliot, 1913.
Æ. saldanhensis Barnard, 1927.
Æ. takanosimensis Baba, 1930.

From Engel's description it appears that these species can be divided into two groups according as the right liver is many-branched or has two rows arranged in an elongate horse-shoe. To the second group belong the species *Æ. glauca* and *Æ. faustina*, and possibly also *Æ. drusilla*, for the anus lies between the fifth and sixth rows, and this number of rows anterior to the anus is inconsistent with a many-branched right liver. All the others, including the new species to be described below, have a many-branched right liver. If the anal papilla is described as lying behind the eighth row of cerata, it is highly probable that the right liver is five- or six-branched. The position of the anus is not mentioned in Barnard's description of *Æ. saldanhensis*, but his figure suggests a many-branched right liver.

Æolidiella multicolor n. sp. Text-figs. 27–29 ; Pl. II, fig. 4.

About twenty specimens of this species have been found on the shores of False Bay at Dalebrook and St. James. Most have been found under stones laying eggs and one or two crawling among weed. They have been found at all seasons, but chiefly in the summer months.

The body is elongated and slightly depressed. The average dimensions of several specimens when preserved are 20 mm. long by 5 mm. broad by 3 mm. high. When fully extended the length may reach 35 mm.

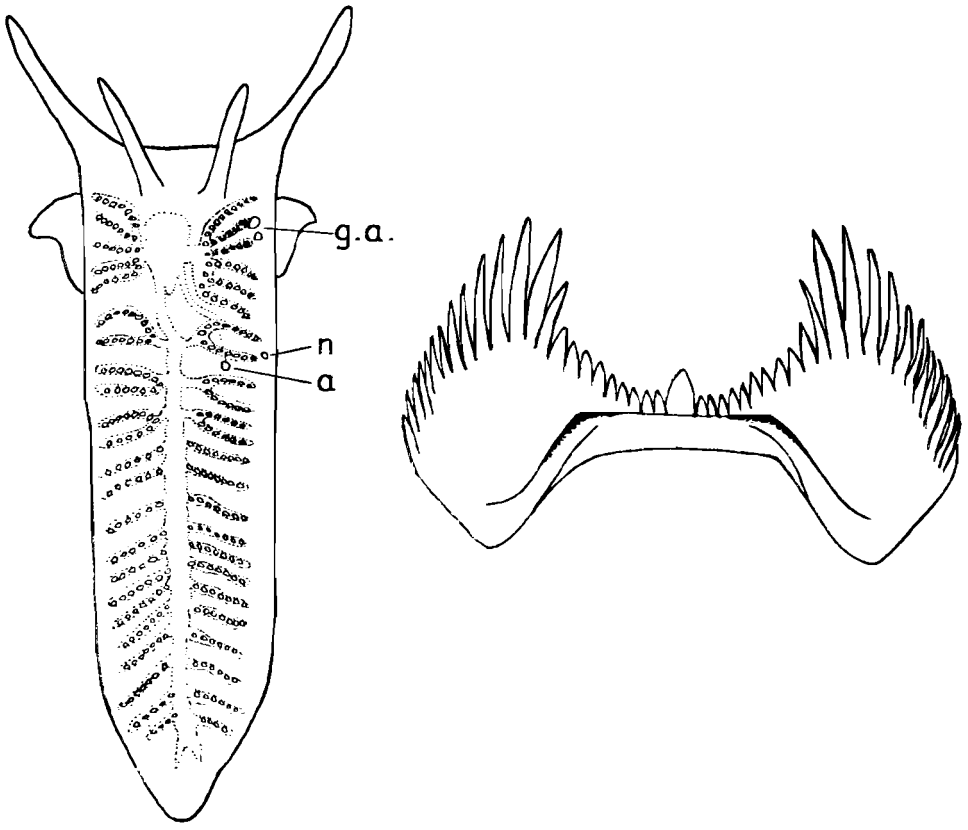
The anterior corners of the foot are prolonged into short tentacular processes. The oral tentacles are long and slender, the rhinophores short and quite smooth. The tail is very short, never more than 2 mm. long in any of the preserved specimens. The foot is wide, but narrower than the body.

The colour of this species (Pl. II, fig. 4) is very variable. The general body colour is translucent white. A dotting or a series of patches of orange extends in two lines along each side of the back between the cerata. These two lines are close together on the back, diverge round the pericardial hump, unite in front of it, diverge again, leaving a small lenticular clear space and join up between the rhinophores. Then the two lines pass outwards towards the inner edges of the bases of the oral tentacles. Each ceras has an orange base, a pruinose blue middle and an orange tip with dots of opaque white. The extent of these colours on the cerata is very variable and the blue may vary in intensity as well as extent.

The liver system (text-fig. 27) is very highly branched. The right liver

and its left partner have 6 or 7 branches all quite simple, without any crowding of the cerata towards the distal end. The genital openings, which when closed are not easily noticeable, lie close together under the third row on the right. The first three branches of the posterior lobe of the left liver have the form of elongated arches, and all the remaining 10–12 branches have their own con-

TEXT-FIGS. 27, 28.



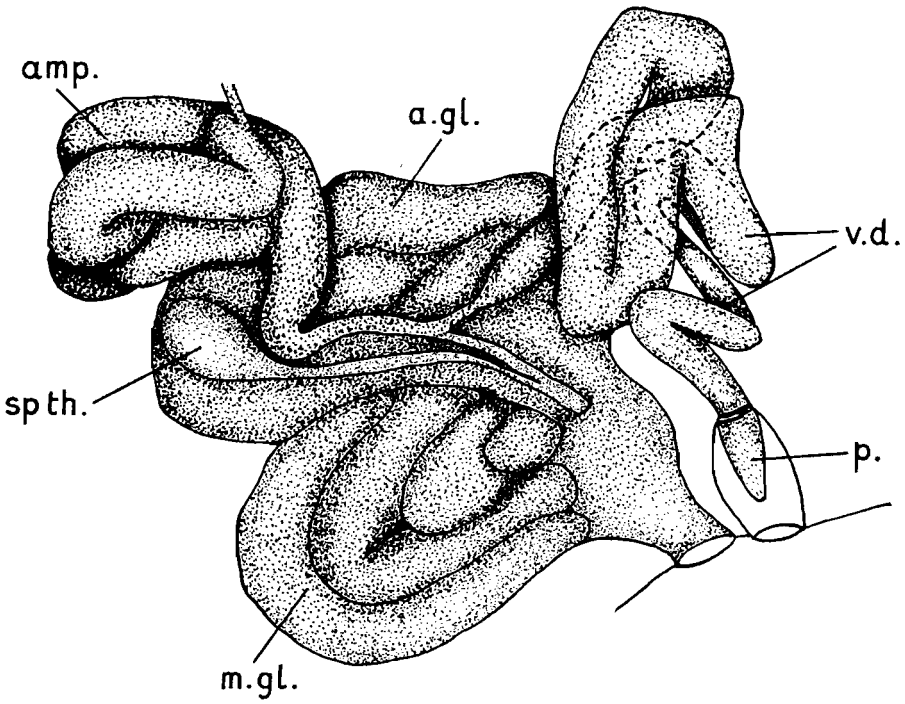
Æolidiella multicolor n. sp. 27, "liver" system; 28, radula tooth.

nections with the central canal. The cerata are densely placed in all rows. The interhepatic space is quite wide, and the spaces between the rows are very narrow except for that in which the anal papilla is situated. The proximal ends of the rows leave a wide space on the back, but the disposition of the cerata in life obscures this to a great extent. The anus lies in the space between the first and second arches of the left liver on the right side (*i.e.*, between the eighth or ninth row of cerata). The nephroproct is preanal at the distal end

of the row immediately in front of the anus and just within the space between the limbs of the first posterior group of the left liver.

The radula bears 15–19 teeth ; each (text-fig. 28) is pectinate and widely emarginated medially and with a prominent central cusp. Each wing bears 23–27 denticles, the outer ones long and tapering, with the longest denticles in the middle of each wing. These teeth are very closely similar to the illustration which Barnard (1927) gives of those of *Æ. saldanhensis*.

TEXT-FIG. 29.



Æolidiella multicolor n. sp. Genital mass.

The genital mass (text-fig. 29) bears a distinct resemblance to that of *Æ. glauca*, although it shows differences in detail. The ampulla is long and much coiled—much longer than that of *Æ. glauca*. The vas deferens is long, coiled, and has a thicker proximal portion and a narrower distal portion, but both are glandular. The penis is small, conical and unarmed, and has no associated glands. The spermatheca is club-shaped, and has a long narrow duct which enters the oviduct close to its origin.

This species falls into the second section of the genus as it has a many-

branched right liver, and its affinities are to be sought in this group rather than with the European *Æ. glauca*. As has been mentioned above, the radula teeth are similar to those of *Æ. saldanhensis* Barnard, 1927, but this species has rounded corners of the foot while my specimens have distinct though short tentaculiform processes. Bergh considered that this was an important specific criterion, while Engel (1925) doubts if it has any importance. No colour descriptions of Barnard's specimens are extant, and he tells me that the type material has been inadvertently mislaid so it is impossible to compare my specimens with his. In view of the brevity of his original citation it would appear wise to differentiate my specimens as a distinct species, until such time as specimens of Barnard's species can be identified with certainty and comparisons drawn.

In many points my specimens agree with Engel's paraphrase of Bergh's description of *Æ. indica* from Mauritius. The arrangement of cerata is very similar in the two species. *Æ. indica* has 15–18 rows arranged in three groups : I, 5–7 ; II, 2–3 ; III, 8. My specimens have 22–25 branches in the same three groups : I, 6–7 ; II, 6 ; III, 10–12. The larger number of rows in the second and third groups may well be due to the larger average size of my specimens. If, as Engel suggests, the proportions of breadth to length and height to length are specific, then my specimens are widely separate from *Æ. indica*, for in my specimens the ratio breadth to length varies between 1/5 and 1/7 ; the ratio of height to length between 1/6 and 1/10, which are to be compared to 1/3 and 1/3·5 respectively for *Æ. indica*. These proportions vary with the state of contraction, and so one might not be able to rely on them. The radula teeth of *Æ. indica* are said to be as in *Æ. glauca* ; the teeth of my specimens are much wider than this and of quite a different appearance. The colours of the two species are also markedly different, yellows predominating in *Æ. indica* and blues and orange in *Æ. multicolor*. But one cannot put too much reliance on colour differences, for *Æ. glauca* shows very wide colour differences. Taking all these points into consideration I think that *Æ. multicolor* is probably a distinct species closely allied to *Æ. indica*, with which it may prove on closer comparison to be identical.

Family Glaucidæ.

This family was established by Alder and Hancock (1855) to include the pelagic genus *Glaucus* Forster, 1777. Bergh (1864) also recognized the family and added to it the genus *Glaucilla*, which he considered to be a sub-genus of *Glaucus*, although the differences between the two are sufficient to be generic. Several subsequent authors, including Barnard (1927) and Thiele (1931), have not recognized the family, and have included the genera in the family Æolidiidæ, with the rank of a sub-family. Others, Vayssière (1913), Odhner (1926)

Pruvot-Fol (1934) and Baba (1949), have recognized the family as distinct. Since these two genera have so many peculiar specializations it seems best to retain them as a separate family.

Both the genera included in this family are closely allied and broadly similar in form. The animals are pelagic and float, suspended by the sole of the foot from the surface film of the water. This upside-down position has, as will be shown later, had various effects on the internal organs. The head is short and not clearly demarcated from the body. The mouth is terminal and not directed ventrally as is usual in most members of the Eolidacea. The oral tentacles and the rhinophores are very short, conical and not retractile. The dorso-lateral region of the body is extended into two pairs of arm-like processes, at the outward ends of which (*i.e.*, in a ventro-lateral position) are inserted the bunches of cerata. A third, and in medium-sized and large specimens, a fourth bunch of cerata occur on cushions slightly elevated above the body surface, and only a short way behind the base of the second pair of arms. In *Glaucus* the cerata are inserted in a single series on a horse-shoe at the outward ends of the arms ; in *Glaucilla* they are inserted in multiple series.

The genital opening in both genera lies in the space between the two arms on the right, and the anus just behind the second arm on the right. In *Glaucus* the renal opening is just in front of the insertion of the second arm ; its position in *Glaucilla* has not been described. The penis is strong, long and contractile, and when extended is coiled in a spiral. That of *Glaucus* is armed with a strong hook, while that of *Glaucilla* is unarmed.

This family shows resemblances to both the Facelinidæ and the Æolidiidæ but is quite distinct from either. The anus is cleioproct and lies behind the second group of cerata on the right. This position is characteristic of some members of the Æolidiidæ, and would seem to suggest that the Glaucidæ are closely related to them. On the other hand it may well have arisen independently from the Facelinid facies, and I think that this is more probable. The renal opening or nephroproct of *Glaucus* is situated in front of the second group of cerata, *i.e.*, in the interhepatic space, a position characteristic of many Facelinids, but a position never occupied in any Æolidiid. In these the nephroproct is frequently adanal, and is always behind the anterior branches of the second liver group on the right.

The arrangement of the organs in the genital mass shows strong affinities to both the Facelinid and the Æolidiid facies and may easily be derived from either. However, the large size and in one genus the armature of the penis suggest Facelinid affinities, for whereas some Facelinids possess a large penis with a hook, no Æolidiid yet described possesses these attributes.

The form of the radula teeth is also indicative of Facelinid rather than Æolidiid affinities. Of itself little reliance can be placed on this resemblance, but when the very characteristic shape of the Æolidiid radula teeth is taken into account some consideration may be given to the shape of the teeth.

Genus *Glaucus* Forster, 1777.

Glaucus Forster, G., 1777, p. 49 ; Bergh, R., 1884, p. 10 (full synonymy) ; Iredale, T., 1940, p. 40.

A detailed account of the early discoveries and descriptions of this interesting genus has been given by Bergh (1864), and this account is more or less repeated in translation in his ' " Challenger " Report ' (1884). Bergh (1864) has also given a discursive and detailed anatomical and systematic study of *Glaucus* and a less detailed account of *Glaucilla*. Later (1888) he seems to have formed the opinion that the five species he recognized in 1864 and 1884 were actually forms of one circum-tropical species. Some subsequent authors have accepted this opinion and others have not. Until opportunities arise for a detailed study of specimens of *Glaucus* from several oceans and seas, one cannot form a definite opinion. However, so far as the present discussion is concerned it is unnecessary to go into the question, for all the South African specimens are easily recognized as *Glaucus atlanticus*.

Glaucus atlanticus Forster, 1777.

Glaucus atlanticus Forster, G., 177, p. 49 ; Bergh, R., 1884, p. 16 (full synonymy) ; Bergh, R., 1888, p. 676 ; Bergh, R., 1890, p. 876 ; Bergh, R., 1907, p. 94 ; Odhner, N. H., 1926, p. 29 ; Pruvot-Fol, A., 1934, p. 57 ; Ruedeman, R., 1934, p. 19 ; Vannucci, M., 1939, p. 115.
Glaucus marinus (du Pont) Baba, K., 1949, pp. 114, 185.

Whether the specific name of this species should be *atlanticus* Forster, 1777, or *marinus* du Pont, 1763, is a matter about which specialists seem unable to come to a definite decision, for although there is a general preference for Forster's name, the other makes it appearance from time to time in the literature (*e.g.*, Baba, 1949). I am informed by Mr. T. Iredale, formerly of the Australian Museum, Sydney, that the name *marina* of du Pont is pre-Linnean and so has to be discarded.

Specimens of *Glaucus atlanticus* (text-figs. 30–32) are frequently cast up on the beaches of the south and south-east coasts of South Africa, especially during the late summer and chiefly after periods of easterly winds which have tended to bring warm surface water close inshore. On January 28, 1951, over twenty specimens were collected from a falling tide on the mile of Fish Hoek beach on the shores of False Bay. Specimens have also been collected on the shores of Algoa Bay near Cape Recife and on various beaches in the vicinity of Port Alfred, all in January, 1952. They have also been seen in February, 1952, drifting past a trawler on the fishing-grounds off Cape Padrone and Woody Cape, east of Port Elizabeth. On all occasions when they have been collected there have been seen specimens of *Velella* sp., *Porpita* sp., *Physalia* sp., *Janthina* spp. and occasionally the small pelagic crab *Planes minutus*.

The external features have been frequently described and the appearance of the animal is well known. The head is short and not distinctly marked off

from the body. The oral tentacles and rhinophores are very short and there appear to be no eyes. The dorso-lateral region of the body-wall is drawn out into two arm-like extensions. Ventrally the extension is not so great. Thus the horse-shoes of cerata which are inserted on the apices of the arms face ventrolaterally. The central and most dorsal cerata in each arch are very large and the cerata decrease in size ventrally on each side of these. The number of cerata in each horse-shoe is variable and dependent to some extent on the size of the specimen. A larger number is always present on the first pair of arms, and the largest cerata on these arms are bigger than the largest cerata on the second pair. A third and sometimes a fourth group of cerata lie on either side a short distance behind the second pair of arms and adjacent to one another. The third group is present on all specimens I have examined, even the smallest, of less than 10 mm. long when fully expanded ; the fourth only occurs on medium-sized and large specimens. Each of these groups is inserted on a cushion very slightly elevated above the general body surface. Each contains fewer and smaller cerata than the anterior groups and those borne by the fourth group are smaller than those borne by the third. The cerata are caducous and easily broken off, leaving a large almost rectangular scar in which can be seen the narrow passage for the duct leading from the liver canal to the diverticulum within the ceras. Each ceras is almost rectangular in section—due to the crowding in the horse-shoes—and tapers towards the tip, becoming rounded in section as it becomes less crowded by its neighbours.

The foot is broad and well developed. Its anterior corners are rounded, and there are only slight indications of a pedal groove in front along its anterior edge. The tail is very long and slender, and the foot extends to its tip.

The genital atrium is conspicuous, lying dorsolaterally in the space between the first and second arms on the right. The anus is also on the right, dorsolaterally in the space between the second arm and the third group of cerata, just anterior to the most dorsal of these cerata. The nephroproct lies on the right just anterior to the base of the second arm (text-figs. 30, 31), and on the dorsal surface. Baba (1949) describes that in his *G. marinus* (du Pont) (= *G. lineatus* Reinhardt (Bergh)) the anus and nephroproct lie close together in front of the second arm. If this observation be correct, then his Glaucus is not *G. marinus* (du Pont), which all authorities are agreed is *G. atlanticus*. Bergh (1864) illustrates several species of *Glaucus*, and in all cases where he indicates the position of the anus he puts it between the second and third groups of cerata. While in my specimens there is a slight variation in the exact situation of the anus—it may be placed more dorsally or more posteriorly than the position already described—the intestine always passes behind the liver canal leading to the second group of cerata.

The buccal mass is large and strong, and is provided with strong jaws, the masticatory edge of each of which is armed with a large and indefinite number of saw-like teeth. The radula is uniseriate and the teeth are arched

with a prominent central cusp, which may or may not have one or more lateral denticles directly on it, and there are a variable number of lateral denticles in addition. These lateral denticles are long and slender and vary in number between four and twelve on either side. The variations in form of the central cusp and in the number of lateral denticles may be shown on one and the same radula. Only one of the four radulæ examined had a series of teeth which showed no variations.

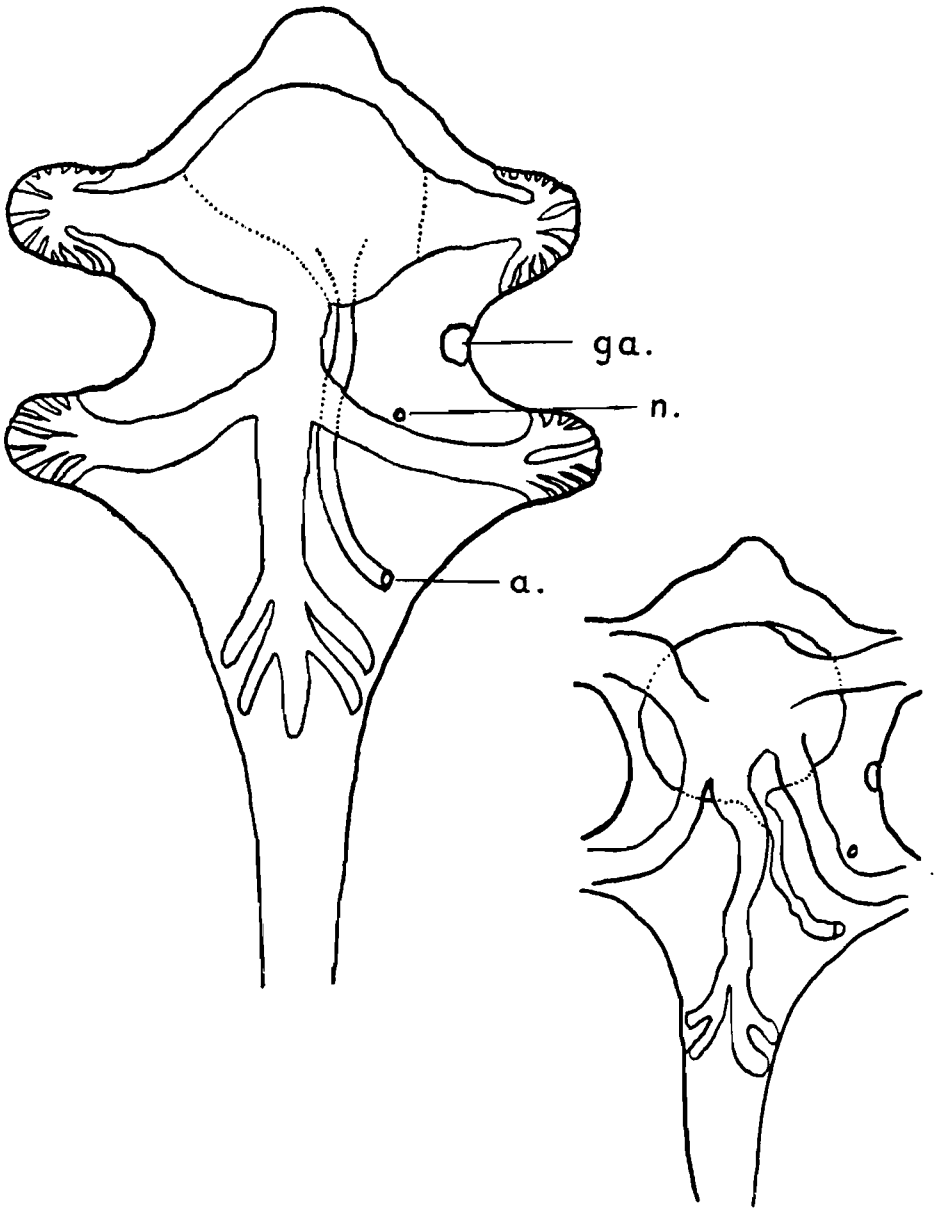
The œsophagus is very short and passes into the gastric cavity, and as a result the nerve ring is closely adjacent to the buccal mass. The salivary glands are quite large, compact, convoluted structures which lie closely appressed ventro-laterally to the anterior surface of the gaster. Their ducts, which are deeply pigmented, run inwards to pass through the nerve ring and enter the buccal mass, running parallel to the œsophagus.

The gastric cavity is large and extensive and bulges anteriorly into the head. It is usually distended with bubbles of air, and thus in addition to its digestive function would seem to act as an hydrostatic organ. It would appear that the bubbles of air can be released or taken in at will. While under observation in a finger-bowl the animals were frequently seen to be blowing bubbles. The walls of the gastric cavity show that it is made up of two organs. The walls of the anterior portion and much of the roof and floor of the cavity are smooth, shiny and thin-walled. The walls of the posterior portion on the left and also round the origin of the right lobe of the digestive gland are thicker-walled, woolly in appearance, and of the same chocolate colour as the lobes of the digestive gland. Hence it would appear that the stomach has been enlarged by the inclusion of the proximal portions of the digestive glands to form what I have called the gastric cavity.

The two lobes of the digestive gland are separated by a thin-walled portion of the wall of the gastric cavity, on the right side of the posterior wall of the cavity. The ducts of the digestive glands are very wide, glandular and chocolate brown in colour. They originate from the dorsal wall of the gastric cavity. The posterior duct of the left lobe bends immediately after its origin and runs towards the ventral surface of the visceral mass, then it bends again and proceeds backwards, just above the foot, giving off long branches to the second groups of cerata and shorter branches to the third and fourth groups. All branches bend about the middle of their course to turn dorsally before reaching the groups of cerata which they serve. There is some variation in the mode of branching of the posterior branch of the left lobe (compare text-figs. 30 and 31). The roots of the ducts which serve the second groups of cerata may originate from the dorsal walls of the gastric cavity, and not from the main posterior branch, which in this case supplies only the third and fourth groups. This modification was noticed in two specimens which were dissected while still fresh, but not in any of four preserved specimens.

When the branches of the digestive gland reach the tips of the arms they

TEXT-FIGS. 30, 31.



Glaucus atlanticus Forster. 30, " liver " system ; 31, abnormal " liver " system.

divide to serve the horse-shoes of cerata, and the pattern of this division is fairly constant. In four specimens dissected it agreed closely with the description given by Bergh (1864). The right lobe and its left partner divide into three or four main distributaries. The centre ones feed the large central cerata and the lateral ones bend downwards and outwards to run parallel to the anterior and posterior limbs of each horse-shoe, and give off narrow canals to each ceras. Within the ceras the canal widens and branches irregularly. In the second pair of arms the main branches divide into two distributaries, which turn downwards and outwards to serve the cerata of these groups. The cerata of the third and fourth groups are served by undivided branches from the main canal.

It is interesting to note that these posterior branches of the digestive gland occupy a different place from that usually occupied by these branches in most other Eolidacea. In most forms the branches of the posterior lobes are dorsal in position, and lie above the gonad. In *Glaucus*, while the anterior branches—the right liver and its left partner—remain dorsal in position, the posterior branches are ventral. This shift of position is probably the result of the inverted attitude which *Glaucus* adopts. It would appear that when the gonad develops, being heavier, it displaces the lobes of the digestive gland so that they become ventral in position. Bergh (1875) describes that in *Pterœolidia* the posterior branch of the digestive gland is similarly ventral in position.

The intestine leaves the postero-ventral face of the gastric cavity, just anterior to the " hepatic " portion. It passes ventrally through the coils of the genital mass, and then bends dorsally and crosses above the branch of the digestive gland serving the second group of cerata on the right. It discharges at the anus dorso-laterally in the space between the second and third groups, just behind the base of the second arm.

Compared with other Eolidacea the alimentary canal of *Glaucus* shows a considerable simplification. The mode of division of the main duct of the right liver suggests that the horse-shoe is derived from a branching system with three or four rows of cerata, as in some species of the Facelininæ or of *Æolidiella*. Also the second group is easily derived from the elongated arches characteristic of the anterior branches of the posterior lobe of the same two groups. The position of the anus is the same as that found in some of the Æolidiids, but on the other hand it may well have arrived in this position having been independently derived from the Facelinid facies.

The renal organ lies close to the ventral surface between the wall of the gastric cavity and the gonad, and at the base of the right-hand margin of the pericardium. Its duct passes dorsally and discharges to the exterior just in front of the base of the second arm on the right. The nephroproct is thus abanal, and separated from the anus by the first posterior branch on the right of the digestive gland. This position is suggestive of Facelinid rather than of Æolidiid affinities, and in fact makes it necessary to derive the mode of branch-

ing of the liver system and the position of the anus independently from the Facelinid facies.

The gonad is of the usual Eolid type and lies dorsally, occupying the bulk of the body cavity behind the gastric cavity and pericardium. The hermaphrodite duct is long and narrow and passes ventrally, coiling through the genital mass for some distance before swelling up into the ampulla. The ampulla (text-fig. 32) is of moderate length, and lies, closely coiled in three limbs, between the mucous and albumen glands. Distally it narrows gradually, and when it has attained a width similar to that of the proximal portion of the duct it divides to form separate vas deferens and oviduct.

The vas deferens is very long and is divided into three sections. Two of these are of similar diameters, and are connected by a very short, much narrower portion. The proximal portion is shorter than the distal portion and constitutes about one-third of the total length. Both are muscular, and in addition have glandular walls. The two long portions are stained a pale bluish purple while the connecting portion is deeply pigmented, the purplish black pigment being contained in chromatophores which are readily seen under low magnification.

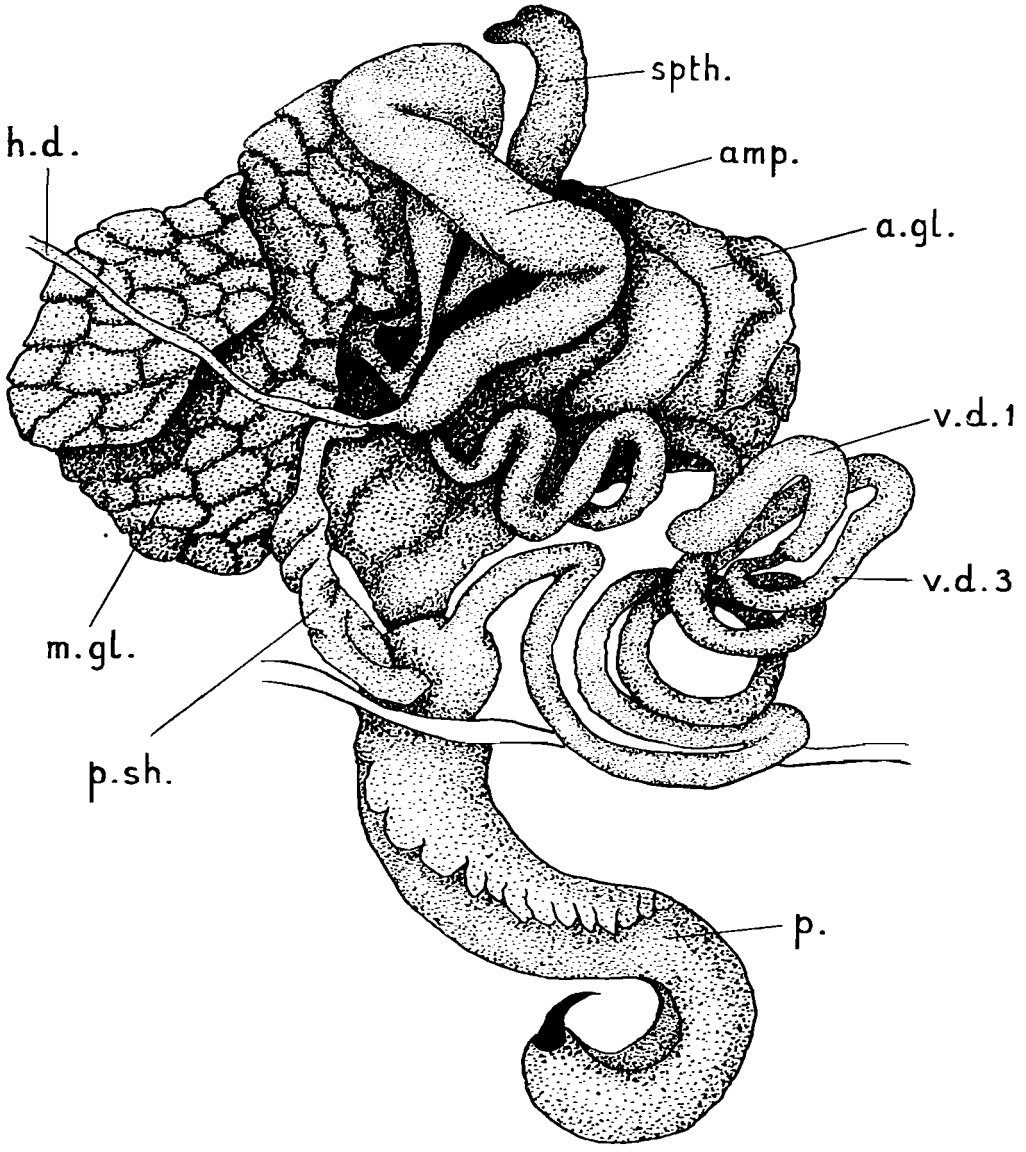
The vas deferens passes abruptly into the base of the penis. When fully exserted the penis is very long and coiled in a spiral. It is highly muscular, very thick and roundly triangular in cross section. It tapers slightly. The tip is capped by a strong hook, towards the tip of which the vas deferens opens. Attached to the wall of the genital atrium just dorsally to the base of the penis is a thin-walled penis sac or scabard. When the penis is exserted this sac has wrinkled walls and is about half as long as the penis. Into this scabbard the tip of the penis is inserted when it is being withdrawn and passes almost right up to its inner end. The walls of the scabbard then stretch slightly. When withdrawn, the penis does not partially invaginate within its basal portion as does that of some species of Facelina. It does, however, shrink to about two-thirds of its length when erected. There is a strong retractor muscle which runs from the base of the penis across to the left side of the foot.

This penis sac is not in any way homologous with the penis sac so characteristic of the Cuthonidæ. It appears to be a peculiarity of *Glaucus*, and no similar structure is recorded from any other Nudibranch.

The oviduct quite soon widens into a duct of similar width to the ampulla and just at the beginning of this wide portion the spermathecal duct enters. This duct is short and narrow and leads into the spermatheca, a deeply pigmented, wide tubular organ with a narrower curved tip. The spermatheca lies parallel to the longer limb of the ampulla and pressed between it and the first coil of the oviduct. The mucous and albumen glands are very different in appearance. The mucous gland is much coiled and convoluted and discharges into the distal portion of the oviduct. The albumen gland which forms the wall of the middle reaches of the oviduct is not highly developed and the

lumen of the oviduct is wide and the walls thin ; there are about three or four limbs to the coil. The number of coils is difficult to discover by dissection, for the thinness of the walls and the width of the lumen render the whole organ very fragile.

TEXT-FIG. 32.



Glaucus atlanticus Forster. Genital mass.

From the lumen of the oviduct in the region of the albumen gland several short strings of eggs were removed. Similar short, uncoiled strings about 2 cm. long were laid by specimens kept under observation in a finger-bowl. This method of egg-laying, which is so different from other Eolids, may account for the fact that the albumen gland is neither so voluminous nor so thick walled as in other members of the order. Each of the strings contains about 12 to 20 eggs in a single series.

The vagina, which is short and thin walled, lies adjacent to, just behind and just ventral to the base of the penis.

SUMMARY.

This paper describes eleven members of the tribe Eolidacea found on the coasts of South Africa. They are :

Catriona speciosa n. sp., *Facelina olivacea* n. sp., *Facelina annulata* n. sp., *Facelina faurei* Barnard, *Favorinus horridus* n. sp., *Godiva* n. genus with *Godiva quadricolor* (Barnard), *Echinopsole fulvus* n. genus et sp, *Cratena capensis* Barnard, *Amanda armata* n. genus et sp., *Æolidiella multicolor* n. sp., *Glaucus atlanticus* Forster.

The genera of the sub-family Facelininæ are fully discussed and the genus *Acanthopsole* Trinchese is reinstated. It is shown that the genus *Hervia* Bergh is a synonym of *Facelina* Alder and Hancock and the redistribution of species ascribed to *Hervia* is discussed.

The reproductive organs of *Glaucus* are described and its relationships to other Eolids is discussed.

LETTERING OF TEXT FIGURES.

a., anus.
ac. gl., accessory gland.
a. gl., albumen gland.
amp., ampulla of hermaphrodite gland duct.
g.a., genital apertures.
h. d., hermaphrodite duct.
m. gl., mucous gland.
n., nephroproct.
od. o., oviducal opening.
p., penis.
p. gl., penis sac or gland.
p. h., penis hook.
p.s., preputial pocket.
p. sh., penis sheath or scabbard.
spth., spermatheca.
spth. d., spermathecal duct.
v., vagina.
v.d., vas deferens.
v.d. 1, v.d. 3, sections of vas deferens.

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EXPLANATION OF PLATES I AND II.

Illustrating Mr. William Macnae's paper, " On some Eolidacean Nudibranchiate Molluscs from South Africa."

PLATE I.

FIG. 1.—*Catriona speciosa* n. sp.

FIG. 2.—*Facelina olivacea* n. sp.

FIG. 3.—*Facelina annulata* n. sp.

FIG. 4.—*Favorinus horridus* n. sp.

PLATE II.

FIG. 1.—*Echinopsole fulvus* n. sp.

FIG. 2.—*Crateria capensis* Barnard.

FIG. 3.—*Amanda armata* n. sp.

FIG. 4.—*Æolidiella multicolor* n. sp.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

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FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

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