

# PLURELLIDAE, A NEW PHLEBOBRANCHIATE FAMILY OF THE ASCIDIACEA

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## *Synopsis*

A new colonial phlebobranchiate species from Investigator Strait, South Australia, is described and assigned to a new genus for which a new family, Plurellidae, is erected. The species shares certain convergent characteristics with *Pyrosoma* (Thaliacea) but these are not regarded as phylogenetically significant.

## INTRODUCTION

Species of the aberrant family Perophoridae were previously regarded as the only colonial forms in the enterogonid order Phlebobranchia. The new species described below, although morphologically related to *Ascidia spp.*, reproduces vegetatively and forms large colonial aggregates. It has been assigned to a new genus for which a new family Plurellidae, is erected. The family is distinguished from Perophoridae in many ways and the colonial habit shared by the two families does not indicate a phylogenetic affinity and does not clarify the problematical affinities of that family (Berrill, 1950).

## Family PLURELLIDAE new family

*Type genus* : *Plurella* n. gen.

Branchial sac with internal longitudinal vessels supporting secondary papillae at their junction with transverse and parastigmatic vessels ; stigmata rectangular, not coiled ; dorsal lamina a plain edged membrane ; gut on left of branchial sac ; gonads not present in the gut loop ; zooids reproduce vegetatively to form large colonial aggregates.

## Genus PLURELLA n.g.

*Type species* : *Plurella elongata* n. sp.

Dorsal gland opens into the peribranchial cavity by many simple openings ; several sac-like ovaries open by separate ducts.

## PLURELLA ELONGATA n.sp.

*Type location* : Investigator Strait, Coll. J. Watson.

*Holotype* : Station Y. 18. Low flat reef, 101 ft ; National Museum of Victoria registration number : H164.

*Paratypes* : Station Y. 19. Low flat reef, 106 ft ; National Museum of Victoria registration numbers : H165, 166 (attached to roots of *Halocynthia hispidia*).

*Description* : Large hemispherical colonies comprising aggregates of elongate zooids adhering to one another along their length. The longest zooids extend across the base of the colony and, as new zooids are added, in parallel to the colony, it increases in diameter and height. There is some irregularity in the parallel arrangement of zooids as they curve to match the form already established. Each zooid is completely surrounded by a thin layer of test impregnated with sand and, for most of its length, is loosely adherent to adjacent zooids. Posteriorly,

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at the base of the endostyle there is a circular area of very thin test which is free of sand, and it is possibly here that budding occurs. The body wall in the region of the gonads is very closely adherent to the test, and here the colony is more compact so that the surface area occupied by the atrial openings of the zooids is less than that occupied by the anterior ends of the zooids, which are free for about 0.5 cm of their length.

Zooids are up to 4.0 cm long with wide branchial apertures anteriorly and atrial apertures posteriorly. Both apertures are surrounded by very weak circular muscles. They are wide open and of almost the same diameter as the siphons. There are about 12 pointed lobes on the margin of the branchial aperture and six on the margin of the atrial aperture. The branchial siphon is a long, delicate tube, without conspicuous musculature except for the very delicate circular muscles around the aperture. It is about one-quarter of the length of the branchial sac and is delimited basally by a ring of about 40 simple branchial tentacles. There is a wide flat prebranchial area. The body musculature is confined to broad strong transverse bands on the right side of the thorax. To the left of the dorsal lamina there are about seven small oval areas, equidistant down the length of the branchial sac, where rays of very short fine muscle fibres extend from the body wall into the branchial sac. There is only a very small peritubercular V with a minute dorsal tubercle with a simple opening. The dorsal ganglion is about three-quarters of the distance down the branchial sac and the neural gland is slightly anterior and to the left of the ganglion. The neural gland opens into the peribranchial cavity by numerous simple openings along the length of its duct between the gland and the prebranchial peritubercular area. The branchial sac is long and only slightly wider than the branchial siphon. There is a single simple fold to the left of the dorsal lamina.

There are about 50 very fine internal longitudinal vessels on each side of the branchial sac with rounded secondary papillae where they cross the transverse and occasional parastigmatic vessels. There are two to three oval stigmata in each mesh. The oesophagus, from the postero-dorsal corner of the thorax, is short and opens into a rounded, smooth-walled stomach. The gut loop is simple and open with the intestine extending anteriorly and curving dorsally into a short posteriorly directed rectum which opens by a two-lipped anus into the base of a posteriorly directed atrial siphon from the posterior part of the dorsal border of the zooid. The gut is covered with excretory cells.

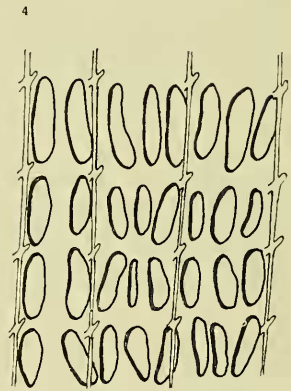
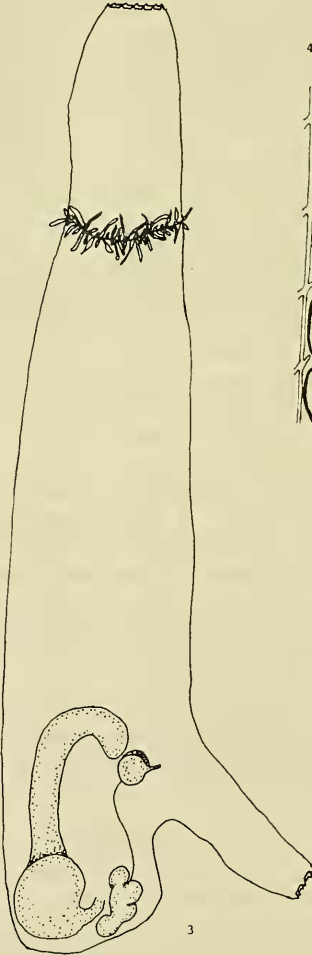
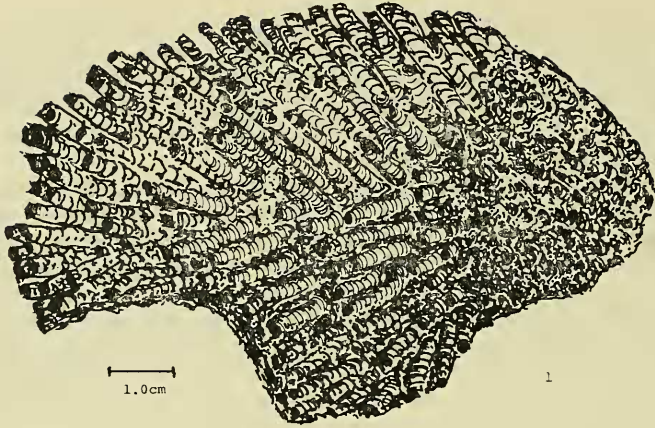
The heart extends obliquely across the right side of the posterior end of the branchial sac.

There is a long compact slightly lobed clump of testis follicles in the mid-line posterior to the branchial sac. Two to three fine ducts extend anteriorly more or less in the mid-dorsal line and then across the posterior border of the base of the atrial siphon from the right. Here each male duct expands into a rounded seminal vesicle which is associated with a sac-like ovary. Each ovary and seminal vesicle opens immediately into the base of the atrial siphon. The gonads and their ducts are embedded in the transparent body wall which, in this region, is firmly associated with the test.

The atrial siphon is as long, although not as wide as the branchial siphon, and is equally delicate and without conspicuous musculature except for the very fine circular bands surrounding the apertures which in the specimens examined are always wide open.

#### PHYLOGENY

The branchial sac and dorsal lamina, and the confinement of body musculature to the right side of the body demonstrate affinities with *Ascidia* spp., while the separate openings of the neural gland were previously thought to be exclusive to *Phallusia*. The species is, therefore, regarded as belonging



to the suborder Phlebobranchia. However, the budding process appears to involve the ectoderm and mesoderm from the body wall posterior to the branchial sac and does not appear to be identical with the process in Perophoridae (the only phlebobranch family in which budding was previously known), where new zooids form from a basal vascular stolon.

The species demonstrates convergent evolution with certain species of colonial Styelidae. In particular, the unusual form of the colony with branchial and atrial openings at opposite ends has been observed in a new species of *Polyandrocarpa* from Victoria (Kott, in press), in which the dorsal gland and ganglion are similarly posterior in association with the posterior position of the atrial apertures and the elongate zooids.

The unusual gonads and short oviducts of the present species are also similar to those found in certain genera of the Styelidae, where testis and ovary are often separated and where the gonads are separated into several parts served by separate ducts.

It is the position of the gonads, posterior to the branchial sac and at the edge of the atrial aperture that has drawn attention to other similarities in the form of zooid and colony of *Pyrosoma* (order Pyrosomida in the sub-class Thaliacea). The wide open branchial and atrial apertures with the pointed lobes lining the apertures, the posteriorly directed atrial opening from the posterior end of the body, and the site for bud formation are all similar to the condition found in *Pyrosoma*. However, although it is tempting to explore the probable ascidian origin for *Pyrosoma* (see Neumann, 1935; Berrill, 1950) through an ancestor it shares with the present species, the similarities are more likely to be due to convergence; and to have resulted from the style of colony in both, where the progressive addition of new zooids has forced the atrial aperture to the posterior end of the body and has favoured the development of long siphons to gain access to the surface through the crowded zooids. This contention is supported by the presence of an ascidiid dorsal lamina in Plurellidae while the Pyrosomidae retain the primitive dorsal languets of the Cionidae.

The family Plurellidae, therefore, must be considered phylogenetically related to the Ascidiidae, from which it has evolved by the development of a process of vegetative reproduction, a reduction in zooid size, the development of colonies, and the specialization of the gonads.

#### ACKNOWLEDGEMENTS

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Figs 1-5. 1, Colony. 2, Zooid opened along ventral surface and branchial sac removed to show branchial tentacles, neural gland openings, small circular muscle areas connecting body wall and branchial sac, gut loop and gonads. 3, Individual removed from test from left side. 4, Portion of branchial sac. 5, Seminal vesicle and flask-shaped ovary.