This sub-order includes a single family, the Pyrosomidæ, con­taining one well-marked genus, *Pyrosoma* (Péron), with several species. They are found swimming near the surface of the sea, chiefly in tropical latitudes, and are brilliantly phosphorescent. A fully developed *Pyrosoma* colony may be from an inch or two to upwards of four feet in length. The shape of the colony is seen in fig. 20. It tapers slightly towards the closed end, which is rounded. The opening at the opposite end is reduced in size by the presence of a membranous prolongation of the common test (fig. 20, B). The branchial apertures of the ascidiozooids are placed upon short papillæ projecting from the general surface, and most of the ascidio­zooids have long conical processes of the test projecting outwards beyond their branchial apertures (figs. 20, 21, and 22). There is only a single layer of ascidiozooids in the *Pyrosoma* colony, as all the fully developed ascidiozooids are placed with their antero­posterior axes at right angles to the surface and communicate by their atrial apertures with the central cavity of the colony (fig. 21).

Their dorsal surfaces are turned towards the open end of the colony. The more important points in the structure of the ascidiozooid of *Pyrosoma* are shown in fig. 22. A circle of tentacles, of which one, placed ventrally (fig. 22, *tn*), is larger than the rest, is found just inside the branchial aperture.

From this point a wide cavity, with a few circularly-placed muscle bands run­ning round its walls, leads back to the large branchial sac, which occupies the greater part of the body. The stigmata are elongated trans­versely and crossed by internal longitu­dinal bars. The dor­sal lamina is repre­sented by a series of eight languets (Z). The nerve ganglion (on which is placed a small pigmented sense organ), the sub­neural gland, the dor­sal tubercle, the peri­pharyngeal bands, and the endostyle are placed in the usual positions. On each side of the anterior end of the branchial sac, close to the peri­pharyngeal bands, is a mass of rounded gland cells which are the source of the phosphores­cence. The alimentary canal is placed posteriorly to the branchial sac, and the anus opens into a large peribranchial (or atrial) cavity, of which only the median posterior part is shown *(pbr)* in fig. 22. The reproductive organs are developed in a diverticulum of the peri­branchial cavity, and consist of a lobed testis and a single ovum at a time. The development takes place in a part of the peribranchial cavity (fig. 21, *em).* The segmentation is meroblastic, and an elongated embryo is formed on the surface of a mass of yolk. The embryo, after the formation of an alimentary cavity, a tubular nervous system, and a pair of laterally placed atrial tubes, divides into an anterior and a posterior part. The anterior part then segments into four pieces, which afterwards develop into the first ascidiozooids of the colony, while the posterior part remains in a rudimentary condition, and was called by Huxley the “cyatho- zooid ” ; it eventually atrophies. As the four ascidiozooids increase in size, they grow round the cyathozooid and soon encircle it (fig. 21, *asc* and *cy*). The cyathozooid absorbs the nourishing yolk upon which it lies, and distributes it to the ascidiozooids by means of a heart and system of vessels which have been meanwhile formed. When the cyathozooid atrophies and is absorbed, its original atrial aperture remains and deepens to become the central cavity of the young colony, which now consists of four ascidiozooids placed in a ring, around where the cyathozooid was, and enveloped in a common test. The colony gradually increases by the formation of buds from these four original ascidiozooids.

Phylogeny.

The accompanying diagram shows graphically the probable origin and course of evolution of the various groups of *Tunicata,* and therefore exhibits their relations to one another much more correctly than any system of linear classification can do. The ancestral *Proto- Tunicata* are here regarded@@1 as an offshoot from the *Proto-Chordata—*the common ancestors of the *Tunicata (Uro­chorda), Amphioxus (Ceρhalochorda),* and the *Verte­brata.* The ancestral *Tunicata* were probably free- swimming forms, not very unlike the existing *Appendiculariidæ,* and are represented in the life-history

of nearly all sections of the *Tunicata* by the tailed lar­val stage. The *Larvacea* are the first off­shoot from the ancestral forms which gave rise to the two lines of descendants, the *Proto-Thaliacea* and the *Proto- Ascidiacea.* The *Proto- Thaliacea* then split into the ancestors of the existing *Cyclomyaria* and *Hemimyaria.* The *Proto-Ascidiacea* gave up their pelagic mode of life and became fixed. This ancestral process is repeated at the present day when the free-swimming larva of the Simple and Compound Ascidians becomes attached. The *Proto-Ascidiacea,* after the change, are probably most nearly repre­sented by the existing genus *Clavelina.* They have given rise directly or indirectly to the various groups of Simple and Com­pound Ascidians and the *Pyrosomidæ.* These groups form two lines, which appear to have diverged close to the position of the family *Clavelinidæ.* The one line leads to the more typical Compound Ascidians, and includes the *Polyclinidæ, Distomidæ, Didemnidæ, Diplosomidæ, Cœlocormidæ,* and finally the *Ascidiæ Salpiformes.* The second line gave rise to the Simple Ascidians, and to the *Botryllidæ* and *Polystyelidæ,* which are, therefore, not closely allied to the other Compound Ascidians. The later *Proto- Ascidiacea* were probably colonial forms, and gemmation was re­tained by the *Clavelinidæ* and by the typical Compound Ascidians *(Distomidæ,* &c. ) derived from them. The power of forming colonies by budding was lost, however, by the primitive Simple Ascidians, and must, therefore, have been regained independently by the ancestral forms of the *Botryllidæ* and the *Polystyelidæ.* If this is a correct interpretation of the course of evolution of the *Tunicata,* we arrive at the following important conclusions. (1) The *Tunicata,* as a whole, form a degenerate branch of the *Proto­Chordata ;* 2) the *Ascidiæ Salpiformes (Pyrosoma)* are much more closely related to the typical Compound Ascidians than to the other pelagic *Tunicata,* viz., the *Larvacea* and the *Thaliacea* ; and (3) the *Ascidiæ Compositæ* form a polyphyletic group, the sections of which have arisen at several distinct points from the ancestral Simple Ascidians.

*Bibliography.*—(z) Cuvier, “Mém. s. les Ascidies,” &c., in *Mém. d. Mus.,* vol. ii. p. 10, Paris, 1815 ; (2) Savigny, *Mémoires sur les Animaux sans Vertèbres,* pt. ii. fasc. i., Paris, 1816; (y) Lamarck, *Hist. Nat. d. Anim. sans Vertèbres,* 1st ed., Paris, 1815-23; (*4*) O. F. Müller, *Zool. Danica,* vol. iv., 1806; (5) Milne-Ed­wards, “Observ. s. les Ascidies Composées,” &c., in *Mém. Acad. Sci.,* Paris, vol. xviii., 1842 ; (*6*) Schmidt, *Zur νergl. Physiol. d. wirbellos. Thiere,* Bruns-

@@@1 By Dohrn and others their point of origin is placed considerably further up on the stem of the *Chordata,* thus causing the *Tunicata* to be regarded as very degenerate *Vertebrata* (see *32).*