

unbranched tubes. The swollen knobs are very abundant and large in some parts of the surface layer, where they are arranged like bunches of grapes. Deeper down in the test this arrangement is never found, and most of the knobs are not terminal but occur upon the course of the vessels (Pl. IV. fig. 13), or where several intersect. In the large knobs in the surface layer blood-corpuscles are very abundant, and the knobs are flattened out parallel with and close to the surface, and altogether look like a respiratory apparatus. Those in the deeper parts, however, below the Ascidiozooids, are comparatively rarely filled with blood-corpuscles, while most of them show variously shaped masses of cells, which are undoubtedly buds in different stages of development (see Pl. IV. fig. 13, *gm.* and *gm'*). The youngest of these, placed in small enlargements on the vessels, contain each a few blood-corpuscles and a few large cells which very soon assume the unmistakable characters of ova. These latter increase in size and slightly in number, and form the most prominent feature in all sizes of buds. In the later stages (Pl. IV. fig. 13, *gm.*) the ova occupy one end of the bud, while the rest is formed of an opaque mass of cells derived apparently from the blood-corpuscles. The whole is closely invested by the wall of the swollen vessel, which is now of considerable size.

Savigny, in his description of the marginal tubes,¹ as he called the vessels of the test in the Botryllidæ, seems to have regarded them as an apparatus for the production of buds, and this view, which was more fully elaborated and established by Milne-Edwards,² was generally accepted until Metschnikoff³ and Krohn⁴ in 1869 stated that the previous investigators had been mistaken, and that gemmation took place from the sides of the bodies of the Ascidiozooids, and that the marginal tubes were merely blood-vessels. Since then the vessels seem almost universally to have been regarded as having nothing to do with gemmation. Ganin,⁵ however, in 1870 and Giard in 1872⁶ stated that in the Botryllidæ buds might be produced in the stolons or vessels as well as from the bodies of the Ascidiozooids.

About five years ago, while working out the anatomy and histology of the genus *Coellella* (see below, p. 88), I was astonished to find that there was good reason to believe that in that Ascidian at least the vessels were most directly concerned in the production of new Ascidiozooids, and that, just as in the present species, the bud was formed of elements from three sources—the wall of the vessel, blood-corpuscles, and large cells which become ova. The wall of the vessel is formed of ectoderm lined by connective tissue from the mantle, the blood-corpuscles are mesoderm cells, and the ova according to E. van Beneden's researches⁷ are derived from the mesoderm. This, however, does

¹ "Tubes marginaux" and "rameaux vasculaires," Mémoires, 1816, pp. 47 and 231, pl. xxi. fig. 1.

² Observations, &c., 1842.

³ Ueber die Larven und Knospen von Botryllus, *Bull. Acad. Sci. St. Petersburg*, vol. xiii. p. 293.

⁴ *Archiv f. Naturgesch.*, Jahrg. xxxv. Bd. i. pp. 190 and 326.

⁵ Neue Thatsachen &c., *Zeitschr. f. wiss. Zool.*, t. xx. p. 512.

⁶ Recherches sur les Synascidies, *Archives d. Zool. expér.*, t. i. p. 574.

⁷ *Zool. Anzeiger*, 1881, No. 88, p. 375.