

by a delicate layer of protoplasm, and having a nucleus at one side, the whole of the interior of the cell being a large vacuole. These are found typically developed among the Ascidiidæ (fig. 2, *c.*, and Pl. XXX. fig. 3, *bl.*). Other protoplasts secrete in their interior pigment granules, generally of a dark-brown colour, and this process may be carried to such an extent as to almost entirely obliterate the protoplasm of the cell (fig. 2 *d.*, and Pl. XXIX. fig. 3, *p.c.*). Others, which remain in a less modified condition, are found scattered through the matrix in varying quantities and sizes. They may be fusiform, rounded, stellate, or irregularly branched.

The matrix is usually clear and homogeneous, with a gelatinous or cartilaginous consistency. Frequently, however, it becomes fibrillated in parts, and in some cases, especially amongst the Cynthiidæ, is modified into a fibrous structure, very complicated in the arrangement of its layers, and occasionally continued into simple or branched spine-like projections from the outer surface. In other cases some parts of the test may undergo a sort of cornification, so as to change their appearance and consistency.



FIG. 2.—Transverse section through the test of *Ascidia*, showing the matrix in which lie large bladder cells (*c*) scattered in the inner layers, and smaller bladder cells (*a*) near the surface (the left side of the figure), blood-vessels (*b*) with terminal knobs, and pigment cells (*d*)—magnified about 40 times.

Usually, especially when it is thick, the test is penetrated by a number of blood-vessels, which are continued out from the body wall into the test, pushing a process of the ectoderm before them. In the adult they enter as two large trunks placed close together, usually near the posterior end of the ventral edge, and these two main stems almost invariably give off corresponding branches which run together, ramifying chiefly in the outer layers of the test (Pl. XXIX., fig. 3), where they end in terminal bulbs, usually by two twigs opening into one bulb, thus allowing the two vessels to communicate.

Spicules have been described as occurring in the tests of various Tunicata. These are probably in most cases post-mortem deposits, but in some species of *Salpa* siliceous spicules appear to be normally present, while in certain of the Ascidiæ Compositæ, large quantities of calcareous deposits are formed in the investing mass, and are in some cases especially developed, as Giard has shown, in autumn, as a protection during the hibernation of the colony.