

B. THE PINNULES.

The pinnules are repetitions of the arms on a small scale, and are especially adapted for the protection of the genital glands (Pl. Vc. figs. 7, 8, 10, *t*; Pl. VII. fig. 7; Pl. X. fig. 20).

In no case is a pinnule developed earlier than the second joint above the first radials of the calyx. This condition occurs in the two five-armed genera *Thaumatocrinus* (Pl. LVI. figs. 1, 2) and *Eudiocrinus*. One species of the latter (*Eudiocrinus varians*) has this second brachial free and capable of lateral movement, while in another (*Eudiocrinus indivisus*) it is the epizygal of a syzygy. The corresponding radial joint of *Metacrinus* is of the same character, and there are pinnules on each of the following radials as far as the axillary (Pl. XXXVIII.; Pl. XXXIX. fig. 1; Pl. XLII.; Pl. XLIII. fig. 2; Pl. XLIV.; Pl. XLV. fig. 1; Pl. XLVI.; Pl. XLVIII. fig. 1; Pl. XLIX. fig. 1; Pls. L.–LII. fig. 1). But in the majority of Neocrinoids which have the third radial an axillary, the preceding joint bears no pinnule, while it sometimes contributes to the enlargement of the cup.

Pinnules are always absent from every axillary joint, from the hypozygal of every syzygy (Pl. XXXa. fig. 10*b*; Pl. XXXII. figs. 4, 6, 13, 14; Pl. L. figs. 11, 12), and also from the lower one of every pair of joints which are united by a ligamentous articulation; so that in the great majority of Comatulæ, as in some species of *Pentacrinus*, the first joint after each axillary bears no pinnule. In the former group too the pinnules on the third and the four or five following brachials which form the arm-bases, do not appear till after those of the eighth and following joints, though the pinnule of the second brachial is developed comparatively early; while in *Atelecrinus*, *Rhizocrinus*, and *Bathocrinus* more or fewer of the lowest brachials are permanently devoid of pinnules.

The lowest pinnules of the Comatulæ, and in a less degree those of the Pentacrinidæ also, usually differ somewhat from their successors; and they may present a variety of characters, which are of considerable value in the discrimination of species, owing to the comparative constancy of their occurrence. They are frequently distinguished by the presence of spurs or keels upon their basal joints, as in *Actinometra solaris*; or they may be long, slender, flexible, and flagelliform, as in *Antedon rosacea*; or they may be stiff, straight, and spine-like, as in *Antedon protecta*; or they may have large prismatic basal joints, as in *Metacrinus* (Pl. XXXVIII.; Pl. XXXIX. fig. 1; Pl. XLIII. figs. 2, 4; Pl. XLIV. fig. 2; Pl. XLVI.; Pl. XLIX. figs. 1, 2; Pl. L. figs. 1, 2; Pl. LII. fig. 1); or the dorsal surfaces of their joints may have forward projecting keels, as in *Pentacrinus asterius* (Pl. XIII. figs. 1, 14).

Dr. Carpenter¹ has observed that the first pinnules of the ten-armed *Antedon rosacea*, which habitually arch over the disk and are much longer than their successors, are

¹ On the Structure, Physiology, and Development of *Antedon (Comatula) rosacea*, *Proc. Roy. Soc.*, vol. xxiv., 1876, p. 226.