united to the preceding joint by a bifascial articulation instead of by syzygy. In fact it is a general rule in all Crinoids that pinnules are only borne by those joints which are united to their successors by paired muscular bundles.

The hypozygal in the brachial syzygies may be fairly considered as losing its individuality. Not only does it bear no pinnule, but it takes no part in the movements of the arm. But when two joints are united by ligamentous bundles on either side of a vertical ridge, they are able to share in the lateral movements of the arm, though not in those of flexion and extension; and it therefore seems unreasonable to consider a pair so united as equivalent to one joint only.

Sir Wyville Thomson was accustomed to regard the stem and its appendages as constituting the "vegetative system" of the Crinoid, as distinguished from the more strictly animal portions, viz., the cup and arms. In describing *Rhizocrinus* for example,[1] he specially alluded to the great "preponderance in bulk of the vegetative over the more specially animal parts of the organism;" and he subsequently pointed out that in *Hyocrinus* and *Bathycrinus*,[2] as in *Rhizocrinus*, there is "a comparatively excessive development of the vegetative system." This was generally the case throughout the Bourgueticrinidæ and Apiocrinidæ, none of which have any very great number of arm-joints, though the "body" may be considerably enlarged with the help of the upper part of the stem. Thus, for example, d'Orbigny[3] describes two twenty-armed species of *Millericrinus*, each reaching a total length of one metre, out of which the calyx and arms together only take up 86 and 94 millimetres respectively, less than one-tenth of the whole; while in one ten-armed species the calyx and arms together only measure 29 out of 920 millimetres.

Among the Palæocrinoids there is considerable variation in the relative development of the stem as compared with the body and arms. The latter are often absent altogether, as in the Blastoids[4] and many Cystids; while they are few in number and poorly developed in *Haplocrinus*, *Pisocrinus*, *Symbathocrinus*, &c. On the other hand, the body and arms, so enormously developed in *Crotalocrinus*, are quite extensive in many Cyathocrinidæ and Actinocrinidæ; but the stem is often large and complicated at the same time, as in *Barycrinus* and *Megistocrinus*.[5]

In the Liassic Extracrinidæ the stem, immensely developed as it may be, still falls considerably short of the body and arms in the complication of its structure. *Extracrinus briareus* has a comparatively short stem; but in *Extracrinus subangularis* it may exceed 50 or even 70 feet,[6] with but few cirri except near the calyx, and those

[1] "Porcupine" Crinoids, *Proc. Roy. Soc. Edin.*, vol. vii. p. 771.

[2] *Journ. Linn. Soc. Lond.* (Zool.), vol. xiii. p. 48.

[3] Hist. Nat. des Crinoïdes, pp. 39, 41, 44.

[4] The so-called "pinnules" of the Blastoids cannot be properly compared to those of the Crinoids, for they do not seem to have contained the genital glands.

[5] Revision of the Palæocrinoidea, vol. i. pp. 14, 15.

[6] Encriniden, pp. 271, 291.