Chapter 3

SEGMENTATION AND THE DIVISIONS OF THE BODY

The cuticle of an insect forms a more or less hardened exoskeleton and, although perfectly continuous over the whole body, it remains flexible along certain definite, usually transverse, lines. Here the cuticle becomes infolded and is membranous in character. The body of an insect therefore presents a jointed structure which is an example of segmentation, and is divided into a series of successive rings variously known as segments, somites or metameres. In many cases the definitive segment incorporates part of what was primitively an intersegmental sclerite. The flexible infolded portion of the cuticle between adjacent definitive segments is the so-called intersegmental membrane whose function is to allow free movement of the body.

Segmentation is not only shown in the external differentiation of the body but also involves many of the internal organs. In the Annelida and the Onychophora the internal structure of each segment is very similar to that of the segment preceding or following it. In such highly evolved animals as insects the primitive segmentation, in so far as it affects the internal anatomy, has undergone profound modifications; the segmental repetition of parts is nevertheless retained to some extent in the central nervous system, the heart, tracheal system and in the body musculature.

The cuticle also exhibits localized areas of hardening which are sometimes delimited by sutures. The latter name has been given to several somewhat different structures. It may denote (i) the external groove or sulcus corresponding to an internal ridge-like inflection of the cuticle which provides mechanical rigidity, or (ii) a line of thinner, weaker cuticle along which rupture or bending of the integument can occur at ecysis, or (iii) a narrow, flexible, membranous zone of unsclerotized cuticle, or (iv) a linear impression without any obvious mechanical significance. In certain regions the sclerites do not come into apposition by sutures and are thus, as it were, islands of cuticle surrounded by membrane. Complete fusion of adjacent sclerites is common, particularly among the higher orders of insects, all traces of sutures being lost.

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The Divisions of a Body Segment

In most adult insects, and in many of their larvae, the body-wall of a typical segment is divisible into four definite sclerotized regions: a dorsal region or tergum, a ventral region or sternum, and a lateral region or pleuron on each side of the body. Each of these regions may be differentiated into separate sclerites. In this case the sclerites composing the tergum are known as tergites, those of the sternum as sternites, and those constituting each pleuron as pleurites. Between adjacent segments there may be present small detached plates or intersegmentalia and such sclerites belong partly to the segment in front and partly to the segment behind them. According to their position they are termed intertergites, interpleurites and intersternites.

The Segmental Appendages

In the embryo, each body segment may bear a pair of outgrowths or appendages which may or may not be retained in postembryonic life. Among adult insects, an appendage is normally attached to its segment between the pleuron of its side and the sternum. Typical appendages are segmented tubes invested with a dense cuticle. Between adjacent segments, the cuticle remains membranous and becomes infolded to form the articular membrane. On account of its jointed structure, the whole or part of an appendage is movable by means of its muscles. An insect appendage consists typically of a limb base and a shaft. There is no evidence of a biramous condition among the appendages in any insects.

Processes of the Body-Wall

In addition to true segmental appendages numerous other outgrowths of the body-wall are found in various insects. Unlike true appendages, processes of the body-wall are by no means invariably represented by embryonic counterparts; they may or may not be segmentally arranged, they may be originally paired or unpaired, and more than a single pair is sometimes borne on a segment. They differ from cuticular processes in containing a definite extension of the body cavity and in some cases they are freely movable. It is sometimes difficult to distinguish between such processes and true appendages but the principal types of organs which have been included under this category are: (1) Pseudopods, which are characteristic of many dipterous larvae. (2) Scoli, or thorny processes, characteristic of Nymphalid and Saturniid larvae: the anal horn of Sphingid larvae is also of a very similar nature. (3) Branchiae or gills which are found in most aquatic insect larvae (see p. 226). (4) Wings (see p. 50), which are always confined to the meso- and metathorax and attain their full development in adult insects.