

METAMERISM in Annelida

1. Introduction

In biology, metamerism is a linear series of body segments fundamentally similar in structure, though not all such structures are entirely alike in any single life form because some of them perform special functions. In animals, metameric segments are referred to as somites or Segments or metameres. In plants, they are referred to as metamers or, more concretely, phytomers. When the segmentation in bilateral animals, such as annelids, involves a longitudinal division of the body into a linear series of similar section or parts, it is called metameric segmentation or metamerism. Each section or part is called a segment or somite or metamere. Each metamere typically repeats some or all of the various organ units. The term metamerism is applied only when organs of mesodermal origin are so arranged. The primary segmental divisions are the body wall musculature and sometimes the coelom. This in turn imposed a corresponding metamerism on the associated supply systems (nerves, blood vessels and excretory organs). Longitudinal structures such as gut, principal blood vessels and nerves extend the entire length of body, passing through successive

segments. Other structures, such as gonads, are repeated in each or few segments only.

Metamerism is always limited to the trunk region of the body. The head represented by the prostomium and bearing the brain and some organs, and the pygidium, represented by the terminal part of the body which carries the anus, are not metameres.

In true metamerism, there is a serial repetition of homologous organs, like nephridia, nerves, muscles, reproductive organs, appendages etc. in each segment but these organs function in coordination with the others. All segments are integrated into a single functional unit. In true metamerism new segments are added in front of the last segment called pygidium. Hence posterior segments are younger as compared to the anterior ones. Coelom is divided by intersegmental septa into compartments, each of which can be regulated independently of the others.

Truly segmented animals typically have an anterior acron and posterior pygidium and various intermediate segments called metameres or somites. In higher invertebrates, such as arthropods,

metamerism provided an opportunity for specialization of segments into head, thorax and abdomen and serially repeated organs could be specialized resulting in rapid evolution.

Pseudometamerism occurs in members of class cestodes in which every segment is independent of the other and contains complete set of organs that have no connection with organs in other segments. During growth new segments are added in front, in the neck region and hence the posterior-most body segment is the oldest one and the anterior segments are younger.

Metameric Animals

Metameric segmentation of the body, encountered for the first time in Annelida, is of considerable interest because the most successful groups of animal kingdom, i.e., Arthropoda and Vertebrata, also have their parts metamerically repeated. At least one group of Mollusca (e.g. Chiton) also exhibits metamerism: Metameric segmentation seems to have evolved three times independently in animal kingdom (i) in the annelida-arthropods, (ii) In the chordates and in (iii) cestodes.

External & Internal Metamerism

Metamerism is conspicuously visible in most annelids, both externally as well as internally. The common earthworm is a good illustration of both external and internal metamerism. Its body consists of a great number of similar segments and all the body organs, such as musculature, setae of locomotion, blood vessels, nerves ganglia, excretory organs and gonads, etc., are repeated segmentally. Even the coelom is divided into segmental compartments by the intersegmental transverse mesenteries called septa. Only the digestive tract remains unaffected but it also extends through every segment. In arthropods, metamerism is chiefly external, while man and other vertebrates show an internal metamerism of body muscles, nerves, certain blood vessels, vertebrae and ribs.

Complete & Incomplete Metamerism

In annelids worms, metamerism is complete, affecting practically all the systems. The metameres are essentially alike or homonomous, each having segmental blood vessels, nerves, nephridia and coelomoducts. This condition is called homonomous metamerism. On the other hand, higher animals such as arthropods and vertebrates, show incomplete metamerism because of division of labour, the segments or metameres of different regions of their body become

greatly dissimilar. This is called heteronomous metamerism. However, incomplete metamerism should not be confused with the repetition of single organs such as shell plates or gills in certain unsegmented animals like molluscs.

In arthropods and vertebrates, metamerism is more complete and metameres are uniform and clear in the larval and embryonic stages. But, subsequent specialization or modification, so that the segments are no longer similar. It may result from simplification, by loss of metameres, by fusion of segments called cephalization, by differentiation between segments by disappearance of organs or by development of other structure, such as limbs. Heteronomous condition always appears first at the anterior end and progresses posteriorly. In segmented animals, varying degrees of specialization are met with some of which are extreme.