**Metamerism: Metamerism In Annelids, Type, Theories of Origin And Significance Of Metamerism**

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**1. Definition**

In some animals, the body is divided into a series of compartments arrange one behind to the other. These compartments are called segments or somites or metameres. The Linear arrangement of segments one behind the other is called Metamerically segmented. Metamerism is the division of body into Anterior-posterior rows forming similar segments called somites/metamere. Each metamere typically has repetition of body organs. The term metamerism is only applicable when organ of mesodermal origin are arranged so. Organs like nephridia, blood vessels, reproductive bodies etc.

Example: Annelida, Arthropoda&Chordata .

**1.1 Metamerism in Annelid**

The body of [Annelids](http://www.biozoomer.com/2014/10/annelida-characters-and-classification.html) is divided into a number of segments longitudinally. All the segments look alike. They are called metameres and this is called metamerism. In these segments all systems are repeatedly arranged. Usually the metamerism is confined to the trunk region of the organisms. Cephalic and anal regions may not show metameric nature in the caphalic region sense organs are concentrated, where in the anal region new segments are produced in front of anal segment.

[](http://www.biozoomer.com/)

**2. Types of metamerism**

**(i) True Metamerism :**

True Metamerism is found in Annelids, Arthropods & Chordates. In true metamerism, the segmentation of the body is based on the segmentation of mesoderm. New segments are formed at the posterior end (in front of the anal segment ). Hence the youngest segments occur at the anterior end. The segments work in co- operation with all other segments.

**(ii) Pseudo Metamerism / Superficial Metamerism :**

Pseudo metamerism is exhibited by tape worms(Platyhalminthes). Here the segmentation of the body is based on the segmentation of ectoderm. New segments are formed at the anterior end (just behind the scolex). Hence the youngest segments occur at the anterior end & the old segments occur at the posterior end. The segments works as independent units.These is no co-operation between the segments.

**(iii) Homonomous Segmentation :**

If all the segments of an animals are identical, the segmentation is called homonomous segmentation. The homonomous segmentation is not found in any existing animal as at least a few of the anterior segments are always specialization is called Cephalization. The closest approach to homonomous segmentation is found in some polychaetes in which all the segments between the head and the anal segment are alike-Homonomous segmentation is a primitive condition.

**(iv) Heteronomous Segmentation:**

If the segments are dissimilar, the segmentation is called Heteronomous segmentation.

Examples : Arthropods & Chordates.

**(v) External Metamerism:**

In Arthropods the metamerism is external. Internally the segments are not marked by partitions.

**(vi) External & Internal Metamerism:**

In Annelids the segmentation is marked externally as well as internally. Internally, the segments are separated by transverse partition called Septa.

**(vii) Complete Metamerism:**

When segmentation is seen in all the organs, the metamerism is called Complete Metamerism.

Example : Annelida

**(viii) Incomplete Metamerism:**

When segmentation is not seen in all organs, the metamerism is called Incomplete Metamerism.

Examples :Arthropoda&Chordata

**3. Theories of evolution or origin in metamerism segmentation**

The origin of metamerism is not clearly known. Many theories were proposed to explain the development of metamerism.

**1) Corm and fission theory:**

This theory was proposed by Perrier (1882). According to this theory the existence of segmented animals occurred when the non segmented ancestors underwent asexual transverse fission. A chain of zooids are formed which remain united from end to end due to incomplete separation. This occurs in some platyhelminths and annelids even today. In the passage of time these zooids got integrated both morphologically are physiologically to form a segmented individual. But had certain drawbacks.

**A)**  No gradation of age was found.

**B)**   Asexual transverse fission occurred in sessile animals but the ancestors of annelids were probably free swimmers.

**2) Pseudometamerism:**

This theory was proposed by Hyman (1951). This theory suggests that metamerism evolved secondarily due to the repetition of body organs like blood vessels, nephridia, reproductive bodies and nerve cord etc.

Because of this repetition of organs it resulted in segmentation of body by the formation of cross-partition between them, thus each segments will receive a part of the repeating organ. This process is observed in somite formation of larvae and in some adult annelids even today, this type of metamerism was thought to be an adaptation to swimming mode of life. But all ribbon like animals can swim whether they are segmented or not.

**3) Cyclomerism:**

This theory was originally proposed by Sedgwick (1884) and later it was supported by Remane (1950, 63). According to this theory 4 gastric or enterocoelic pouches arise from the digestive cavity or gut. Out of the 4 pouches two of them got divided to form 3 pairs of coelomic cavities – Protocoel, Mesocoel, and Metacoel. The loss of protocoel and mesocoel lead to the existence of non segmentedcoelomic animals such as mollusca.

Later the metacoel got segmented primarily giving rise to segmented annelids. The phylogenetic implication of this theory is that the bilateral metazoans were originally segmented and coelomate, but the acoelomate and non-segmented groups (flat worms) lost these characters primarily.

**4) Embryological theory:**

According to this theory the existence of segmented animals was an embryological accident. Due to the elongation and growth the of larvae/embryo the mesoderm of it was under a lot of mechanical stress which made it fragmented. Later when they larvae grew into adult it got segmented.

**5) Locomotion theory:**

This theory was proposed by R.B Clark (1964). According to this theory the segmentation of annelids was an adaptation to locomotion and burrowing. The ancestors of annelids used to burrow marine sand and mud. Their coelom was filled by fluids that served as hydrostatic skeleton that helped in burrowing but it hampered locomotion. So the body was divided into septa to provide flexibility. One part of the body can contract while other part of the body remains relaxed. Thus metamerism in annelids initiated from the division of coelom and later the whole body got segmented.

**4. Significance of metamerism:**

1. It has provided effective locomotory mechanism coordinated contraction along body generates efficient body undulating movement.
2. The segments will show high structural development which gave scope for evolution.
3. Metamerism has greatly contributed toward the greater complexity of animal body and higher grade of organisation in animals. Thus, some indication of primitiveness of an animal can be determined by the degree of segmentation it displays.
4. Fluid filled coelomic compartments provide hydro static skeletons for burrowing. Different turgerpressure are effected by flow of coelomic fluid from one part of the body to the other.
5. Different segments can be specialized for different functions- which leads to the development of organization. It is not clearly marked in annelids, but well developed in arthropods. example-Spermatheca, clitellium are involved with reproduction, thus regional specification of the body with proper division of labour.
6. Metamerism has helped in locomotion in many ways. The co-ordination of muscle contraction and the fluid filled coelomic cavity makes swimming and locomotion movement more efficient and it is more advanced over ciliary or creeping movement found in lower invertebrates.
7. The fluid filled coelomic cavities serves as a hydrostatic skeleton which helps in burrowing. Precised movement also occurs by differentiated turgor affected by the flow of body fluid from one part of the body to other.
8. Another advantage of metamerism or segmentation is that it provides opportunity to different segments to specialize it for different function. Thus it leads to rapid evolution of high grade of organization. This is not clearly marked in annelids but it is well developed in arthropods.