

EVOLUTION OF METAMERISM



PRESENTED BY SAIMOUN

METAMERISM ???

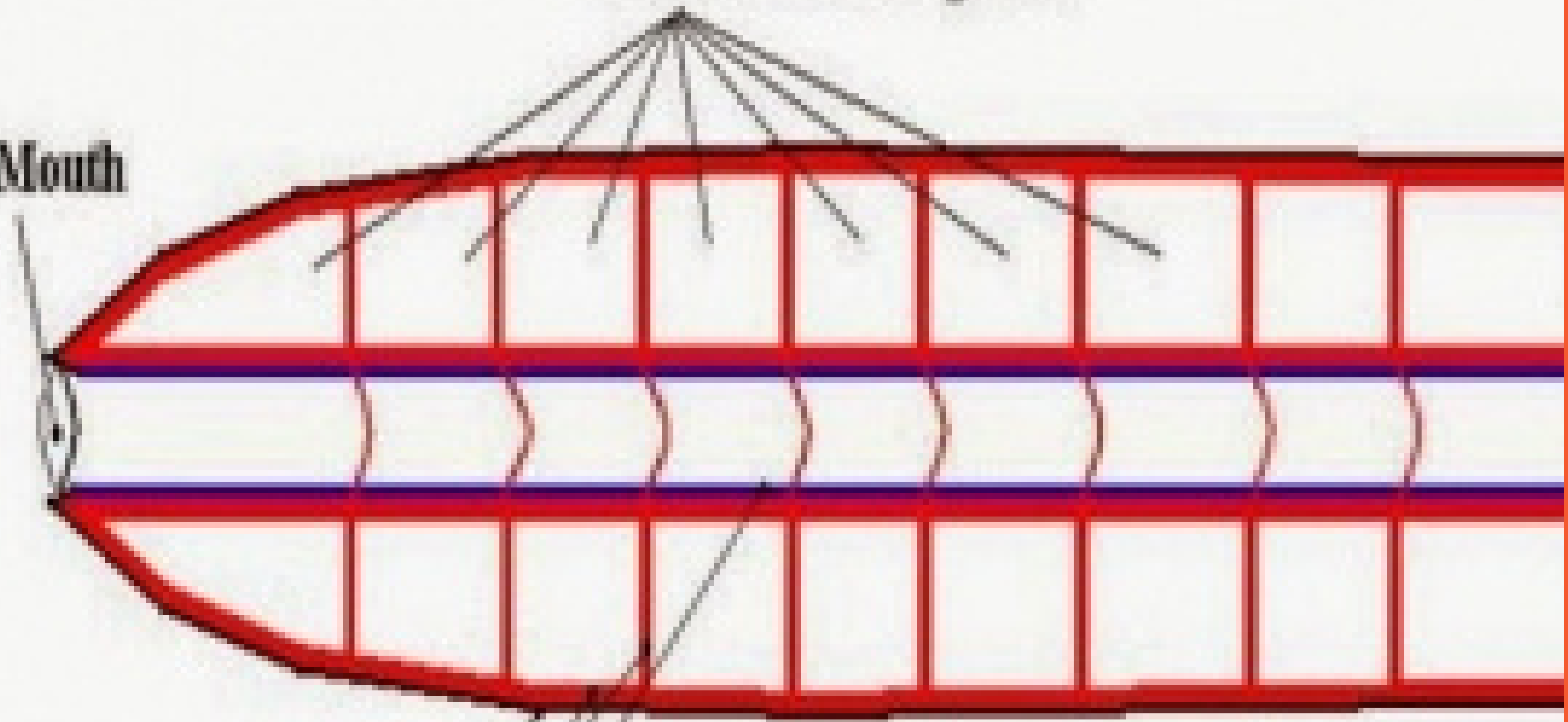
Metamerism is the condition when the general segmentation of bilateral animals involves longitudinal division of the body into linear series of similar sections.

Metamerism is also known as **metameric segmentation**. Each section is called **metamere** or **somite** or **segment**.

Each of these segments has repeats of some or all units of organ. This term metamerism is used only when the organs of mesodermal origin are so arranged.

Coelom in each segment

Mouth

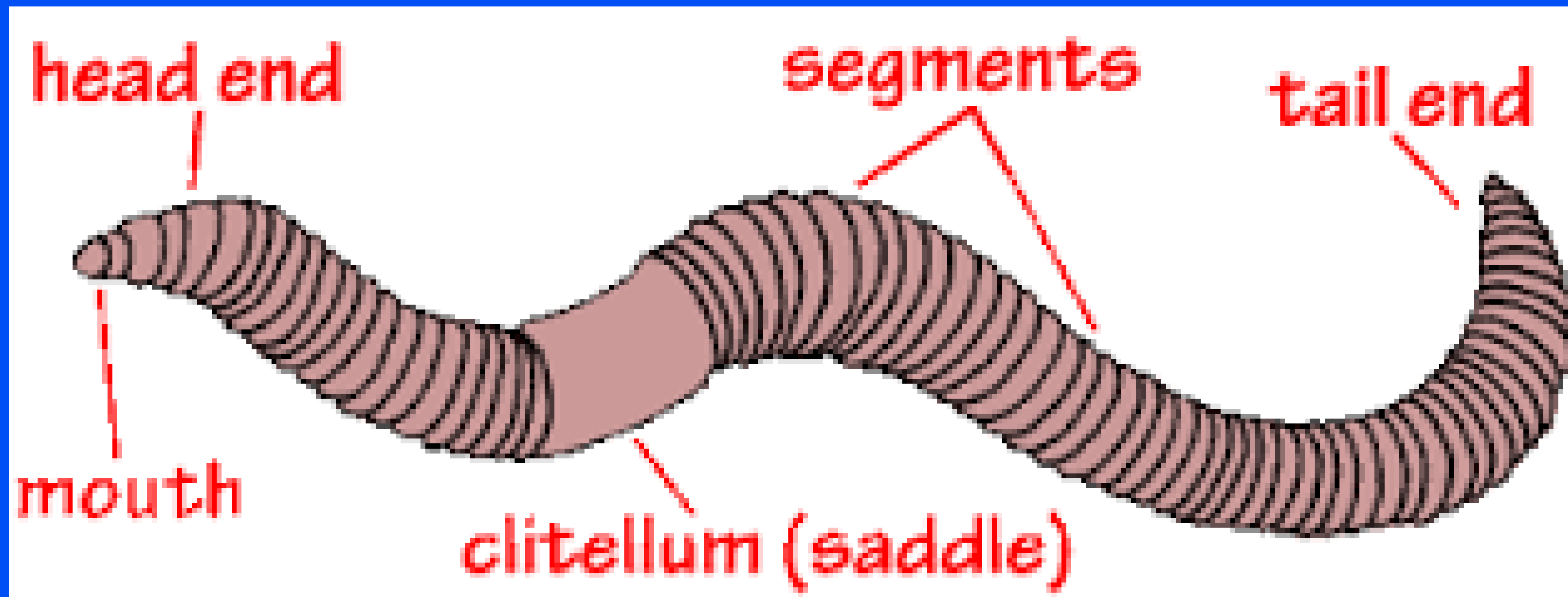


epidermis (ectoderm)

mesodermal tissue

gut lining (endoderm)

Metamerism is a Greek term meaning meta- after ,
mere -part



Metamerism in animal kingdom include ,

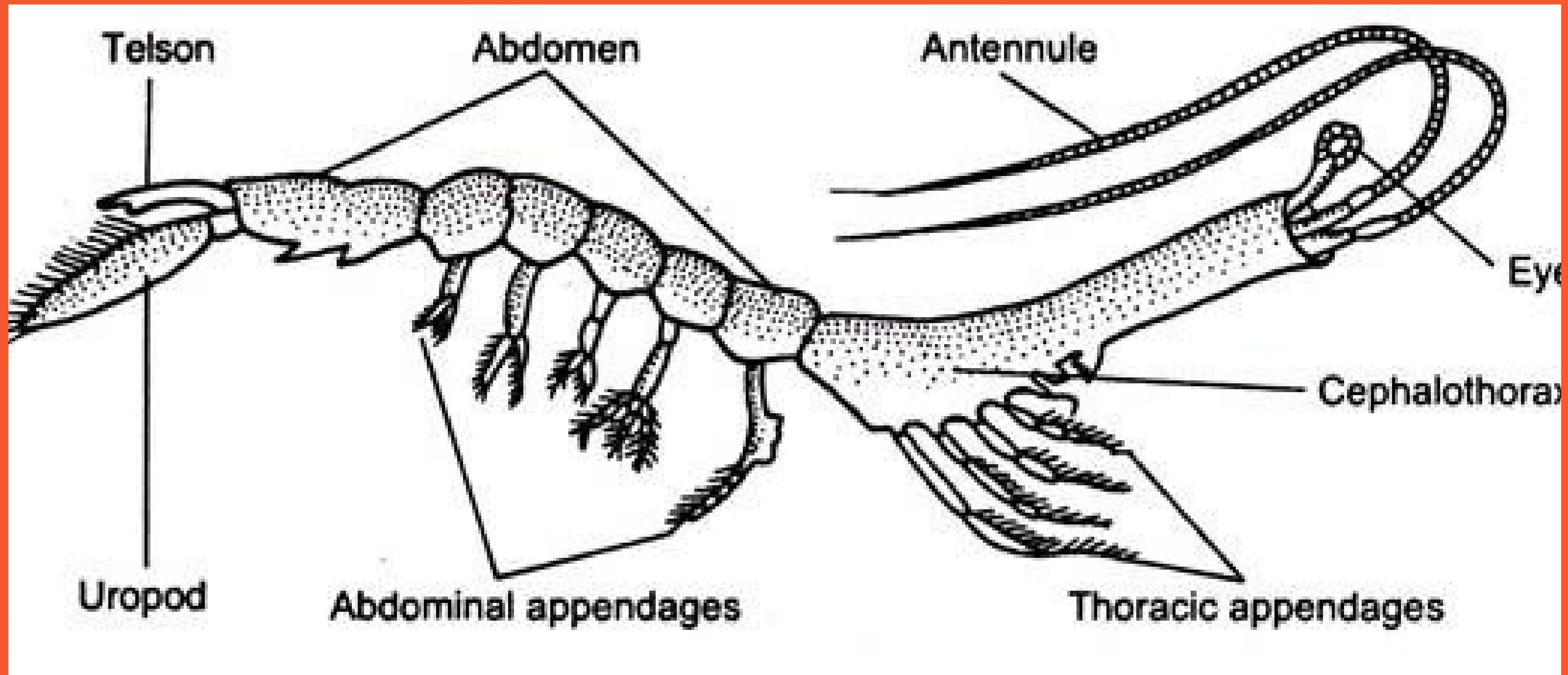
- Metamerism encountered for the first time in annelids.
- Apart from this it is also found in phylum arthropoda and vertebrata.
- Tapeworms show pseudometamerism or strobilization, which is not true metamerism.

TYPES OF METAMERISM

1 . External and internal metamerism :-

- In most of annelids,metamerism is conspicuously visible both externally and internally.
- Example, *Pheretima posthuma* ,it has numerous body segments and all body being repeated segmentally .
- Moreover even the coelom is segmentally divided into compartments by intersegmental transverse mesenteries called septa .
- Only the digestive tract escapes this metamerism and it extends through every segment.

- In arthropods ,metamerism is chiefly external.
- Humans and other vertebrates show internal metamerism of nerves,blood vessels

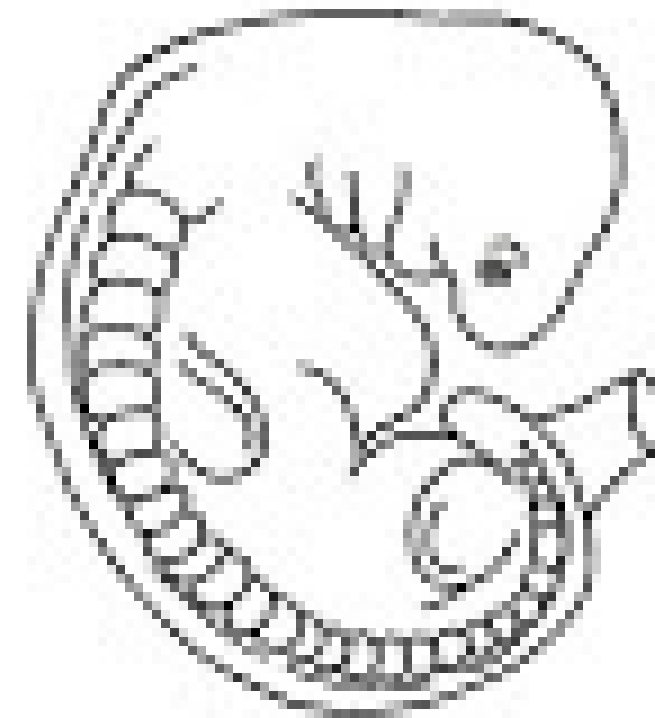


25 SOMITES

Somite or metameric body segment

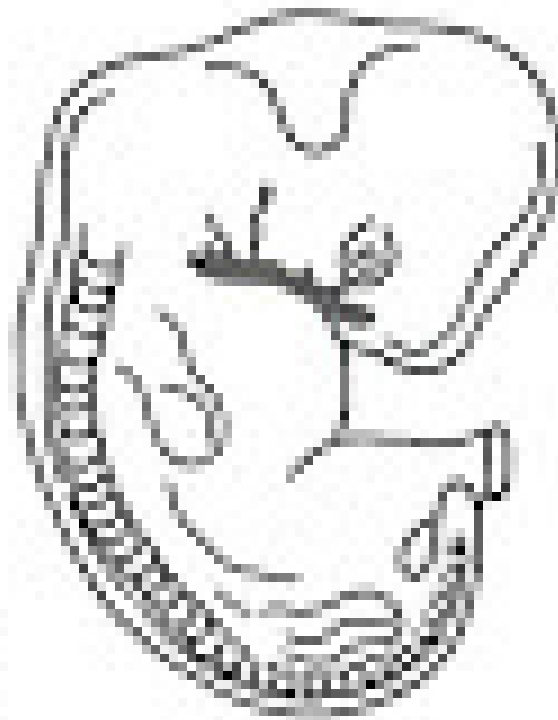


DAY 28
3.4 mm



30 + SOMITES

DAY 32
5.0 mm



DAY 37
10.5 mm



DAY 40
13.4 mm

Complete and incomplete metamerism:-

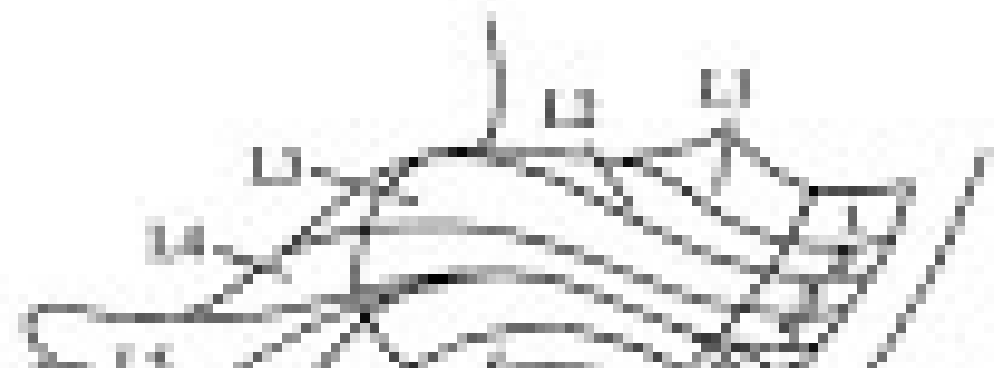
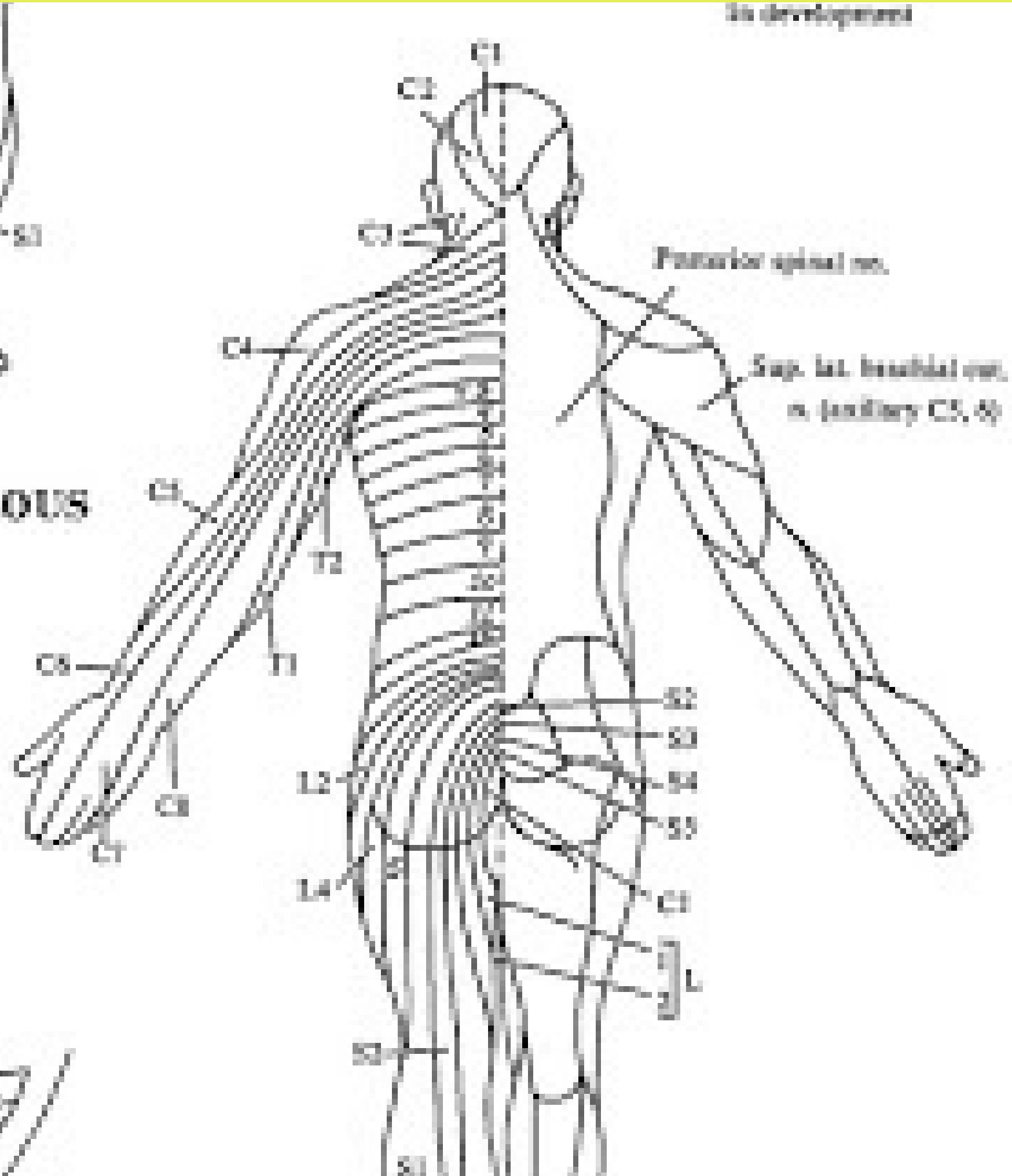
- Complete type of metamerism practically affects all the body systems .
- In this type the metameres are homonomous and each metamere has segmental blood vessels, nerves ,coelomducts and nephridia .
- Thus this condition is also called homonomous metamerism .
- Metamerism in arthropods and other higher animals is incomplete because of division of labour.consequently metameres of different regions of body vary considerably. such a condition is called heteronomous metamerism.

- The larval and embryonic stages of arthropods and other vertebrates show complete metamerism with uniform metamereres .
- But these metamereres become unclear in the adults succeeding specialisation .

Lat. vent. cut. n. (S1, 2)

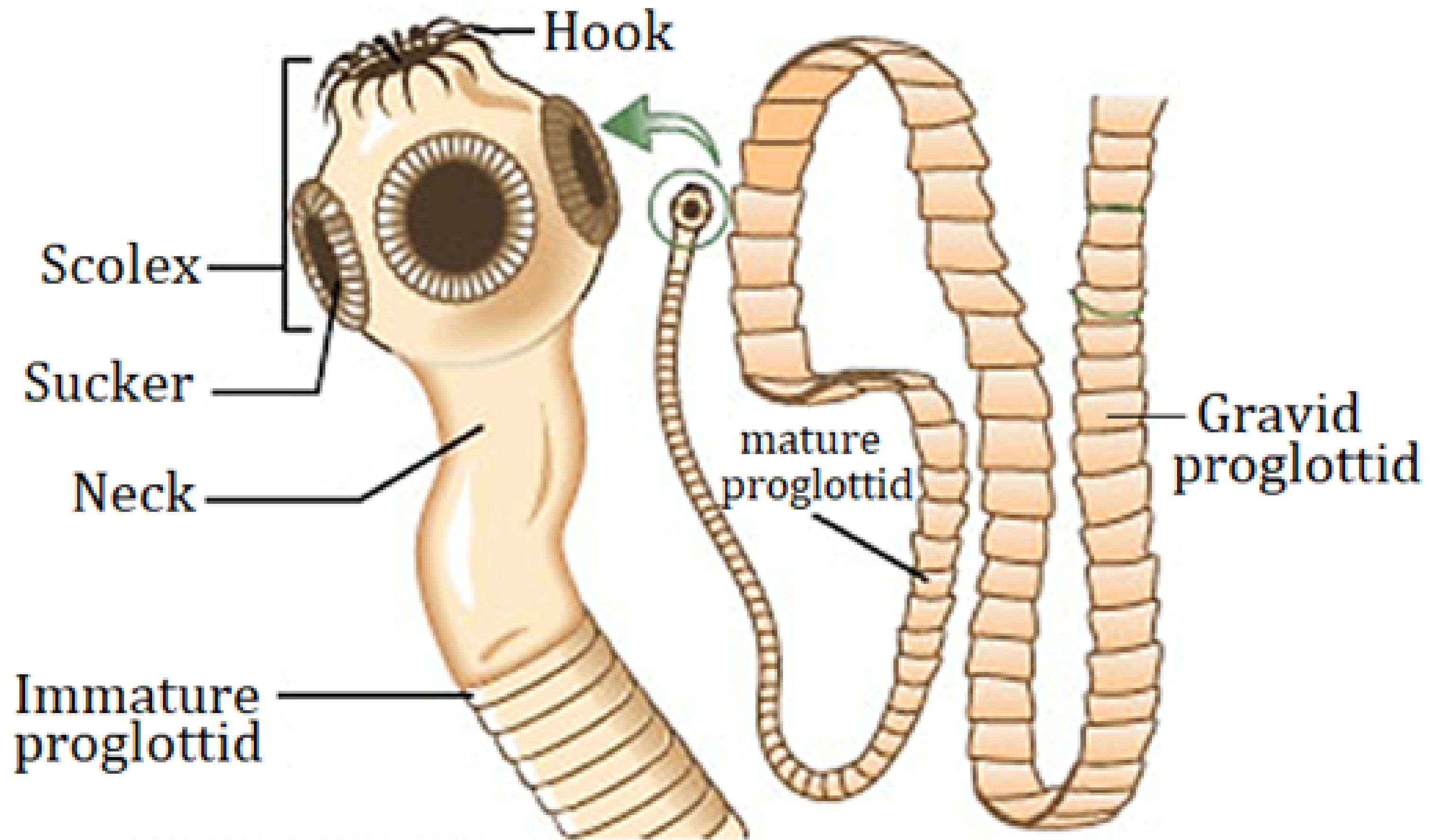


DERMATOME AND CUTANEOUS NERVE DISTRIBUTION IN ADULT



True and pseudometamerism :-

- True segments in annelids are developed during the embryonic stages whereas the pseudo segments present in tapeworms are superficial which are formed as a result of strobilization .
- the proglottids of tapeworms are not true segments but rather they are complete reproductive individuals.



Pseudo-segmentation in tapeworm

THEORIES OF ORIGIN AND EVOLUTION OF METAMERISM:-

Pseudometamerism theory:-

- this theory was proposed by Hymen and Goodrich in 1951.
- This theory explains Pseudometamerism that occurs in Cestodes such as tapeworms.
- According to this theory ,metamerism initially developed secondarily as a result of repetition of body parts like blood vessels , coelom, nerves etc.
- Later a segmented condition arouse by the formation of cross partitions between them, so that each segment receives a part of each system.

- This of formation of cross partitions after basic segmentation is also seen in modern day Annelids during development of somites in larval and adults stages .
- According to this theory it is believed that pseudo segmentation is an adaptation for an undulatory movement .

FISSION THEORY:-

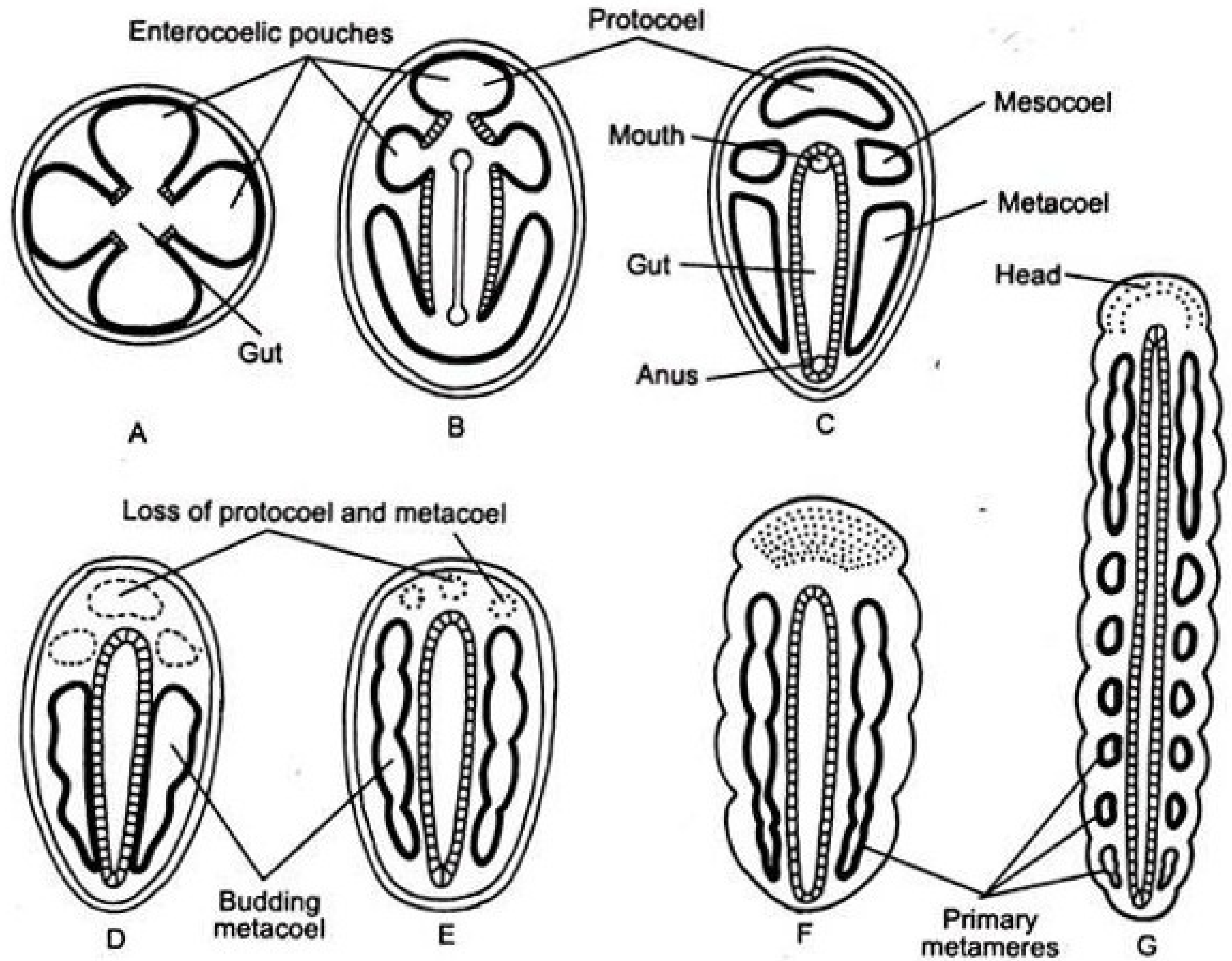
- This theory was proposed by Perrier in 1882. It postulates that pseudometamerism evolved in flatworms by strobilation of body.
- Strobilation is mainly aimed to increase the rate of reproduction.
- Proglottids of helminths are serially arranged segments but in reverse order and they increase reproductive capacity many times.
- This theory proposes that metamerism resulted when some non-segmented ancestors divided repeatedly by transverse fission or asexual budding to produce a chain of sub-individuals.
- Such a process occurs even in modern-day Annelid and Platyhelminthes animals.

- Later these individuals integrated morphologically and physiologically into one complex individual .
- Thus according to this theory a segmented animal is a chain of completely coordinated sub - individuals.

CYCLOMERISM THEORY :-

- This theory is proposed by Sedgwick in 1884.
- According to this theory ,metamerism in chordates evolved for better arrangement of organs in coelom .
- This theory assumes that coelom originated in some ancestral radiate actinozoan coelenterates ,through the separation of four gastric pouches from the central digestive cavity .
- Initial division of two pouches resulted in three pairs of coelomic cavities namely protocoel ,mesoscoel and metacoel in ancestral coelomates .
- Later loss of protocoel and mesocoel led to unsegmented coelomates like molluscs .
- Then the sub-division of metacoel produce primary segments,leading to the development of segmented Annelids.

- This provided septa and compartments in coelom in which organs could be arranged in a better way.
- The phylogenetic assumption of this theory is that, all bilateral metazoans were originally segmented and coelomate and those coelomate unsegmented groups like flatworms lost these character later.



LOCOMOTORY THEORY :-

- This theory is proposed by Clark in 1964 .
- This theory postulates that metamerism evolved as an adaptation to locomotion of different kinds .
- It evolved independently in chordates for locomotion which was previously carried out by lateral undulation of body in primitive aquatic vertebrates ..
- Annelid metamerism probably evolved for burrowing.
- Metamerism allowed myotomes or muscle bundles and nerves to be arranged segmentally for better coordination of undulatory movement of body

SIGNIFICANCE OF METAMERISM

- It has provided effective locomotory mechanism as the coordinated contraction along body generates efficient body undulating movement .
- Fluid filled coelomic compartments provide hydrostatic skeletons for burrowing . Accurate movements can take place by differential turgor pressures affected by flow of coelomic fluid from one part of the body to the other.
- Different segments can be specialised for different functions leading to the development of high grade of organisations. it is not clearly marked in annelid, but well developed in arthropods. example spermatheca, clitellum are involved with reproduction , thus regional specification of the body with proper division of labour



THANKS YOU

BEST OF LUCK