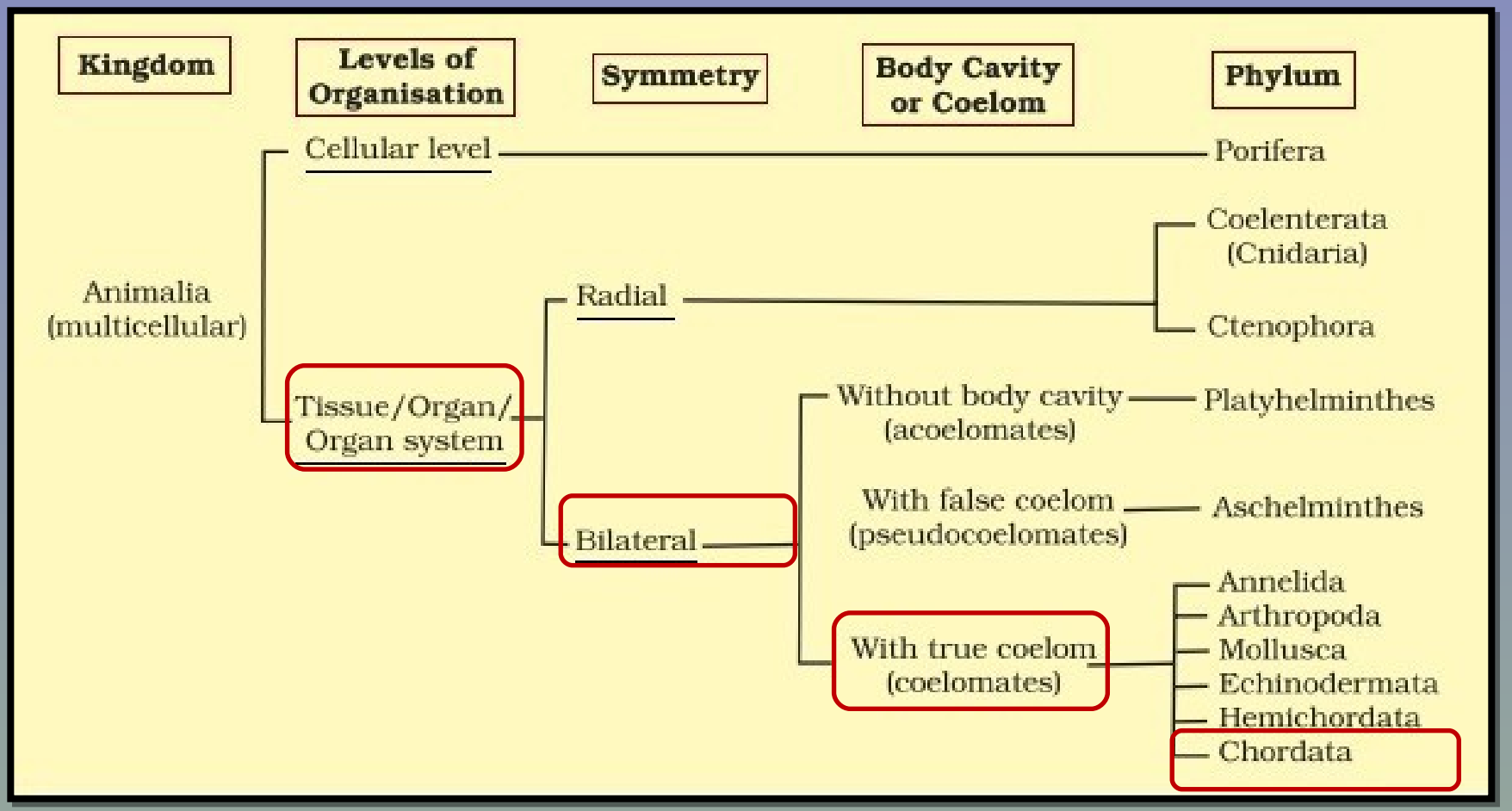
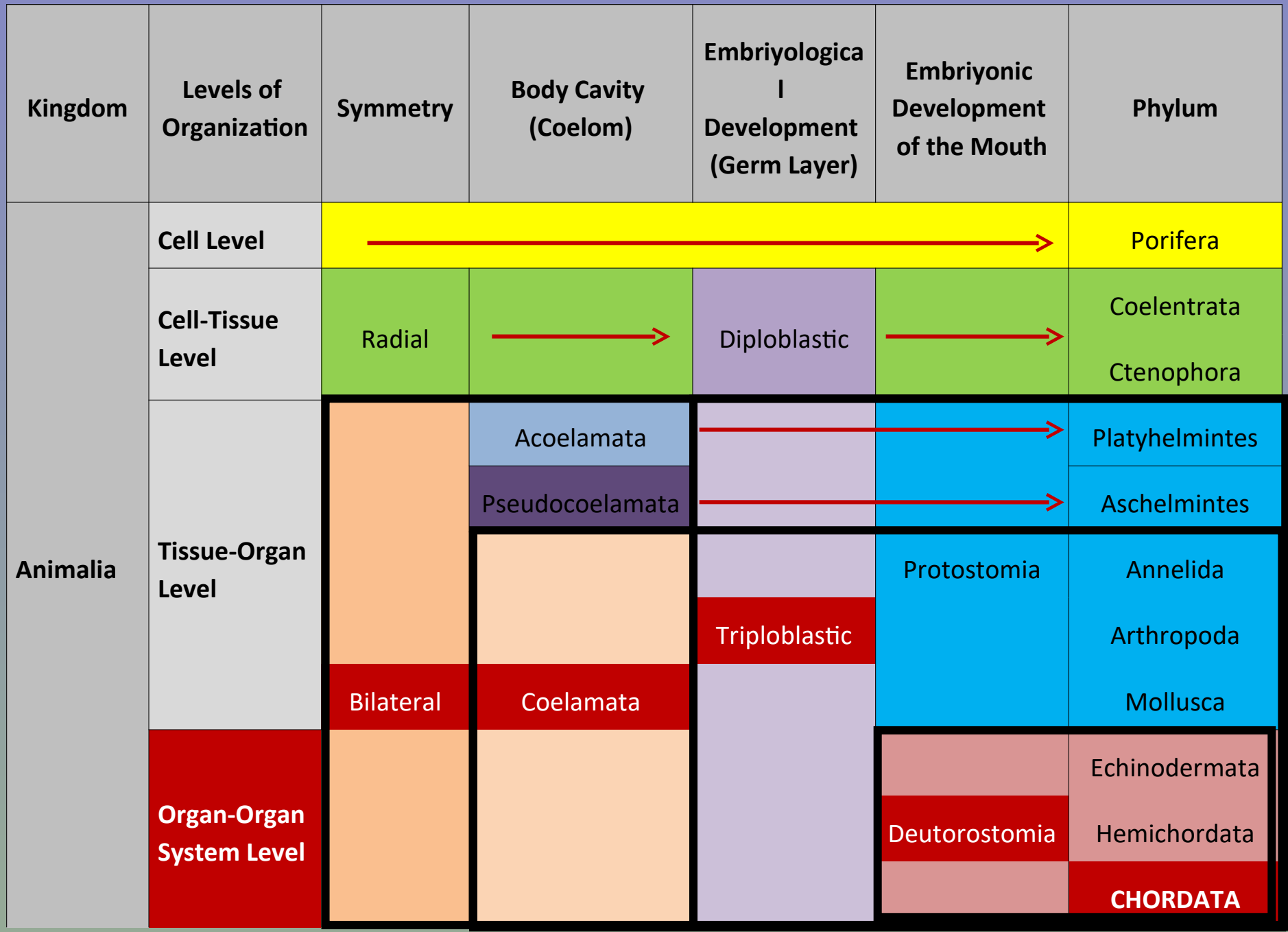
ORIGIN AND GENERAL FEATURES OF PHYLUM CHORDATA



Triploblastic; Deutorostomia; Endoskeleton; Complete gut cavity; mostly dioecious organisms


Kingdom
Levels of Organization
Symmetry
Body Cavity (Coelom)
Embriyological Development (Germ Layer)
Embriyonic Development of the Mouth
Phylum
Animalia
Cell Level
Porifera
Cell-Tissue Level
Radial
Diploblastic
Coelentrata
Ctenophora
Tissue-Organ Level
Acoelamata
Pseudocoelamata
Platyhelmintes
Aschelmintes
Bilateral
Coelamata
Triploblastic
Protostomia
Annelida
Arthropoda
Mollusca
Organ-Organ System Level
Deutorostomia
Echinodermata
Hemichordata
CHORDATA

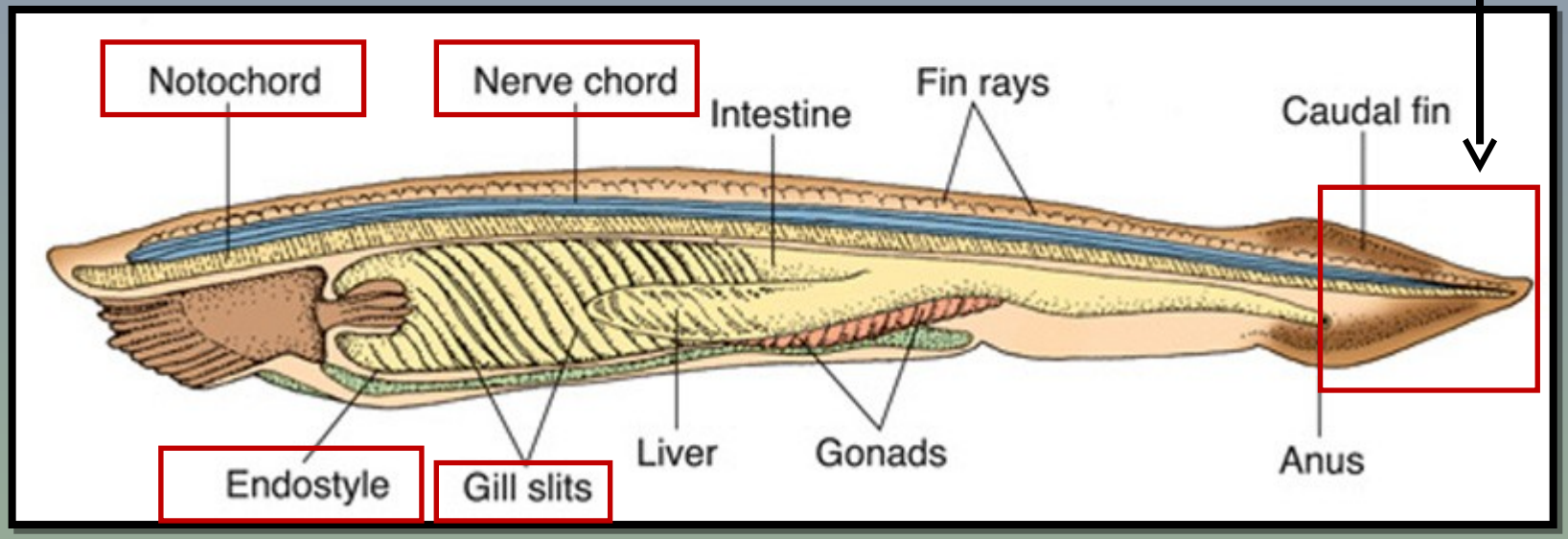
GENERAL FEATURES OF CHORDATA

1. **Notochord**
2. **Postanal tail**
3. **Dorsal tubular nerve cord**
4. **Pharyngeal pouches (slits)**
5. **Endostyle-Homologous with thyroid**
6. Bone and cartilage
7. Bilateral symmetry
8. Triploblastic
9. Coelom well developed
10. İnternal Segmentation
11. Complete gut cavity (mouth and anus)
12. Close circulation

FIVE DISTINCTIVE CHARACTERS

FIVE DISTINCTIVE CHARACTERS

- NOTOCHORD
- DORSAL TUBULAR NERVE CHORD
- ENDOSTYLE
- PHARANGEAL SLITS
- POST ANAL TAIL



NOTOCHORD: is a flexible, rodlike structure, extending the length of the body.

- It is the first part of the endoskeleton to appear in an embryo.
- It is **a hydrostatic organ** which contain fluid in single, large cavity (unlike nematods).
- In Amphioxus and in jawless vertebrates, the notochord persists throughout life.
- In most vertebrates, the notochord is replaced by vertebrae, but trace of the notochord may persist between or ithin the vertebrae.

DORSAL TUBULAR NERVE CHORD

- In most inveretbrate phyla, this structure is ventral to the digestive track and is solid.
- In chordates, this sturcture is single and found dorsal to the digestive track, and is tube.
- The anterior end becomes enlarged to form the brain in vertebrates.

PHARYNGEAL POUCHES AND SLITS

- Pharyngeal slits is the opening that lead from the pharyngeal cavity to the outside.
- In aquatic chordates, two pockets break through the pharyngeal cavity and they meet to form the **pharyngeal slits**.
- In tetrapod (terrestrial) vertebrates the pharyngeal pouches (sacs) give rise to several different sturctures such as: Eustachian tube, middle ear cavity, tonsils, paratyroid glands

ENDOSTYLE AND THYROID GLAND

- Until recently, endostyle was not recognized as a chordate character.
- But now, it is known that the thyroid gland is derived from it.
- The thyroid gland occurs only in all chordates.
- The **Endosytle**, secretes mucus for trapping small food particules.

POSTANAL TAIL

- Provide the motility that larval tunicates and amphioxus to free-swimming.
- In humans, the tail is found only as a vestige.

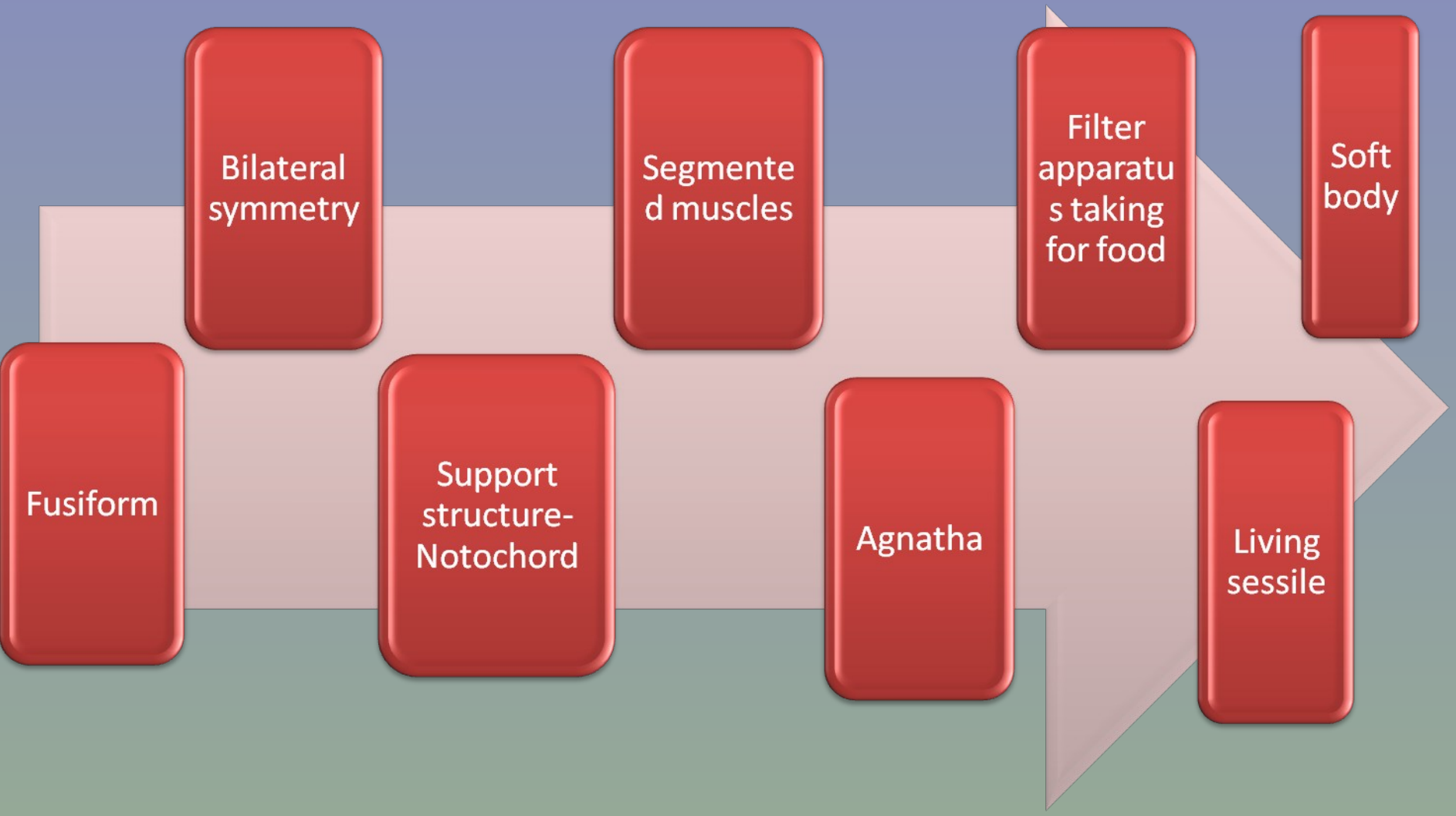
ANCESTRY AND EVOLUTION OF CHORDATES

Chordata phylum surely developed from invertebrates

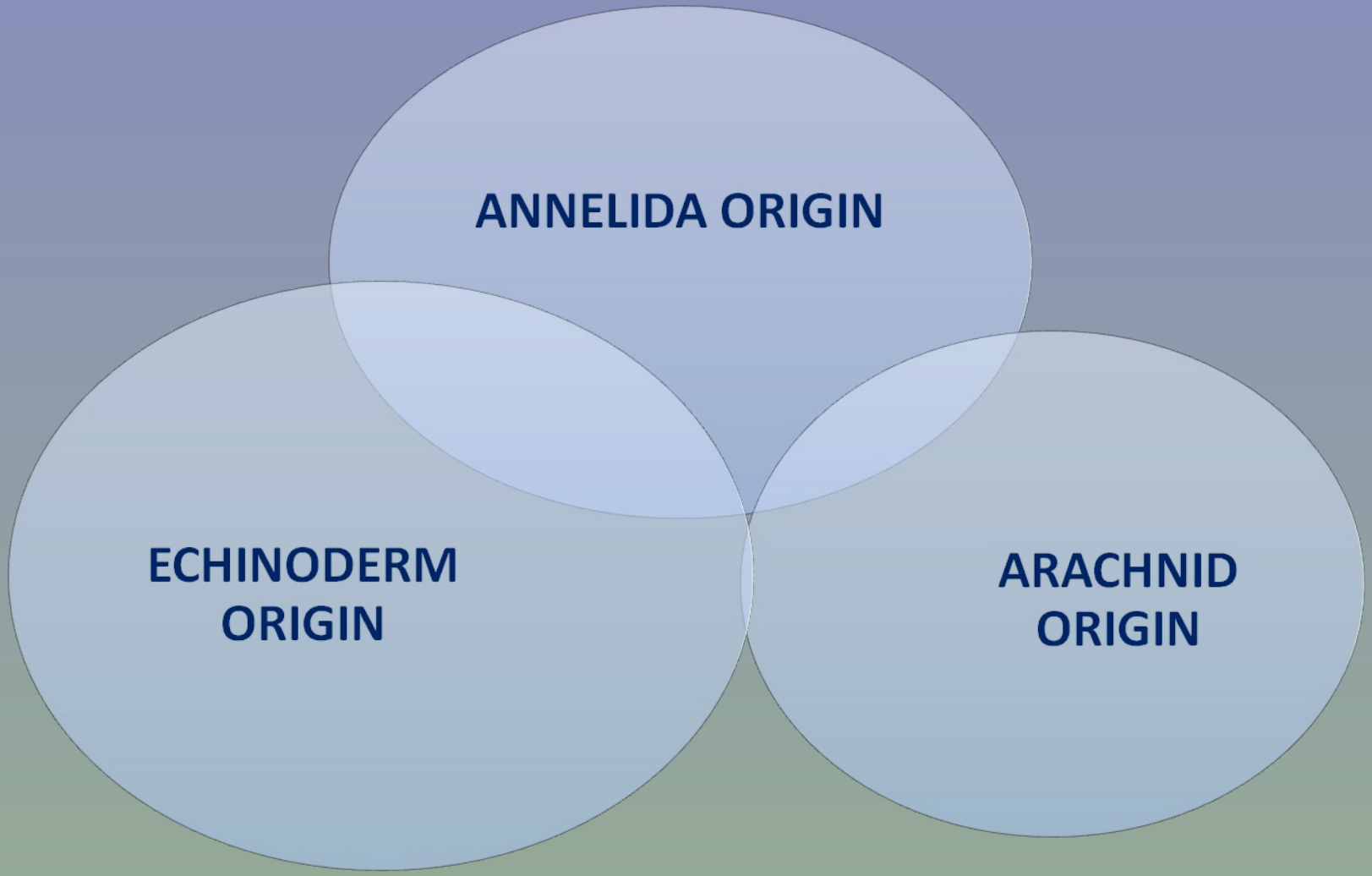
BUT
THERE ARE NO FOSSILS TO CLEAR UP THE EVOLUTION OF CHORDATA

Several theories were put forward to clarify the ancestor of Chordate

Considering the today's Primitive Chordate, the ancestor of Chordata can has following characteristics:

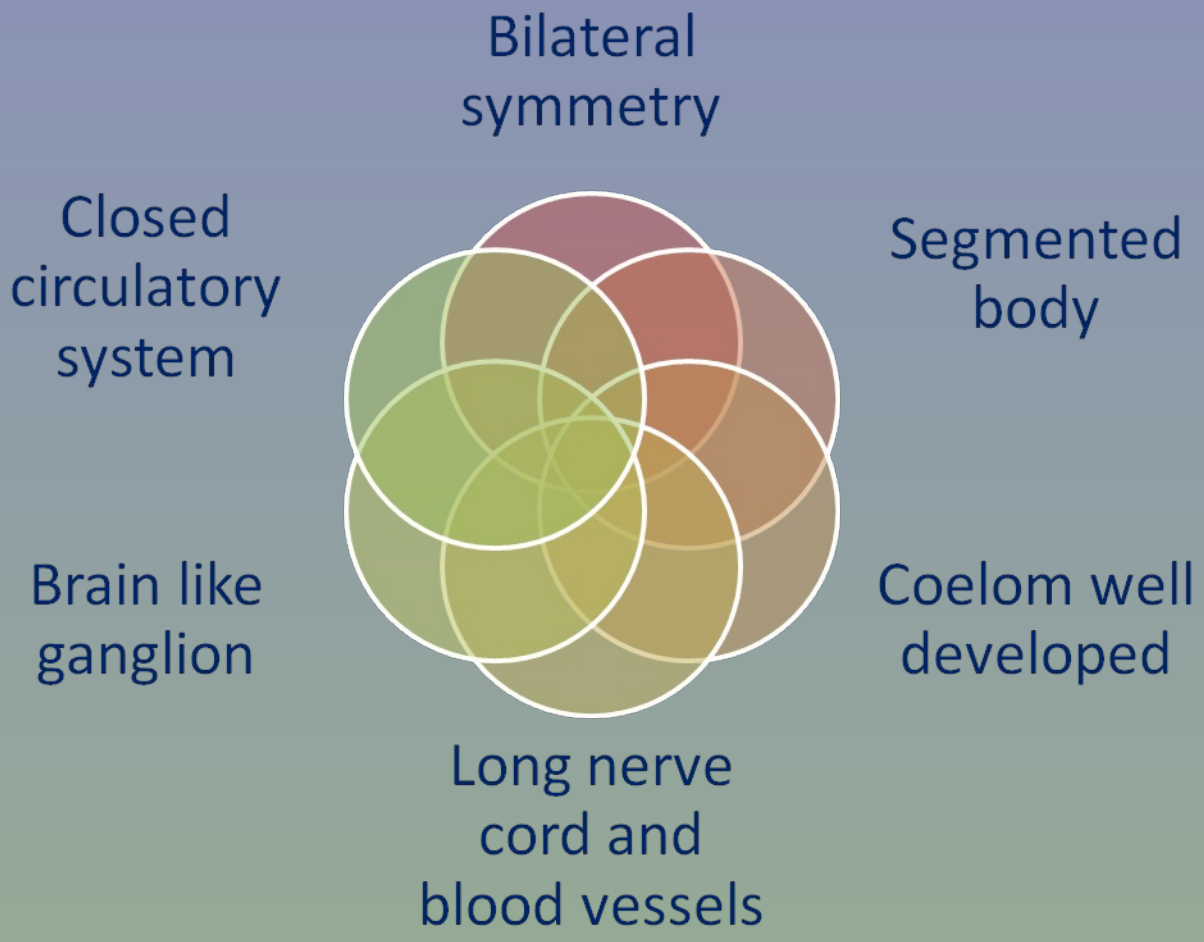


THE MOST IMPORTANT THEORIES



ANNELID ORIGIN

SIMILARITIES WITH THE CHORDATE



ANNELID ORIGIN

DIFFERENCES WITH THE CHORDATE

1. **Annelid:** Segmentation is seen in **all tissues and organs from outside of the body to the digestive tract**

   Chordata: Segmentation is seen in **certain tissues such as muscle**.

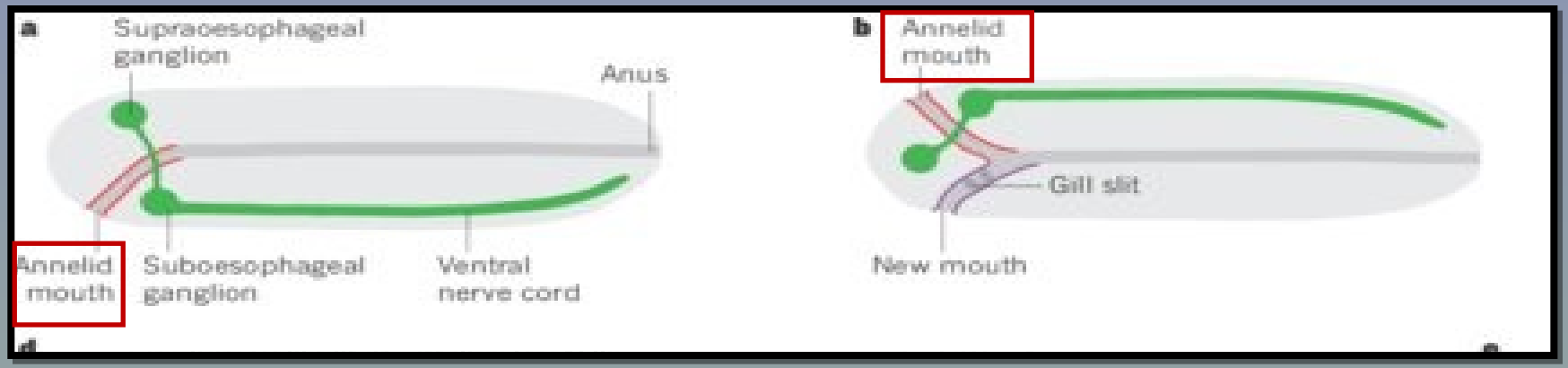
2. **Annelid:** Nerve cord is **not tubular** and extends **in ventral**

   Chordata: Nerve cord is **tubular** and extends **in dorsal**

Some scientist suggested that that chordates may be an inverted annelid (torsion)

Had the reversal occurred, the ventral mouth should have passed through the dorsal.

However, the mouth of the chordate is also in the ventral.



Besides;
Lack of **notochord** and **gill slit**
Schizocoel type coelom

REJECTED

ARACHNID ORIGIN

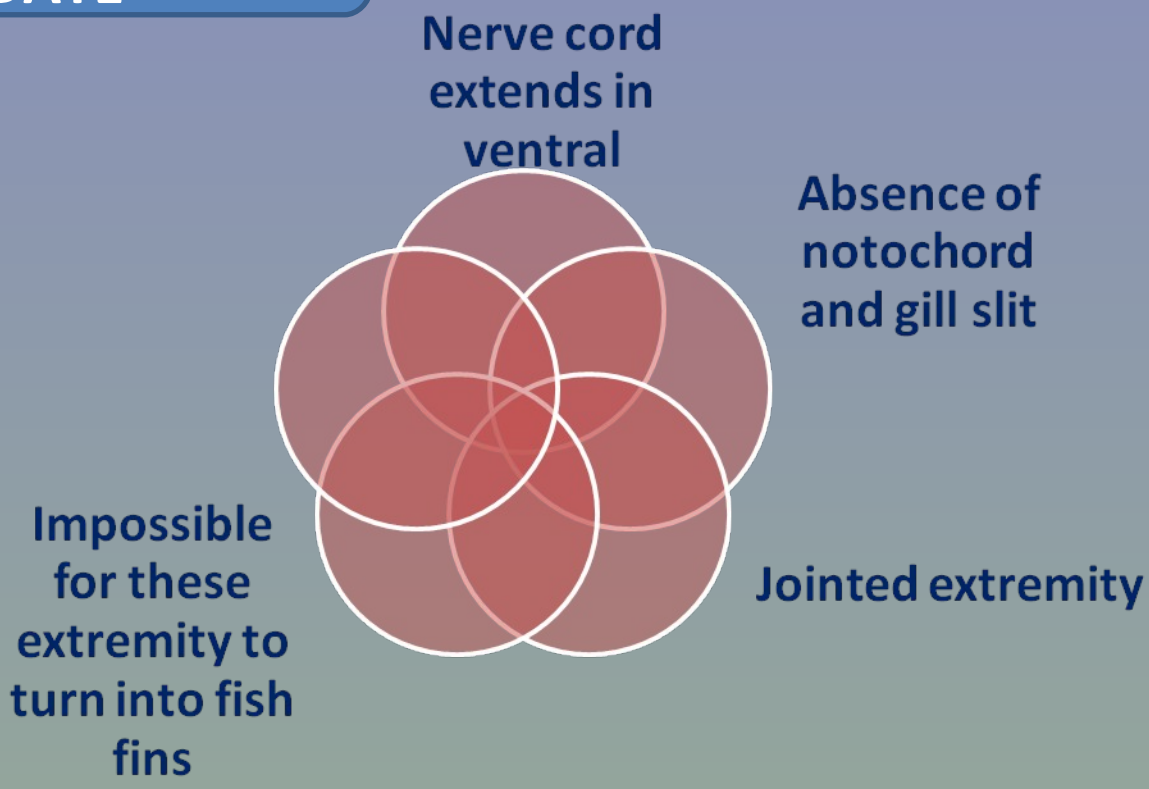
Arthropoda, including the Arachnida class, is believed to originate from an annelid-like worm.

It has been suggested that Eurypterid (member of Arthropoda) which lived in Paleozoic may be the ancestor of Chordata due to the chitin exoskeleton

SIMILARITY: The fossil Ostracoderm fish that lived in Ordovician and Devonian had the dermal armor skeleton

ARACHNID ORIGIN

DIFFERENCES WITH THE CHORDATE



REJECTED

ECHINODERM ORIGIN

➢ The theory was given by Johannes Muller (1860) and it is based on the comparative studies of **larval stages of echinoderms and hemichordates.**

Tornaria Larvae Hemichordata

Auricularia Larvae Echinoderm

Bipinnaria Larvae Echinoderm

Dipleurula Larvae Echinoderm

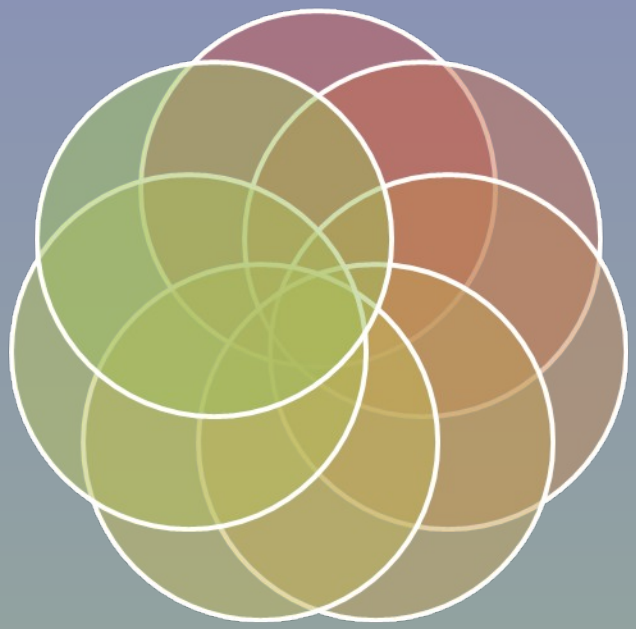
The number of chambers in the coelom is equal.

ECHINODERM ORIGIN

ADMITTED

Blastomeres have equal potential

Mezoderm origin skeleton



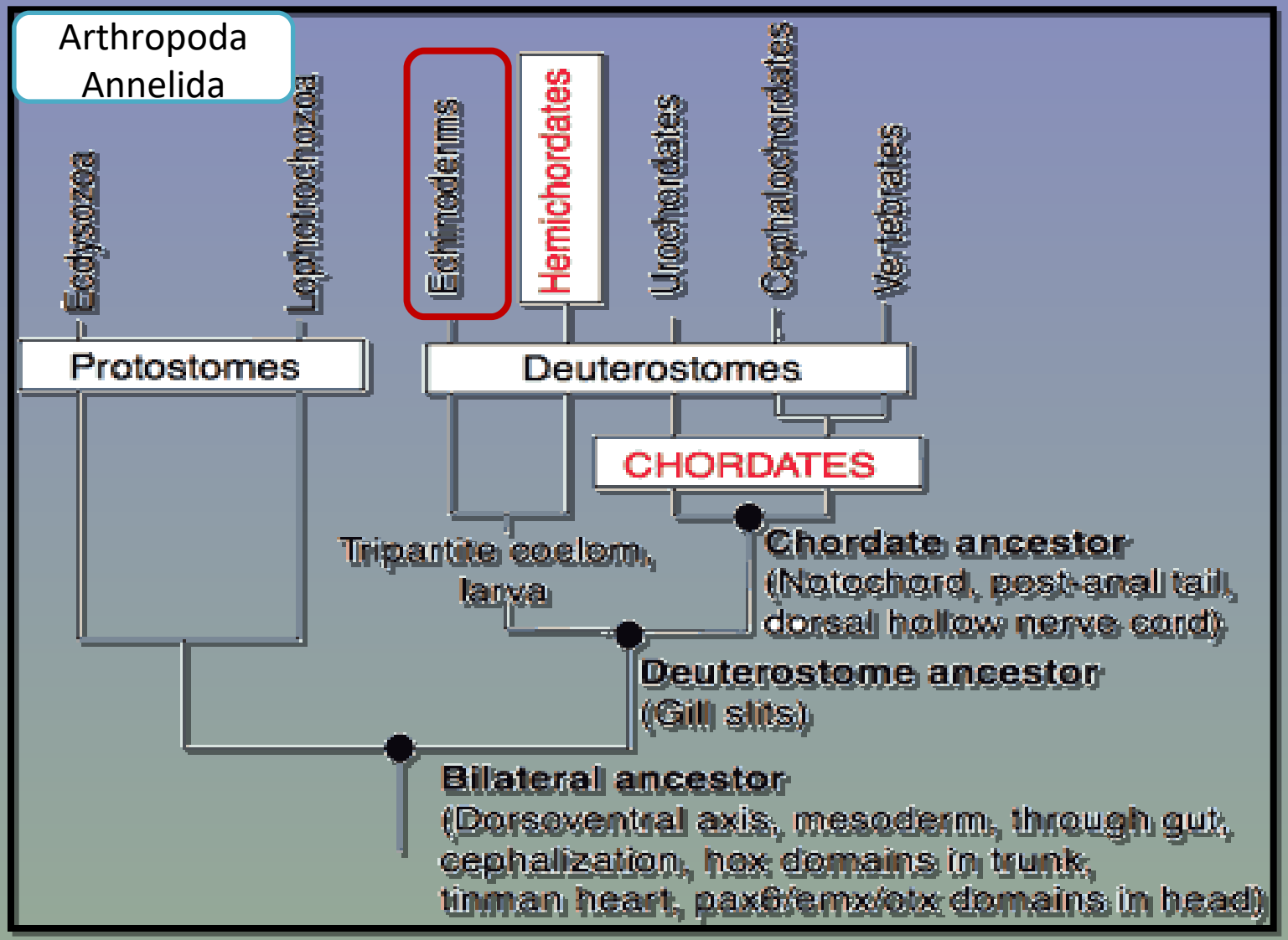
Deutorostomia

Biochemical similarity

(Blood serum; muscle chemistry)

Coeloms are enterocoel

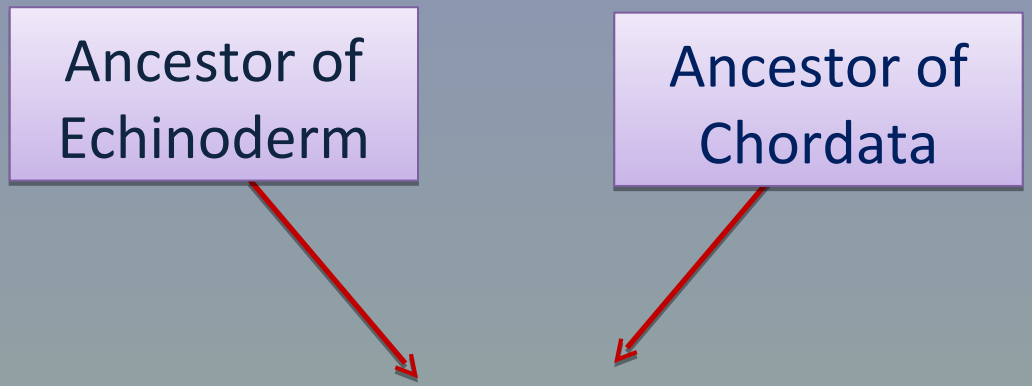
ANCESTRY AND EVOLUTION OF CHORDATES



CAMBRIAN CHORDATES

Pikaia is the best known early chordates which looks little like an *Amphioxus*

It is a fact that vertebrates and primitive chordates do not form directly from Echinoderm.



The gill slits (for respiration) formed as a result of the development of the filter-feeding (for taking food) system.

Primitive Echinoderm + Pterobranchia (Hemichordata)

Ancestor of Chordata

Collecting their food with their feather like structure (arm-feeder)

Primitive

Sessil

Free –living form

Degenerative metamorphosis

Lost many of its chordate characteristics Adult Tunicata

Metamorphosis is not seen;
Free-living larvae **(protect chordata features) ;**
Neoteny
Migrating to the entrance of the river

Migrating to the upstream of the river

Cyclostomata

To adapt to the freshwater;
- Developed strong muscle for movement
- Developed kidney for excretion
- Developed sense organs
- Increased body size

Recently, spectacular fossils of sof-bodied animals have been found in the Early Cambrian Chengjiang formation in Southern China

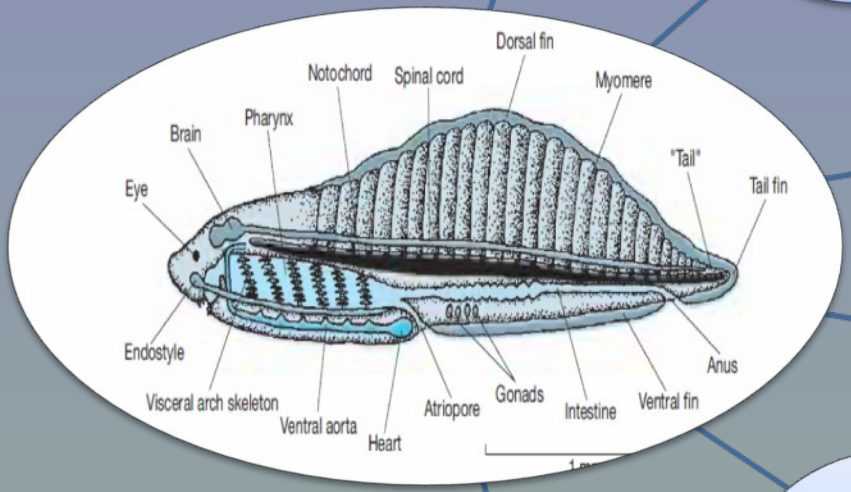
The Chengjiang deposit includes **the earliest known true vertebrates** and **some challenging fossils that may be early chordates**

Haikouella is the most vertebrate-like member of the Chengjiang Fauna

The Chordate Features of *Haikouella*

Large brain

Clearly defined eyes



Thickened branchial bars

Upper lip → Similar to larval lamprey

Endostyle

Tentacles

Suggest that this animal was a suspension feeder, like *Amphioxus*

SUB-SYSTEMATICS GROUPS OF CHORDATA

PHYLUM: CHORDATA

I. GROUP: ACRANIA – PROTOCHORDATA

SUBPHYLUM: UROCHORDATA (TUNICATA)

CLASS: Thaliacea

SUBPHYLUM : CEPHALOCHORDATA

CLASS: Leptocardia

II. GROUP: CRANIATA

SUBPHYLUM: VERTEBRATA

SUPER CLASS: PISCES

CLASS: Myxini

CLASS: Petromyzontida

Cyclostomata
Jawless Fishes

CLASS: Chondrichthyes

CLASS: Actinopterygii

CLASS: Sarcopterygii

Osteichthyes

SUPER CLASS: TETRAPODA

CLASS: Amphibia
CLASS: Reptilia
CLASS: Aves
CLASS: Mammalia

Combining Vertebrate Animal Classes in Different Groups