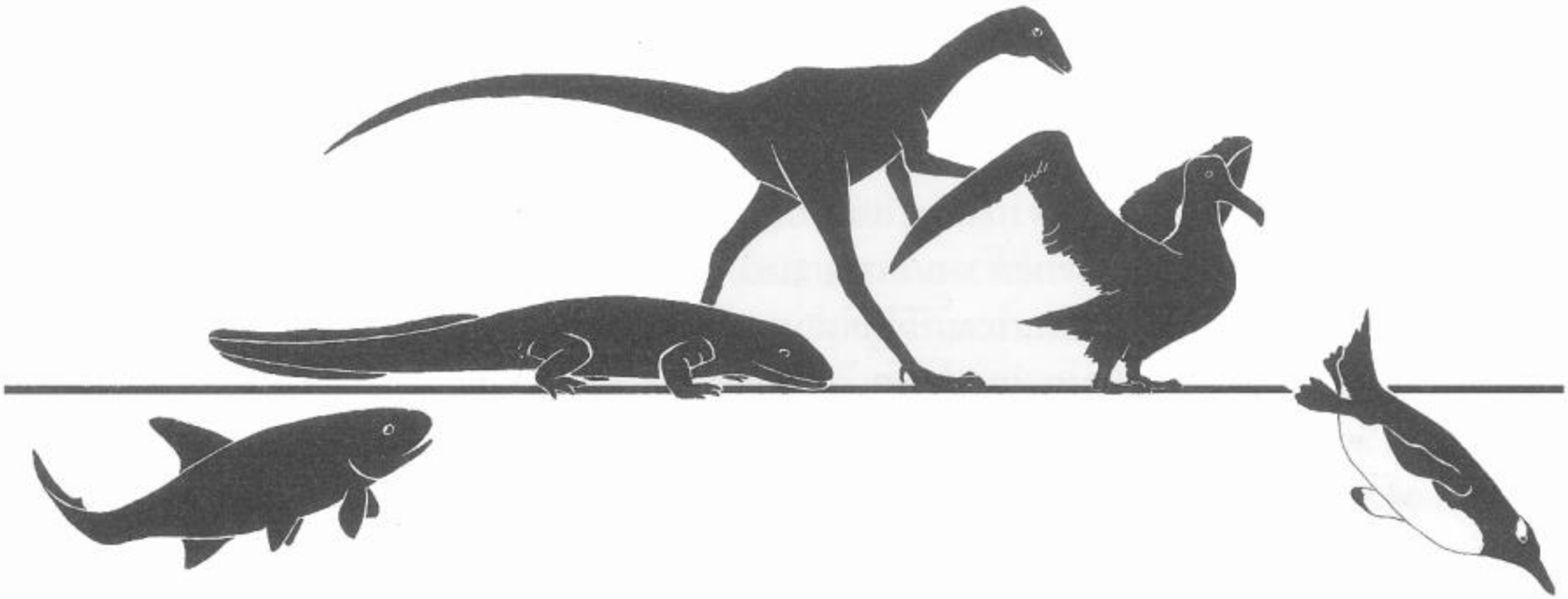
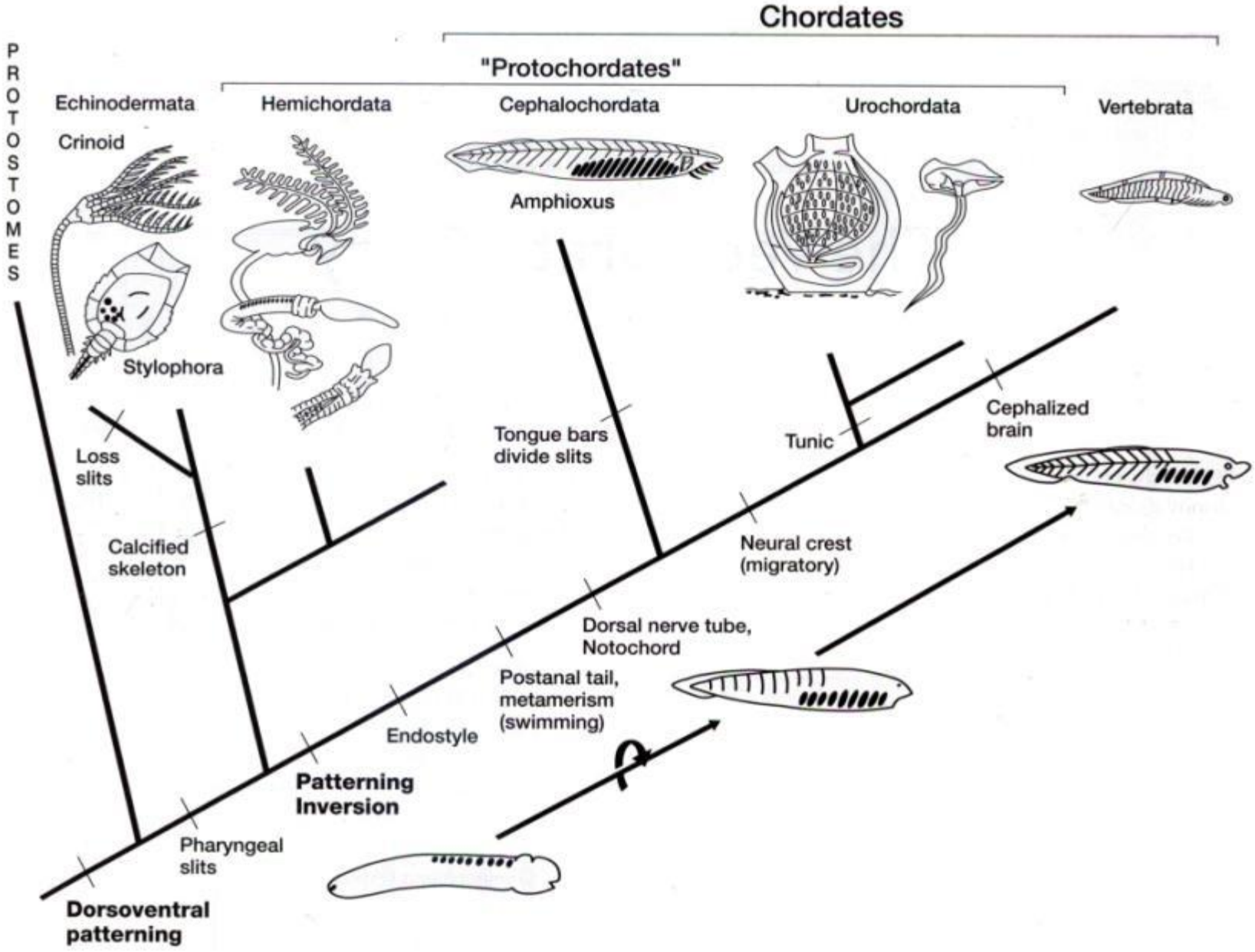


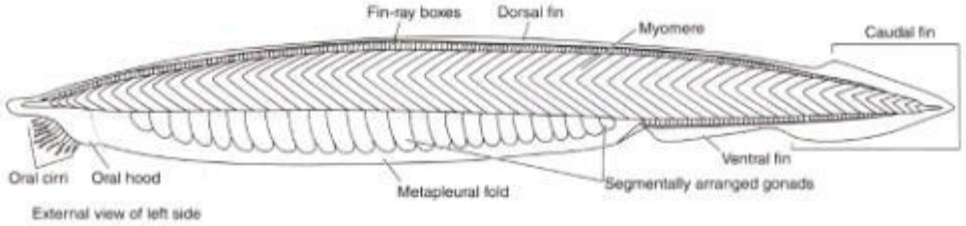
Stuart S. Sumida
Biology 342

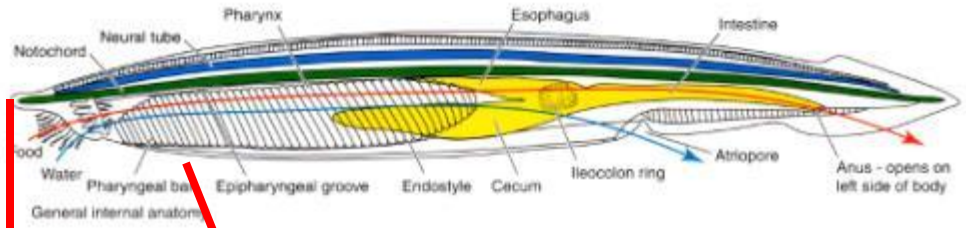
# Phylogey of Basal Chordata

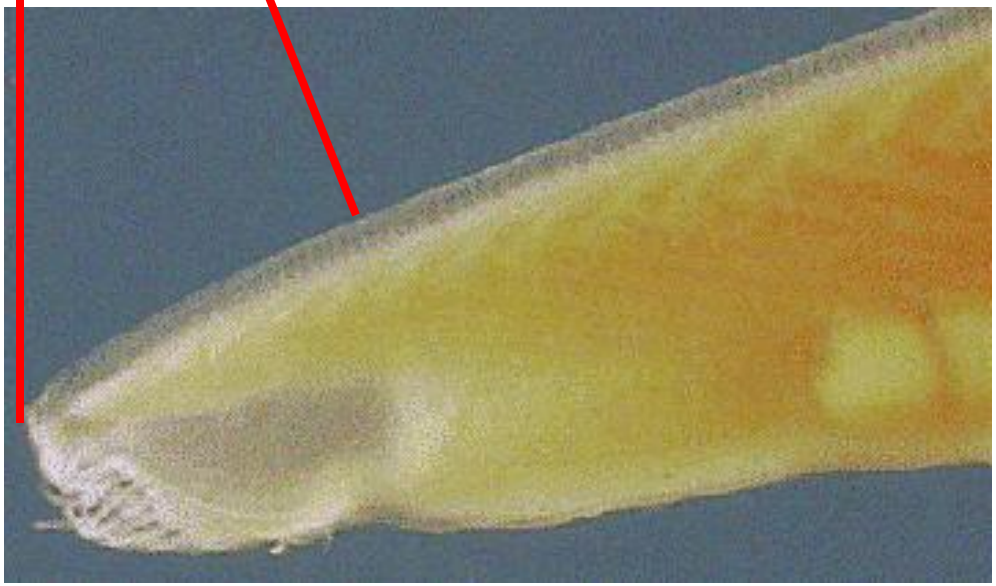
FEATURES TRADITIONALLY CONSIDERED TO BE SYNAPOMORPHIES OF CHORDATA:

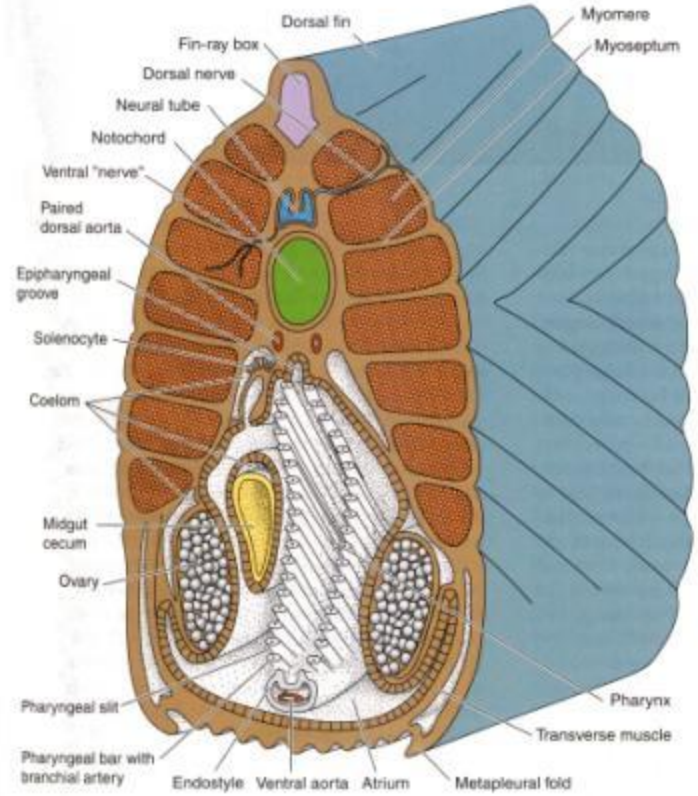
- Dorsal Hollow Nerve Cord
- Notochord
- Pharyngeal Gill Slits or Pouches
- Endostyle
- Post-anal Tail
- Segmented Body Musculature


Chordates
"Protochordates"
PROTOSTOMES
Echinodermata
Hemichordata
Cephalochordata
Urochordata
Vertebrata
Crinoid
Stylophora
Amphioxus
Loss slits
Calcified skeleton
Tongue bars divide slits
Tunic
Cephalized brain
Neural crest (migratory)
Dorsal nerve tube, Notochord
Postanal tail, metamerism (swimming)
Endostyle
Patterning Inversion
Pharyngeal slits
Dorsoventral patterning

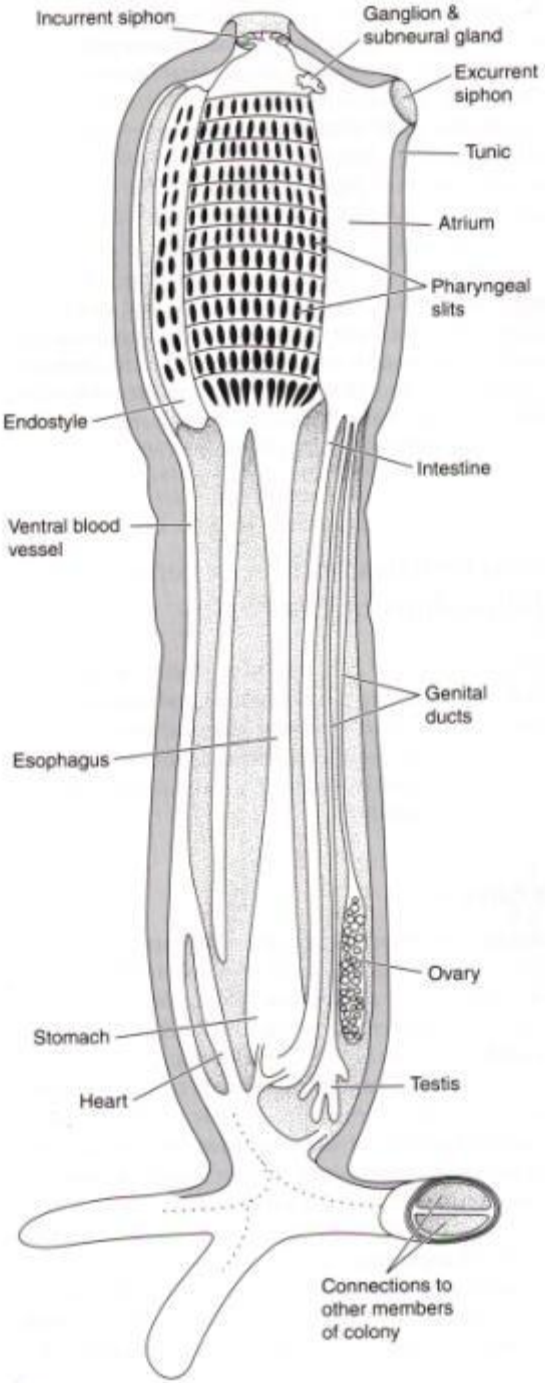

Fin-ray boxes
Dorsal fin
Myomere
Caudal fin
Oral cirri
Oral hood
Ventral fin
Metapleural fold
Segmentally arranged gonads
External view of left side

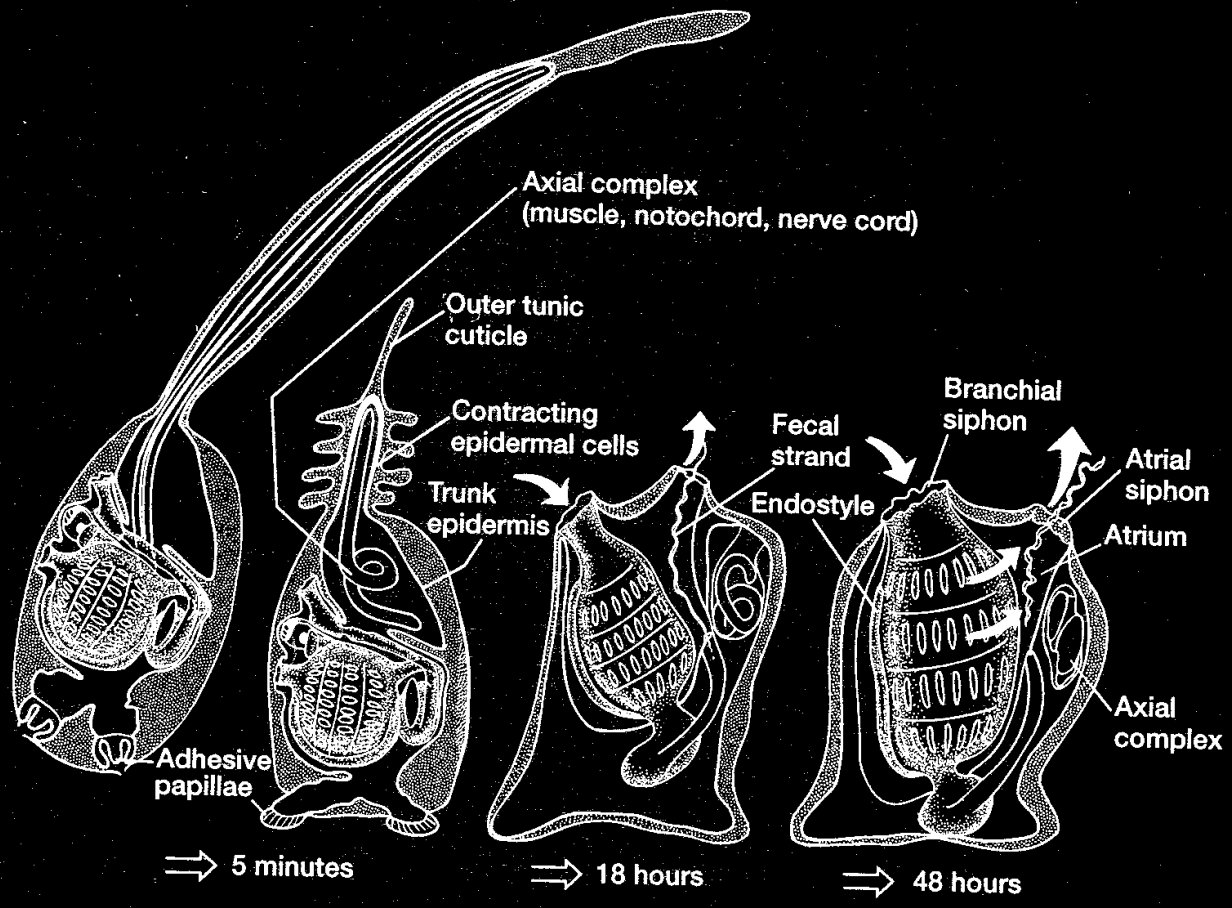

Pharynx
Esophagus
Intestine
Notochord
Neural tube
Water
Epipharyngeal groove
Endostyle
Cecum
Ileocolon ring
Atriopore
Anus - opens on left side of body



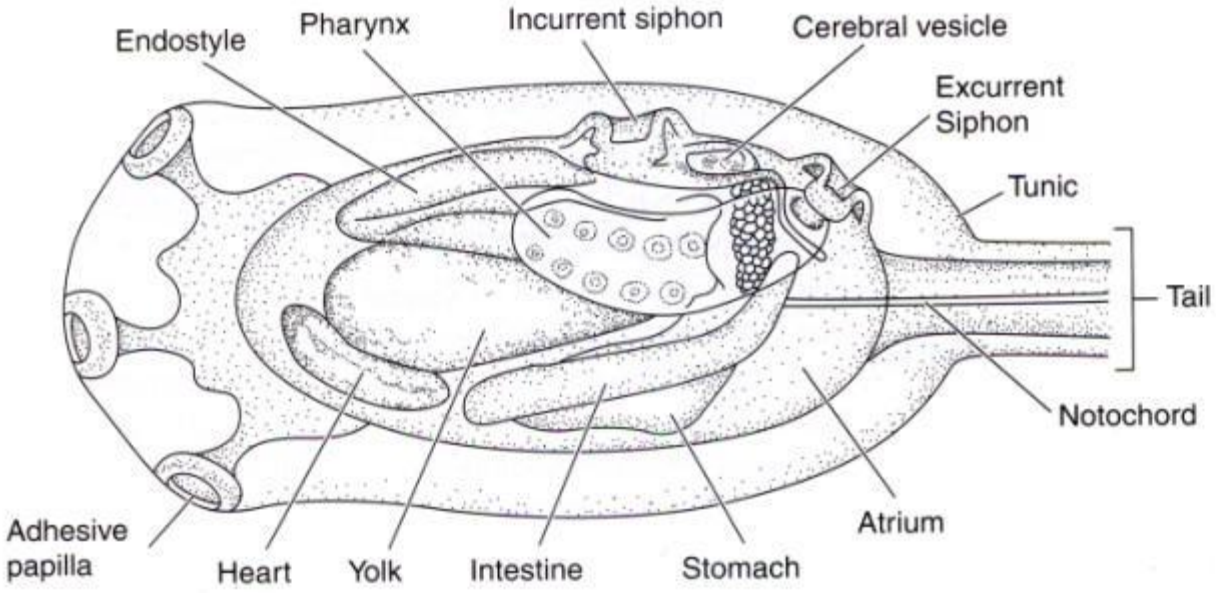

Dorsal fin
Myomere
Fin-ray box
Myoseptum
Dorsal nerve
Neural tube
Notochord
Ventral "nerve"
Paired dorsal aorta
Epipharyngeal groove
Solenocyte
Coelom
Midgut cecum
Ovary
Pharyngeal slit
Pharynx
Transverse muscle
Pharyngeal bar with branchial artery
Endostyle
Ventral aorta
Atrium
Metapleural fold

# More “fish-like” CEPHALOCHORDATA

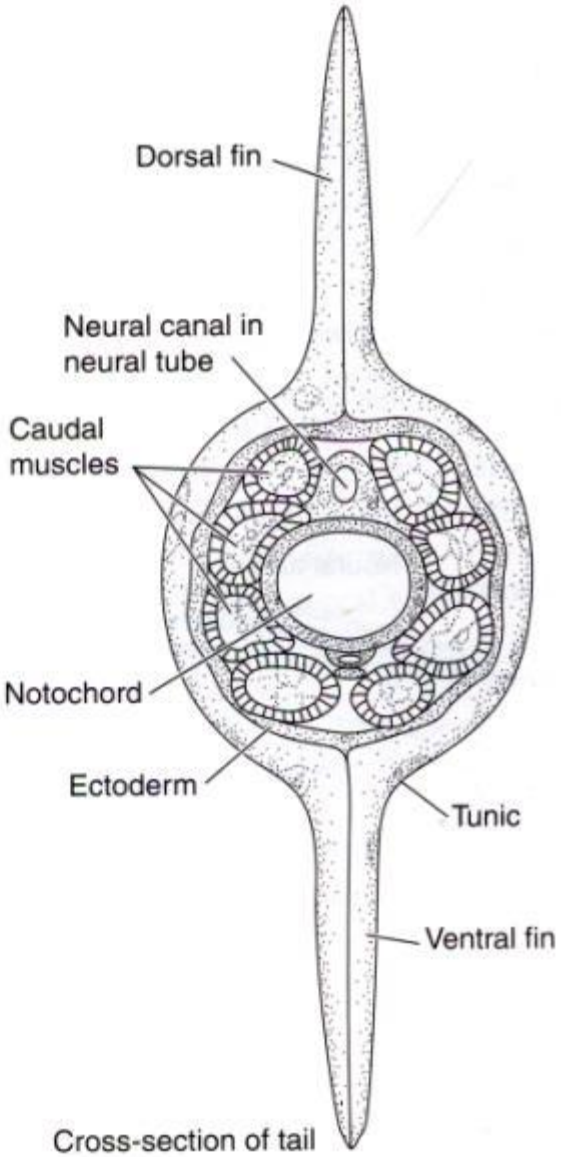

Incurrent siphon
Ganglion & subneural gland
Excurrent siphon
Tunic
Atrium
Pharyngeal slits
Endostyle
Intestine
Ventral blood vessel
Genital ducts
Esophagus
Ovary
Stomach
Testis
Heart
Connections to other members of colony



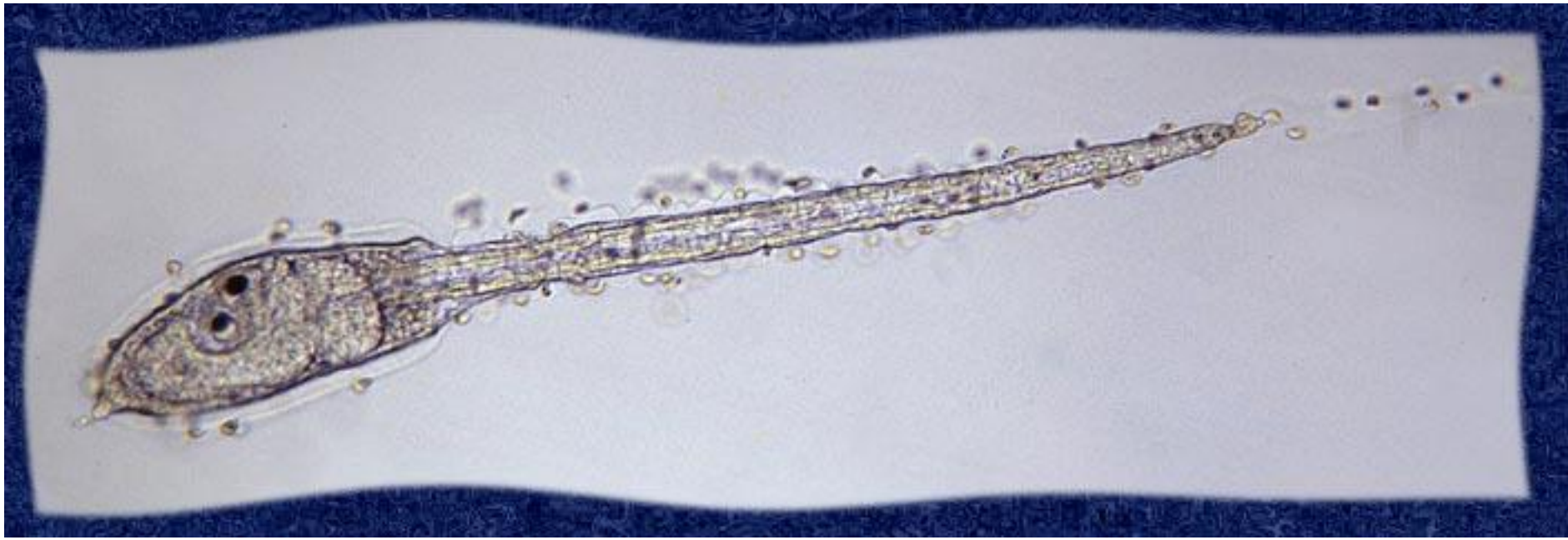

# TUNICATE: Metamorphosis from larva to adult



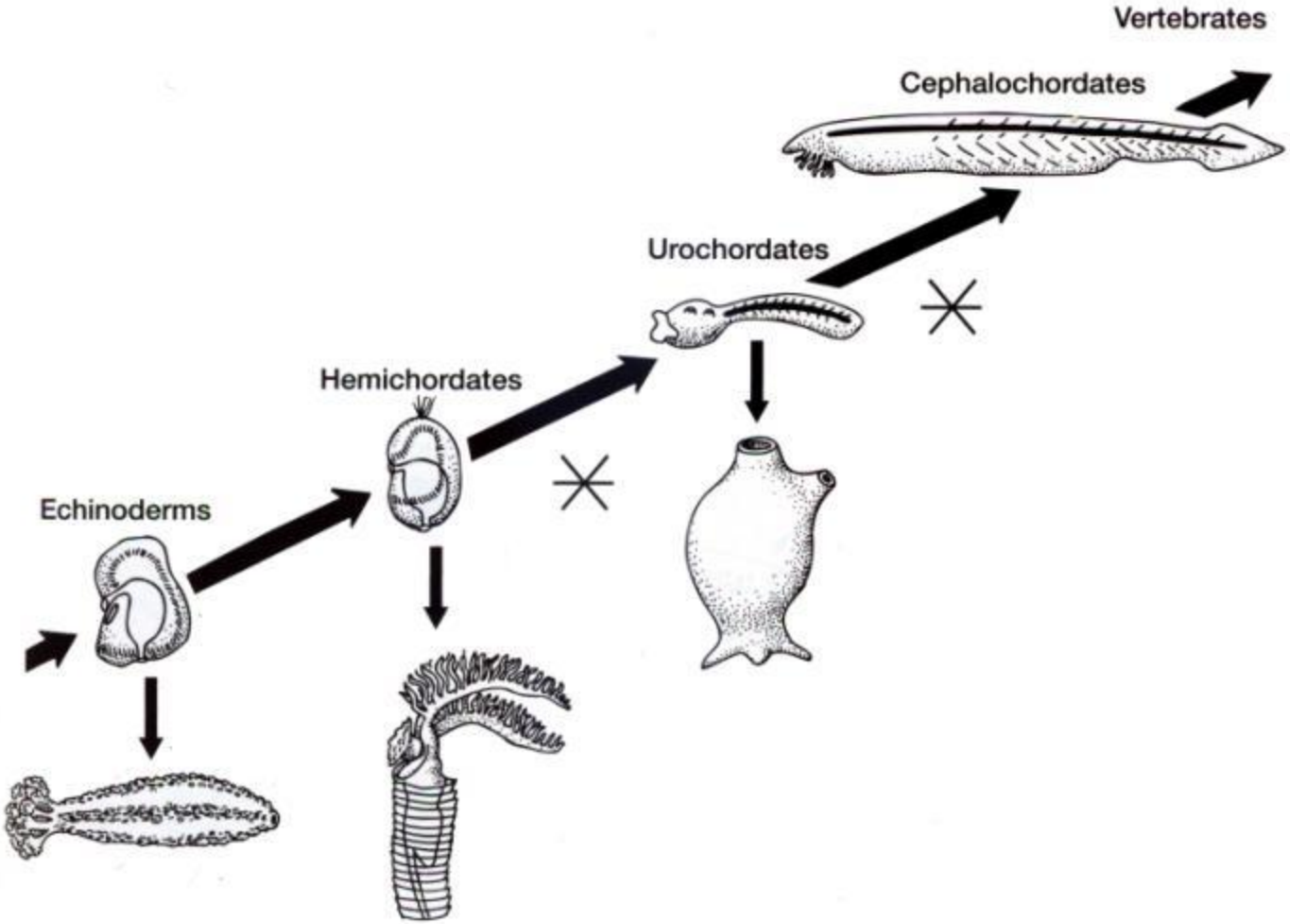

Lateral view of head

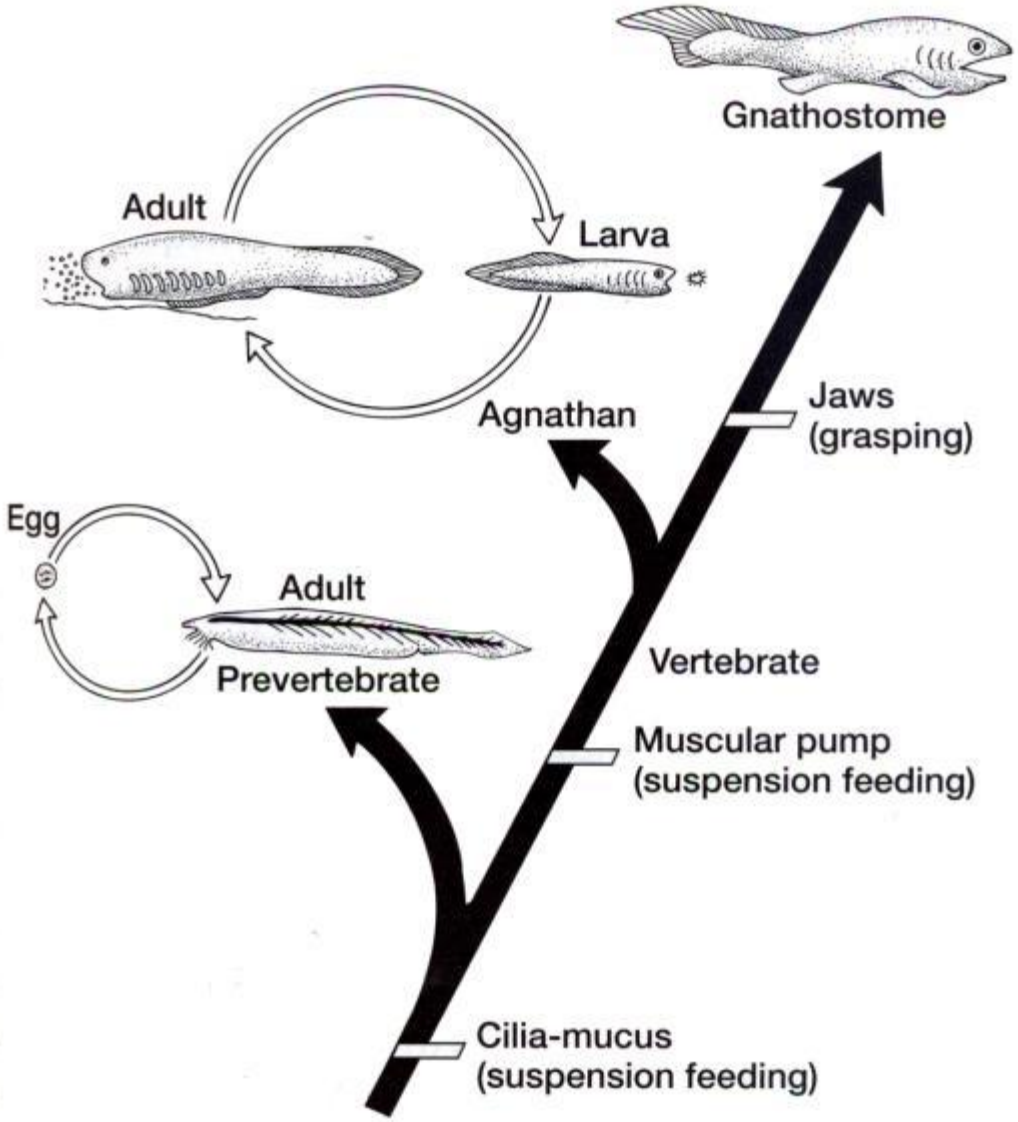


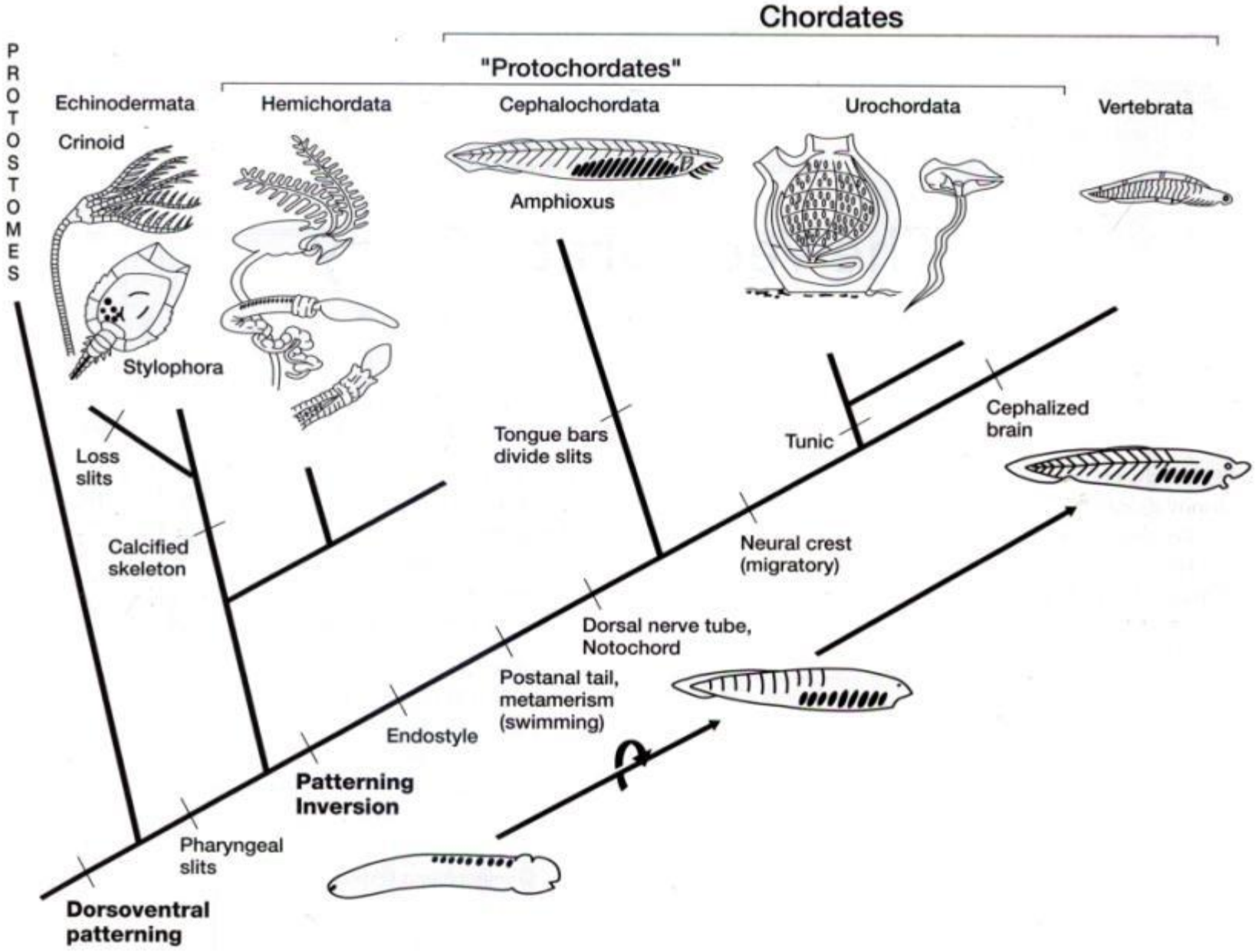

Cross-section of tail



The new larval stage of a urochordate


Vertebrates
Cephalochordates
Urochordates
Hemichordates
Echinoderms


Gnathostome
Adult
Larva
Agnathan
Jaws
(grasping)
Egg
Adult
Prevertebrate
Vertebrate
Muscular pump
(suspension feeding)
Cilia-mucus
(suspension feeding)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Neural crest (migratory)
Dorsal nerve tube, Notochord
Postanal tail, metamerism (swimming)
Endostyle
Patterning Inversion
Pharyngeal slits
Dorsoventral patterning

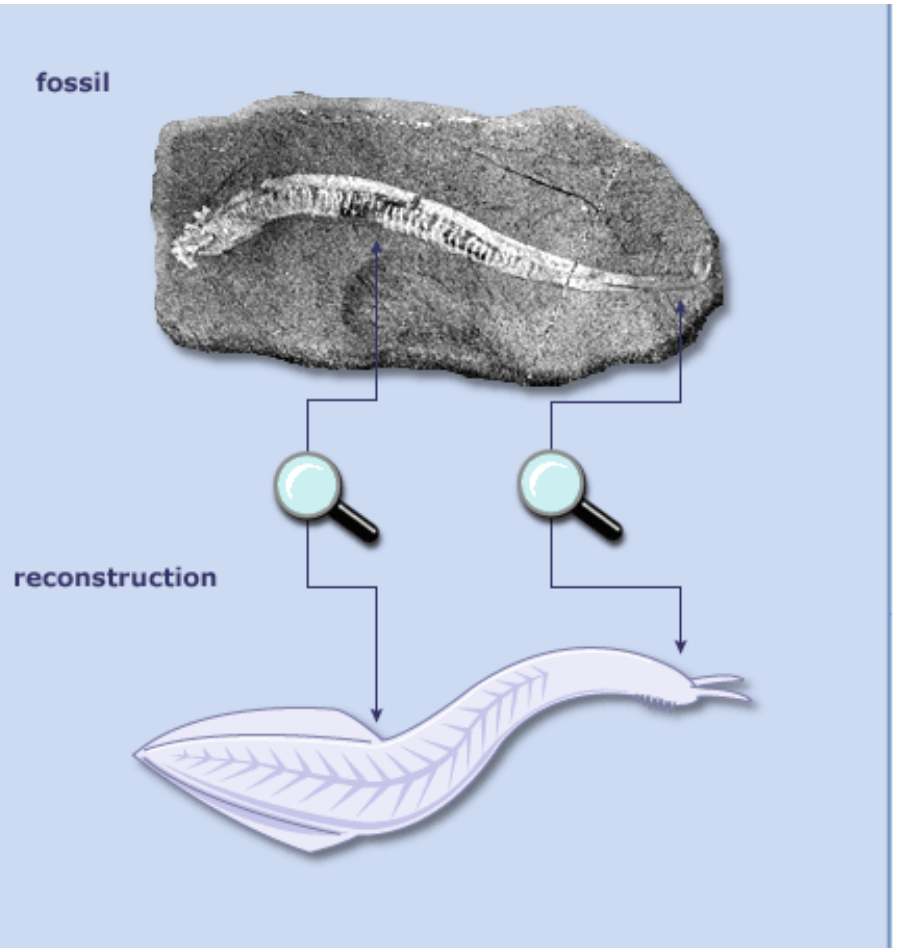
# VERTEBRATA (CRANIATA)

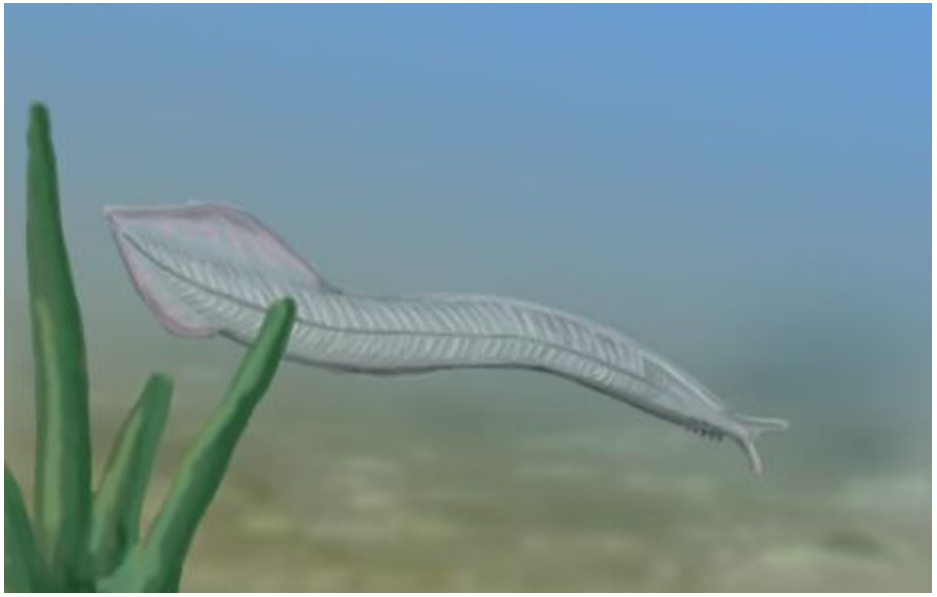
Defining Feature(s)

Neural Crest?

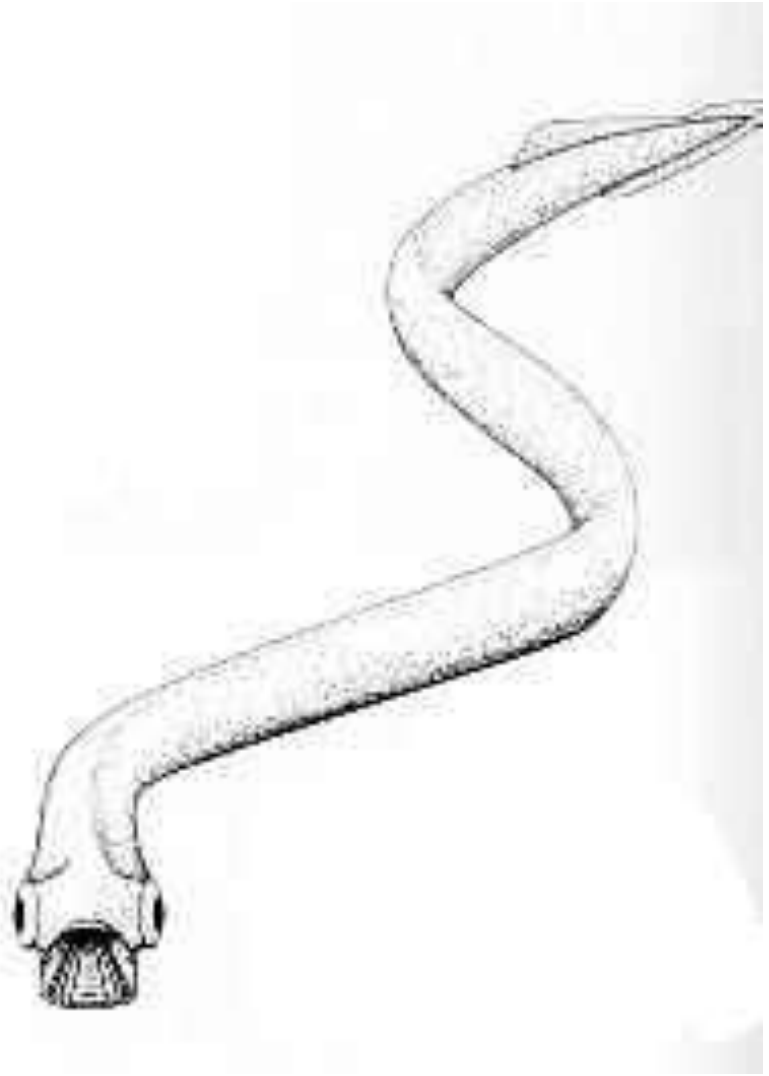
- Fully expressed and migratory neural crest
- Ectodermal placodes that develop into cranial sensory structures.
    - Nasal placode
    - Optic placode
    - Otic placode

*Pikaia* is considered by some to the earliest known vertebrate, but some consider it to be a  cephalochordate.

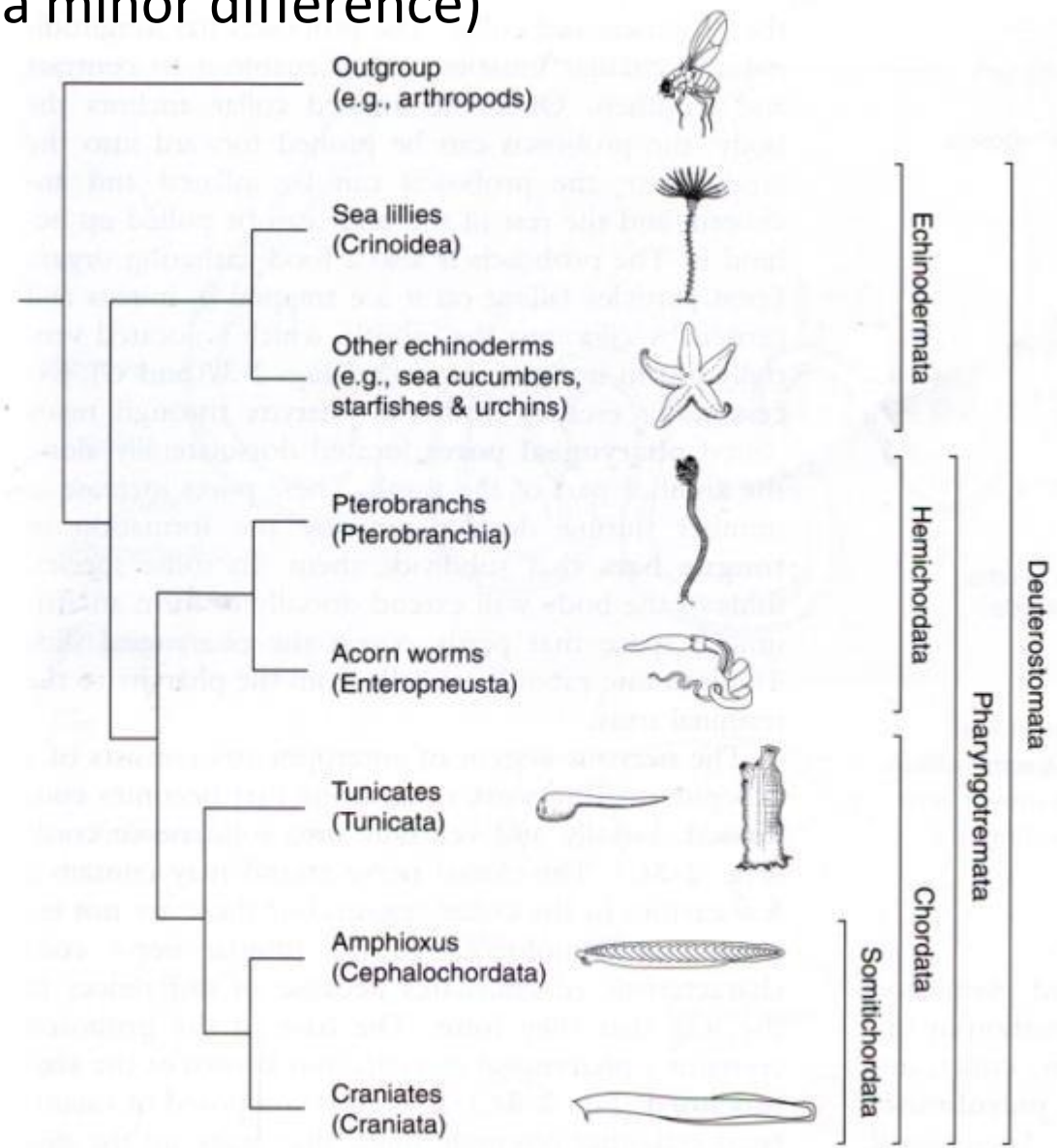




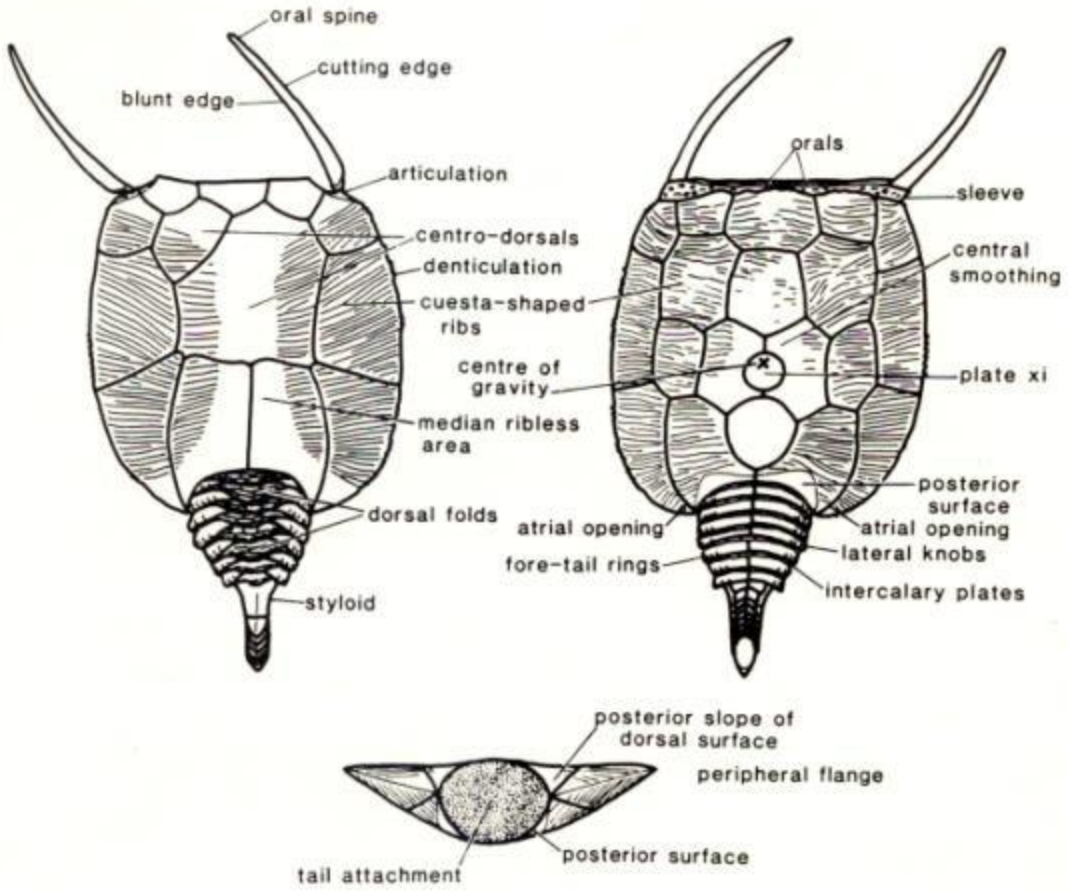
Conodonts were long known from only dental apparatus. They are now thought to be primitive vertebrates. The “tooth plates” are made of tissues only known to develop from neural crest, and whole body fossils are now known.

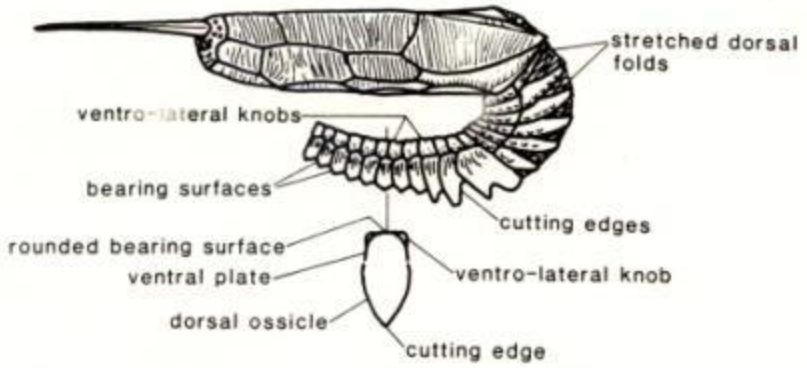


# ALTERNATIVE HYPOTHESES OF VERTEBRATE ORIGINS – 1
# (a minor difference)




Alternative hypothesis of closest sister group to Vertebrata wherein Cephalochordata are considered closer than Tunicata (= Urochordata)




ALTERNATIVE HYPOTHESES OF VERTEBRATE ORIGINS – 2 (a more significant difference)

R. P. S. Jeffries and the "Calcichordata"

*Placocystites* – a "calcichordate", a group considered by most to be a group of echonidoerms called "mitrates".

Hagfishes
(Myxiniformes)
Lampreys
(Petromyzontiformes)
Cartilaginous fishes
(Chondrichthyes)
Ray-finned fishes
(Actinopterygii)
Coelacanths
(Actinistia)
Lungfishes
(Dipnoi)
Caecilians, salamanders
& frogs (Lissamphibia)
Turtles
(Testudines)
Tuatara & squamates
(Lepidosauria)
Crocodilians
(Crocodilia)
Birds
(Aves)
Platypus & echidnas
(Monotremata)
Opossums & kangaroos
(Metatheria)
Placental mammals
(Eutheria)
Archosauria
Diapsida
Sauropsida
Theria
Mammalia
Amniota
Tetrapoda
Rhipidistia
Sarcopterygii
Osteichthyes
Gnathostomata
Vertebrata
Craniata