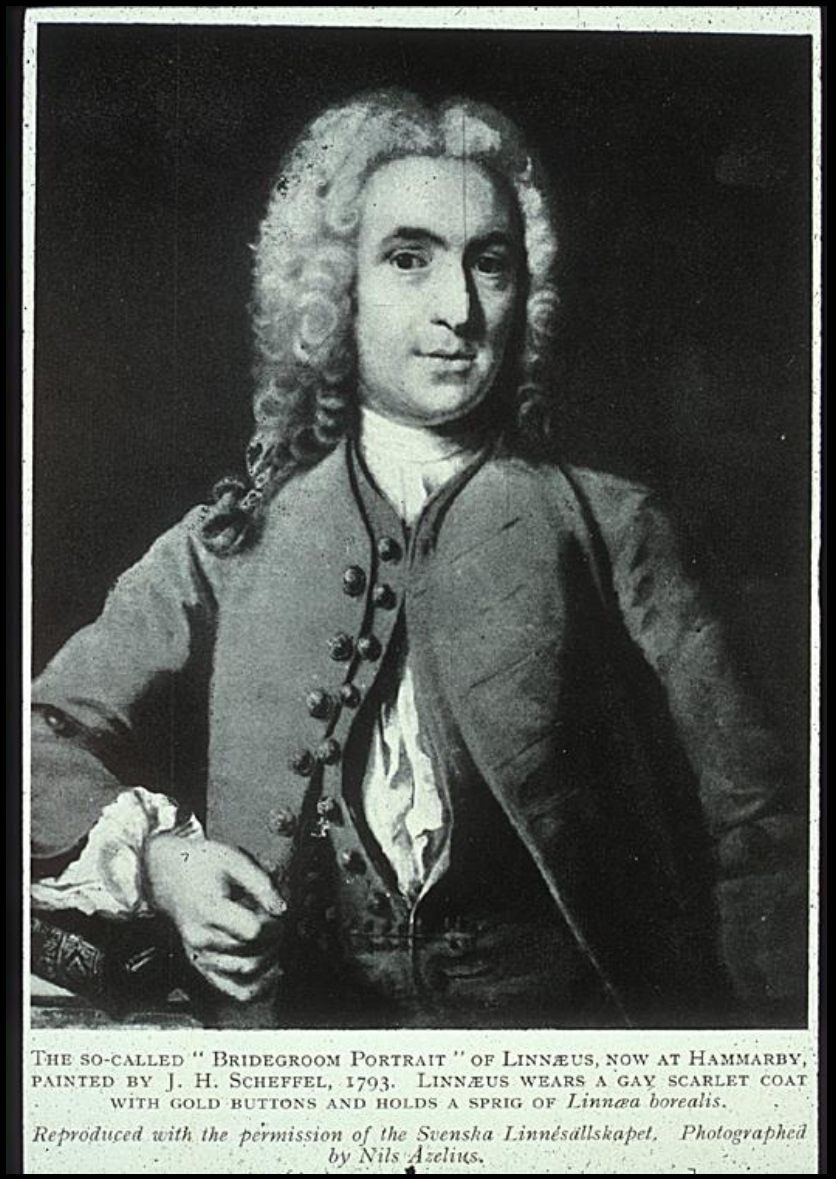
Why is Linnaeus famous?

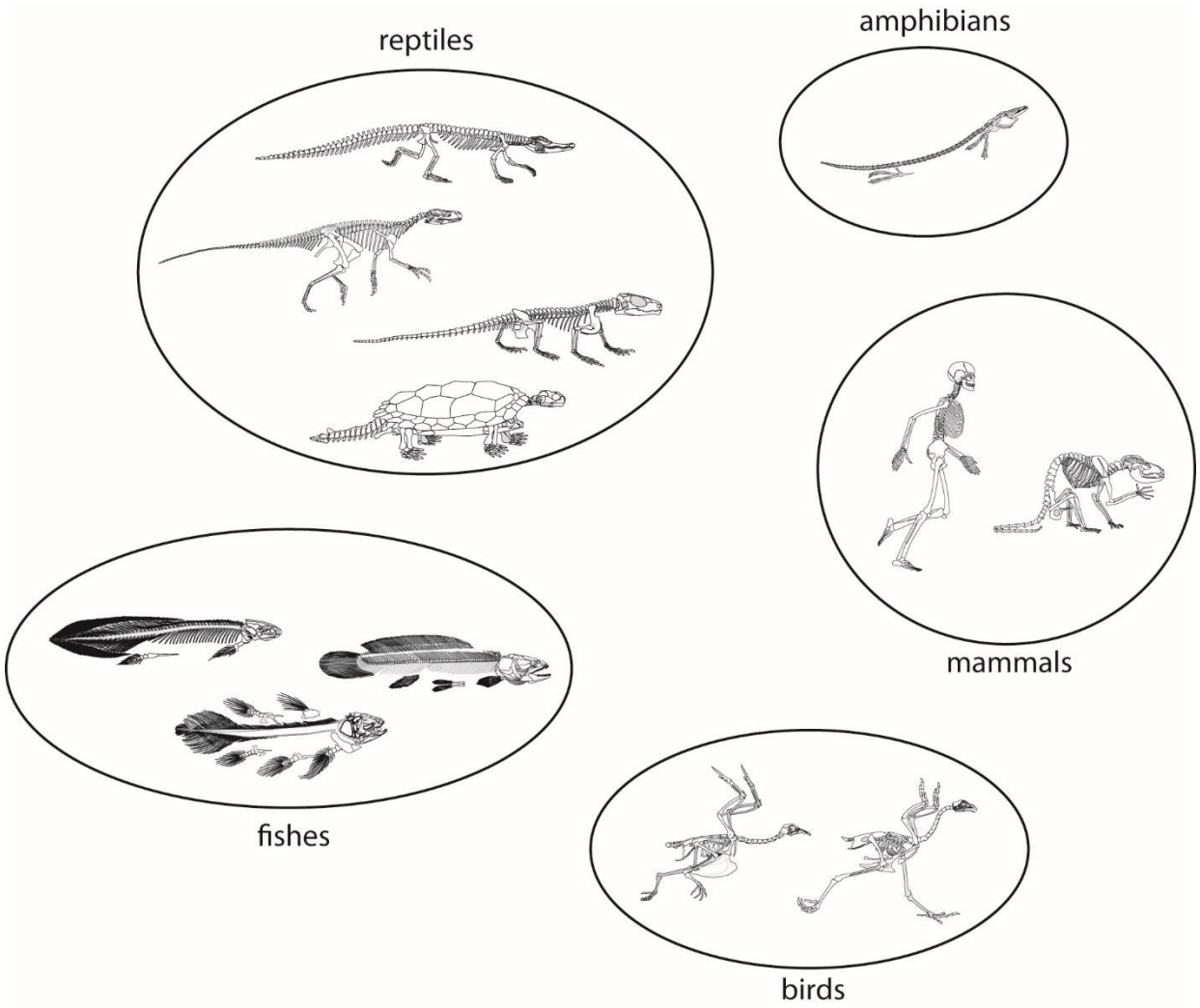
Systema Naturae (1758)



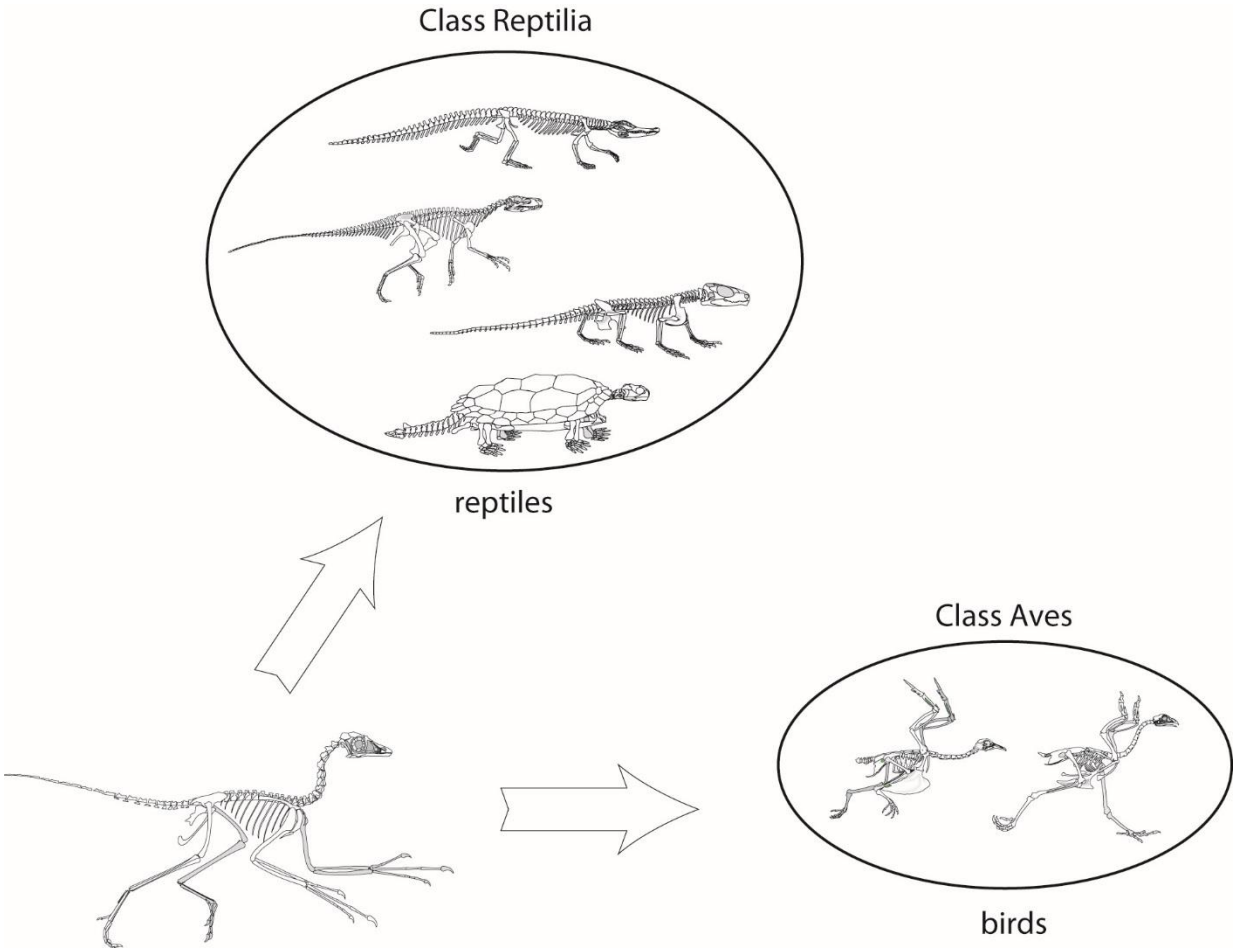
THE SO-CALLED "BRIDEGROOM PORTRAIT" OF LINNÆUS, NOW AT HAMMARBY, PAINTED BY J. H. SCHEFFEL, 1793. LINNÆUS WEARS A GAY SCARLET COAT WITH GOLD BUTTONS AND HOLDS A SPRIG OF *Linnæa borealis*.

Reproduced with the permission of the Svenska Linnésällskapet. Photographed by Nils Azelius.

Linnaean classification…..

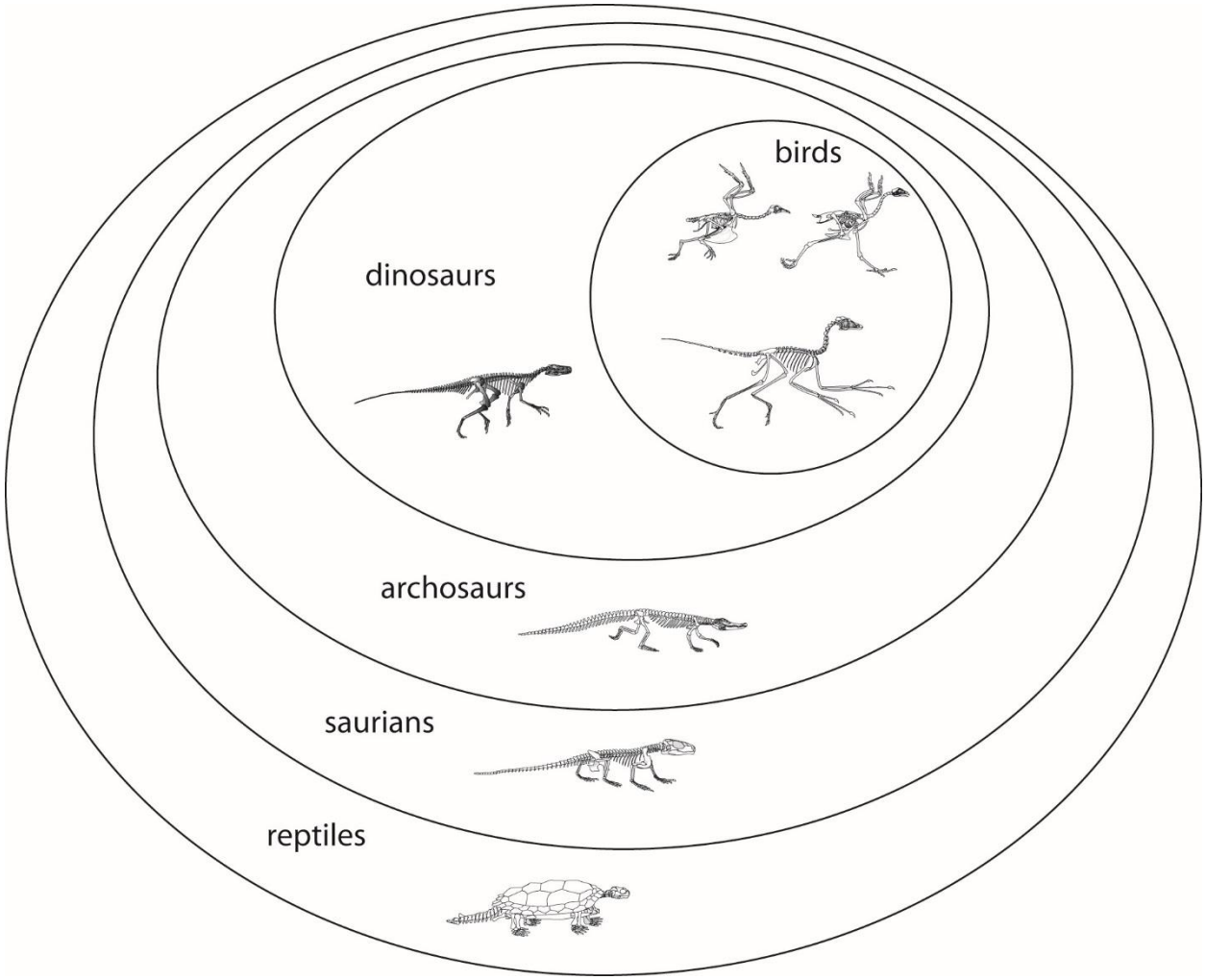


…has a hard time with evolving organisms. Transitional forms from the fossil record spawned the theory of evolution, and now an evolutionary system of classification



Archaeopteryx – a Jurassic fossil with feathers and teeth….

Phylogenetic nomenclature is hierarchical….



Cladogram: evolutionary map of relationships, or phylogeny

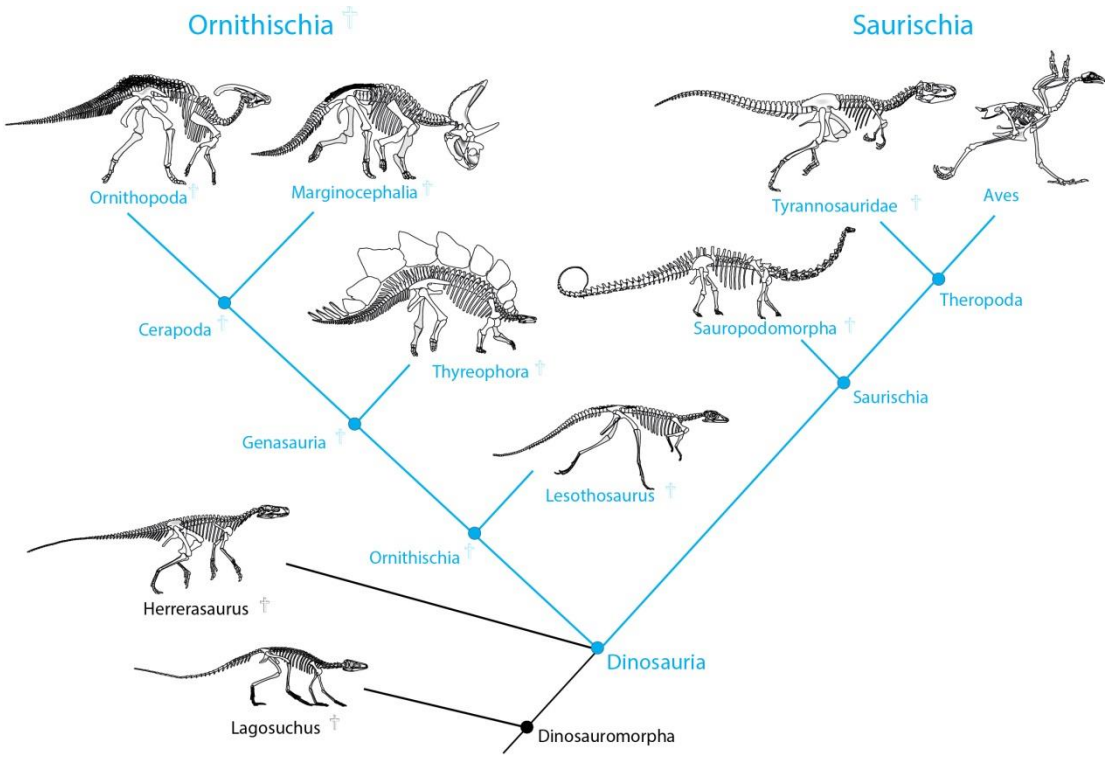


Figure 12.01 Dingus & Rowe

Monophyletic group: an ancestor and ALL of its descendants

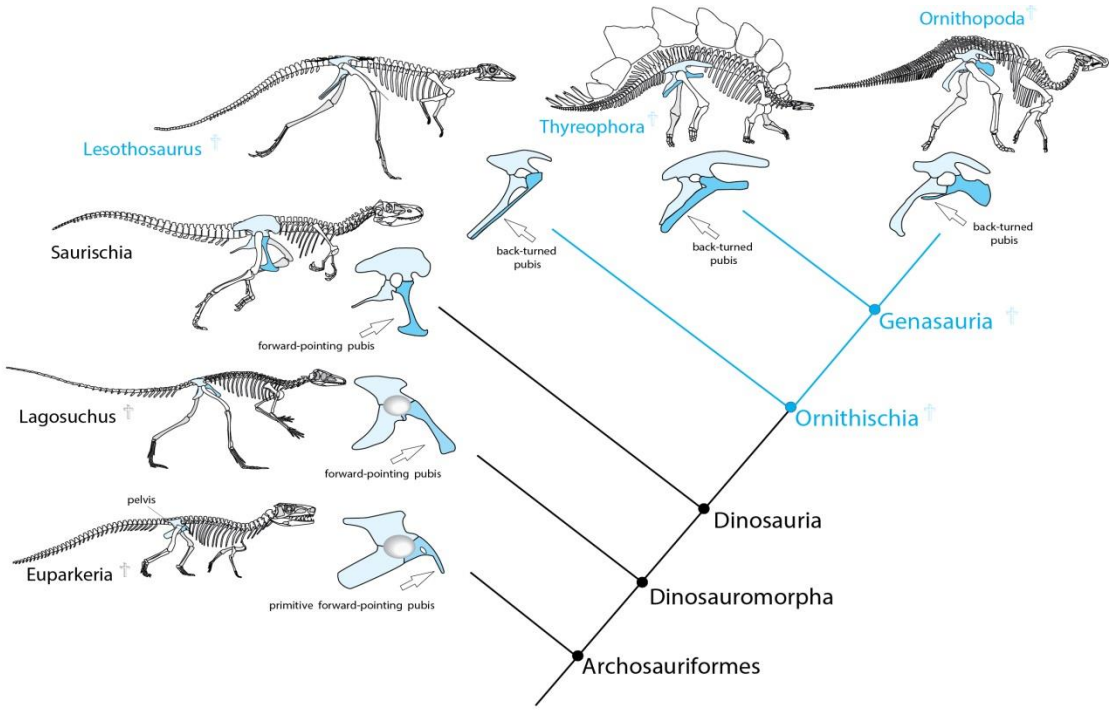
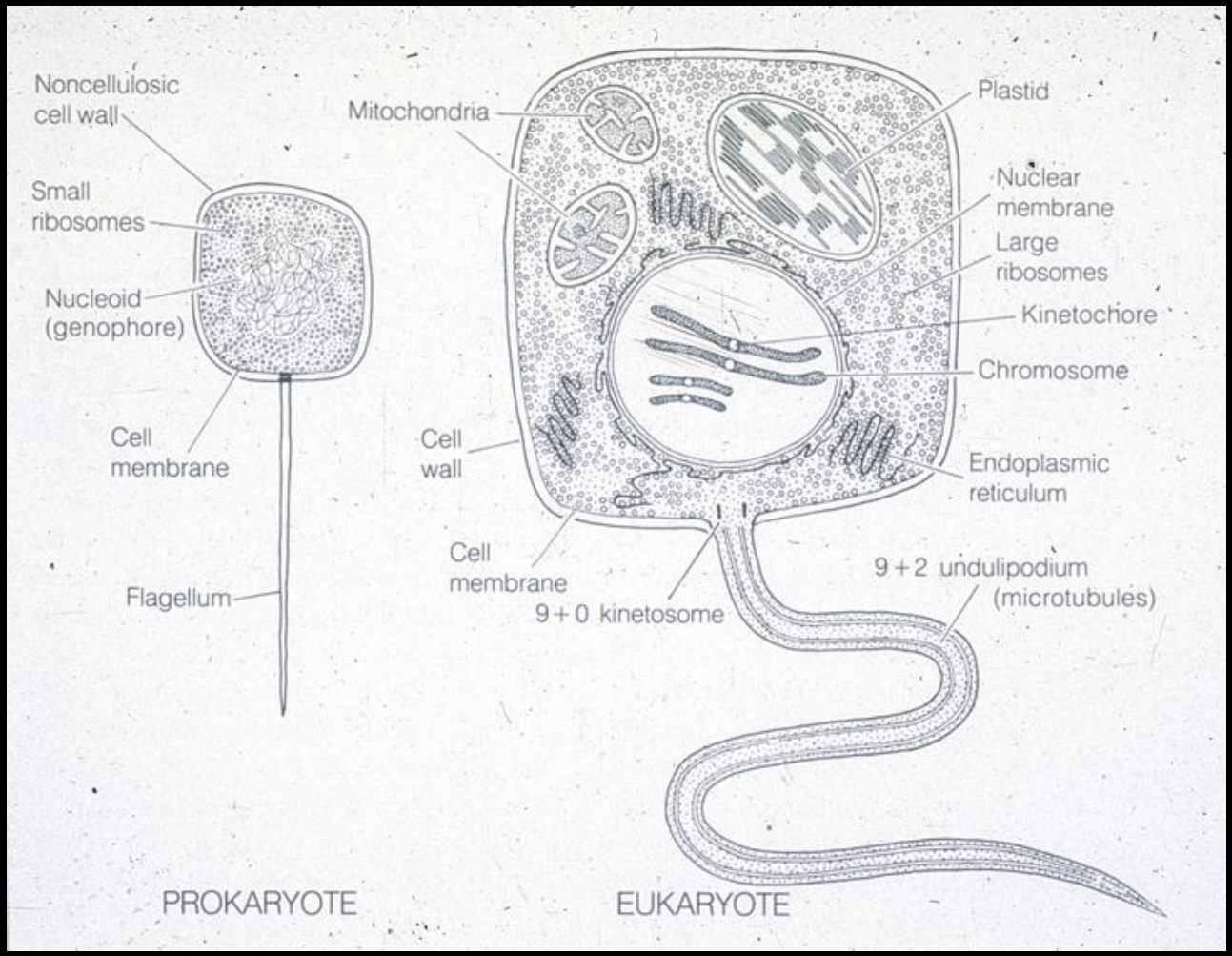


Figure 12.02 Dingus & Rowe


Noncellulosic cell wall
Small ribosomes
Nucleoid (genophore)
Cell membrane
Flagellum
PROKARYOTE
Mitochondria
Plastid
Nuclear membrane
Large ribosomes
Kinetochore
Chromosome
Cell wall
Endoplasmic reticulum
Cell membrane
9+0 kinetosome
9+2 undulipodium (microtubules)
EUKARYOTE

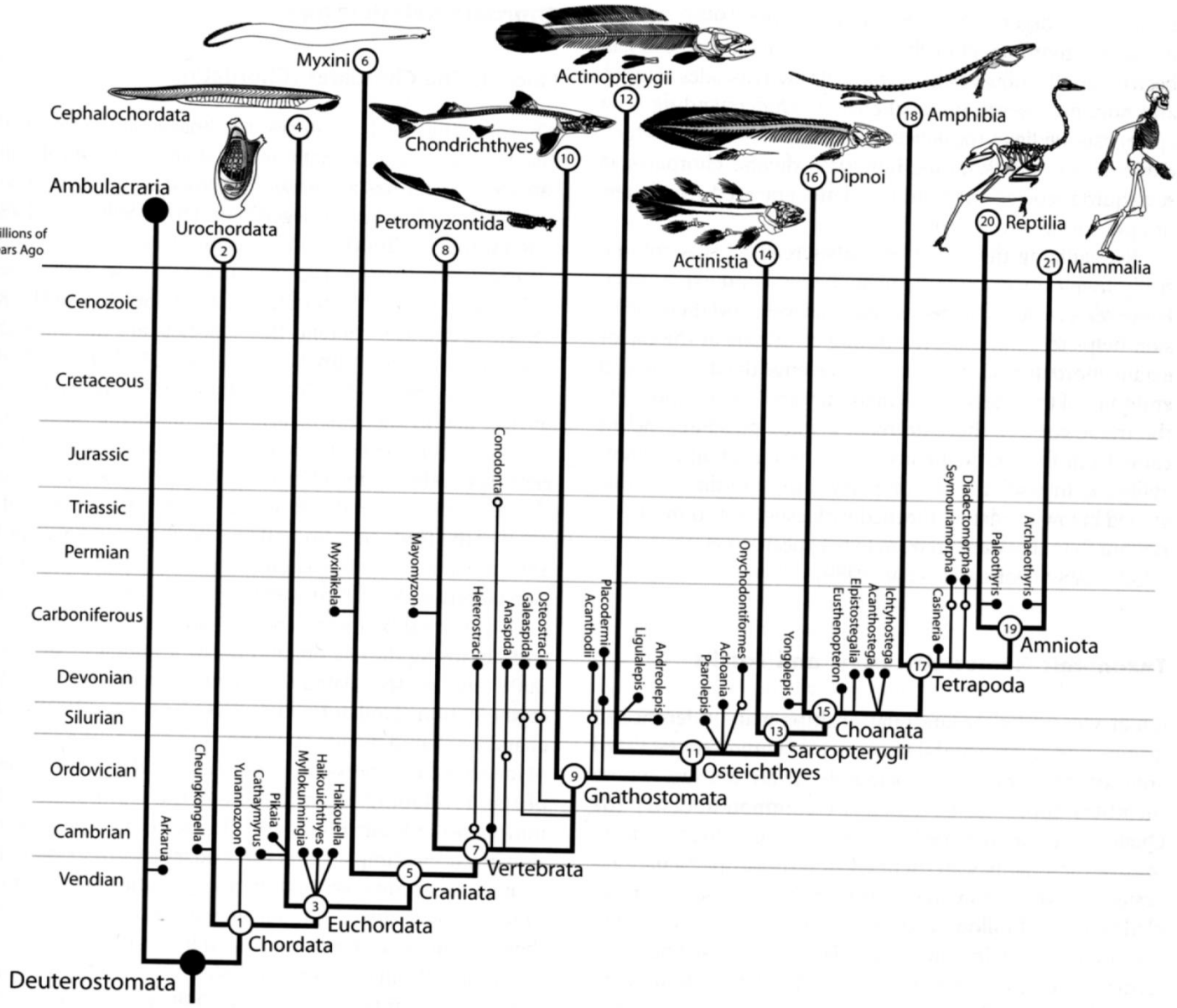
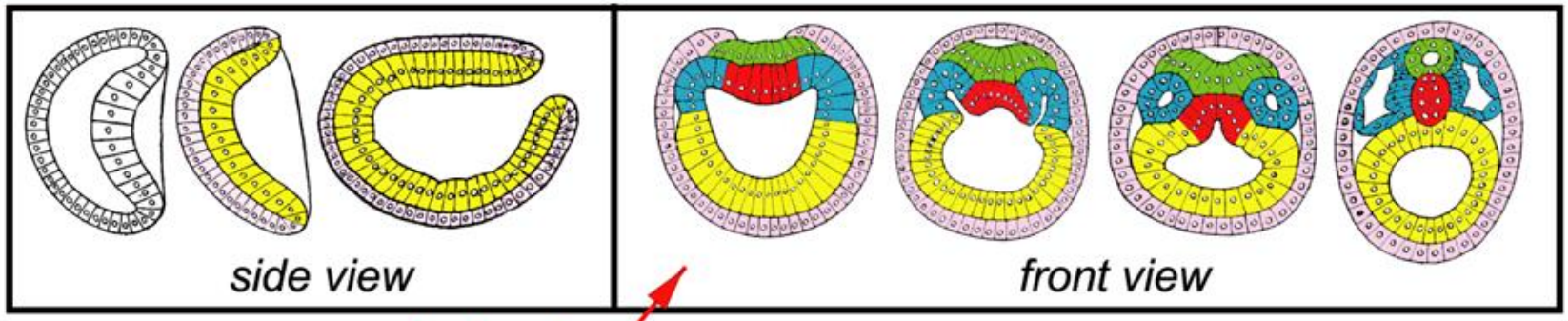


Figure 23.1. Chordate phylogeny, showing the relationships of extant lineages and the oldest fossils, superimposed on a geological time column. Nodal numbers are keyed to text headings.



vertebrate ontogeny

Geological time

0
Cenozoic
65
Mesozoic
245
Paleozoic
350
550
570
Precambrian
4600 millon years ago

vertebrate history

56,000 species

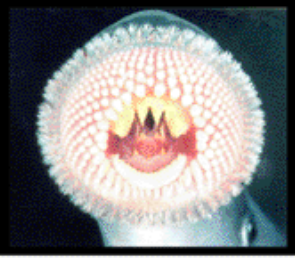
vertebrate diversity

1. reptiles
2. amphibians
3. lungfishes
4. coelacanths
5. ray-finned fishes
6. sharks
7. lampreys

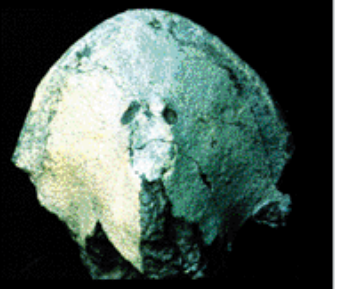
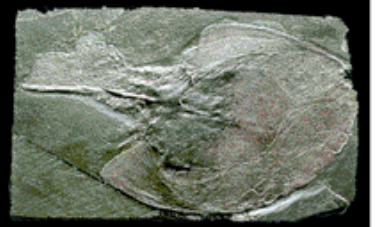
vertebral column

human

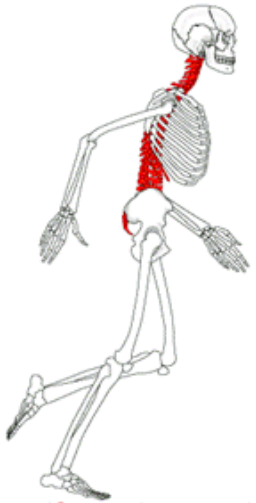
Vertebrata



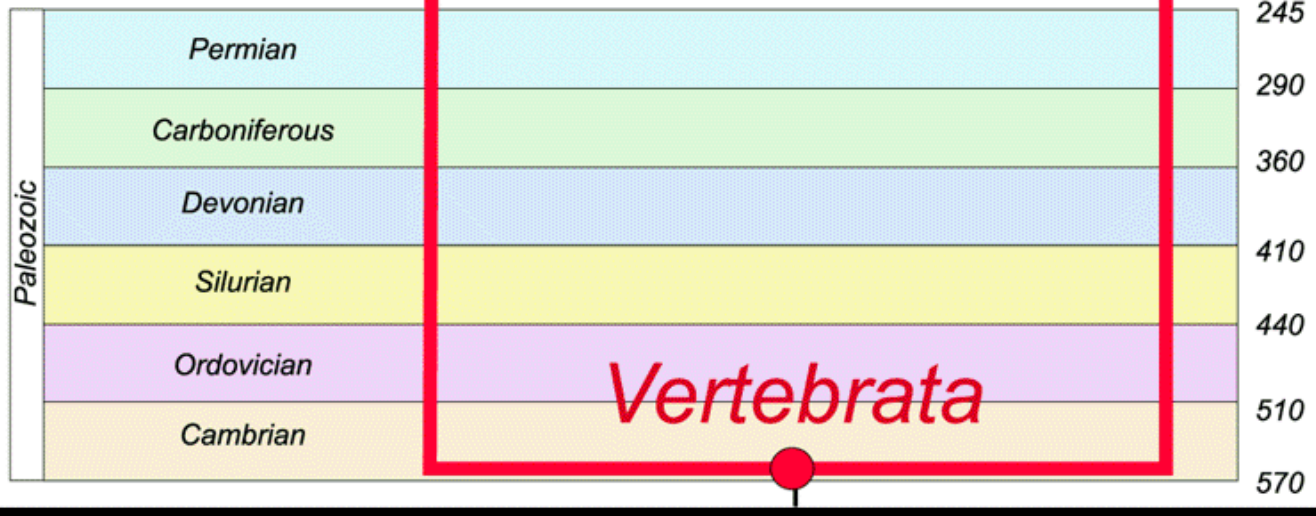
Lampreys - Petromyzontida



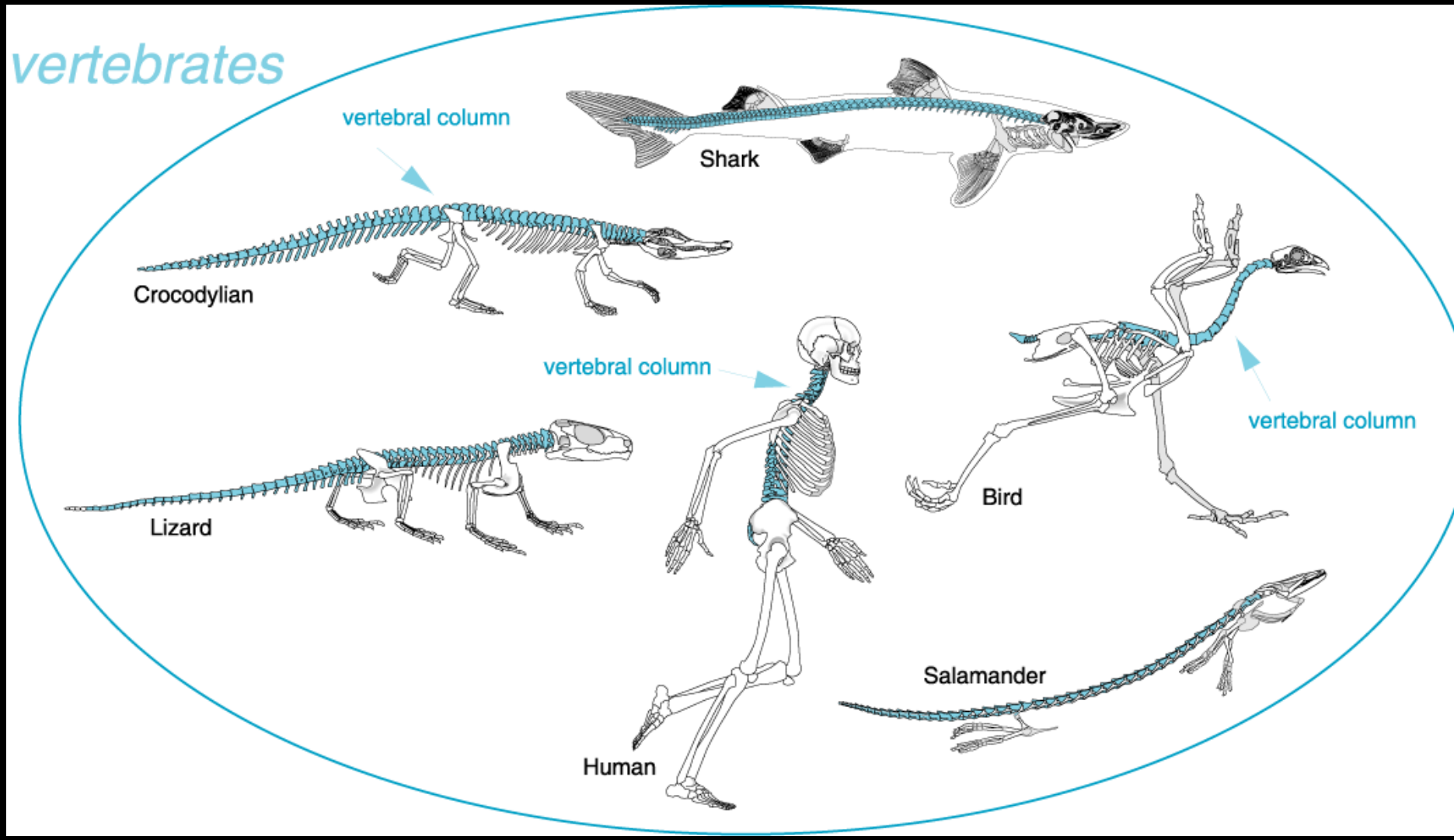
43 living species
2 extinct species

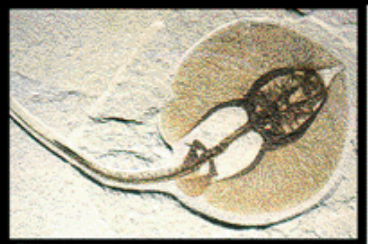
7.

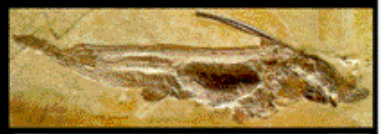
Gnathostomata



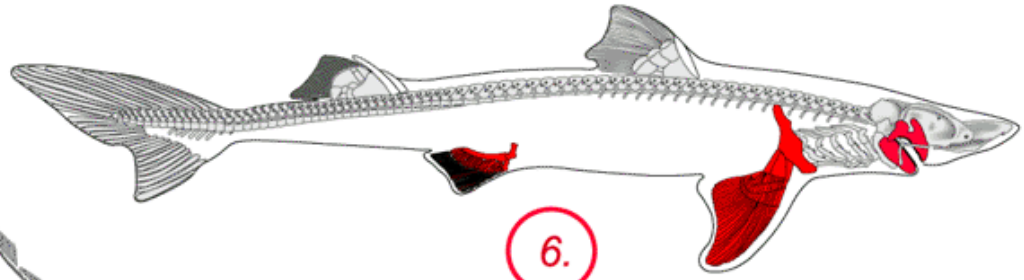
The vertebral column is a synapomorphy of Vertebrata – it arose in the ancestral vertebrate

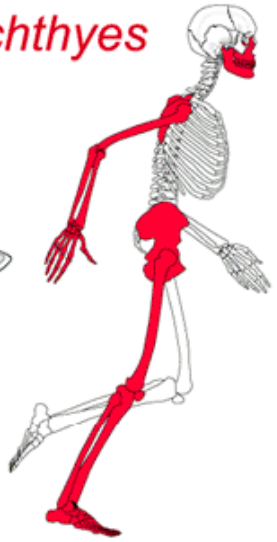






sharks and rays - Chondrichthyes





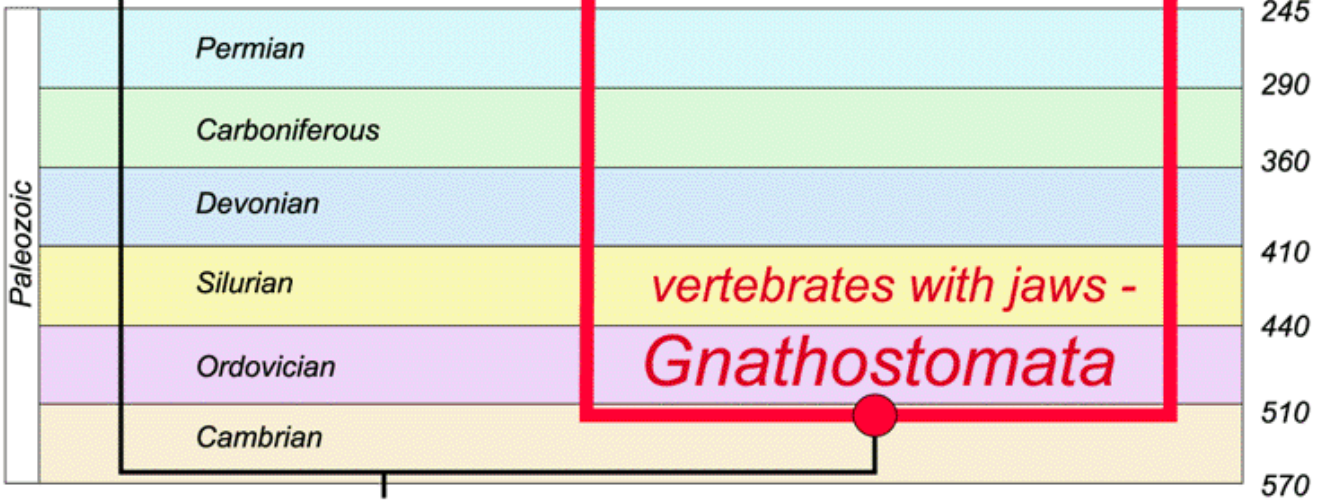
Lampreys

7.

6.

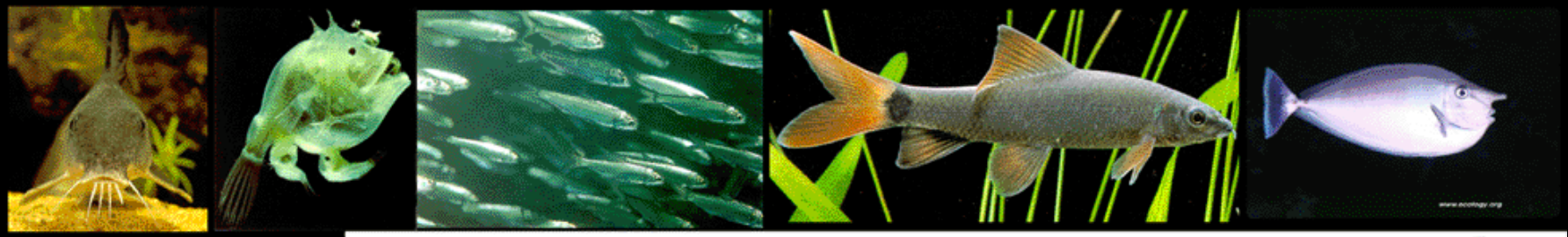
960 living species
hundreds of extinct species

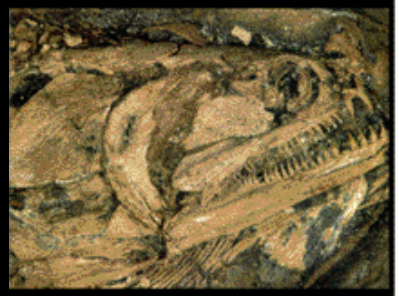
Osteichthyes



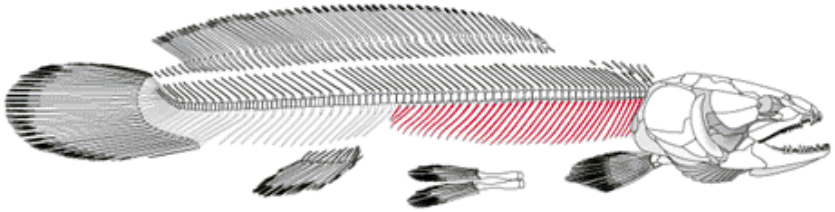
vertebrates with jaws -

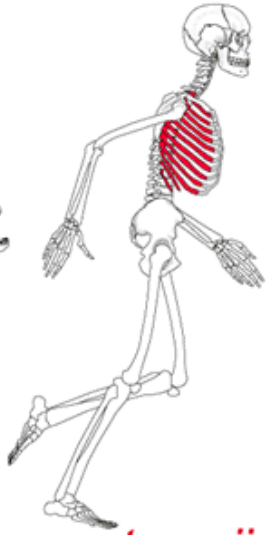
Gnathostomata





ray-finned fishes - Actinopterygii





5.

24,000 living species
thousands of extinct species

Sarcopterygii

7.

6.

Paleozoic

Permian

Carboniferous

Devonian

Silurian

Ordovician

Cambrian

245

290

360

410

440

510

570

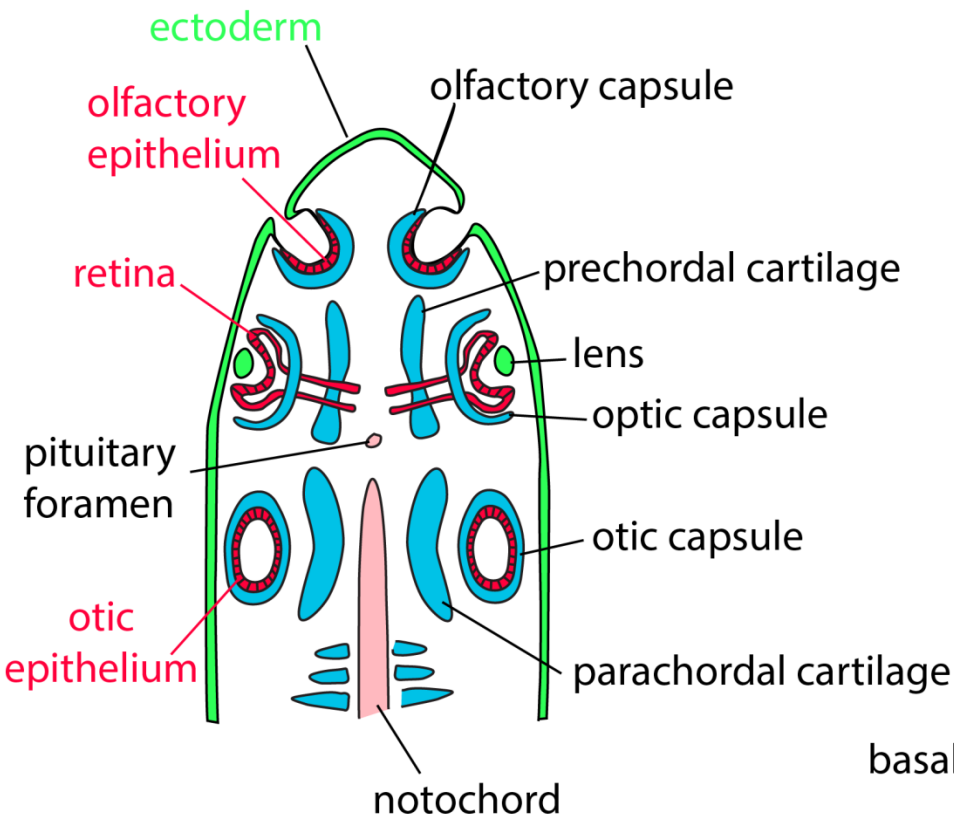
vertebrates with lungs

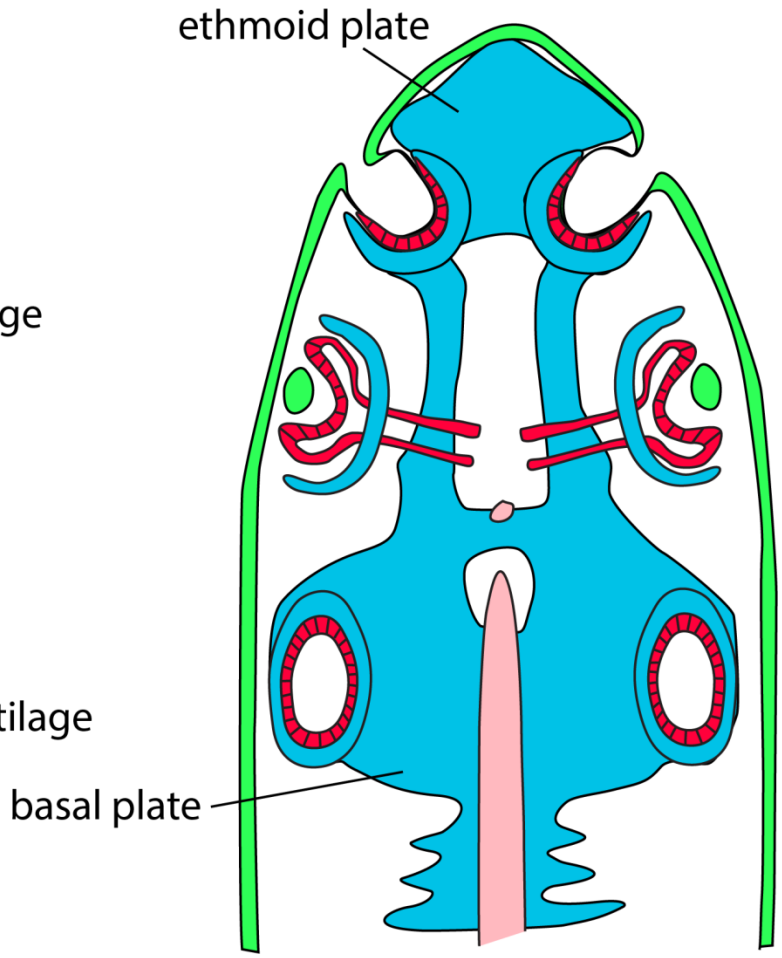
Osteichthyes

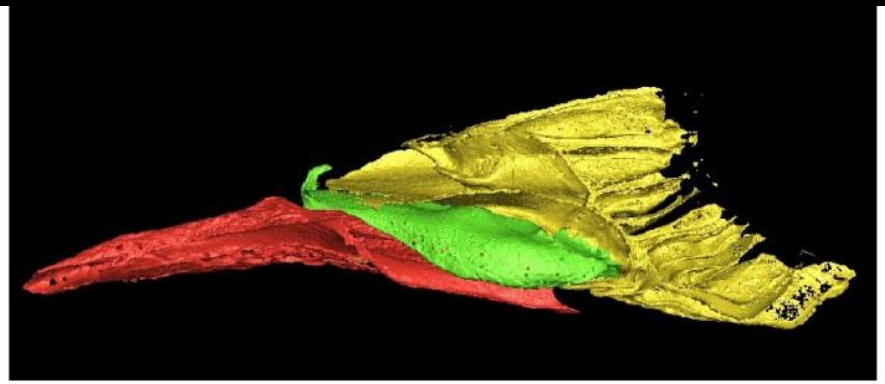
jaws - gnathostomes

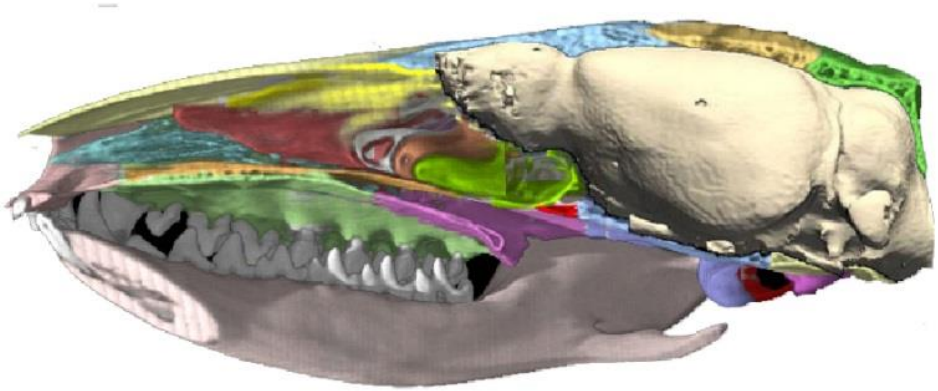
vertebrates

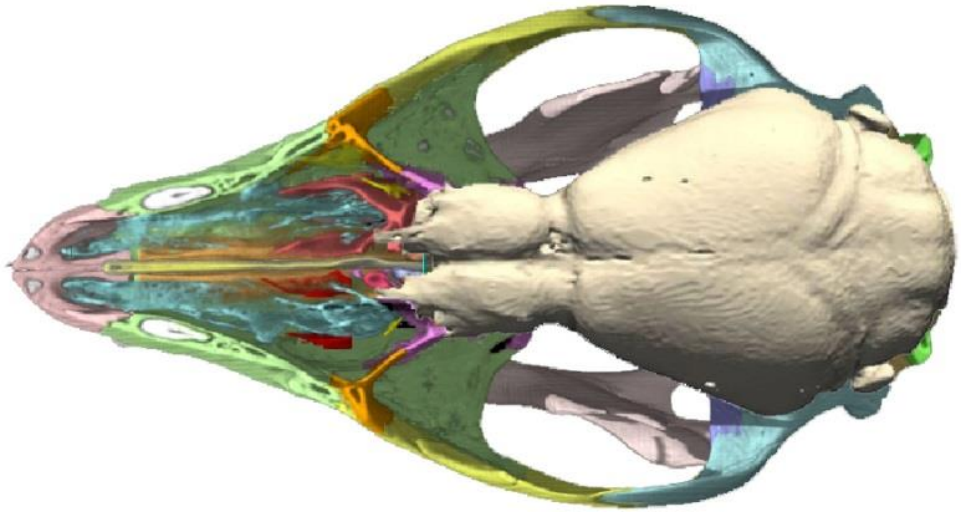
Neurocranium











The lateral line system

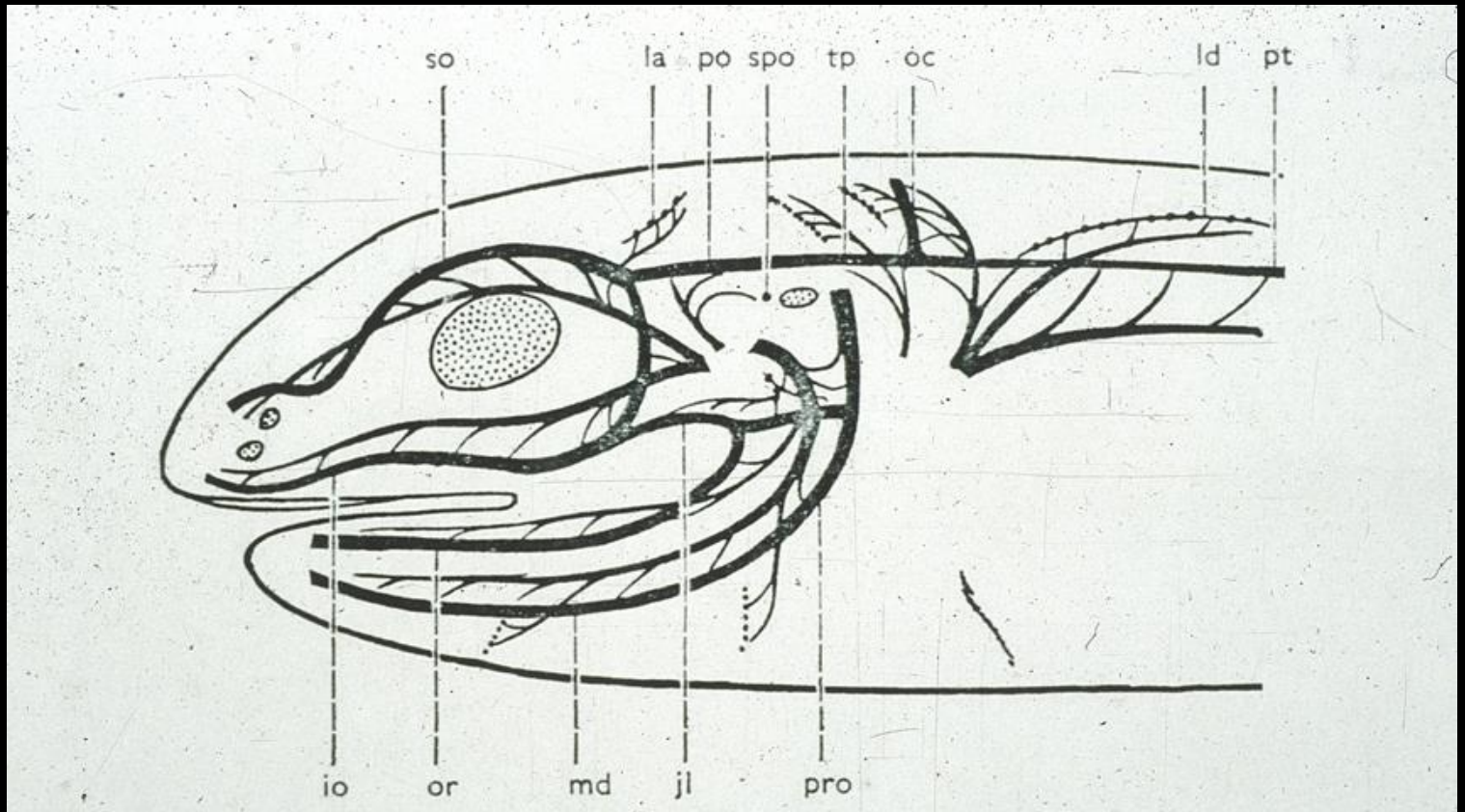
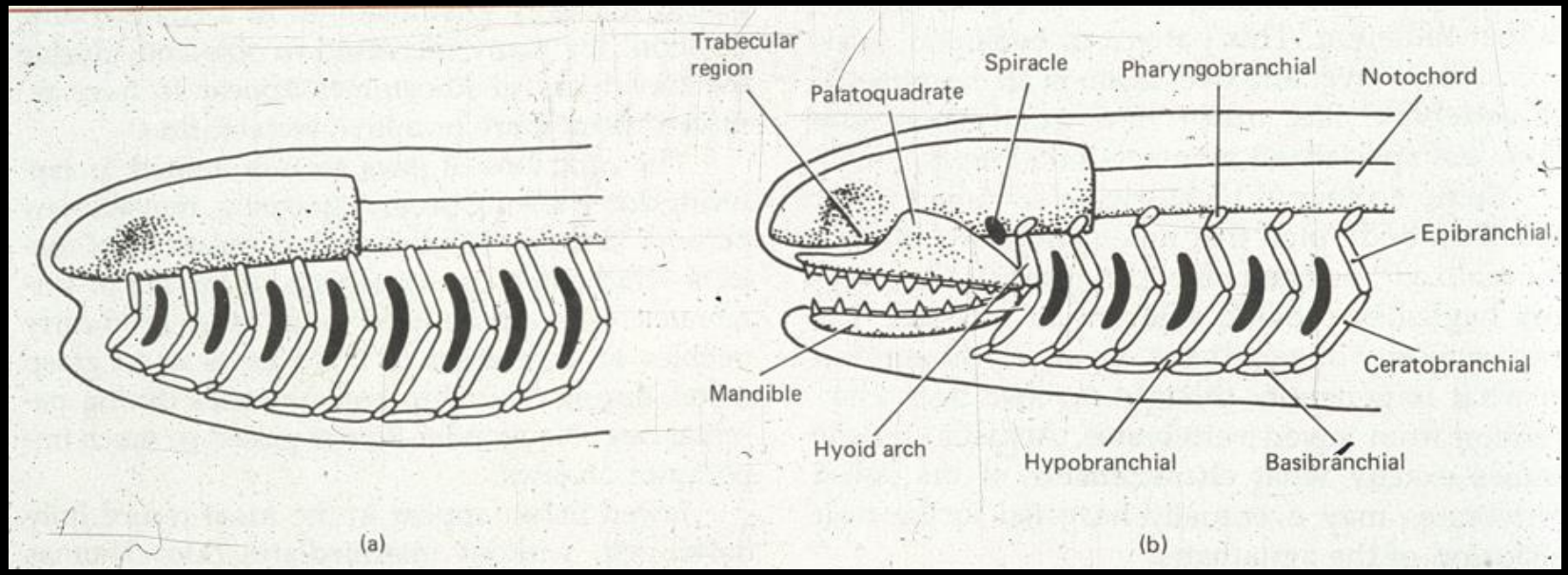


FIG. 11. — Schéma de la distribution des organes de la ligne latérale chez les Poissons (d'après Goodrich).

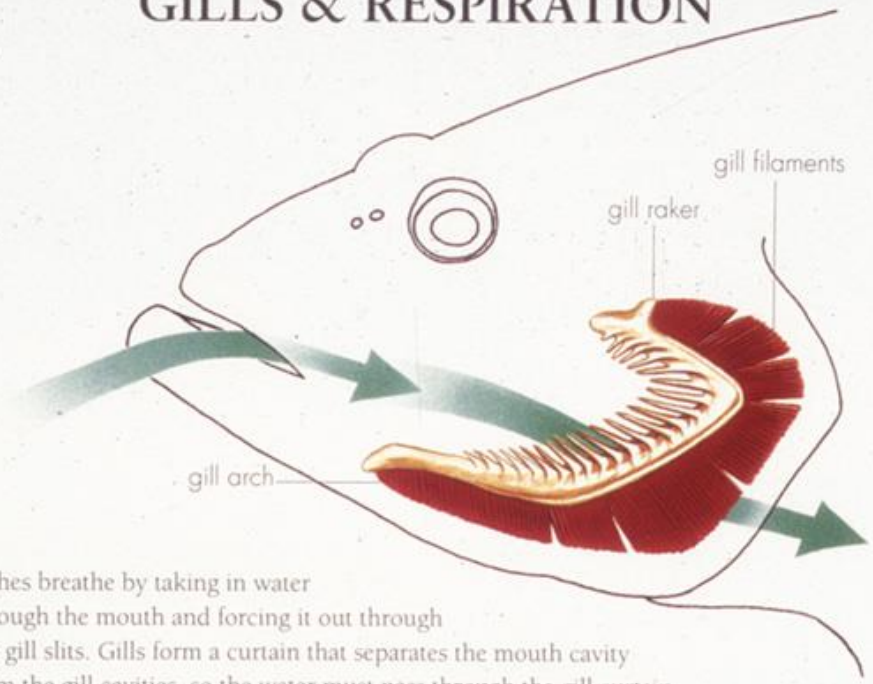
io, canal infraorbitaire; *jl*, canal jugal; *la*, lignes antérieures des organes en fossettes; *ld*, lignes dorsales des organes en fossettes; *md*, canal mandibulaire; *oc*, canal occipital transverse; *or*, canal oral; *po*, canal postorbitaire; *pro*, canal préoperculaire ou hyomandibulaire; *pt*, canal principal du tronc; *so*, canal supraorbitaire; *spo*, neuromaste spiraculaire; *tp*, canal temporal.

The ancestral vertebrate had a head organized like this



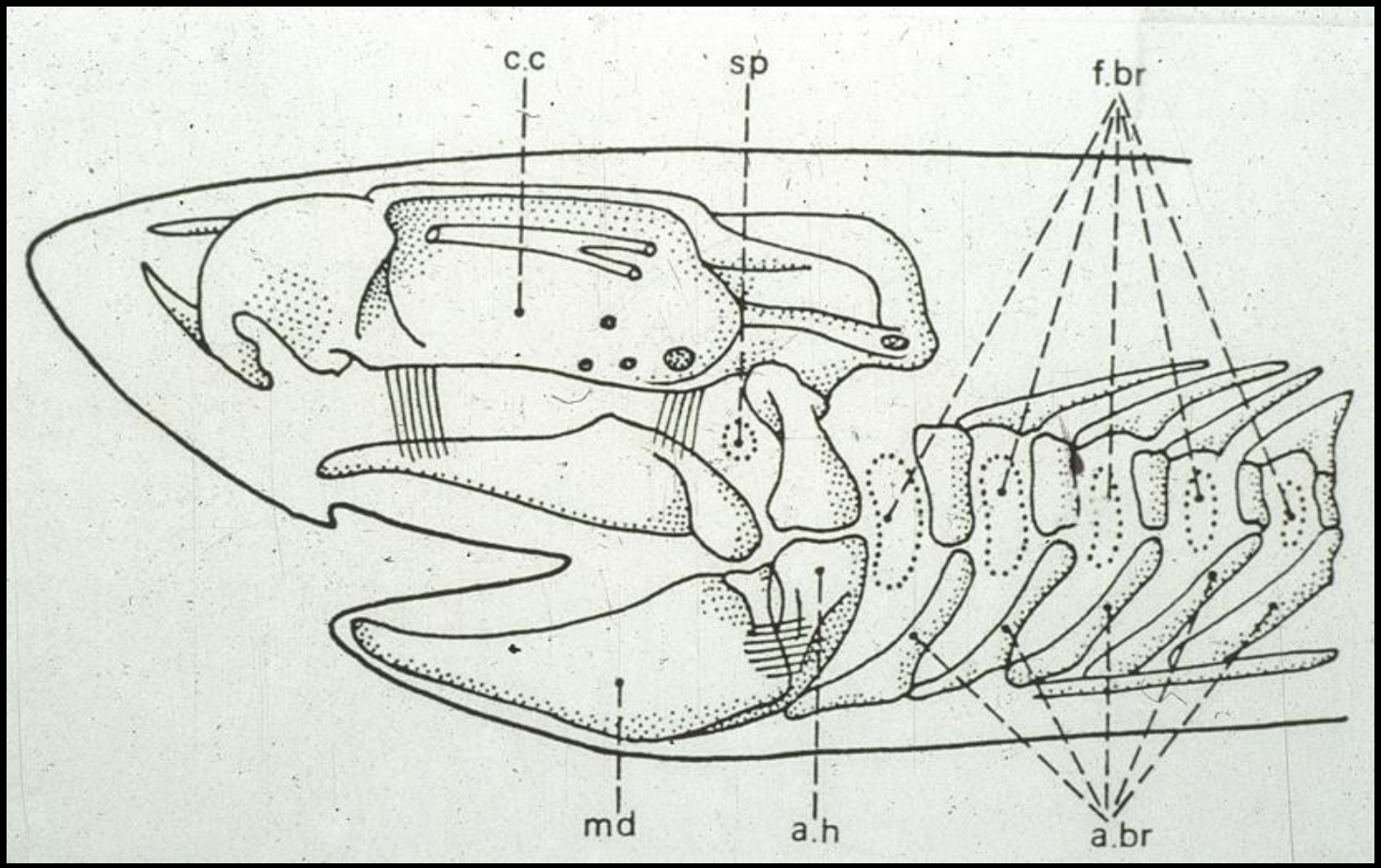
The ancestral gnathostome had a head organized like this, with jaws

GILLS & RESPIRATION



Fishes breathe by taking in water through the mouth and forcing it out through the gill slits. Gills form a curtain that separates the mouth cavity from the gill cavities, so the water must pass through the gill curtain. During this process, up to 95 percent of the oxygen in the water taken in is extracted, making the respiratory efficiency of fish gills the highest among water-breathing organisms. Indeed, such a high efficiency in capturing oxygen is needed because water is so dense and contains only $^{1}/_{30}$ of the oxygen in air.

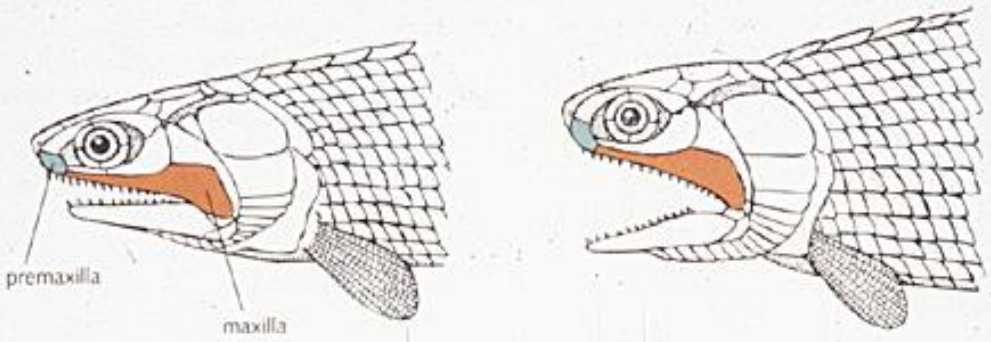
Chondrichthyes…the jaws and branchial arches are held together with ligaments



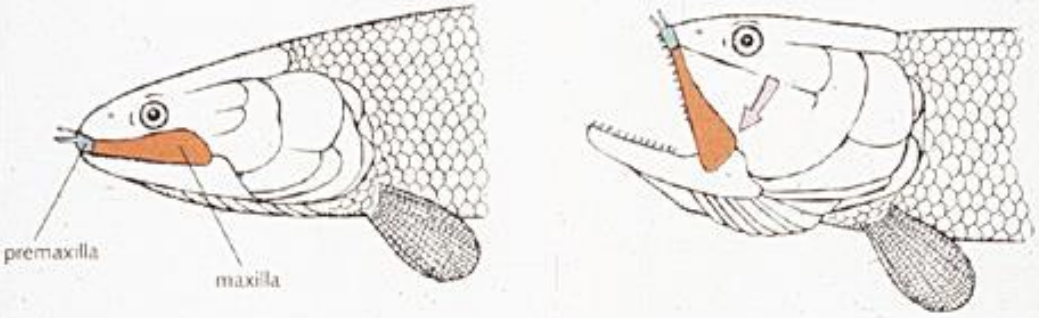
Chondrichthyes…the jaws and branchial arches are held together with ligaments jaws can swing forward on their suspensory liagmaent

Chondrichthyes

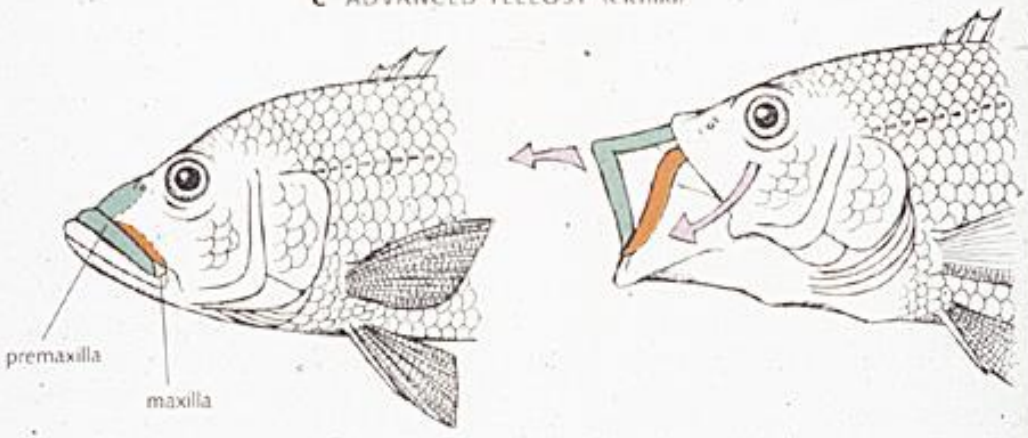
A PRIMITIVE RAY-FIN *Maythomasia*



B PRIMITIVE NEOPTERYGIAN *Amia*



C ADVANCED TELEOST (Cichlid)



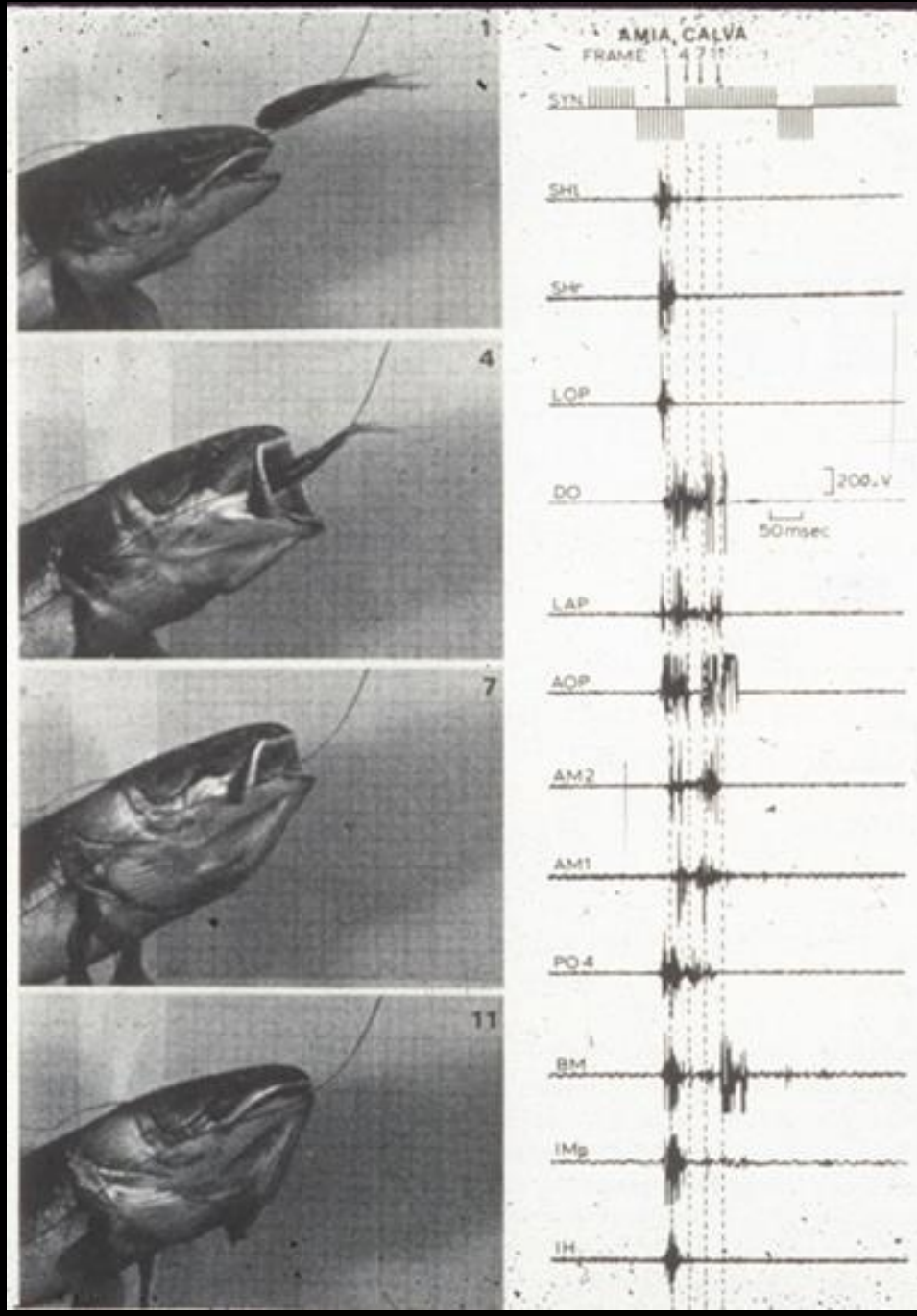
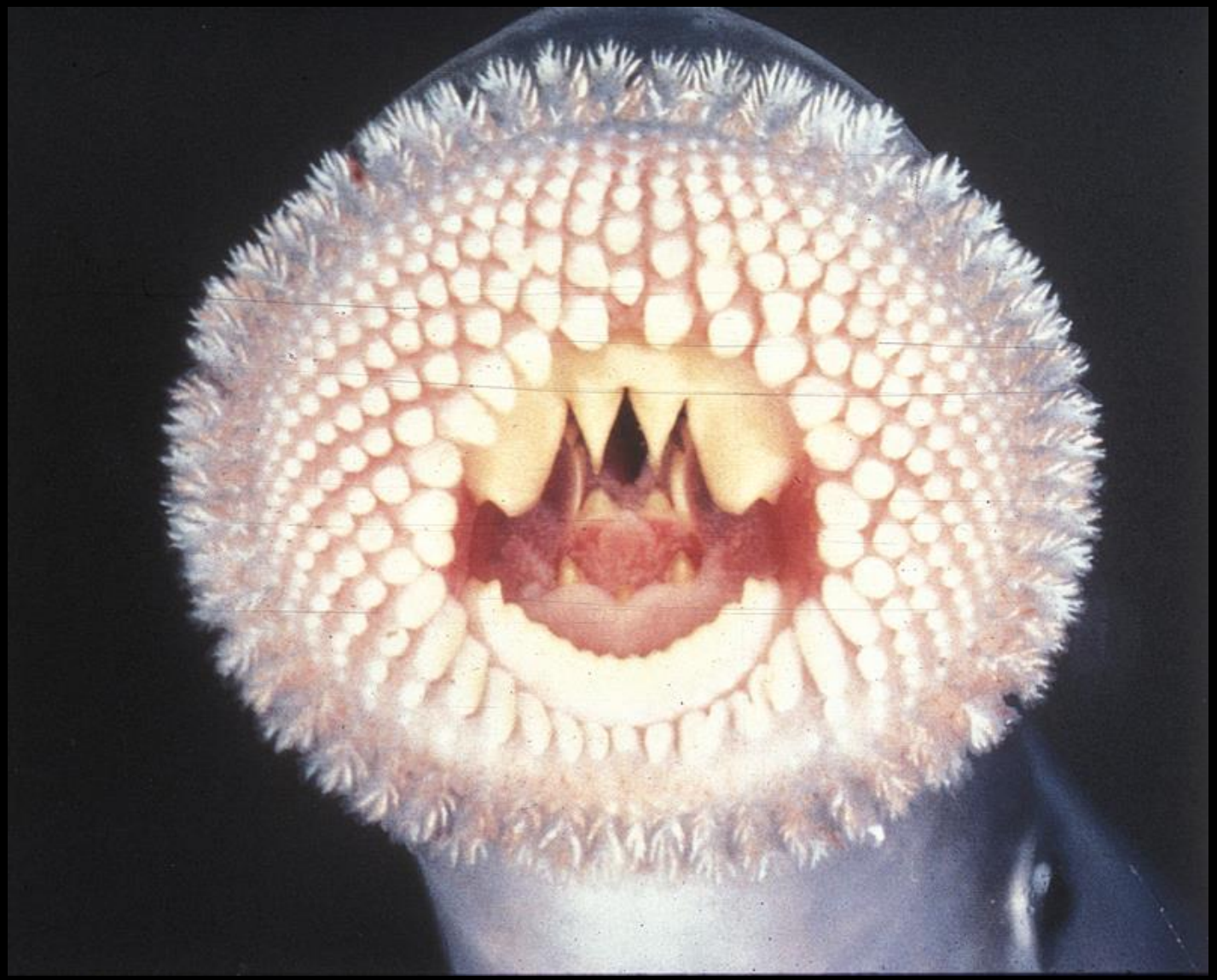
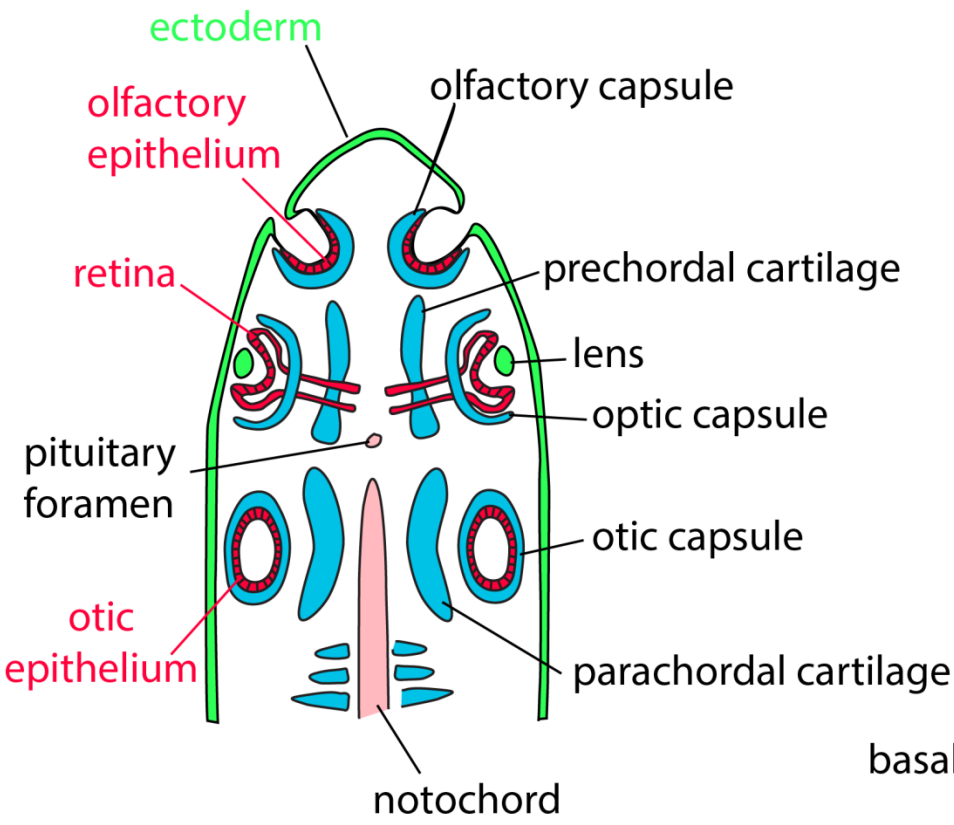


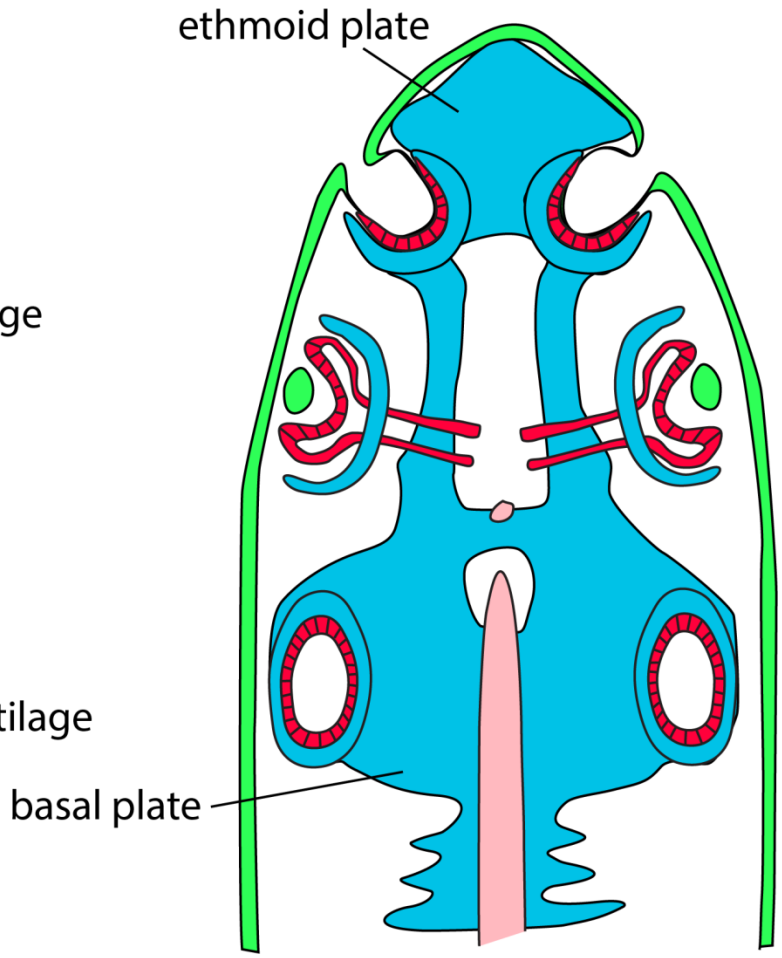
Figure 12-4 Prey capture in the bowfin *Amia calva*. The frames *(left)* are from a high-speed (200 frames/sec) film that is synchronized with electromyographic recordings of cranial muscles *(right)*. The recordings are a summary of 45 feeding events. The wire leading from the head muscles to the recording apparatus can be seen in the photographs. Note that the maxilla swings anteriorly to produce a nearly circular mouth opening at peak gape (frame 4) as the prey enters the mouth. Both the levator operculi and sternohyoideus muscles are active at the start of the expansive phase and activate couplings 2 and 3 (Fig. 12-2) to cause mouth opening. Muscles: *SHl, SHr* = left and right sternohyoideus muscles; *LOP* = levator operculi; *DO* = dilator operculi; *LAP* = levator arcus palatini; *AOP* = adductor operculi; *AM*2, *AM*1, and *PO*4 = divisions of the adductor mandibulae; *BM* = branchiomandibularis; *Imp* = intermandibularis posterior; *Ih* = interhyoideus. (From Lauder, 1980d.)

Petromyzontida

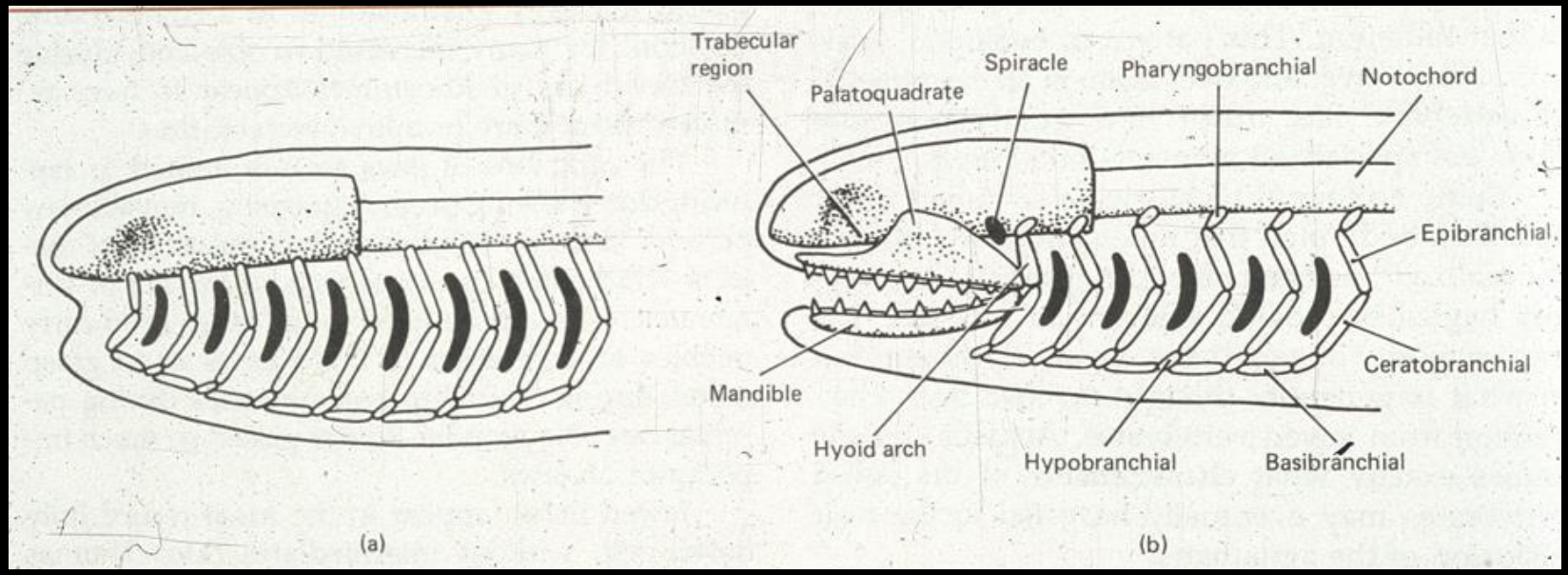


Neurocranium



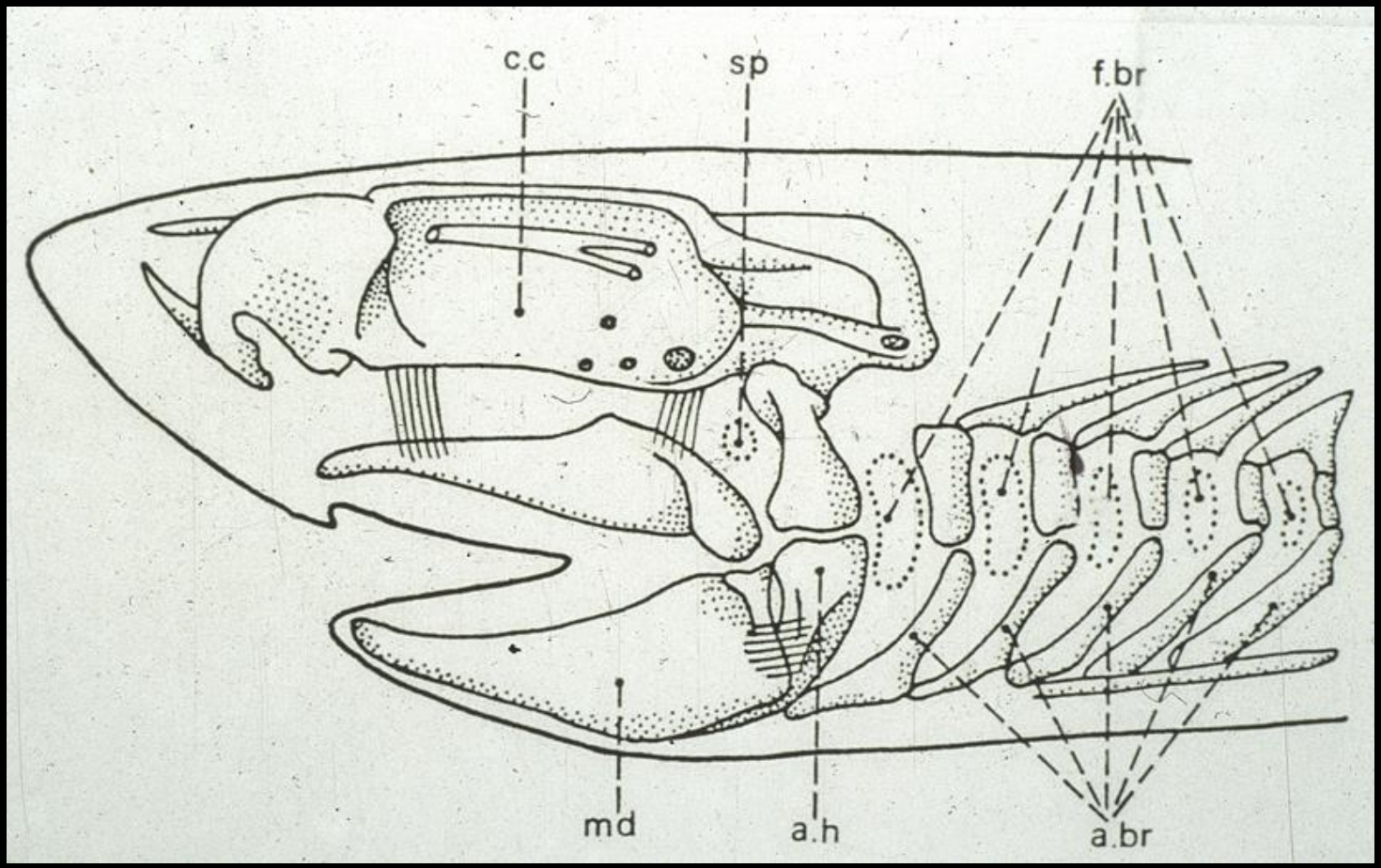


The ancestral vertebrate had a head organized like this



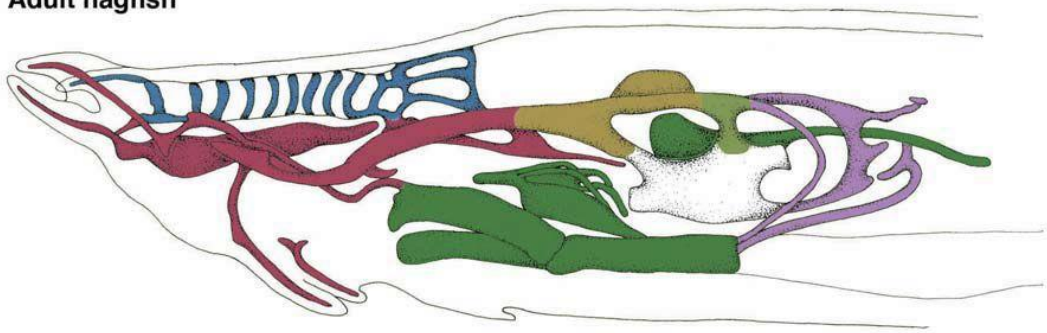
The ancestral gnathostome had a head organized like this, with jaws

Chondrichthyes…the jaws and branchial arches are held together with ligaments

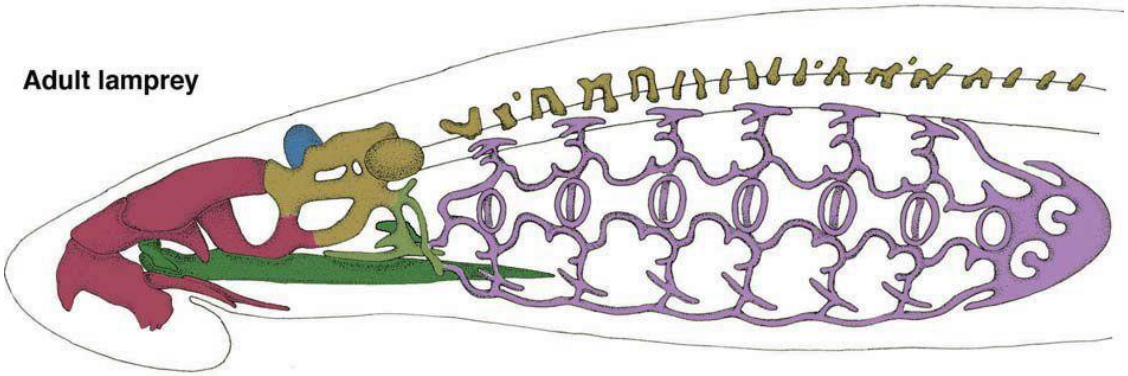


ANP-derived nasal cartilages
PHP-derived premandibular cranium
mandibular arch-derivatives
hyoid arch-derivatives
3rd and posterior pharyngeal arch skeletons
mesodermal neurocranium and otic capsules

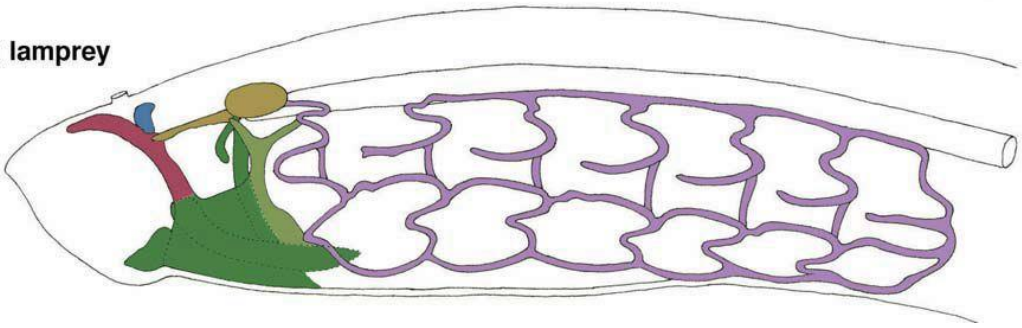
Adult hagfish

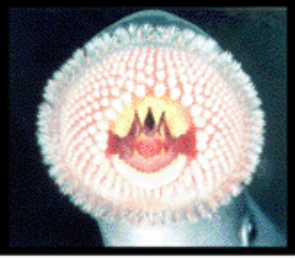


Adult lamprey

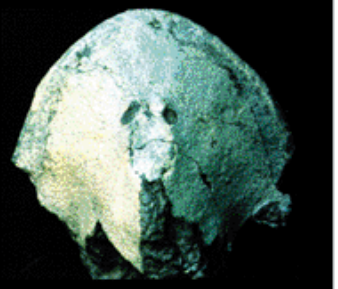
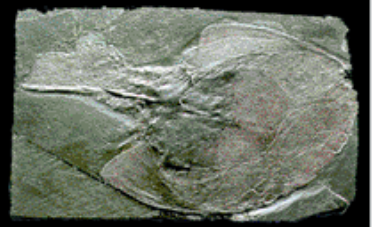


Larval lamprey

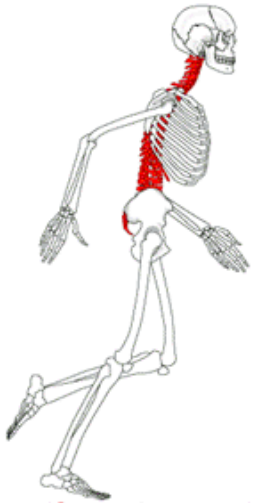




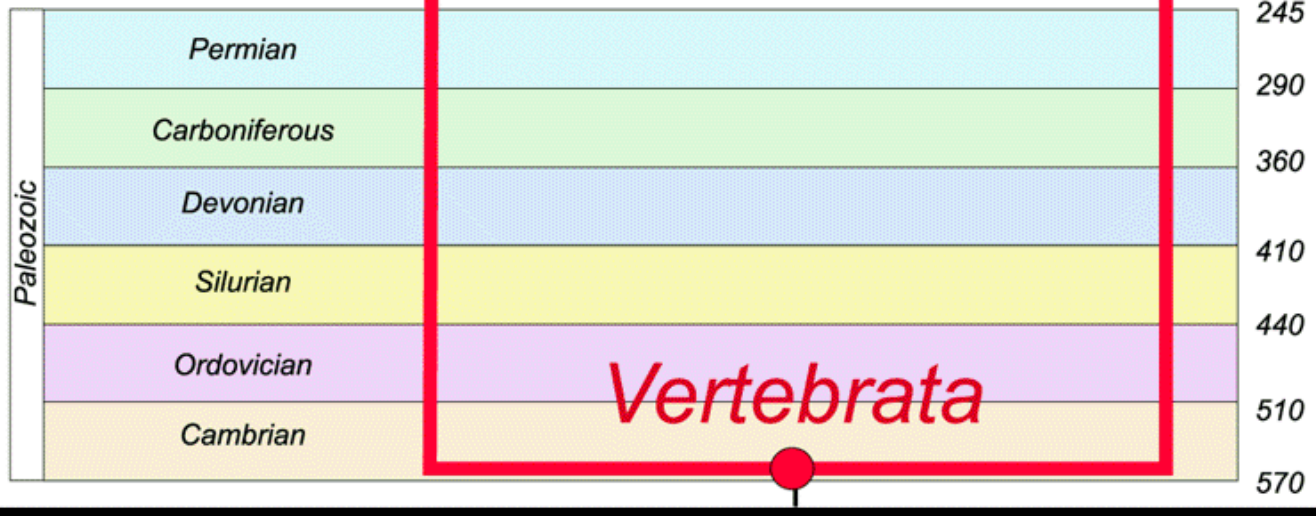
Lampreys - Petromyzontida

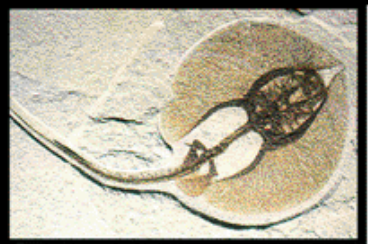


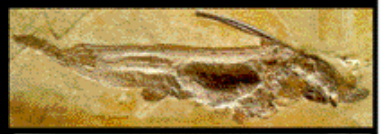
43 living species
2 extinct species

7.

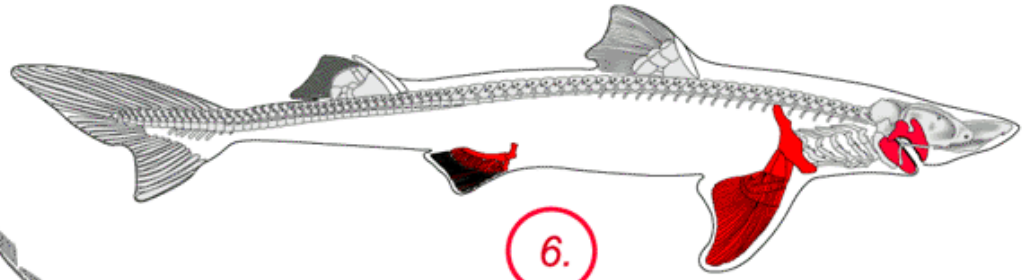
Gnathostomata

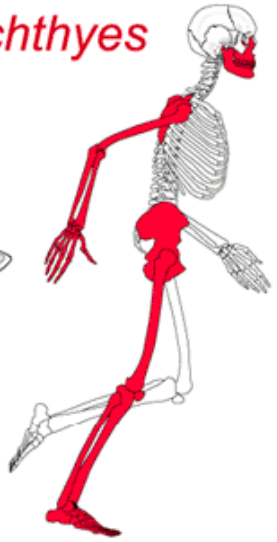






sharks and rays - Chondrichthyes





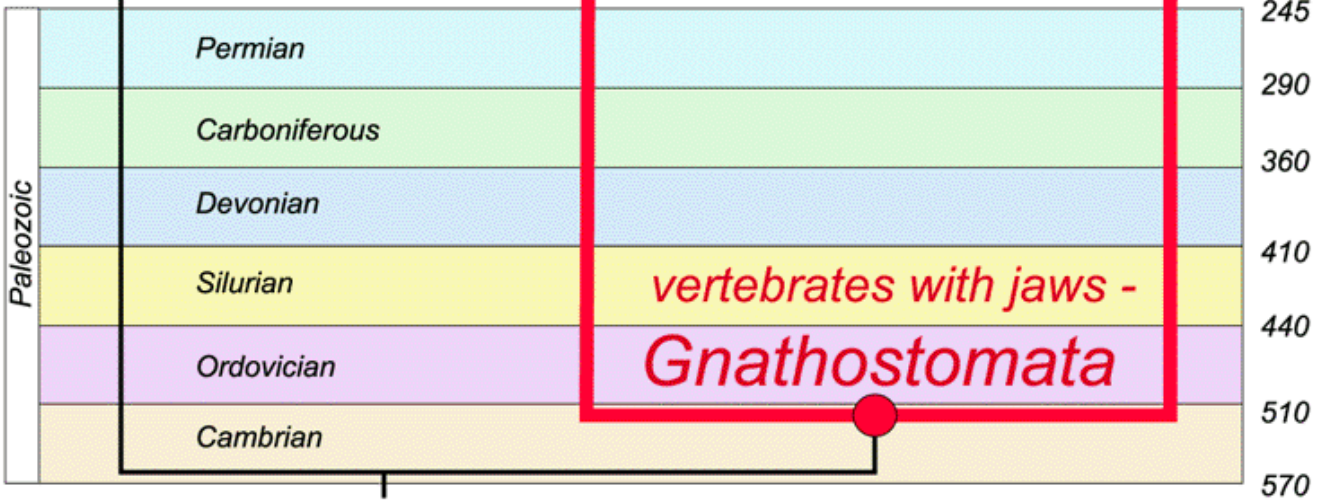
Lampreys

7.

6.

960 living species
hundreds of extinct species

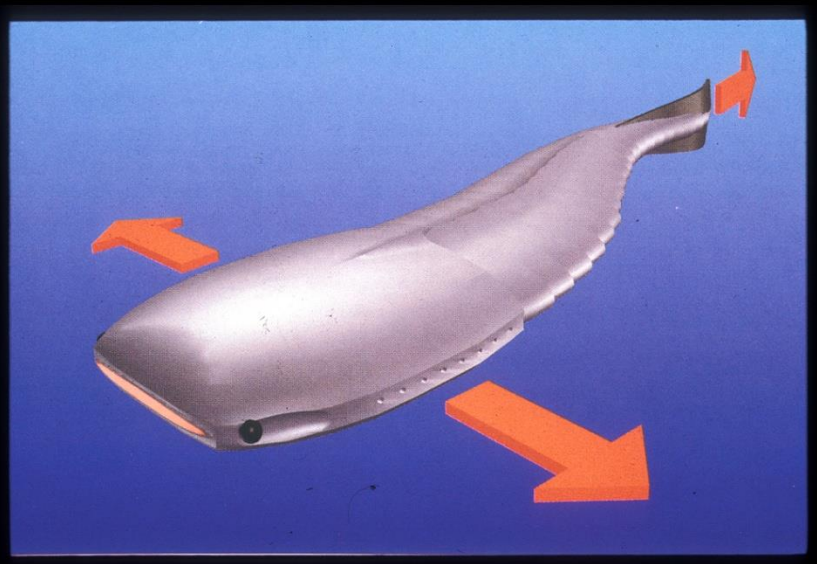
Osteichthyes

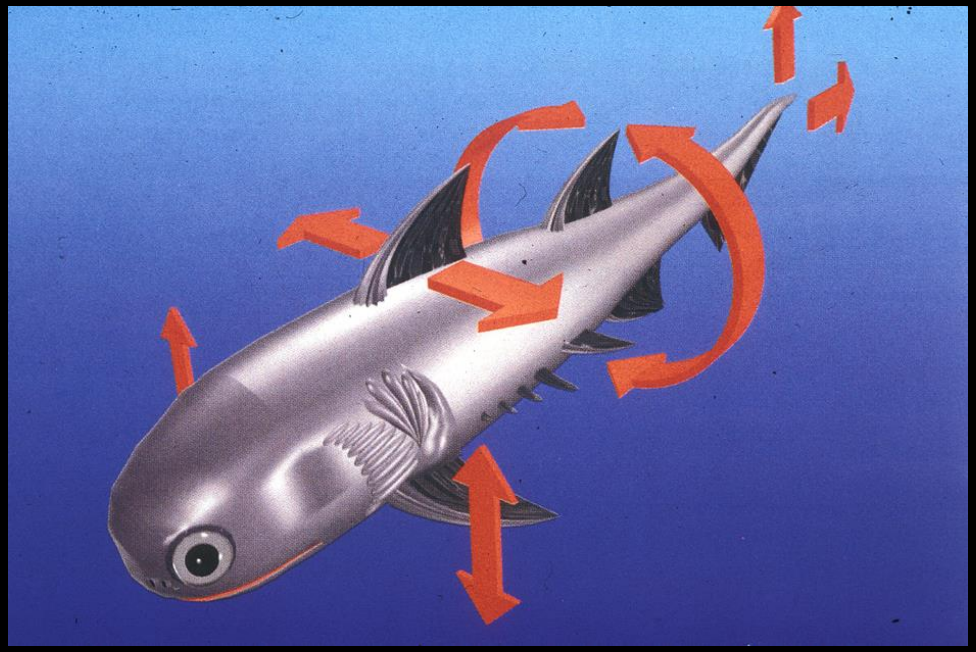


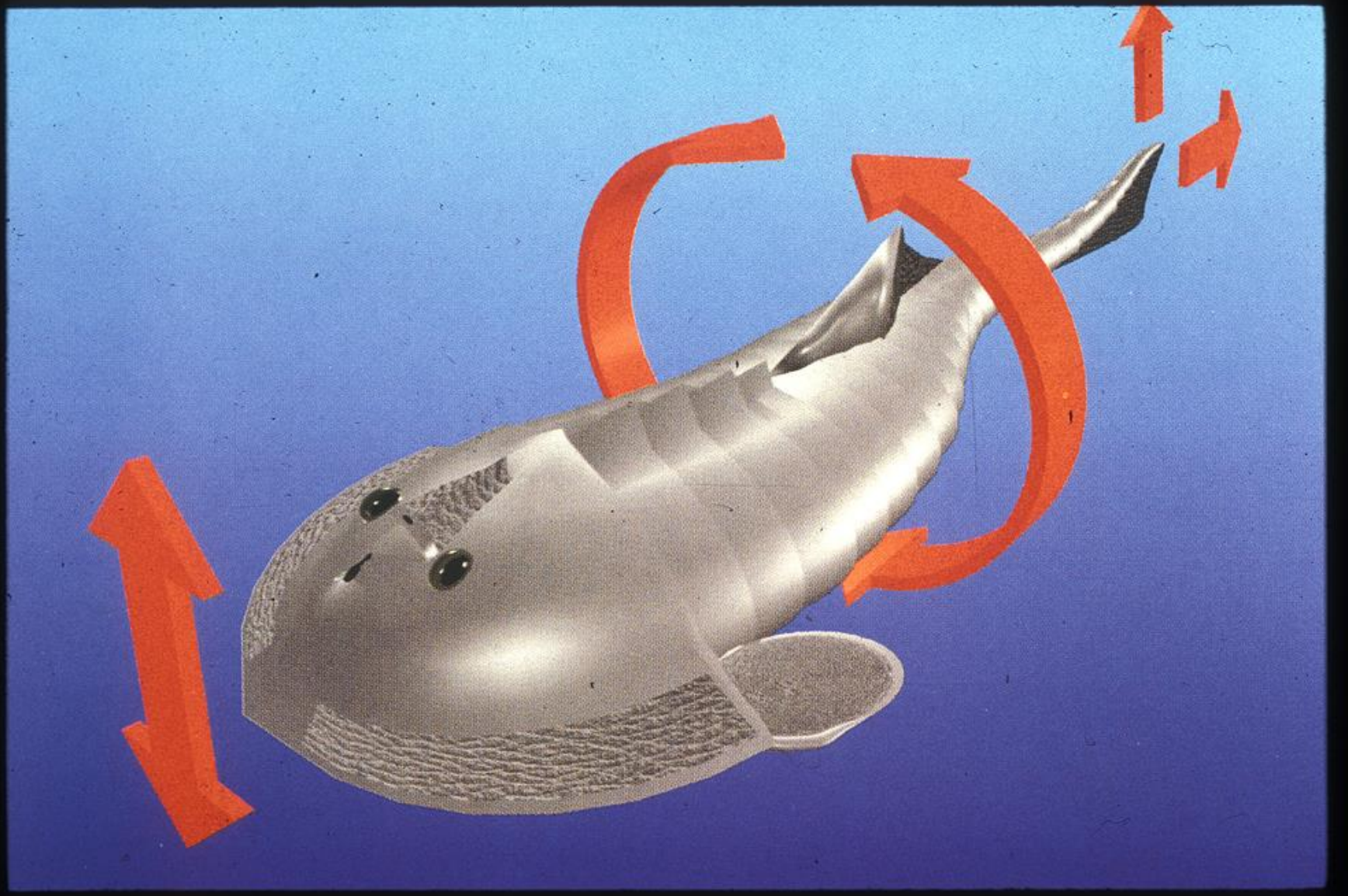
vertebrates with jaws -

Gnathostomata

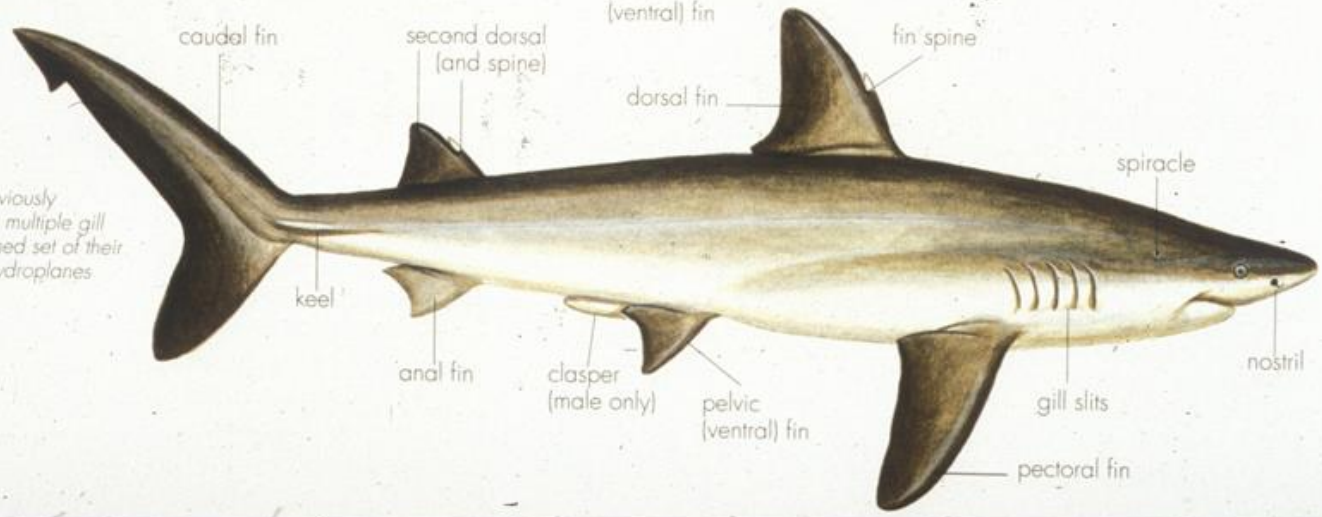
Gnathostoata synapomorphy: paired appendages







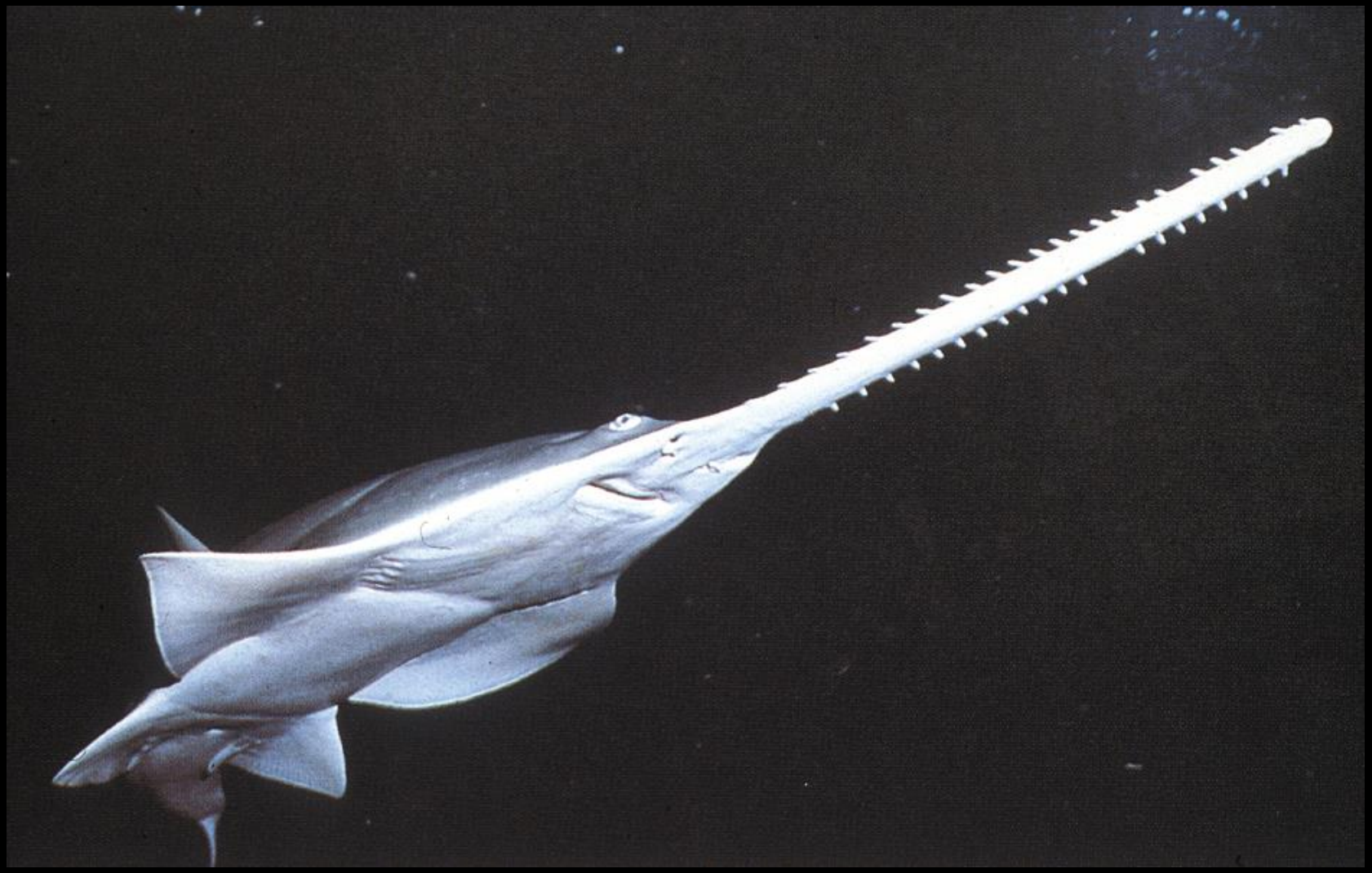
► *A generalised bony fish showing major morphological features. Fishes vary widely in size, position, and arrangement of fins and other appendages, and no single species has all the features shown.*



► *Sharks differ most obviously from bony fishes in their multiple gill slits and in the outstretched set of their pectoral fins, used as hydroplanes rather than oars.*

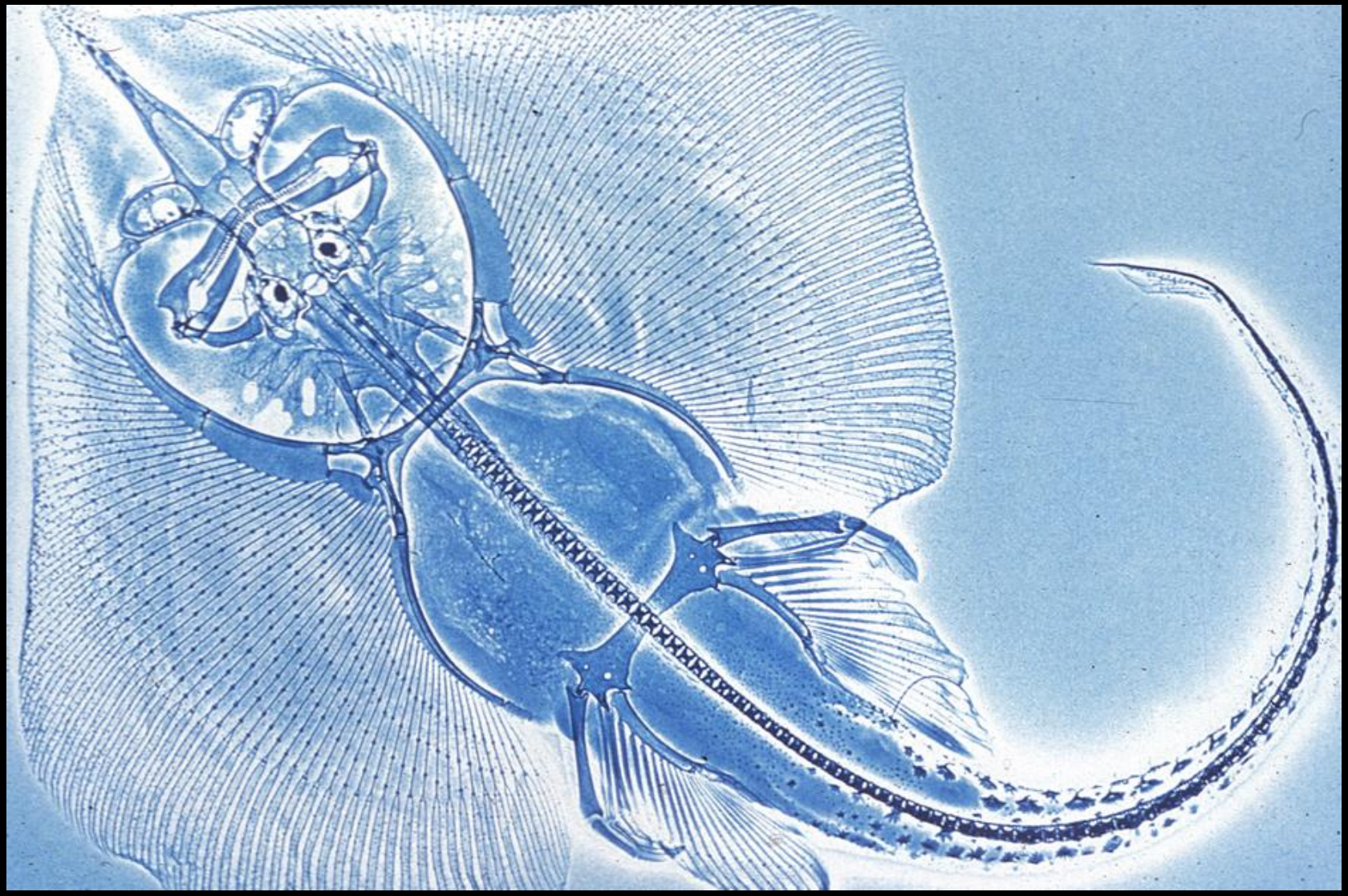
Paired appendages in a shark

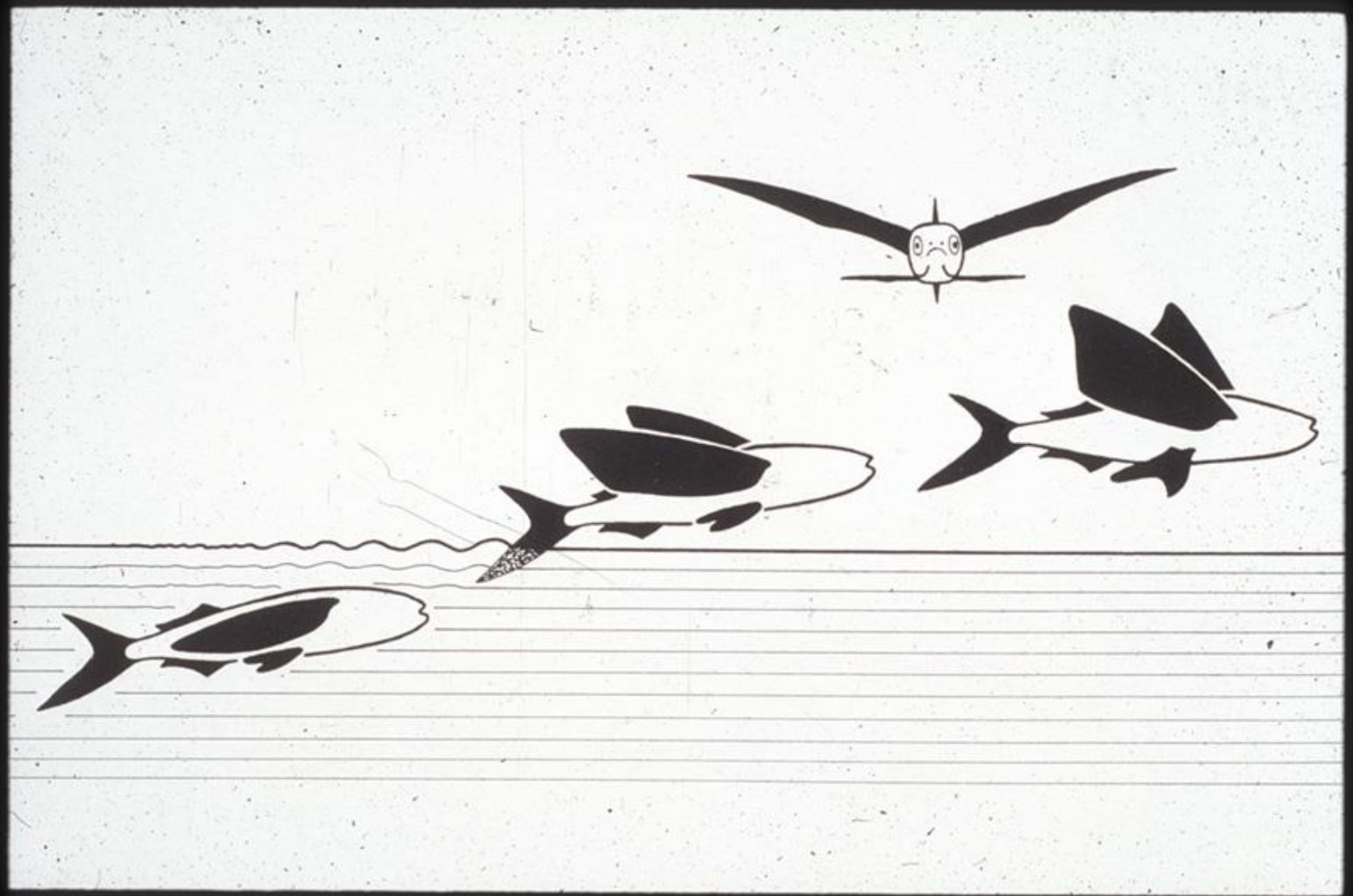
Expanded pectoral appendages in a shark

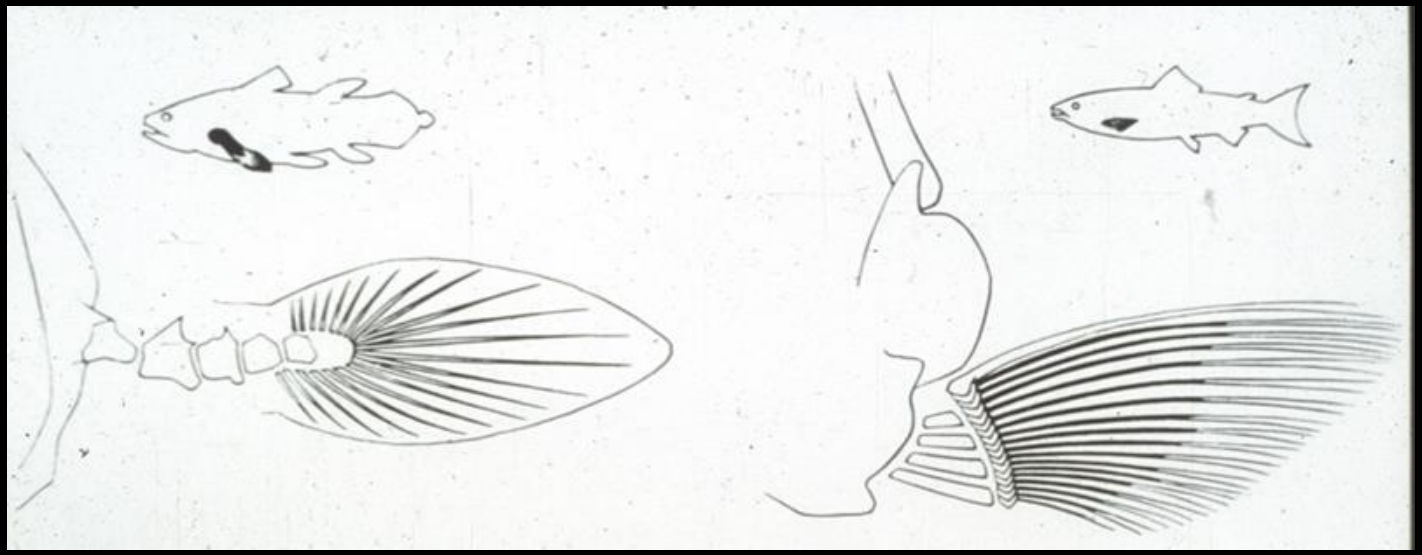


Huge pectoral fins
in a ray
(a kind of shark)

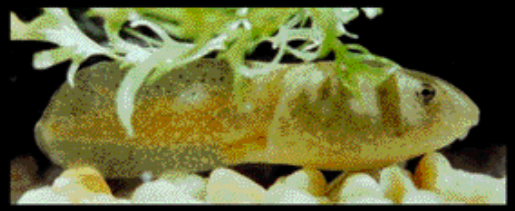
Huge pectoral fins in a ray (a kind of shark)

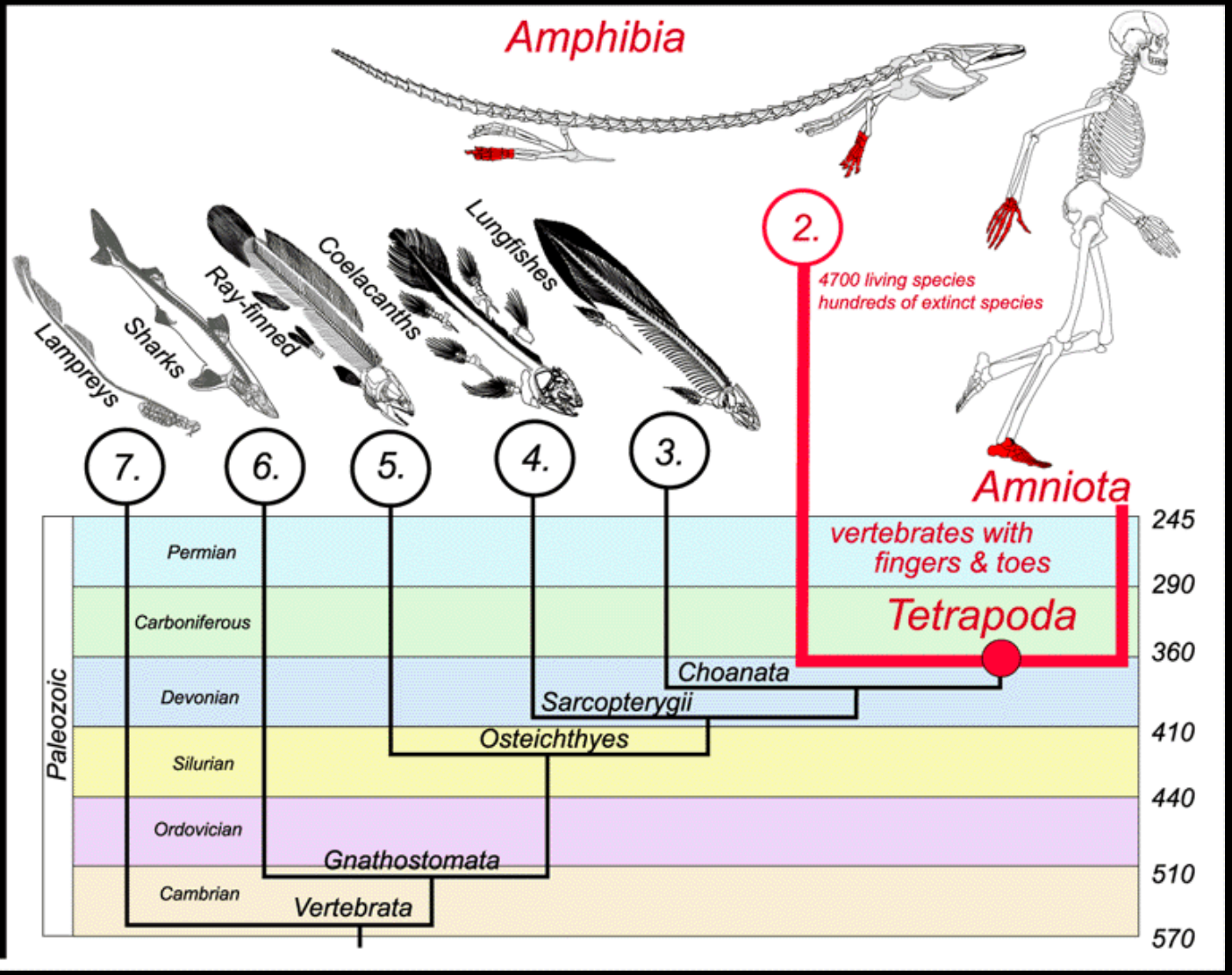












Amphibia
Lampreys
Sharks
Ray-finned
Coelacanths
Lungfishes
2.
4700 living species
hundreds of extinct species
Amniota
7.
6.
5.
4.
3.
vertebrates with
fingers & toes
Tetrapoda
Choanata
Sarcopterygii
Osteichthyes
Gnathostomata
Vertebrata
Paleozoic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambrian
245
290
360
410
440
510
570

Amniota (almost)
Permian of Texas