

Natural Sciences 360

Legacy of Life

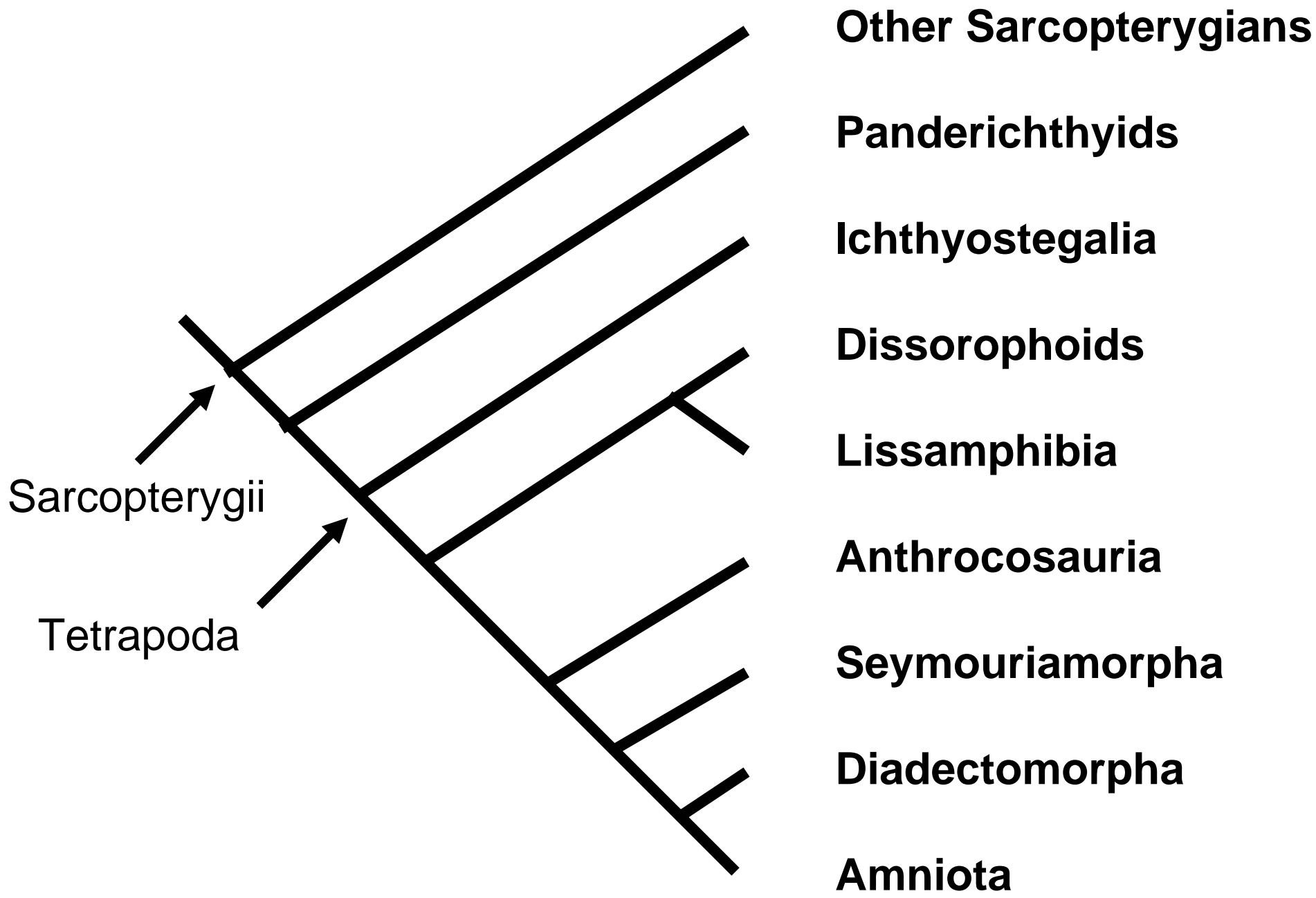
Lecture 11-12

Dr. Stuart S. Sumida

PHYLUM CHORDATA
Subphylum VERTEBRATA

TETRAPODA

“The Water-to-Land Transition”



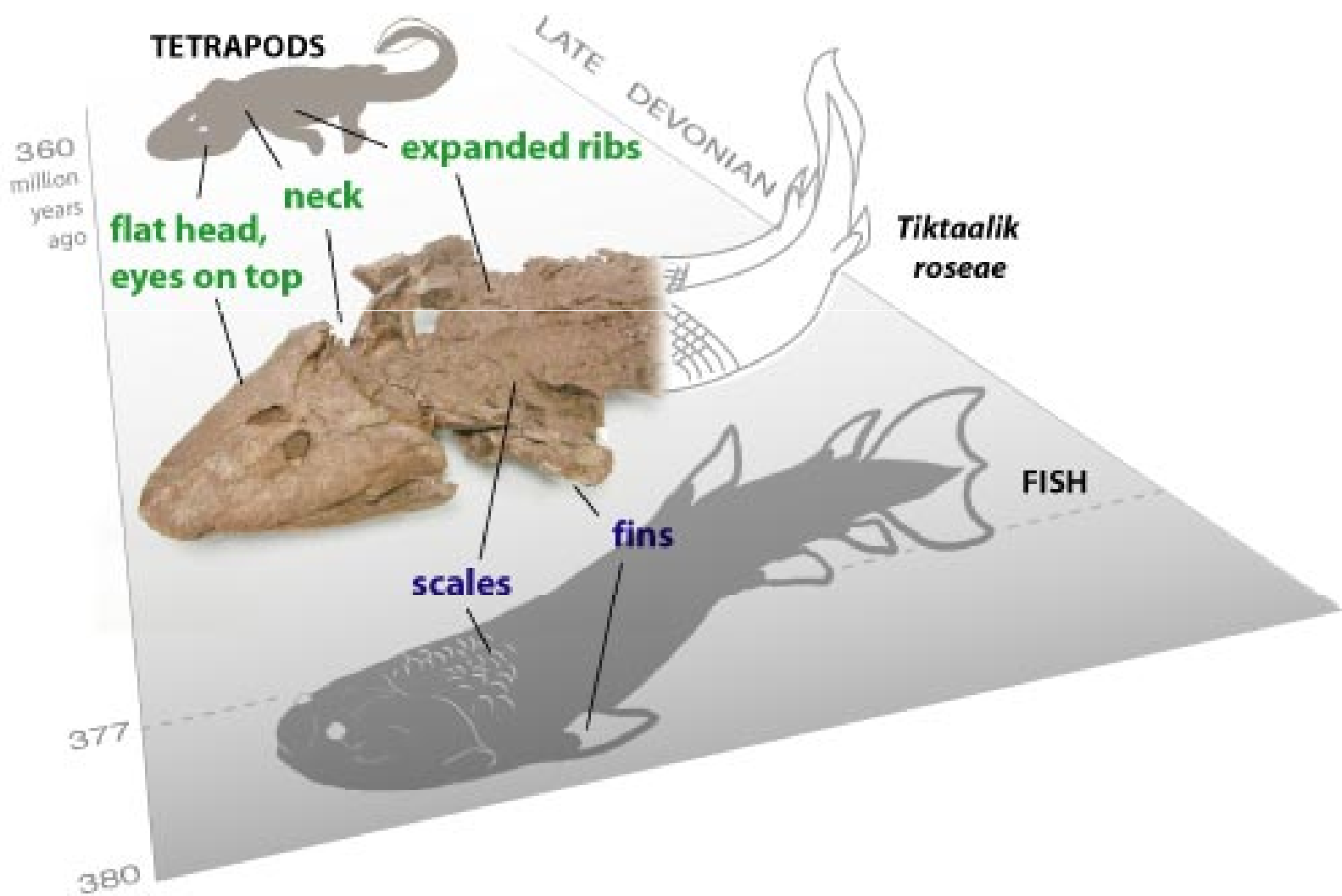
Panderichthyids were the most tetrapod-like of the sarcopterygian fishes.

Tiktaalik roseae – a lobe-finned fish intermediate between typical sarcopterygians and basal tetrapods.

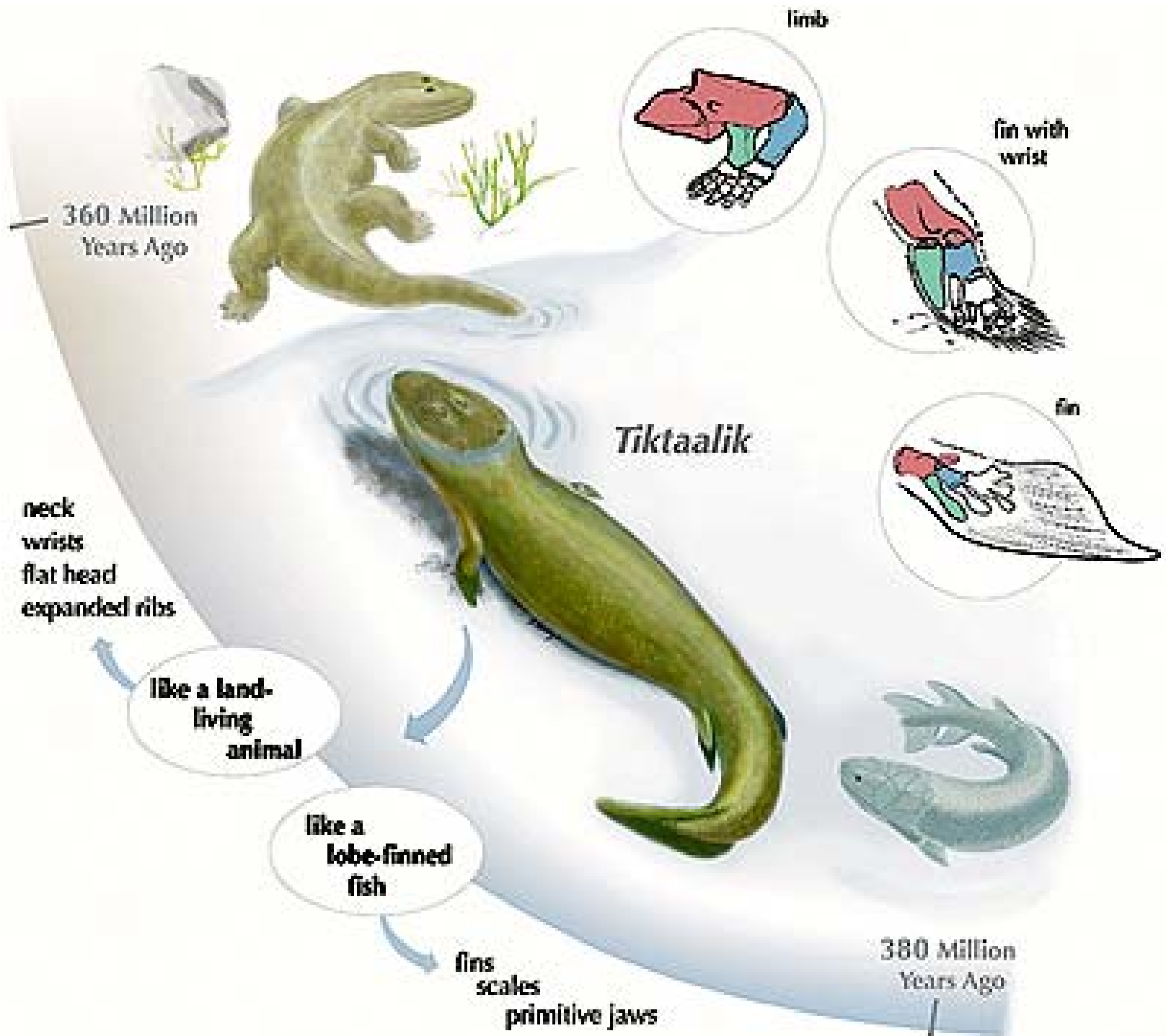


Mid to Late Devonian; 375 million years old.





Tiktaalik is probably a panderichthyid fish or close relative of them.



limb

fin with wrist

fin

Tiktaalik

360 Million Years Ago

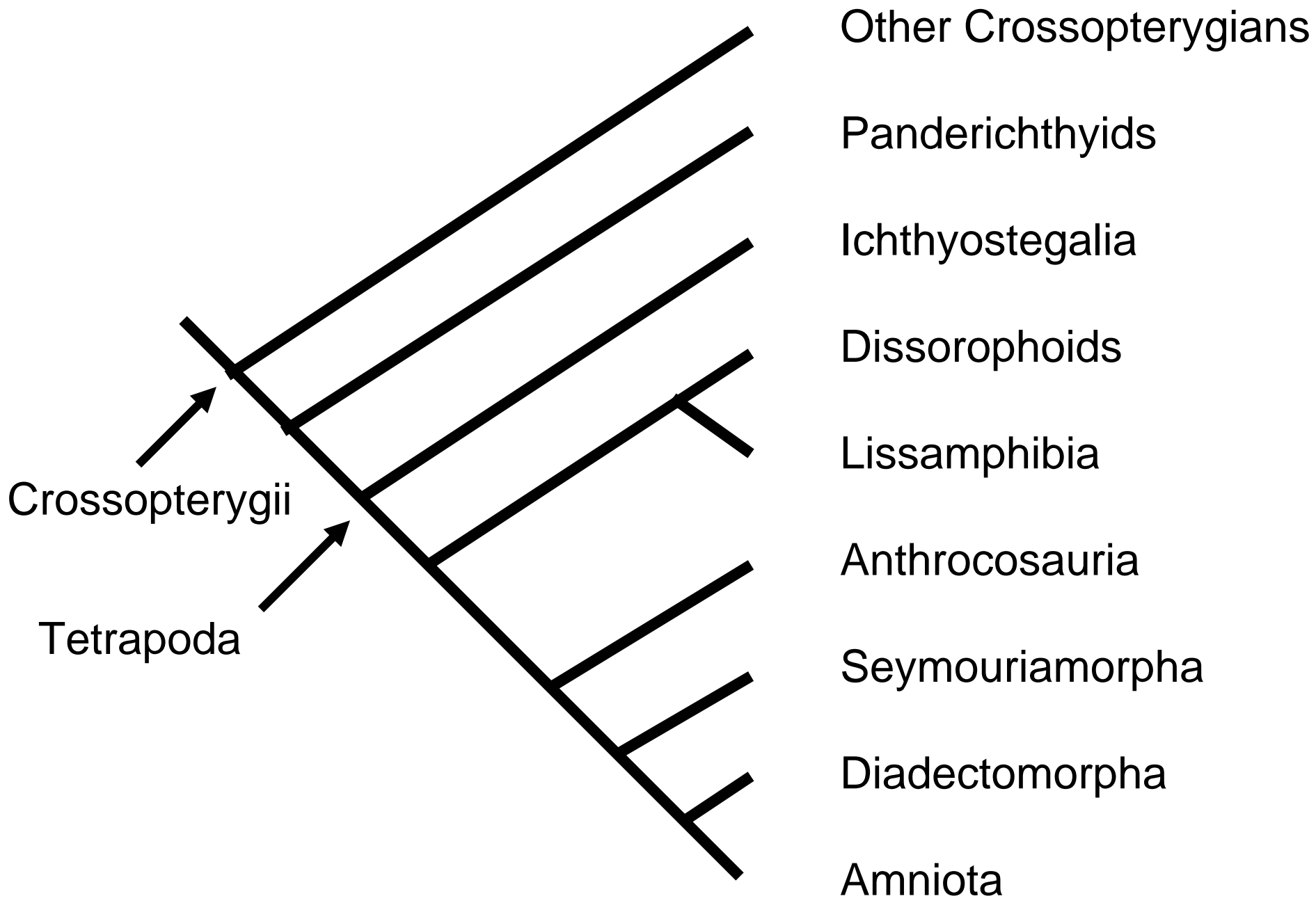
380 Million Years Ago

neck
wrists
flat head
expanded ribs

like a land-living animal

like a lobe-finned fish

fins
scales
primitive jaws





Acanthostega gunneri



Acanthostega gunneri

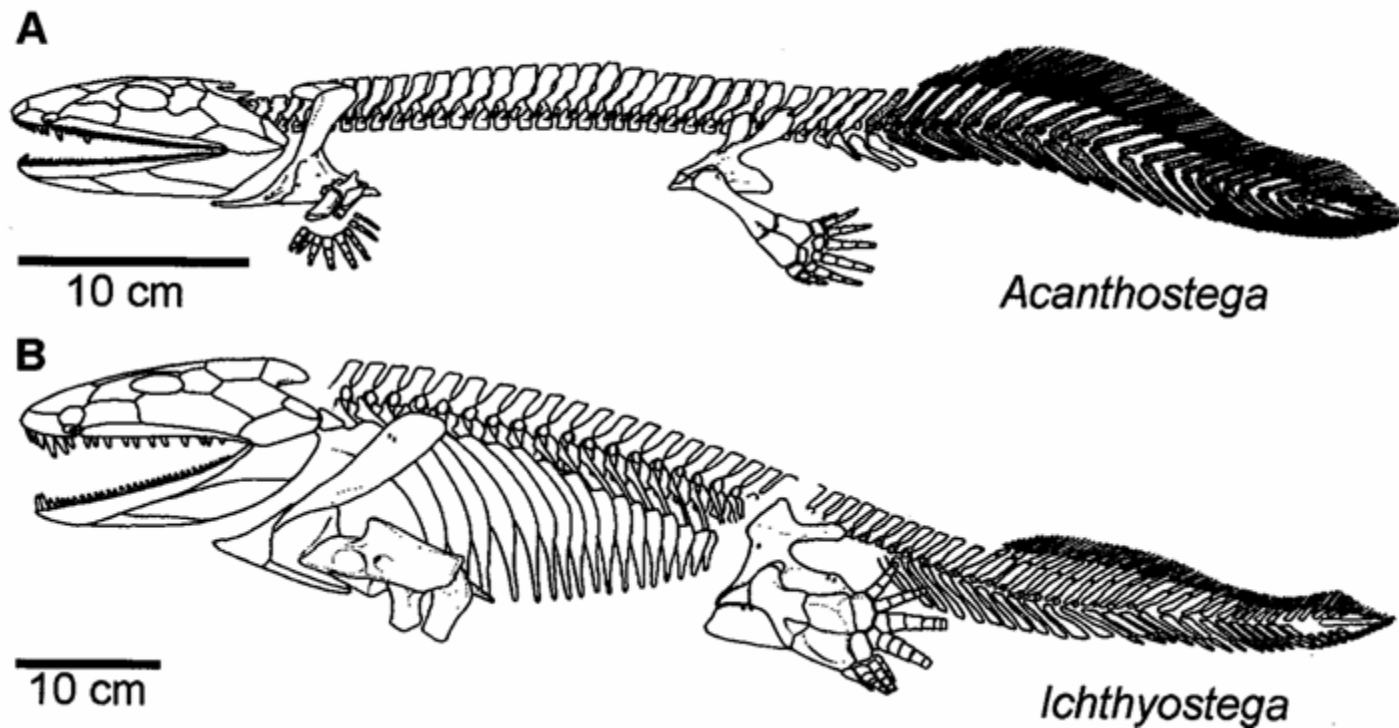


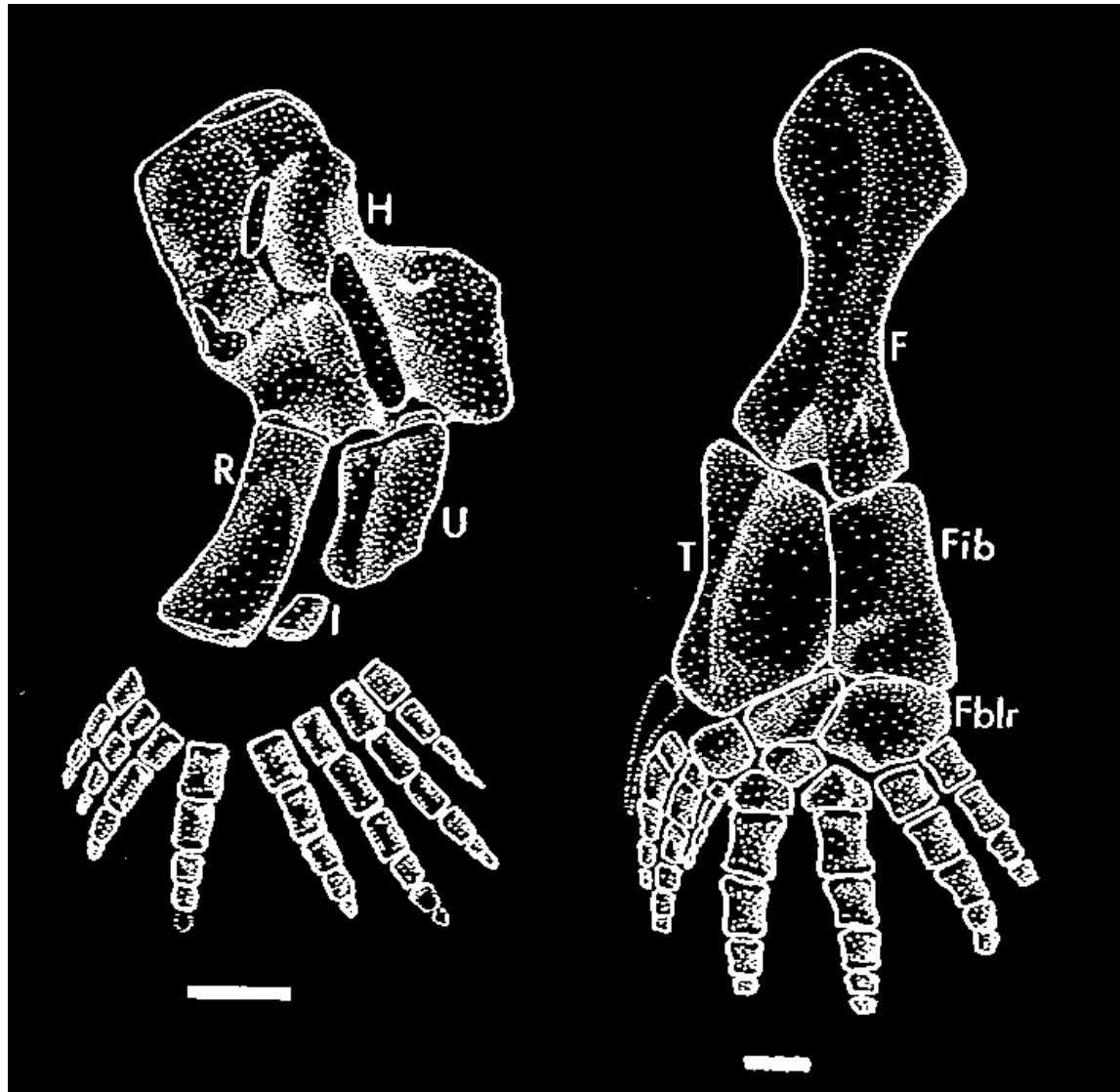
Acanthostega gunneri



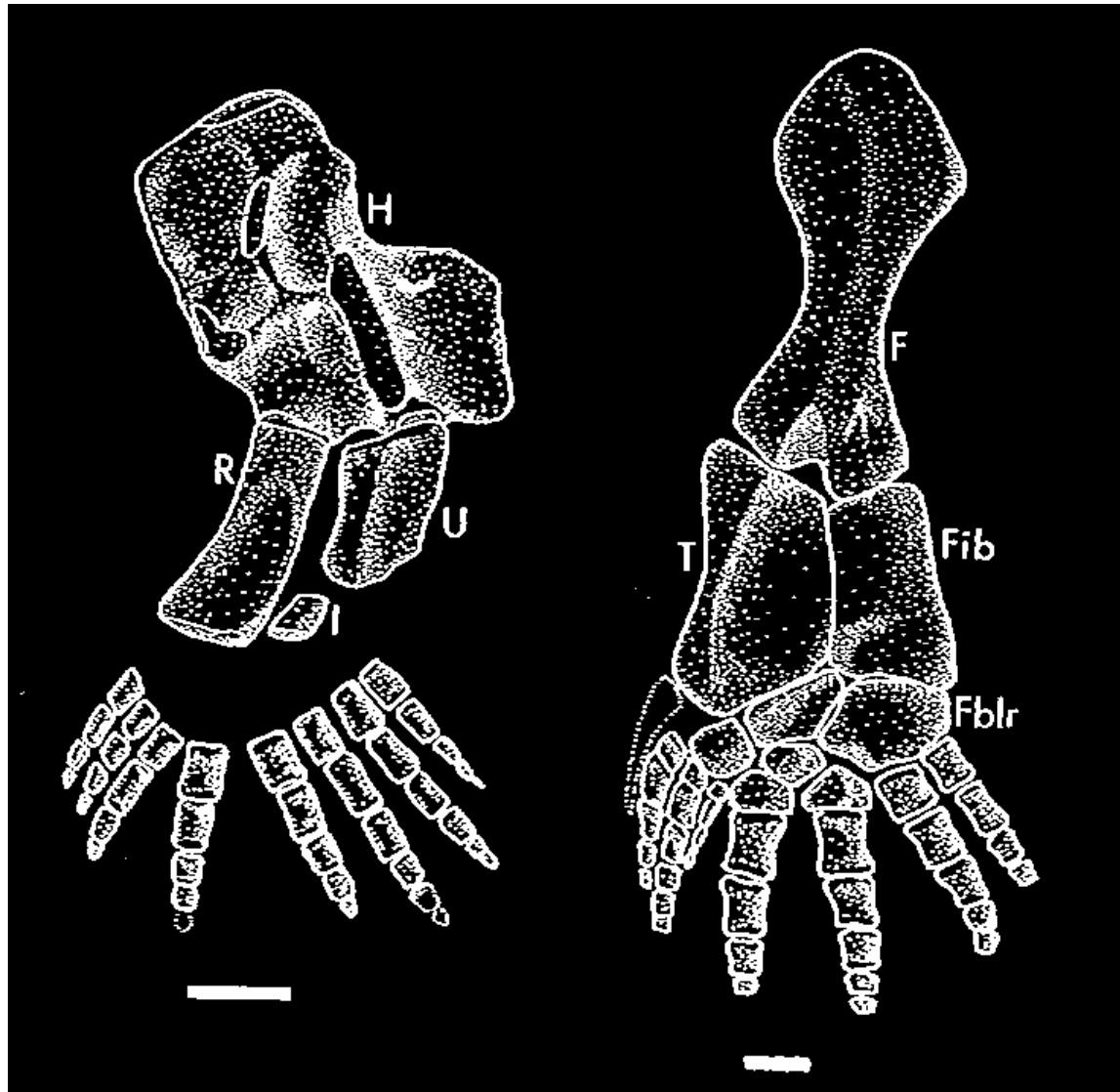
Acanthostega gunneri

The Earliest Tetrapods (such as Ichthyostegalians) were Very “Fish-like”





Fins or Limbs...?



Fins or Limbs...? Yes, polydactylous fins/limbs.

The Water-to-Land Transition

Recall the Problems plants faced:

- Desiccation (drying out)
- Support out of water
- Reproduction on land

The Water-to-Land Transition

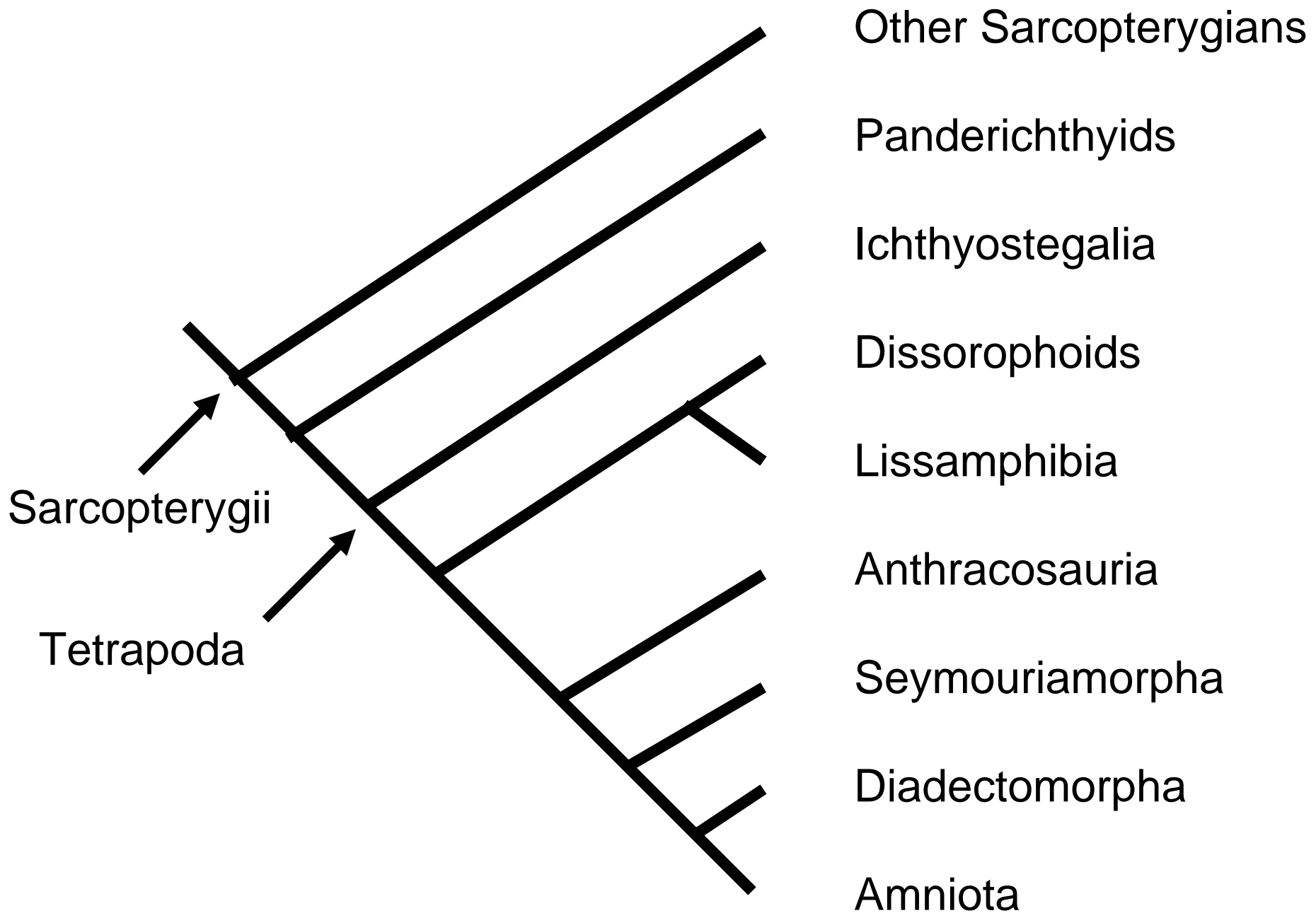
Problems Animals faced:

- Desiccation (drying out)
- Support out of water
- Breathing
- Locomotion on land

How did early TETRAPODS deal with these problems?

- Vertebrae that interlocked more tightly
- Thick, heavily scaled skin
- Fins became stout massive legs (lobe-fins preadapted for this)
- Emphasis on lungs instead of gills in adults

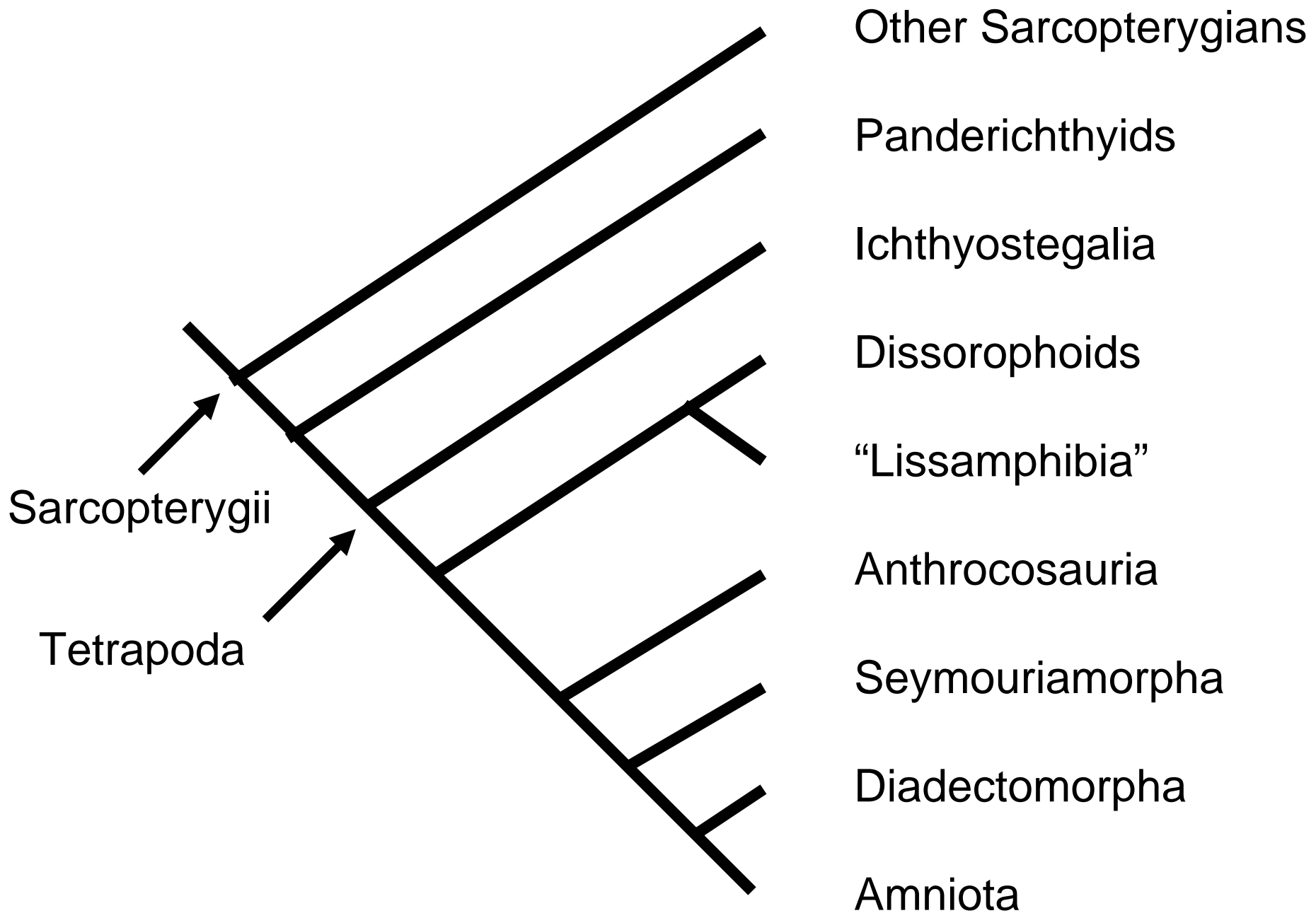






Diplocaulus sp.
DMNS 8905/6
Early Permian, 275 mya
Vale Formation, Texas
Length: ~84 cm

© DMNS. Photo by Rick Wicker



Living Amphibians:

All used to be included in a group called Lissamphibia

Lissamphibia was considered a natural group because all have similar teeth (pedicillate) and all have similar ear bones.

Lissamphibia included:

- Gymnophiona (limbless amphibians)
- Caudata (salamanders)
- Anura (frogs and toads)



- Gymnophiona (limbless amphibians)



Caudata
(salamanders)



Caudata (salamanders)



Anura
(frogs and toads)



Anura (frogs and toads)



Anura (frogs and toads)



Anura (frogs and toads)



Anura (frogs and toads) – *Scaphiopus couchi*



Anura
(frogs and toads)

NEW INFORMATION!!!

It turns out...

We've found some important new fossil material that has given us the opportunity to reassess the evolutionary relationships of "Lissamphibia".

A new animal – now known as *Gerobratrachus hottoni* was discovered.

From the Early Permian, about 280 million years old, of present-day north-central Texas

Looks remarkably like a frog, but still has a longer body and a tail like a salamander.

Gerobatrachus hottoni

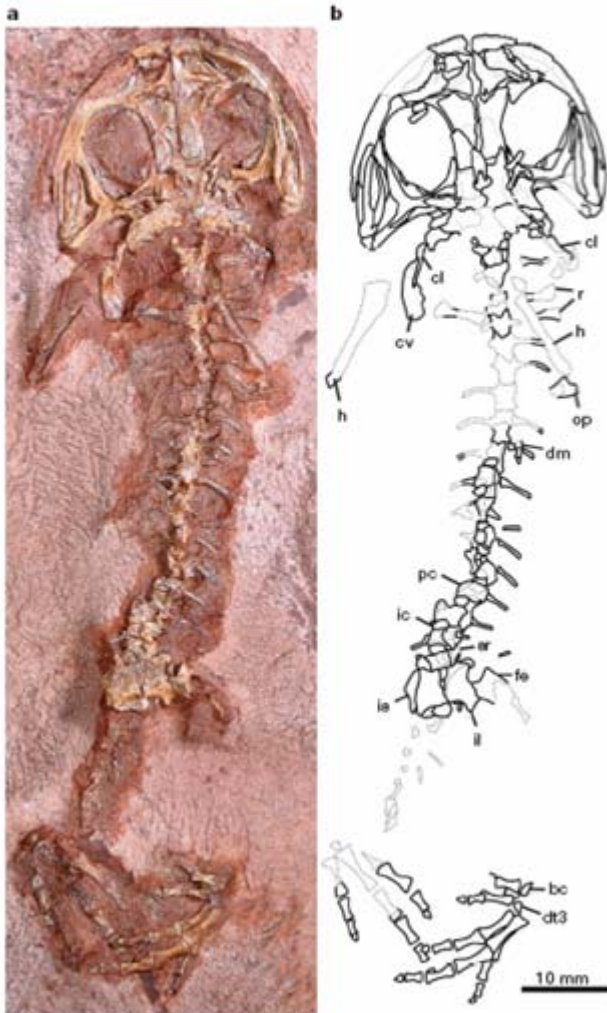


Figure 1 | *Gerobatrachus hottoni*, gen. et sp. nov., holotype specimen USNM 489135. Complete specimen in ventral view, photograph (left) and interpretive outline drawing (right). Abbreviations: bc, *basale commune*; d, cloithrum; cv, clavi; dm, digital elements of the manus; dt3, distal tarsal 3; fe, femur; h, humerus; ic, intercentrum; il, ilium; is, ischium; op, olecranon process of ulna; pc, pleurocentrum; r, radius; sr, sacral rib.

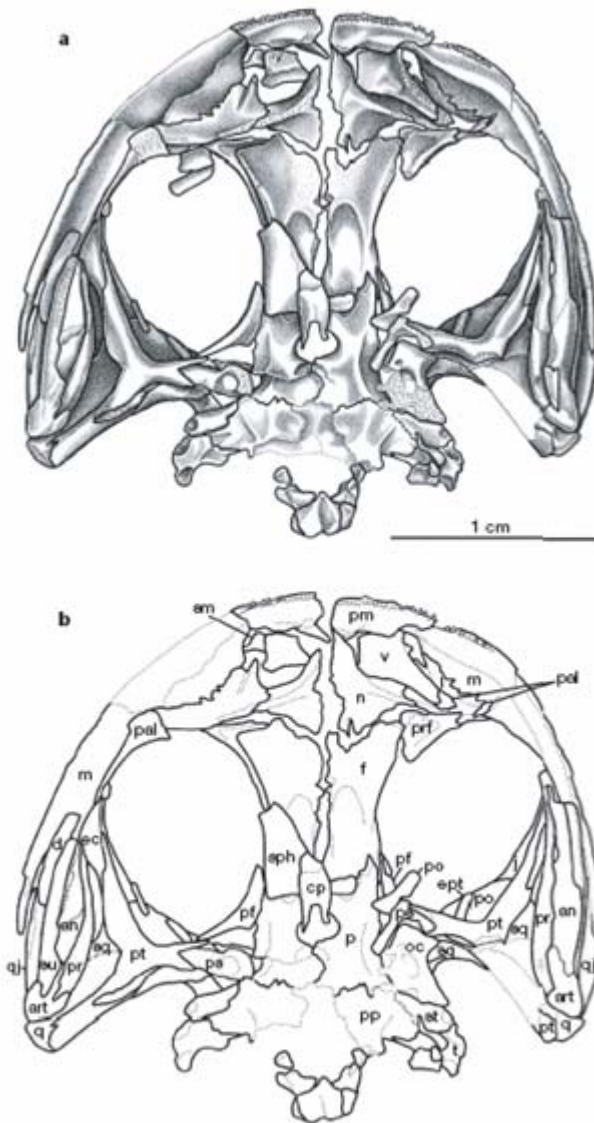


Figure 2 | *Gerobatrachus hottoni*, gen. et sp. nov., holotype specimen USNM 489135. a, Close-up interpretive specimen, and b, outline drawing of skull in ventral view. Abbreviations are the same as for Fig. 1 and: an, angular; art, articular; cp, cultriform process of parasphenoid; d, dentary; ec, ectopterygoid; ept, epipterygoid; f, frontal; j, jugal; l, lacrimal; m, maxilla; n, nasal; oc, portion of otic capsule; p, parietal; pal, palatine; pf, postfrontal; pm, premaxilla; po, postorbital; pp, postparietal; pr, prearticular; prf, prefrontal; ps, parasphenoid; pt, pterygoid; q, quadrate; qj, quadratojugal; sm, septomaxilla; sph, sphenethmoid; sq, squamosal; st, supratermporal; su, surangular; t, tabular; v, vomer.

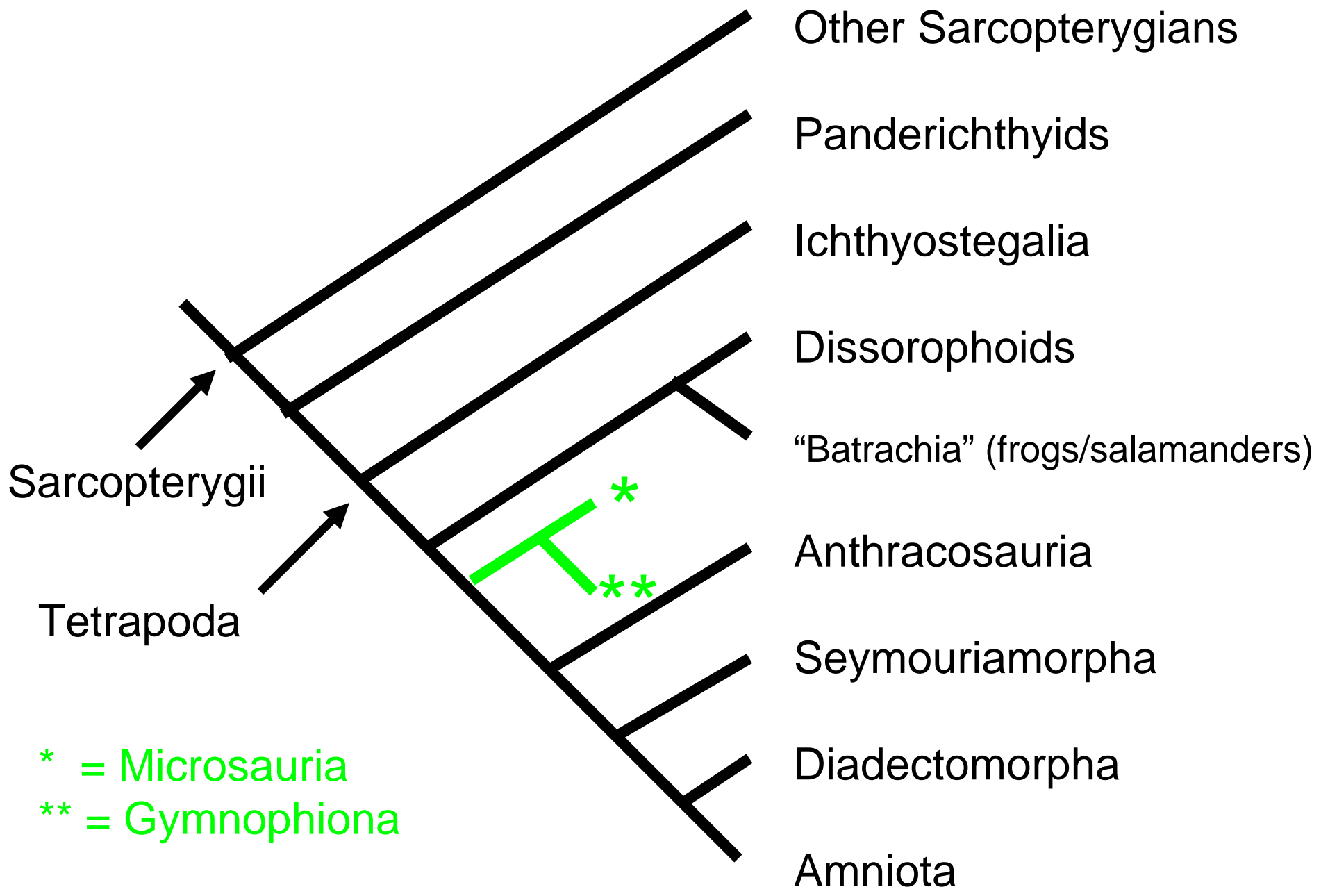


It turns out:

With the help of *Gerobatrachus*, we now know that frogs and salamanders are closely related, but gymnophionans are convergent in their dental features.

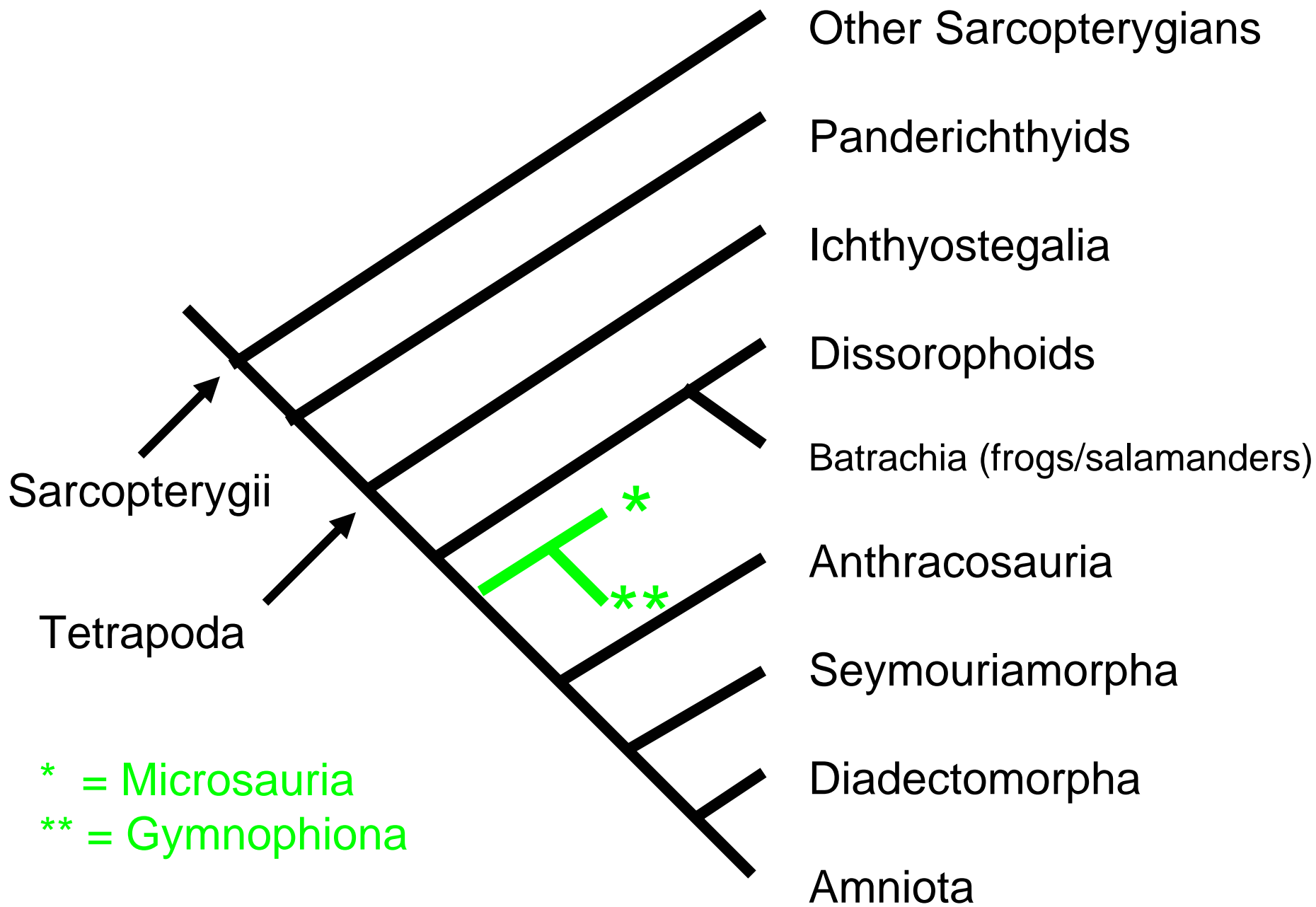
Frogs and salamanders ARE related to dissorophoid amphibians.

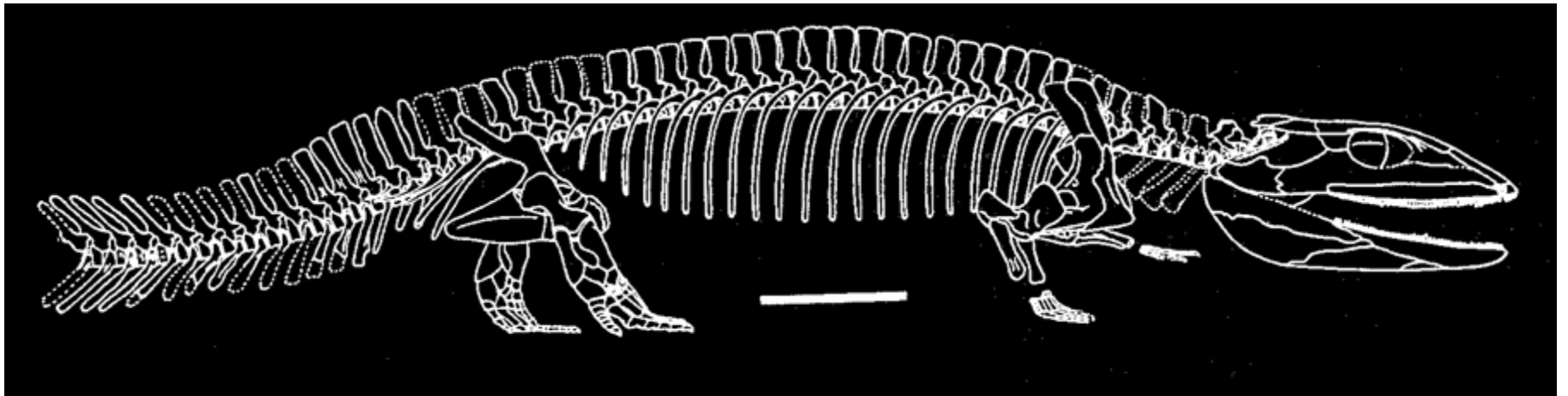
Whereas gymnophionans are probably related to a group called MICROSAURS.



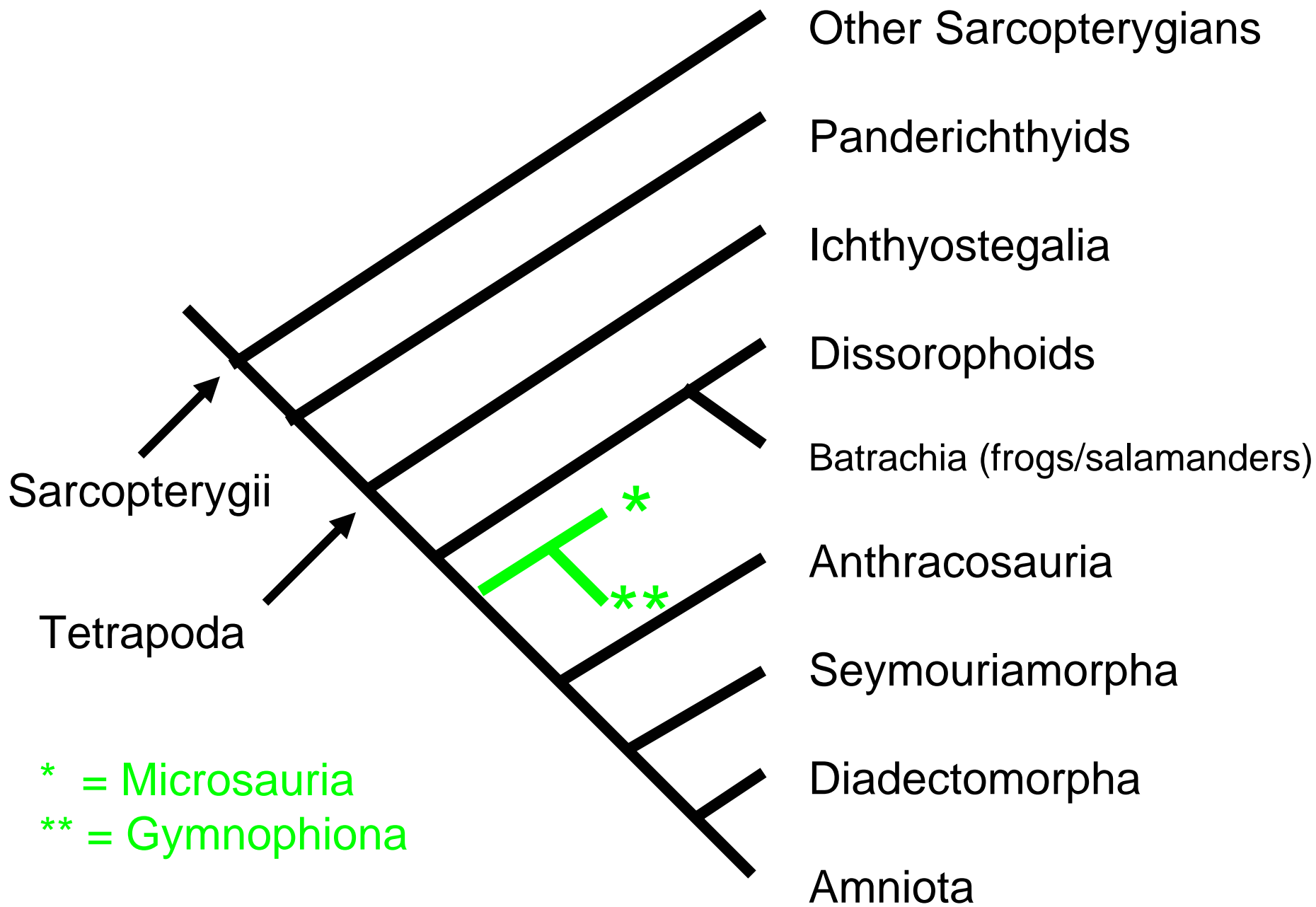
In other words...

“Lissamphibia” is not a
true group; also known as
“POLYPHYLETIC”





Proterogyrinus – a highly terrestrial amphibian
Carboniferous Period



* = Microsauria
** = Gymnophiona



Advanced Seymouriamorpha Amphibian:
Seymouria sanjuanensis – from the Early Permian of
Europe and the U.S.

