

# Amphibians

- First vertebrates adapted to land environment
- Preceded onto land by plants, insects, snails
- ~350 million years ago



# Amphibians

- Not completely land adapted
- Structurally between fish & reptiles
- Most cannot be far removed from water



*Ambystoma californiense* © 2011 William Flanagan



# Amphibians

- Things to be considered in water to land movement:
- 1)  $O_2$  content of air greater than water (less effort to take up  $O_2$  from air)
- 2) air less dense (lack of body support)



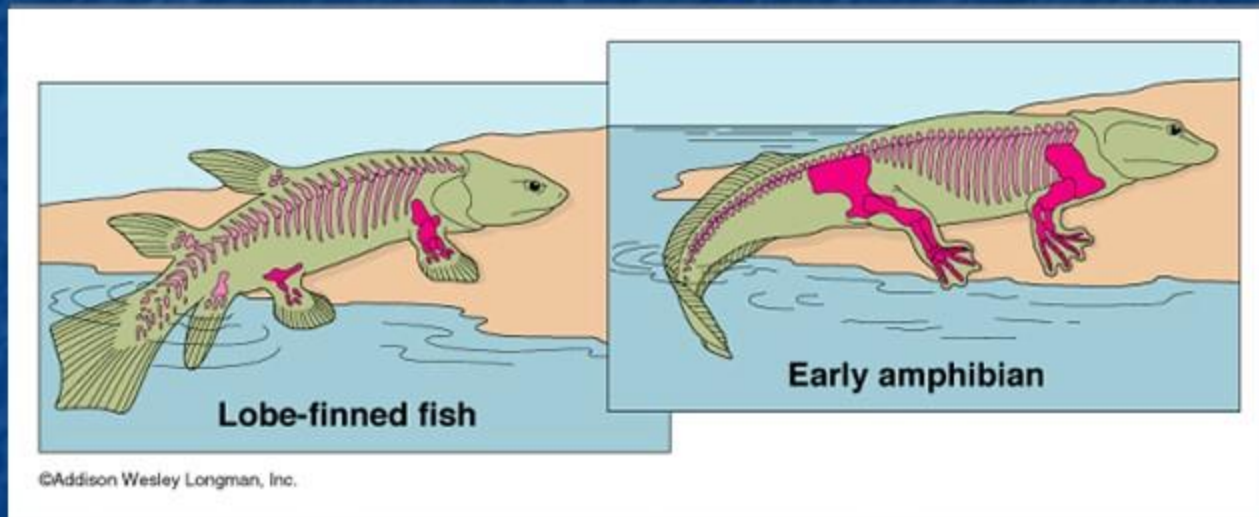
# Amphibians

- 3) greater temperature fluctuations (unpredictable temperature extremes)
- 4) greater habitat variety (cover, shelter, breeding areas)



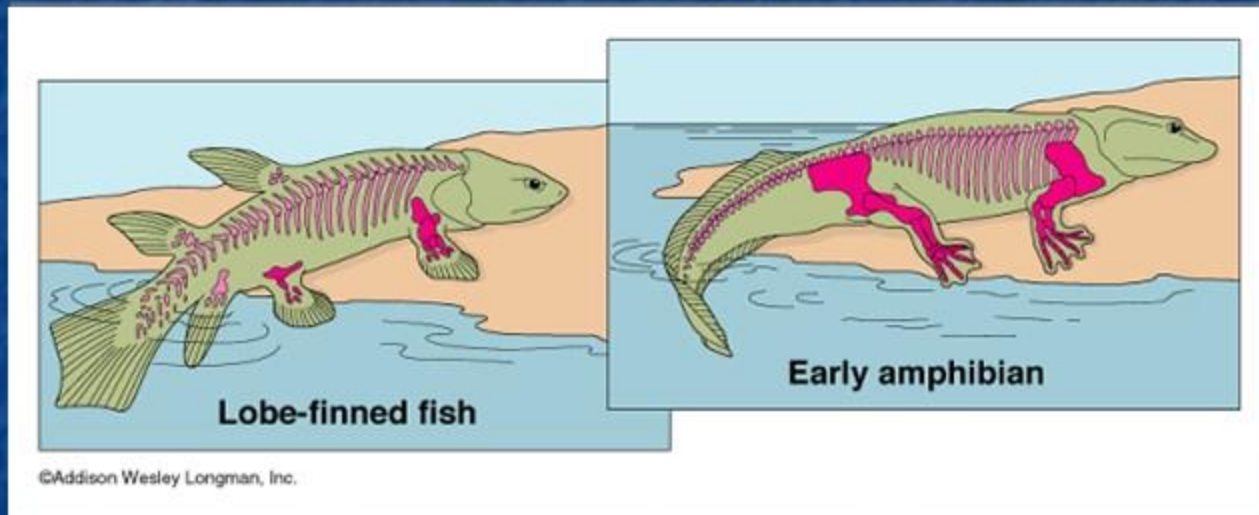


# Earliest Amphibians



- Appeared to have arisen from lobe-finned fishes
- Were abundant during period when amphibians first appeared
- Possessed characteristics that benefited first amphibians

# Earliest Amphibians



- Strong, mobile fins - used as stabilizers during swimming
- Used as paddles to pull themselves across land in search of water



# Earliest Amphibians



- Lungs - lived in freshwater lakes & streams during periods of alternating floods, droughts
- Gills useless in low dissolved  $O_2$  areas or dry areas
- Surviving fishes of this period developed simple lung

# Amphibian Diversity

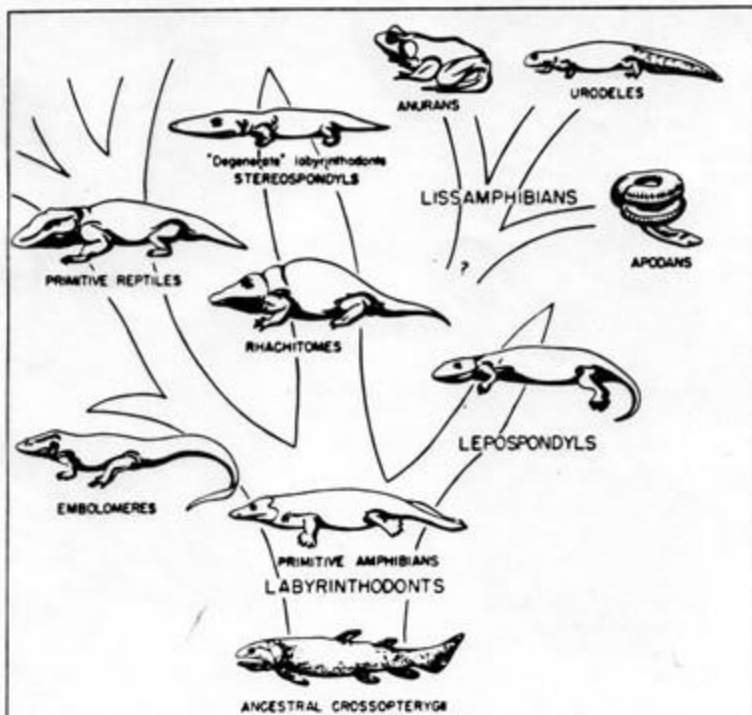


Figure 2-9. A "family tree" of the Amphibia. The surviving groups are shown at the upper right. They probably have a common origin, but whether this origin, in the late Paleozoic, was from rhachitomous labyrinthodonts or Paleozoic lepospondyls is still uncertain. (Romer, A. S., and Parsons, T. S.: The Vertebrate Body. 5th Ed. Philadelphia, W. B. Saunders Co., 1977.)

- Became better adapted to water
  - Bodies became more flattened
  - Some developed webbed feet
  - Some developed weaker legs & stronger tails for more efficient swimming



# Amphibian Diversity

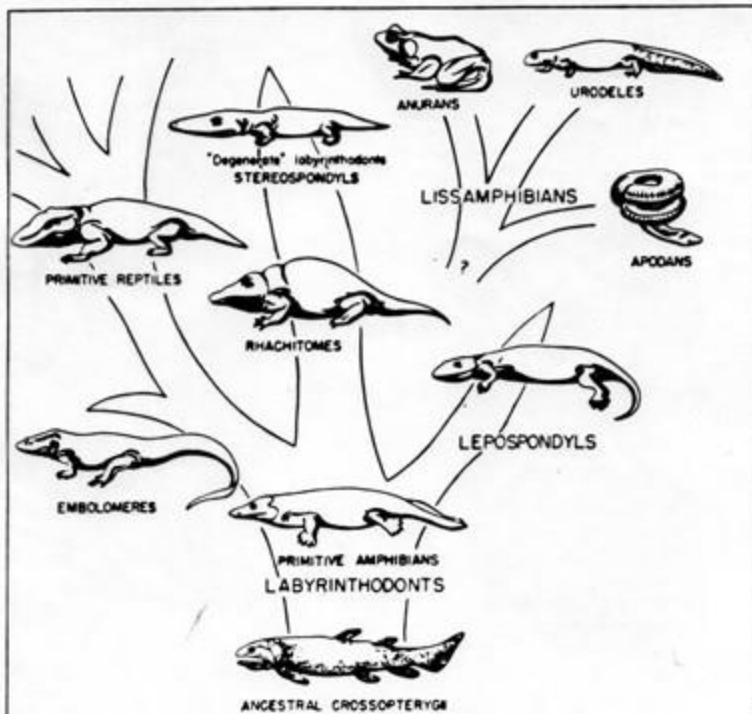


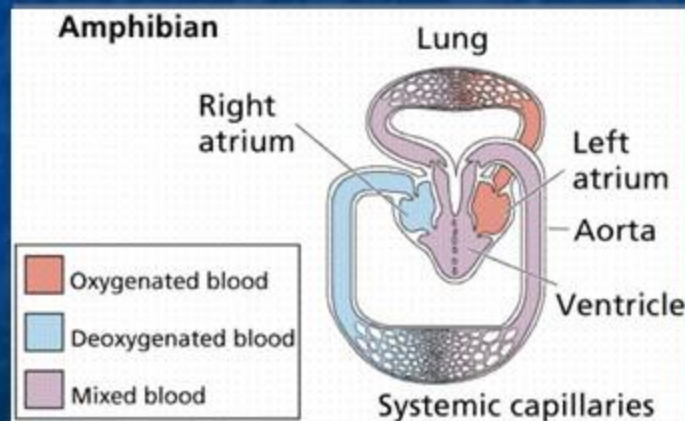
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- Produced 3 basic groups of amphibians present today
- Order Anura (without tail) - frogs, toads
- Order Caudata (with tail, Urodela) - salamanders & newts
- Order Gymnophiona (naked snake) - caecilians

# Lungs & Circulation

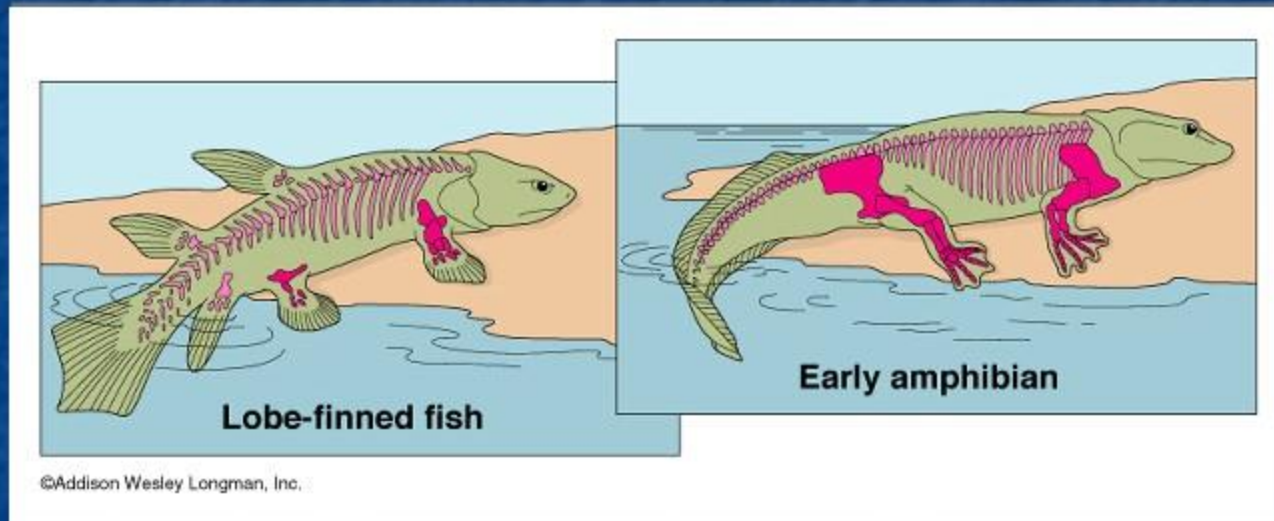


- Improved on efficiency of simple lung
- Supplied it with capillary network to improve O<sub>2</sub> uptake
- Double circulation
  - Systemic
  - Pulmonary





# Jointed Limbs



- Strengthening of limbs - 5 digits, joints
- Improvements in pelvic, pectoral girdles
- Developed for continued survival in aquatic environments, but pre-adapted others for life on land

# Amphibian Characteristics



- Aquatic ectotherms - body temperature varies with the environment
- Difficult to withstand temperature extremes of terrestrial environment



# Amphibian Characteristics



- Skin must be kept moist - obtain much of their  $O_2$  through the skin
- Thin, unprotected from desiccation

# Amphibian Characteristics

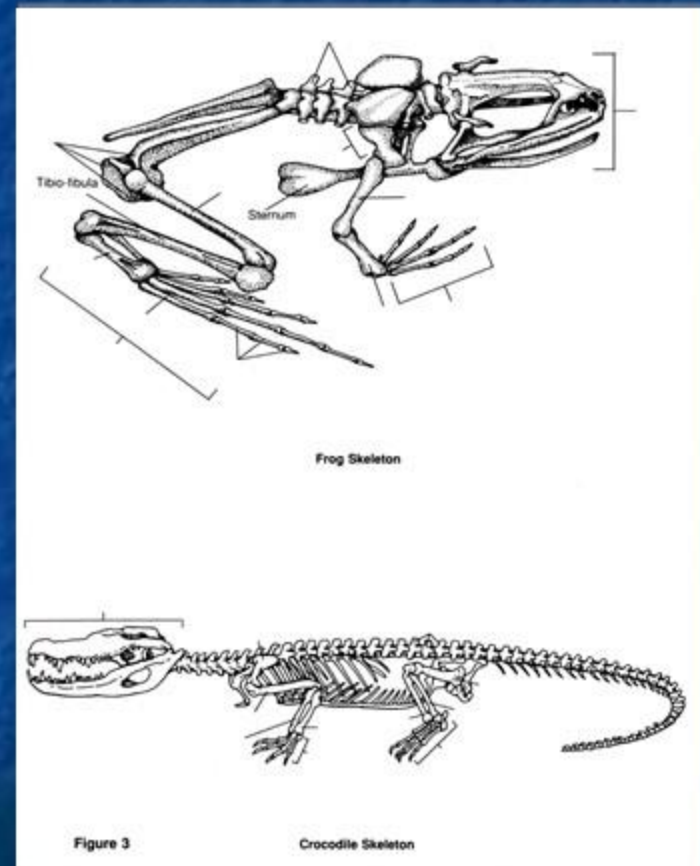


- Mode of reproduction requires water or moisture
- Eggs fertilized externally
- Larvae must pass through an aquatic tadpole stage



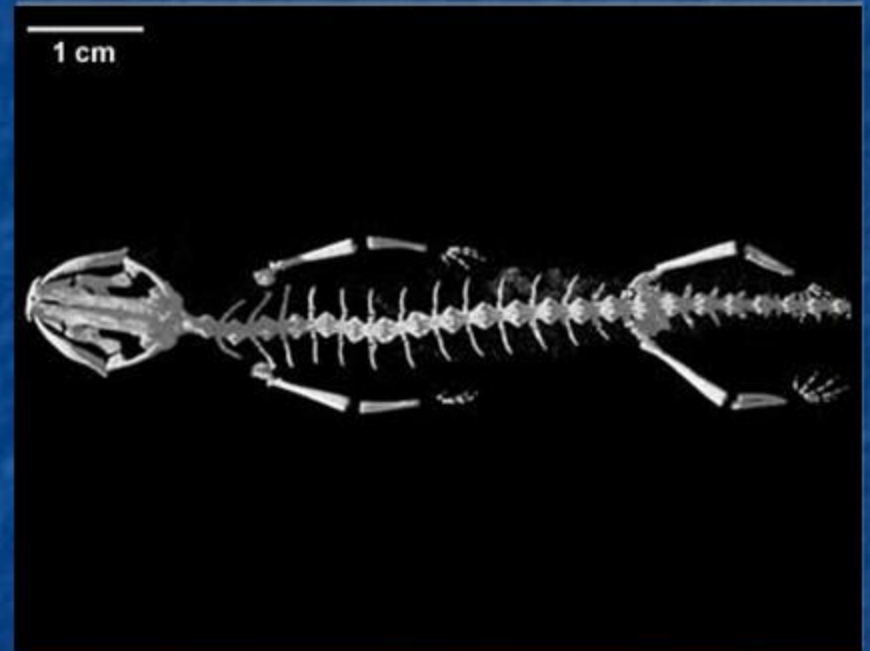
# Amphibian Characteristics

- Skeleton mostly bony
- Varying number of vertebrae
- Some may have ribs
- Notochord does not persist



# Amphibian Characteristics

- Great variety of body forms
- Elongated trunk with distinct head, neck, tail, 4 legs (tetrapods)
- Frogs with compact depressed body, fused head & trunk, no neck





# Amphibian Characteristics

- Some legless forms without distinct body regions (caecilians)



# Amphibian Characteristics

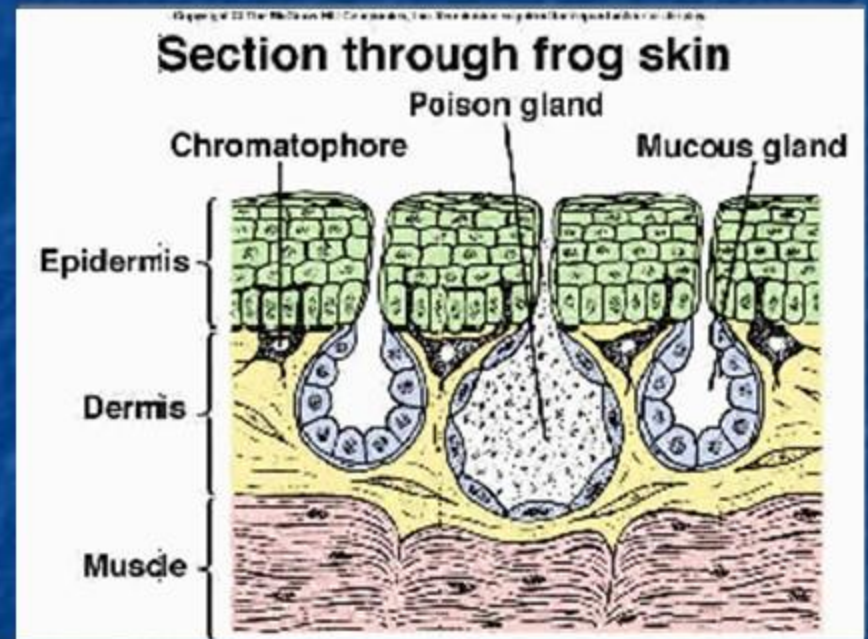
- Webbed feet common
- No “true” claws or nails on digits





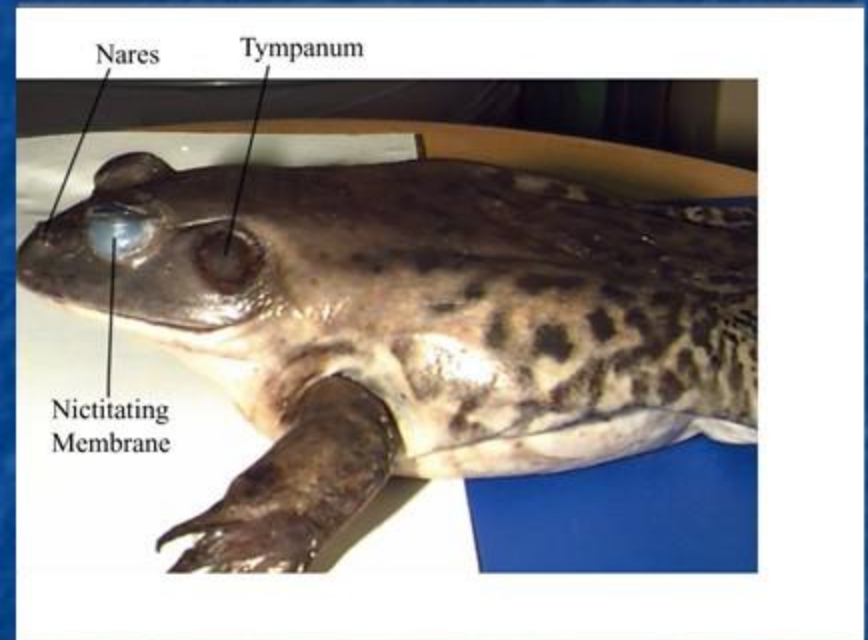
# Amphibian Characteristics

- Skin smooth and moist
- No ectodermal scales (some have concealed dermal scales)
- Many glands - some poisonous



# Amphibian Characteristics

- Two nostrils open into mouth cavity
- Breathe with mouth closed





# Amphibian Characteristics

- Respiration via lungs, skin, gills
- Some salamanders lack lungs
- Skin well vascularized
- External gills in larvae may persist throughout life in some

