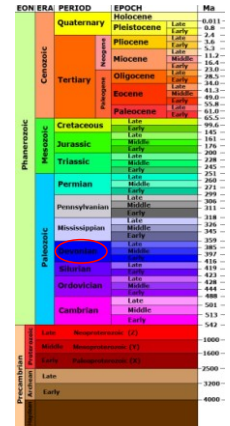
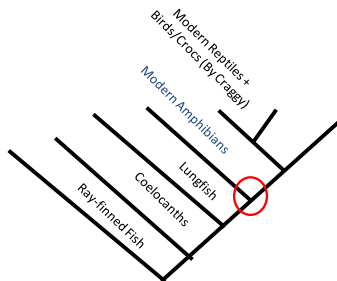


Zool 407. Herpetology, Ornithology and Mammalogy (1 unit, 4 credits, 100 marks)**A. Herpetology**

- Origin, evolution and adaptive radiation of amphibians and reptiles.
- Food and feeding behaviour
- Breeding biology and parental care of amphibians and reptiles
- Adaptation to amphibious life
- Biological and economical importance of amphibians and reptiles
- Poisonous and non-poisonous snakes, snake bites and treatment.

Origin and Evolution of Amphibians

Geological Time Scale

**Origin and Relationships of Modern Amphibians****Origin and Evolution of Amphibians**

The first major groups of amphibians developed in the Devonian period, around 370 million years ago, from lobe-finned fish similar to the modern coelacanth and lungfish.

Lungfish had evolved multi-jointed leg-like fins with digits that enabled them to crawl along the sea bottom.

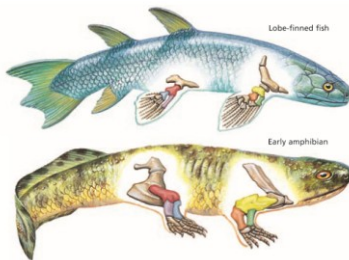
Some fish had developed primitive lungs to help them breathe air when the stagnant pools of the Devonian swamps were low in oxygen.

They could also use their strong fins to hoist themselves out of the water and onto dry land if circumstances so required.

Eventually, their bony fins would evolve into limbs and they would become the ancestors to all tetrapods, including modern amphibians, reptiles, birds, and mammals.

Origin and Evolution of Amphibians

Amphibians have similar bone structure to primitive lobe-finned fishes. The colored bones in the figure are homologous structures between lobe-finned fish and amphibians. Homologous structures are anatomical structures that share a common ancestry.

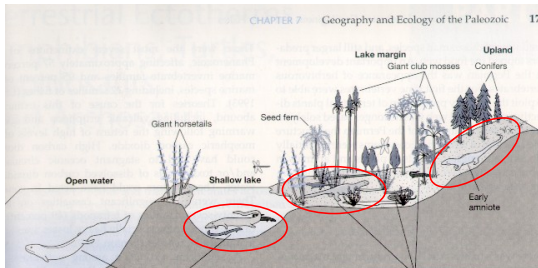
**Sarcopterygii—Lobe Fin Fishes**

- Appendages are Similar in Structure to Amphibians
- Most Modern Forms Use Them for Locomotion
 - Walk on Bottom
 - Swim
- Two Major Groups
- Coelocanthids—2 Living Fossils from Indian Ocean
- Lungfish
 - 1 Species each in Australia, Africa, and South America
 - Sister to Terrestrial Vertebrates
 - Australian Species is Very Different
 - Walks on Bottom of Ponds/Streams
 - Very similar to Paleozoic and Mesozoic forms
 - South American + African Forms
 - Gills Mostly Remove Carbon Dioxide
 - Drown Without Air
 - African Form Aestivate
 - Both Originally Considered Salamanders



(Images from Pough et al., Vertebrate Life)

Pugh et al., 2002. Vertebrate Life, Fig 7-5



Late Carboniferous of Europe--Any place to look for this around here?

Origin and Evolution of Amphibians

At the end of the Devonian period (360 million years ago), the seas, rivers and lakes were teeming with life while the land was the realm of early plants and devoid of vertebrates, though some, such as *Ichthyostega*, may have sometimes hauled themselves out of the water.

It is thought they may have propelled themselves with their forelimbs, dragging their hindquarters in a similar manner to that used by the elephant seal.

In the early Carboniferous (360 to 345 million years ago), the climate became wet and warm. Extensive swamps developed with mosses, ferns, horsetails and calamites.

Air-breathing arthropods evolved and invaded the land where they provided food for the carnivorous amphibians that began to adapt to the terrestrial environment.

There were no other tetrapods on the land and the amphibians were at the top of the food chain.

Origin and Evolution of Amphibians

Ichthyostega was one of the first primitive amphibians, with nostrils and more efficient lungs.

It had four sturdy limbs, a neck, a tail with fins and a skull very similar to that of the lobefinned fish, *Eusthenopteron*.

Amphibians evolved adaptations that allowed them to stay out of the water for longer periods.

Their lungs improved and their skeletons became heavier and stronger, better able to support the weight of their bodies on land.

They developed "hands" and "feet" with five or more digits

the skin became more capable of retaining body fluids and resisting desiccation

The fish's hyomandibula bone in the hyoid region behind the gills diminished in size and became the stapes of the amphibian ear, an adaptation necessary for hearing on dry land.

Origin and Evolution of Amphibians

They were the top land predators, sometimes reaching several metres in length, preying on the large insects of the period and the many types of fish in the water.

They still needed to return to water to lay their shell-less eggs, and even most modern amphibians have a fully aquatic larval stage with gills like their fish ancestors.

After the Carboniferous Rainforest Collapse amphibian dominance gave way to reptiles.

Lissamphibia

- The Lissamphibia includes all three modern groups of amphibians. All three have smooth skin, hence their name ("Liss" means smooth.).
- The oldest fossil salamanders date to the Jurassic (about 145 mya).
- The oldest true frog fossils date to 190mya, but froglike vertebrates are known from 200 mya.
- Caecilian fossils are scarce but the oldest known are from 195 mya. These had well-developed eyes and small functional limbs (unlike modern forms).



Callobatrachus sanyanensis: fossil frog from Lower Cretaceous.

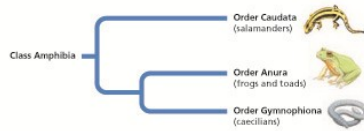
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Origin and Evolution of Amphibians

Diversification of amphibians

During the late Devonian period and the Carboniferous period (359 million to 299 million years ago), amphibians split into two main evolutionary lines.

One line included the ancestors of modern amphibians, and the other line included the ancestors of reptiles.



Origin and Evolution of Amphibians

Modern amphibians

Modern amphibians are a very diverse group, but they do share several key characteristics:

- Most change from an aquatic larval stage to a terrestrial adult form. This transformation is called *metamorphosis*.
- Most have moist, thin skin with no scales.
- Feet, if present, lack claws and often are webbed.
- Most use gills, lungs, and skin in respiration.
- Eggs lack multicellular membranes or shells. They are usually laid in water or in moist places and are usually fertilized externally.