# Vertebrates fossils:

Animals with backbones are called vertebrates. They include reptiles, amphibians, fish, birds and mammals. In many western States, vertebrate fossils, such as skeletons of dinosaurs, camels, and saber-toothed tigers, are common in Mesozoic and Cenozoic rocks.

# Mesozoic Reptiles

The Mesozoic era, meaning the age of middle life or the age of mideval life, started 225 million years ago and ended 65 million years ago. It lasted for 160 million years. It has three periods, namely Triassic, Jurassic and Cretaceous.

During the entire Mesozoic era the reptiles literally rules over the earth.

The reptiles of the Mesozoic era occupied every available ecological niche and was totally dominant over other animal groups of that period. So, the Mesozoic era is called the Golden age of Reptiles.

Some of the Mesozoic reptiles like the Dinosaurs were giant land dwellers, Some like the pterosaurs were flying and Some Others like Ichthyosaurs were adapted to an aquatic life.

## Outline classification of Mesozoic Reptiles:

The major reptilian groups of the Mesozoic era are the following.

1. Thecodonts.
2. Dinosaurs
3. Pterosaurs (flying reptiles)
4. Ichthyosaurs and plesiosaurs (marine reptiles)
5. Therapsids (mammal like reptiles)

1. Thecodonts :

Thus type of reptiles appeared at the begining of the Triassic period and they became extinct at the end of the Triassic time. eg: Erythrosuchus.

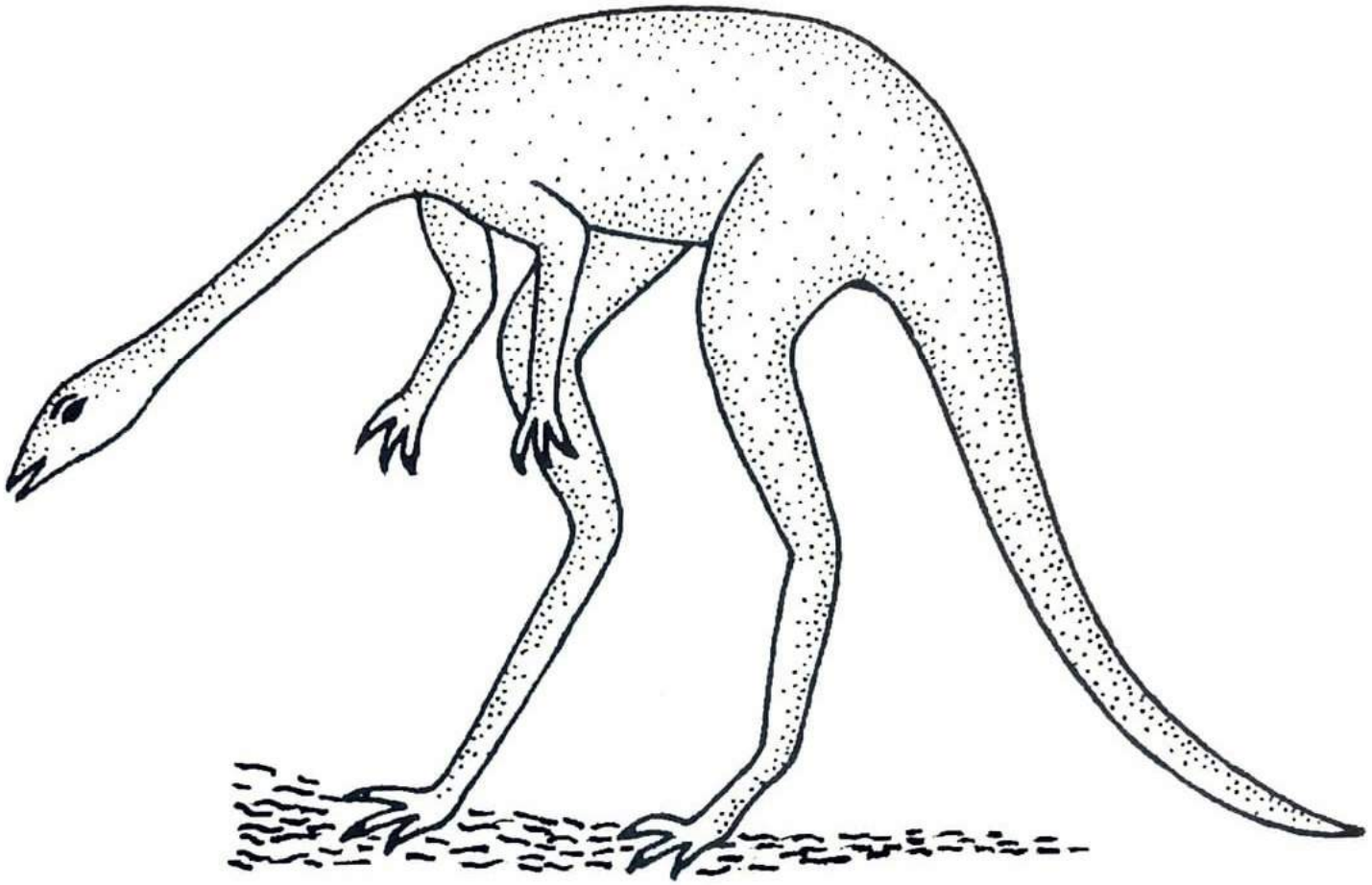
2. Dinosaurs :

From the middle of Triassic to the end of Cretaceous the dinosaurs dominated the earth. At the end of Cretaceous period, the dinosaurs became extinct. eg: Reptile like. } Saurischia
1. Dinosaurs
2. Bird - like } Ornithischia.
Dinosaurs

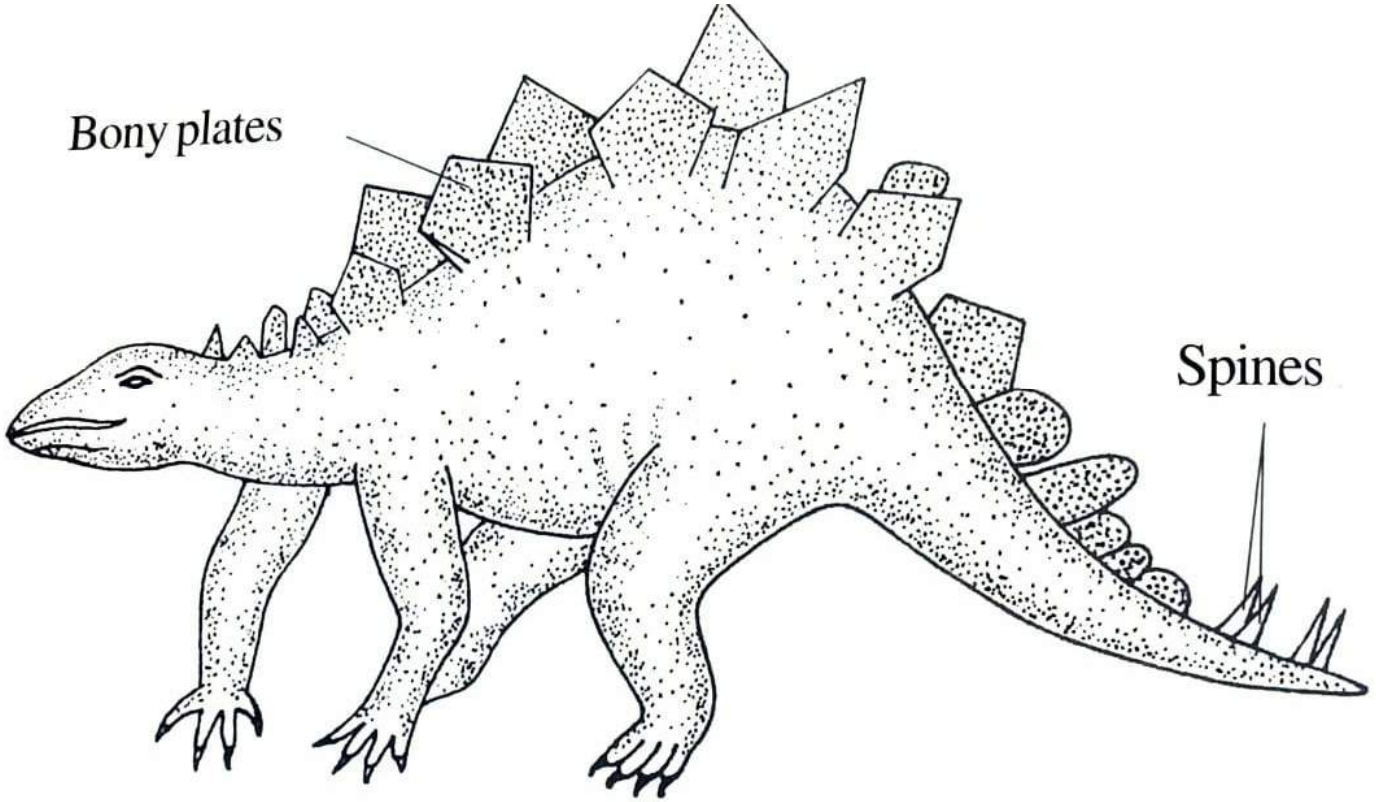
1) Saurischia : The pelvic was arranged similar to that of reptiles and have the name Saurischia i.e reptile - like pelvis. It was small bipedal carnivores like the ancestral thecodonts.

2) Ornithischia : This arrangement of pubis and ischium is similar to the pelvis of birds. i.e. birds like pelvis.

# Saurischian dinosaur



# Stegosaurus-plated dinosaur



Ornithischian dinosaurs had no teeth in both upper and lower jaws. The upper portion of the skull and jaws were modified into a beak in some of them, most of them were quadrupedal.

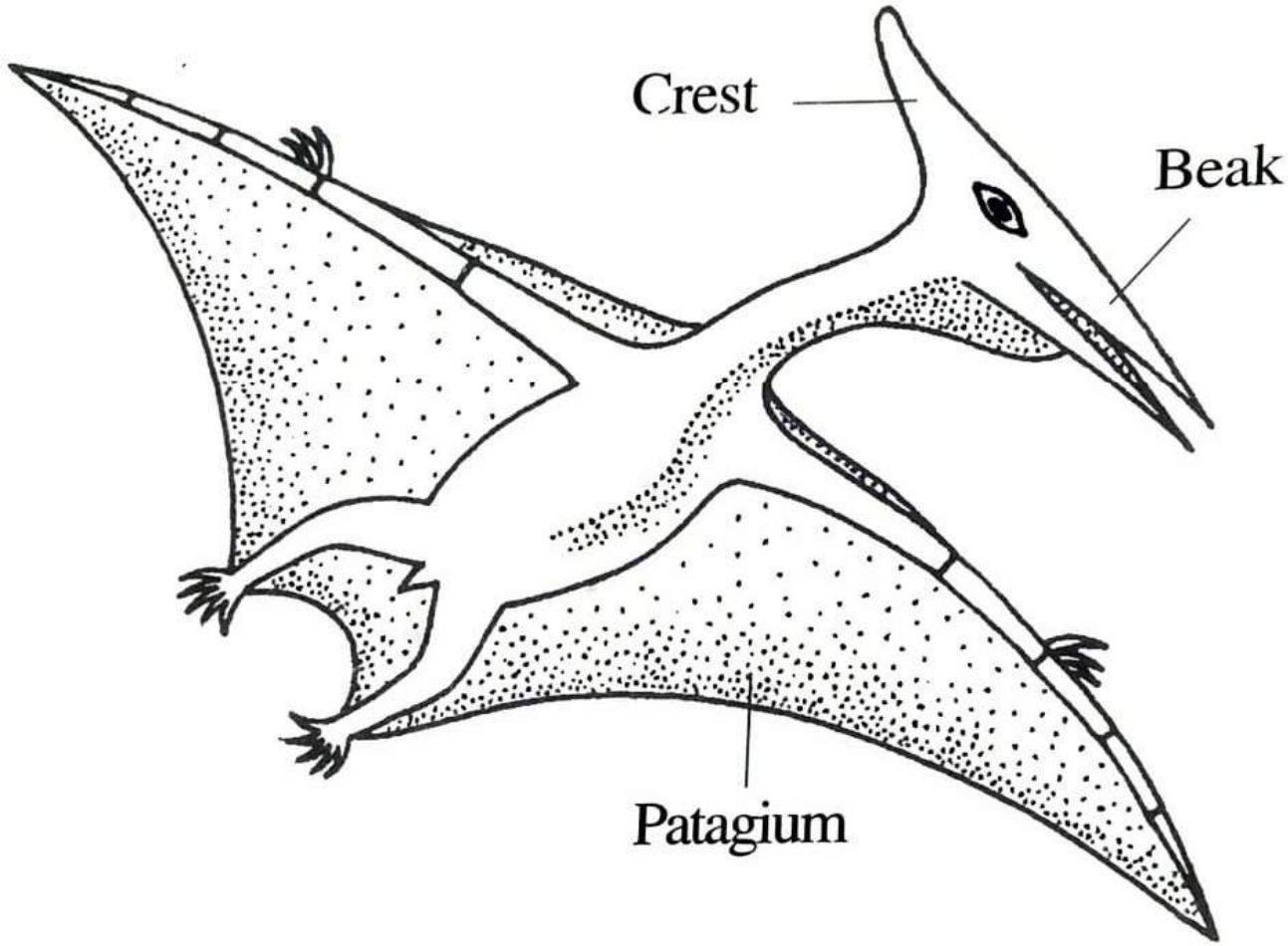
3. Pterosaurs (Flying Reptiles)

These flying reptiles flourished during the Jurassic and lived upto the late Cretaceous times.

The main feature of pterosaurs was the presence of membrane wings. The 5th digit became extremely long and strong and helped for the attachment of the membrane wing.

The thumb and the other three digits were small and armed with claws. They were used for climbing.

# Pteranodon -flying reptile



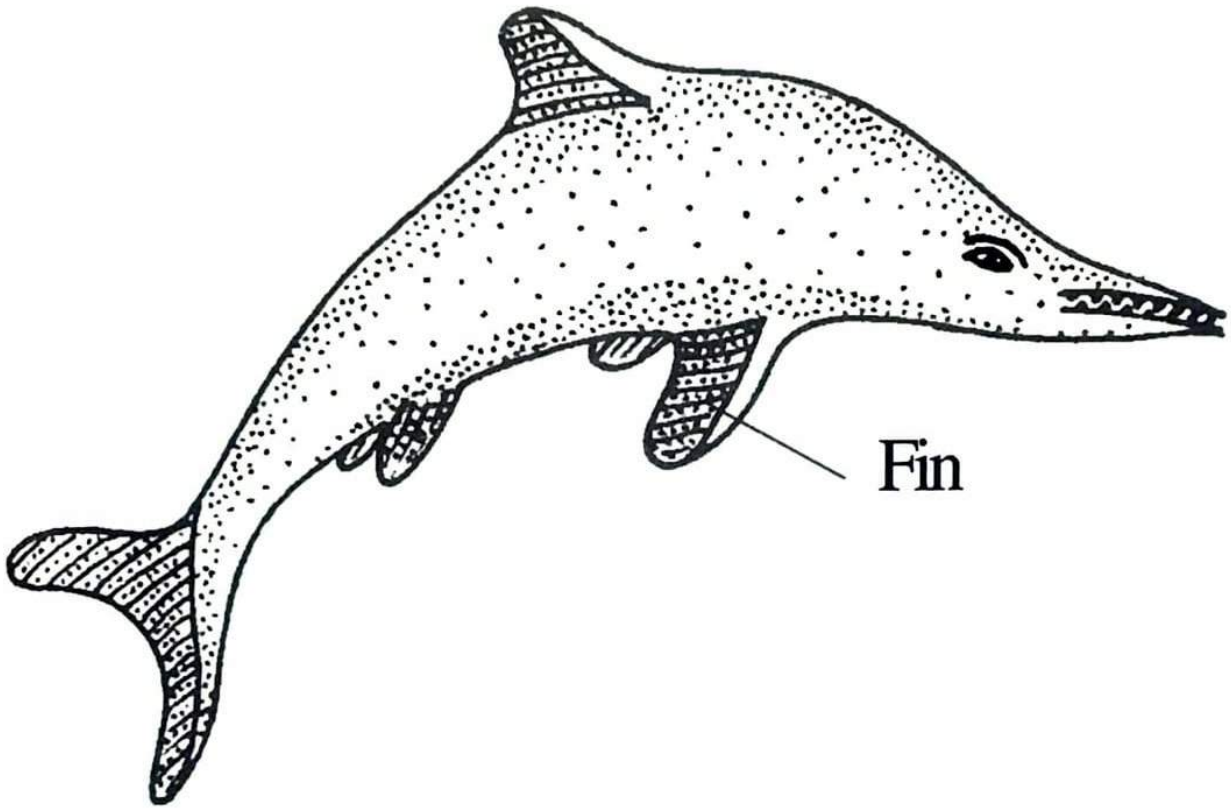
It had very large brain. The cerebellum was like that of birds and was the centre of muscular co-ordinations associated with flight.

The eyes were large with sclerotic plates.
Eg: Rhamphorhynchus & Pteranodon.

## Ichthyosaurs and plesiosaurs (marine reptiles)

Some reptiles went back to the water. The legs and feet were modified into paddles for swimming. eg: Ichthyosaurs (fish like reptiles) and plesiosaurus.

# Ichthyosaurus-fish reptile



## 5. Therapsids (Mammal-like Reptiles)

There were Synapsid reptiles which were the ancestors of mammals.

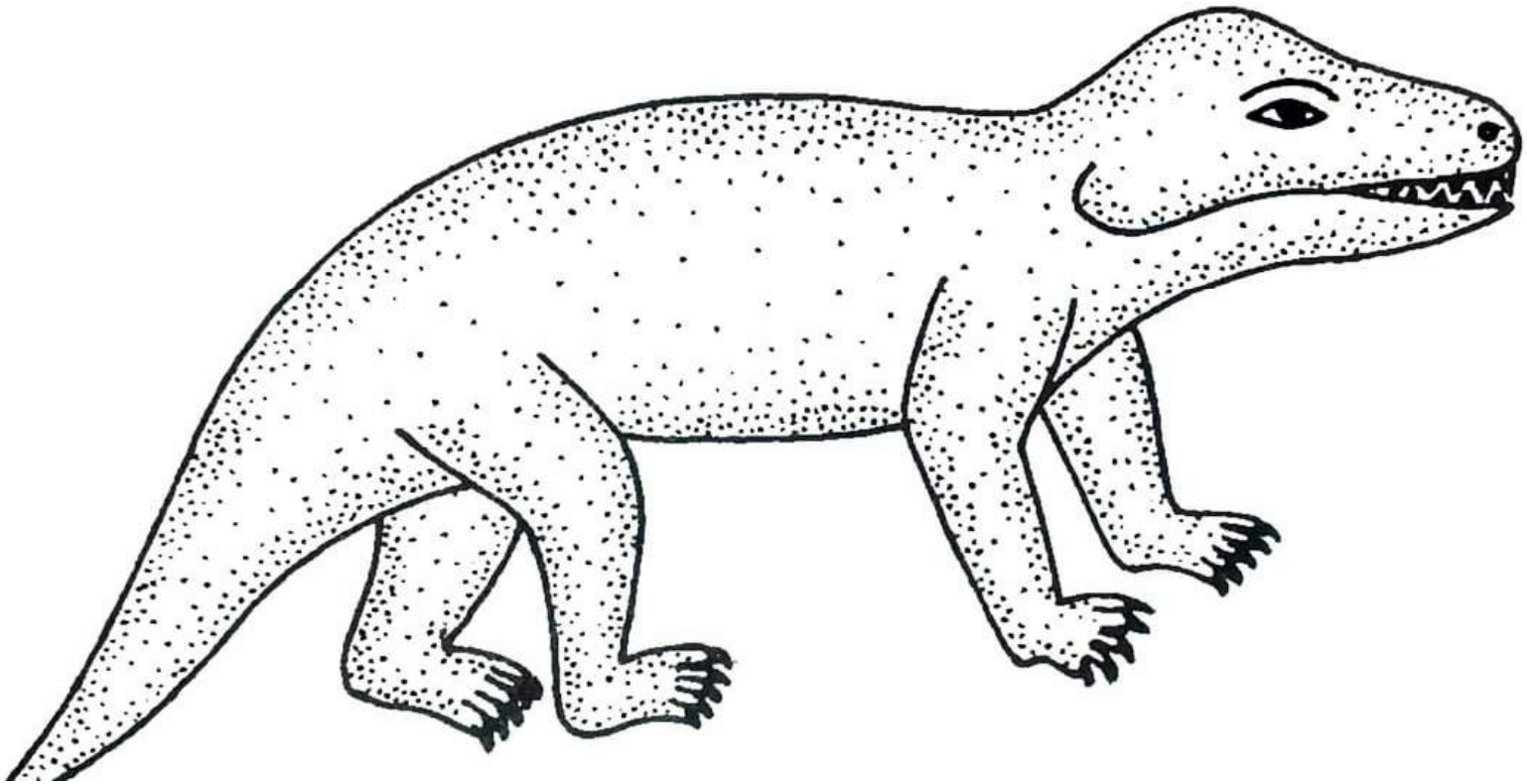
Some of the mammal-like reptiles approched so closely the mammalian stage. The major group of mammal-like reptiles included the following:

i) pelycosauria – eg: Dimetrodon

ii) Therapsids – eg: Tritylodon.

iii) Ictidosaurs – eg: Diarthrognathus.

# Cynognathus -mammal –like reptile



## Dino saurs :

Dino saurs are mesozoic reptiles. The term was coined by Sir. Richard Owen. It means terrible lizards. biggest animals, they are the dominant groups during the mesozoic era. So mesozoic era is called the Golden Age of Reptiles.

Dino saurs are not living today. They became completely extinct. Not even a single individual is living today. So, Dinosaurs are fossile animals, the remains of their bones on the rocks, the coloured figures of dianosaurs are only reconstructions of fossile bones, teeth, plate, etc..,

Dino saurs came in many shapes as well as many sizes. Some walked on all four limbs, other walked only on their hand limb. They were herbivores, carnivores and omnivores. They lived in all the habitats. They were land dinosaurs, flying dinosaurs and aquatic dinosaurs. By the end of Mesozoic era all the dinosaurs disappeared.

They are may theories about the cause of the extinction of Dinosaurs. They are the following.

1- Eruption theory: This theory claims that widespread volcanism could be the real cause for mass extinction.

2. Competition: Competition with the primitive mammals. i.e. primitive mmamals ate the eggs of dinosaurs & caused their downfall.

3. Epidemic: It is belived that extinct by epidemic, viral, bacterial or protozoan diseases.

4. Large Size: Enormous size. They were too clumy to survive.

5. Poor faculty of Reproduction: They were unable to reproduce. This was caused by the failure of production of sperms because of too much heat. Lead to their all hatch out into males. without female dinosaurs could not have gone on breeding.

6. Diffi...

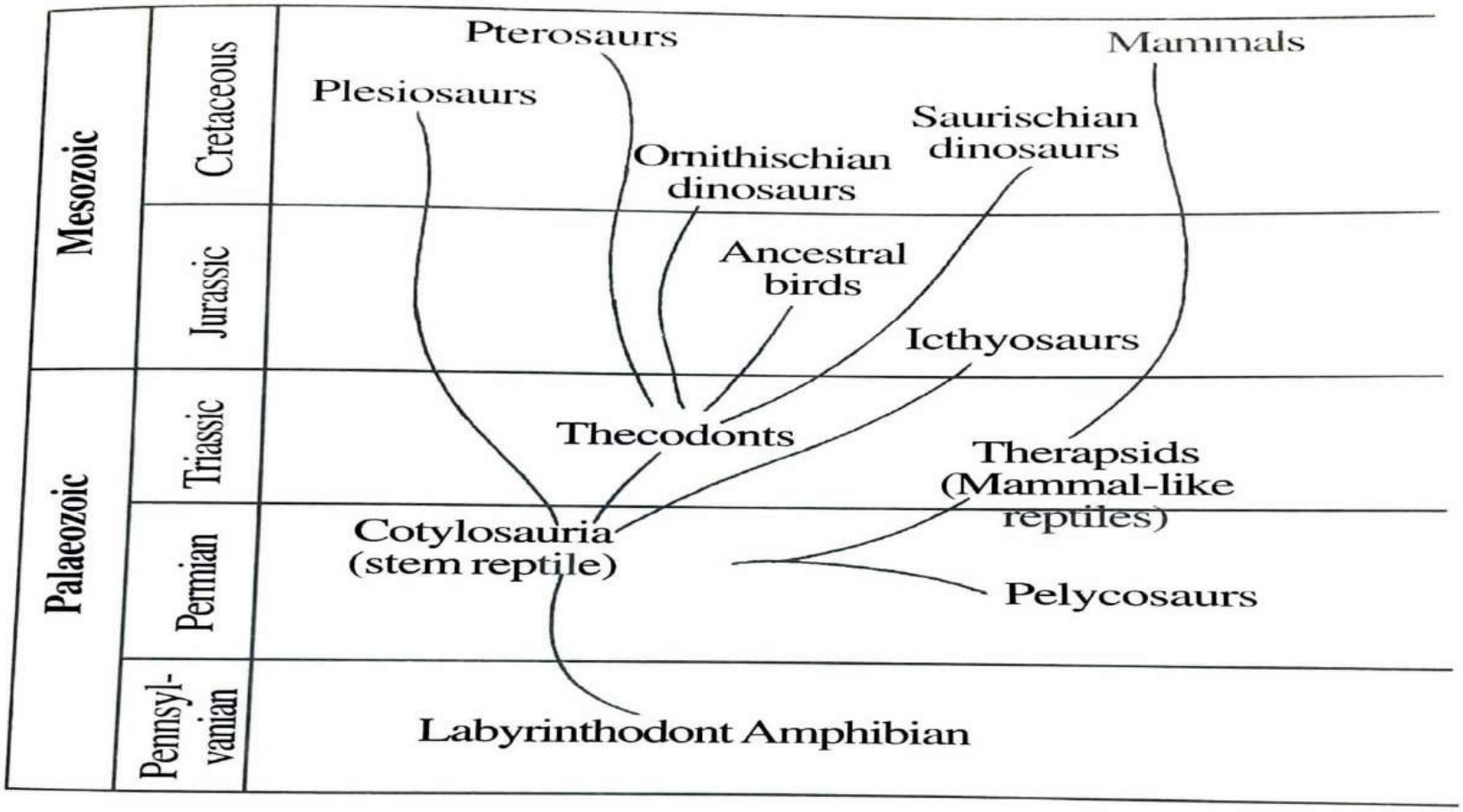
6. Difficulty in Copulation: They were unable to copulate because of their large size.

7. Environmental changes: Changed climate produced New kind of poisoned plants. So flesh eating were starved to death. The giant dinosaurs experienced difficulties in regulating their body temperature due to environmental changes.

8. Collision Theory: mass extinction of dinosaurs must have been caused by the impact of an object from Space Casteroid or a Comet) with a diameter of 10 km. This collision kicked

Out enough dust in the atmosphere to block
Sun light for months and cool the earth.
The dark and cold killing many plants
and animals on every continent.

# Family tree of reptiles



# Archaeopteryx

Bird is a highly specialized descendant of some reptilian ancestors, so Huxley to state that birds are glorified reptiles.

The origin of birds from reptiles is evidenced by a connecting link called Archaeopteryx. It is a fossil animal. Hence it is called a missing link. It is considered as the first bird originated on the land.

The earliest-known bird in the fossil record is Archaeopteryx lithographica. meaning ancient wing. It dates back to the late Jurassic period about 140 million years ago. It was discovered in a slate quarry at Langenaltheim, Bavaria (Germany). in 1861. by Andreas wagner.

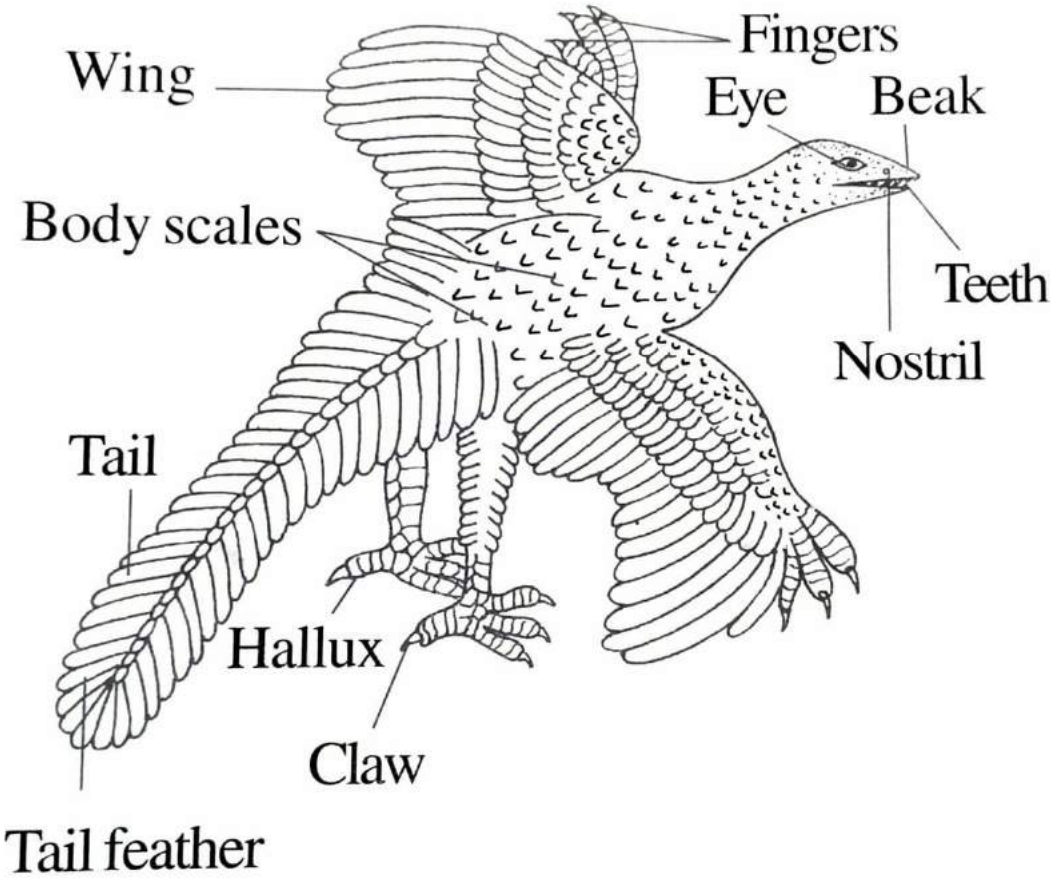
Archaeopteryx seems to have been a terrestrial bird, about the size of a crow and with a long tapering tail like that of a typical dinosaur.

This primitive bird is considered to be a Connecting link (or) transitional stage between reptiles and birds, as it possesses both reptilian as well as avian characters.

Reptilian characters:

1. Jaws are provided with homodont teeth.
2. The tail is long, lizard - like and with 20 free caudal vertebrae.
3. Bones are not pneumatic

# Archaeopteryx



4. Cervical vertebrae are fewer, 9 or 19.
5. The vertebrae are amphicoelous as in Sphenodon.
6. Cervical and abdominal ribs are present in addition to thoracic ribs. Ribs are single headed and without uncinate process.
7. Sternum is weak or absent.
8. Eyes are provided with sclerotic ossicle.
9. Scales are present.
10. Fore limbs are provided with three free fingers tipped with claws. The phalangeal formula is 2, 3 and 4 in I, II and III fingers.
11. Carpals and metacarpals are free: there is no carpometacarpus.
12. pelvic girdle has an elongated ilium and a backwardly directed pubis.

## Avian characters :

1. presence of feathers (contours & flight feathers)
2. Fore limbs are modified as wings.
3. Tail bears two rows of feathers.
4. Rounded brain case.
5. Bones in the skull are intimately fused.
6. Beaks are present.
7. Bones of limbs and girdles are birds like
8. A 'V' shaped furcula is present.
9. Tibia and fibula are separate.
10. A keel is present on the sternum.

# LABYRINTHODONTS

- Labyrinthodonts are the most ancient amphibians known, as well as the first vertebrates to have walked on land, having evolved from their fish ancestors during the **Devonian period**.

- Labyrinthodont (Greek, "maze-toothed") is an obsolete term for any member of the extinct superorder (Labyrinthodontia) of amphibians, which constituted some of the dominant animals of Late **Paleozoic and Early Mesozoic times** (about 350 to 210 million years ago).

- The name describes the pattern of infolding of the dentine and enamel of the teeth, which are often the only part of the creatures that **fossilize**.

- They are also distinguished by a heavy solid skull (and therefore often named "Stegocephalia"), and complex vertebrae, the structure of which is useful in older classifications of the group.
- The labyrinthodonts flourished for more than 150 million years. Particularly the early forms exhibited a lot of variation, yet there are still a few basic anatomical traits that make them fairly easy to recognise.

## **Paleobiology**:

- The early labyrinthodonts where mostly aquatic, hunting in shallow water or weed filled tidal channels. They were short-legged and large headed, some could be up to four meters long.
- Their skulls were massive, and their jaws were lined with small, sharp, conical teeth. Also, there was a second row of teeth on the roof of the mouth. In their way of living labyrinthodonts were probably similar to fishes - they laid eggs in the water, where their larvae developed into mature animals.

- Characteristically labyrinthodonts have vertebrae made of 4 pieces, an intercentrum, two pleurocentra, and a neural arch/spine. While able to support some weight, the labyrinthodonts would have been slow and clumsy on land.
- Some of the larger adults may have been confined to water. They also had special sense organs in the skin that formed a system for perception of water fluctuations.
- Some of them possessed well developed gills and many seemingly had primitive lungs.
- They could breathe atmospheric air; that was a great advantage for residents of warm shoals with low oxygen levels in the water.

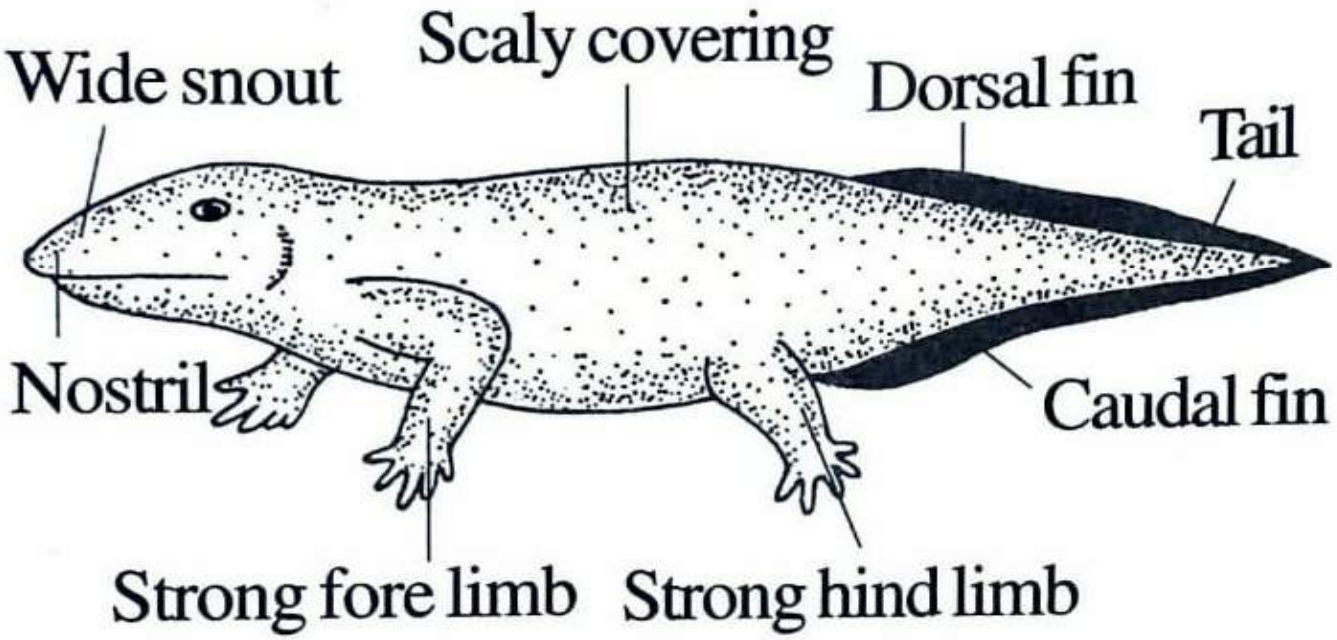
- The air was inflated into the lungs by contractions of a special throat sac.
- Primitive members of all labyrinthodont groups were probably true water predators, and only advanced forms that arose independently in different groups and times, gained an amphibious, semi-aquatic mode of living.
- Their bulky skeleton and their short limbs suggest that the majority of the labyrinthodonts were slow walkers on land.

**Evolution**

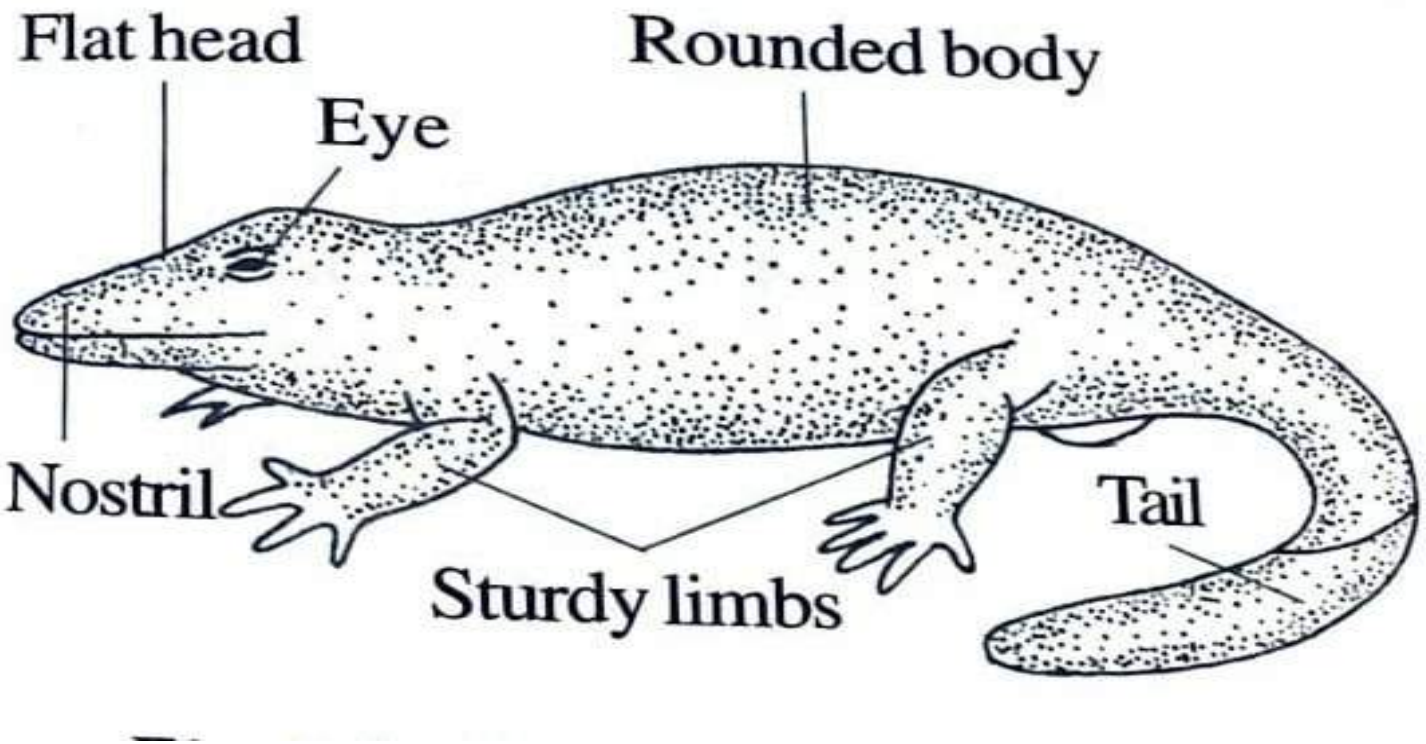
- The Labyrinthodontia evolved from **a bony fish group**: the fleshy-finned rhipidistia. Nowadays only a few living representatives of these fish remains: two species of coelacanth and six species of lungfish.
- The most diverse group of the labyrinthodonts was **the Batrachomorpha**.
- Though these animals looked more like crocodiles, they most probably gave rise to the order Anura, the amphibians without tails, which include, in particular, the modern frogs.

- **Batrachomorphs** appeared in the Late Devonian, but they had worldwide distribution in the continental shallow basins of the Permian (Platyoposaurus, Melosaurus) and Triassic Periods (Thoosuchus, Benthosuchus, Eryosuchus). Some batrachomorphs existed until the end of the Cretaceous.

**Ichthyostega an extinct amphibian Showed fish like characters.**



# Eryops megacephalus



## Classification

- The term Labyrinthodont was coined by **Hermann Burmeister** in reference to the tooth structure.
- Labyrinthodontia was first used as a systematic term by **Richard Owen** in 1860, and assigned to Amphibia the following year.
- It was ranked as superorder by Romer, A. S. in 1947.
- The traditional classification (e.g. Romer 1966, also repeated in Colbert 1969, Daly 1973 and Carroll 1988) has three orders.
- **Ichthyostegalia** (primitive ancestral forms (e.g. Ichthyostega) - Late Devonian only). While undoubtly amphibians on anatomy and habit, the Ichthyostegalia are ancestral to all tetrapodes, and are not amphibians in the cladistic sense.

- **Temnospondyli** (common, small to large, flat-headed forms with either strong or secondarily weak vertebrae and limbs - mainly Carboniferous to Triassic e.g. Eryops . Temnospondyls are the only "Labyrinthodonts" currently considered to be "true amphibians" in that they are more closely related to modern Lissamphibia than to other tetrapodes.
- **Anthracosauria** (deep skulls, strong vertebrae but weak limbs, evolving towards and ancestral to reptiles - Carboniferous and Permian - e.g. Seymouria). The Anthracosauria are thought the direct ancestral to the early reptiles, and thus separate from modern ("true") amphibians.