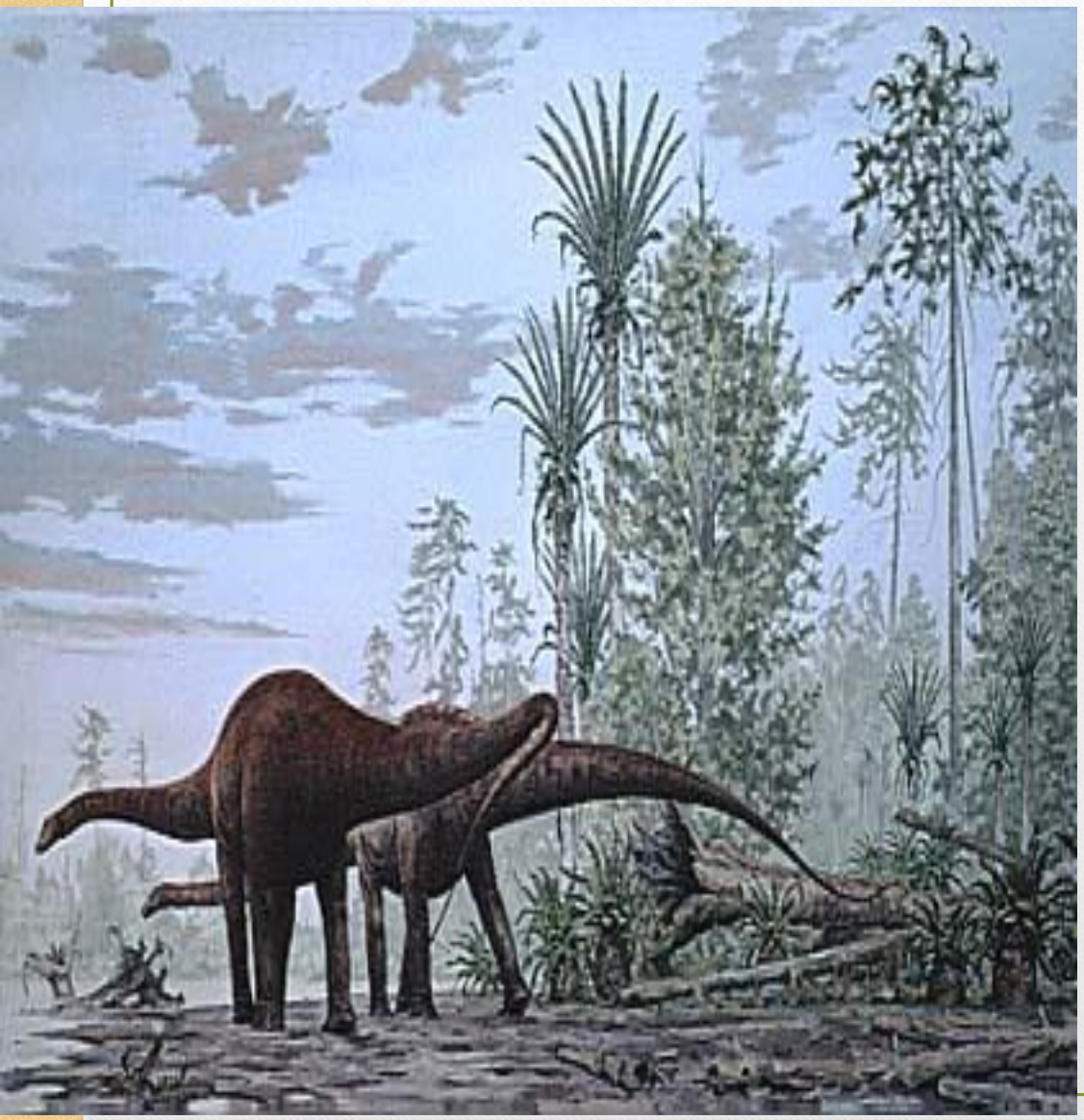
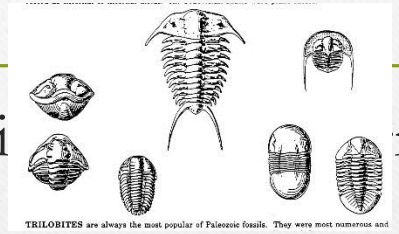
Mesozoic Life

Life of the Mesozoic Era

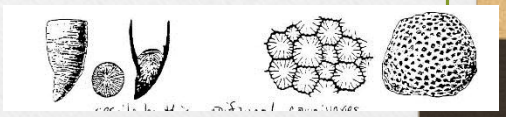


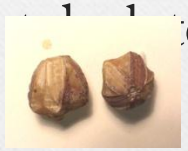
- Age of Reptiles
  - most diverse and abundant land dwellers
- Mammals appear
- Birds appear
- Flowering plants appear
- Some marine invertebrate groups recover Pm\Tr
- Another big extinction at end K

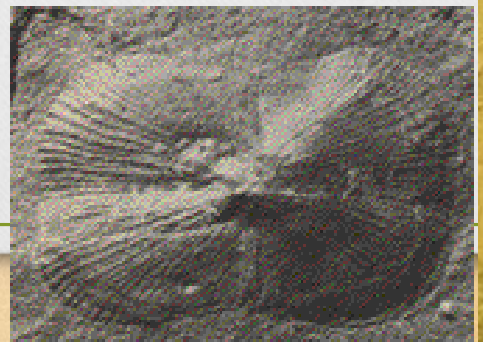
Just before the Mesozoic: Permian\Triassic Extinctions



- Many major P… roups extinct
- a) Trilobites
- b) Rugose and …e corals
- c) Blastoids
- d) Fusulinid foraminifera
- e) Brachiopods and crinoids severely reduced





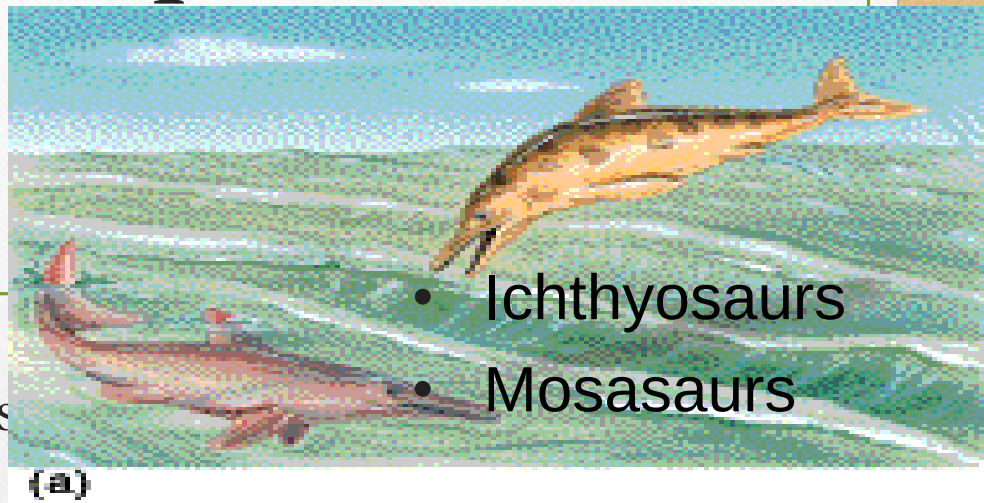


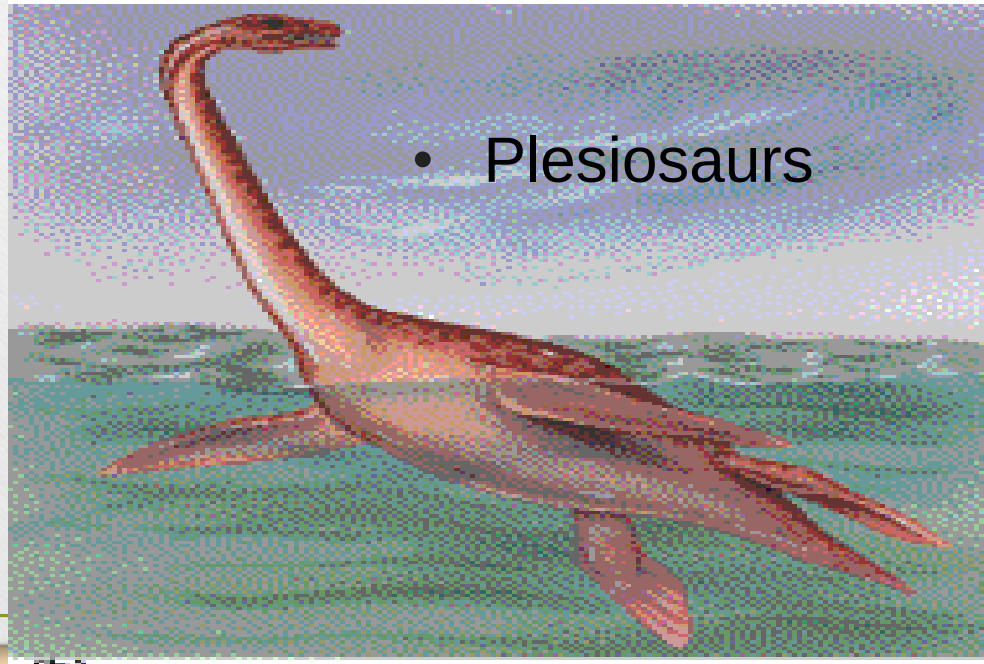
Replacement radiations

- New marine groups assumed ecological roles of extinct organisms
- a) New corals and planktonic foraminifera
- b) Several classes of mollusks
  - Ammonites radiate
  - Clams replace many brachiopod groups
  - Rudistid clams become reef formers
- Marine Reptiles replace fish as top marine predators

Marine Reptiles

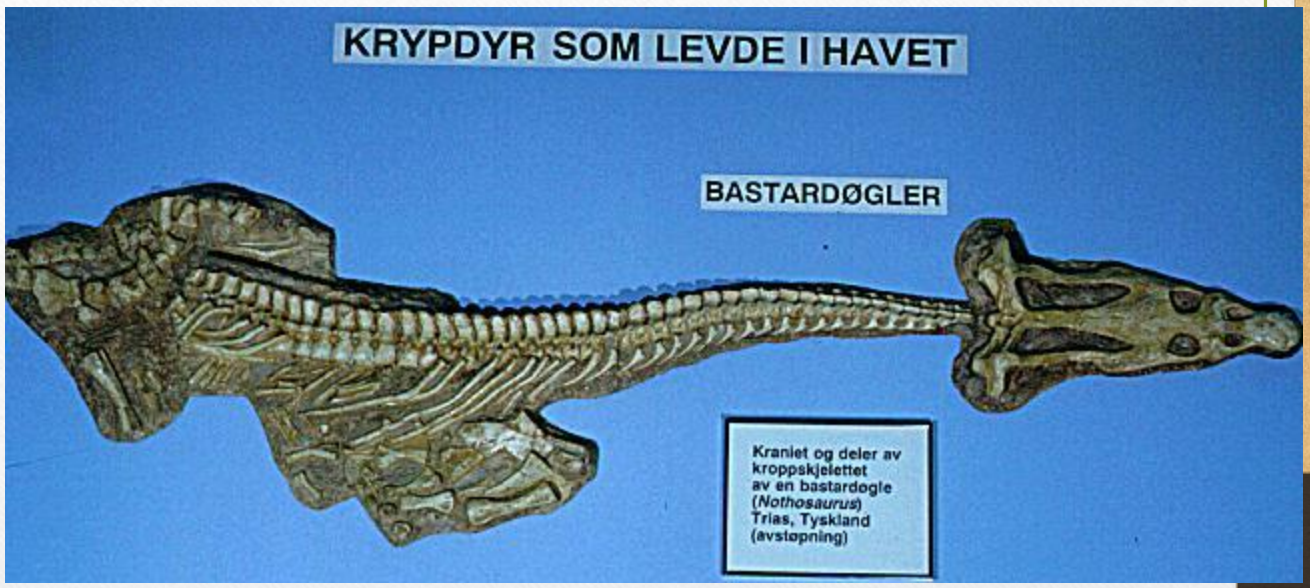
- Several groups of Triassic diapsid and euryapsid reptiles became successful marine predators
- They developed streamlined bodies
- Flipperlike modifications of limbs
- Large size





Mosasaurs - Marine Lizards

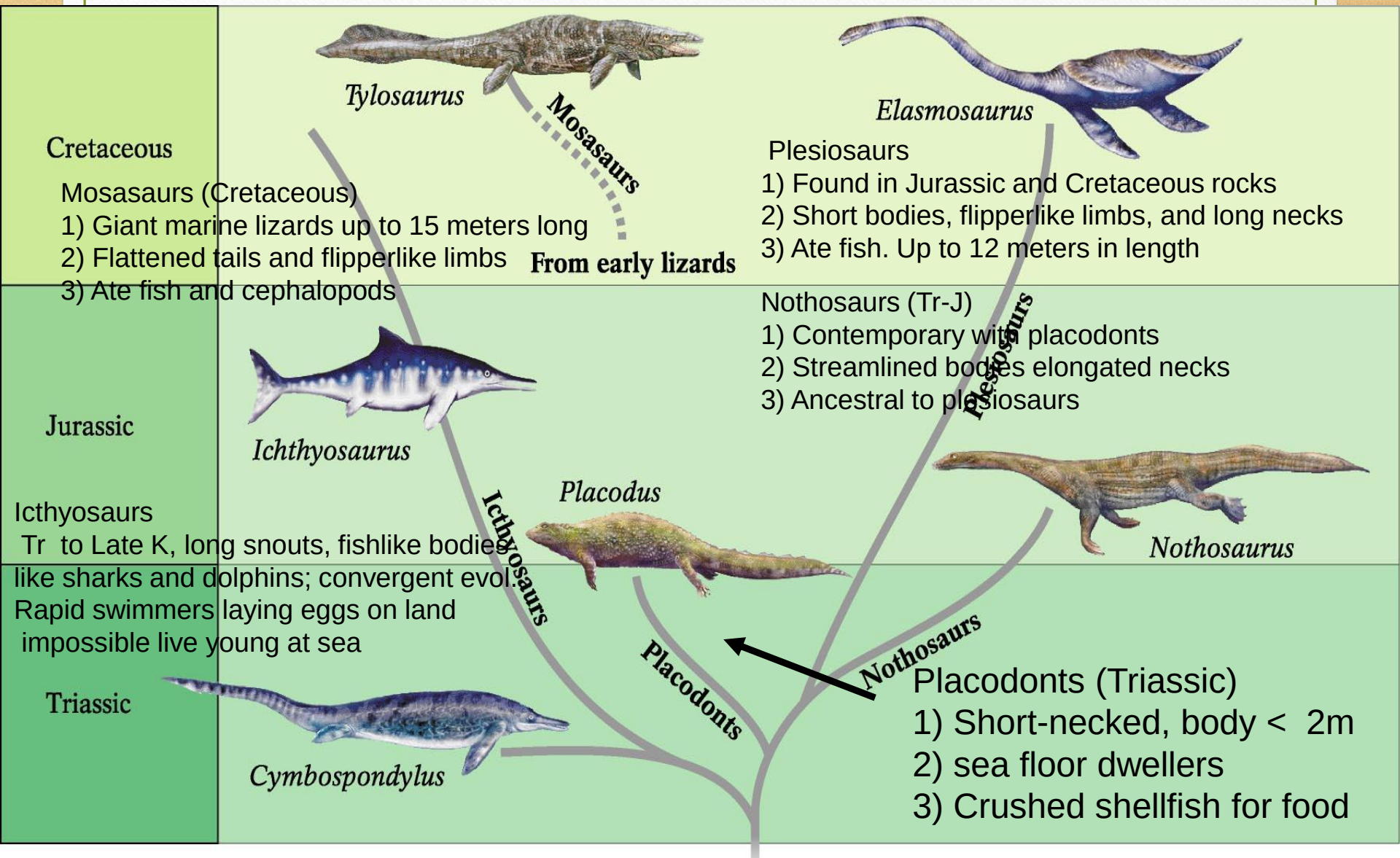
Diapsids



A really big ”Goanna” or Monitor Lizard

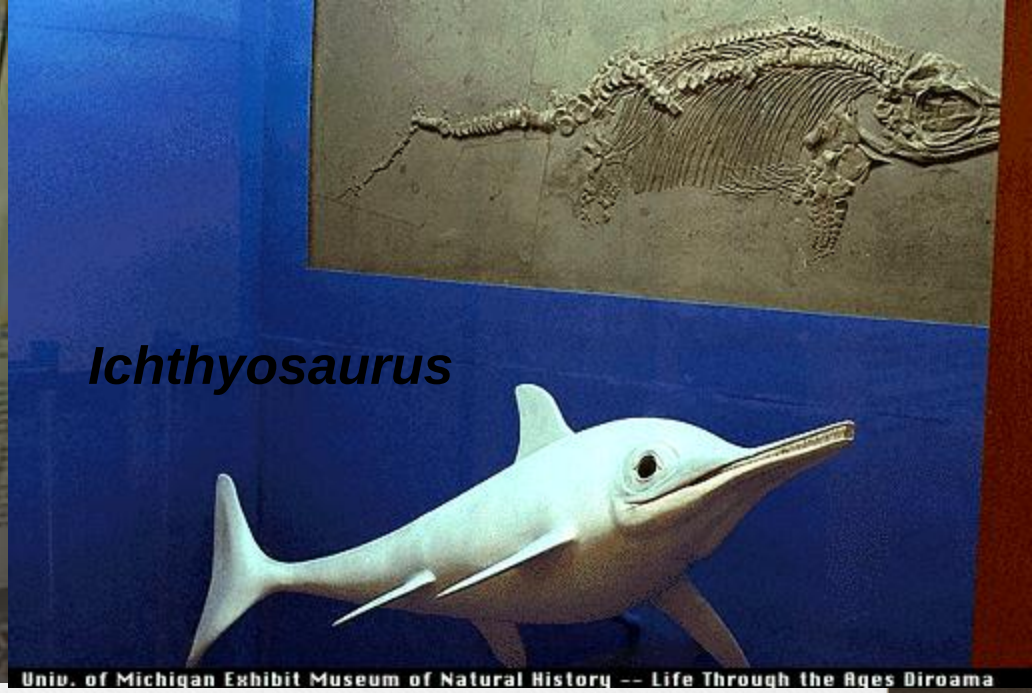
Lived offshore near here

Euryapsid Marine reptiles



Plus Marine Crocodiles

Placodonts



Plesiosaurus

Top marine predators in Mesozoic, mostly ate fish and ammonites

Land Plants Gymnosperms

- Cycads
  - Cylindrical trunks and large-fernlike leaves
  - Dominant during Jurassic, common until Cretaceous
- Conifers
  - most modern conifer types
  - dominated Cretaceous forests as cycads declined
- Ginkgoes
  - Common in Mesozoic forests
  - Single surviving species like Mesozoic ancestors

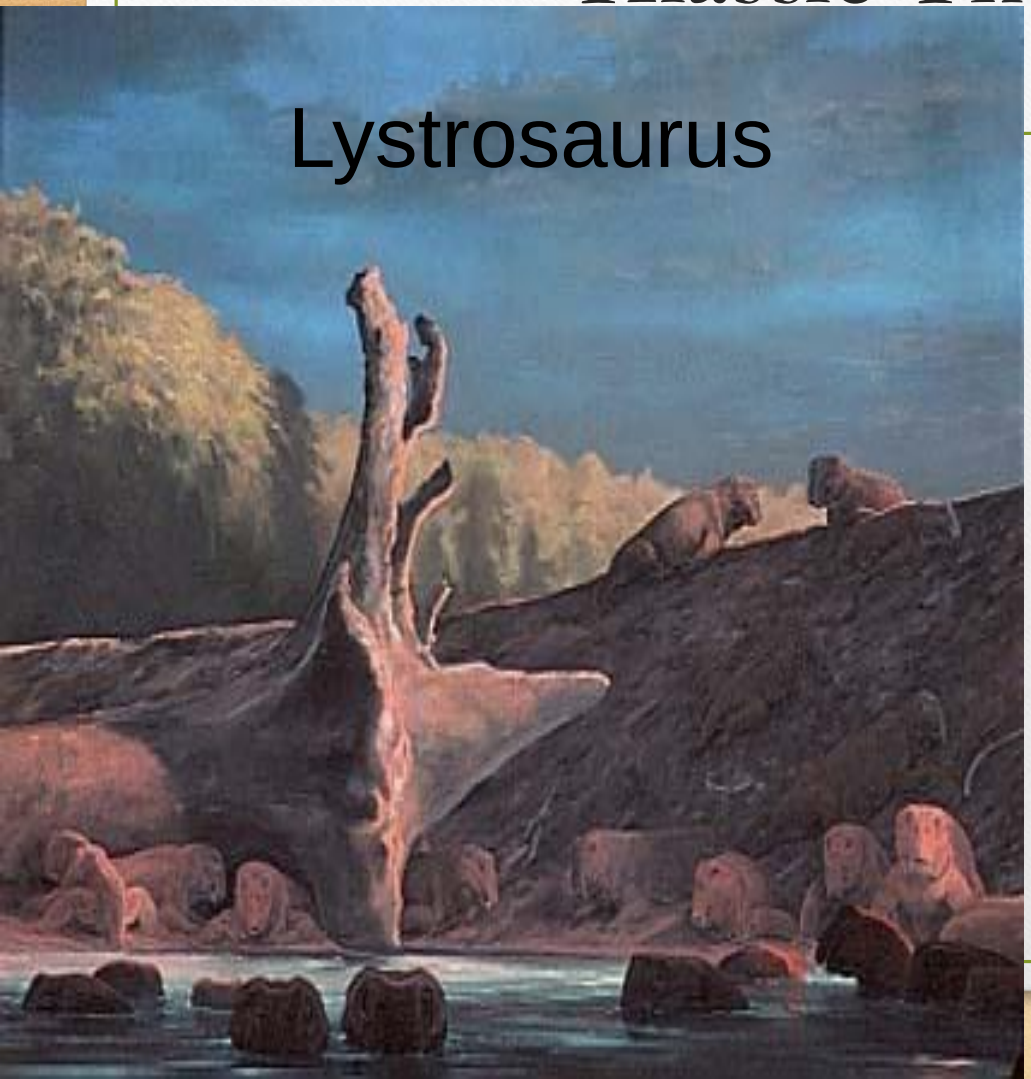
Angiosperms - Flowering Plants

- Most significant Mesozoic evolutionary event
- Flower uses color and scent to encourage insect pollination
- Higher pollination success rates than gymnosperms that use wind
- Manufacture of seeds with a food supply
- Animals became important in distributing seeds from fruits

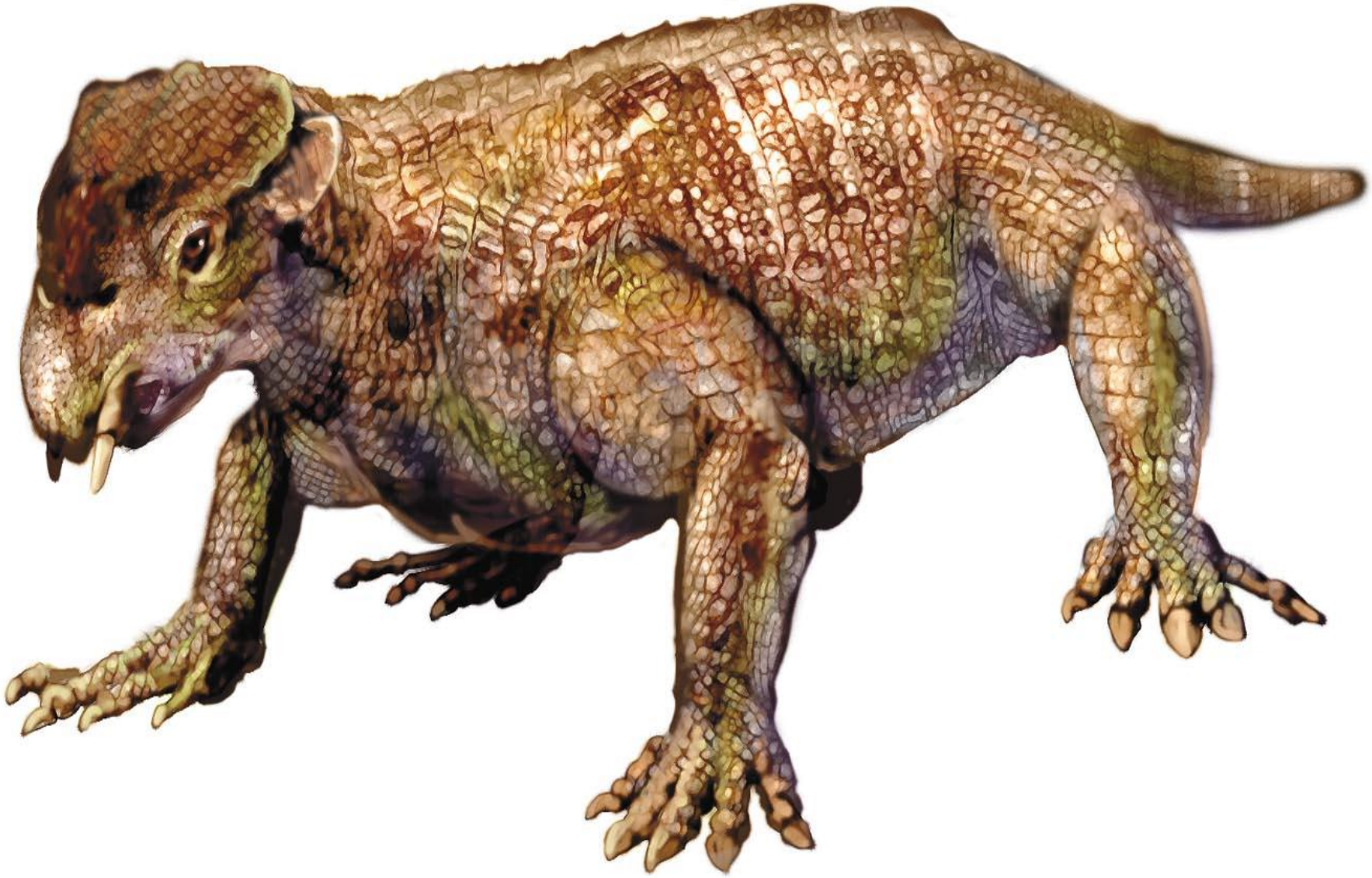
Mammal-Like reptiles

- Therapsid reptiles recovered from Permo-Triassic extinctions
- Cynodonts radiated in Early Triassic
- Gondwana carnivorous *Cynognathus* found in Africa and South America
- Herbivorous cynodonts lived until Middle Jurassic

Triassic Therapsids



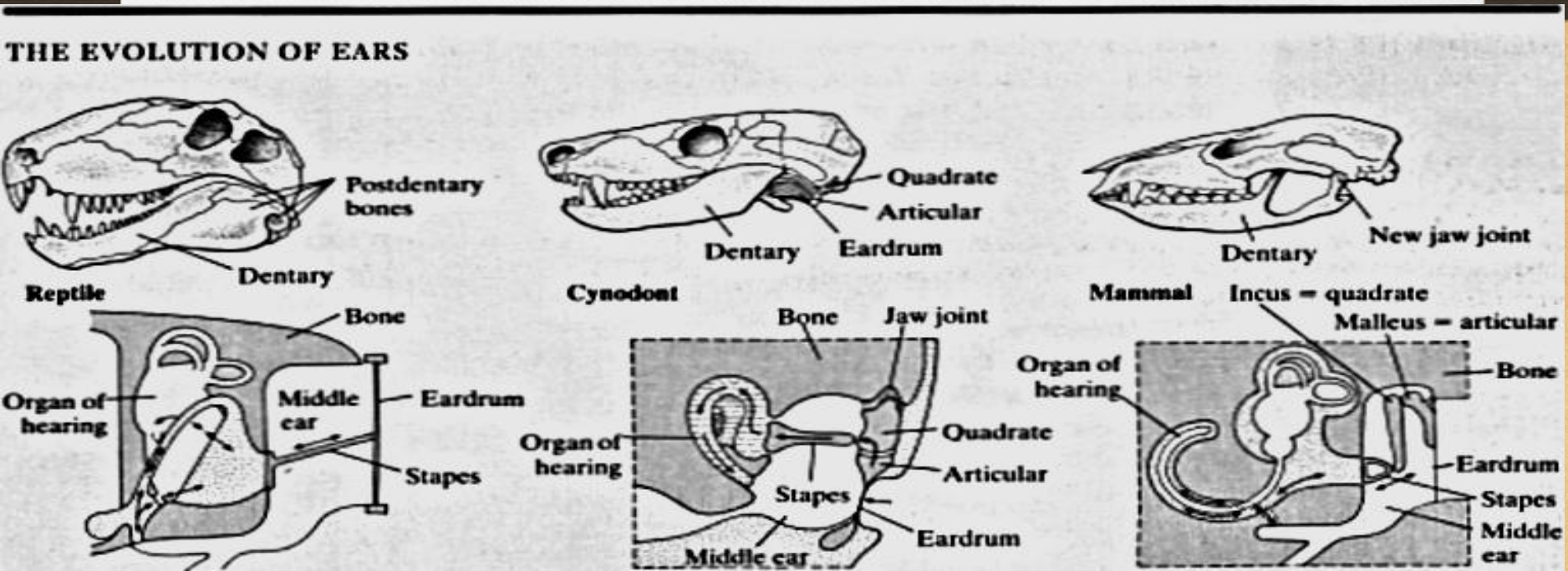
Mesozoic Therapsids



Lystrosaurus

Origin of Mammals

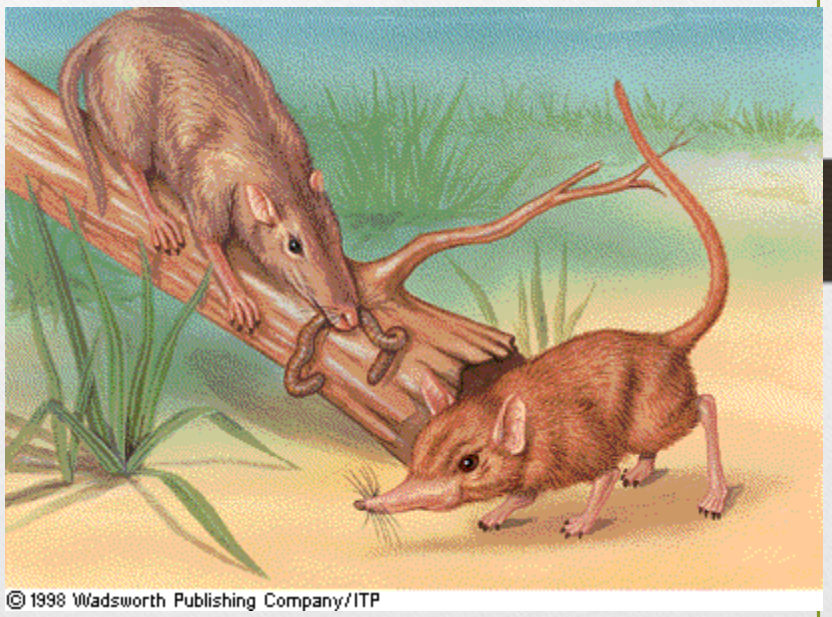
- Therapsids gave rise to cynodonts, which evolved into the mammal class
  - skeletal structure is used to identify mammals in the fossil record
  - differences in the lower jaw and ear in particularly distinguish mammals



Origin and Early History of Mammals

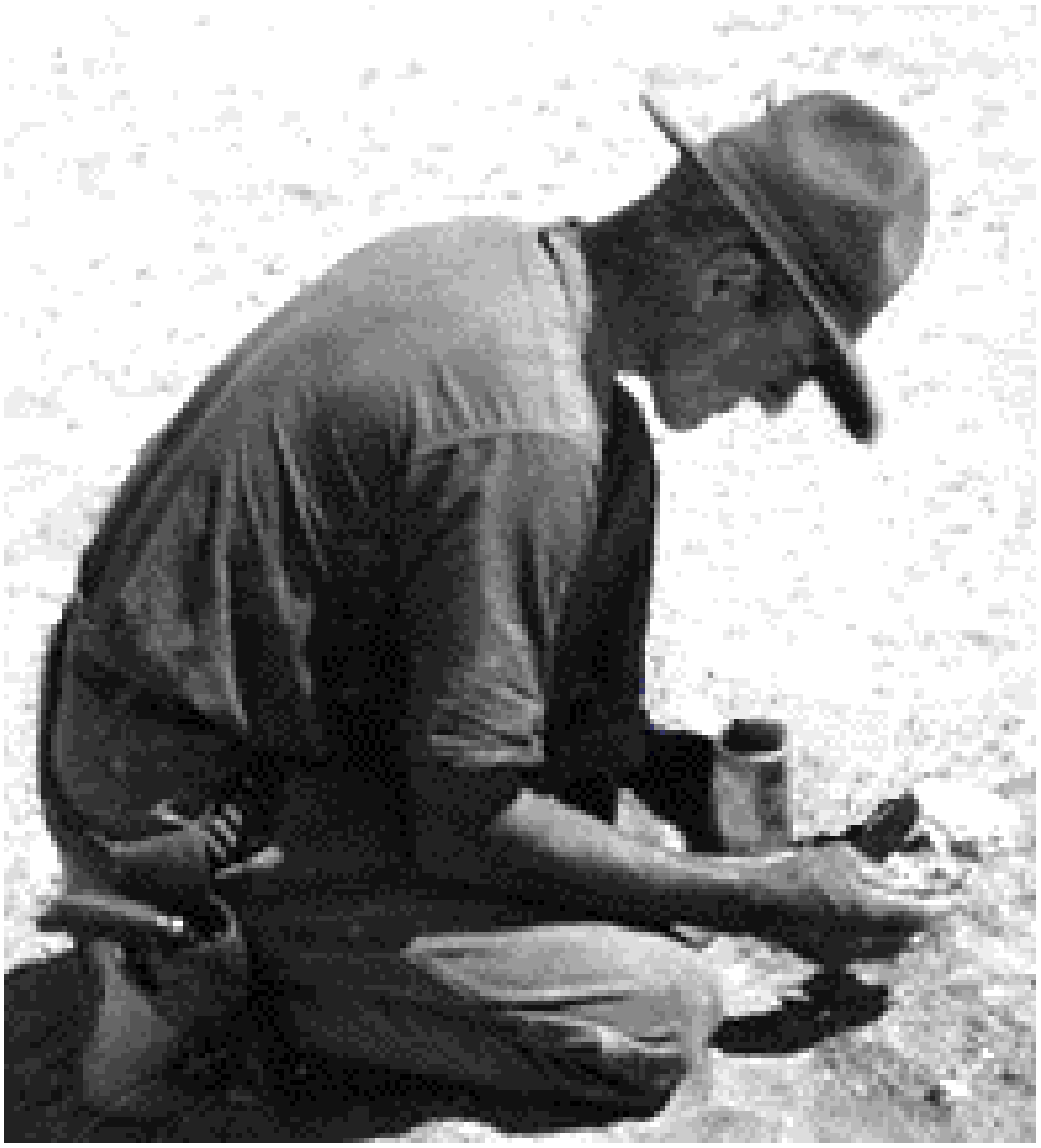
- Mammal diversity remained low throughout the Mesozoic
  - branches did develop however
    - monotremes
    - marsupial
    - placental

Eupantotheres ancestral to marsupials and placentals

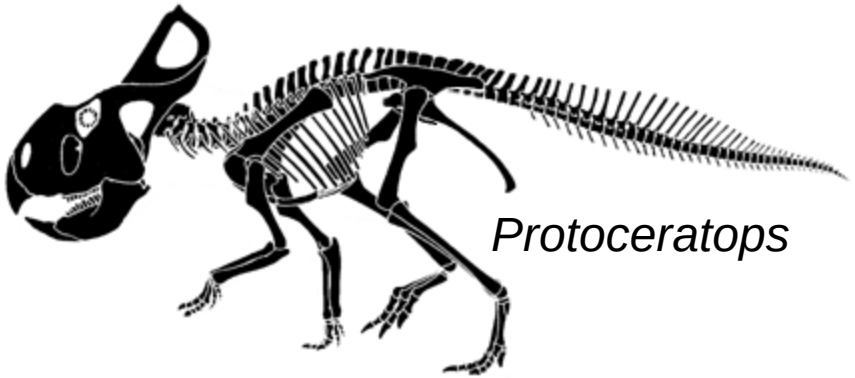


Was looking for early humans

Roy Chapman Andrews



1884 – 1960



Protoceratops

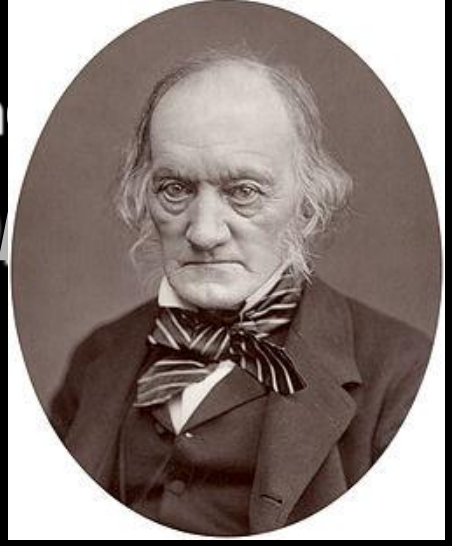
In the Gobi desert of Mongolia, found the first dinosaur nests and evidence of parental care in the dinosaurs *Protoceratops*

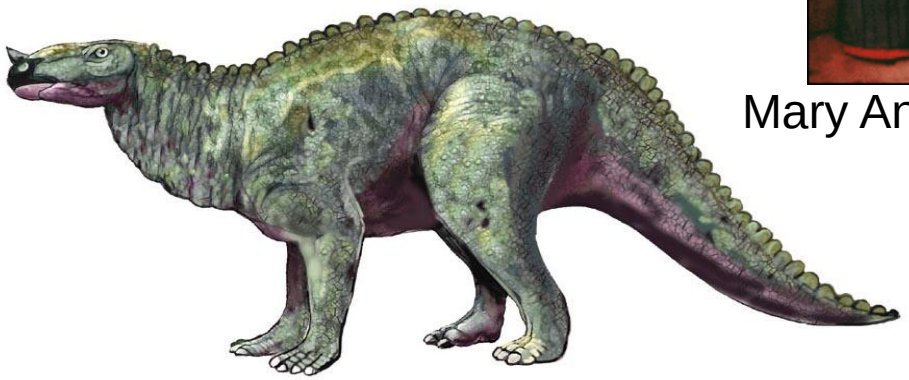
Modern studies of Dinosaurs still test his theories

Discussion: *Oviraptor*

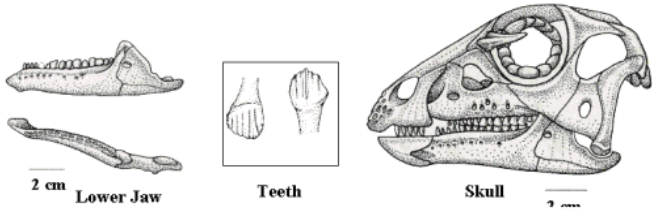
First di found *Igu do*

Mary Anning

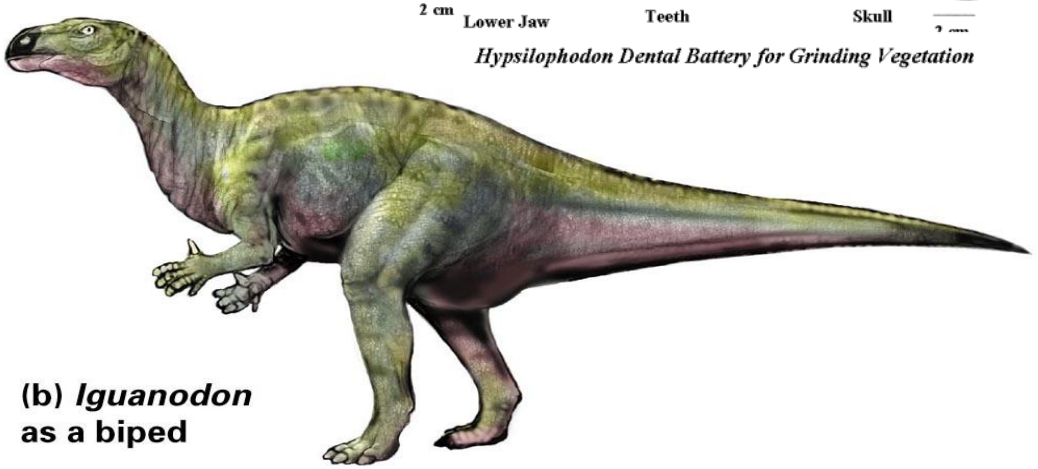




(a) *Iguanodon* as a quadruped



Hypsilophodon Dental Battery for Grinding Vegetation

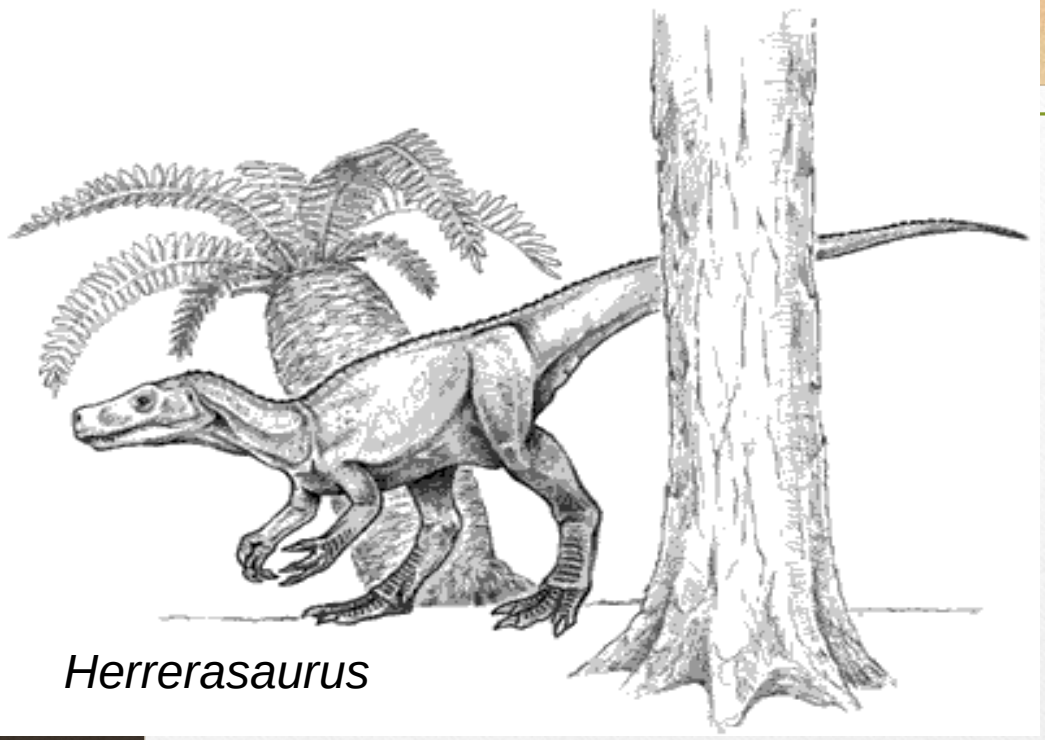


(b) *Iguanodon* as a biped

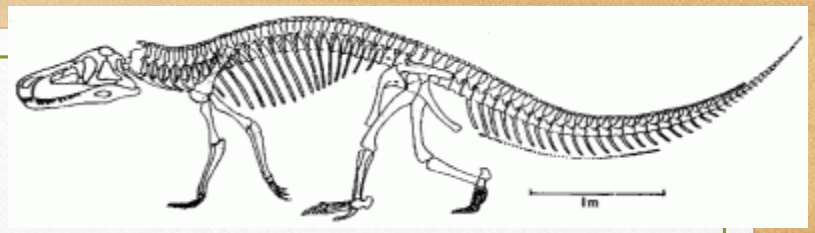
- First dinosaur discovered in 1822
- 1842 Richard Owen "dinosaur"
- Dinosaurs are terrestrial, so they are rare fossils

Dinosaur Ancestry

- Archosaurs, reptiles that radiated in Pm and especially Early Triassic
- Small bipedal forms may have been ancestral to dinosaurs and birds



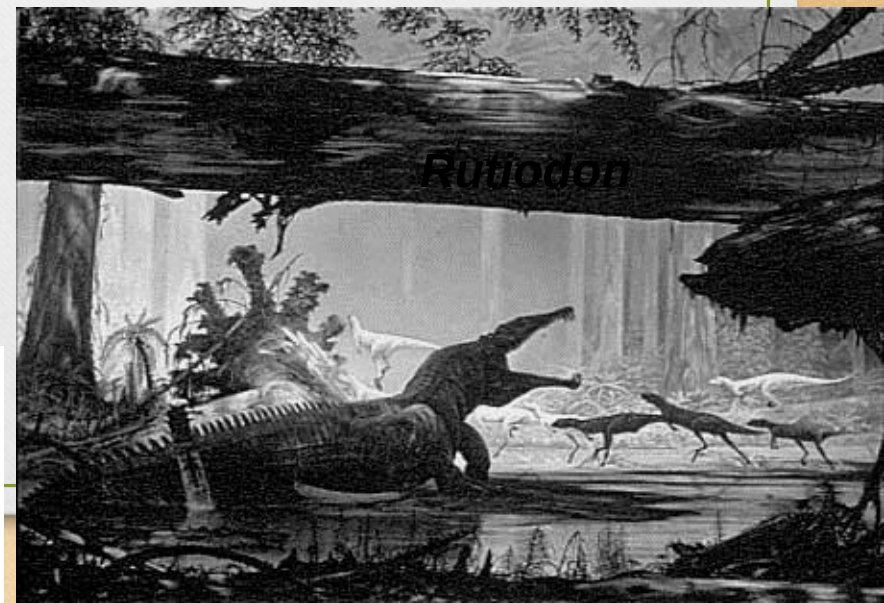
Herrerasaurus



Basal Archosaurs

Common fossil near campus

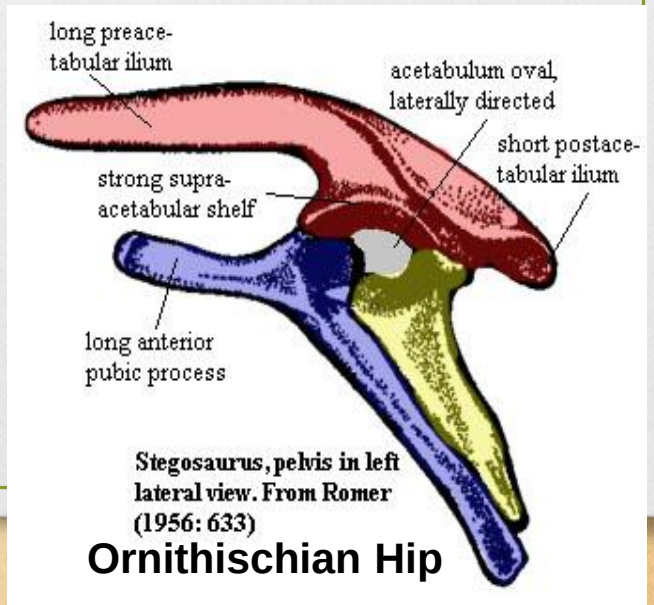
Phytosaurs



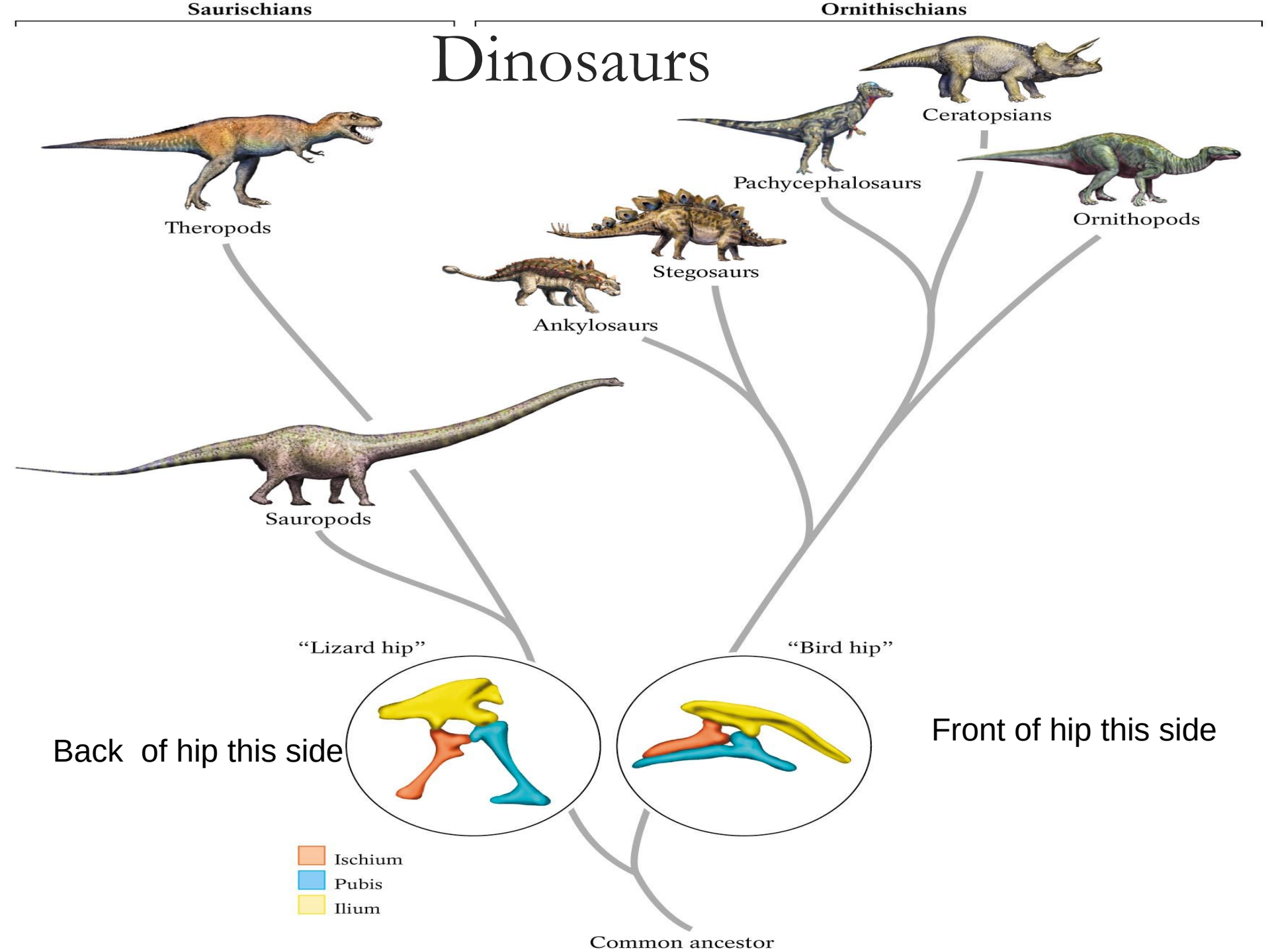
Rutiodon

Archosaurs and the Origin of Dinosaurs

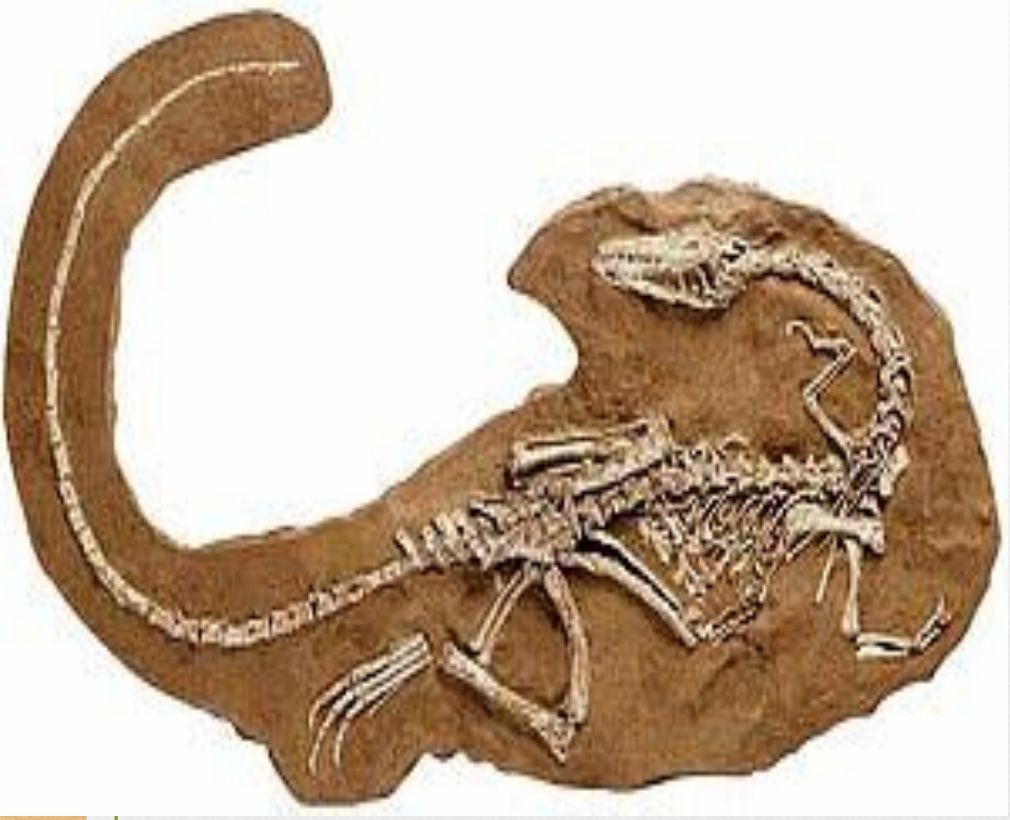
- Archosaurs gave rise to crocodiles, pterosaurs, dinosaurs, and birds
- Dinosaurs two groups distinguished by hips:
  - Saurischia (lizerd hip)
  - Ornithischia (bird hip)



Dinosaurs


Saurischians
Ornithischians
Theropods
Ceratopsians
Pachycephalosaurs
Ornithopods
Stegosaurs
Ankylosaurs
Sauropods
"Lizard hip"
"Bird hip"
Back of hip this side
Front of hip this side
Ischium
Pubis
Ilium
Common ancestor

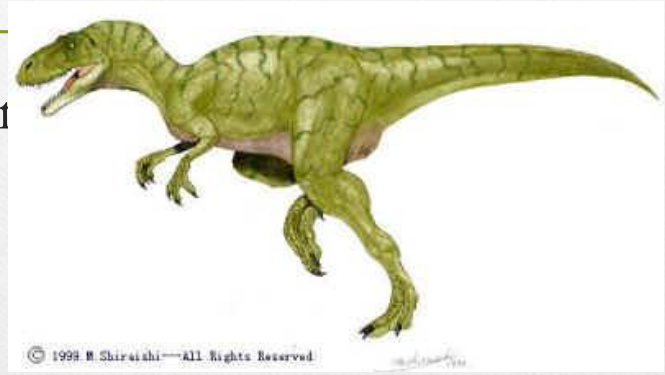
Dinosaurs



- Saurischians
  - theropods were bipedal carnivores
  - sauropods were the giant, quadrupedal herbivores
- Ornithischians
  - Ornithopods (duckbill)
  - Pachycephalosaurs
  - Ankylosaurs
  - Stegosaurs
  - Ceratopsians

Saurischian Dinosaurs

- Theropods, the carnivorous di



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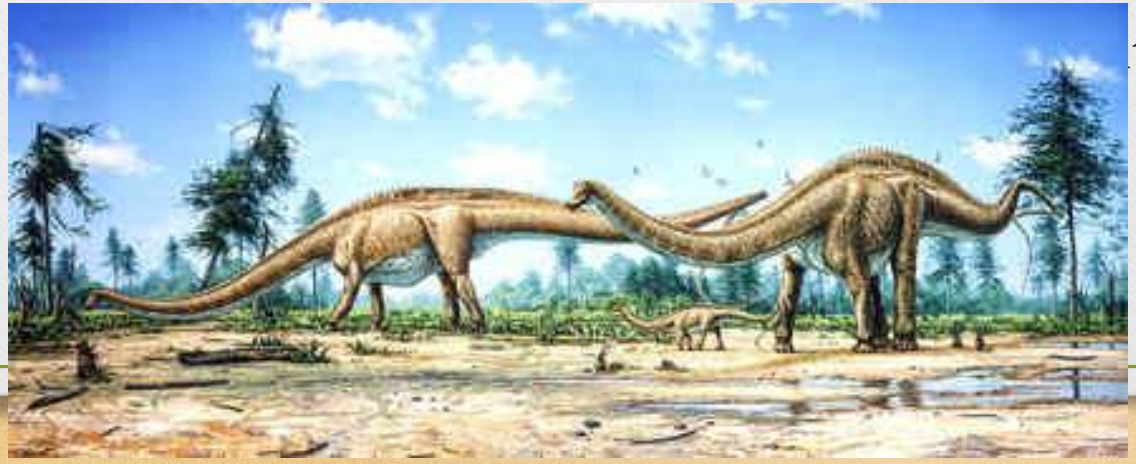
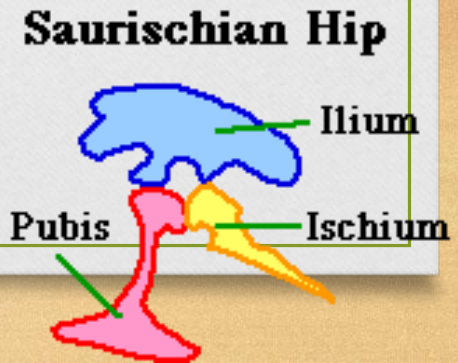
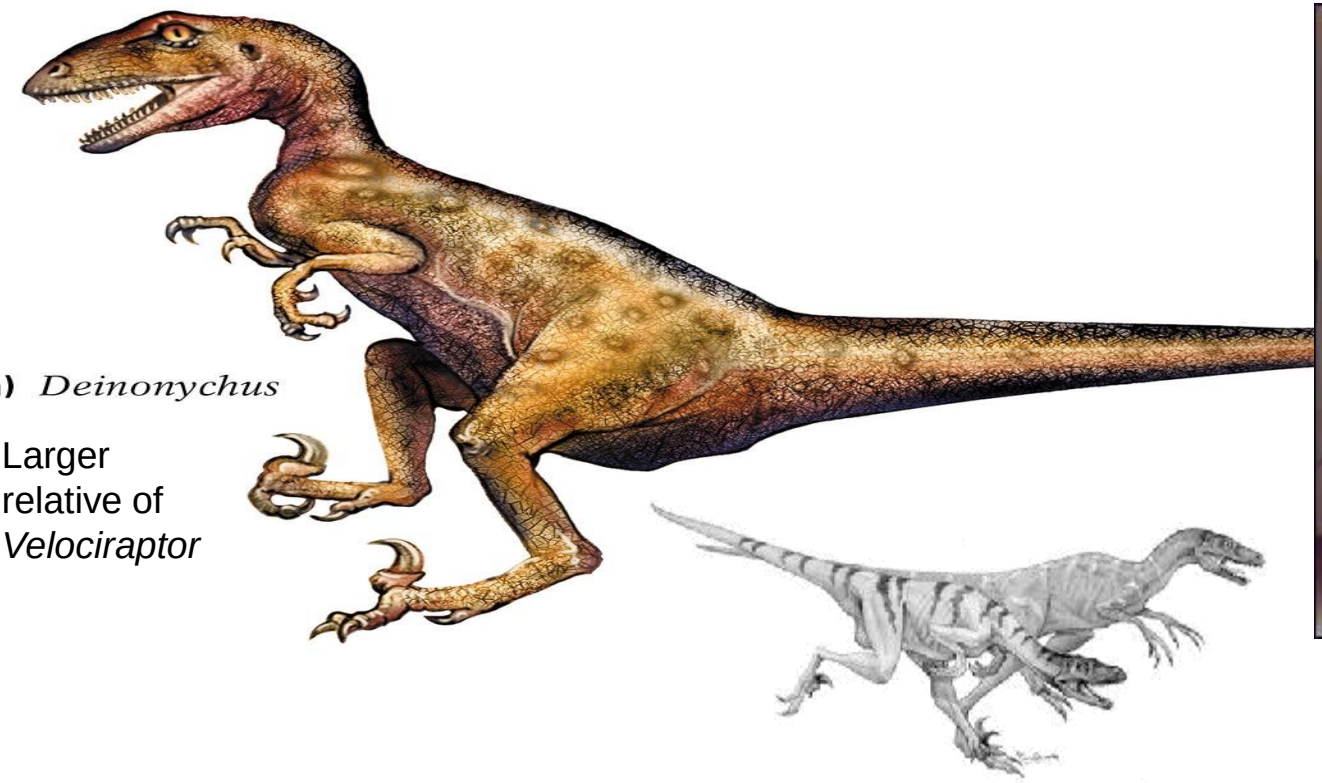


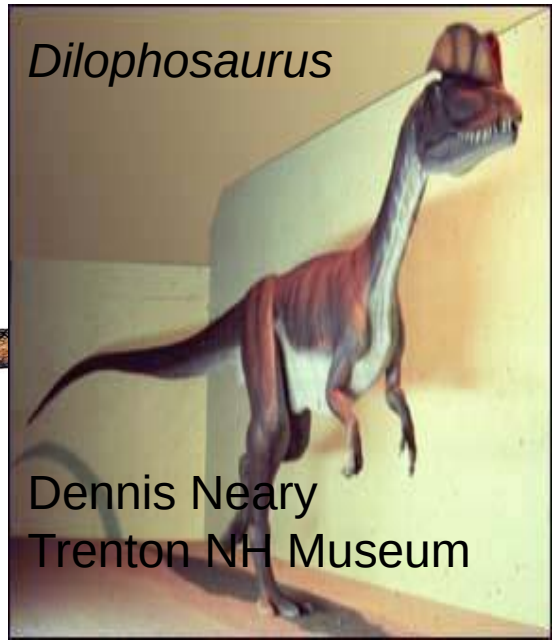


Theropods



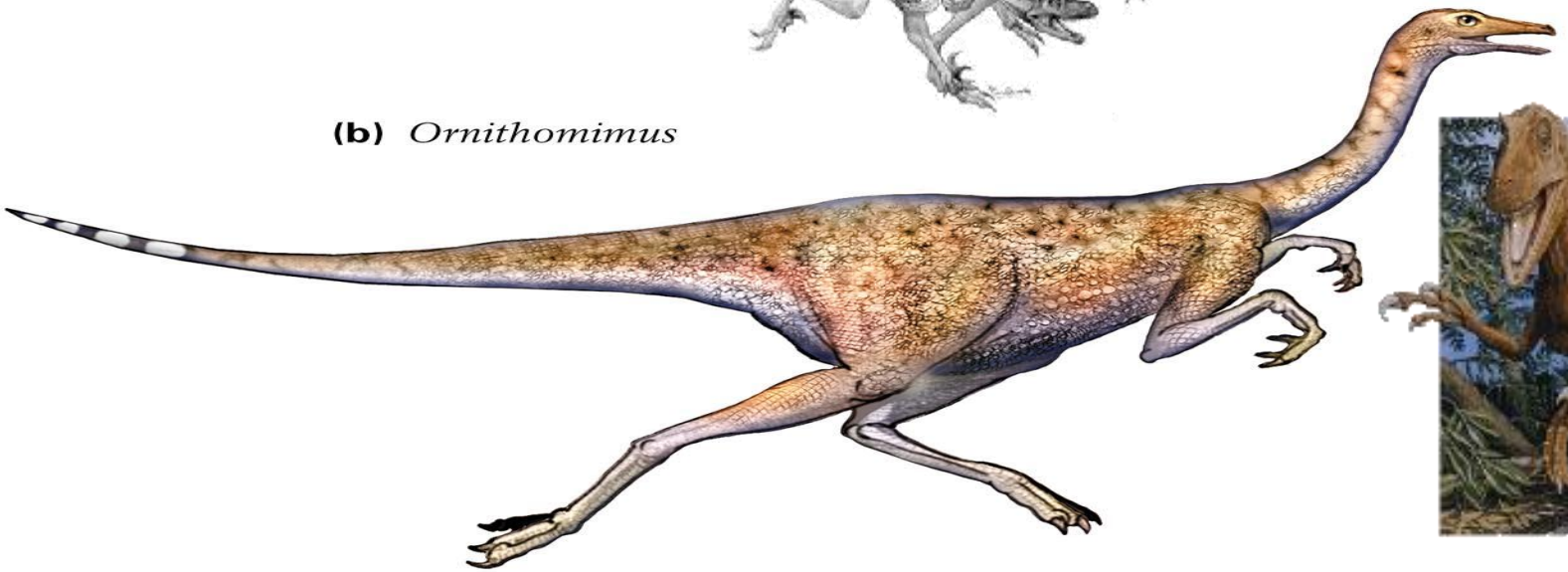
(a) *Deinonychus*

Larger relative of *Velociraptor*

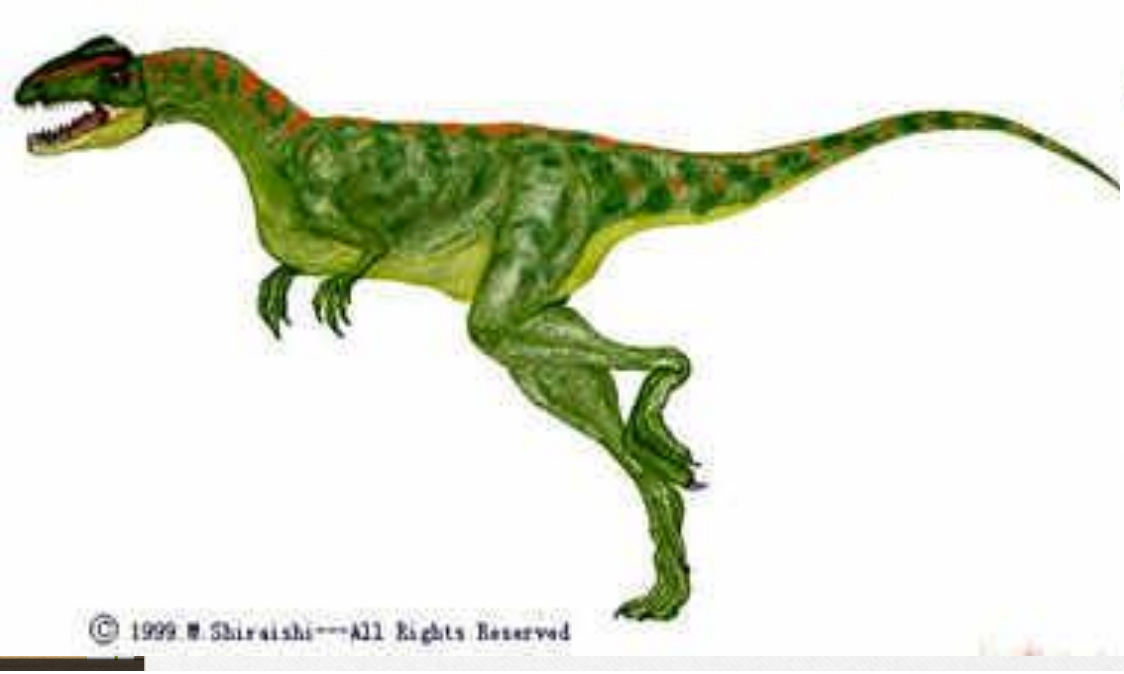


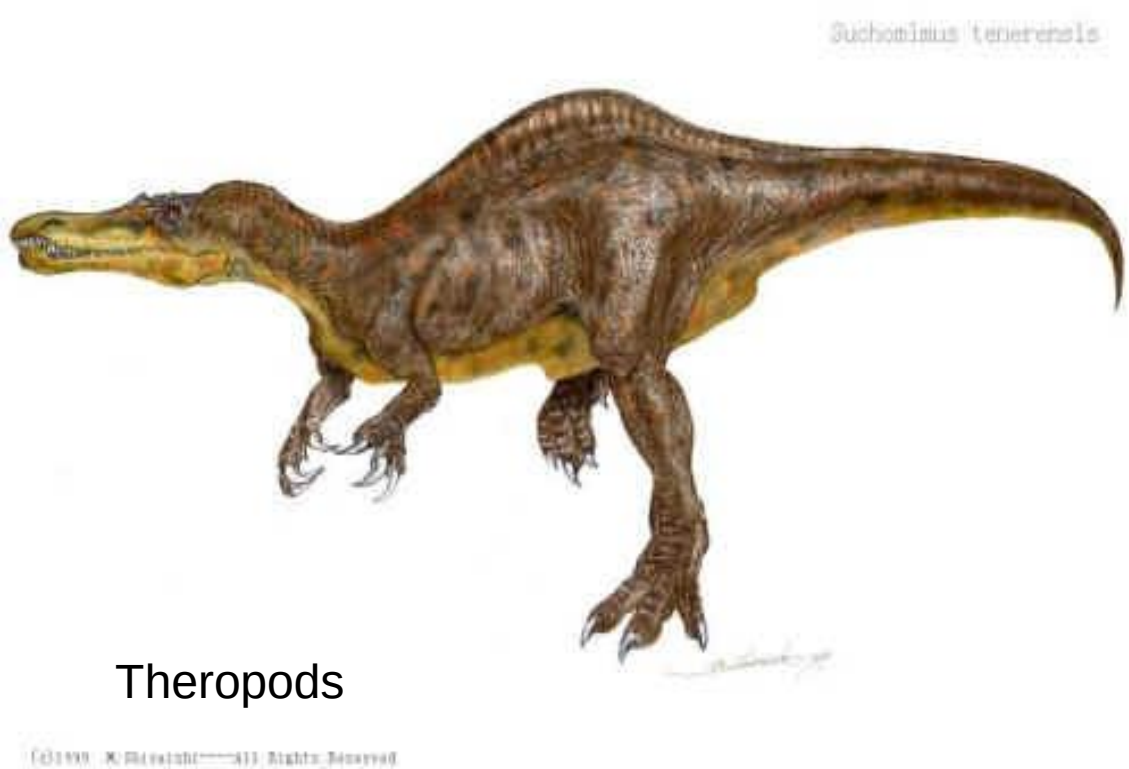
Dilophosaurus

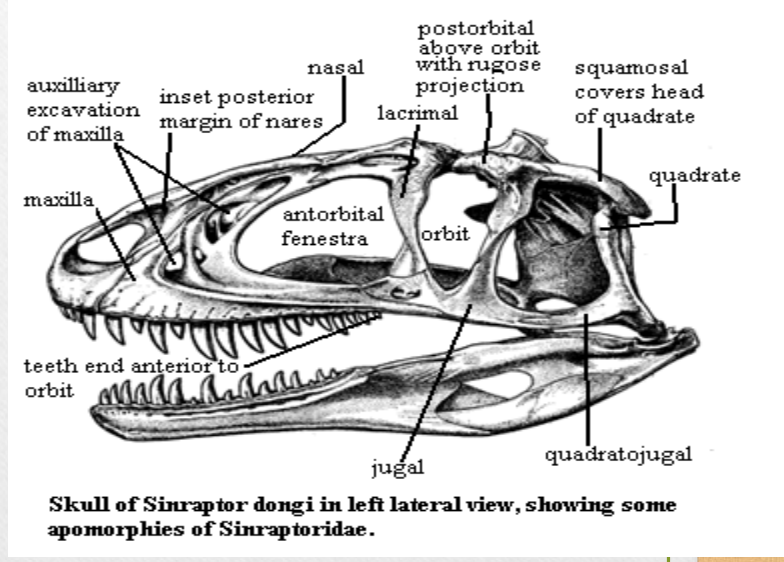
Dennis Neary
Trenton NH Museum



(b) *Ornithomimus*







Skull of Sinraptor dongi in left lateral view, showing some apomorphies of Sinraptoridae.

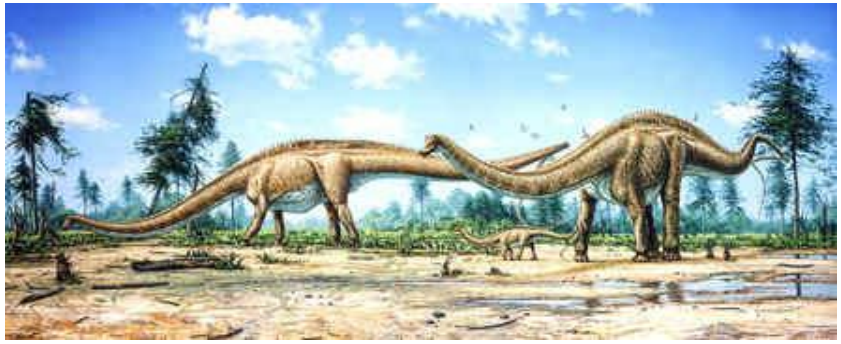
Theropods

Sauropods

Sauropods

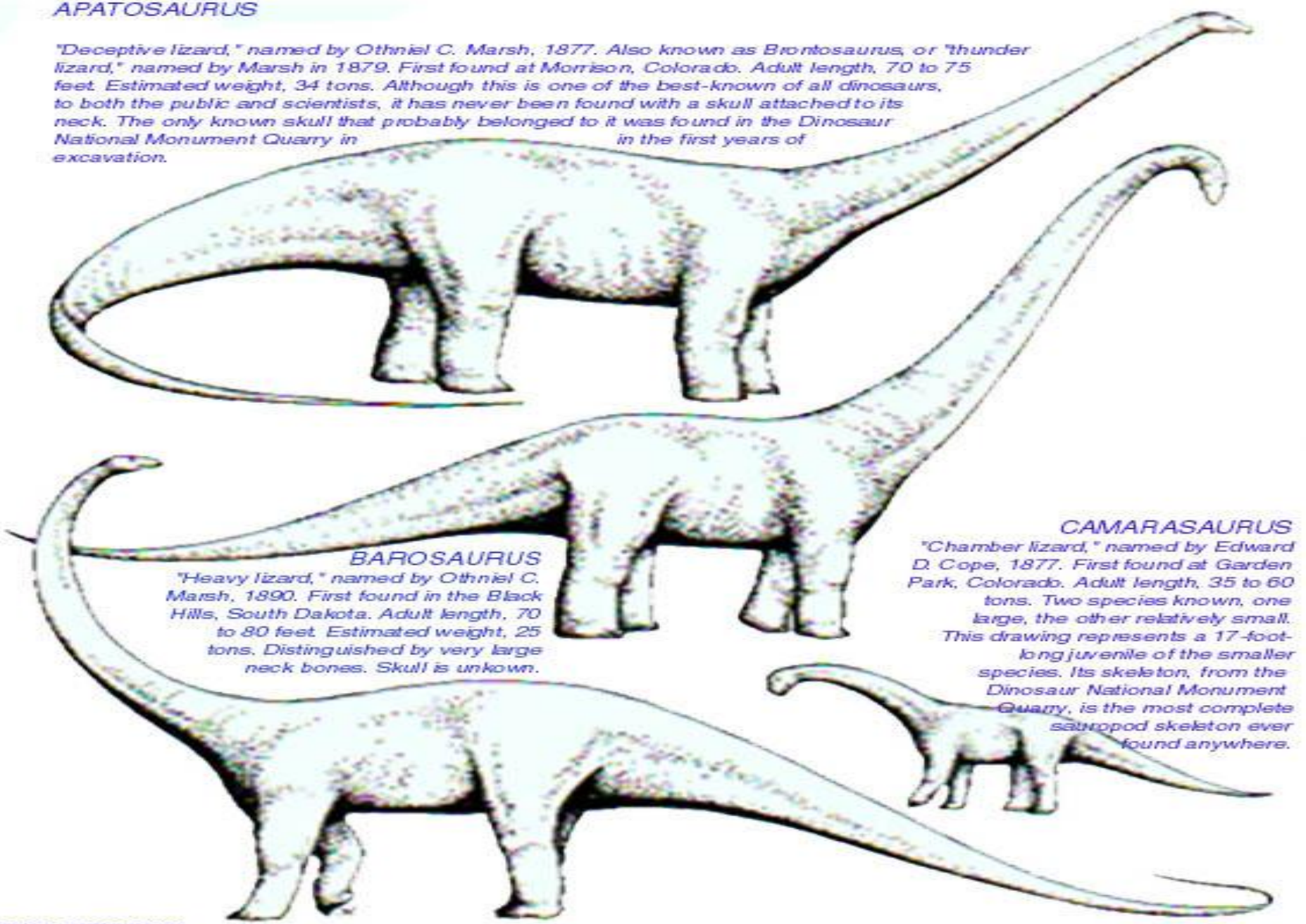
Apatosaurus

Brachiosaurus



Parental Care, Herds, Land

Seismosaurus



APATOSAURUS

"Deceptive lizard," named by Othniel C. Marsh, 1877. Also known as Brontosaurus, or "thunder lizard," named by Marsh in 1879. First found at Morrison, Colorado. Adult length, 70 to 75 feet. Estimated weight, 34 tons. Although this is one of the best-known of all dinosaurs, to both the public and scientists, it has never been found with a skull attached to its neck. The only known skull that probably belonged to it was found in the Dinosaur National Monument Quarry in in the first years of excavation.

BAROSAURUS

"Heavy lizard," named by Othniel C. Marsh, 1890. First found in the Black Hills, South Dakota. Adult length, 70 to 80 feet. Estimated weight, 25 tons. Distinguished by very large neck bones. Skull is unkown.

CAMARASAURUS

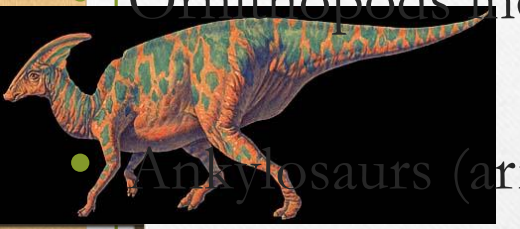
"Chamber lizard," named by Edward D. Cope, 1877. First found at Garden Park, Colorado. Adult length, 35 to 60 tons. Two species known, one large, the other relatively small. This drawing represents a 17-foot-long juvenile of the smaller species. Its skeleton, from the Dinosaur National Monument Quarry, is the most complete sauropod skeleton ever found anywhere.

DIPLODOCUS

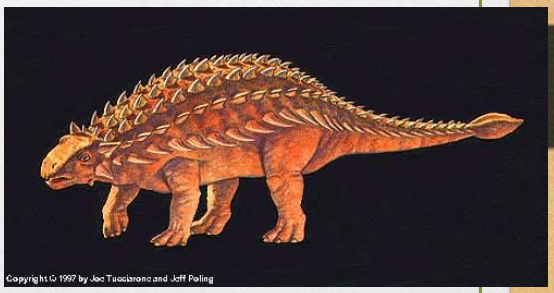
"Double beam," named by Othniel C. Marsh, 1878. First found at Garden Park, Colorado. Adult length, 75 to 85 feet. Estimated weight, 13 tons. One skeleton found in Wyoming measures nearly 90 feet, the longest dinosaur skeleton known.

Ornithischian Dinosaurs

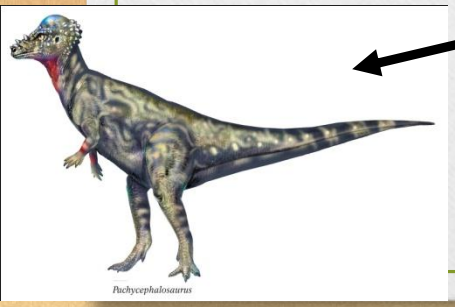
- Stegosaurs (plate-backed dinosaurs)
- Ornithopods including Hadrosaurs (duckbills)



- Ankylosaurs (armored dinosaurs)

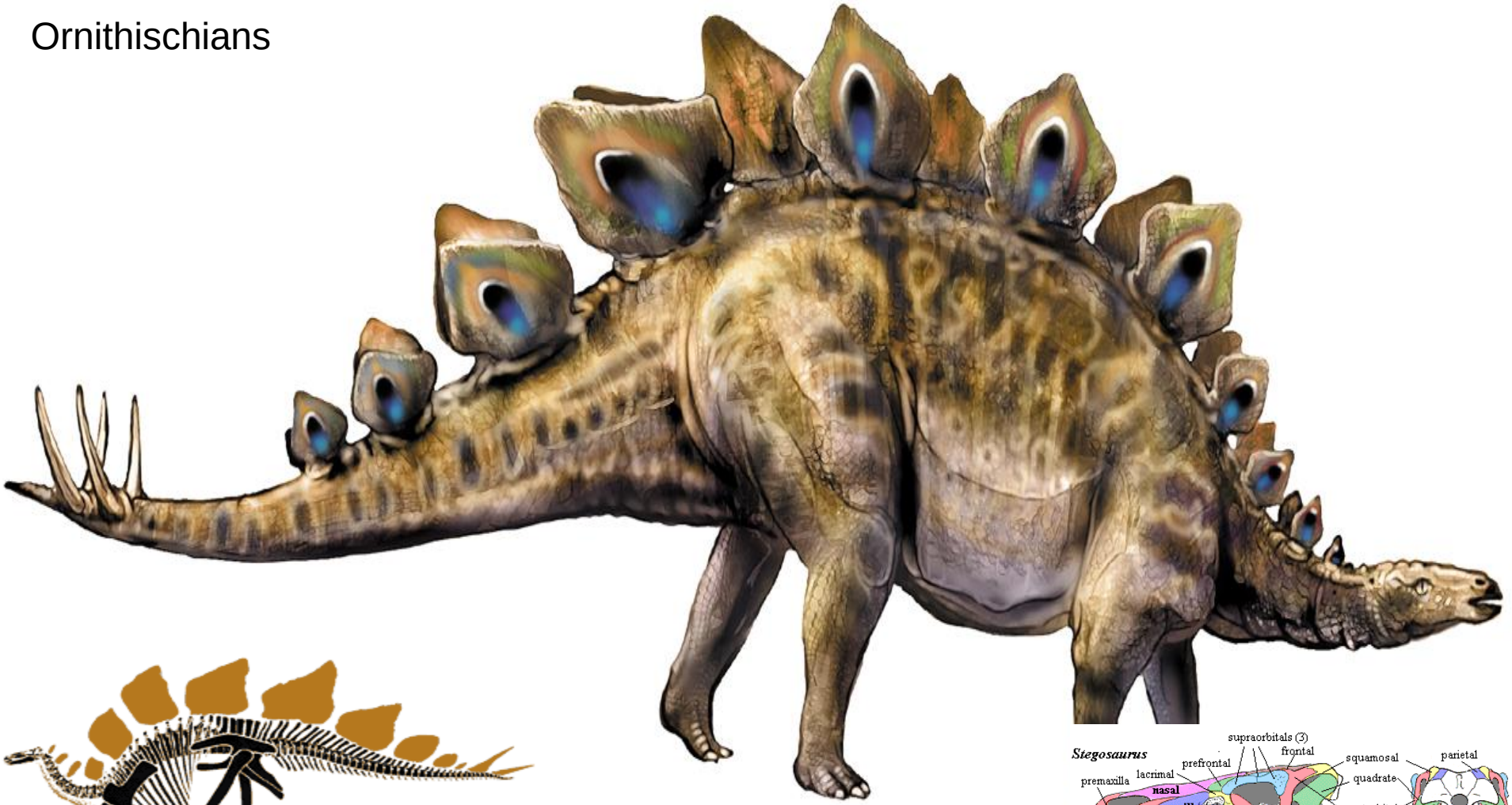


- Pachycephalosaurs (thick-headed dinosaurs)

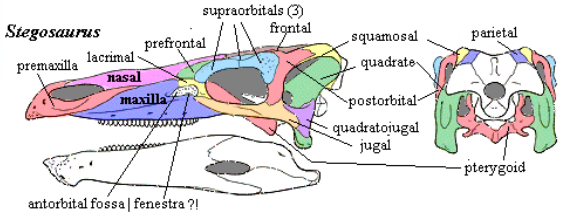


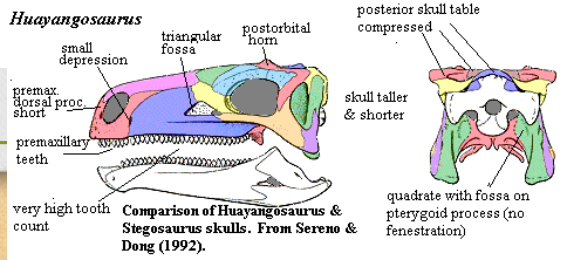
- (horned dinosaurs)

Ornithischians



Stegosaurus

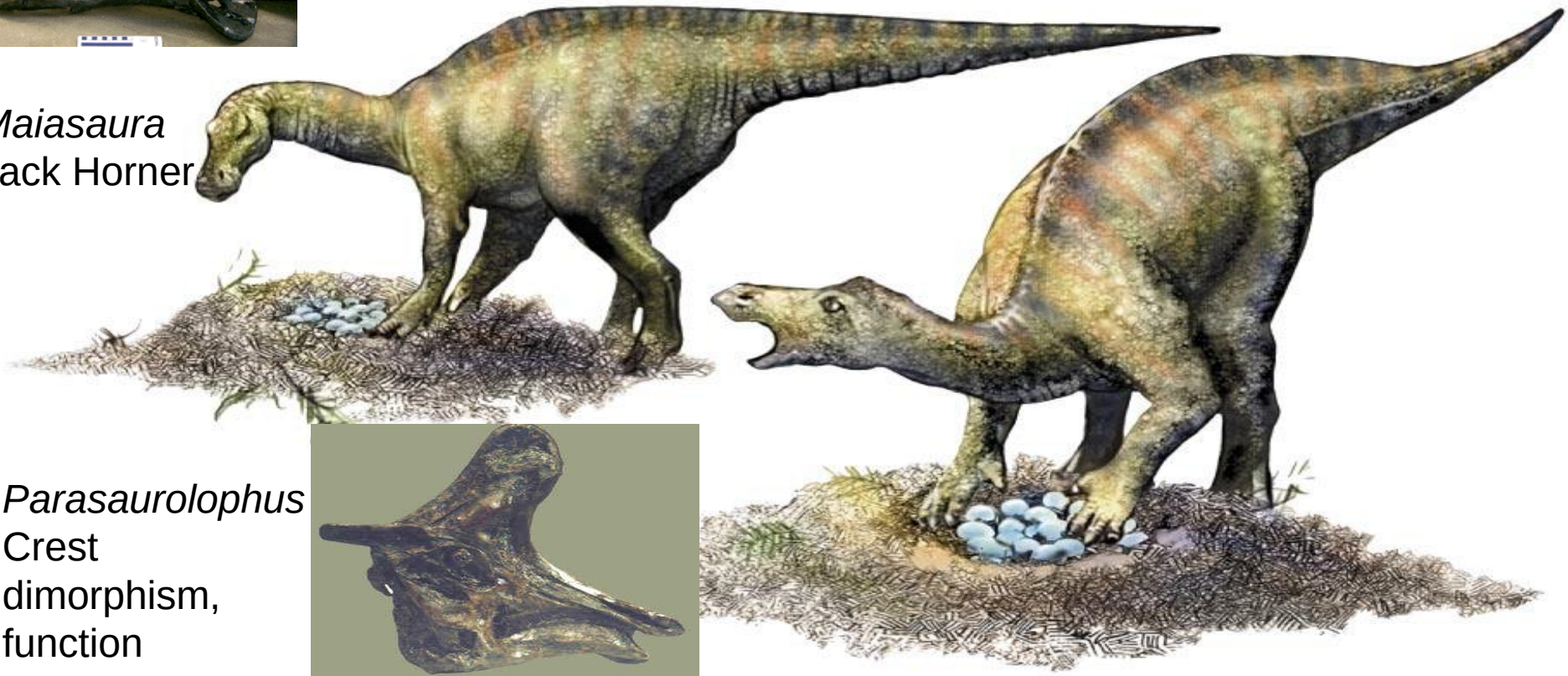




Social behavior in duckbill dinosaurs

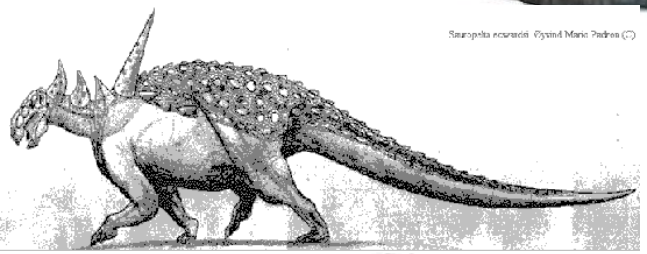
Colony nesting also known in *Protoceratops*
Roy Chapman Andrews

Maiasaura
Jack Horner



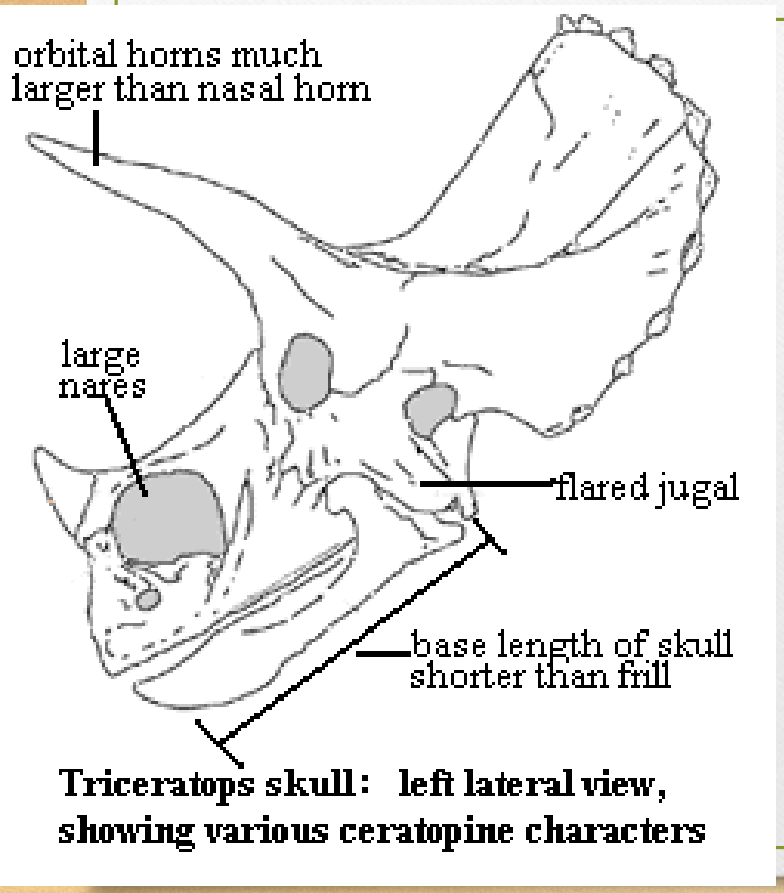
Parasaurolophus
Crest dimorphism, function

Armored dinosaurs

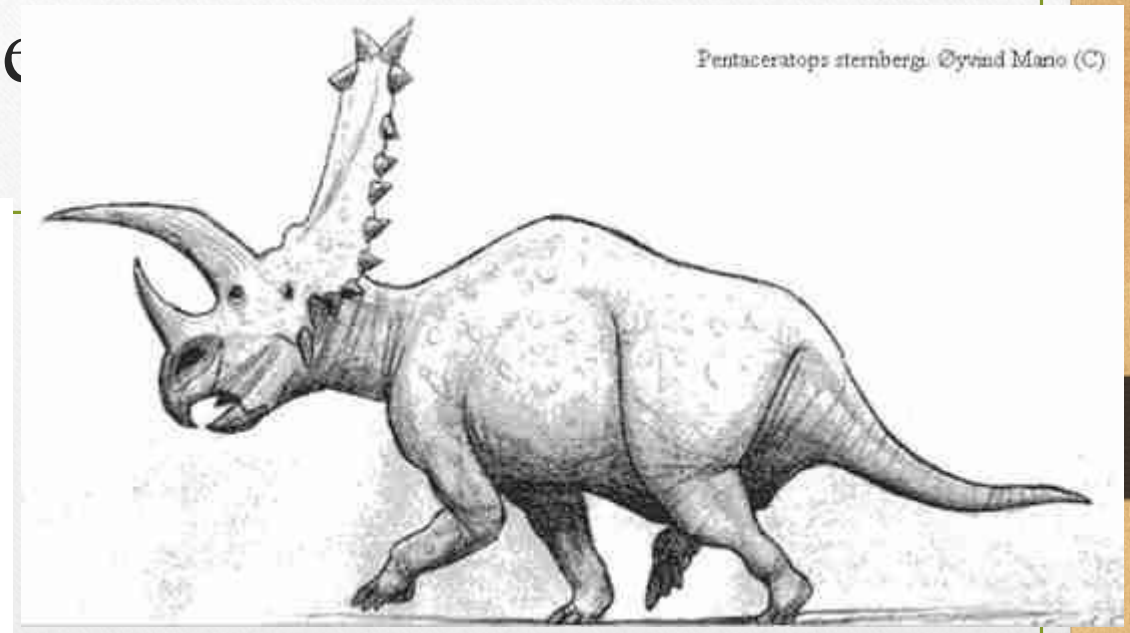


Euoplecephalus
Ankylosaur

Ce



Triceratops skull: left lateral view, showing various ceratopine characters

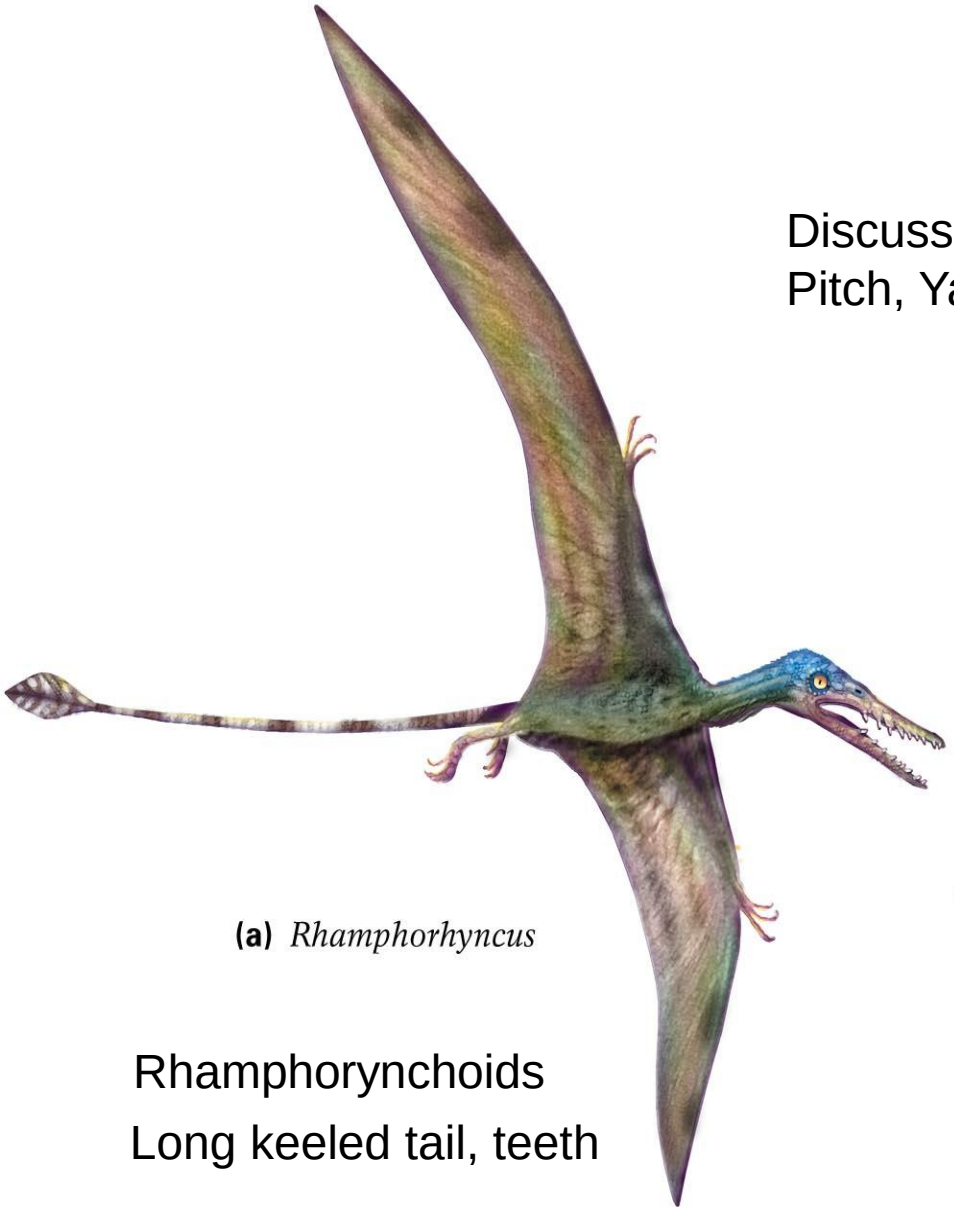


Flying Reptiles

- The pterosaurs were the first vertebrates to fly
  - common from Late Triassic to Cretaceous
  - wing membrane supported by an elongated fourth finger
  - light hollow bones
  - development of brain areas associated with coordination and sight
  - likely to have been endothermic

Principle pterosaur groups

Discussion: stability and steering in flight
Pitch, Yaw and Roll



(a) *Rhamphorhyncus*

Rhamphorynchoids

Long keeled tail, teeth

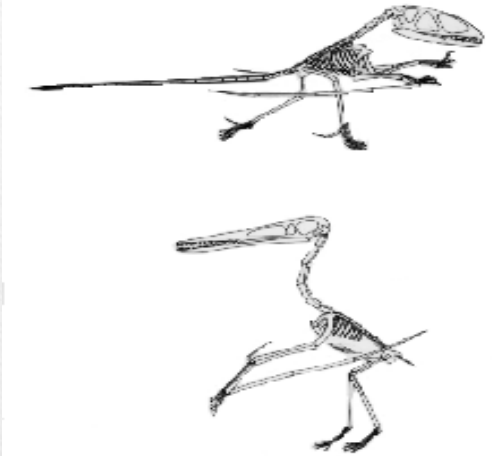
(b) *Pteranodon*

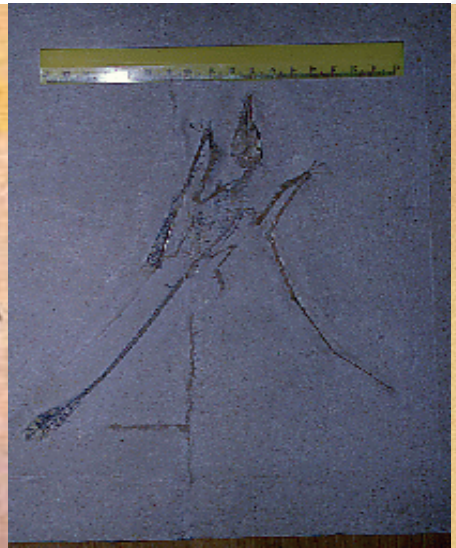
Pterodactyloids

No tail, strong crest

pterosaur

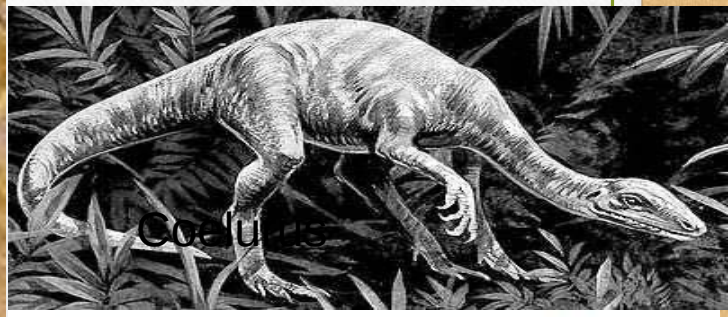
Some have fine “hair”





Jurassic Bird *Archaeopteryx*

Archeopteryx lithographica
Late Jurassic, Solenhofen
Germany



because of its feathers, Archaeopteryx has usually been called a bird--but underneath the feathers, its body was just like that of a small meat-eating dinosaur

The Dinosaurs
Endothermic or Ectothermic?

Robert Bakker,1968

Evident
Bone structures
Oxygen isotopes

ESS 16-1 Figure 2
Earth System History, Second Edition

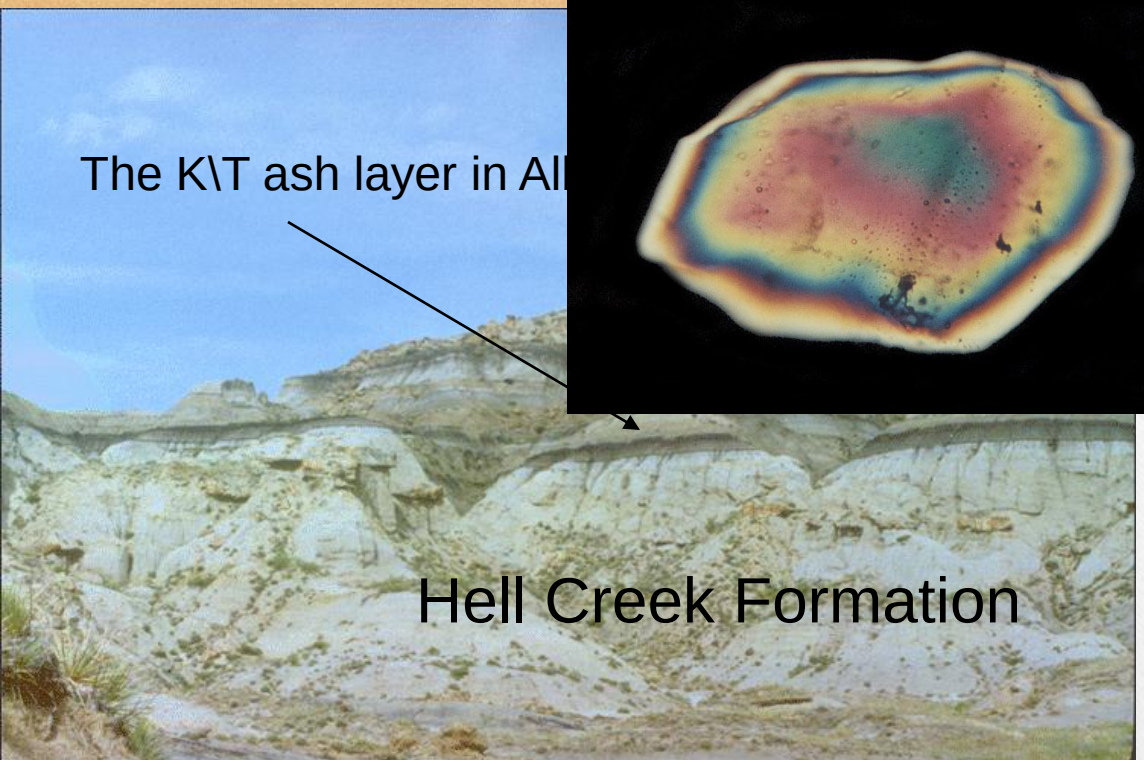
Bone Structure

Mass extinction across Cretaceous / Paleocene

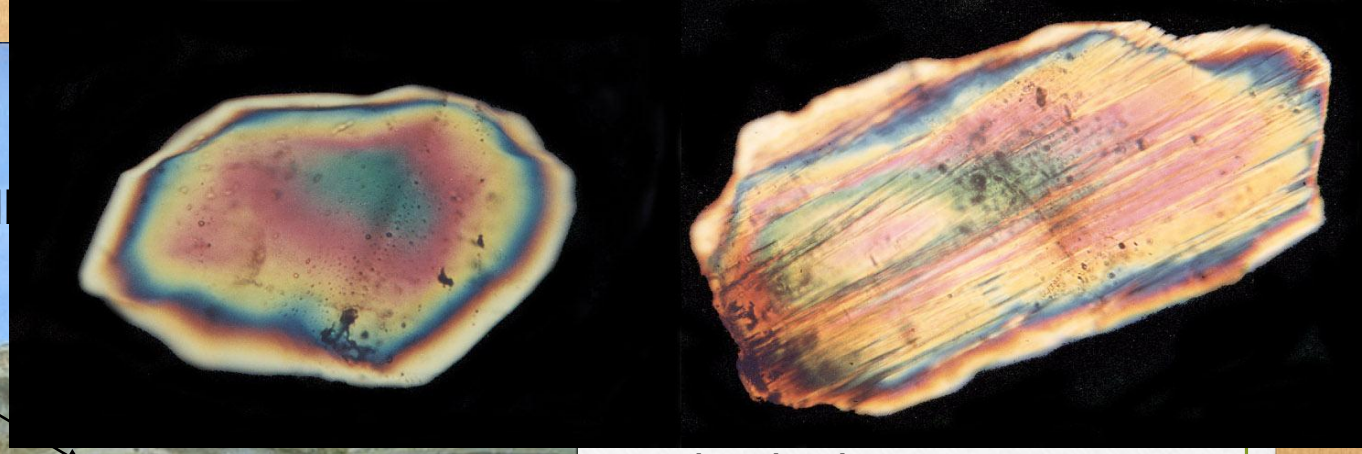
1- Asteroid impact (Supernova)
*Shocked Quartz
*Glassy spherules – tektites
***Soot beds**

2- Terrestrial causes
*Eipric seas
*Volcanic activity (Duccan)
*sea level dropped
*climate change (fluctuation)
***O2 & CO2 variation
***Angiosperms dispersion (Sickness)**
***flux of fresh water to the sea cause of dissolve**

The K\T ash layer in Al

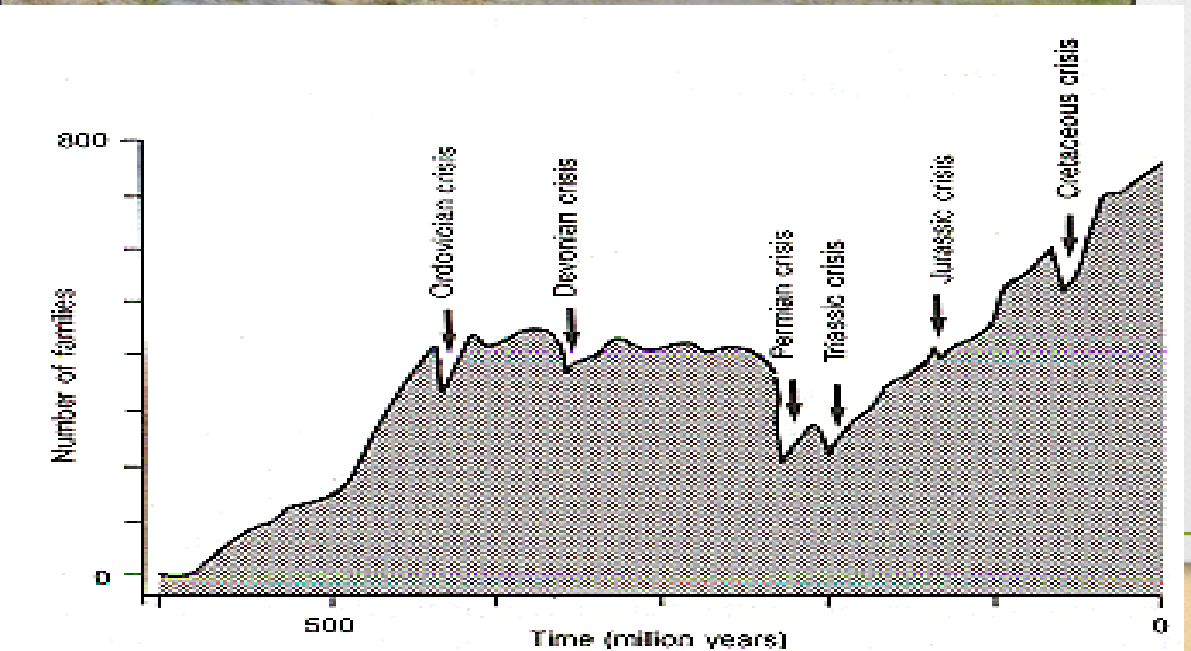


Hell Creek Formation



Shocked Quartz

Luis and Walter Alvarez

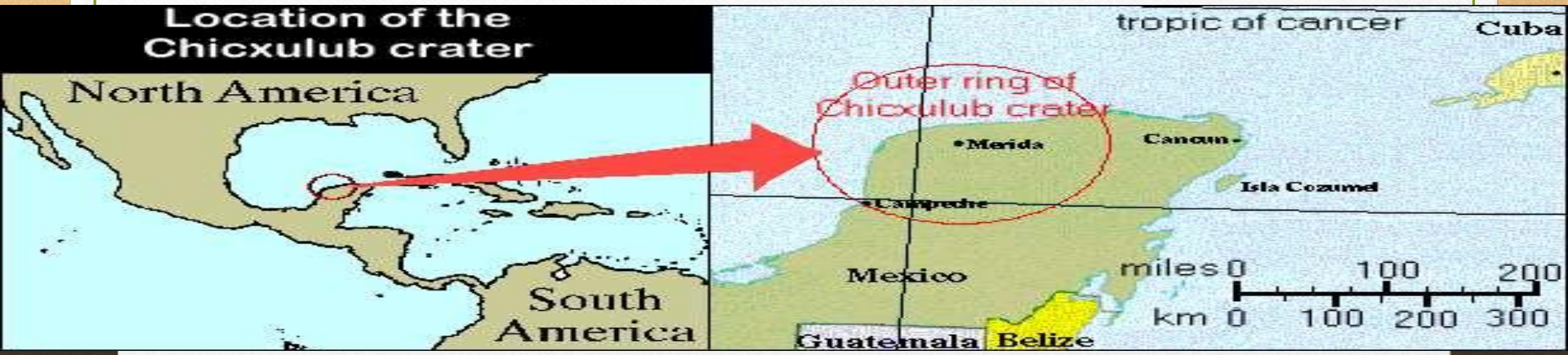


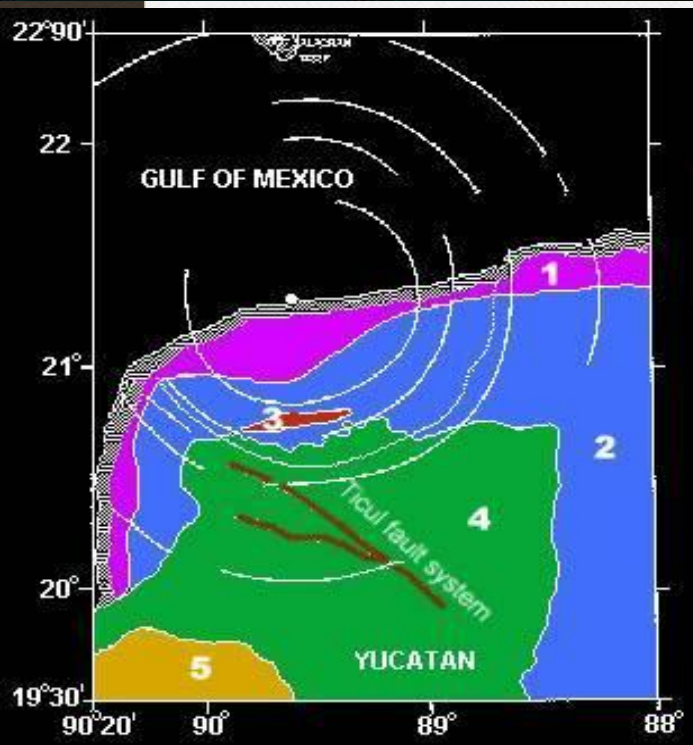
Cretaceous-Tertiary boundary

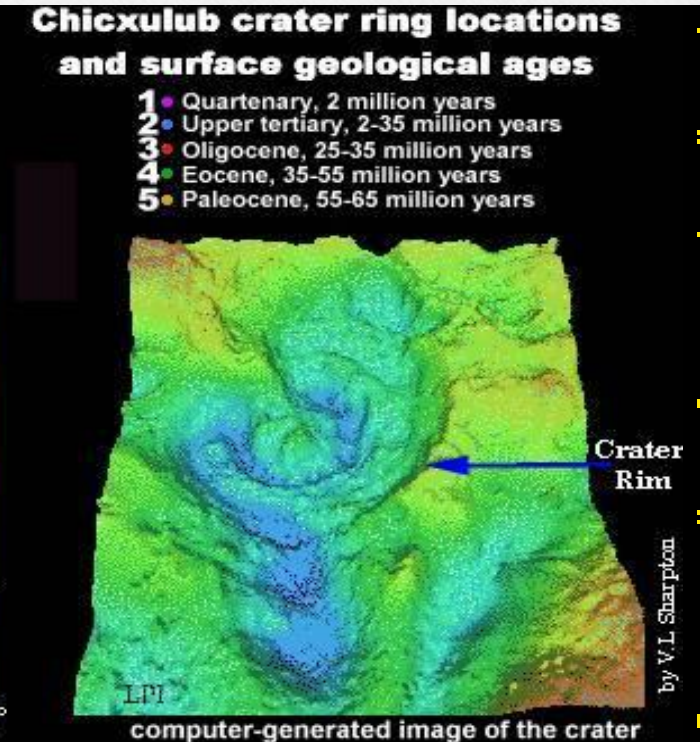
The Chicxulub structure

K-T Mass Extinction - A Crisis in the History of Life

- Cretaceous-Tertiary extinction claimed dinosaurs, flying reptiles, marine reptiles, and many marine invertebrates








Dust cloud
Plants need light
Herbivores eat plants
Carnivores eat herbivores
Survivors can sleep through it.


The End of the Mesozoic