

Introduction to Biology. Lecture 34

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Outline

- 1 Where we are
 - Jurassic park
- 2 Mesozoic-Cenozoic extinction
 - The raise and fall of giant reptiles



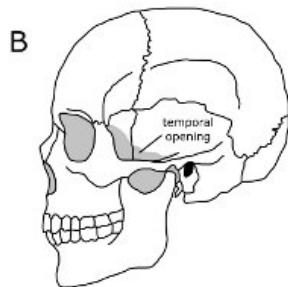
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Where we are Jurassic park



Why mammals are synapsids



Tricodont proto-mammal



Diapsid reptiles

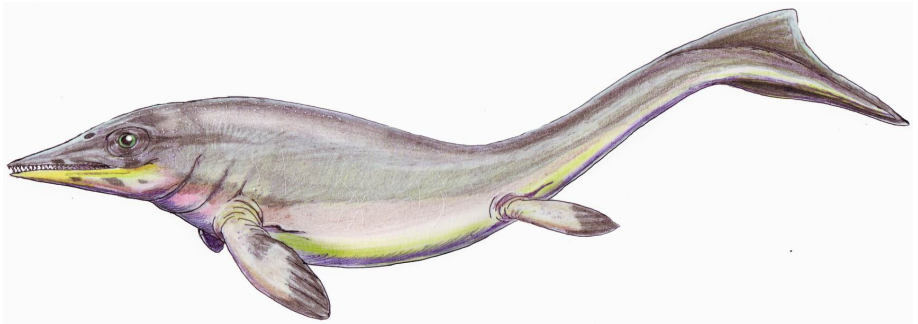
- Ichthyosauria: marine, dolphin-like reptiles
- Sauropterygia: placodonts and plesiosaurs

These two first groups are called “euryapsids”

- Lepidosauria: lizards, snakes and extinct mosasaurs
- Archosauromorpha: proterosuchids, aetosaurs, crocodiles, dinosaurs (including ancestors of birds)



Ichthyosaur



Ichthyosaurs were viviparous. Note also the vertical fin.

Placodont



Covered with skin plates, eat mollusks.



Plesiosaurs



Mosasaur



From North Dakota!



Archosauromorph reptiles

- Proterosuchia, Aetosauria: basal archosauromorphs
- Crocodylomorpha: advanced behavior, four-chambered heart
- Pterosauria: archosaur “bats”, some with fur-like cover. Note that skin membrane is not very effective wing.
- Dinosauria: bipedal archosaurs:
 - Ornithischia: “bird-hipped”, include ankylosaurs and stegosaurs, ornithomimids (like *Iguanodon*), pachycephalosaurs and ceratopsids (but not birds!)
 - Saurischia: “lizard-hipped”:
 - A Theropoda: true bipedal, carnivorous or insectivorous, mostly feathered: Ceratosauria (“southern carnivores”), Allosauroidea and relatives, including *T. rex*, Maniraptora and descendants
 - B Sauropodomorpha: secondary quadrupedal, small heads, long necks, long tails; largest dinosaurs



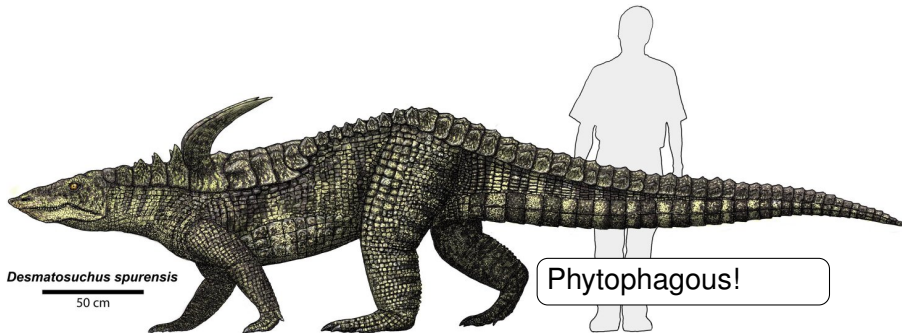
Proterosuchid



Chasmatosaurus
from movie



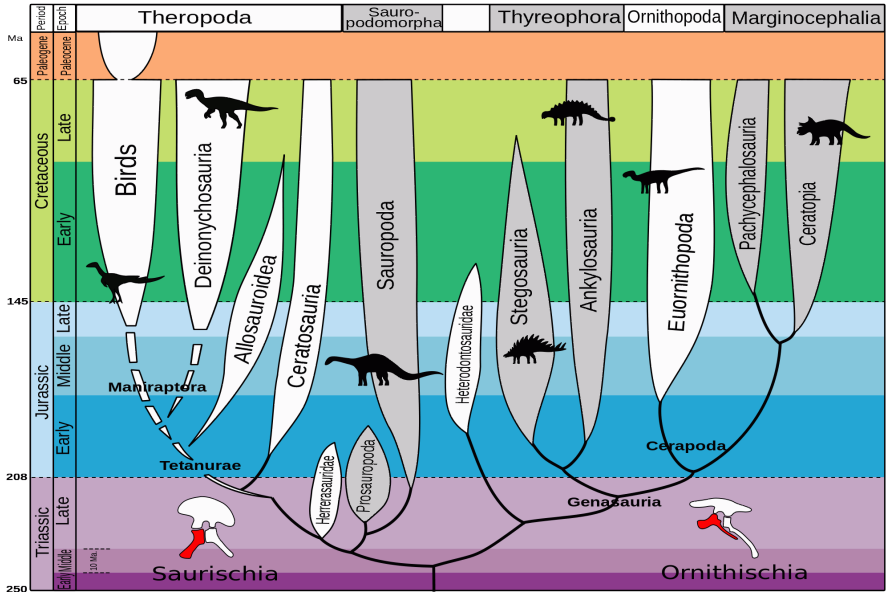
Aetosaur



Dsungaripterus pterosaur



Dinosaurs in time



Early ornithischian *Tianyulong*



Allosaurioid *Yutyrannus* from China



Feathered, warm-blooded, social

Theropoda: *Tarbosaurus* and *Gallimimus*



Early maniraptor *Gigantoraptor*



Late maniraptor *Microraptor*



Four wings!!!
but still not a bird



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Mesozoic-Cenozoic extinction

The raise and fall of giant reptiles



Reptiles and mammals cartoon, part I



Reptiles and mammals cartoon, part II



Mesozoic-Cenozoic extinction

Two extinctions:

- Most of large archosauromorphs, plus plesiosaurs and ichthyosaurs. Crocodiles, birds, mammals, amphibians survived.
- Shelled cephalopods (belemnites, ammonites) and many other marine groups

Plants and insects were not affected at all.



Why they were so big

- To digest plants (cellulose), higher temperature will help. Dinosaurs developed size-related **endothermy**.
- To escape from predators, the prey should grow big.
- As a result, in Jurassic park all herbivores were giants.
- Turtles are an exception, but they live on a very little fuel and are over-armored to escape predators.



Mammals in Jurassic

- They fed mostly on insects
- Their chewing system is not yet developed to the level when they can live on plants
- By the law of ecological pyramid (i.e., 10000 grasses – 100 rabbits – 1 fox), terrestrial ecosystems do not support more than three floors of feeding chain.
- As a result, **small predator (“fox”) ecological niche was empty: there was no constant supply of food**



“Every worm has his weak spot”: egg problem

- Eggs need warming. Physical laws allow egg to be warmed to the center only if it is not exceed ≈ 0.5 m in diameter.
- Forces of evolution pushed dinosaurs to grow as big as possible, but egg size was limited.
- As a result, dinosaur young were vulnerable to everybody who would want to feed on them. Fortunately, the small predator did not exist.

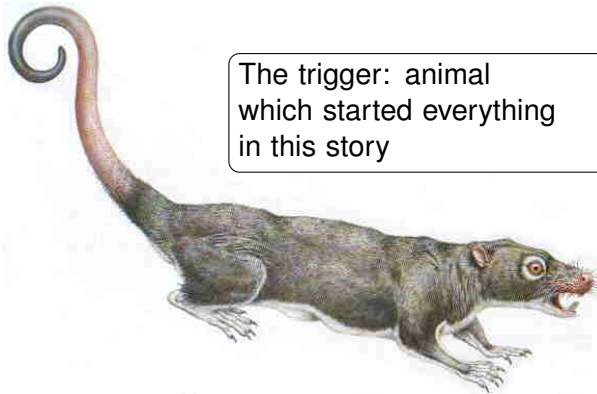


How small predator niche was finally filled

- First herbivorous mammals (multituberculates) appeared in the Middle Cretaceous
- From that point, small predators will have the constant food source
- As a result, they appeared shortly after. They were not only mammals but also snakes and small archosauromorphs.



Multituberculate mammal: first small herbivore

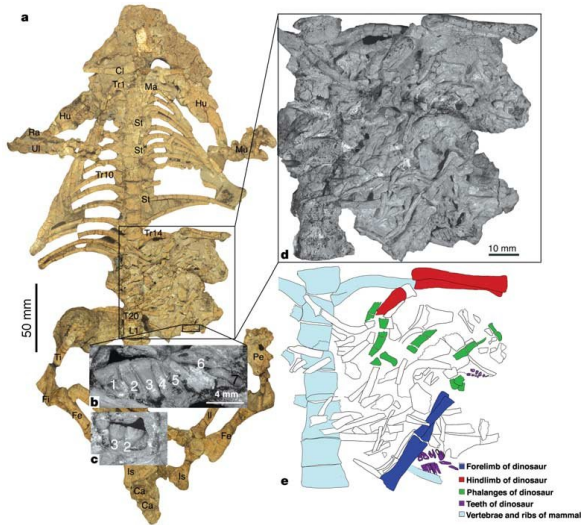


Dinosaurs decline: the theory

- Small predator will occasionally feed on dinosaur young which turn many species to the route of extinction. Moreover, new species do not appear.
- Dinosaur lineages slowly declined towards the late Cretaceous.



Dinosaurs decline: the proof



In 2005, Chinese paleontologists find the tricodont mammal skeleton
with young dinosaur in the stomach



The hero: *Repenomamus robustus* (reconstruction)



Snakes also help in dinosaur extinction



Pterosaurs?

- To escape the competition with better organized birds, they also pushed to be larger and larger.
- At some point, they faced the same “dinosaur problem”: they cannot defend their young...



Asteroid?



Asteroid?

- Impact theories are mentally attractive but do not explain slow and “blurred” extinction as well as existence of “untouchable” groups like plants and insects.
- Ecological palaeontology states that most mass extinctions were results of **biological crises**. The nature of these crises was internal.
- But yes, asteroid could be the “straw that breaks the camel’s back”



Summary

Well, this is me
who killed dinosaurs...



For Further Reading



Dinosaurs.

<http://en.wikipedia.org/wiki/Dinosaur>



Ecological crisis.

http://en.wikipedia.org/wiki/Ecological_crisis

