

Concepts of Biology. Lecture 35

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December 3, 2014



Outline

- 1 Questions and answers
 - Exam 4
- 2 Where we are?
 - Jurassic park
- 3 Mesozoic-Cenozoic extinction
 - The raise and fall of giant reptiles



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Questions and answers

Exam 4



Results of Exam 4: statistic summary

Summary:

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	NA's
23.00	39.25	52.00	48.37	59.00	65.00	25

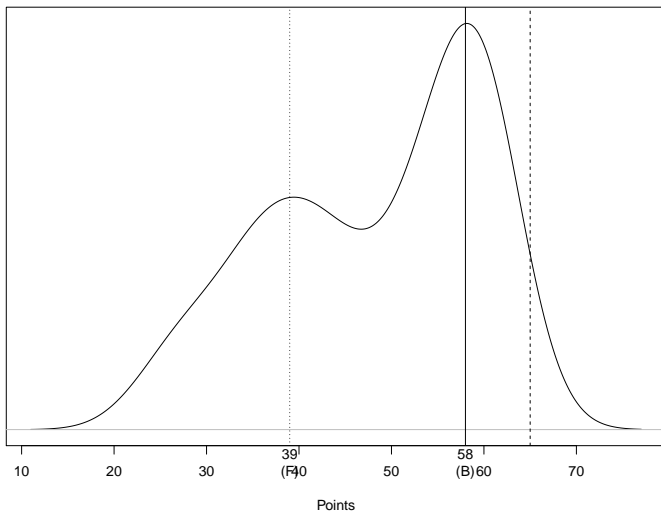
Grades:

F	D	C	B	max
39	46	52	58	65



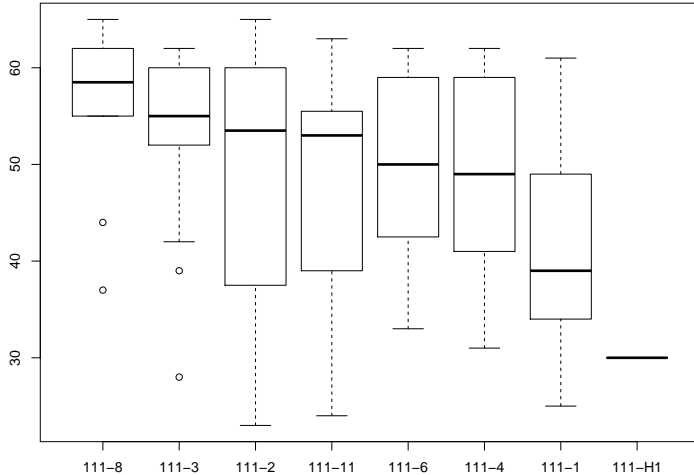
Results of Exam 4: the curve

Density estimation for Exam 4 (Biol 111)



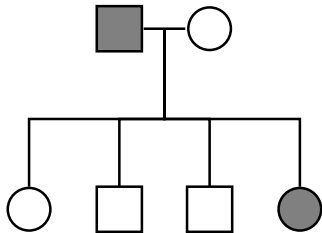
Results of Exam 4: sections

Competition between Biol 111 sections (Exam 4)



Results of Exam 4: two questions

- Epidermis contains:
 - A Several types of tissues
 - **B Several types of cells**
 - C One type of cells
- Is the disease from the pedigree chart below:



- A Dominant
- B Recessive
- **C I need more information**



Where we are?

Jurassic park



From Triassic to Cretaceous

Mesozoic era:

- Triassic: starts 252 Mya
- Jurassic: starts 201 Mya
- Cretaceous: starts 145 Mya, ends 66 Mya



Subdivisions of Cretaceous

System	Series	Stage
Paleogene	Paleocene	Danian
Cretaceous	Upper	Maastrichtian
		Campanian
		Santonian
		Coniacian
		Turonian
		Cenomanian
	Lower	Albian
		Aptian
		Barremian
		Hauterivian
		Valanginian
		Berriasian
Jurassic	Upper	Tithonian

- Hauterivian: first flowering plants (pollen)
- Barremian/Aptian: Famous Yixian formation (China)
- Maastrichtian: end of dinosaur age



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



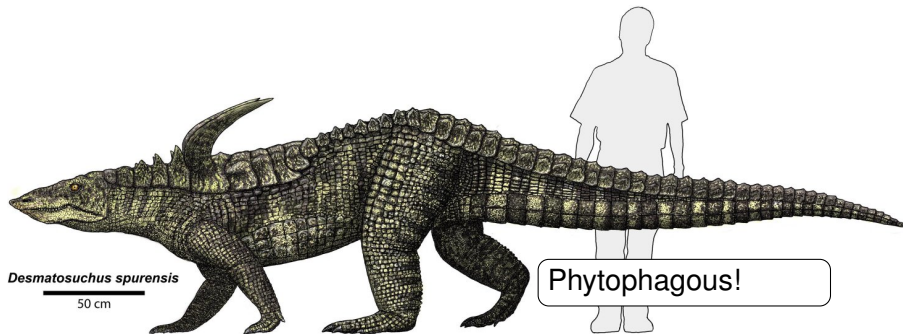
Proterosuchid



Chasmatosaurus
from movie



Aetosaur

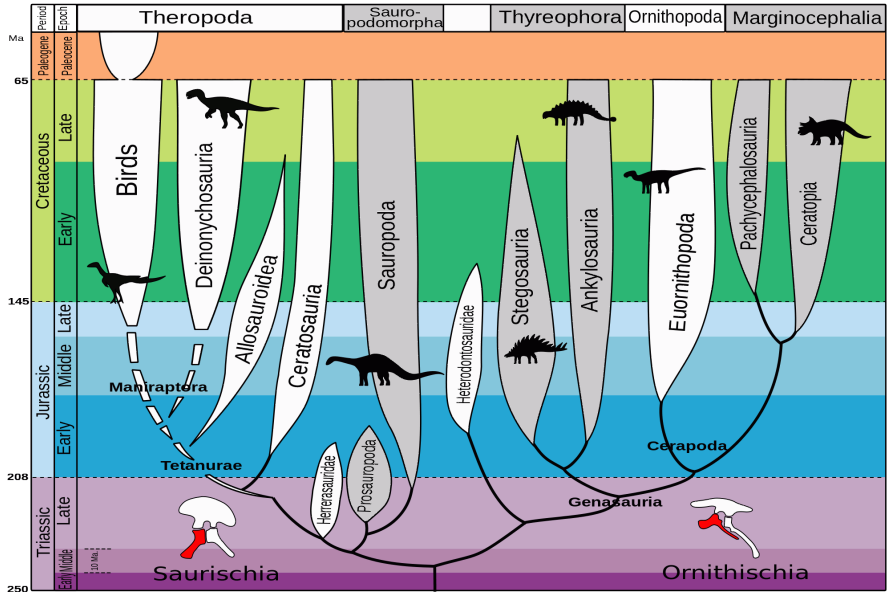


Dsungaripterus pterosaur

©Julius T. Csotonyi
<http://csotonyi.com>



Dinosaurs in time



Early ornitischian *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

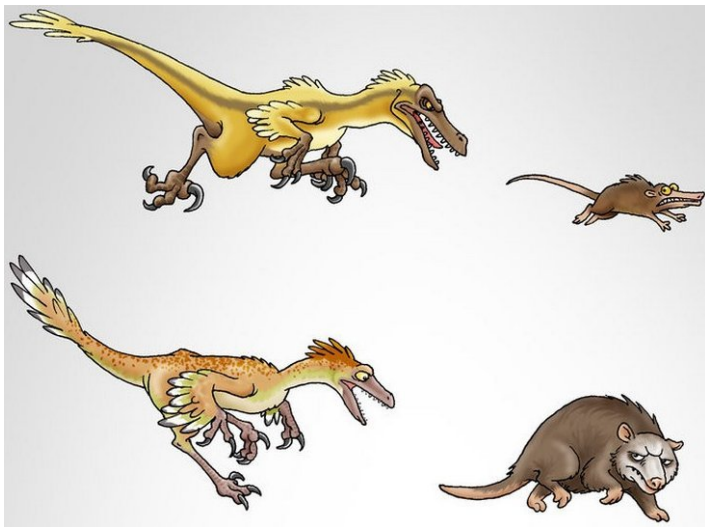


Mesozoic-Cenozoic extinction

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
- As a result, **small predator 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.

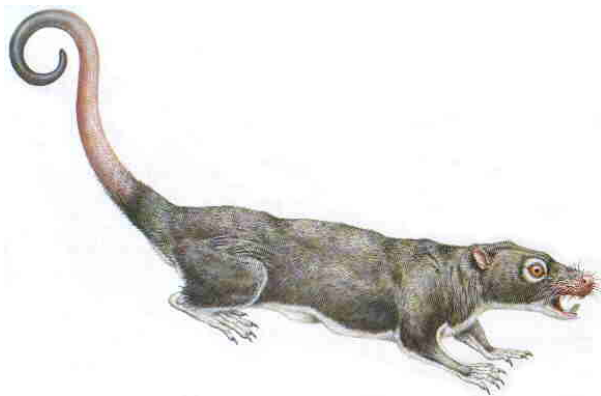


How small predator niche was finally filled

- 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.



Multituberculata mammal: first small herbivore

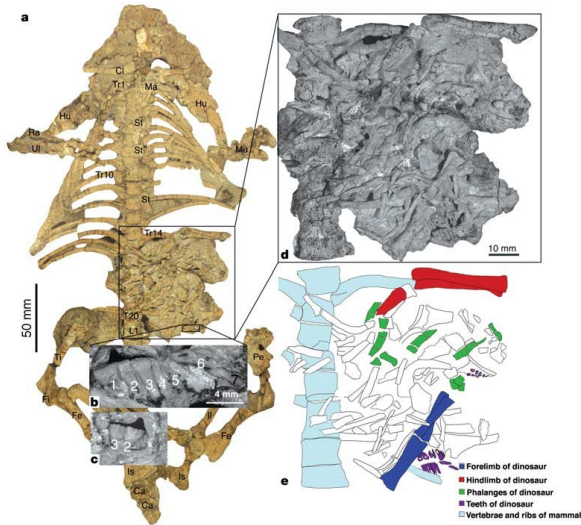


Dinosaurs decline: the theory

- 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”



What about the ocean?

- Marine fauna typically “sits below the salt” on the “ecological dining table”: they feed on nutrients which are left from terrestrial biota
- Every significant change in land flora resulted in mass extinction in the sea.
- In the end of Cretaceous, **grasses** changed the flow of minerals from land to sea completely.
- Dinosaur decline and marine extinction simply coincided.



"Sitting below the salt"



Why dinosaurs did not decrease a size?

- They did. They are birds now.
- However, terrestrial lineages did not withstand competition with mammals.



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

