

# Concepts of Biology. Lecture 35

Alexey Shipunov

Minot State University

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# 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

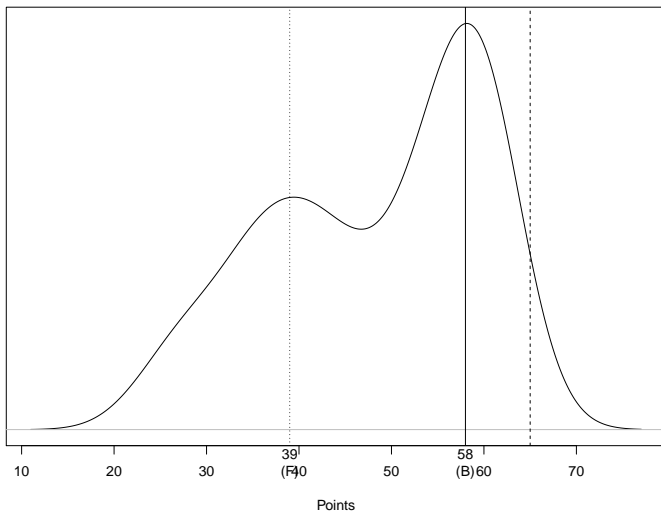
## Grades:

F	D	C	B	max
39	46	52	58	65



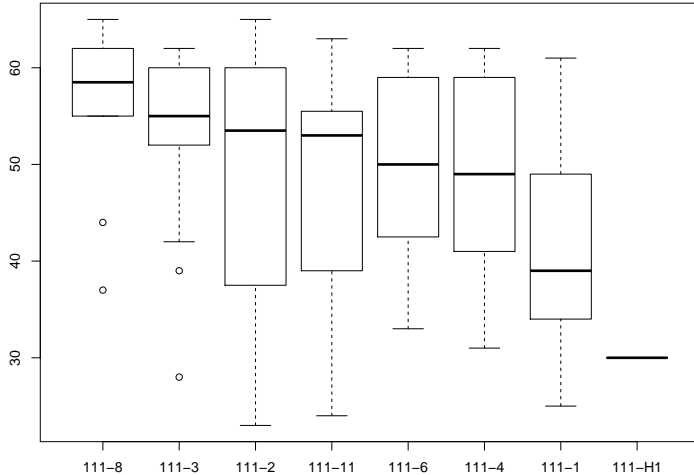
# Results of Exam 4: the curve

Density estimation for Exam 4 (Biol 111)



# Results of Exam 4: sections

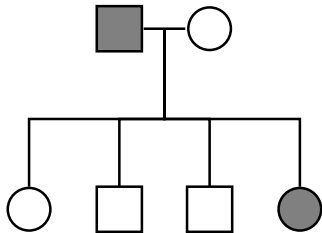
Competition between Biol 111 sections (Exam 4)





# 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



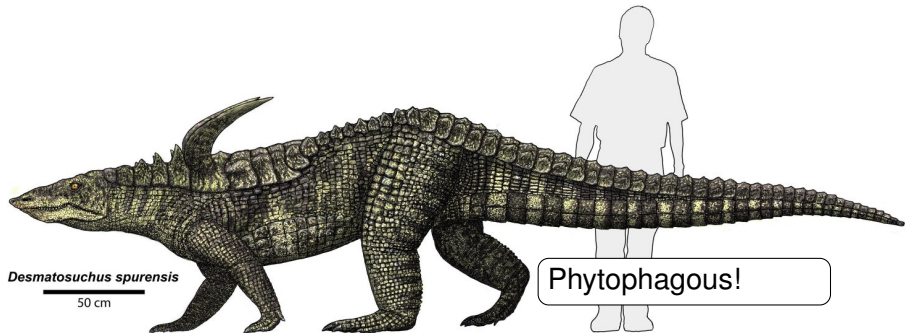
# Proterosuchid



*Chasmatosaurus*  
from movie



# Aetosaur



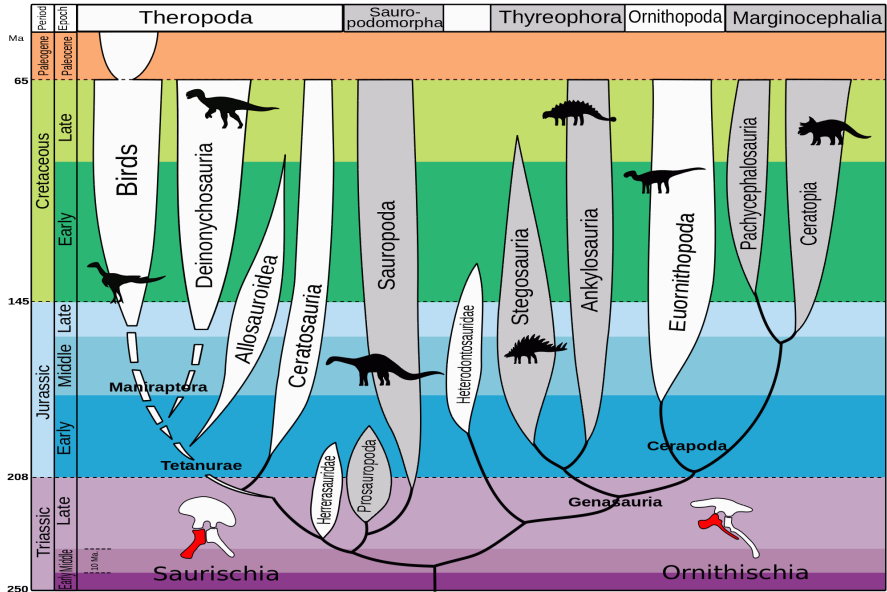
# *Dsungaripterus* pterosaur

©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

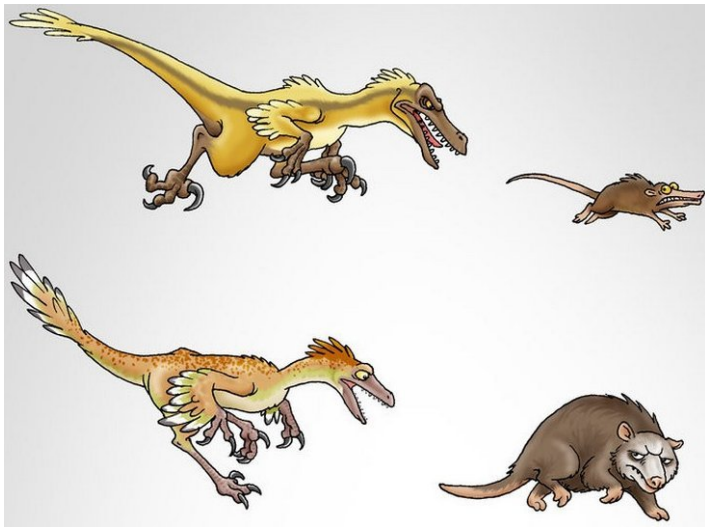


# Mesozoic-Cenozoic extinction

## 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
- 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  $\approx 0.5$  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.

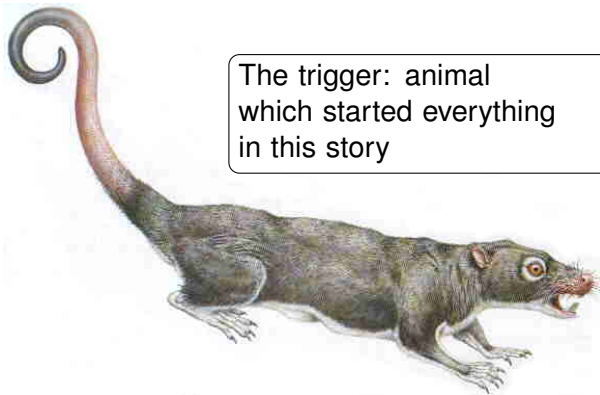


# How small predator niche was finally filled

- 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



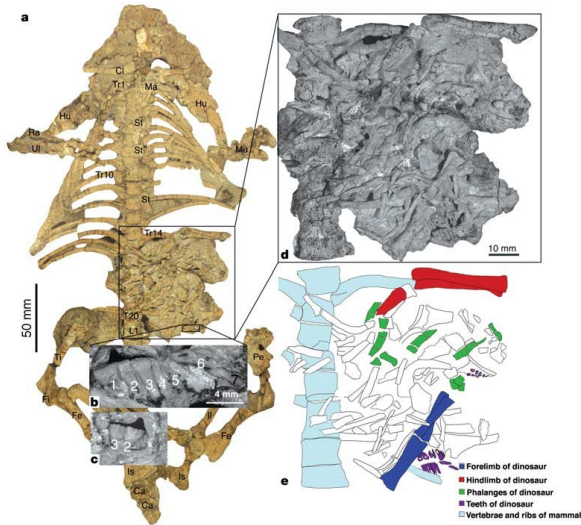
# Dinosaurs decline: the theory

- 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”



# 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](http://en.wikipedia.org/wiki/Ecological_crisis)

