

Concepts of Biology. Lecture 33

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1 How plants got their seeds

- Origin of seed plants

2 Jurassic park

- From Triassic to Cretaceous
- Jurassic and Cretaceous flora and fauna



1 How plants got their seeds

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How plants got their seeds

Origin of seed plants



Life cycle of land plants

- Sporic life cycle with interleaving generations
- Diploid stage grow directly on the haploid stage and even parasitizes on it (e.g., in mosses)
- Originates from the life cycle of algae: diploid stage was an adaptation to the distribution of spores
- Eventually, diploid stage begin to dominate the life cycle



The conflict between size and reproduction

- Competition for the light resulted in growing up; growing up resulted in *secondary thickening*—trees appeared
- Seed plants started as trees, and these trees were diploid stage
- Haploid stage still existed and probably was a minute *prothallium*
- Diploid stage followed the *K*-strategy (slow and smart) whereas haploid prothallium followed the *r*-strategy (random explosions)
- This is a conflict: diploid stage cannot adapt better because free haploid stage was too cranky, it became a hindrance on the way of evolution
- Decision: take haploid stage on the diploid stage and grow it inside

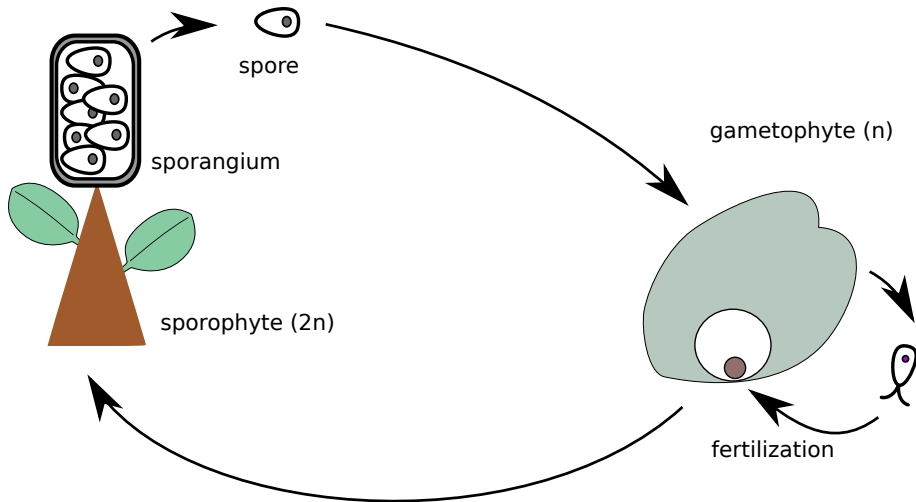


The seed

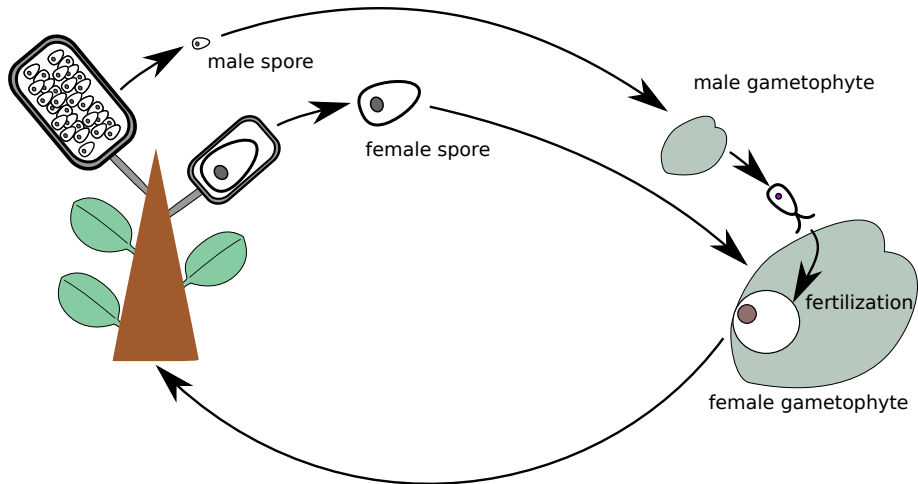
- Seed is the chimeric organ consists of three parts: mother diploid tissue (seed coat), daughter diploid (embryo) and female haploid stage (endosperm)
- Main problems: need for pollination, extremely slow growth (two years in pine tree, up to five years in cycads)



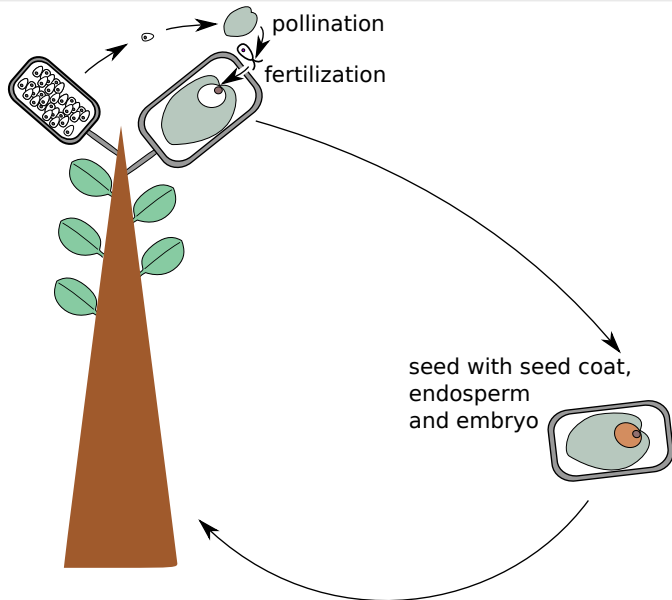
Origin of seed I



Origin of seed II



Origin of seed III



Jurassic park

From Triassic to Cretaceous



From Triassic to Cretaceous

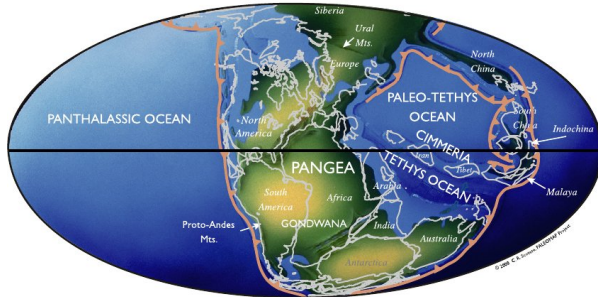
Mesozoic era:

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



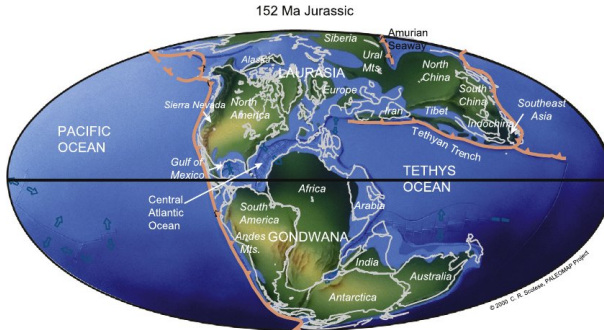
Triassic period

237 Ma Triassic



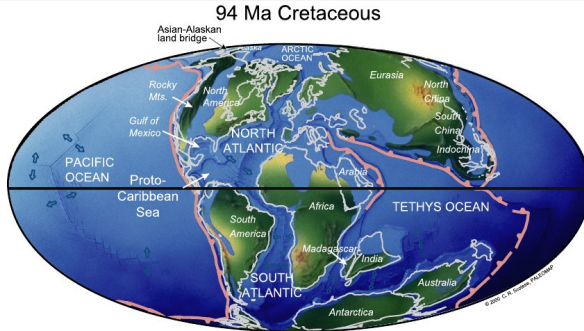
- Pangea broke (part of Africa adhered to North America)
- Climate becoming wetter
- Grasshopper-like insects radiated
- Synapsid reptiles declined, dinosaurs and pterosaurs appeared

Jurassic period



- Atlantic ocean and Rocky mountains appeared
- Peak of dinosaur diversity
- Birds appeared as a lineage of small flying dinosaurs
- In the sea, ammonites and primitive fish dominated

Cretaceous period



- High level of water (second high after Devonian), warm climate even on North and South poles, sea in North Dakota
- Flowering plants appeared and rapidly colonized all land
- Butterflies and flies appeared
- Terrestrial dinosaurs slowly declined and finally disappeared in the very end of period



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



Jurassic park

Jurassic and Cretaceous flora and fauna

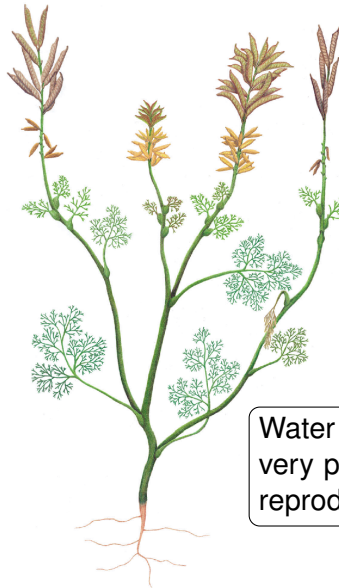


Terrestrial flora

- Spermatophyta
 - Non-angiosperm seed plants (“gymnosperms”)
 - Magnoliopsida (angiosperms, flowering plants)
- Pteridophyta



Archaeofructus (discovered in 2002, Yixian)



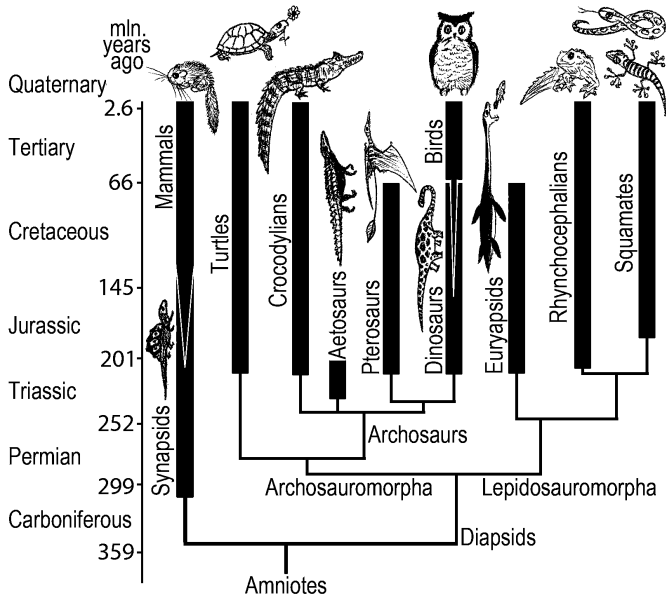
Water plant with
very primitive
reproductive organs

Terrestrial fauna

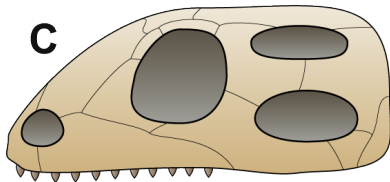
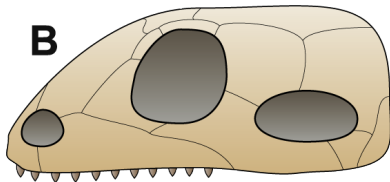
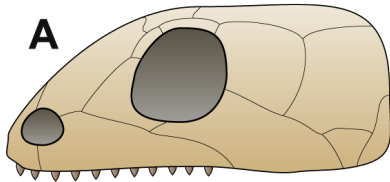
- Amphibia
- Reptilia
 - Synapsida: ancestors of **mammals**, e.g., pelycosaurs
 - Anapsida: **turtles** and many extinct lineages like pareiasaurs from Permian, now frequently united with diapsids
 - Diapsida: the most diverse reptilian group
- Aves (departed from Diapsida)
- Mammalia (in transition from synapsid reptiles to core mammals)



Reptiles, mammals and birds



Subdivisions of reptiles



- A Anapsid skull
- B Synapsid skull
- C Diapsid skull

Tricodont proto-mammal



Diapsid reptiles

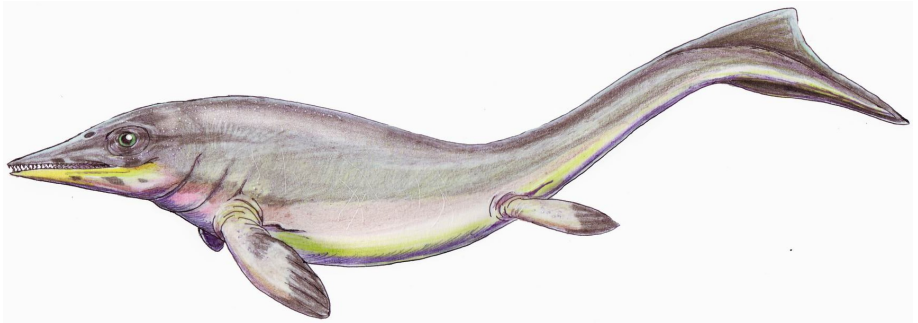
- Ichthyosauria: marine, dolphin-like reptiles
- Sauropterygia: placodonts and plesiosaurs

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



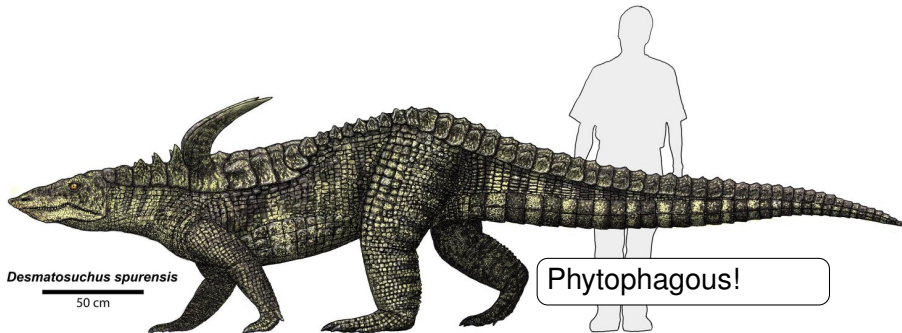
Proterosuchid



Chasmatosaurus
from movie



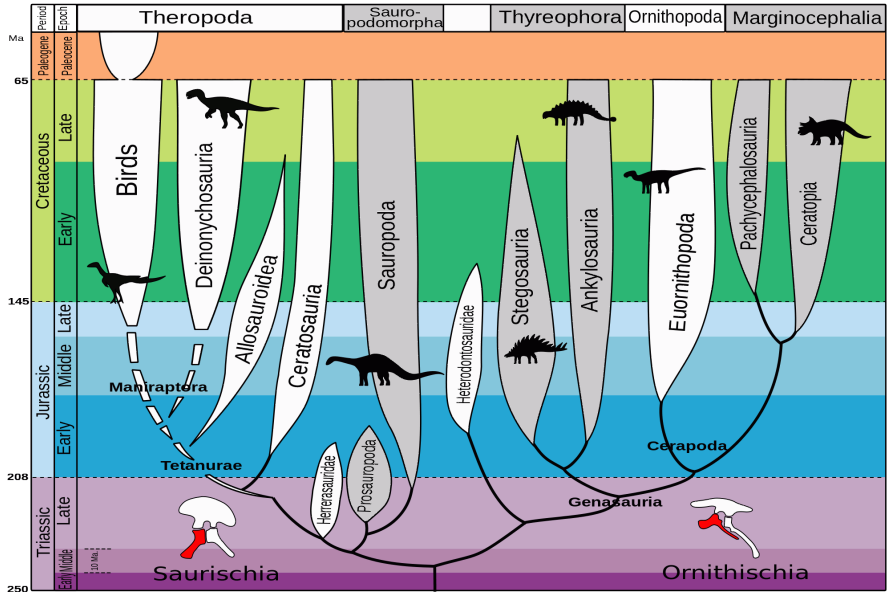
Aetosaur



Dsungaripterus pterosaur



Dinosaurs in time



Early ornithomimid *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



For Further Reading



Seed.

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



Reptiles.

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



Dinosaurs.

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

