Lecture 14: Jurassic 2

Allosaurus and *Stegosaurus* by Gregory Paul (source)

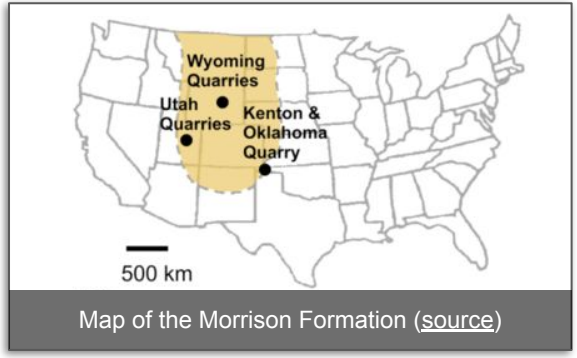
Dinosaur ecology

- **Ecology**: the study of *relationships* among living organisms and their physical environment
- Dinosaurs were dominant, but not isolated
- Understanding the creatures that lived around them help us understand the world dinosaurs lived in

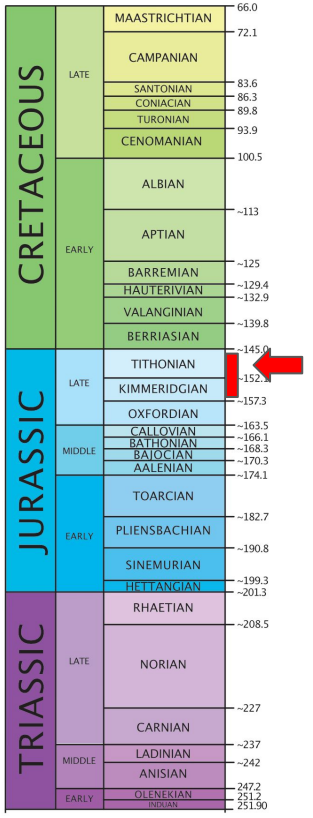
Morrison Formation environment by Brian Engh (source)

Fossil Deposit: The Morrison Formation

- A sequence of late Jurassic sedimentary rock (~156–147 Ma) found in the western United States & Canada



Map of the Morrison Formation (source)



Fossil Deposit: The Morrison Formation

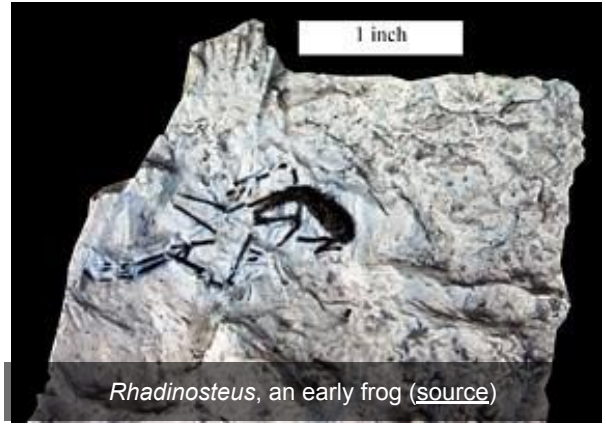
Fossil bed from Dinosaur National Monument, Utah (source)

- Relics of rivers and floodplains; evidence of wet/dry seasons
- Rich in dinosaur fossils representing the three major clades (~40 genera total). Similar fossils found in the Lourinhã Formation in Portugal

Non-dinosaur fossils of the Morrison Formation

Bucklandia (a cycad)

Iridotriton, an early salamander (source)



Rhadinosteus, an early frog (source)

Glirodon, a Jurassic mammal

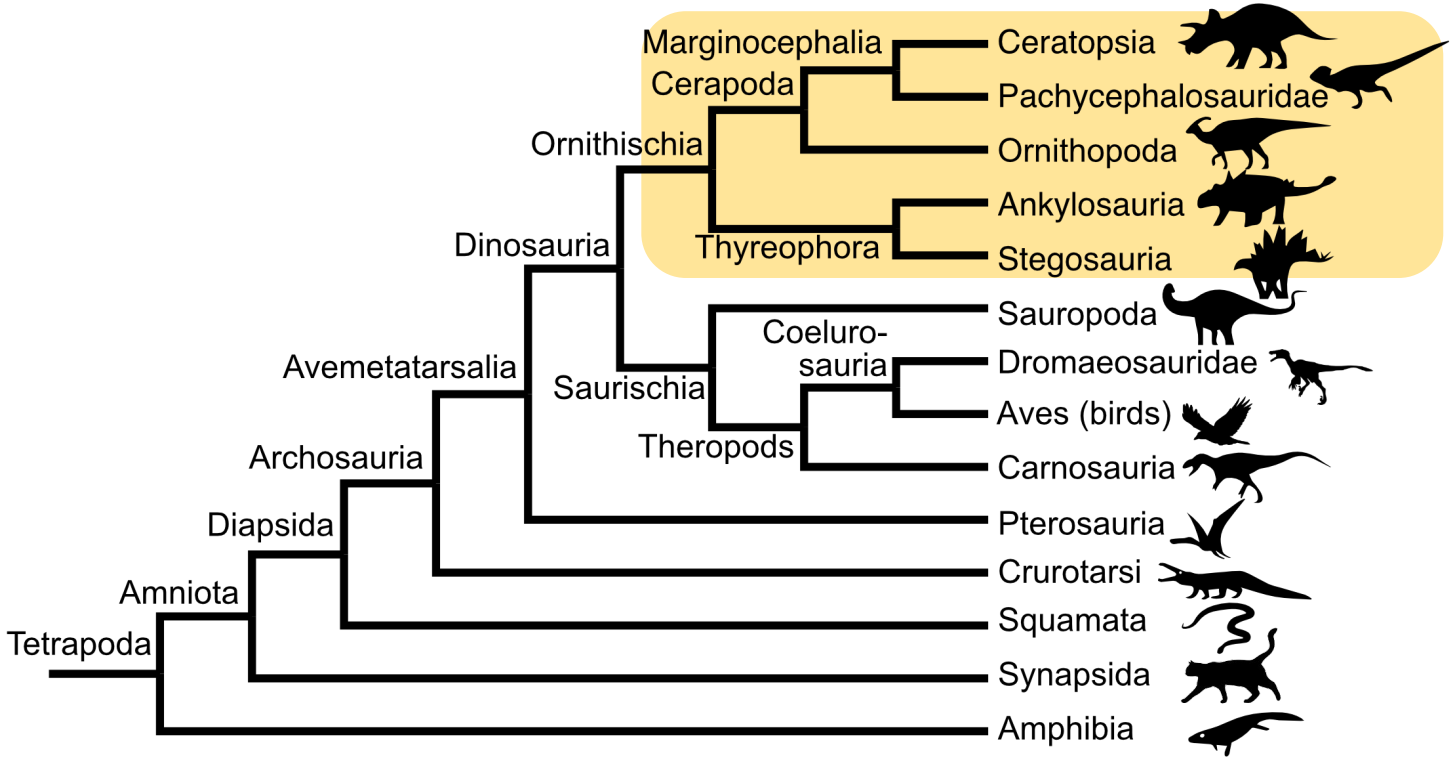
Dorsal

1 inch

Ventral

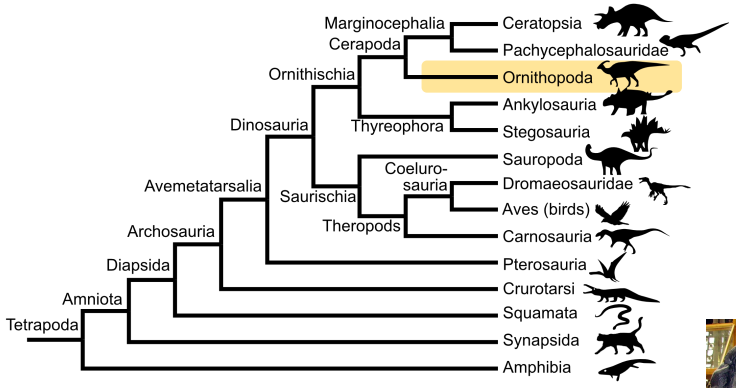
1 inch

Jurassic diversification of Ornithischians



Ornithopods

ornithopods
(clade **Ornithopoda**)
Greek: “ornith” = bird; “pod” = foot




Iguanodon foot (source)


Iguanodon skull (source)

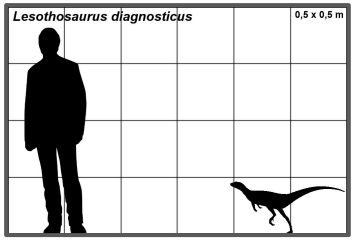
- characteristic three-toed feet
- Traits:
  - no armour
  - horny beak
  - elongated pubis
  - no hole in the lower jaw (no mandibular fenestrae)

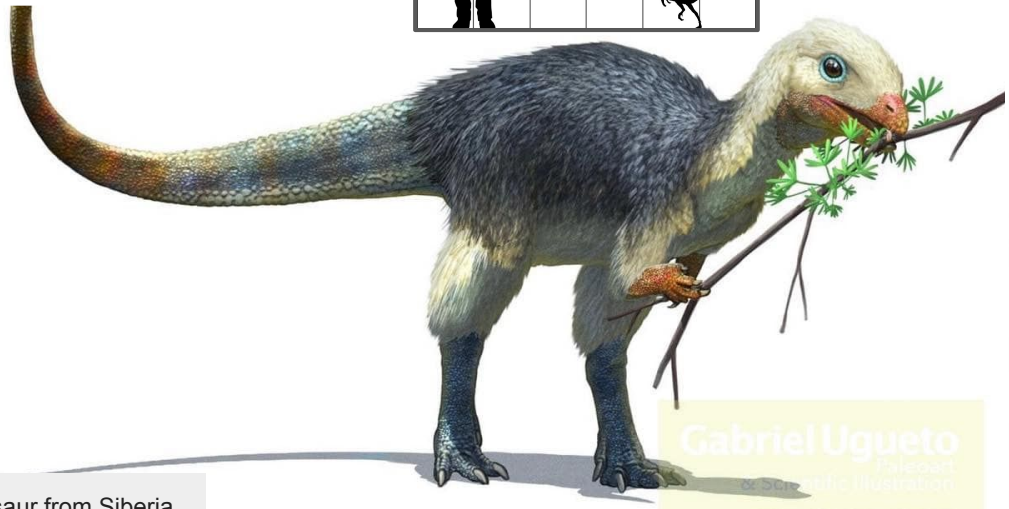
Key Taxon: *Lesothosaurus*

Lesothosaurus

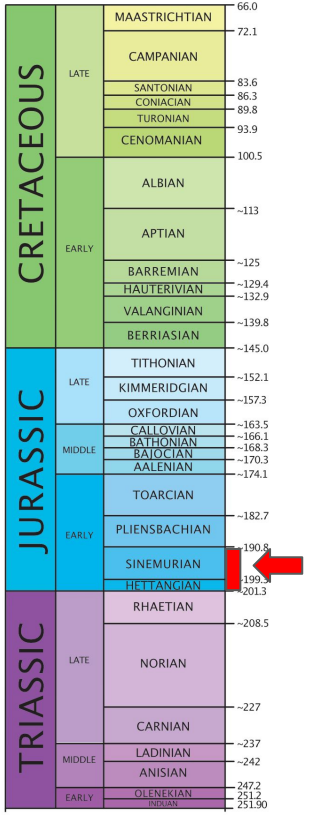
"Lesotho" = A south African country; Greek: "saurus"=lizard

- One of the first ornithopods





Lesothosaurus by Gabrielle Uguero (source)

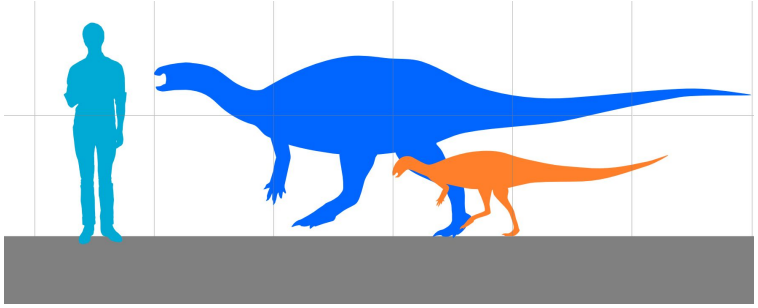


Godefroit, Pascal, et al. "A Jurassic ornithischian dinosaur from Siberia with both feathers and scales." *Science* 345.6195 (2014): 451-455.

Ornithopods of the Morrison formation

- Included small and medium sized herbivores

Dryosaurus by Raul Ramos (source)

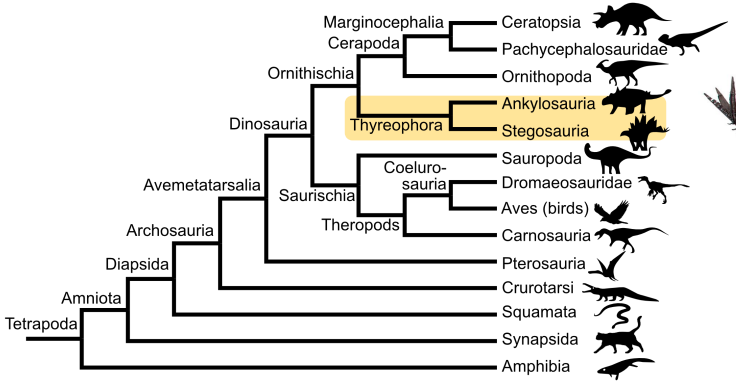


Camptosaurus by NPS/Bob Walters, Tess Kissinger (source)

Thyreophorans

thyreophorans
(clade **Thyreophora**)
Greek: “thyreoph” = shield bearer

- Traits:
  - body armor lined up in longitudinal rows along the **dorsal** portion of the body

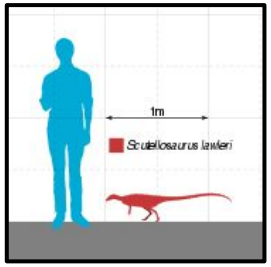


Key Taxon: *Scutellosaurus*

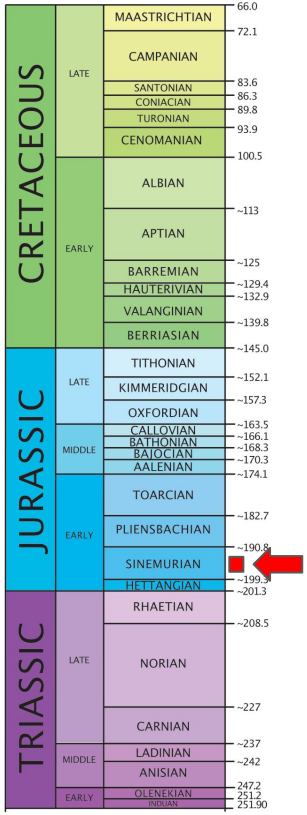
Scutellosaurus

Greek: “scutello” = little-shielded; “saurus”=lizard

Scutellosaurus by Gabrielle Uguero (source)



- Found in Arizona
- Short forelimbs and very long tail suggest it could walk on hind legs

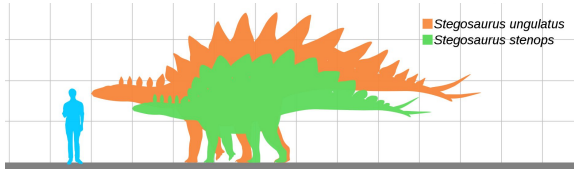


Key Taxon: *Stegosaurus*

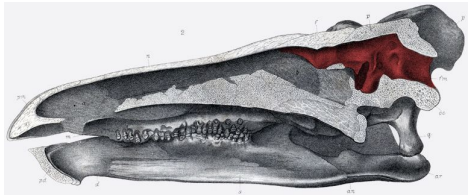
Stegosaurus

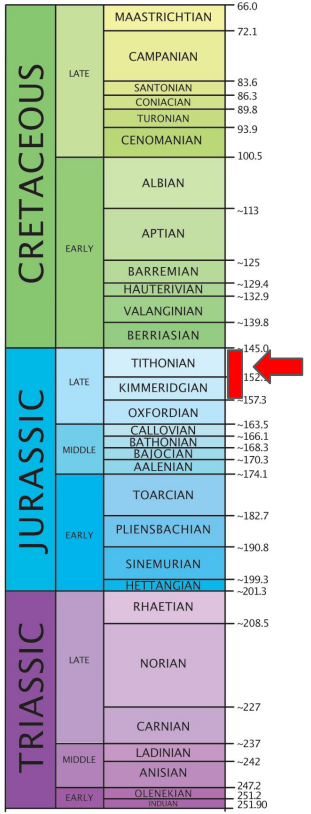
Greek: “stego” = roof “saurus” = lizard

Stegosaurus by Tuomas Koivurinne (source)

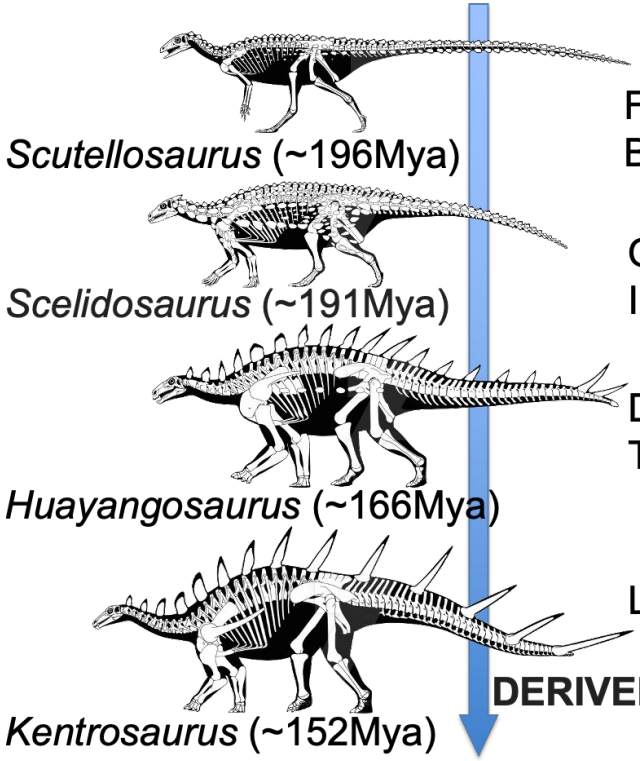


- Tail spikes for defense, function of plates is debated among paleontologists





The evolution of Stegosaurus



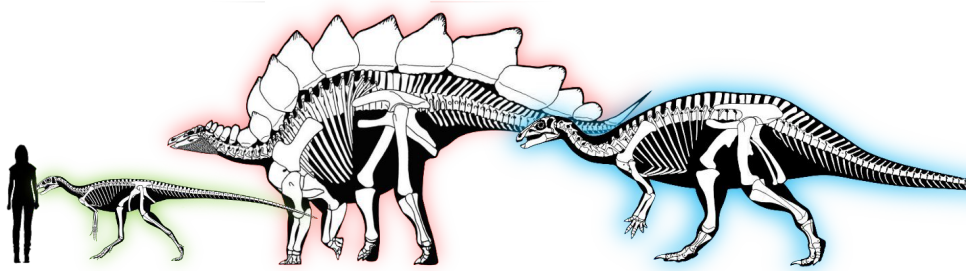
Images by Scott Hartman

Niche partitioning

- **Niche partitioning**: a process where competing species use the environment differently in a way that helps them coexist.

- Not purposeful–the result of natural selection and competition

- Allows for greater diversity



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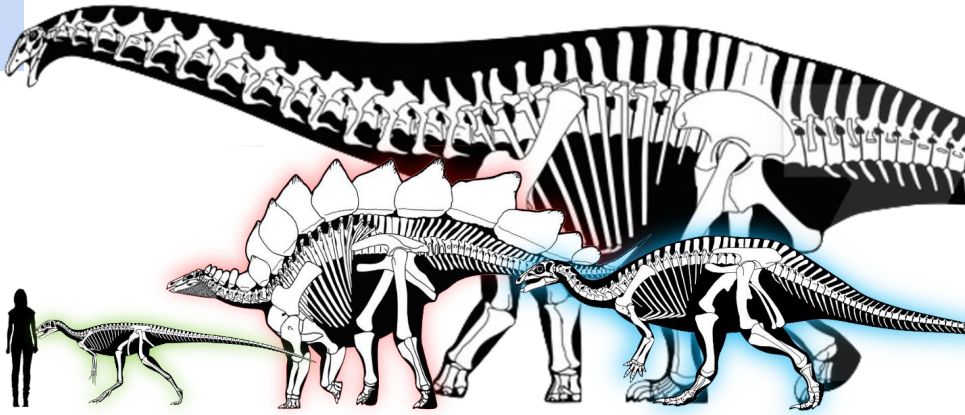
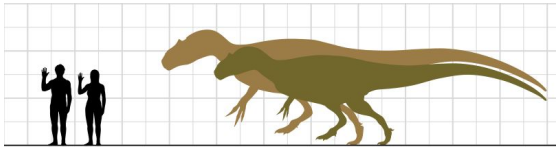


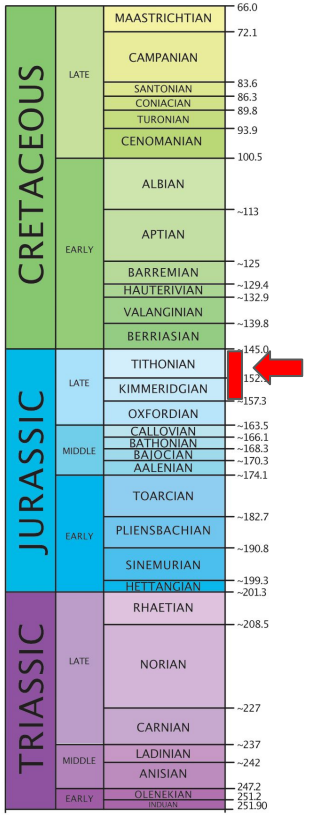
Theropods of the Morrison formation

Allosaurus
Greek: “allos” = different “saurus” = lizard

- *Allosaurus* was the most common predator in the Morrison formation
- ~30 feet long



Allosaurus skeleton (source)

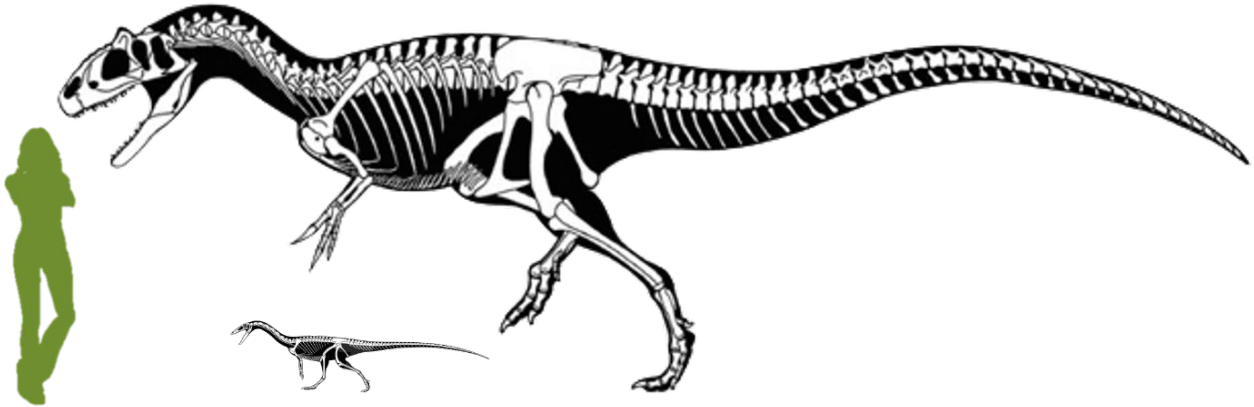


Theropods of the Morrison formation

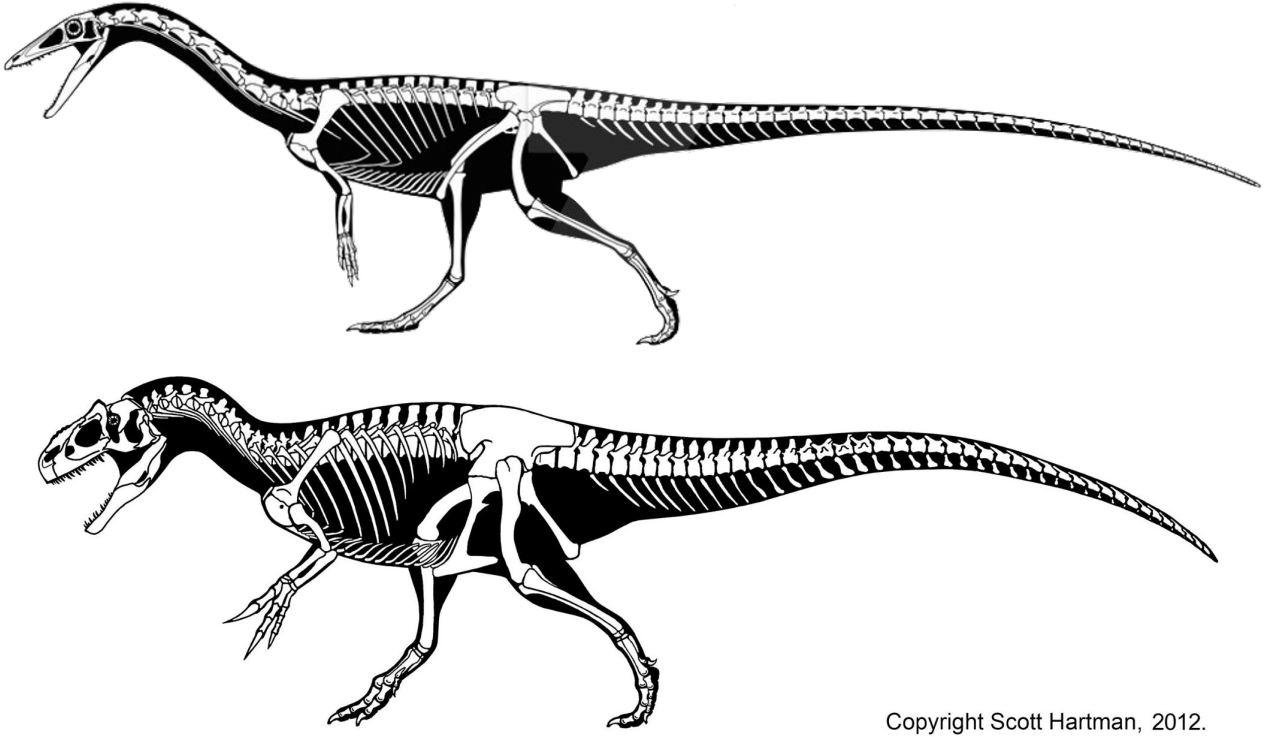
- Strong skull, and flexible jaw, but weak bite force

- Tail vertebrae found with a partially healed puncture wound that fits a *Stegosaurus* tail spike, and a *Stegosaurus* neck plate with a wound consistent with *Allosaurus* bite

Coelophysis vs Allosaurus



Coelophysis vs *Allosaurus*

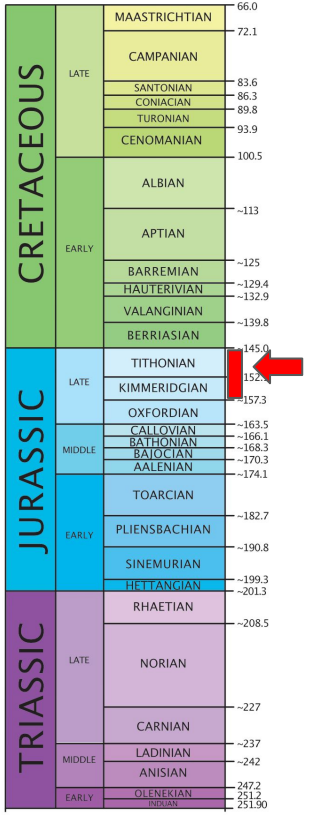


Theropods of the Morrison formation

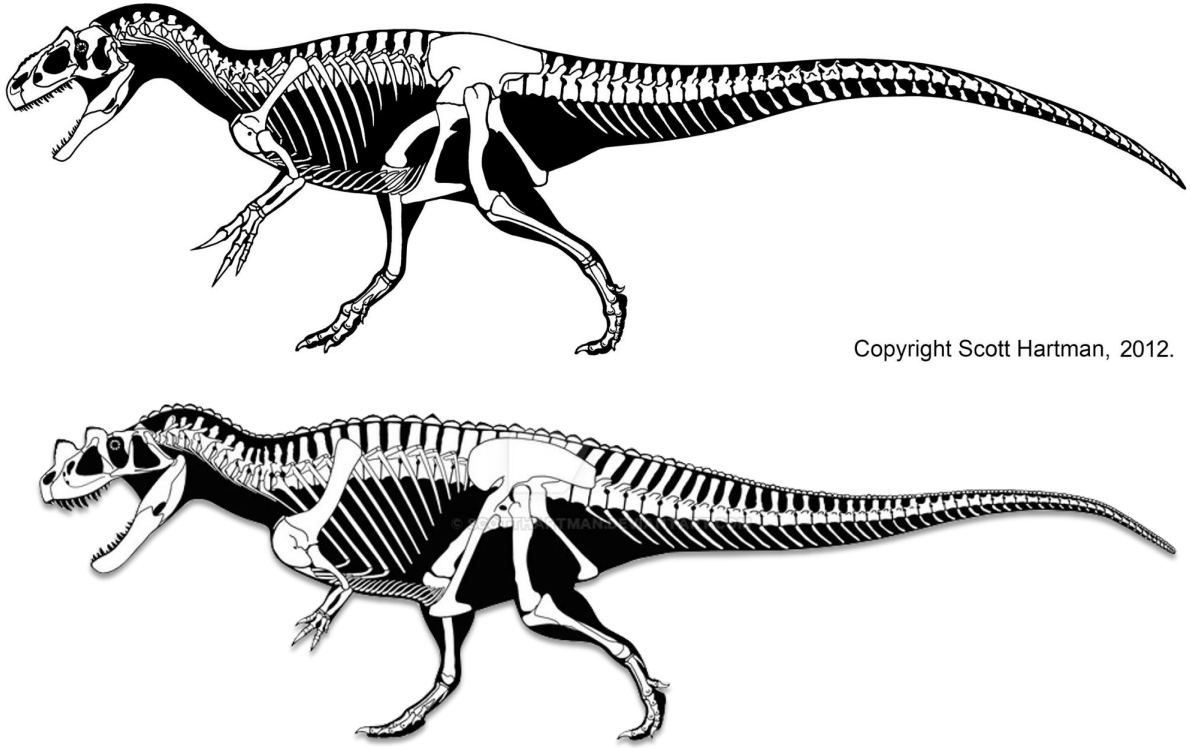
Ceratosaurus

Greek: “cerato” = horn “saurus” = lizard

- About half of the size of *Allosaurus*
- Notable for the elaborate horns over its nose and each eye

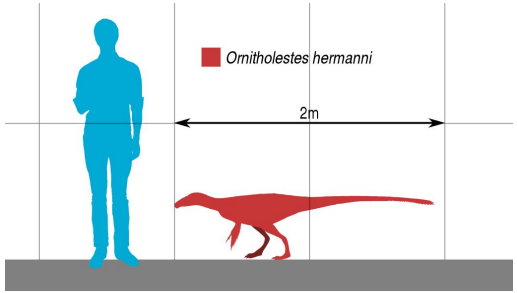


Allosaurus vs Ceratosaurus



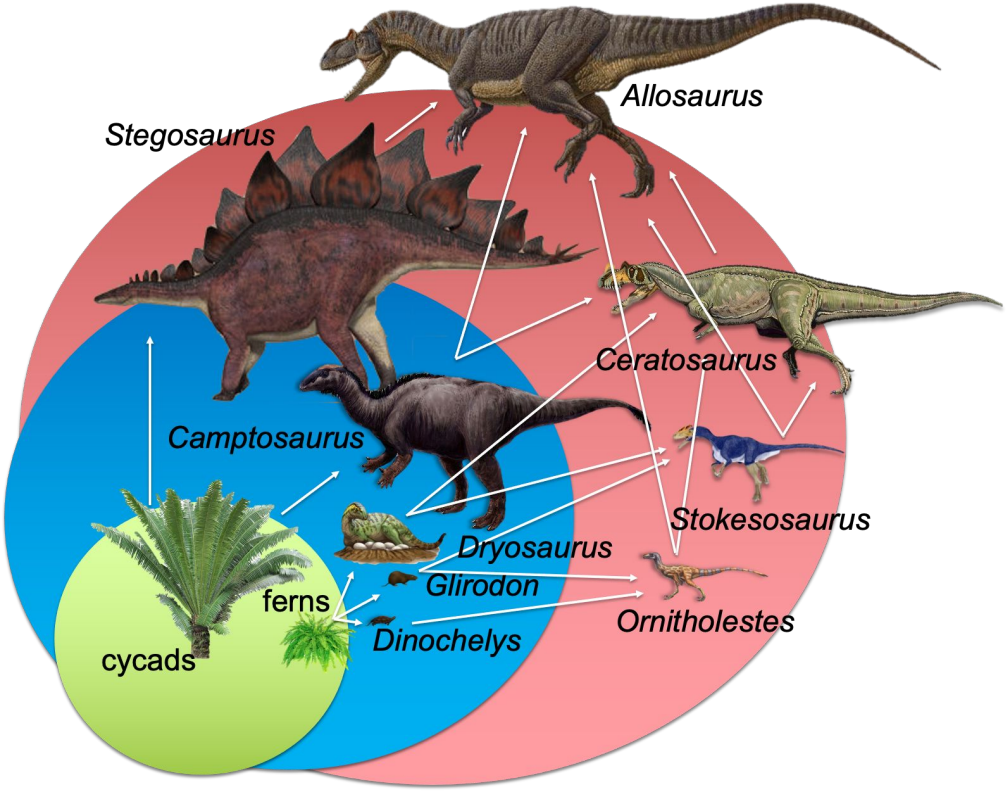
Theropods of the Morrison formation

Ornitholestes (source)



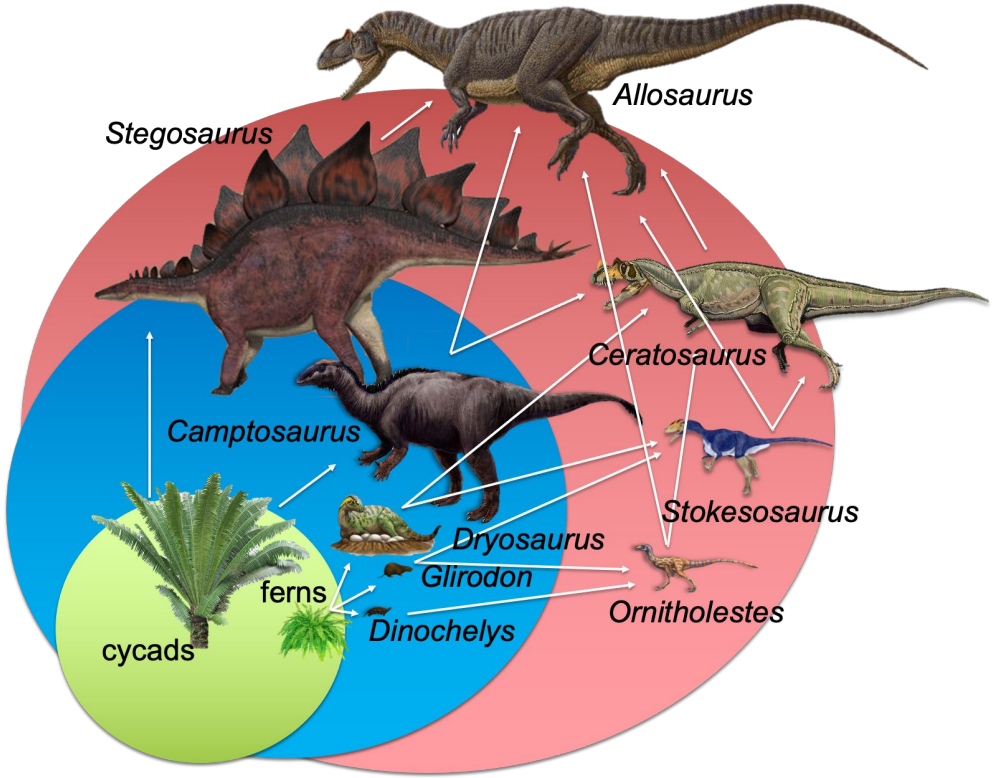
- *Ornitholestes* was one of many small theropods specializing on tiny prey
- Arms were specialized for grasping prey; the range of motion was reminiscent of modern birds

Reconstructing a Jurassic food web

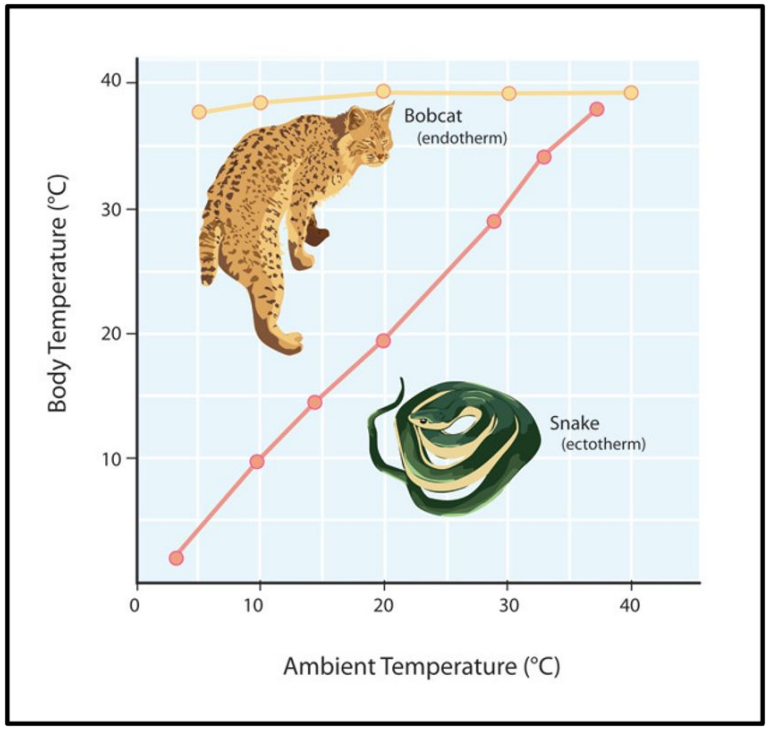


Implications of dinosaur food webs

- Only ~10% of energy is retained as you move up each level in the food web
- Less **biomass** can be sustained at each level (e.g. fewer predators than prey)

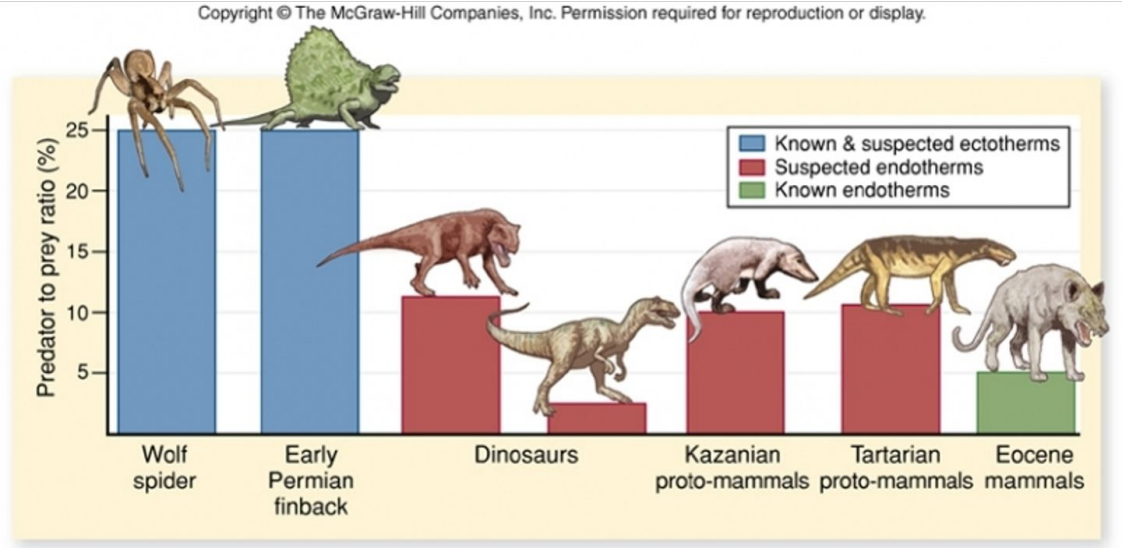


Implications of dinosaur food webs



- Endotherms require more energy to maintain a constant body temperature
- Endotherms therefore need more food than ectotherms
- How would this impact the number of predators compared to prey?

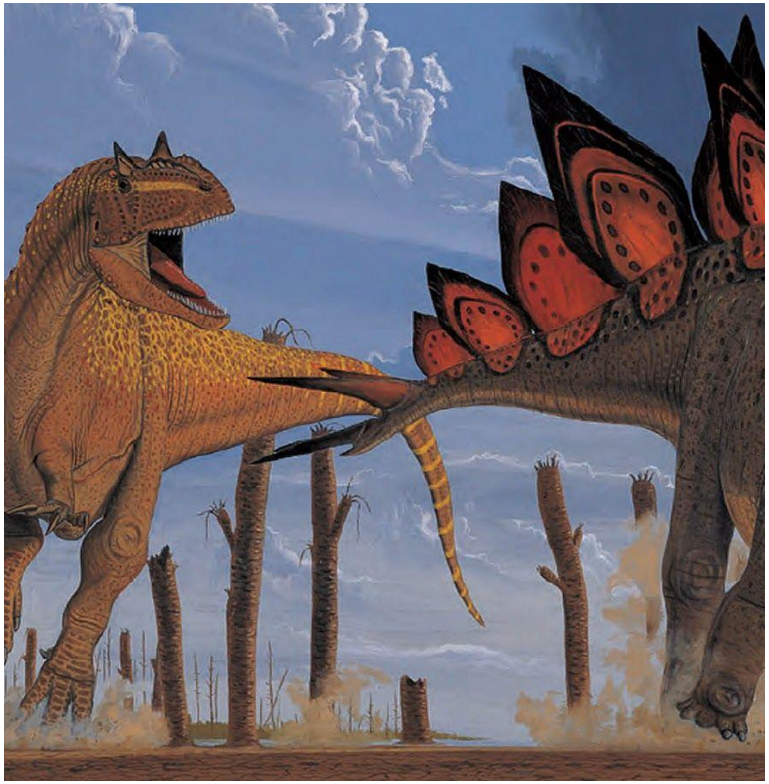
Implications of dinosaur food webs



- The predator/prey biomass ratio for the Morrison Formation as a whole is 8.6%. The values range from 5.1–11.9% at various stratigraphic levels

Foster, John R. Paleoecological Analysis of the Vertebrate Fauna of the Morrison Formation (Upper Jurassic), Rocky Mountain Region, USA: Bulletin 23. Vol. 23. New Mexico Museum of Natural History and Science, 2003.

Conclusion



- Plants and small animals often tell you more about the environment than large animals
- **Niche partitioning** explains the diversity of dinosaur forms
- Adaptations in dinosaur skeletons help us reconstruct food webs
- **Predator : prey ratios** allow us to reconstruct the metabolism of prehistoric carnivores

Next Class