



# Ornithopoda

## The ‘duck-billed’ dinosaurs

Evolution

Space and Time

Basal Ornithopods

Diet

Brains

Movement

Behavior



Genosauria  
Cerapoda  
Marginocephalia  
Pachycephalosauria  
Ceatopsia  
Ornithopoda: ‘bird feet’

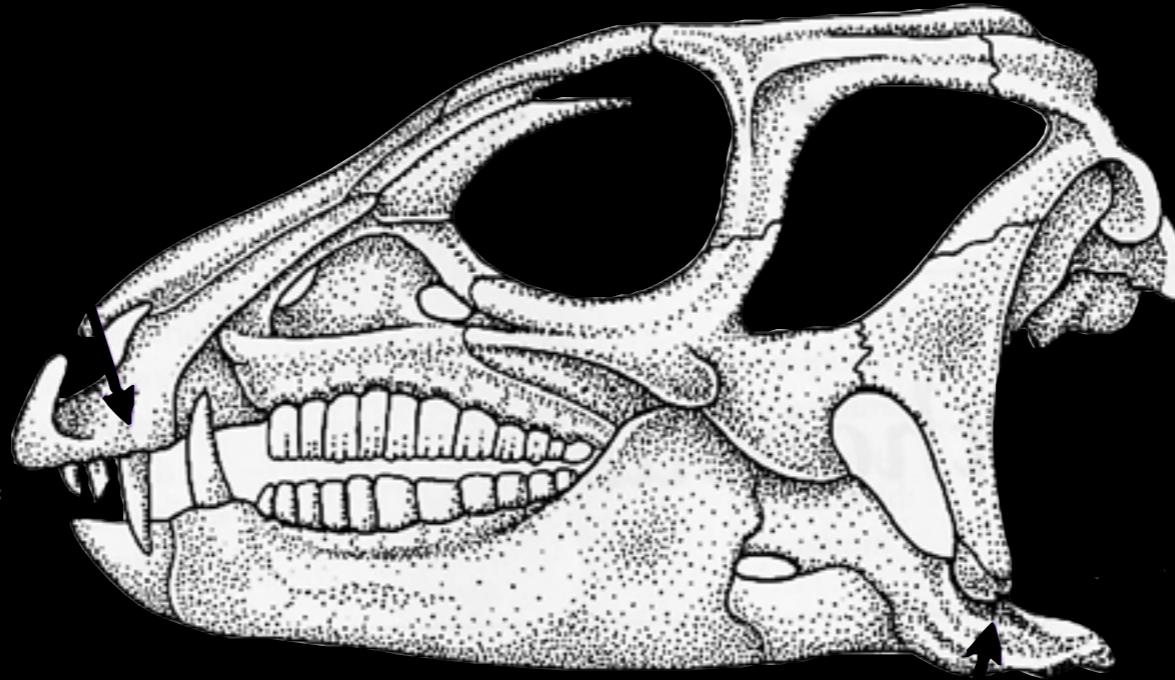


*Iguanodon*



*Edmontosaurus*

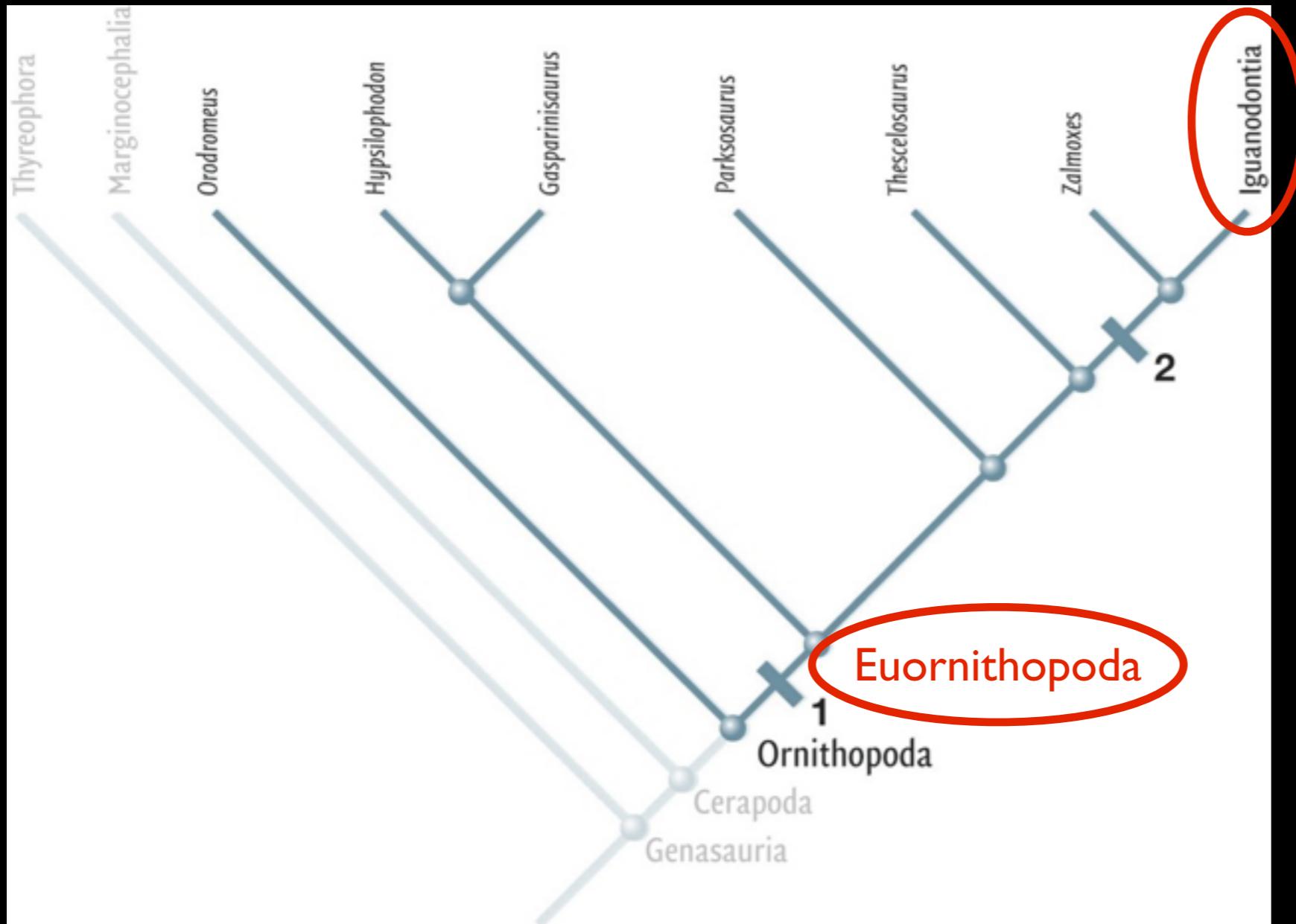
**Primitive Characteristics:** basal Ornithopods are ‘typical’ Ornithischians  
Opisthopubic condition  
No fenestra in mandible



**Derived Characteristics:**  
**Ventrally offset premaxillae**  
**Very low jaw joint**

*Small, bipedal*

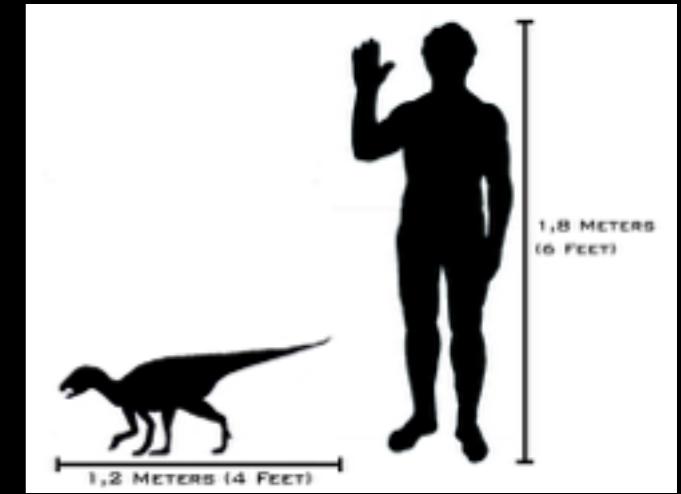
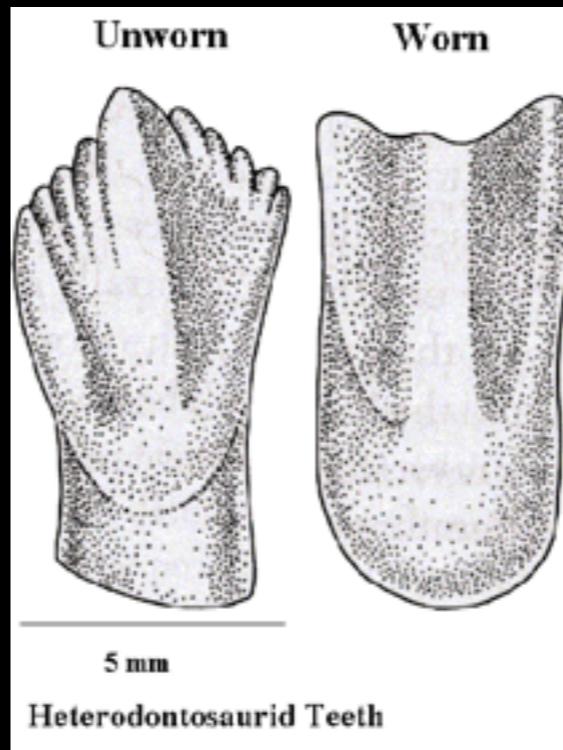
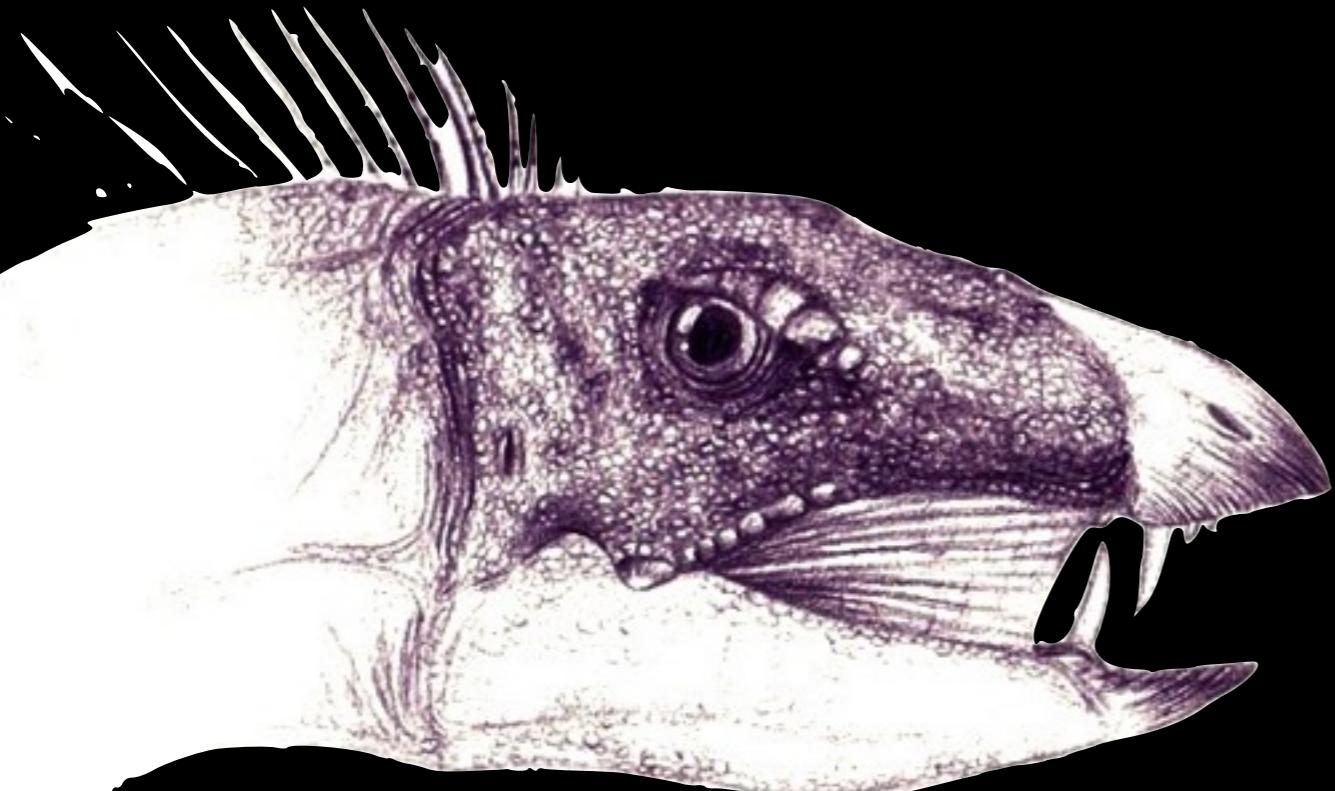
*Derived: Larger, mainly quadrupedal*



## Early Ornithopods & Euornithopods

Small, bipedal

Heterodontosaurids may have been basal Ornithopods (or basal Ornithischians, depending on who you ask)



*Heterodontosaurids: Not Primitive...  
unique chewing.*

*Three kinds of teeth*

*Anterior: Snipping/Cropping*

*Posterior: Chewing*

*Tusks/Caniforms: Potentially display/courtship*





## Heterodontosaurids: Kinetic LOWER JAW

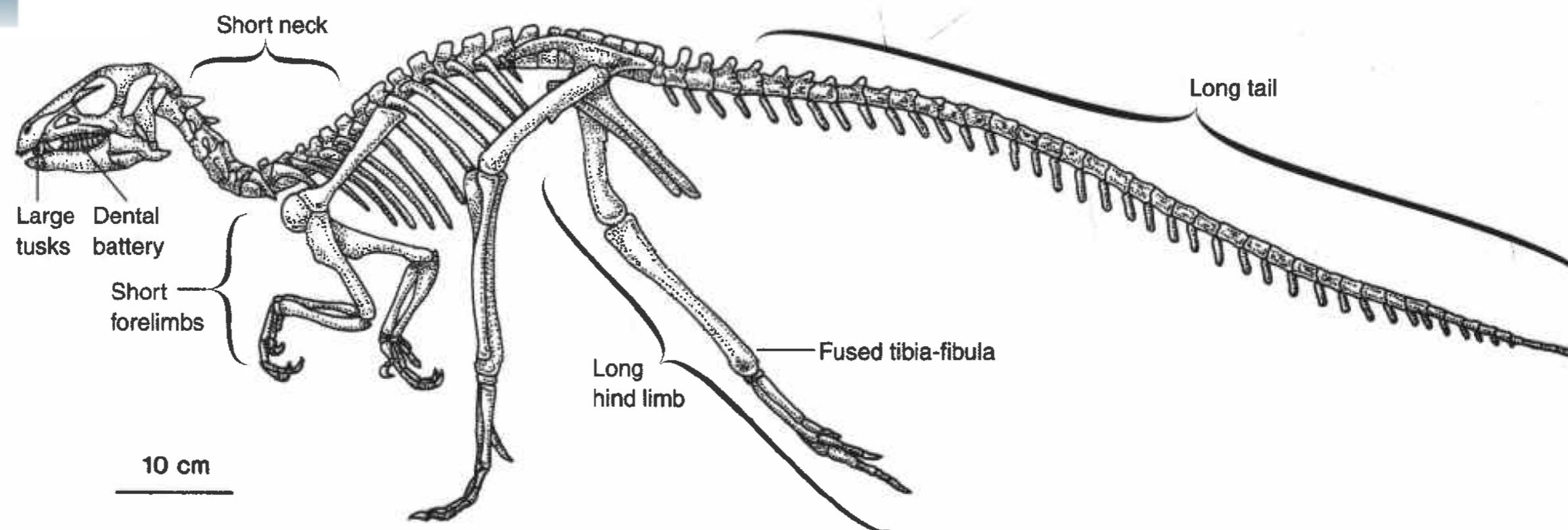
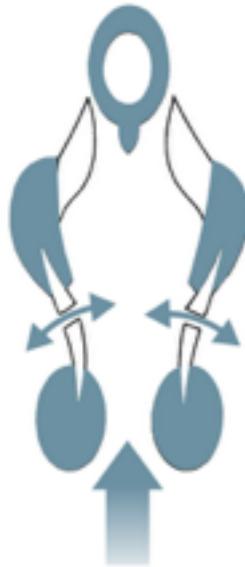


FIGURE 7.4

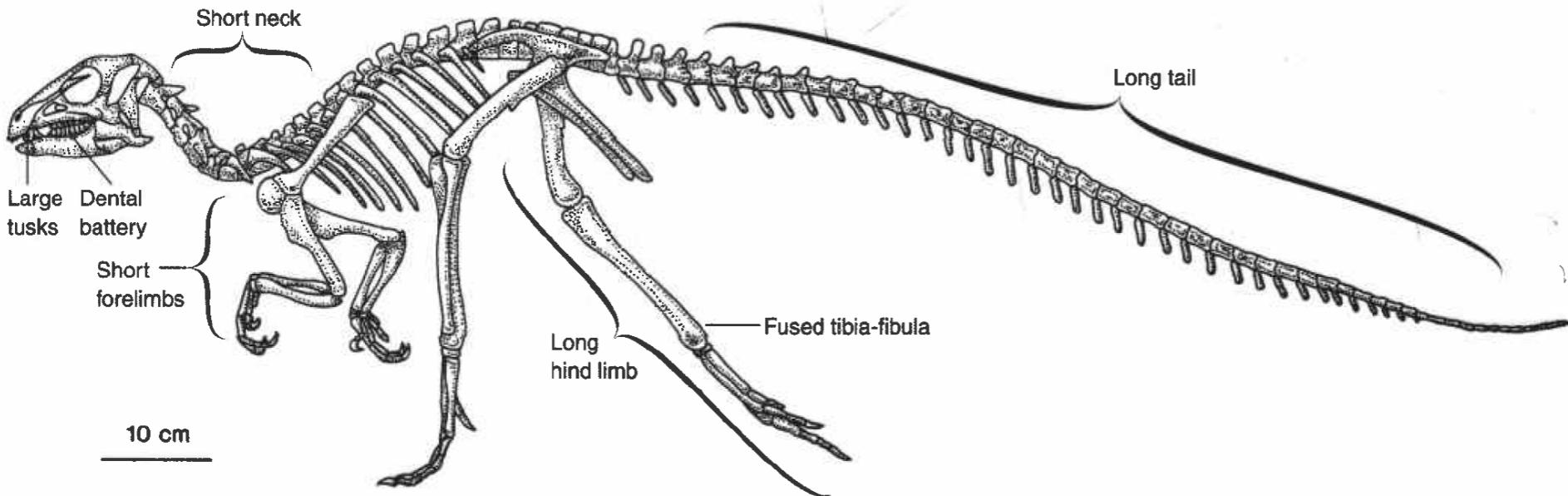
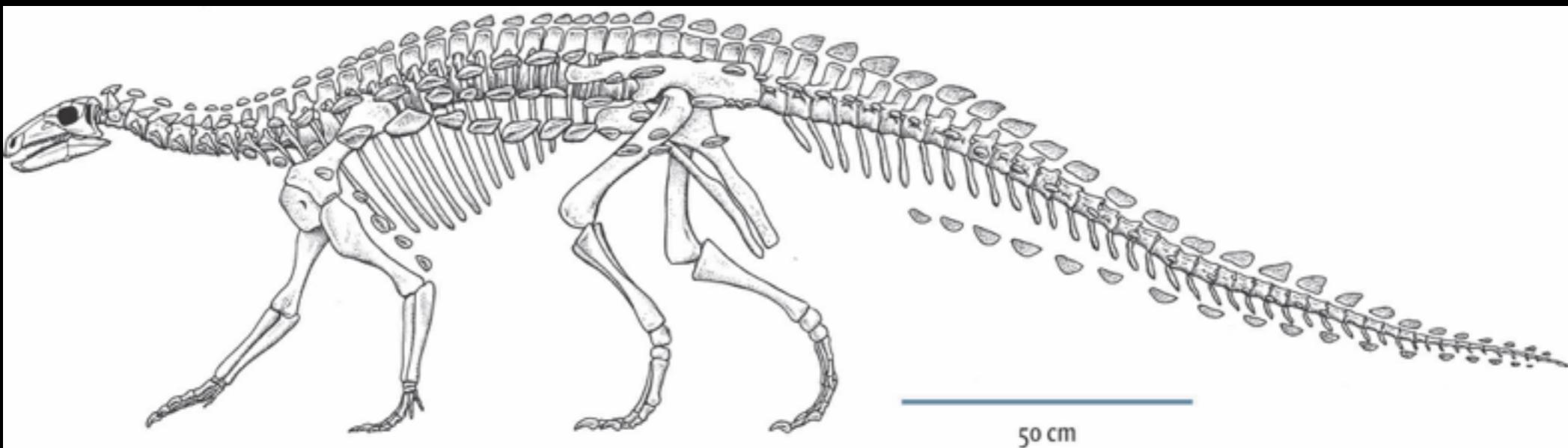


FIGURE 7.4

*Heterodontosaurus*: Short femur; Long tibia/fibula = fast

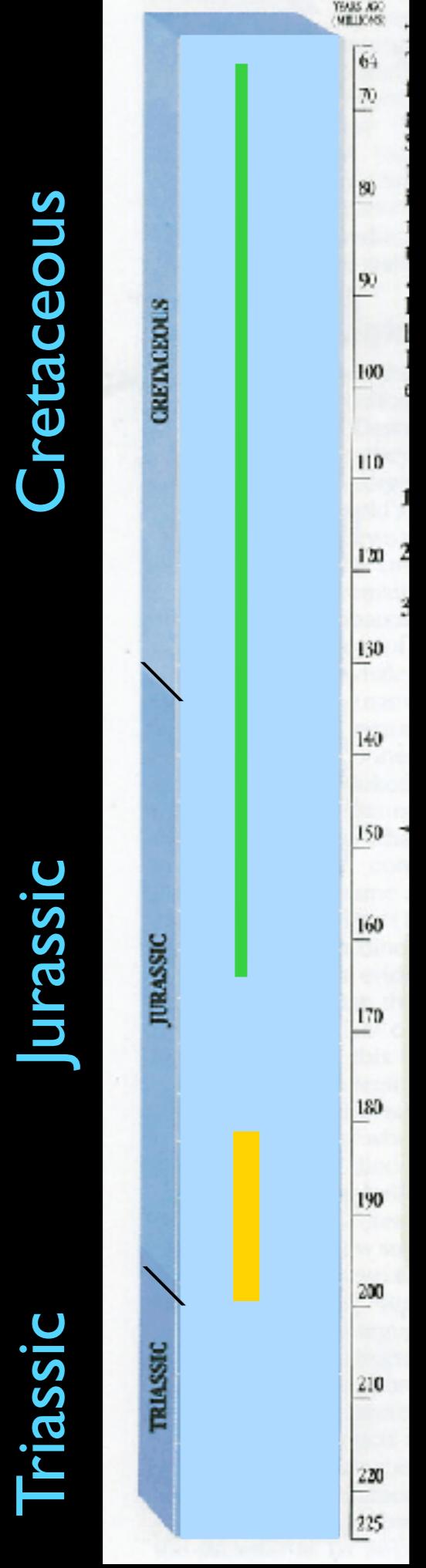
vs.



*Scelidosaurus* (basal Thyreophoran): Long femur; Short tibia/fibula = slow

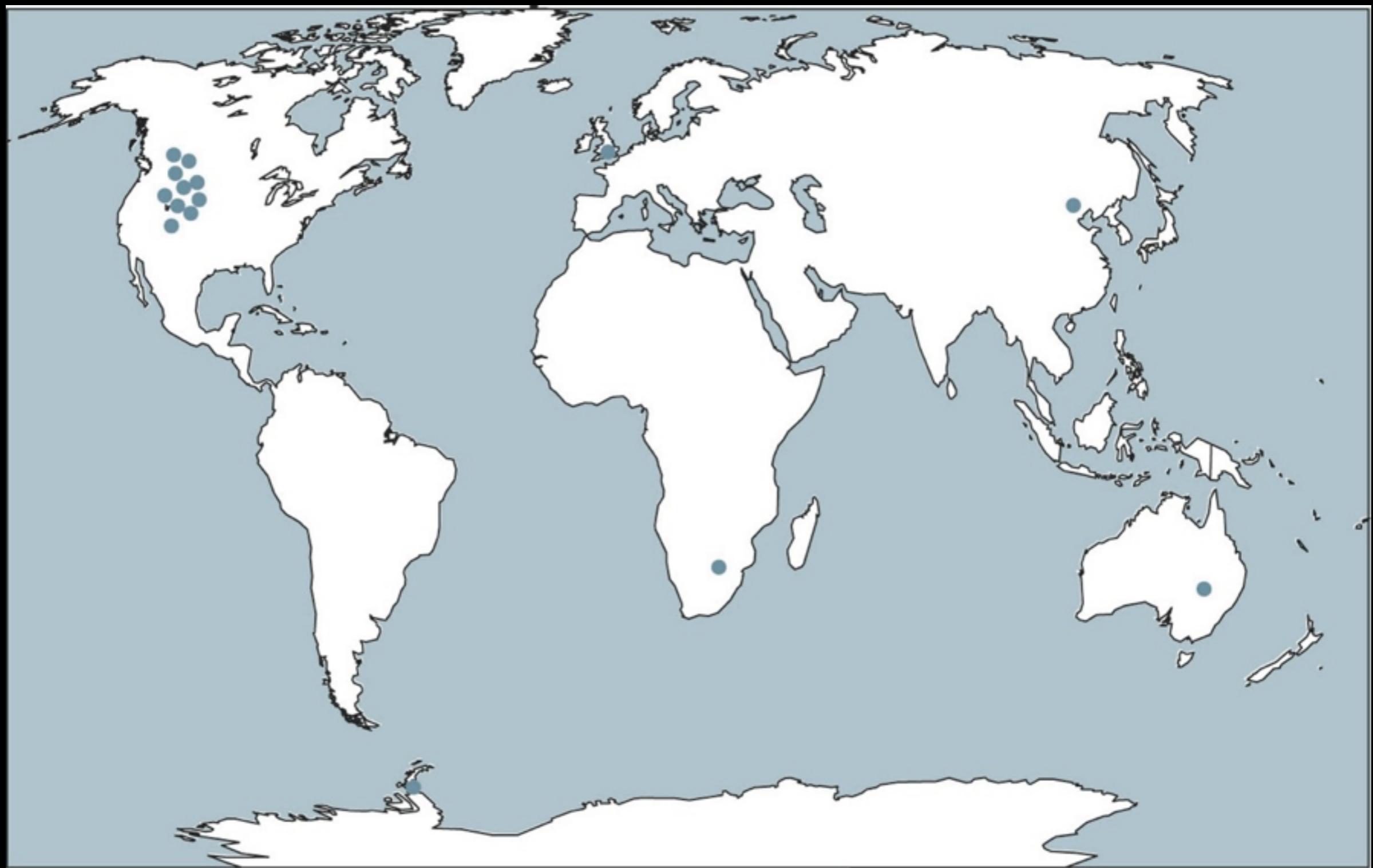


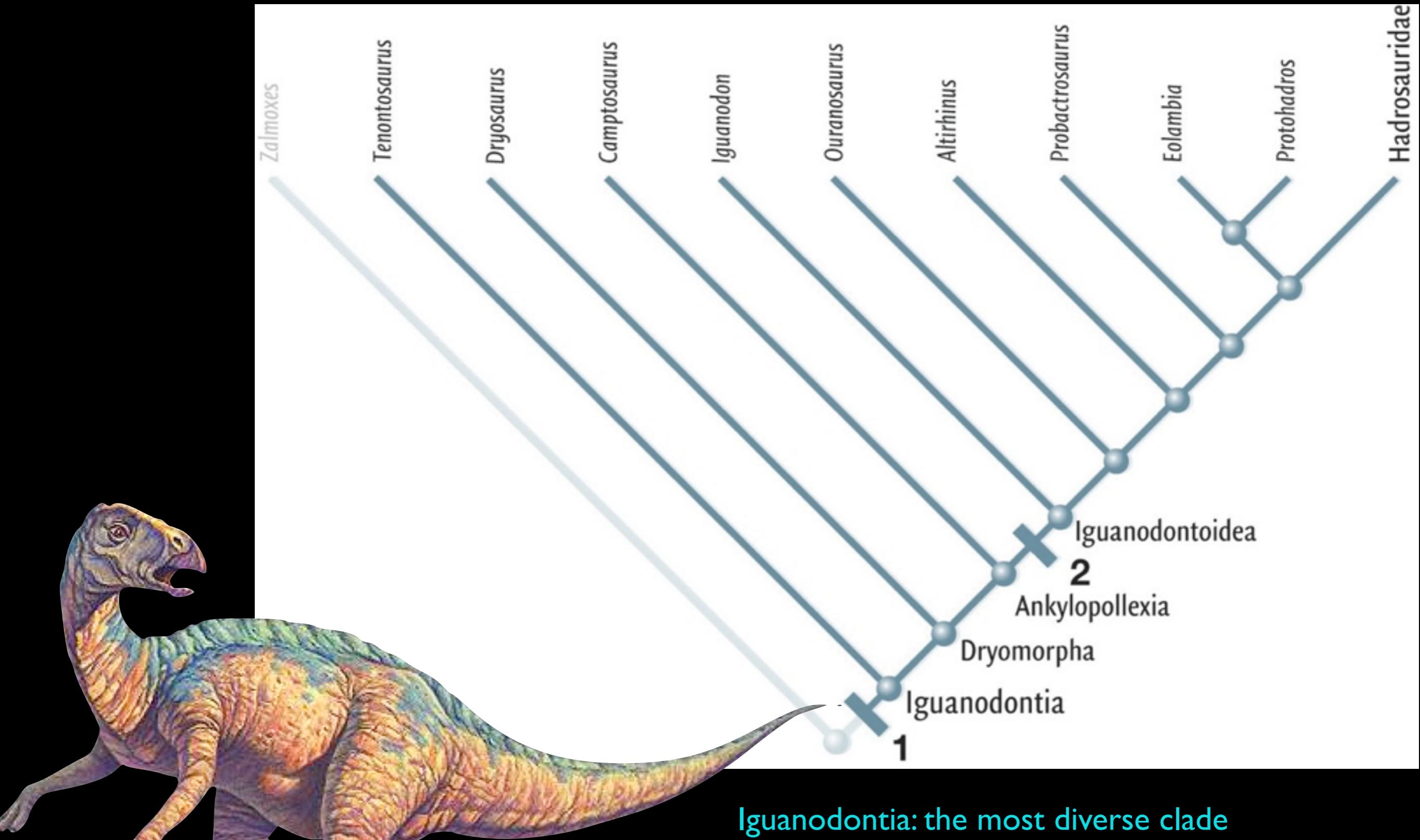
*We will explore this concept more with  
Theropod dinosaurs*



Basal euornithopod time range

Heterodontosaurid time range





**Iguanodontia: the most diverse clade**

- Toothless premaxilla
- Smooth, rounded predentary
- Generally larger
- Derived forms (Ankylopollexia): Expanded dental batteries & spiked thumb

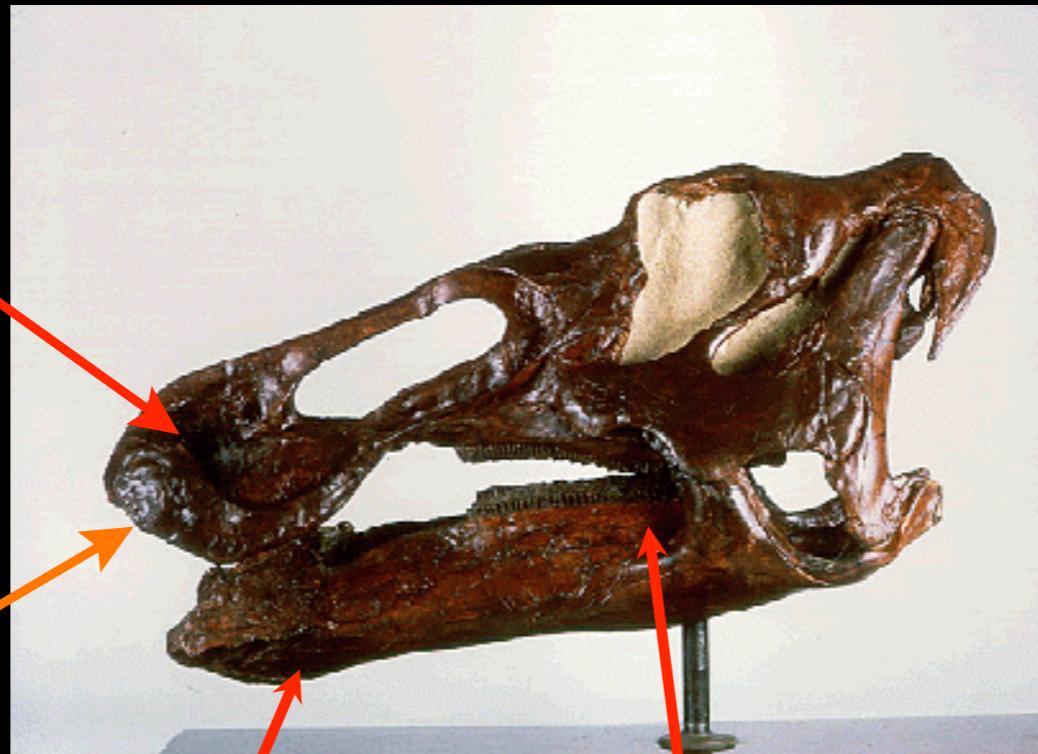
**Tenontosaurus**

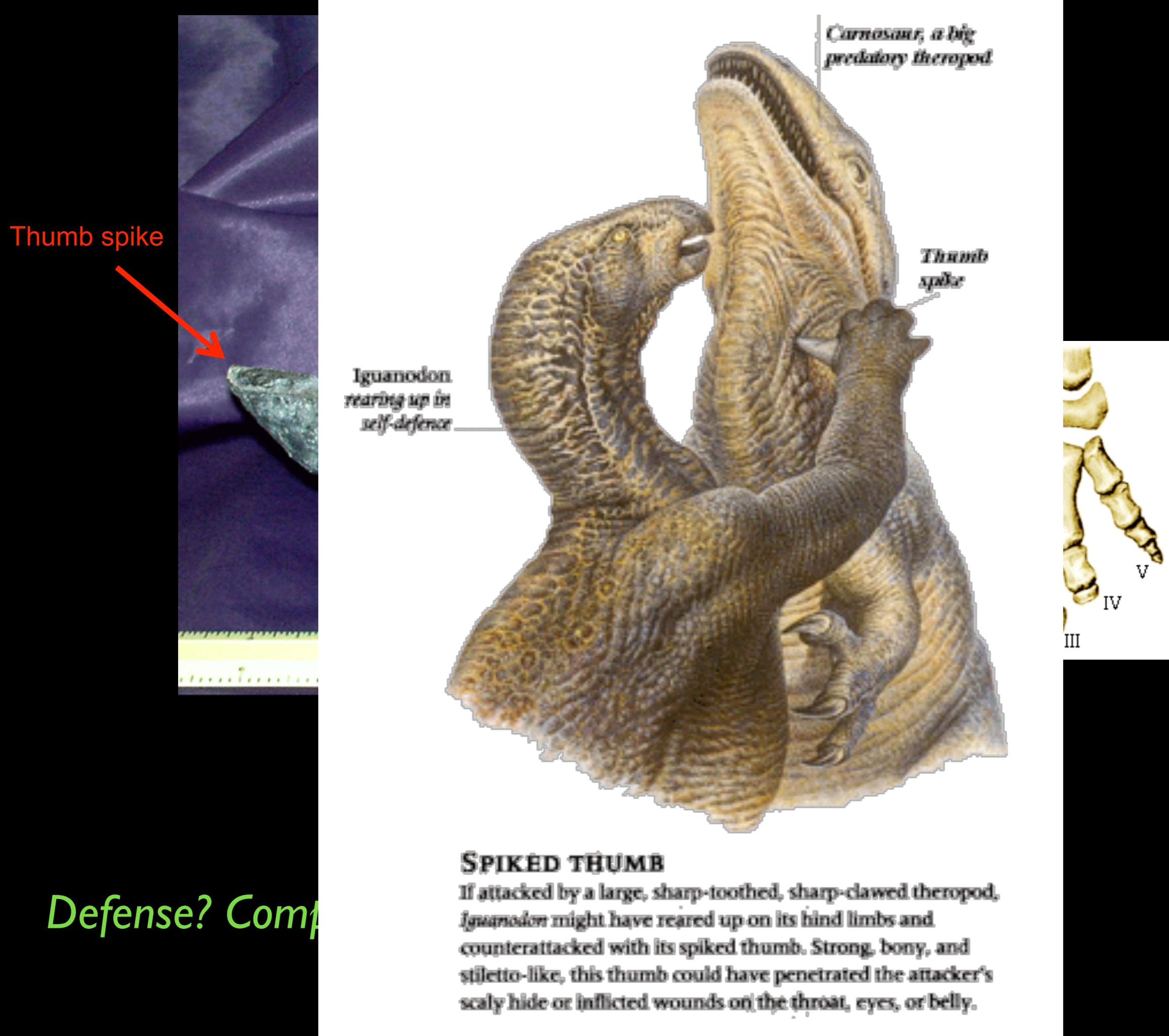
everted pmx

no pmx teeth

broad predentary

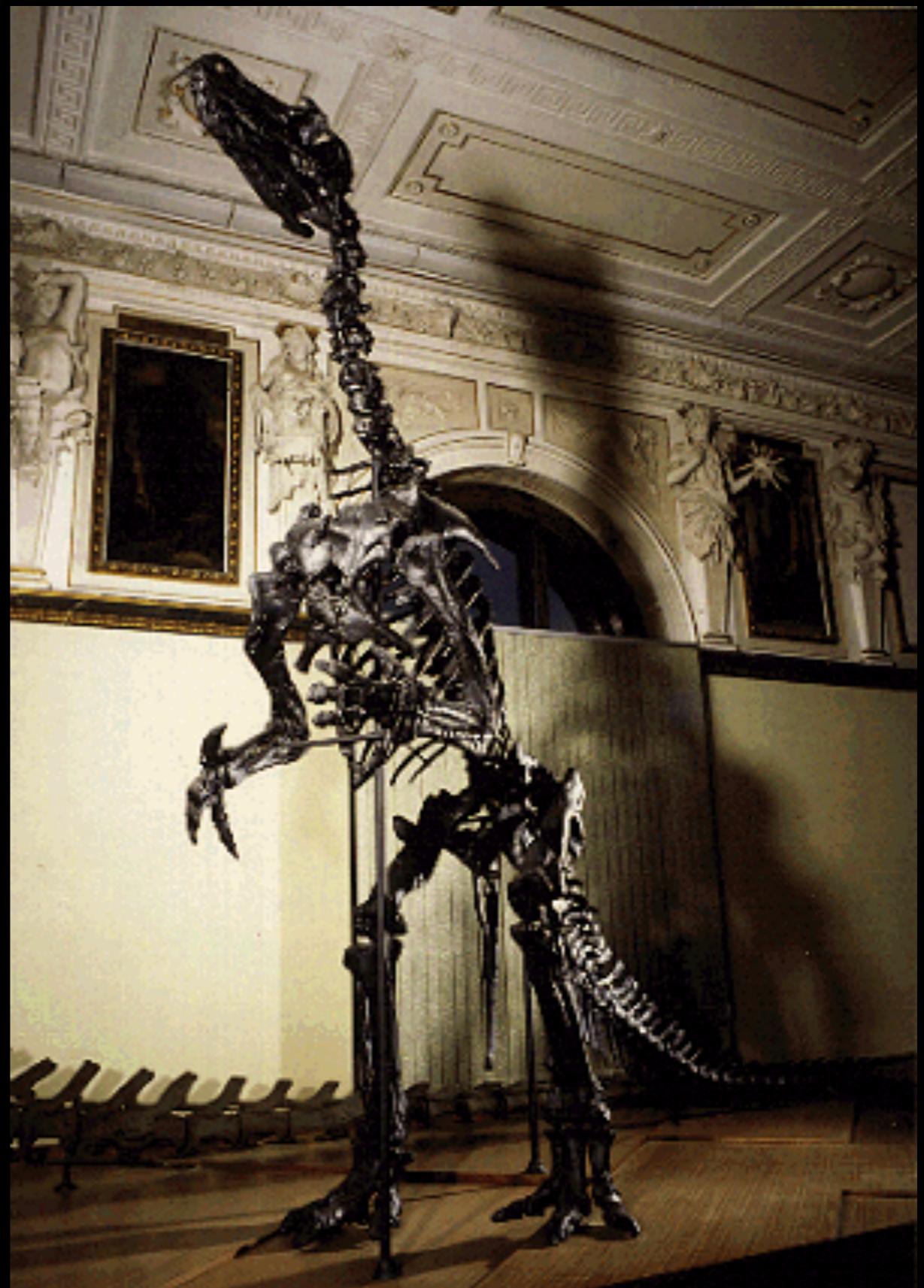
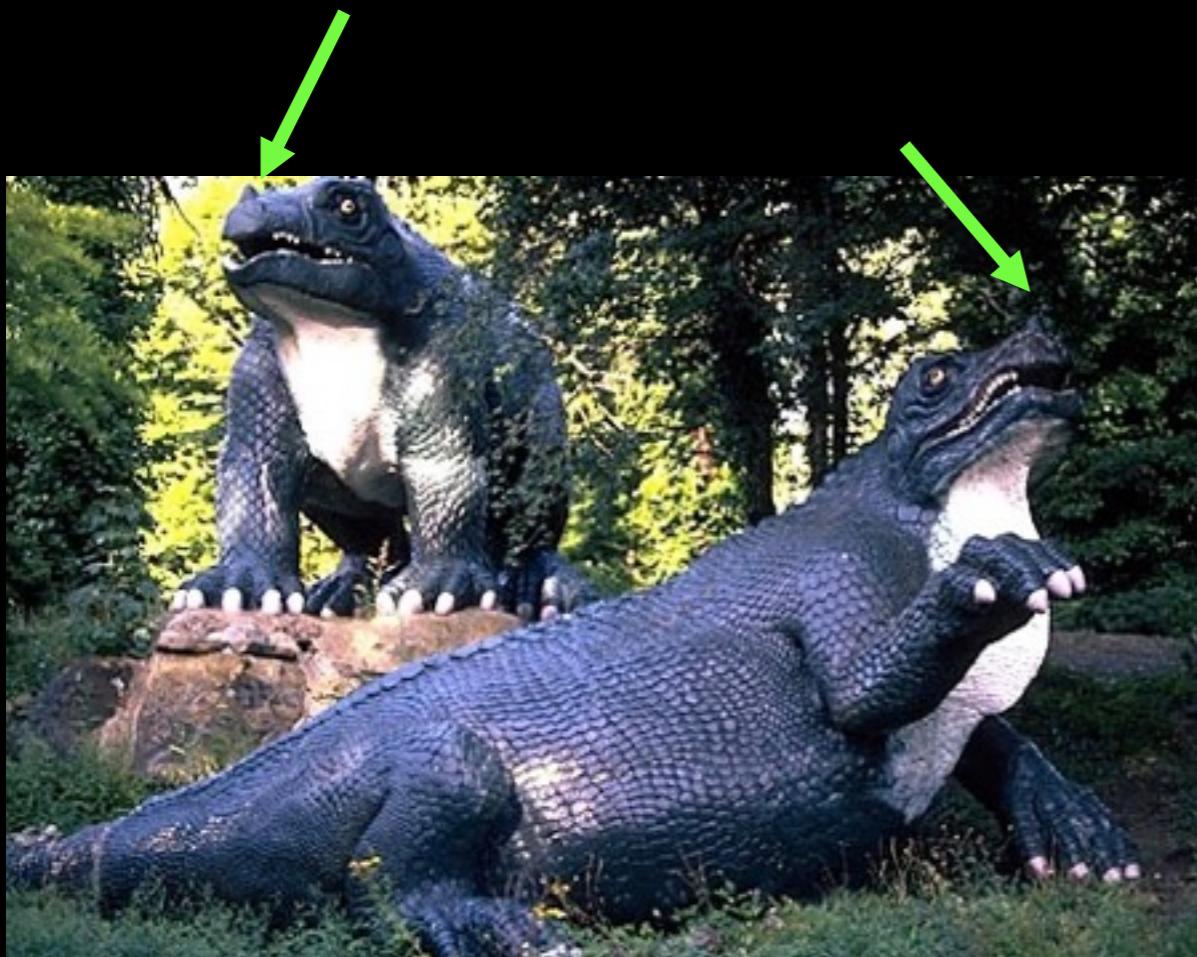
many teeth in dental battery



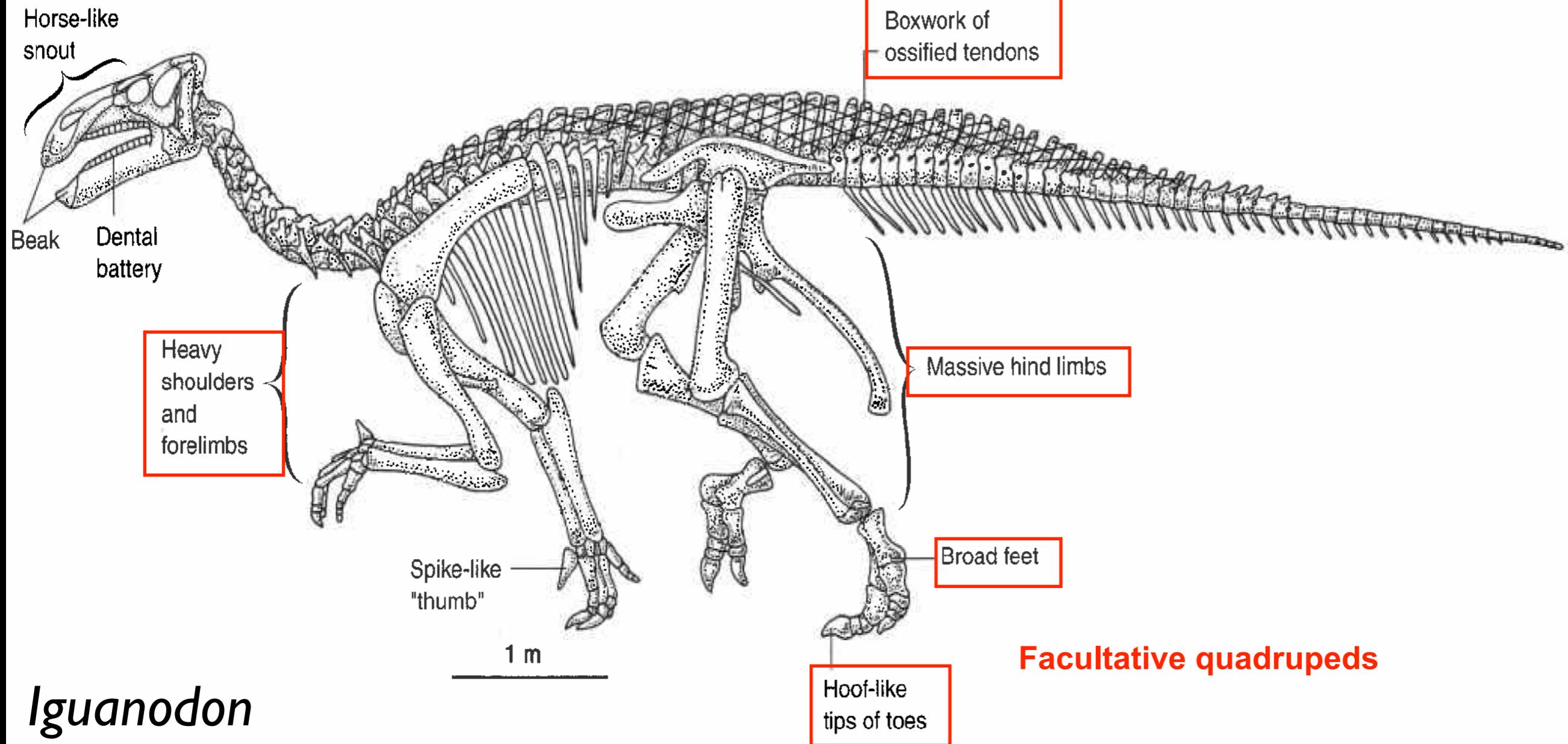


*Defense? Complex*

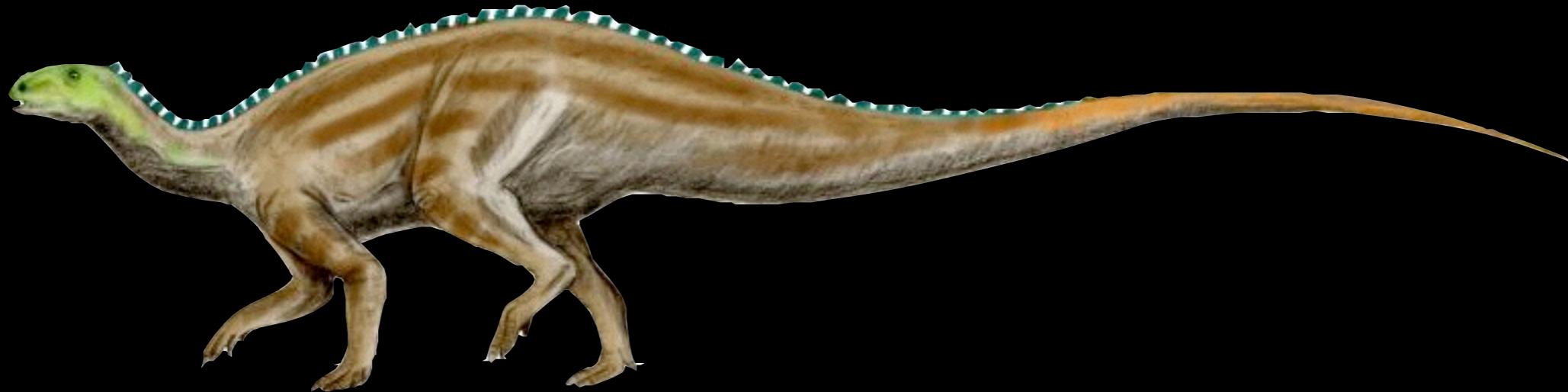
## *Thumb spike placement*



*Big, with appropriate modifications.*





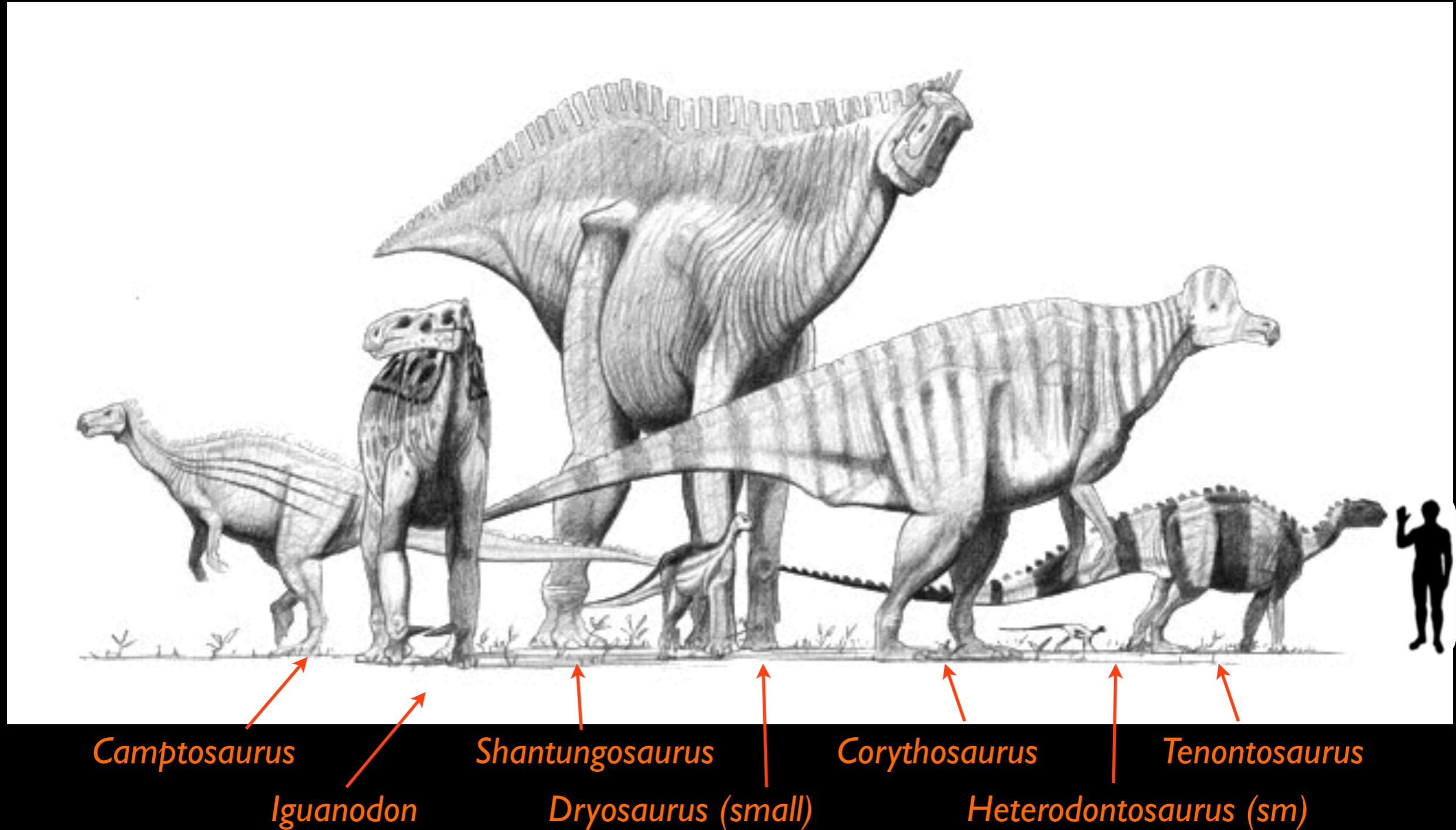


Obligate Bipedal  
Facultative Bipedal



*Tenontosaurus*

# Scales: Ornithopods, great and small

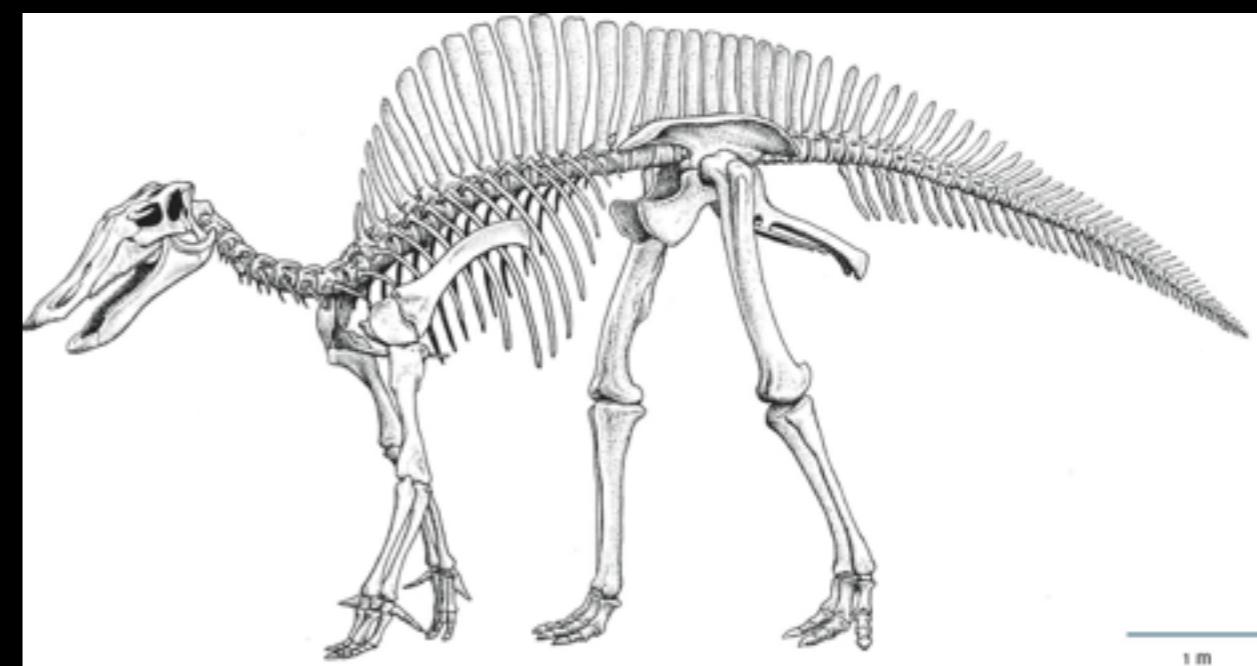


Dryosaurus: one of the smallest; 2.4 - 4.3 m long; 200 lbs

Shantungosaurus: one of the largest; skull 1.6 m (5 ft);  
length: 15 m (50 ft); 16 tonnes = 35,274 lbs

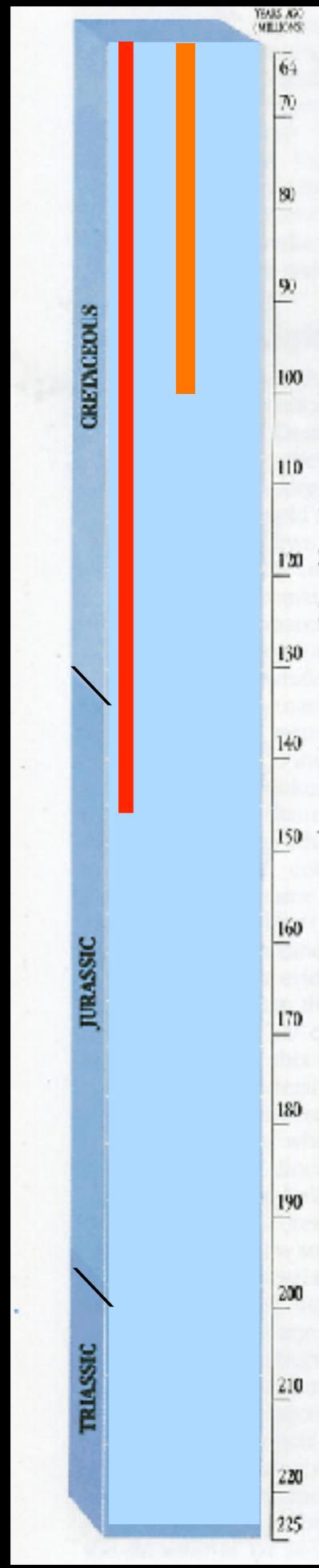


*Ouranosaurus*  
(Niger)



Triassic

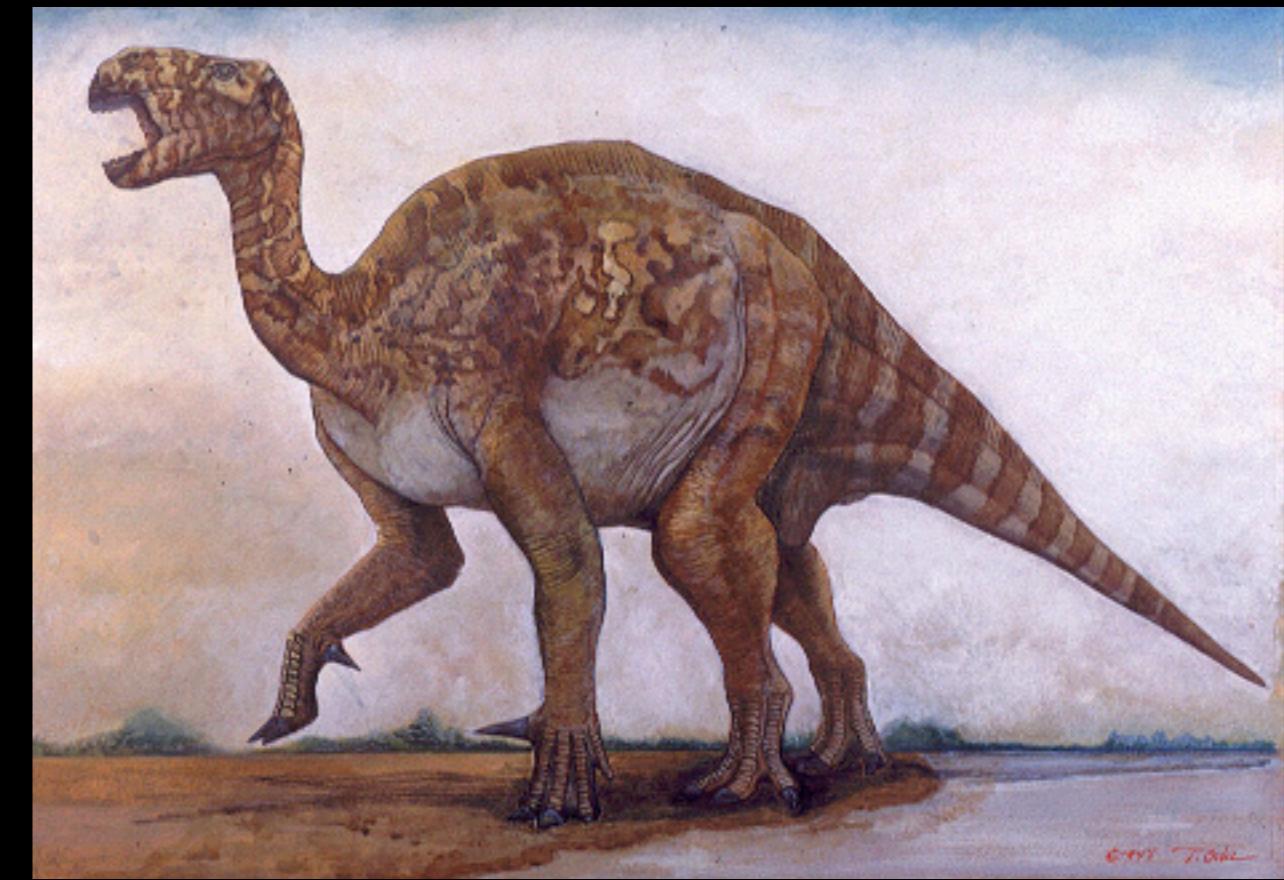
Cretaceous

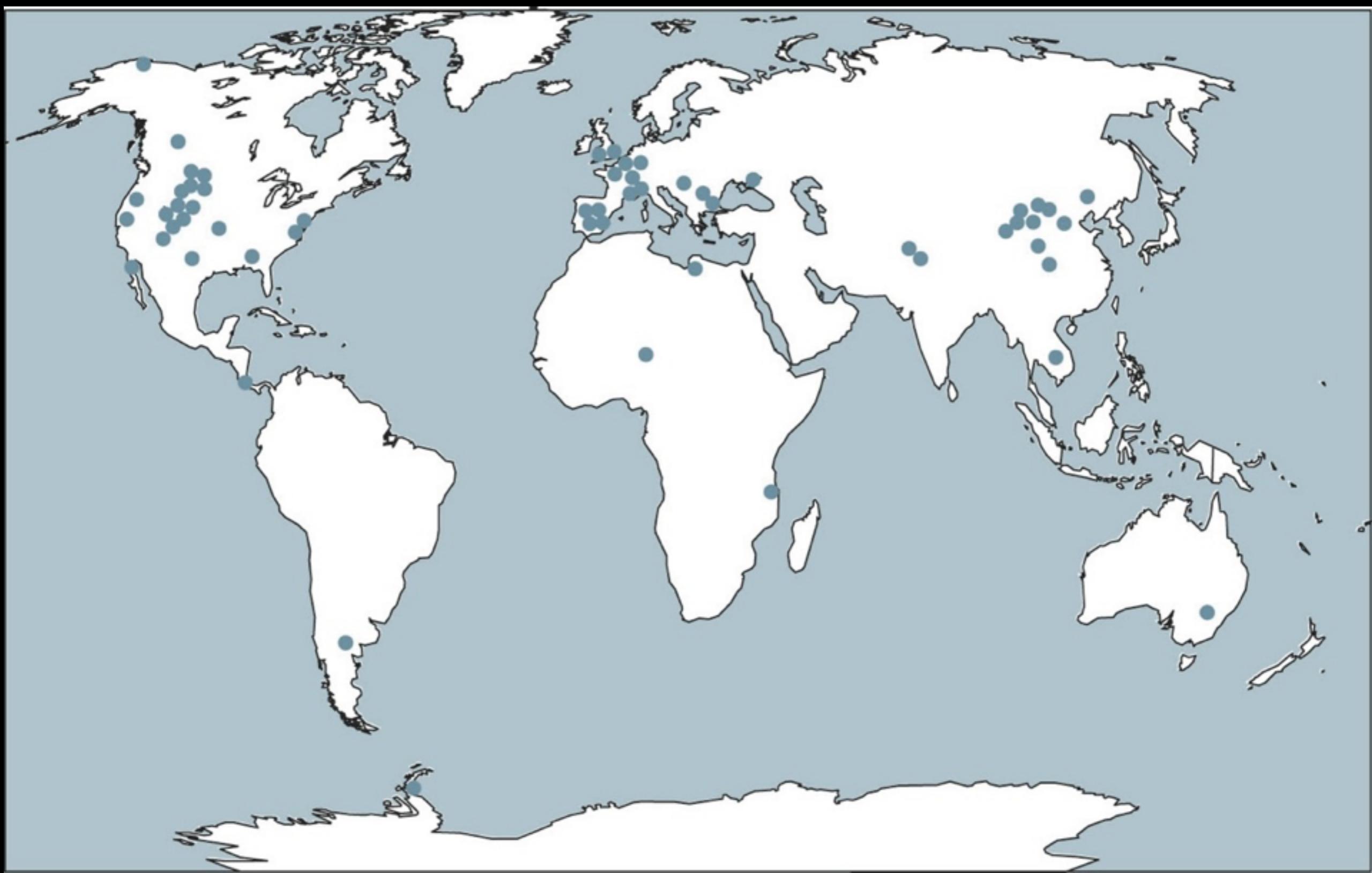


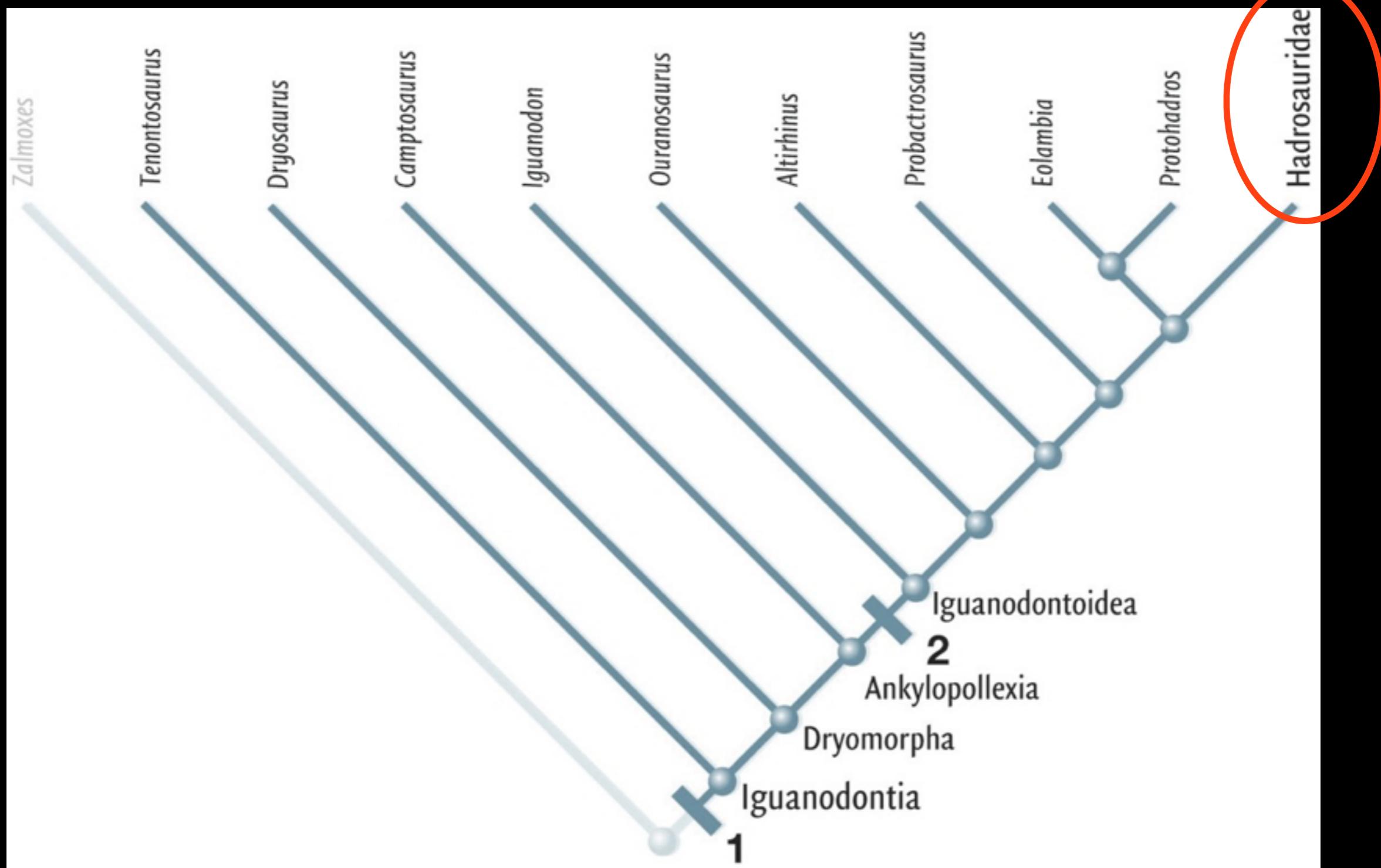
**Hadrosaurid time range**



**Non-hadrosaurid iguanodontian time range**





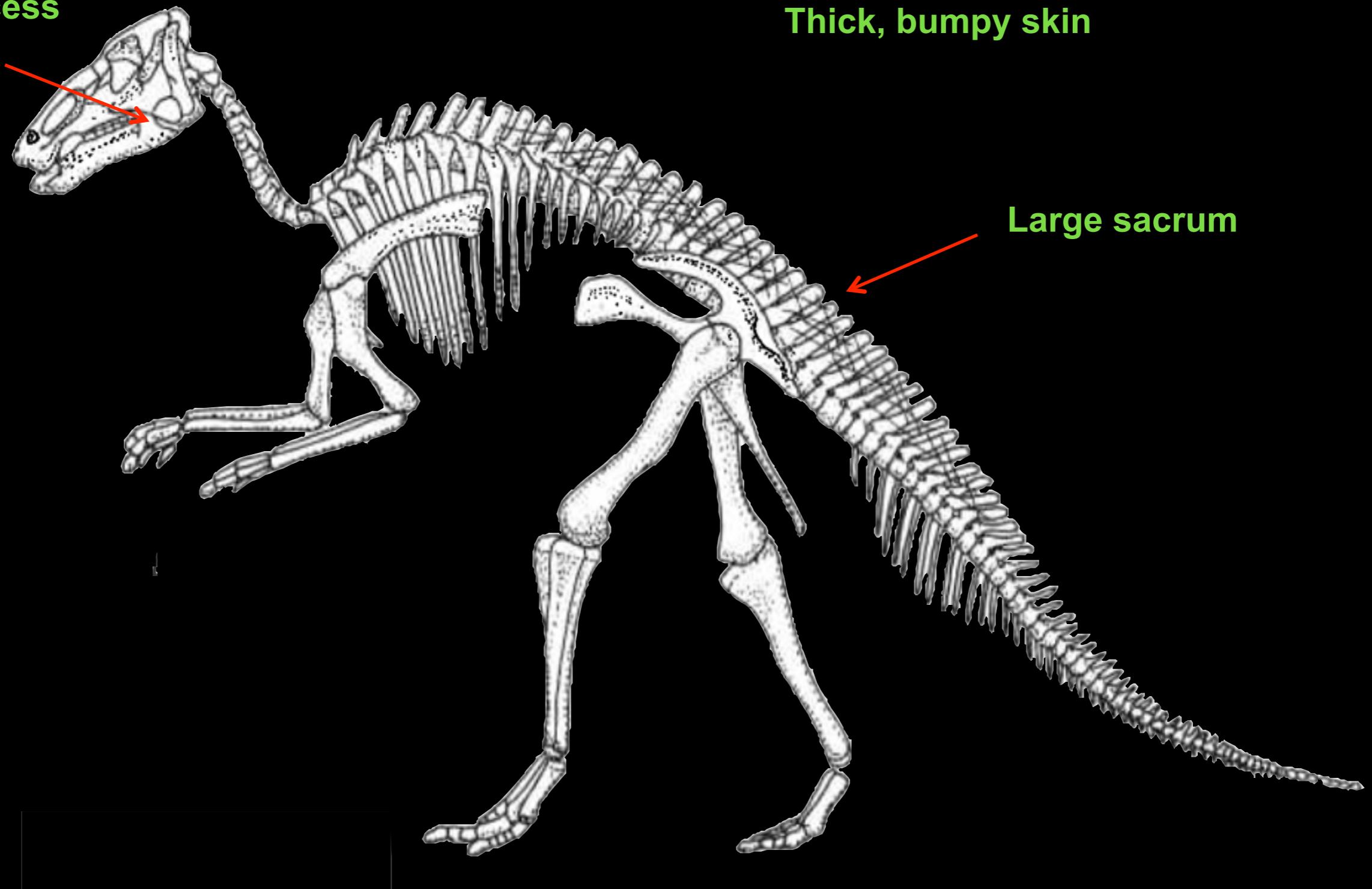


# *Hadrosaurids*

*Well developed dental battery*

*Modifications to skull and mandible to enhance chewing efficiency*

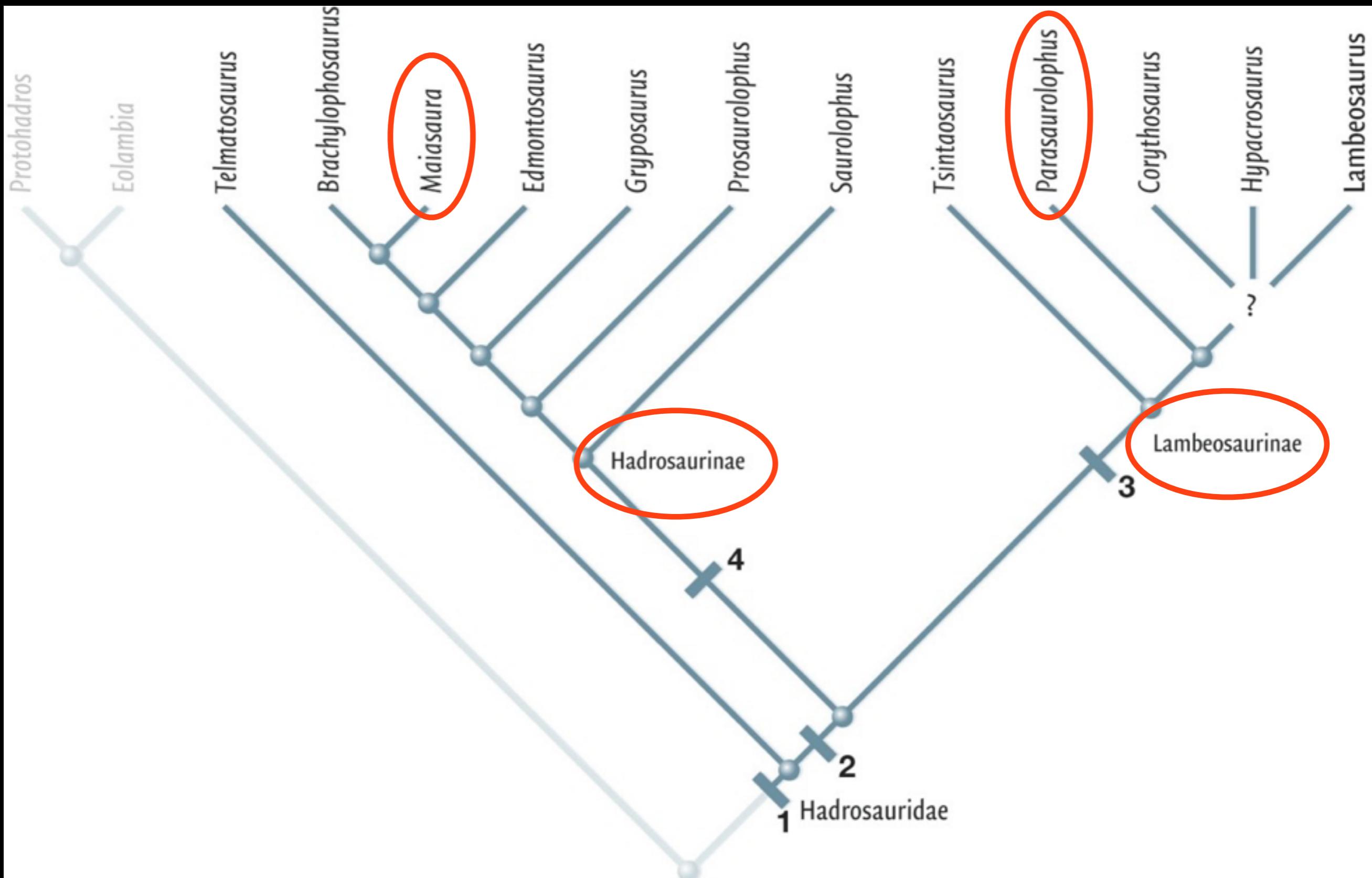
**Large coronoid  
process**





Hadrosaur front foot  
*Anatotitan*





# Meet the Hadrosaurines (wide snouts)



*Anatosaurus*



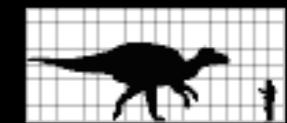


*Edmontosaurus*



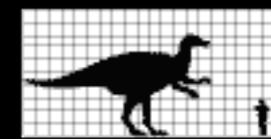


*Maiasaura*

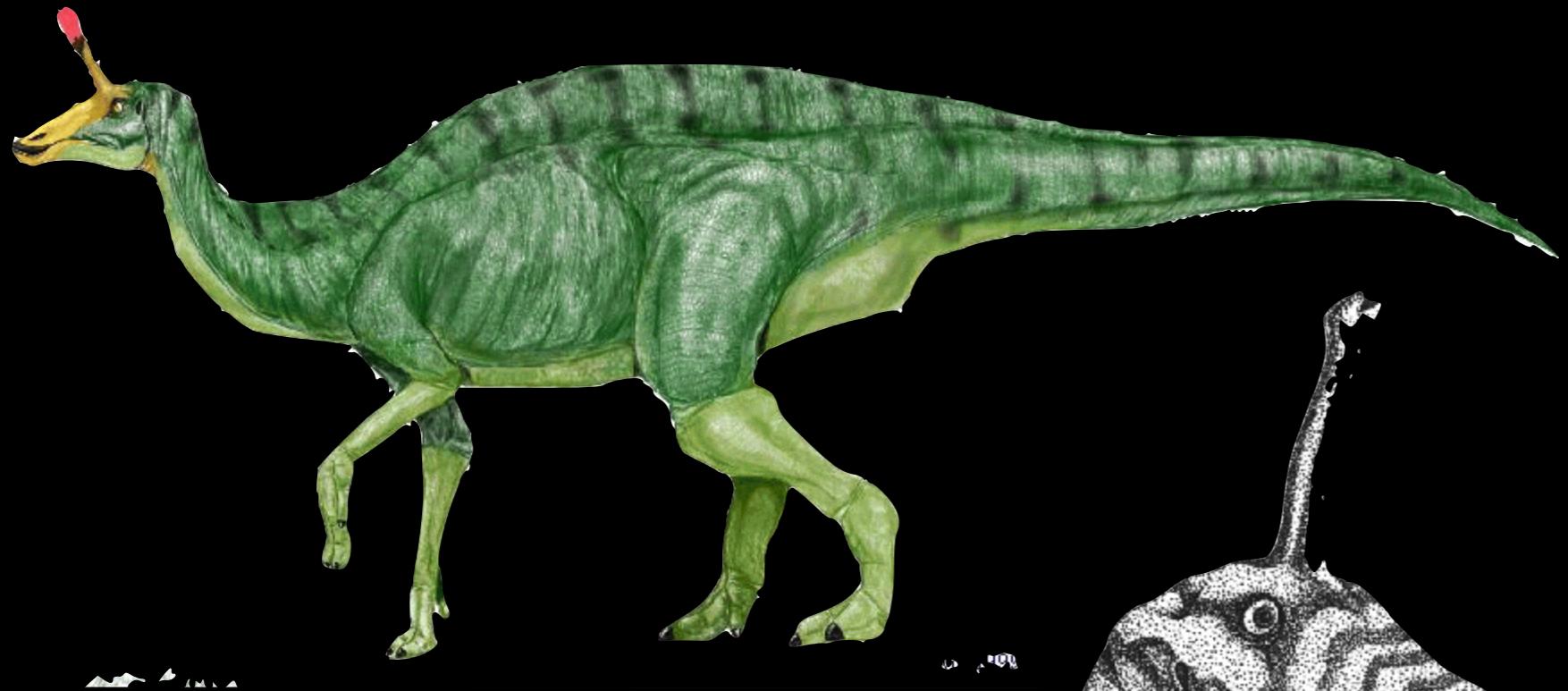




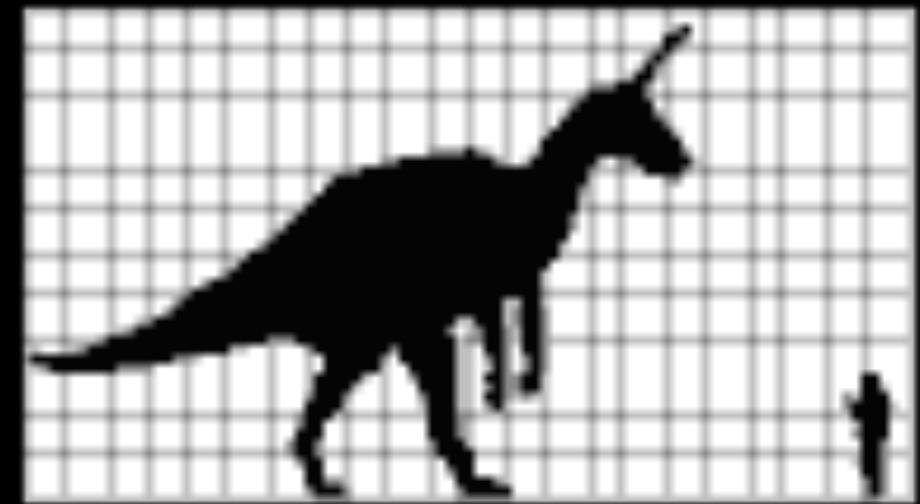
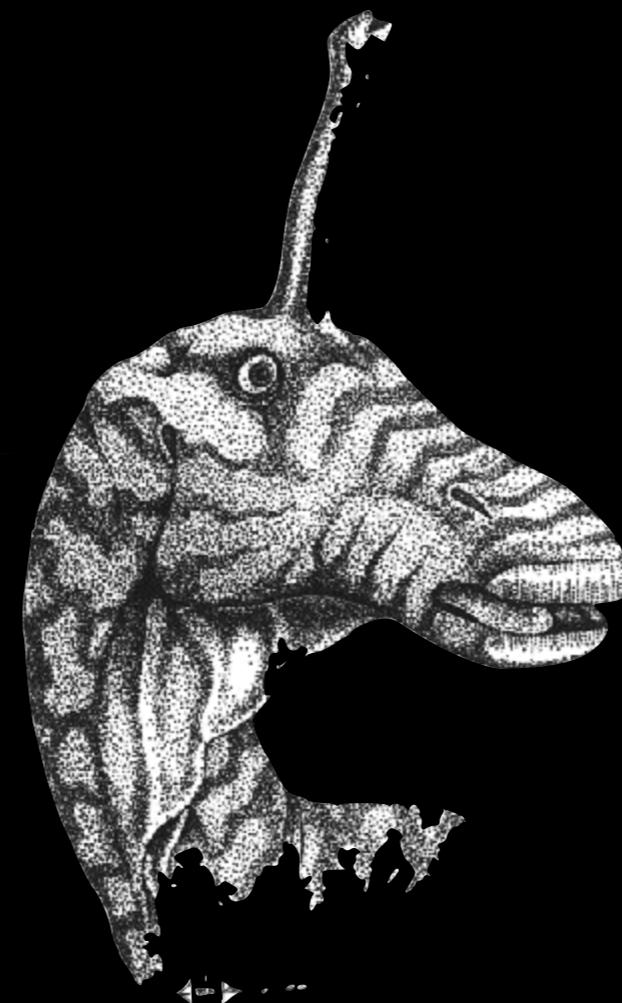
# Saurolophus

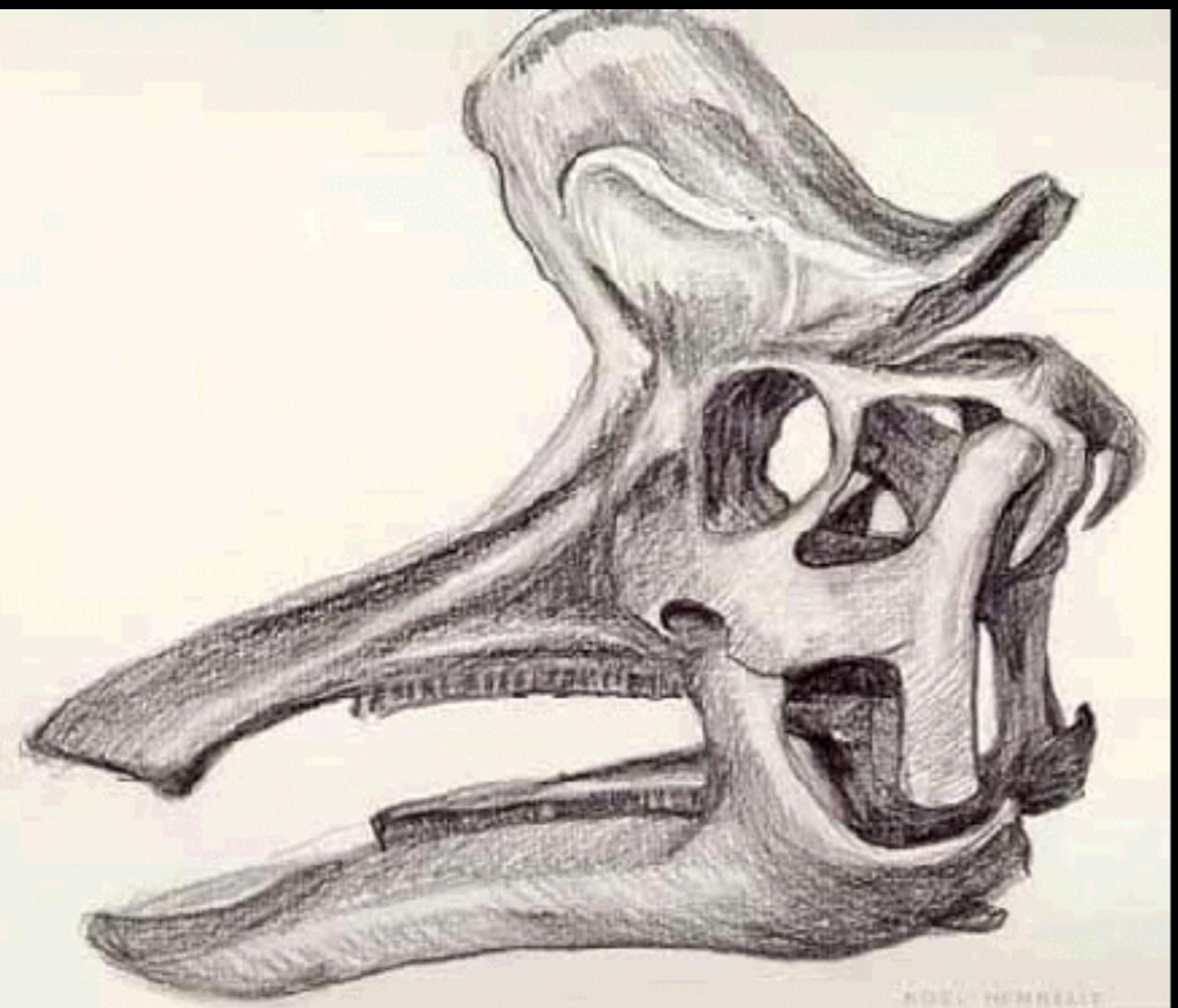


# Meet the Lambeosaurines



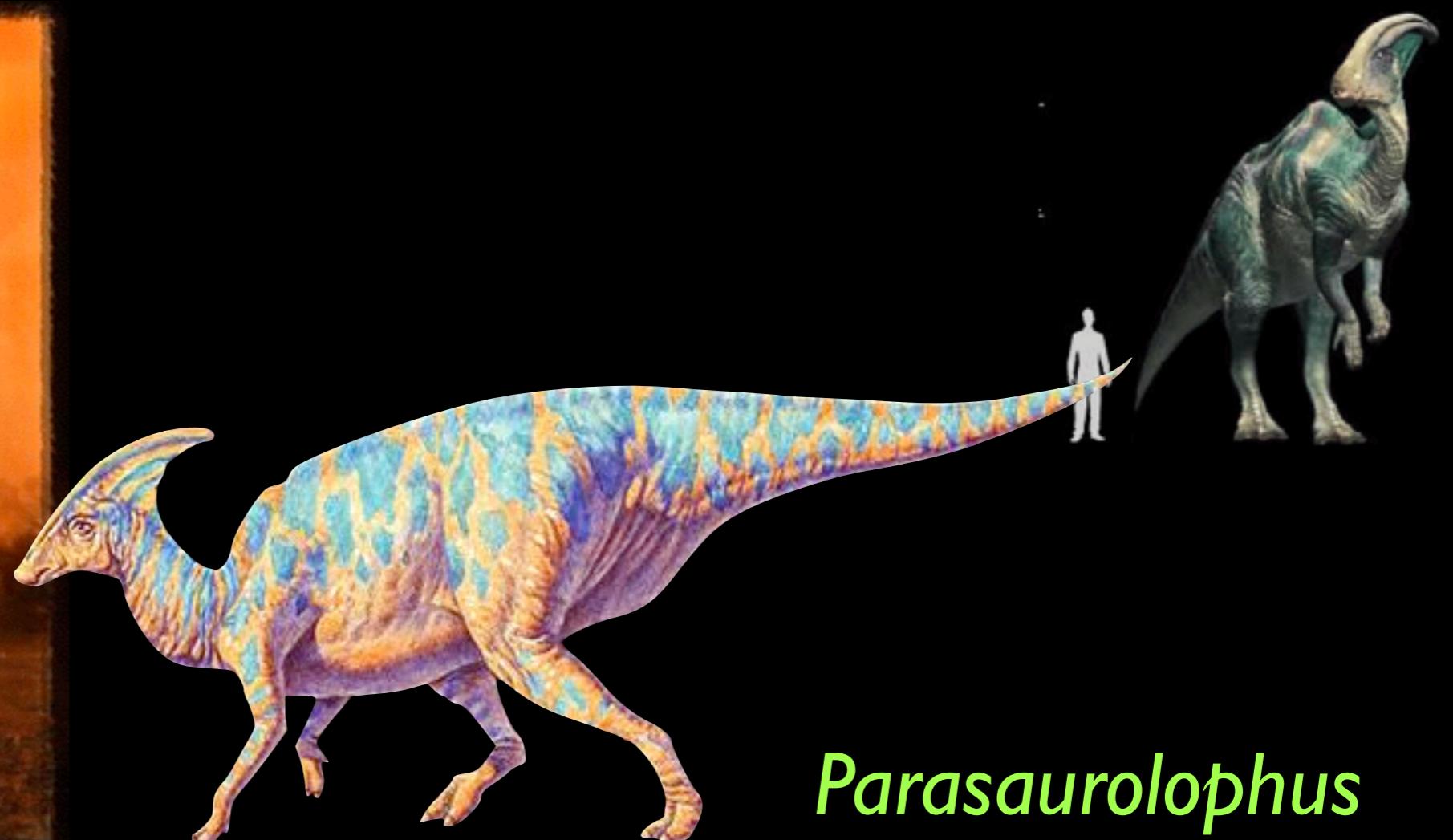
*Tsintaosaurus*



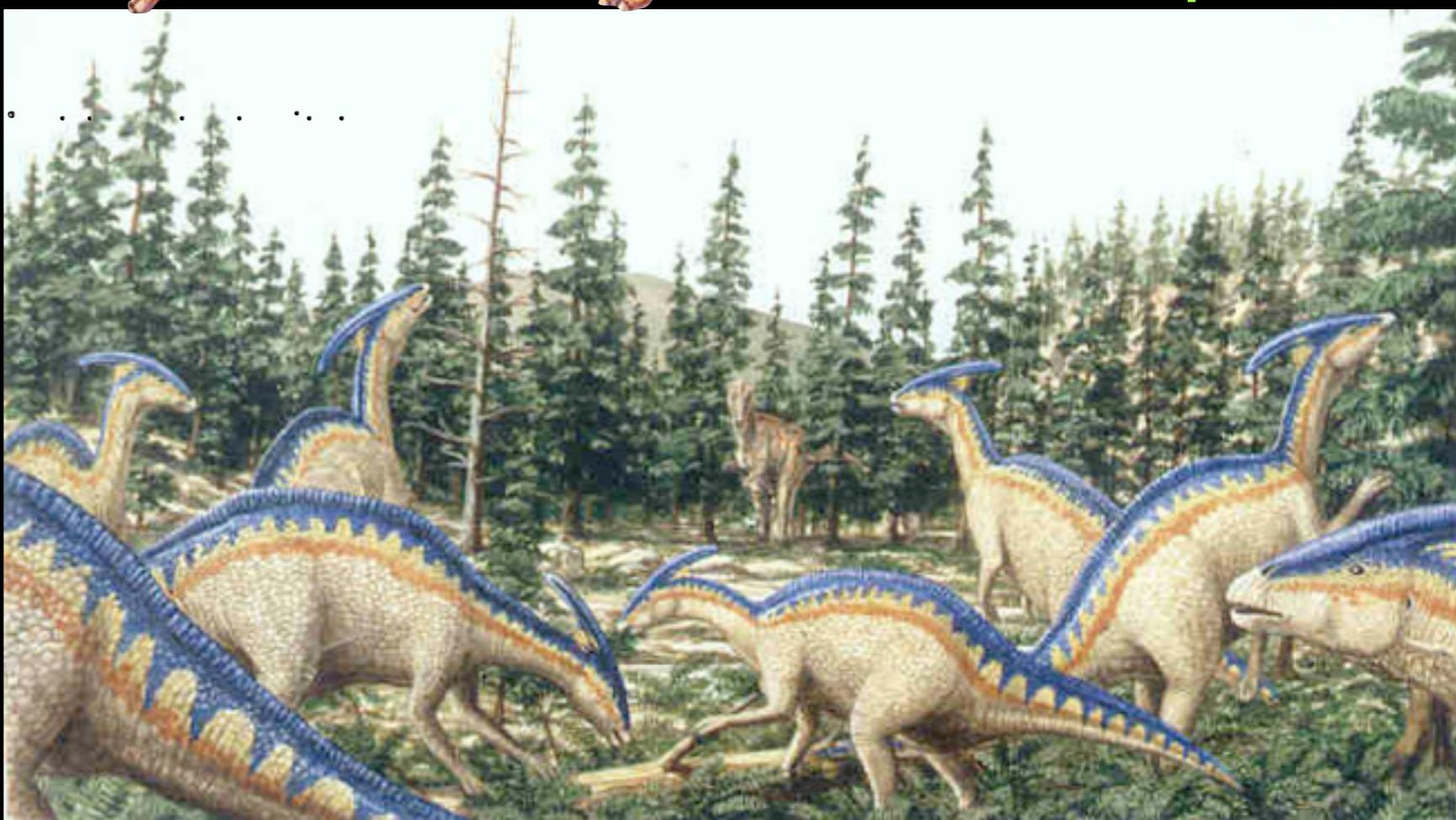


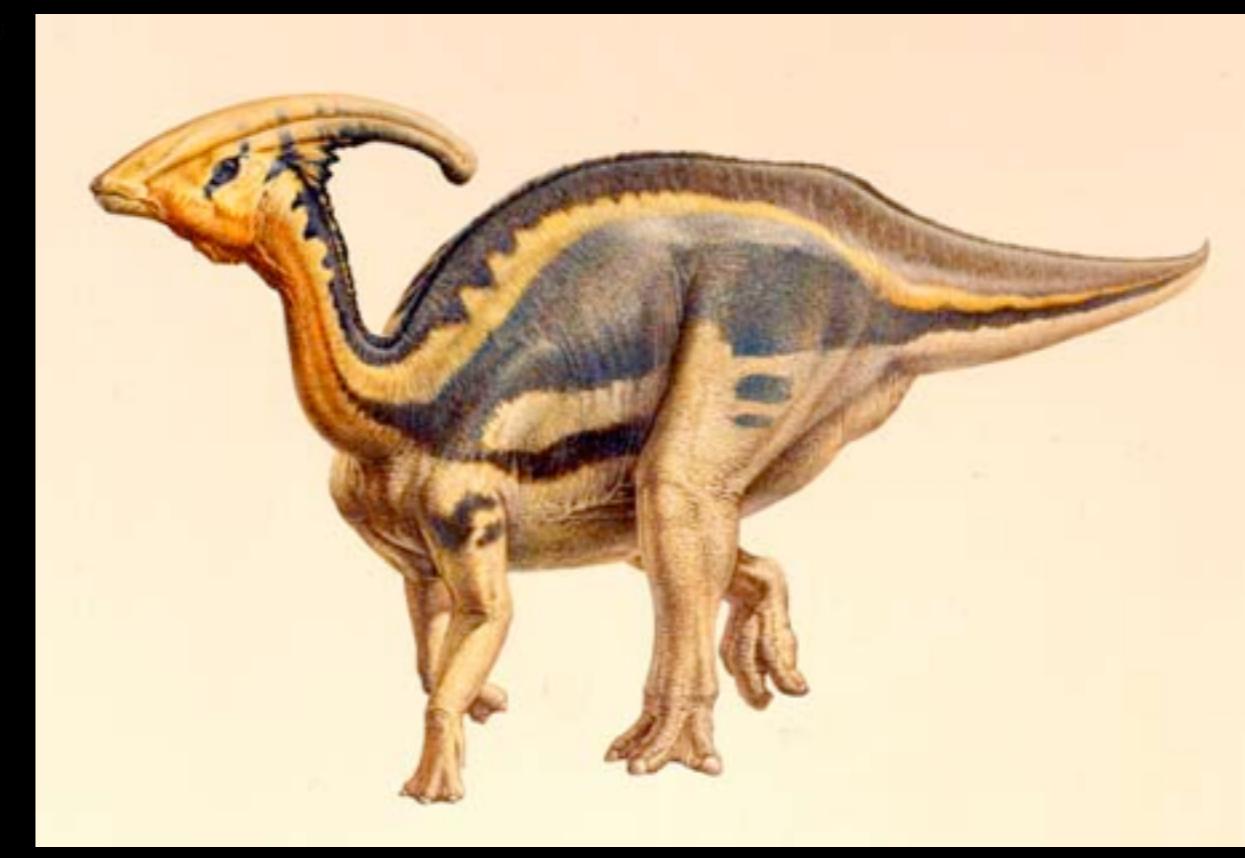
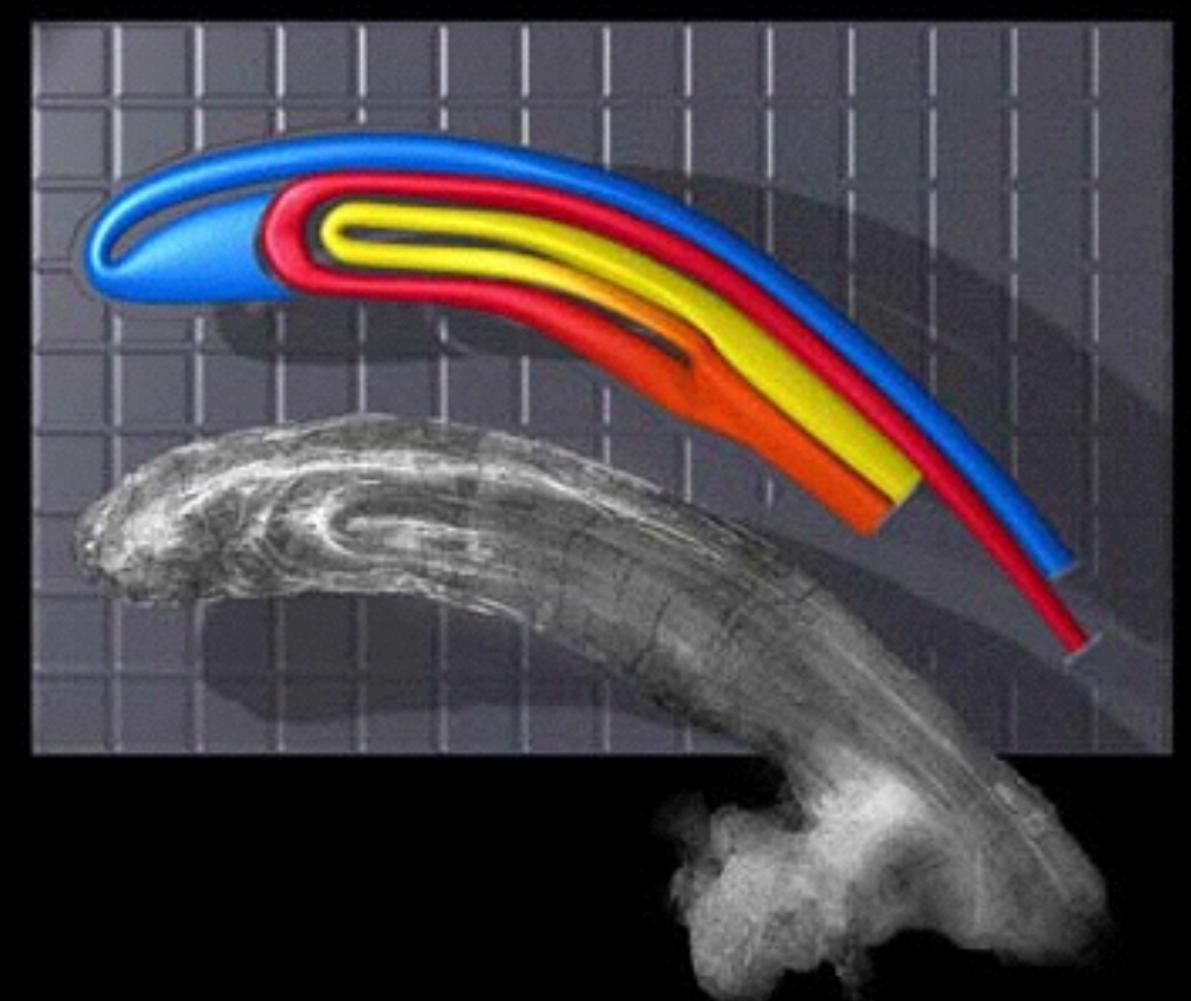
## Lambeosaurus



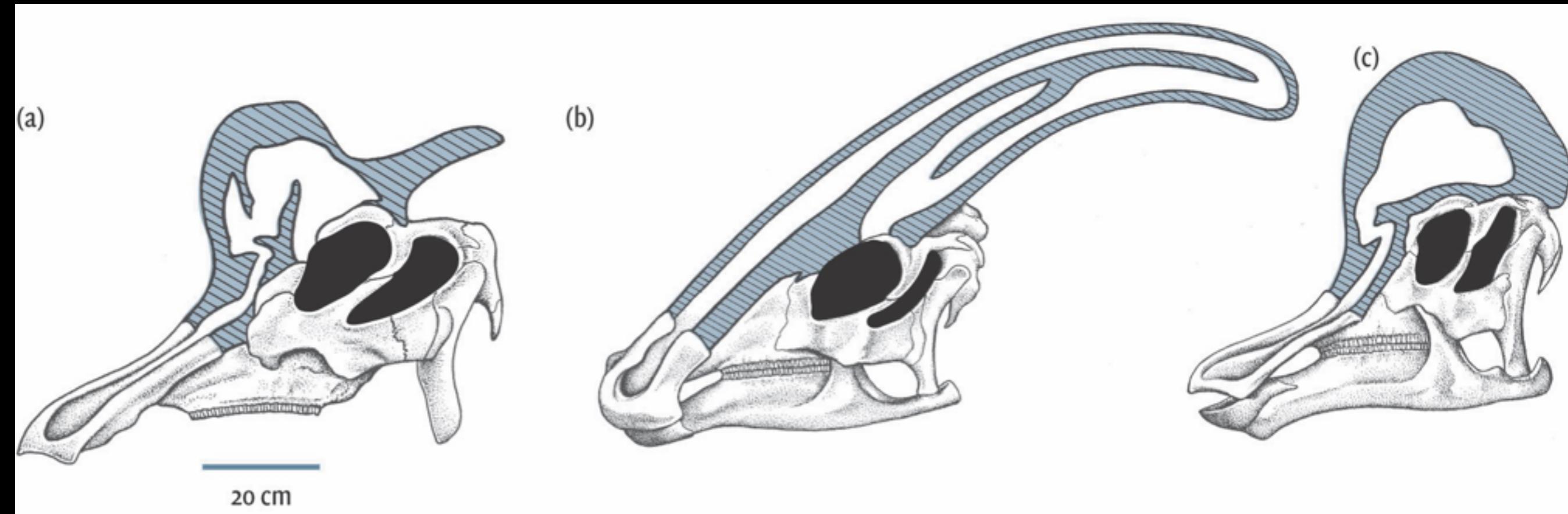


*Parasaurolophus*





**Snorkel?**



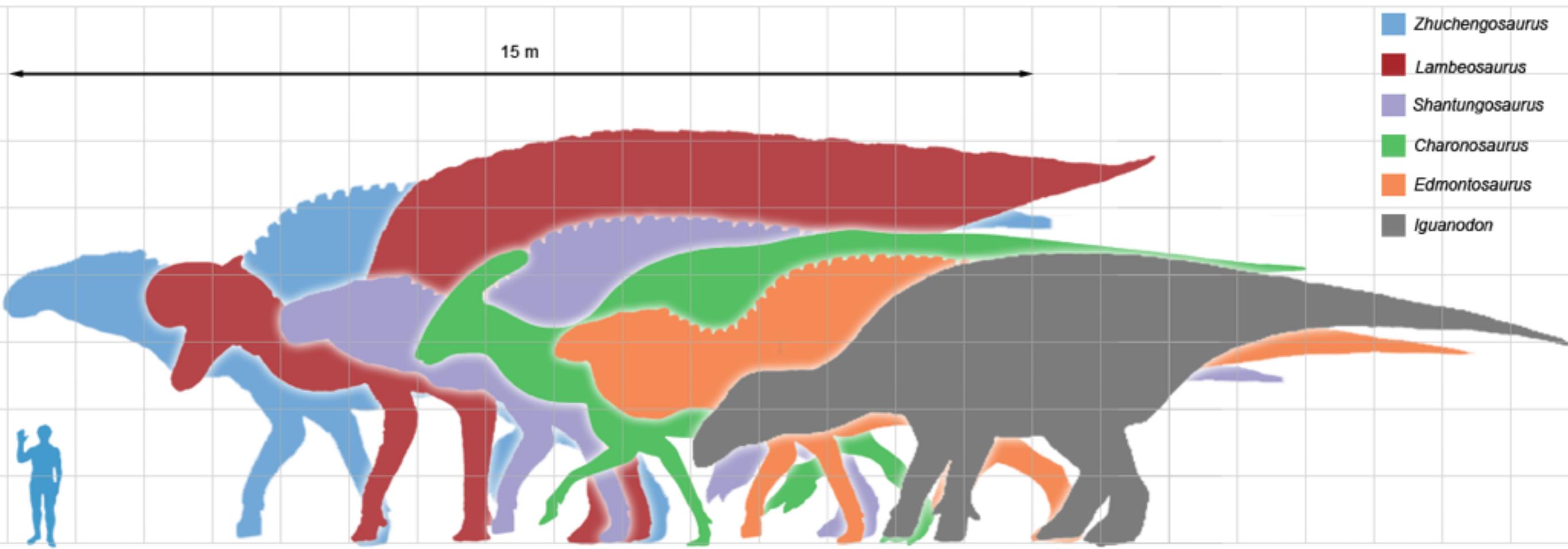
*Lambeosaurus*

*Parasaurolophus*

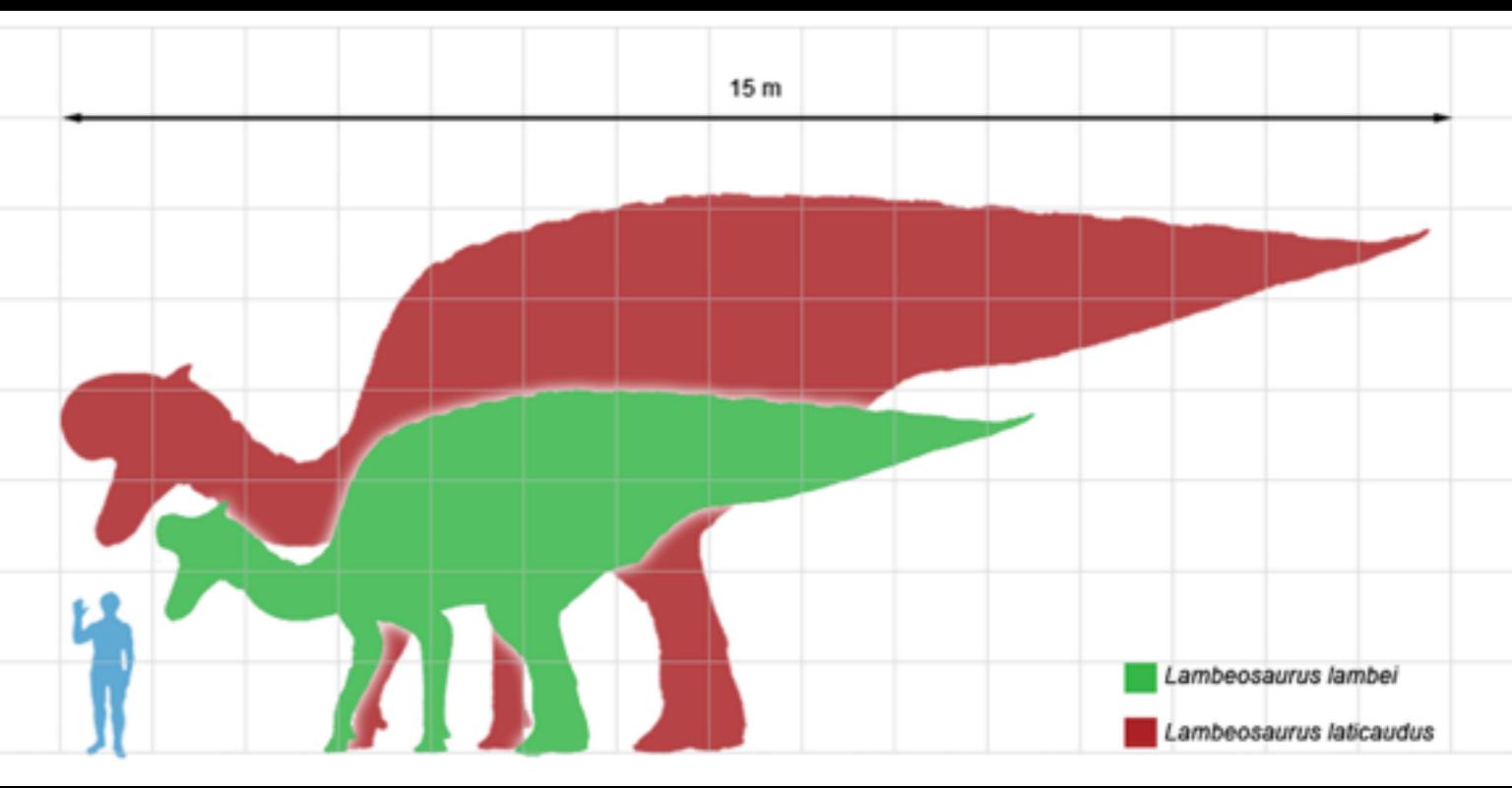
*Corythosaurus*



*Hadrosaur skin*



## Scales: the largest Hadrosaurids

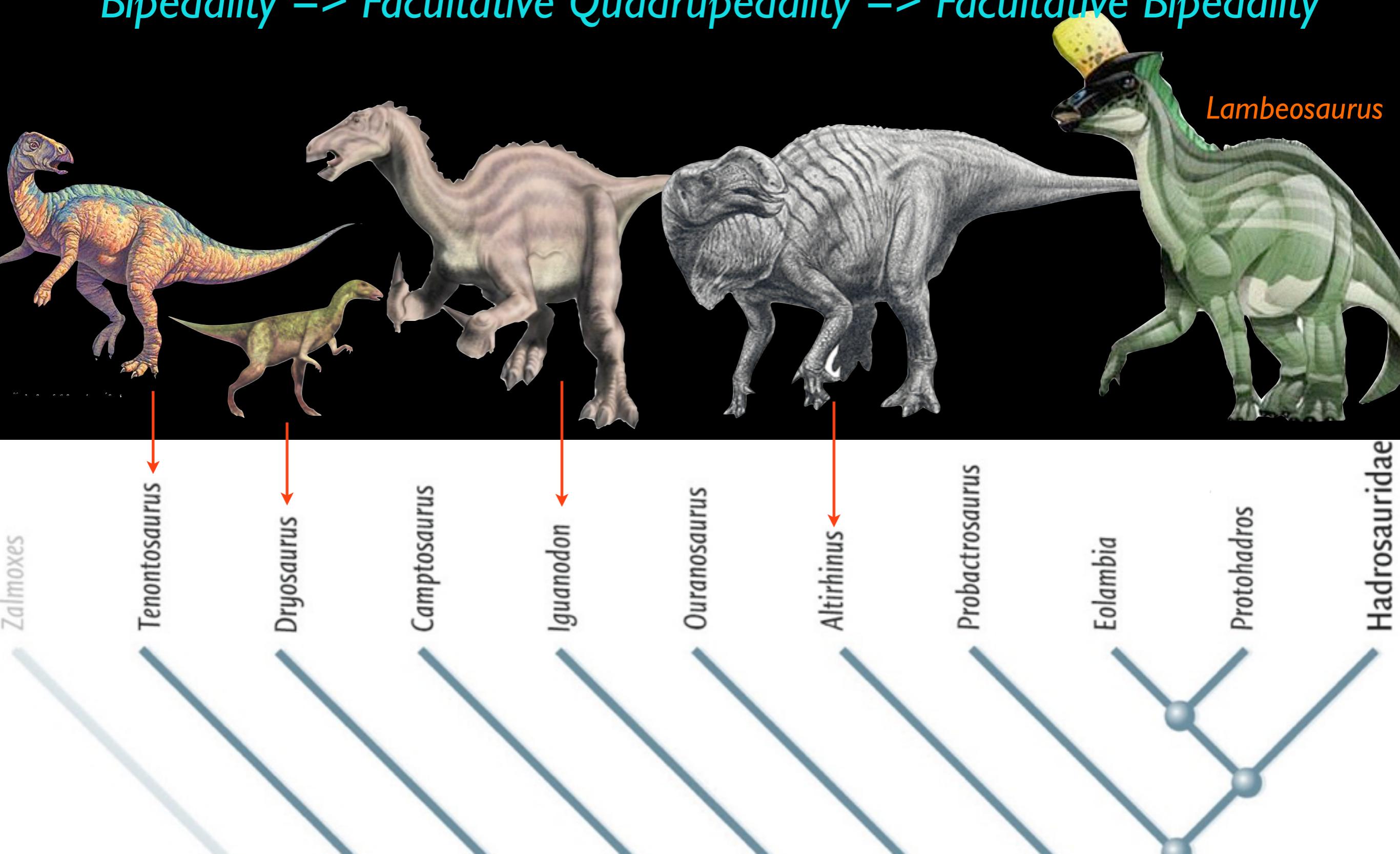


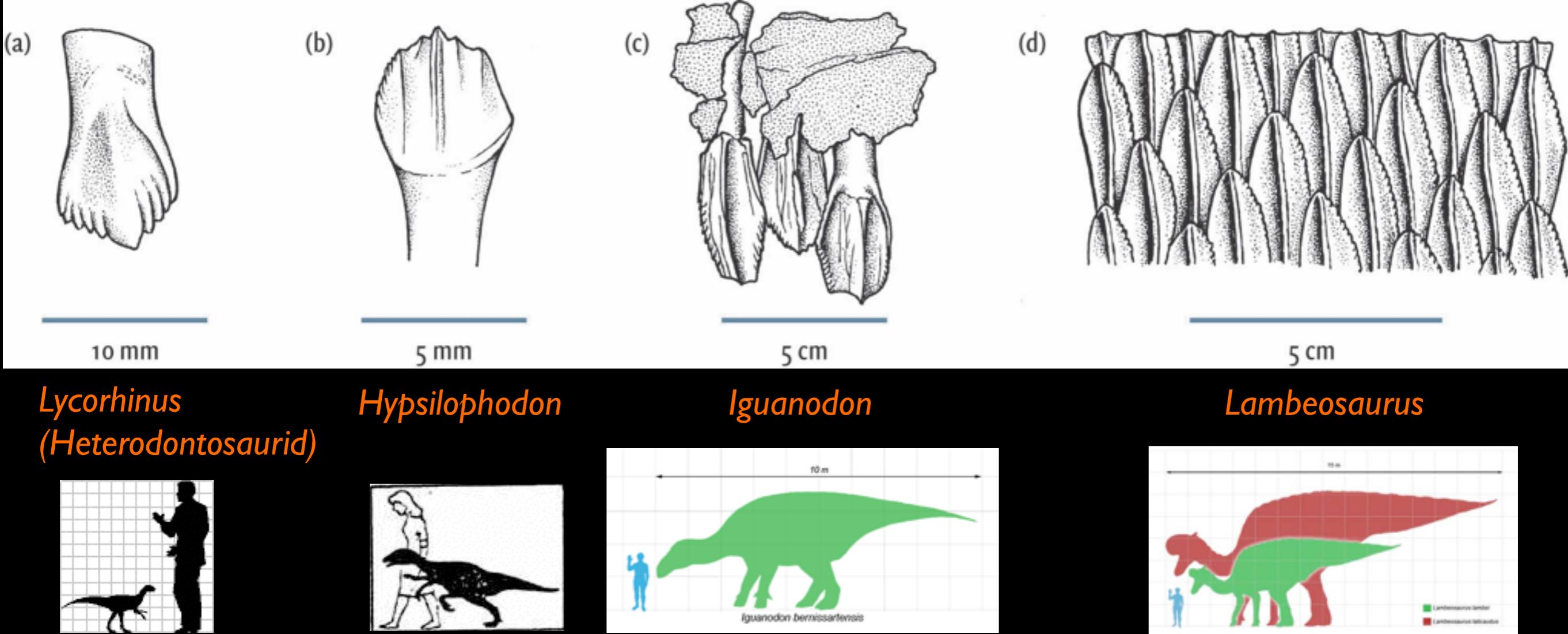
# Major Evolutionary Trends

1. Efficient, robust dental battery

2. Larger body size

Bipedality => Facultative Quadrapedality => Facultative Bipedality





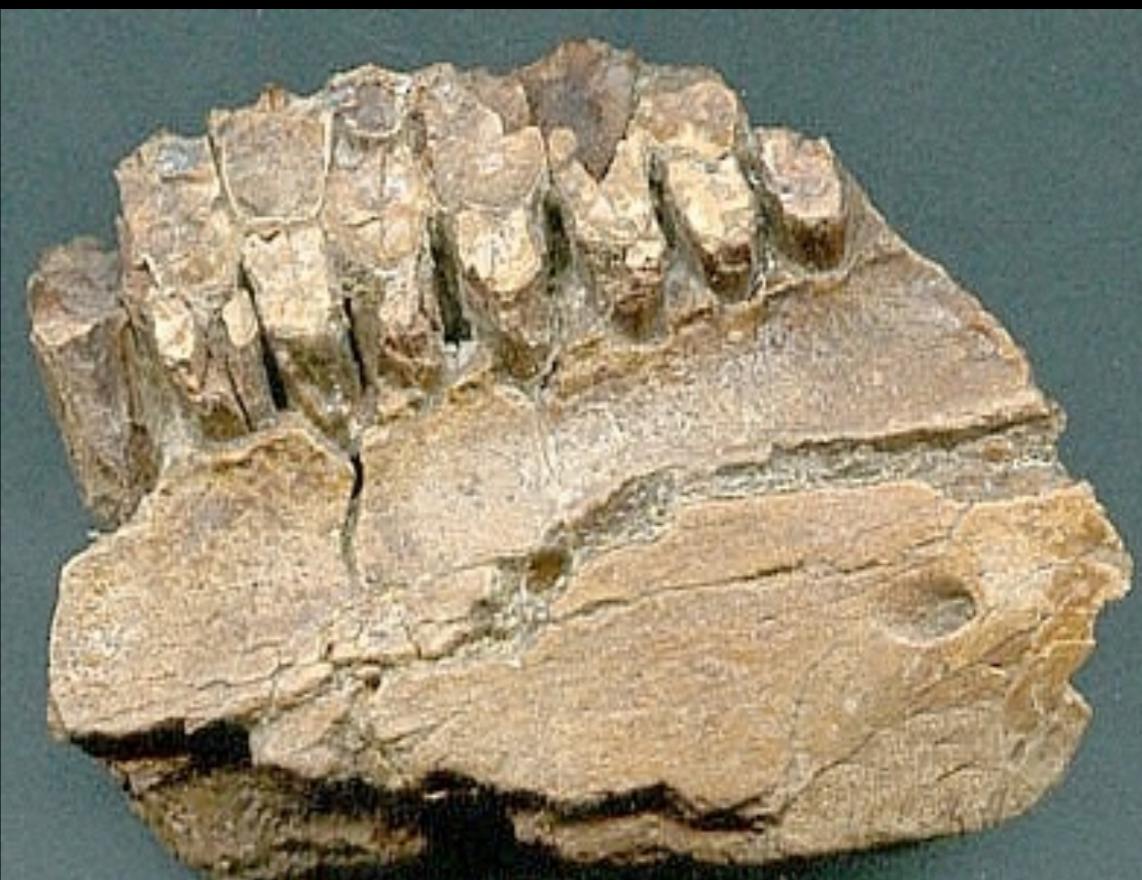
## TRENDS

1. Efficient, robust dental battery
2. Larger body size

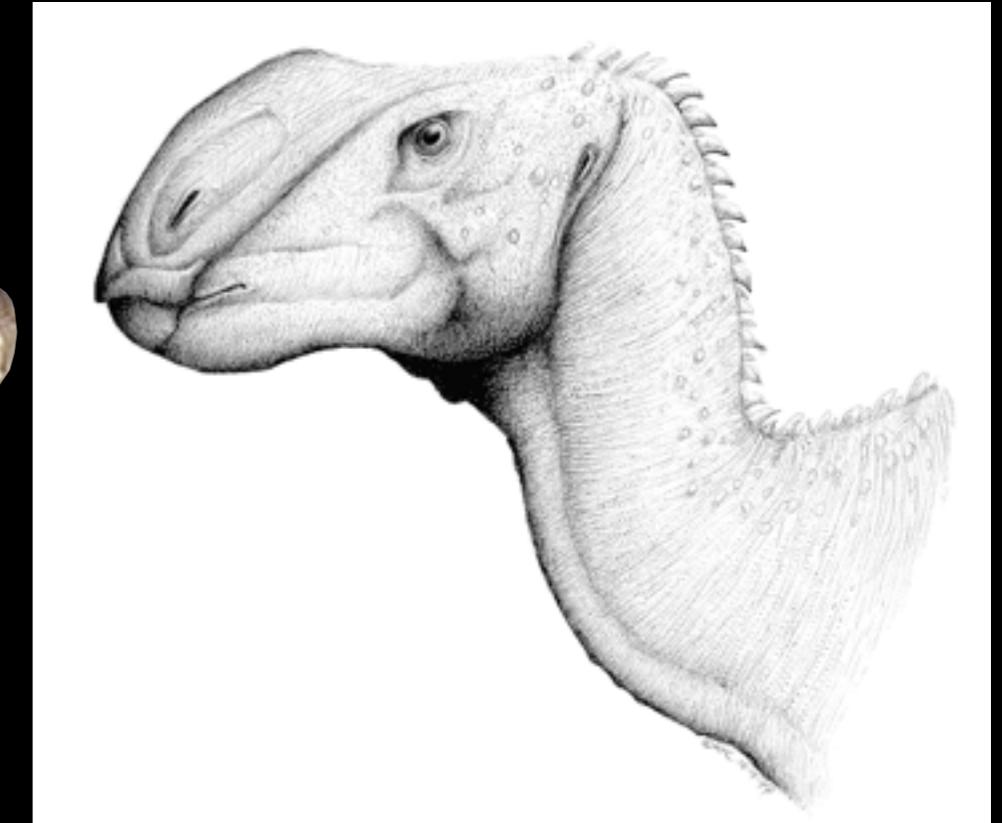
*Gastroliths*

*Large, robust coronoid process*

*Deep, inset tooth row*

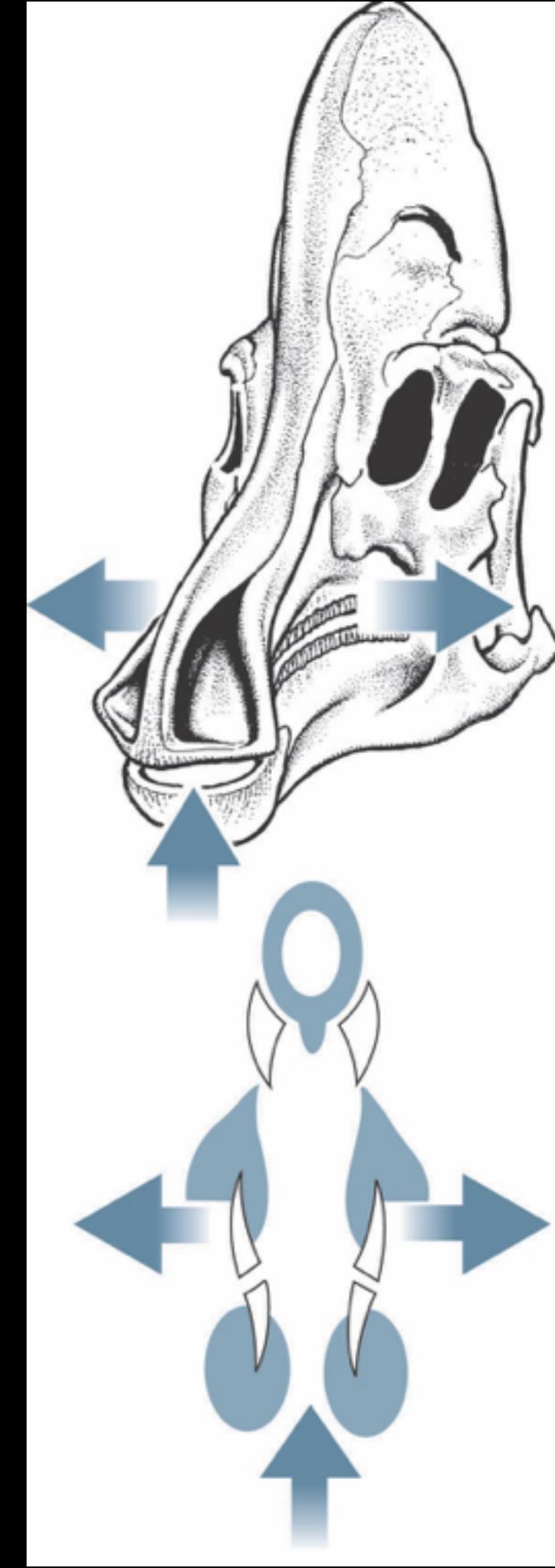


# *Brachylophosaurus*



*A new type of chewing (Euornithopoda)*  
*Pleurokinesis*  
*Lateral mobility of UPPER jaws*

<http://www.youtube.com/watch?v=6Sr5is7-wdk>



# **Visualizing the Pleurokinetic Model for Mastication in an Undescribed Hadrosauroid Dinosaur**



*So what did they eat?*

*Twigs, fruits, berries*

*Ground cover*

*Lower level foliage from conifers*

*Newly evolving Angiosperms*

*Limited to 1-2 meters off the ground; larger animals, up to 4 meters (13 ft)*

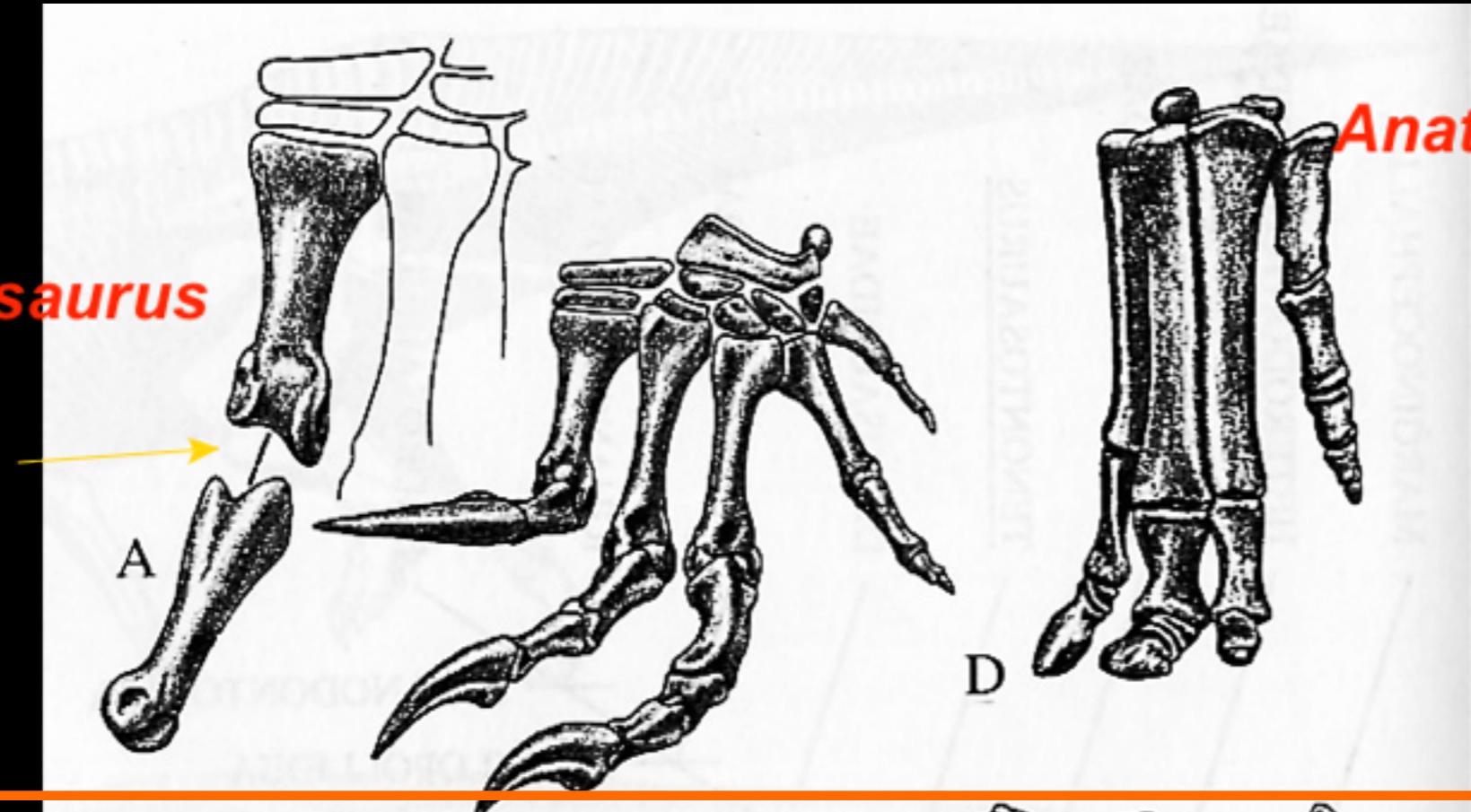




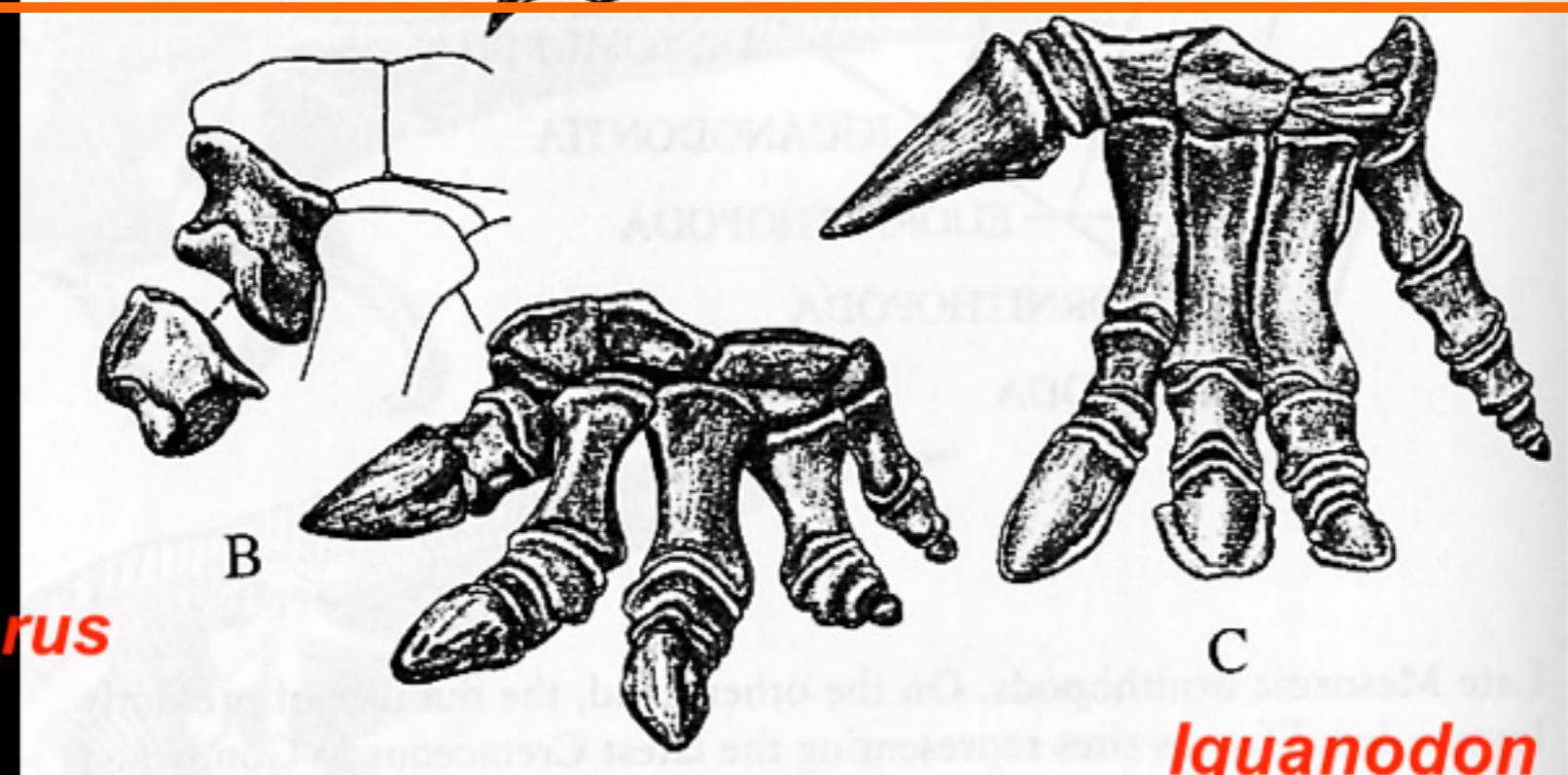
14

LUNCH BREAK!

*Heterodontosaurus*  
Basal  
Ornithopod



*Camptosaurus*



Closely related  
non-Hadrosaur  
*Iguanodontians*

Loss of hand flexibility over time