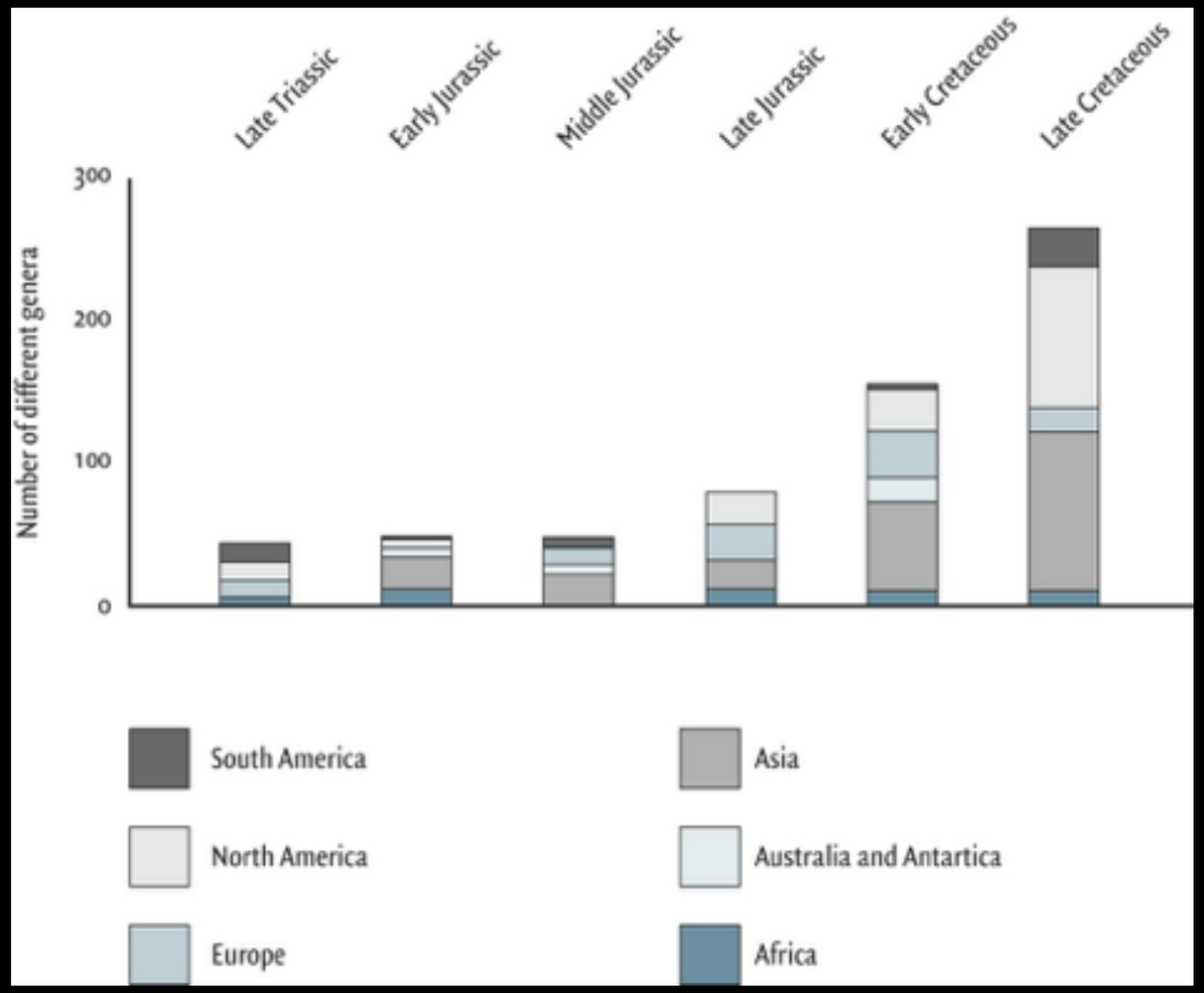
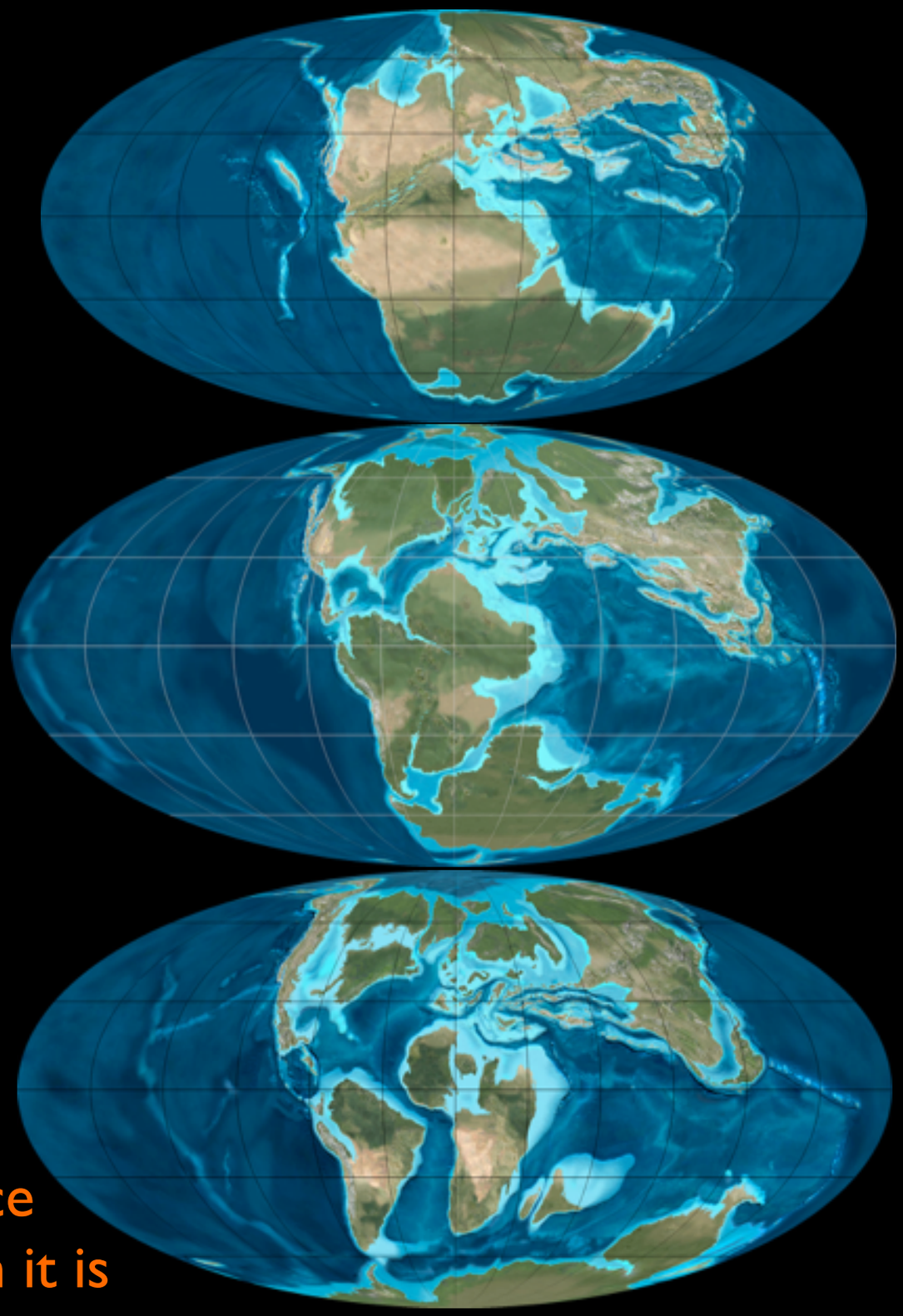
Diversity through time...



Changes in dinosaur diversity by continent



Count species? genera? families? through time

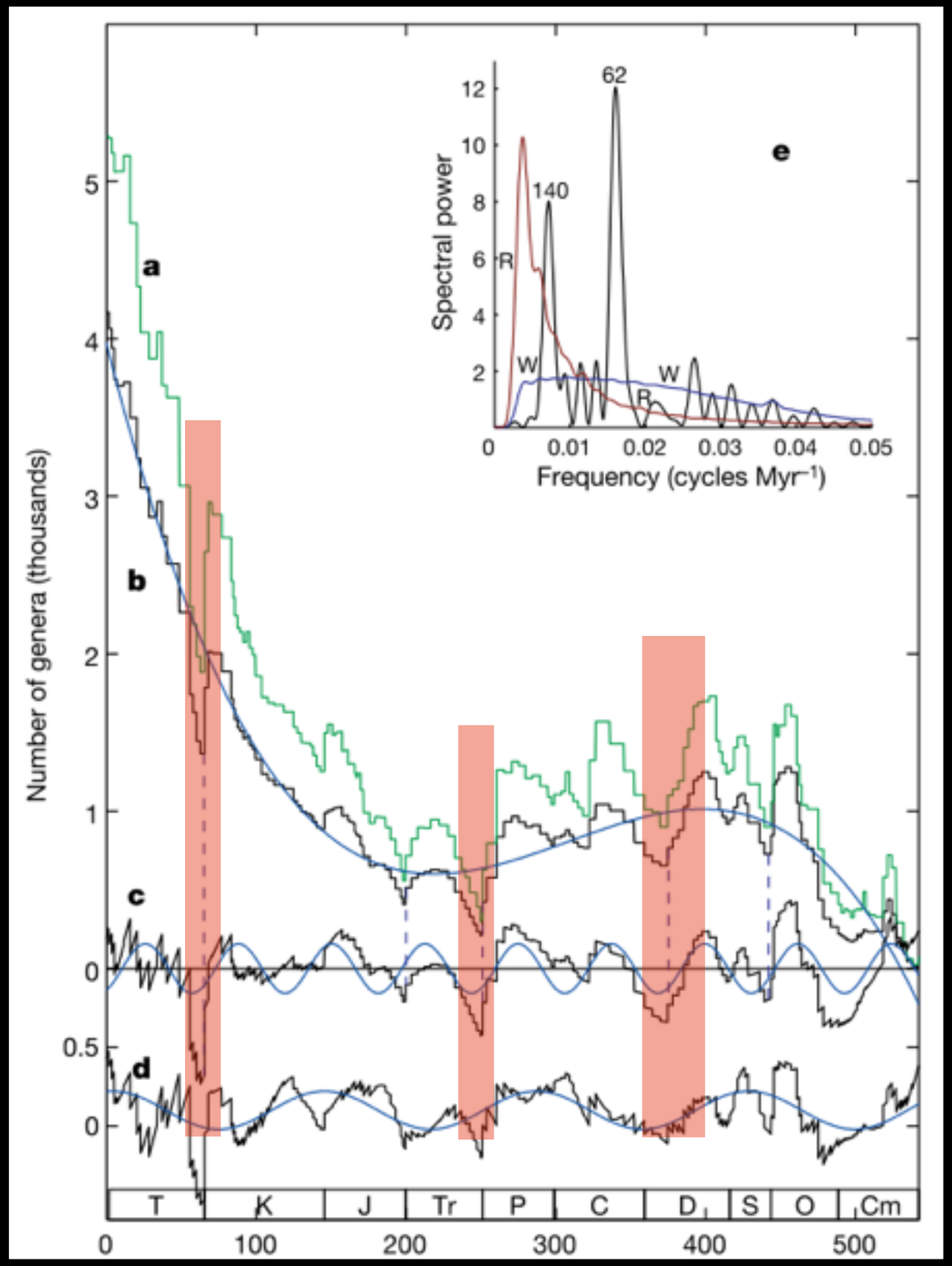
1) steady increase in diversity through time

2) Compare changes in diversity within each place through time... if the changes are consistent, then it is likely not a bias of rock availability

3) Compare changes across taxa...

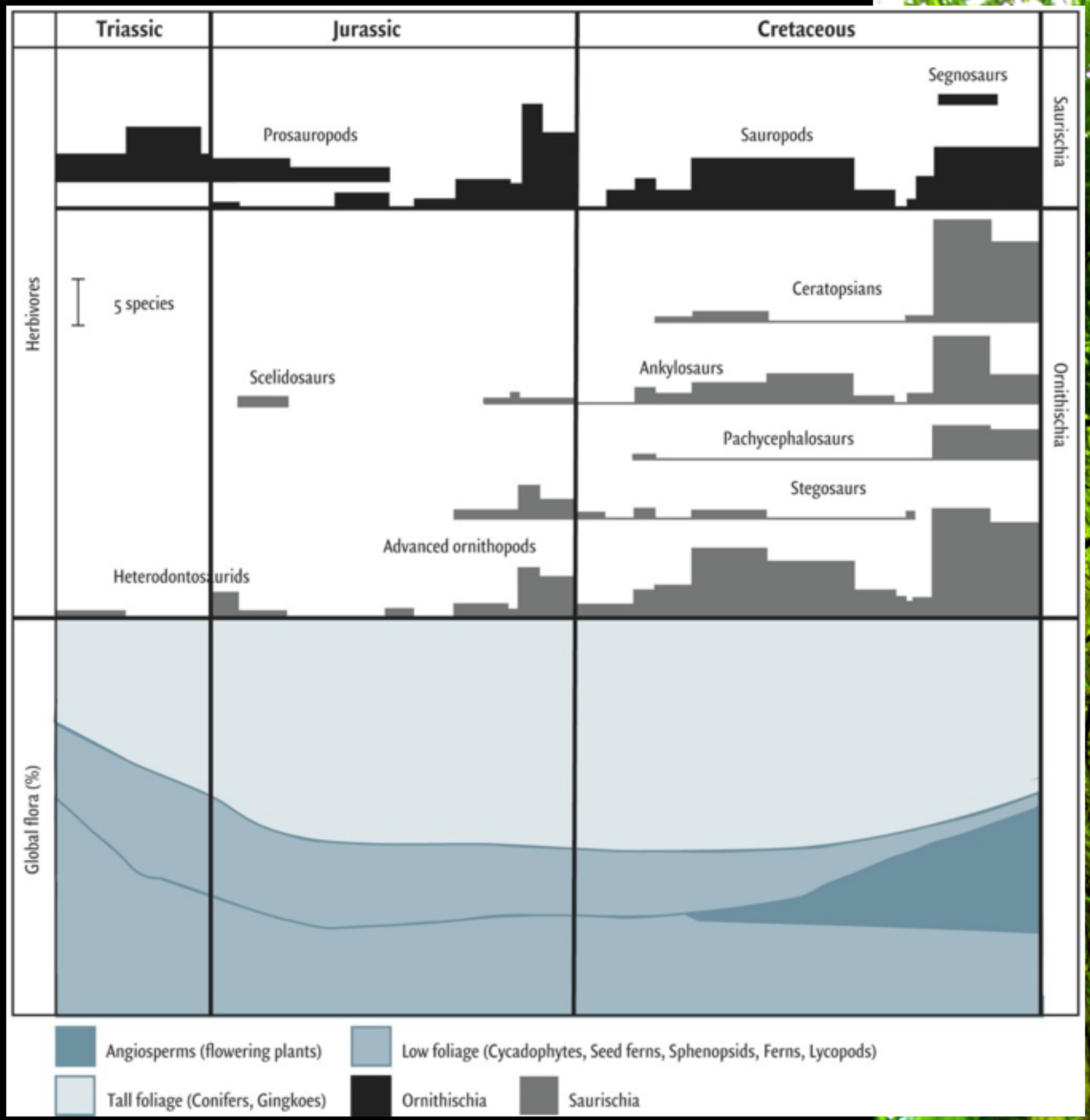
The Pull of the Recent: as we get closer to the recent, fossil biota become better known

Diversity through time...



The Sepkoski Curve

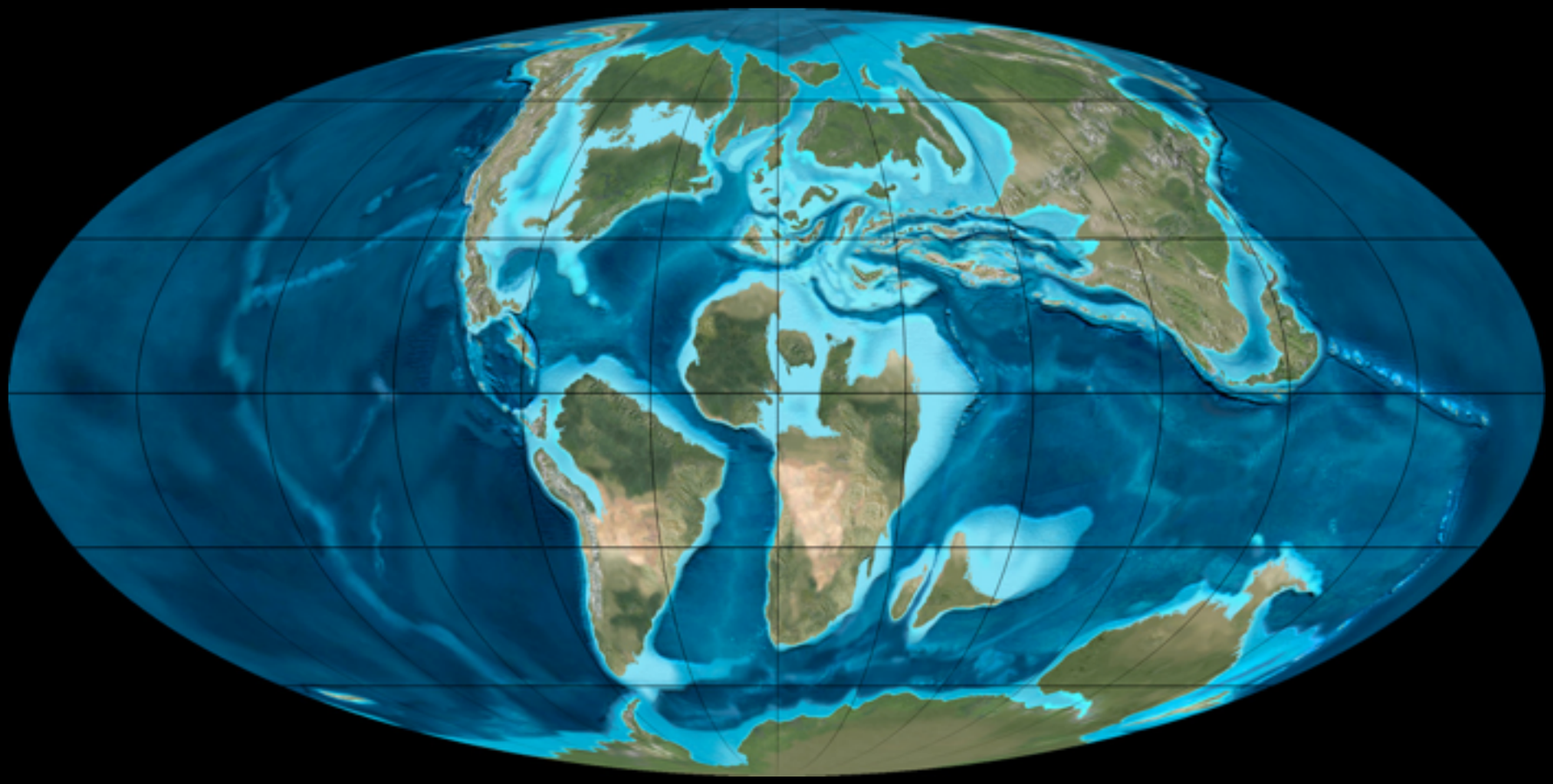
Plant and animal coevolution?



Triassic: Lycopods, seed ferns, ferns decrease in abundance

Late Triassic, Early Jurassic: gymnosperms increase in abundance

Early Cretaceous: Angiosperms undergo an evolutionary burst



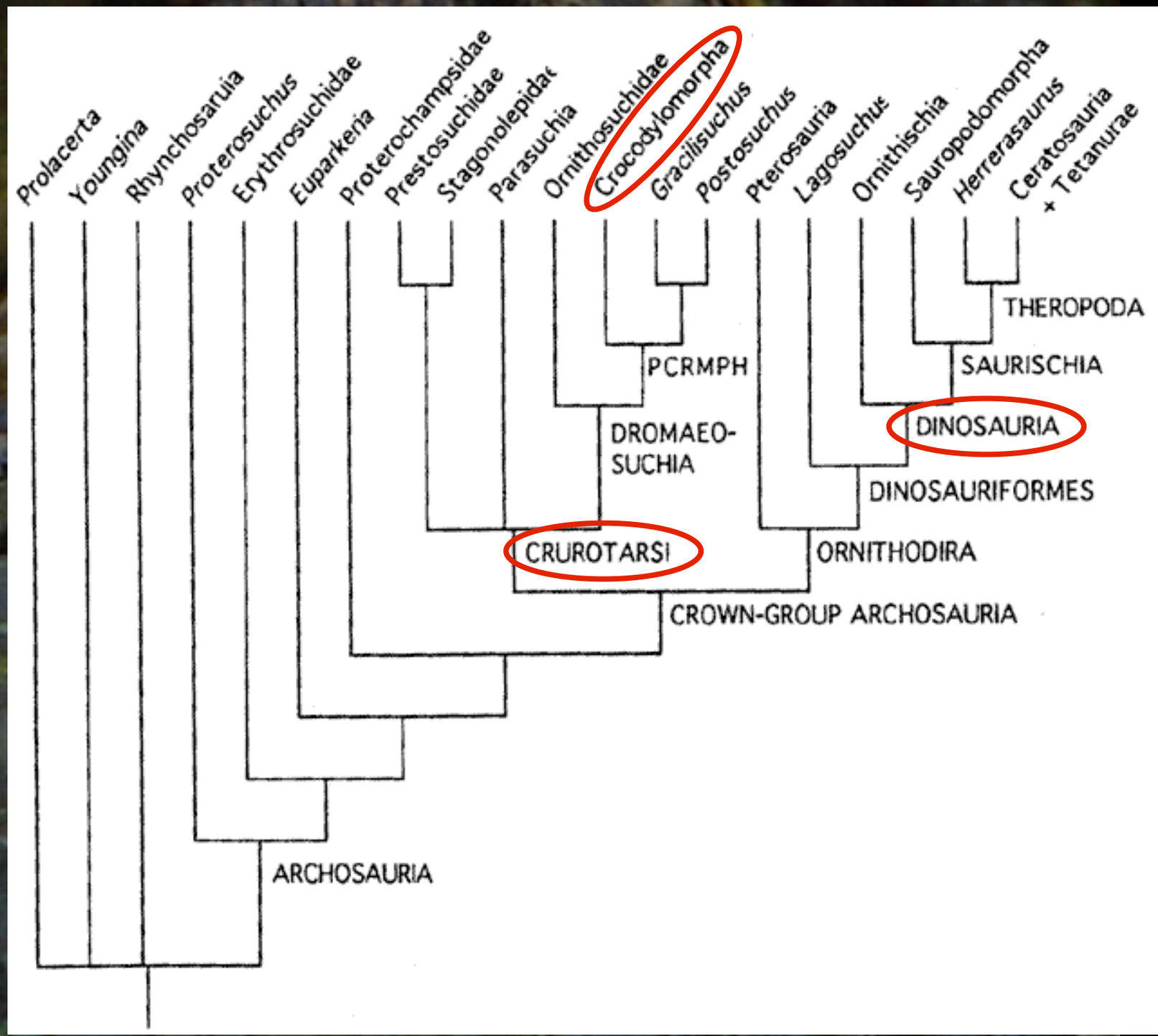
We can TEST whether or not Dinosaur herbivores had an exclusive impact on plants evolution...

1) Advanced herbivores (hadrosaurs, pachycephalosaurs, ceratopsians) were Northern Hemisphere animals.
2) The Southern Hemisphere herbivores were mainly sauropods & early ornthipods (unspecialized)
3) Therefore, if derived Dinosaurian herbivore evolution was linked to angiosperm evolution, the evolution of angiosperms should be very different in the Northern Hemisphere.

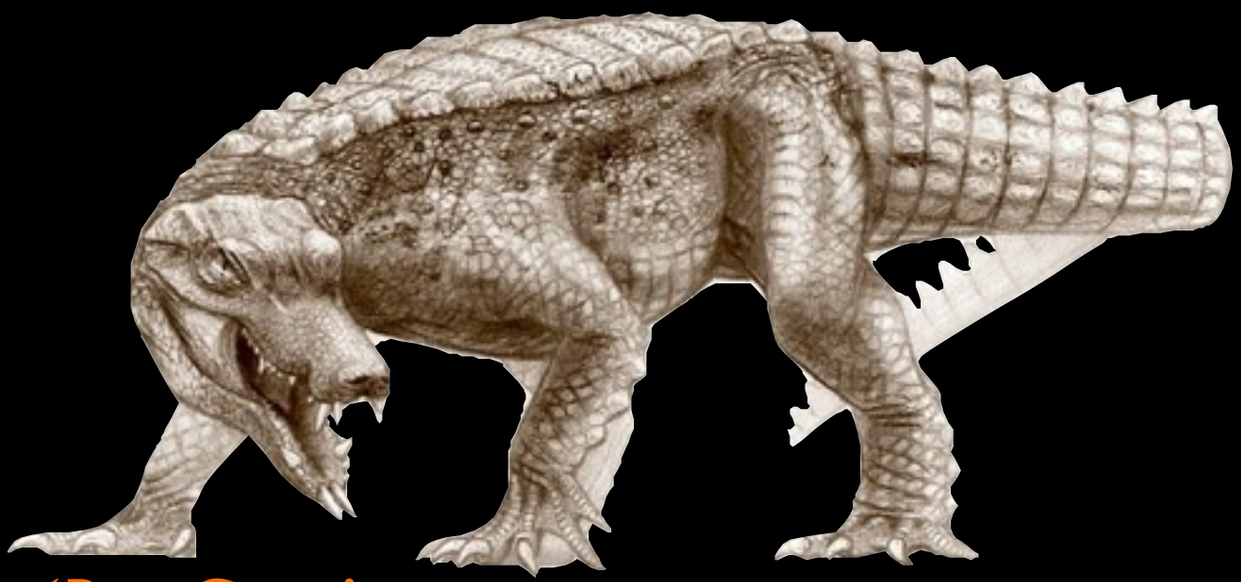
It isn't.

So, although angiosperm evolution certainly had a large effect on Dinosaur evolution, it is doubtful that Dinosaurs had a global effect on angiosperm evolution

The Crocodylomorph explosion
Cretaceous


Prolacerta
Youngina
Rhynchosauria
Proterosuchus
Erythrosuchidae
Euparkeria
Proterochampsidae
Prestosuchidae
Stagonolepidae
Parasuchia
Ornithosuchidae
Crocodylomorpha
Gracilisuchus
Postosuchus
Pterosauria
Lagosuchus
Ornithischia
Sauropodomorpha
Herrerasaurus
Ceratosauria + Tetanurae
THEROPODA
SAURISCHIA
PCRMPH
DROMAEO-SUCHIA
DINOSAURIA
DINOSAURIFORMES
CRUROTARSI
ORNITHODIRA
CROWN-GROUP ARCHOSAURIA
ARCHOSAURIA

Terrestrial Crocodylomorphs



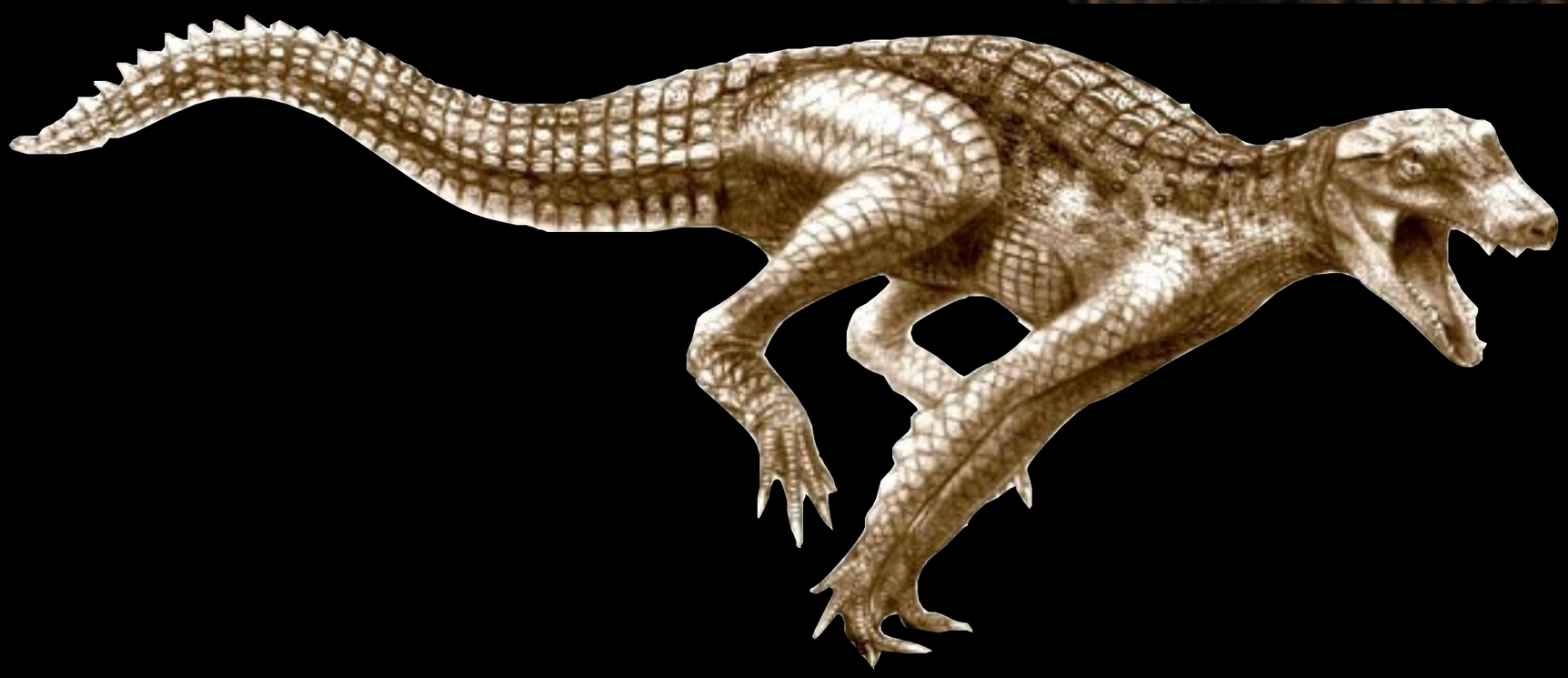
'Rat Croc'
Cretaceous
Araripesuchus
Skull was about the width of a credit card

Terrestrial Crocodylomorphs

'Pancake Croc'
mid-late Cretaceous
Laganosuchus
20 feet long
Jaw was not strong enough to wrestle prey
Was a sit-and-wait underwater predator

Terrestrial Crocodylomorphs

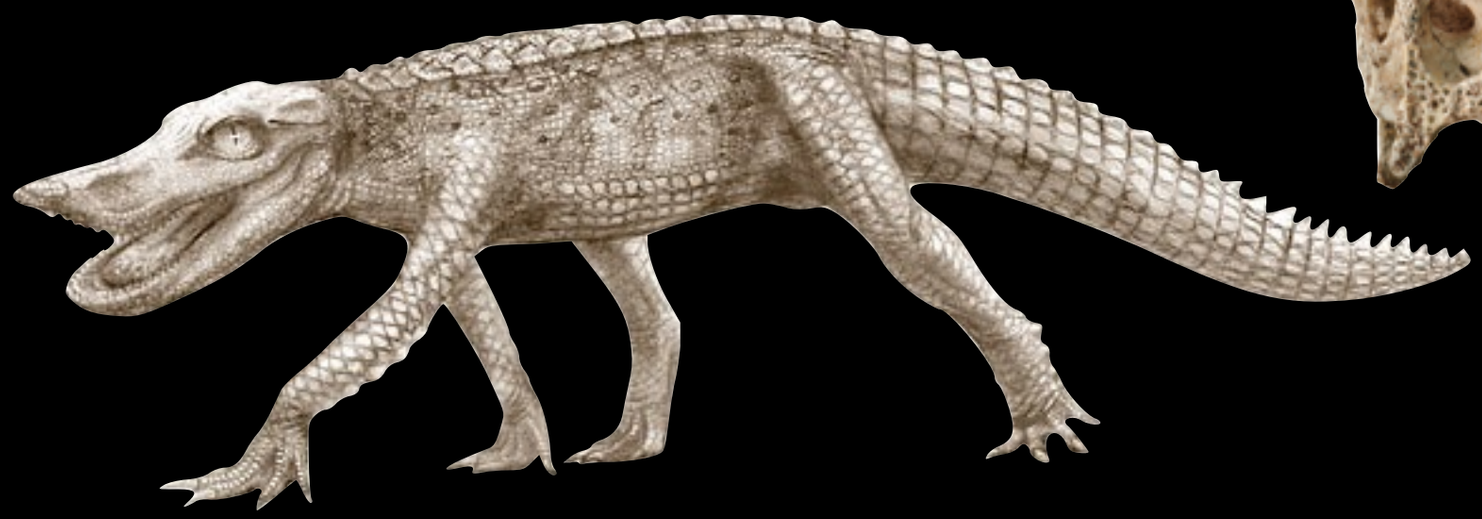
‘Dog Croc’
Araripesuchus
mid-late Cretaceous
Large fore-brain
3 ft long
Plant and grub eater




www.wayofthemaster.com

Terrestrial Crocodylomorphs

‘Duck Croc’
Anatosuchus
mid-late Cretaceous
2.5 ft long
Built to move on land
Brain surrounded by air pockets...
Specialized nose ~ heightened sensory perception



What now Kirk??

Terrestrial Crocodylomorphs

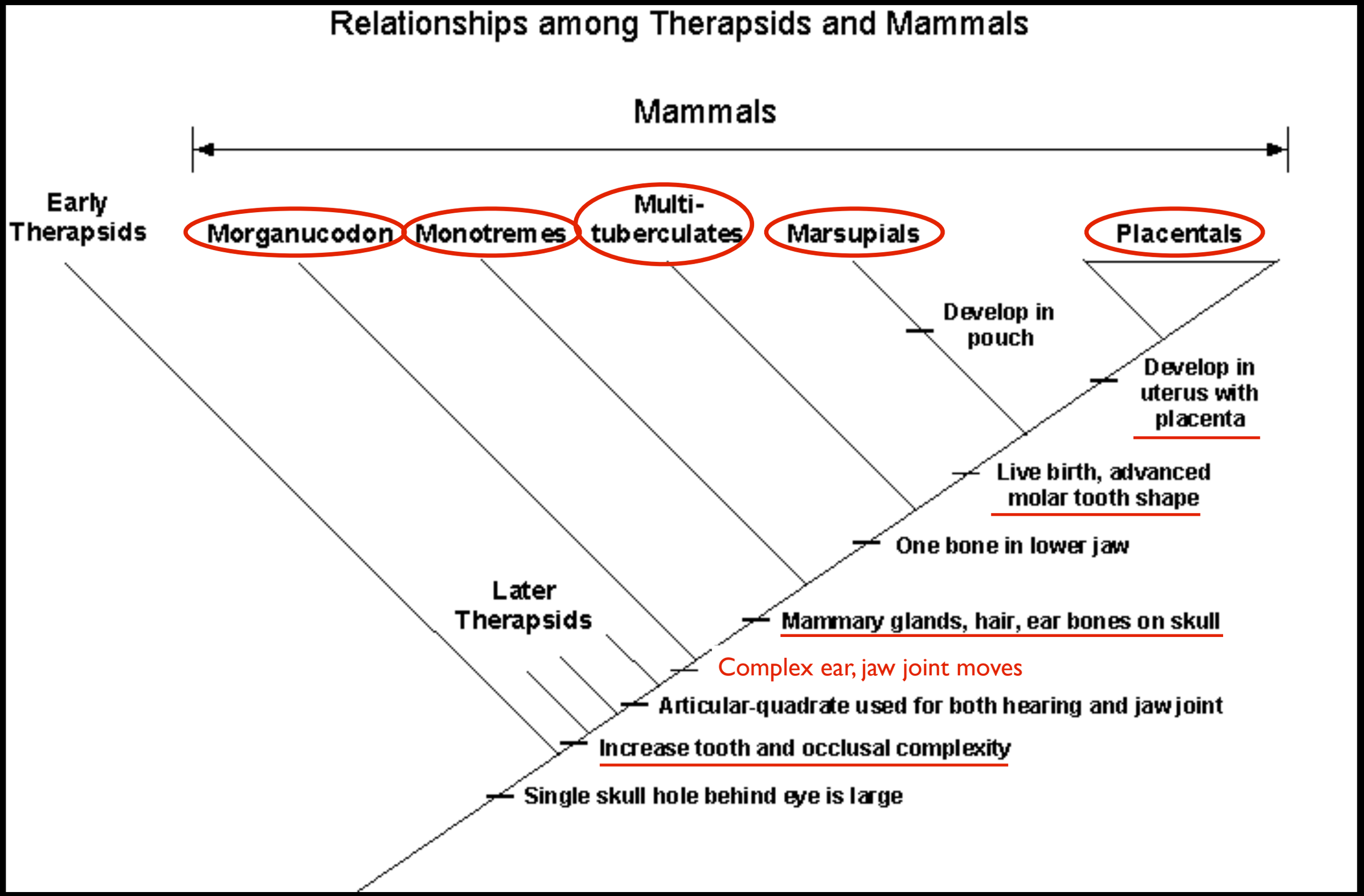
'Boar Croc'
Kaprosuchus
Late Cretaceous
20 ft long
Terrestrial
3 sets of caniniform, notched, teeth
unique among Crocodiliforms
Orbits angled forward (stereoscopic vision)

DINOSAUR EATER

The Origin of Mammals

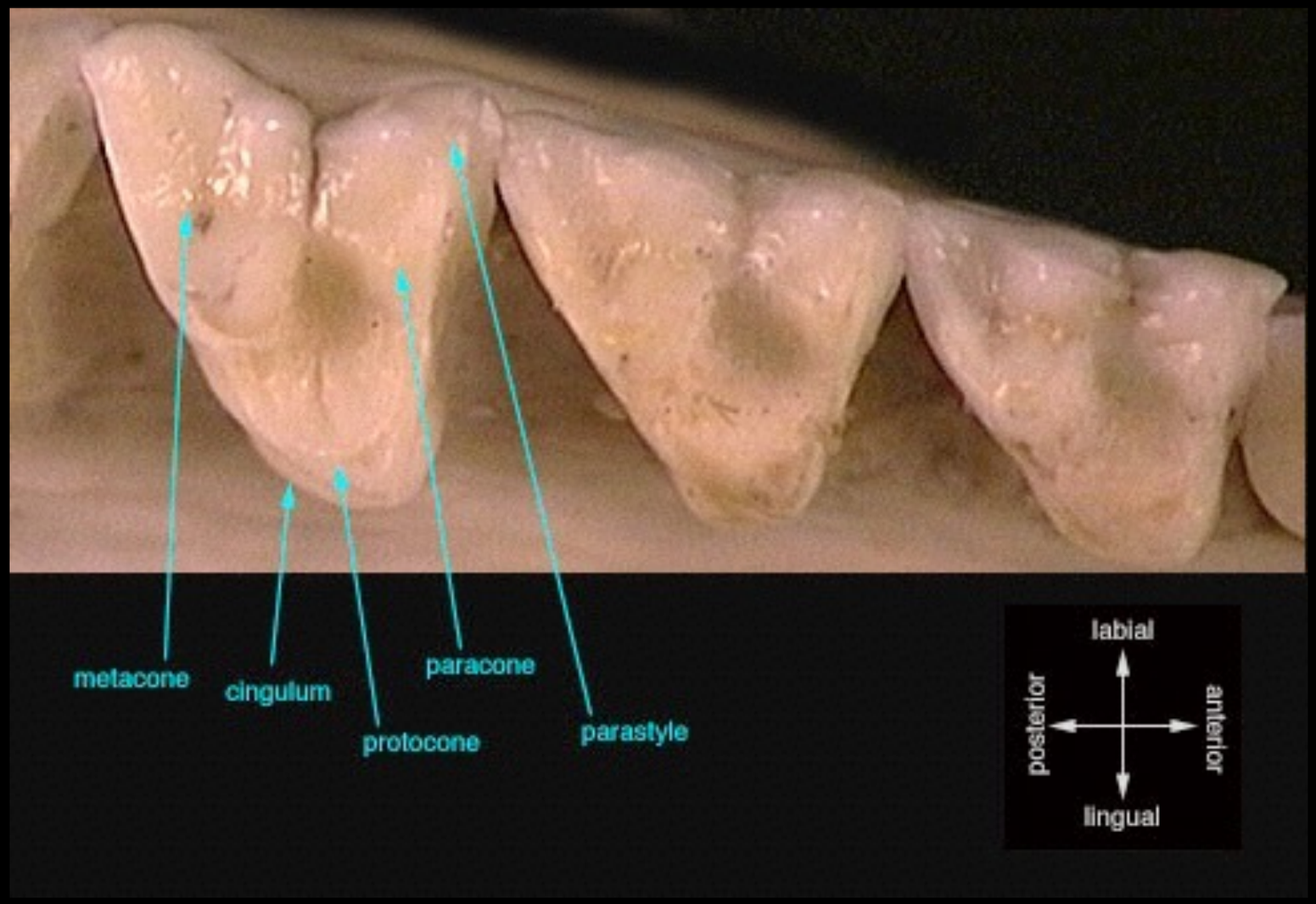
Of teeth and ears

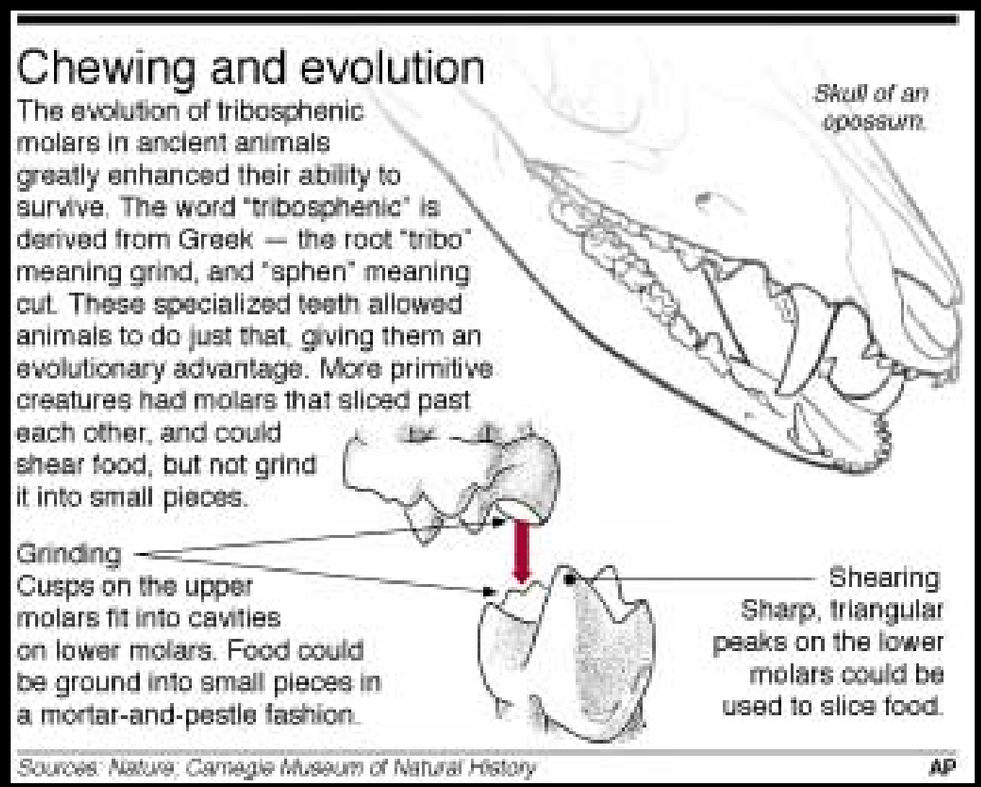
The Origin of Mammals



Mammal Teeth

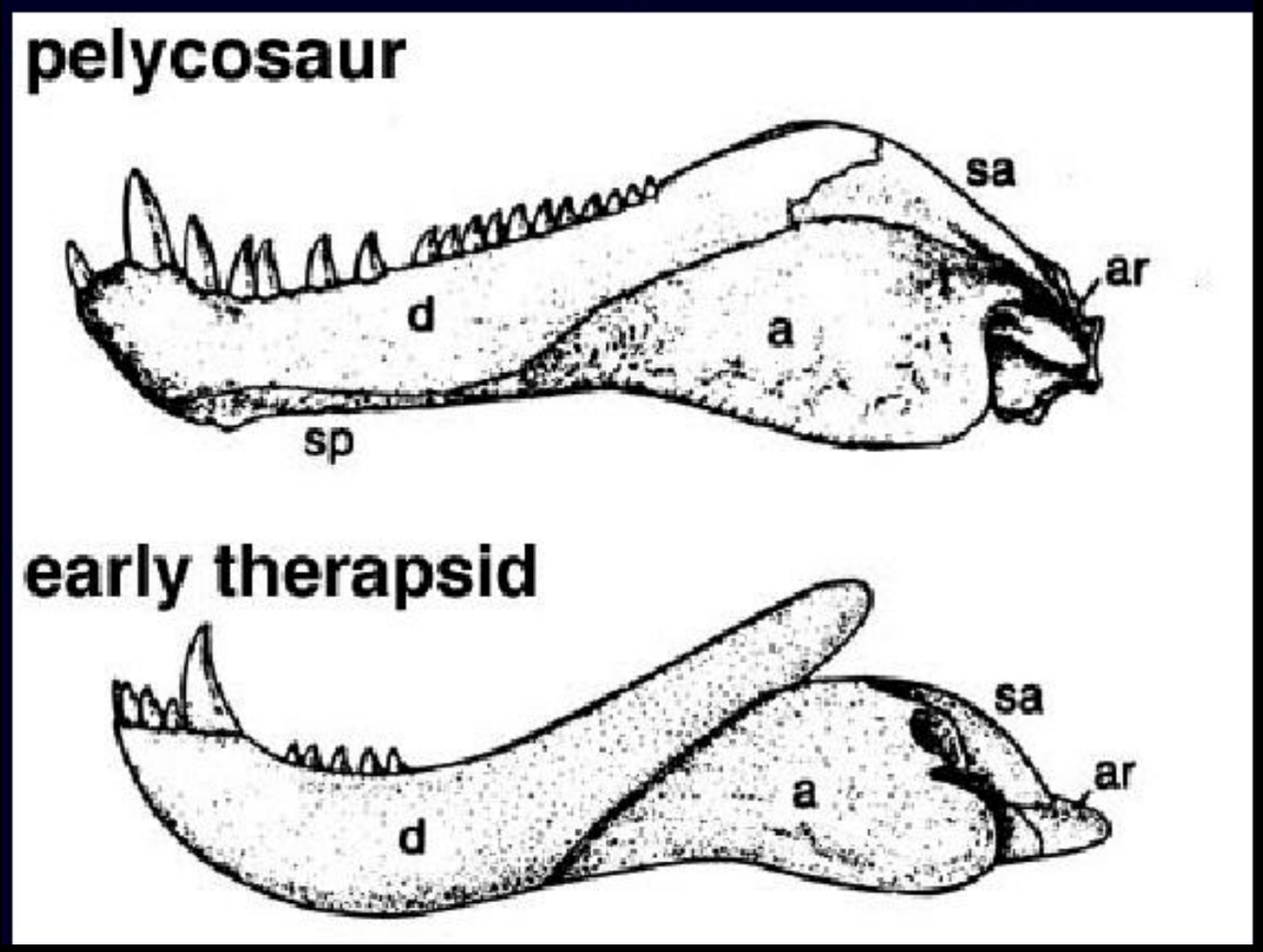
Mammal teeth have complex shapes
Different types of teeth in jaws
Complex occlusion



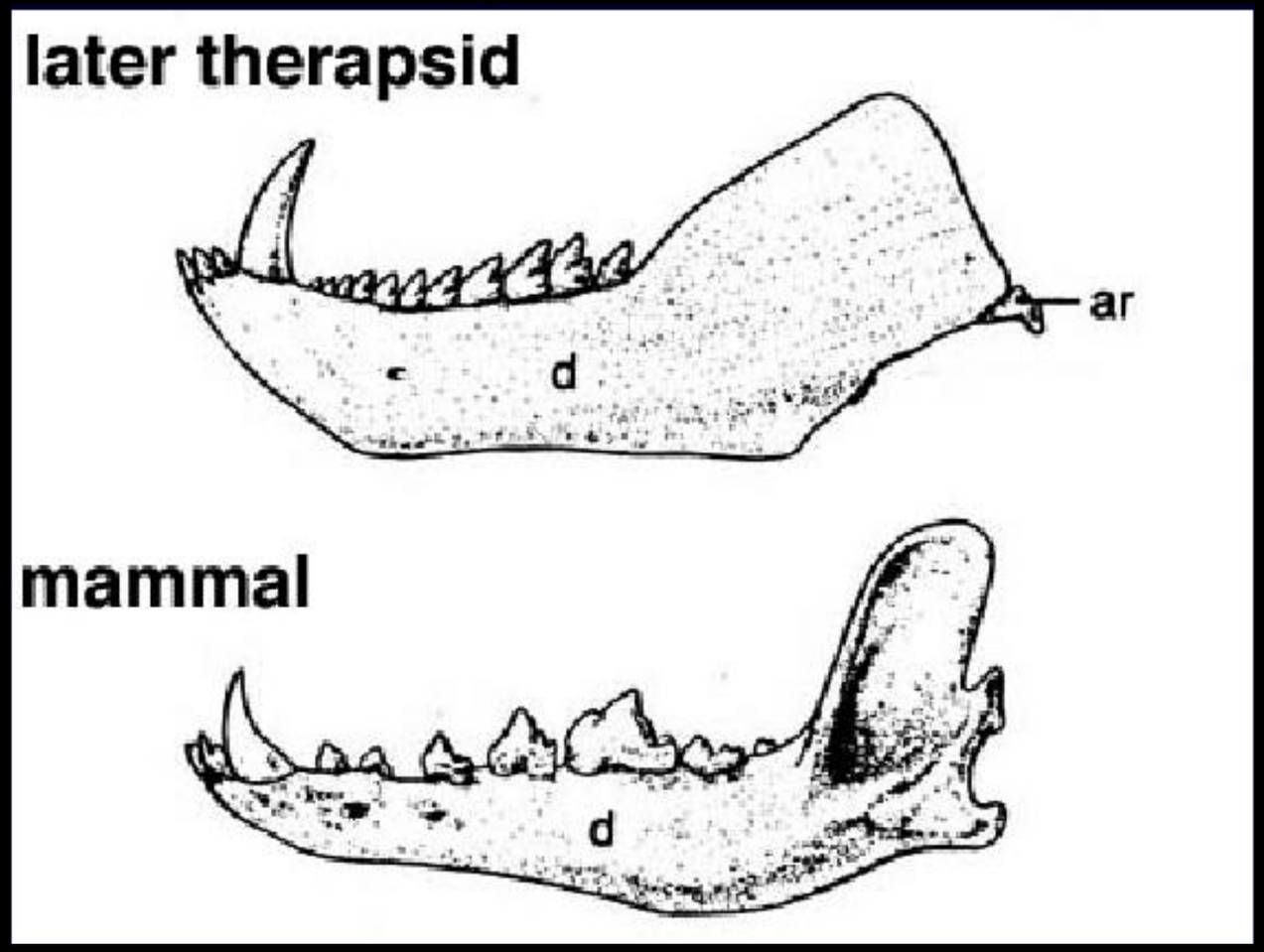


Mammal Jaws

Early synapsids have lower jaws made up of several dermal bones...

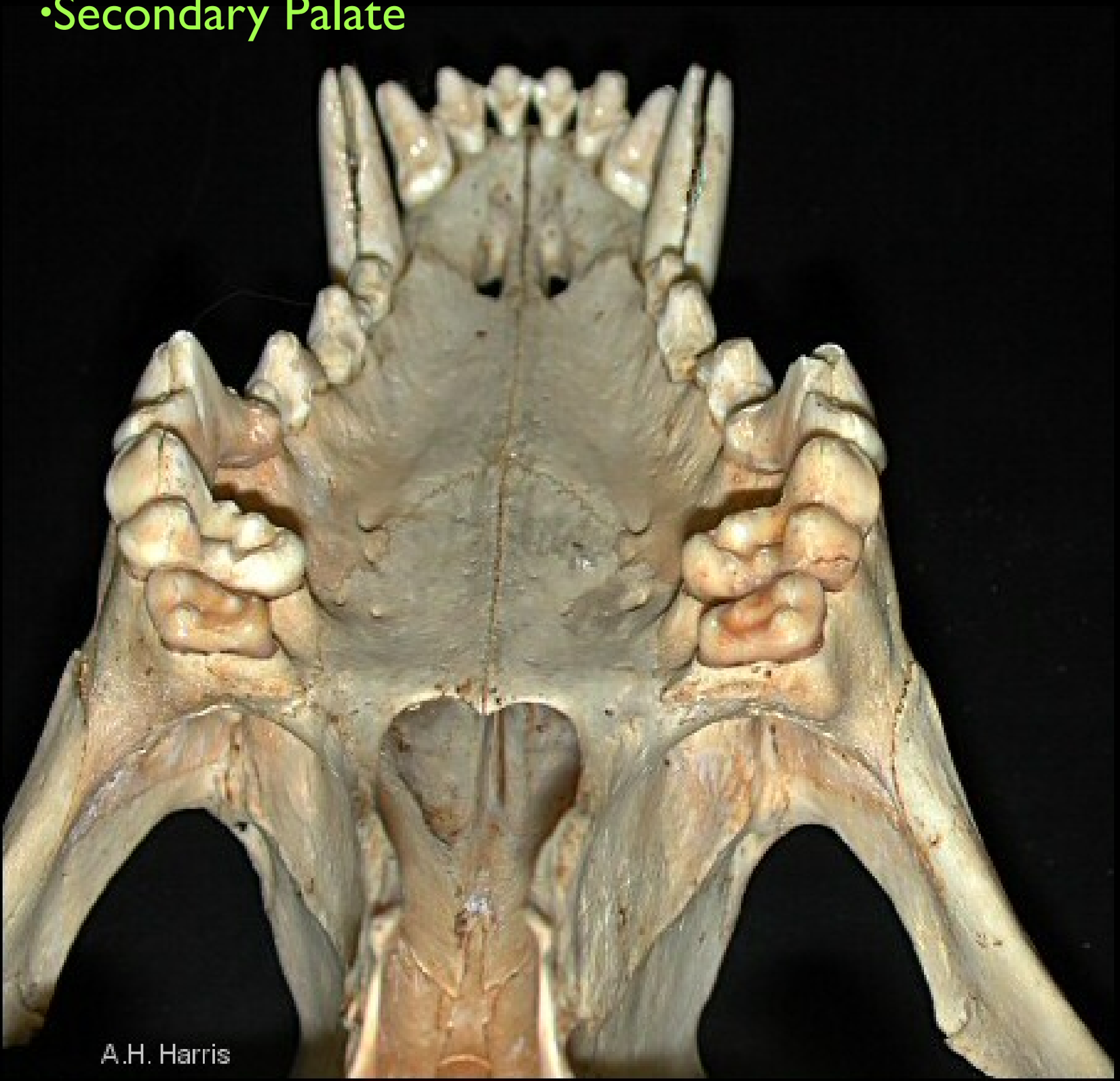


In later Therapsids, the tooth-bearing bone (dentary) takes over and all other bones are lost

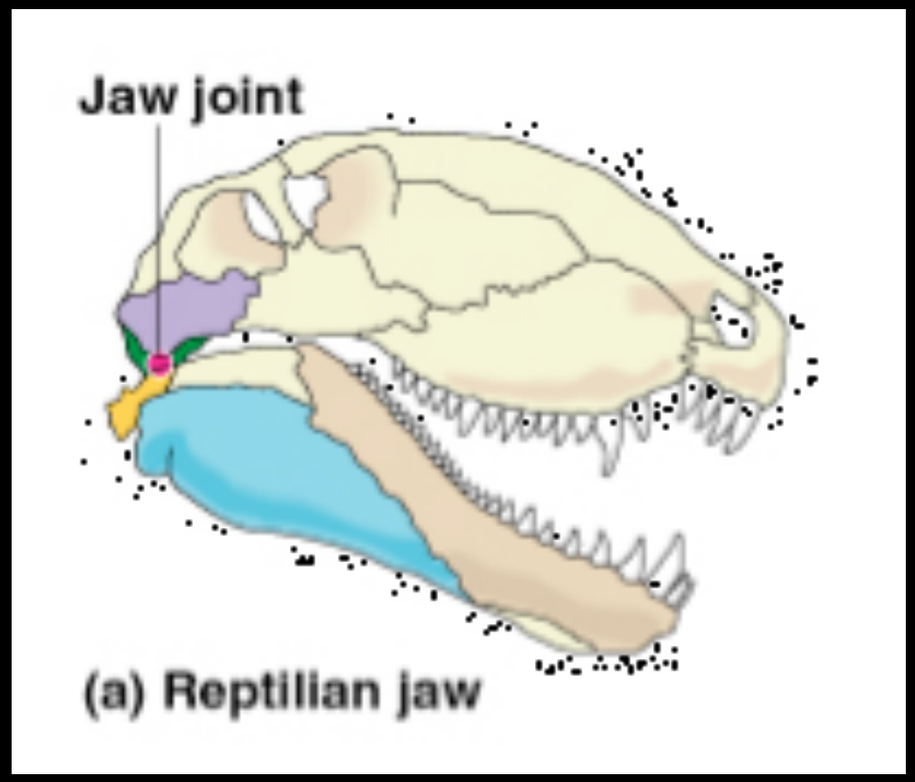


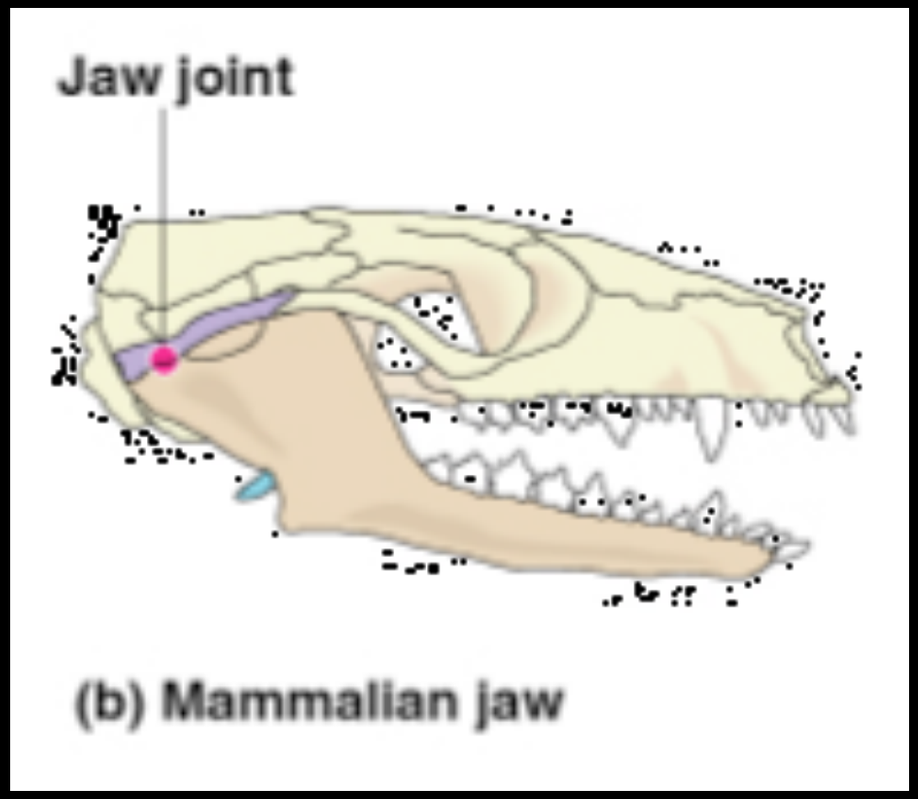
Mammal Jaws + Breathing

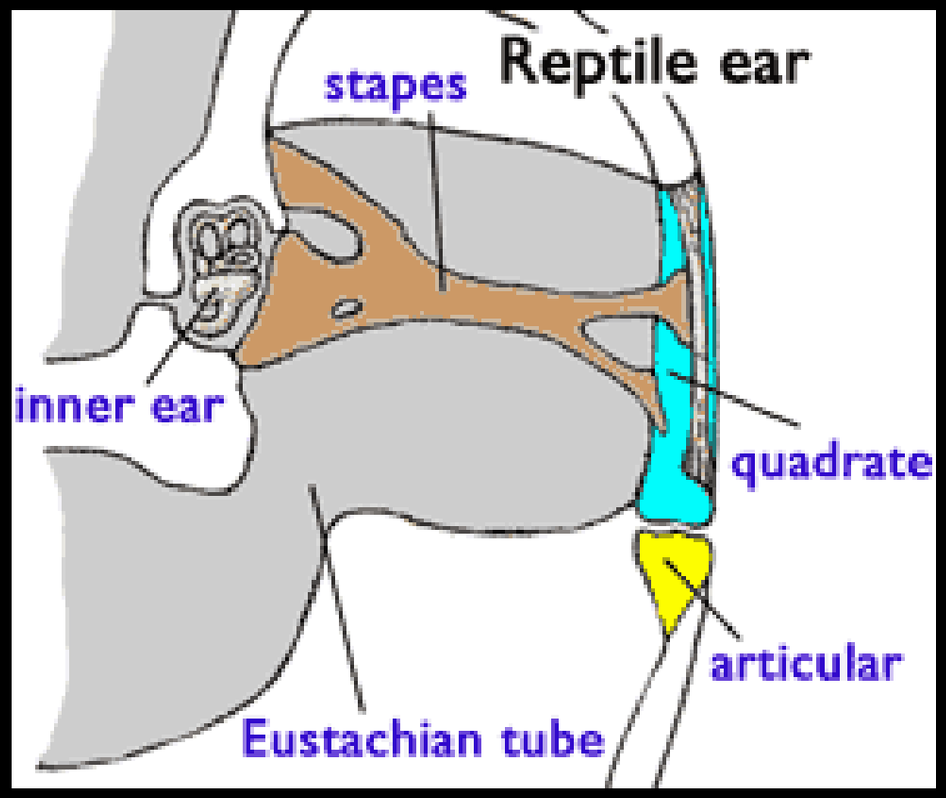
- Secondary Palate

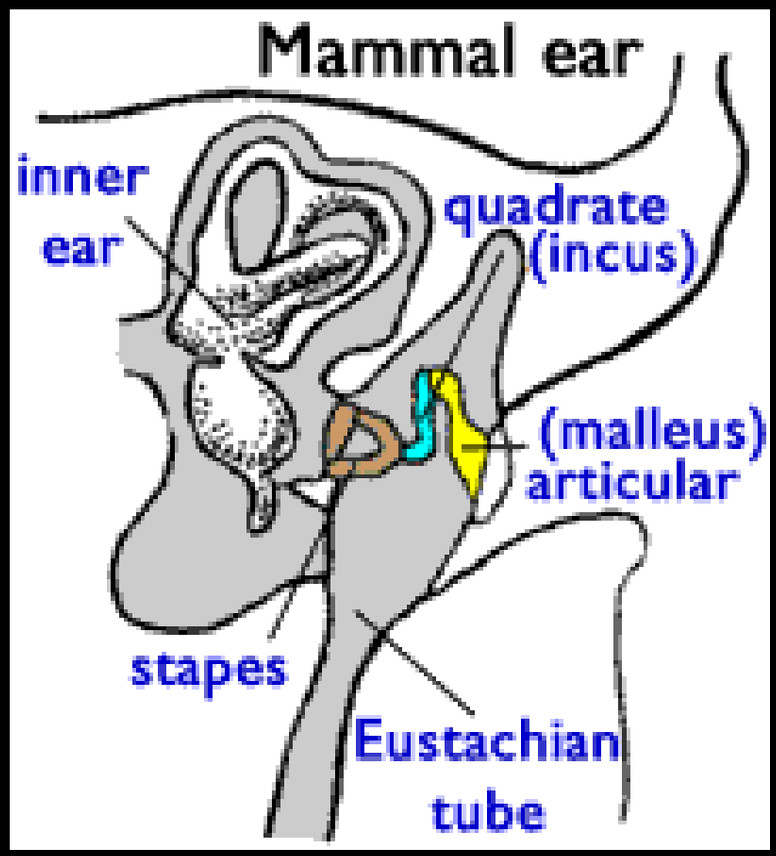


Mammal Ears


Jaw joint
(a) Reptilian jaw


Jaw joint
(b) Mammalian jaw


Reptile ear
stapes
inner ear
quadrate
articular
Eustachian tube


Mammal ear
inner ear
quadrate (incus)
(malleus) articular
stapes
Eustachian tube

Mammal Ears

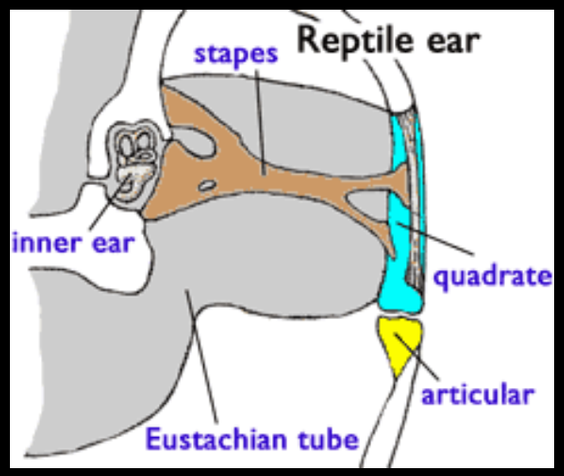
Probainognathus: beginning of the switch

Reptile/Bird *Quadrate-Articular*

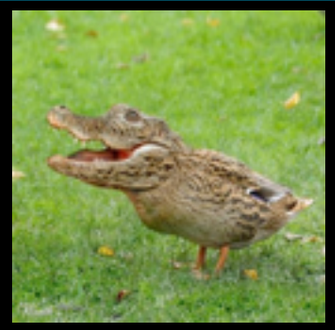
↓

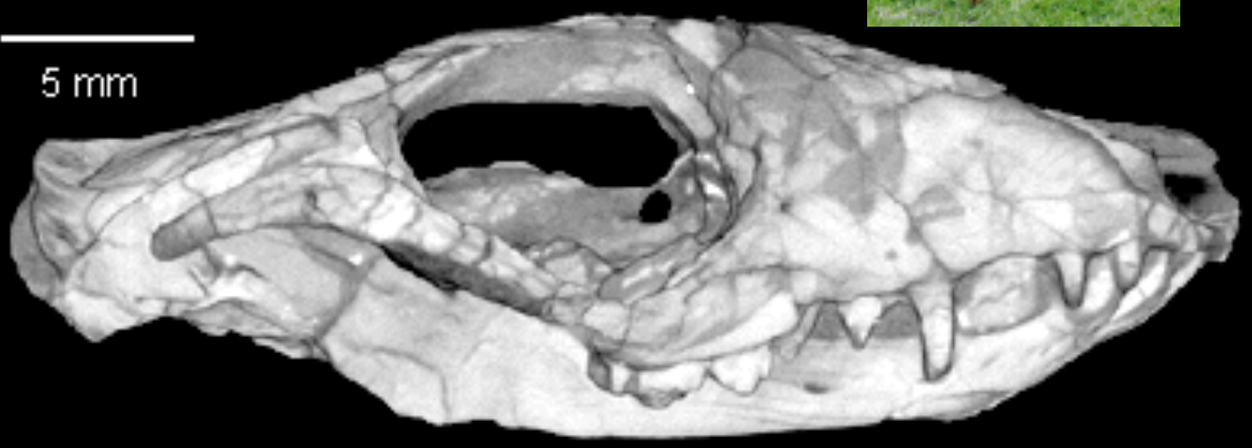
Mammal *Squamosal-Dentary*

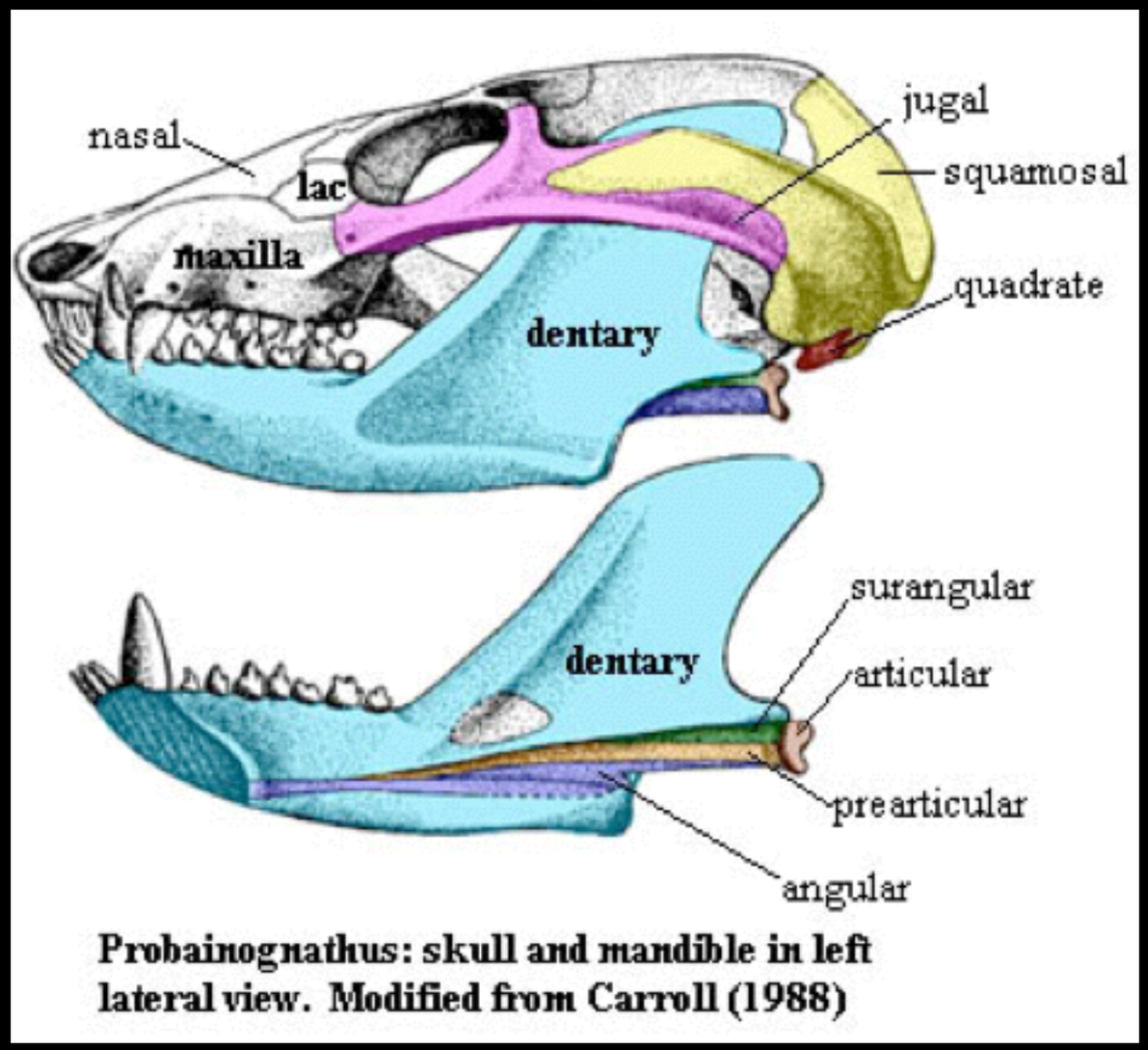
- Expansion of dentary bone
- Reduction of articular and quadrate bones
- First mammals have Dentary-Squamosal articulation
- Initially ear bones were still connected to lower jaw: did not move to the inner ear region until later
- Modern mammalian ear bones attached to SKULL rather than JAW



Evolution →



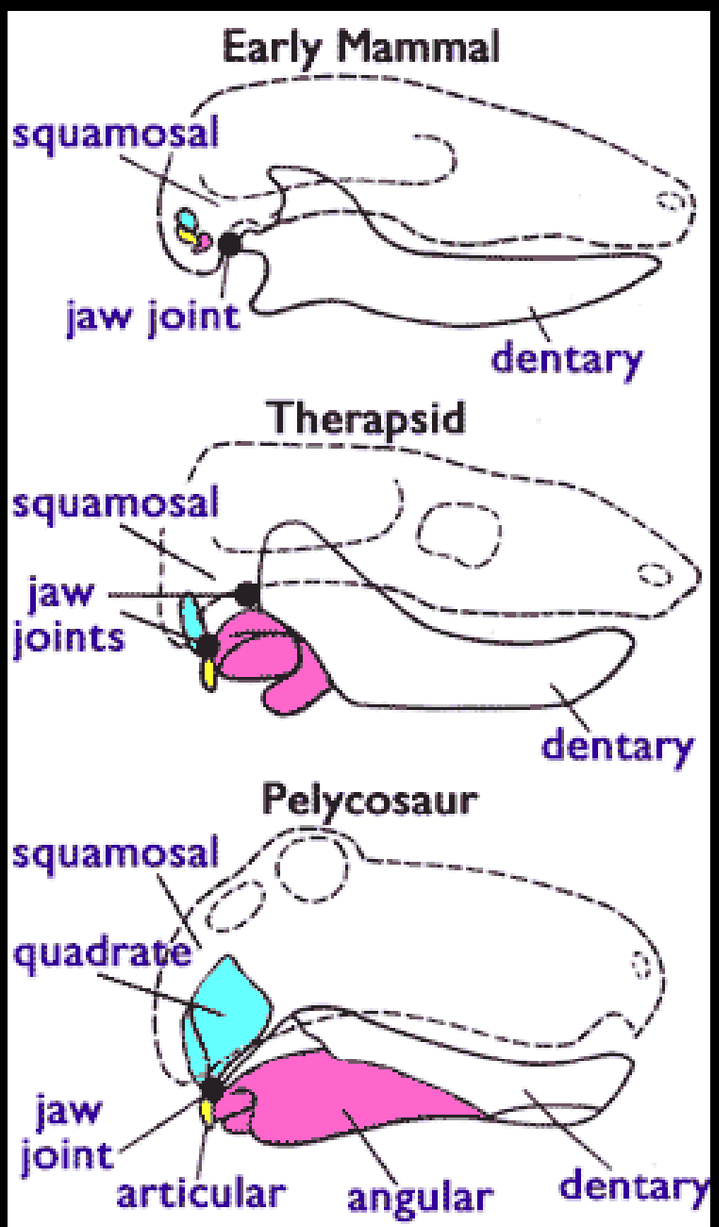


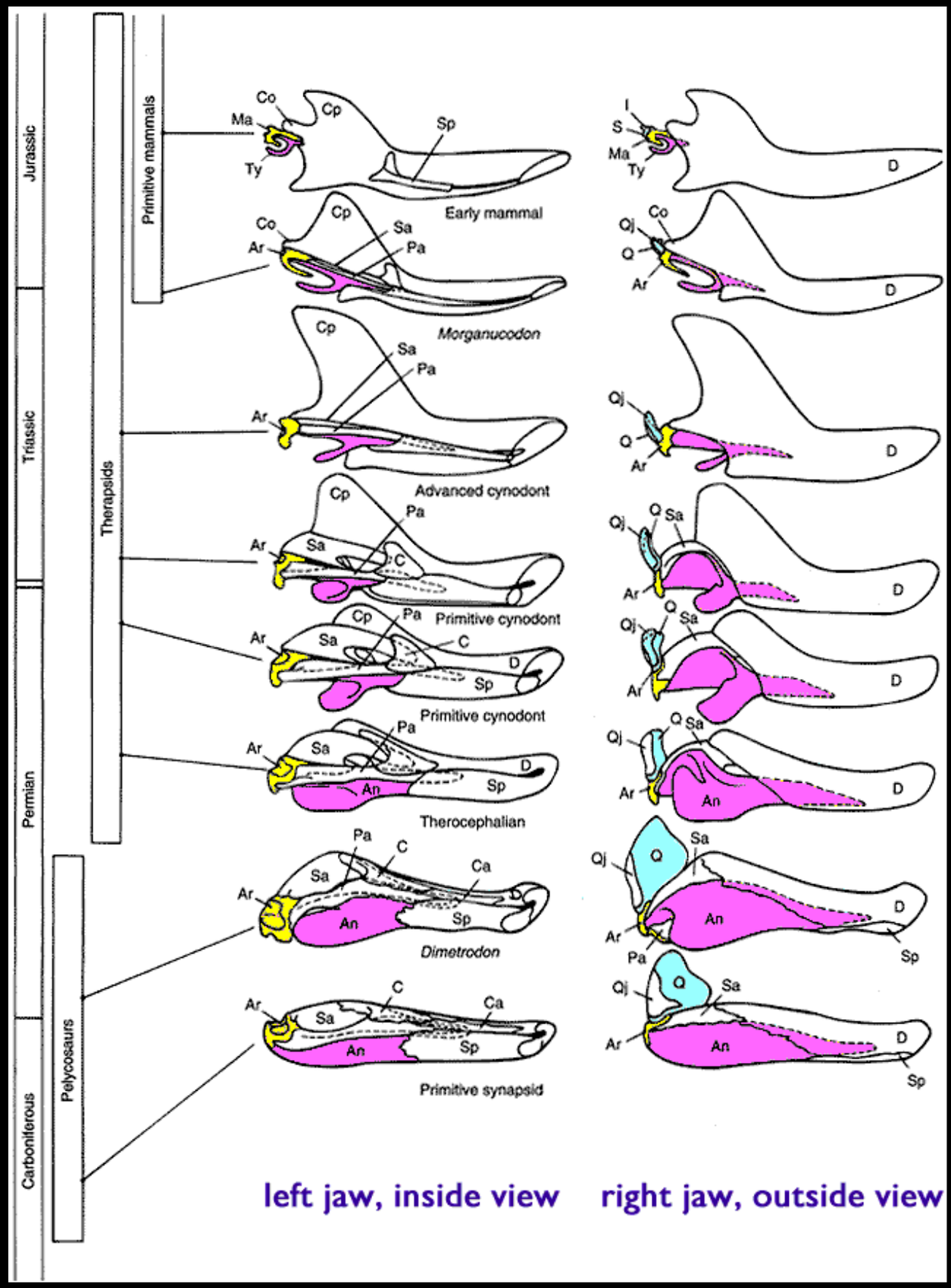


Probainognathus: skull and mandible in left lateral view. Modified from Carroll (1988)

Mammal Ears

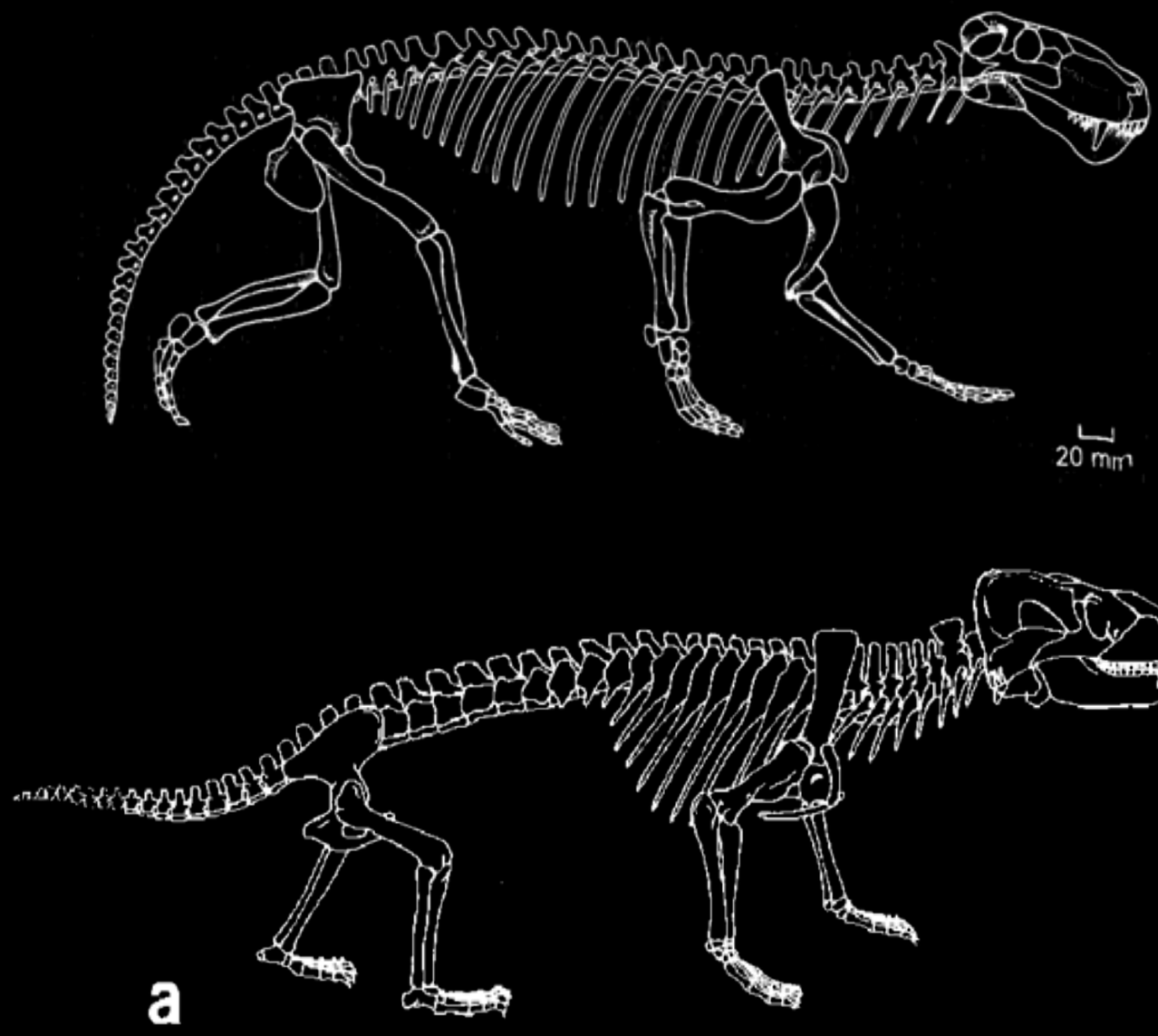
Intermediates? You want 'em, we got 'em

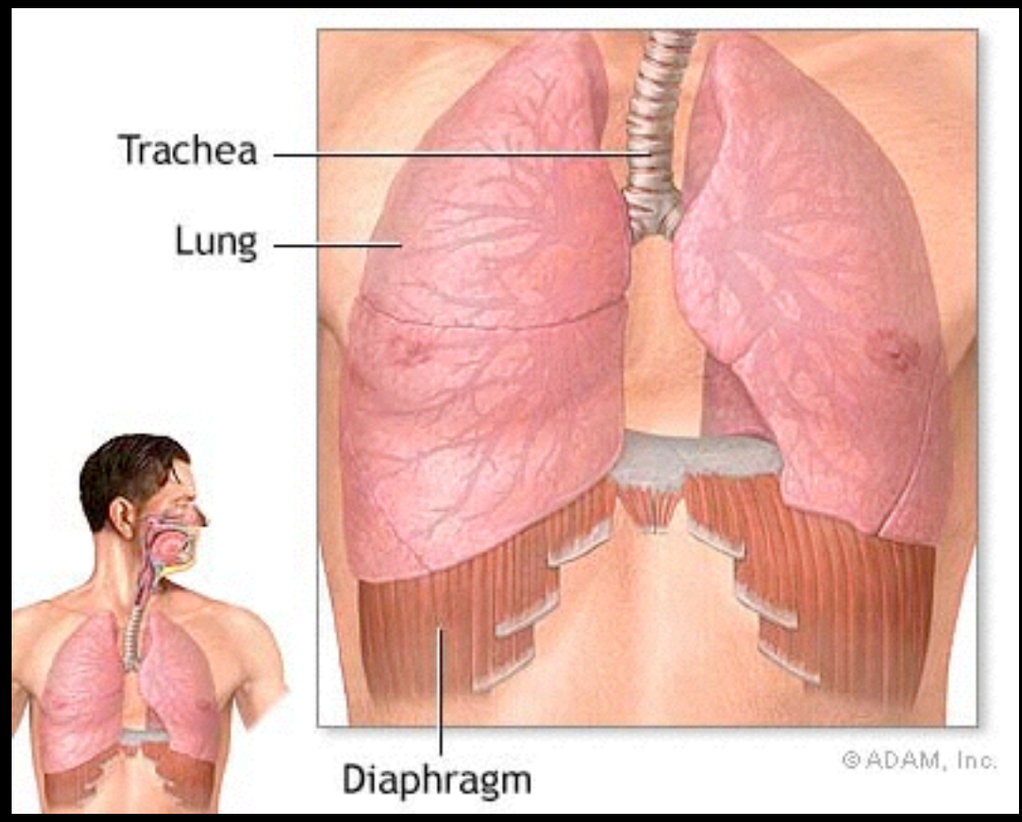




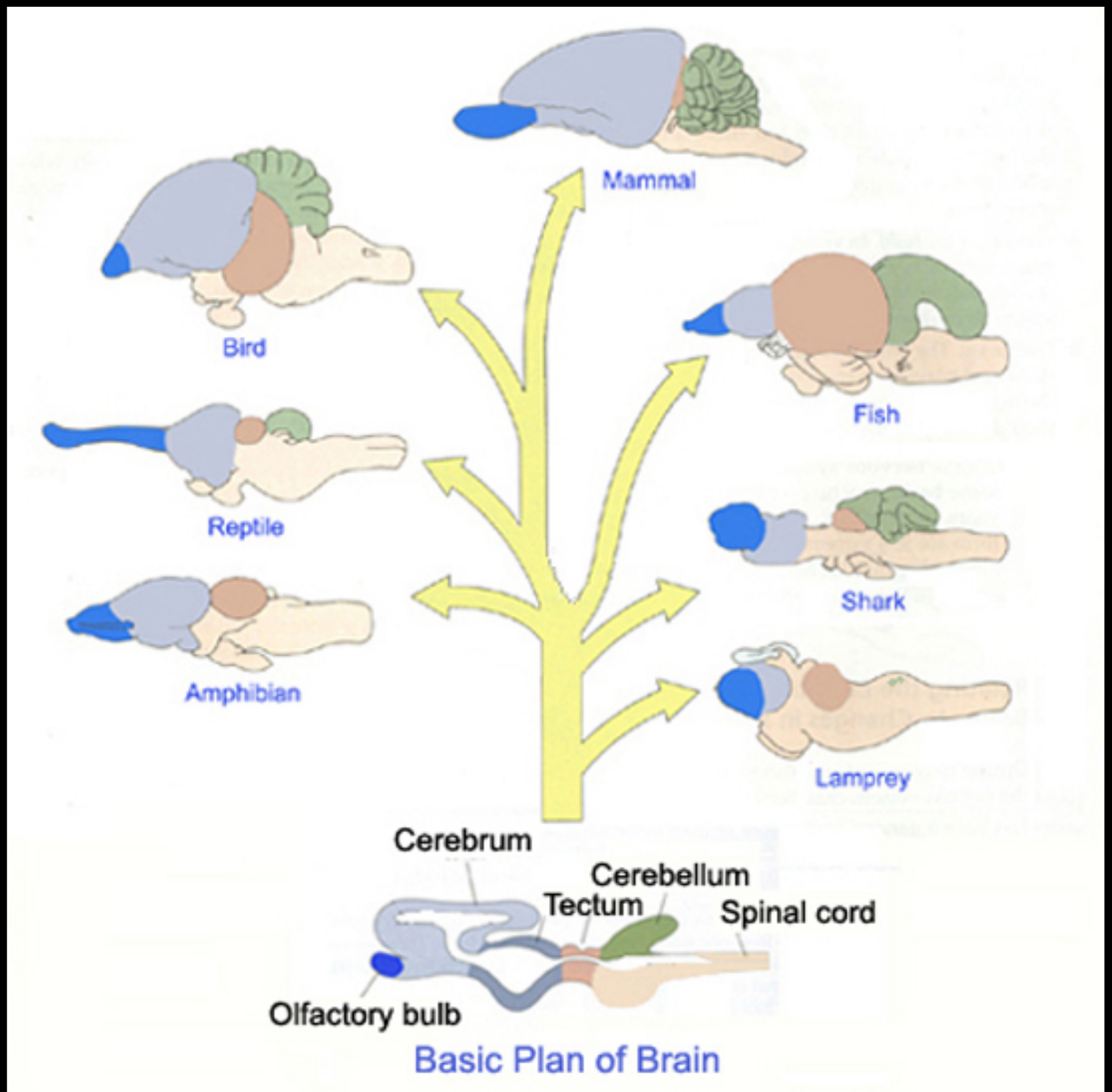
Mammalian locomotion and breathing

- Shift breathing contractions from rib muscles to DIAPHRAM
- This transition can be tracked by counting ribs





Mammalian Brains

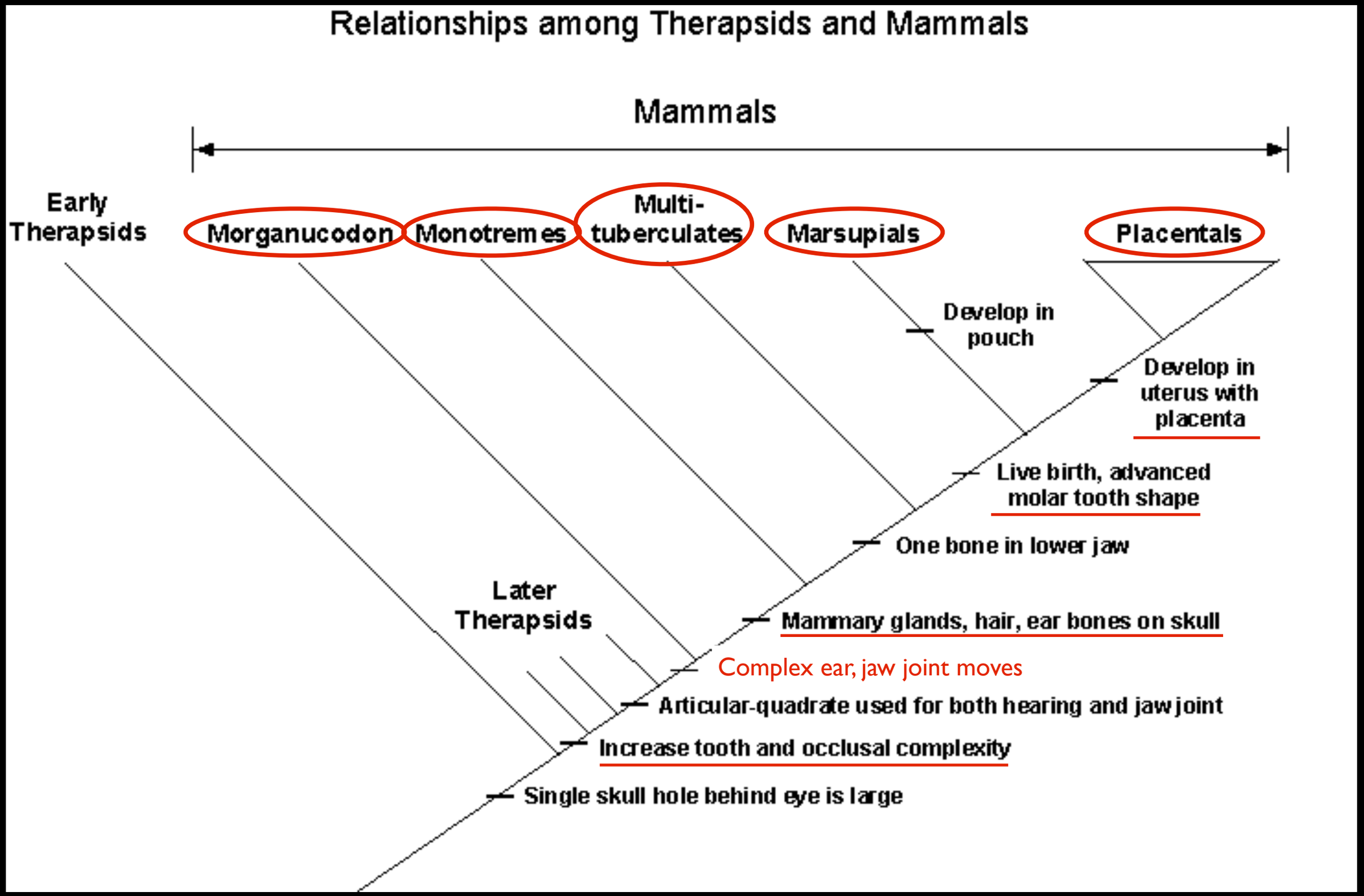


Basic Plan of Brain

BRAIIIIINS!!!

Zombie must eat brains

The Origin of Mammals



The earliest Mammal: *Morganucodon*

- Late Triassic
- Small insectivore
- Climber, Jumper
- True mammal ear but still attached to jaw... not the skull
- Upright hindlimb
- More than one bone in lower jaw and sprawling forelimbs

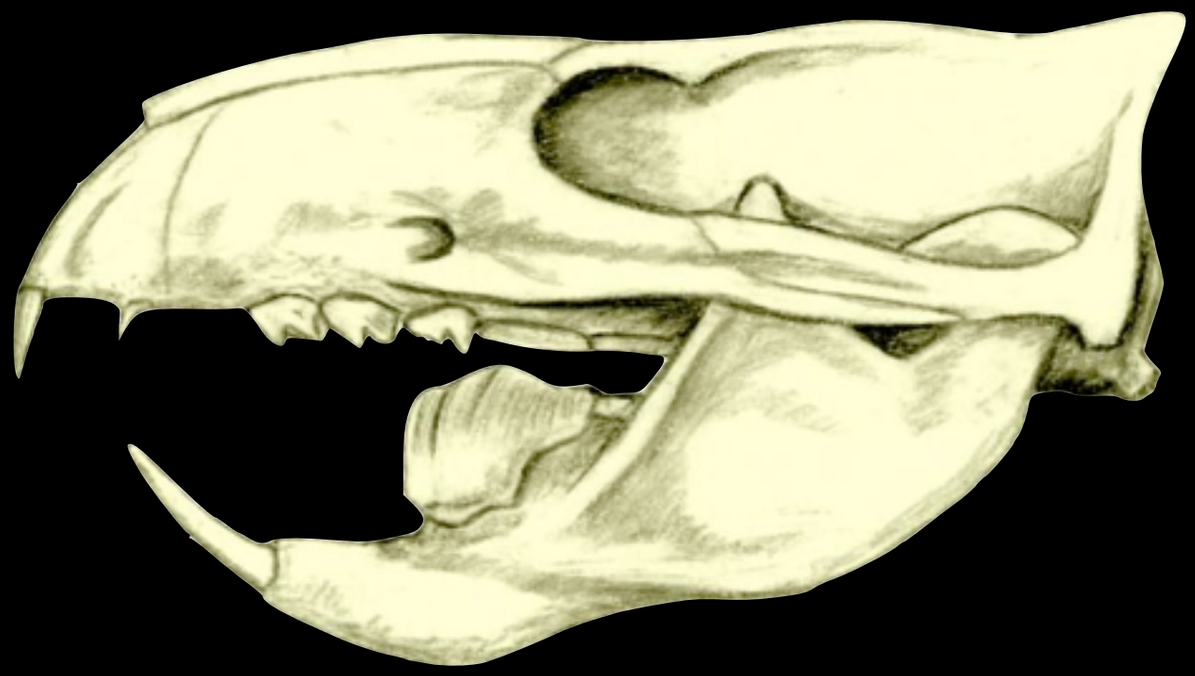
The Monotremes

- Cretaceous to Recent
- Lay eggs!
- No breasts; milk oozes from skin
- Hair
- Ear bones shift from lower jaw to skull during development
- Electroreception
- Modern forms:
  - Insectivores
  - One species is semi-aquatic
  - Only poisonous mammal

Echidna

Platypus

The Multituberculates



- Jurassic to Eocene
- (100 Ma lineage)
- Important small herbivores in Cretaceous and Cenozoic
- Single bone in lower jaw
- Many types of teeth
  - incisors
  - premolars
  - molars
- Evidence of hair in the fossil record
- Some may have given birth to live young

The Marsupials

- Cretaceous to Recent
- Live young (embryos) crawl to pouch, attach to nipple and continue development
- Share complex molar tooth shape with placentals
- Cretaceous forms mostly opossum-like in terms of ecology
- Modern forms diverse- peak diversity in Australia and South America

The Placentals

- Cretaceous to Recent
- Give birth to fully developed young
- Fetus nourished by the Placenta
- Cretaceous forms were mostly shrew-like in terms of ecology
- Modern forms are the dominant group in most ecosystems