Um lembrete:

wrong

right

Q = Quaternary
Ng = Neogene
Pg = Paleogene
K = Cretaceous
J = Jurassic
Tr = Triassic

P = Permian
C = Carboniferous
D = Devonian
S = Silurian
O = Ordovician
E = Cambrian

Hey, I'm you guys! I have the genes for it!
Oh wow, three of us!
Are you sure you're fossil SEVEN already?
Here you go, figured one where we'd get it!
Hey, a third of vertebrate diversity dead off to the side here!
Hey, a third of vertebrate diversity dead off to the side here!
Who are you calling "primitive"?

Q = Quaternary
Ng = Neogene
Pg = Paleogene
K = Cretaceous
J = Jurassic
Tr = Triassic

P = Permian
C = Carboniferous
D = Devonian
S = Silurian
O = Ordovician
E = Cambrian

Hey, I'm you guys! I have the genes for it!

Oh wow, three of us!

Hey, a third of vertebrate diversity down there! Come on over here!

Hey, you guys figured out where we're at yet?

Are you sure you're finished with the drawings already?

Who are you calling primitive?

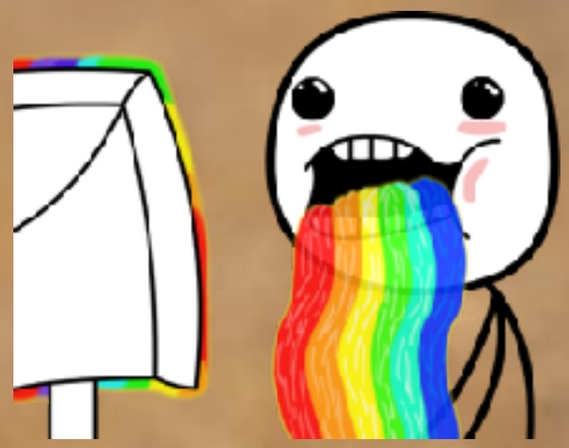
© albertonykus

Mammalia

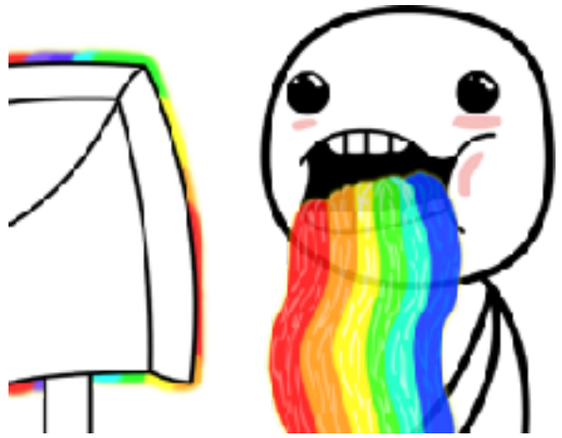
Eduardo S.A. Santos

eduardosantos-lab.weebly.com

27/09/2017



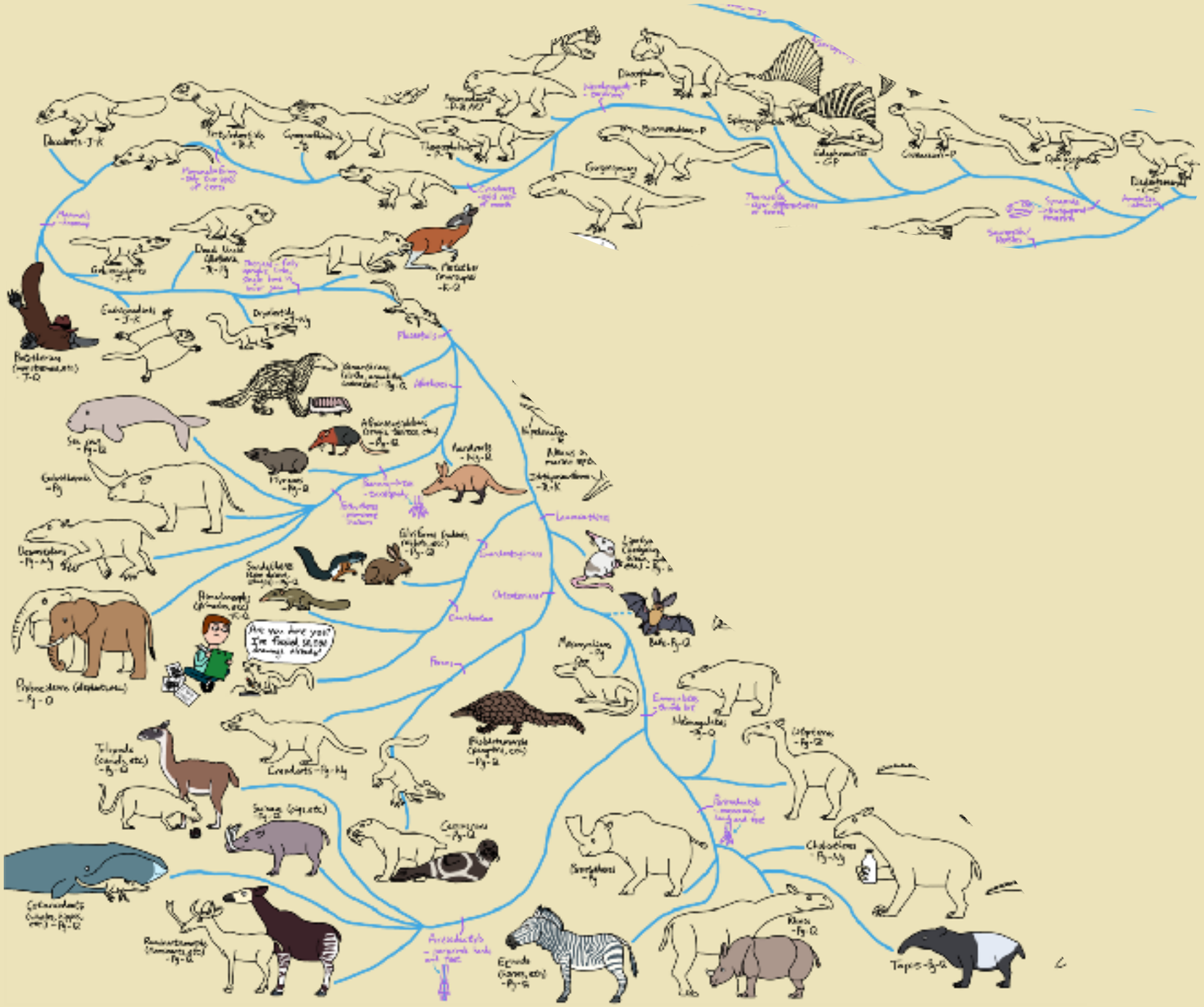
Origem e evolução



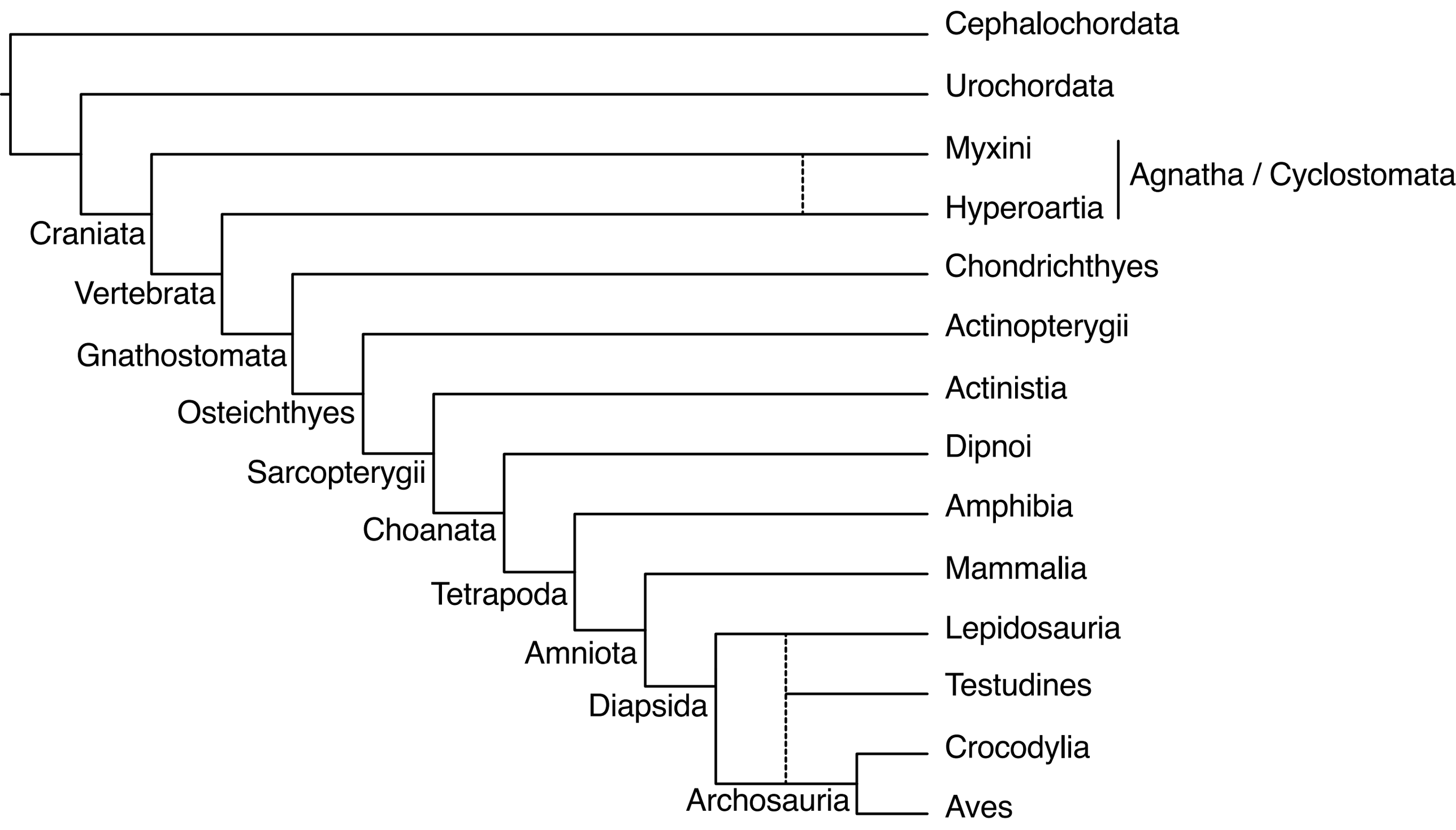
- Quem são os Synapsida?

- Quais são as principais tendências evolutivas?

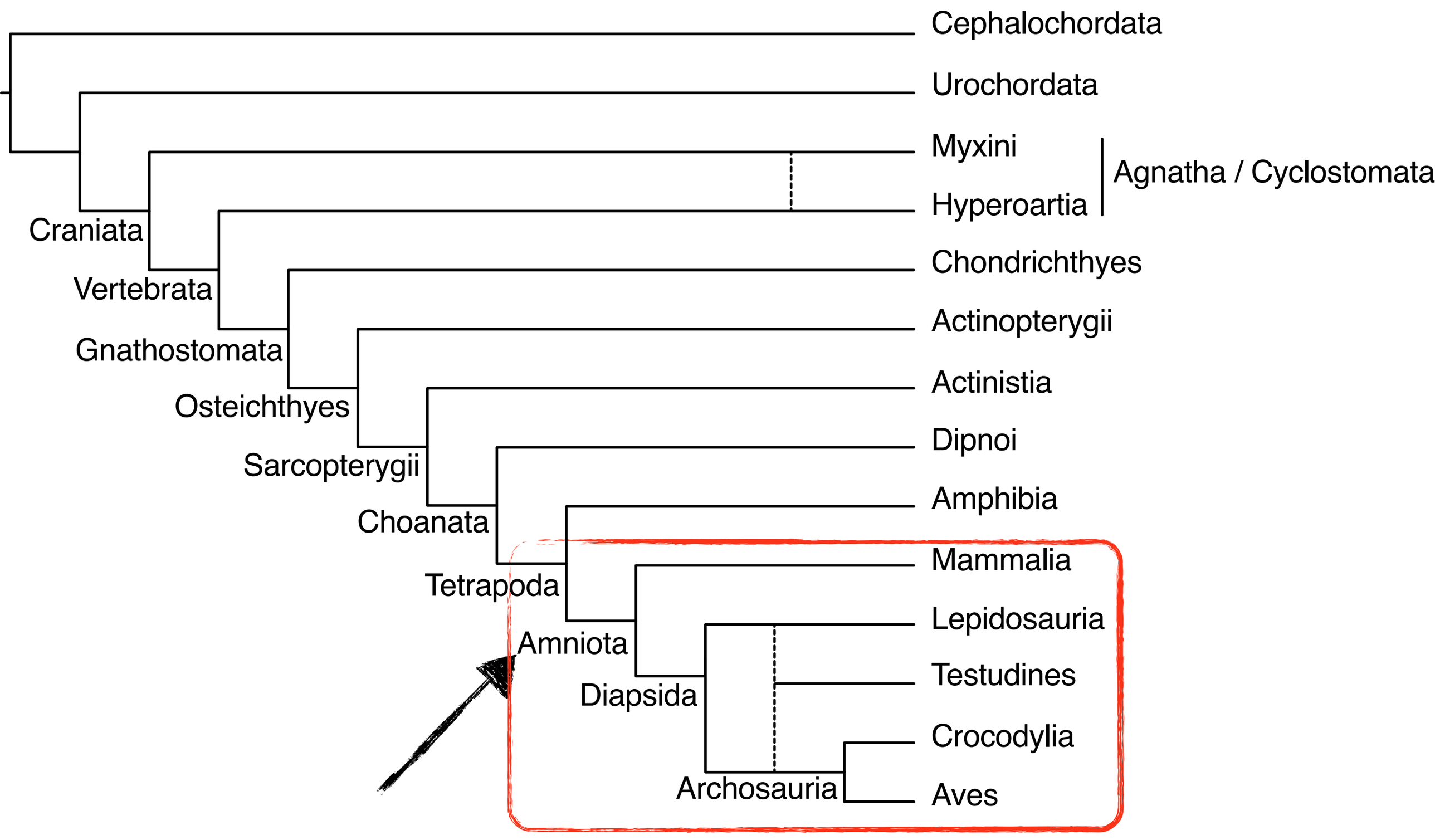
Quem são os Synapsida?



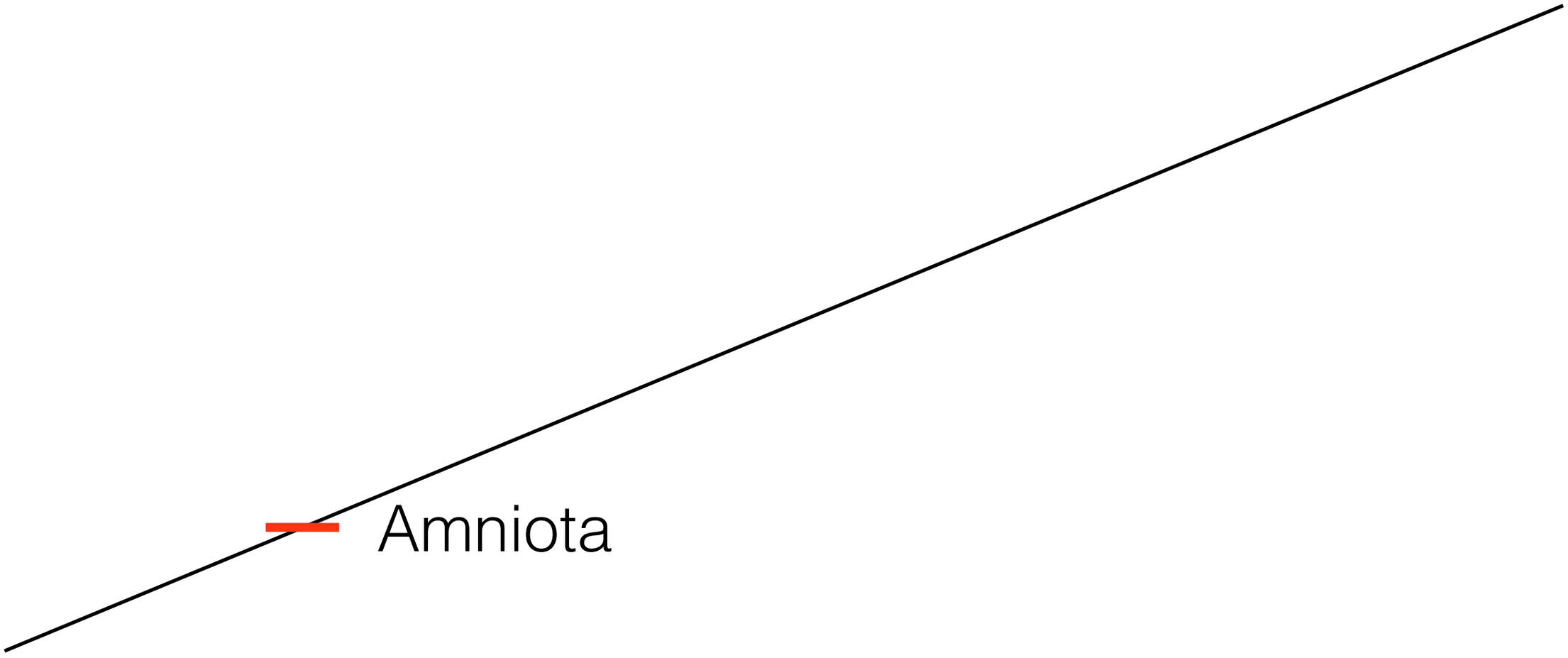
Filogenia de Chordata



Filogenia de Chordata

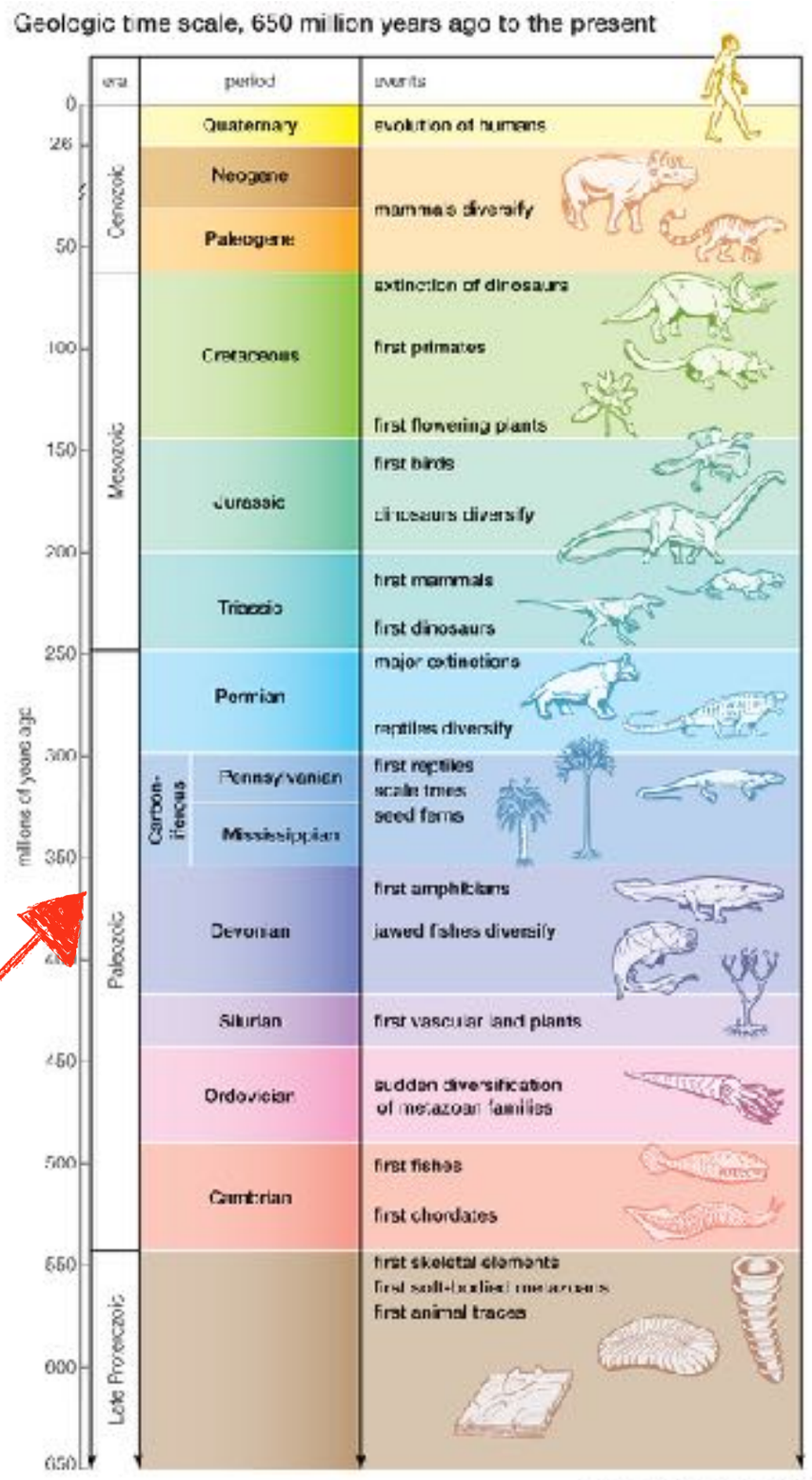


Amniota: origem de Synapsida

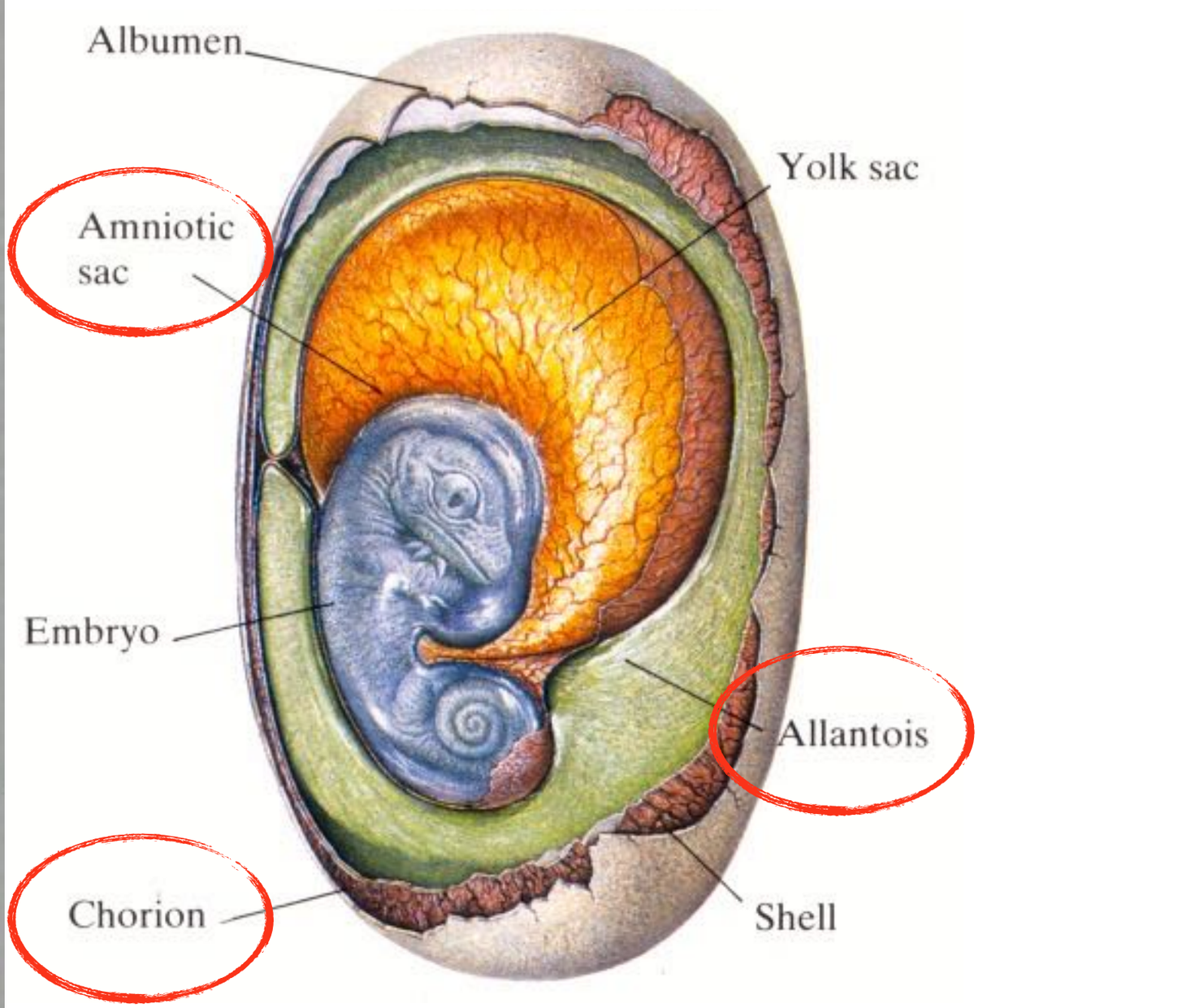


Amniota: origem de Synapsida

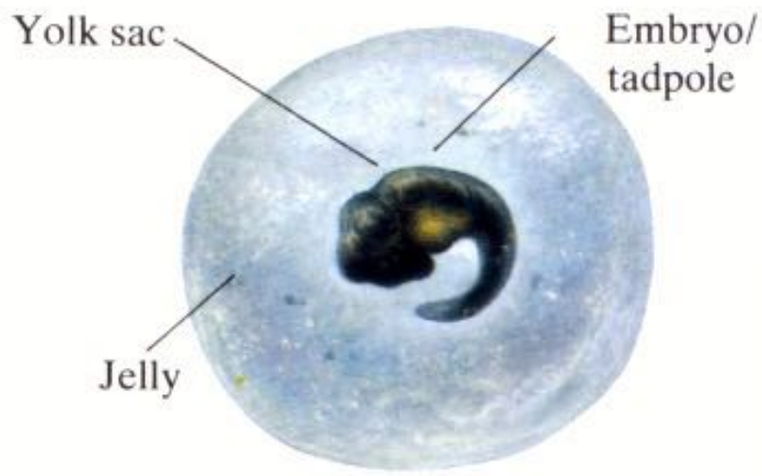
Amniota



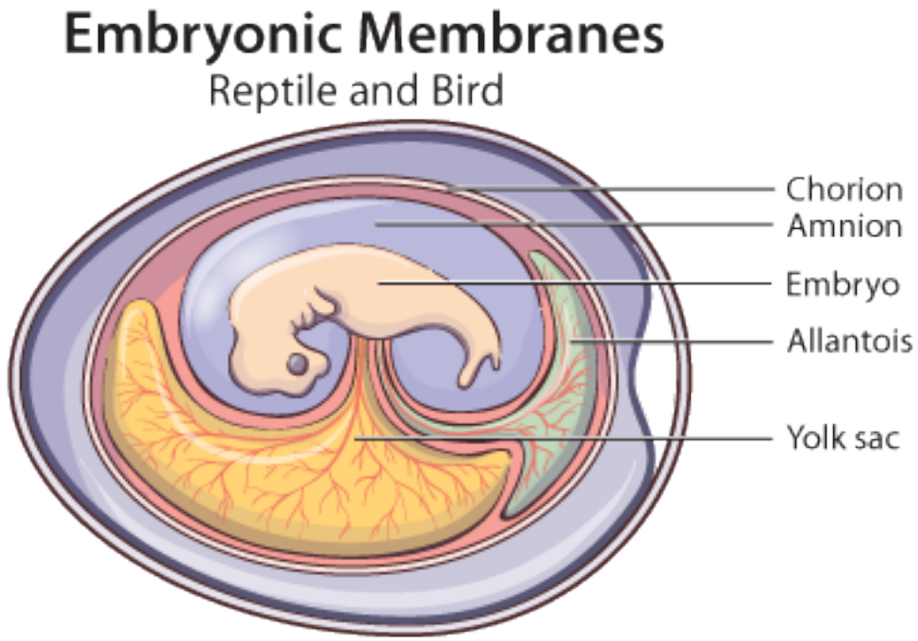
OVO AMNIÓTICO

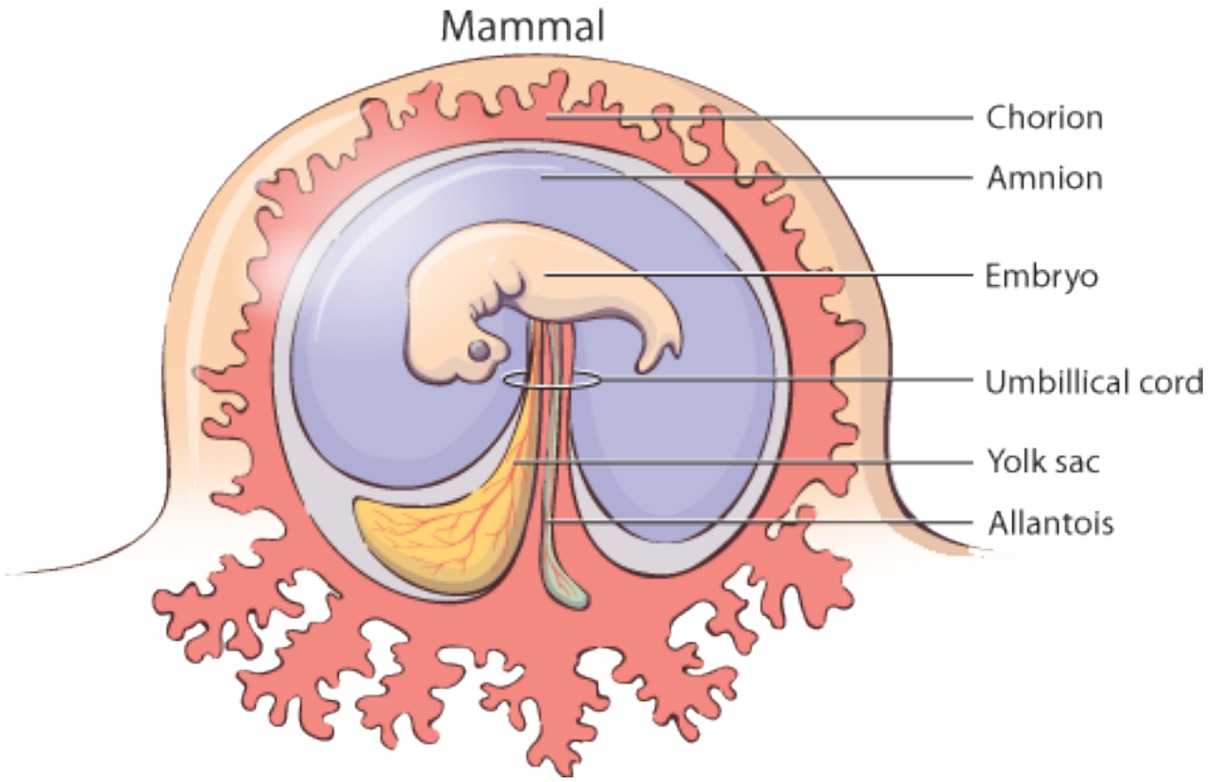


Amphibian egg

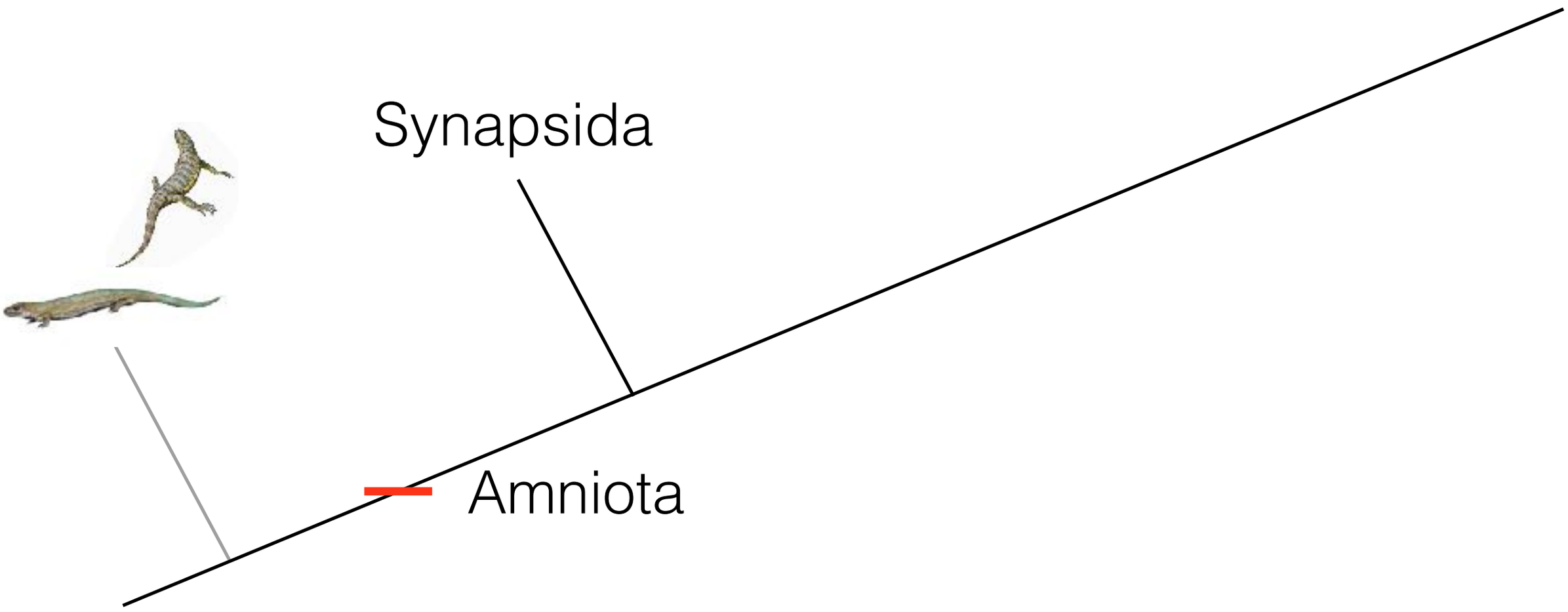


OVO AMNIÓTICO





Synapsida e suas radiações



Synapsida e suas radiações

Synapsida

Sauropsida

Beta-queratina
Excreção ácido úrico

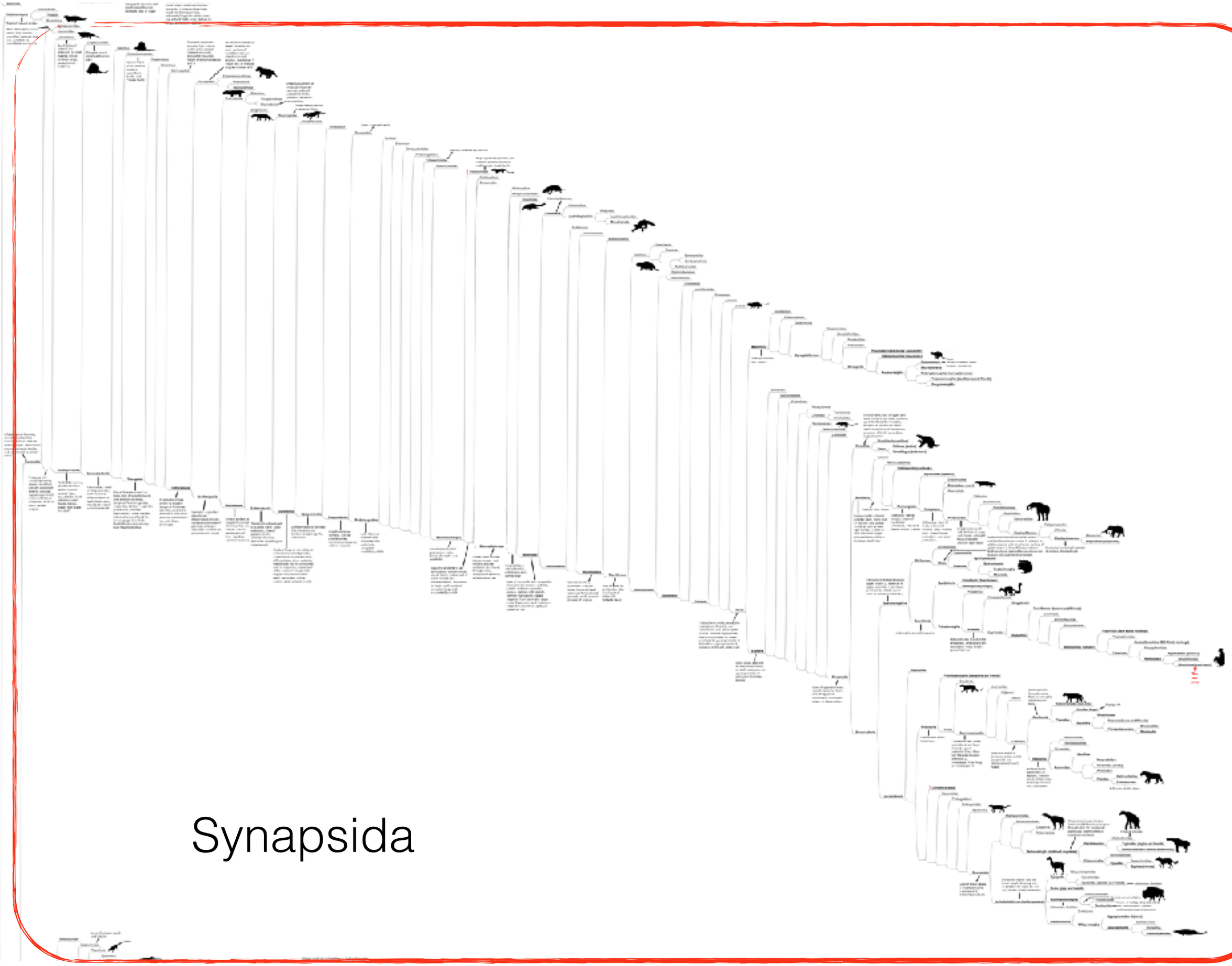
Amniota

Synapsida e suas radiações

Synapsida

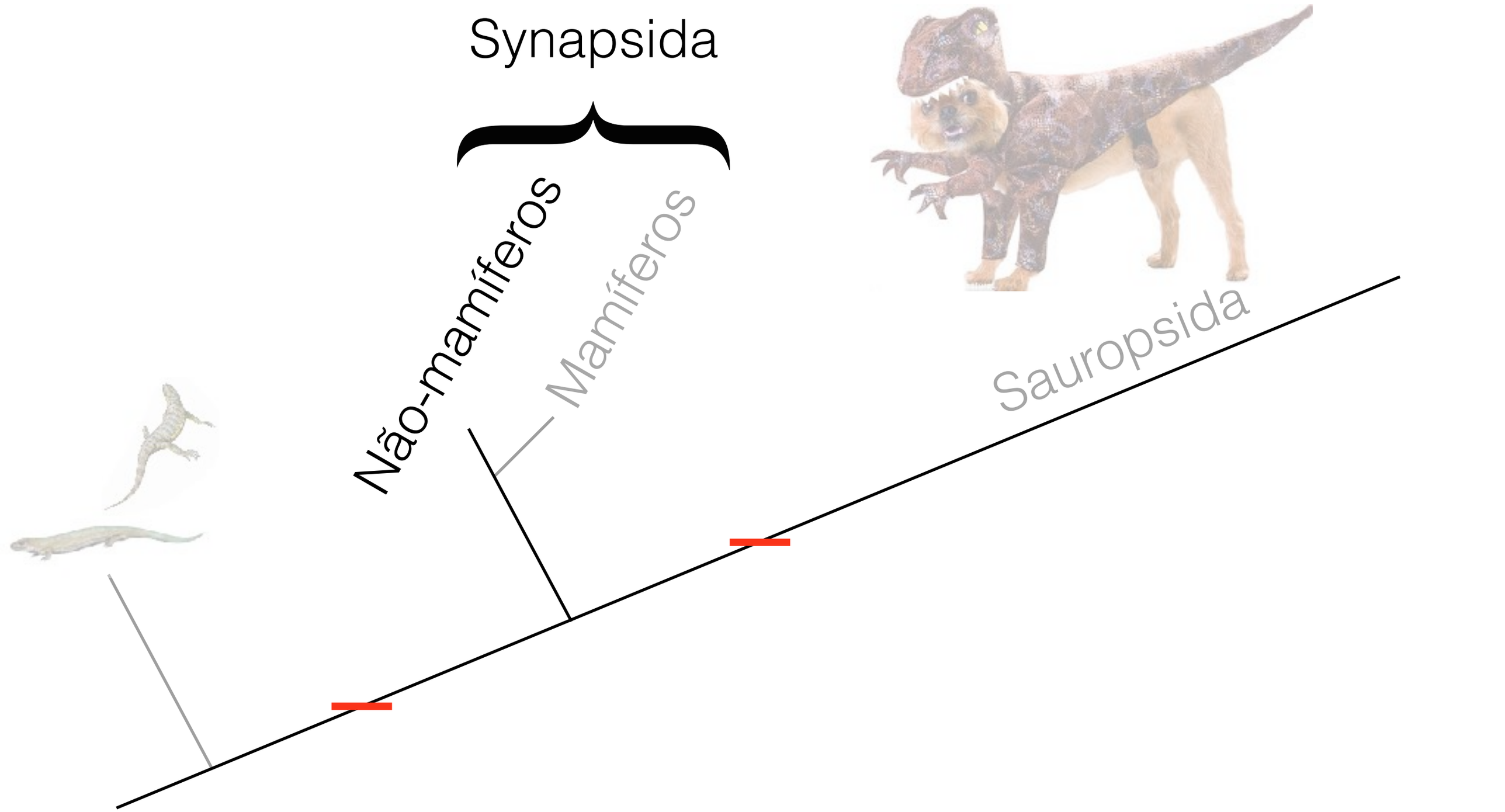
Beta-queratina
Excreção ácido úrico

Amniota

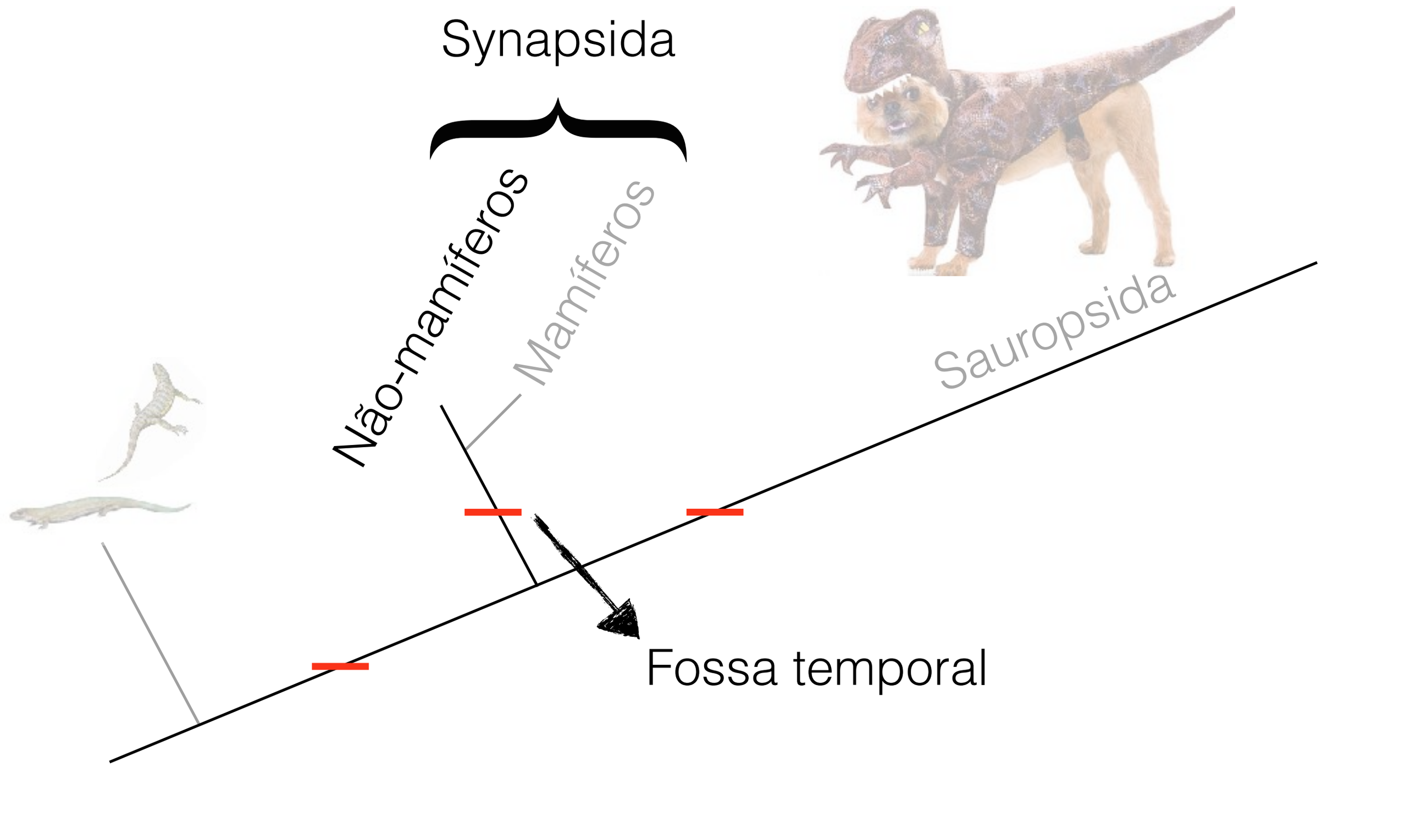


Synapsida

Synapsida e suas radiações

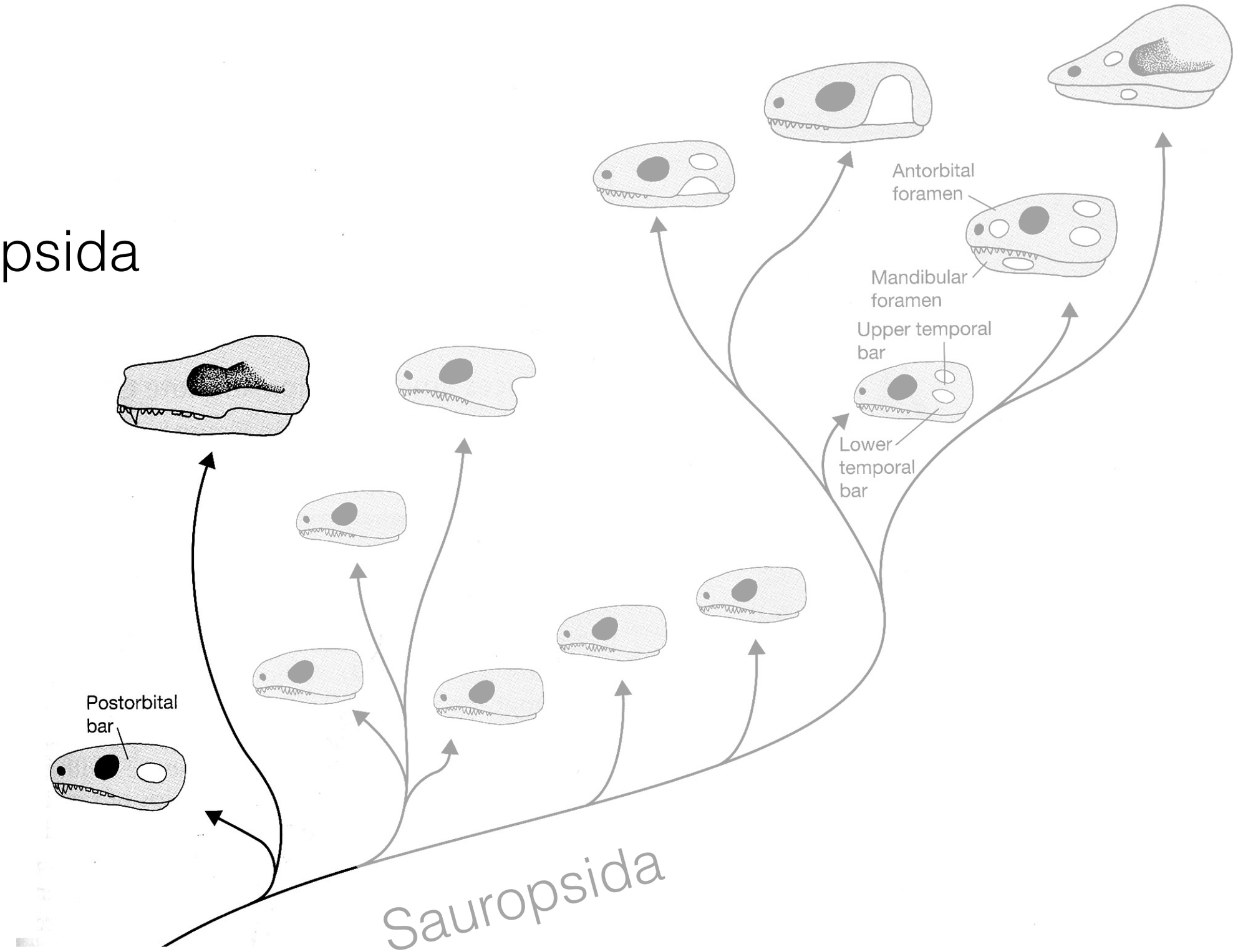


Synapsida e suas radiações



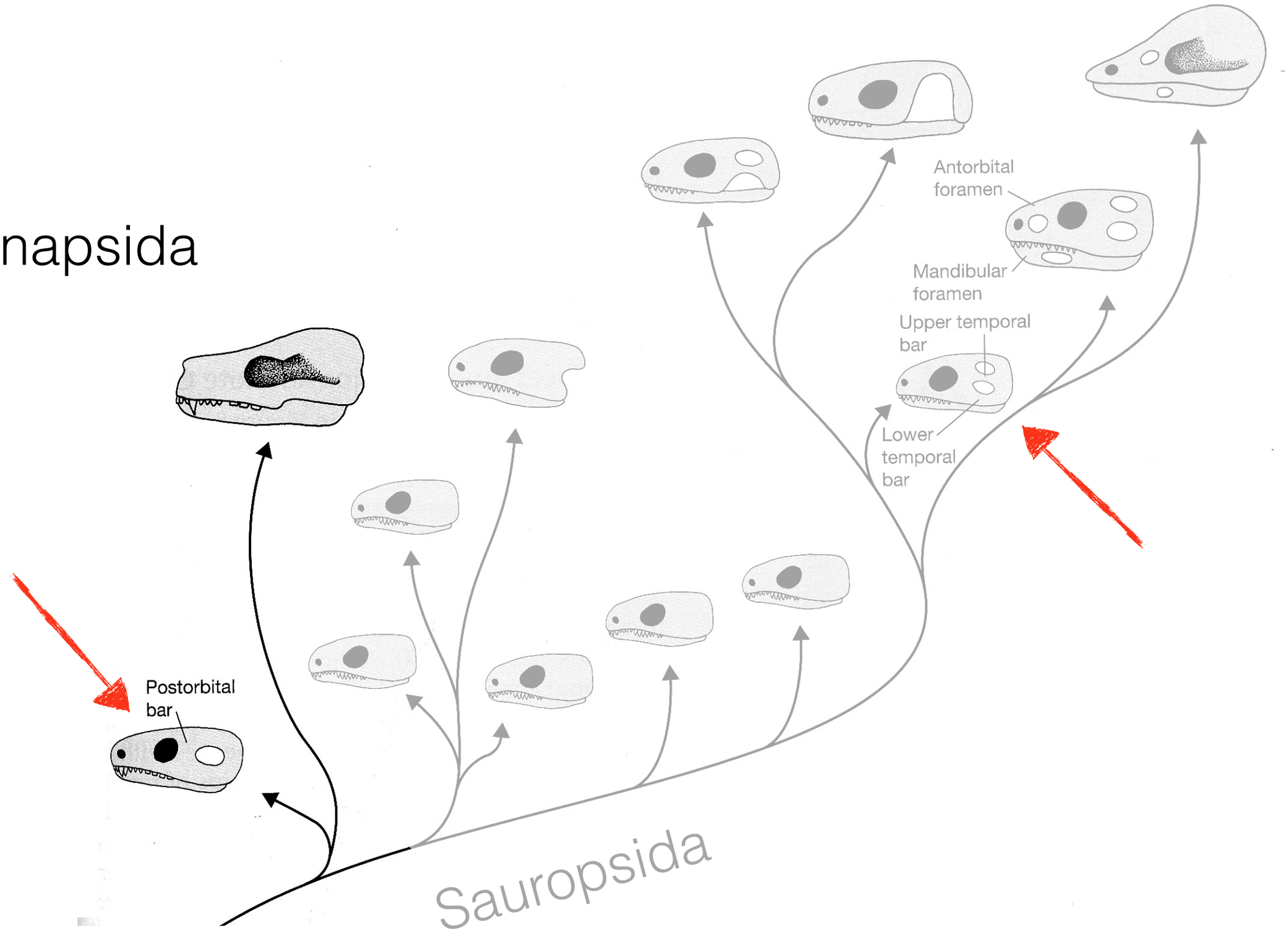
Padrões de fenestração

Synapsida

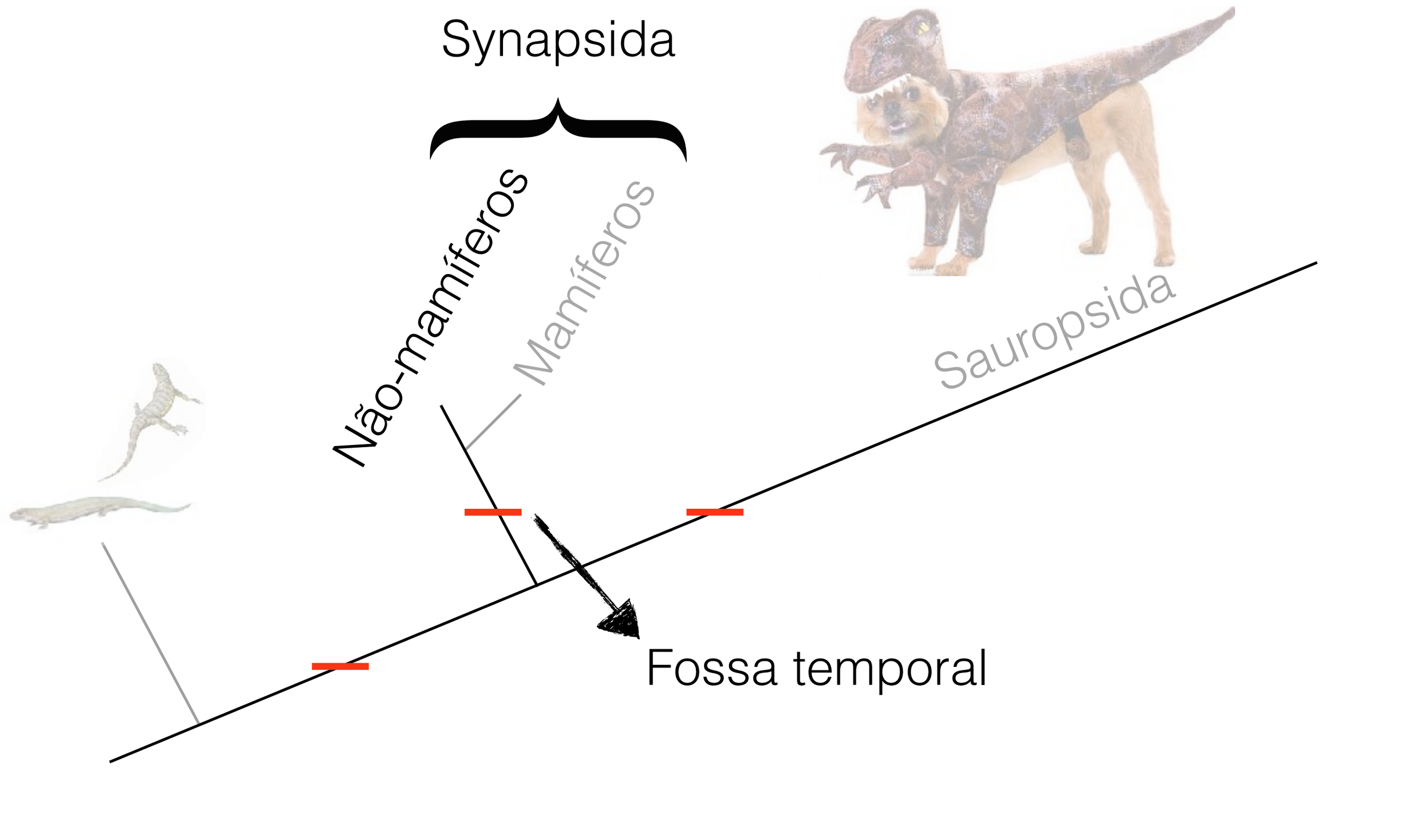


Padrões de fenestração

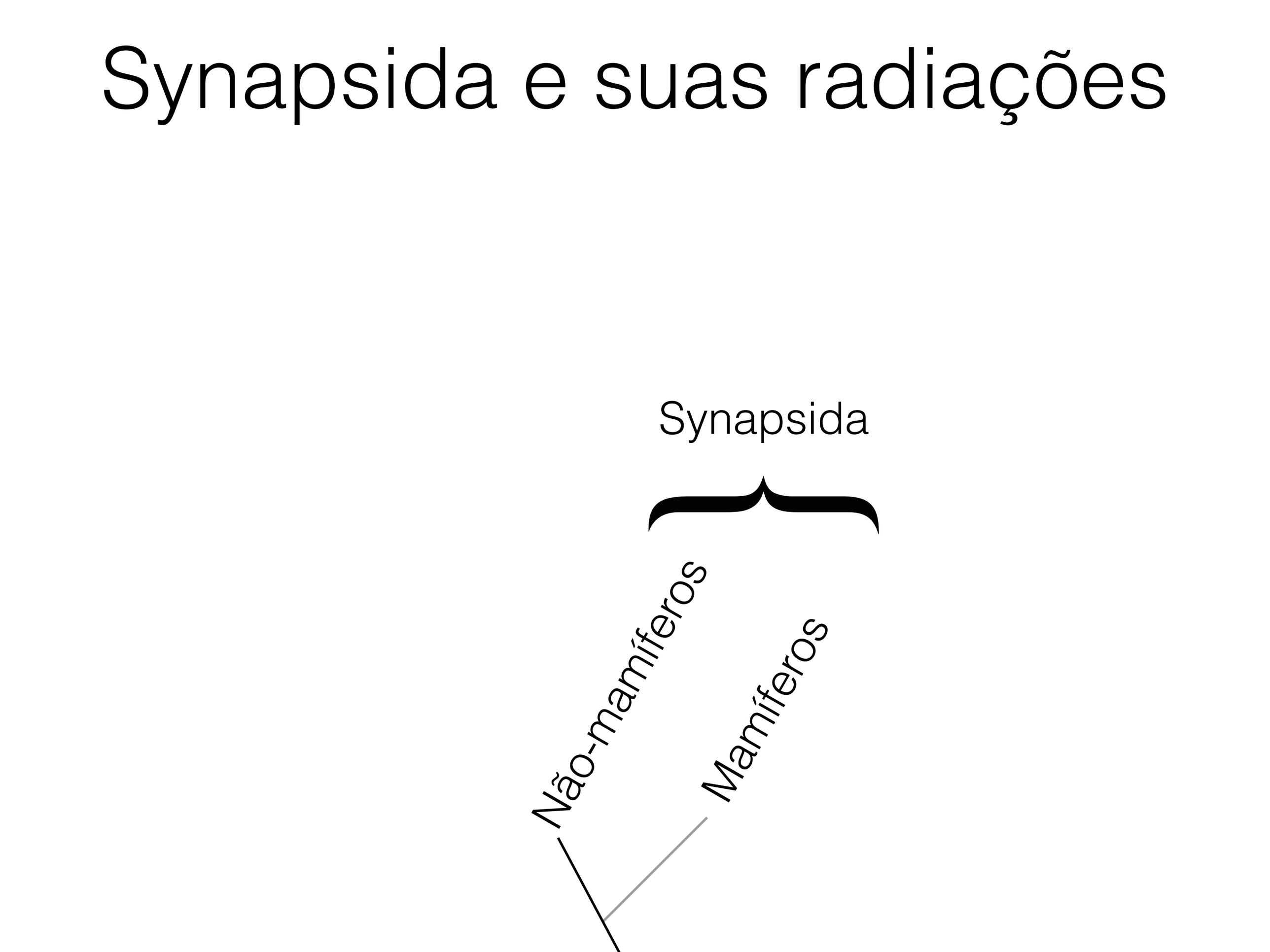
Synapsida



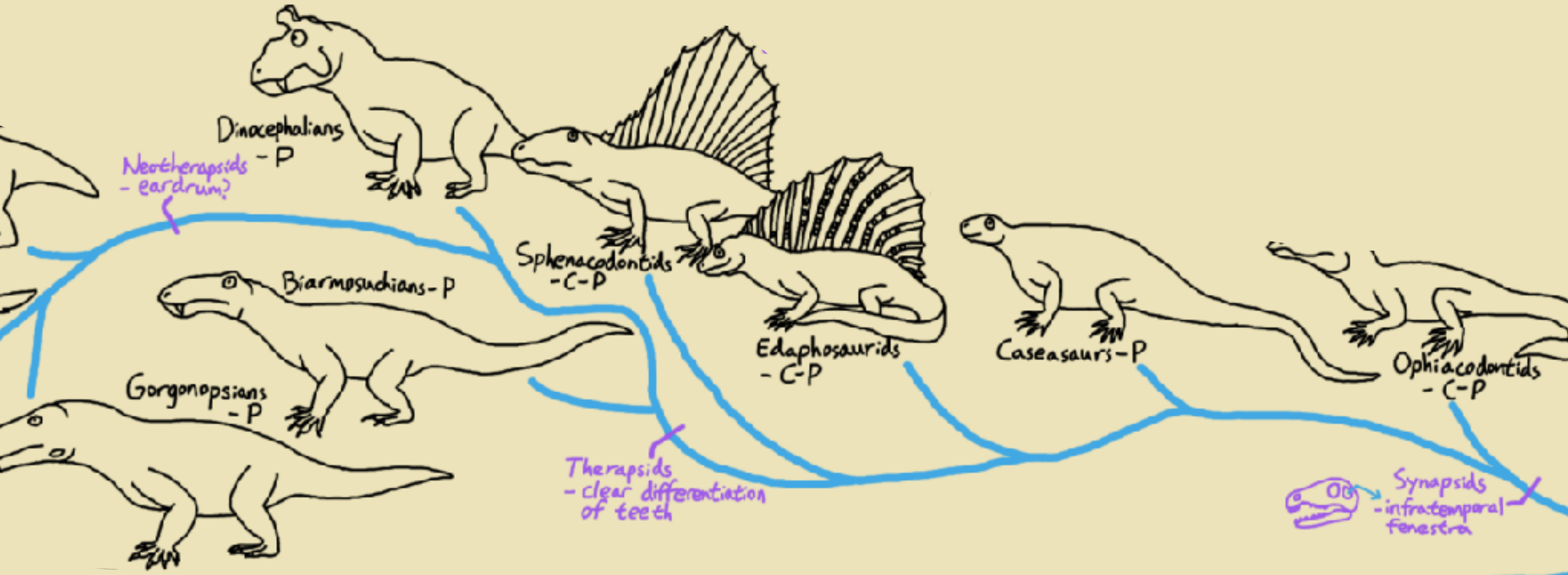
Synapsida e suas radiações



Synapsida e suas radiações



Quem são os Synapsida?



2 principais grupos de Synapsida não-mamíferos

Therapsida

Pelicossauros

Não-cinodontes

Cinodontes

PALEOZOIC | MESOZOIC | CENOZOIC

Carboniferous | Permian | Triassic | Jurassic | Cretaceous | Tertiary

290 | 248 | 206 | 144 | 65 | 0.01 Recent

Millions of years

EOTHYRIDIDAE

CASEIDAE

VARANOPSEIDAE

OPHIACODONTIDAE

EDAPHOSAURIDAE

SPHENACODONTIDAE

BIARMOSUCHIA

DINOCEPHALIA

ANOMODONTIA

GORGONOPSIA

THEROCEPHALIA

PROCYNOSUCHIDAE

THRINAXODONTIDAE

CYNOGNATHIDAE

GOMPHODONTIA

TRITHELEDONTIDAE

PALEOZOIC | MESOZOIC | CENOZOIC

Carboniferous | Permian | Triassic | Jurassic | Cretaceous | Tertiary

290 | 248 | 206 | 144 | 65 | 0.01 Recent

Millions of years

EOTHYRIDIDAE

CASEIDAE

VARANOPSEIDAE

OPHIACODONTIDAE

EDAPHOSAURIDAE

SPHENACODONTIDAE

BIARMOSUCHIA

DINOCEPHALIA

ANOMODONTIA

GORGONOPSIA

THEROCEPHALIA

PROCYNOSUCHIDAE

THRINAXODONTIDAE

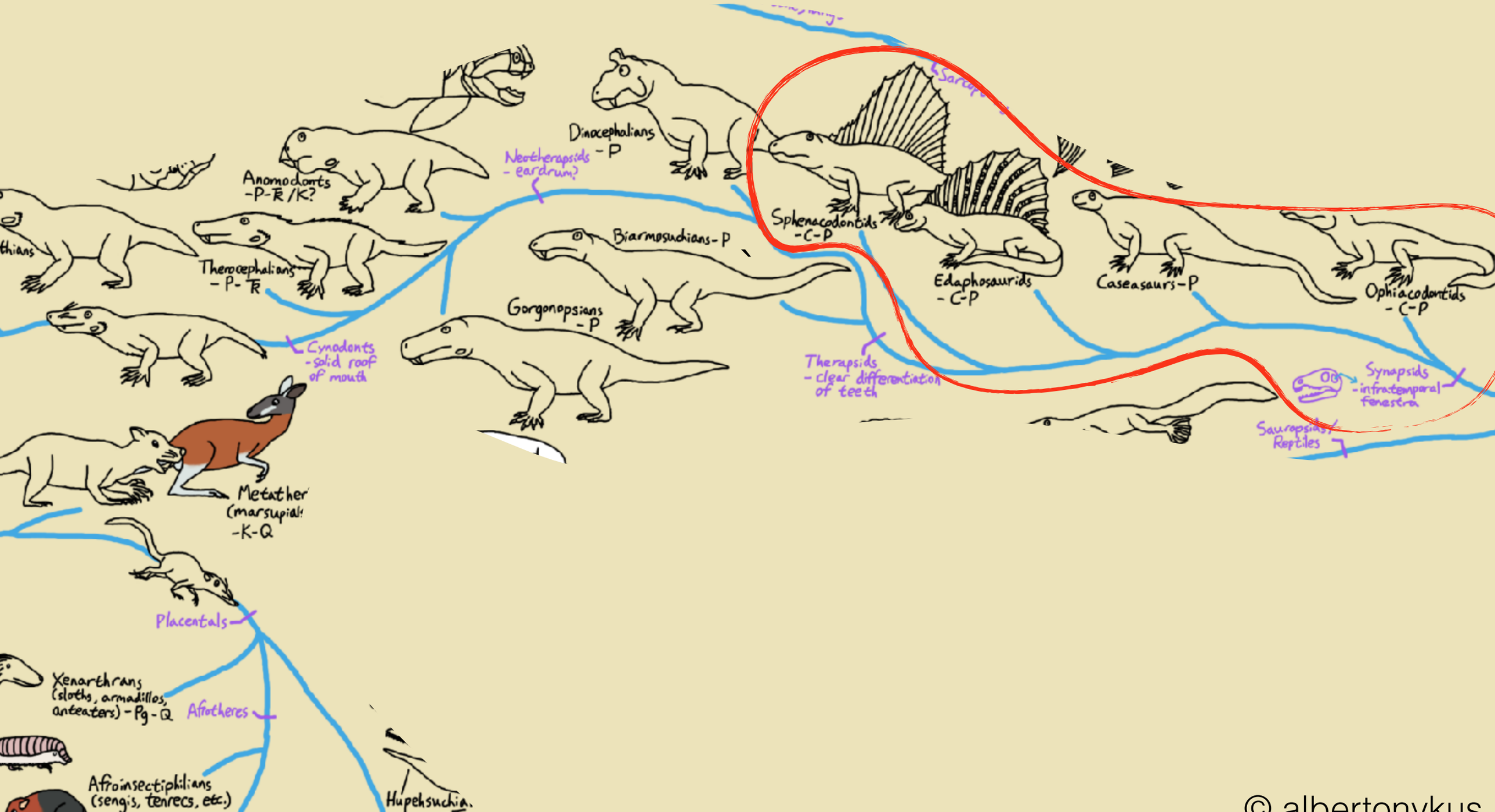
CYNOGNATHIDAE

GOMPHODONTIA

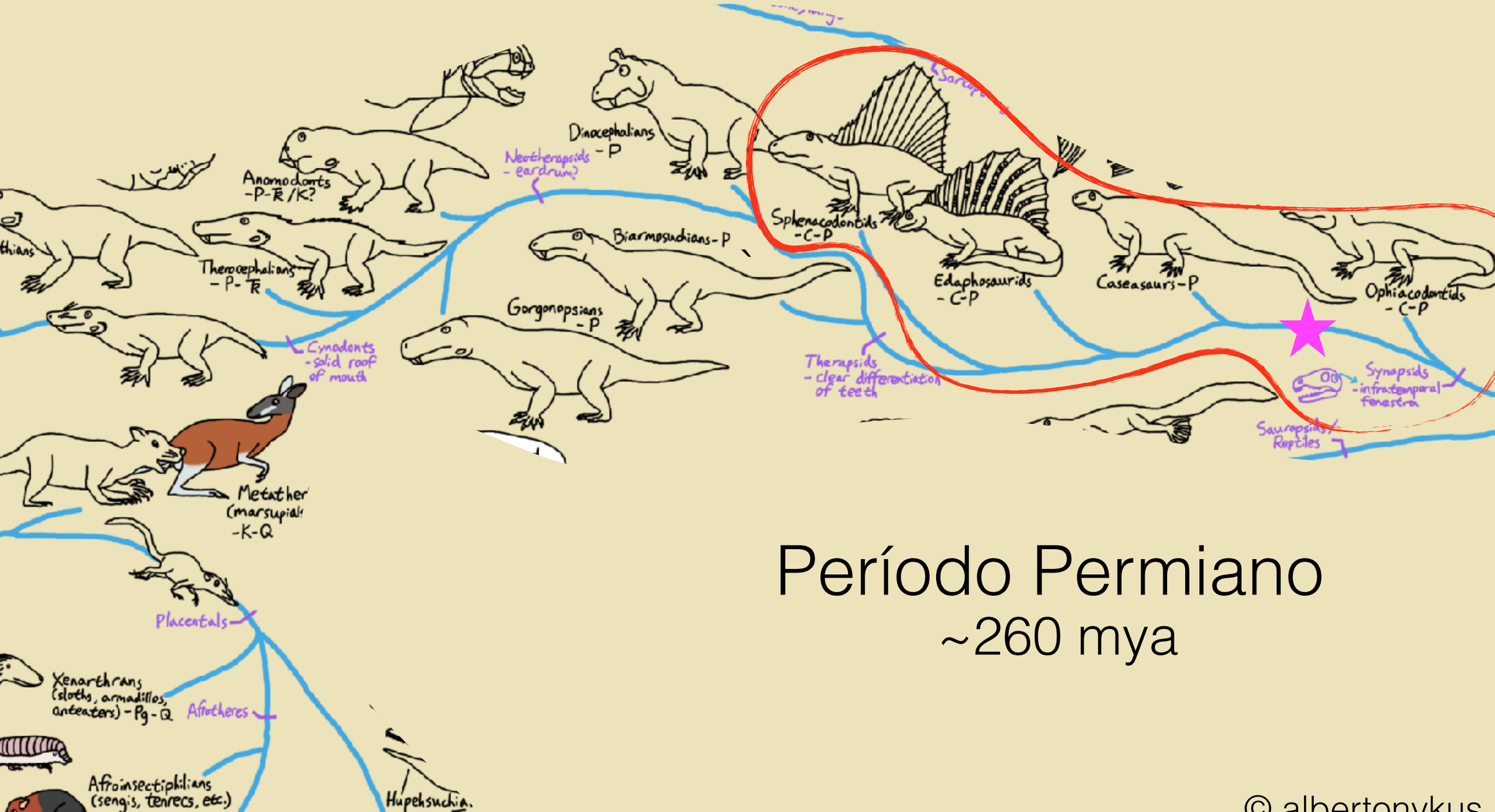
TRITHELEDONTIDAE

Era	Período		
Cenozóico	Quaternário	1.7	
	Terciário	65	• aparecem formas grandes de mamíferos, incluindo ordens atuais
Mesozóico	Cretáceo	144	• grande evento de extinção em massa • dinossauros dominantes • pequenos mamíferos se diversificam
	Jurássico	206	• Pangea começa a separar • dinossauros se diversificam • mamíferos são pequenos e inconspícuos
	Triássico	248	• diversificação dos arcossauros • desaparecimento de muitas linhagens de Synapsida • aparecimento dos primeiros mamíferos
Paleozóico	Permiano	290	• Pangea • grande evento de extinção em massa no final do período • pelicossauros e terápsidos são os maiores e dominantes Tetrapoda • declínio dos Tetrapoda não-amniota • diversificação dos Amniota
	Carbonífero	354	• primeiros Amniota (incluindo primeiros Synapsida - pelicossauros) • diverificação dos Tetrapoda não-amniota
	Devoniano	417	• primeiros Tetrapoda
	Siluriano	443	• peixes com maxilas
	Ordoviciano	490	
	Cambriano	540	• primeiros vertebrados

Eupelycosauria

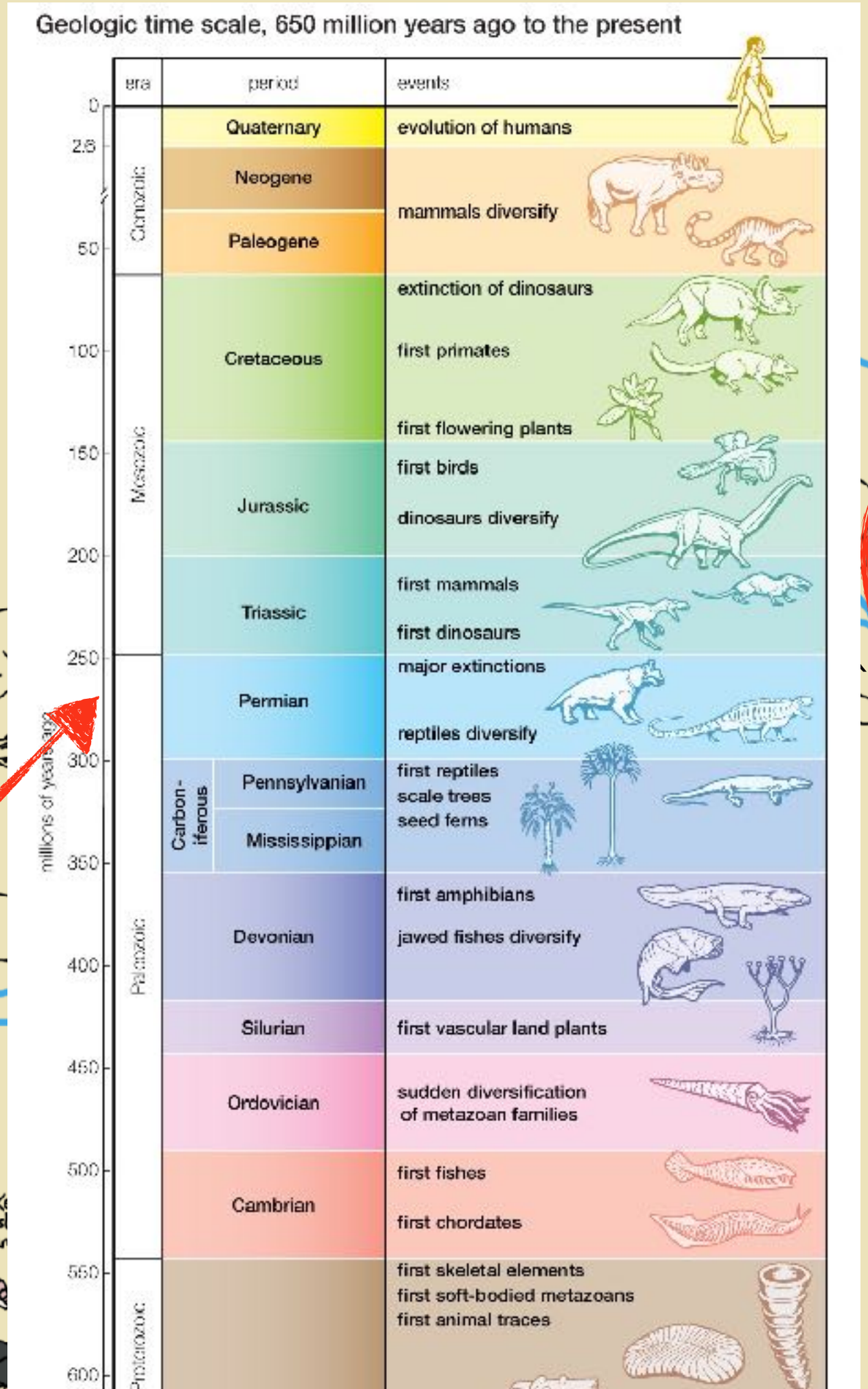


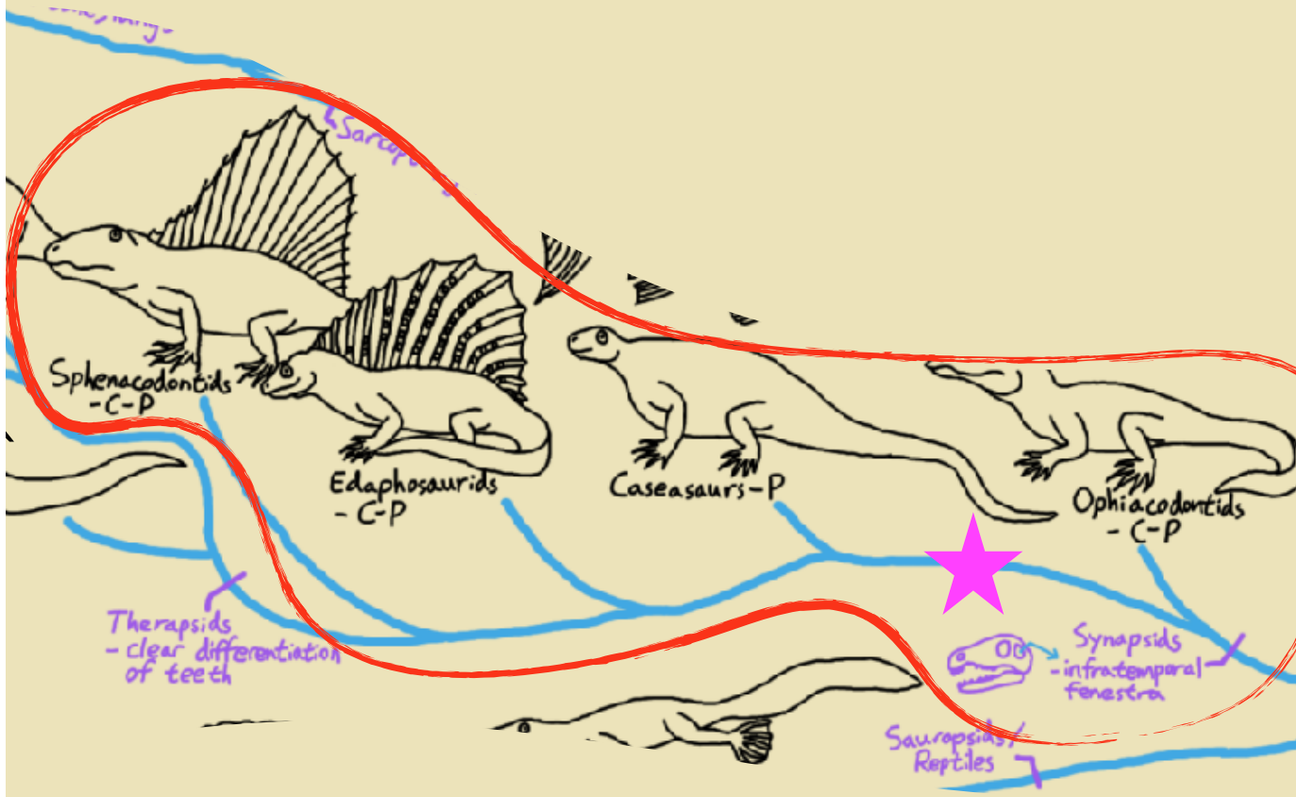
Eupelycosauria



Período Permiano

~260 mya



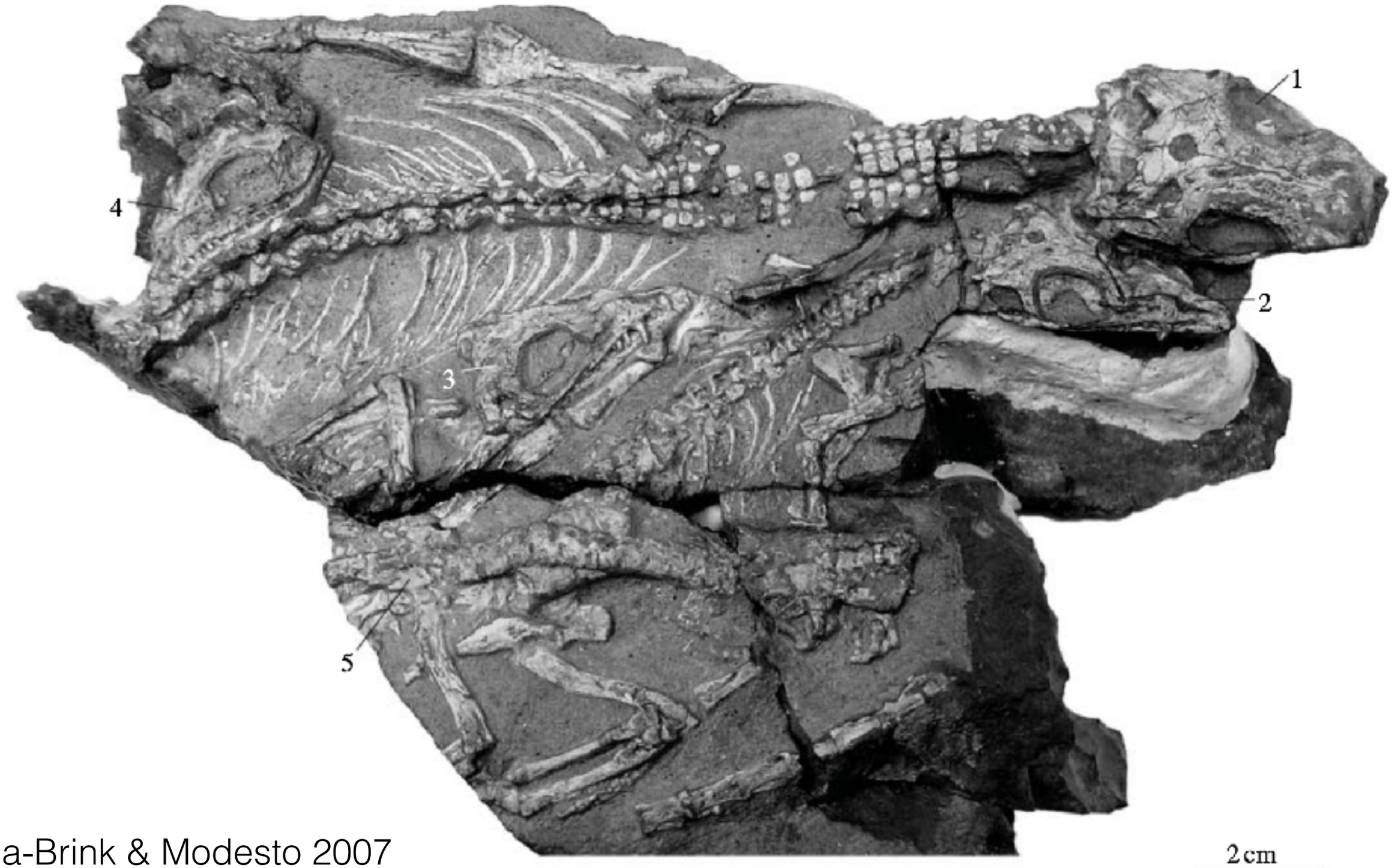


Período Permiano

~260 mya

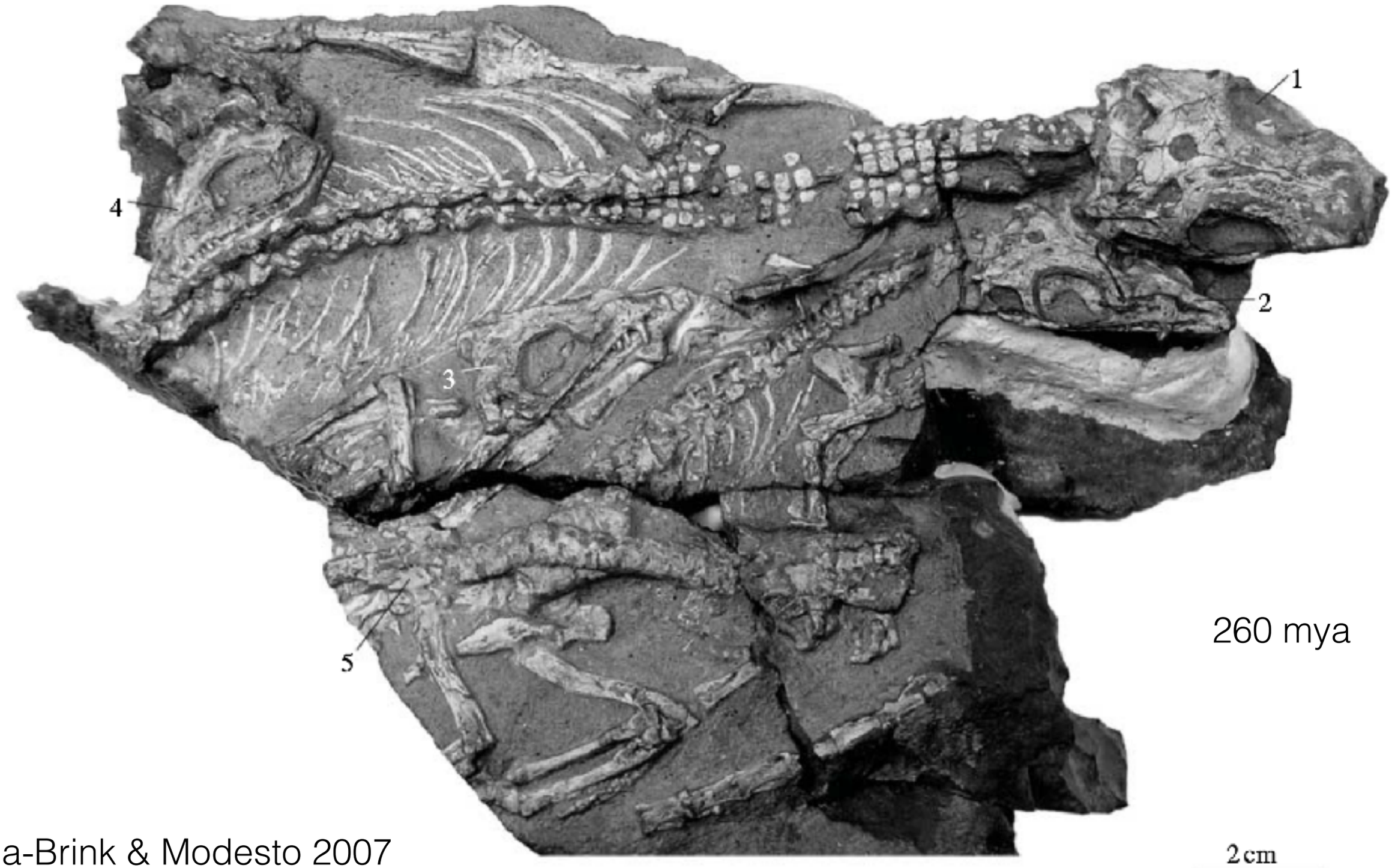
Pelicossauro varanopideo

O que é isso?



Botha-Brink & Modesto 2007

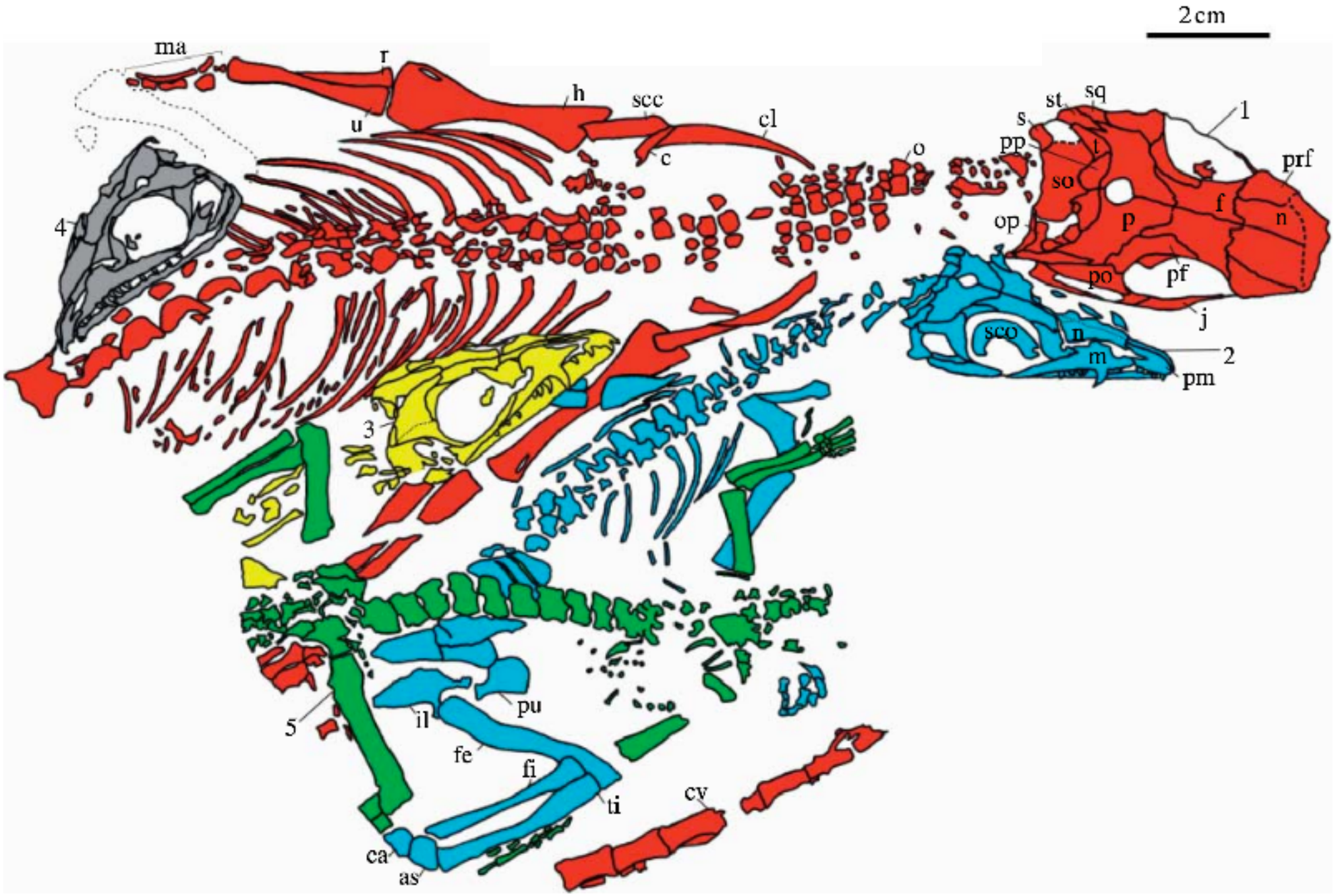
Evidência mais antiga de cuidado parental em amniota



260 mya

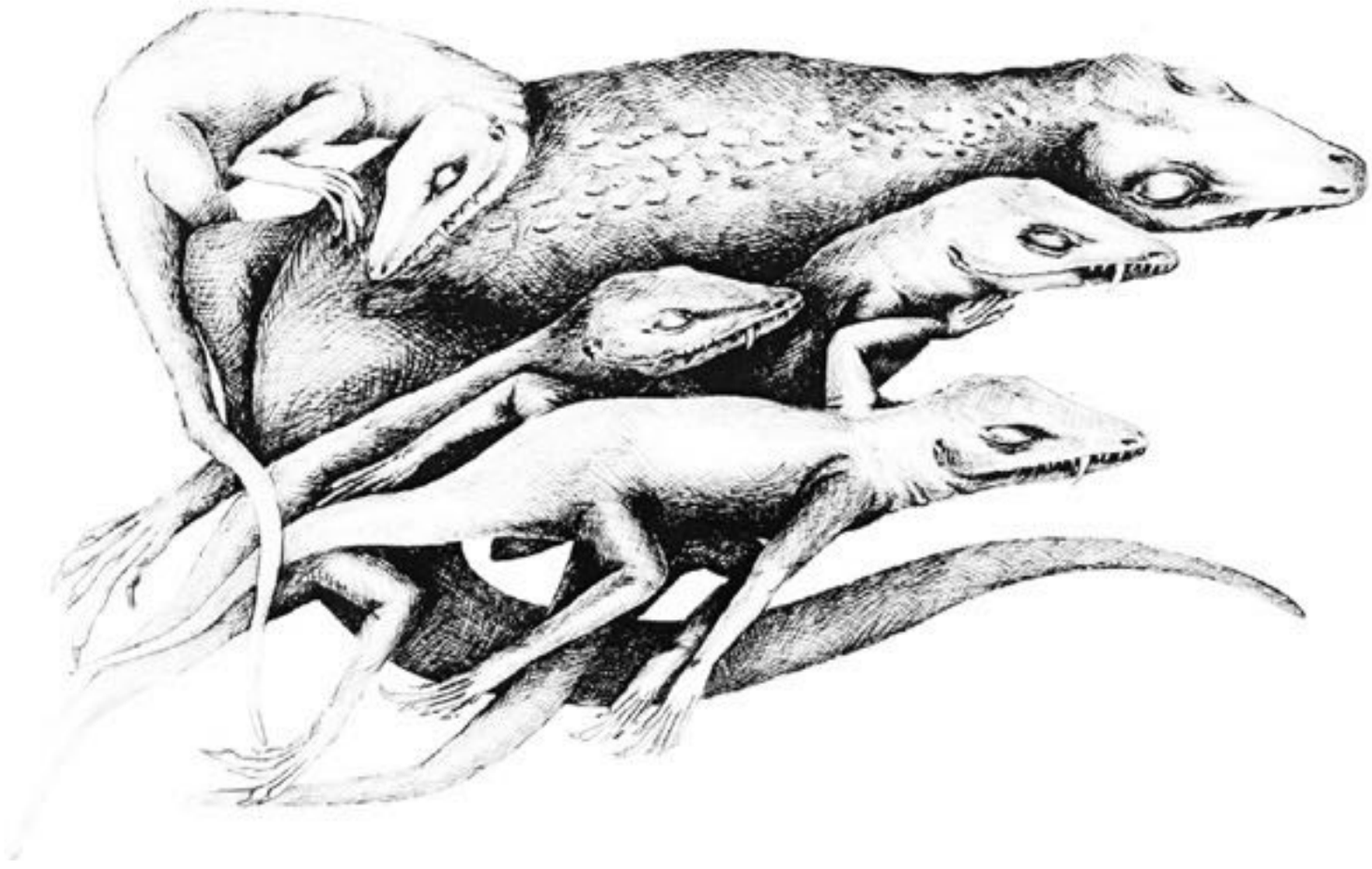
Botha-Brink & Modesto 2007

Evidência mais antiga de cuidado parental em amniota



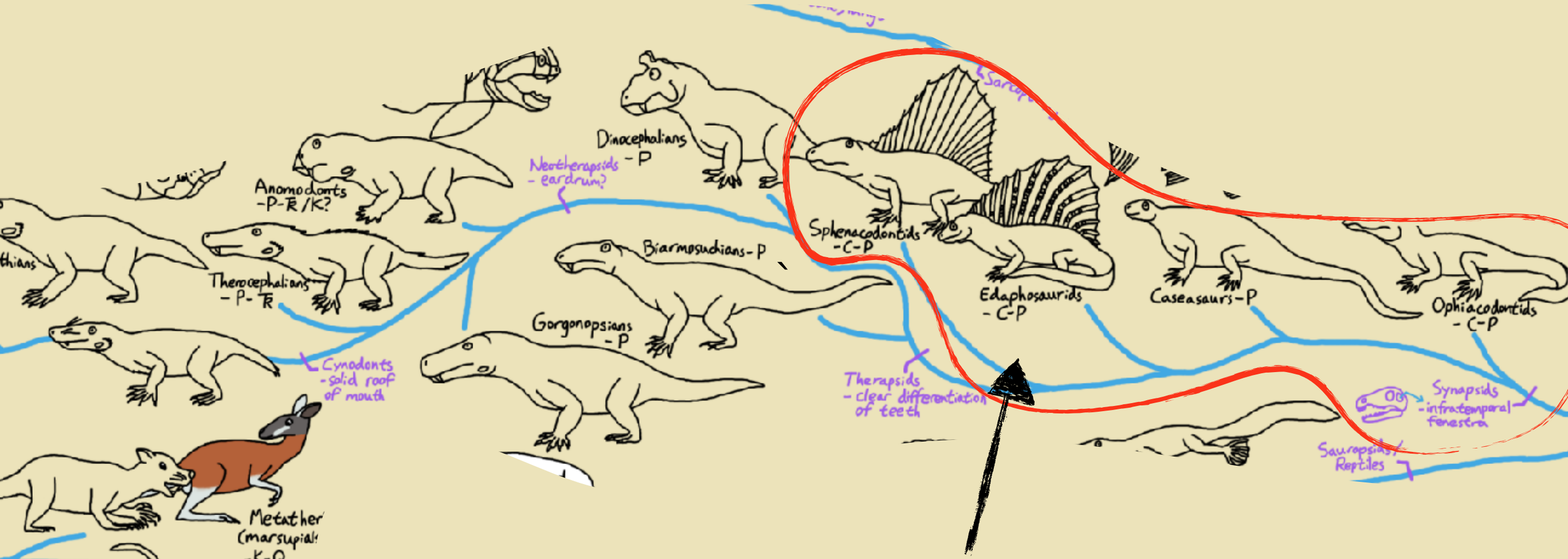
Botha-Brink & Modesto 2007

Evidência mais antiga de cuidado parental em amniota



Botha-Brink & Modesto 2007

“Pelycosauros”



Período Permiano

~260 mya

AGES 4 AND UP

DIMETRODON

WITH Dino-Strike™ Clamping Jaws!

JURASSIC PARK™

LIMITED EDITION

MOVIE COLLECTOR CARD

SAFETY TESTED—meets or exceeds ASTM F963-86

AGES 4 AND UP

JURASSIC PARK™

DIMETRODON

WITH Dino-Strike™ Clamping Jaws!

LIMITED EDITION

MOVIE COLLECTOR CARD

SAFETY TESTED—meets or exceeds ASTM F963-86

AGES 4 AND UP

DIMETRODON

WITH Dino-Strike™ Clamping Jaws!

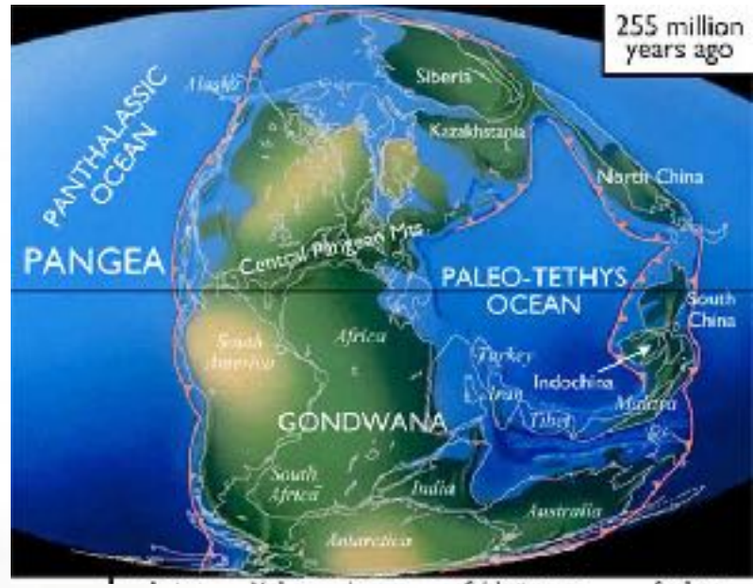
JURASSIC PA

MEMECENTER.COM

SENORGIF.COM

5

SAFETY TESTED—meets or exceeds ASTM F963-96

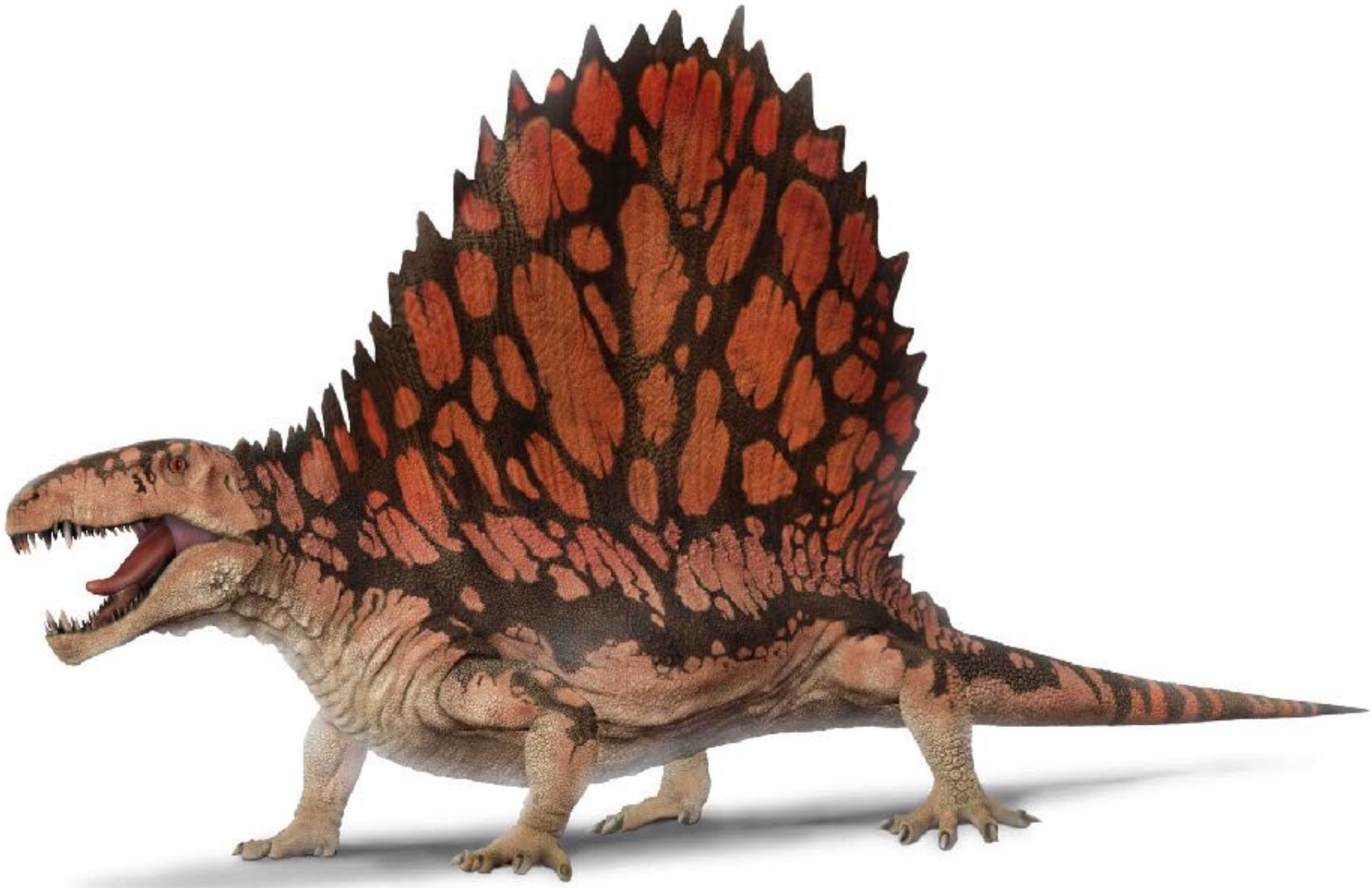

255 million years ago
PANTHALASSIC OCEAN
Siberia
Kazakhstania
North China
PANGEA
Central Pangean Mts
PALEO-TETHYS OCEAN
South China
Africa
South America
Turkey
Iran
Indochina
Malaya
Tibet
GONDWANA
South Africa
India
Australia
Antarctica

Qual é a função?

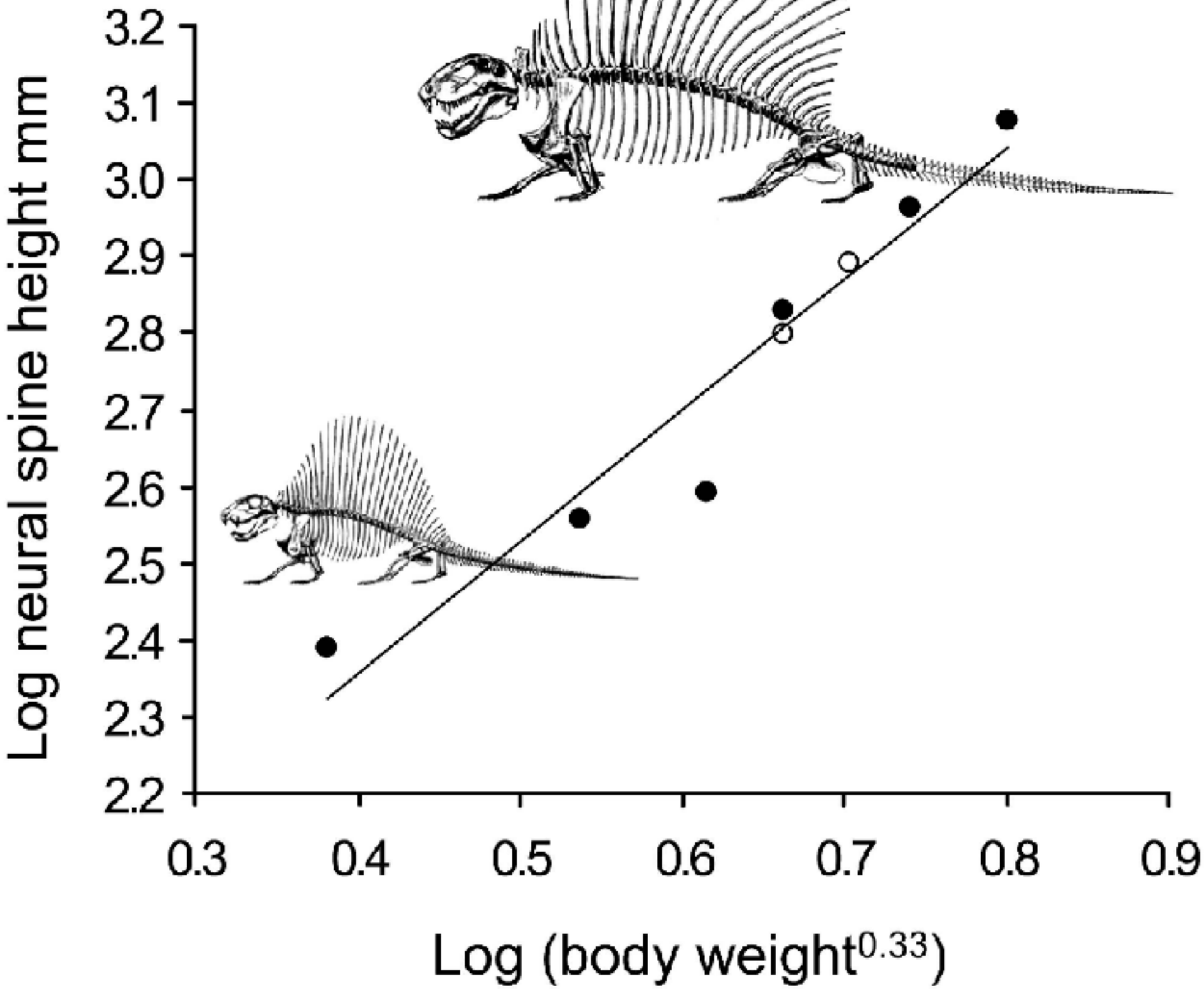
Termorregulação?

Defesa?

Seleção sexual??

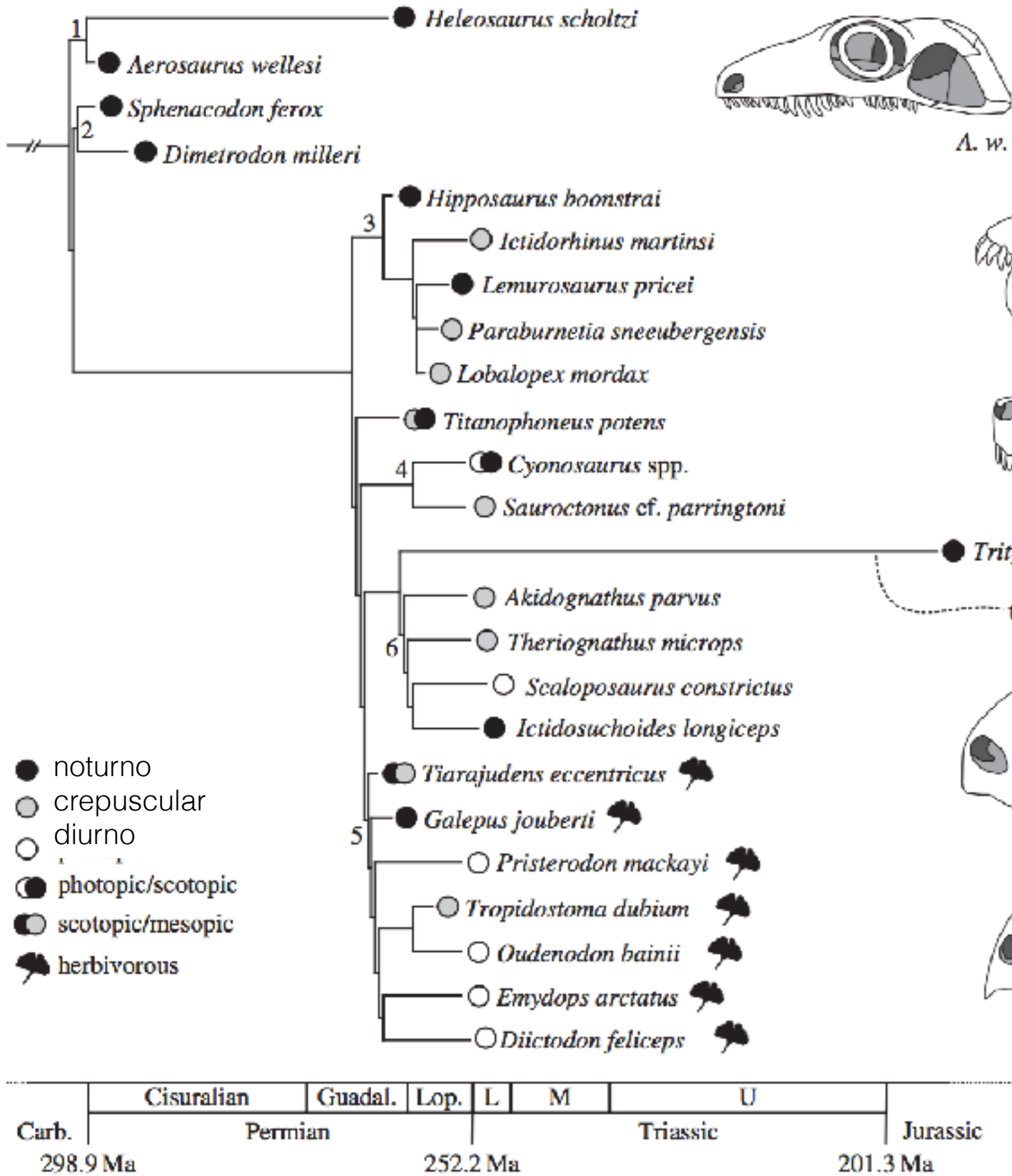


Seleção sexual??



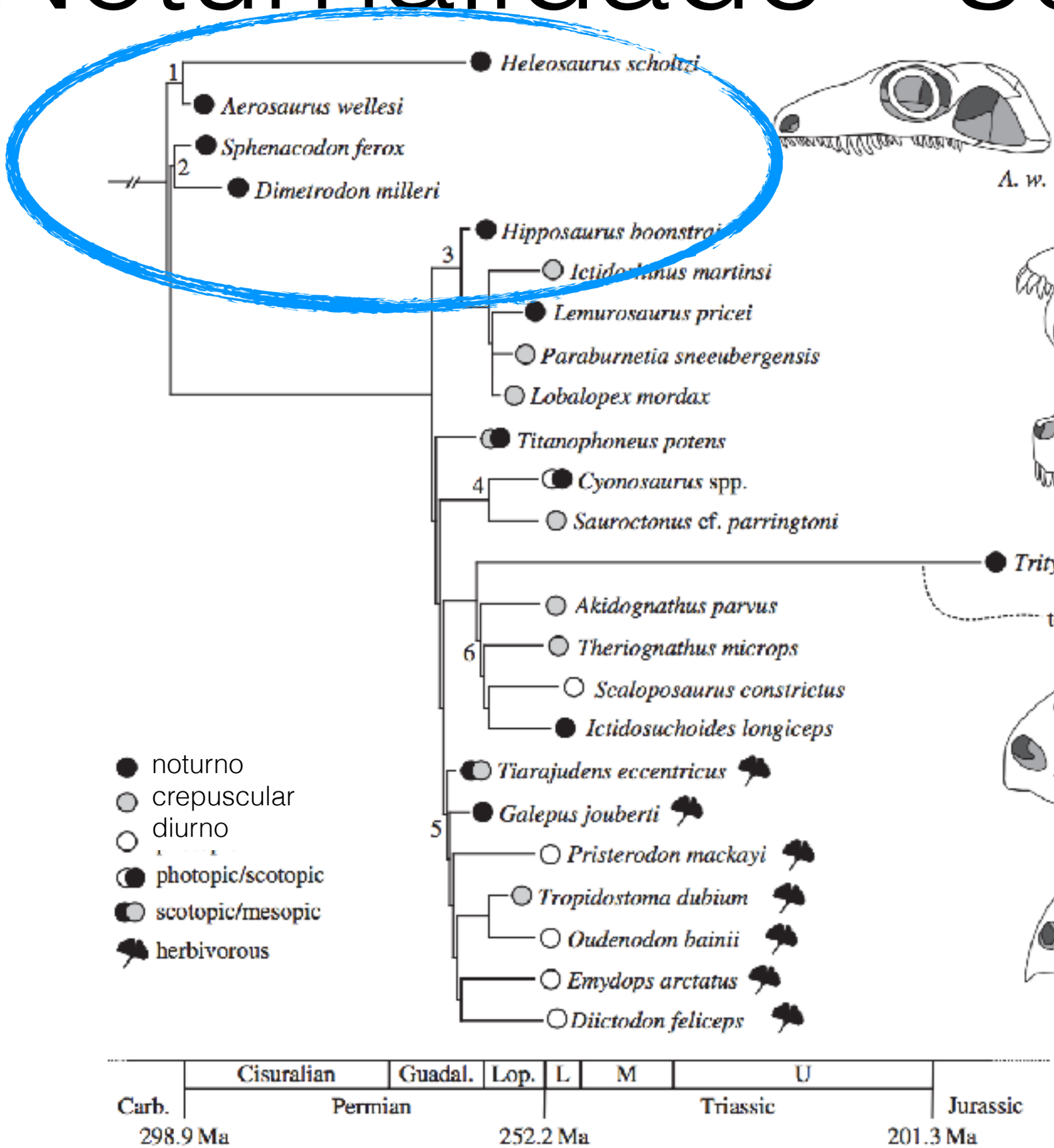
Tomkins et al. 2010

Quando estes animais estavam ativos?



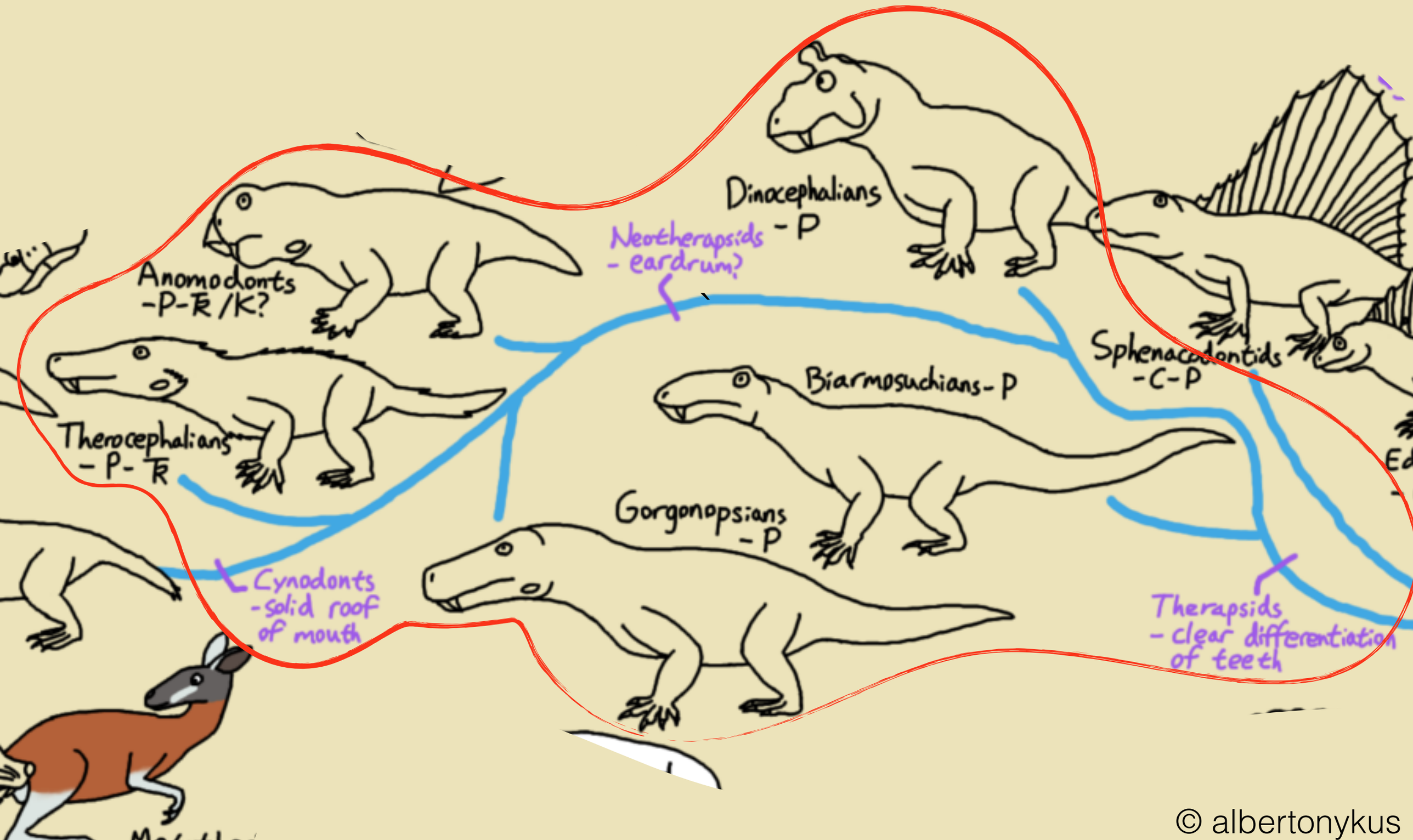
Angielczyk & Schmitz 2014

Noturnalidade ~300mya



Angielczyk & Schmitz 2014

Therapsida



PALEOZOIC | MESOZOIC | CENOZOIC

Carboniferous | Permian | Triassic | Jurassic | Cretaceous | Tertiary

290 248 206 144 65 0.01 Recent

Millions of years

EOTHYRIDIDAE

CASEIDAE

VARANOPSEIDAE

OPHIACODONTIDAE

EDAPHOSAURIDAE

SPHENACODONTIDAE

BIARMOSUCHIA

DINOCEPHALIA

ANOMODONTIA

GORGONOPSIA

THEROCEPHALIA

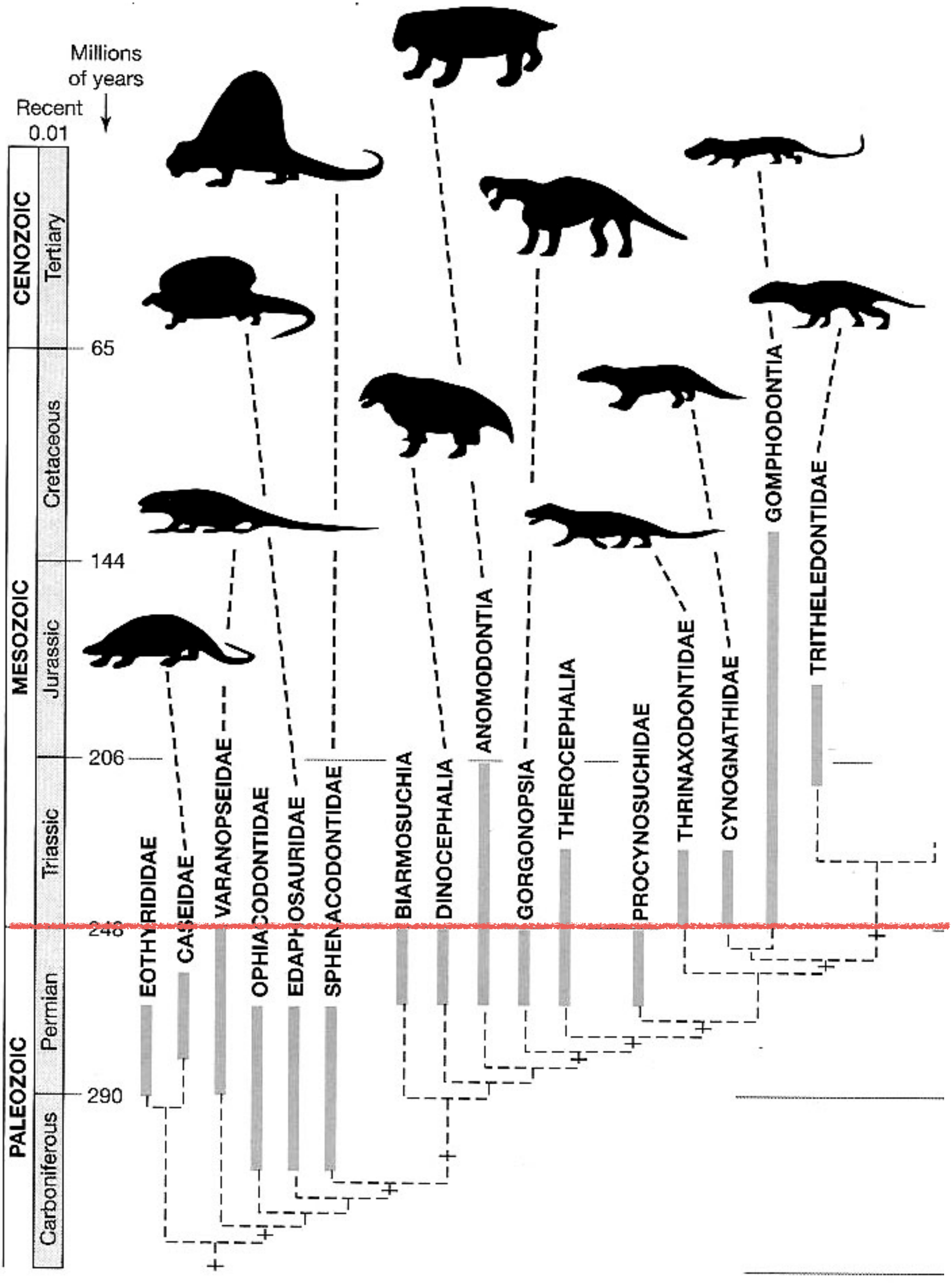
PROCYNOSUCHIDAE

THRINAXODONTIDAE

CYNOGNATHIDAE

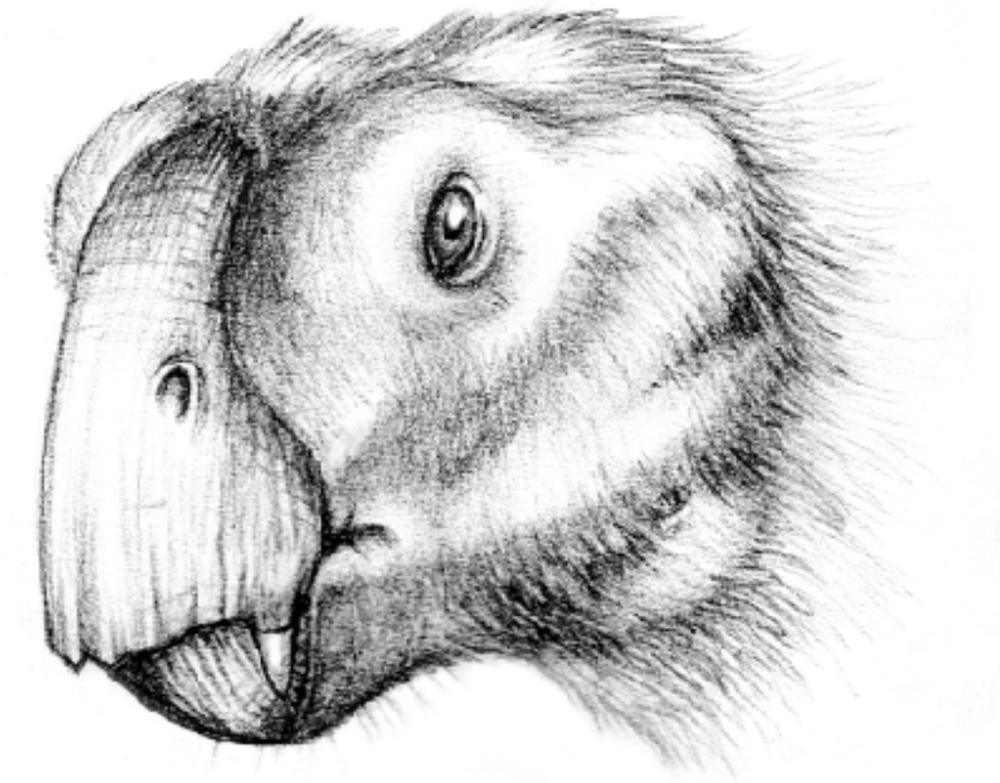
GOMPHODONTIA

TRITHELEDONTIDAE

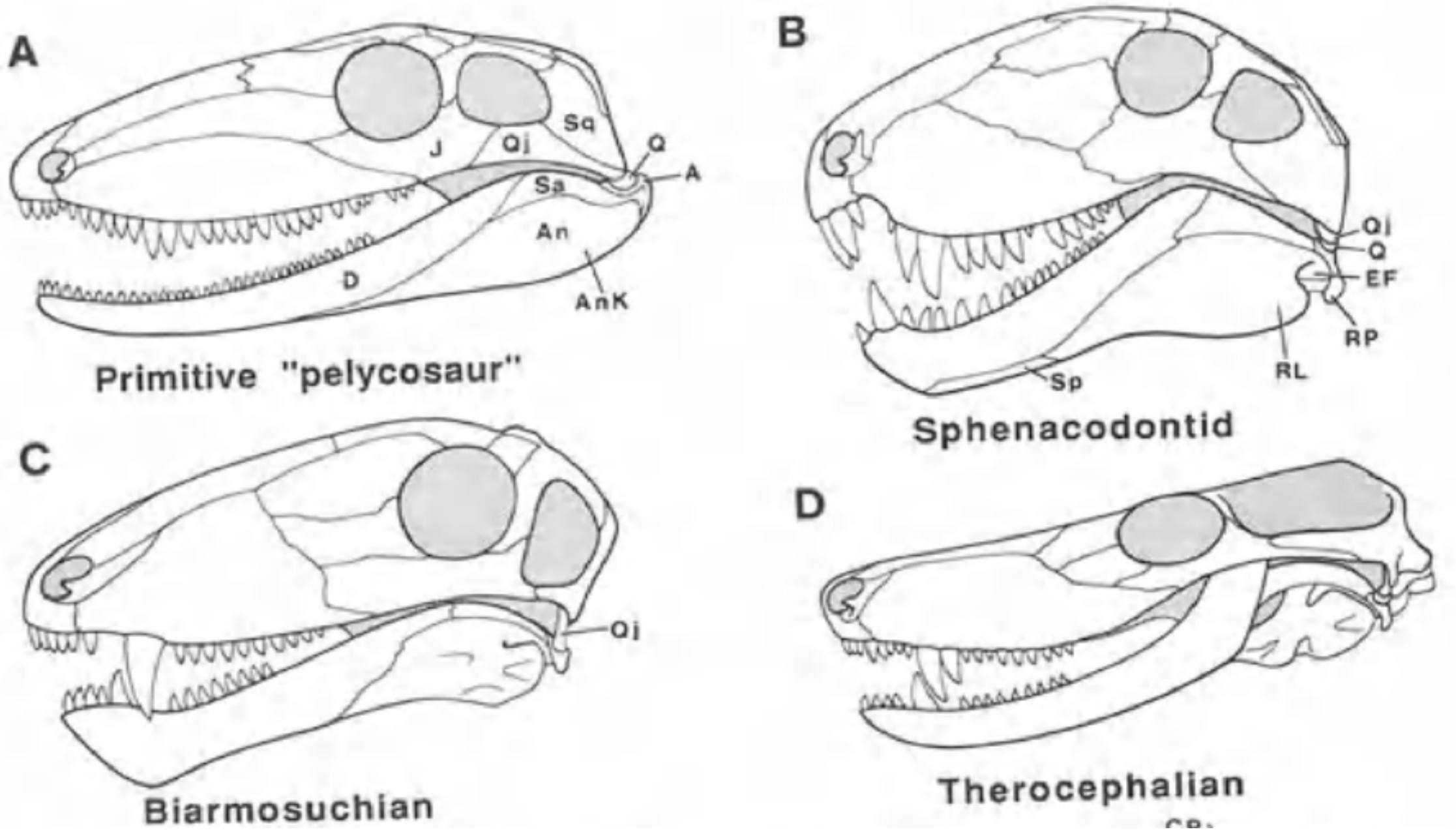

Millions of years
Recent
0.01
CENOZOIC
Tertiary
65
Cretaceous
144
MESOZOIC
Jurassic
206
Triassic
248
PALEOZOIC
Permian
290
Carboniferous
EOTHYRIDIDAE
CASEIDAE
VARANOPSEIDAE
OPHIACODONTIDAE
EDAPHOSAURIDAE
SPHENACODONTIDAE
BIARMOSUCHIA
DINOCEPHALIA
ANOMODONTIA
GORGONOPSIA
THEROCEPHALIA
PROCYNOSUCHIDAE
THRINAXODONTIDAE
CYNOGNATHIDAE
GOMPHODONTIA
TRITHELEDONTIDAE

Therapsida não-cinodonte

Lystrosaurus



Principais diferenças entre pelicossauros e terápsidos



Dinogorgon

Dinogorgon

Suminia

overall fast and
cyclical growth,
independent evolution
of sustained growth in
some lineages

reduced tooth
replacement

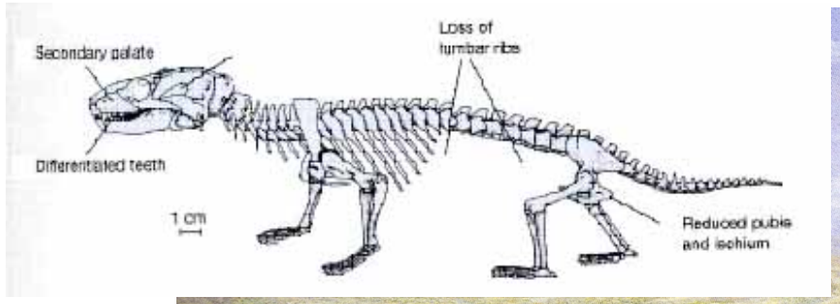
indeterminate
growth

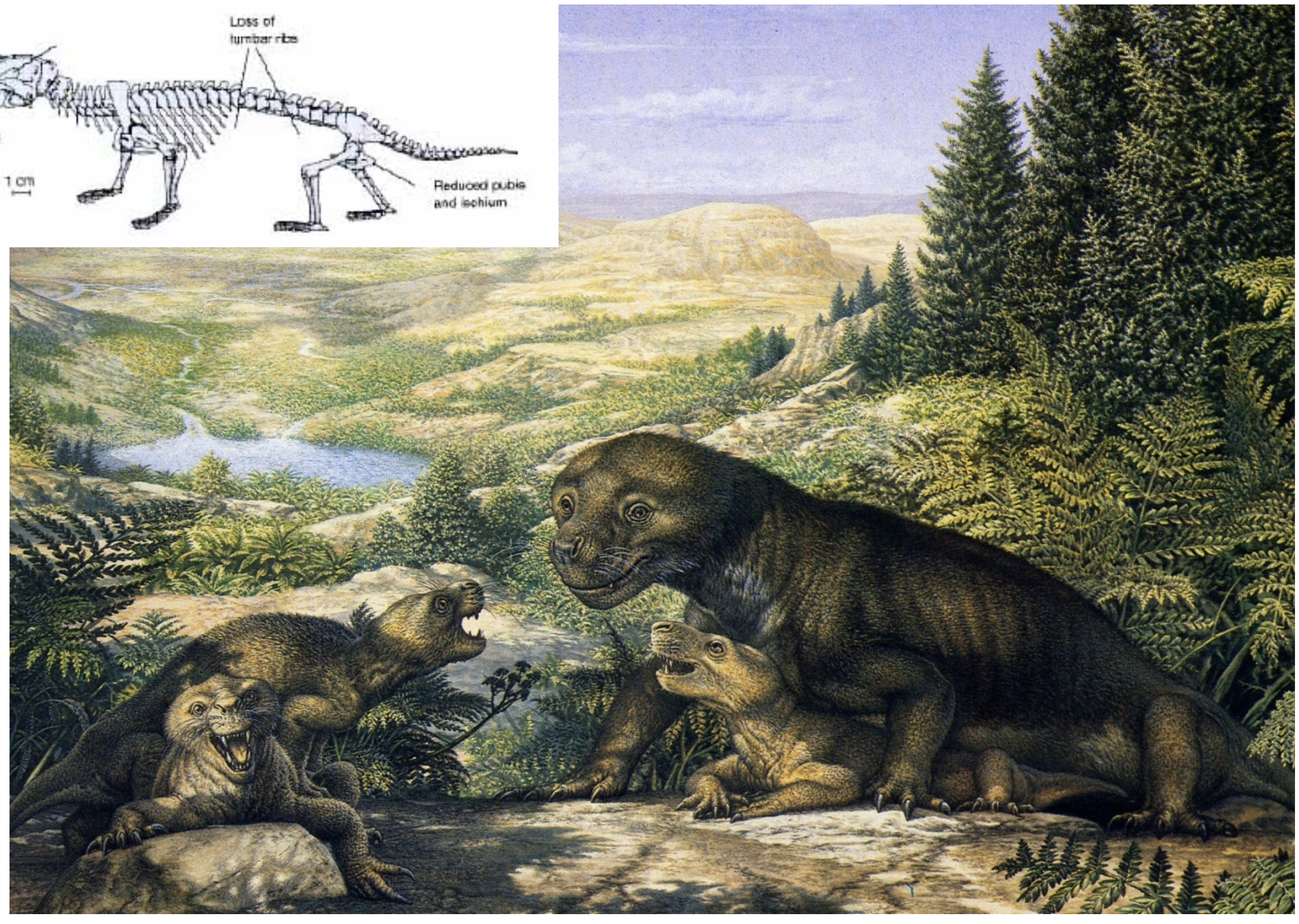
eucynodont
grade

therapsid
grade

sphenacodontian
grade

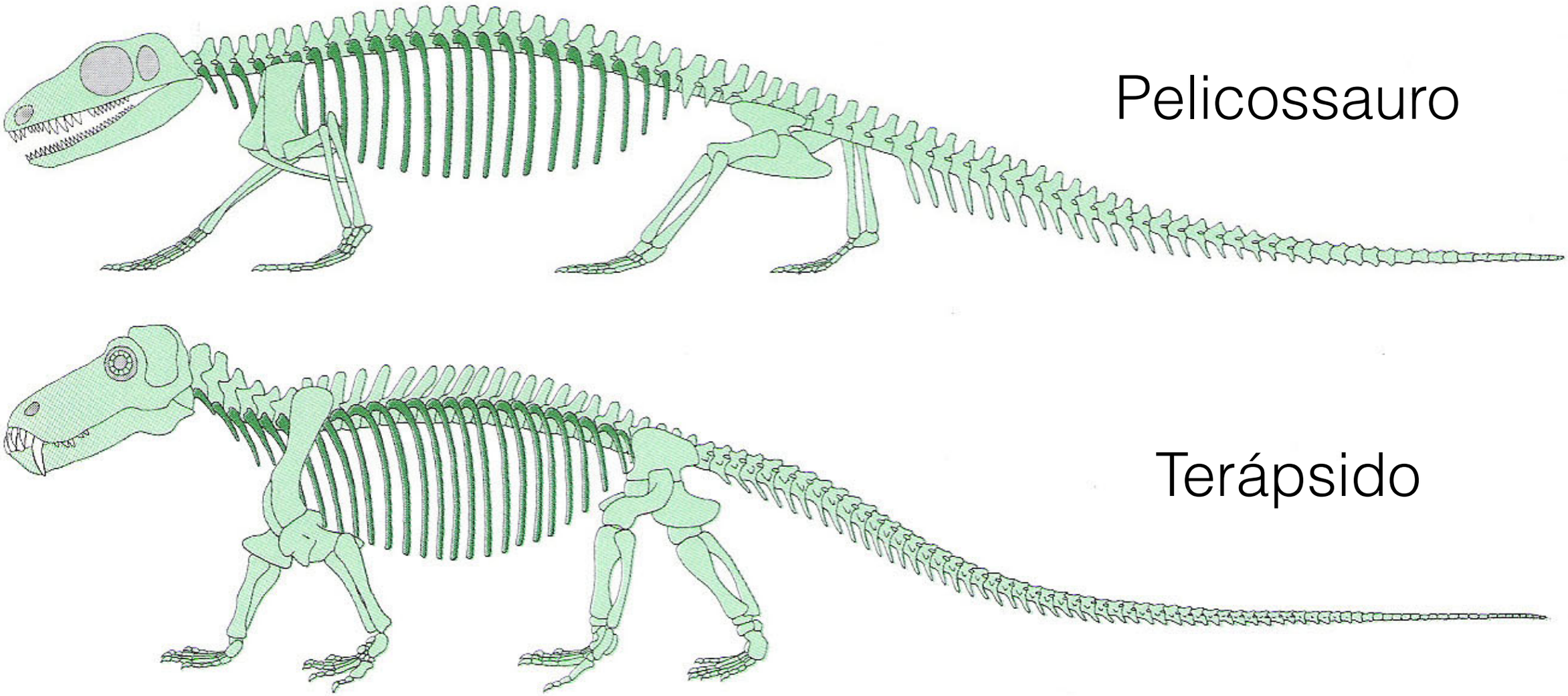
Cinodontes não-mamalianos





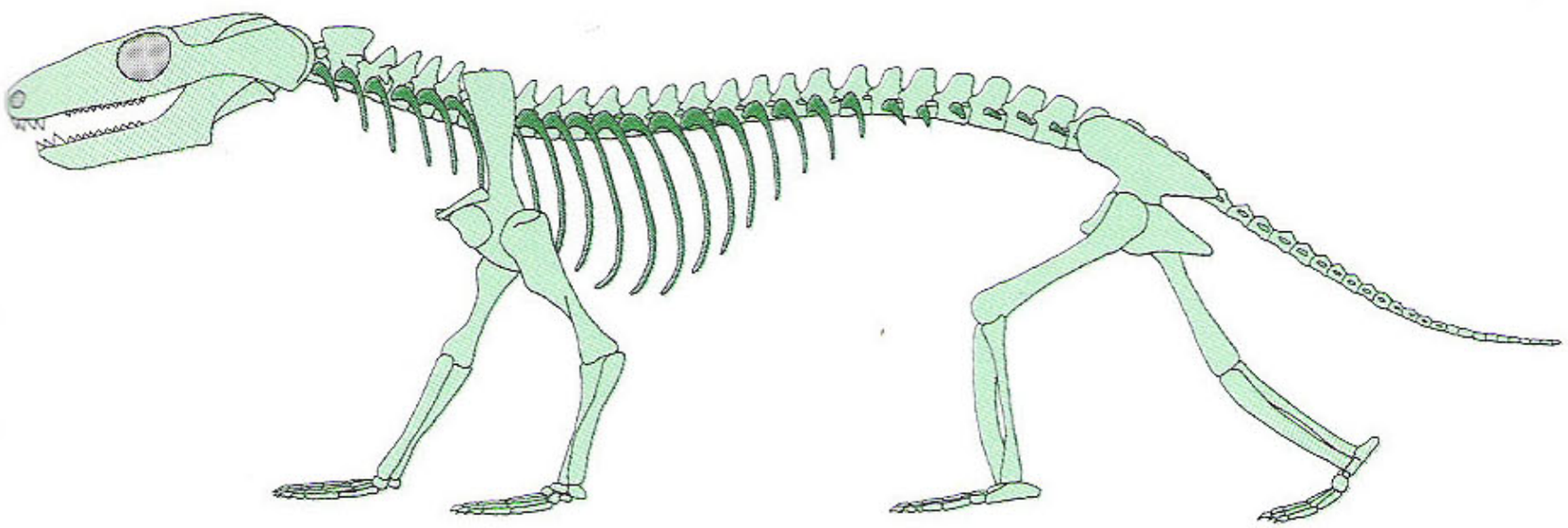
Thrinaxodon

Quais são as principais tendências evolutivas?

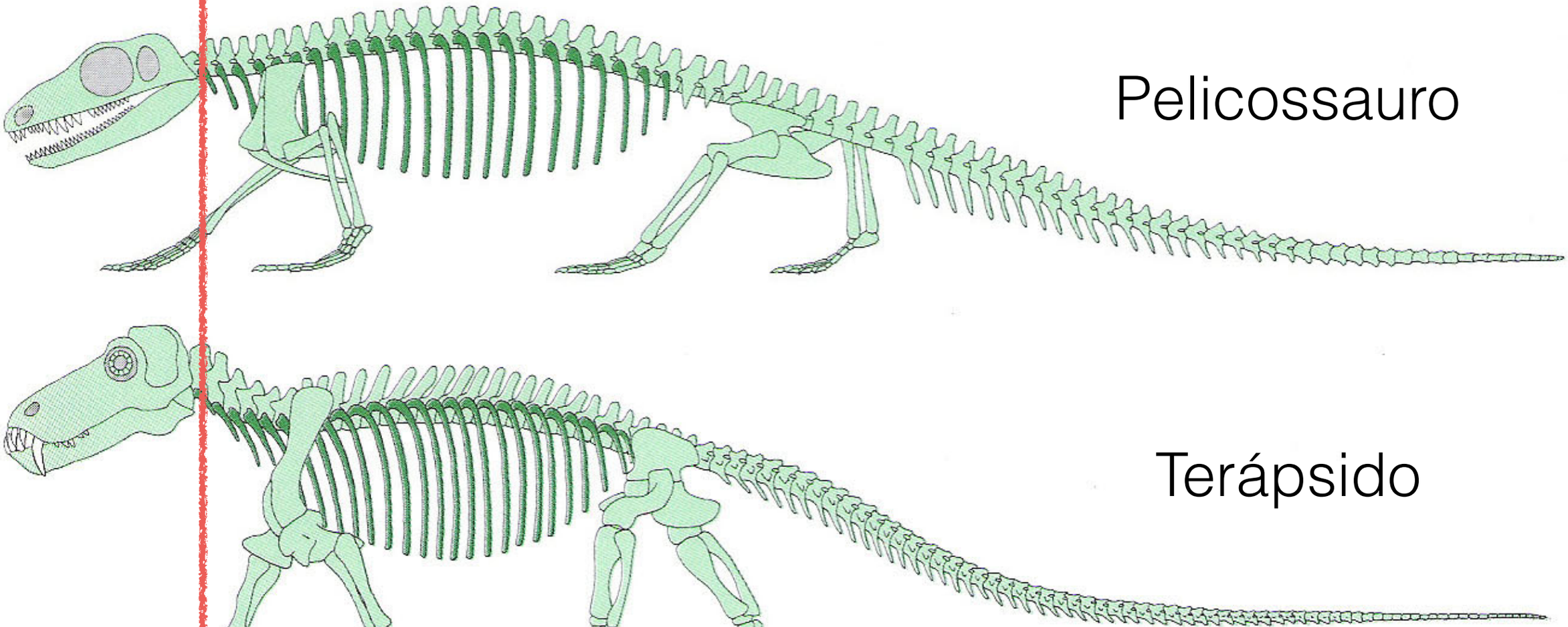


Pelicossauro

Terápsido

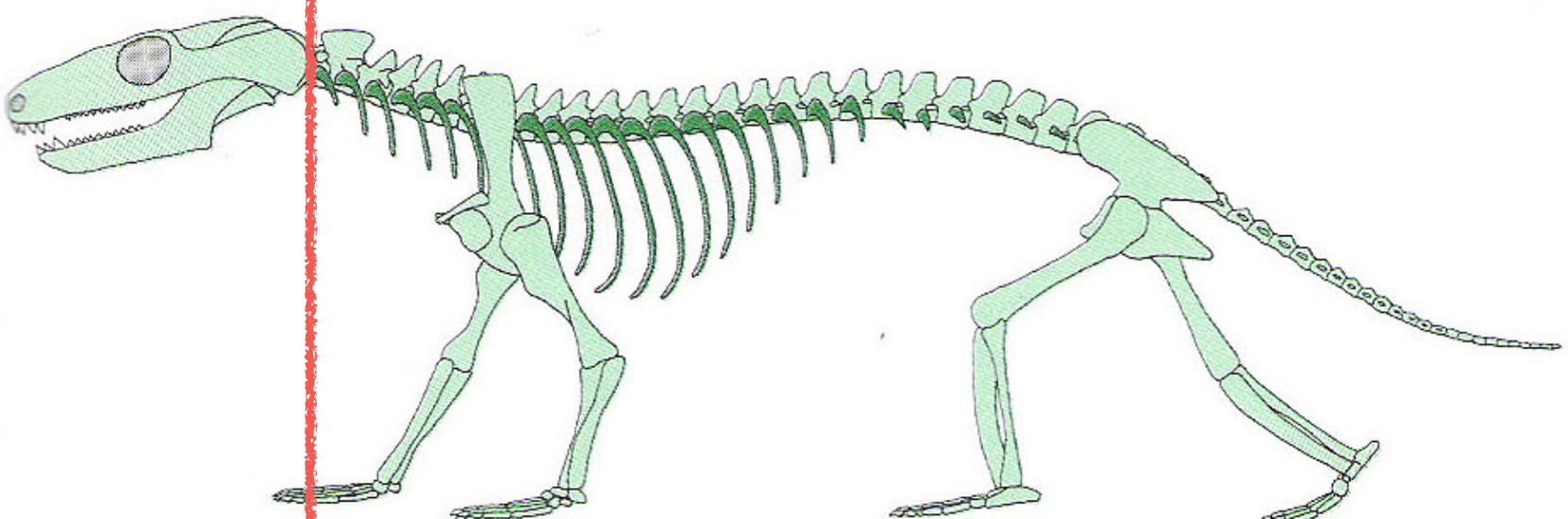


Cinodonte

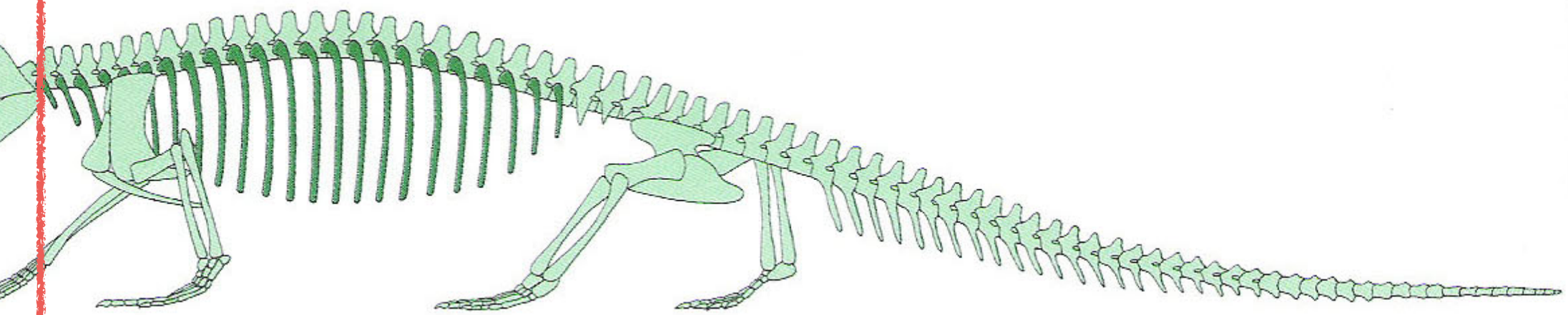


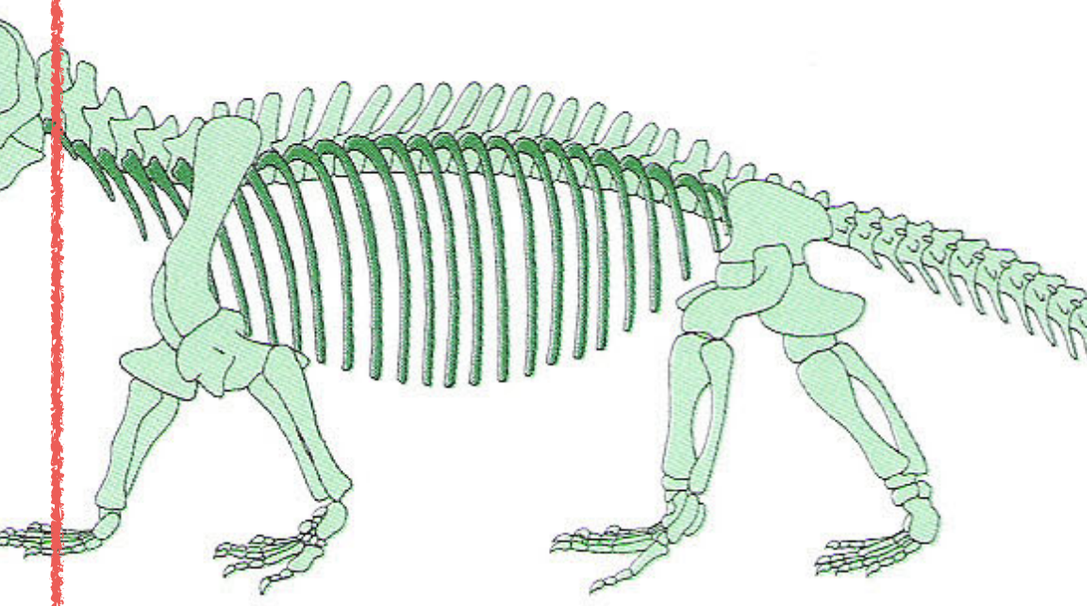
Pelicossauro

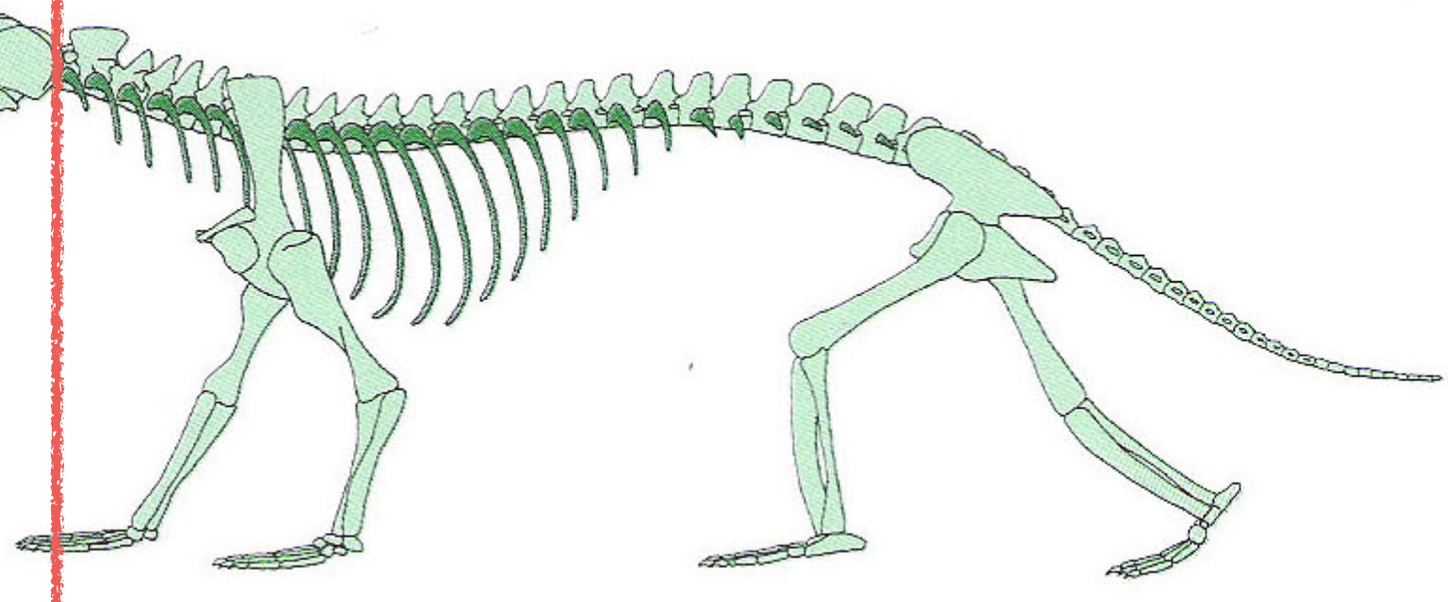
Terápsido



Cinodonte





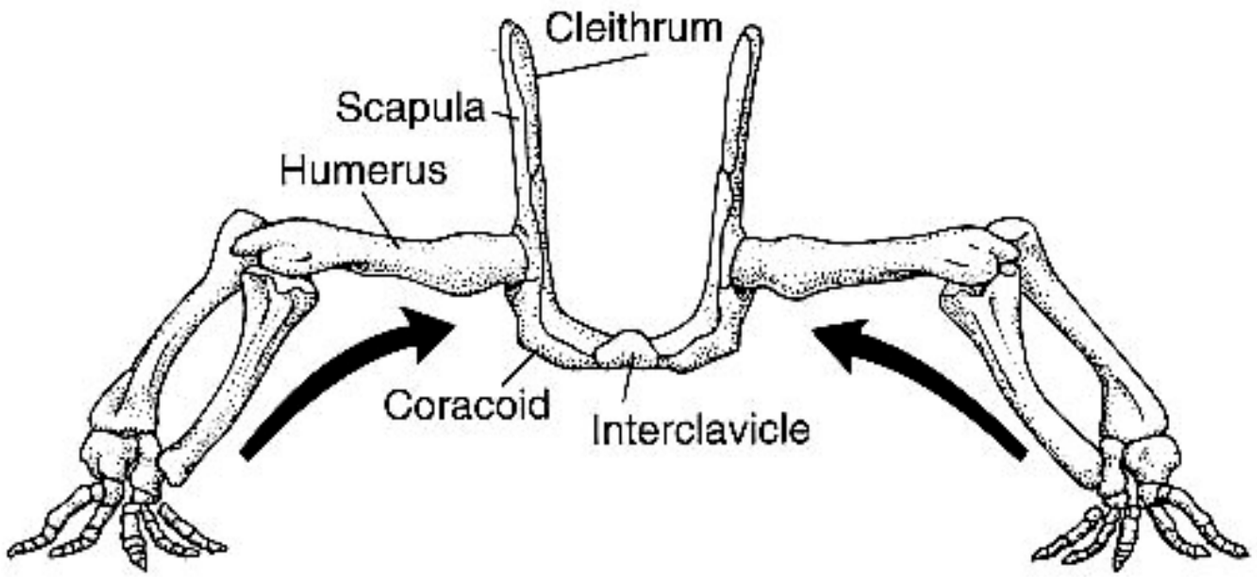


Aumento da taxa metabólica:

Como sabemos?

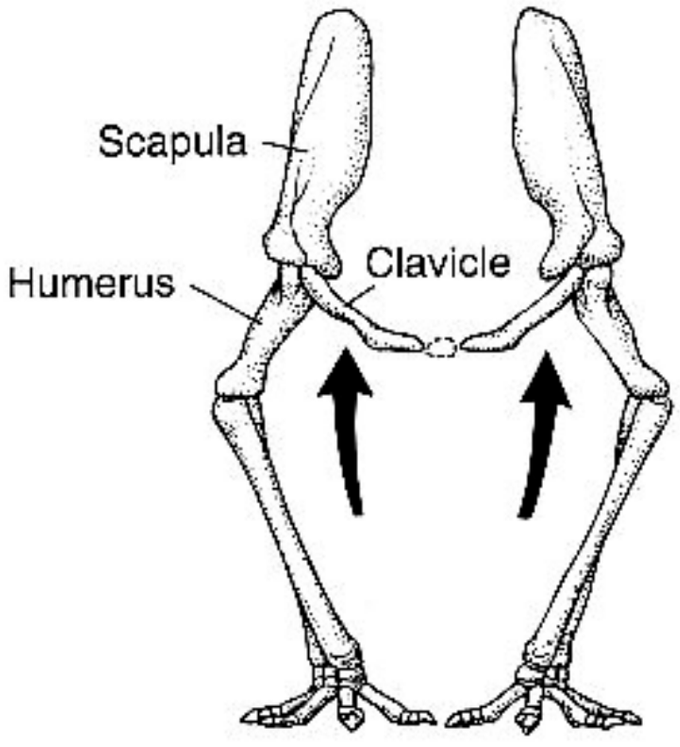
Eficiência do grau de atividade

Pelicossauro



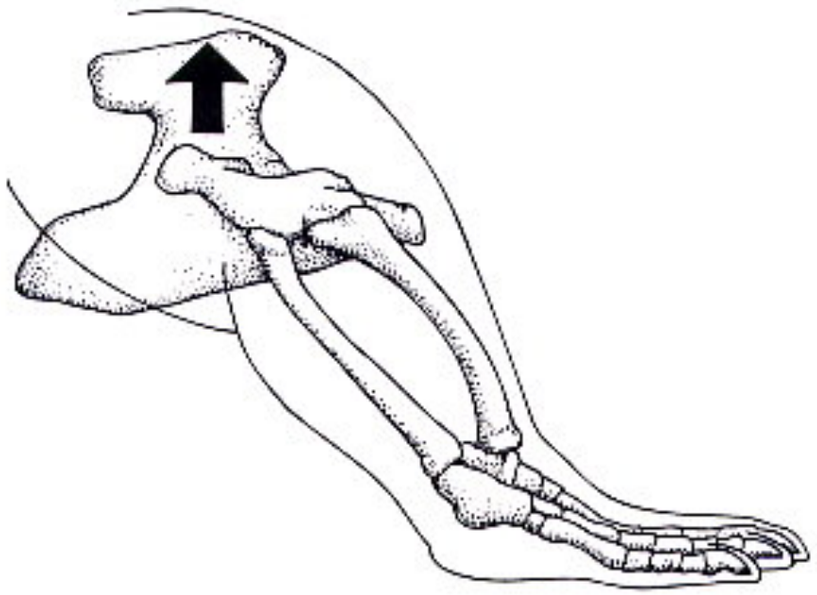
(a)

Cinodonte

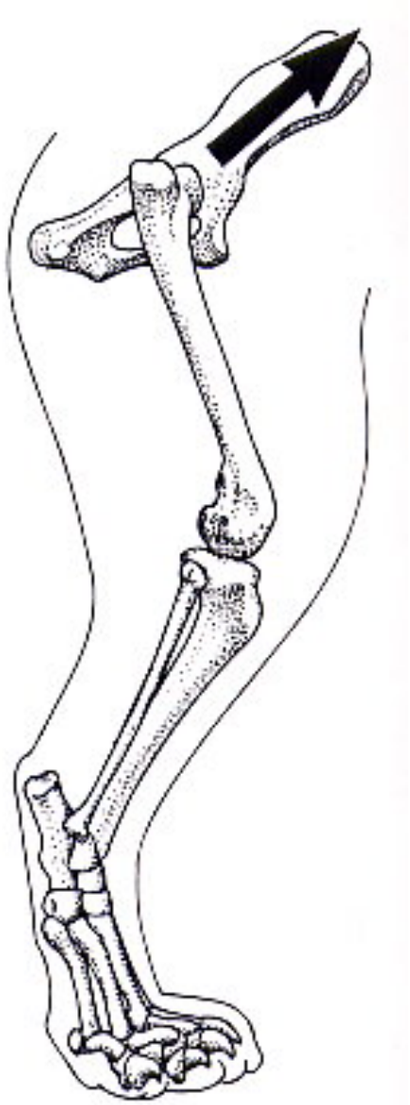


(b)

Eficiência do grau de atividade



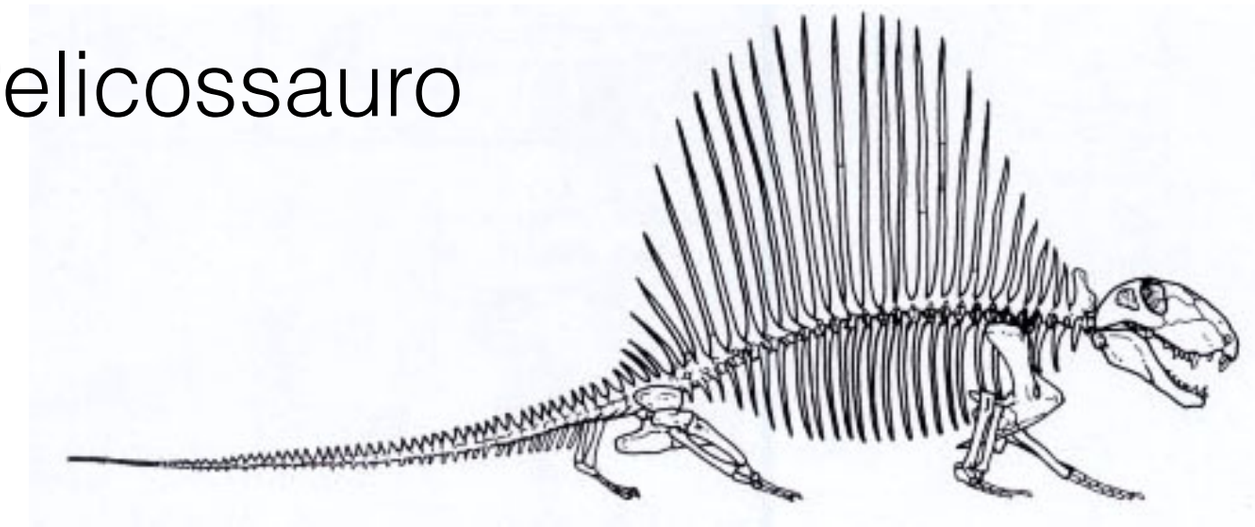
(a) Primitive reptile



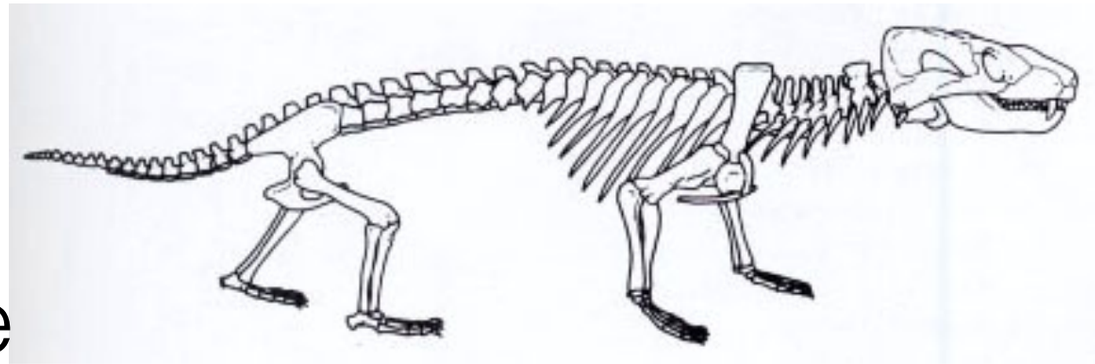
(b) Placental mammal

Eficiência do grau de atividade

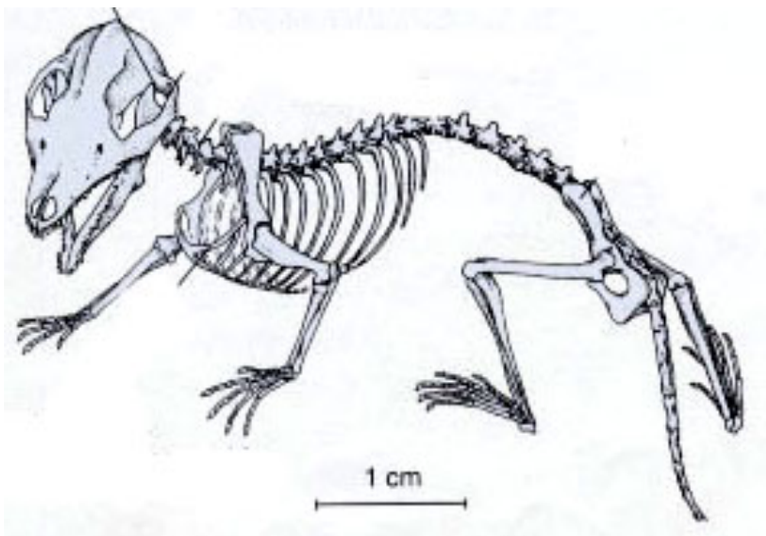
Pelicossauro



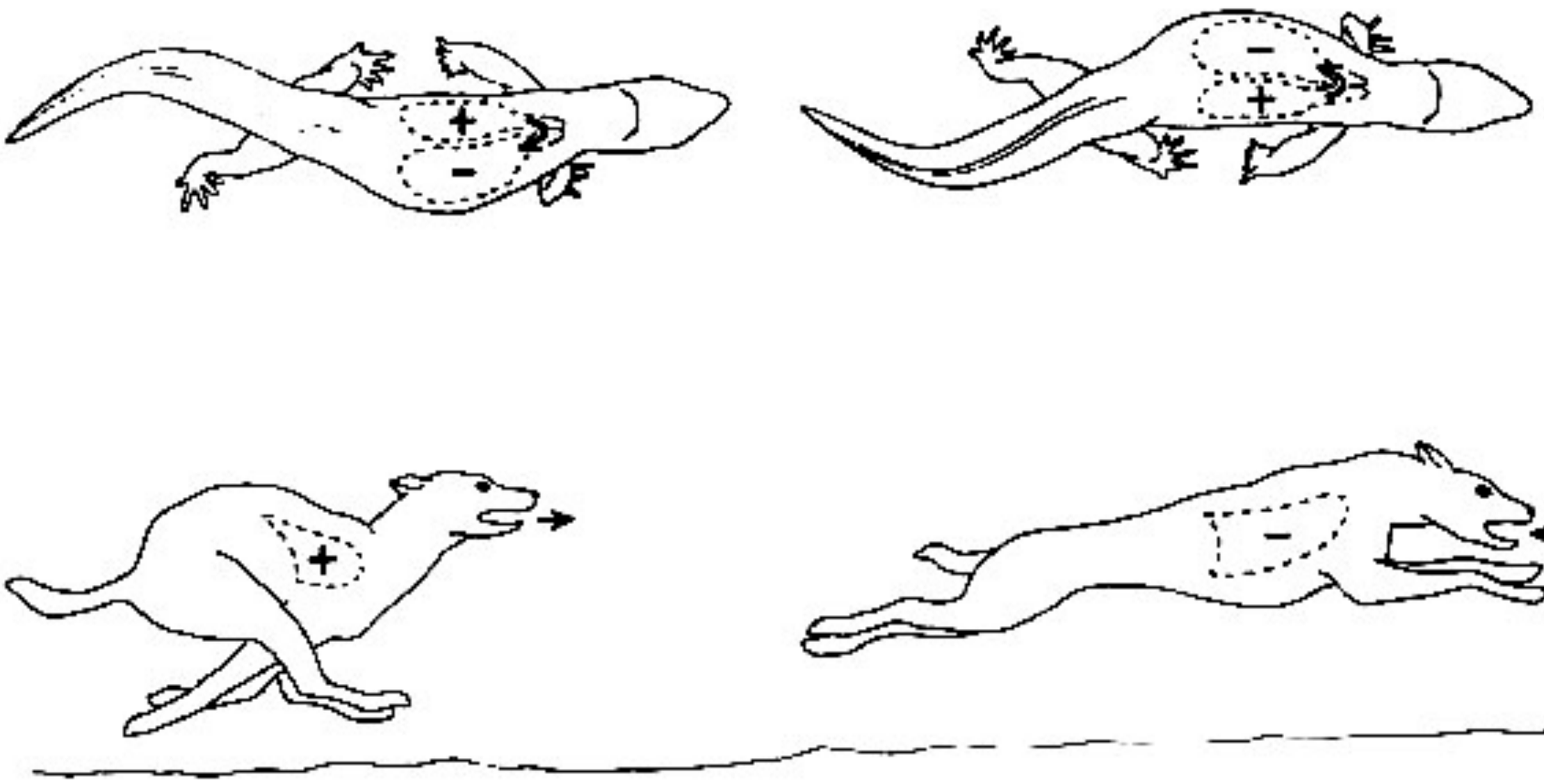
Cinodonte

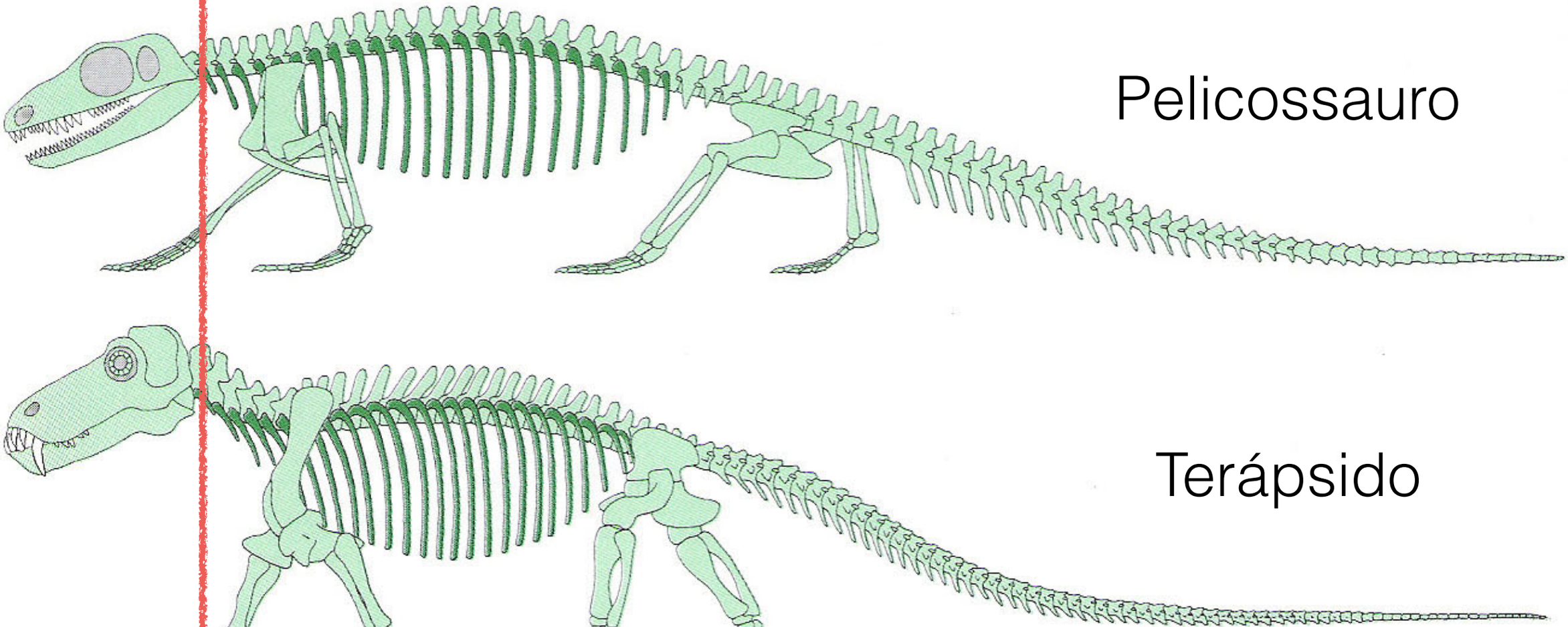


Mamífero



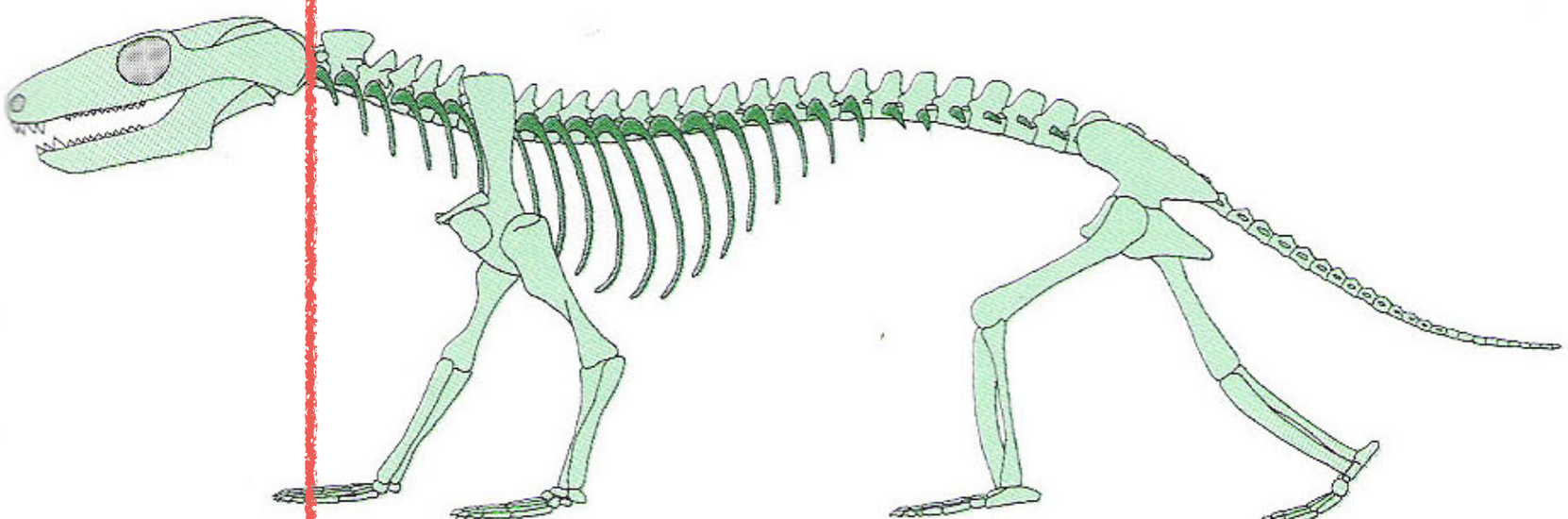
Eficiência do grau de atividade



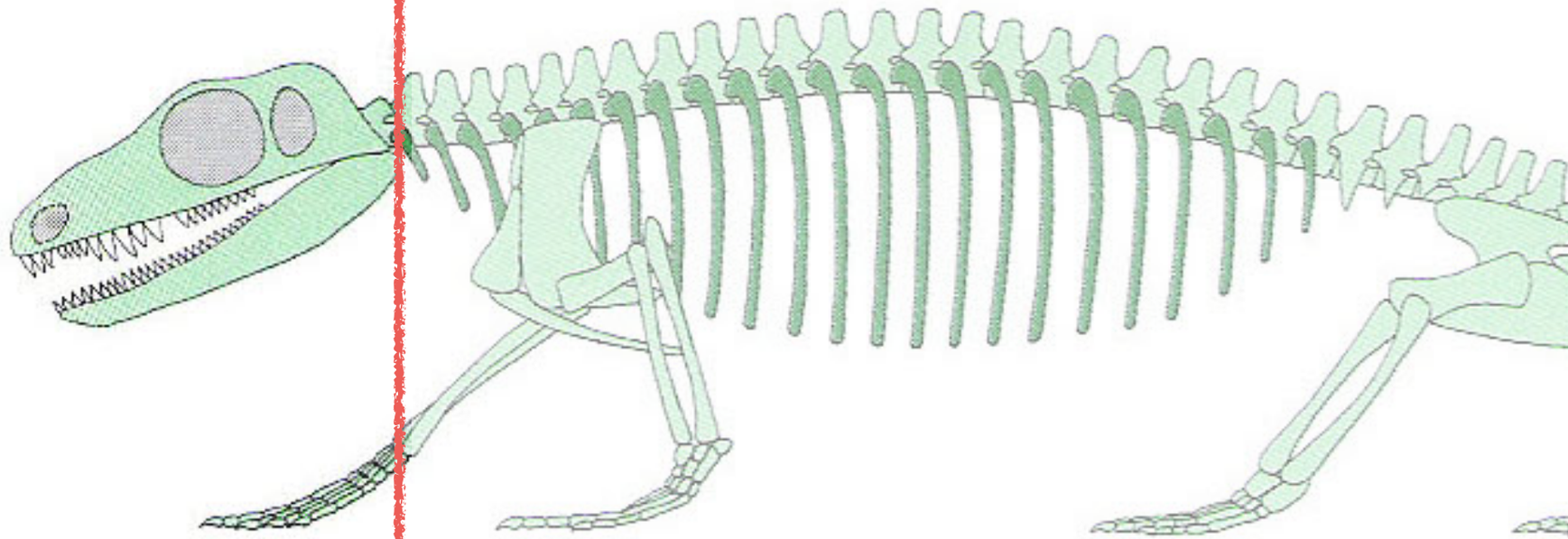


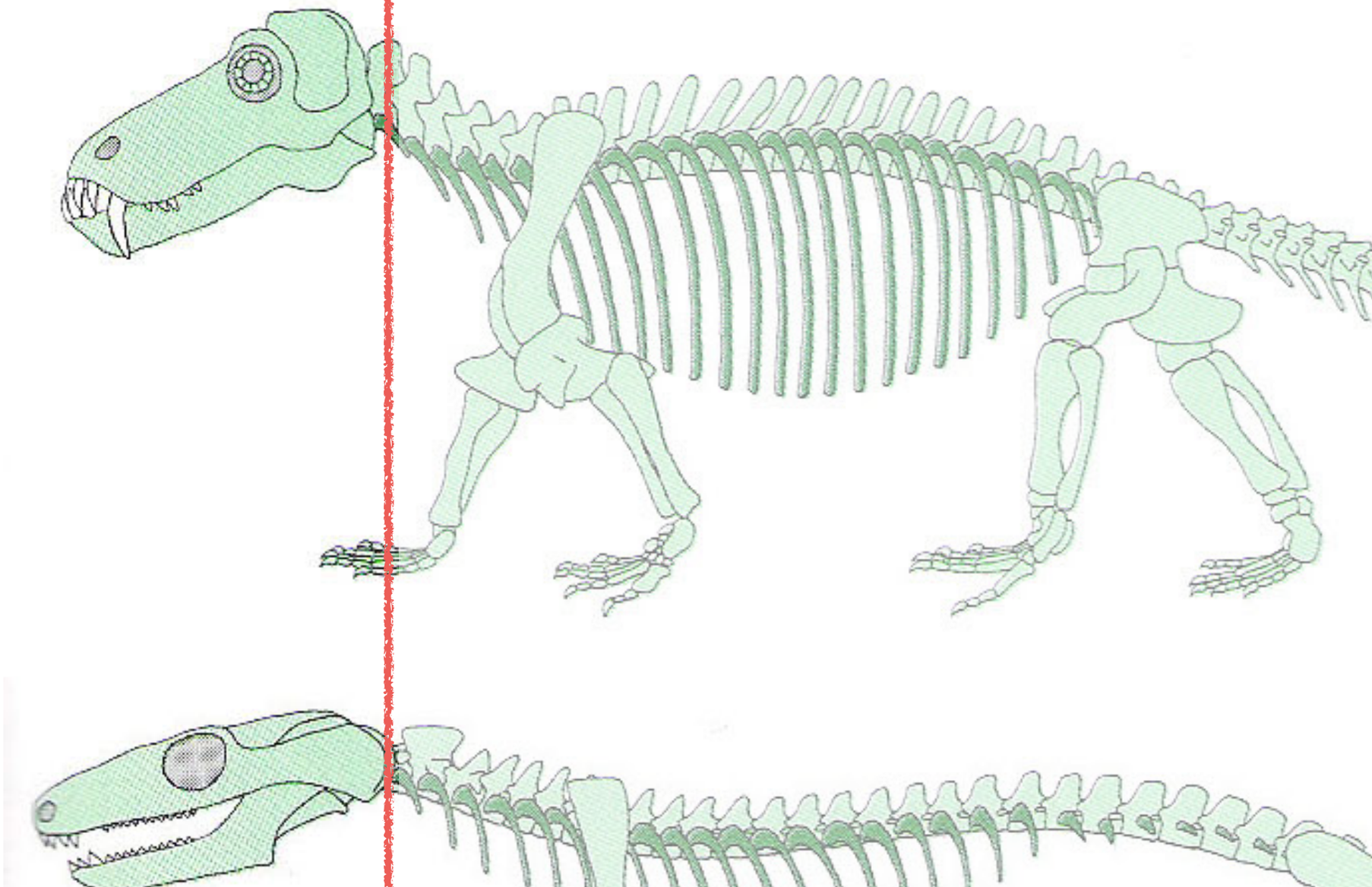
Pelicossauro

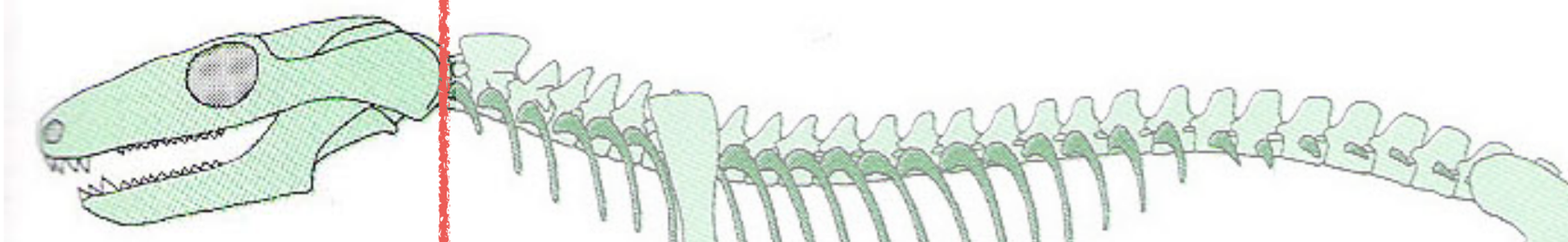
Terápsido



Cinodonte



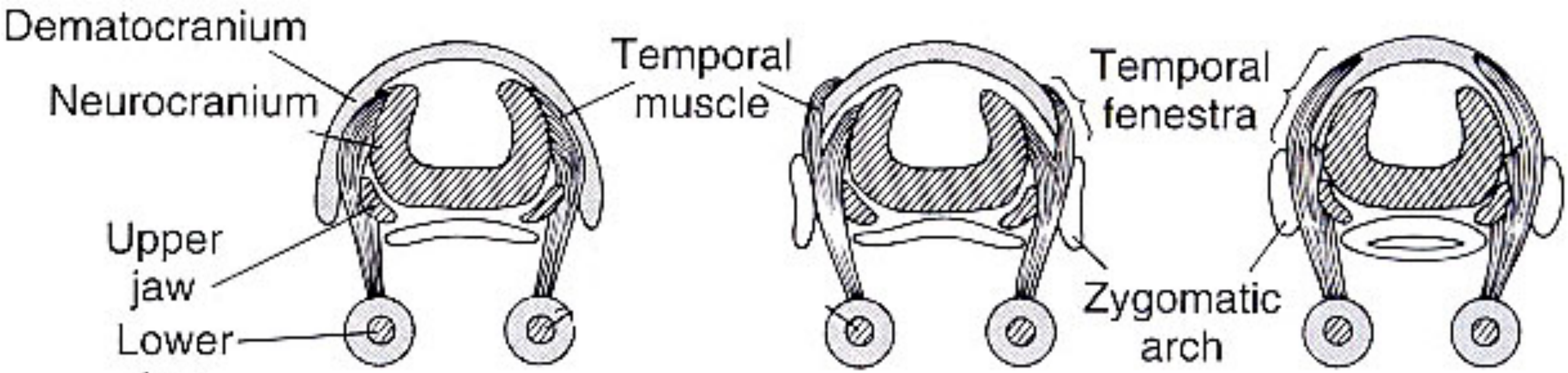




Aumento da taxa metabólica:

Eficiência do processamento de alimentos

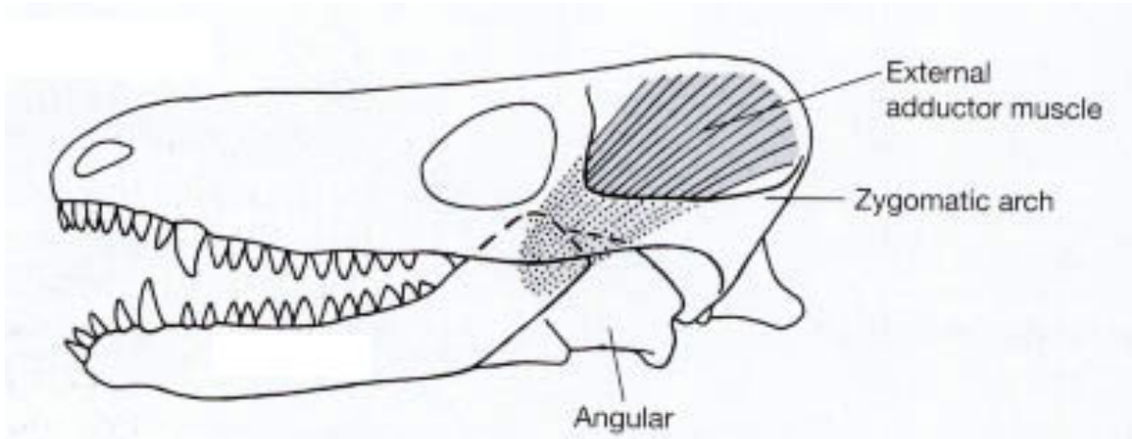
Eficiência do processamento de alimentos



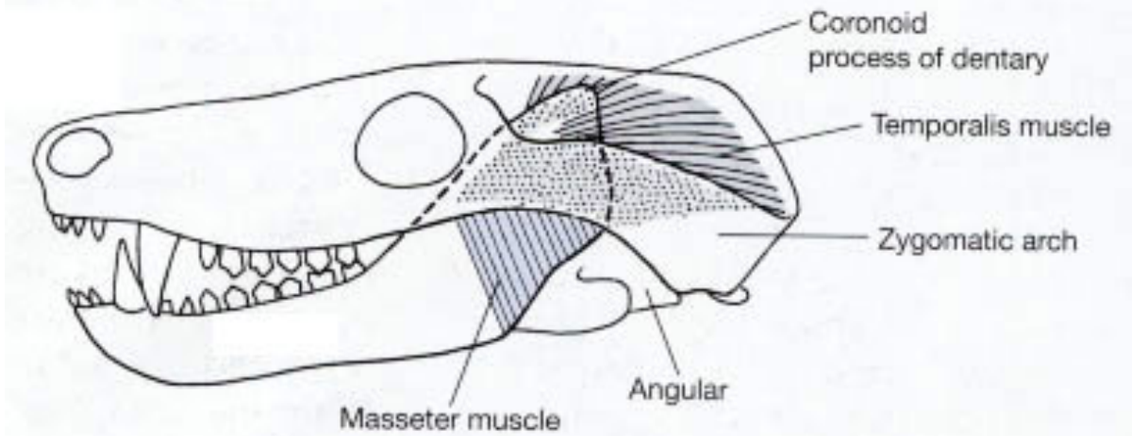
Anápsido Terápsido Mamífero

Eficiência do processamento de alimentos

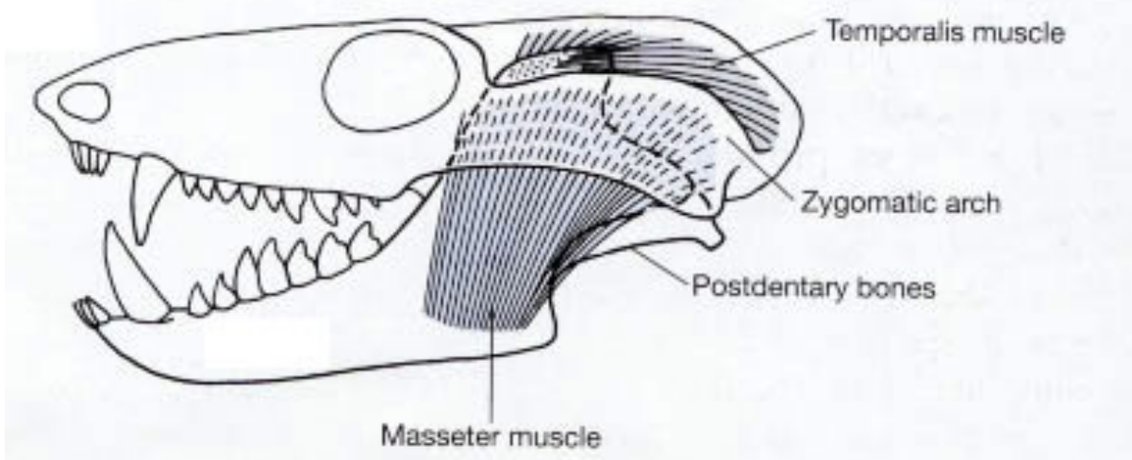
Terapsida
não-cinodonte



Cinodonte basal

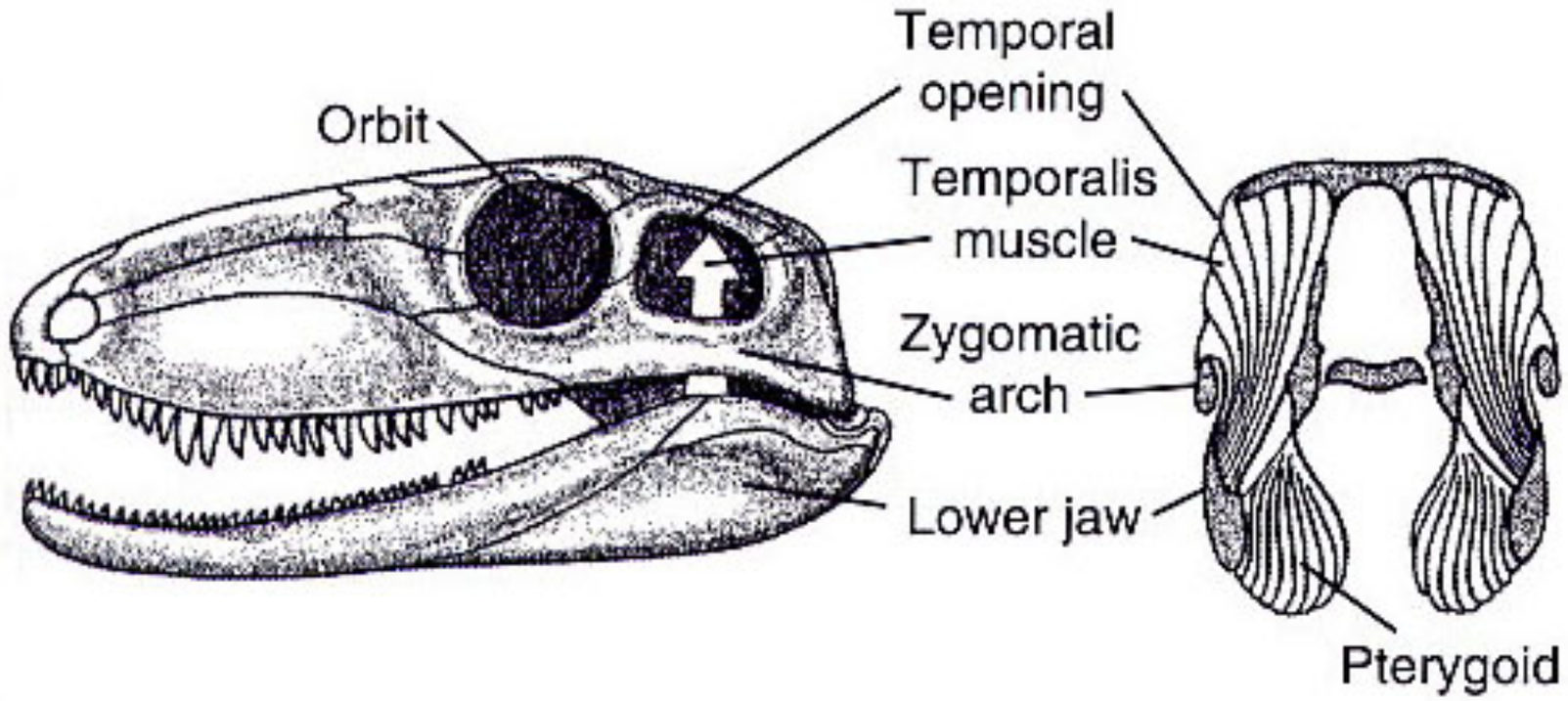


Cinodonte derivado

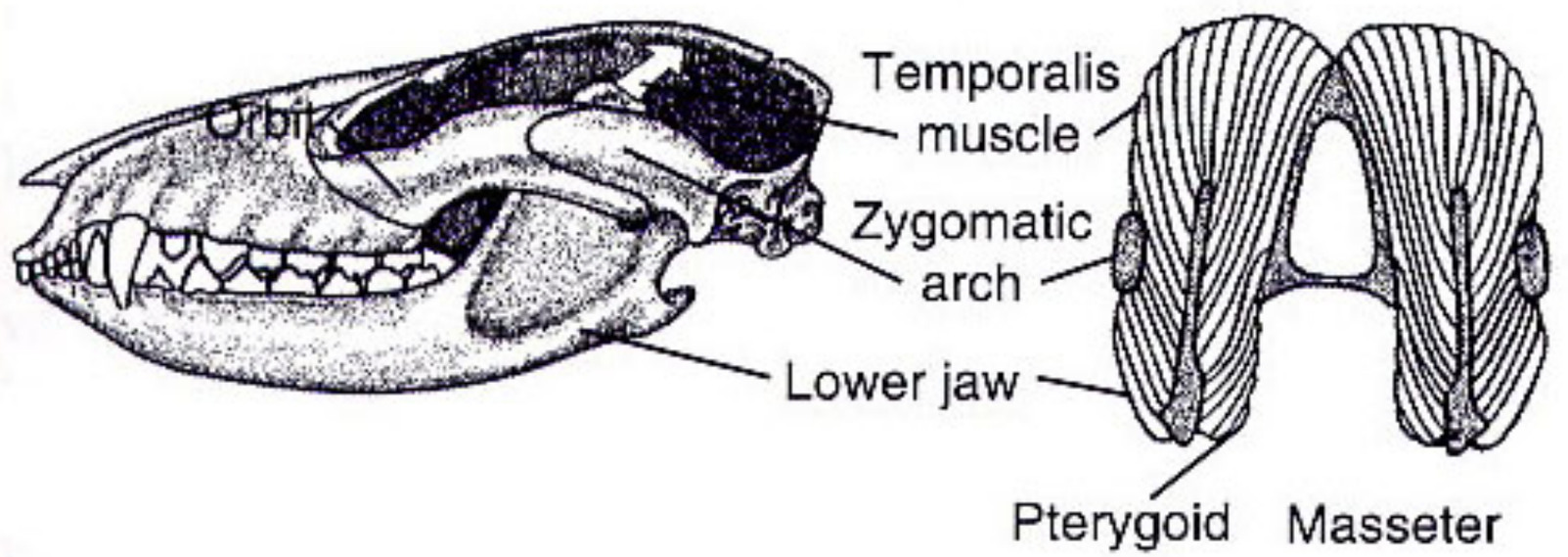


Eficiência do processamento de alimentos

Pelicossauro

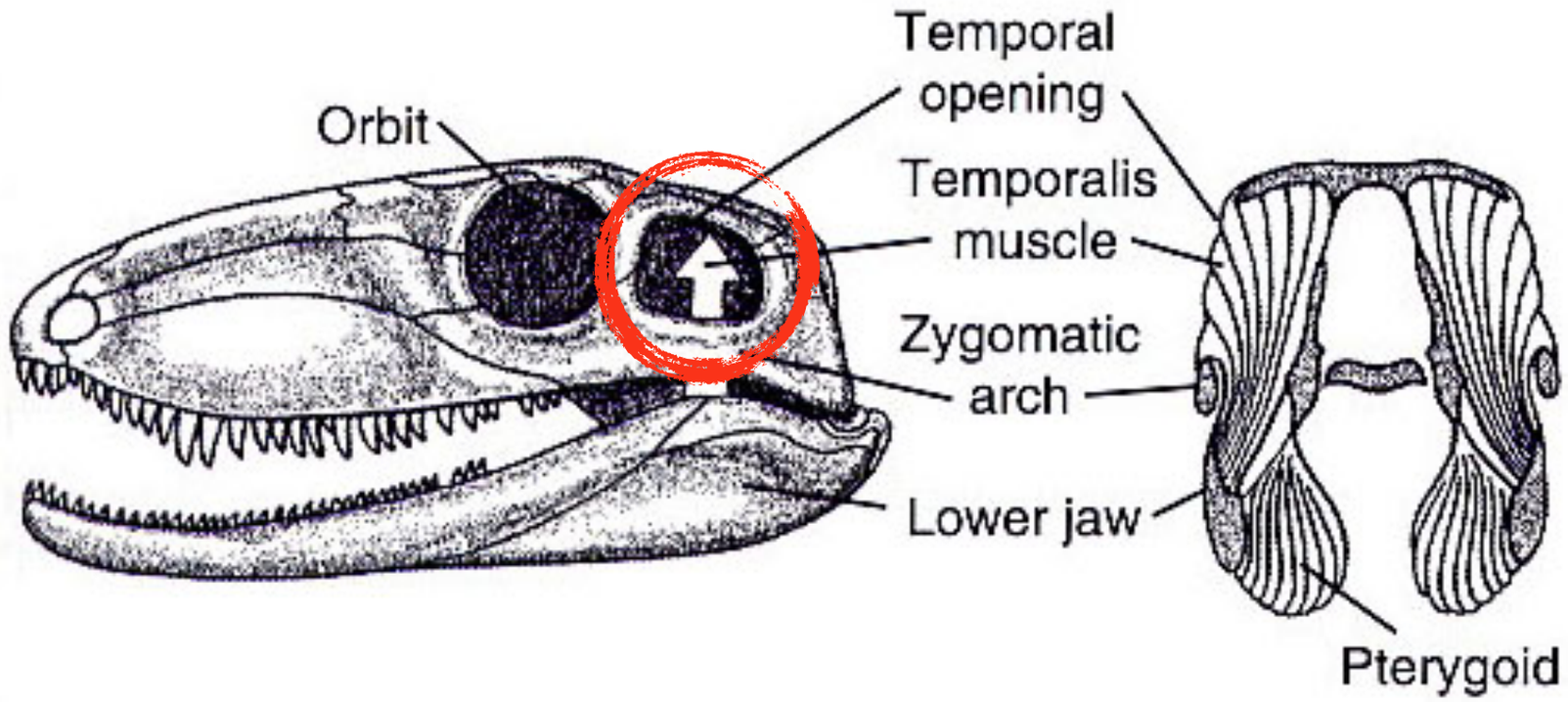


Mamífero

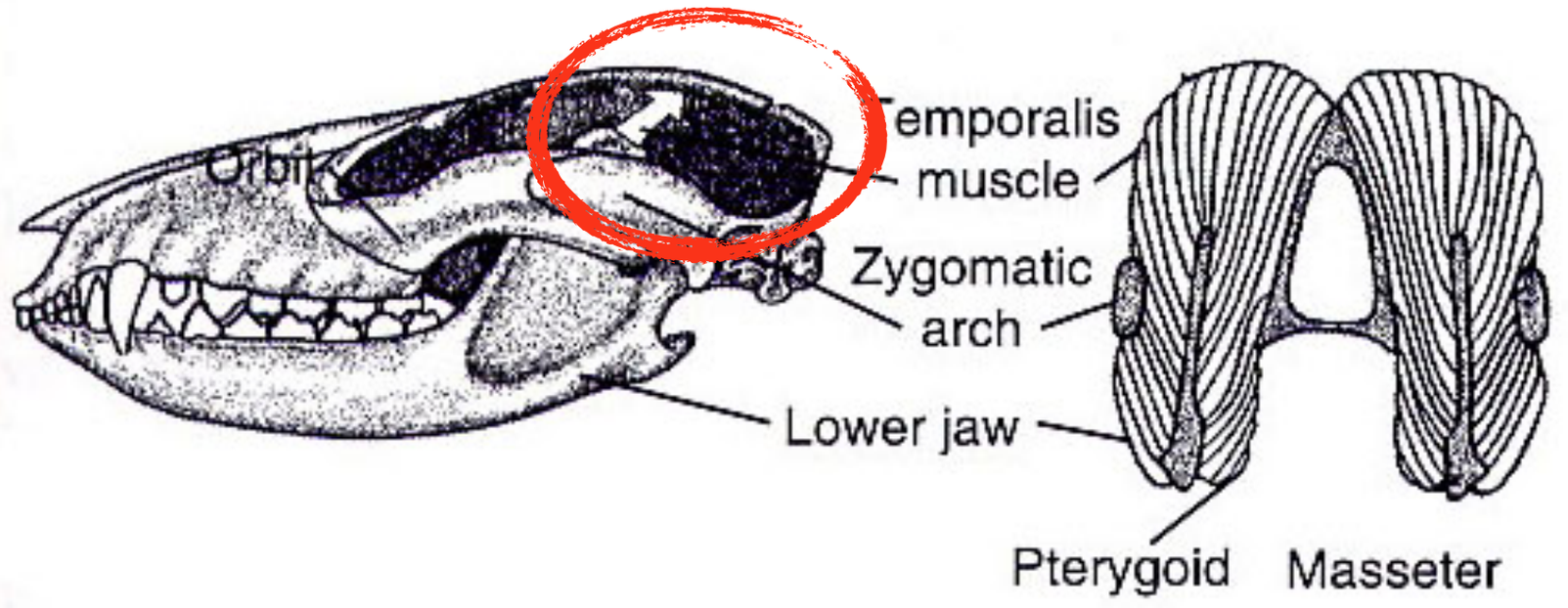


Eficiência do processamento de alimentos

Pelicossauro

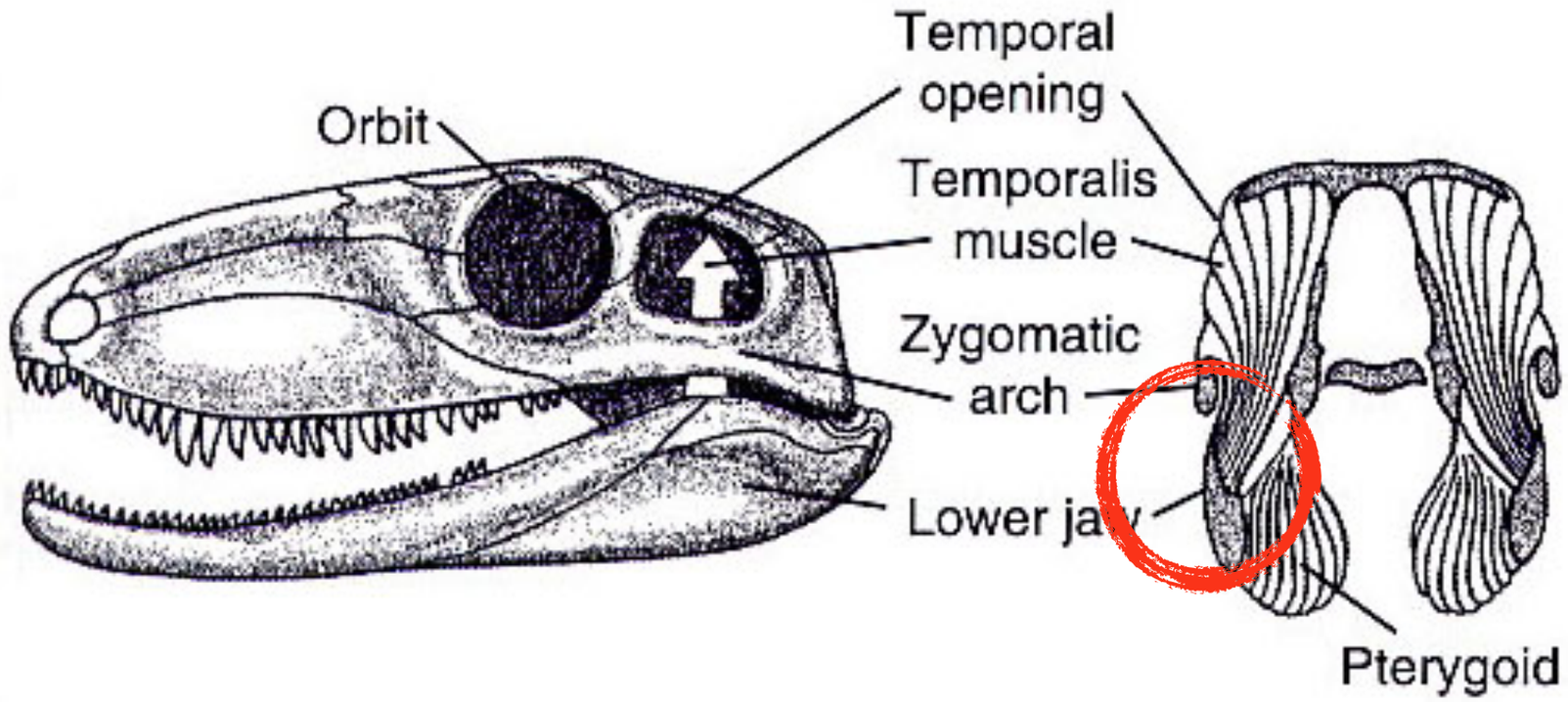


Mamífero

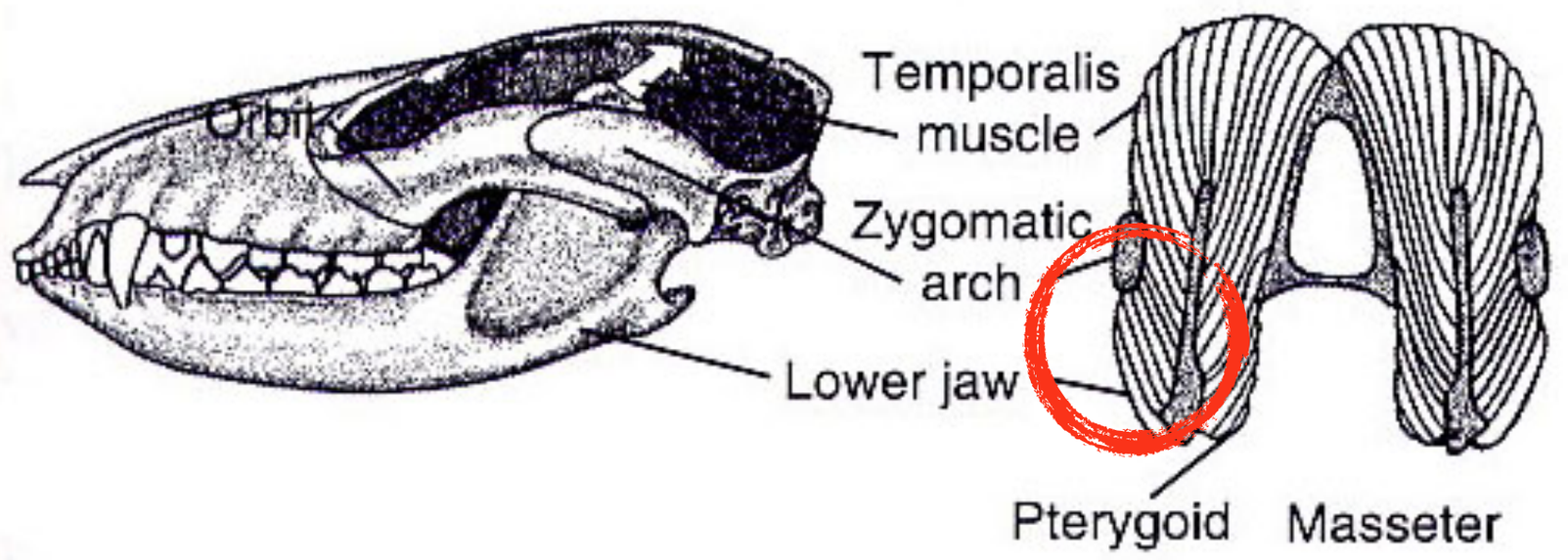


Eficiência do processamento de alimentos

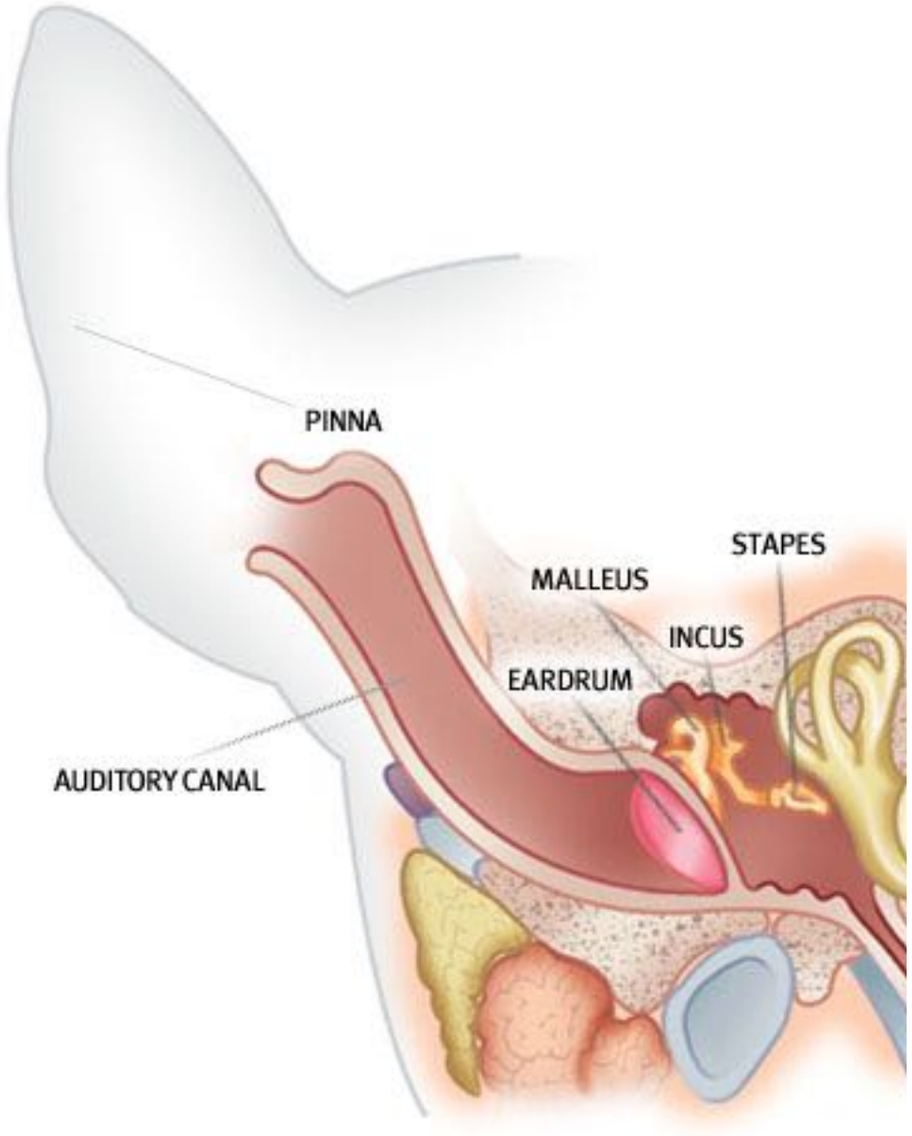
Pelicossauro

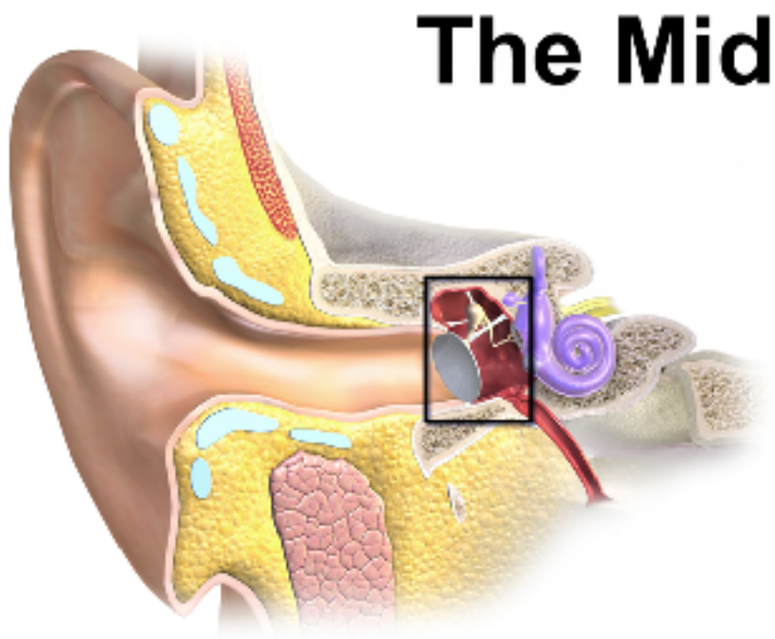


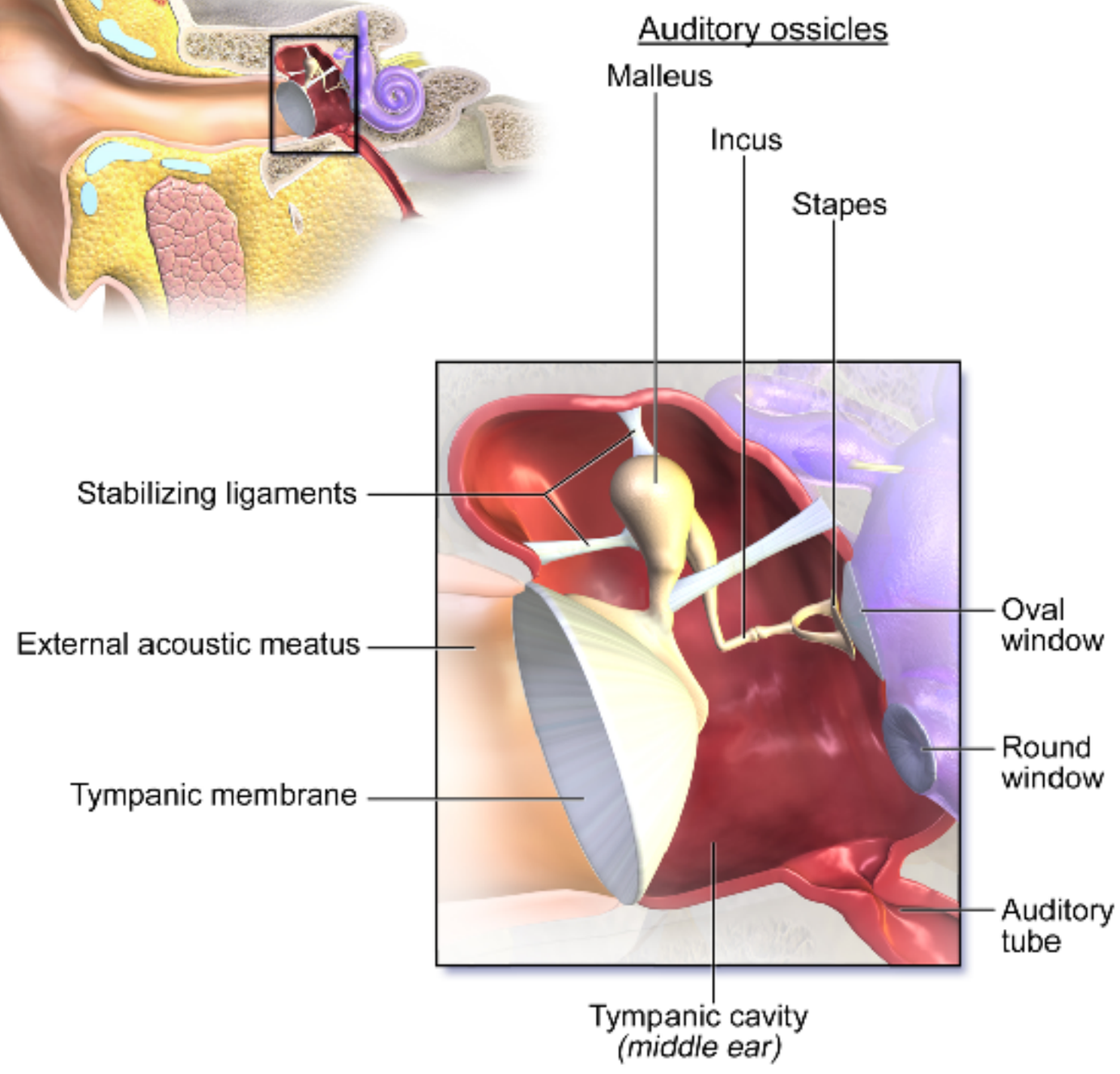
Mamífero



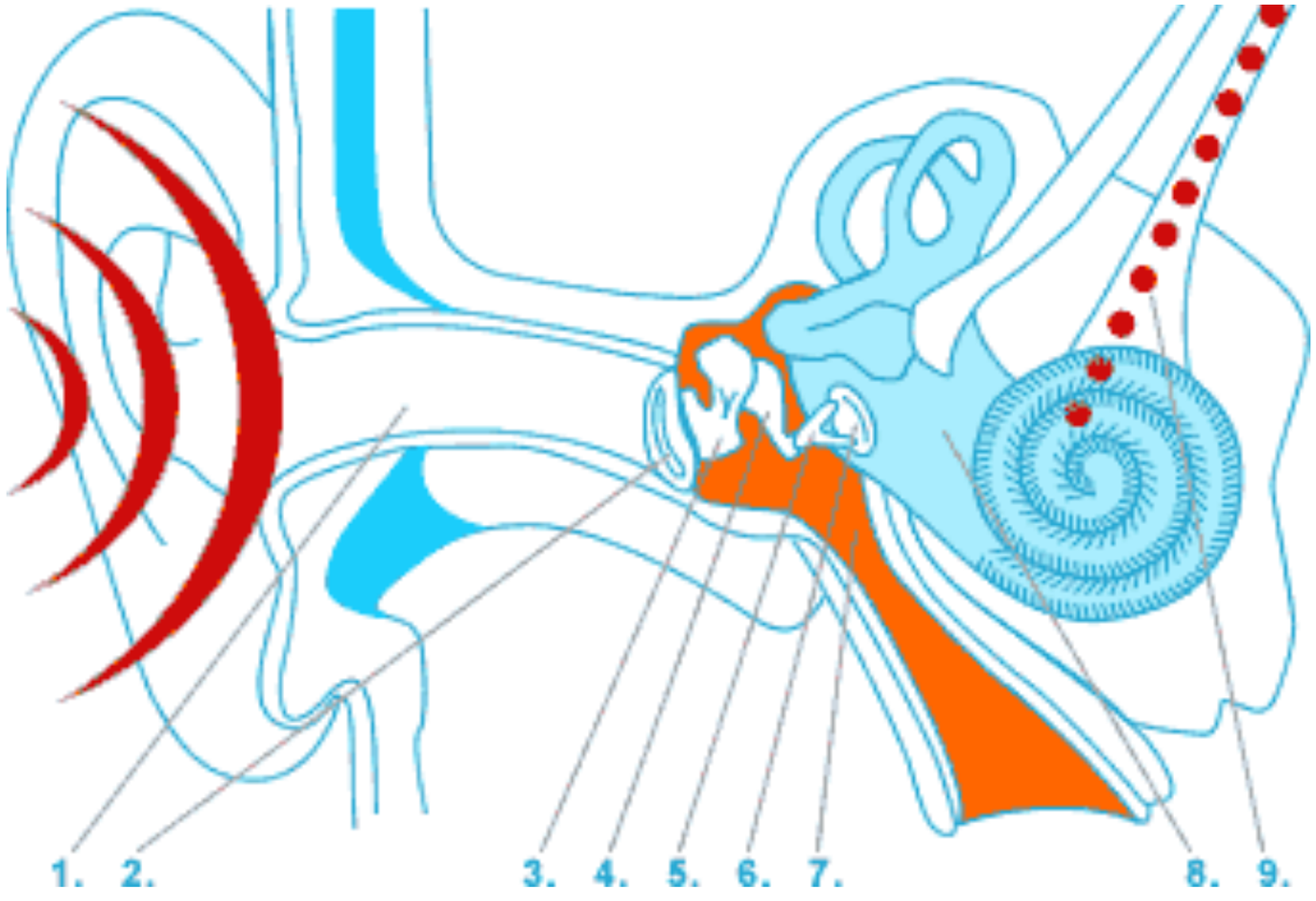
Conflito entre alimentação e audição



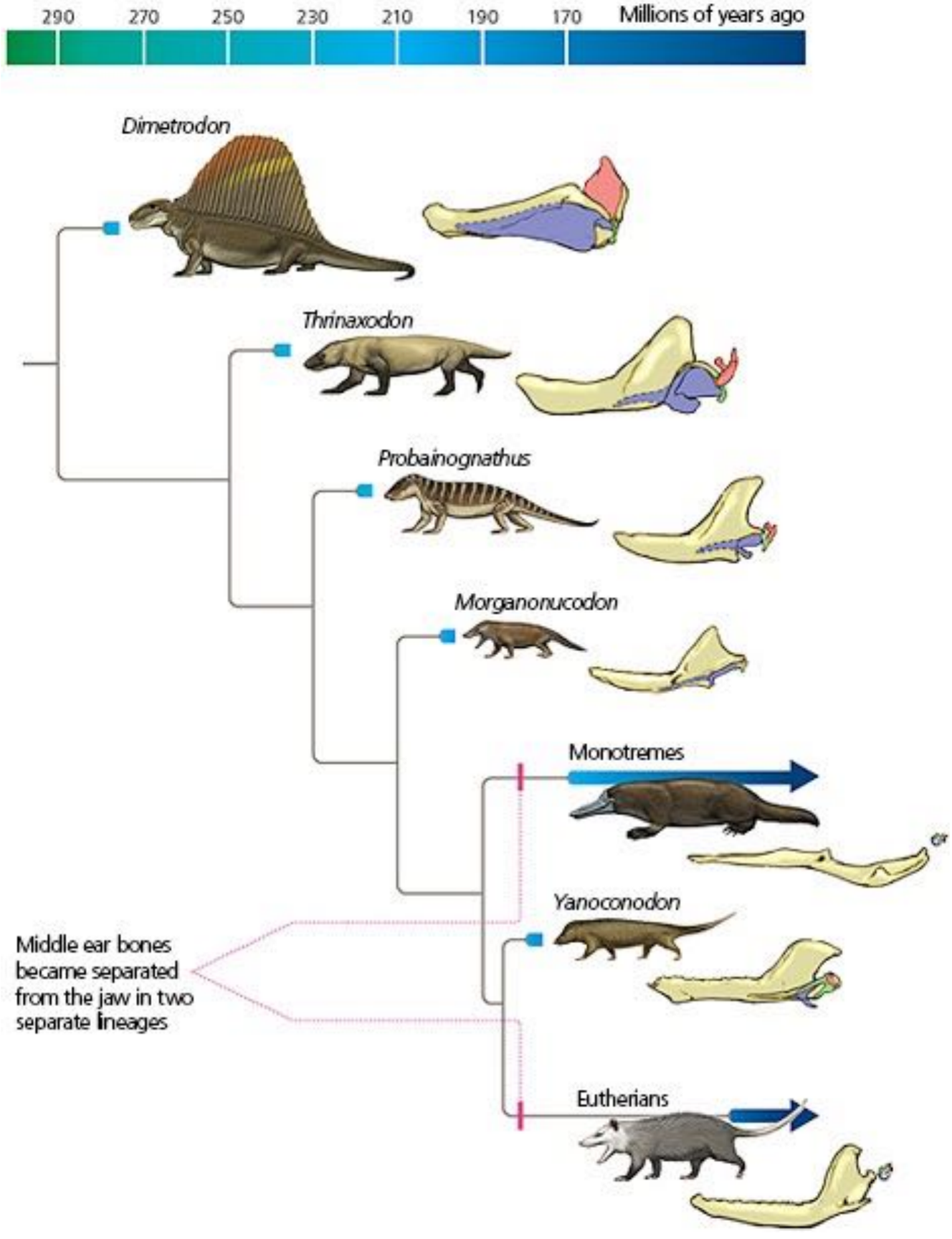




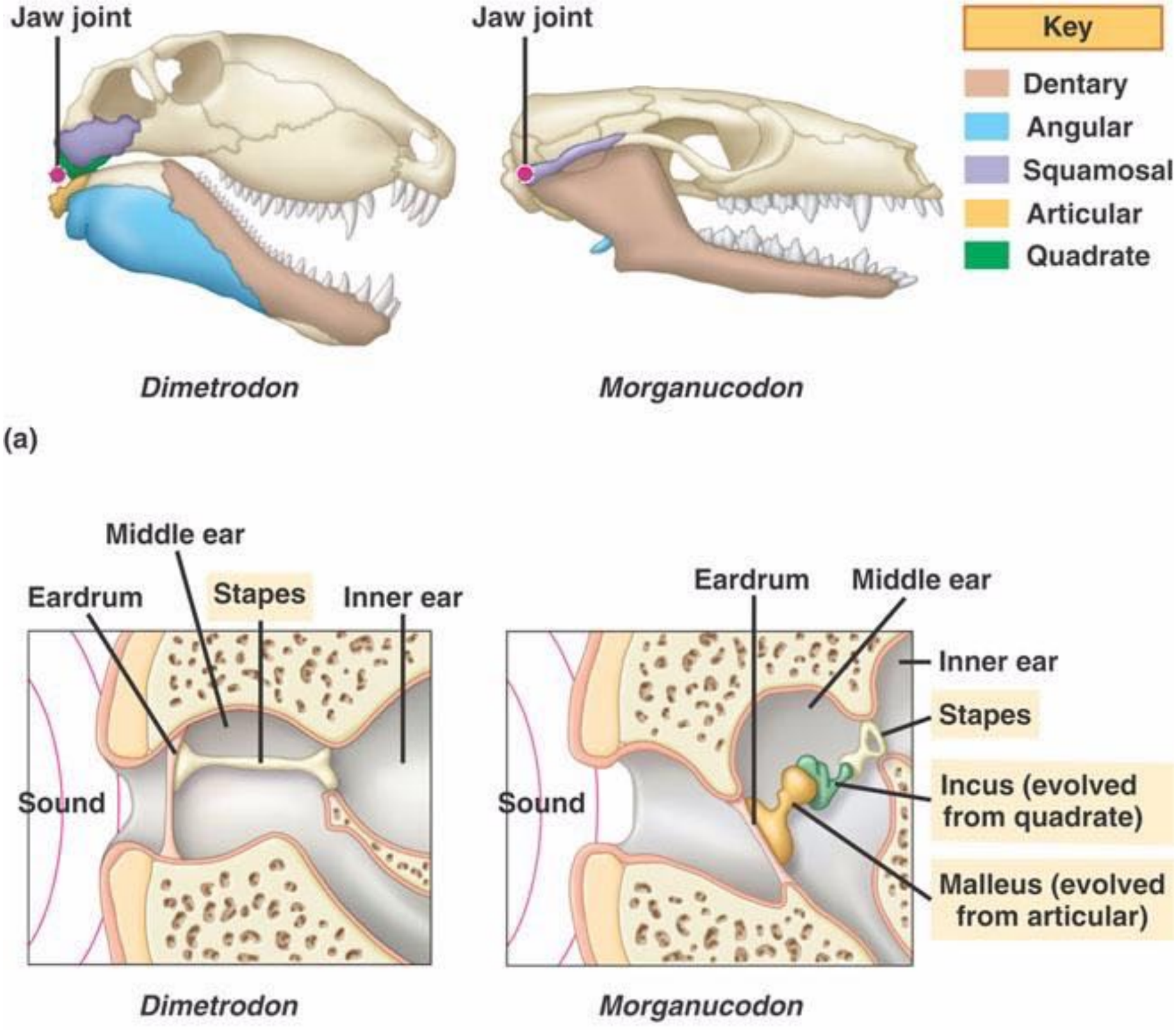
Conflito entre alimentação e audição



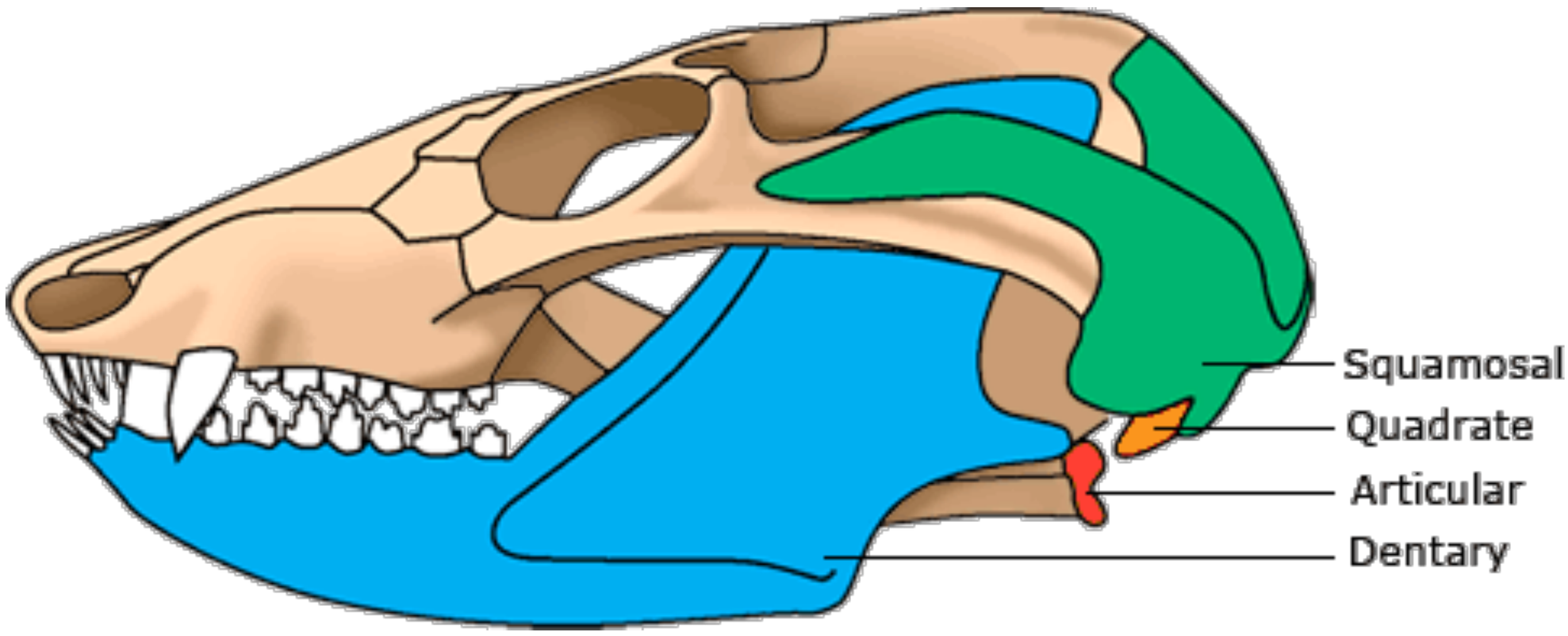
Conflito entre alimentação e audição



Conflito entre alimentação e audição

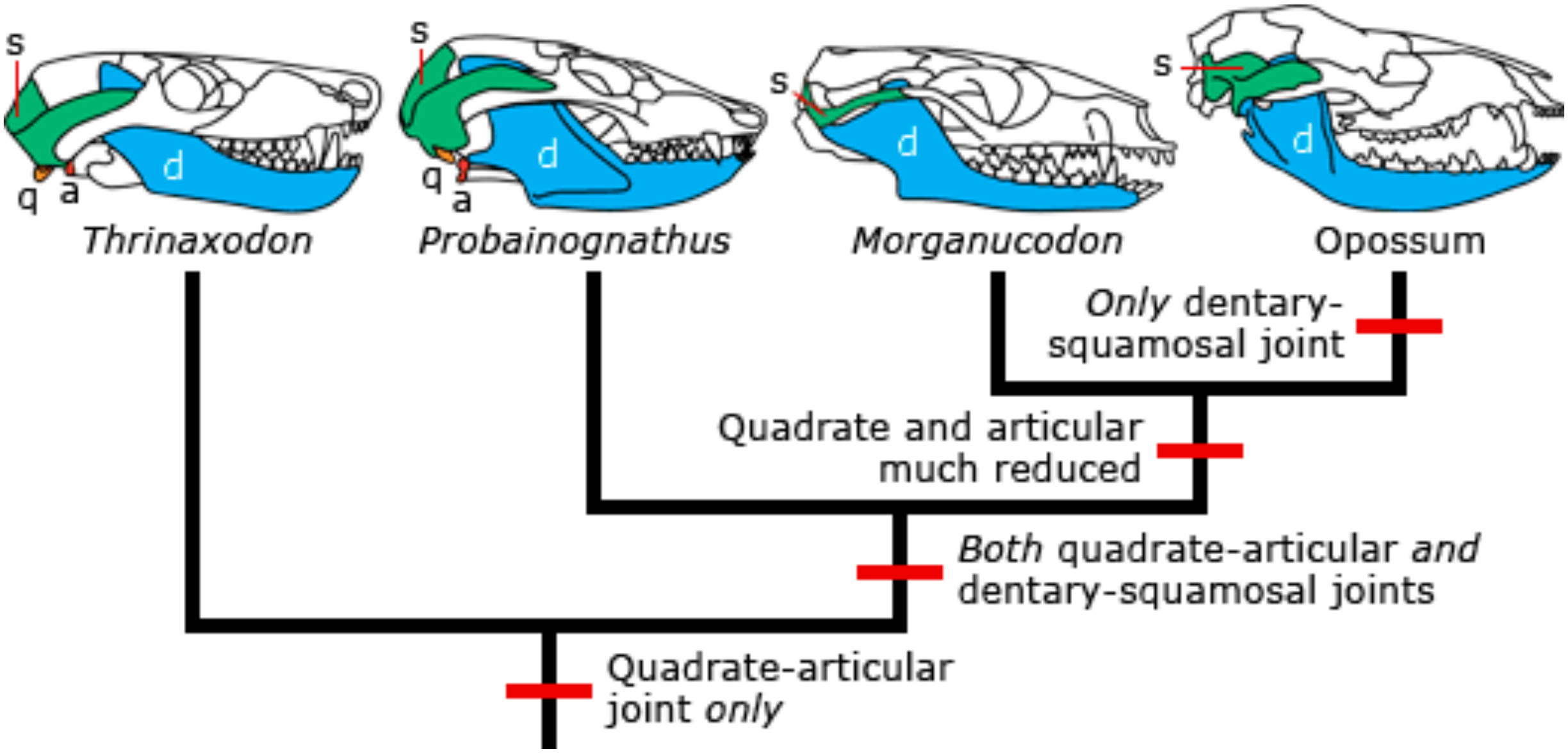


Conflito entre alimentação e audição



Cinodonte

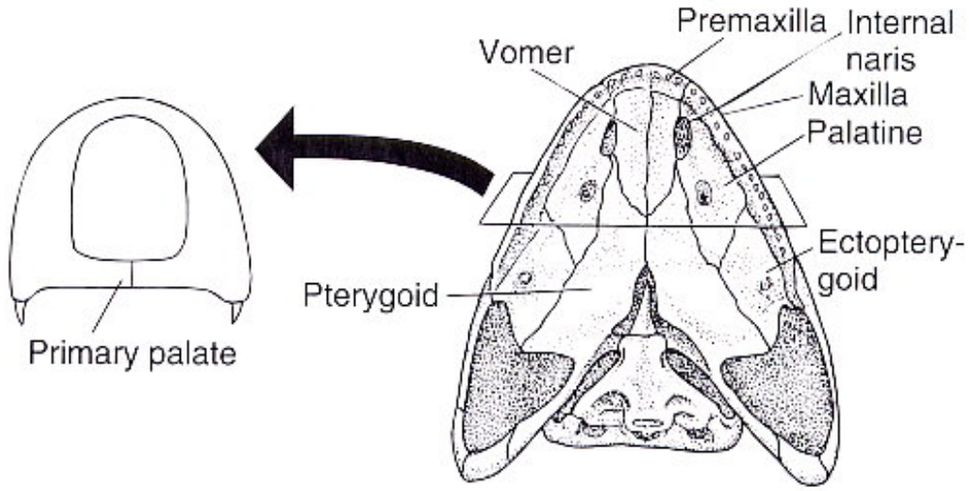
Conflito entre alimentação e audição



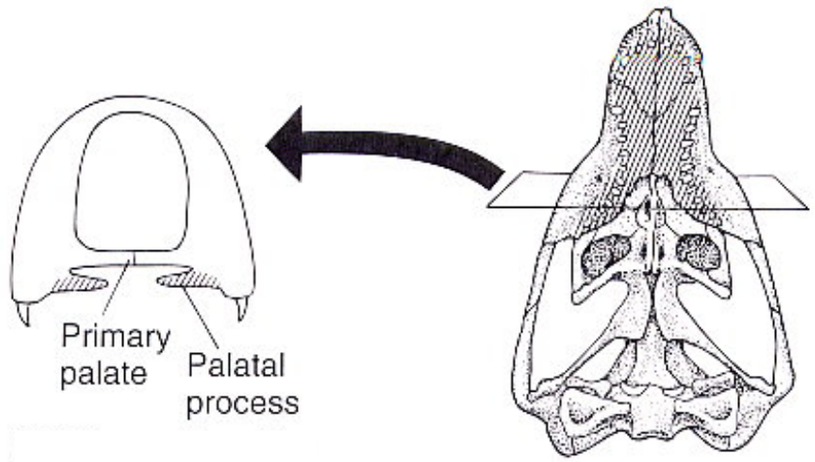
Aumento da taxa metabólica:

Eficiência do processamento de alimentos

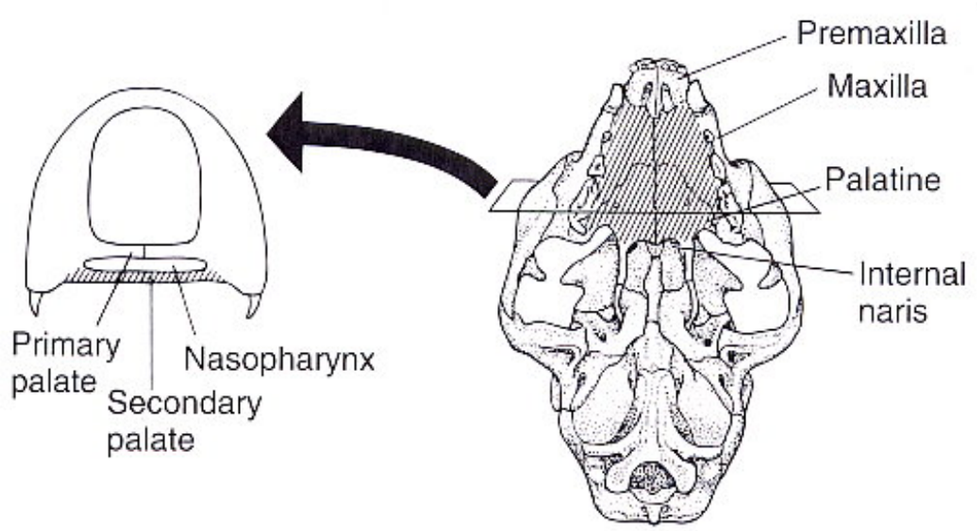
Conflito entre alimentação e respiração



Anfíbio

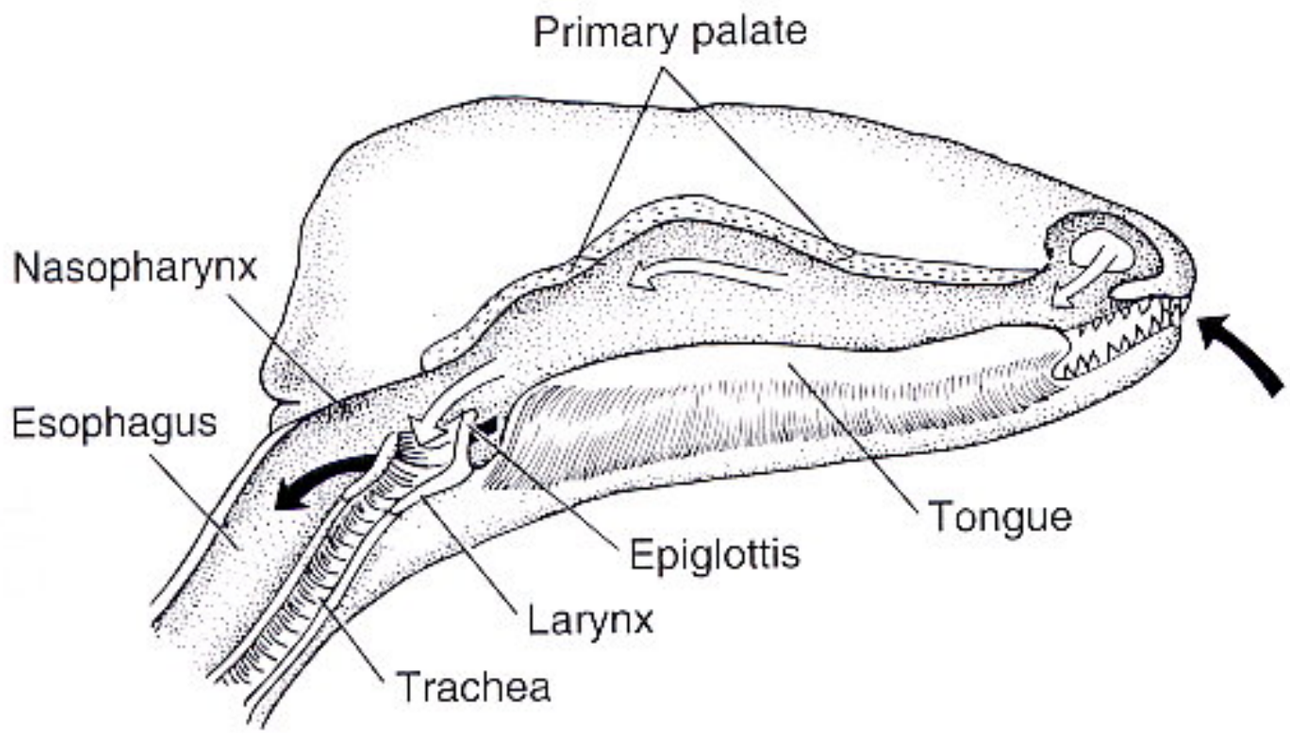


Cinodonte

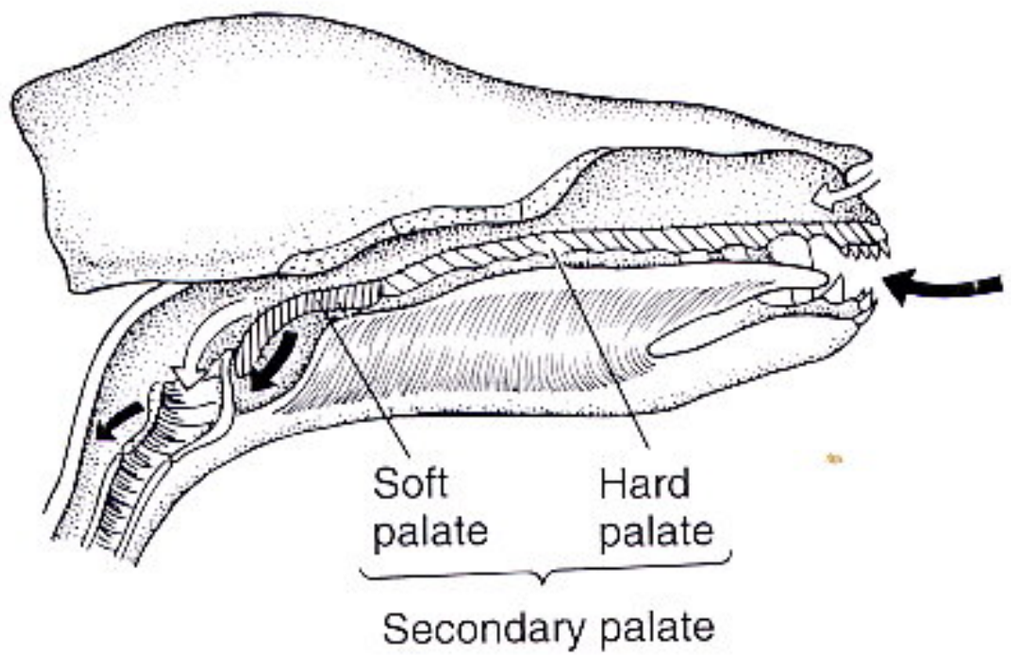


Mamífero

Conflito entre alimentação e respiração

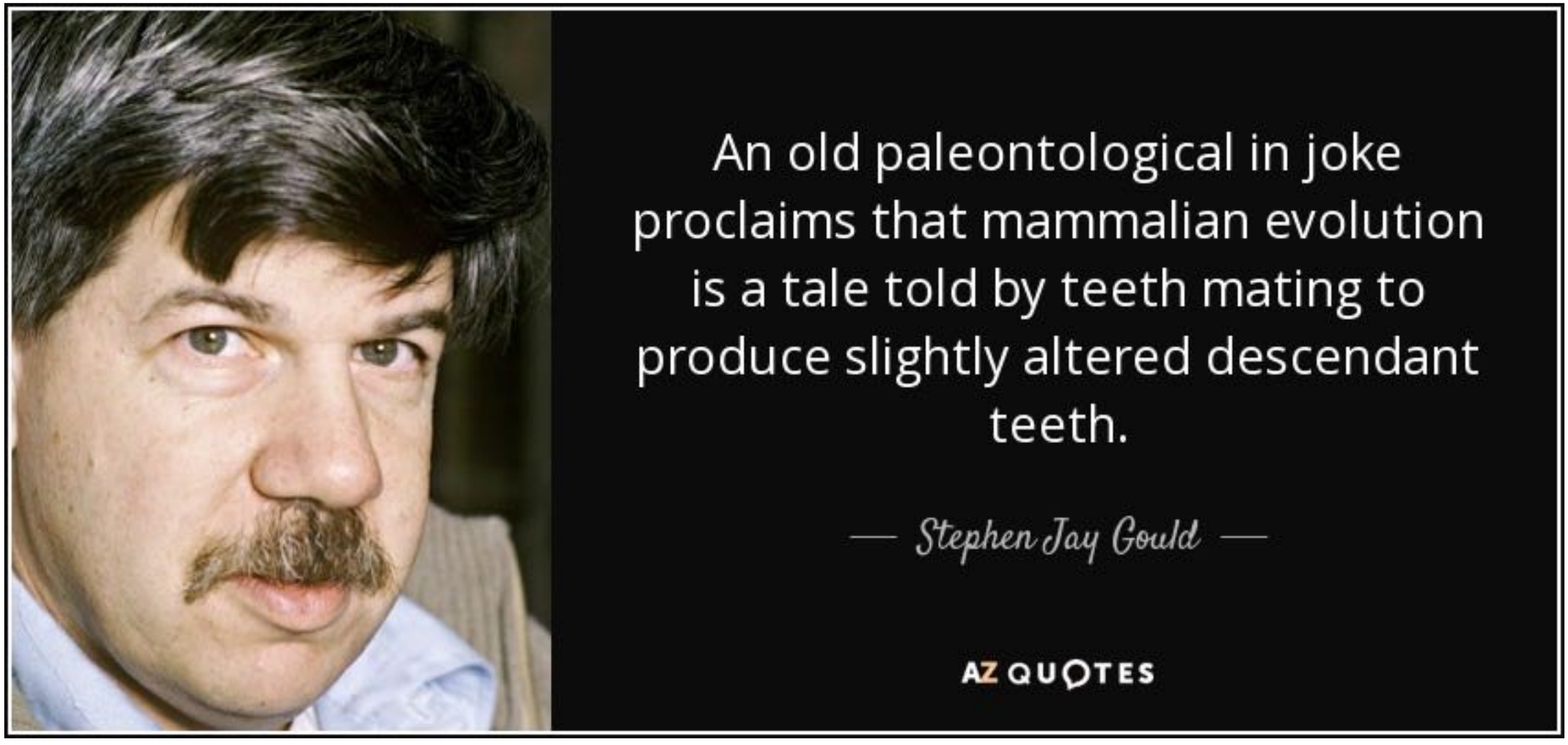


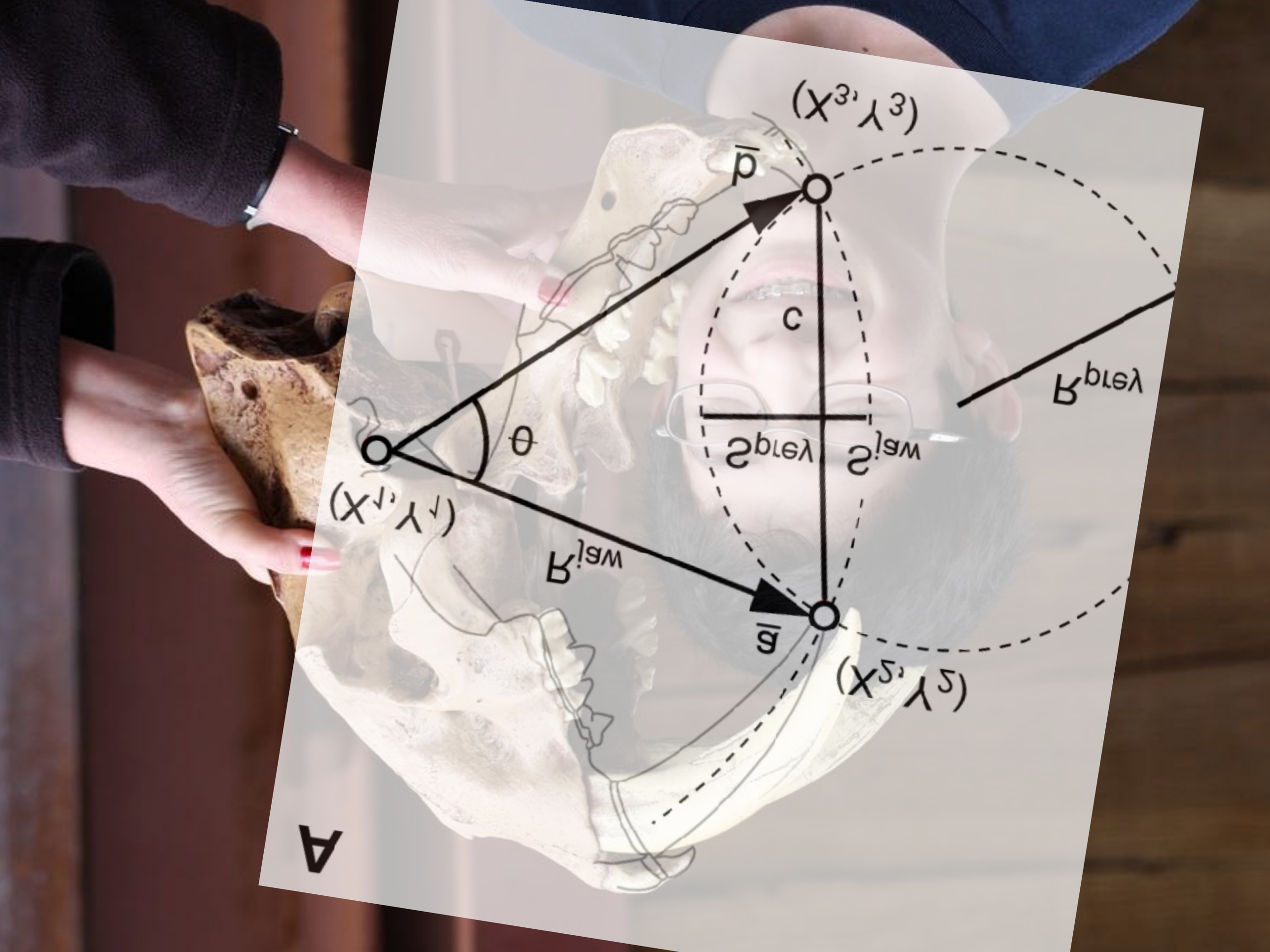
Pelicossauro



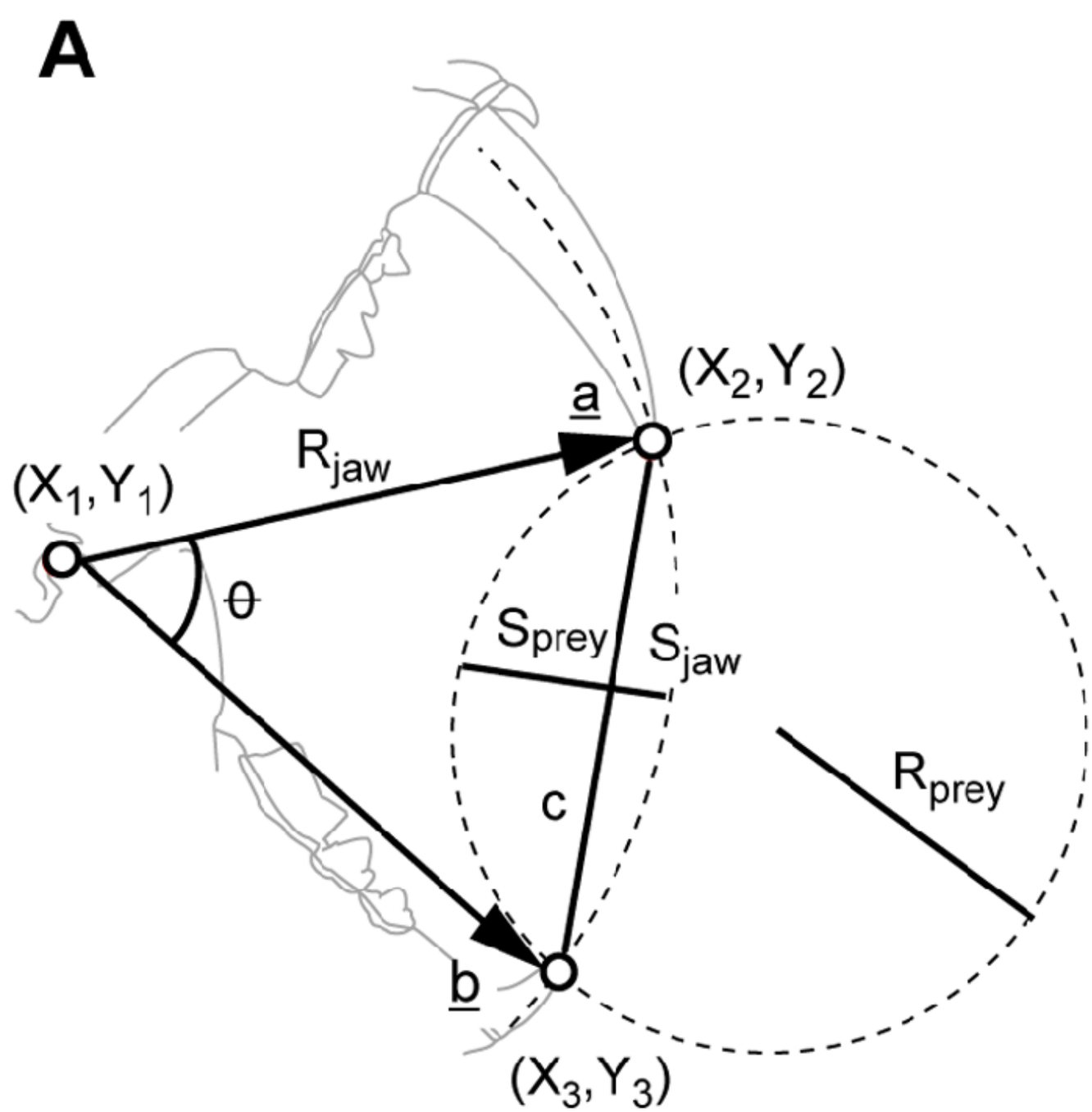
Mamífero

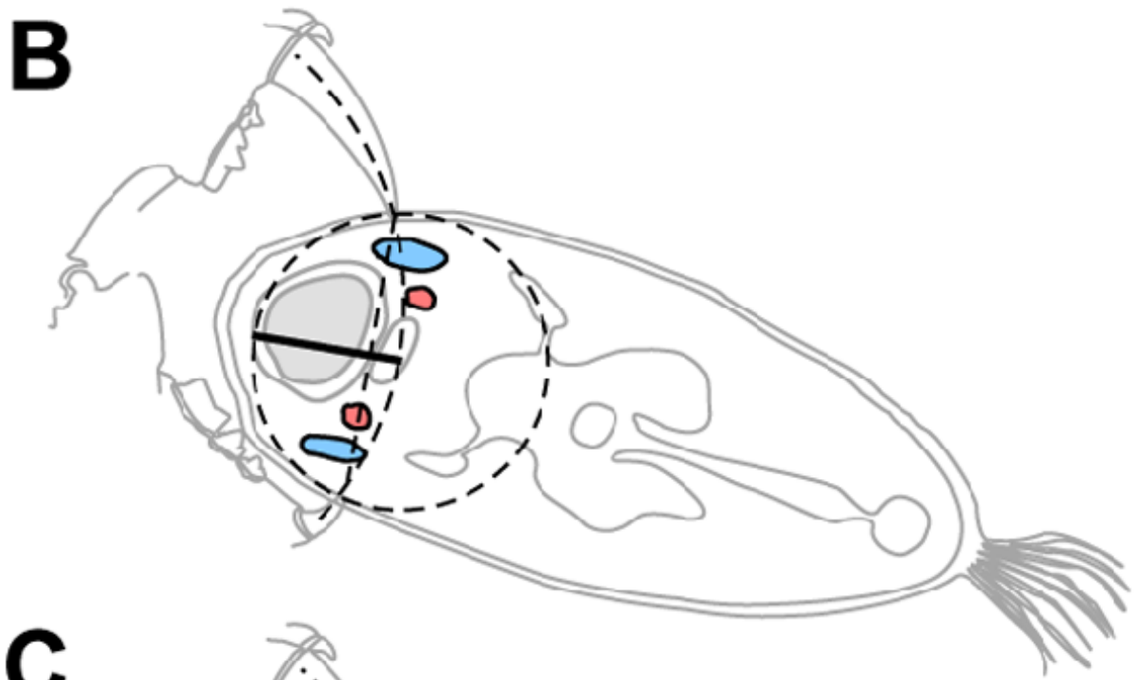
Especialização dos dentes

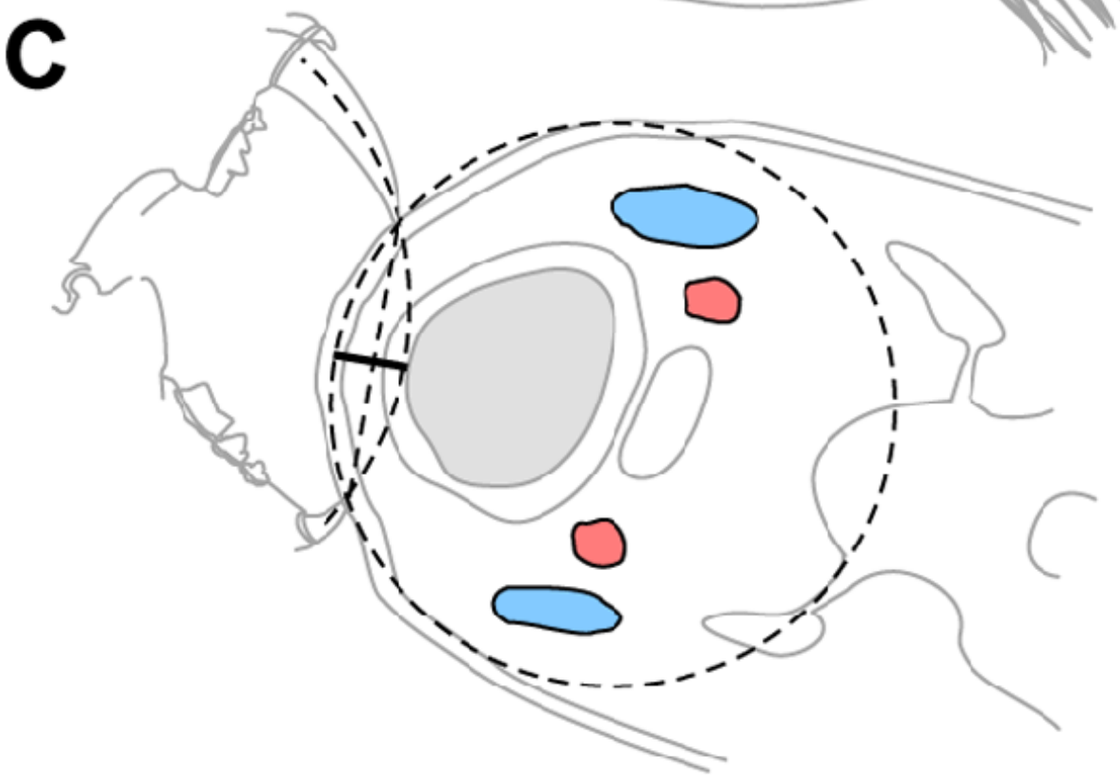



(X_3, Y_3)
$\bar{p}$
c
R_{prev}
S_{prev}
S_{new}
θ
(X_1, Y_1)
R_{new}
$\bar{s}$
(X_5, Y_5)
A

Especialização dos dentes



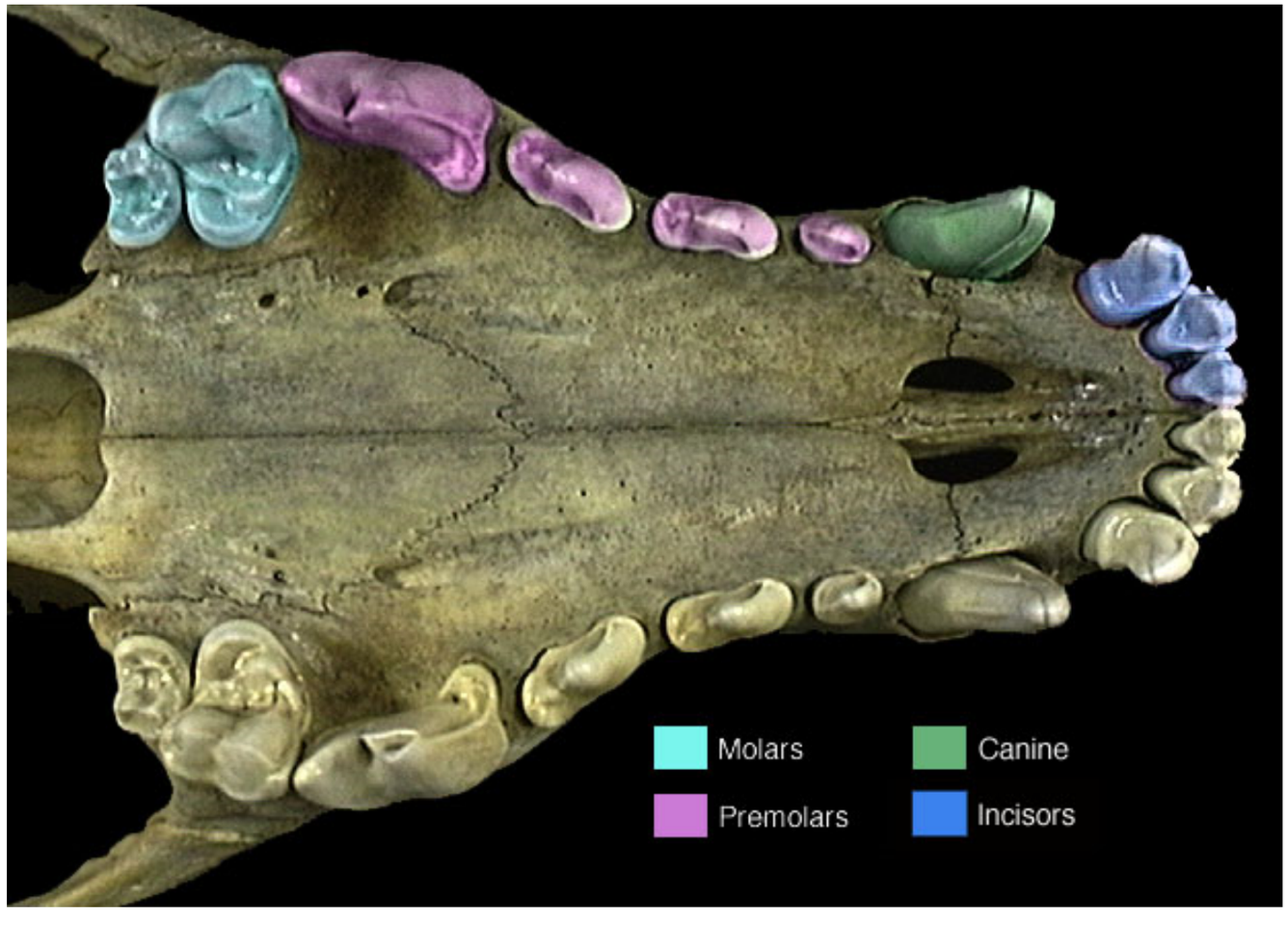


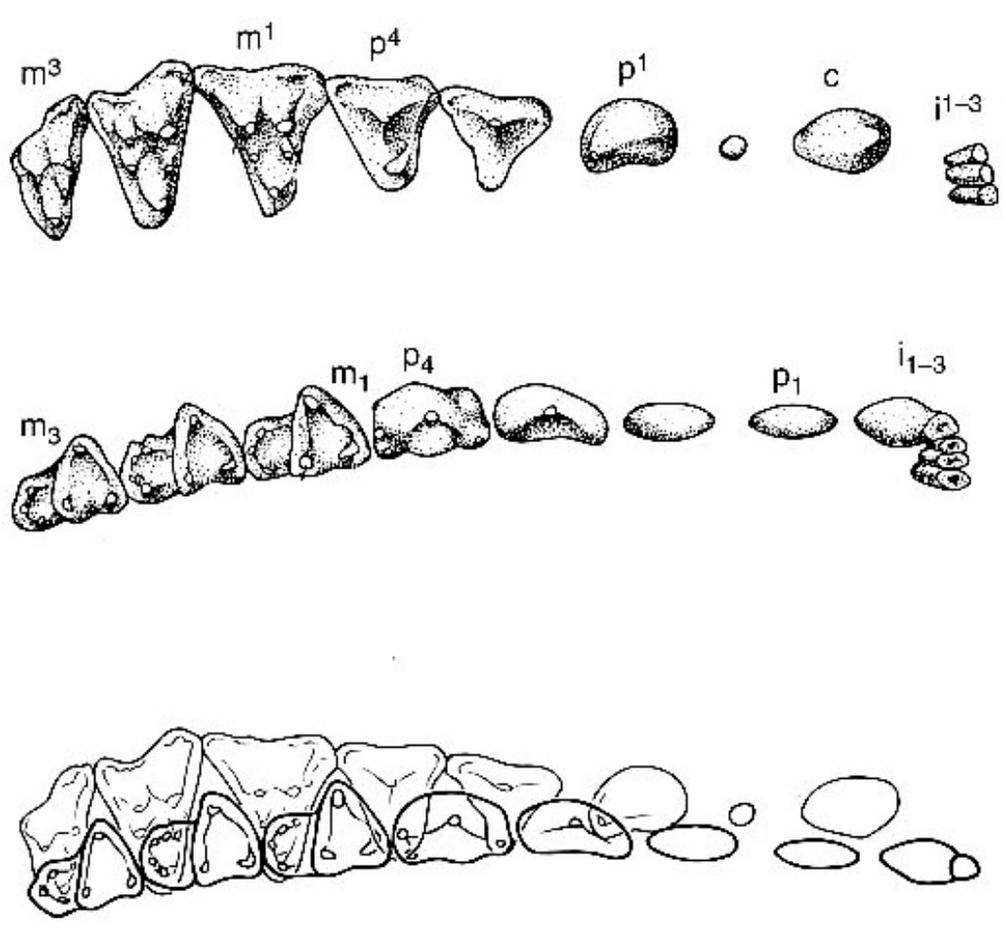


Andersson et al. 2011

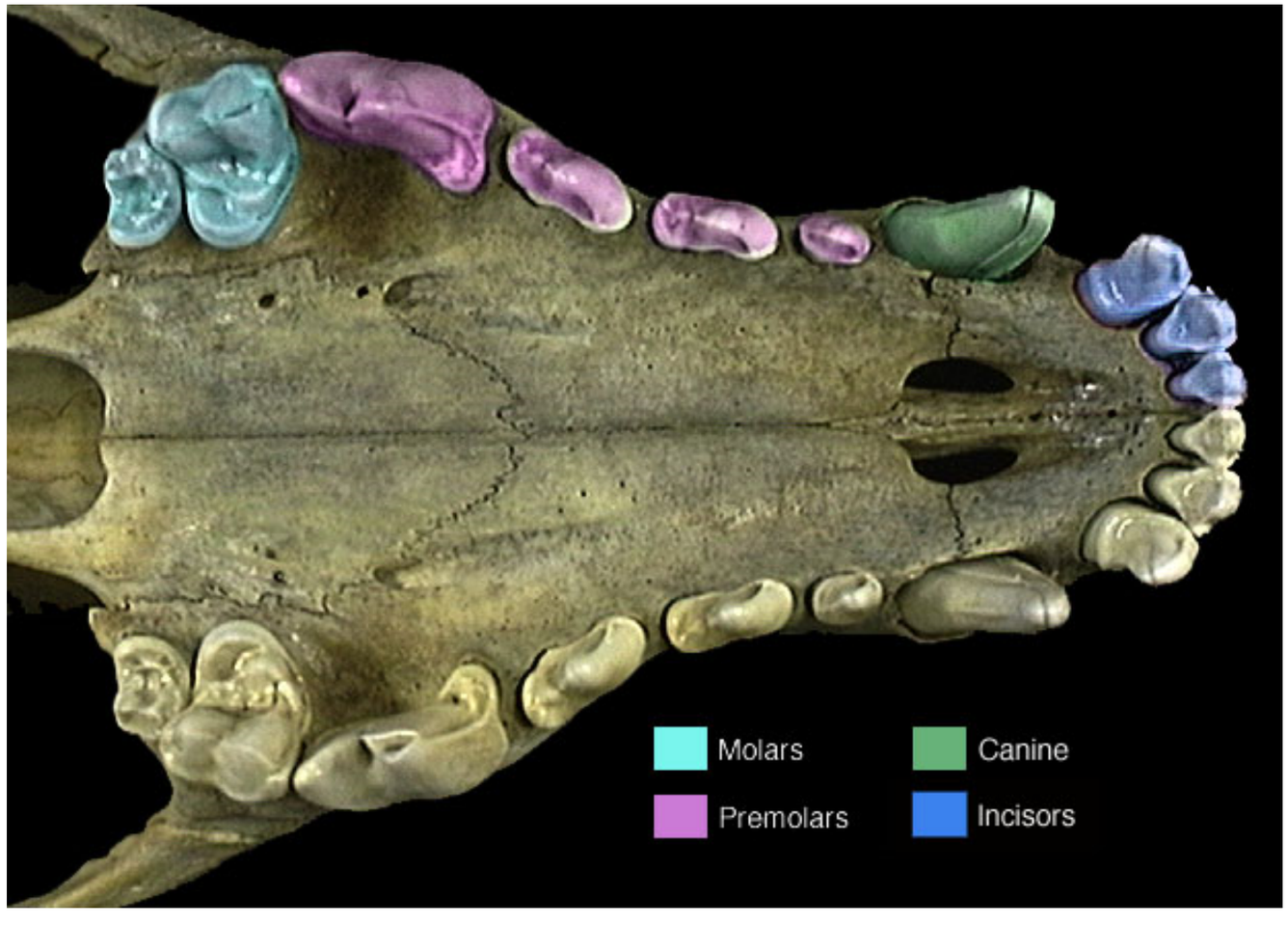

1
2
Humerus bone
Deltoid muscle
3
Blood vessels.
windpipe.
Axis Vertebra.
Section through horse's neck.

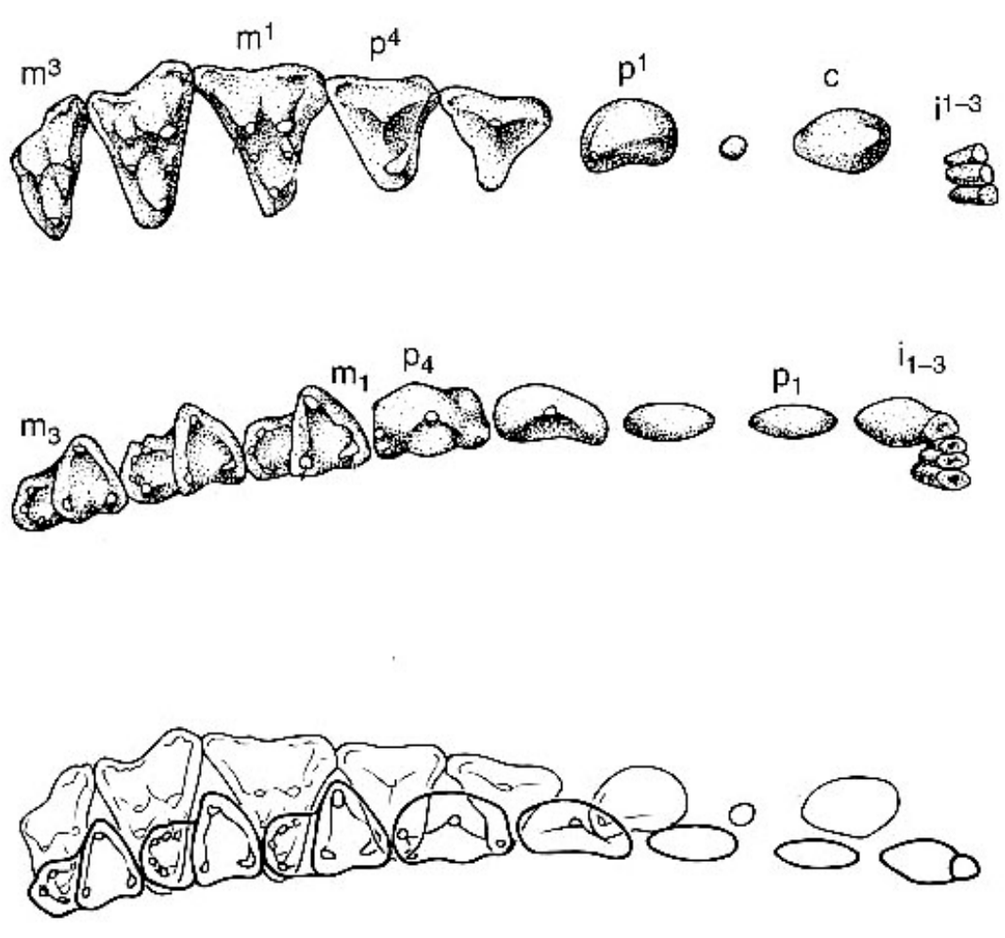
Especialização dos dentes



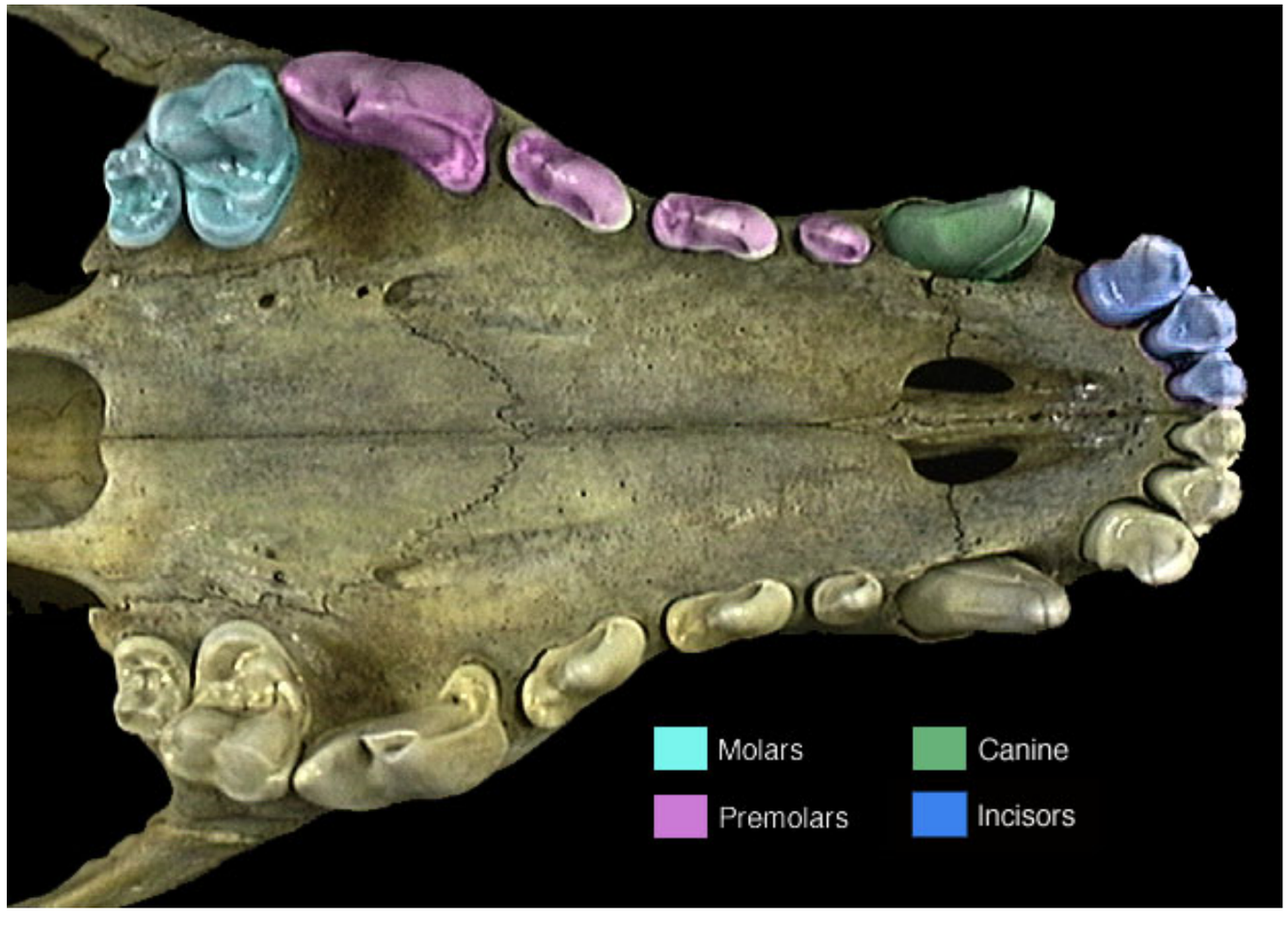


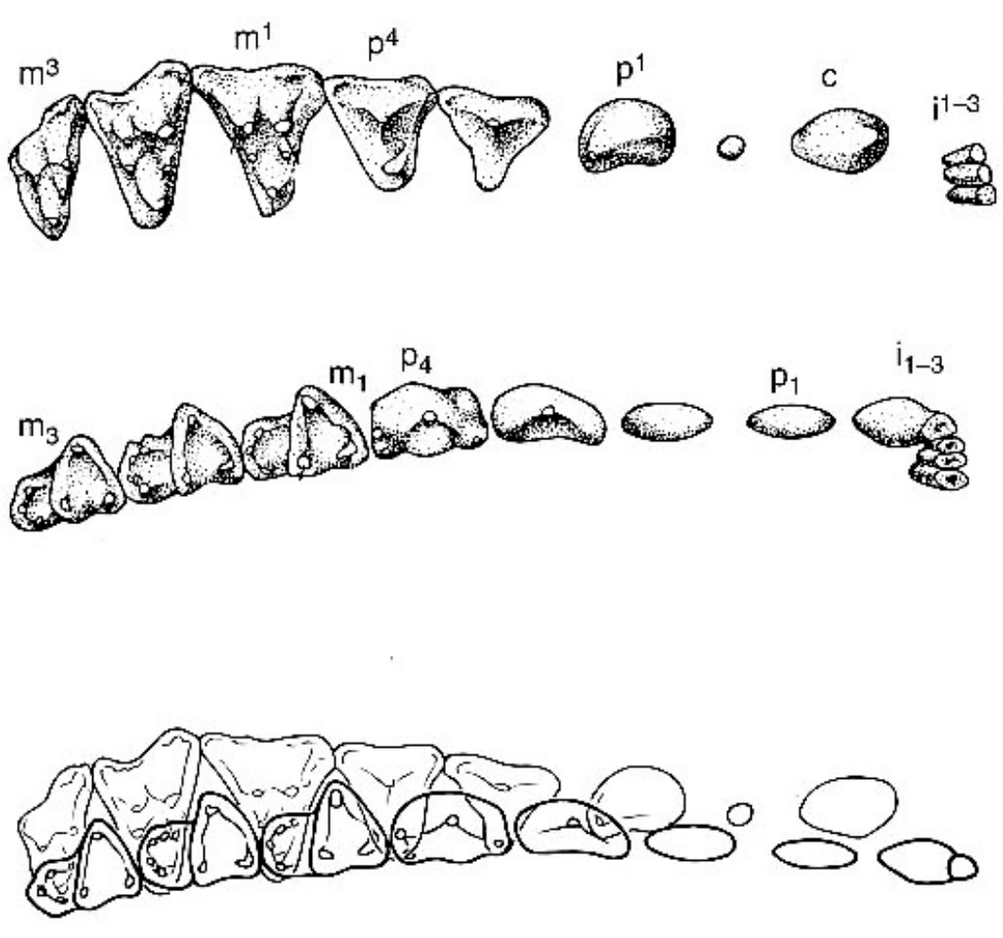
Especialização dos dentes



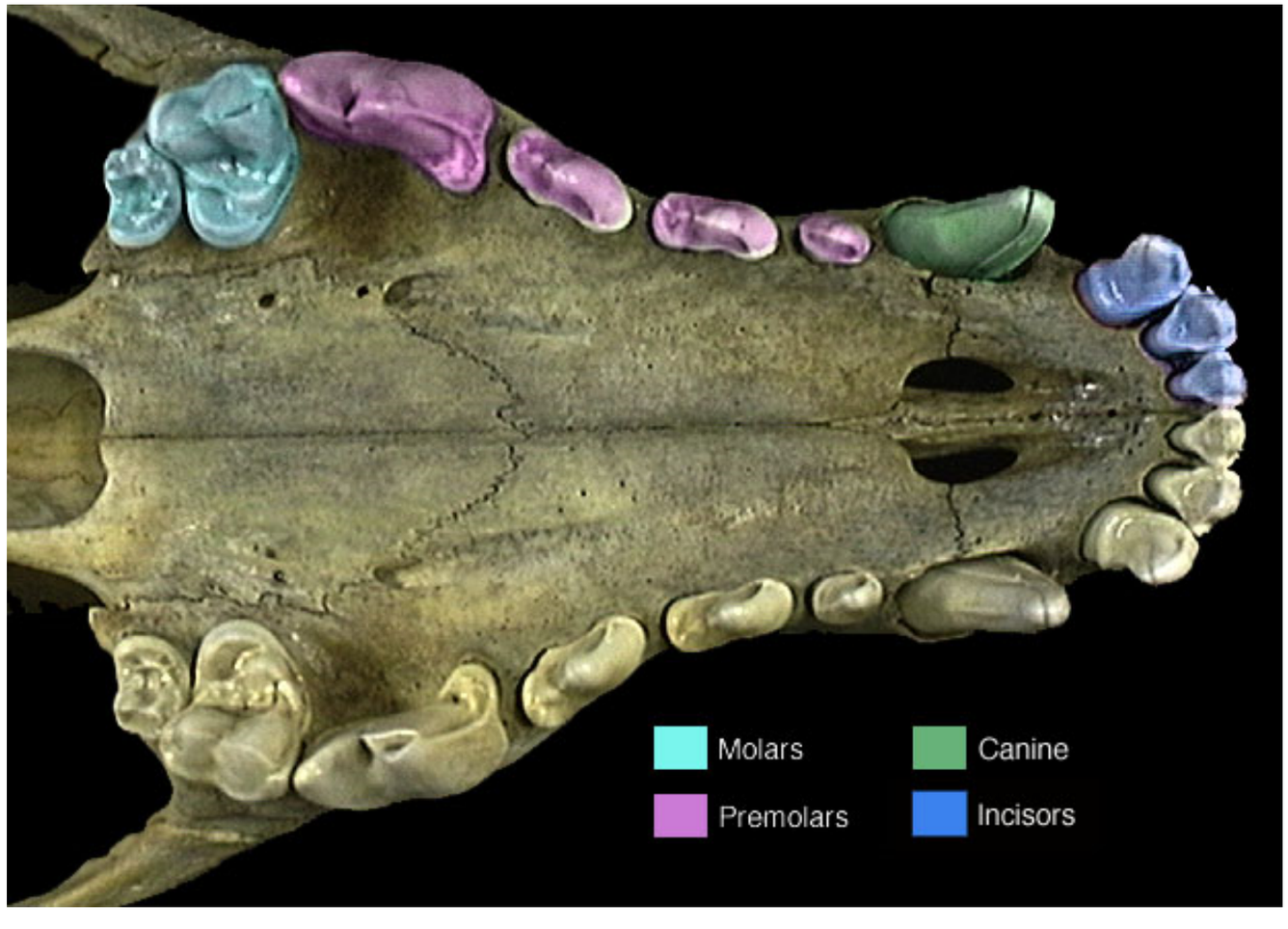


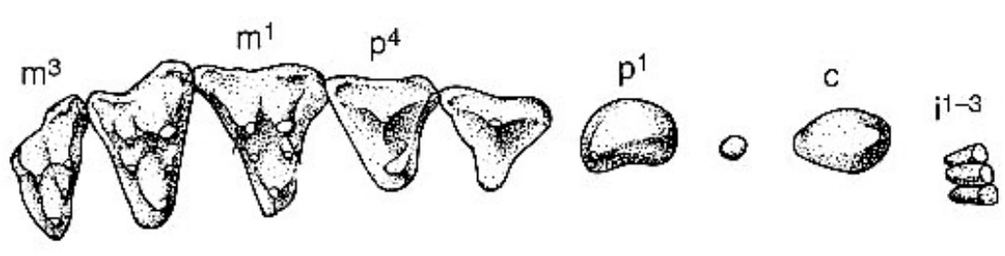
Especialização dos dentes

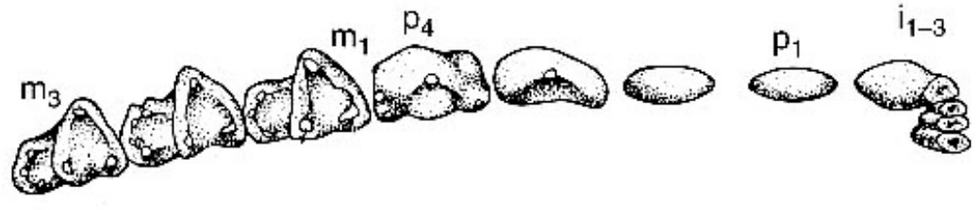


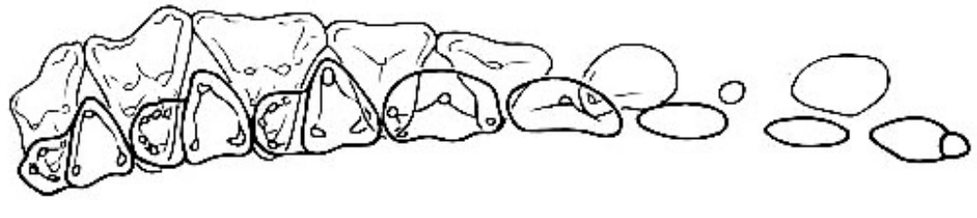


Especialização dos dentes



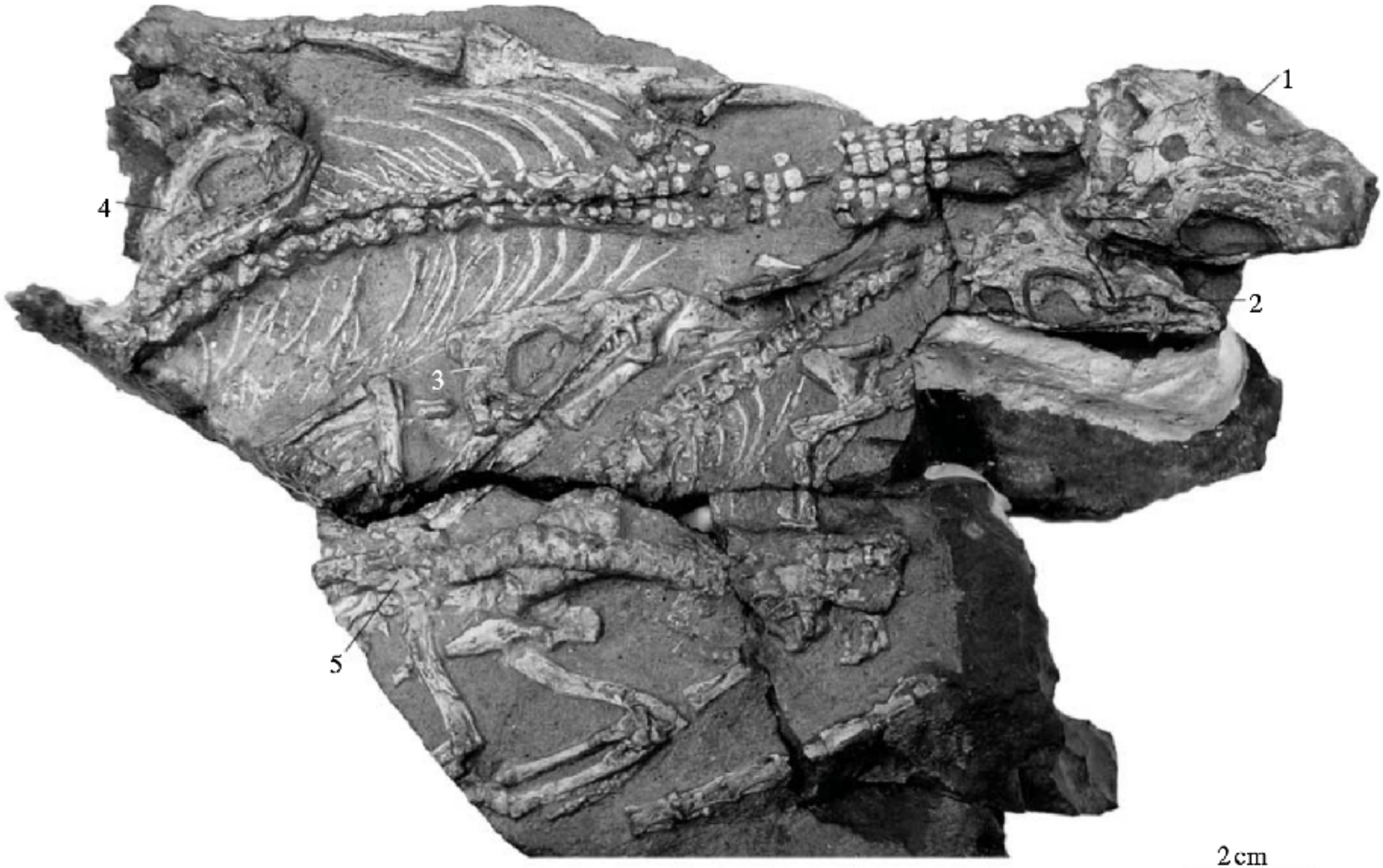




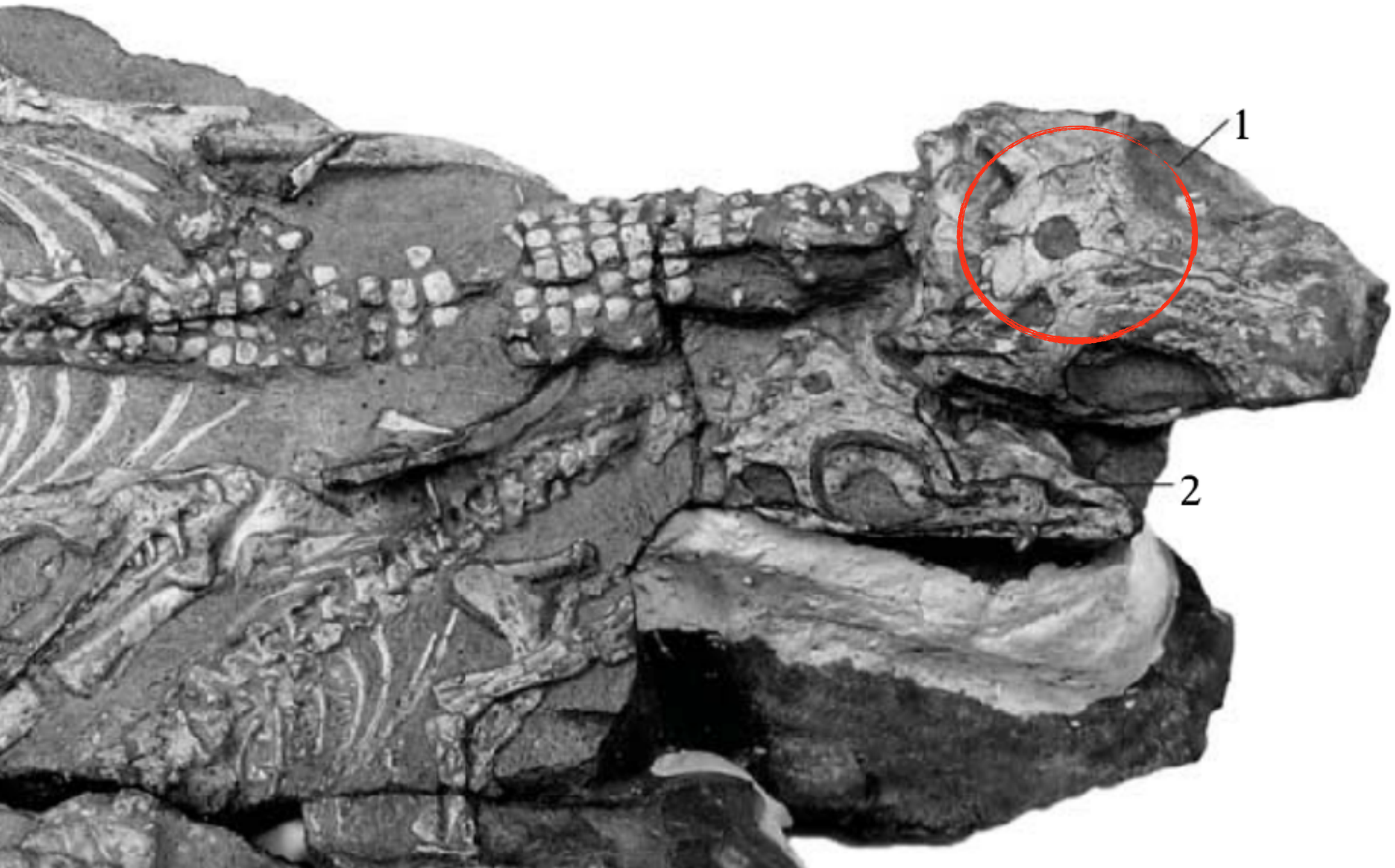


Surgimento da endotermia

Como inferir?



Surgimento da endotermia



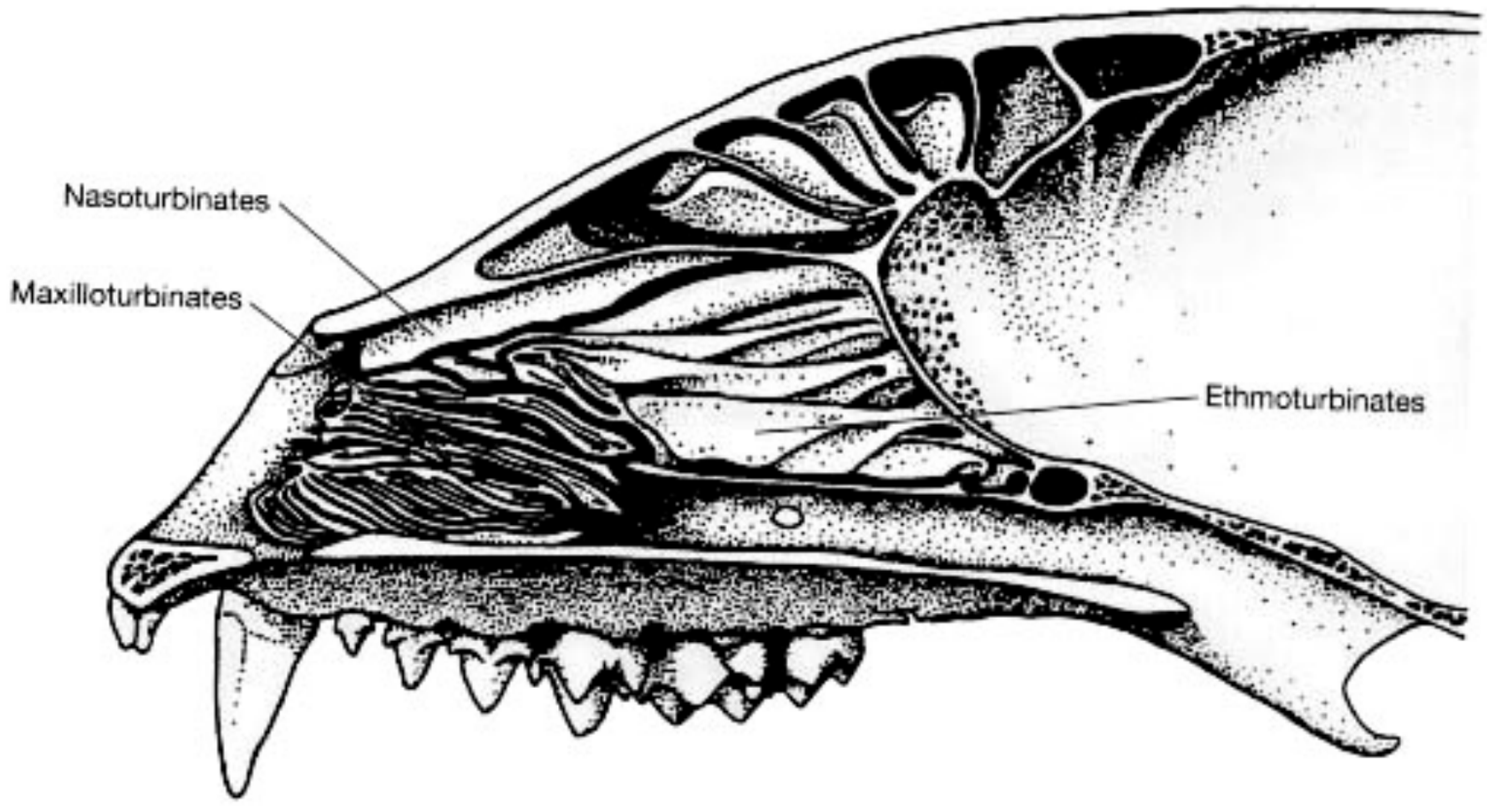
Surgimento da endotermia

DINODONTOSAURO ☛ Extinta
(crânio e mandíbula)
DINODONTOSAUR (skull and jaws) - Extinct

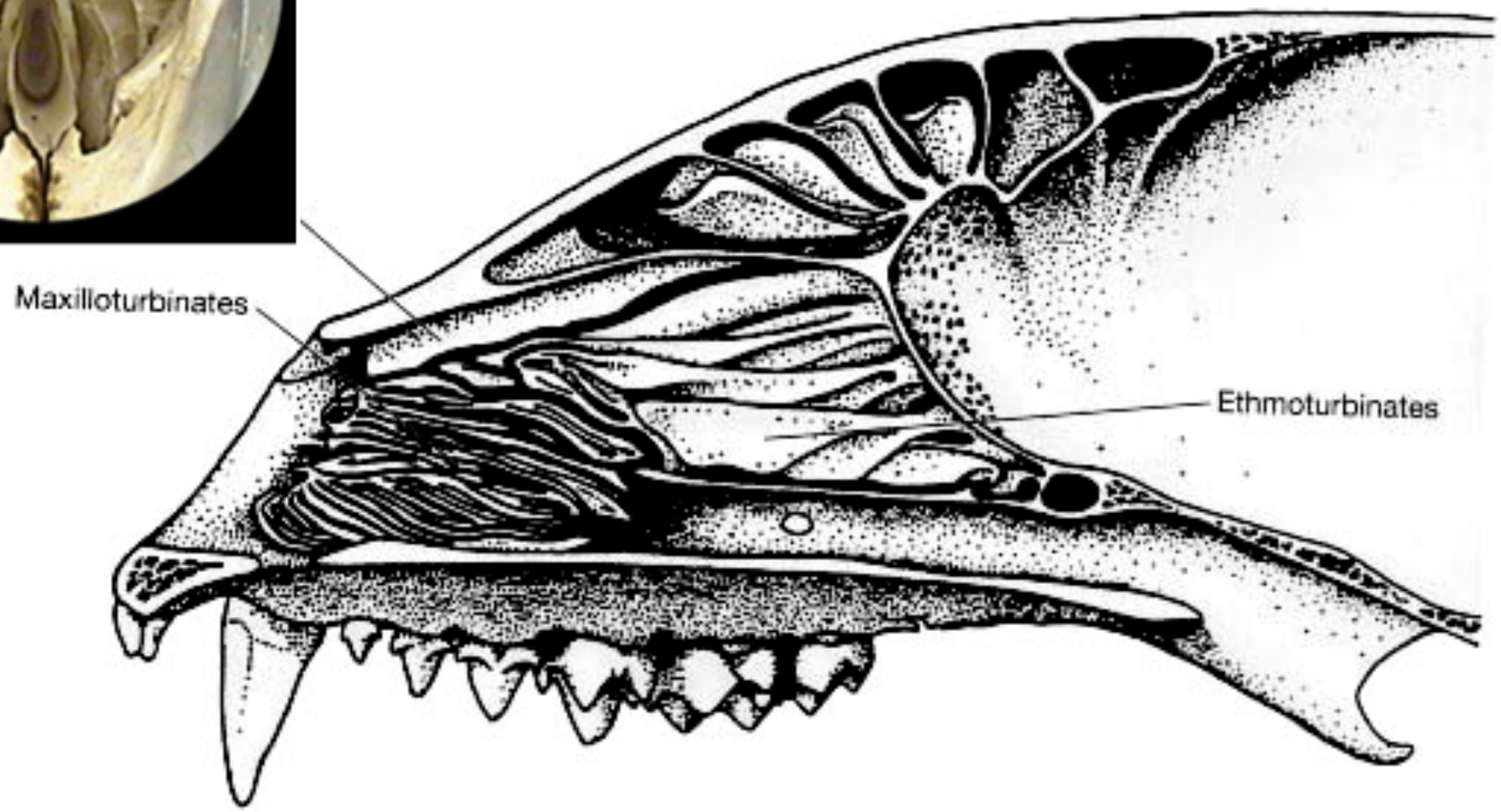
Nome científico:
Dinodontosaurus turpior (von Huene, 1935)
Distribuição: Rio Grande do Sul, Brasil.
Período: Triássico - 238 milhões de anos atrás.

Estando entre os vertebrados terrestres mais abundantes na Terra durante o Permiano, os dicinodontes estavam entre as poucas linhagens que sobreviveram à grande extinção do final desse período. O registro fóssil sugere que espécies como a do dinodontossauro já apresentavam estratégias de coexistência em grupos e cuidado parental. Quando adultos, os indivíduos dessa espécie podiam ultrapassar 1 tonelada.

Surgimento da endotermia



Surgimento da endotermia



Resumo do nosso conhecimento sobre as tendências:

Resumo do nosso conhecimento sobre as tendências:

Eficiência do processamento de alimentos

Resumo do nosso conhecimento sobre as tendências:

Eficiência da locomoção