



**WASSUP  
PEOPLE**



**I AM A BIRD**

# Aves

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[eduardosantos-lab.weebly.com](http://eduardosantos-lab.weebly.com)

19/09/2018



# RECURSOS

HAND BOOK OF BIRD BIOLOGY

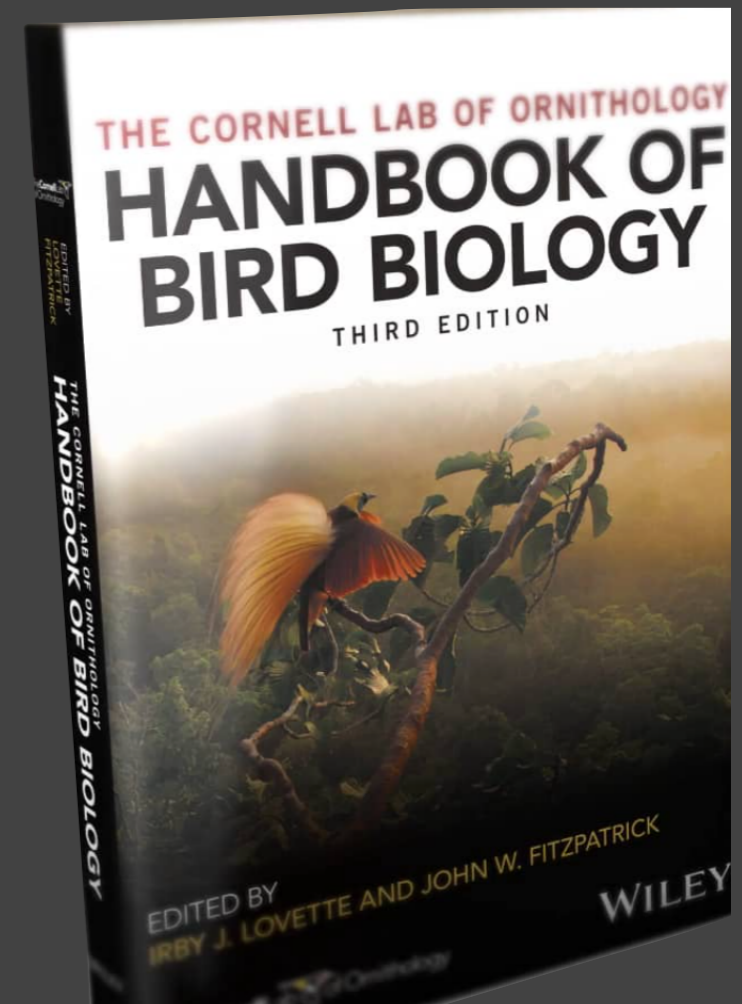
[birdbiology.org](http://birdbiology.org)

ORNITOLOGIA - MZC0017

the life of birds

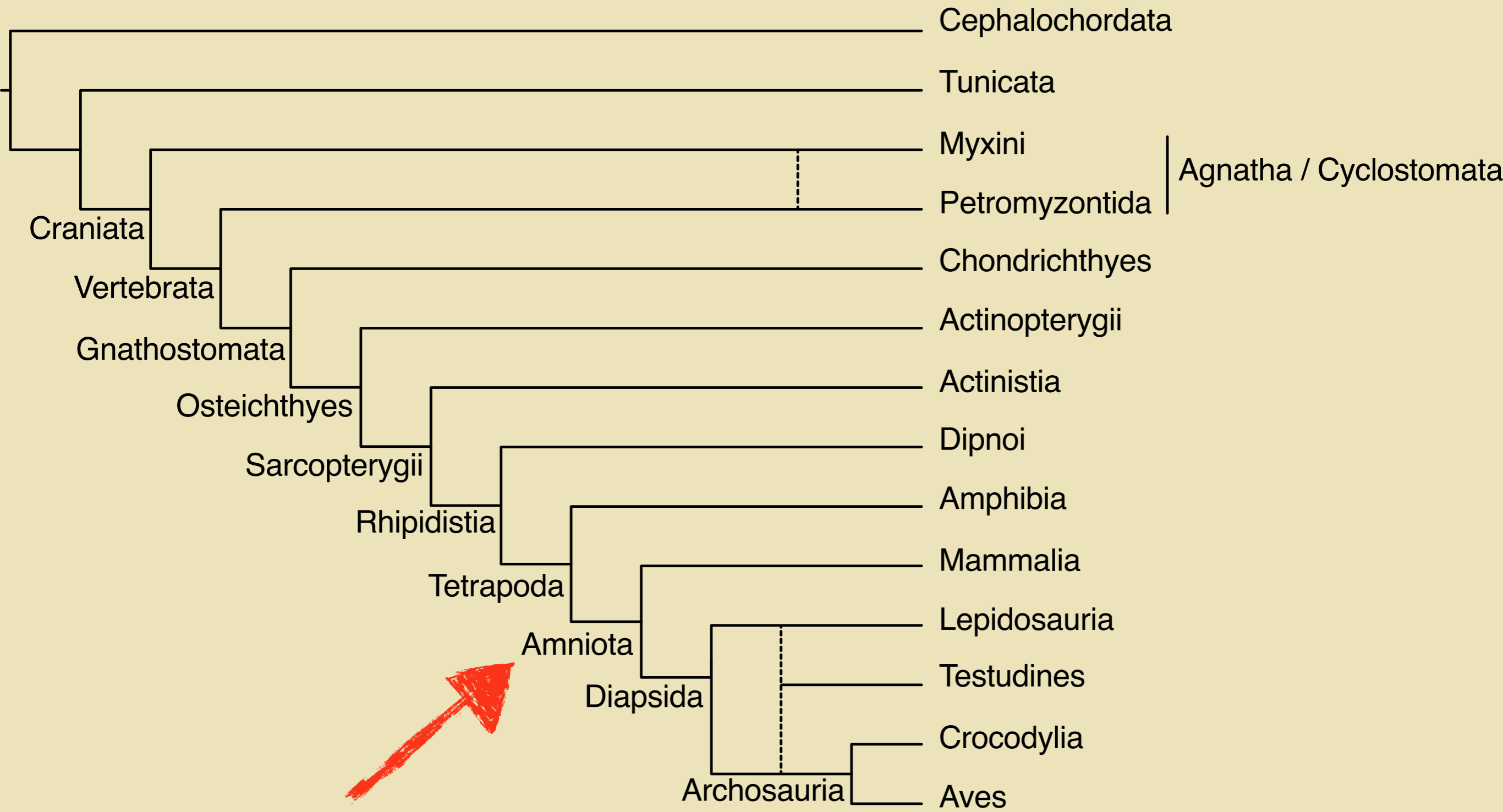
an integrative approach to understanding

bird origins (Science 2014)





# Filogenia de Chordata

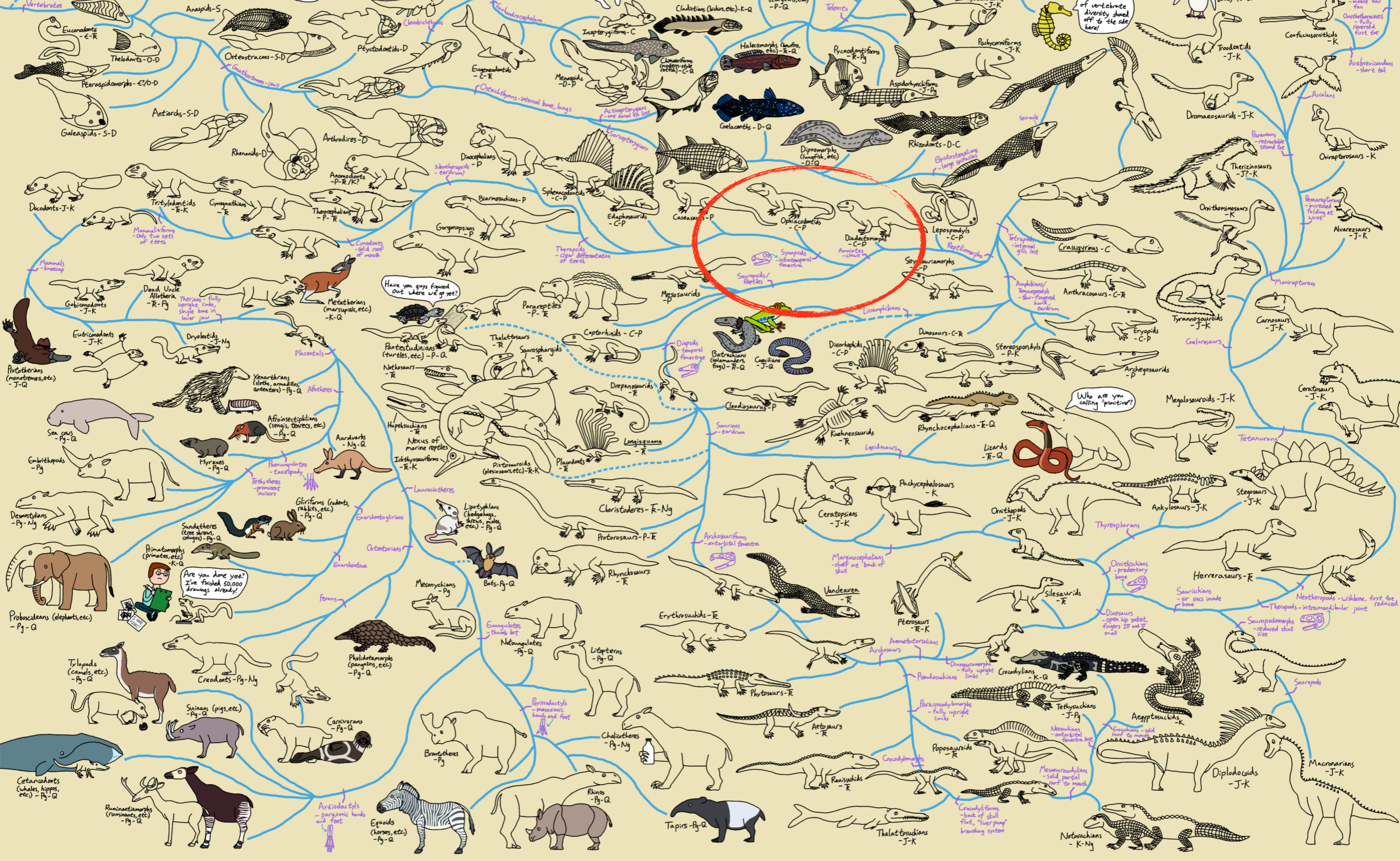




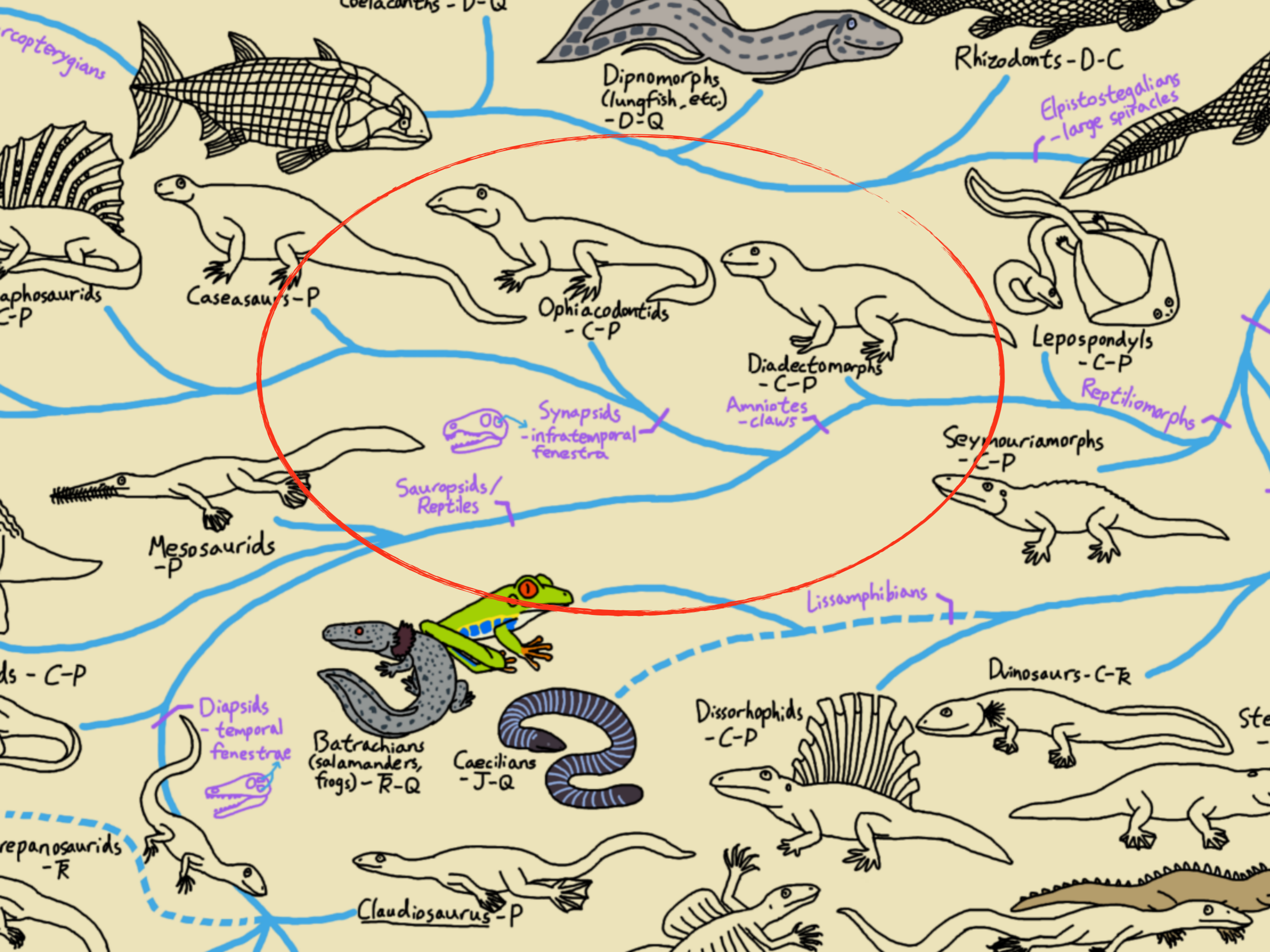




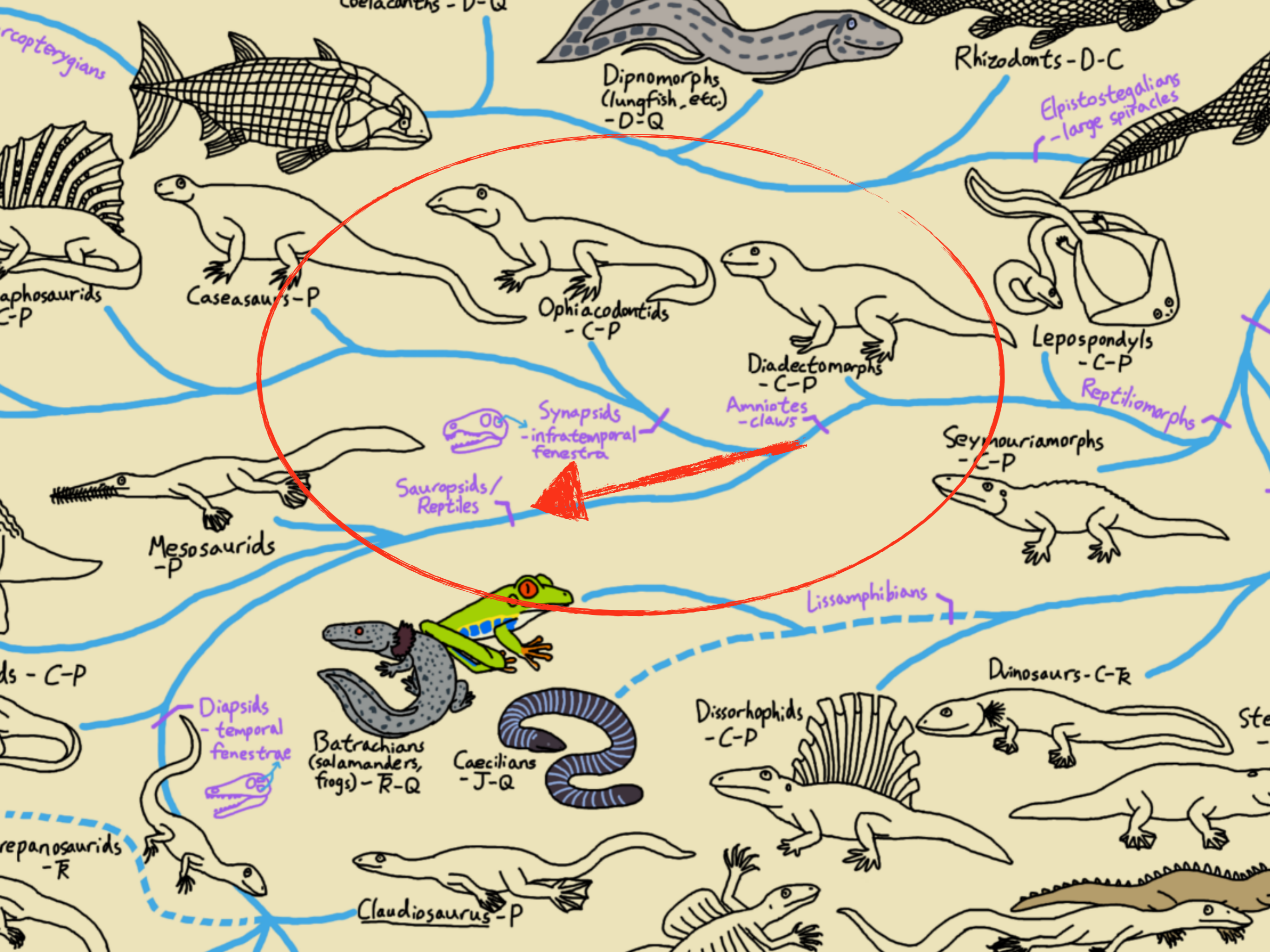
Q = Quaternary  
 Ng = Neogene  
 Pg = Paleogene  
 K = Cretaceous  
 J = Jurassic  
 R = Triassic  
 P = Permian  
 C = Carboniferous  
 D = Devonian  
 S = Silurian  
 O = Ordovician  
 E = Cambrian











Q DIABO

É UM...

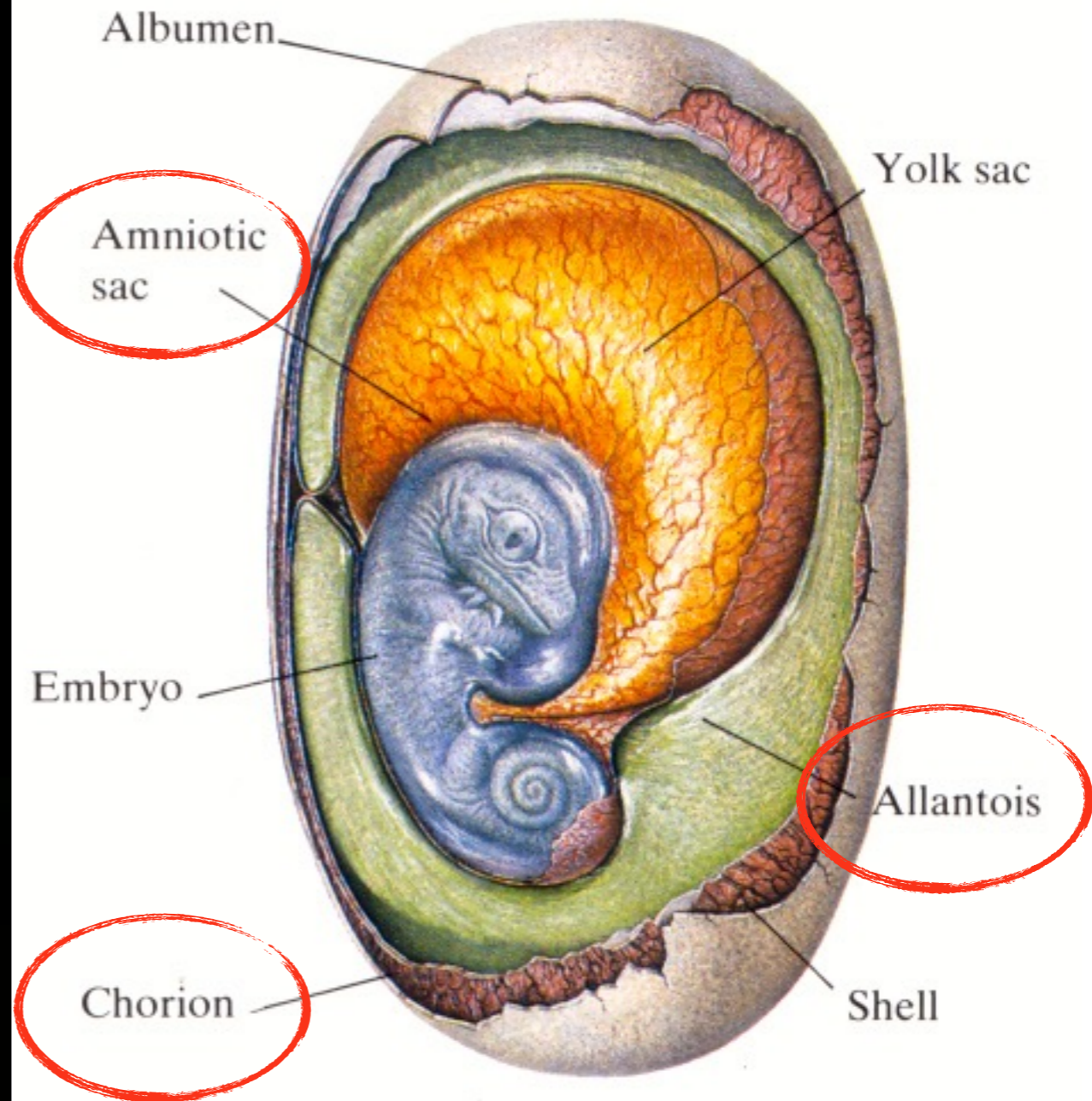


...AMNIOTA





# OVO AMNIÓTICO



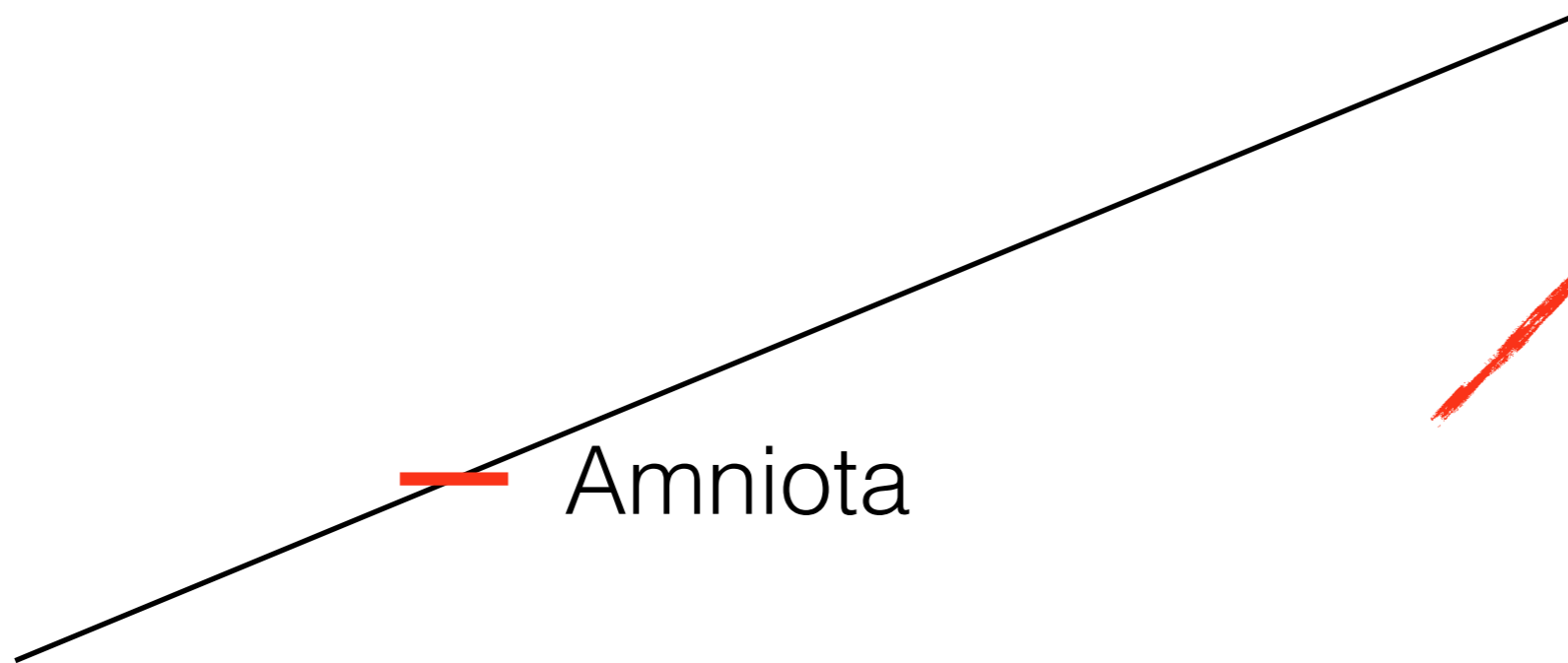
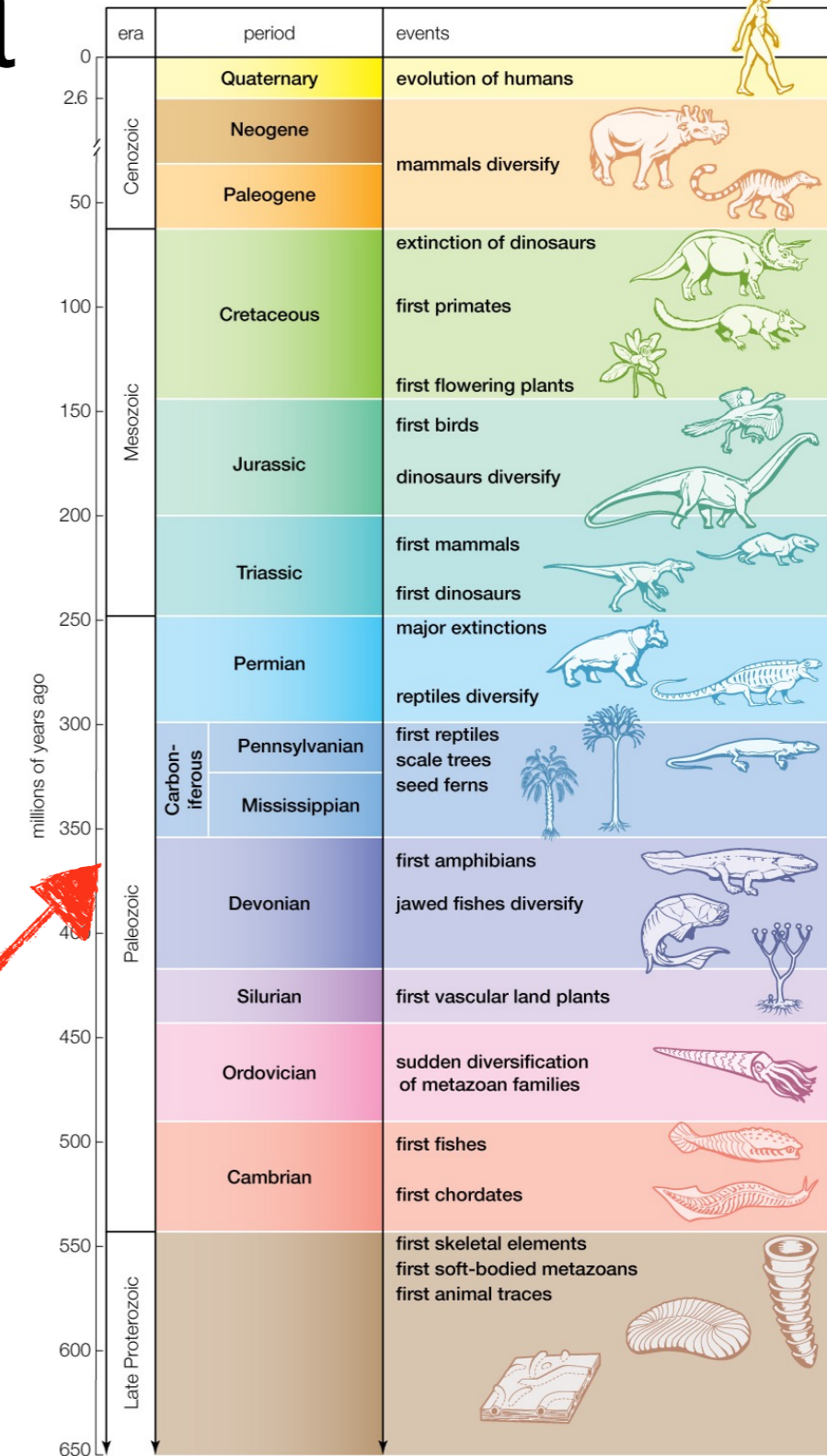
## Amphibian egg





# Amniota: origem de Sauropsida

Geologic time scale, 650 million years ago to the present



# Amniota e suas radiações



Synapsida



Sauropsida



Amniota

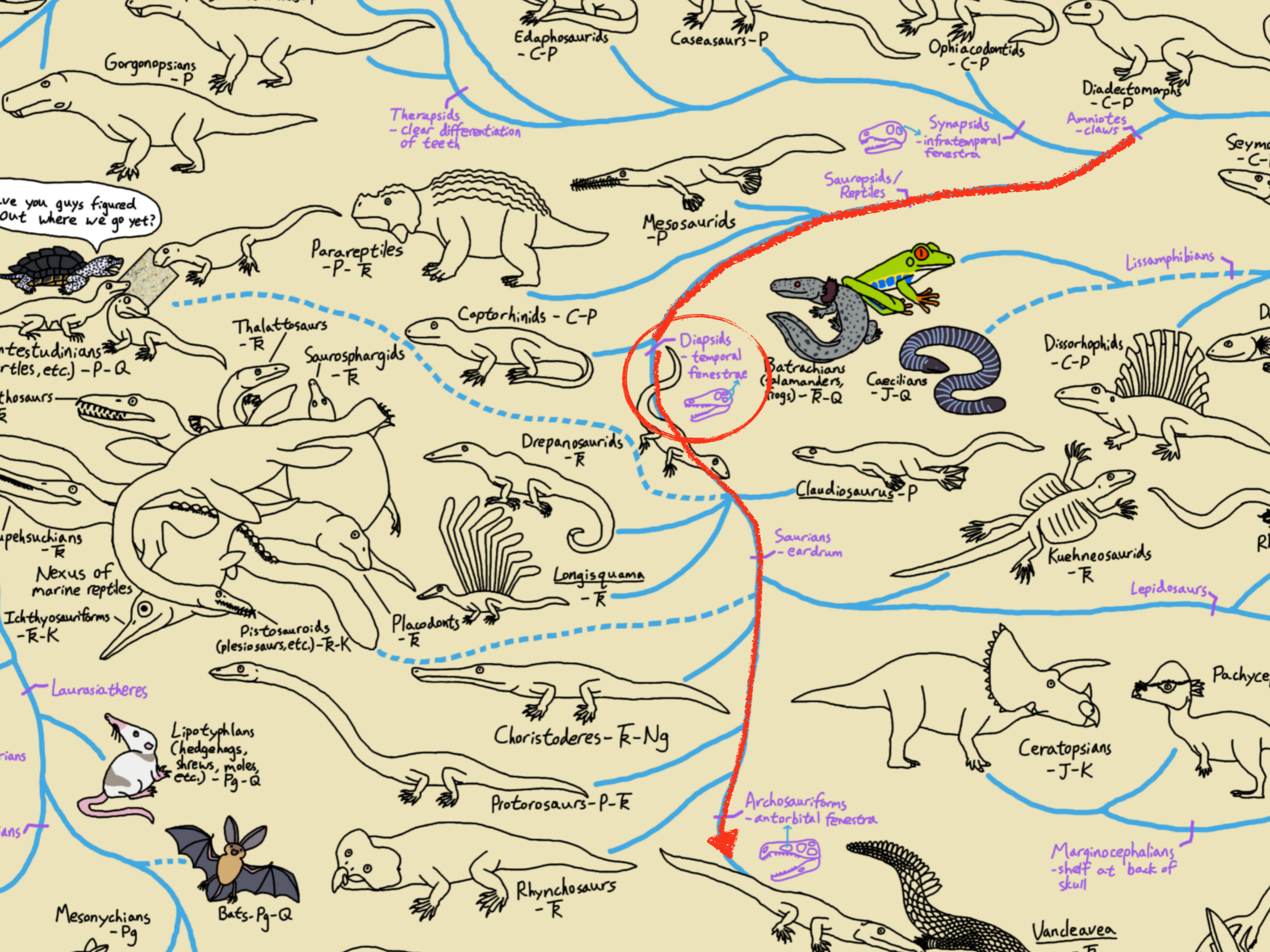
Beta-queratina  
Excreção ácido úrico



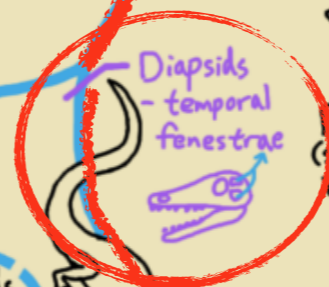








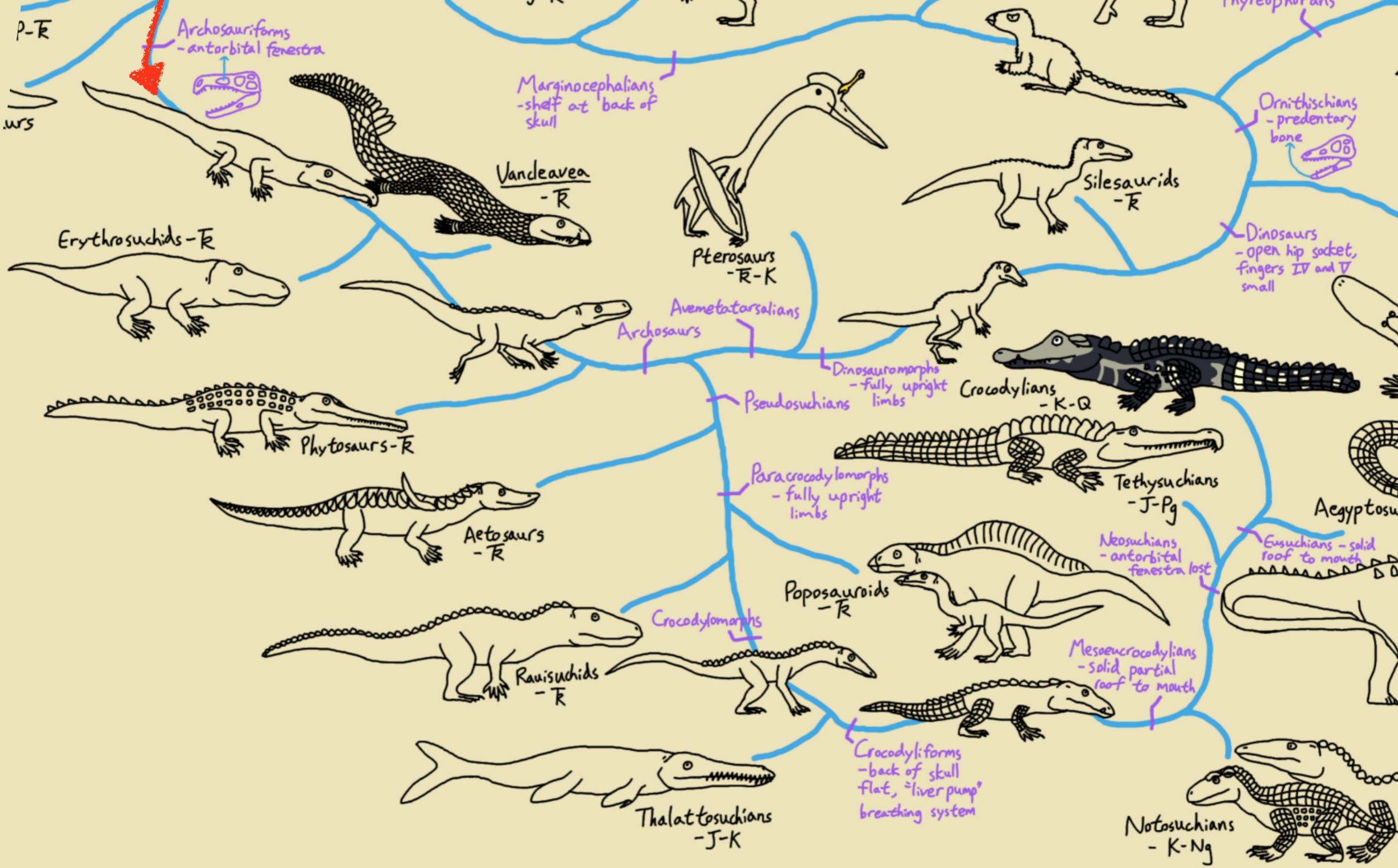
Have you guys figured out where we go yet?





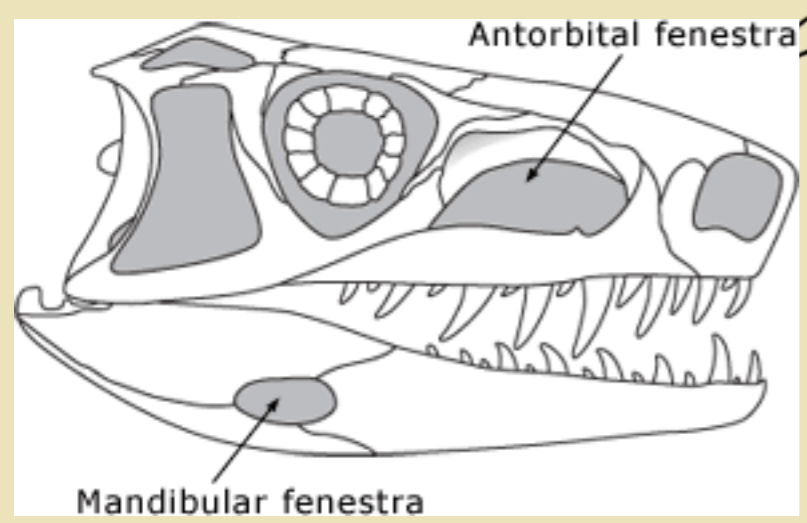
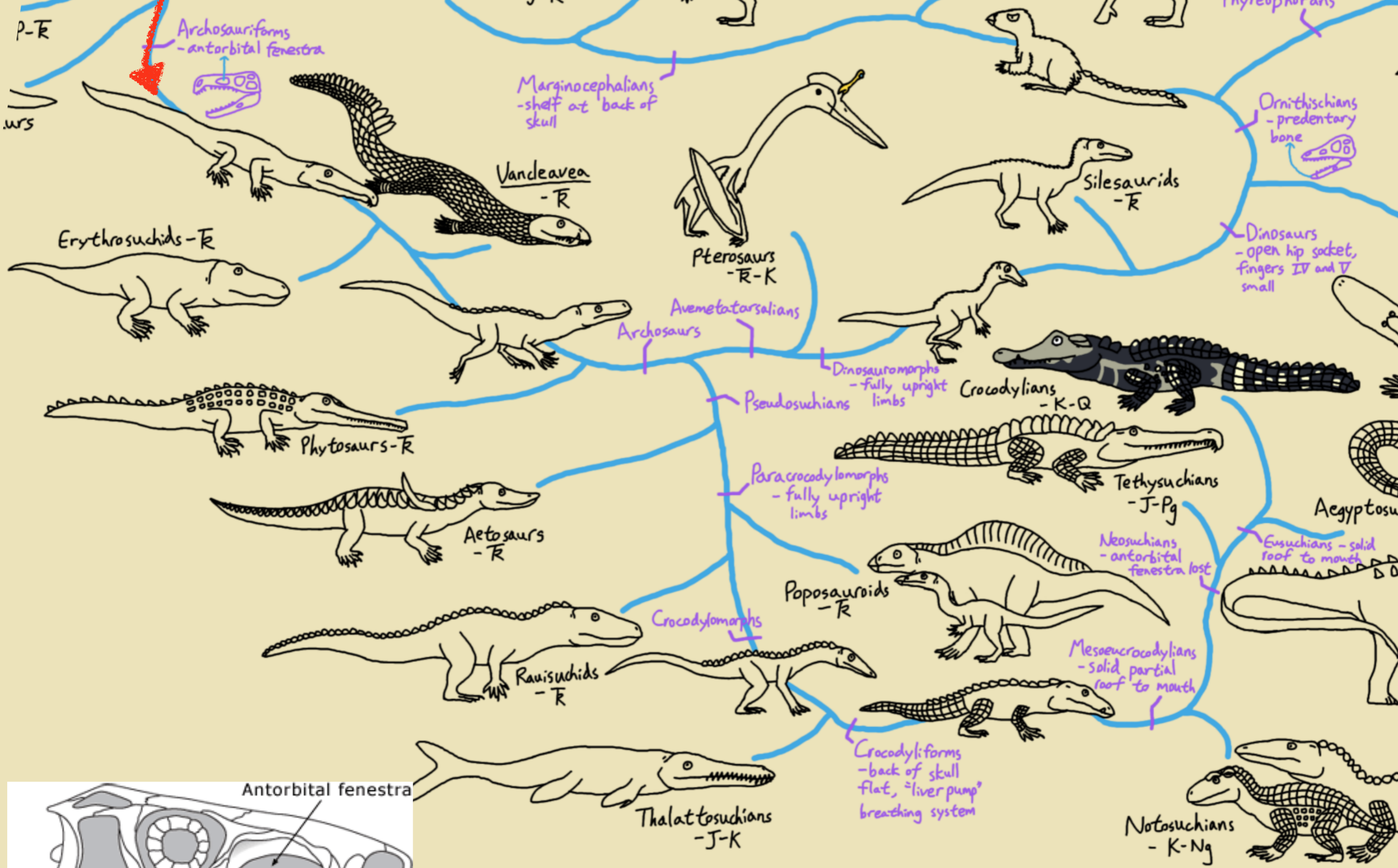






Permiano/Triássico (260 mya)





Permiano/Triássico (260 mya)

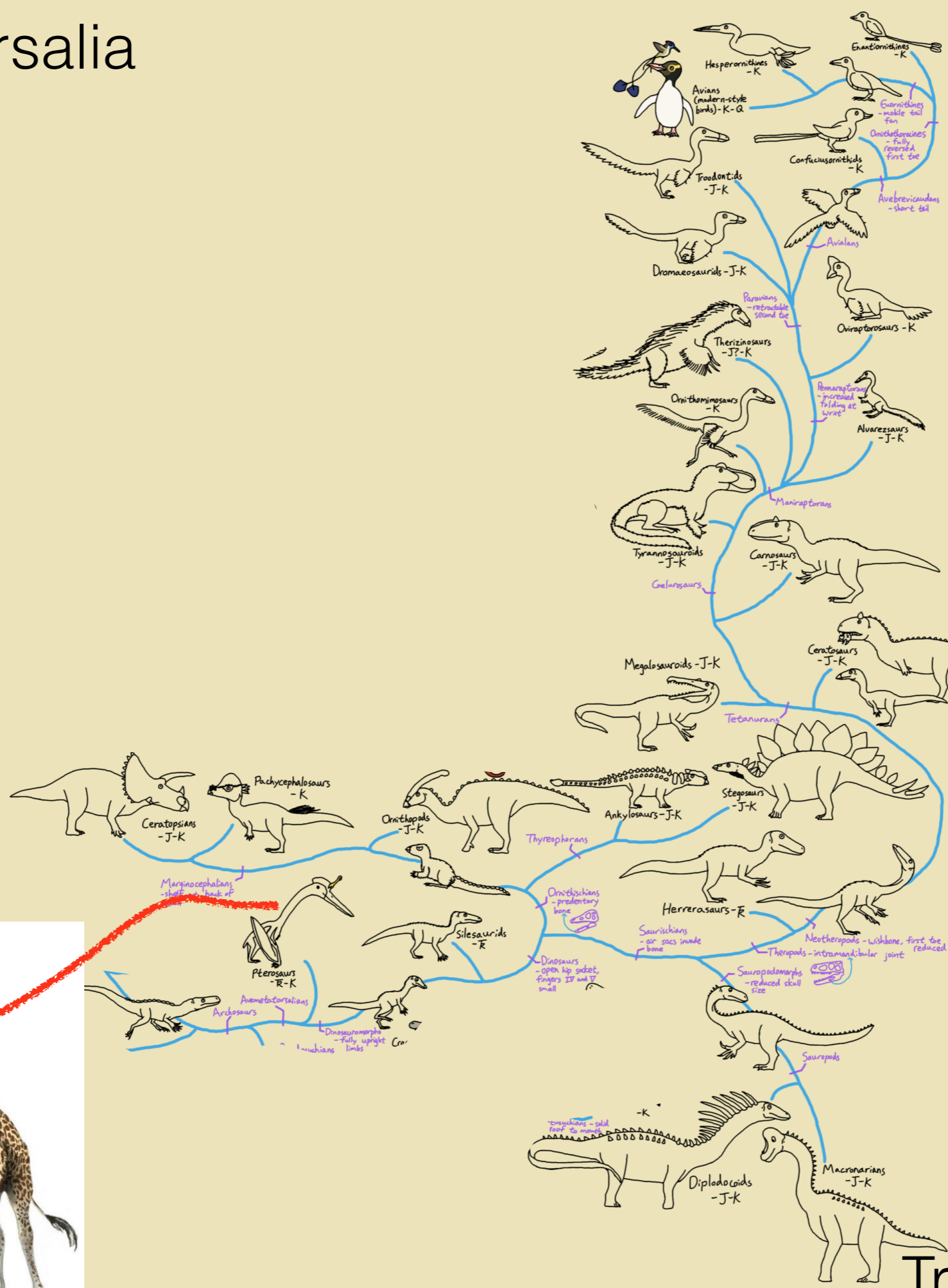




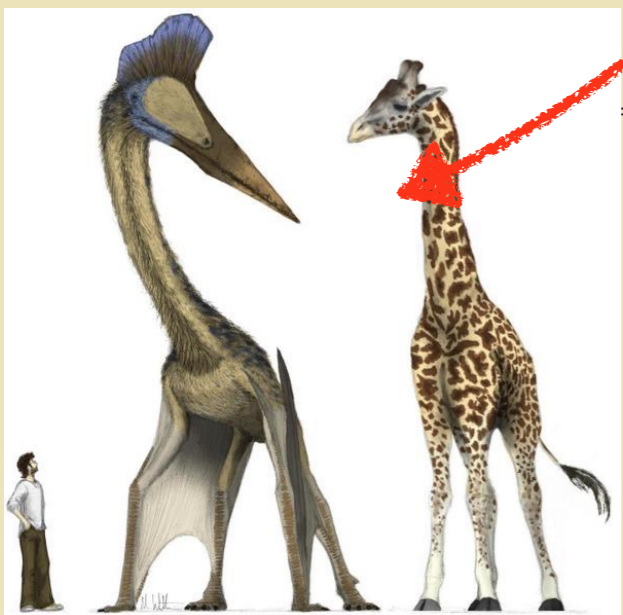




# Avemetatarsalia



## Quetzalcoatlus



Triássico (245 mya)

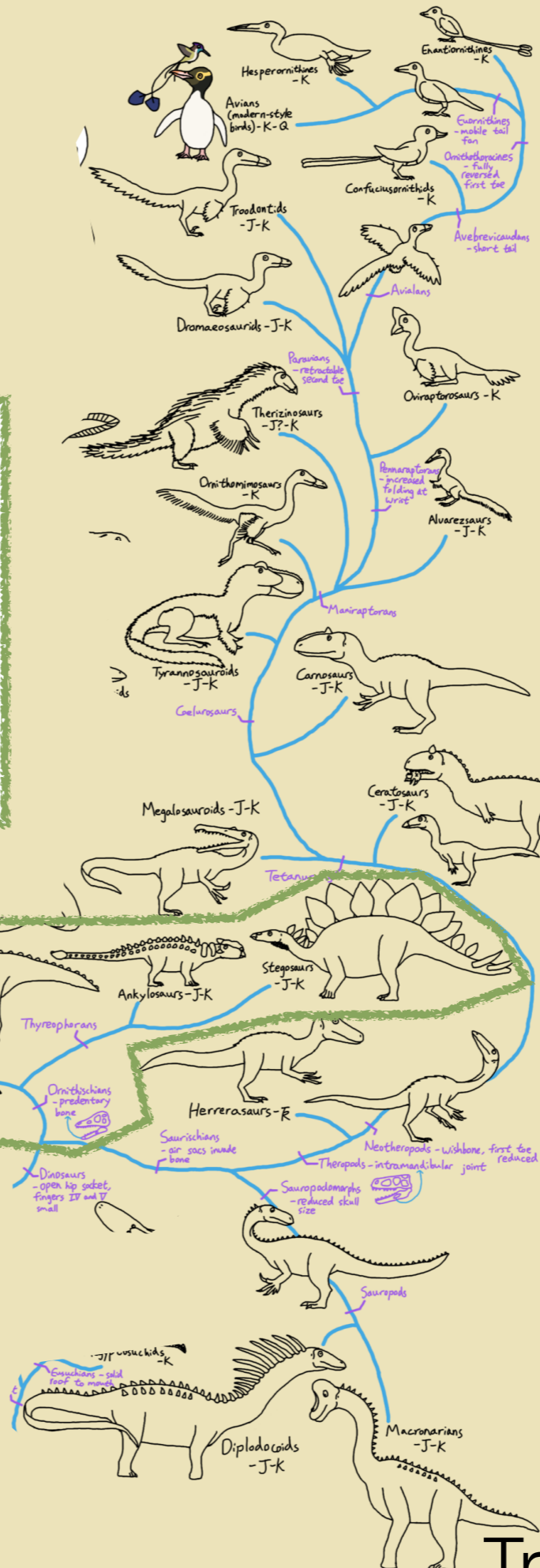
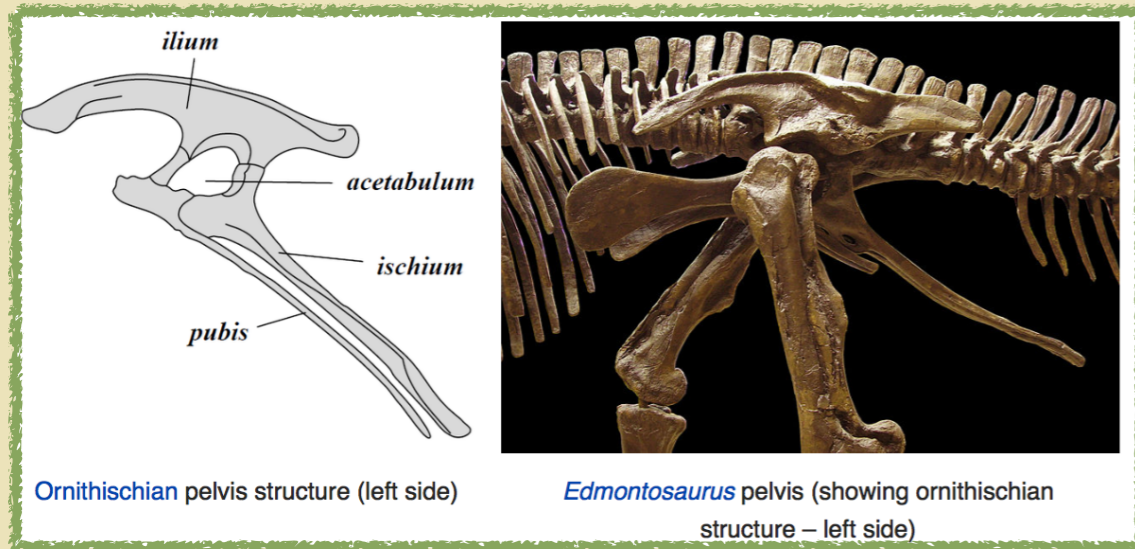






# Dinosauria

- Ornithischia

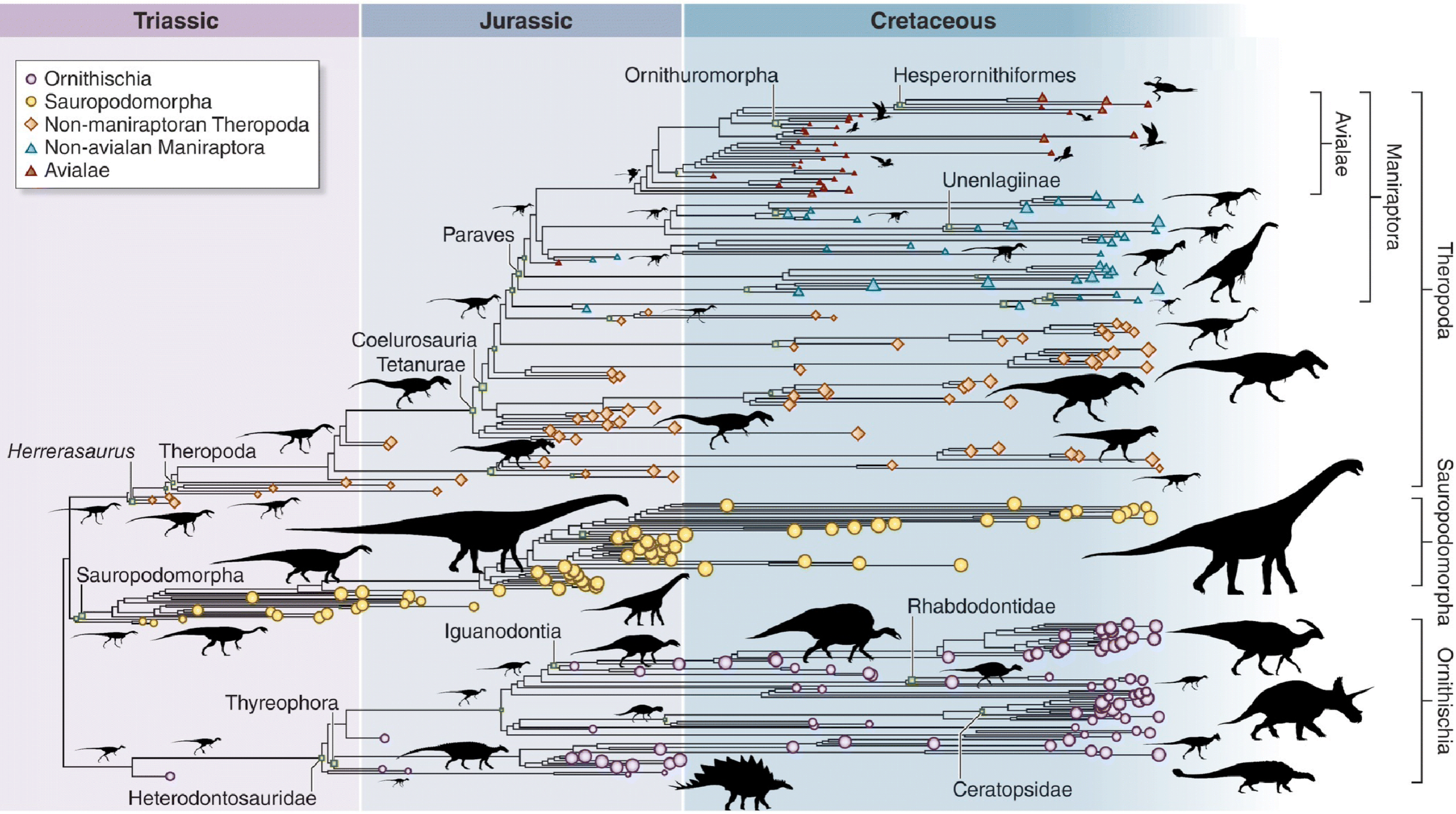


Triássico (245 mya)

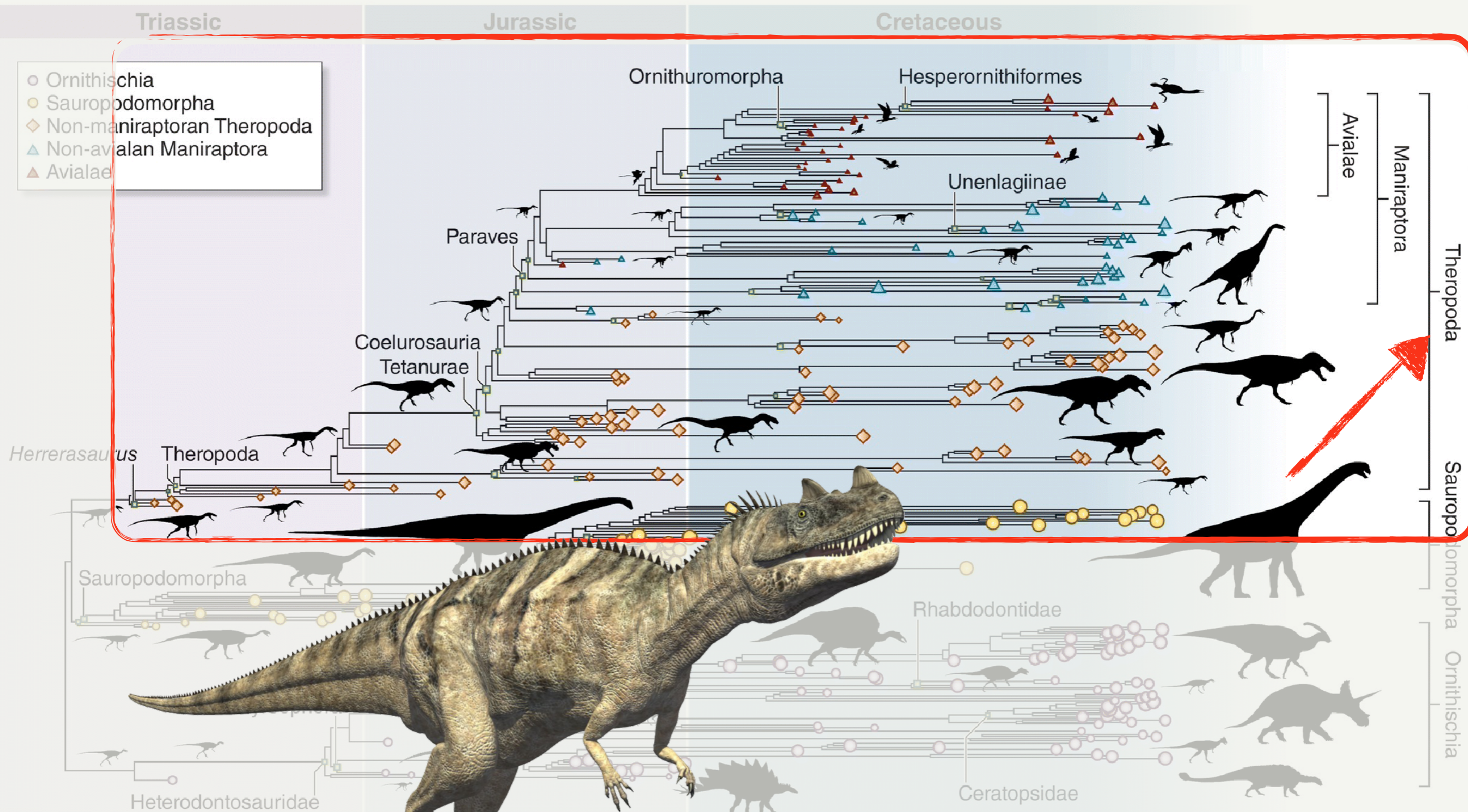




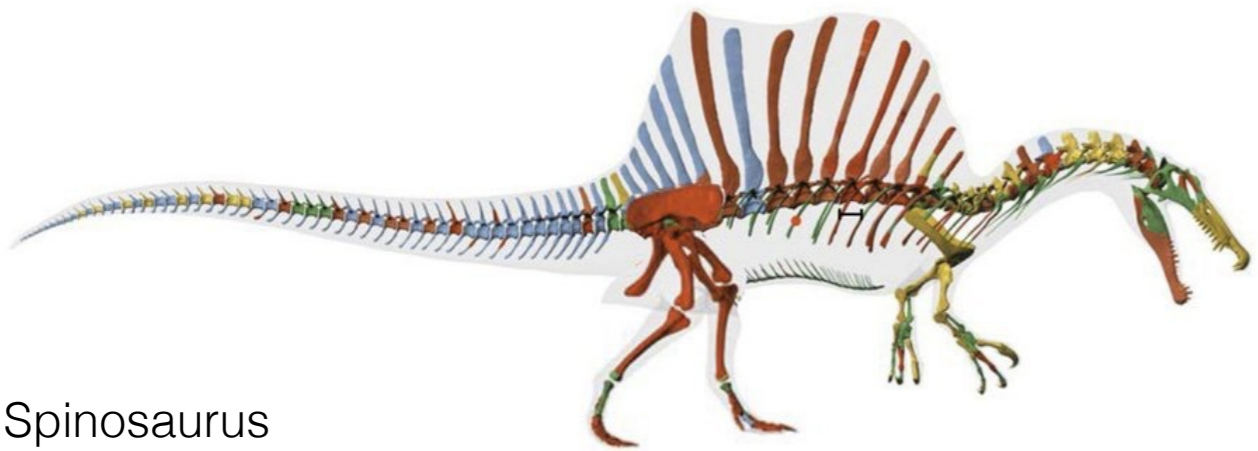
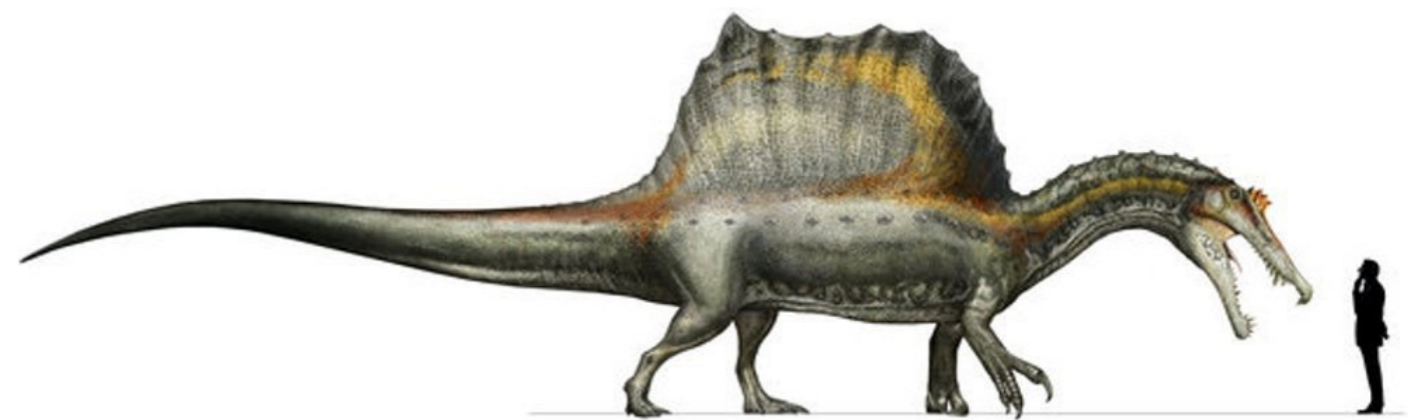
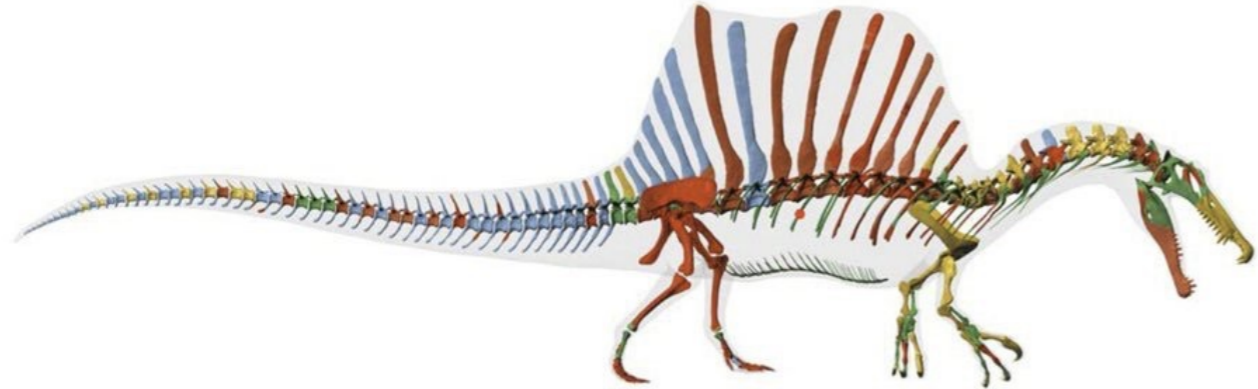




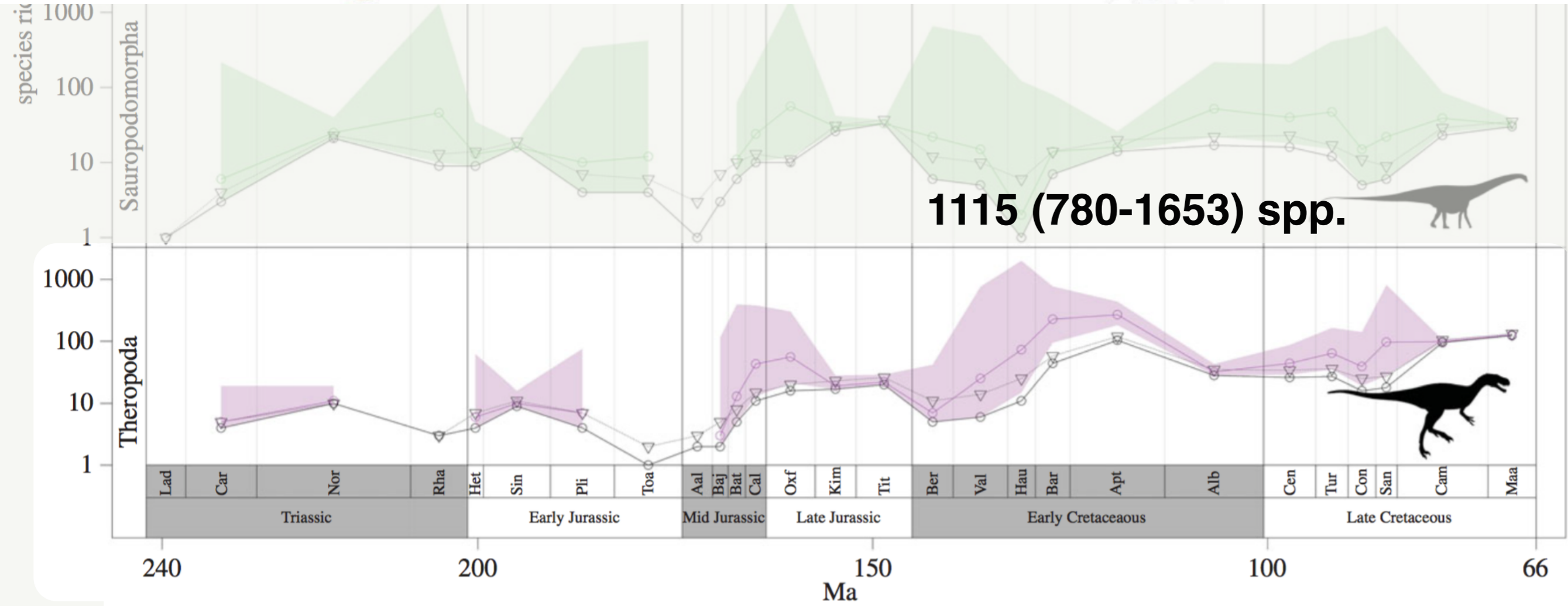








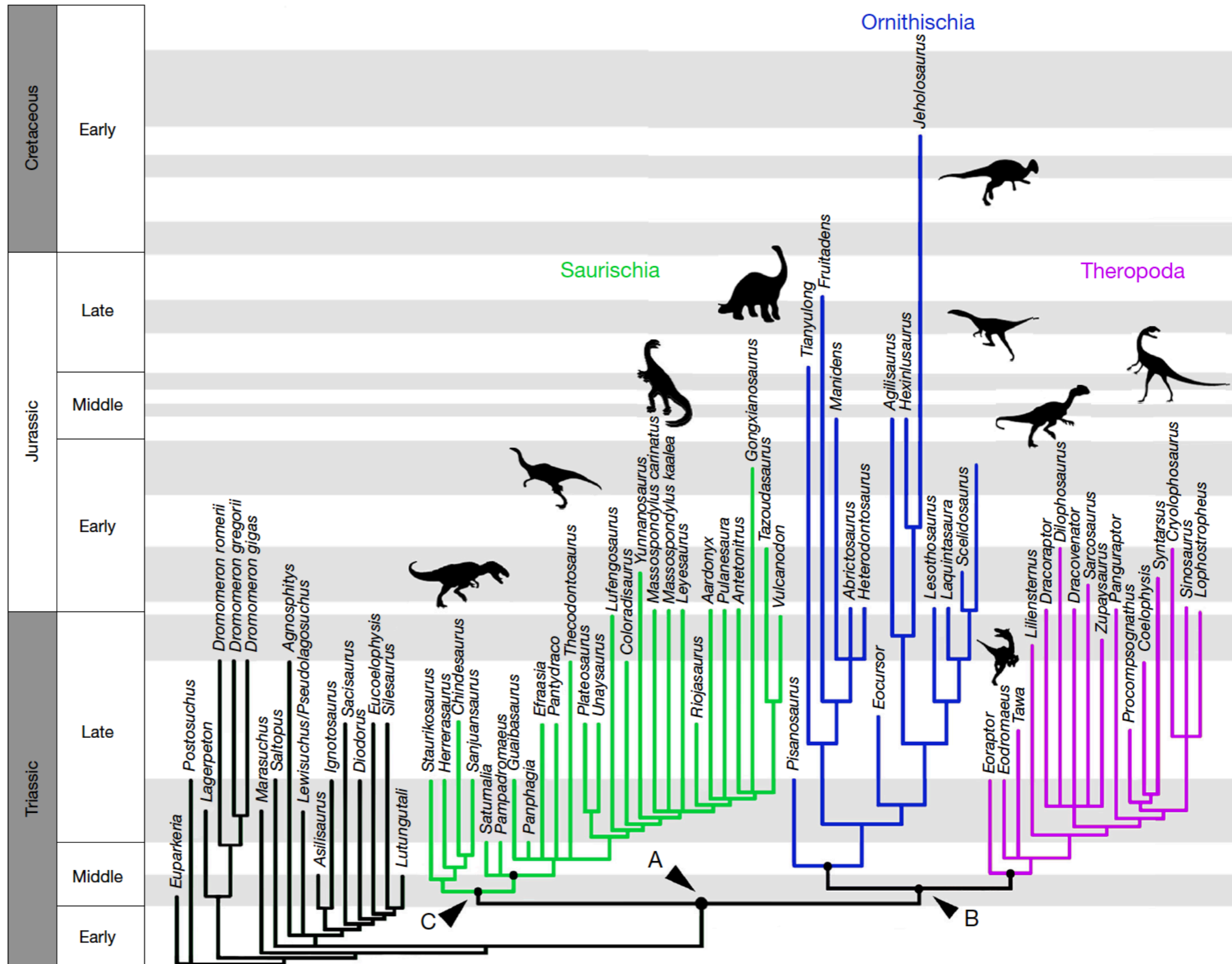
Spinosaurus



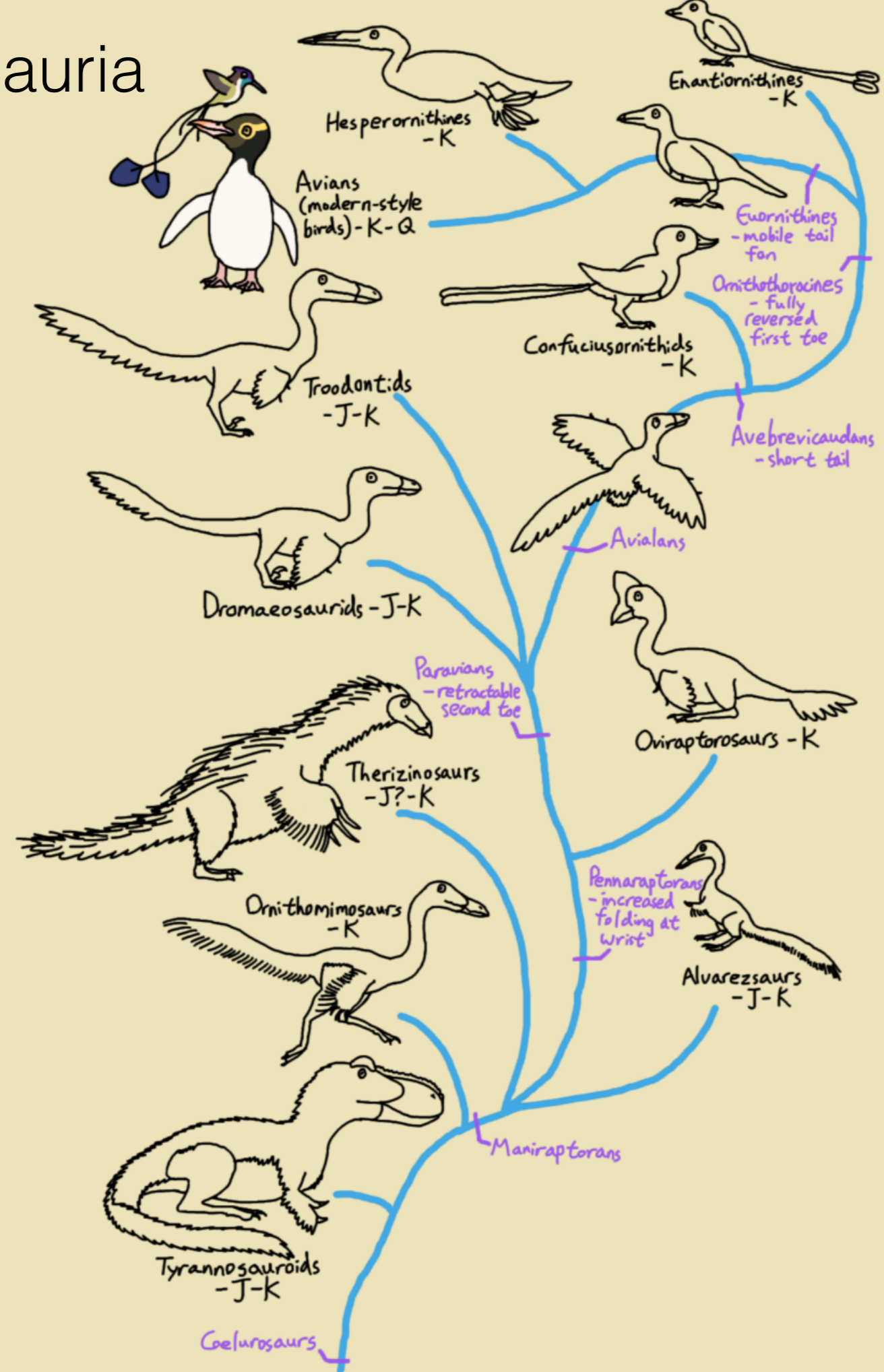


# A new hypothesis of dinosaur relationships and early dinosaur evolution

Matthew G. Baron<sup>1,2</sup>, David B. Norman<sup>1</sup> & Paul M. Barrett<sup>2</sup>



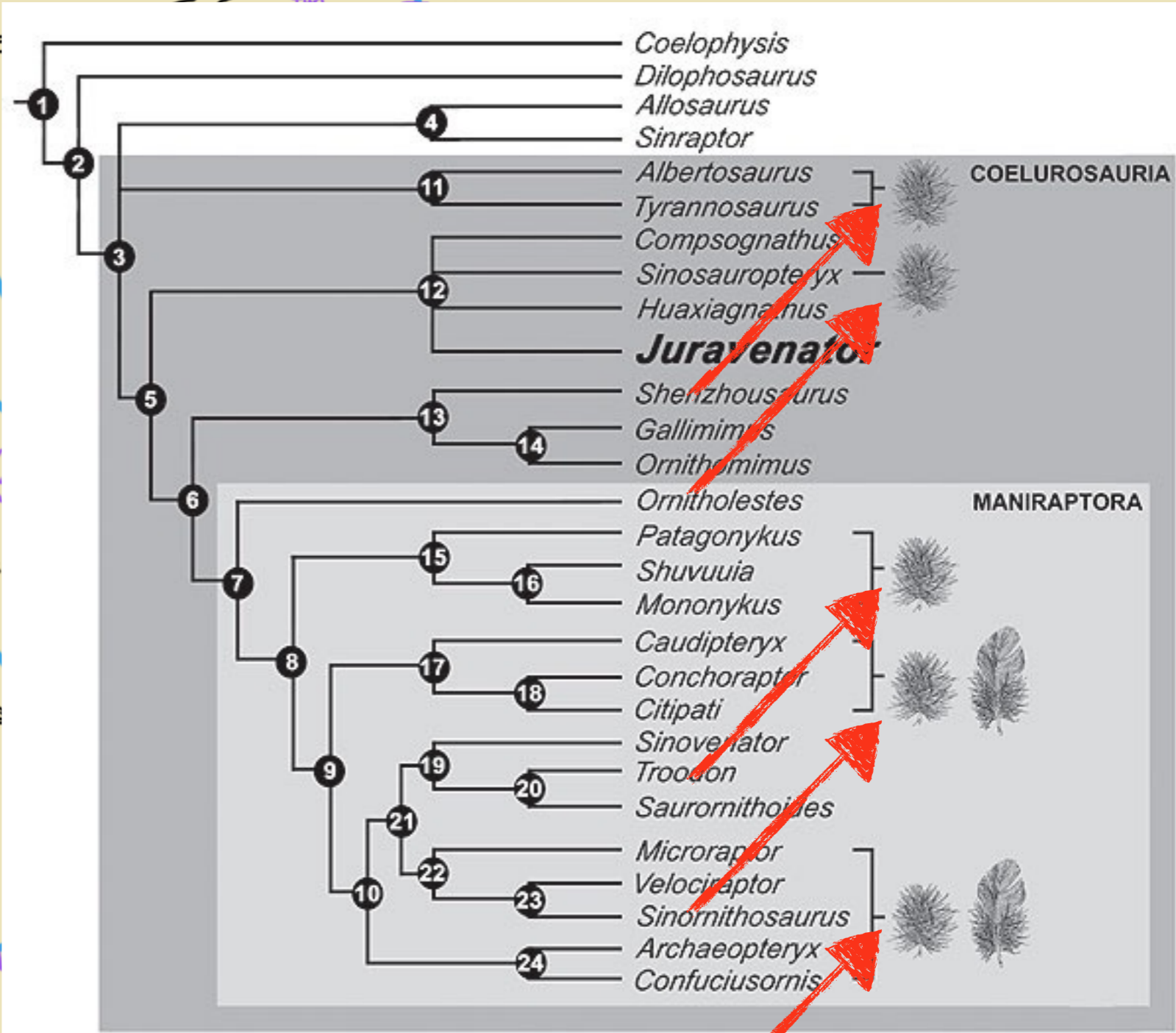
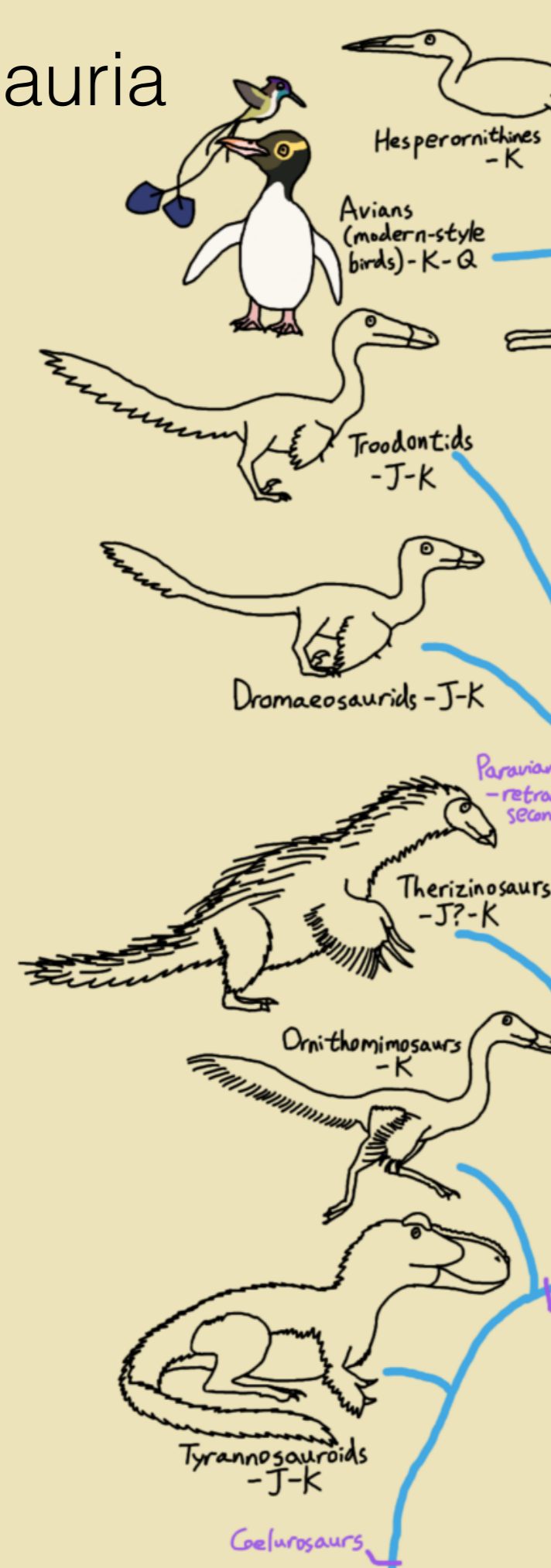
# Coelurosauria



Jurássico (165 mya)



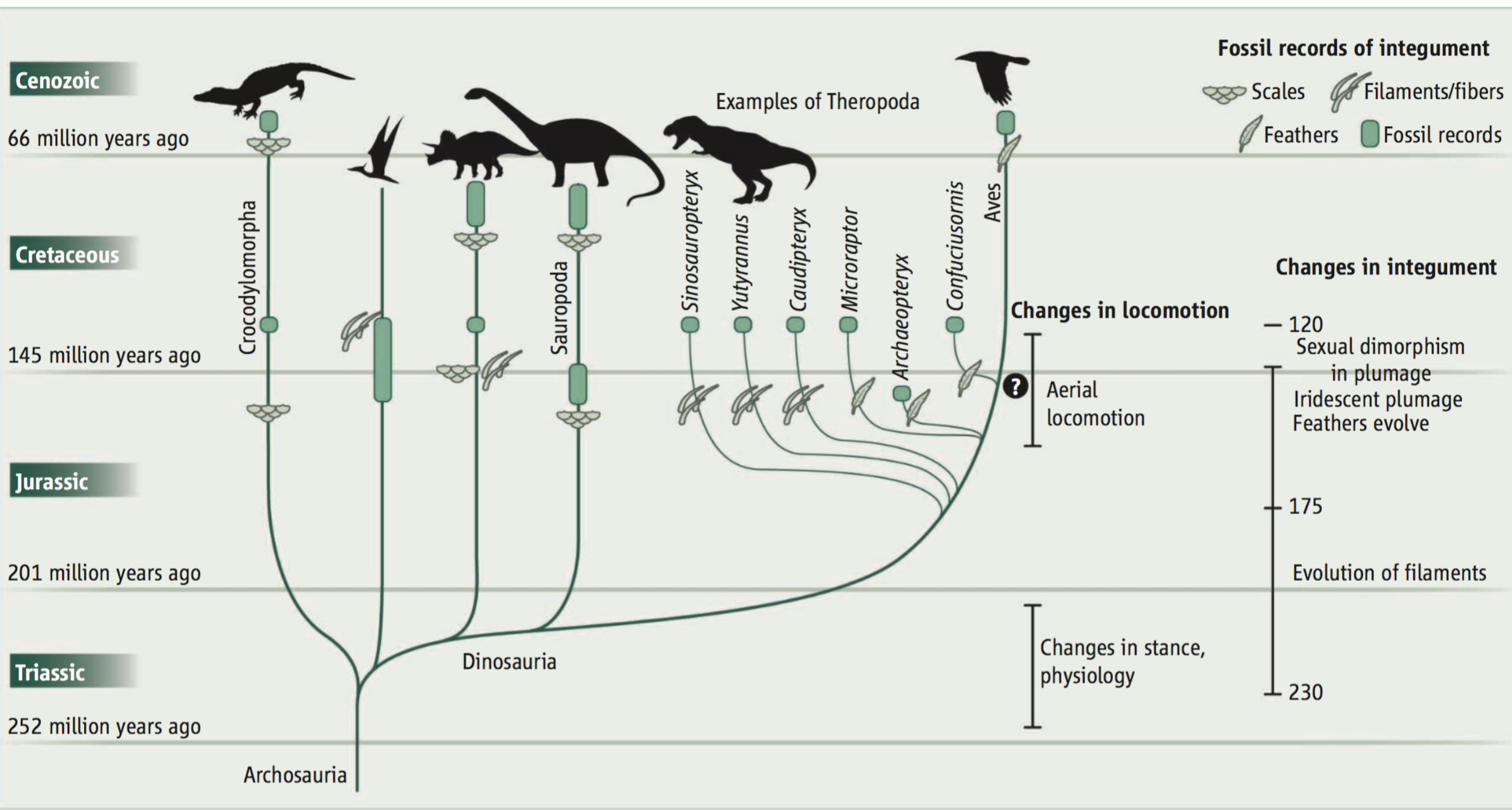
# Coelurosauria



Göhlich & Chiappe 2006

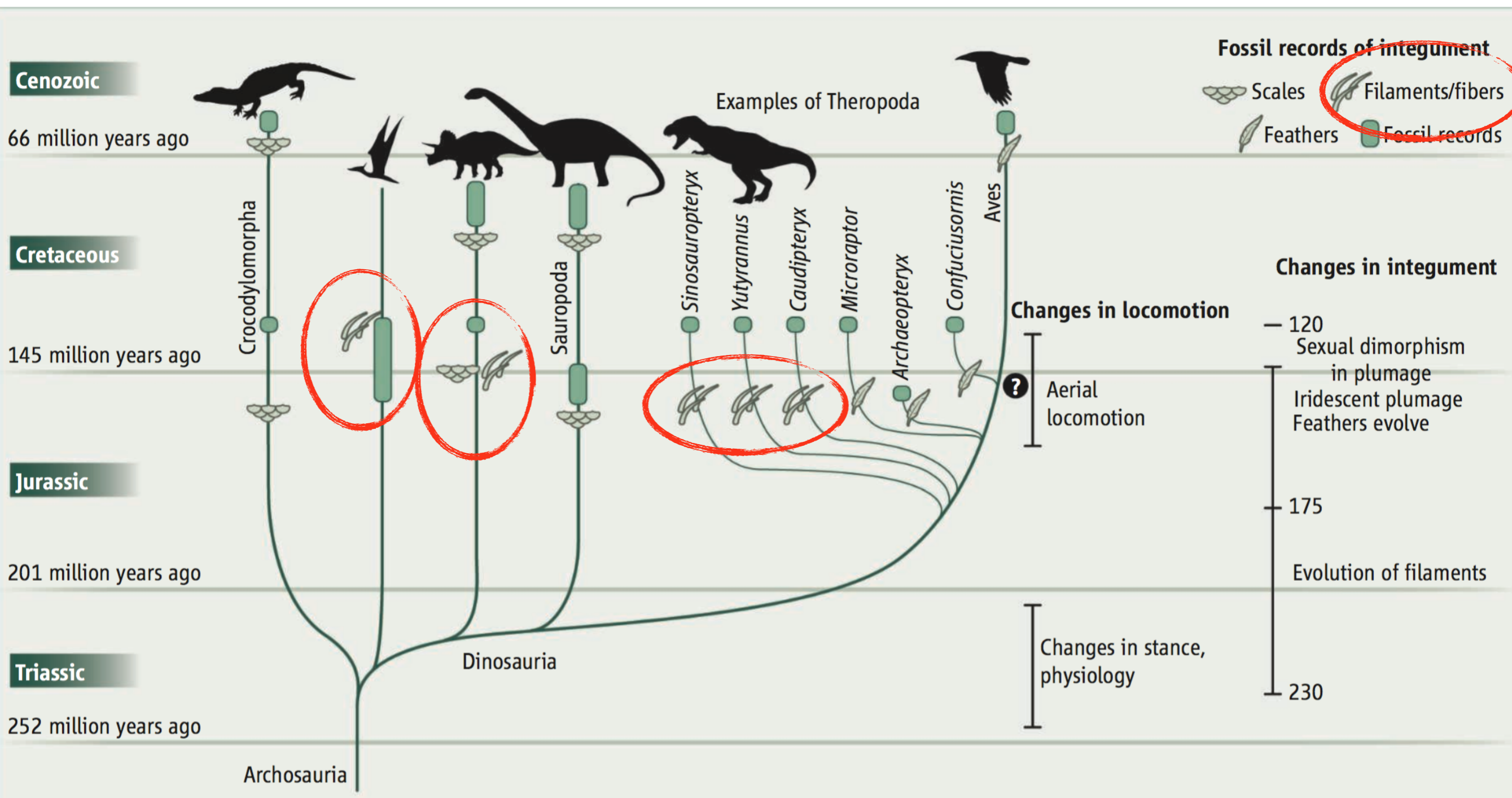
Jurássico (165 mya)

# Coelurosauria

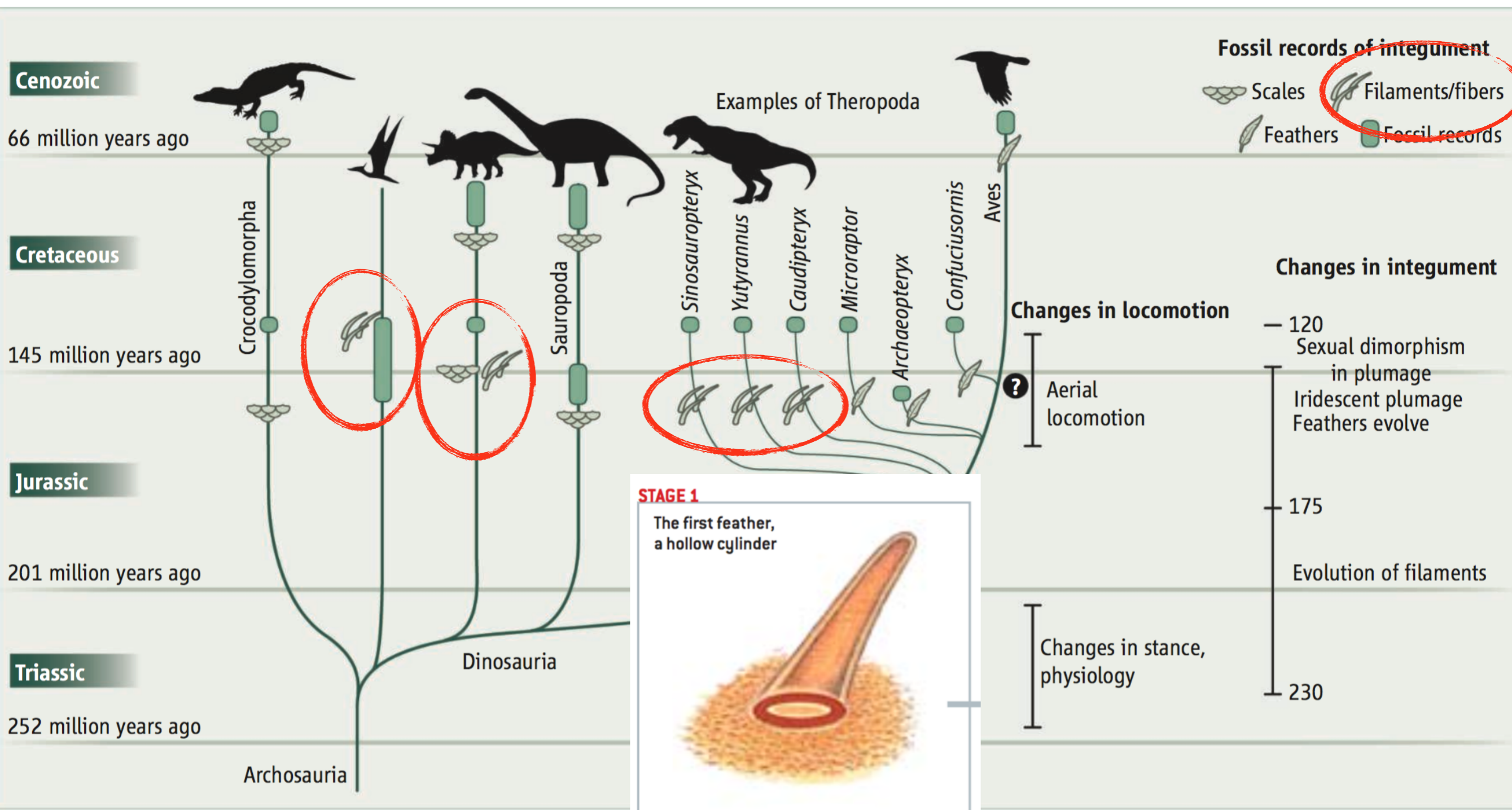




# Coelurosauria



# Coelurosauria



**STAGE 1**

The first feather, a hollow cylinder

**EVOLUTIONARY NOVELTY**  
[All cross sections are through the follicle collar]

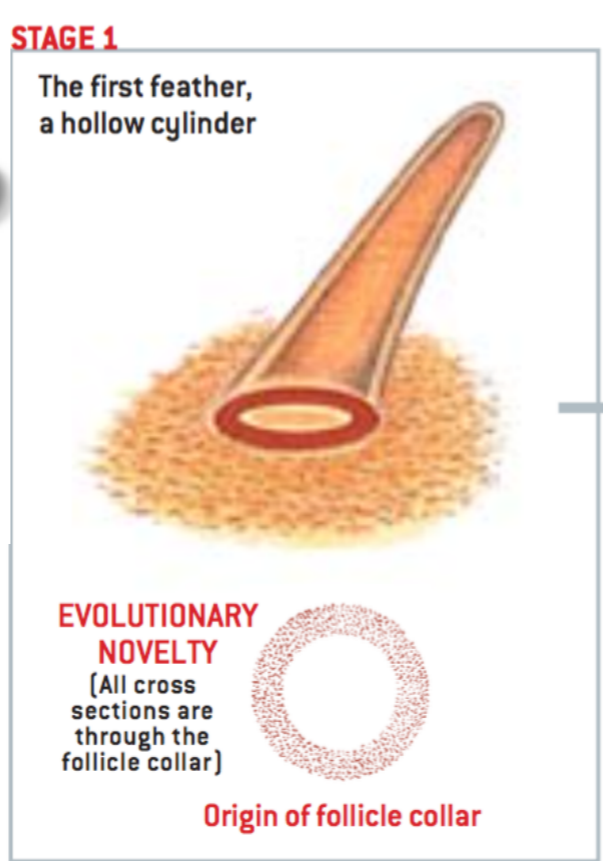
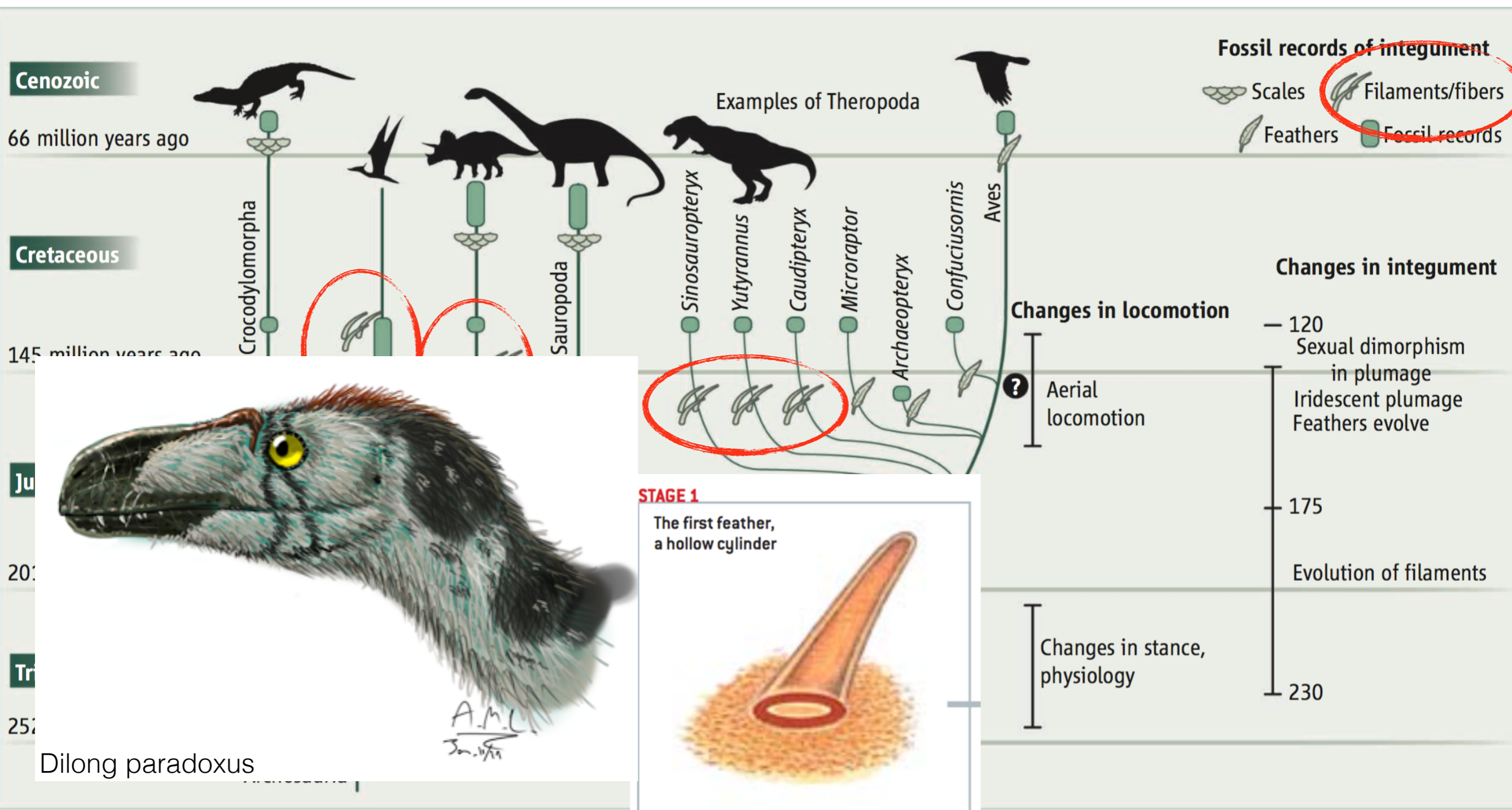
**Origin of follicle collar**

Prum & Brush 2003

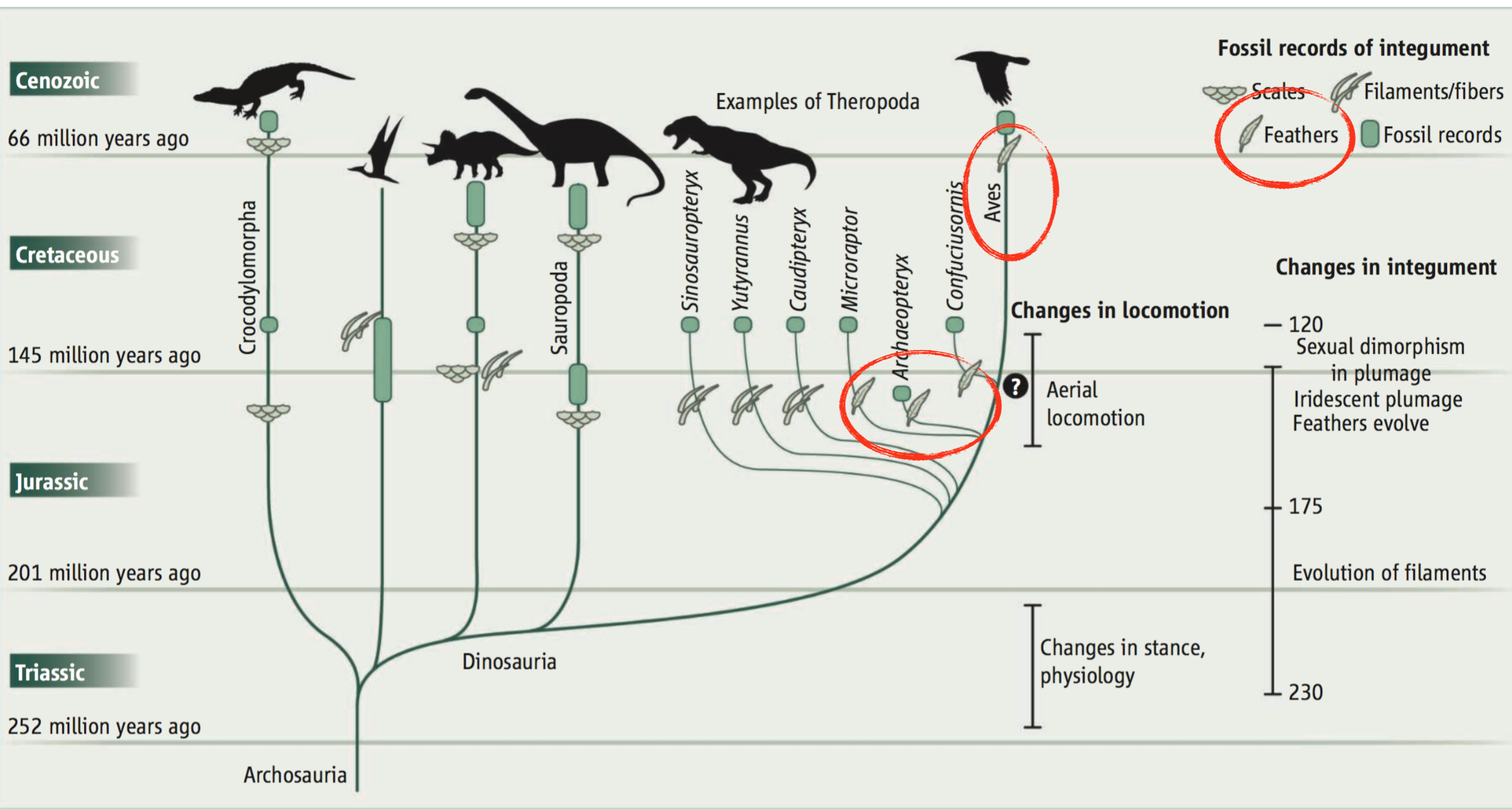
Clarke 2013



# Coelurosauria

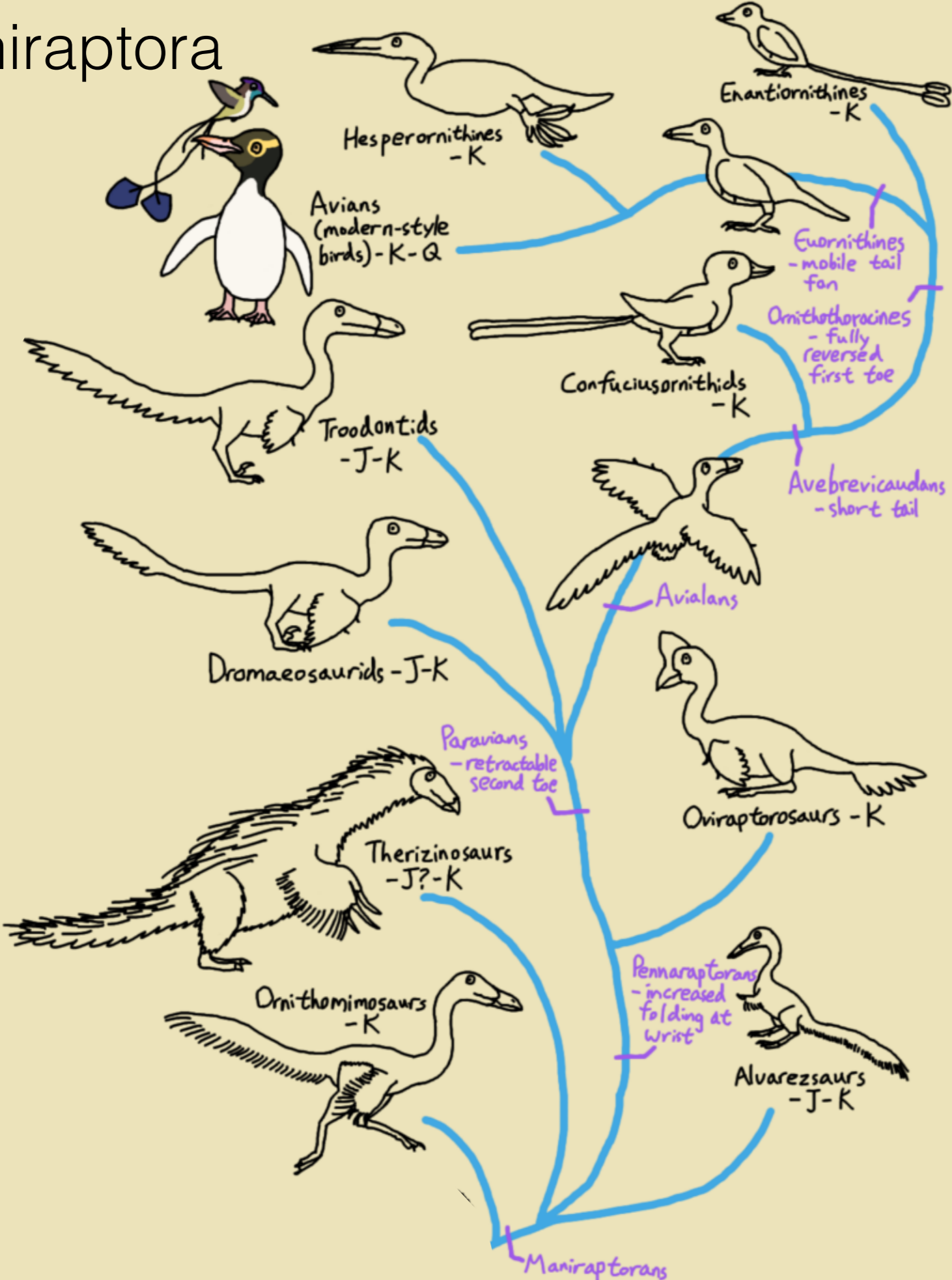


# Coelurosauria



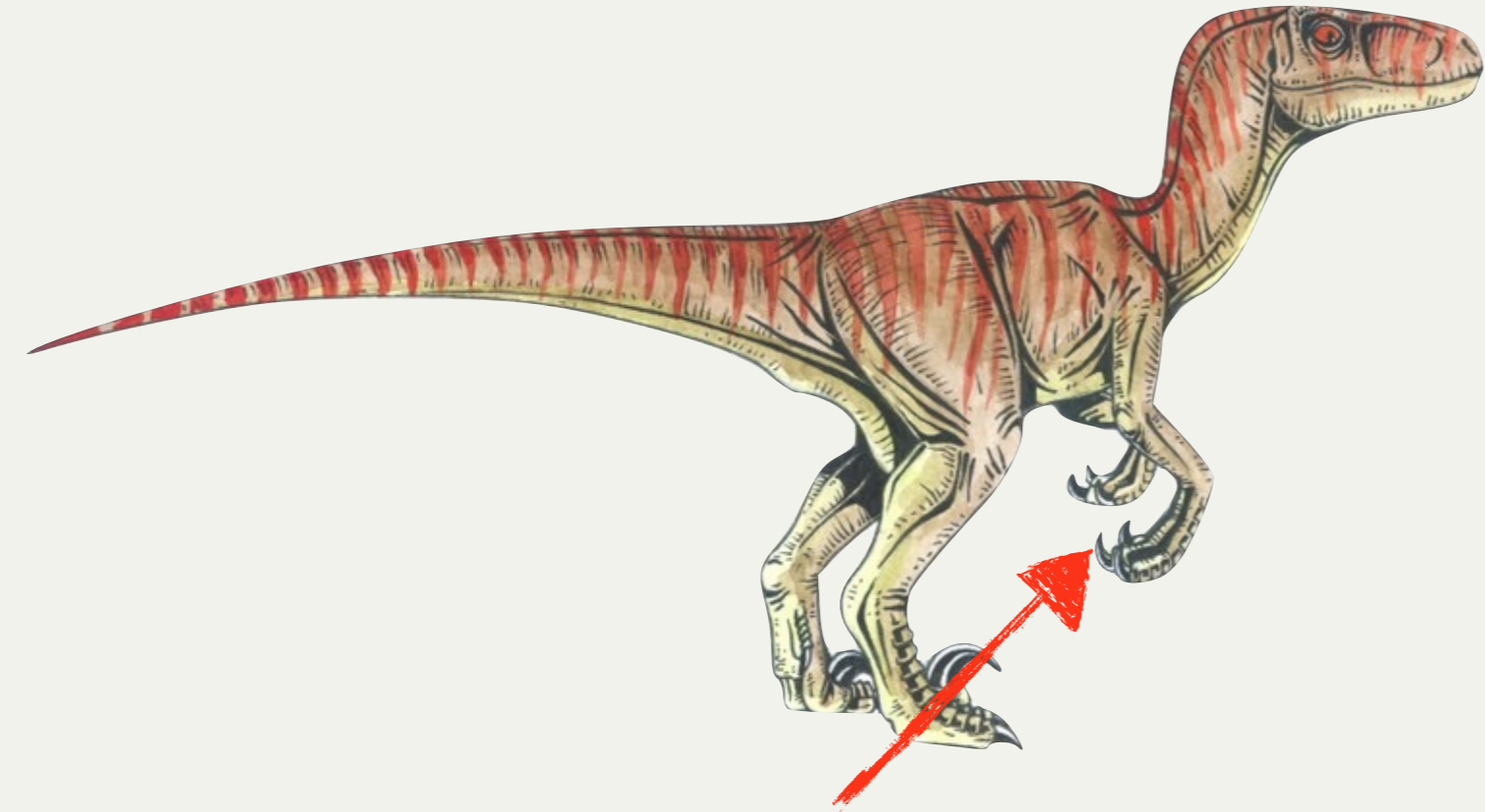


# Maniraptora



Jurássico (160 mya)

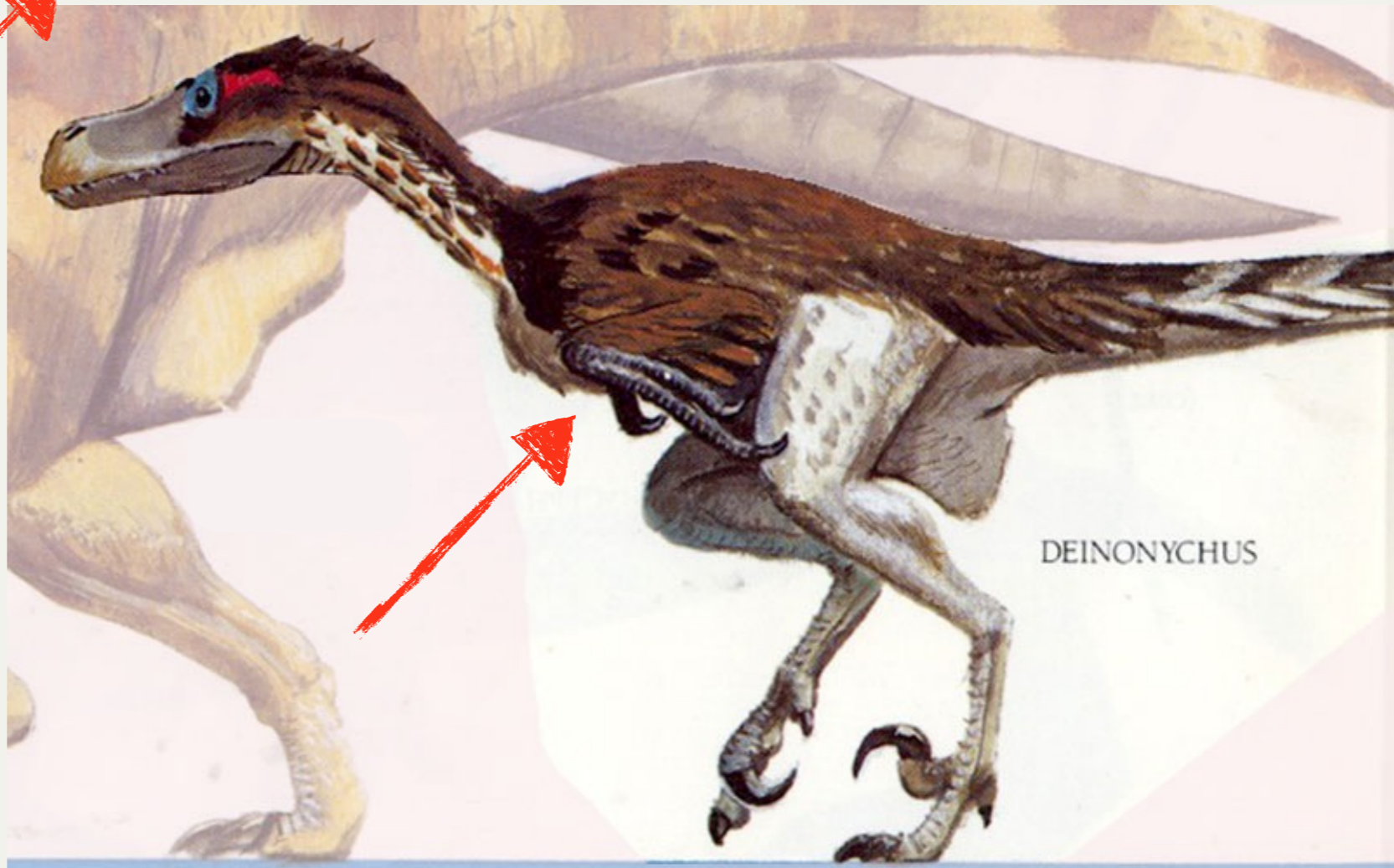
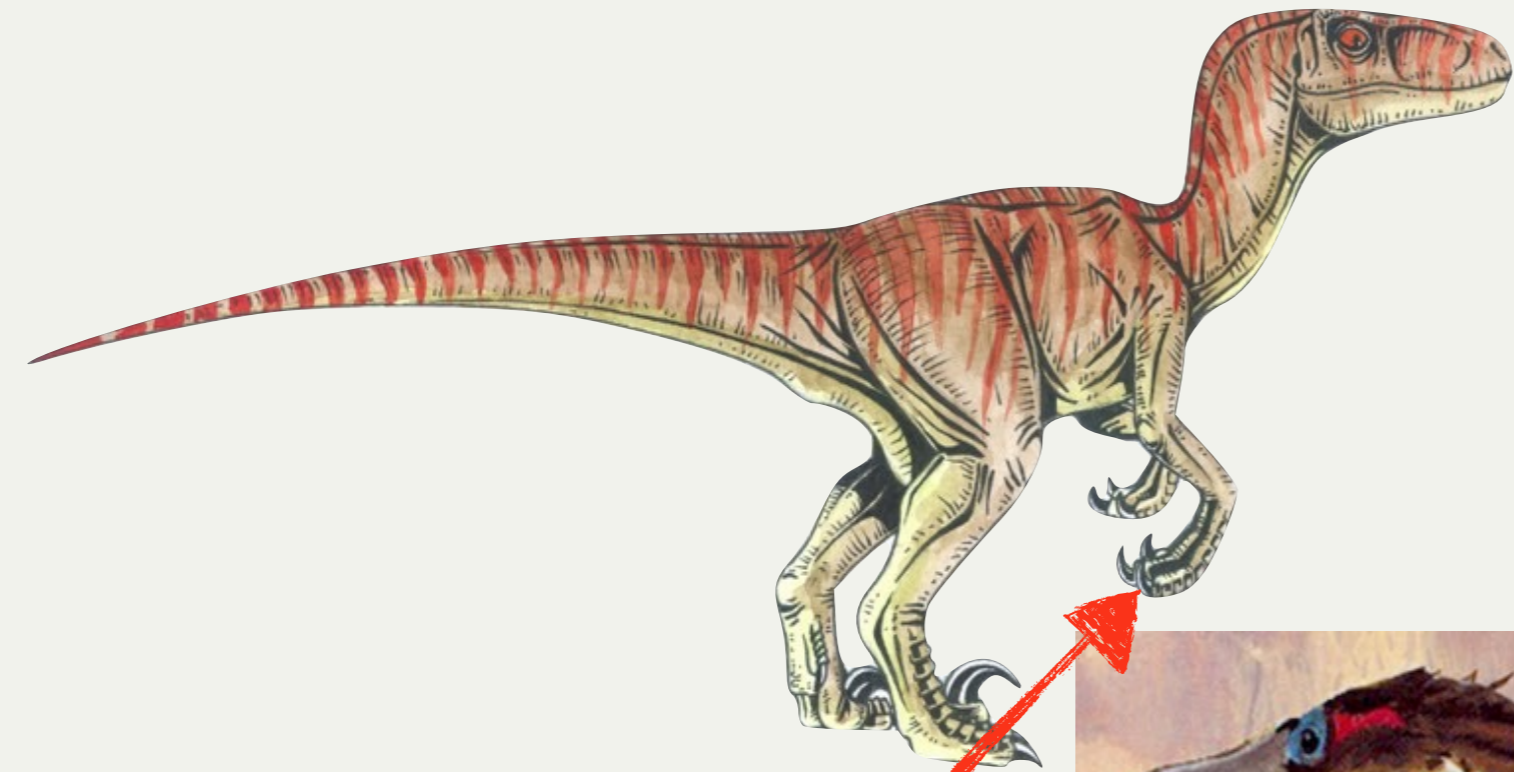
# Maniraptora



*Deinonychus antirrhopus*

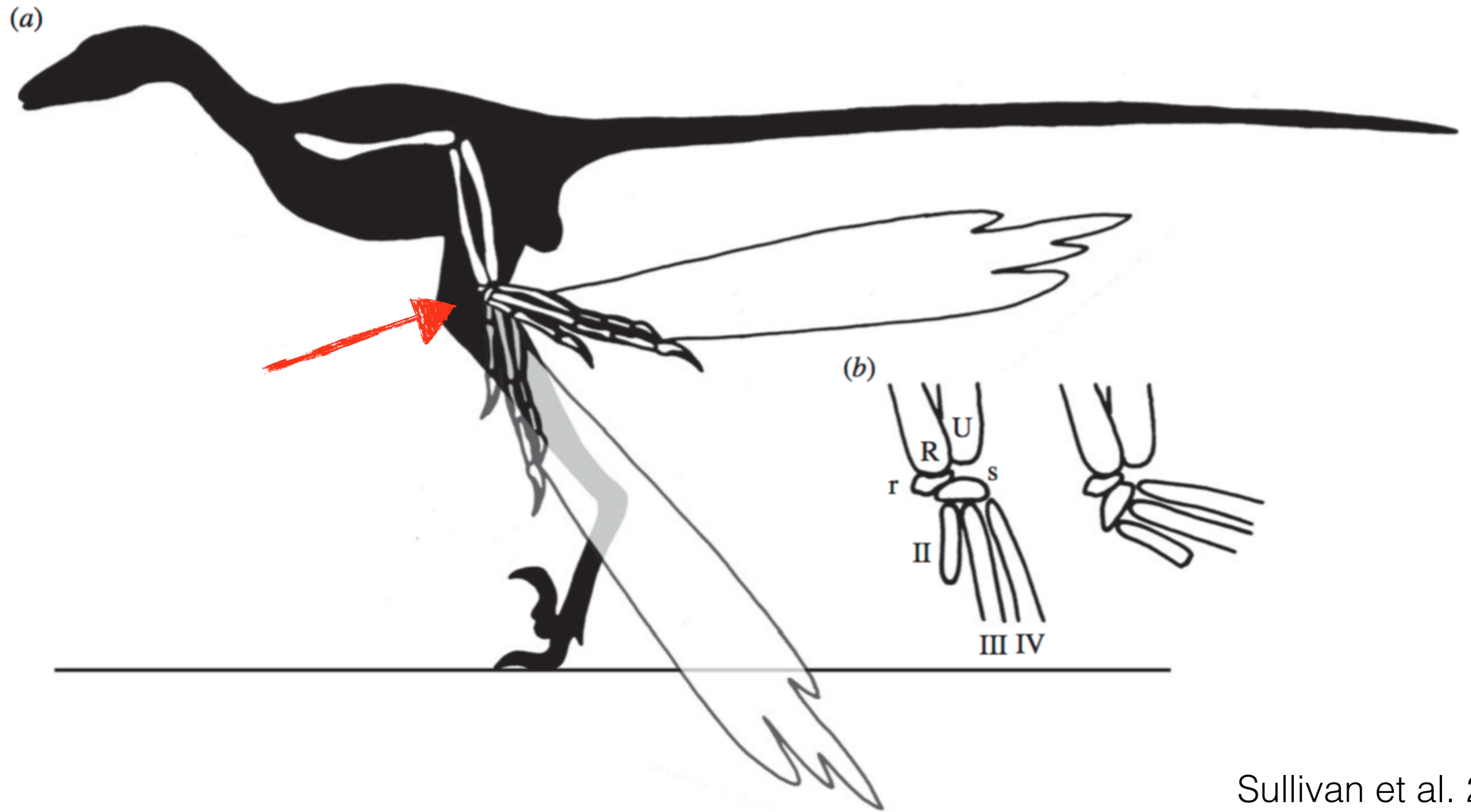


# Maniraptora



Deinonychus antirrhopus

# Maniraptora





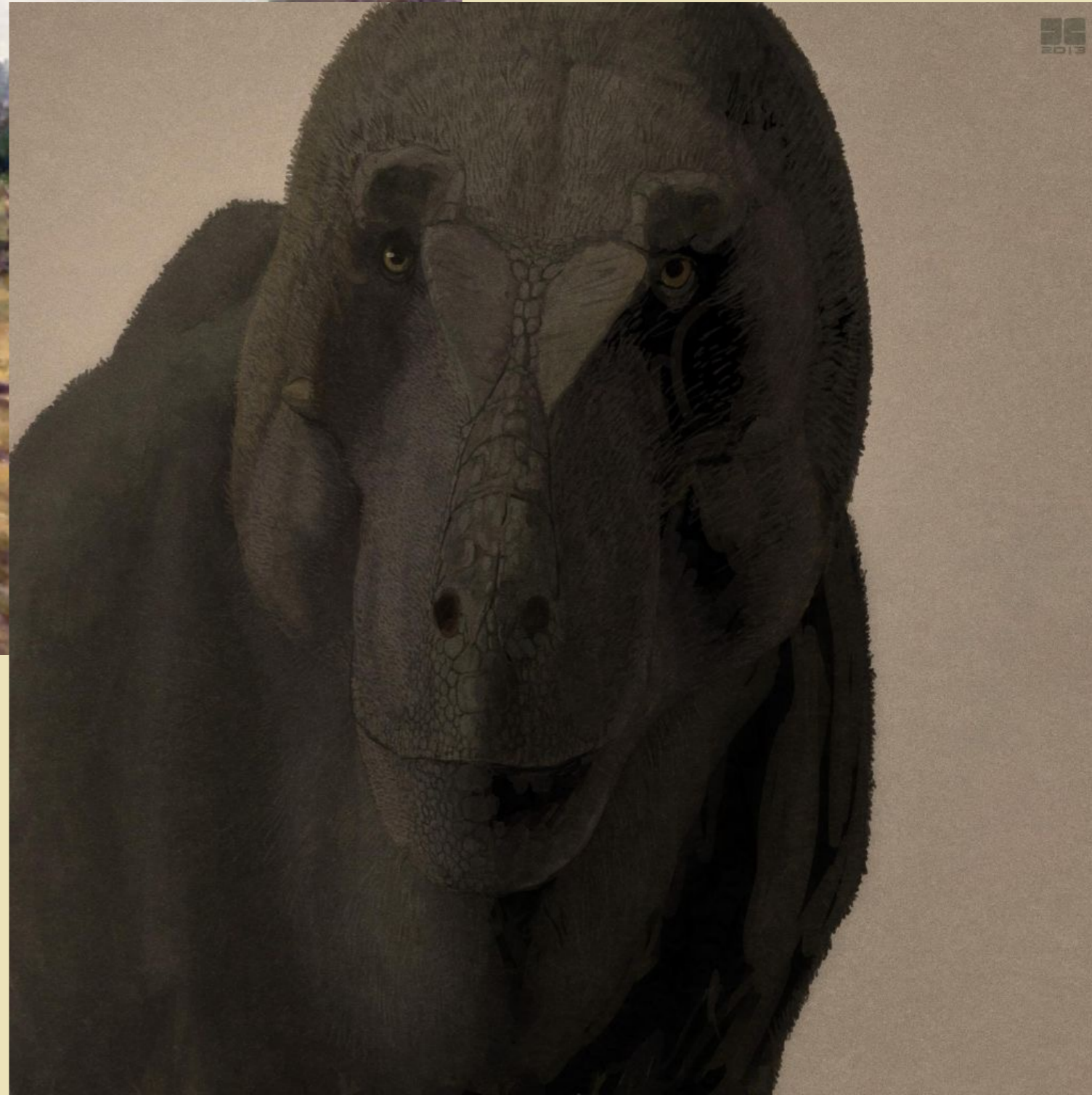


**Deinonychus antirrhopus** (Ostrom, 1969)

Life restoration based on the skeletal reconstruction made by Scott Hartman

Copyright © F. Dalio 2015

Deinonychus antirrhopus

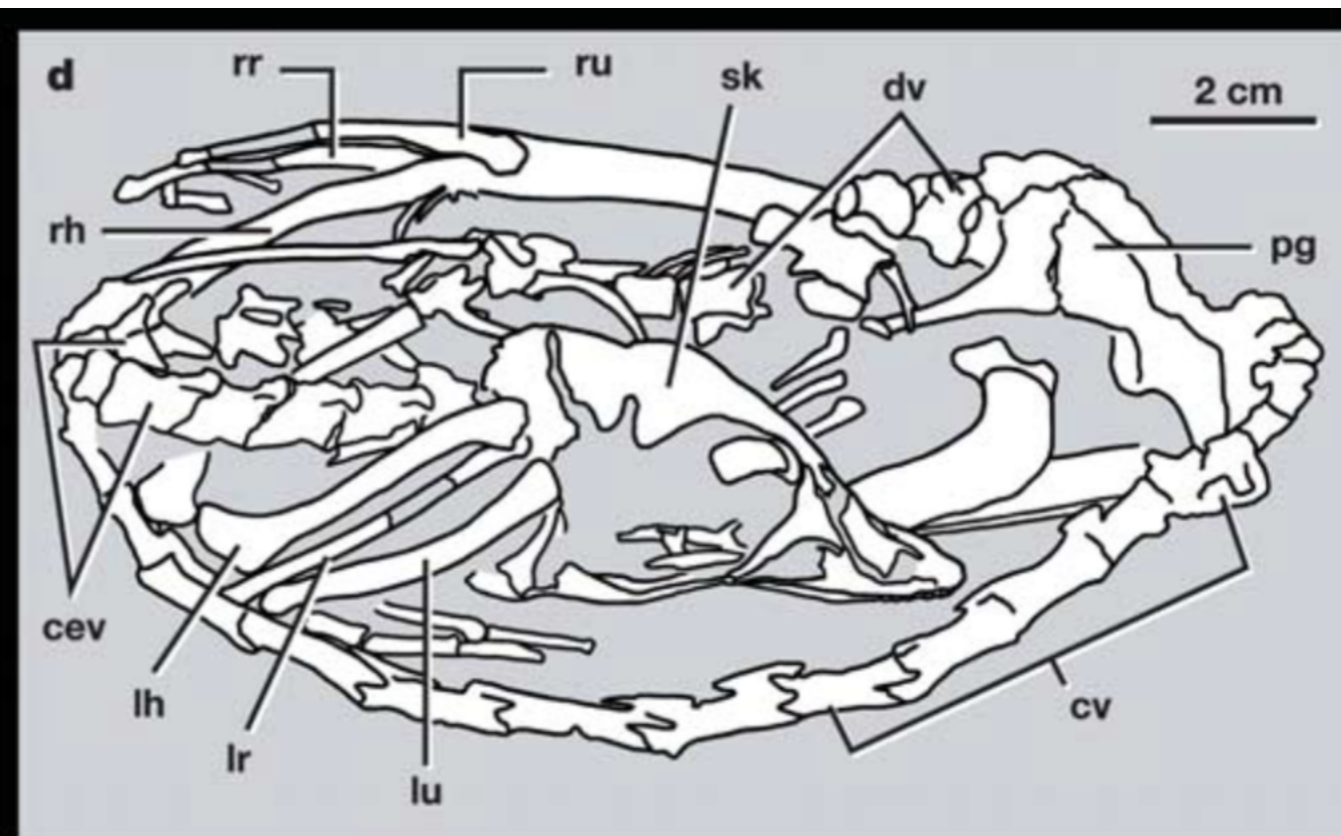


Tyrannosaurus rex



# A new troodontid dinosaur from China with avian-like sleeping posture

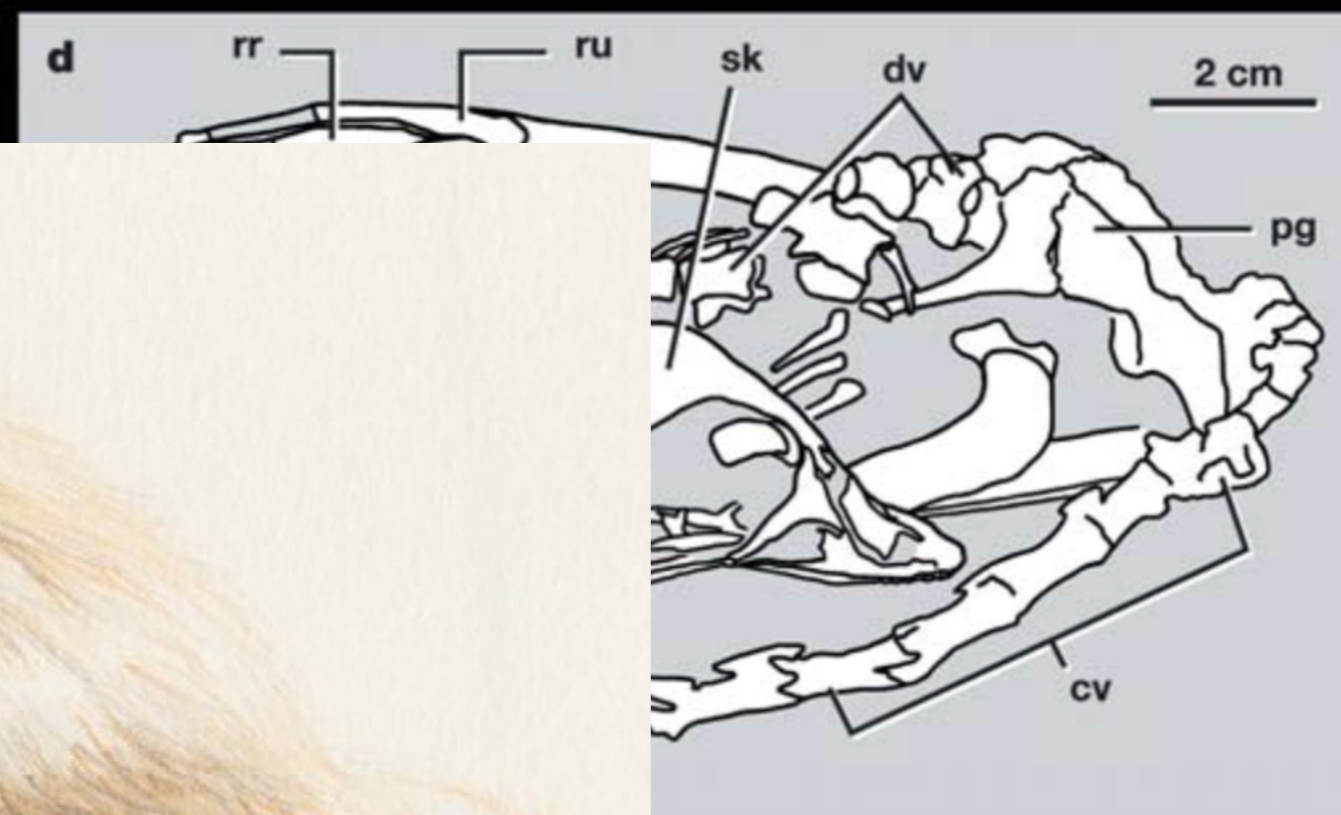
Xing Xu<sup>1,2</sup> & Mark A. Norell<sup>2</sup>





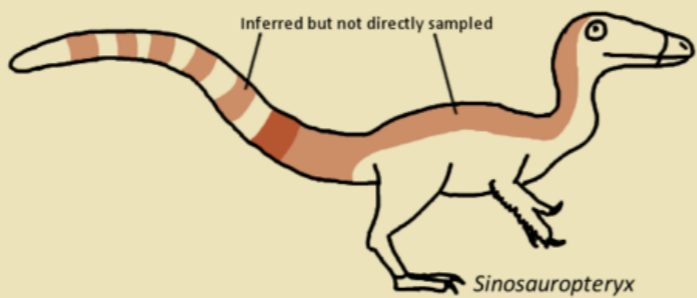
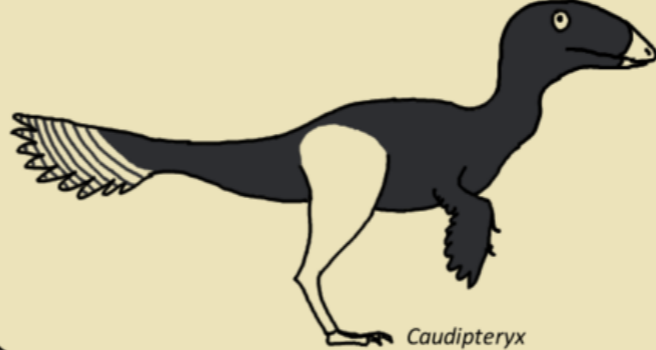
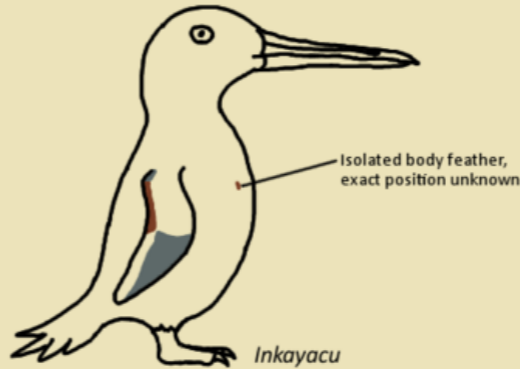
# A new troodontid dinosaur from China with avian-like sleeping posture

Xing Xu<sup>1,2</sup> & Mark A. Norell<sup>2</sup>





# Cores!



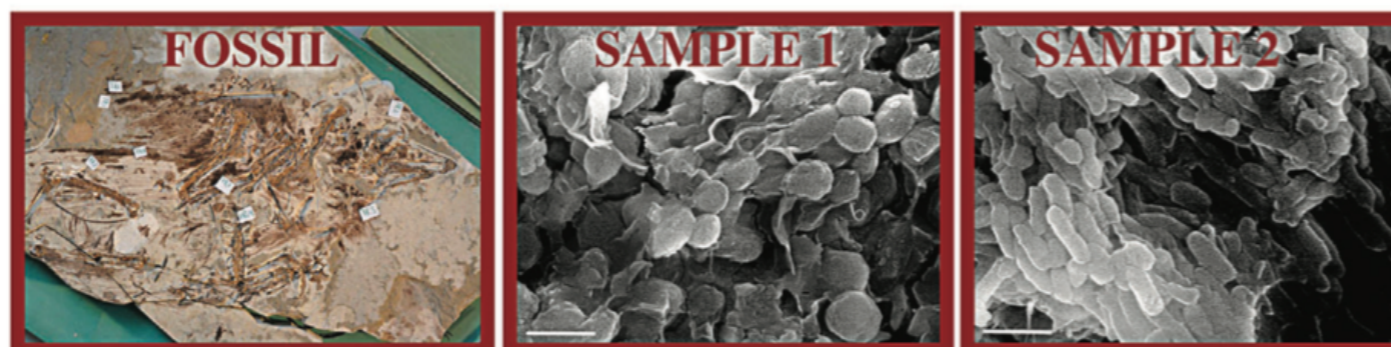
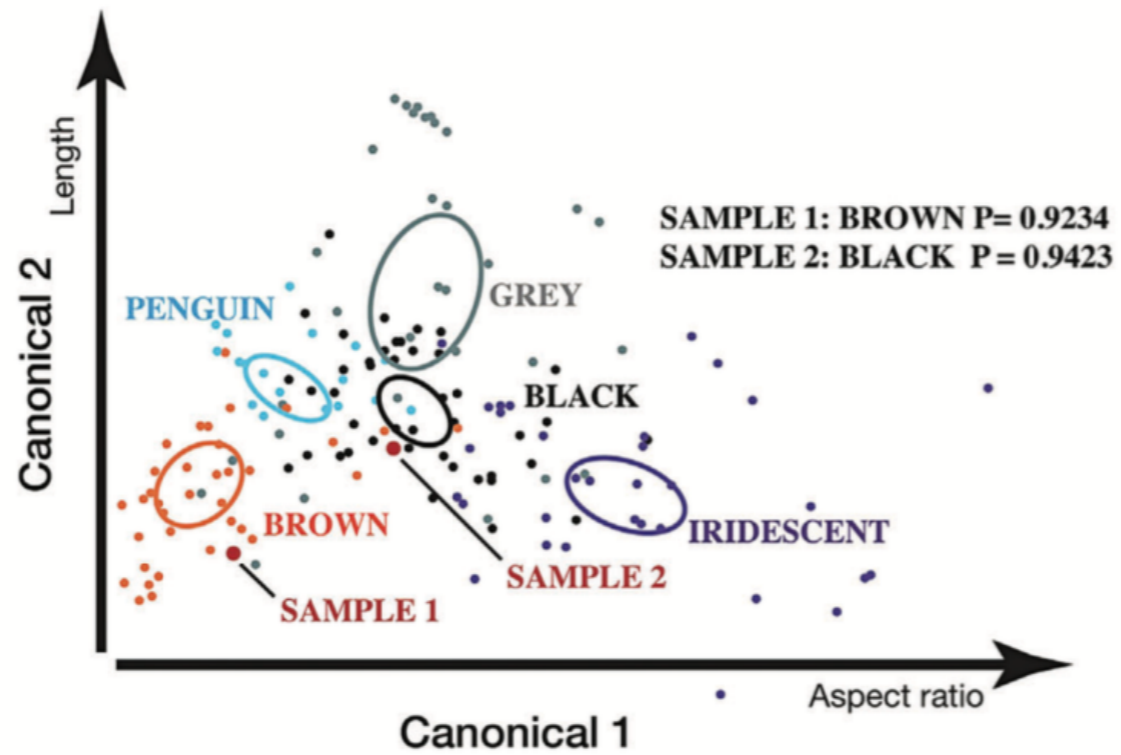
© MAGIA  
NEGRA...



...É ESSA





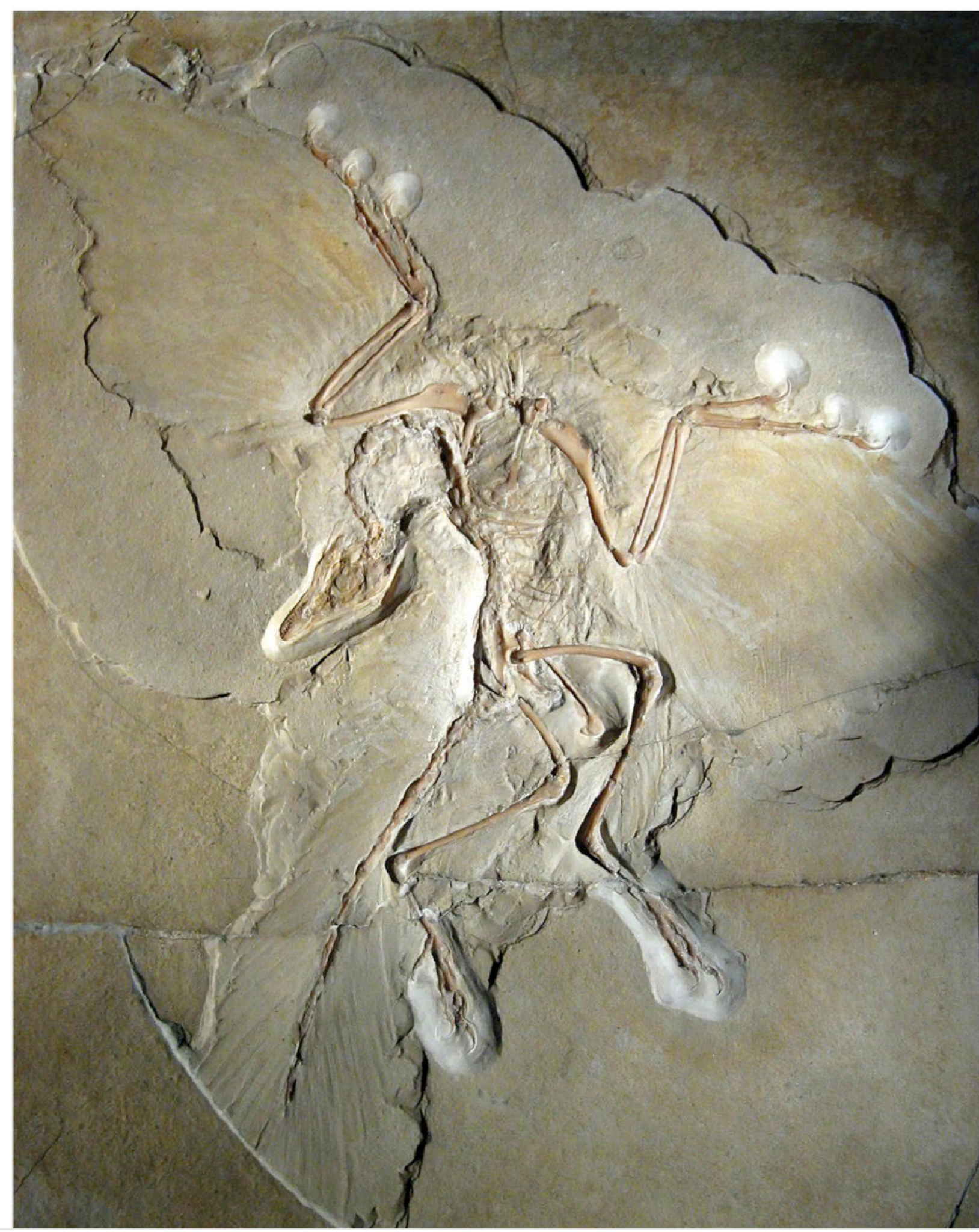




# ELE OU ELA?

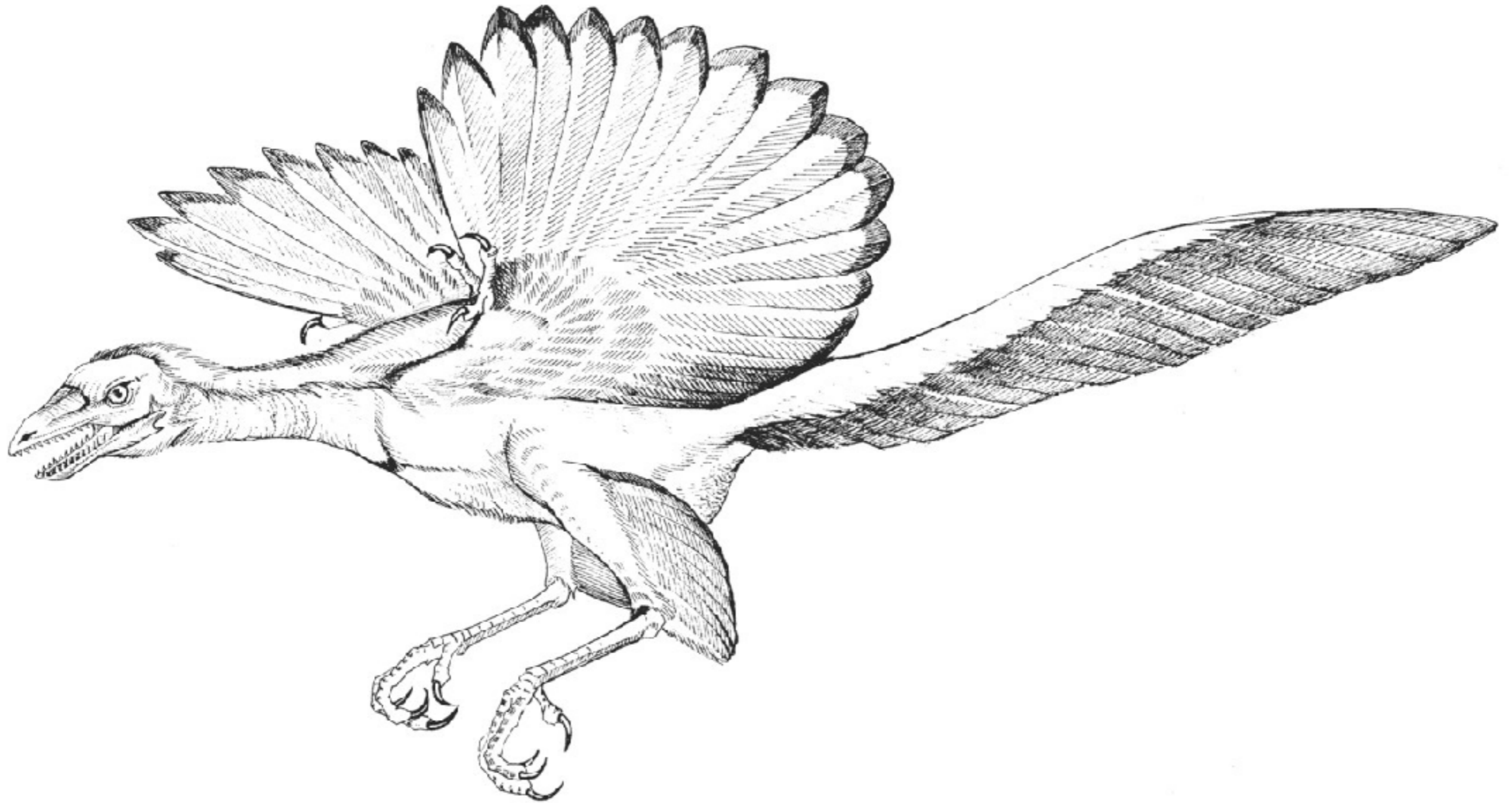






Archaeopteryx



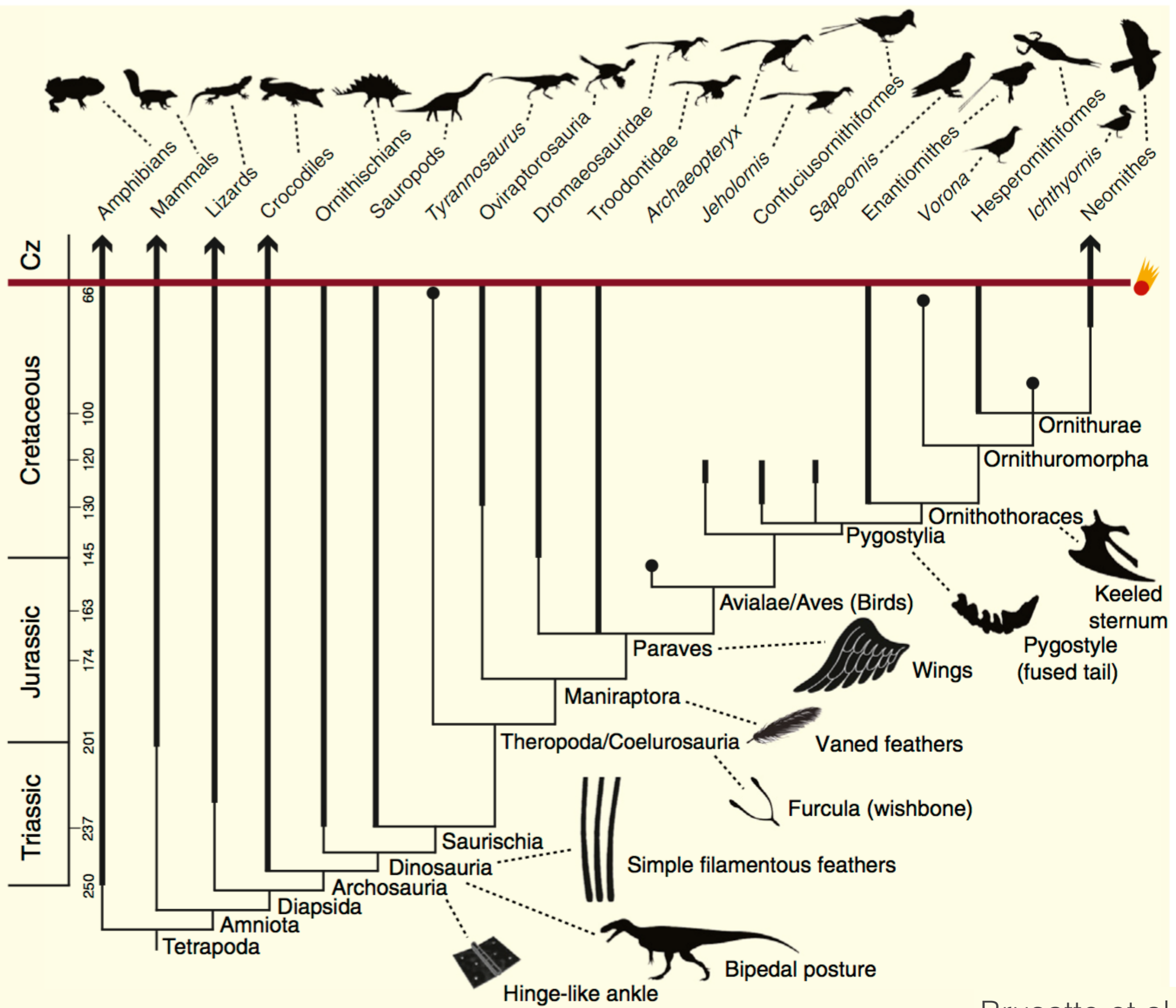


Archaeopteryx

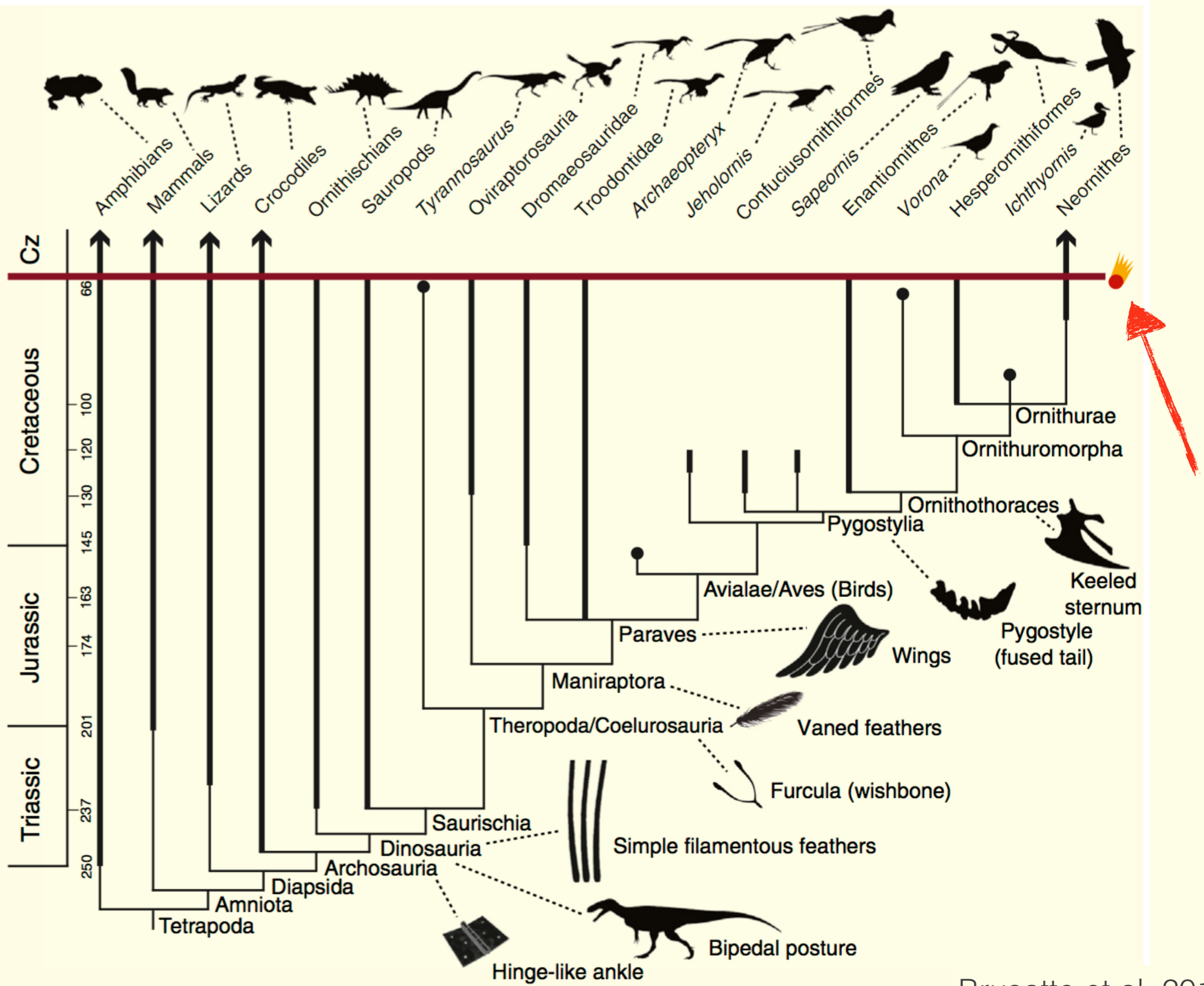


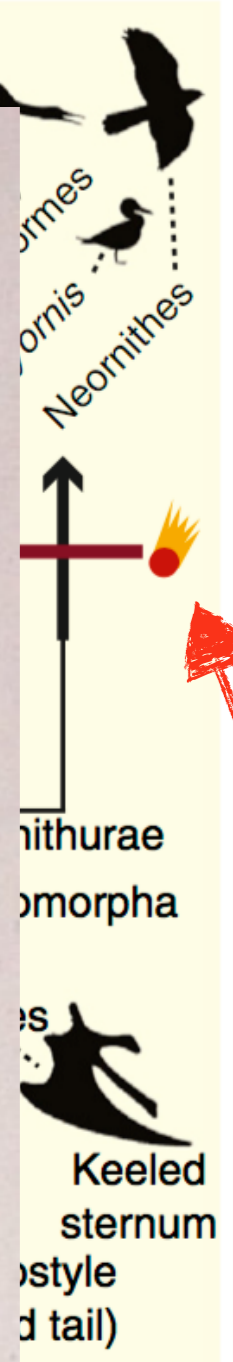
# RESUMO DA HISTÓRIA















FILOGENIA

MACRO-EVOLUÇÃO

AMNIO-TA

ARCHOS-SAUROS

DINOS-SAUROS + AVES

DIVERSIDADE

ORIGEM

ECOLOGIA

ANATOMIA

EVOLUÇÃO

REPRODUÇÃO

COMPOR-TAMENTO

VOO

ALGUMA FISIO-LOGIA

AVES

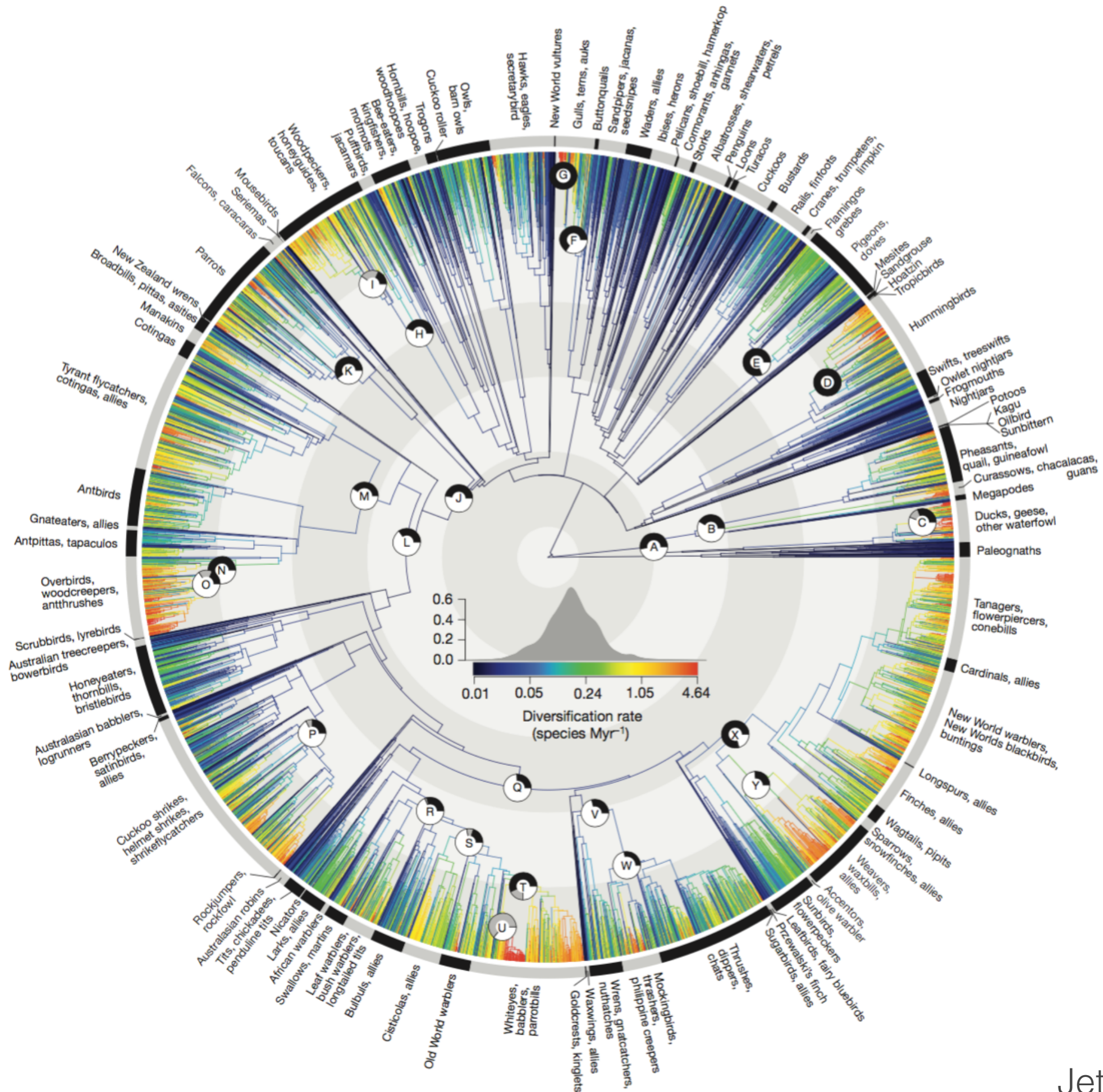
**I am the almighty!**

A fluffy, downy chick with its mouth wide open, standing on a rocky surface. The chick is covered in soft, white and brown down. Its beak is bright red and is stretched wide open. The chick is standing on a ground covered with smooth, grey and blue stones. The background is a soft-focus natural setting.

**Fear the fuzzy!**

**Fear it!**





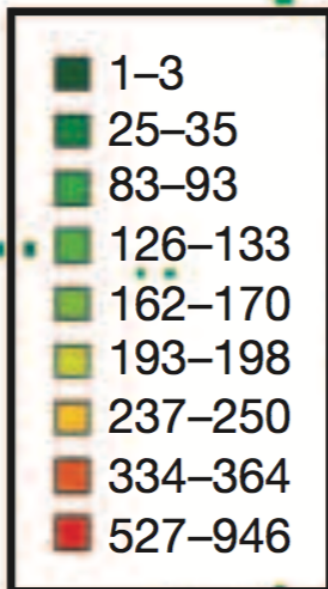


The Cornell Lab of Ornithology  
**Bird Academy**



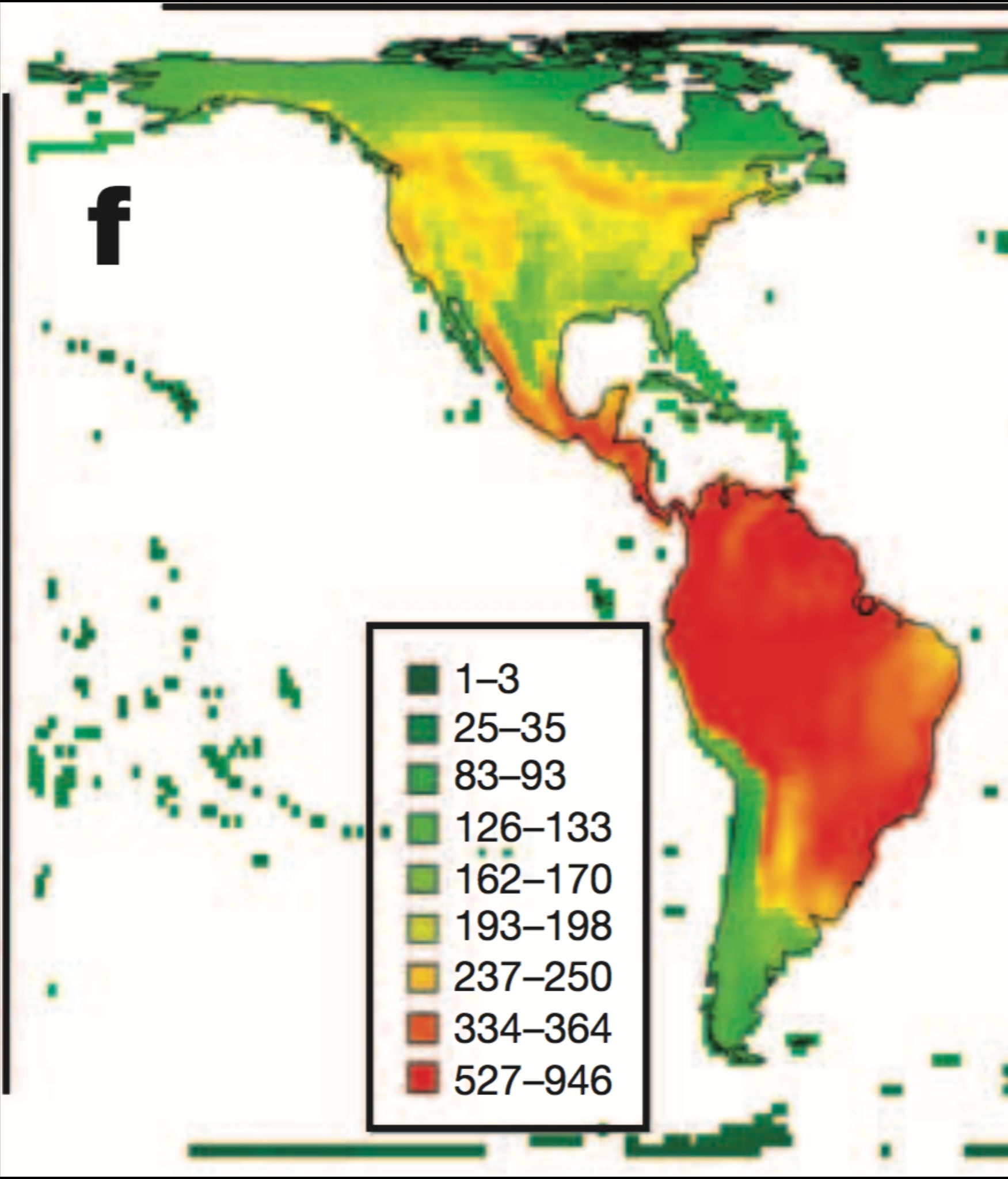


**f**



Richness all

**f**







1.373 spp.

**VENEZUELA**

Georgetown

**GUYANA**

Paramaribo

Cayenne

**SURINAME**

**FRENCH GUIANA**

1.829 spp.

**COLOMBIA**

1.590 spp.

**ECUADOR**

Amazonas

**B R A Z I L**

1.870 spp.

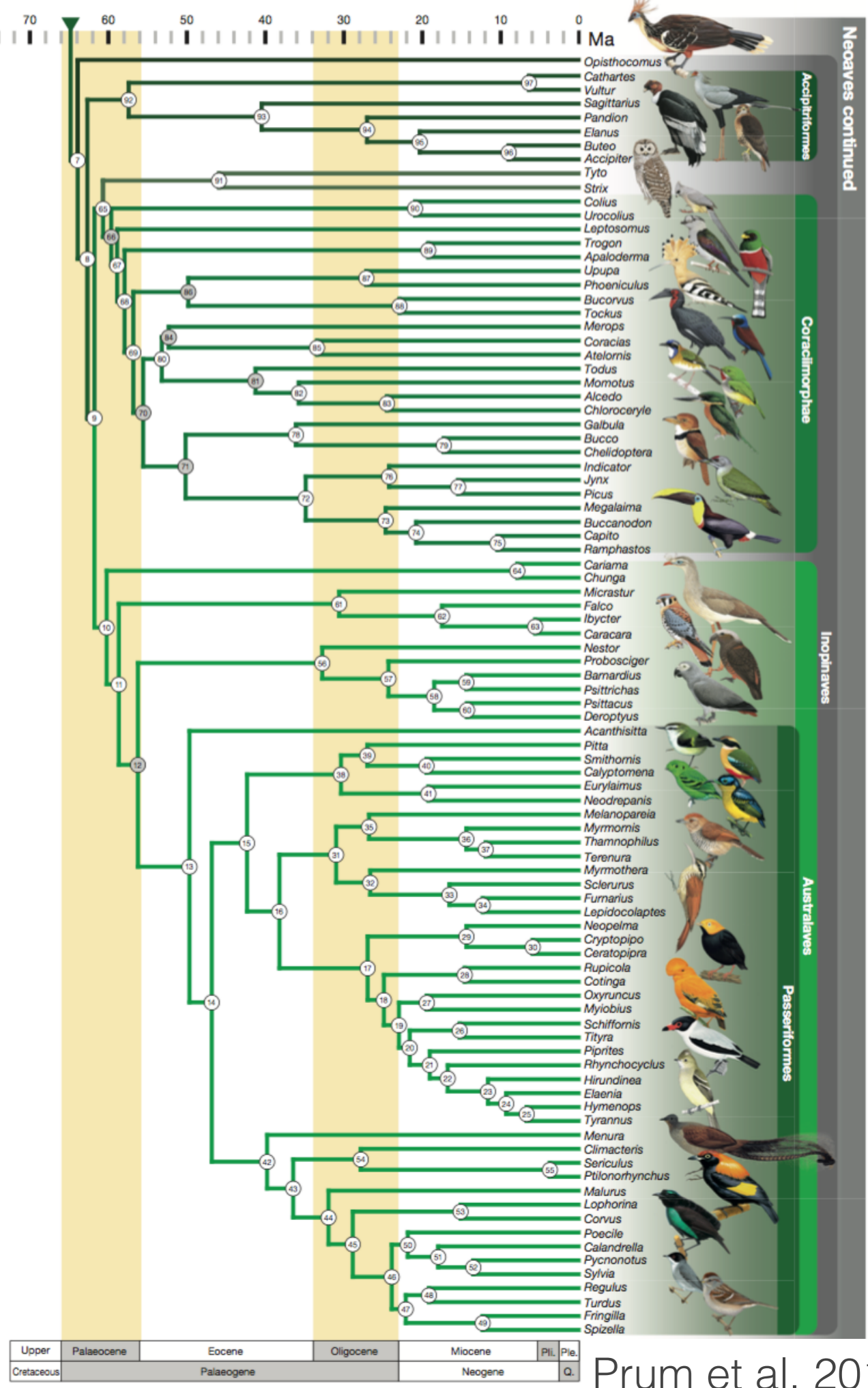
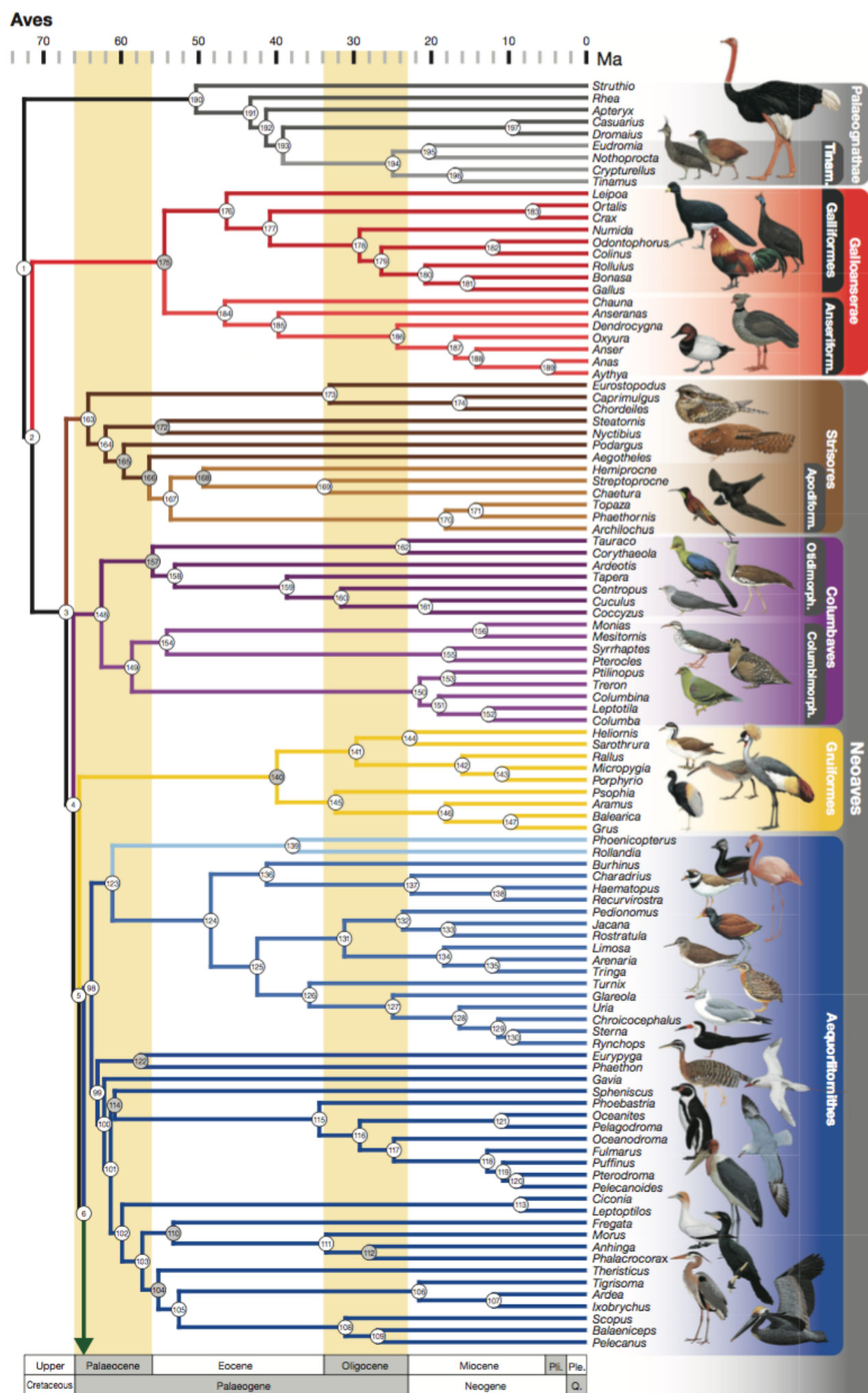
**PERU**

1.760 spp.

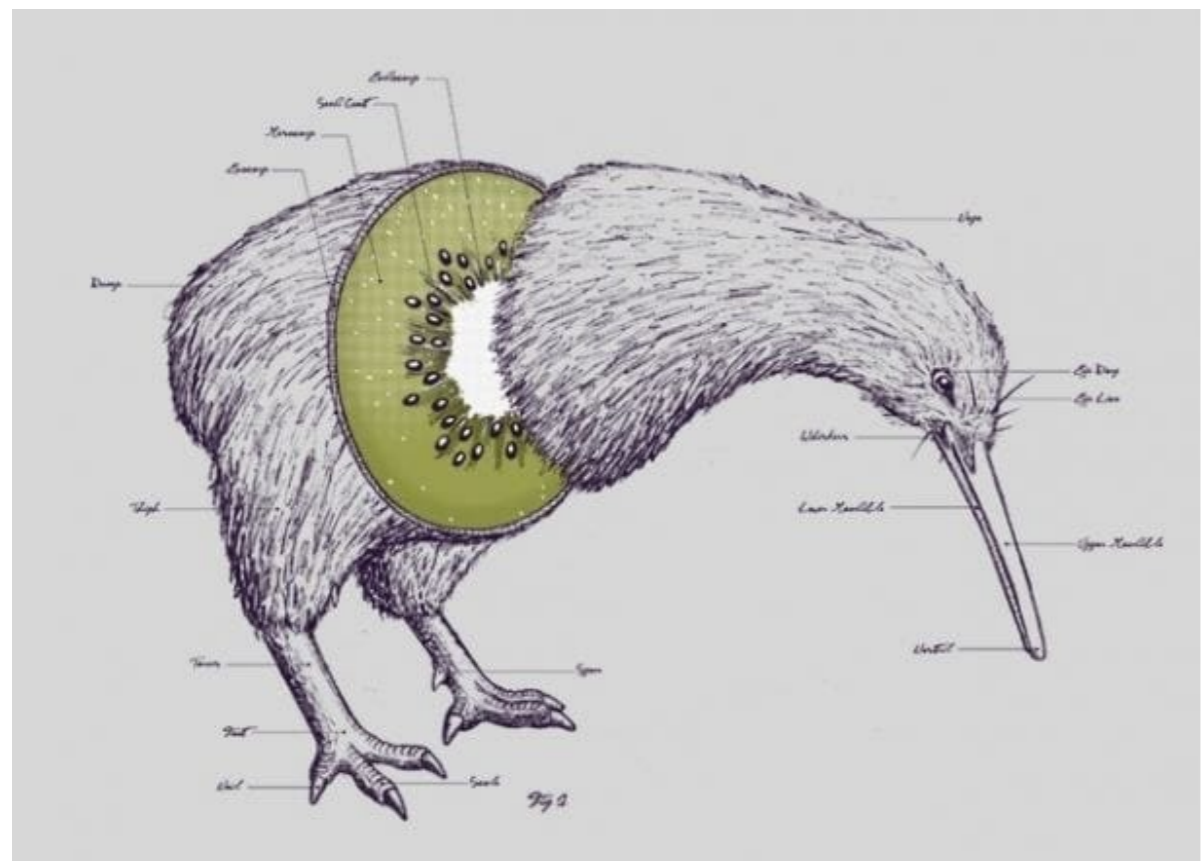
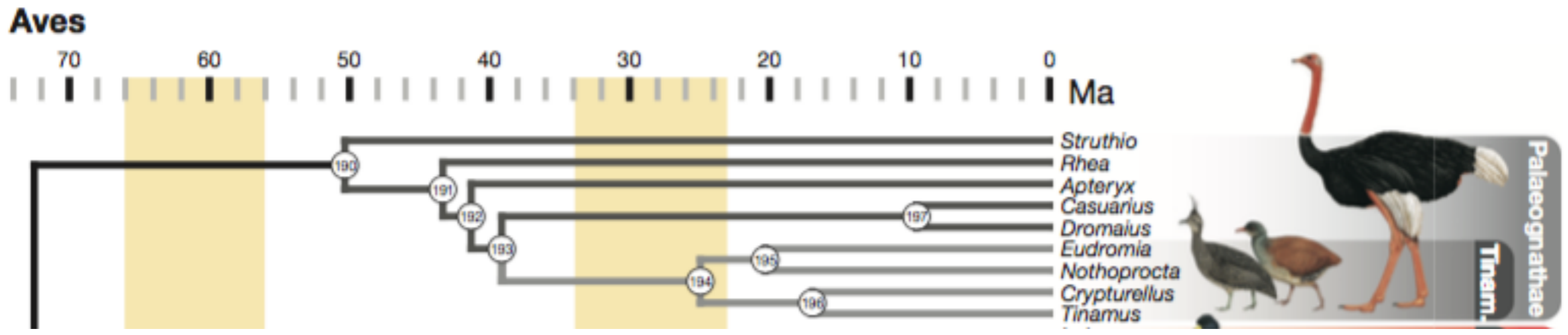
1.381 spp.

**BOLIVIA**

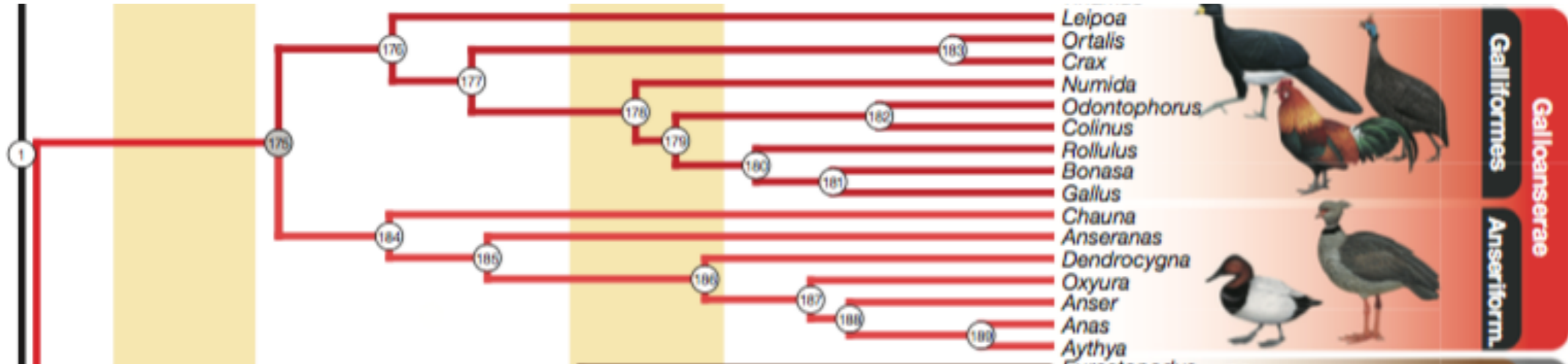
**PARAGUAY**



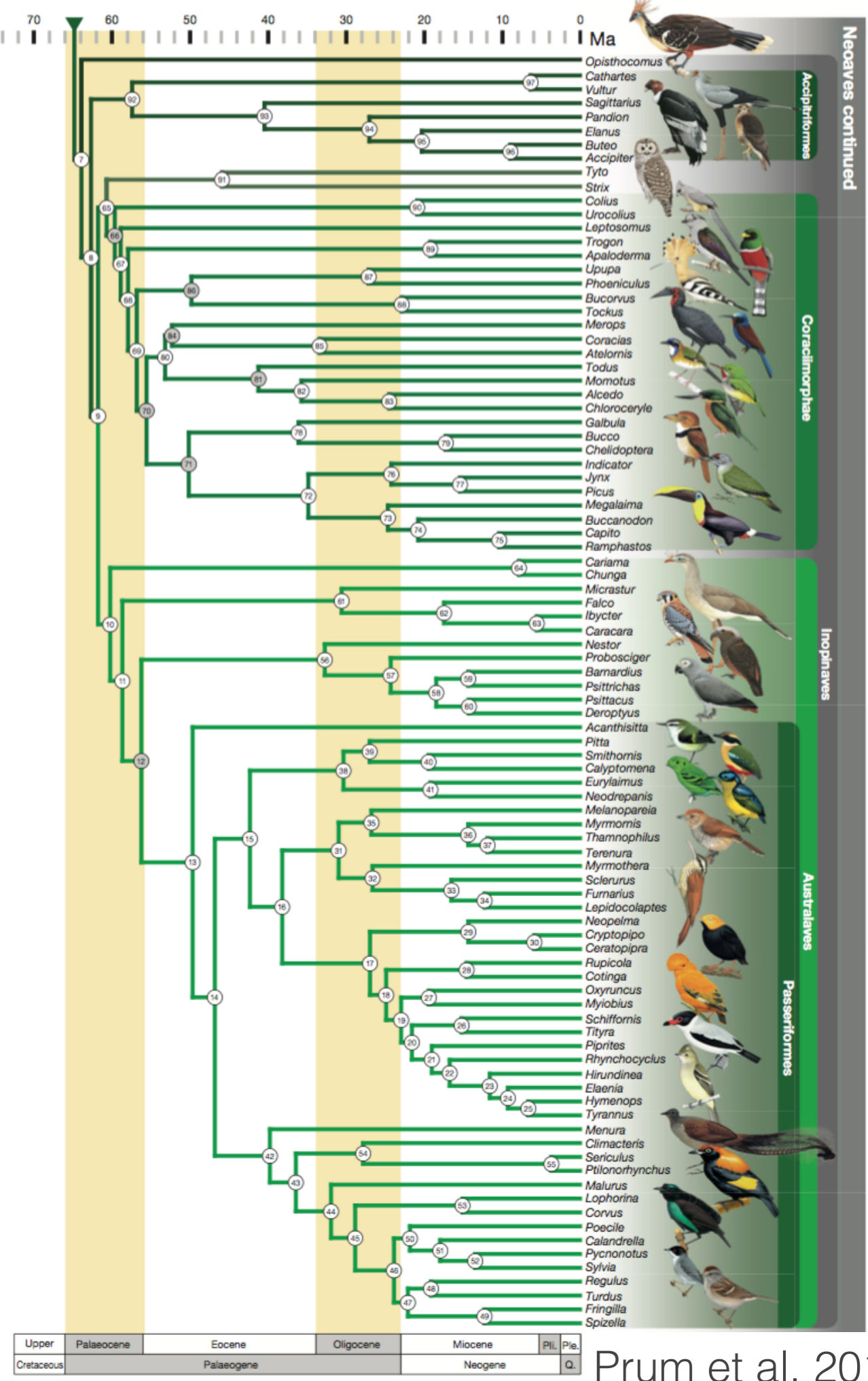
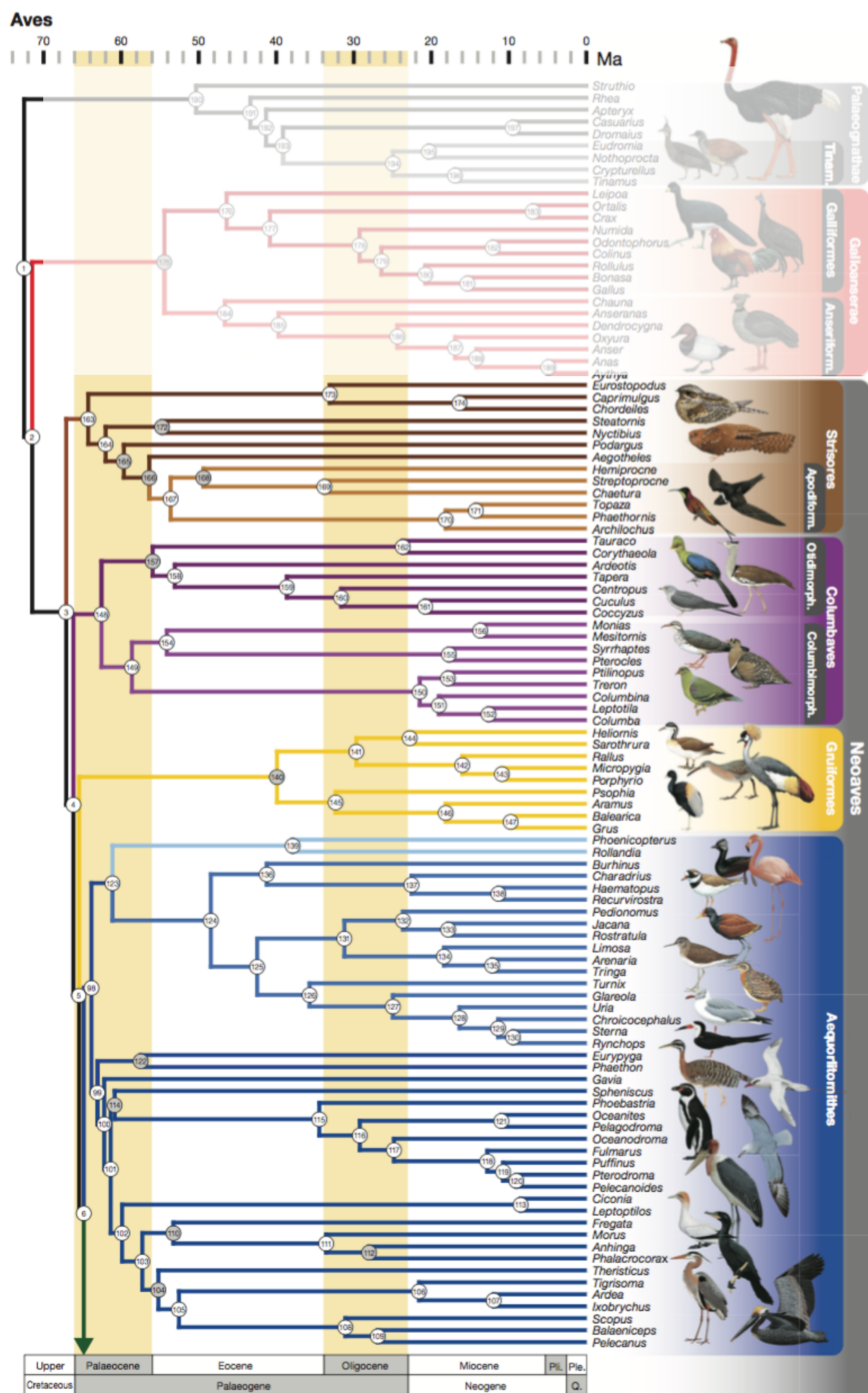




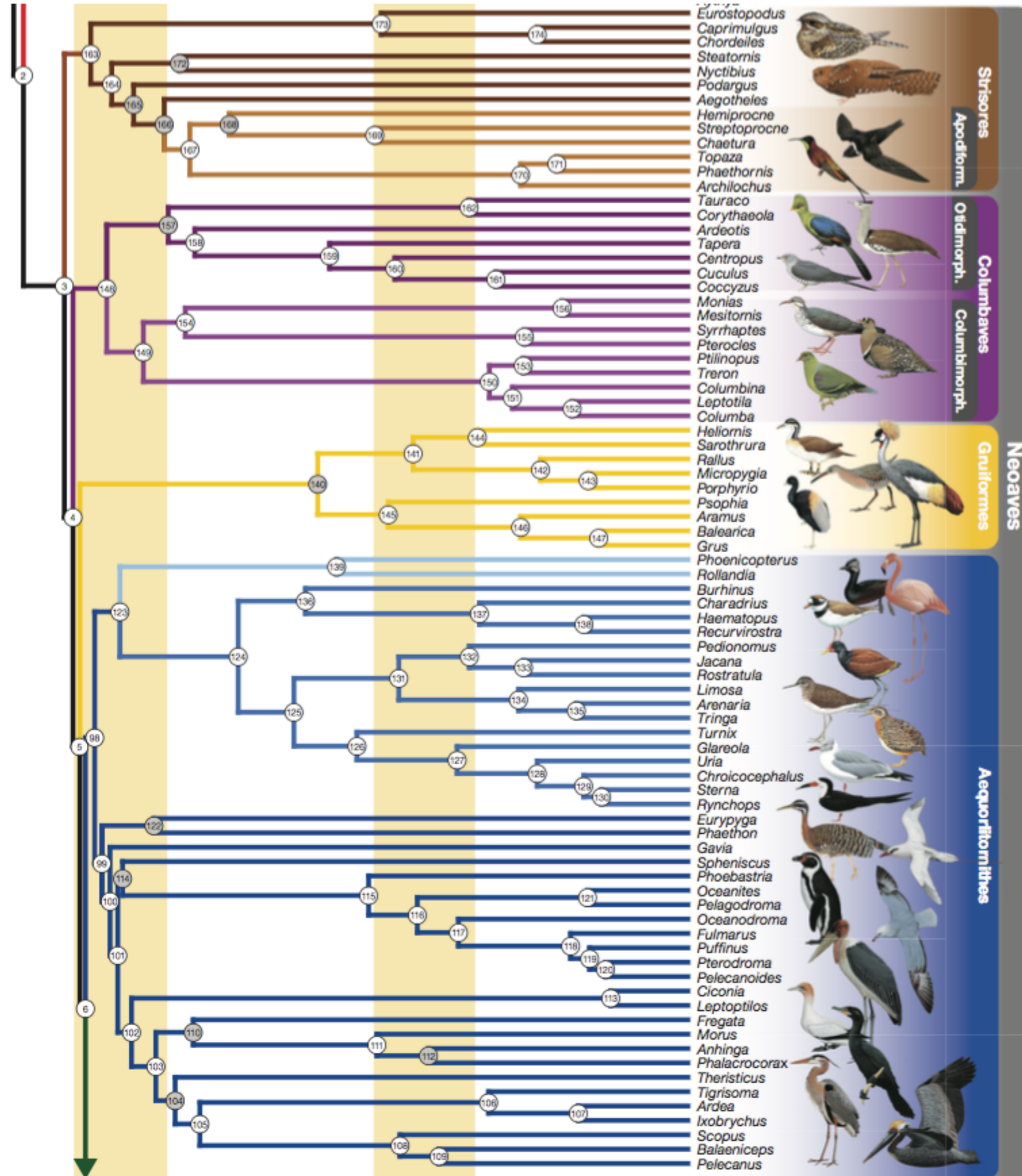








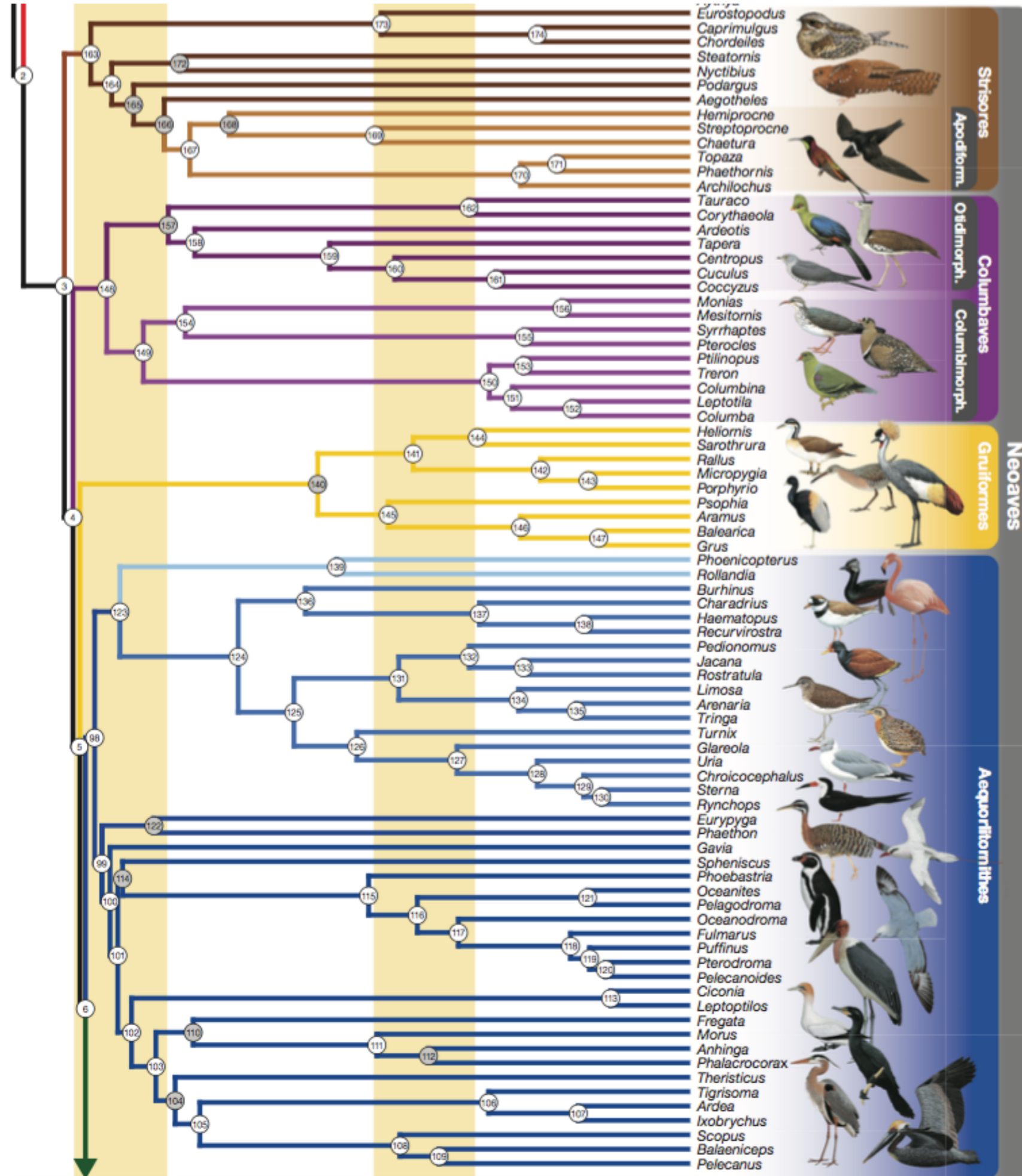
# Strisores (~600 spp)





Strisores (~600 spp)

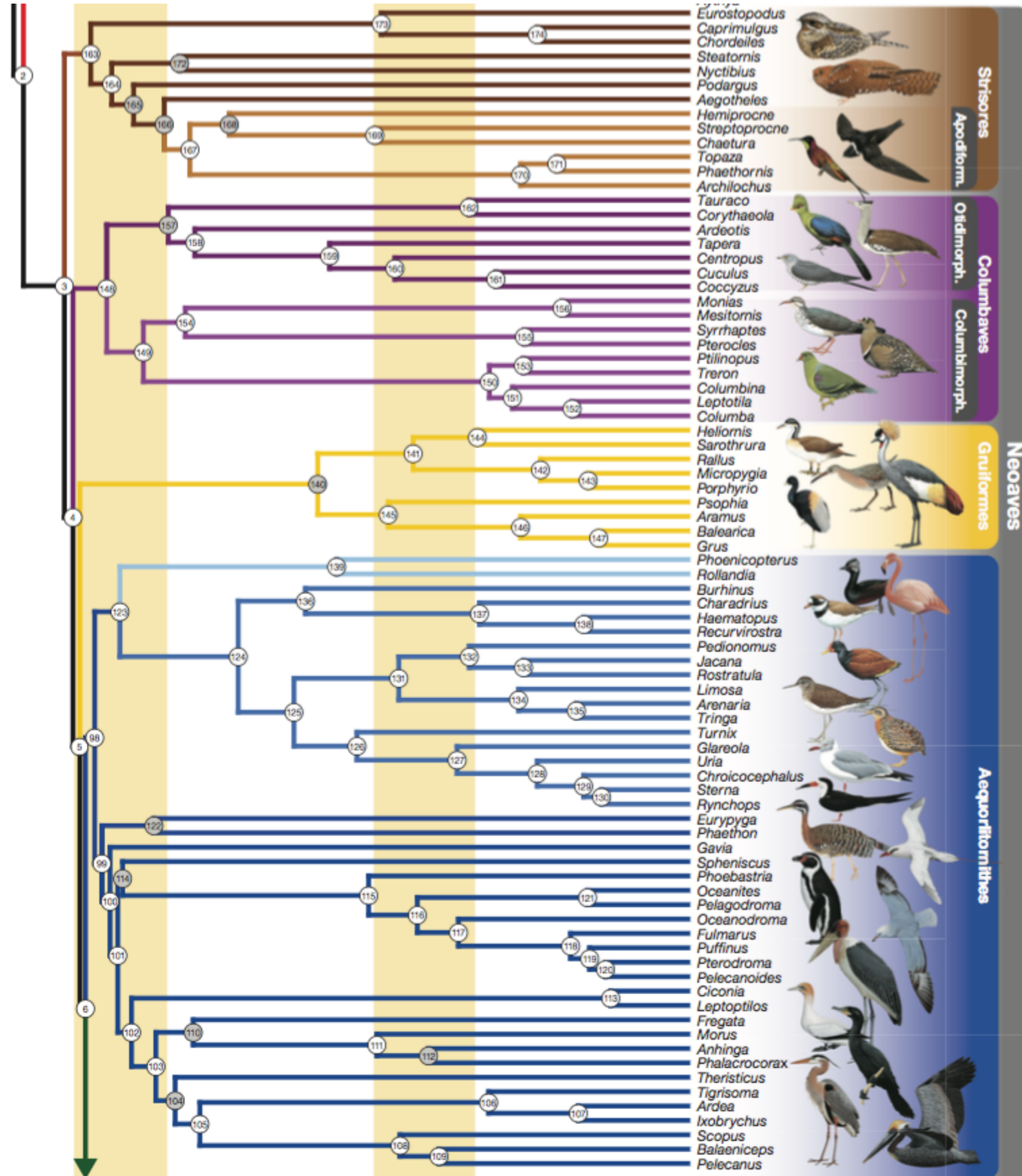
Columbaves (~395 spp)



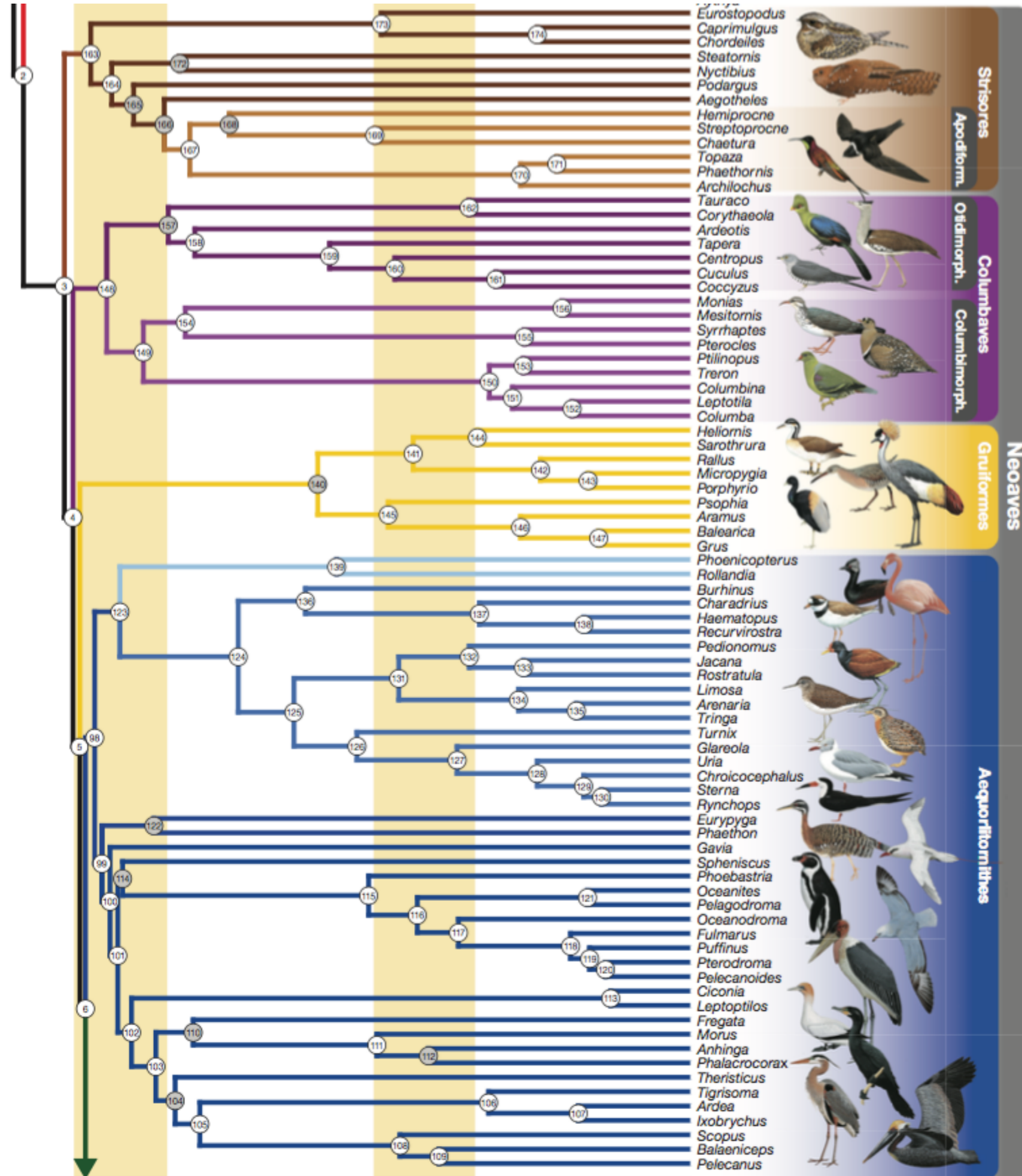
Strisores (~600 spp)

Columbaves (~395 spp)

Gruiformes (~170 spp)





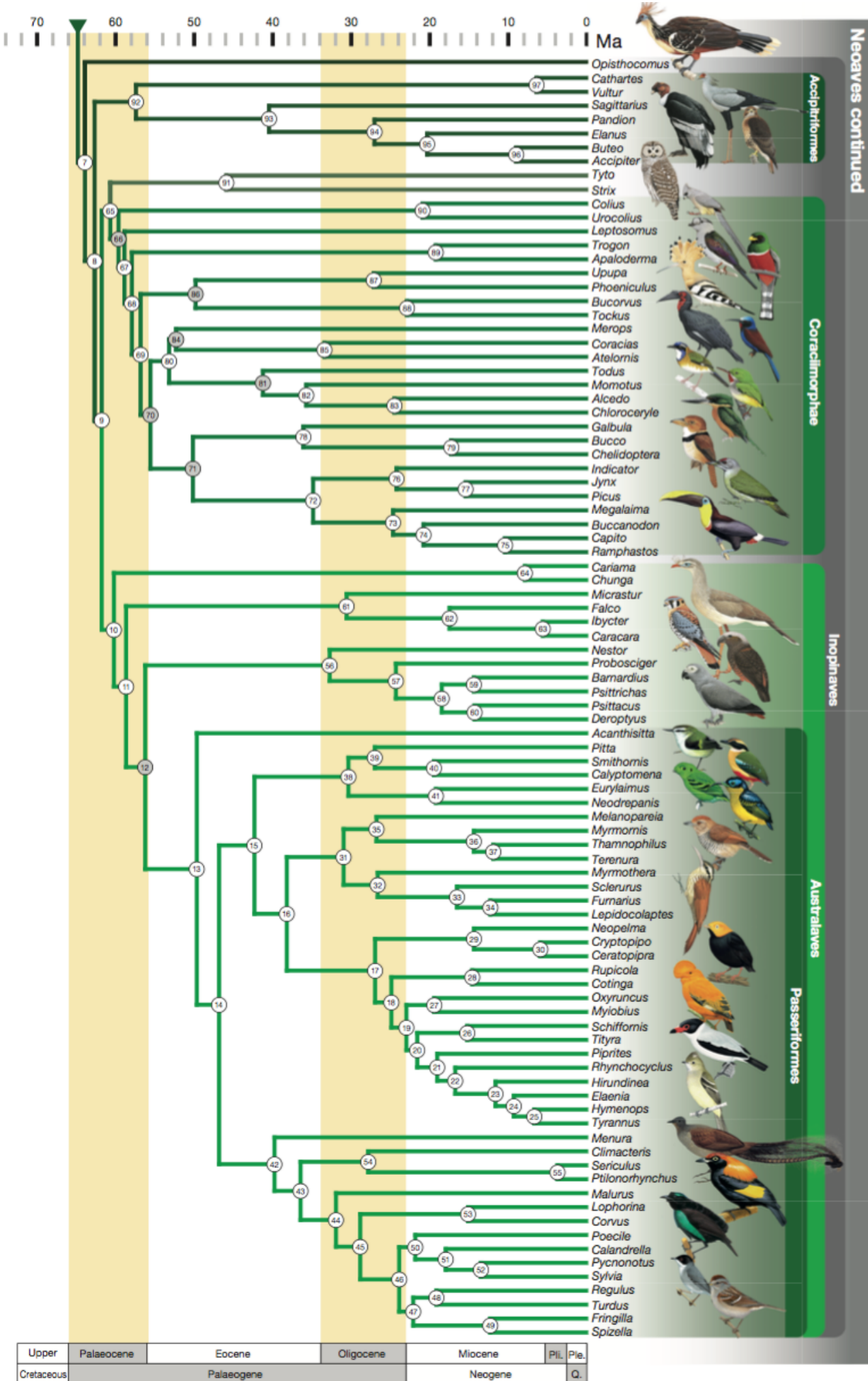


Strisores (~600 spp)

Columbaves (~395 spp)

Gruiformes (~170 spp)

Aequorlithes (~700 spp)

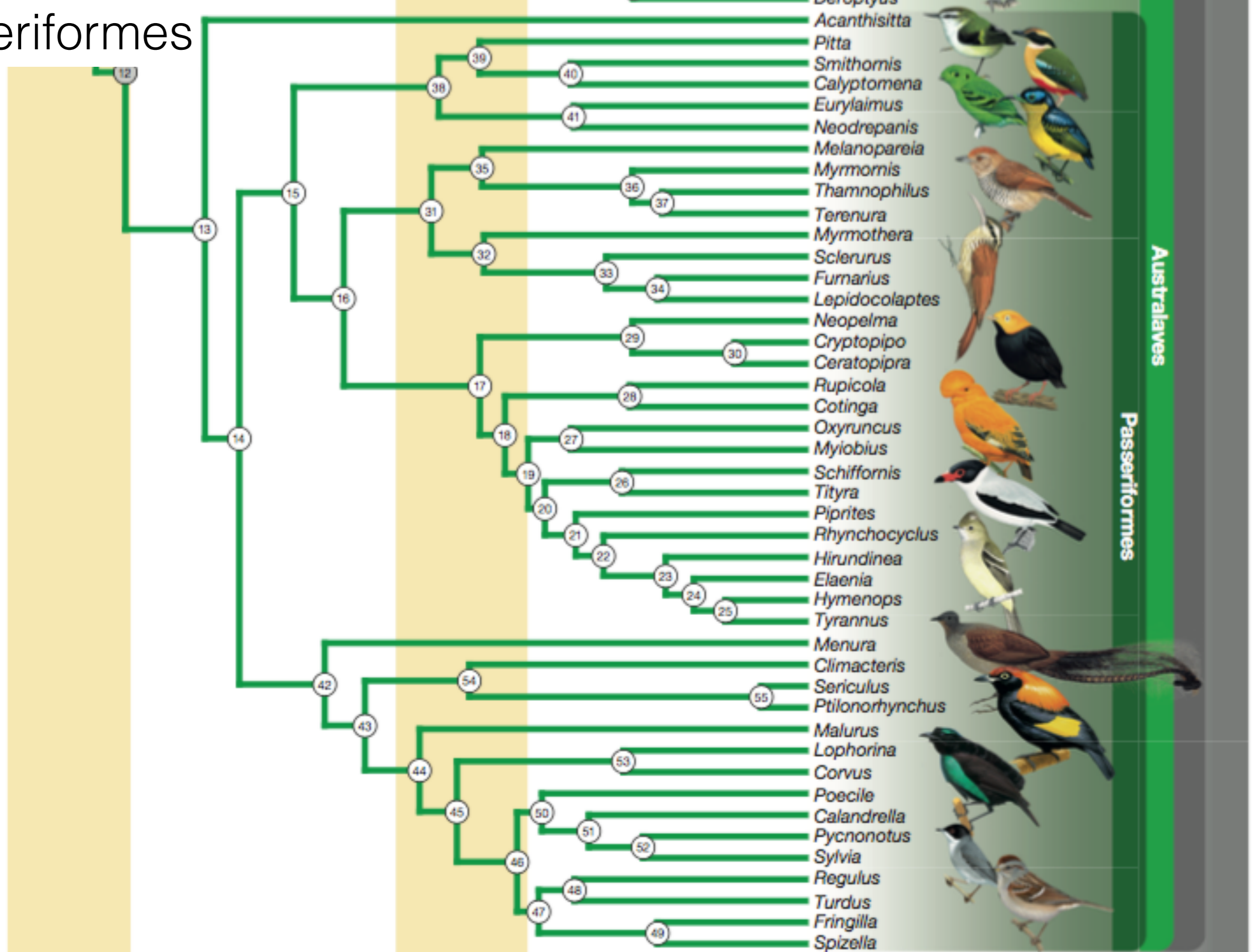


# Telluraves (aves terrestres)





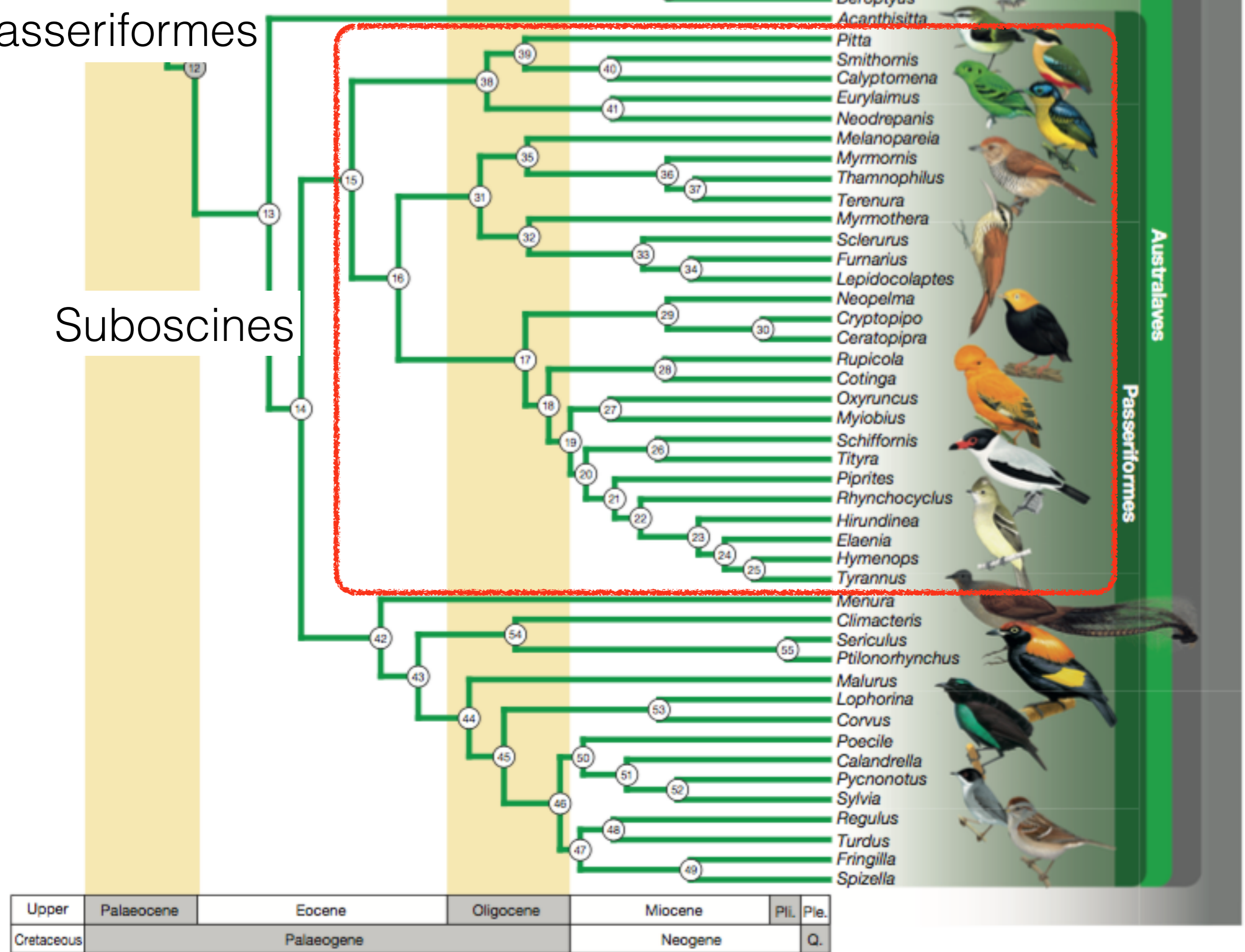
# Passeriformes



Upper	Palaeocene	Eocene	Oligocene	Miocene	Pli.	Ple.
Cretaceous	Palaeogene		Neogene		Q.	

# Passeriformes

## Suboscines

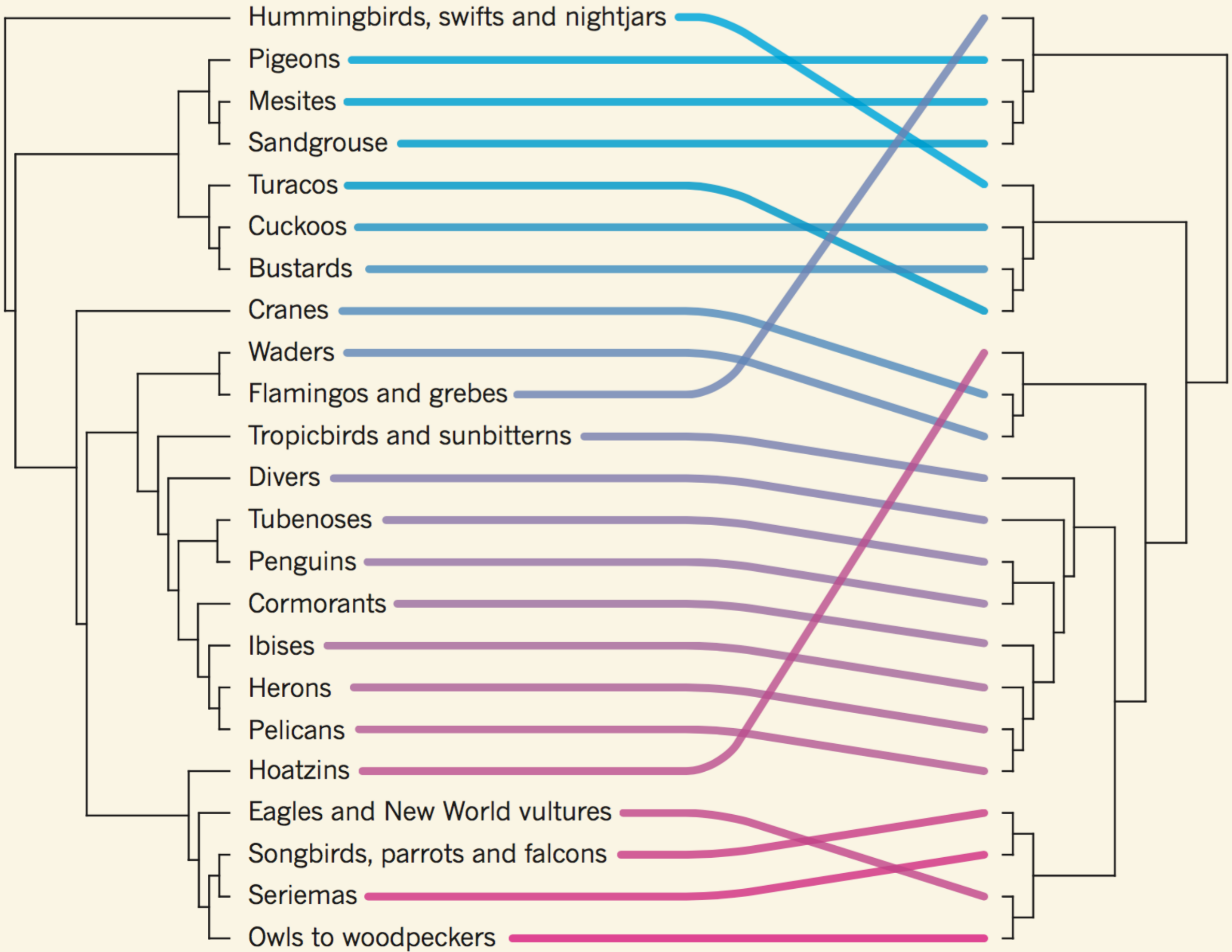




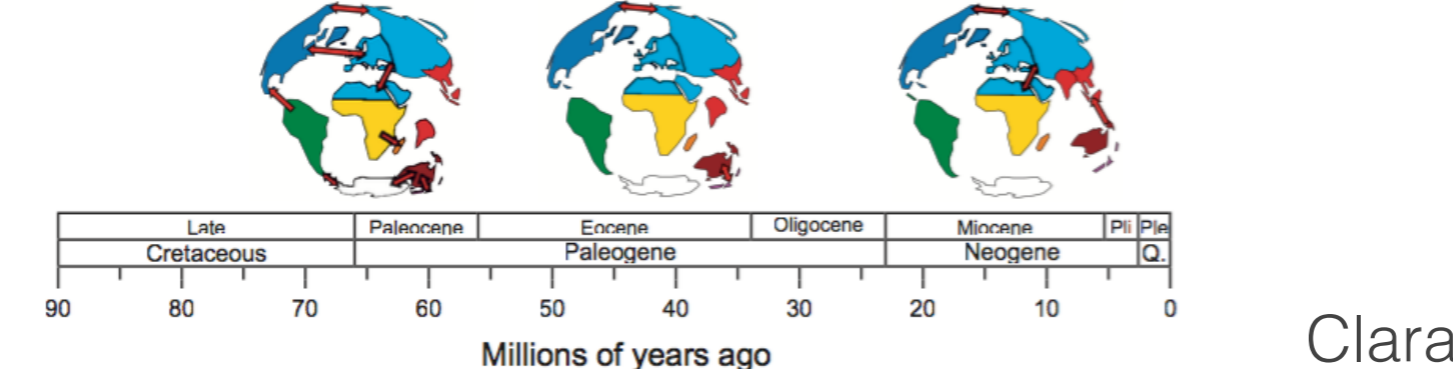
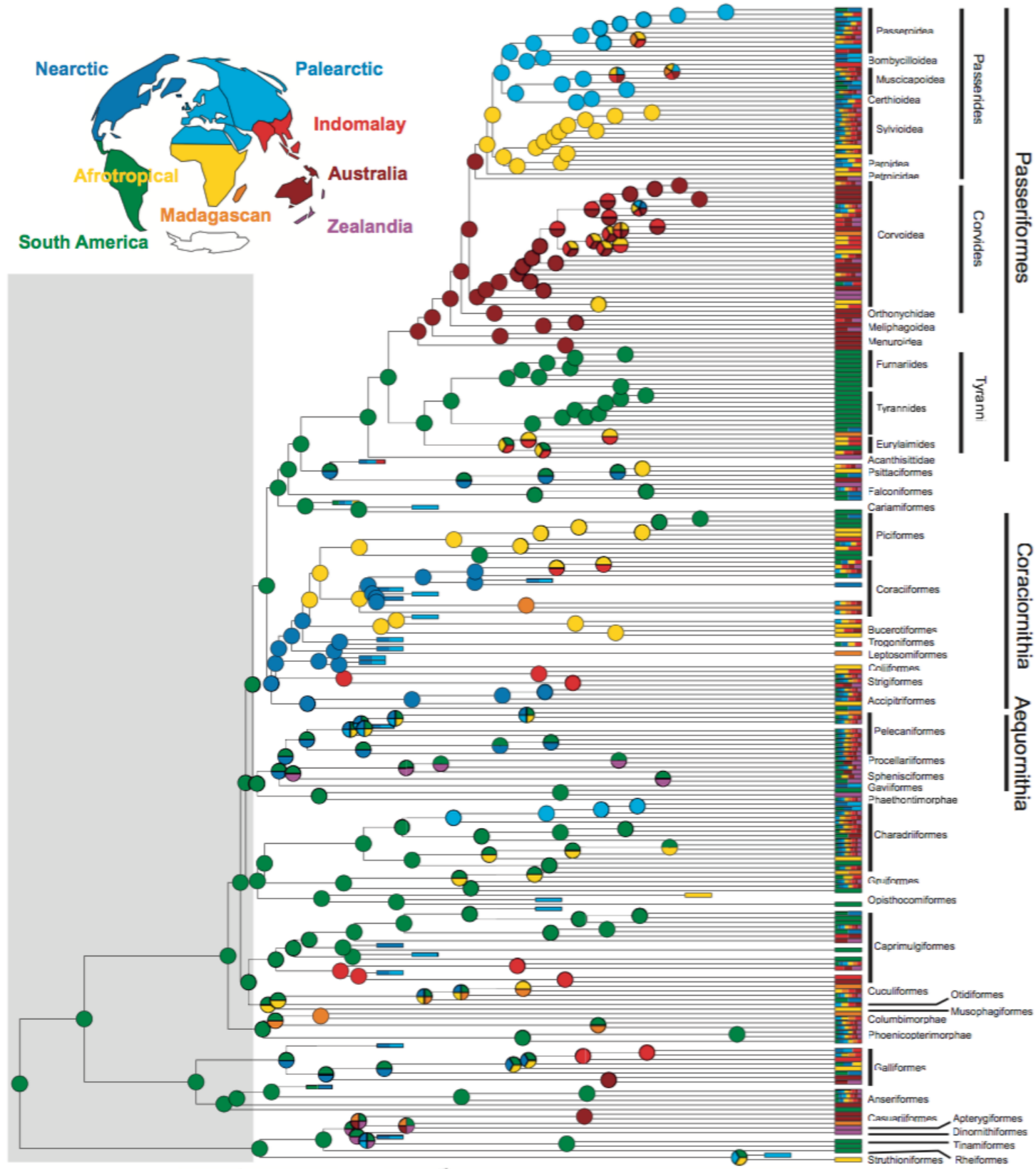


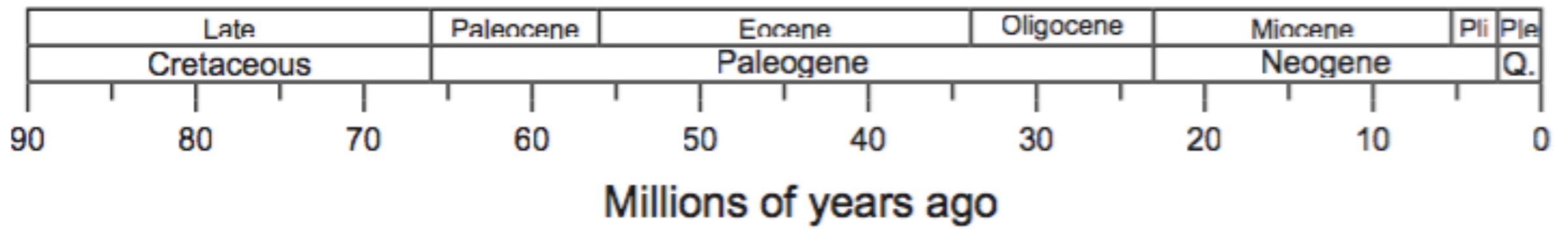
**Prum et al.**

**Jarvis et al.**













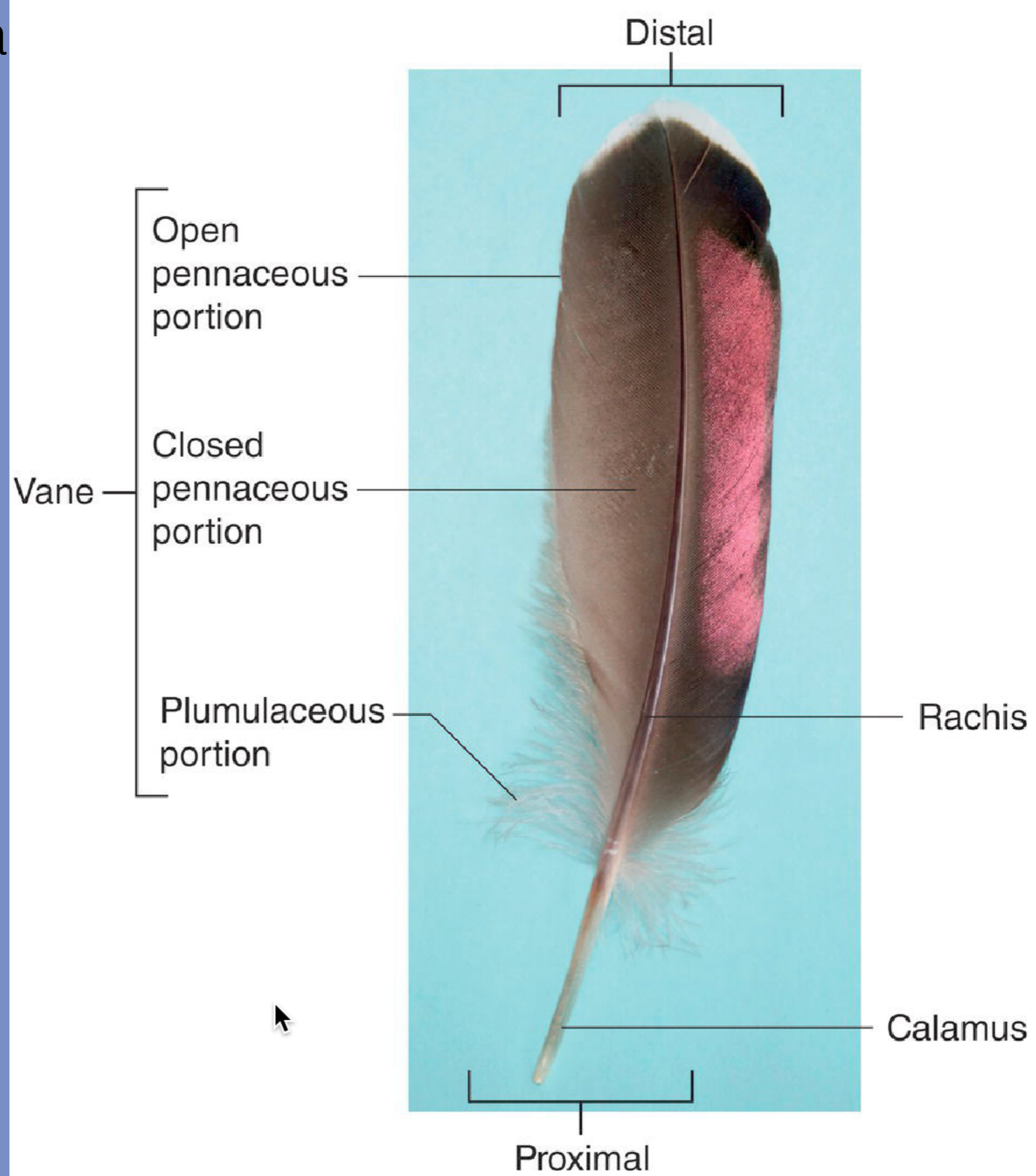


Corpo otimizado para o voo

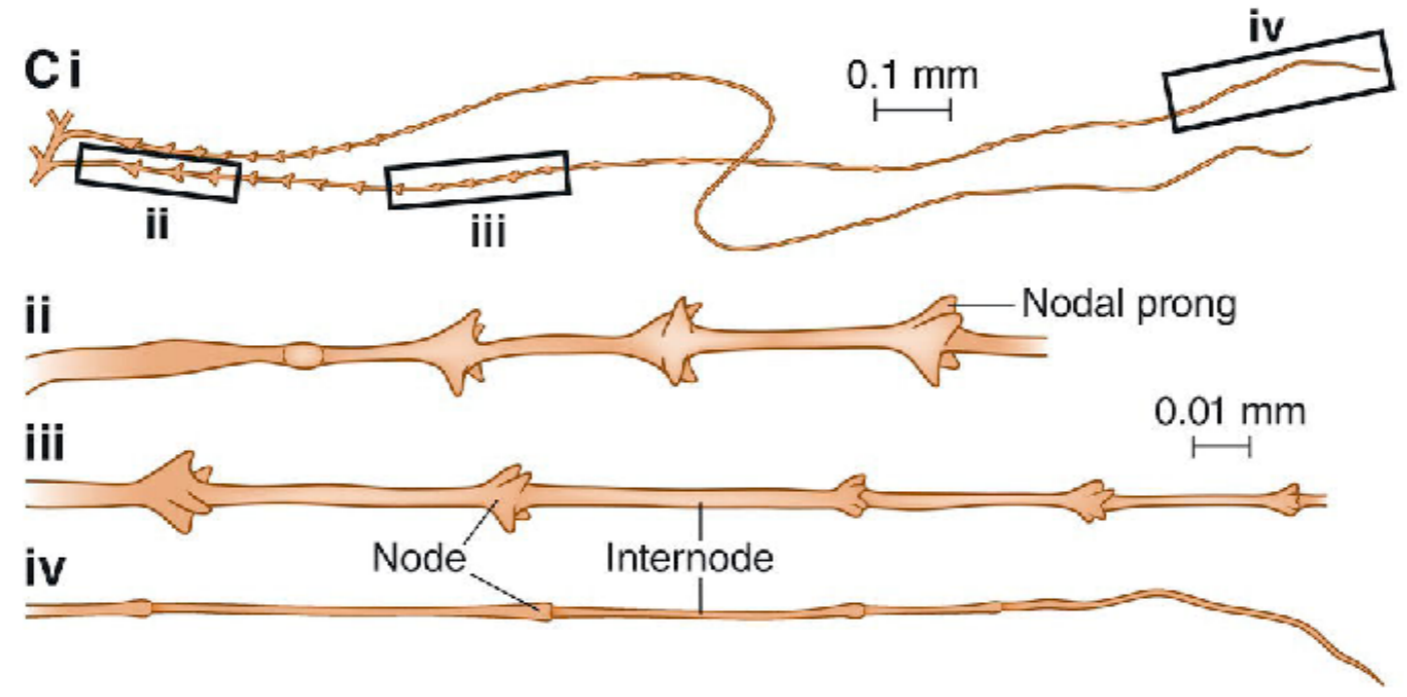
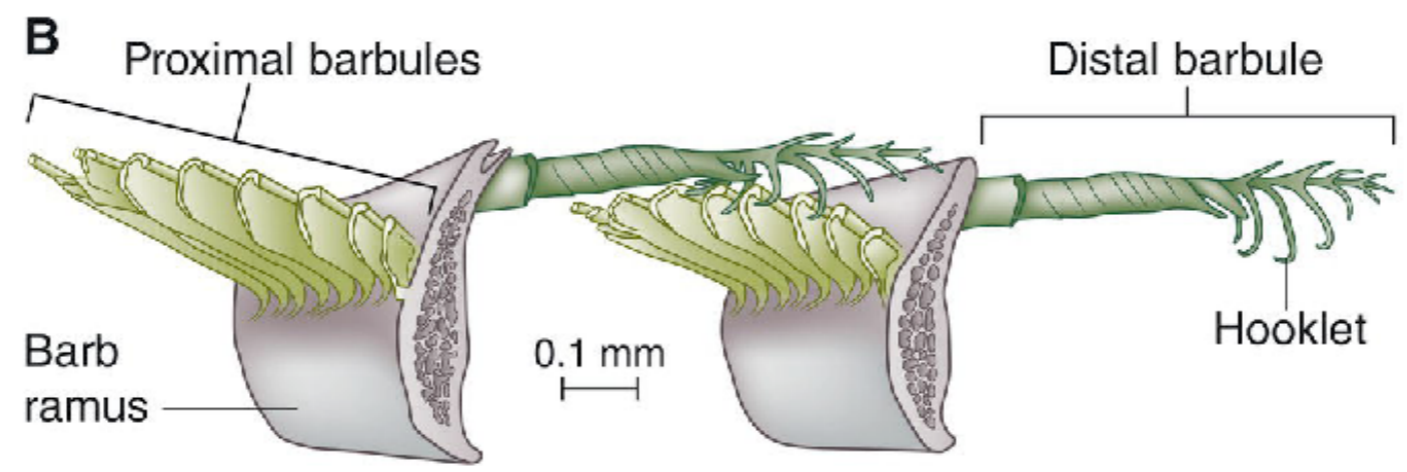
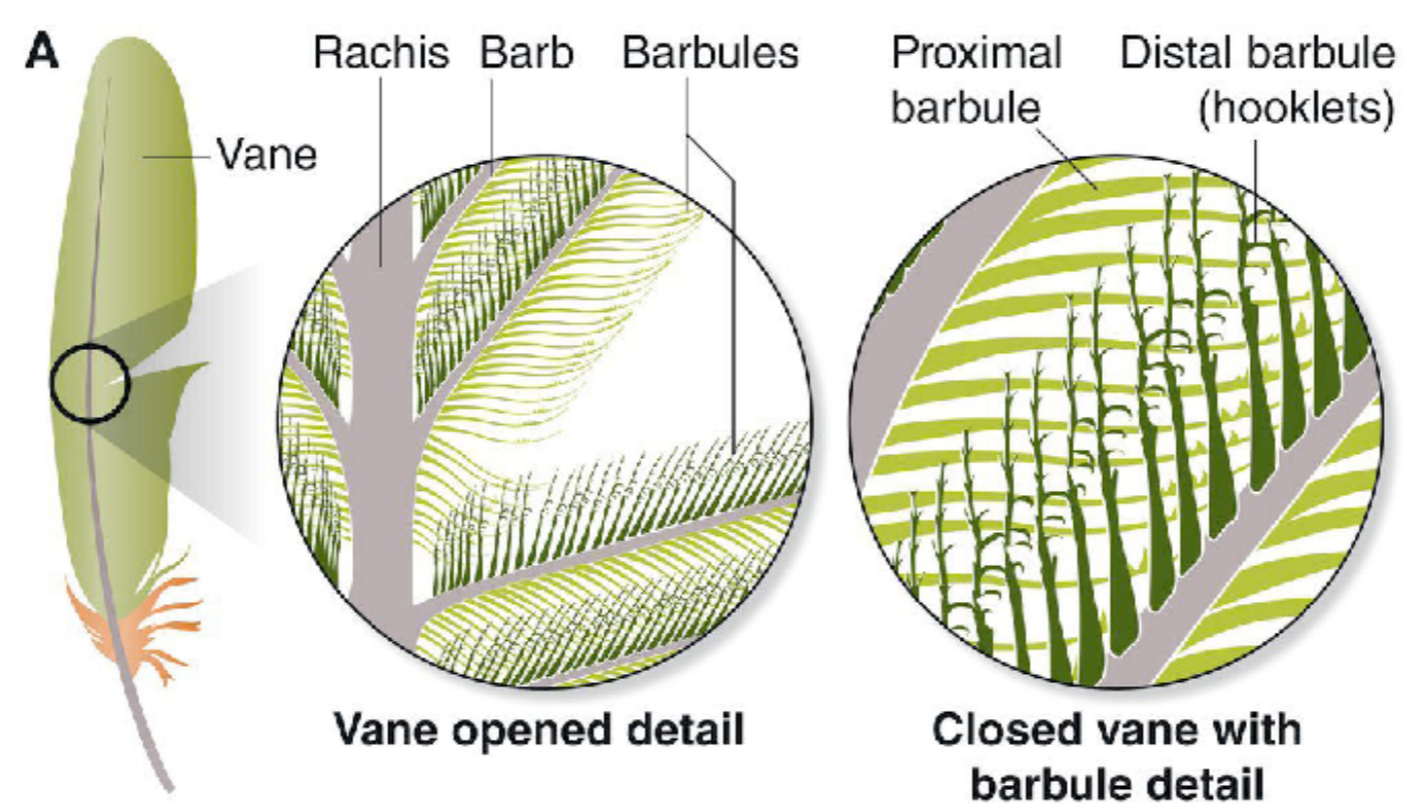
*Falco peregrinus*



# Pena/estrutura

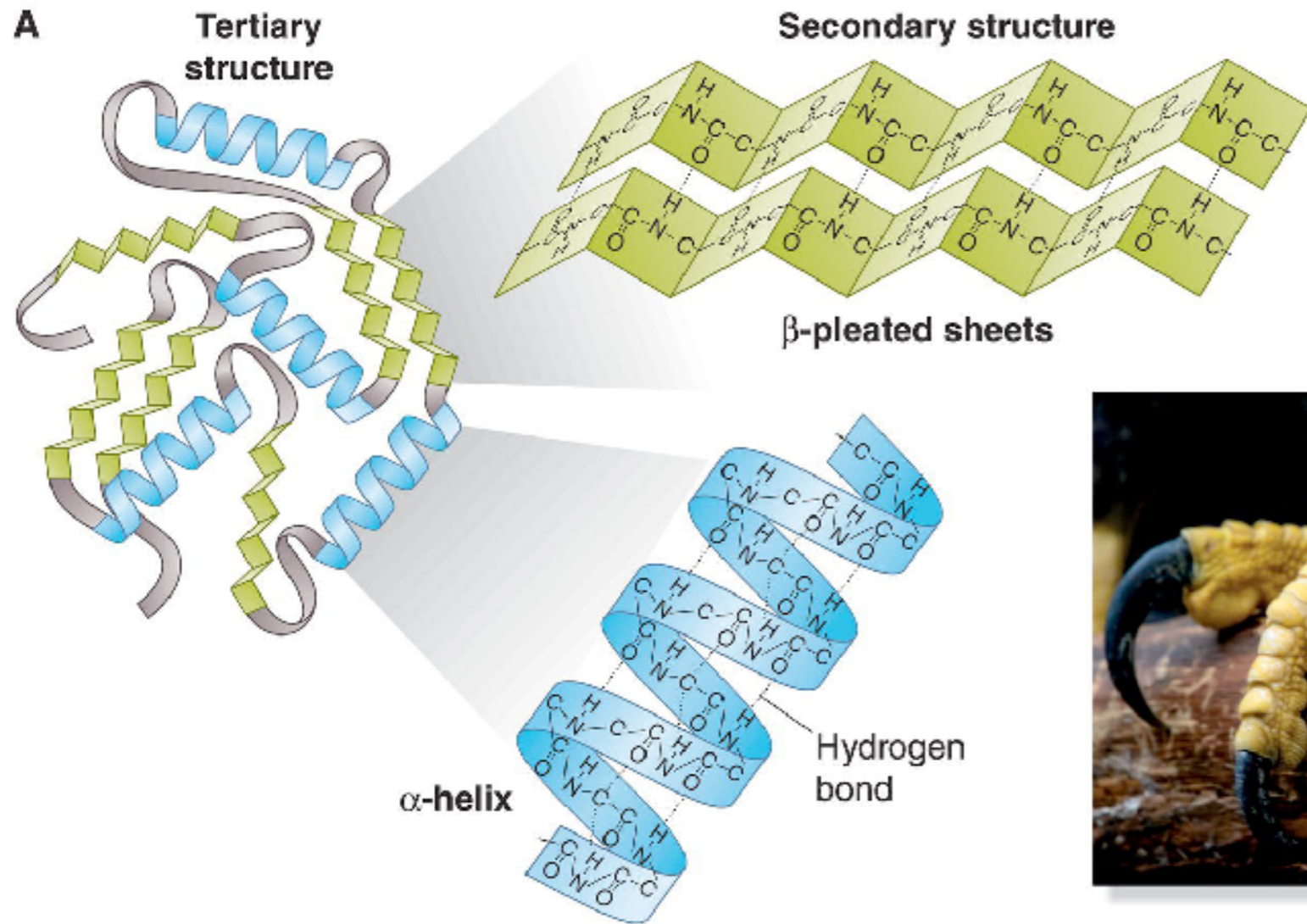


# Pena/estrutura





# Queratina

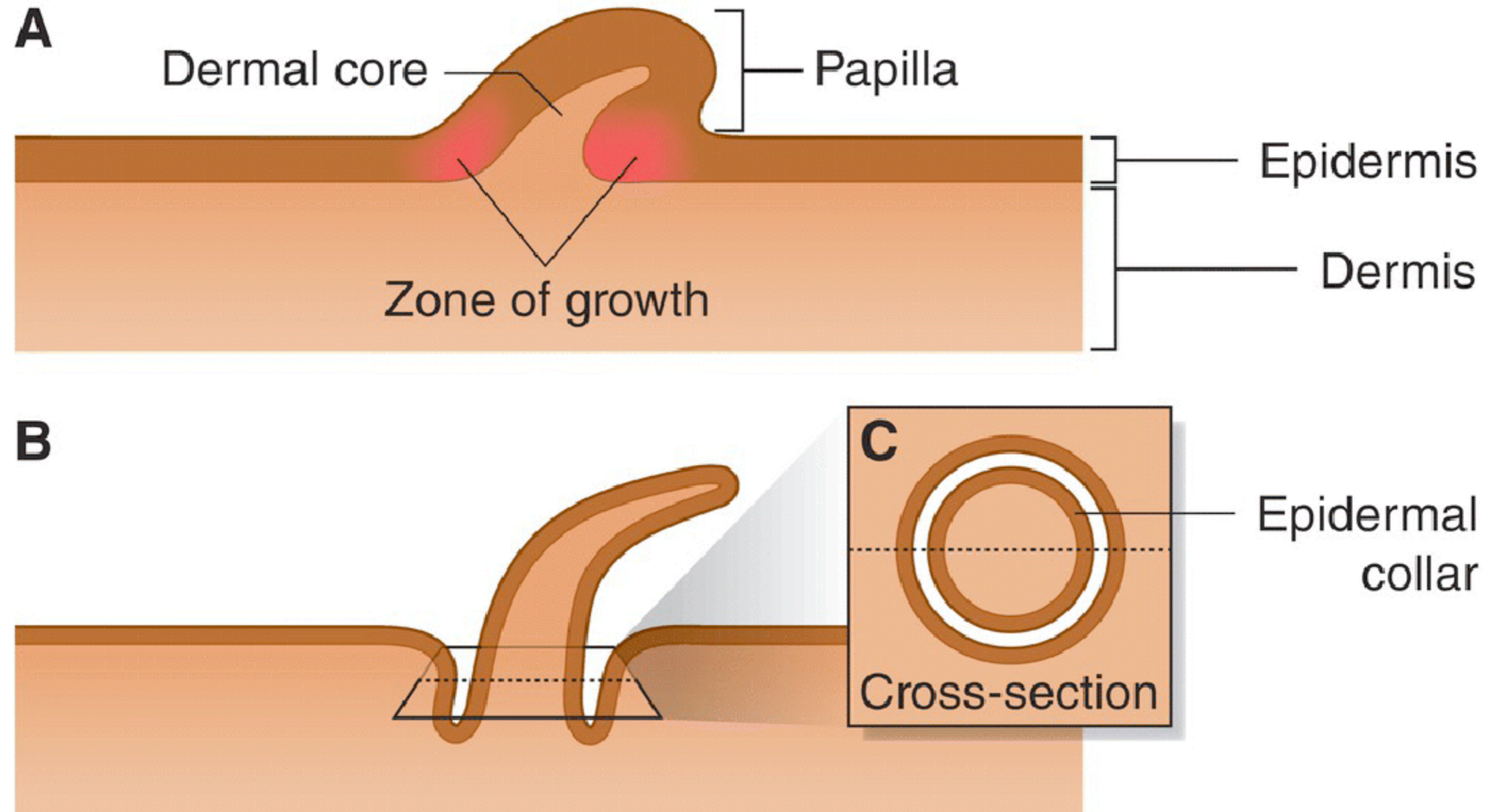


# Desenvolvimento

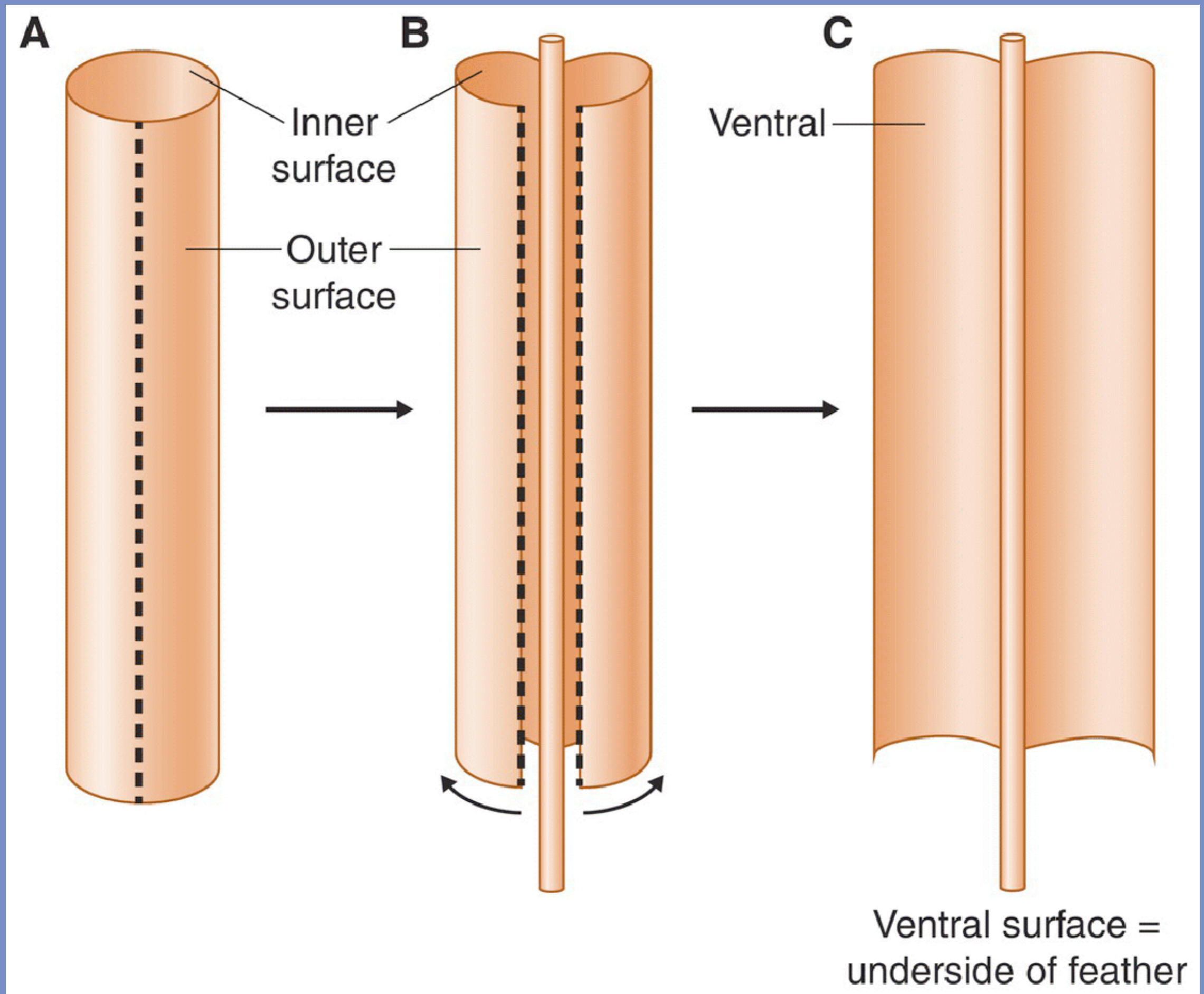




# Desenvolvimento/anatomia folículo

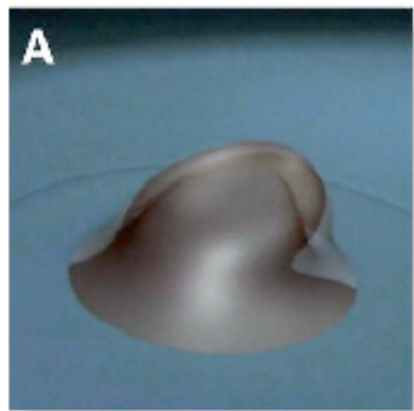


# Desenvolvimento/anatomia folículo

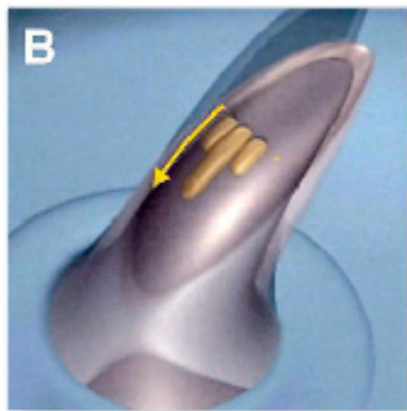




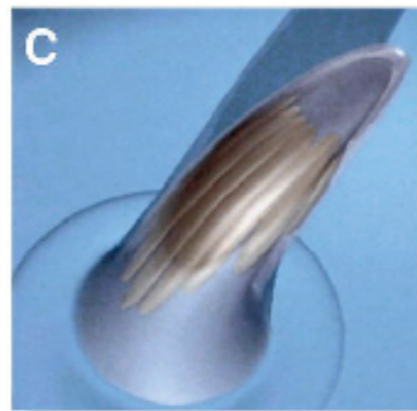
# Desenvolvimento/anatomia folículo



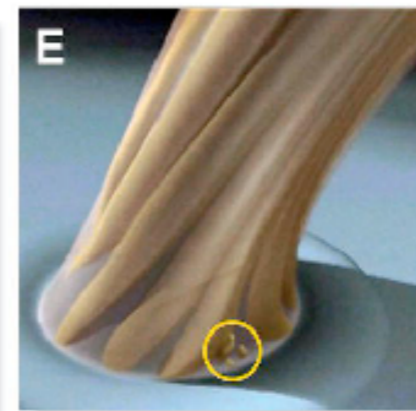
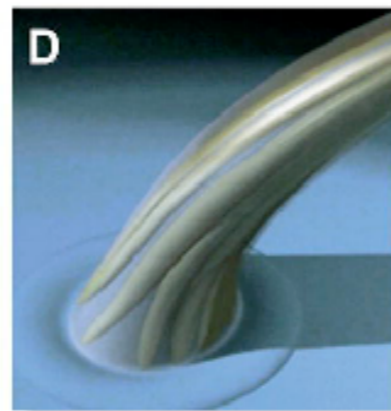
A  
Placode



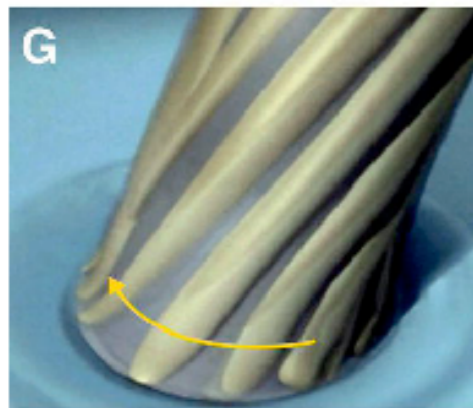
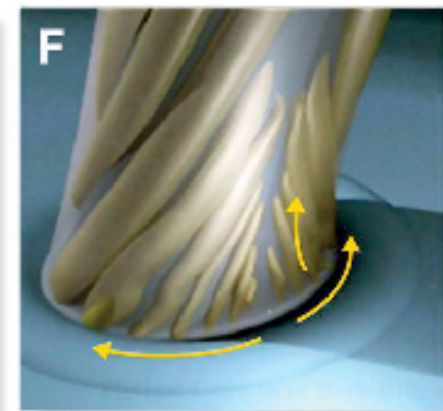
B  
Barb ridges initiate  
in epidermal collar



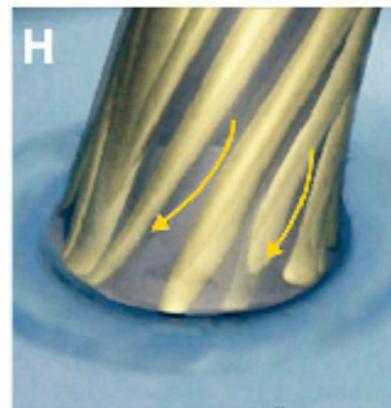
C  
Barb ridges grow to epidermal collar



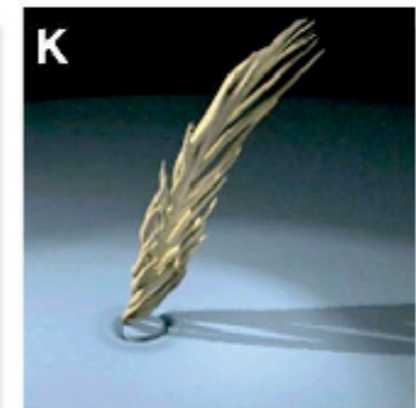
E  
Ventral barb ridge formation



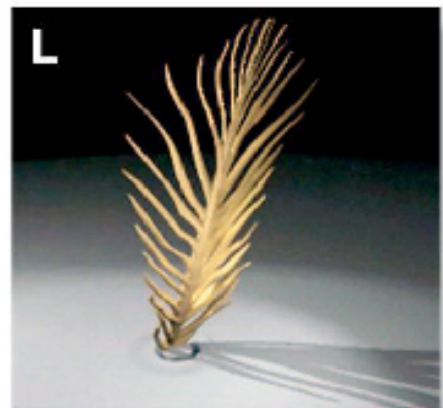
G  
Helical growth of barb ridges end with rachis fusion



J  
Sheath degenerates

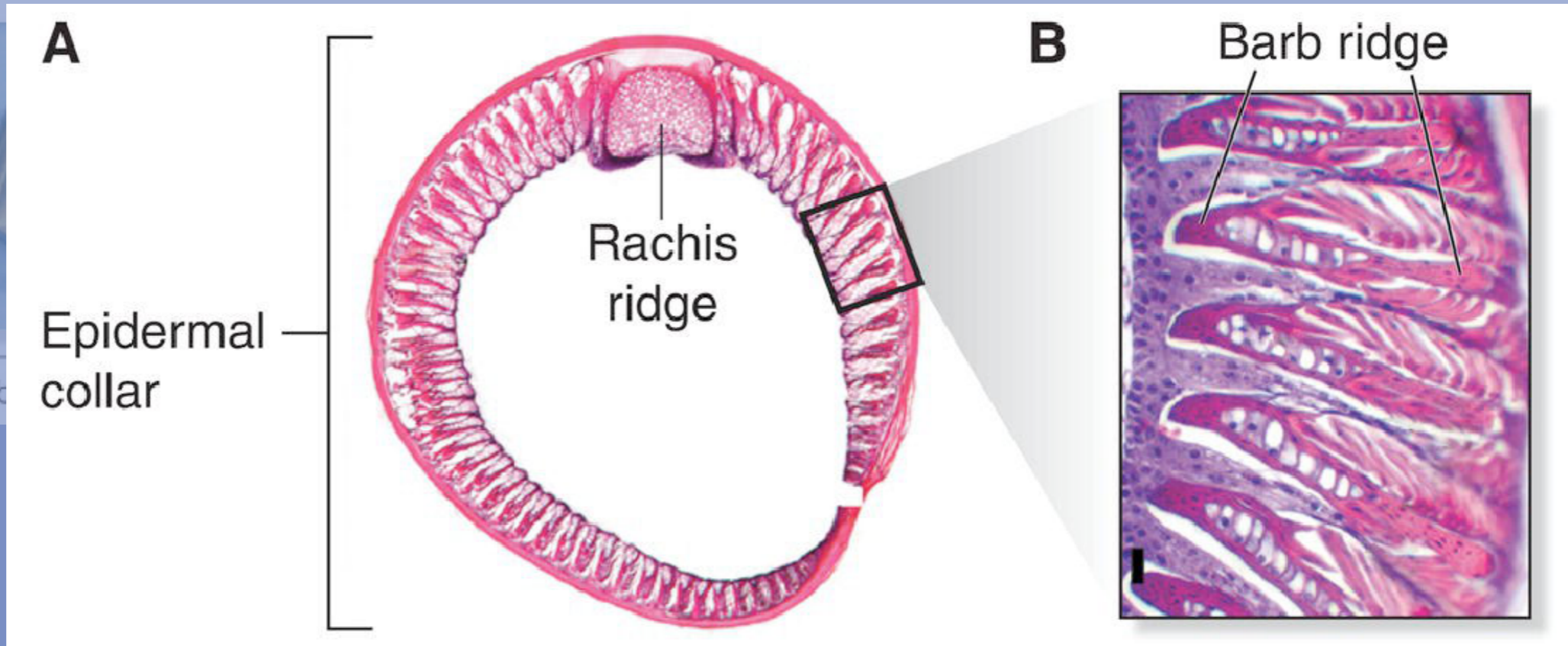
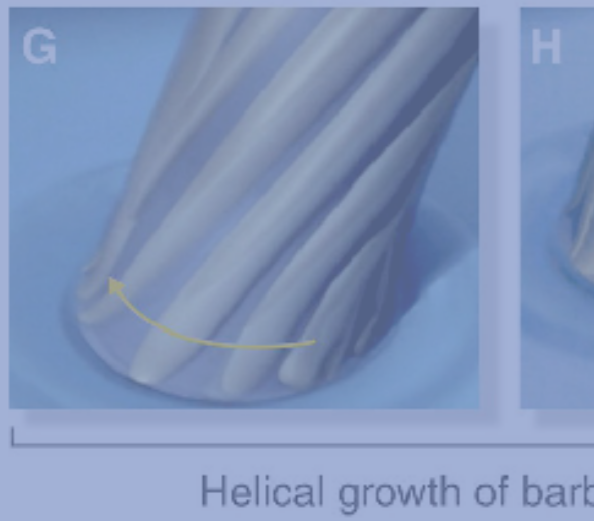
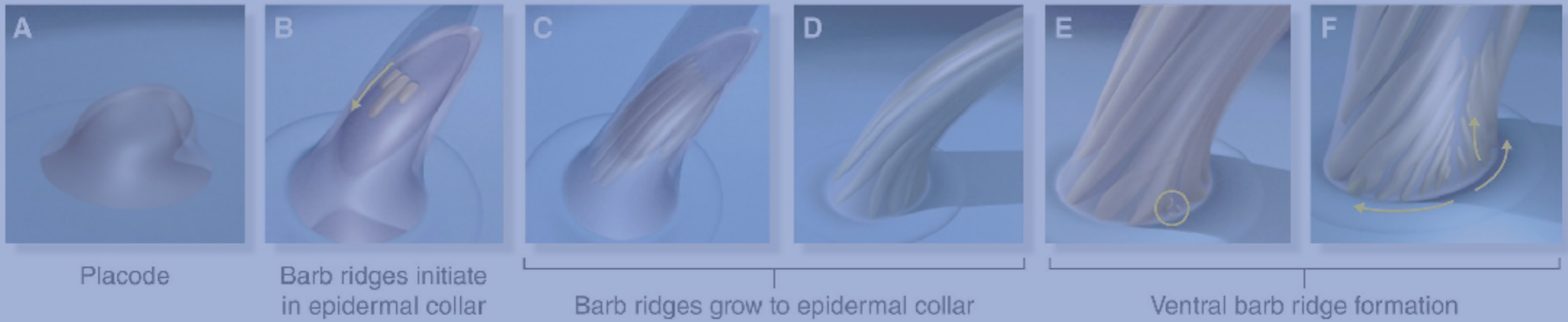


K  
Feather unfurls



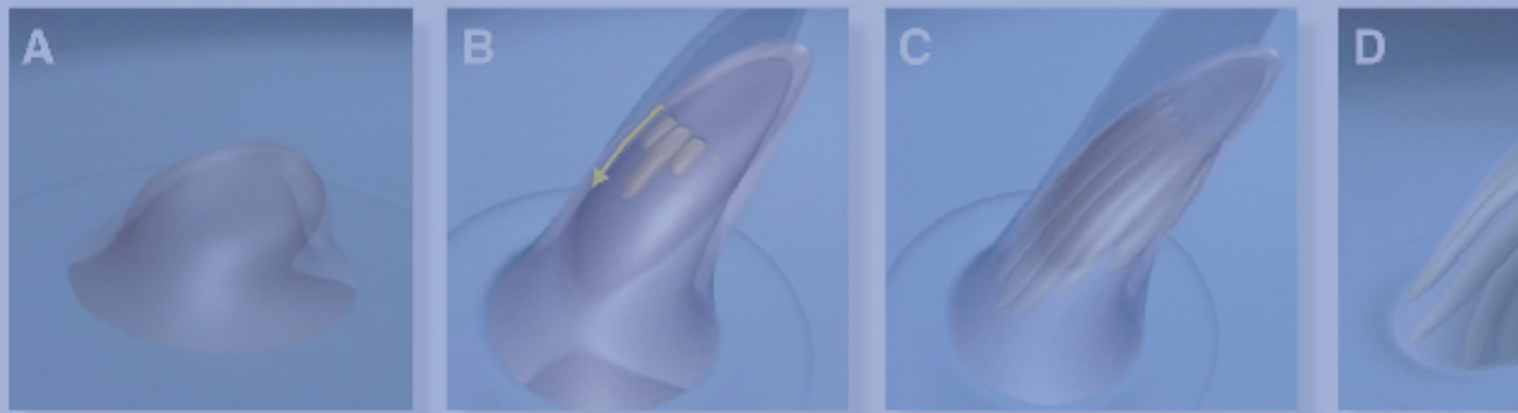


# Desenvolvimento/anatomia folículo





# Desenvolvimento/anatomia folículo



Placode

Barb ridges initiate in epidermal collar

Barb ridges grow to epidermal collar



Helical growth of barb ridges and with rachis fusion

Epidermal collar

Rachis ridge

Sheath

## Relative timing of feather formation

Earlier



Barb

Isochronic growth plate

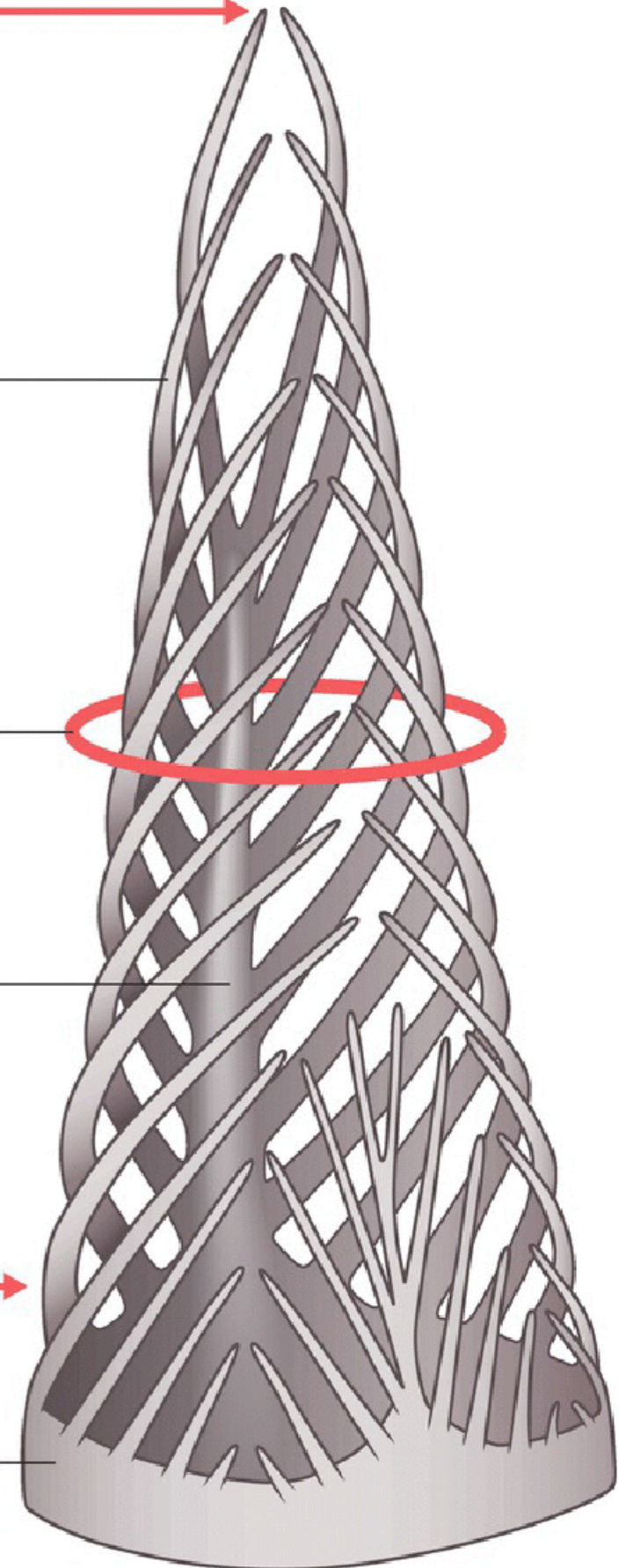


Rachis

Later



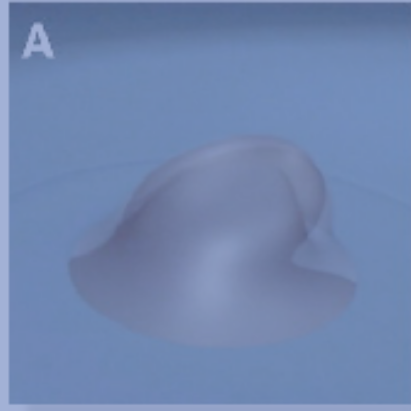
Epidermal collar



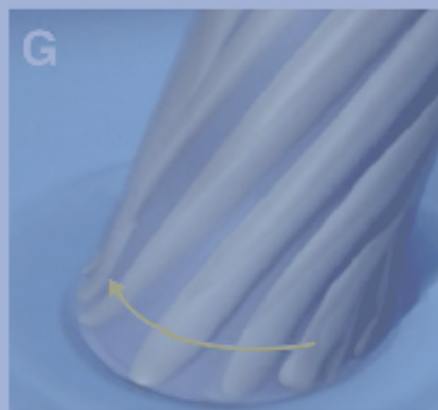


# Desenvolvimento/anatomia folículo

Relative timing of feather formation



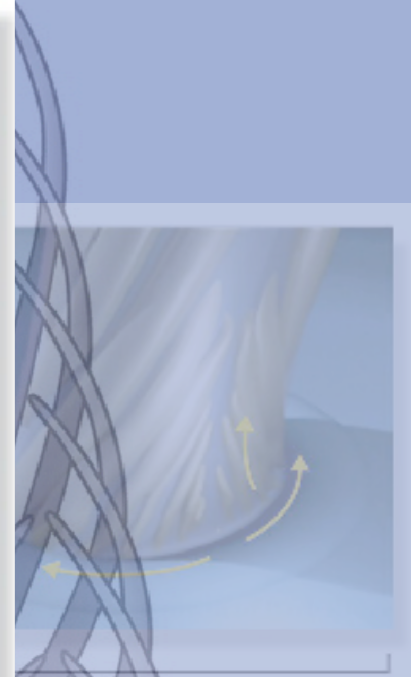
Placode



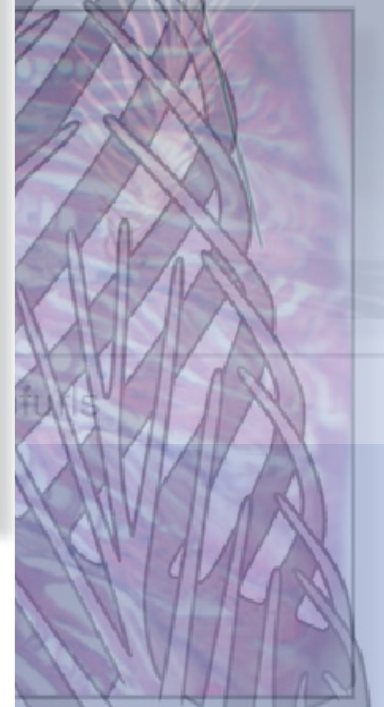
Helical growth

Emerging feather

Sheath (waxy coat around new feather)



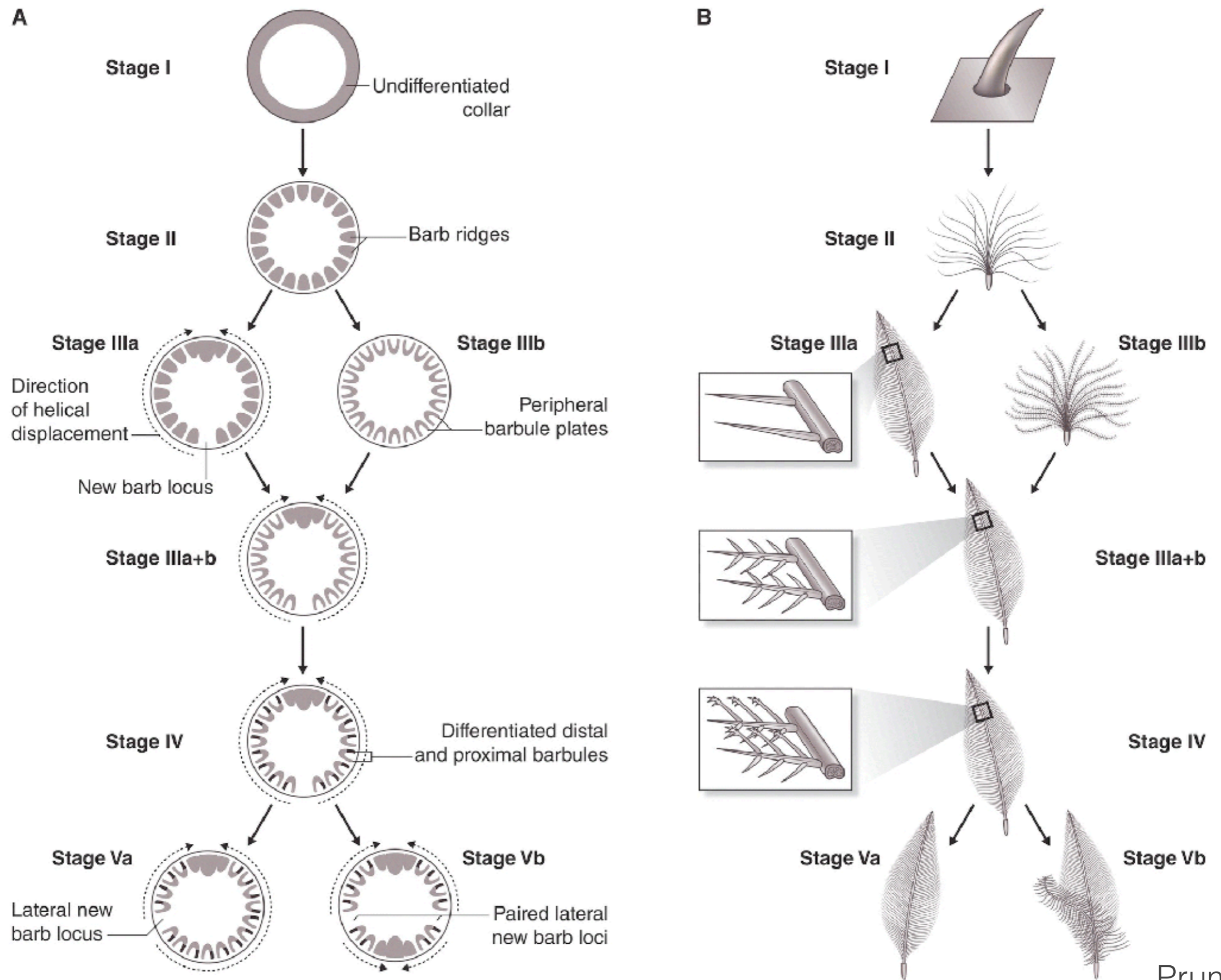
Feather formation  
Vascular ridge



Epidermal collar



# Um cenário para a evolução das penas



# Tipos de penas

A



Rectriz



Rêmige



Semipluma



Contorno  
(tectriz)



Pluma



Filopluma



Cerda

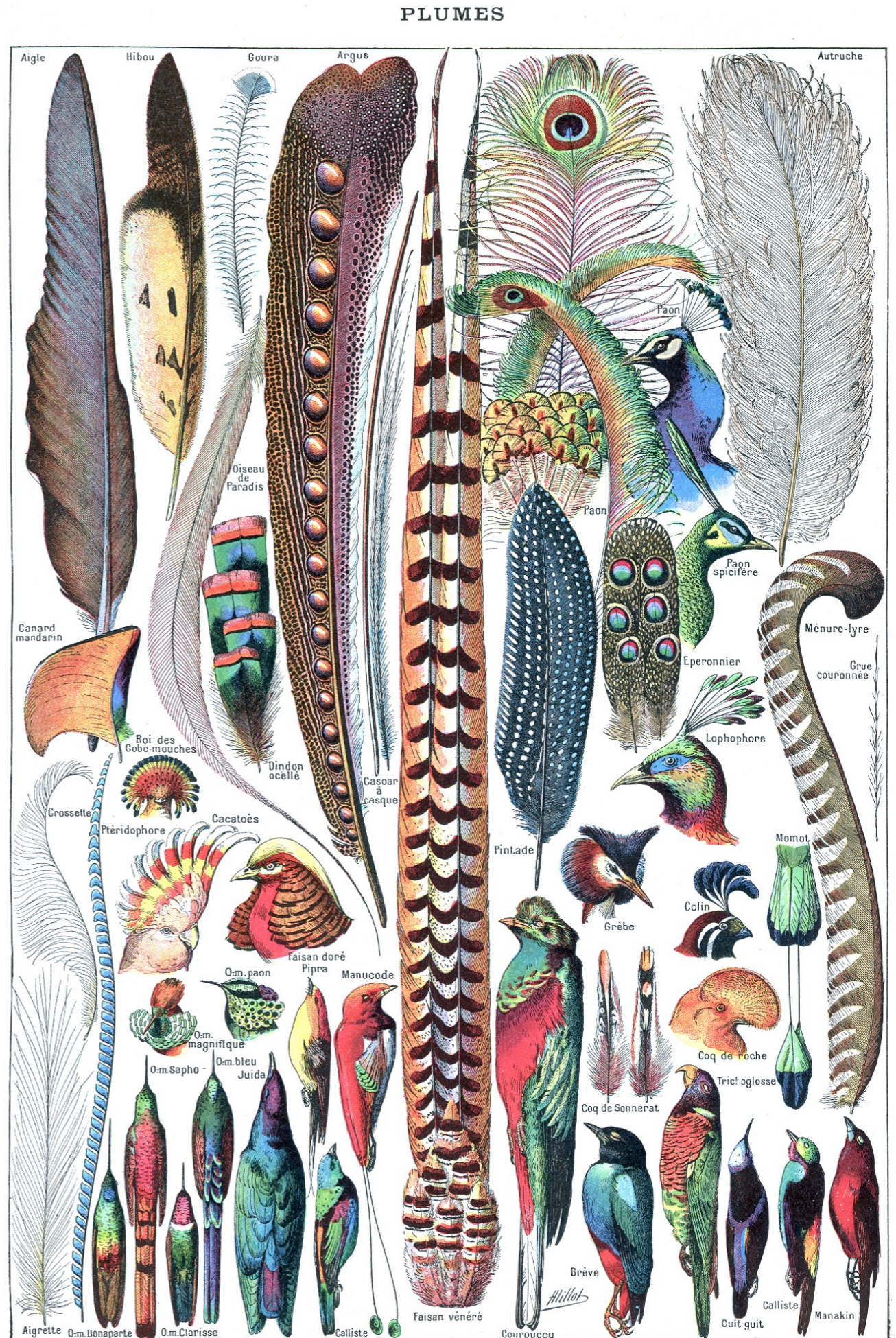
B





# Penas

- Manutenção da temperatura
- Reconhecimento
- Camuflagem
- Corte
- Voo
- Construção de ninhos
- Defesa química
- Produção de sons
- ...





# Manutenção da temperatura



*Thalassarche eremita*

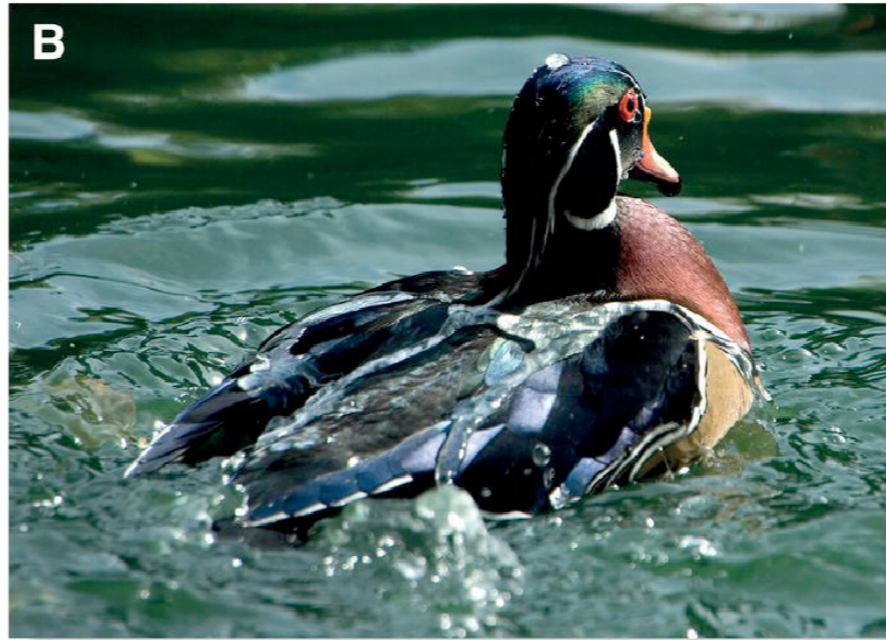
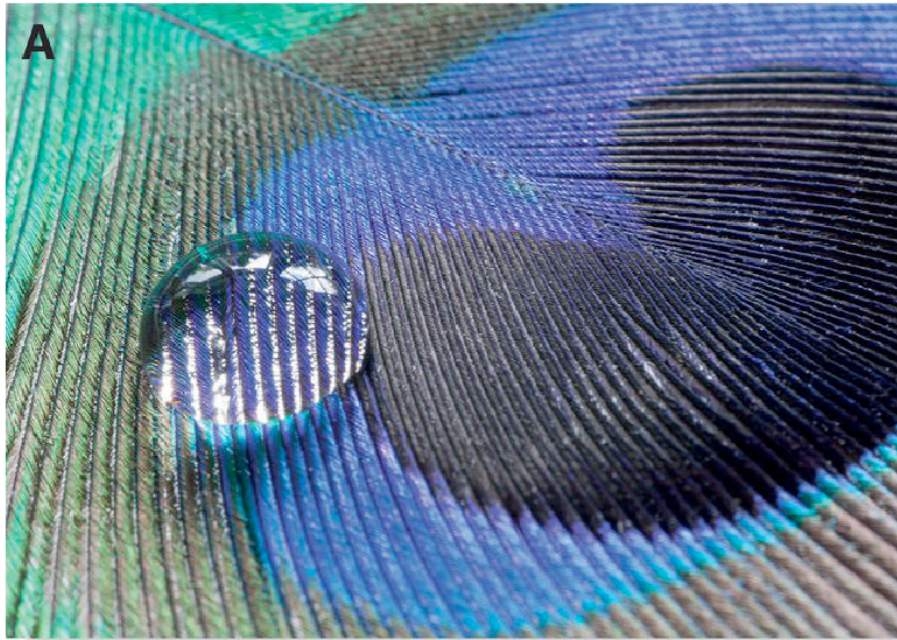


# Termorregulação



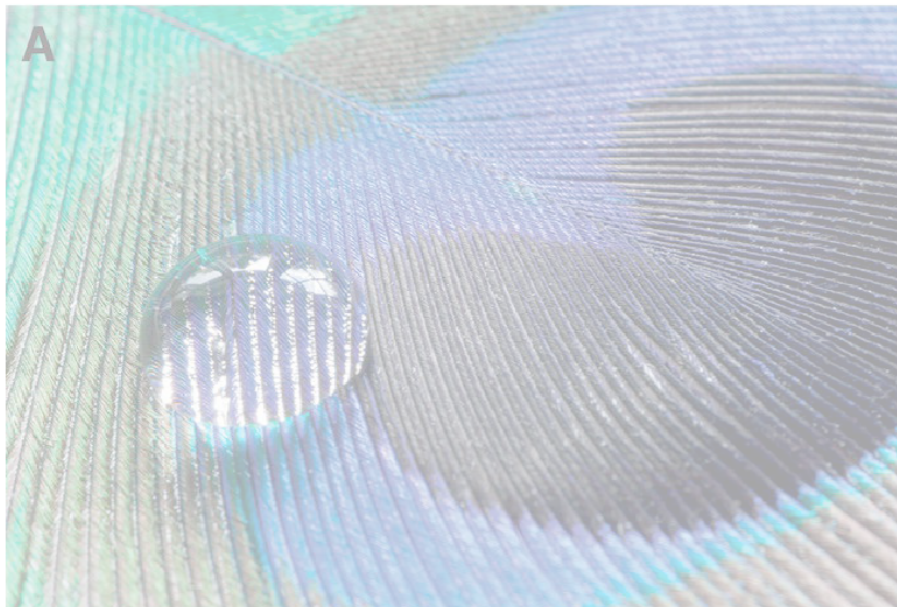


# Impermeabilização





# Impermeabilização



Saturação/lastro



# Comunicação



*Lophorina superba*



# Comunicação



Corte



# Corte

# Corte

MODE **PLAY ▶** F/SEC P **30**



FRAME **-001389** TIME **-001389 MS**



