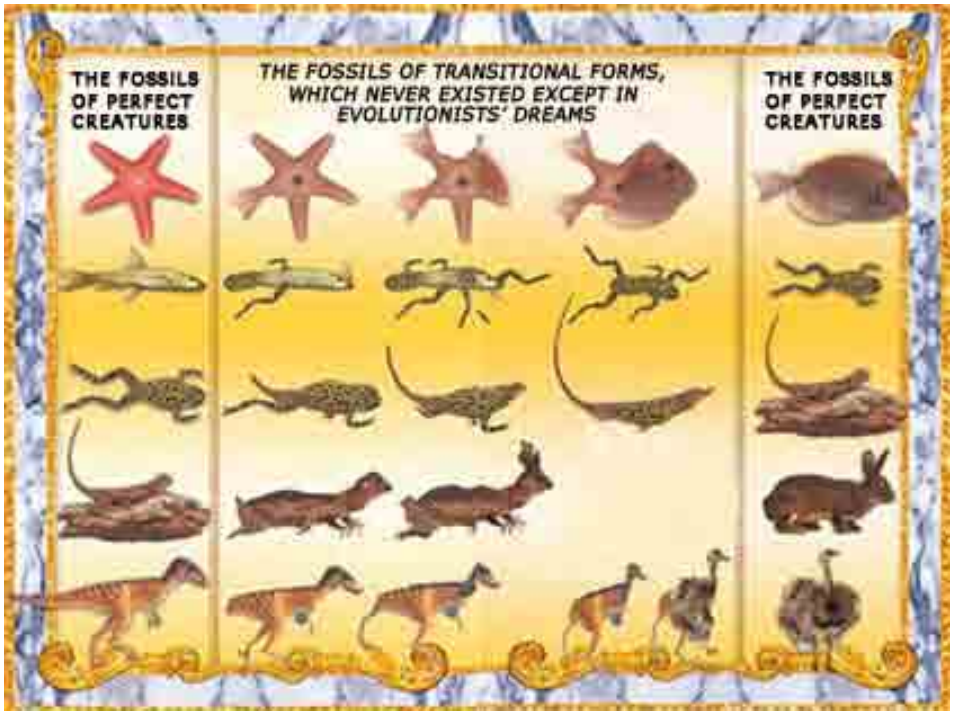
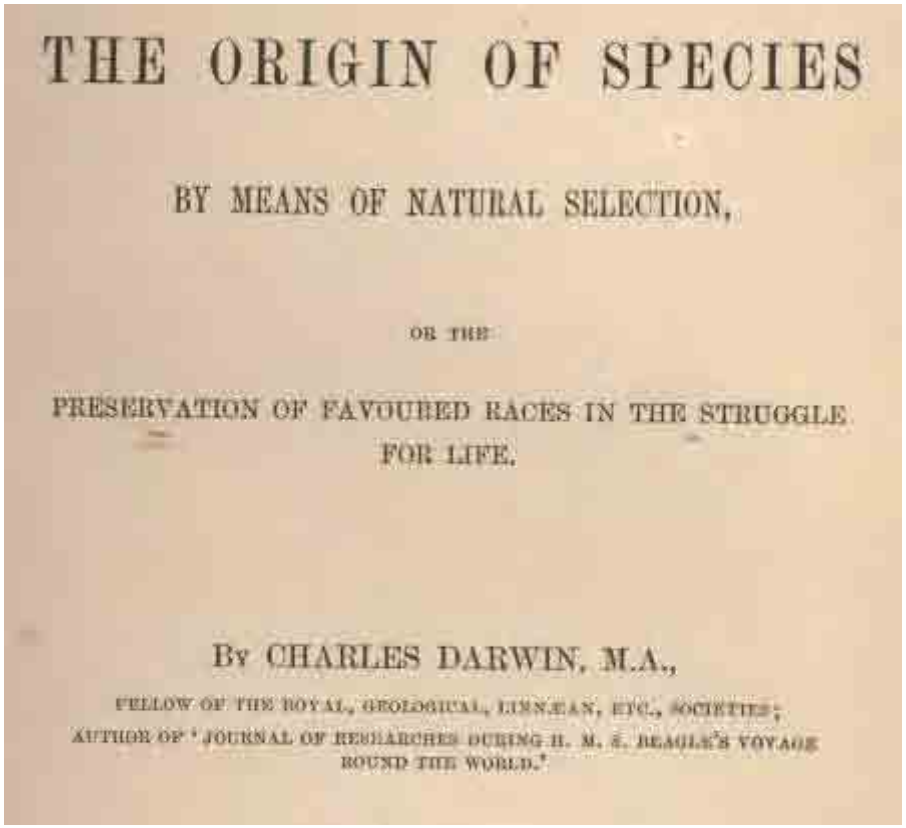
А.О. Аверьянов

Проблема переходных форм между классами животных на примере наземных позвоночных





THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

OR THE

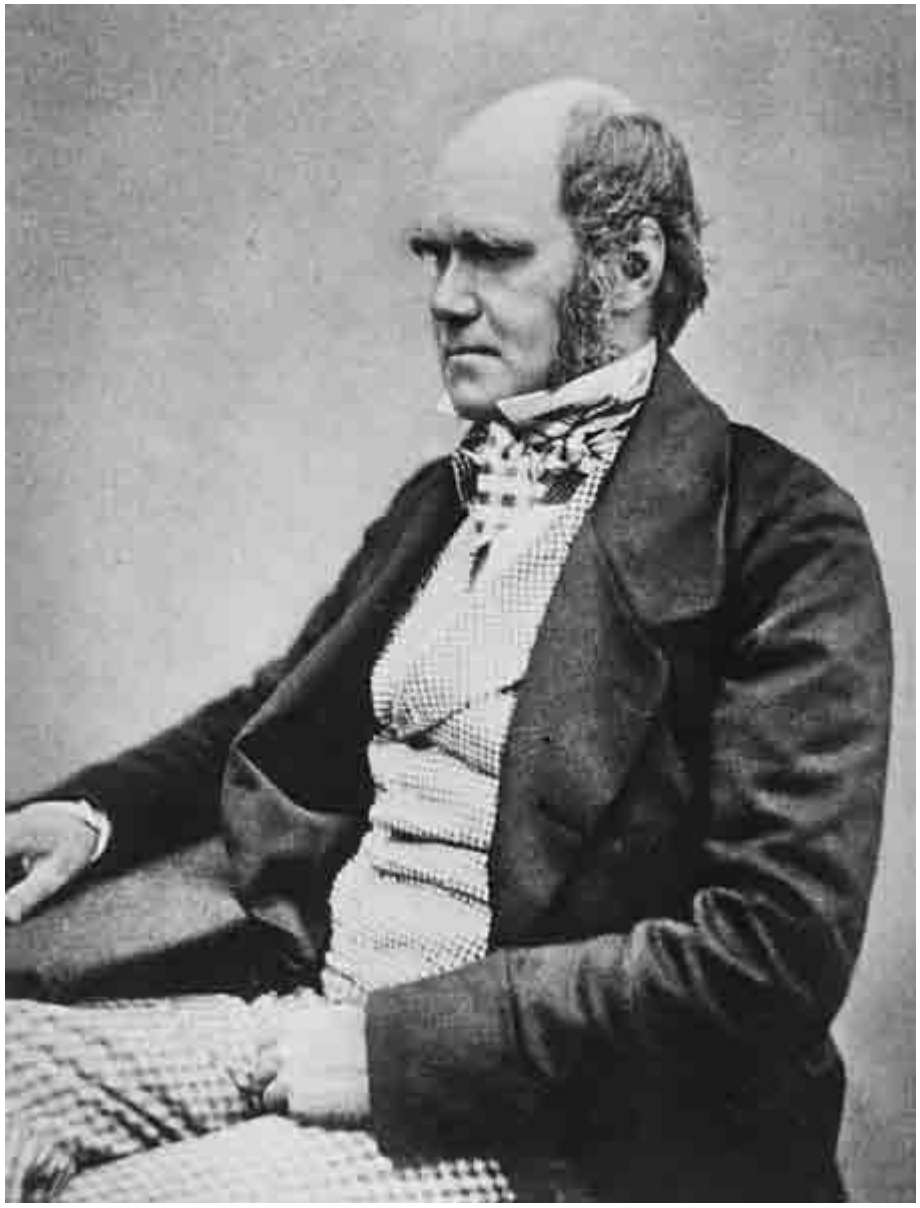
PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE.

By CHARLES DARWIN, M.A.,

FELLOW OF THE ROYAL, GEOLOGICAL, LINNÆAN, ETC., SOCIETIES;

AUTHOR OF 'JOURNAL OF RESEARCHES DURING H. M. S. BEAGLE'S VOYAGE ROUND THE WORLD.'

"Why then is not every geological formation and every stratum full of such intermediate links? Geology assuredly does not reveal any such finely graduated organic chain; and this, perhaps, **is the most obvious and gravest objection which can be urged against my theory**. The explanation lies, as I believe, in the extreme imperfection of the geological record.“ Darwin (1859)



Charles Robert Darwin

(12 February 1809 – 19 April 1882)

Archaeopteryx lithographica

London specimen (1861; Owen, 1863)

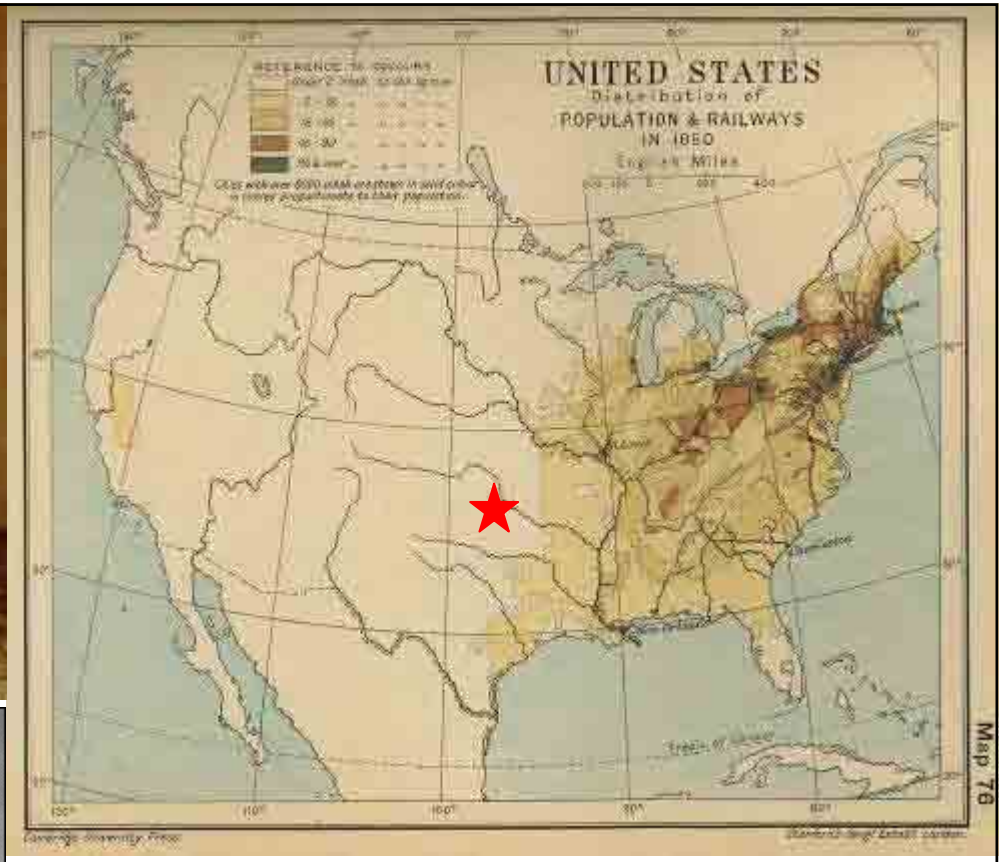
Archaeopteryx siemensii

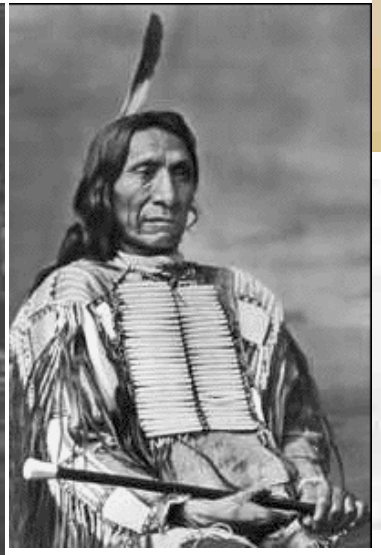
Berlin specimen (1876; Dames, 1884)

Compsognathus longipes

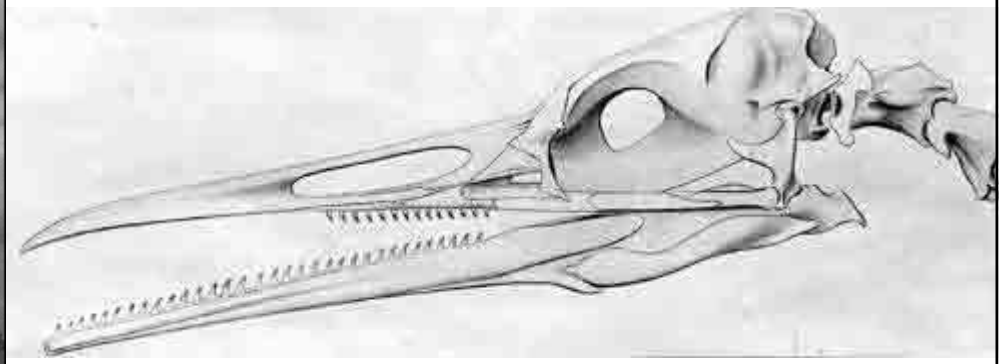
Thomas Henry Huxley
(4 May 1825 – 29 June 1895)

Discovered in 1850s; described by Wagner (1861)

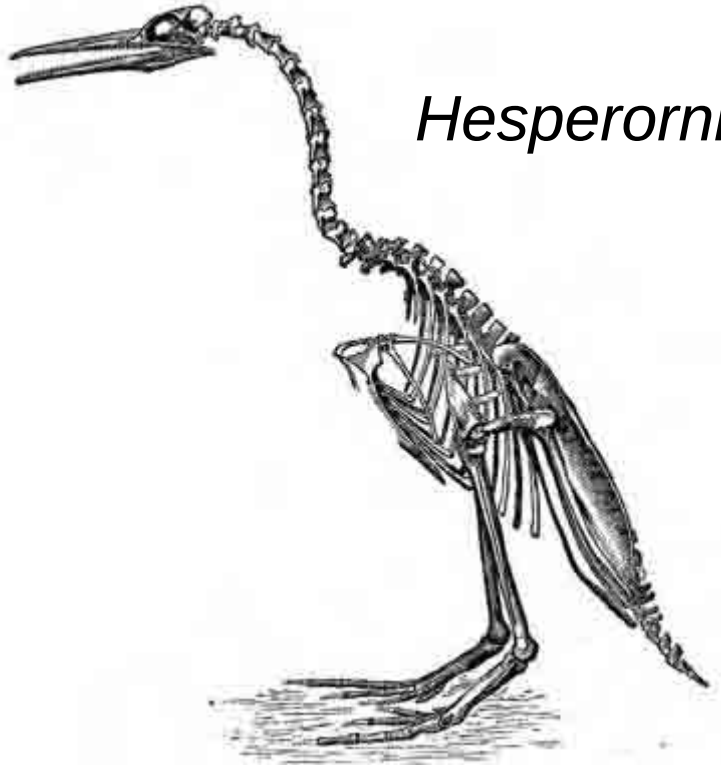




Othniel C. Marsh and 'Red Cloud' pictured in New Haven, Connecticut, c. 1880



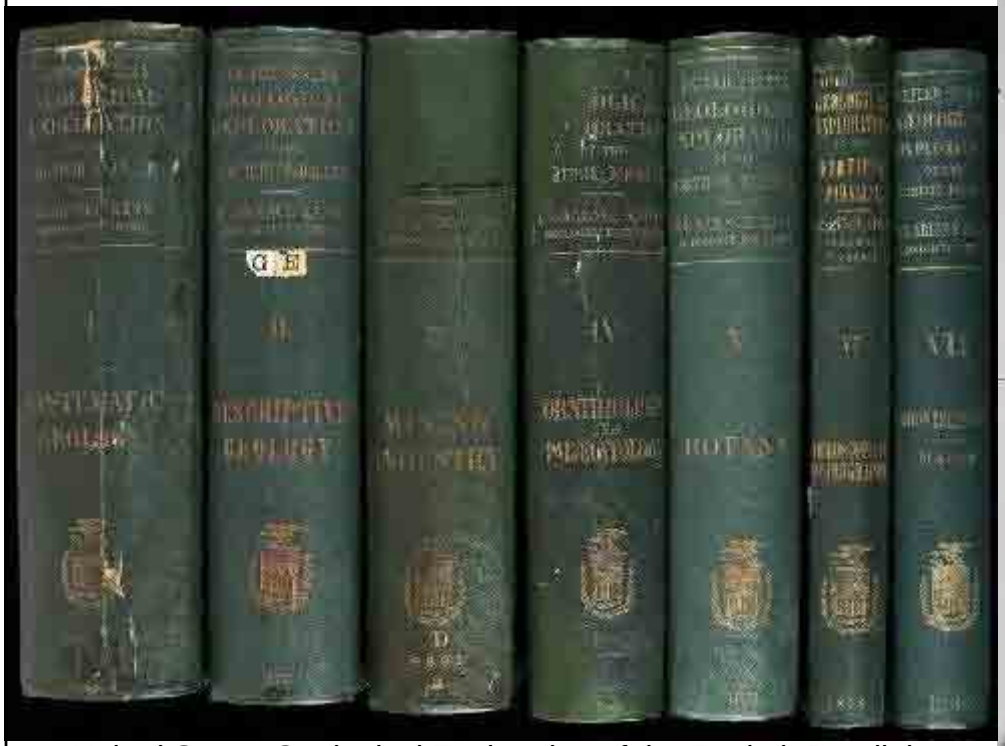
Hesperornis skull reconstruction (Marsh, 1880)



Hesperornis

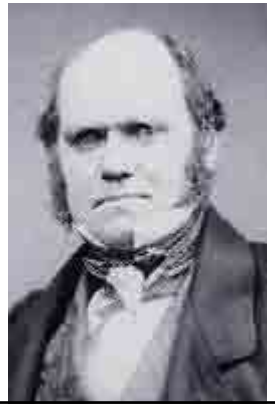
Ichthyornis

Marsh, O.C. (1880): *Odontornithes, a Monograph on the Extinct Toothed Birds of North America*. Government Printing Office, Washington DC.

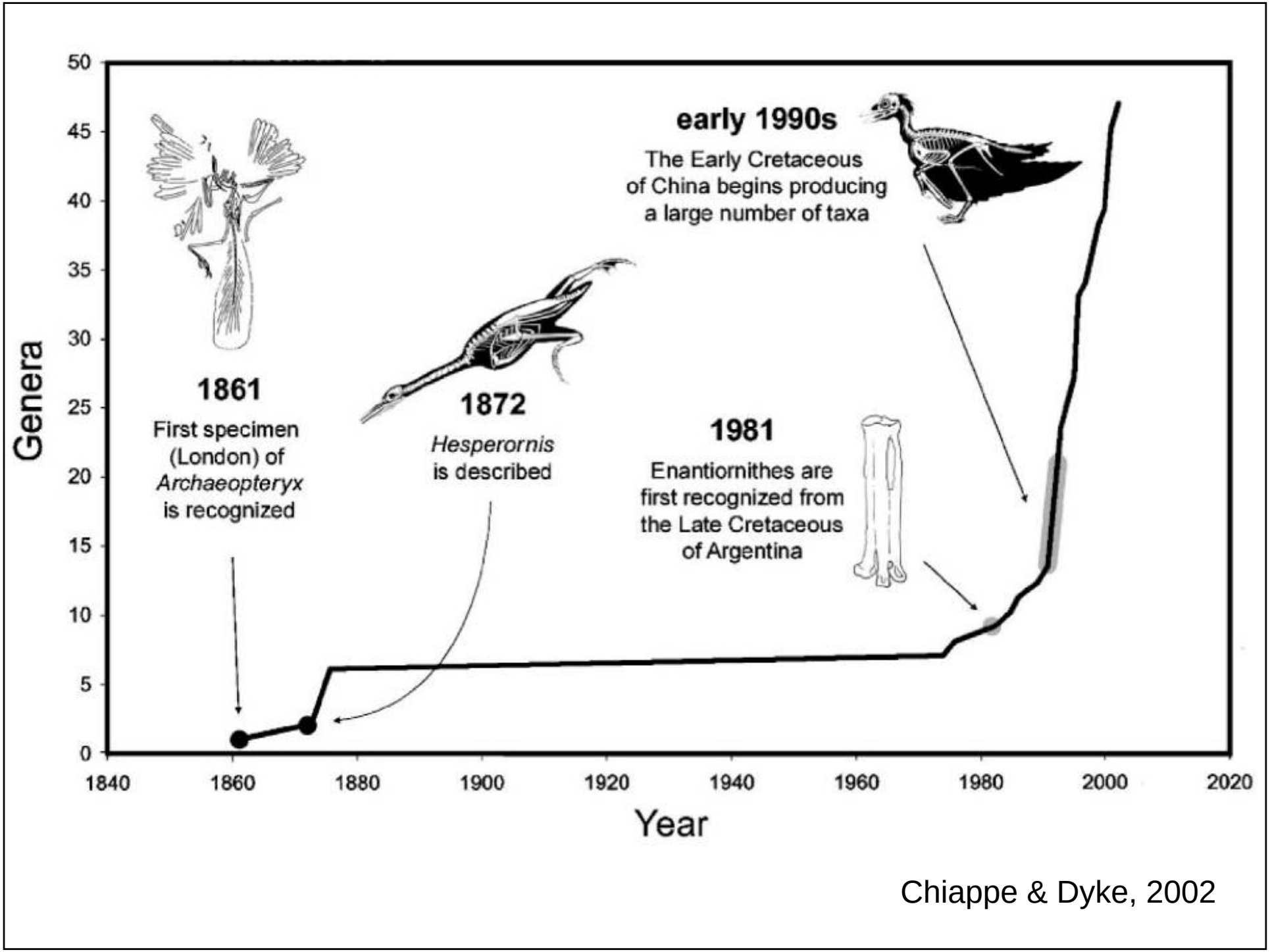


United States Geological Exploration of the Fortieth Parallel

"Your work on these old birds, and on many fossil animals of North America, has afforded **the best support to the theory of Evolution**, which has appeared within the last twenty years."
Darwin, letter to Marsh (31.08.1880)

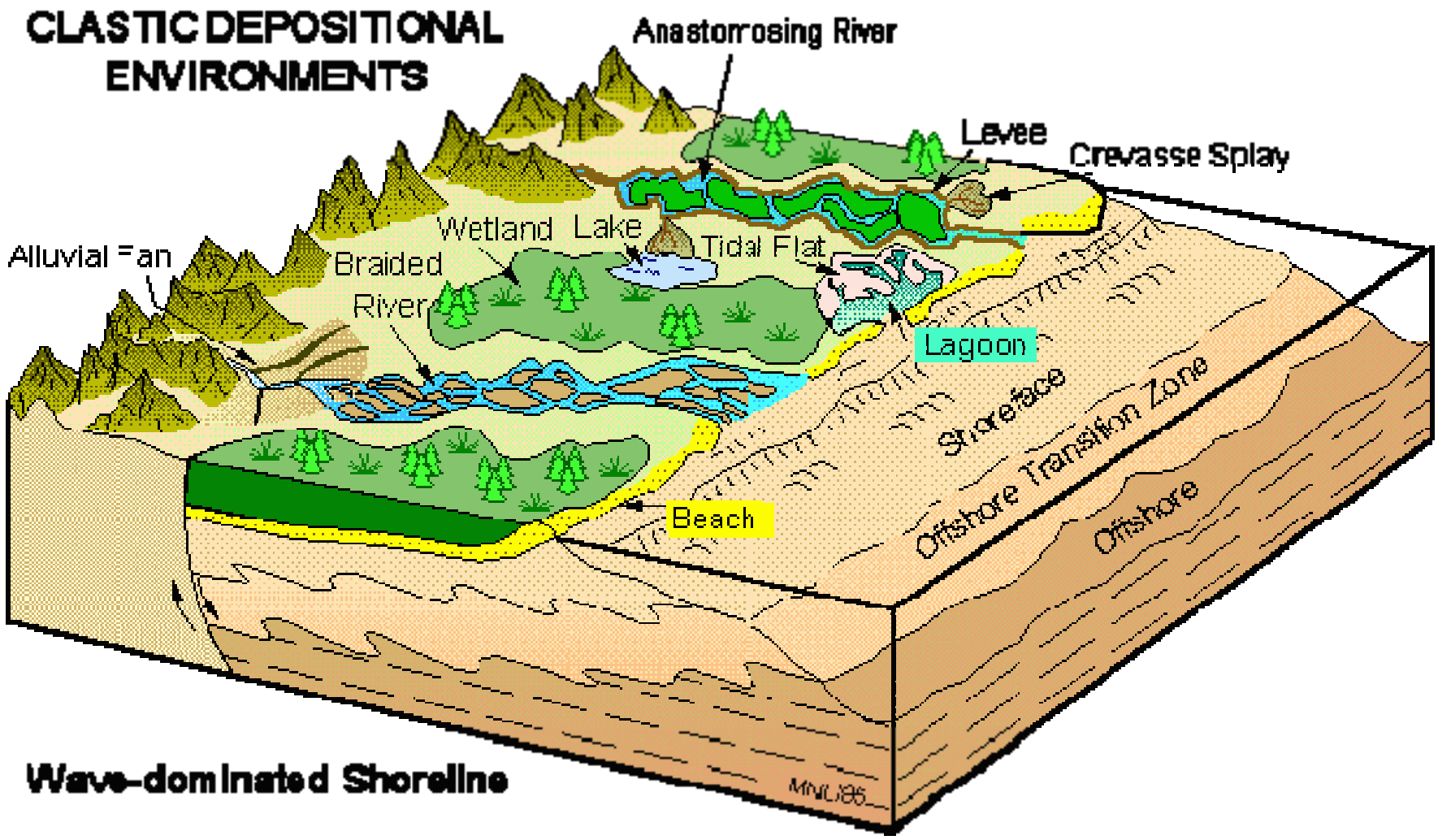


Othniel Charles Marsh
(October 29, 1831 – March 18, 1899)



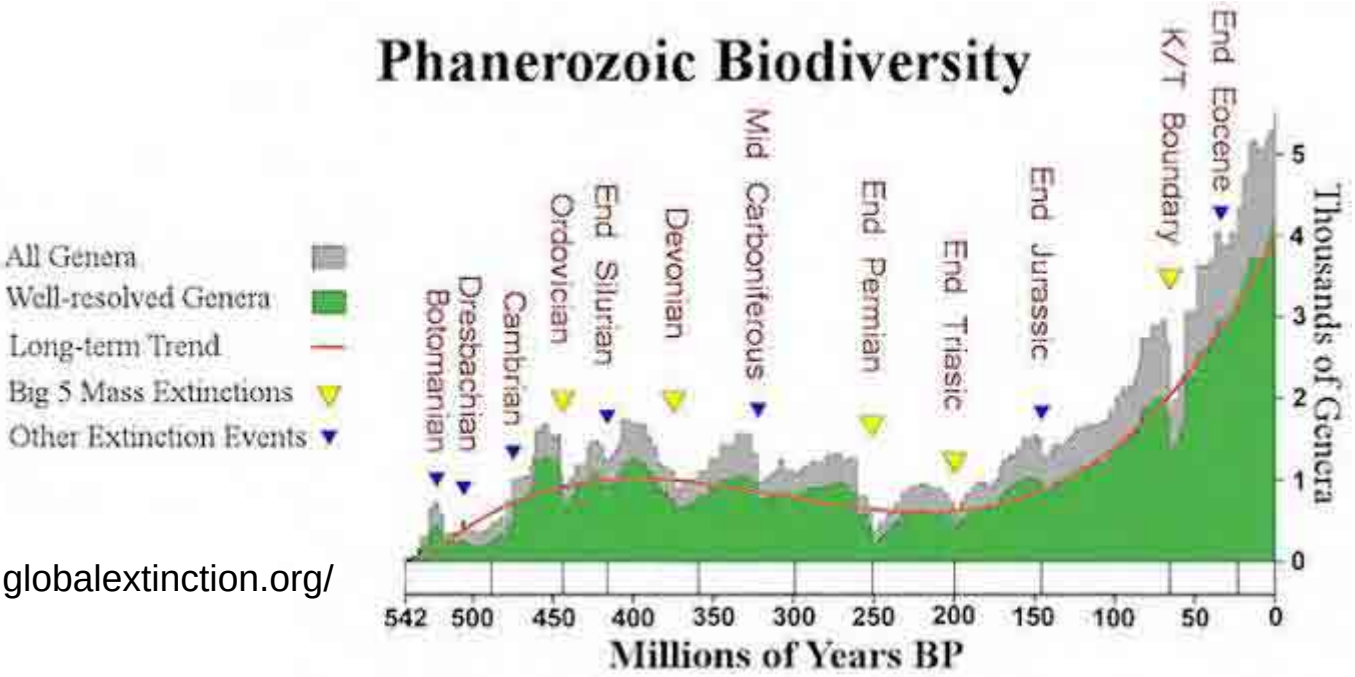
Chiappe & Dyke, 2002

Геологическая летопись

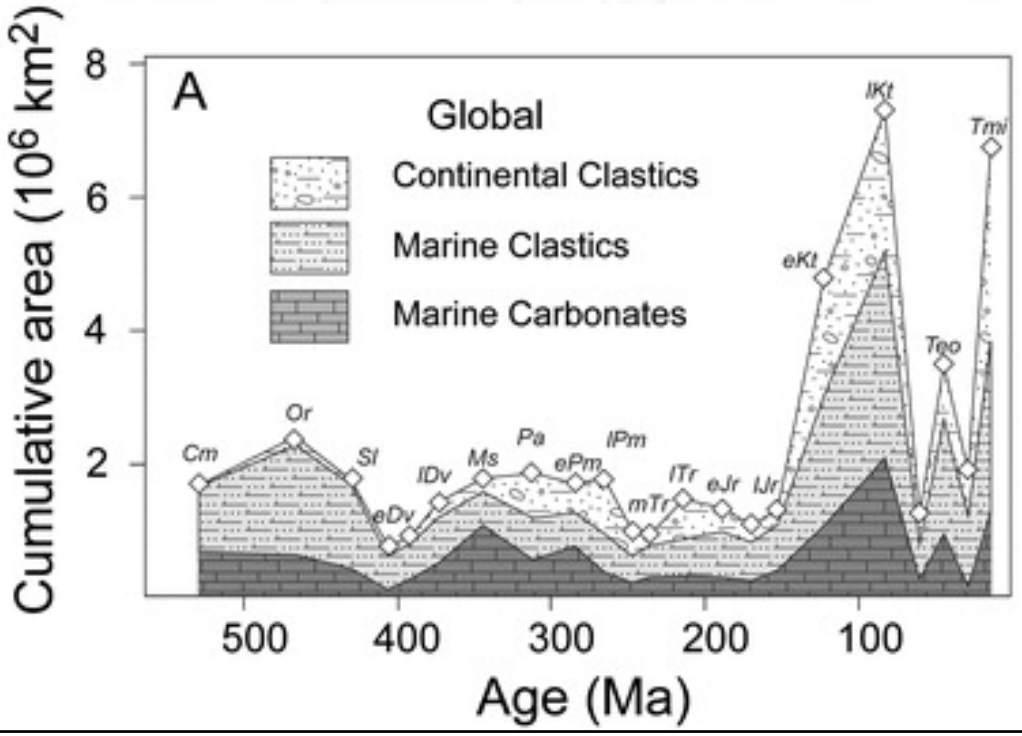


Меловые эпиконтинентальные моря в Северной Америке

★ *Hesperornis*

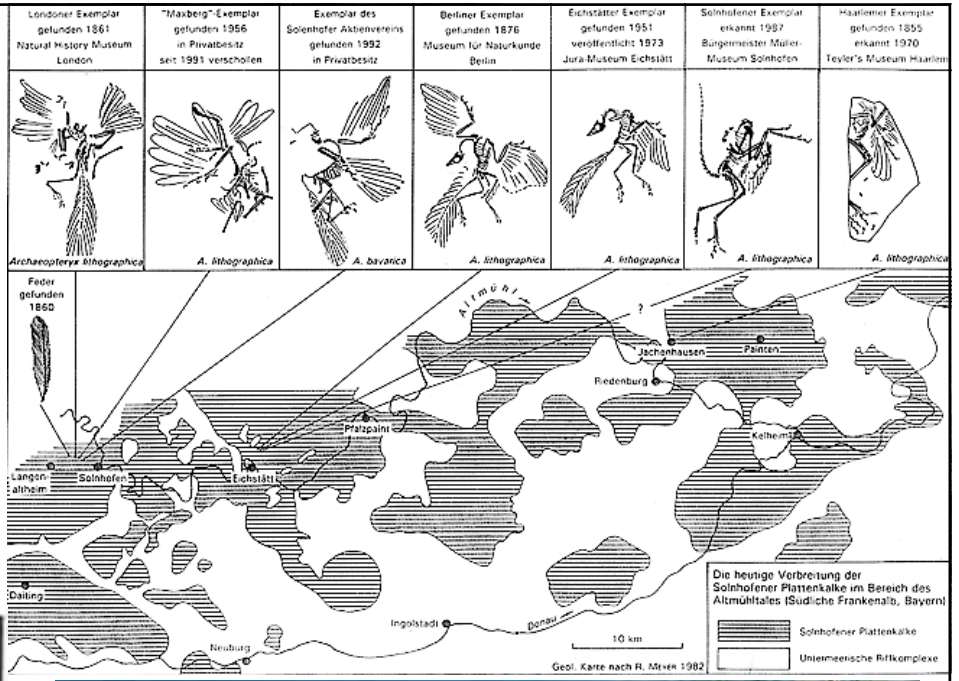


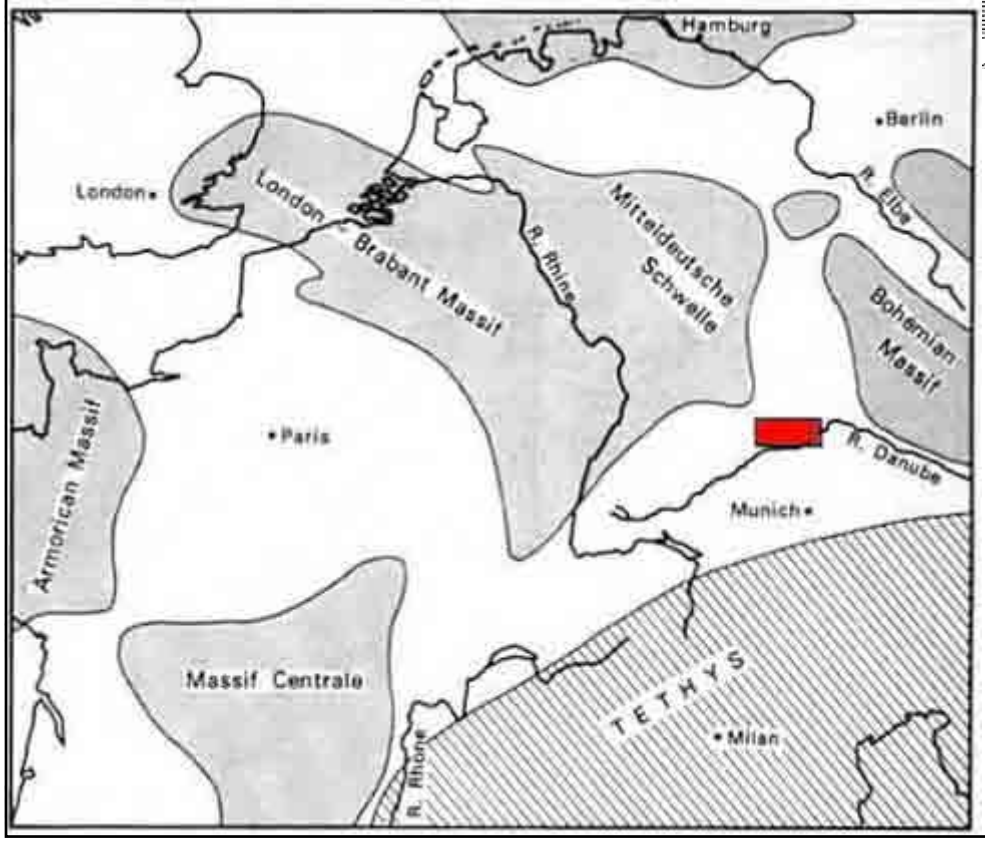
http://www.globalextinction.org/

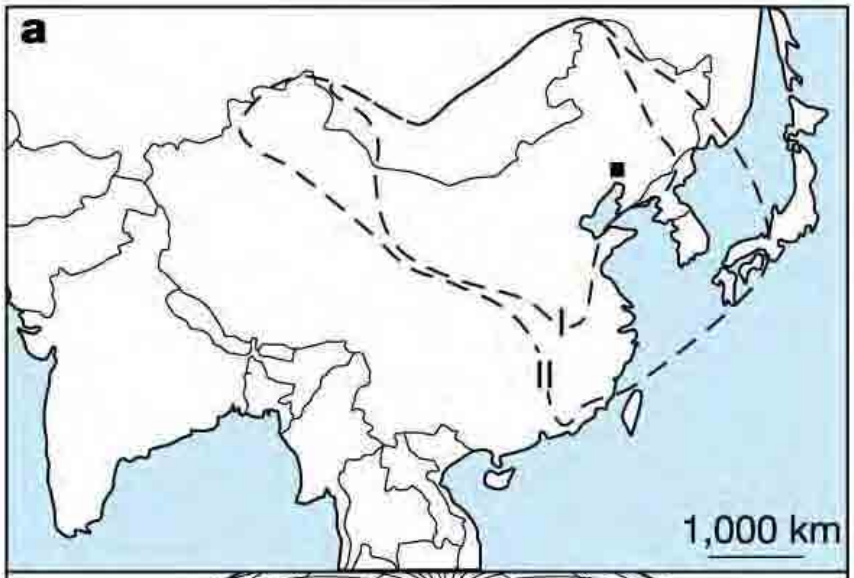


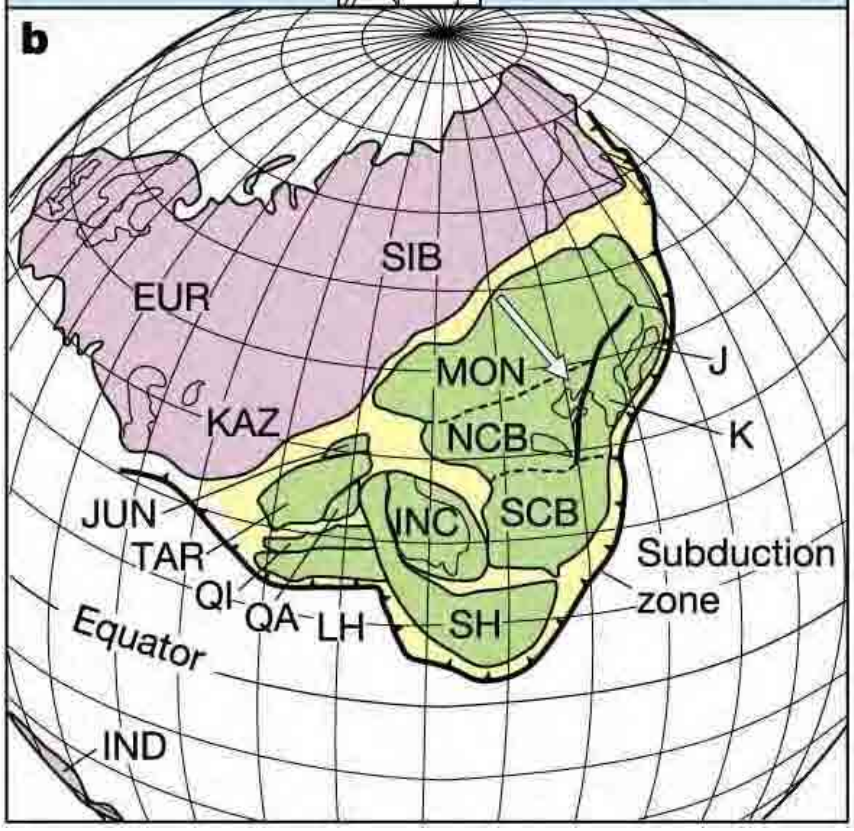
Wall et al., 2009

Solnhofen Plattenkalk



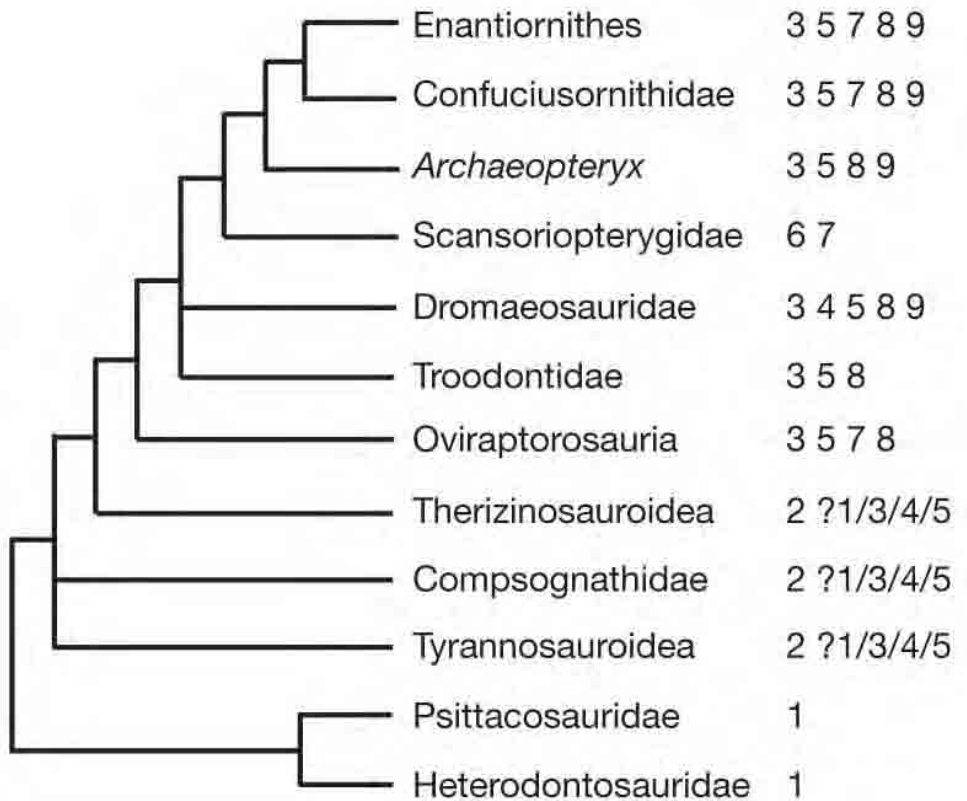






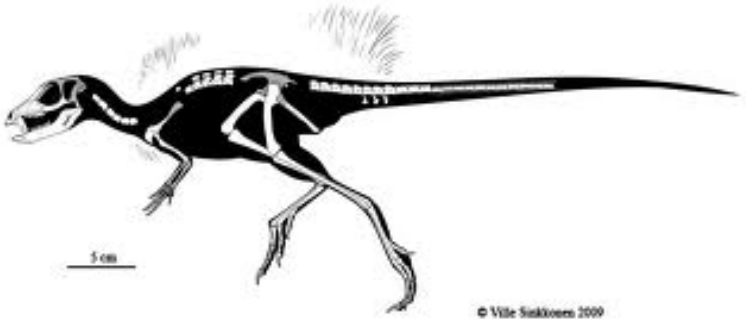
Jehol biota

Confuciusornis sanctus

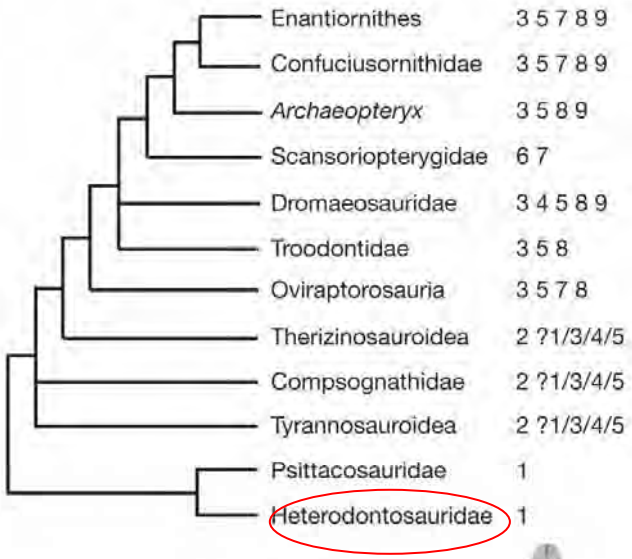


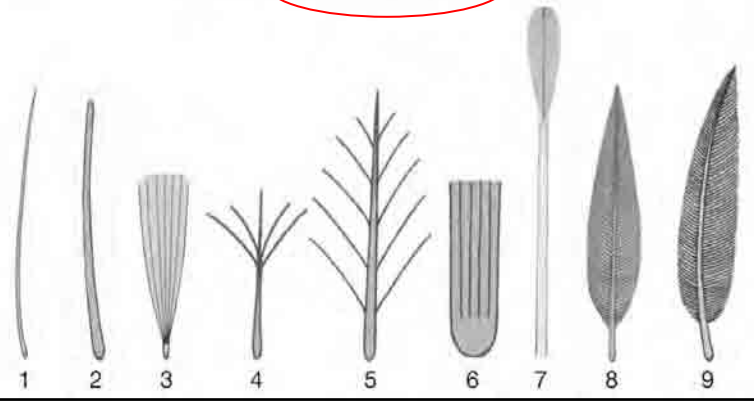
-- «вымершие» морфотипы

Xu et al., 2010

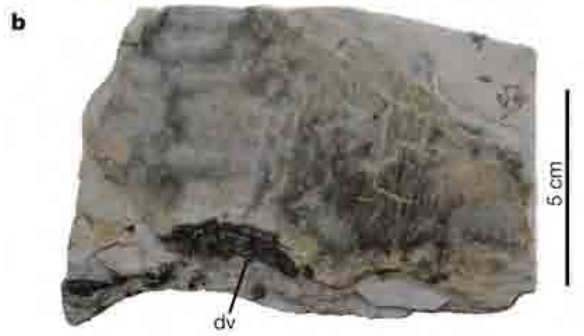


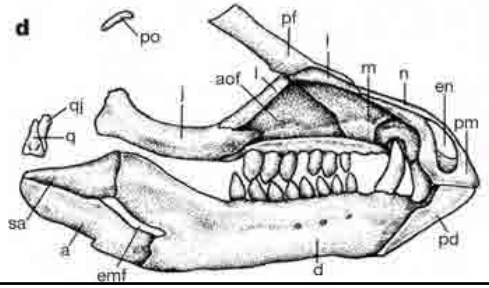
Tianyulong

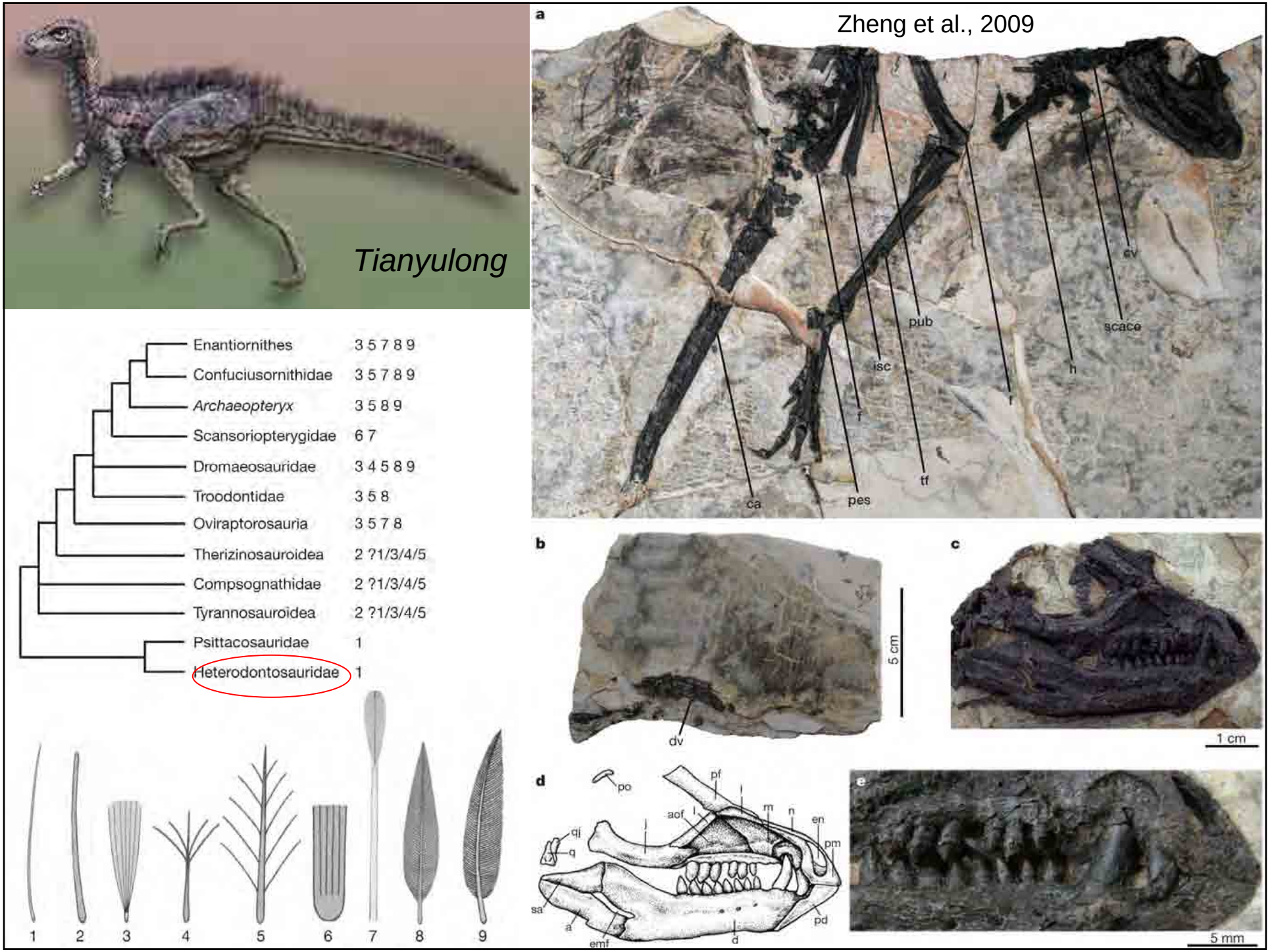


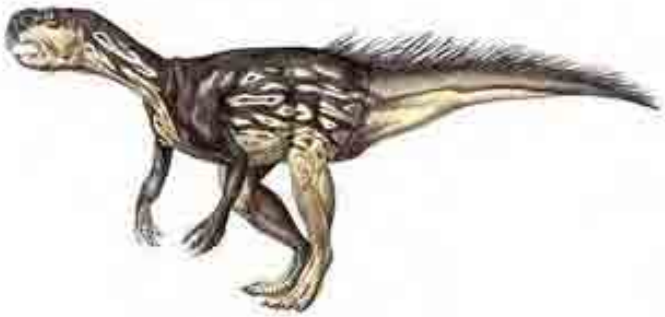


Zheng et al., 2009

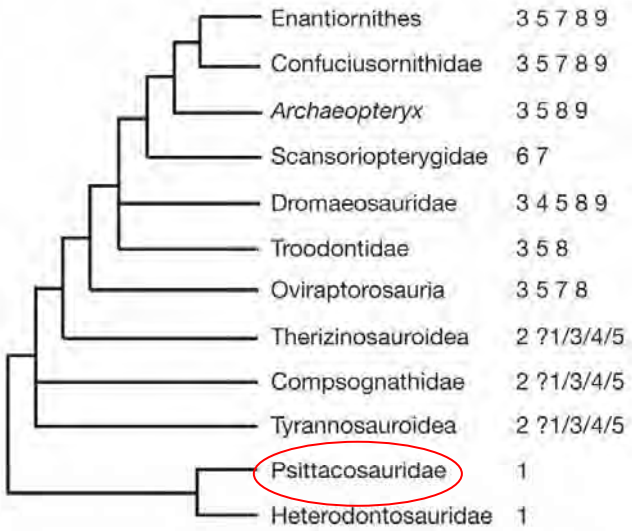


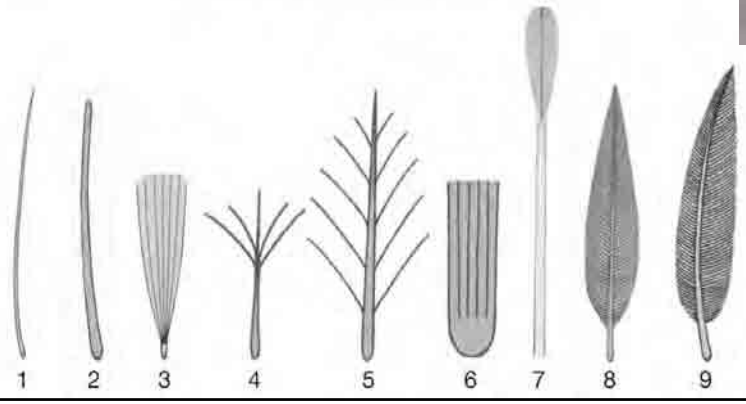






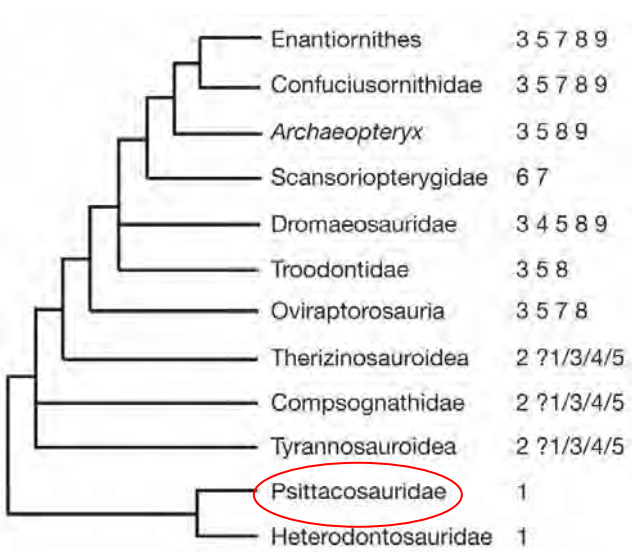
Mayr et al., 2004

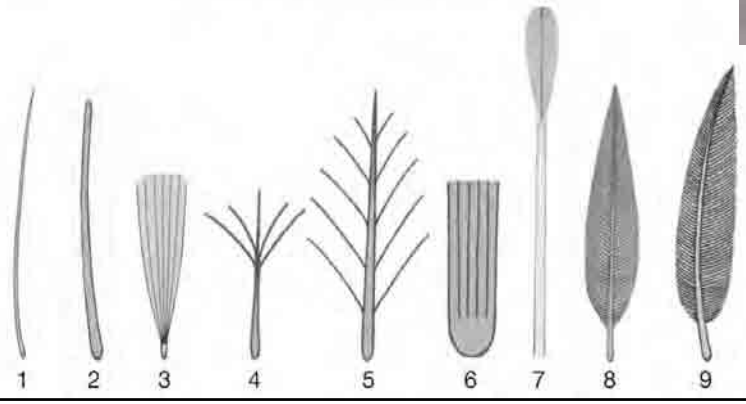




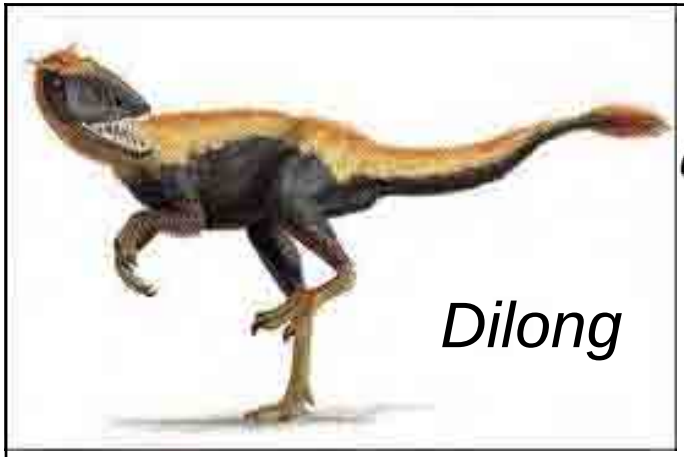
Psittacosaurus

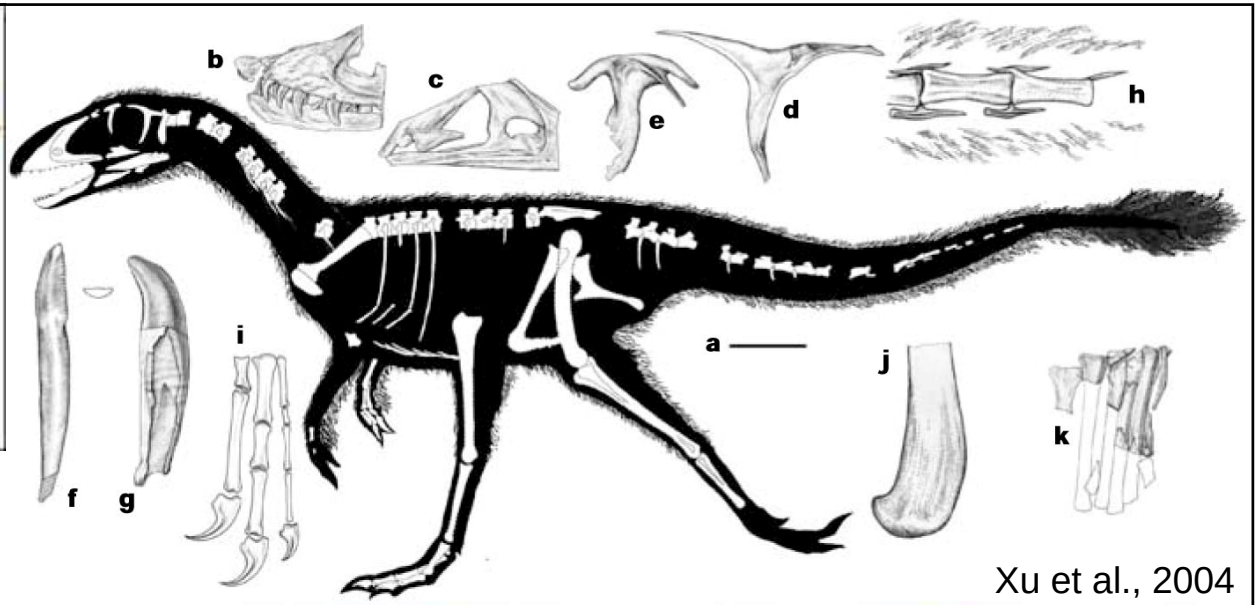
Mayr et al., 2004



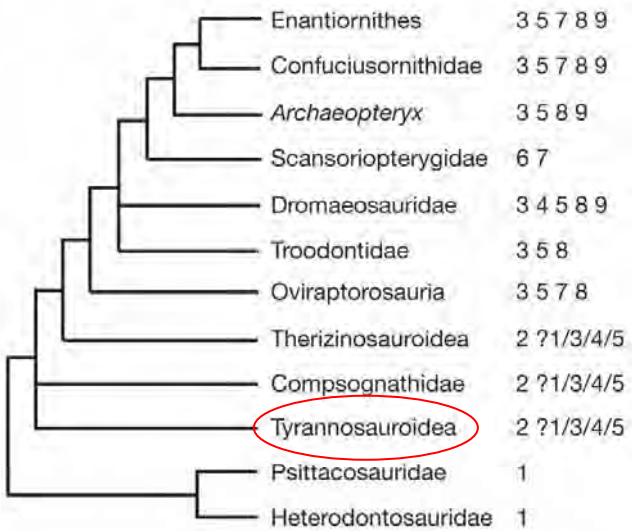


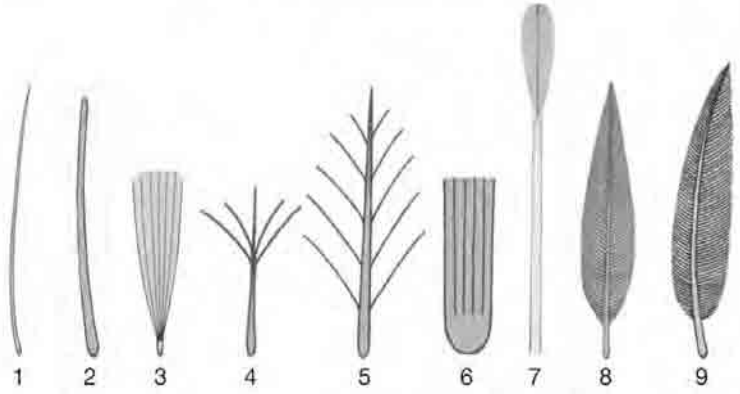
Psittacosaurus

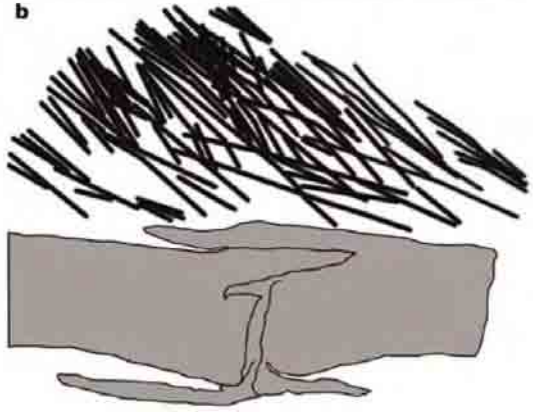




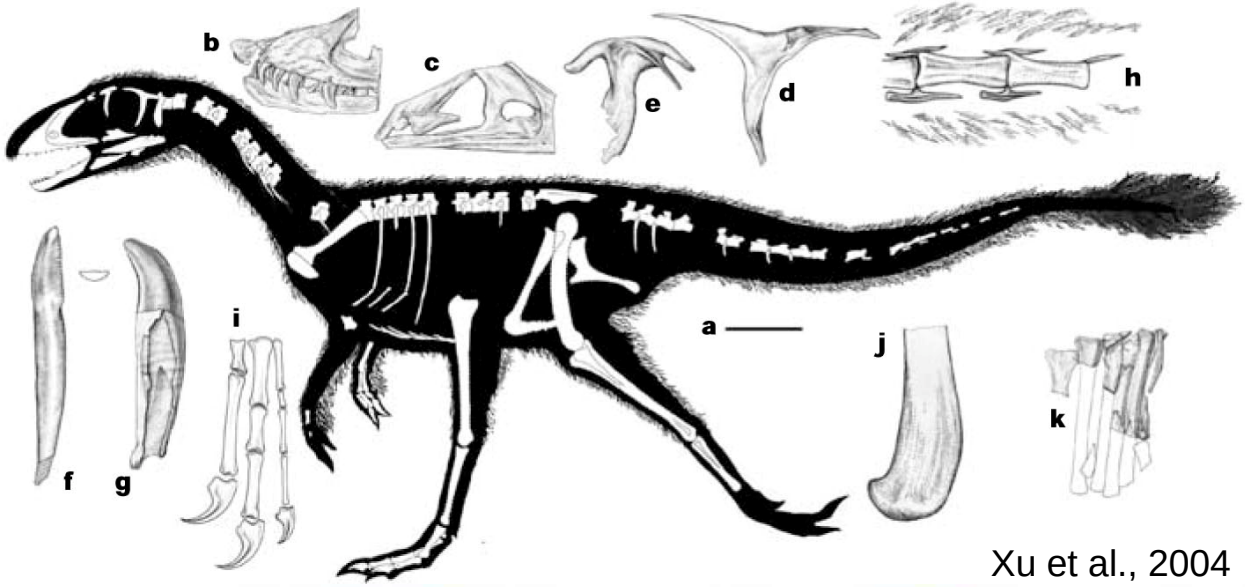
Xu et al., 2004



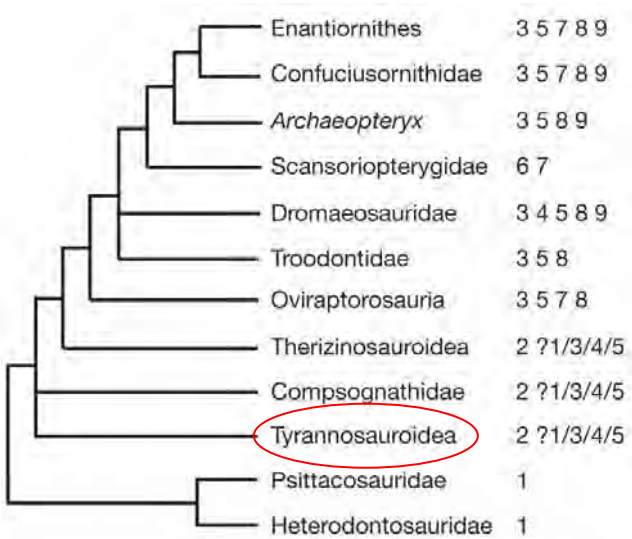


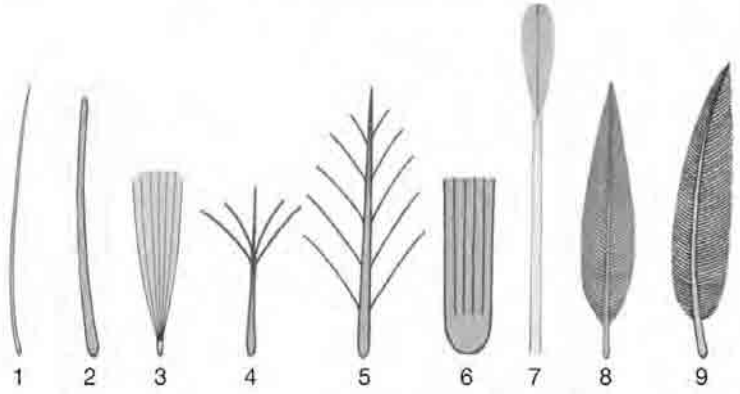


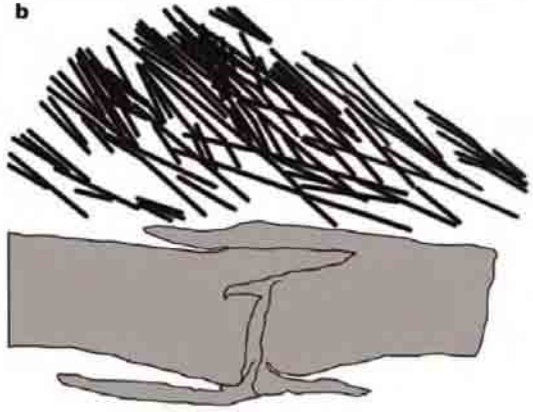
Dilong



Xu et al., 2004

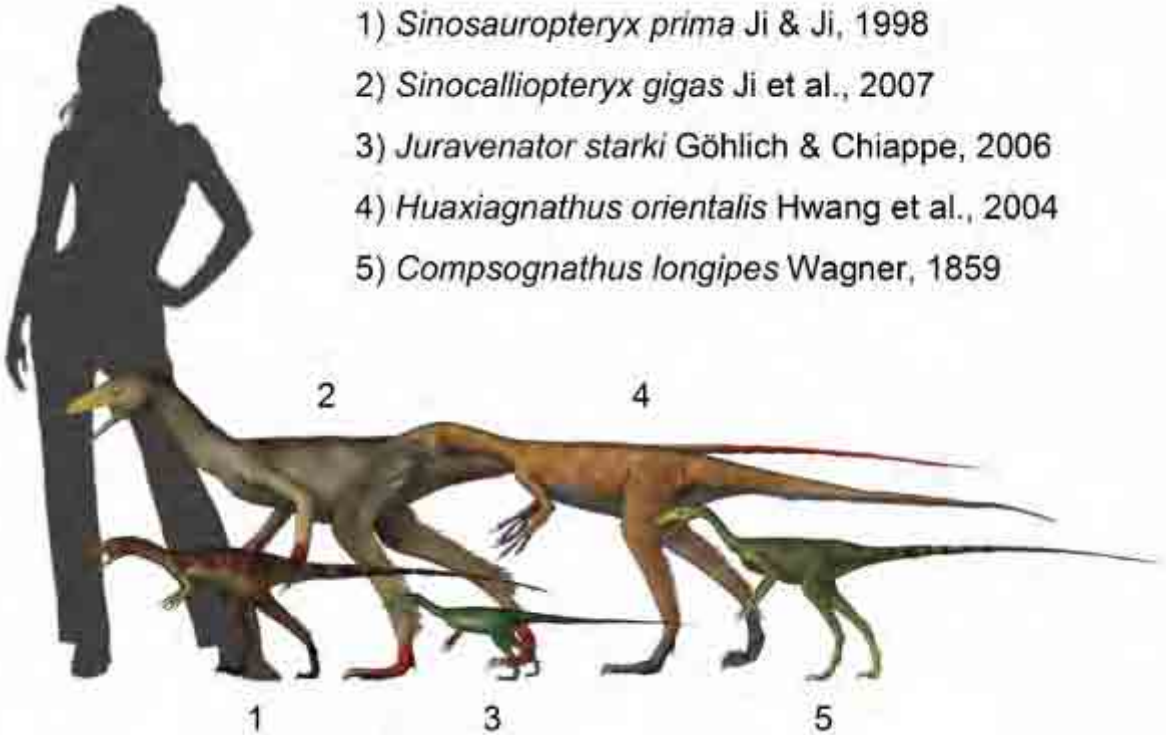


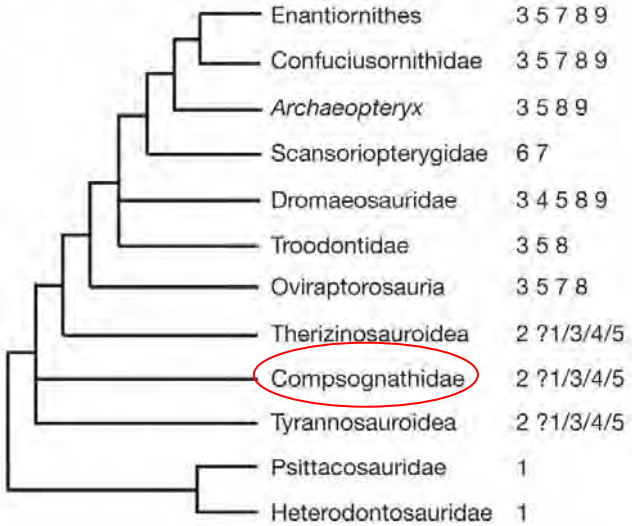


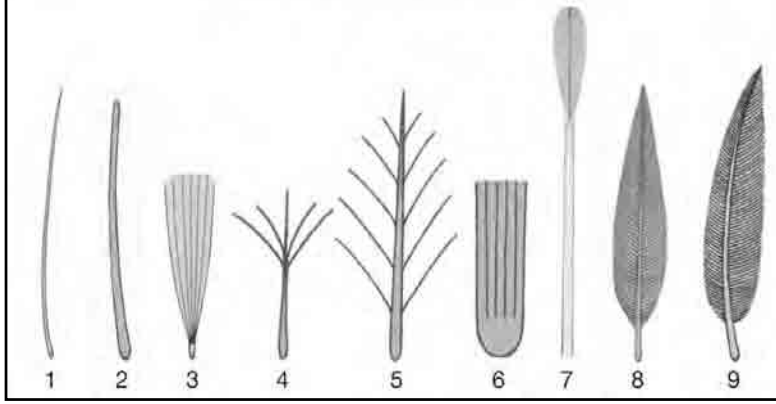


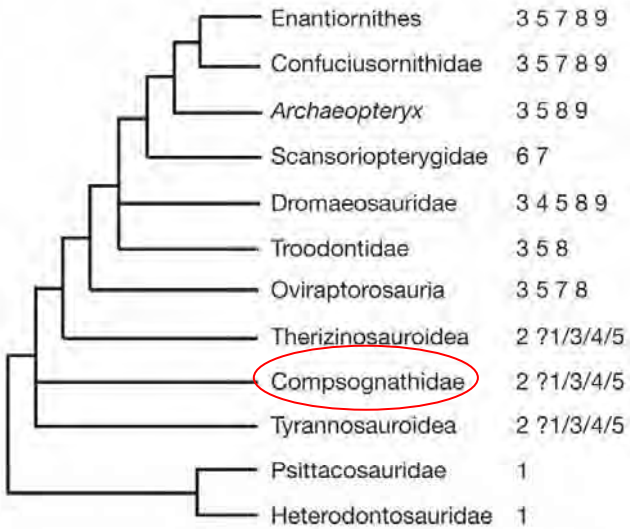
Sinosauropteryx

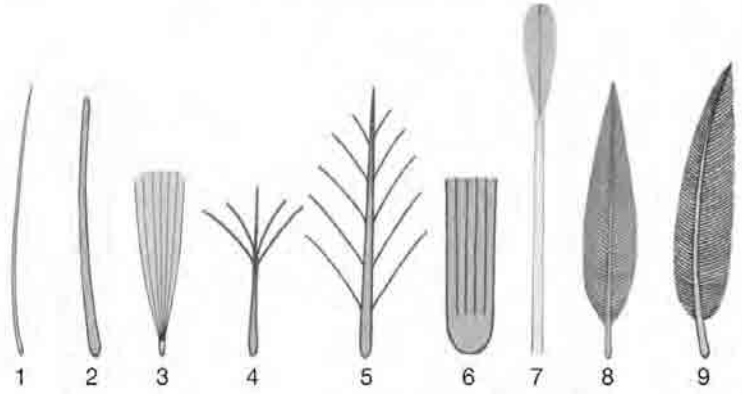
1) *Sinosauropteryx prima* Ji & Ji, 1998
2) *Sinocalliopteryx gigas* Ji et al., 2007
3) *Juravenator starki* Göhlich & Chiappe, 2006
4) *Huaxiagnathus orientalis* Hwang et al., 2004
5) *Compsognathus longipes* Wagner, 1859

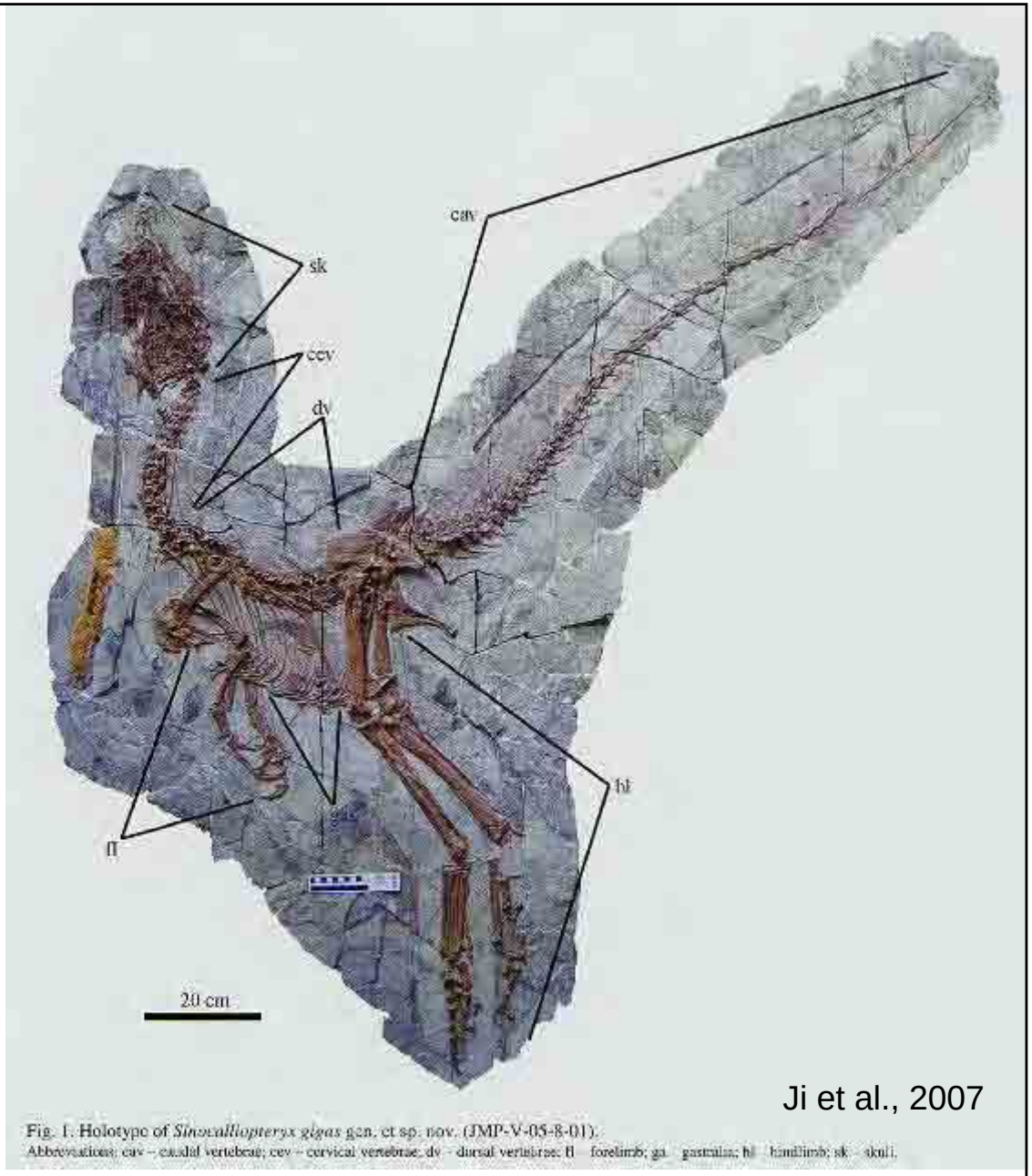








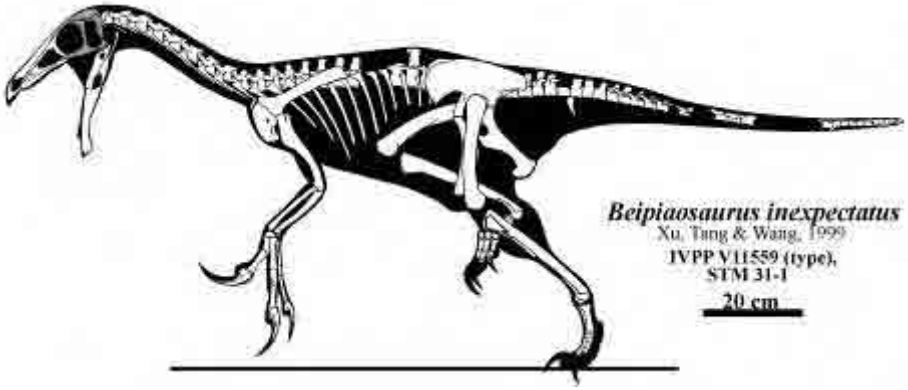




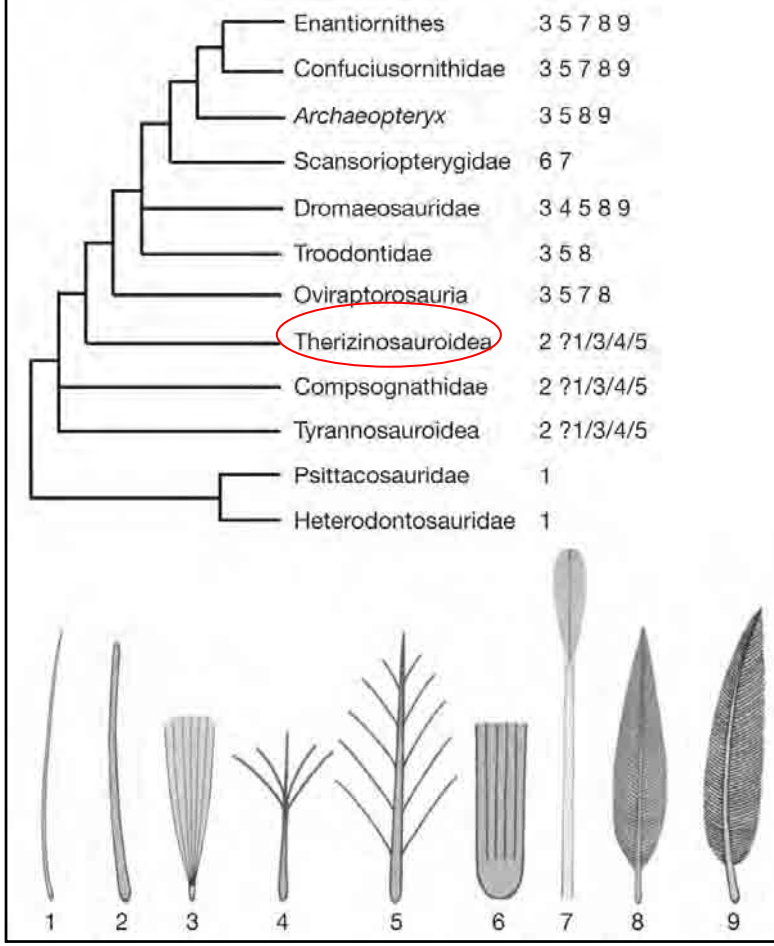
Ji et al., 2007

Fig. 1. Holotype of *Sinocalliopteryx gigas* gen. et sp. nov. (JMP-V-05-8-01).
Abbreviations: cav – caudal vertebrae; cev – cervical vertebrae; dv – dorsal vertebrae; fl – forelimb; ga – gastralia; hl – hindlimb; sk – skull.

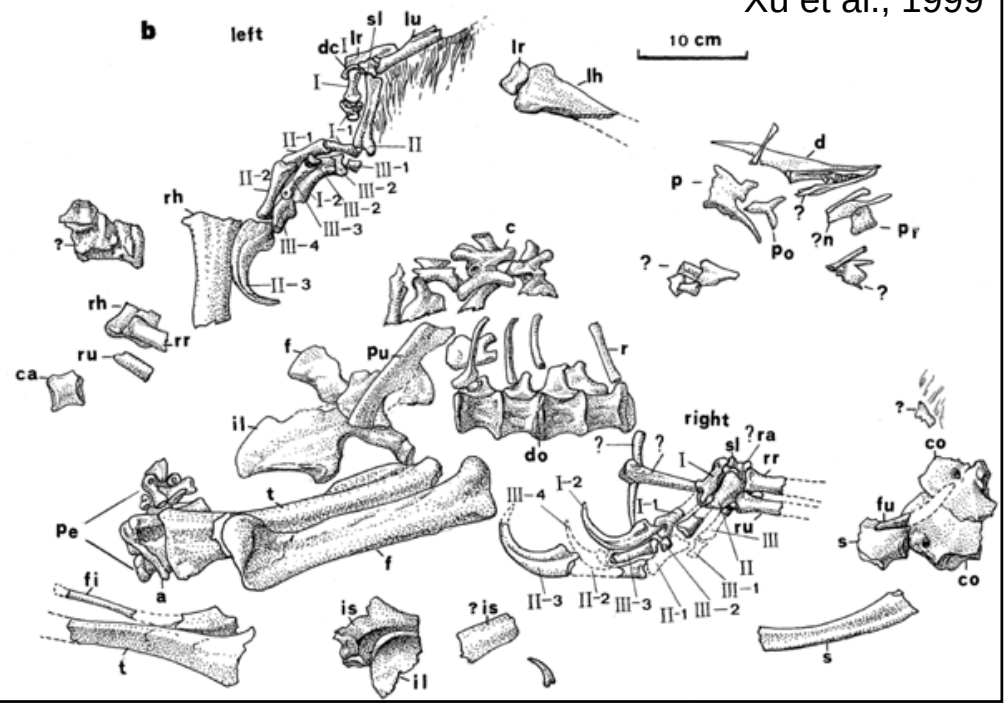
Sinocalliopteryx



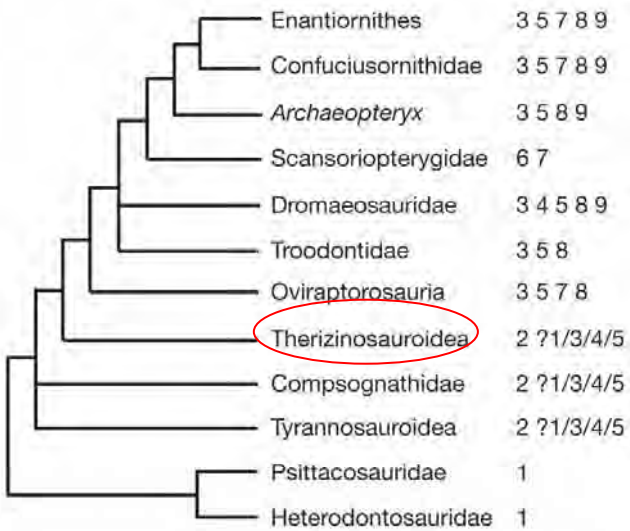
Beipiaosaurus

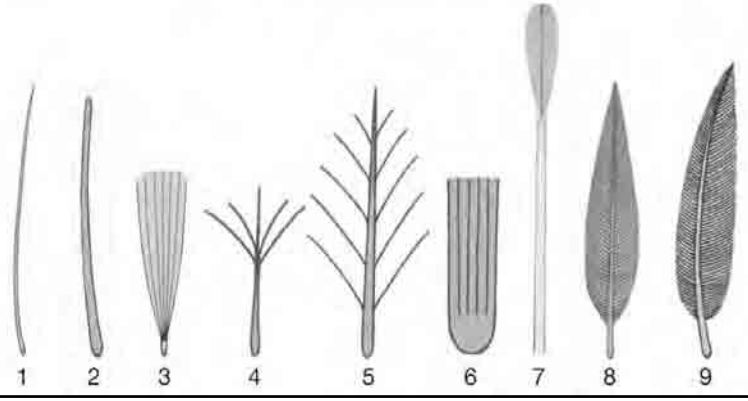


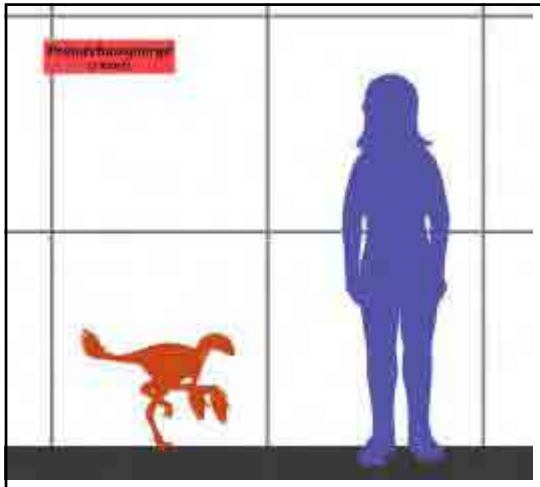
Xu et al., 1999

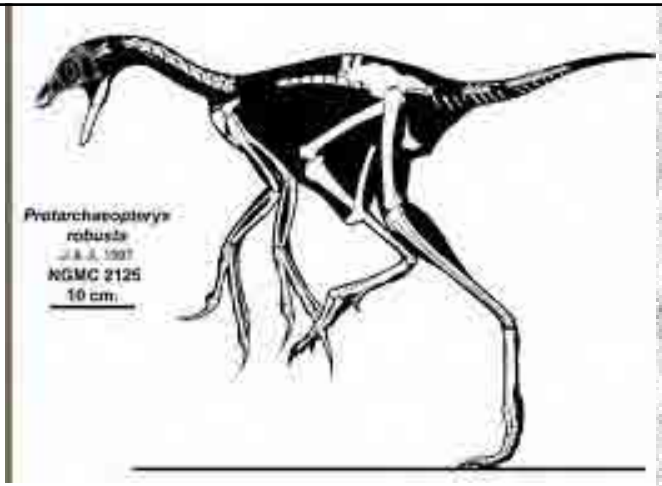


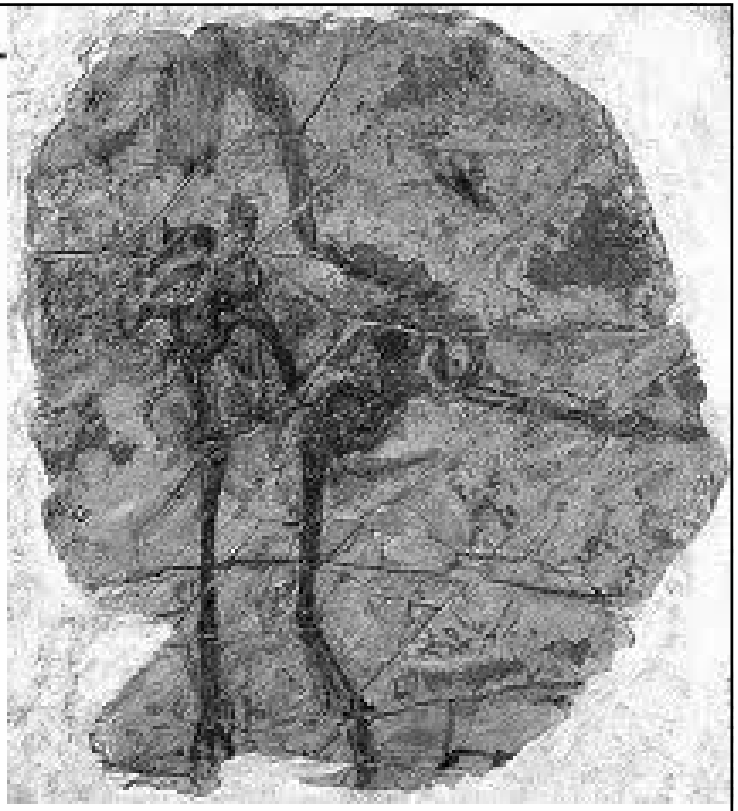
Beipiaosaurus



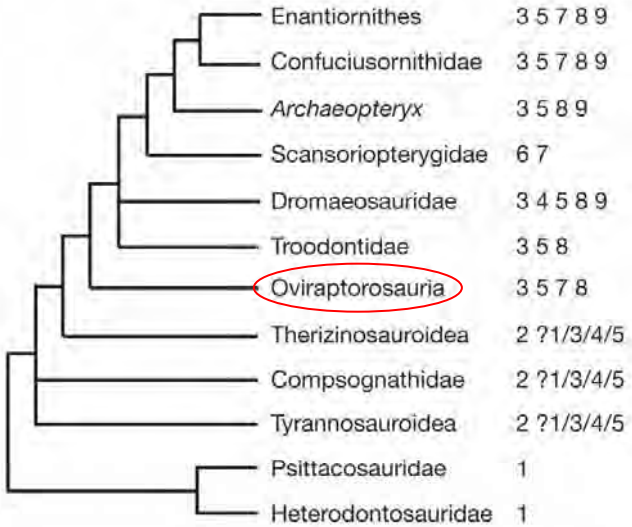


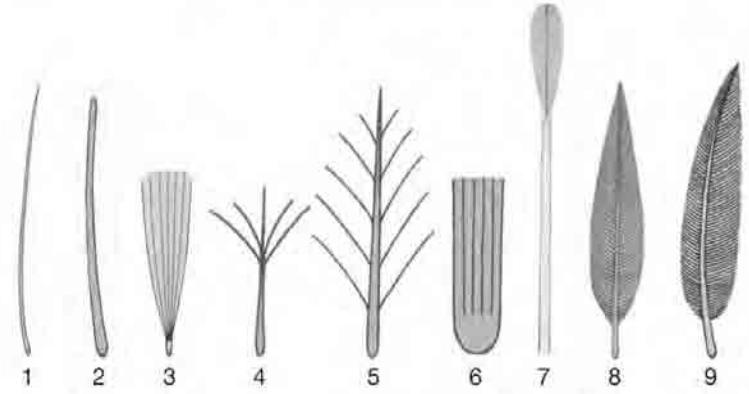


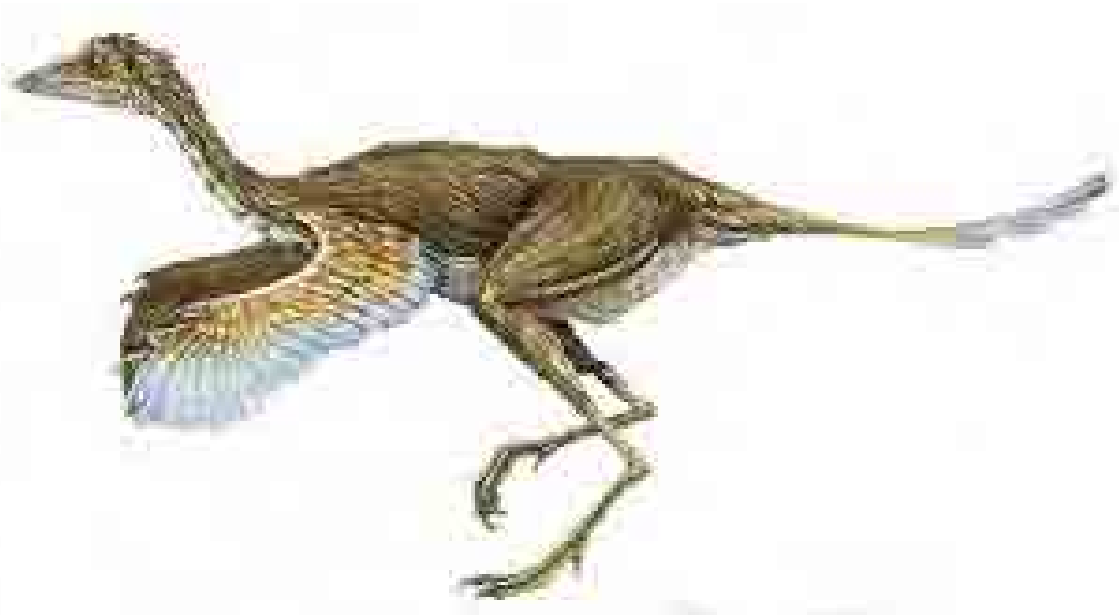


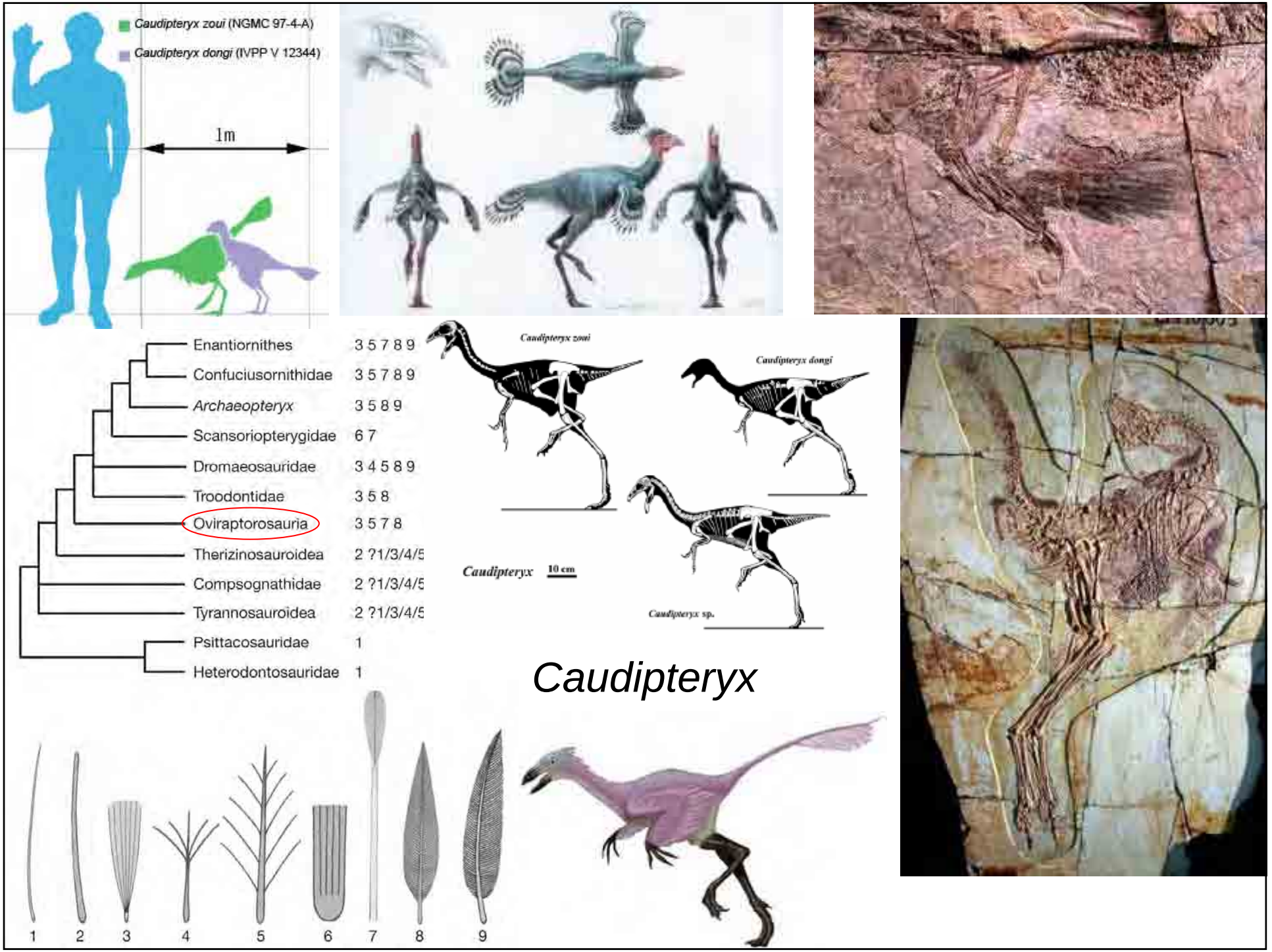


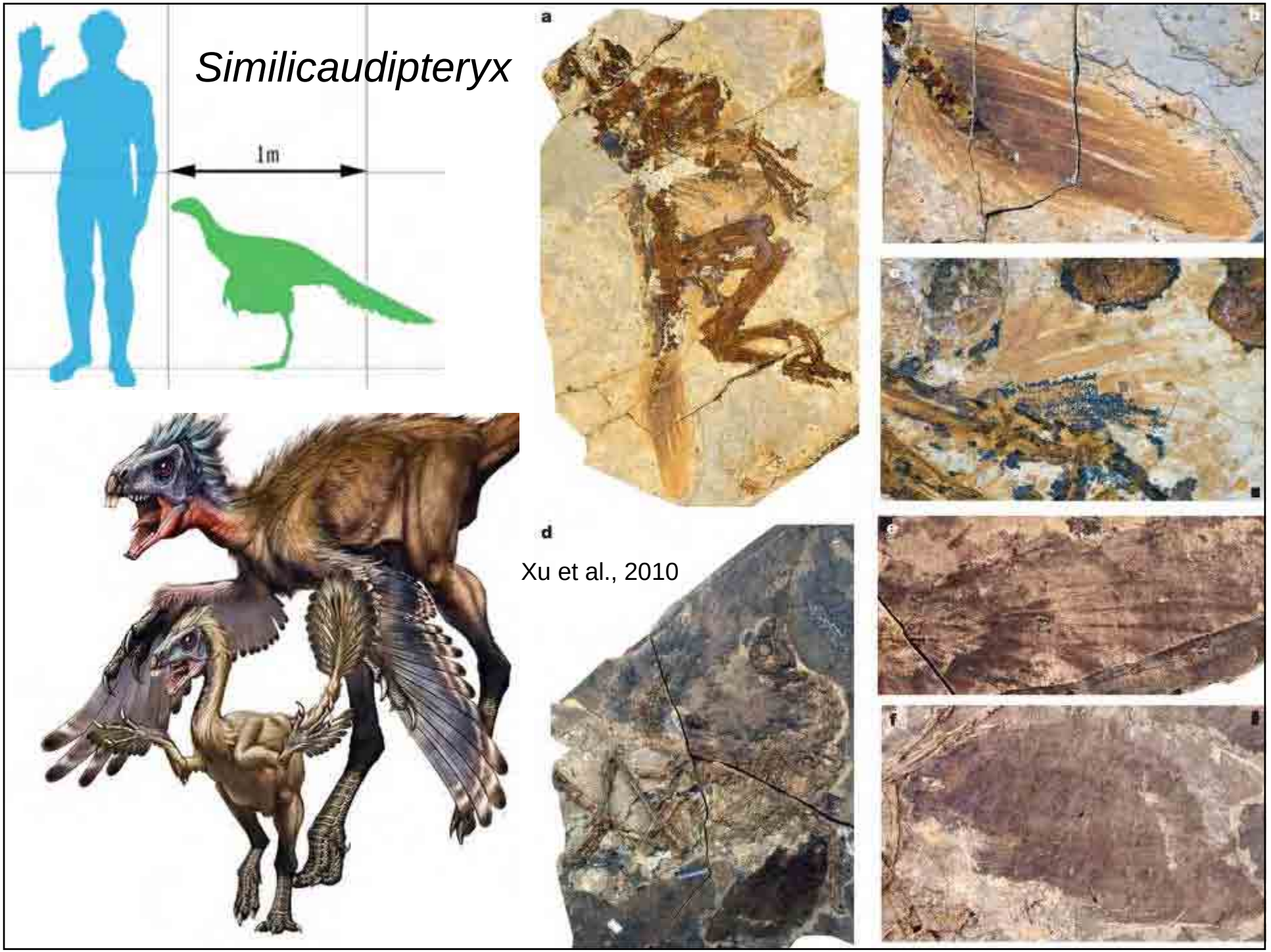
Protarchaopteryx







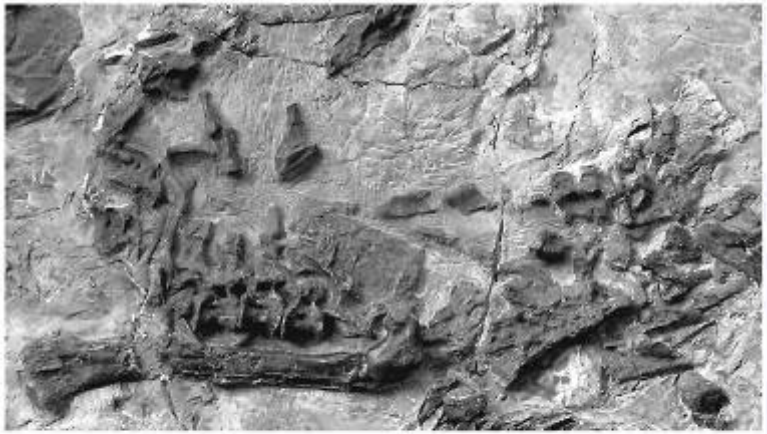


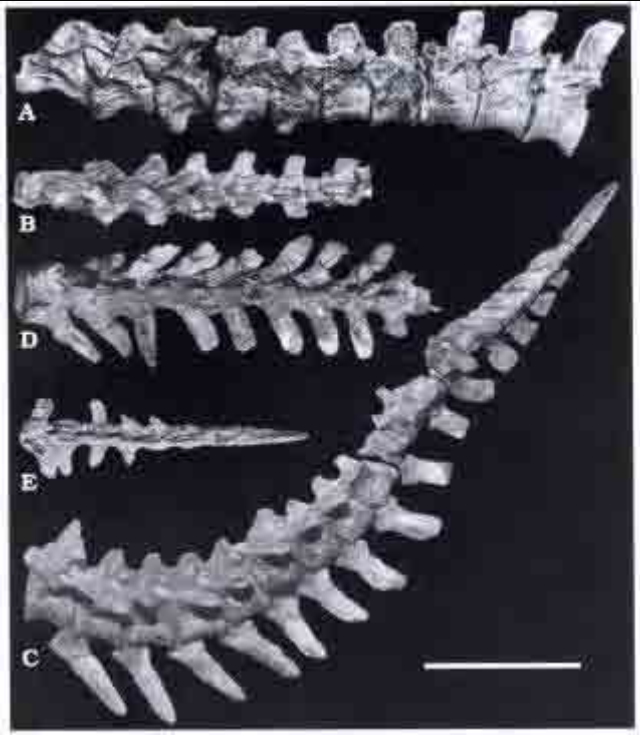


Xu et al., 2010

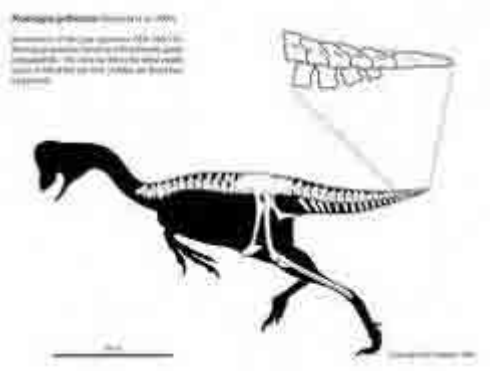
Figure 1 | Developing primary wing feathers of a nestling Great Horned Owl. The distal tip of the planar vane of the pennaceous feathers are emerging from the tubular feather sheath. The sheath surrounds the entire base of the emergent vane, and the rachis runs under the sheath without lateral expansion. Photograph reproduced with permission from B. Hilton.

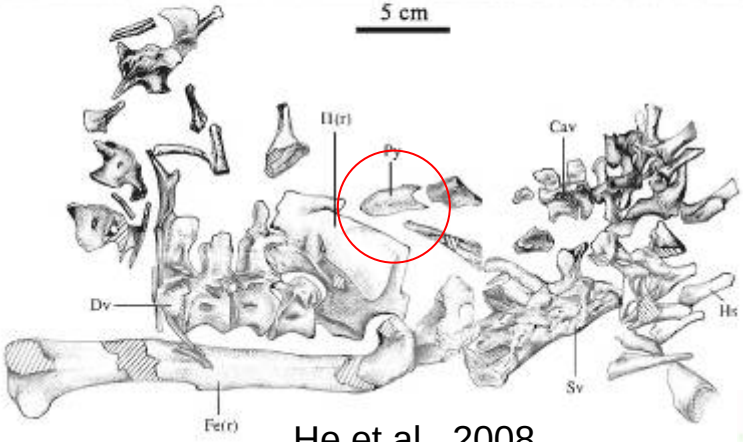
Prum, 2010





Barsbold et al., 2000

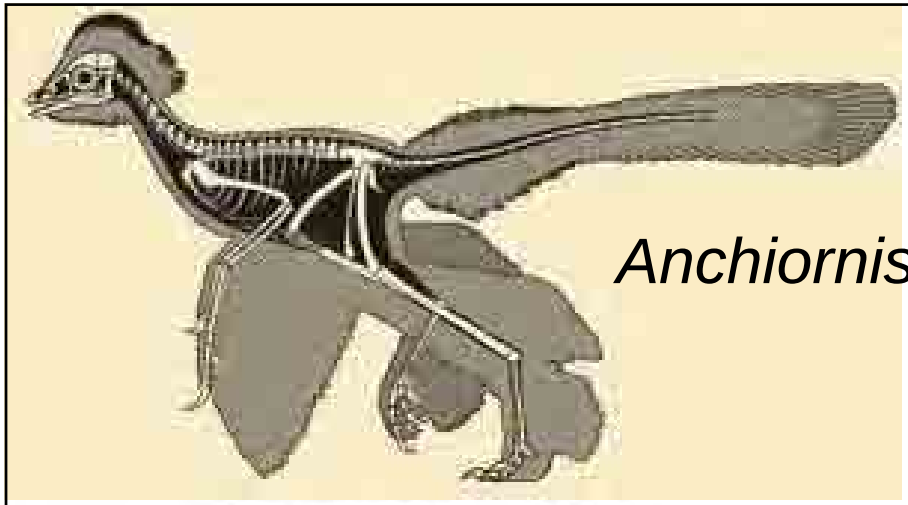




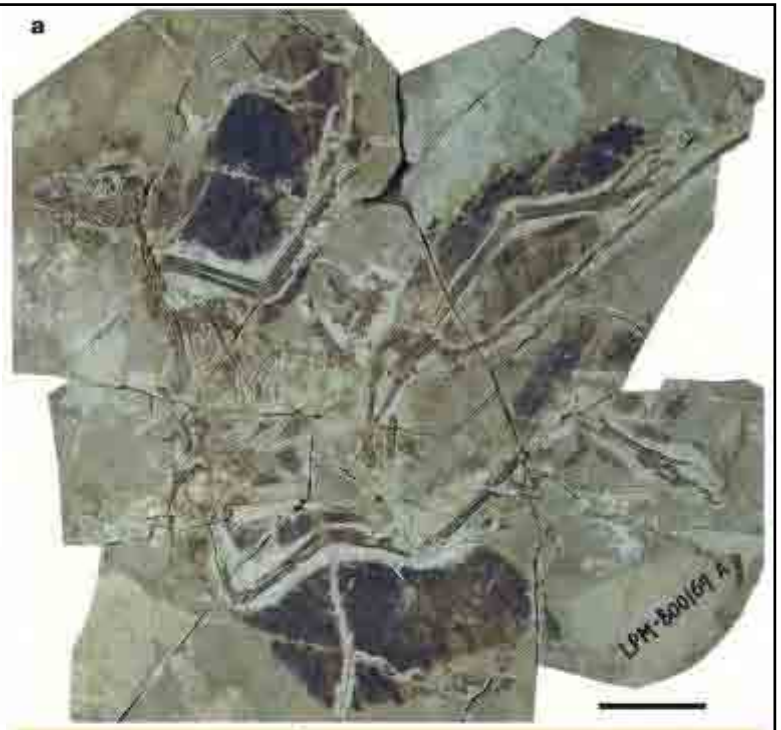
He et al., 2008

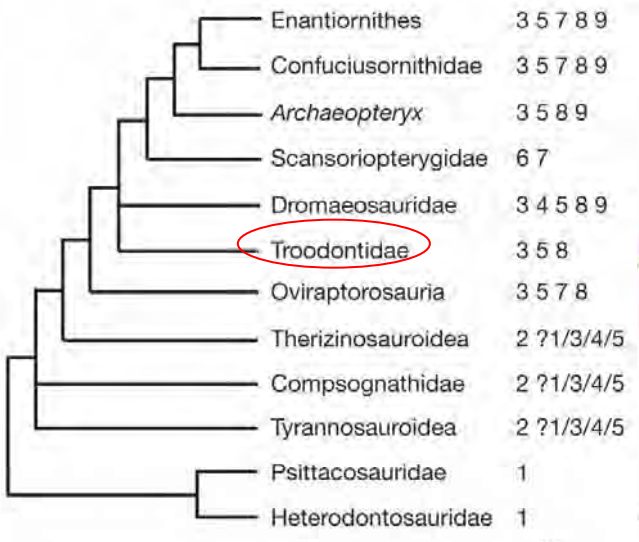
Nomingia

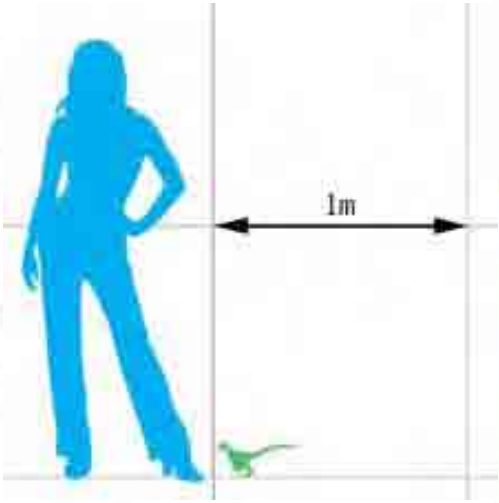
Similicaudipteryx

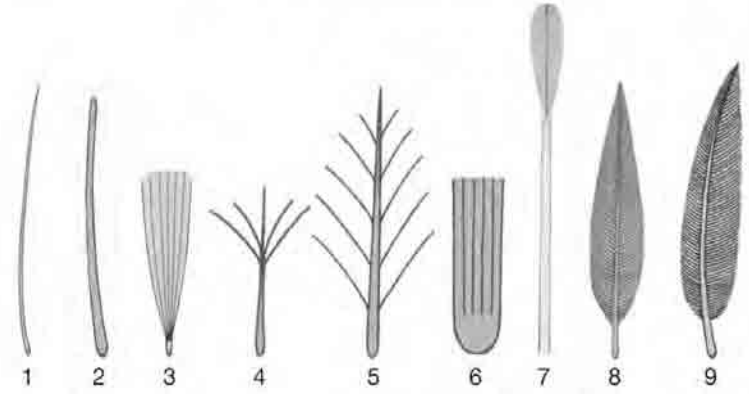


Anchiornis huxleyi

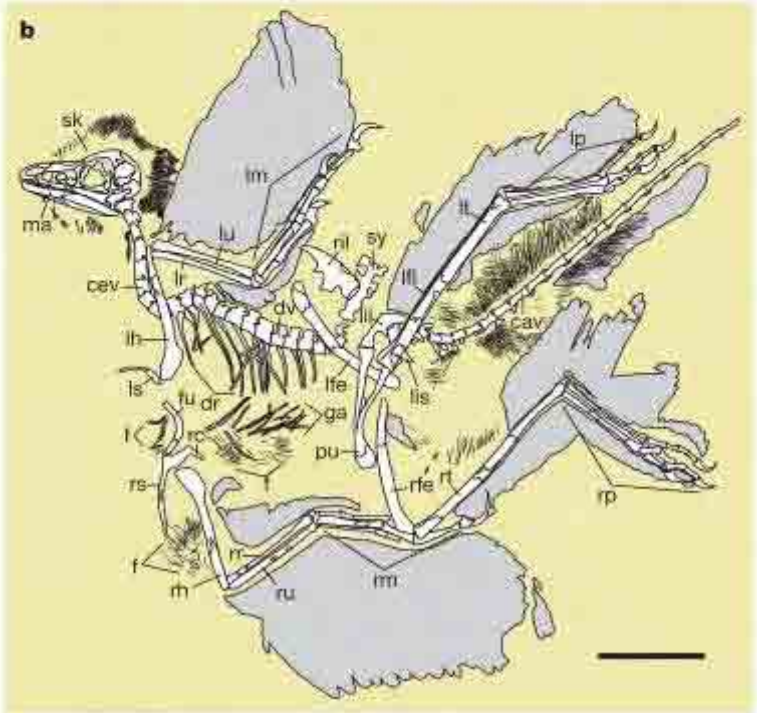


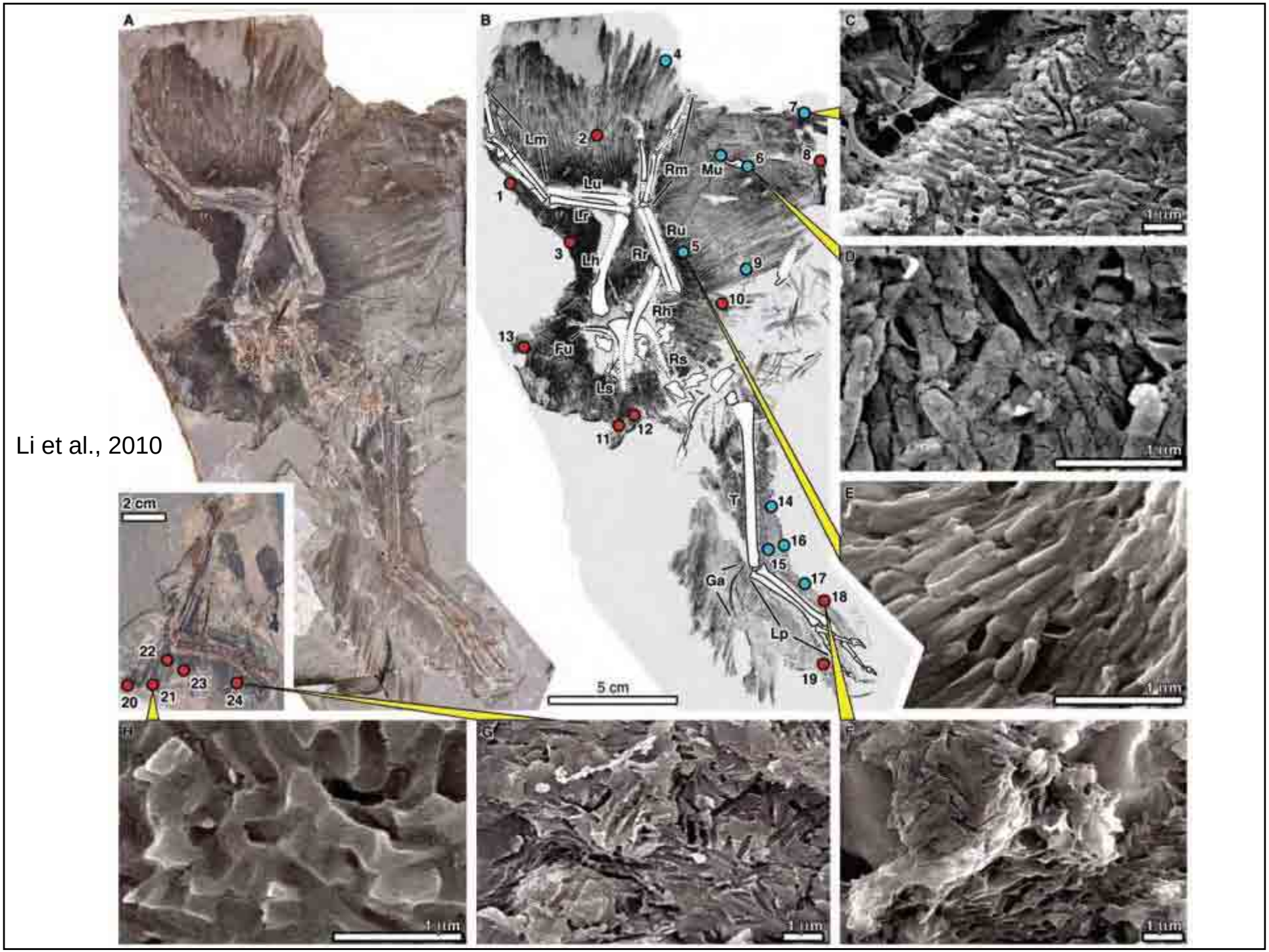






Hu et al., 2009





Li et al., 2010

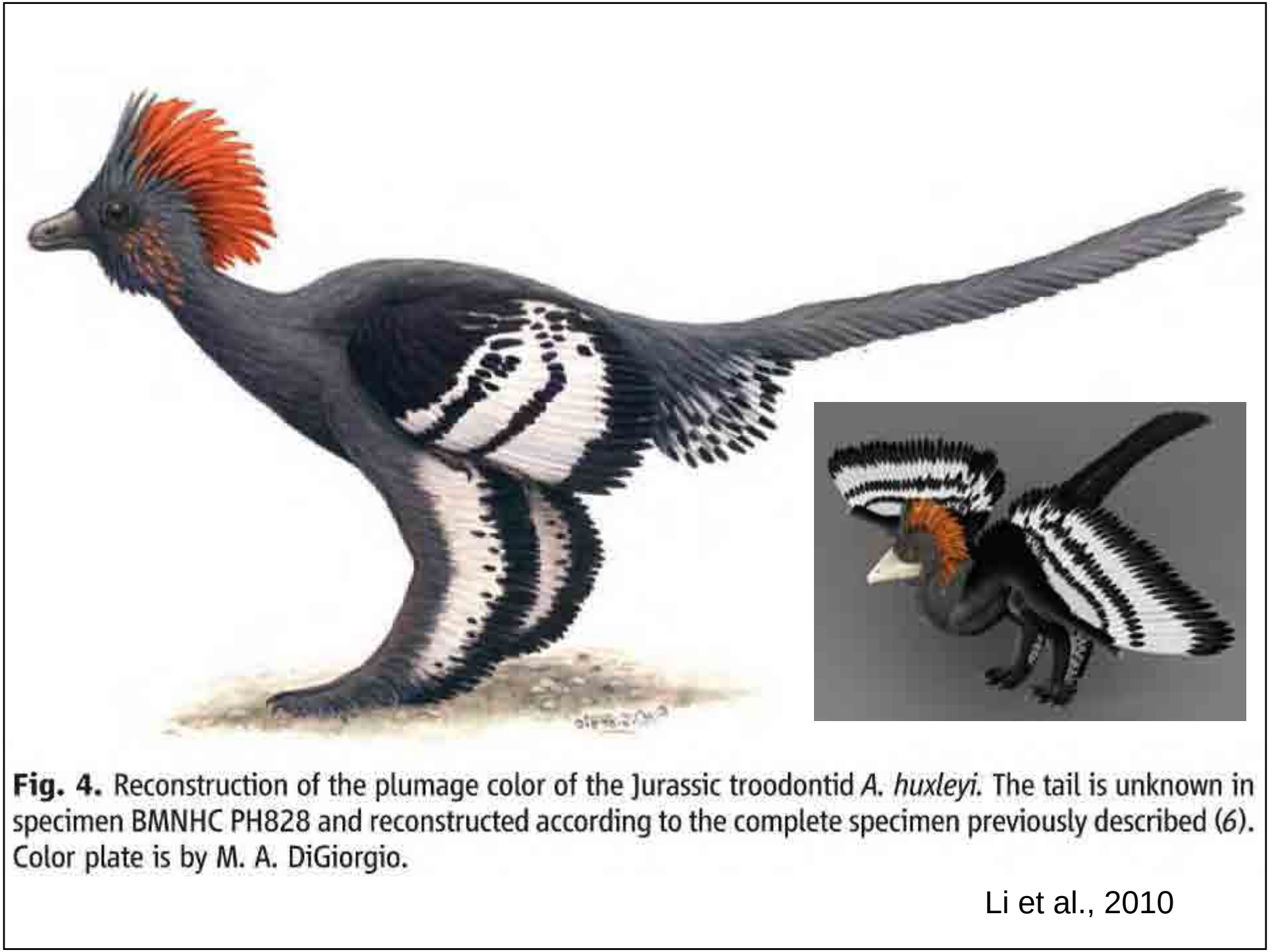
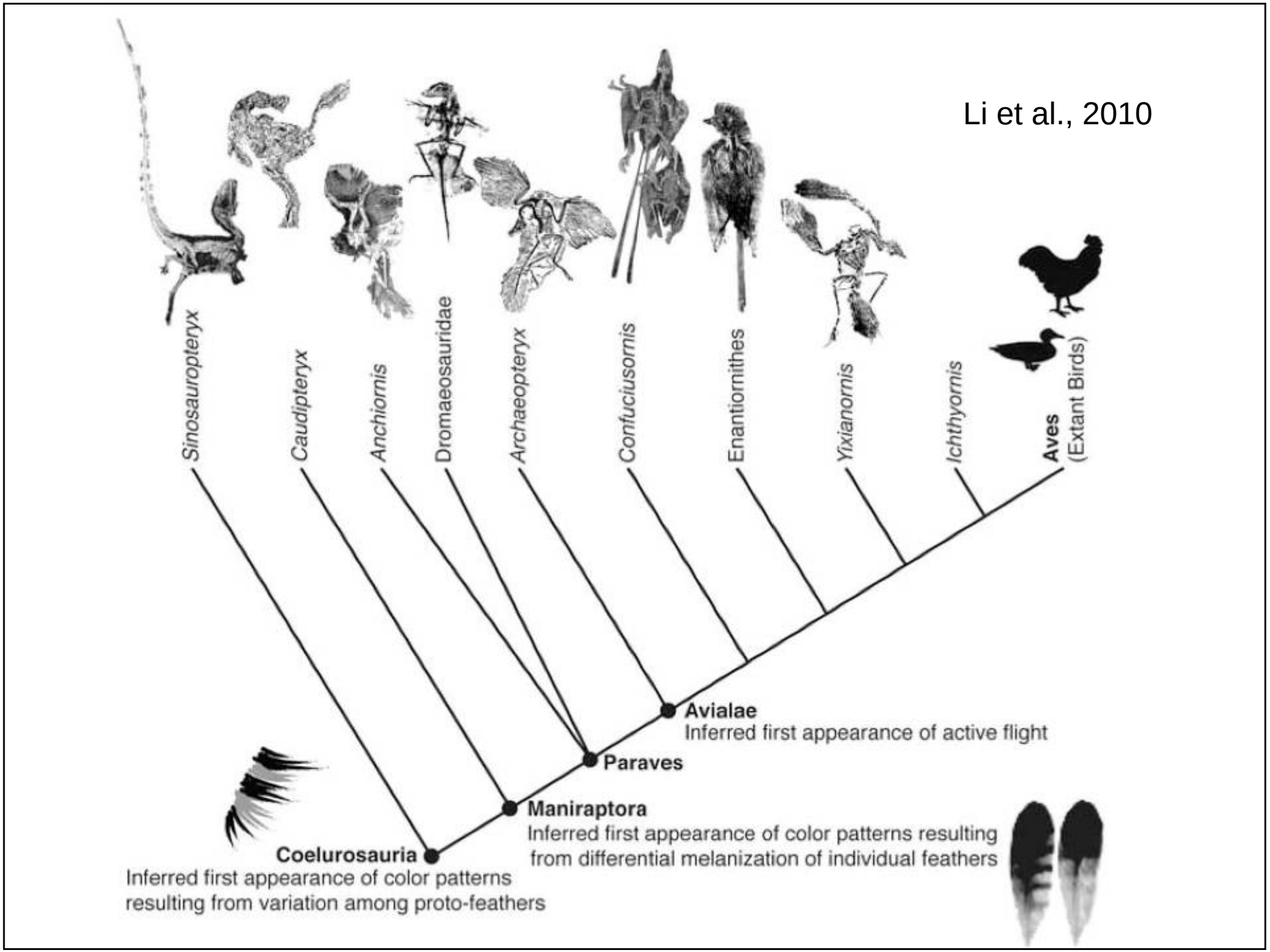


Fig. 4. Reconstruction of the plumage color of the Jurassic troodontid *A. huxleyi*. The tail is unknown in specimen BMNHC PH828 and reconstructed according to the complete specimen previously described (*6*). Color plate is by M. A. DiGiorgio.

Li et al., 2010



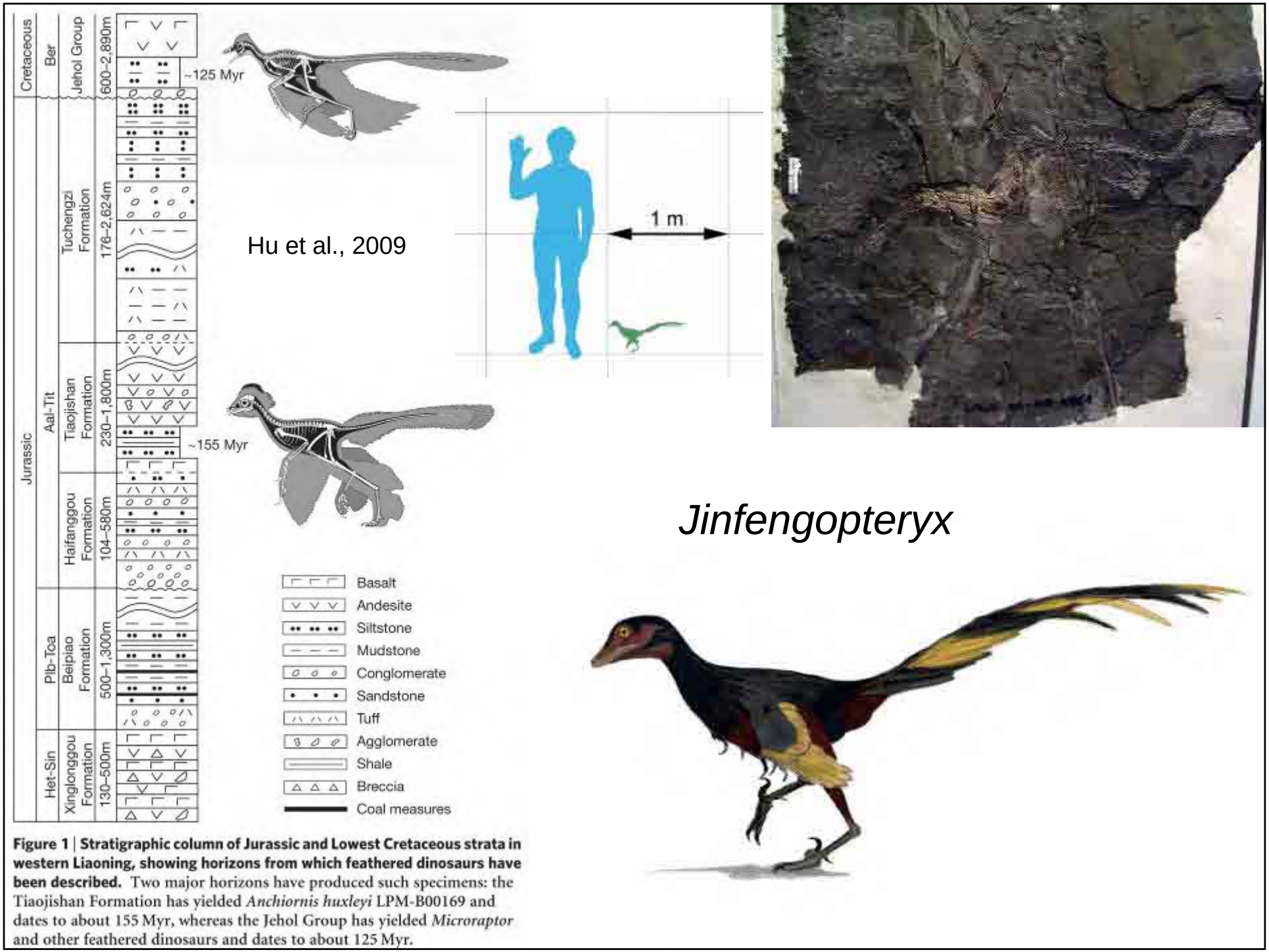
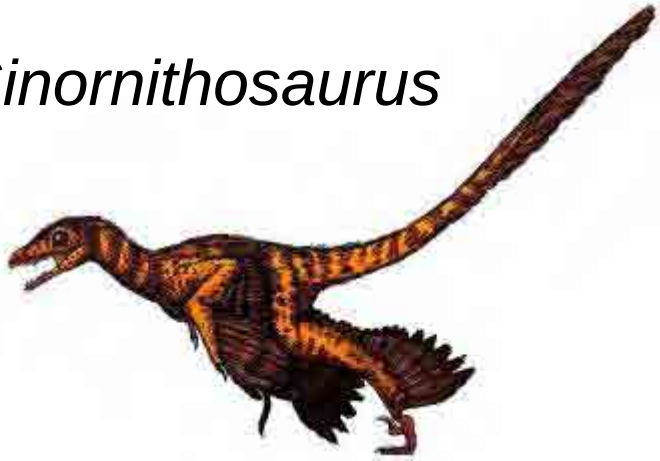
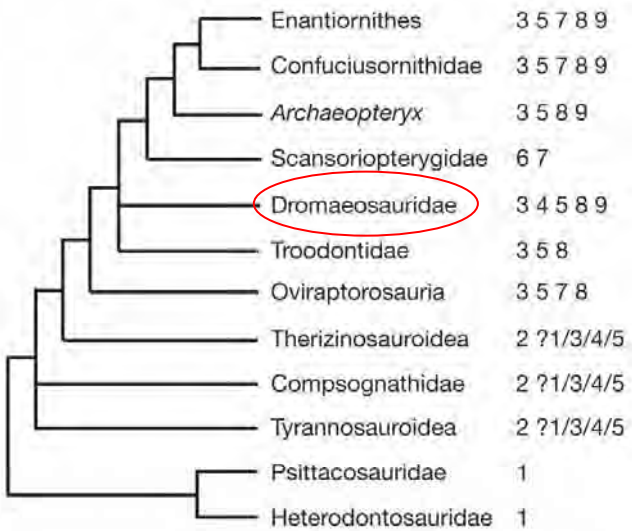
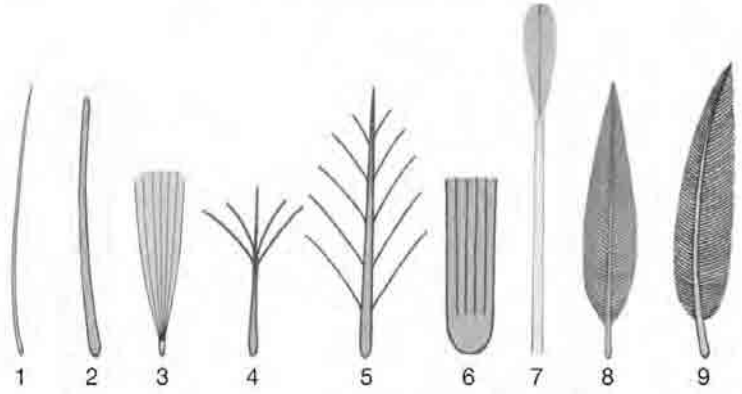


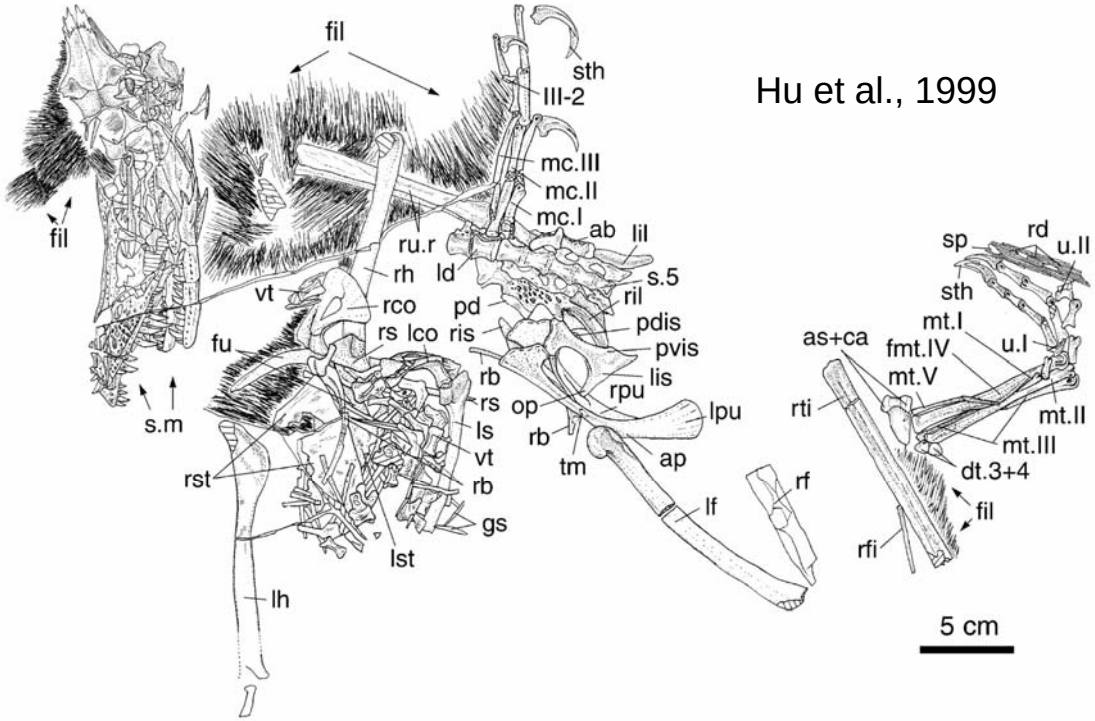
Figure 1 | Stratigraphic column of Jurassic and Lowest Cretaceous strata in western Liaoning, showing horizons from which feathered dinosaurs have been described. Two major horizons have produced such specimens: the Tiaojishan Formation has yielded *Anchiornis huxleyi* LPM-B00169 and dates to about 155 Myr, whereas the Jehol Group has yielded *Microraptor* and other feathered dinosaurs and dates to about 125 Myr.

Sinornithosaurus



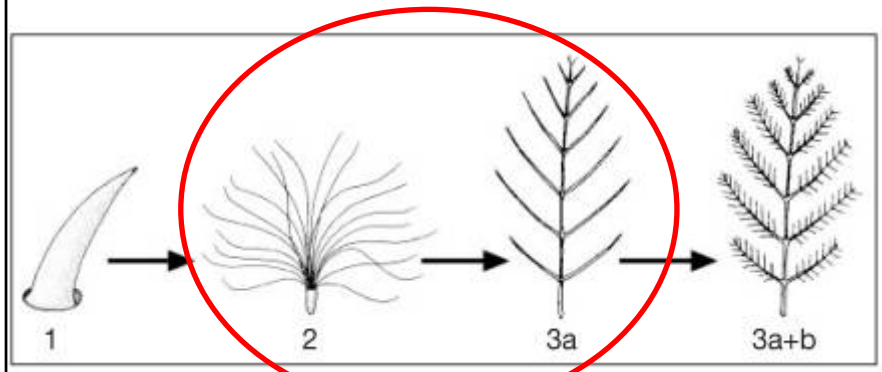


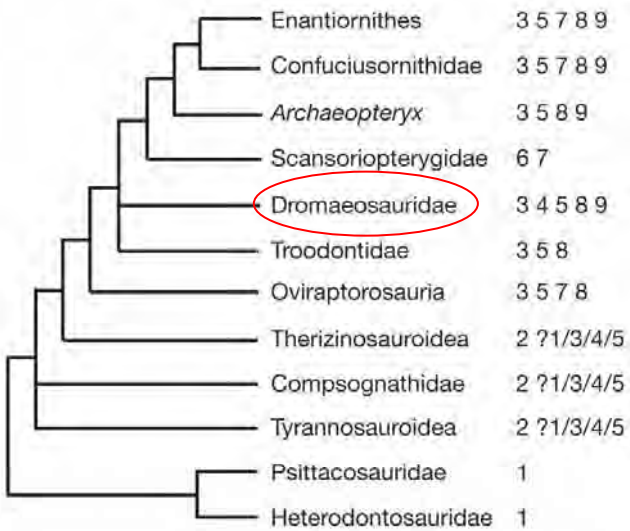


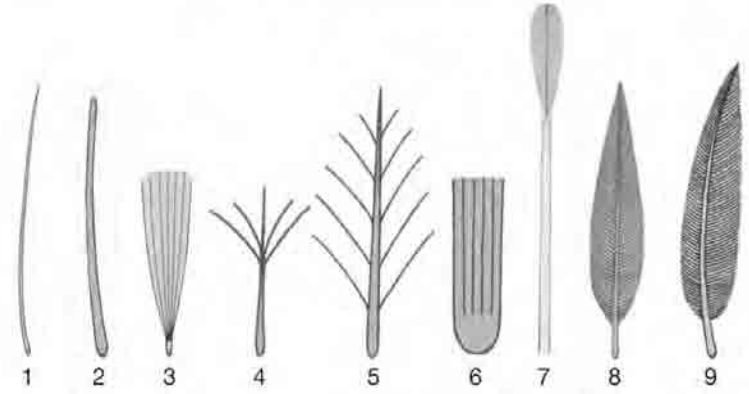


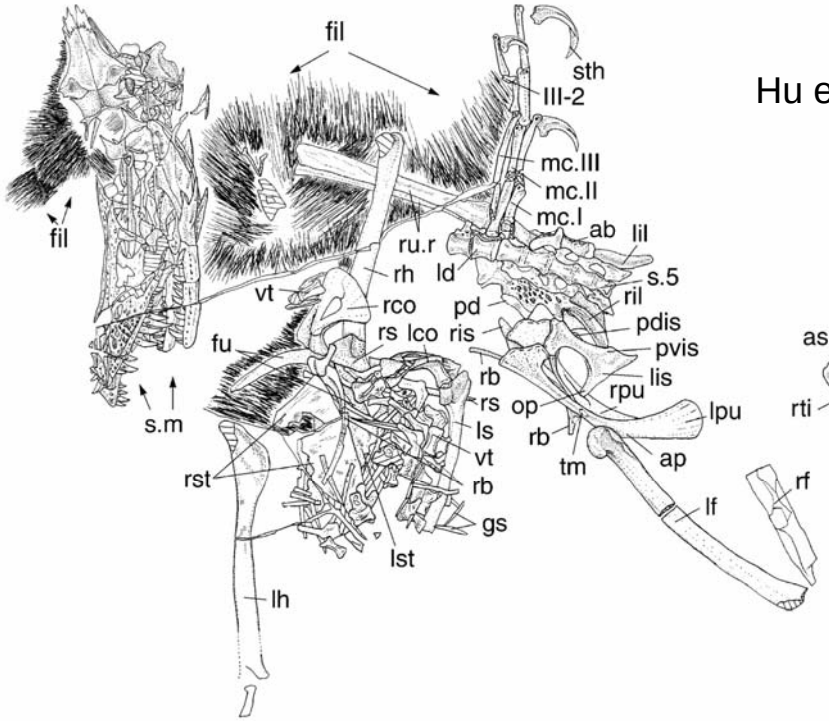
Hu et al., 1999

Sinornithosaurus

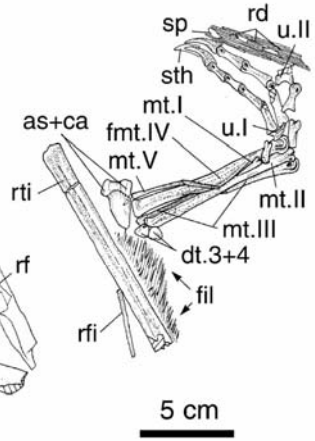


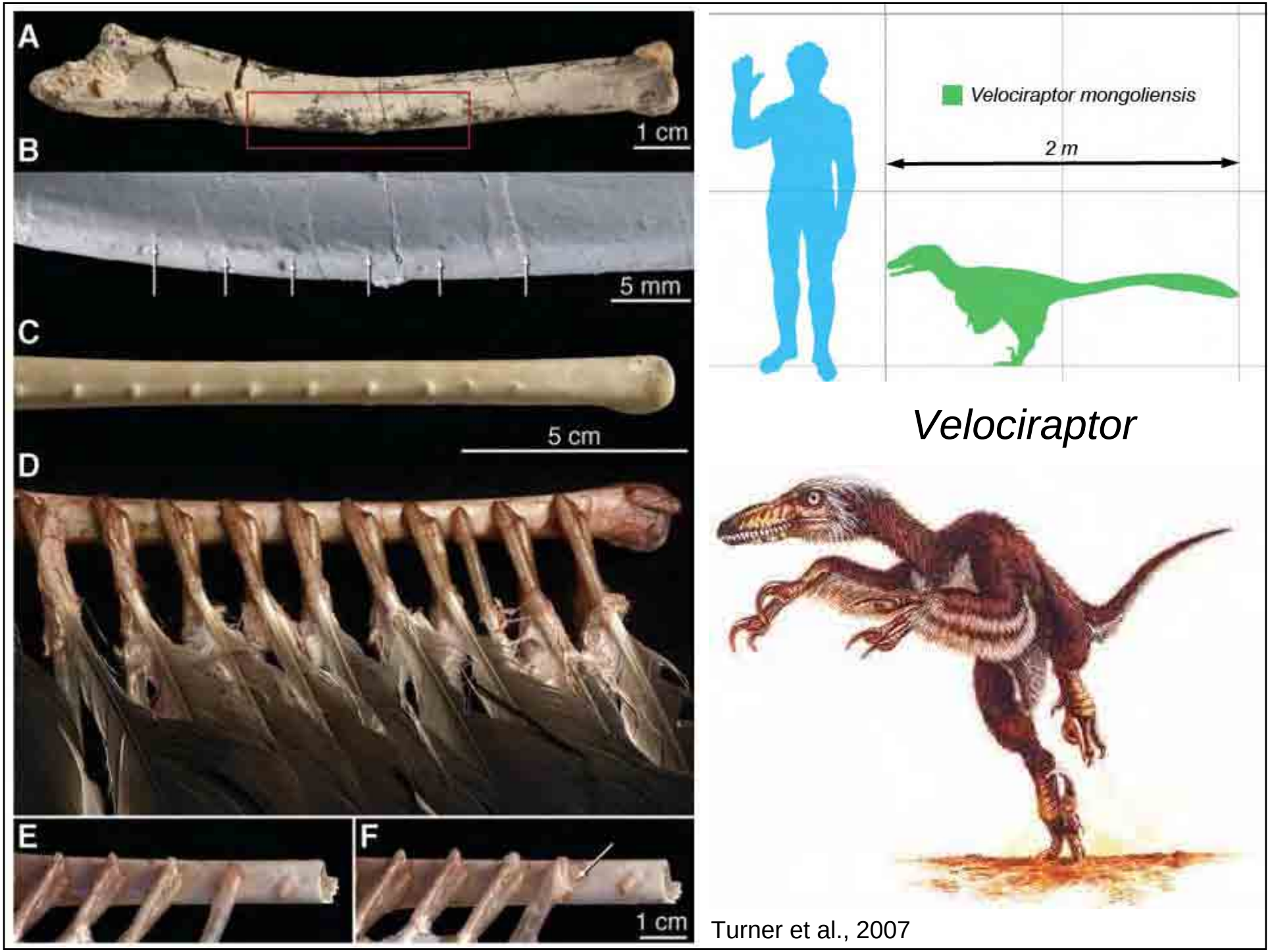


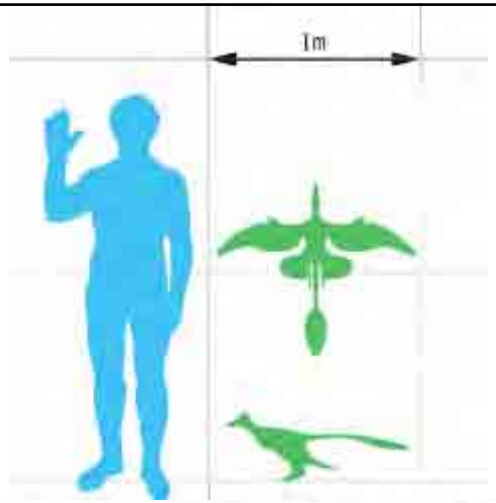


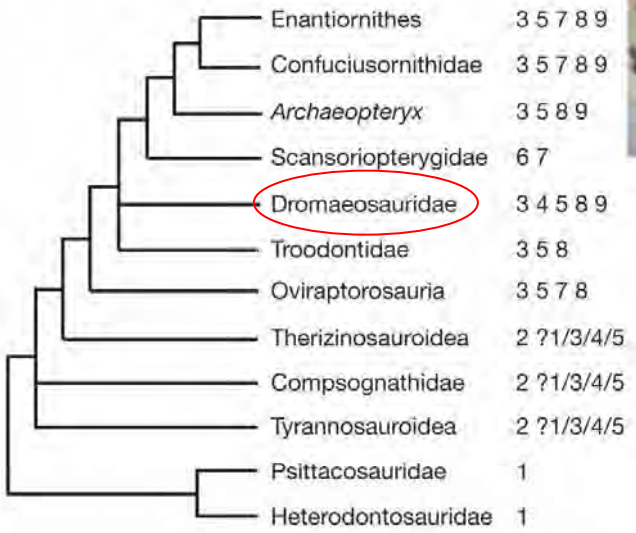


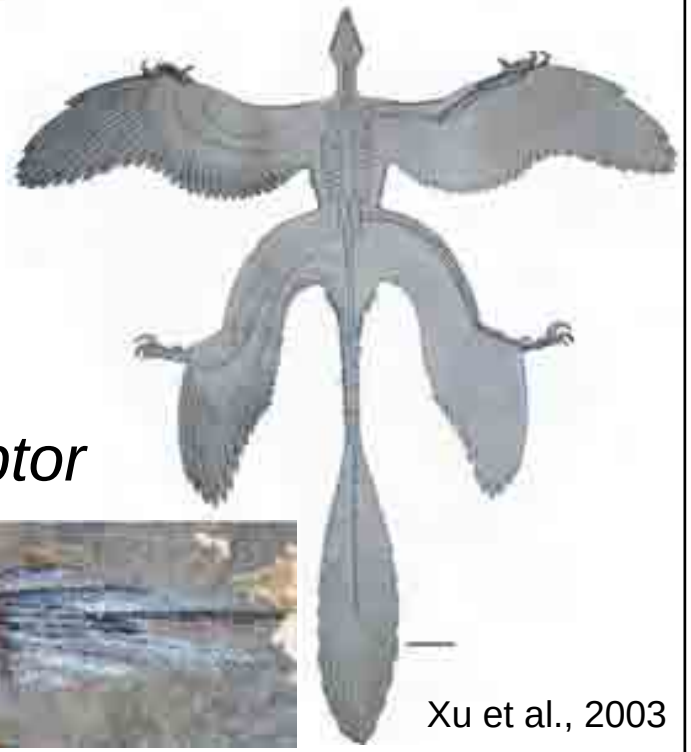
Hu et al., 1999



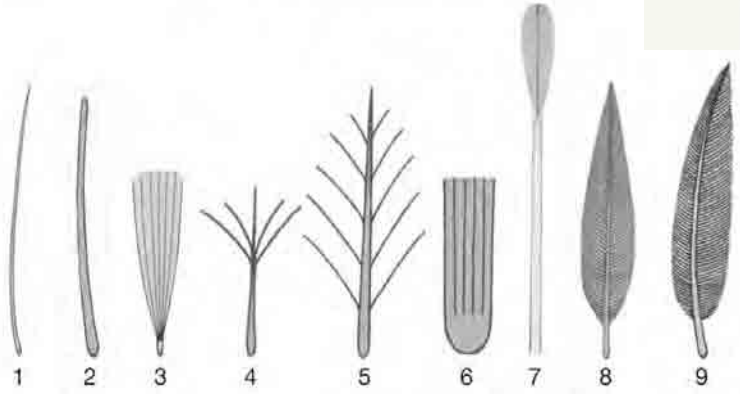




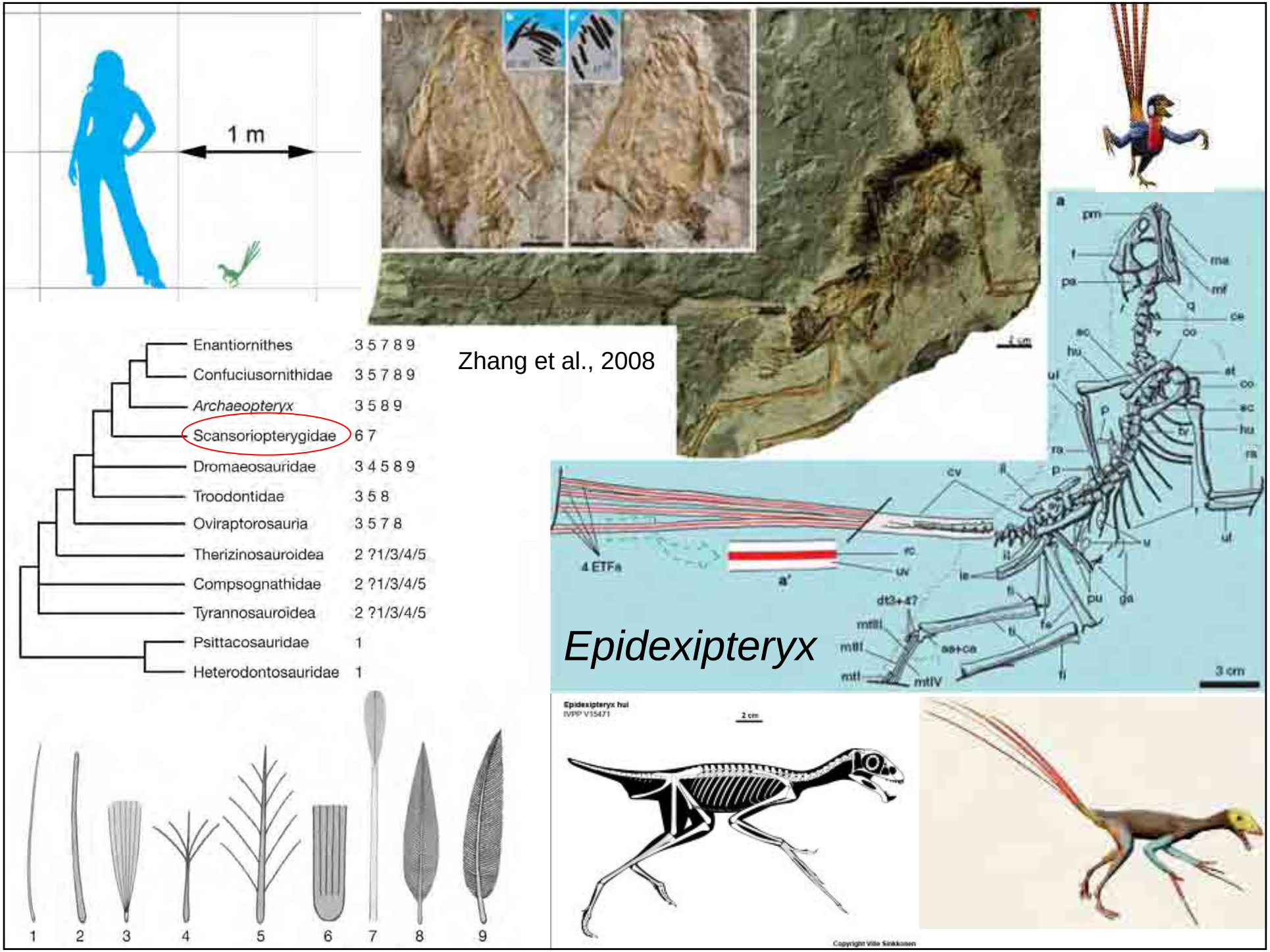


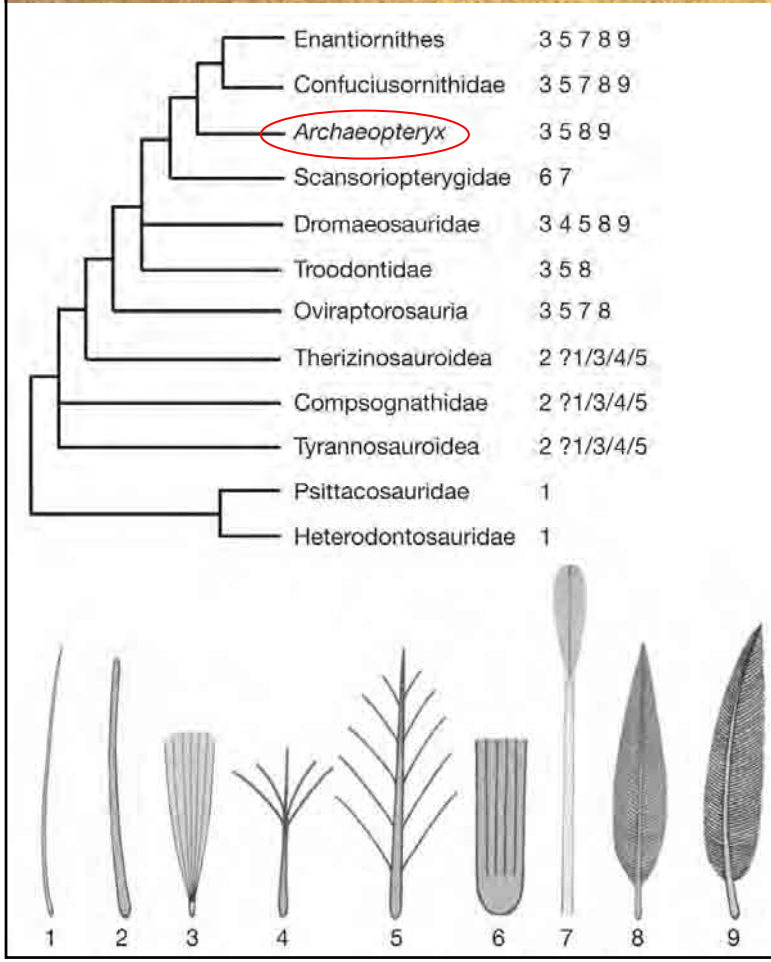


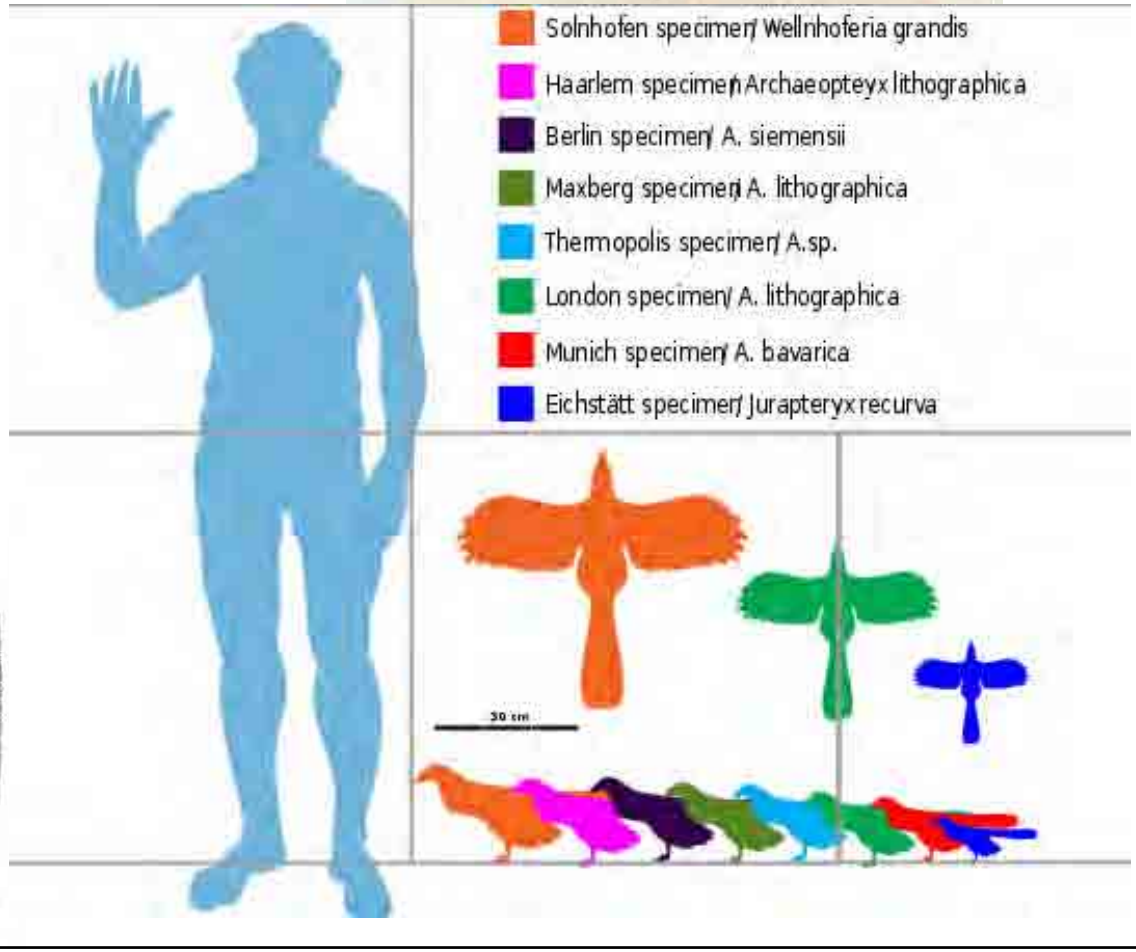
Microraptor



Xu et al., 2003







Archaeopteryx (Berlin specimen)

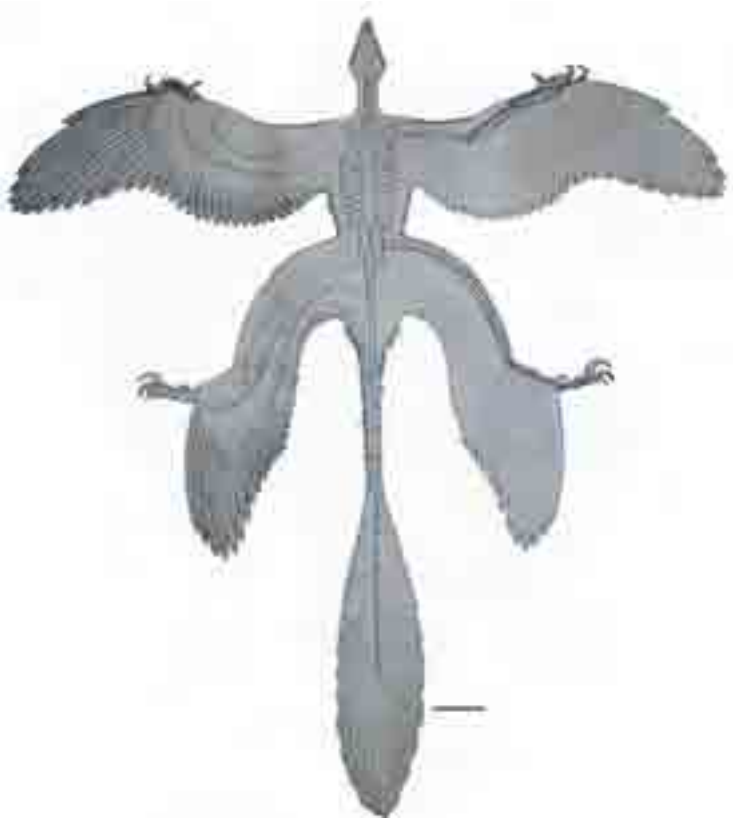
противоотпечаток

Christiansen & Bonde, 2004

Рисунок 1878-1879 гг.

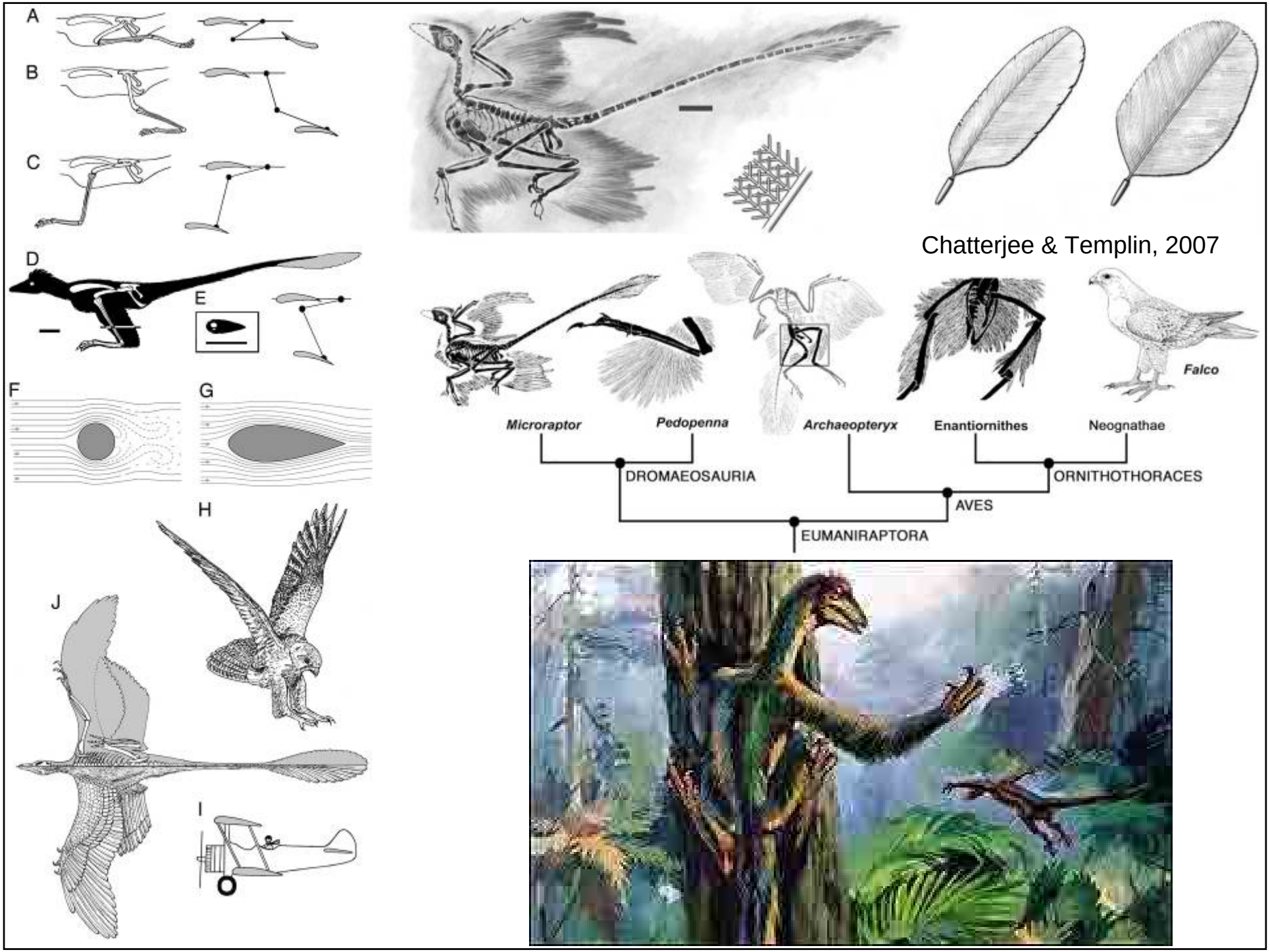
Archaeopteryx (Berlin specimen)

Microraptor



Archaeopteryx

?



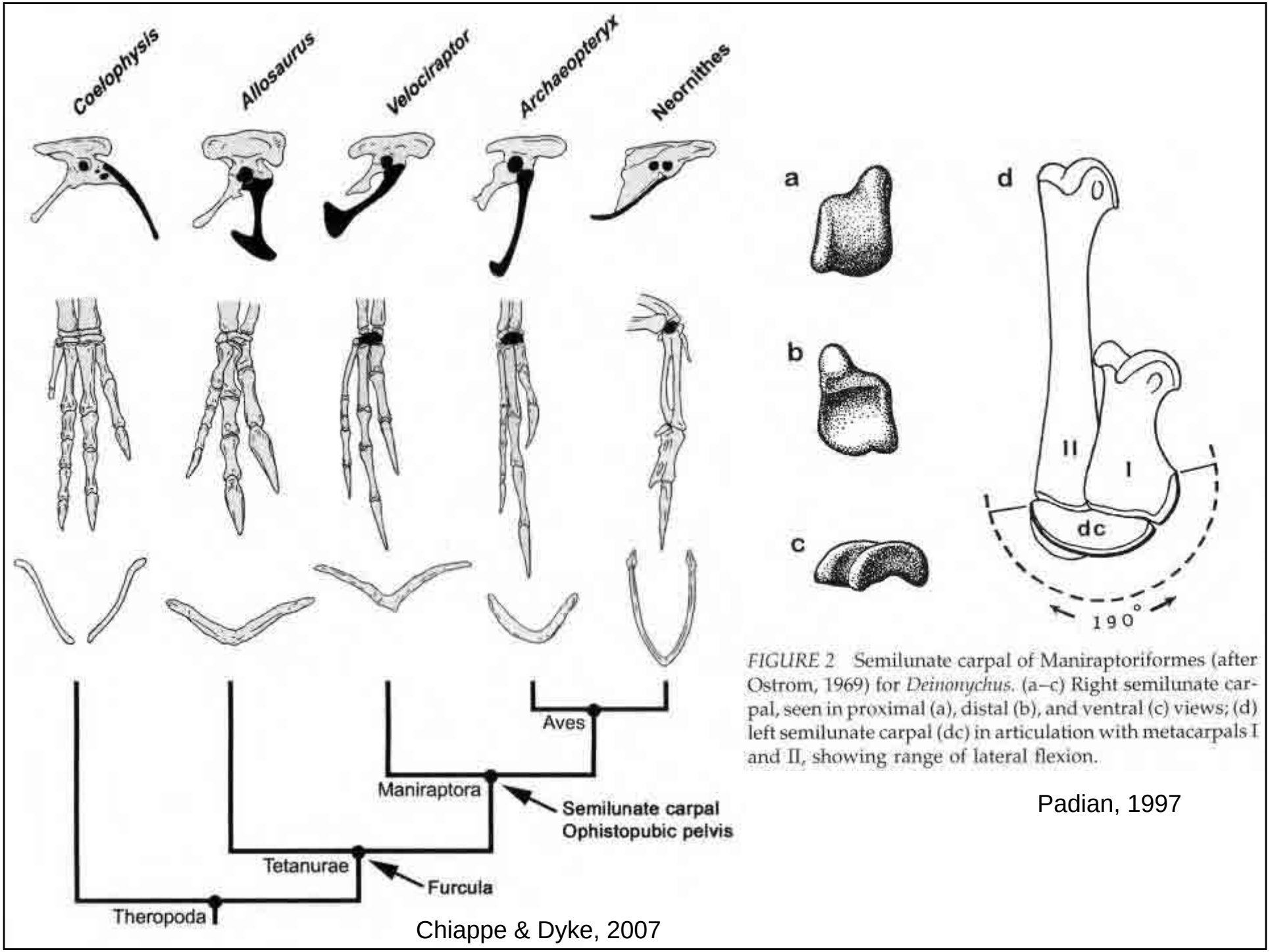
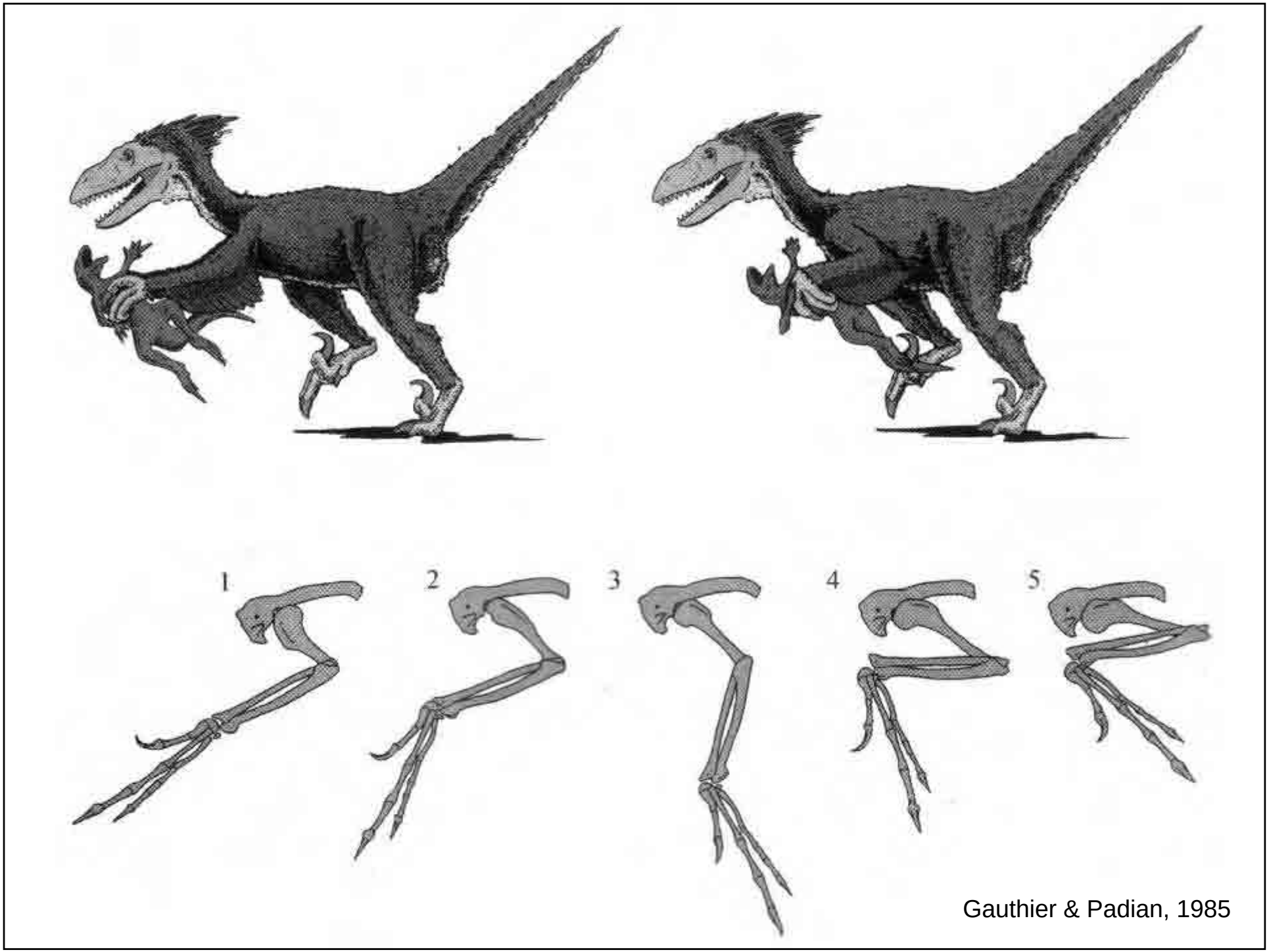


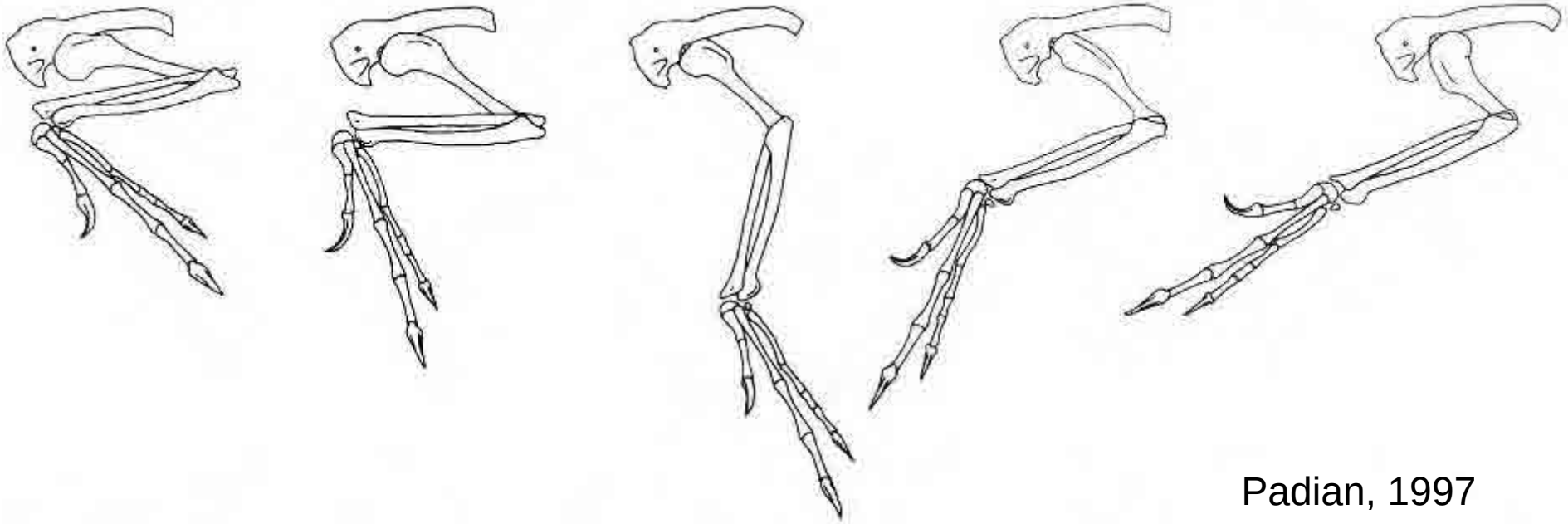
FIGURE 2 Semilunate carpal of Maniraptoriformes (after Ostrom, 1969) for *Deinonychus*. (a–c) Right semilunate carpal, seen in proximal (a), distal (b), and ventral (c) views; (d) left semilunate carpal (dc) in articulation with metacarpals I and II, showing range of lateral flexion.

Padian, 1997

Chiappe & Dyke, 2007

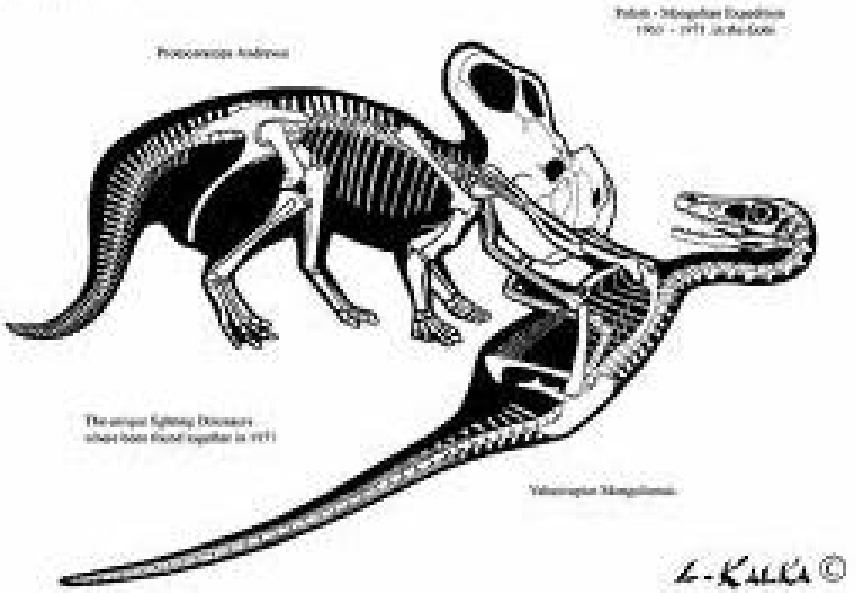


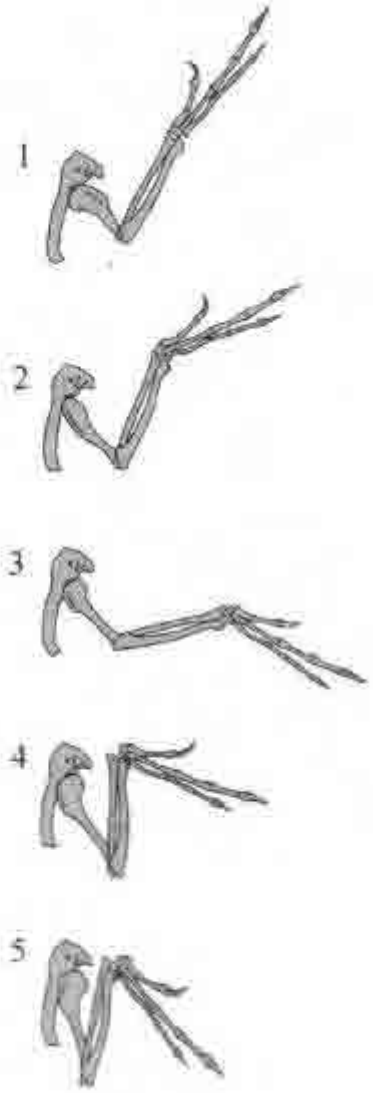
Gauthier & Padian, 1985

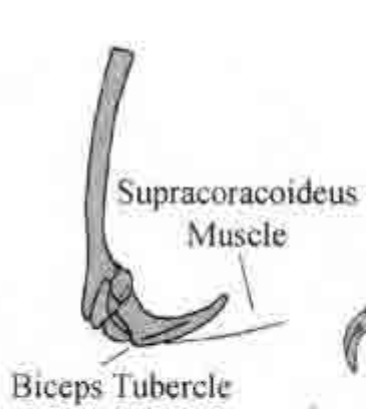


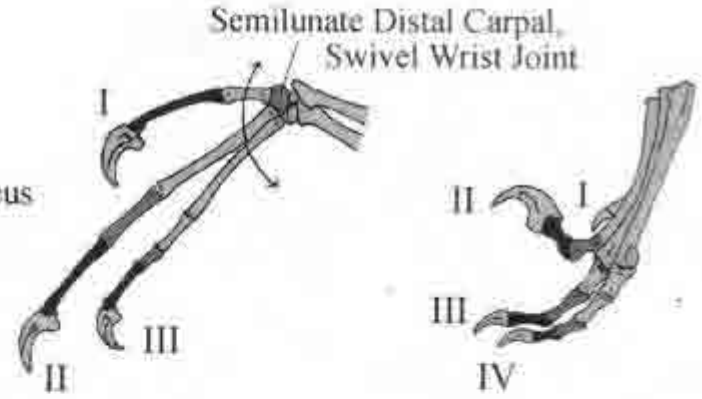
Padian, 1997

FIGURE 3 The predatory stroke of the forelimb in *Deinonychus*, similar to the avian flight stroke. Right shoulder girdle and forelimb in lateral view (after Gauthier and Padian, 1985, with permission).

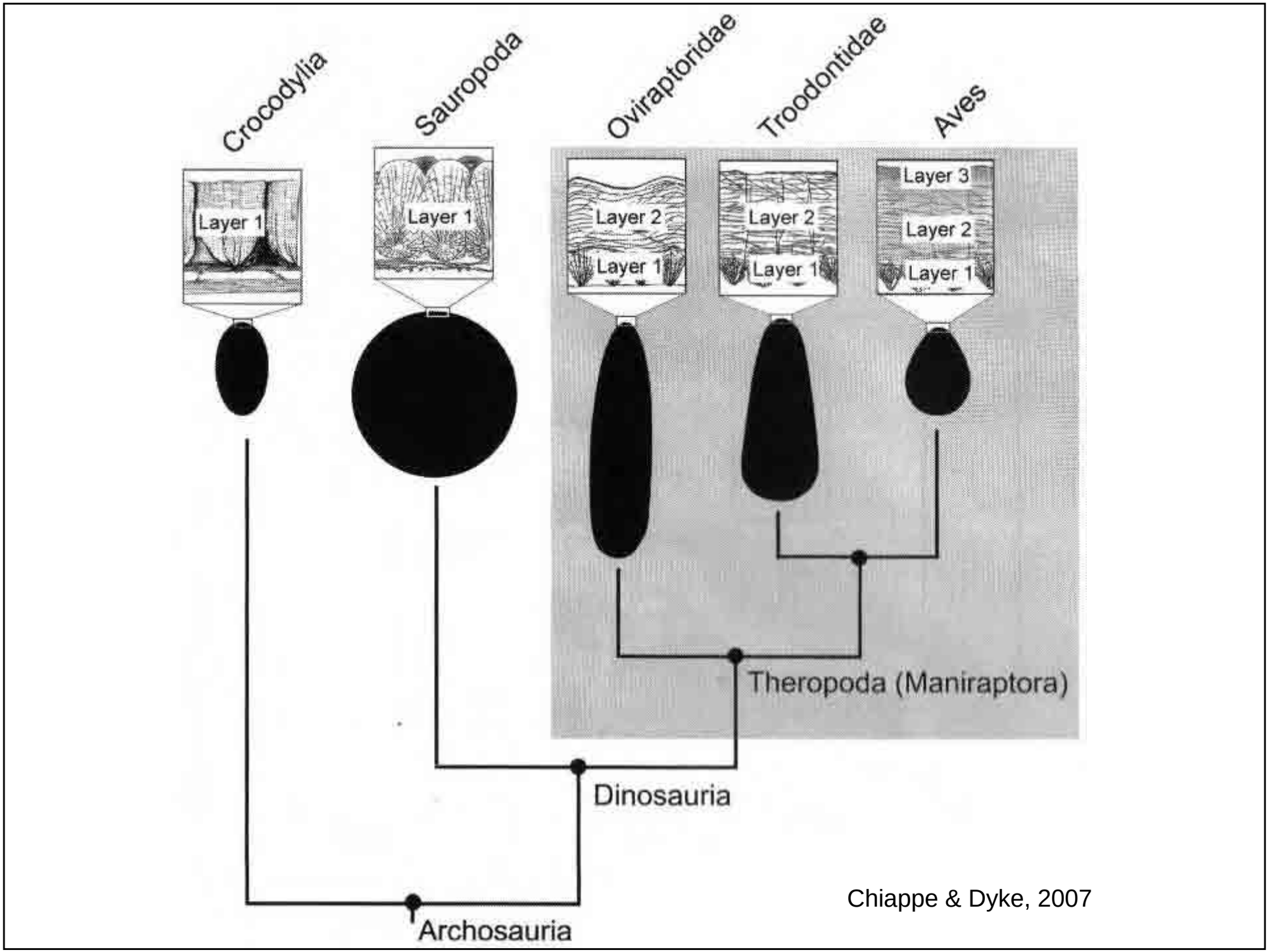




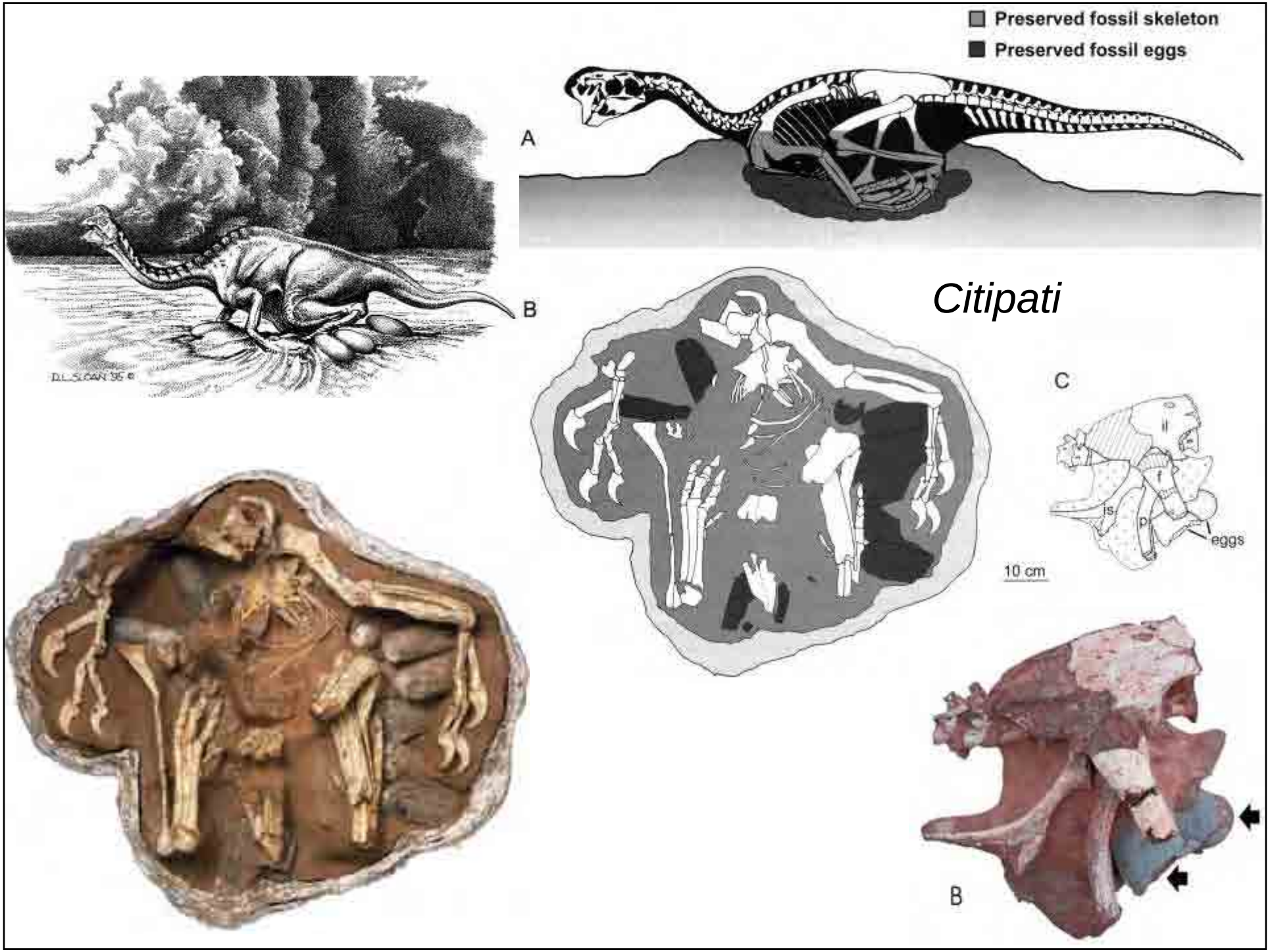




Chatterjee & Templin, 2004



Chiappe & Dyke, 2007



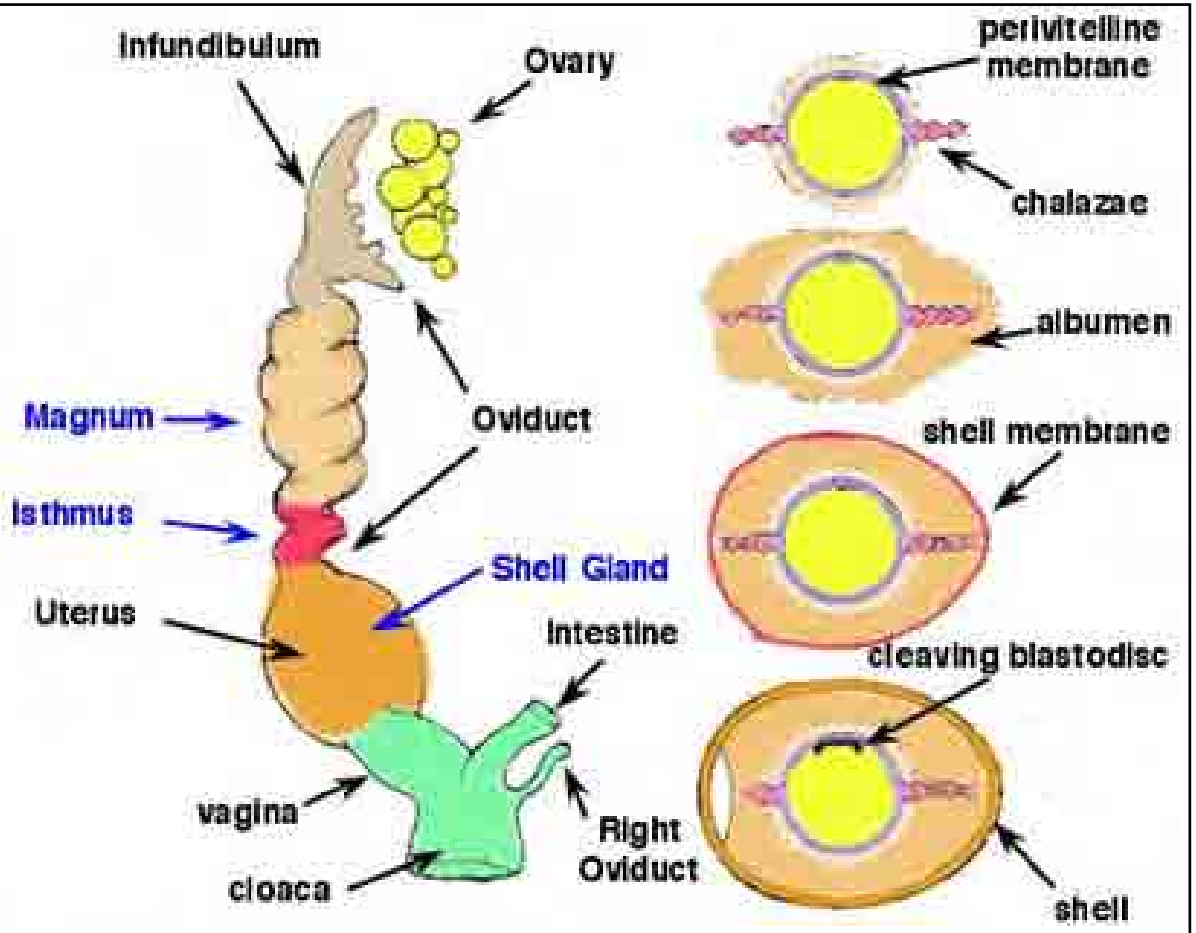
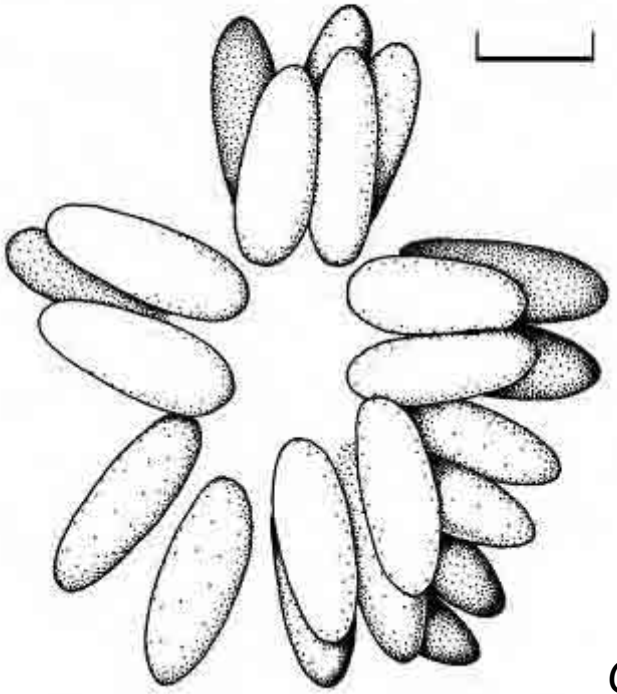
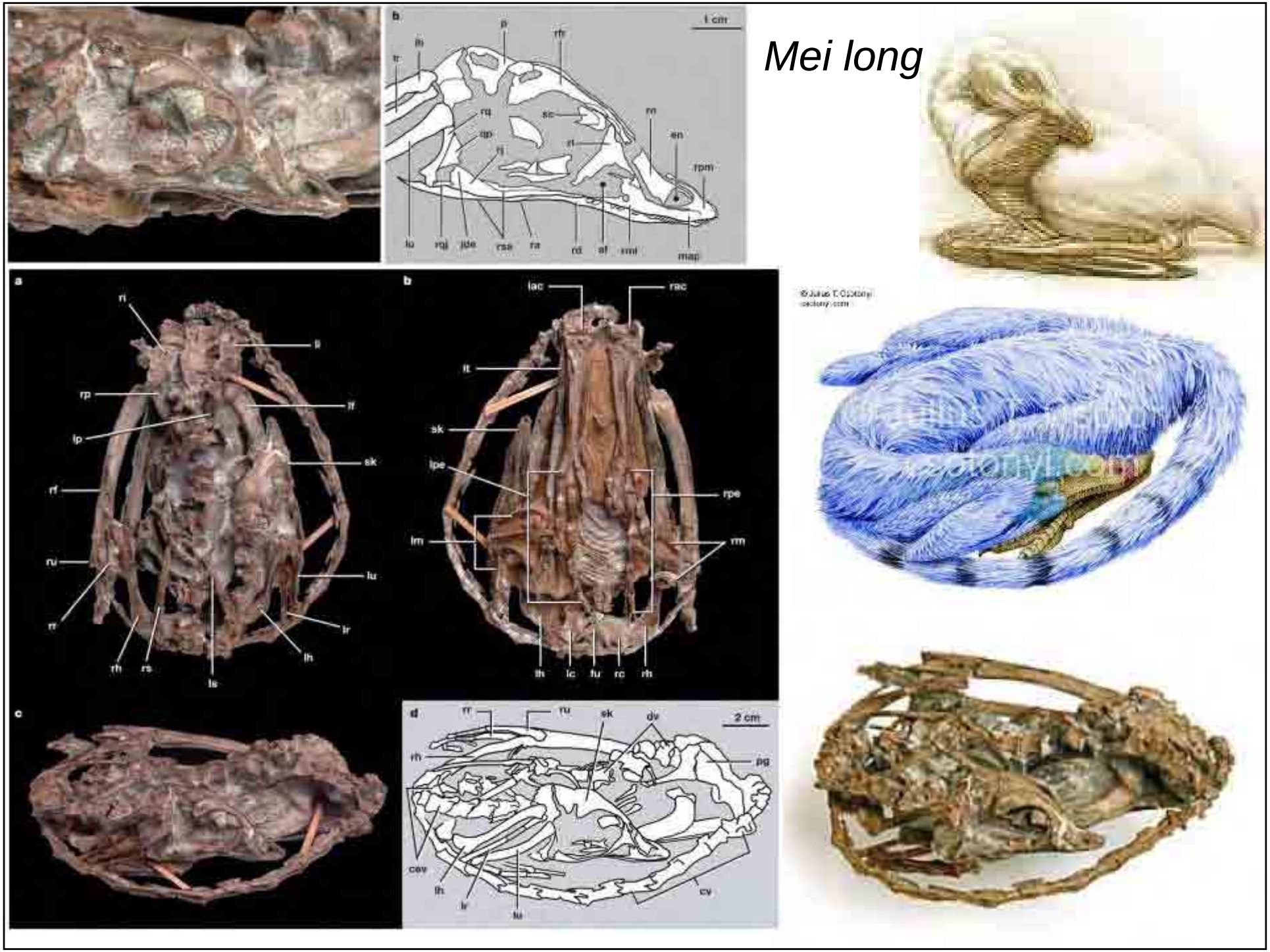


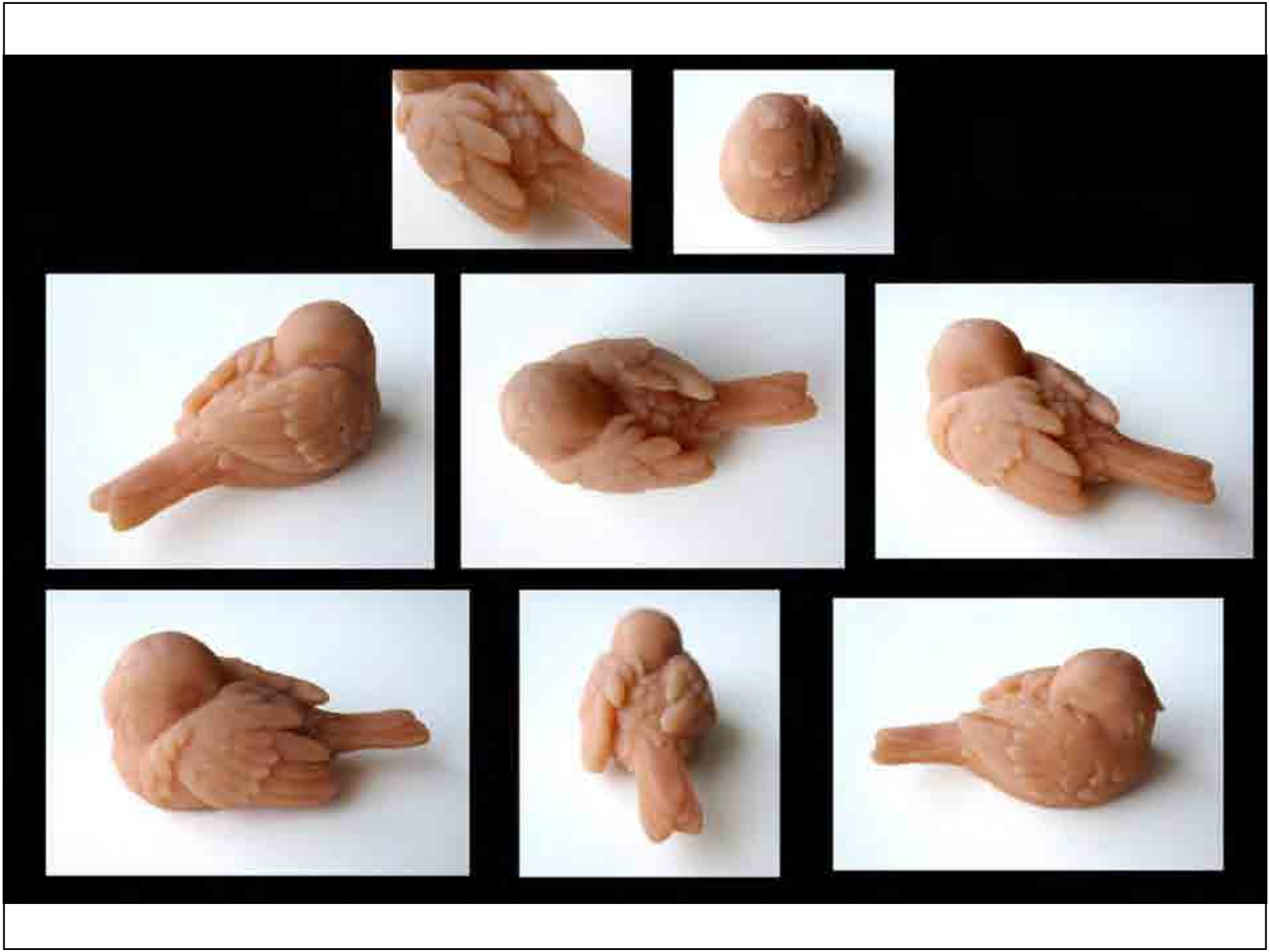
Fig. 3. Nest of elongatoolithid eggs from Mongolia, based on IGM 100/1008. The outlines of some eggs have been restored, but all of the eggs in the drawing are present in the positions shown. Scale bar = 10 cm.



Citipati embryo

Mei long





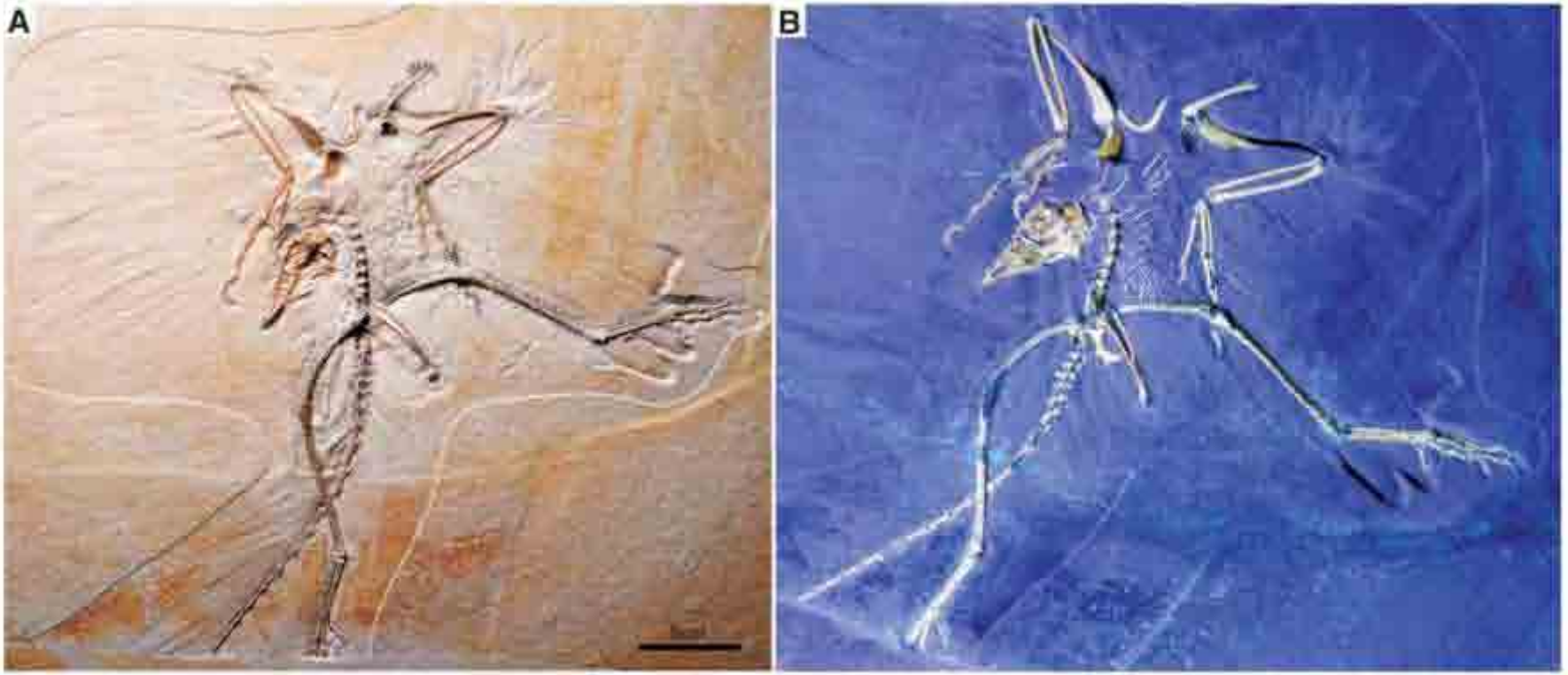
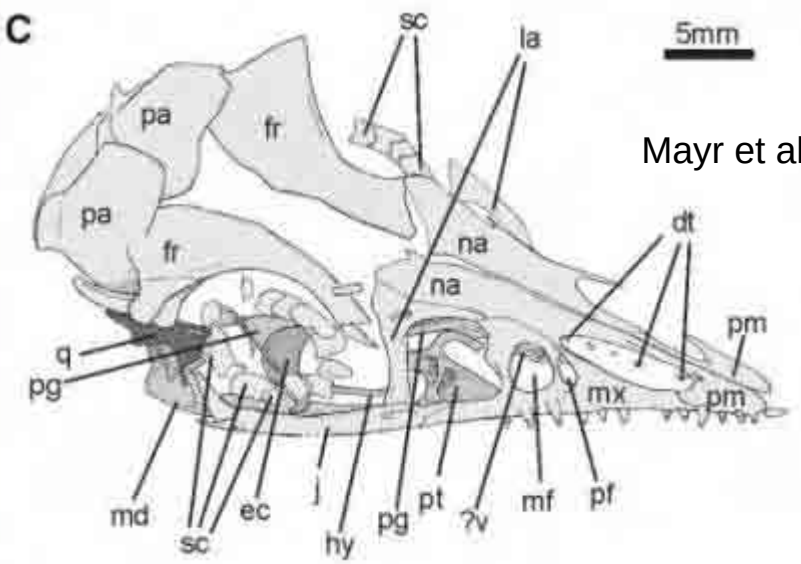
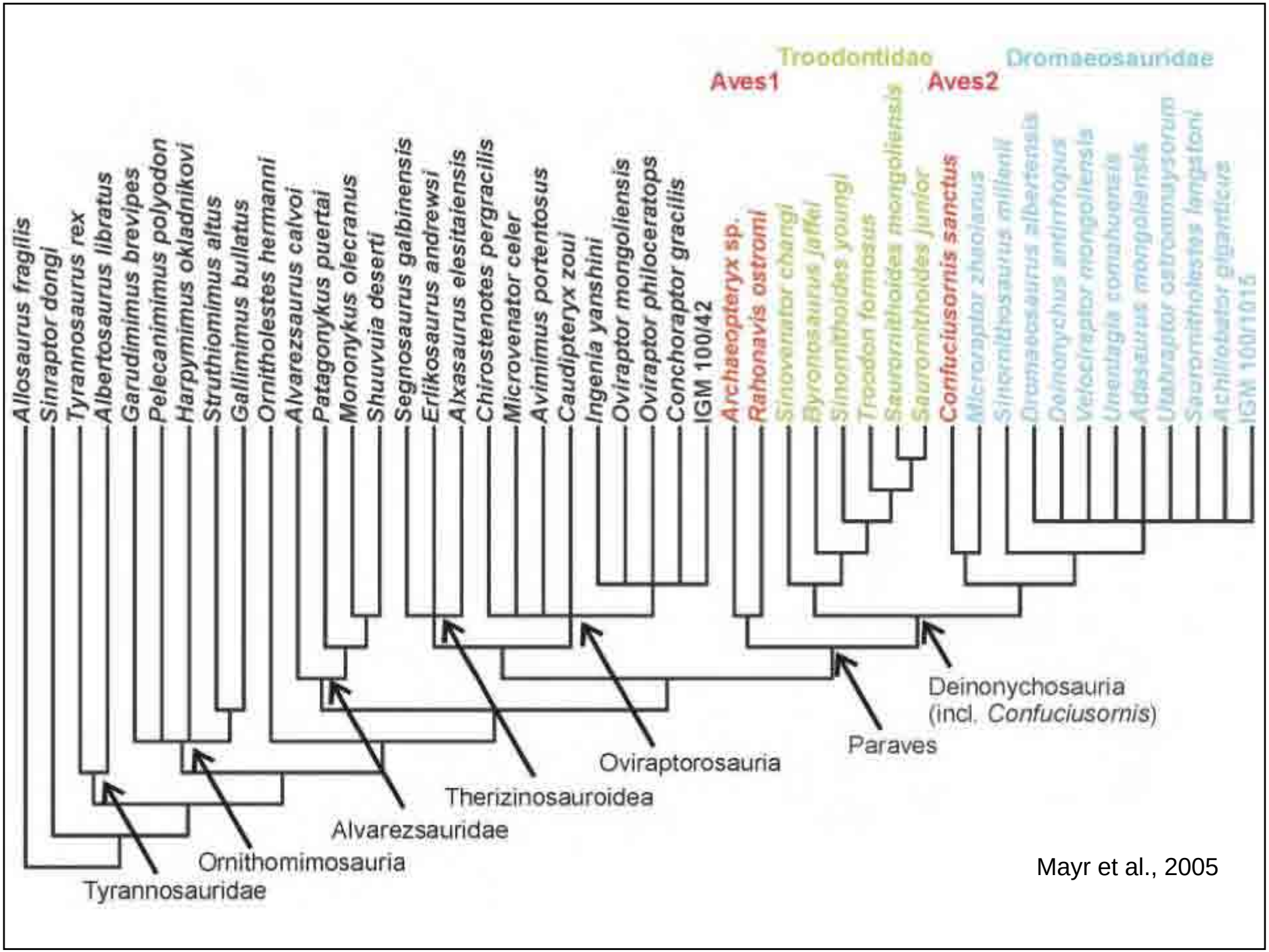


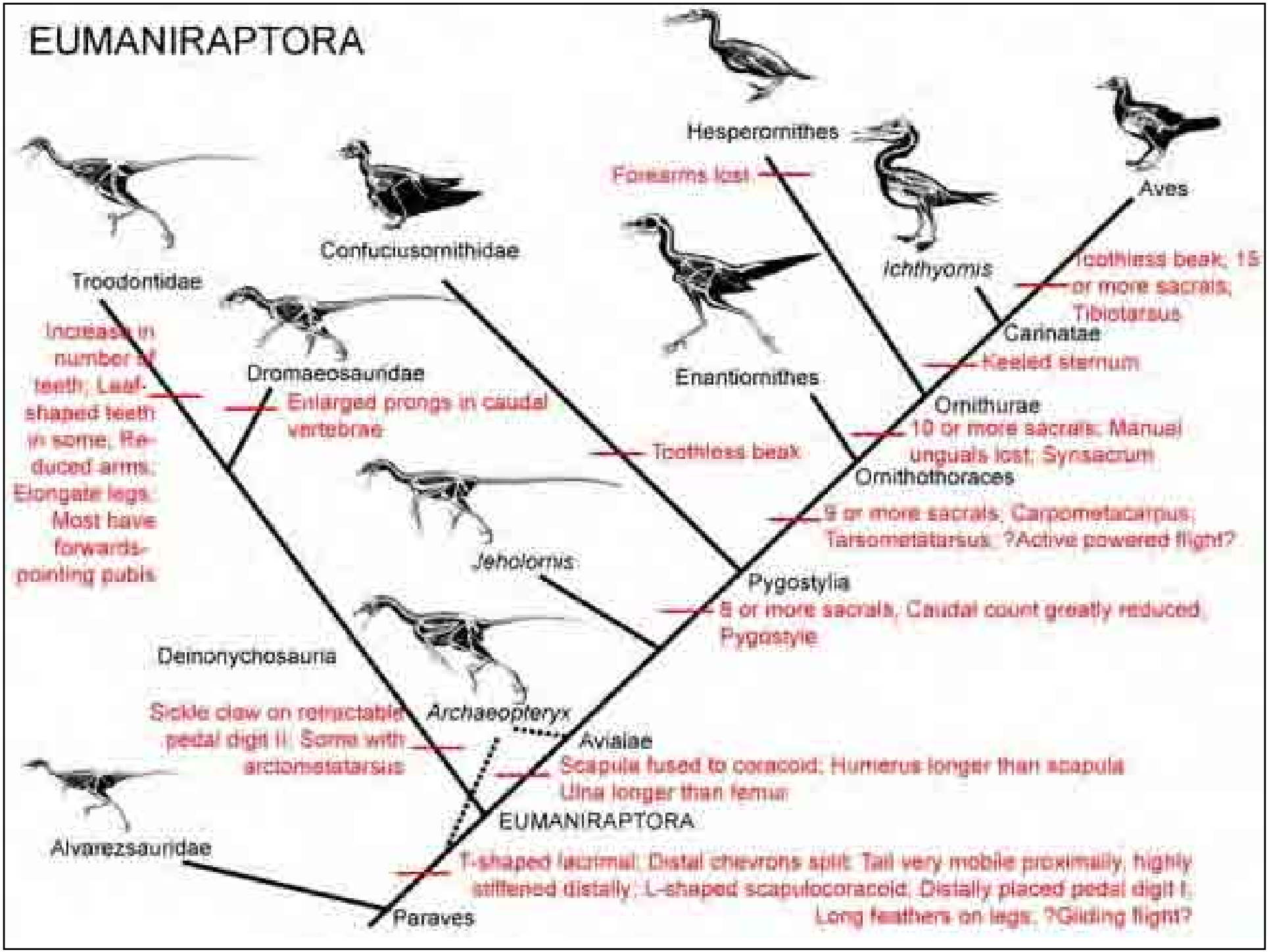
Fig. 1. The 10th skeletal specimen of the Archaeopterygidae (collection number WDC-CSG-100) in ventral view. (**A**) Skeleton with wing and tail feather impressions. (**B**) Ultraviolet-induced fluorescence photograph to show the preserved bone substance.

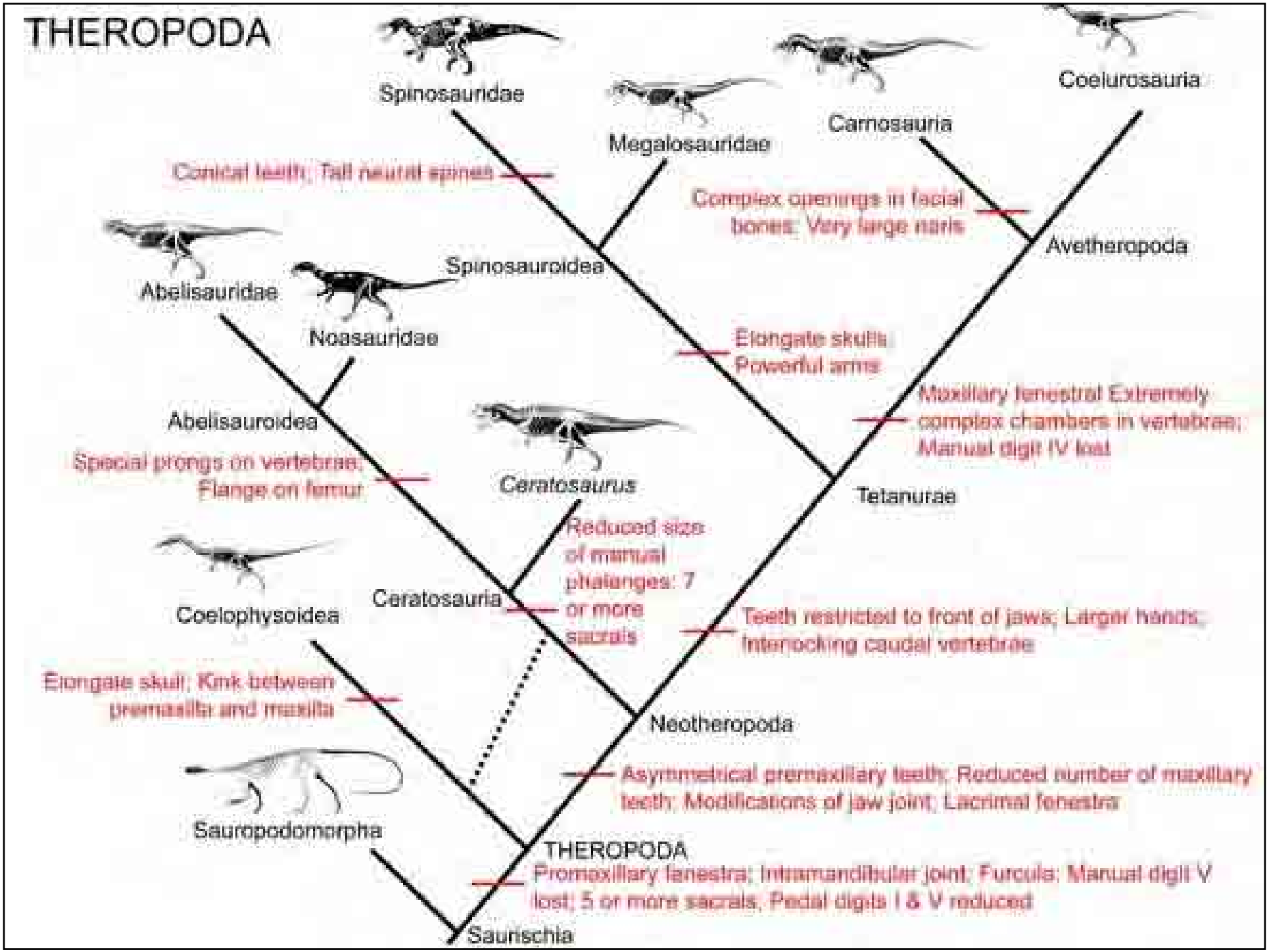


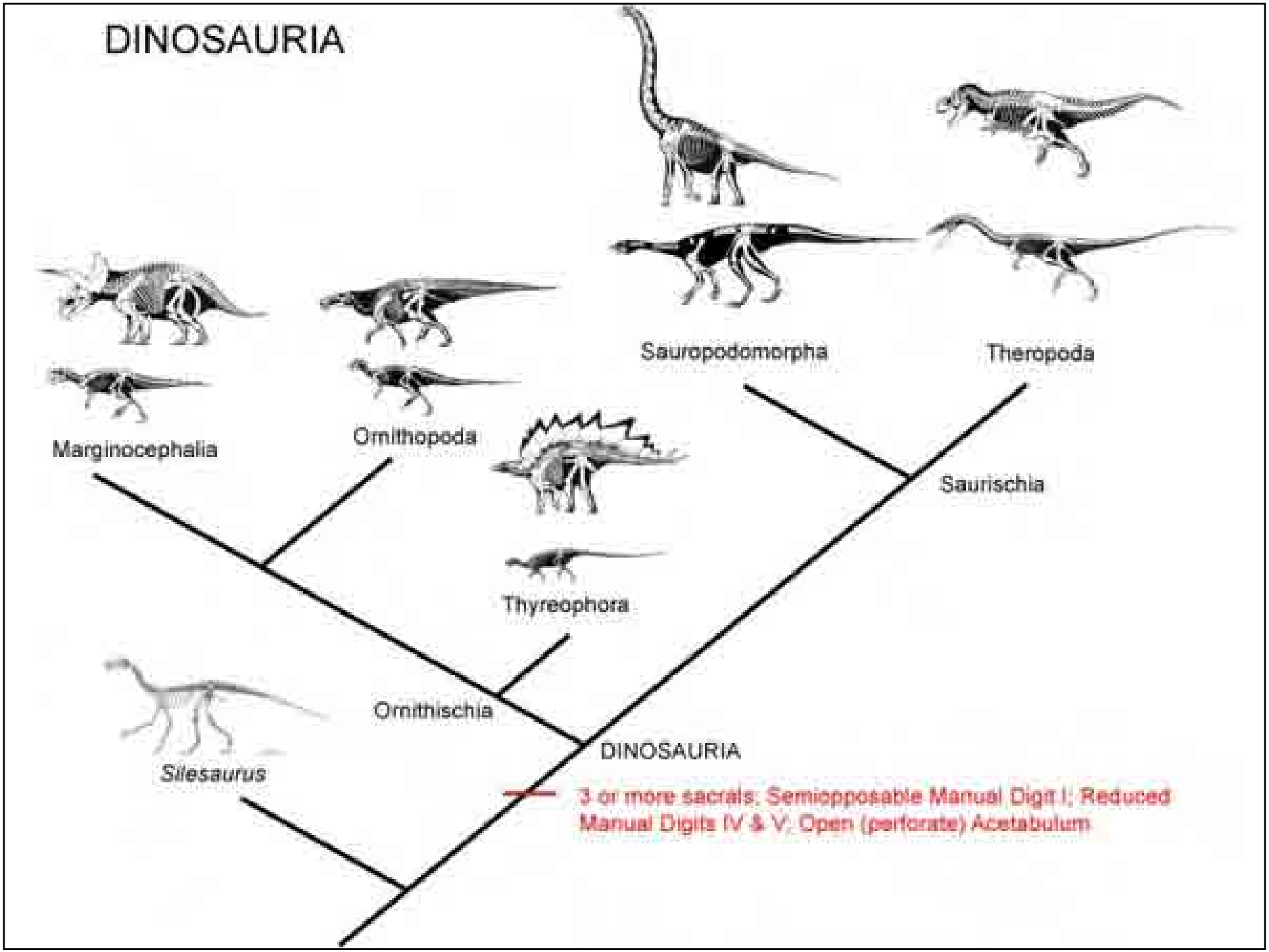
Mayr et al., 2005

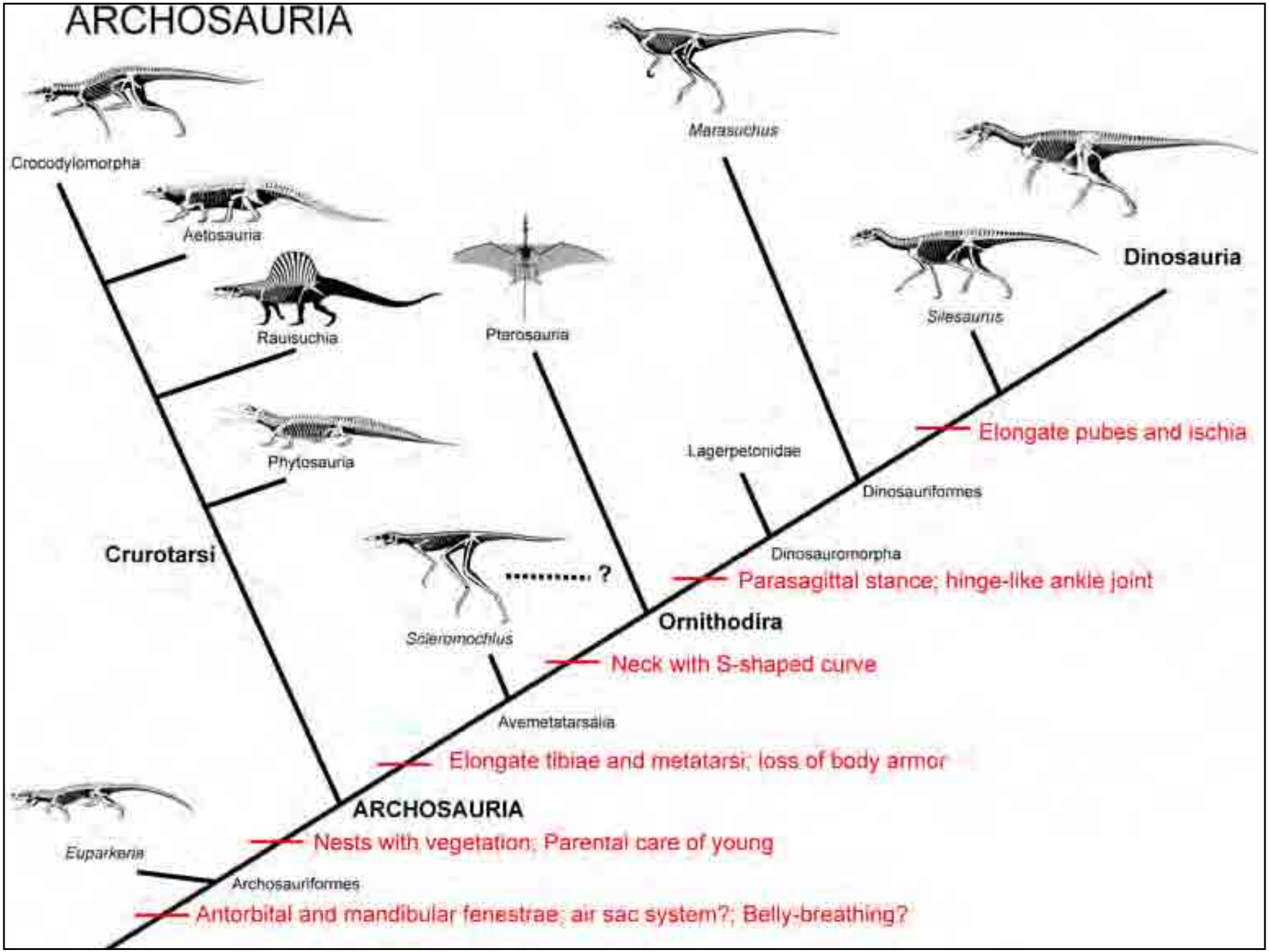


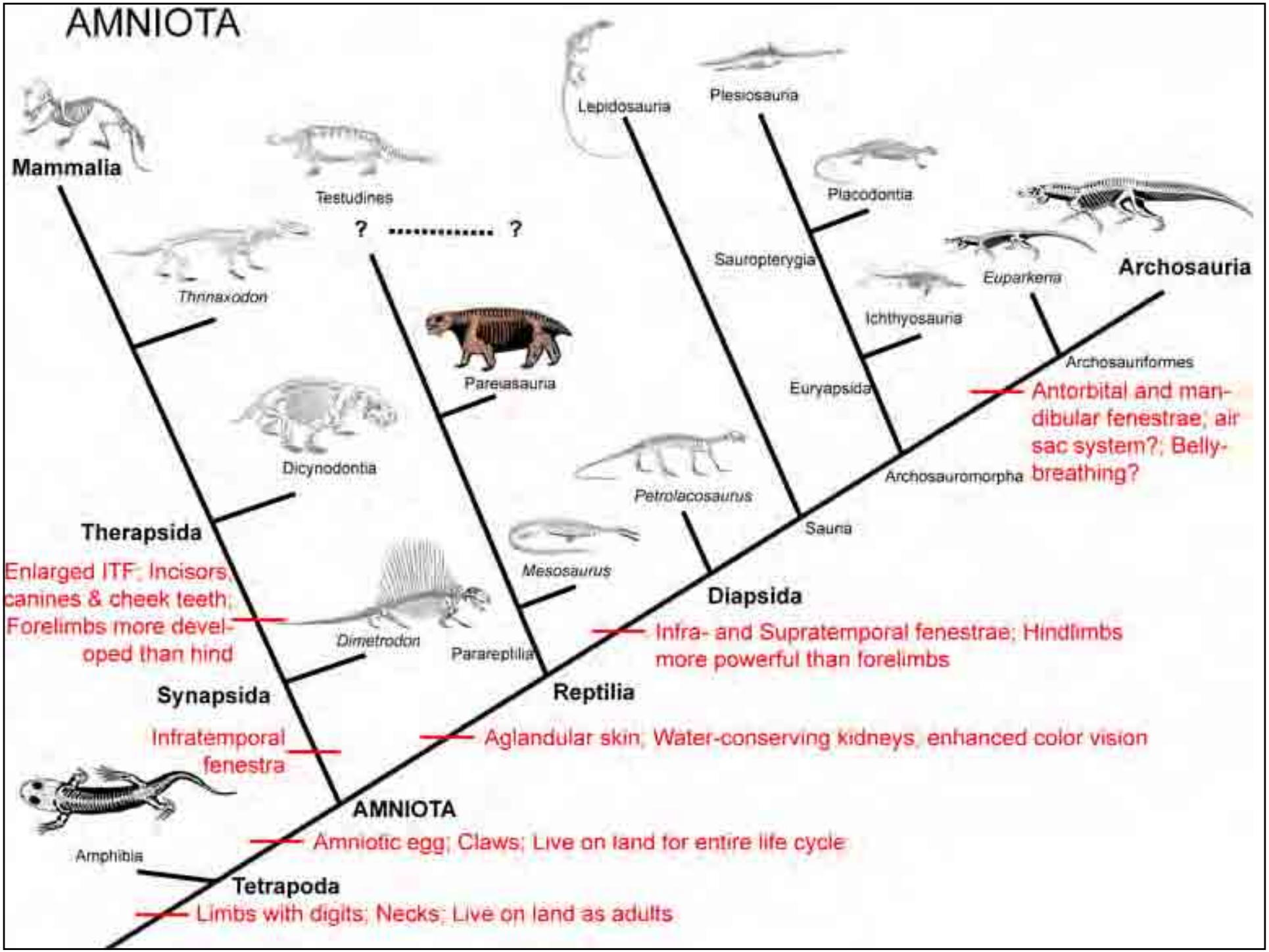
Mayr et al., 2005





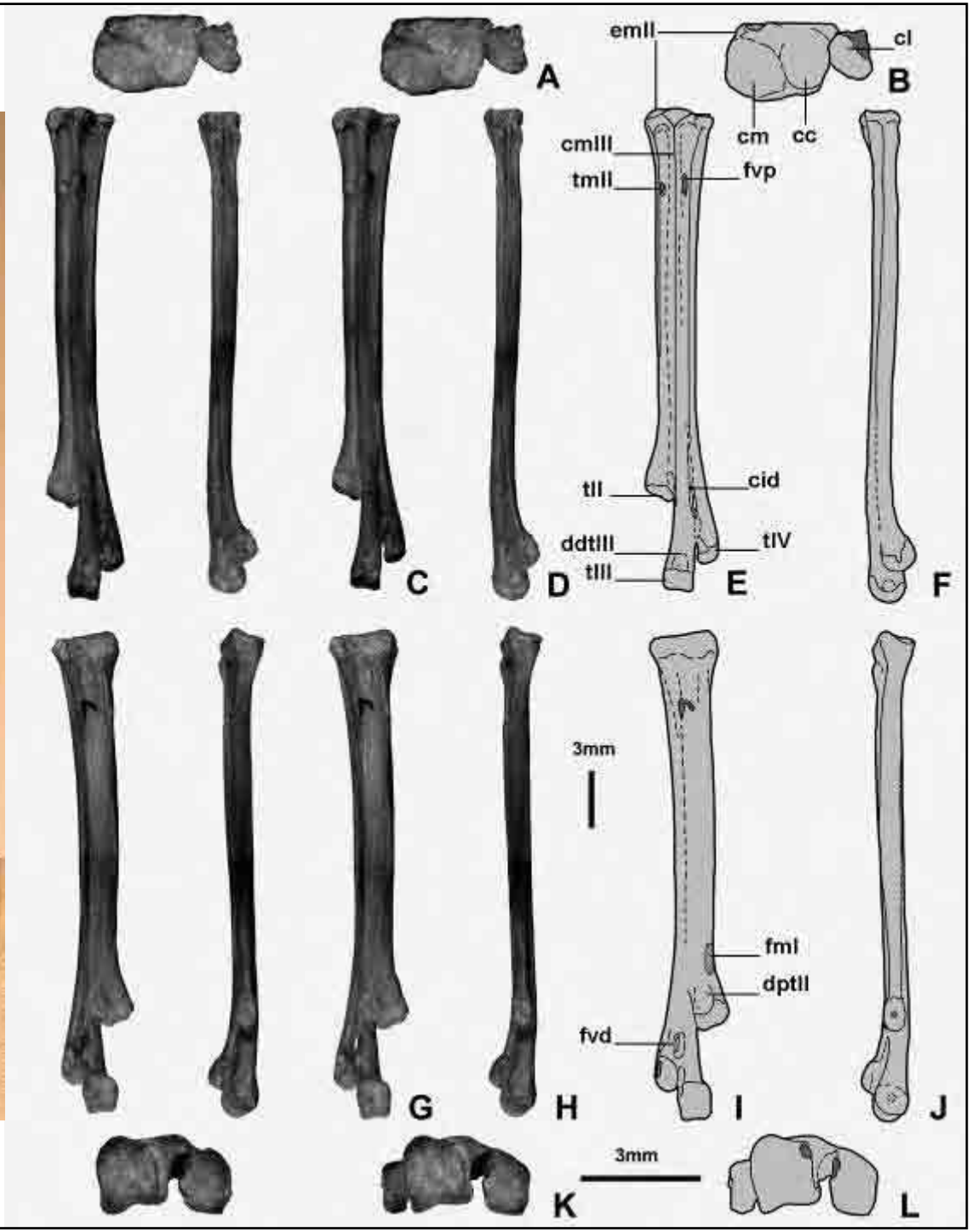






Mystiornis

Mei



Journal of Systematic Palaeontology, Vol. 00, Issue 0, 2010, 1–9

Taylor & Francis
Taylor & Francis Group

A new taxon of birds (Aves) from the Early Cretaceous of Western Siberia, Russia

Evgeny N. Kurochkin[a*], Nikita V. Zelenkov[b], Alexandr O. Averianov[c] and Sergei V. Leshchinskiy[d]

[a]*Profsojuznaya 123, Borissiak Palaeontological Institute, Moscow 117997, Russia;* [b]*Borissiak Palaeontological Institute, Russia;* [c]*Zoological Institute, Saint-Petersburg, Russia;* [d]*Tomsk State University, Tomsk, Russia*

(Received 29 January 2010; accepted 6 July 2010)

In recent decades numerous findings, mostly from the Early Cretaceous of China, have changed traditional conceptions about the diversity and evolution of the most ancient Aves. Findings of Mesozoic birds in Russia are extremely rare. Here we describe a new bird from the Lower Cretaceous (Barremian–Aptian, Ilekskaya Svita) Shestakovo-1 locality (southern Western Siberia, Russia), that has also yielded dinosaurs, mammals, crocodiles, pterosaurs and lizards. *Mystiornis leptocolos* gen. et sp. nov. is based on an isolated metatarsus which displays a mosaic of morphological features allowing us to create a new order, Mystiornithiformes. *Mystiornis* has a fully consolidated (ornithurine-like) gracile metatarsus with a primitive coplanar arrangement of the metatarsals, three separate proximal articular facets, and a uniquely located distal interosseal canal. It also displays diving adaptations previously documented only in Ornithurae.

Keywords: Aves; Mystiornithiformes ordo nov.; Mystiornis gen. n.; Early Cretaceous; Russia; metatarsus

Systematic palaeontology

Class: **Aves** Linnaeus, 1758
Order: **Mystiornithiformes ordo** nov.

Family **Mystiornithidae** fam. nov.
Genus ***Mystiornis*** gen. nov.

Mystiornis leptokolos gen. et sp. nov.
(Fig. 2)

Diagnosis. Metatarsals II–IV completely ossified coplanar throughout their entire length, except for the separate

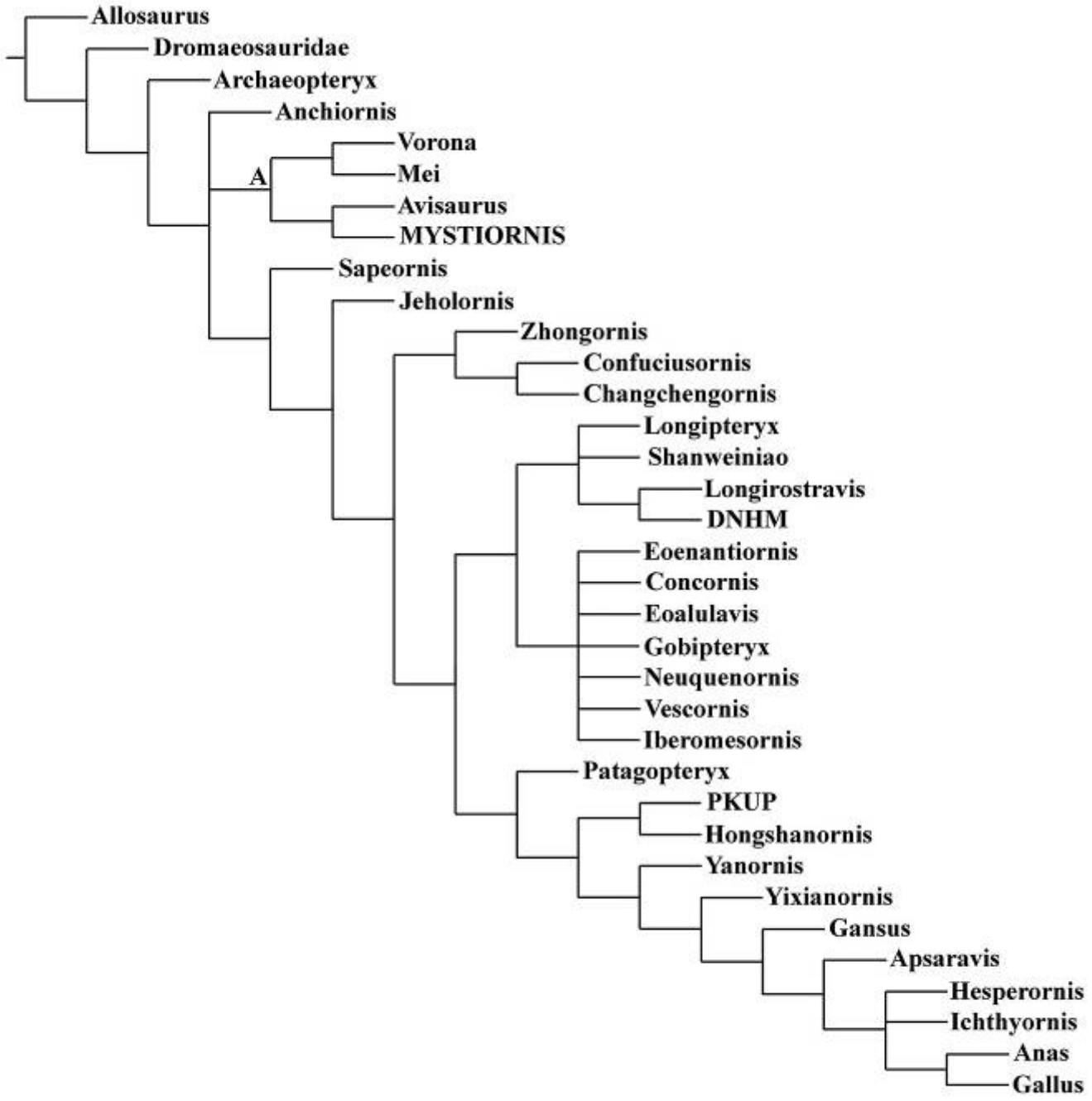
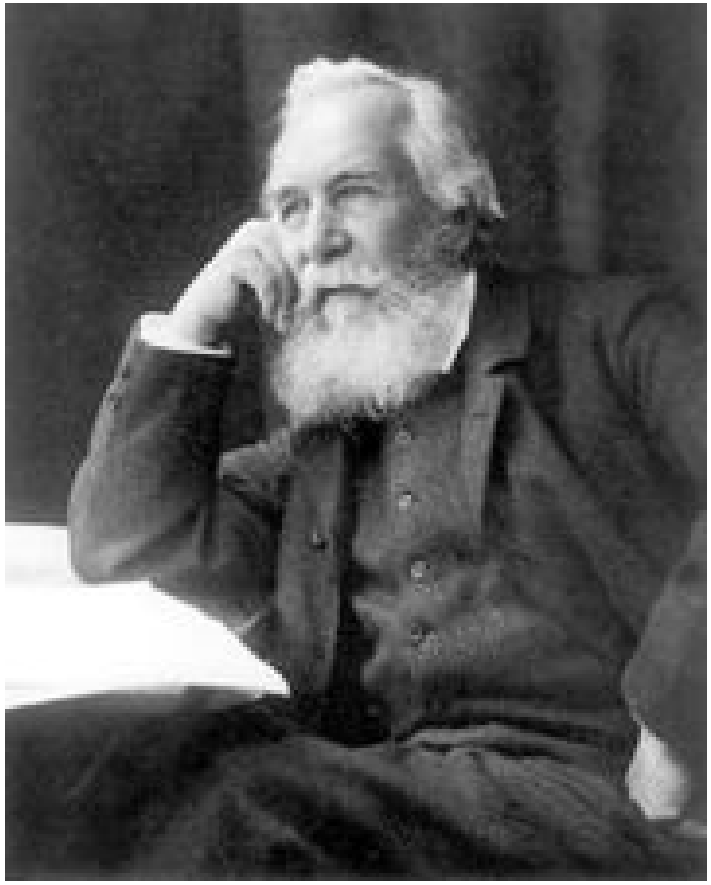
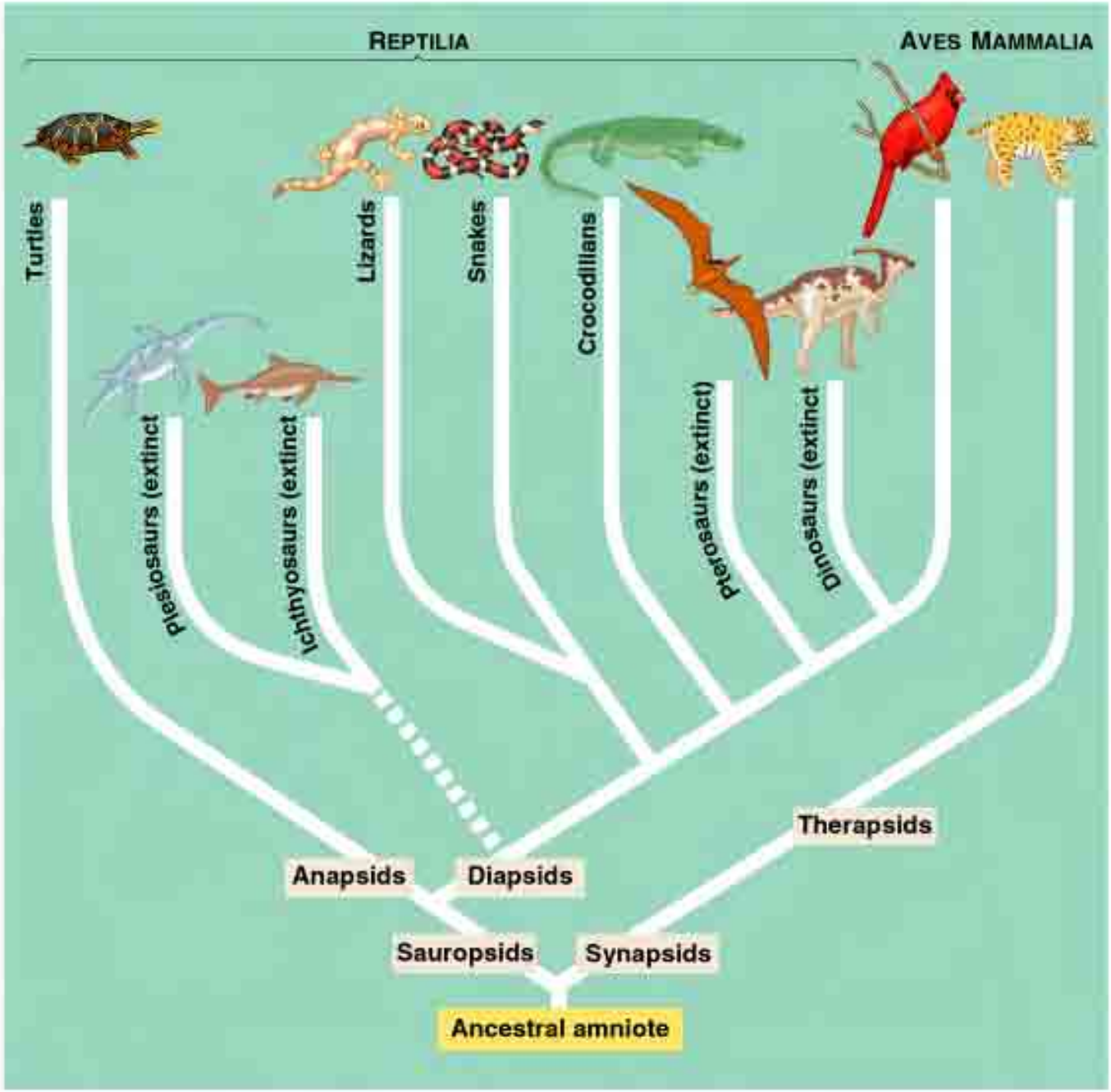


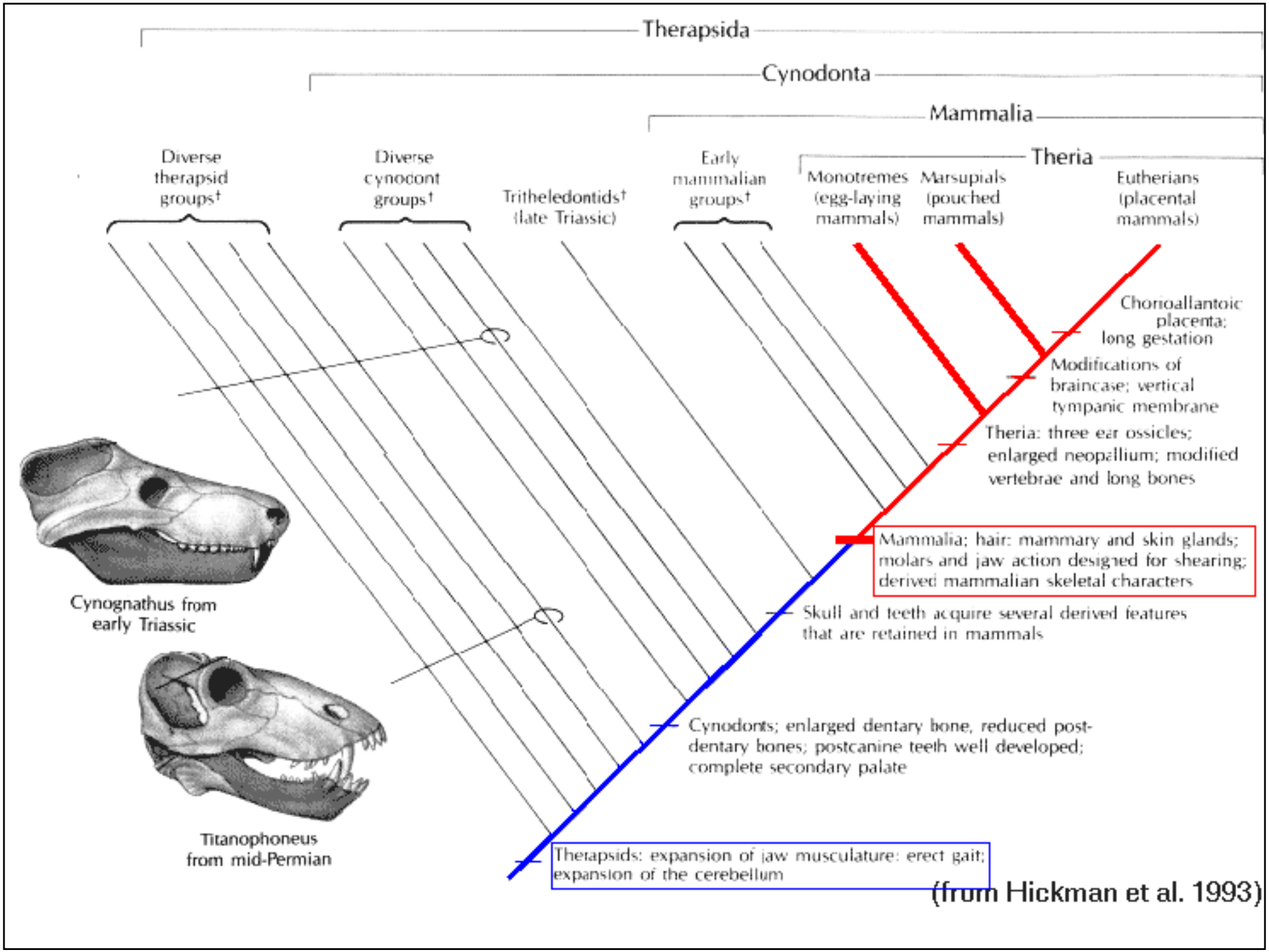
Figure 3. Strict consensus tree recovered from analysis of data matrix modified after O'Connor *et al.* (2009) using PAUP (tree drawn using WinClade). Clade A (see text) is indicated.

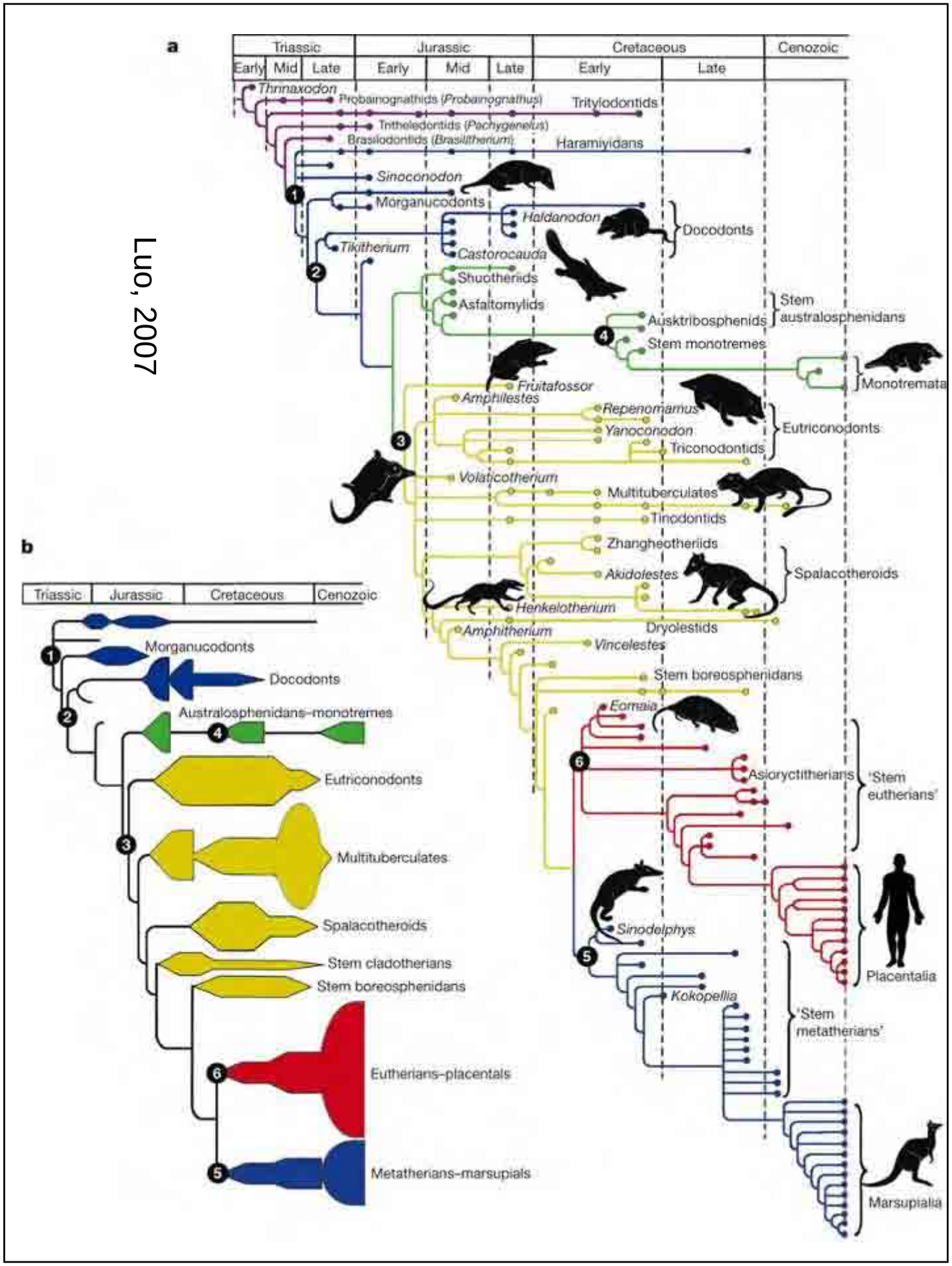


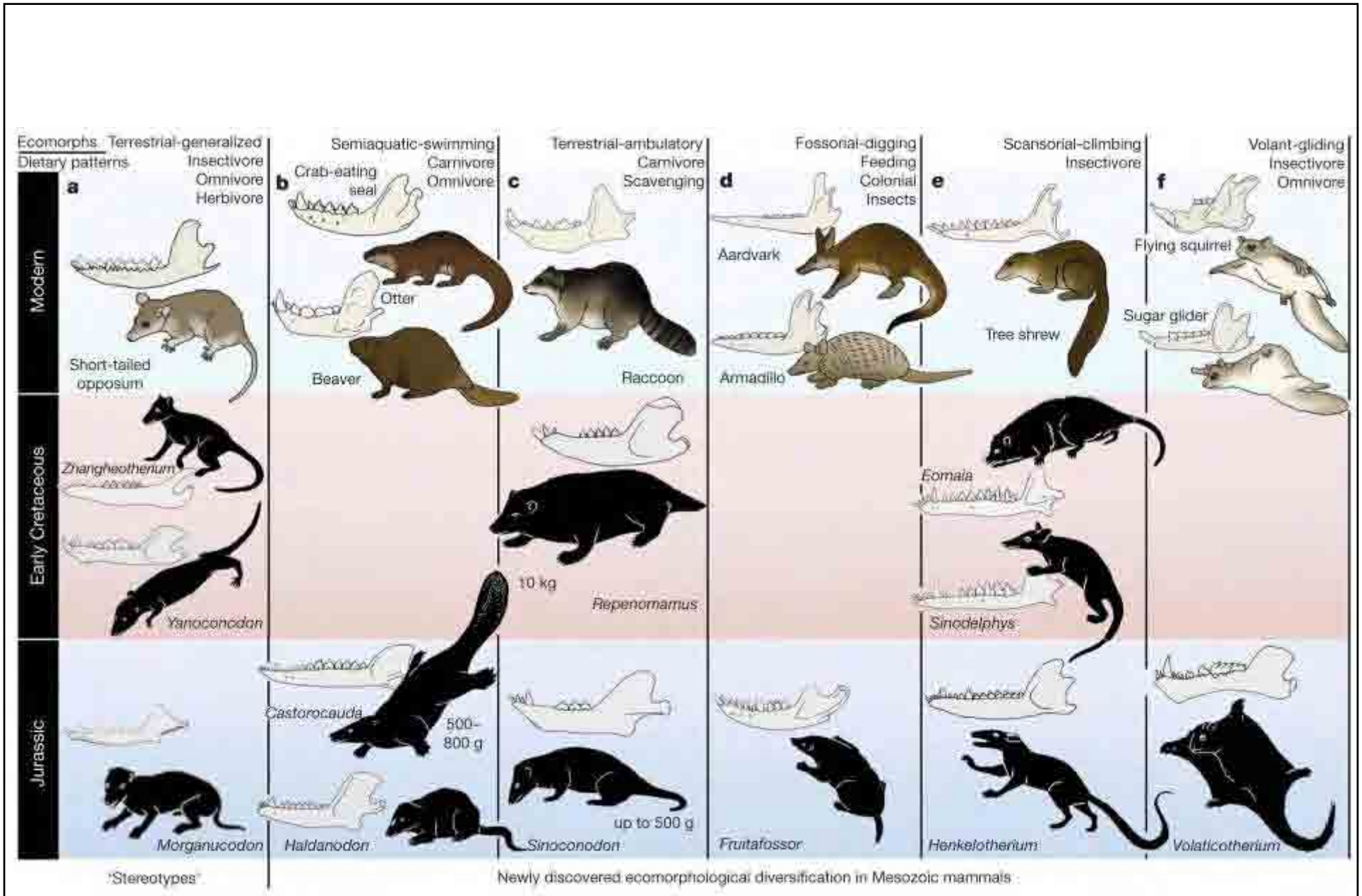
Ernst Haeckel
(1834-1919)

Thomas Huxley
(1825-1895)

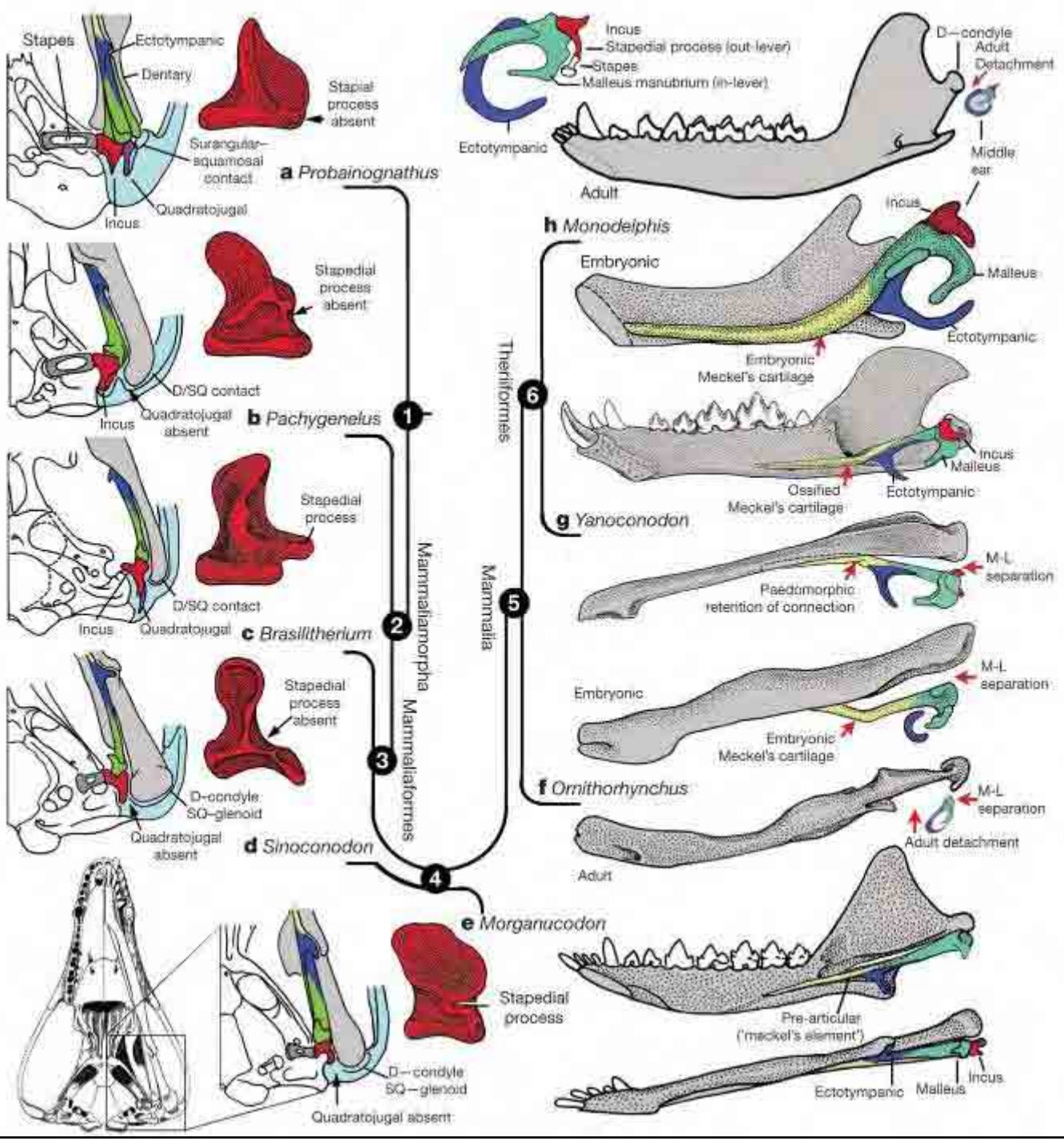


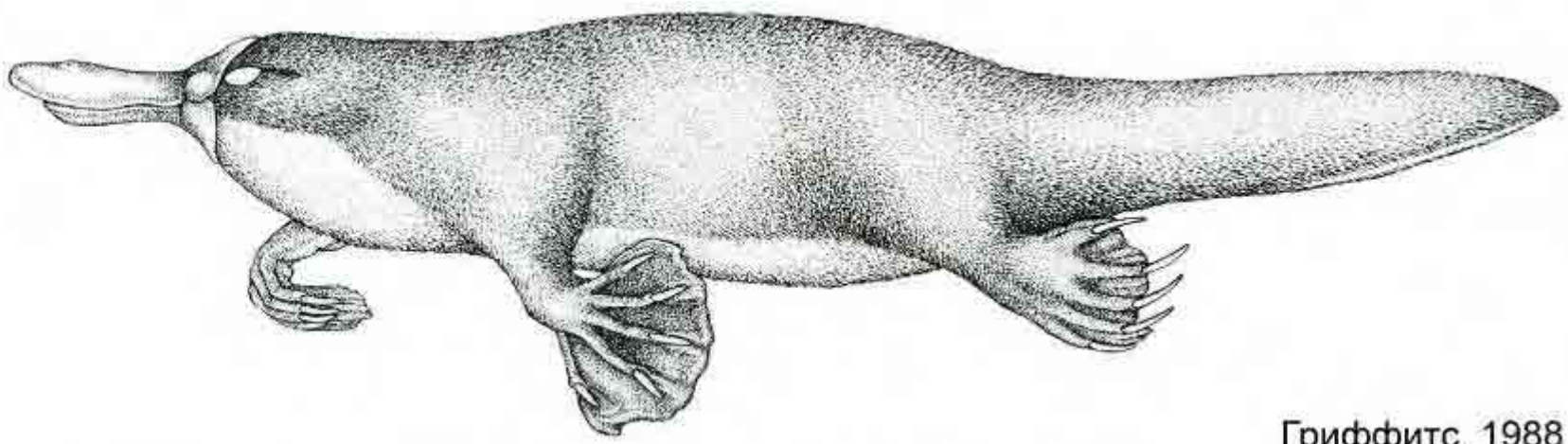






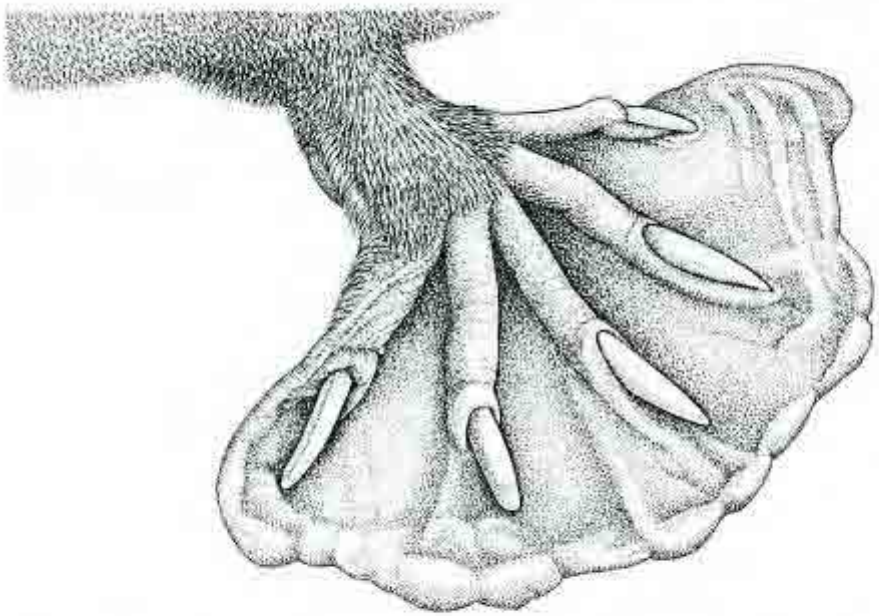
Luo, 2007

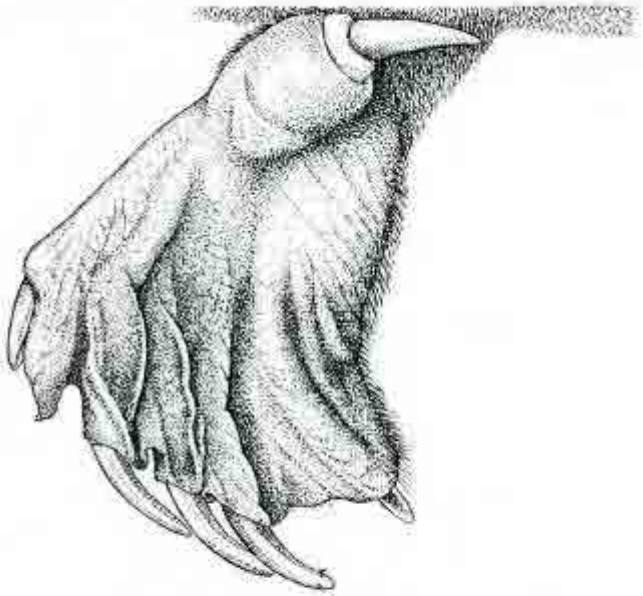




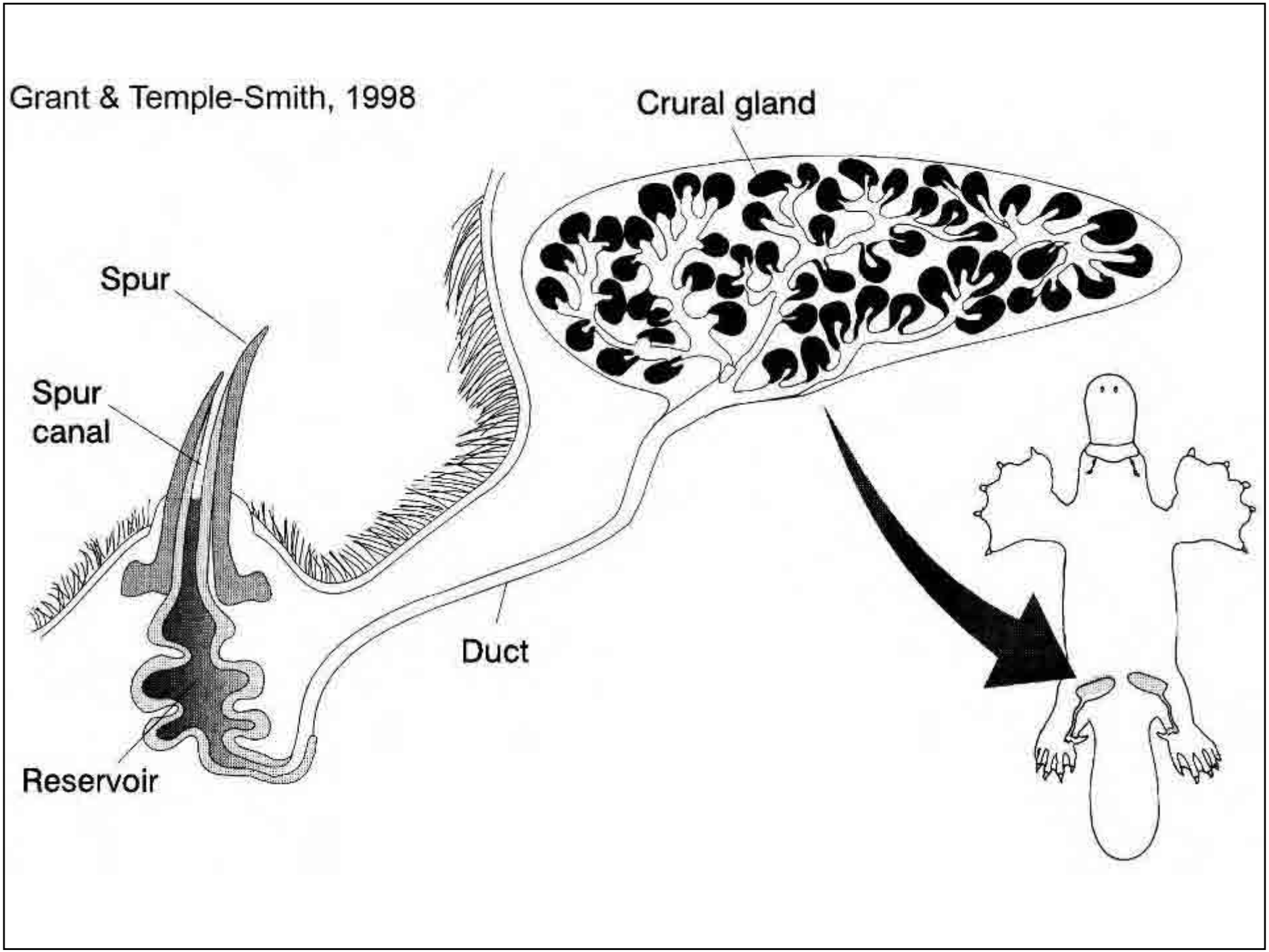
Гриффитс, 1988

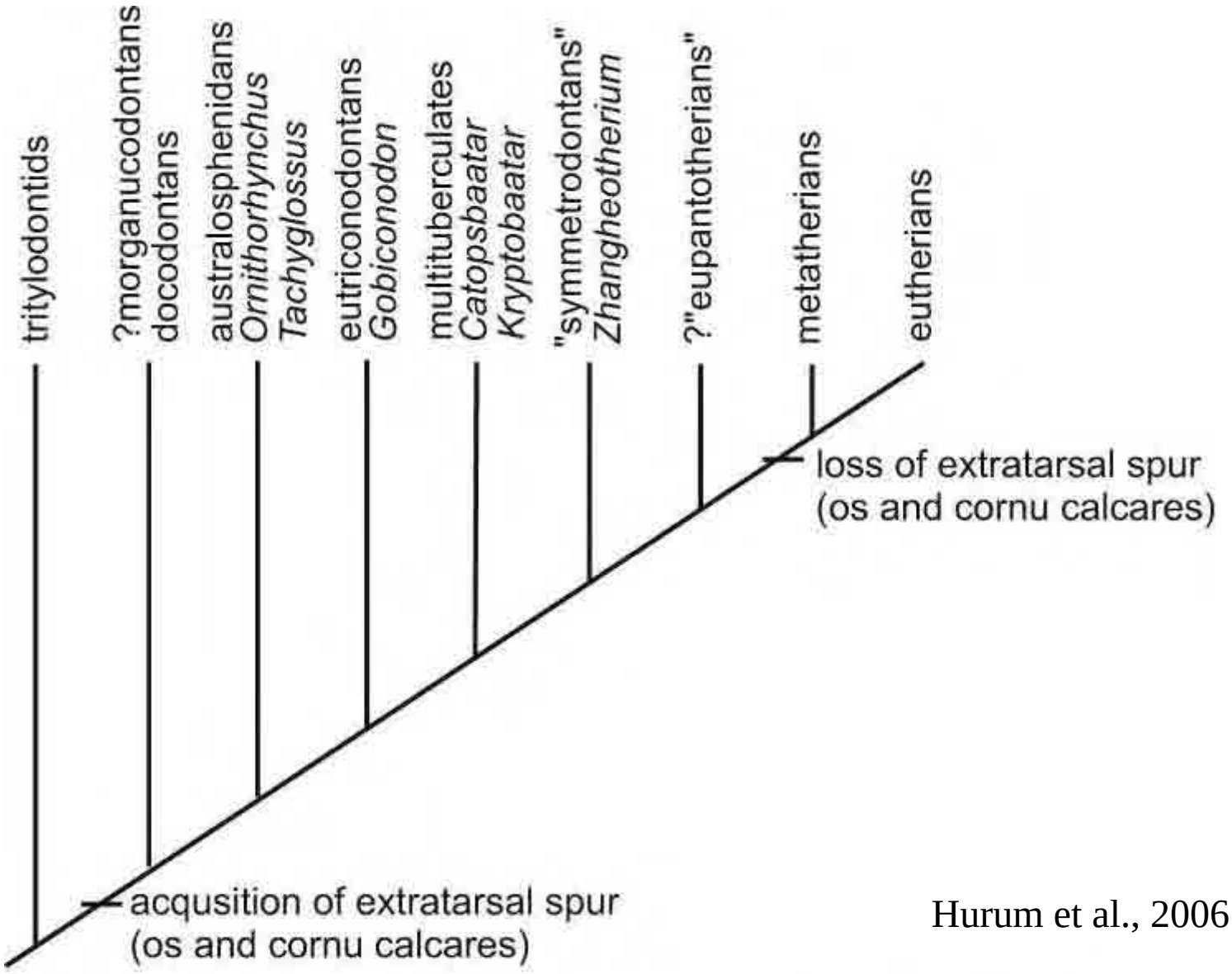
ОБТЕКАЕМОЕ ТЕЛО позволяет утконосу эффективно двигаться и в воде и на суше. Находясь под водой, животное плывет при помощи веслообразных передних лап. На суше утконос перемещается, упираясь в субстрат когтями.





ПЕРЕДНИЕ И ЗАДНИЕ КОНЕЧНОСТИ у утконоса короткие и расположены близко к телу. Передние лапы (*слева*) снабжены широкими перепонками; с их помощью он плавает в воде. На суше перепонки втягиваются, обнажая сильные когти, которыми животное упирается в землю при ходьбе и роет свои норы. На задних лапах (*справа*) также есть когти, в основном помогающие передвижению на суше; кроме того, у самцов на задних ногах над стопой имеется полая шпора, соединенная с особой железой, в которой образуется смертельный яд; эту шпору они используют для нападения и защиты в схватках с другими животными.





Hurum et al., 2006

Fig 9. Tentative evolutionary pattern of extratarsal spur of the main groups of early mammals (cladogram simplified from Luo et al. 2002 and Kielan-Jaworowska et al. 2004).

Kielan-Jaworowska & Hurum, 2006

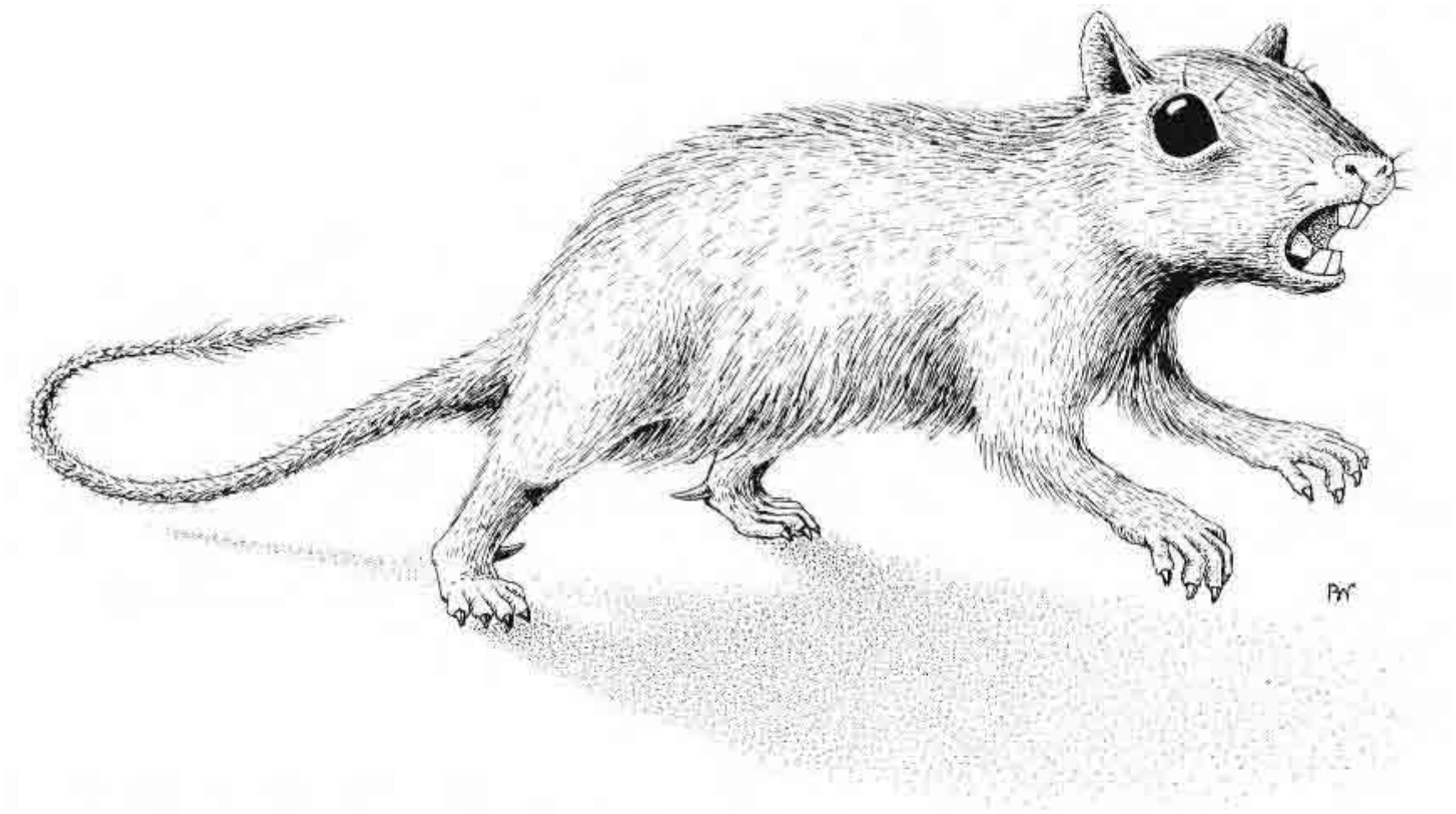
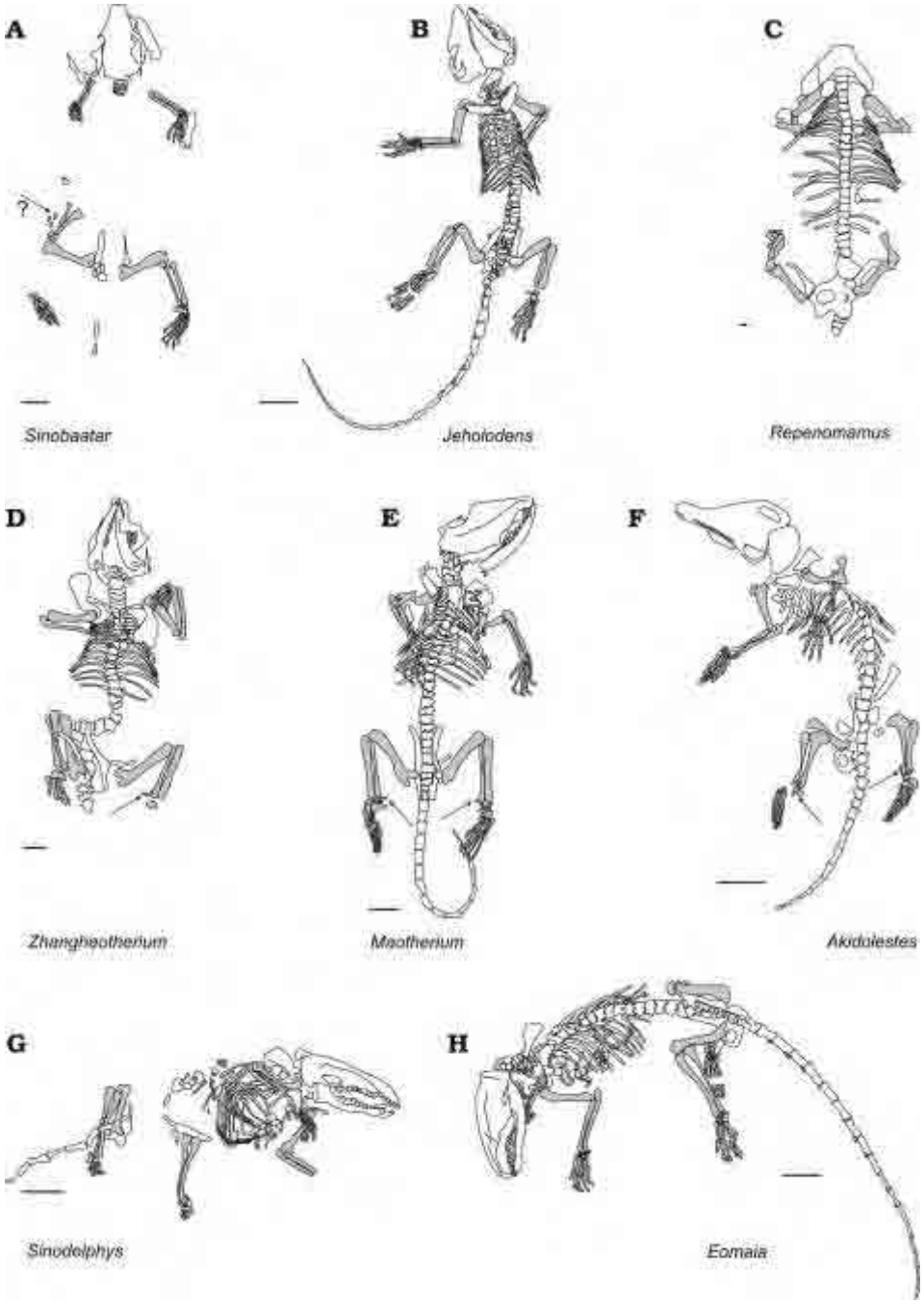


Fig. 2. Reconstruction of the posture of the Late Cretaceous multituberculate *Catopsbaatar catopsaloides* (Kielan-Jaworowska, 1974) from the Gobi Desert, Mongolia, as a plantigrade mammal with sprawling limbs. Skull length is about 60 mm. The size of the spur has been reconstructed based on the length of the male spur in *Ornithorhynchus* in comparison to the length of the foot. The animal is reconstructed in aggressive position, ready for attack, with mobile spurs projecting medially. (Artwork by Bogusław Waksmundzki.)



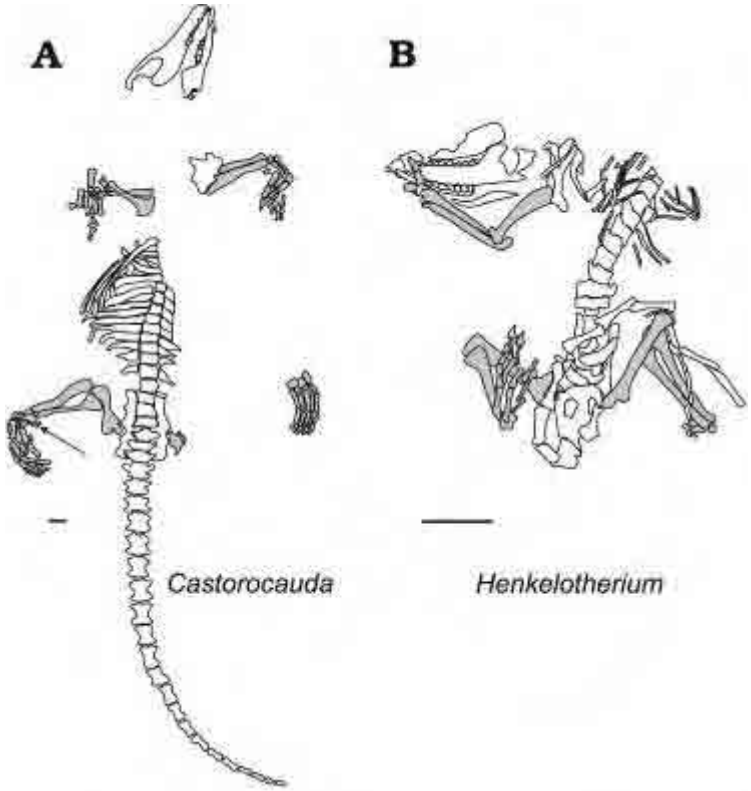
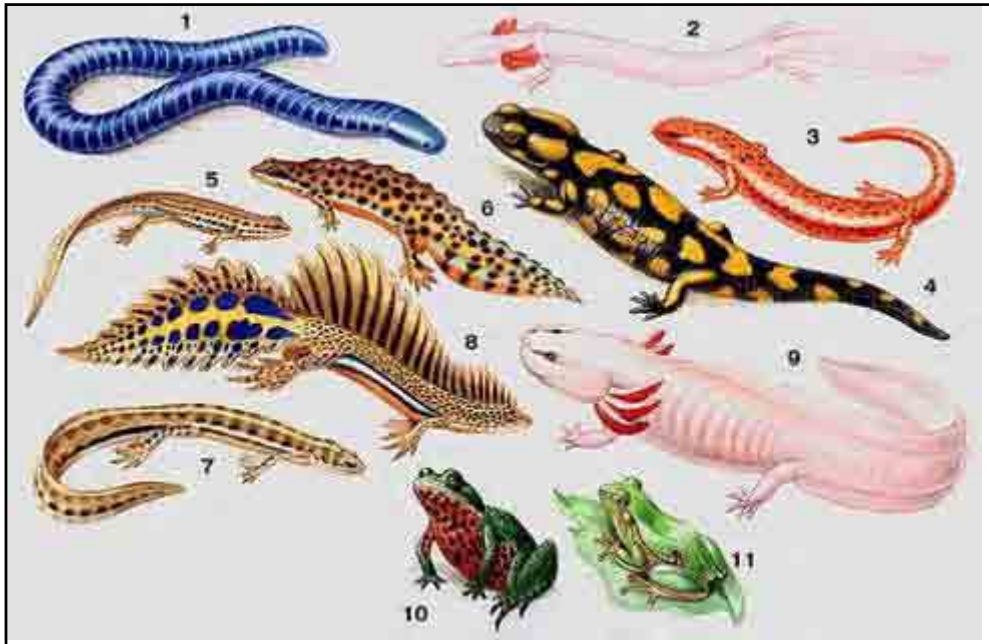
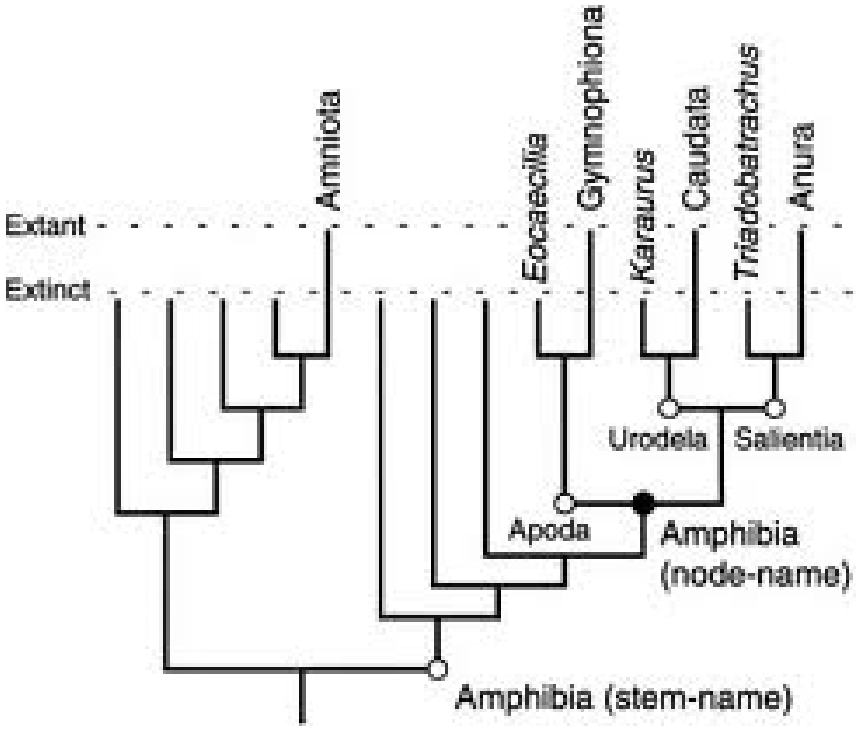


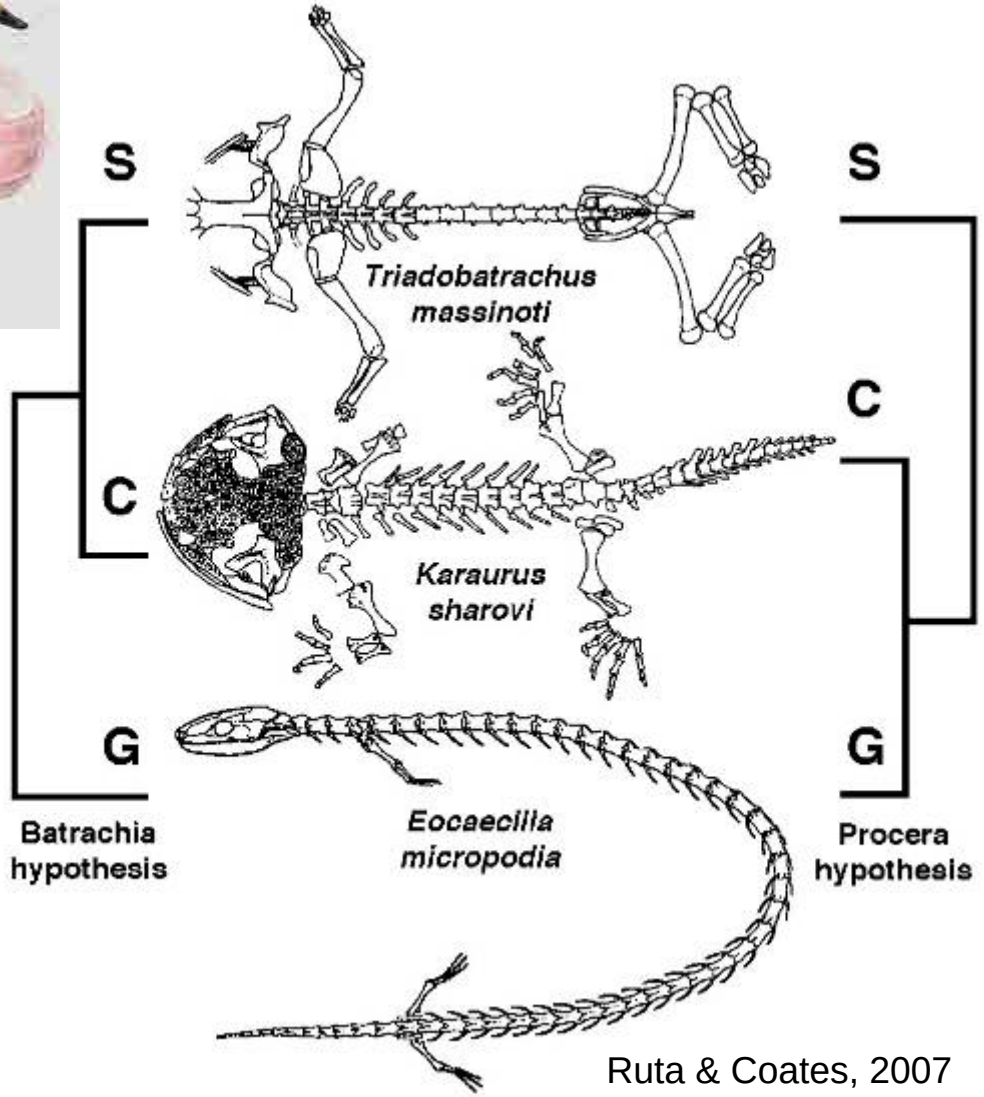
Fig. 5. Diagrammatical drawings of two skeletons of Mesozoic mammals from lacustrine sediments, re-drawn and simplified from the published drawings. Limb bones are shaded in grey. The arrow points to os calcaris. Both skeletons show sprawling posture. They are preserved dorso-ventrally compressed and exposed in ventral views, showing abducted limbs (as those in Jehol Biota, illustrated in Fig. 4A–F). **A**. *Castorocauda lutrasimilis* Ji Q., Luo, Yuan, and Tabrum, 2006, a Middle Jurassic docodontan from north-west China, in ventral view, based on Ji Q. et al. (2006: fig. 1b). **B**. *Henkelotherium guimarotae* Krebs, 1991, a "eupantotherian" from the Kimmeridgian of Portugal, in ventral view, based on Henkel and Krebs (1977). Scale bars 10 mm.

Kielan-Jaworowska & Hurum, 2006

Lissamphibia

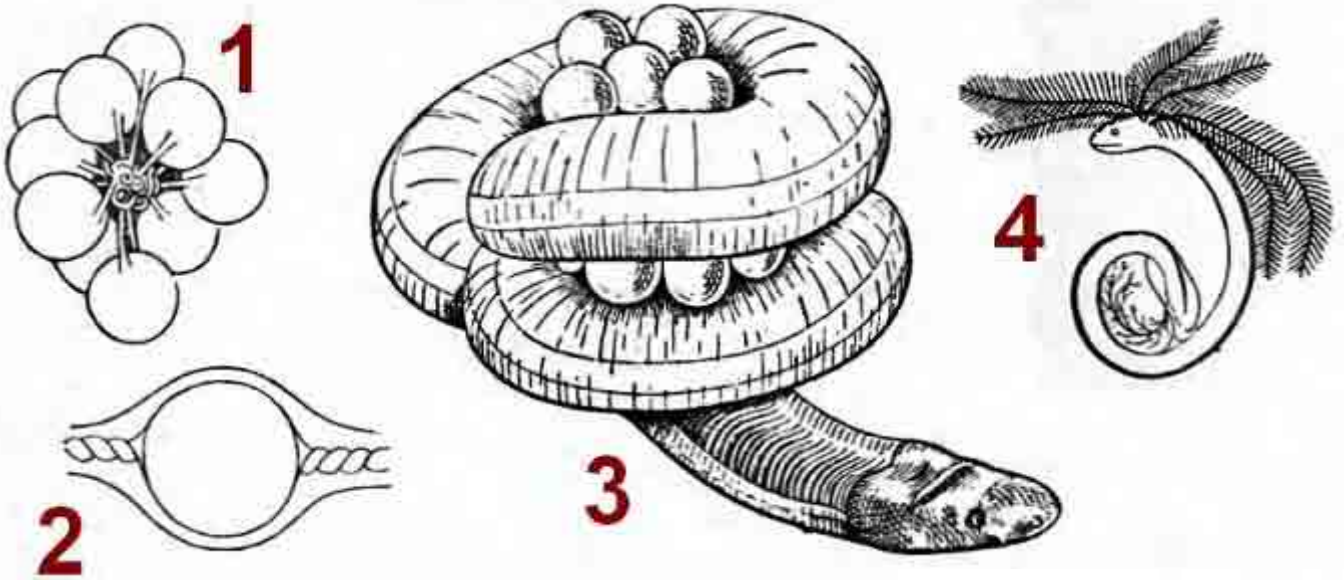


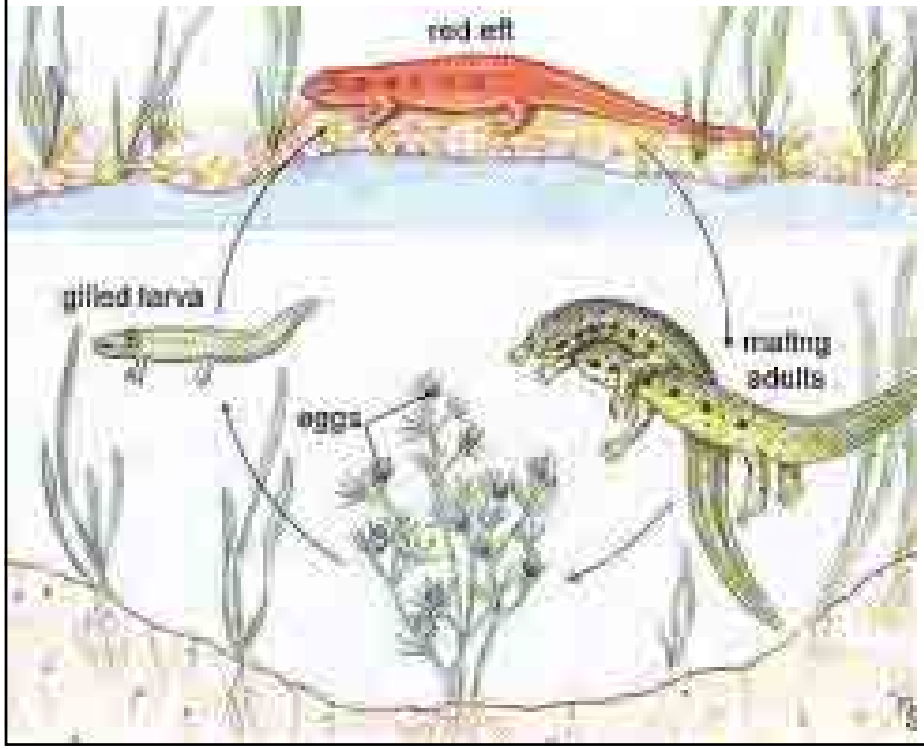


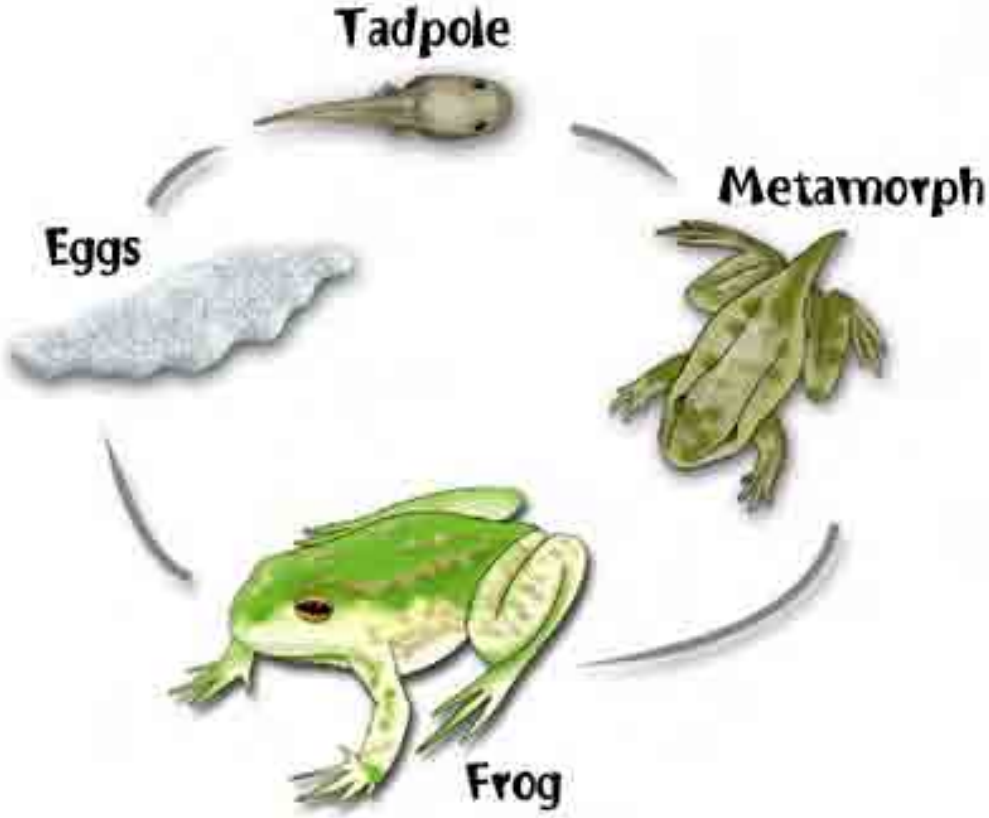


Ruta & Coates, 2007

Метаморфоз

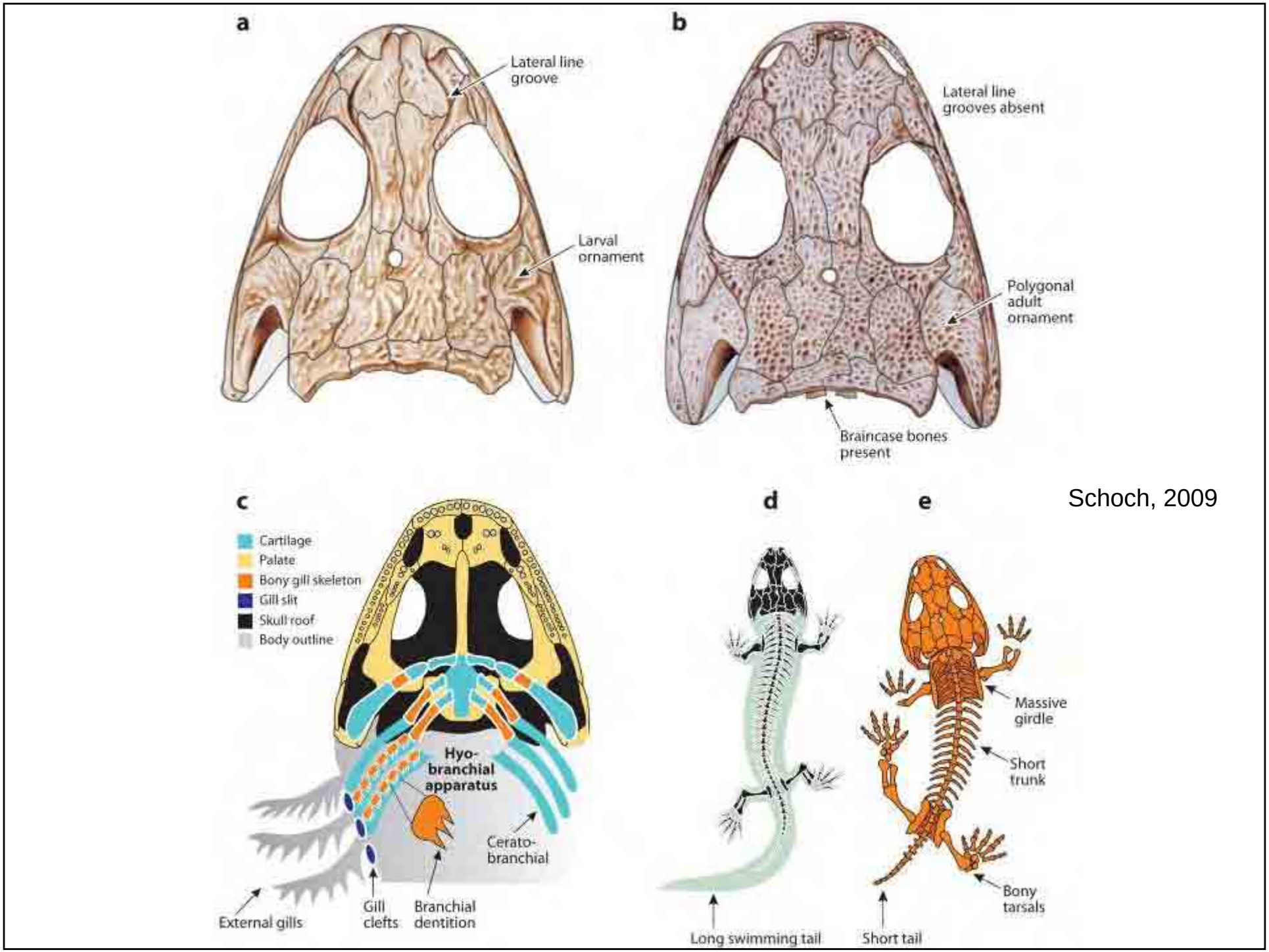




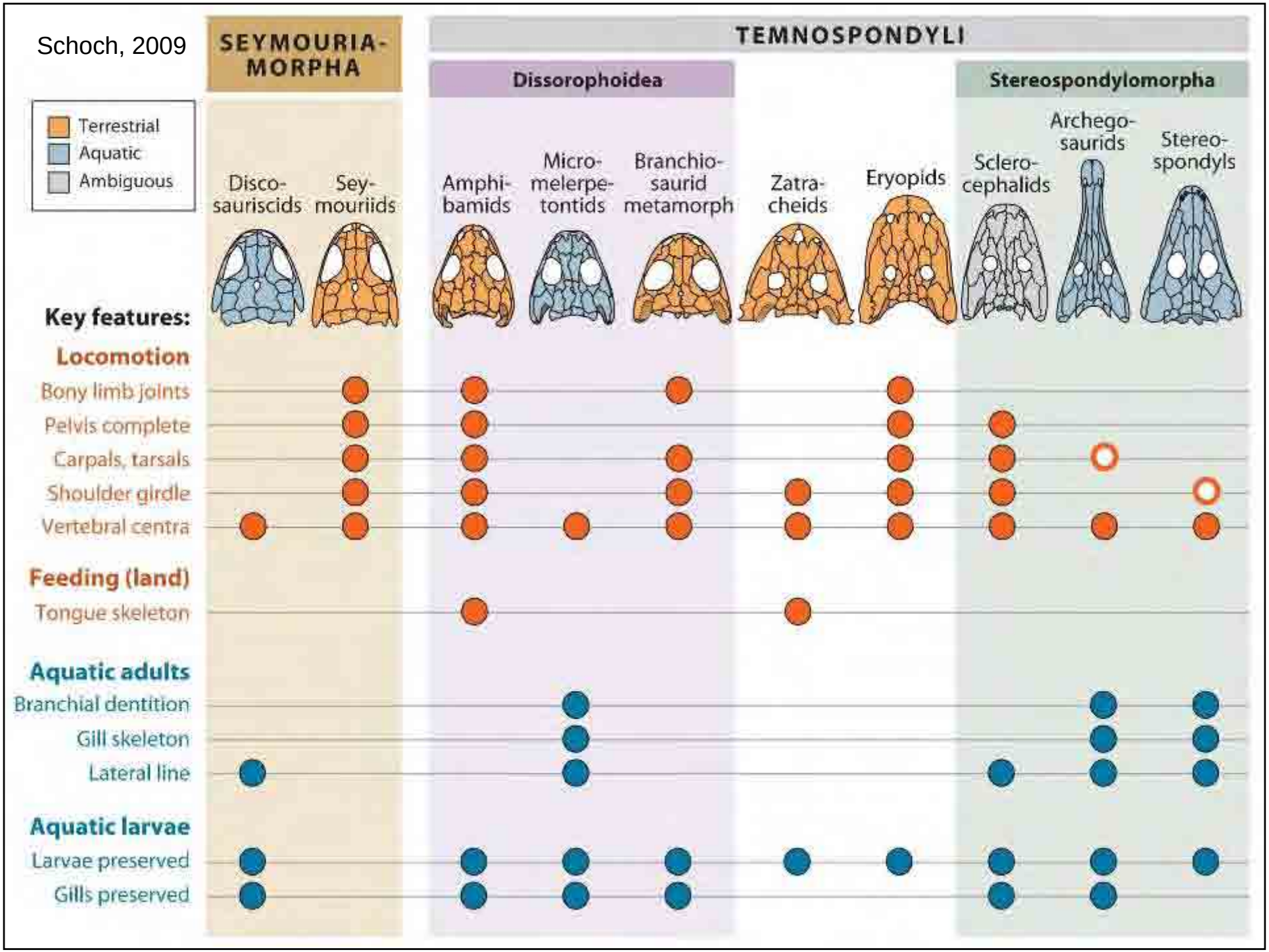


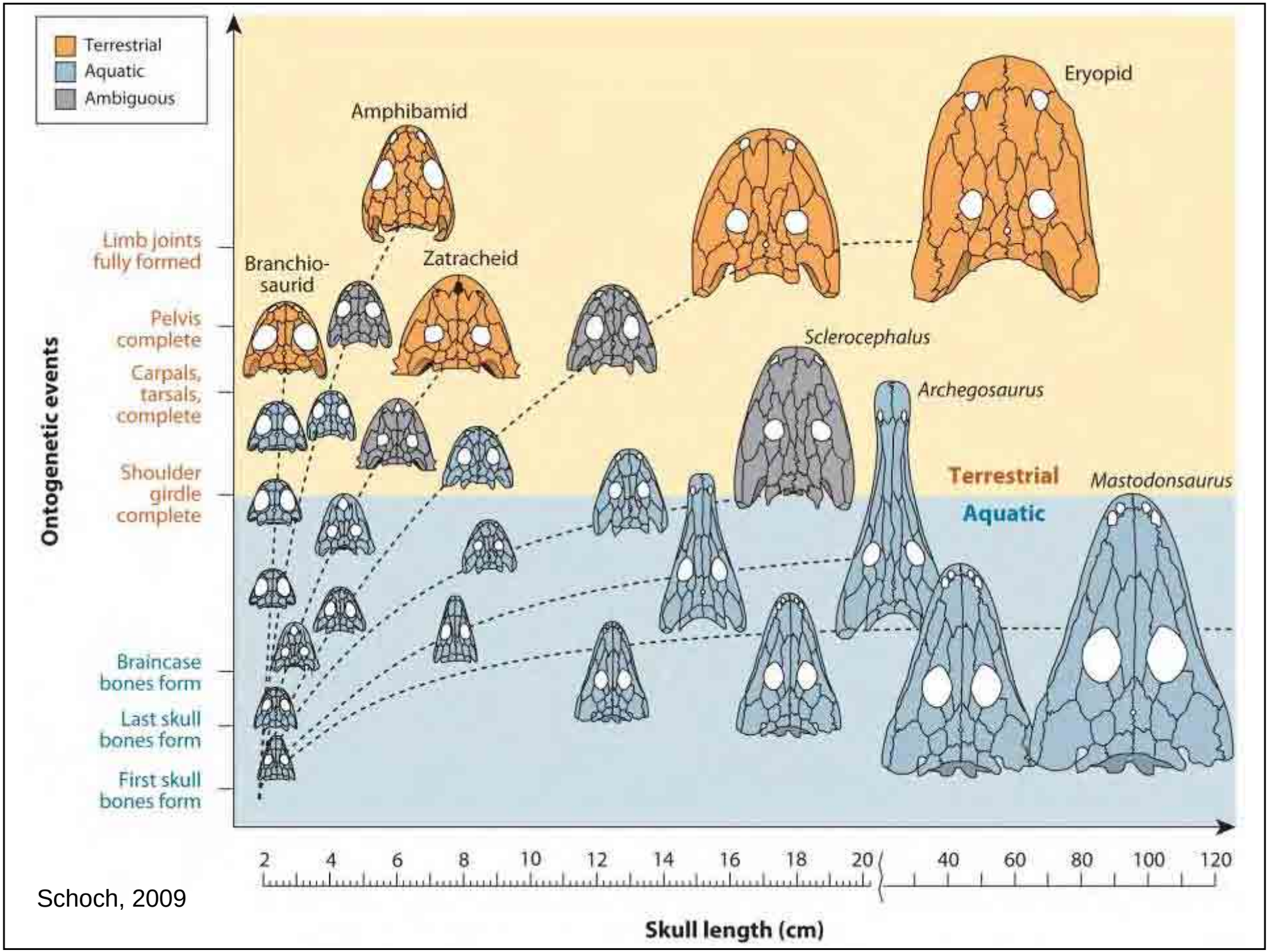
Anderson et al., 2008

Schoch, 2009



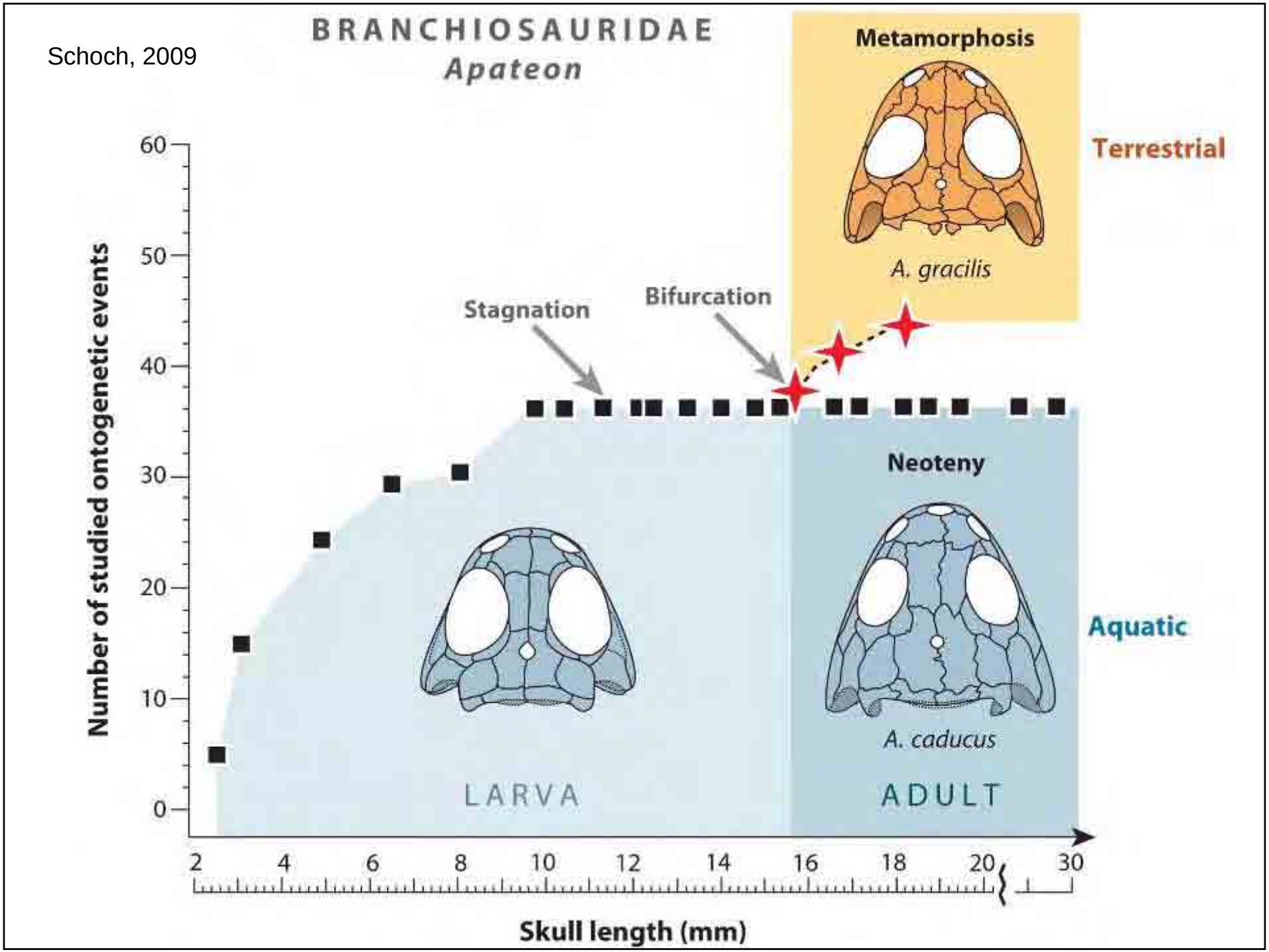
Schoch, 2009

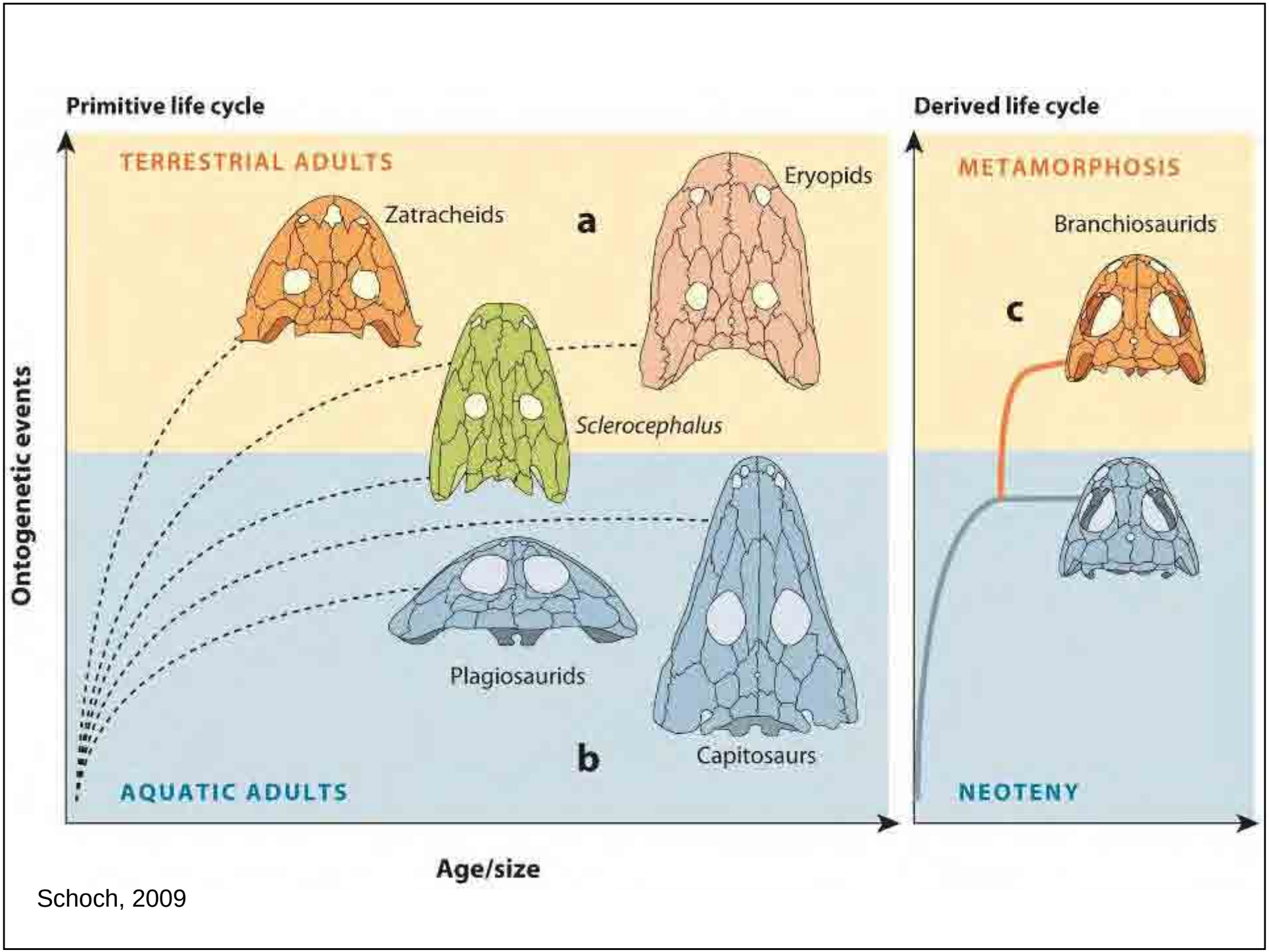




Schoch, 2009

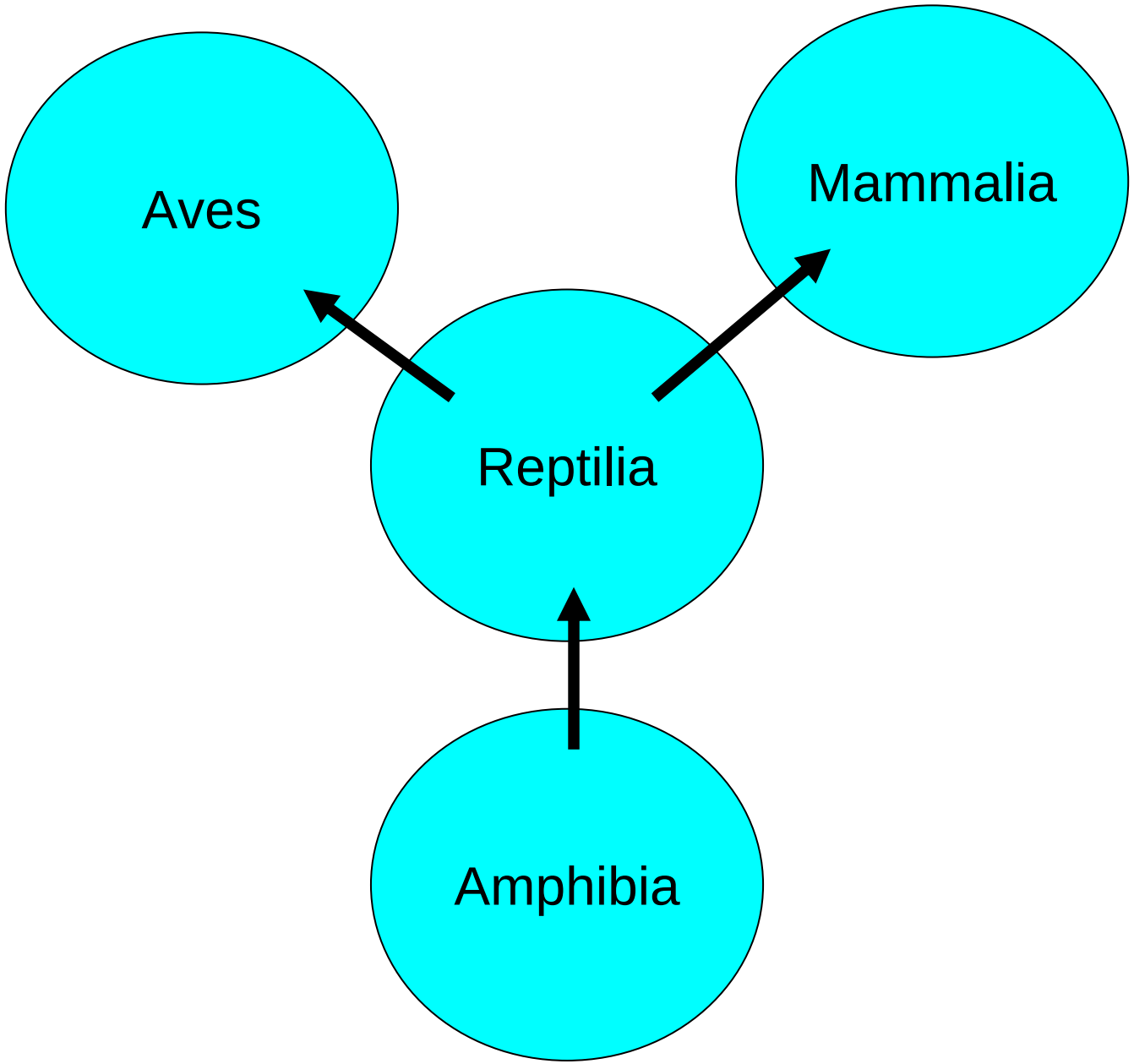
Schoch, 2009





Schoch, 2009

«Классы» позвоночных



Монофилетические группы