

Metatheria

Metatheria is a mammalian clade that includes all mammals more closely related to marsupials than to placentals. First proposed by Thomas Henry Huxley in 1880, it is a slightly more inclusive group than the marsupials; it contains all marsupials as well as many extinct non-marsupial relatives.

Metatheria

Temporal range:

Late Jurassic or Early Cretaceous–Recent^{[1][2][3]}

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Lycopsis longirostris, an extinct sparassodont,
a relative of the marsupials

Scientific classification



Kingdom: Animalia

Phylum: Chordata

Class: Mammalia

Subclass: Theria

Clade: Metatheria
Thomas Henry
Huxley, 1880

Subgroups

- †? *Sinodelphys*
- † *Holoclemensia*
- † *Adinodon*
- † Deltatheroidea

- **Marsupialiformes**

- †*Adelodelphys*
- †Alphadontidae
- †Asiadelphia
- †*Sinbadelphys*
- †*Camptomus*?
- †**Archimetatheria**
 - †Stagodontidae
 - †*Iqualadelphis*
- †Sparassodonta
- †Herpetotheriidae
- †Anatoliadelphyidae

- †Polydolopimorphia
- †Peradectidae
- †Pediomyidae
- Marsupialia

There are three extant subclasses of mammals, one being metatherians:

1. **monotremes**: egg laying mammals like the platypus and the echidna,
2. **metatheria**: marsupials, which includes three American orders (Didelphimorphia, Paucituberculata

and Microbiotheria) and four Australasian orders (Notoryctemorphia, Dasyuromorphia, Peramelemorphia and Diprotodontia),^[4] and the

3. **eutherians**: placental mammals, consisting of twenty-one orders, divided into four superorders.^[5]

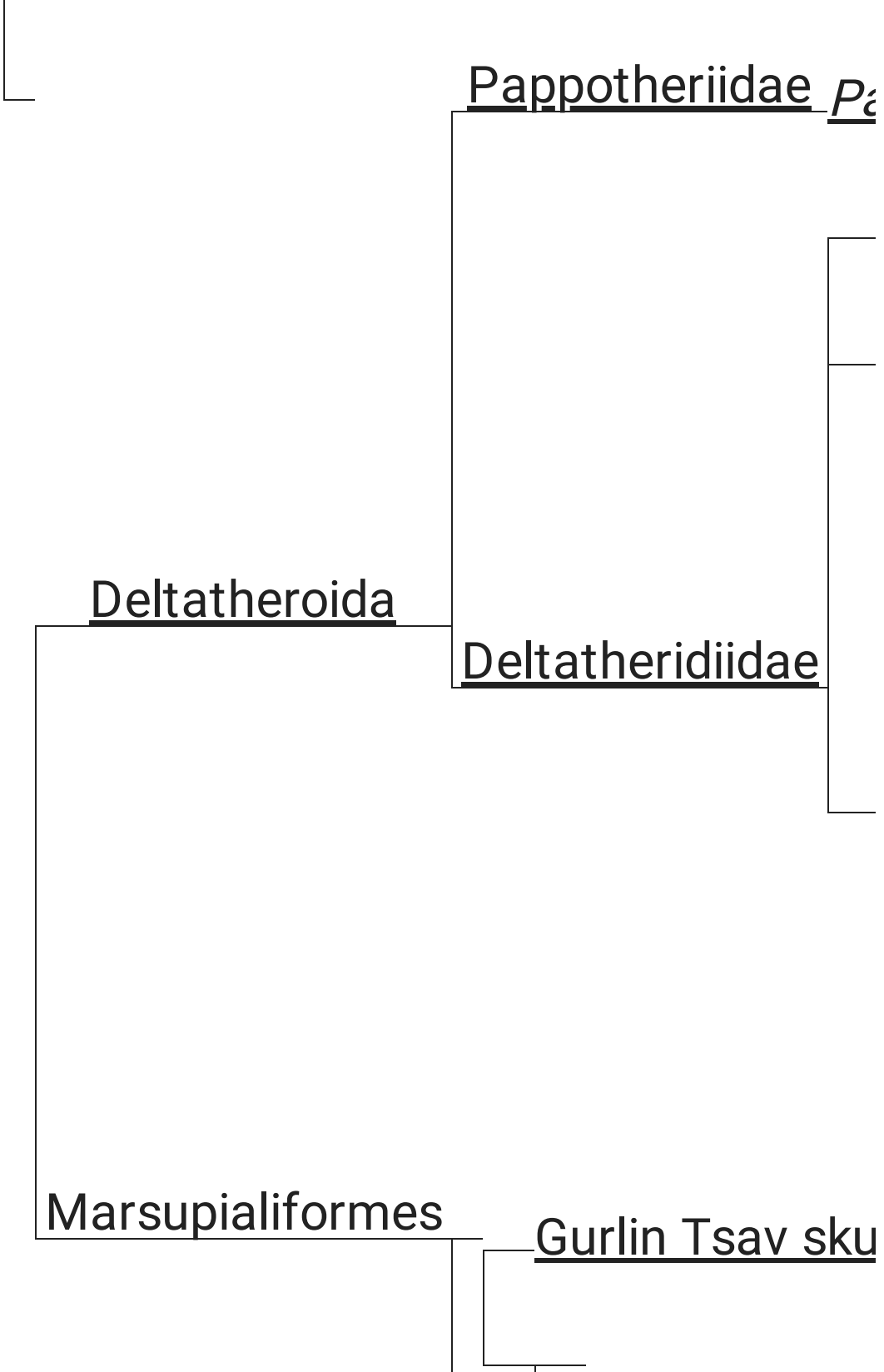
Metatherians belong to a subgroup of the northern tribosphenic mammal clade or Boreosphenida. They differ from all other mammals in certain morphologies like their dental formula, which includes about five upper and four lower incisors, a

canine, three premolars, and four molars.^[6]
Other morphologies include skeletal and anterior dentition, such as wrist and ankle apomorphies; all metatherians share derived pedal characters and calcaneal features.

Classification

Below is a metatherian cladogram from Wilson et al. (2016):^[7]

Metatheria *Holoclemensia*



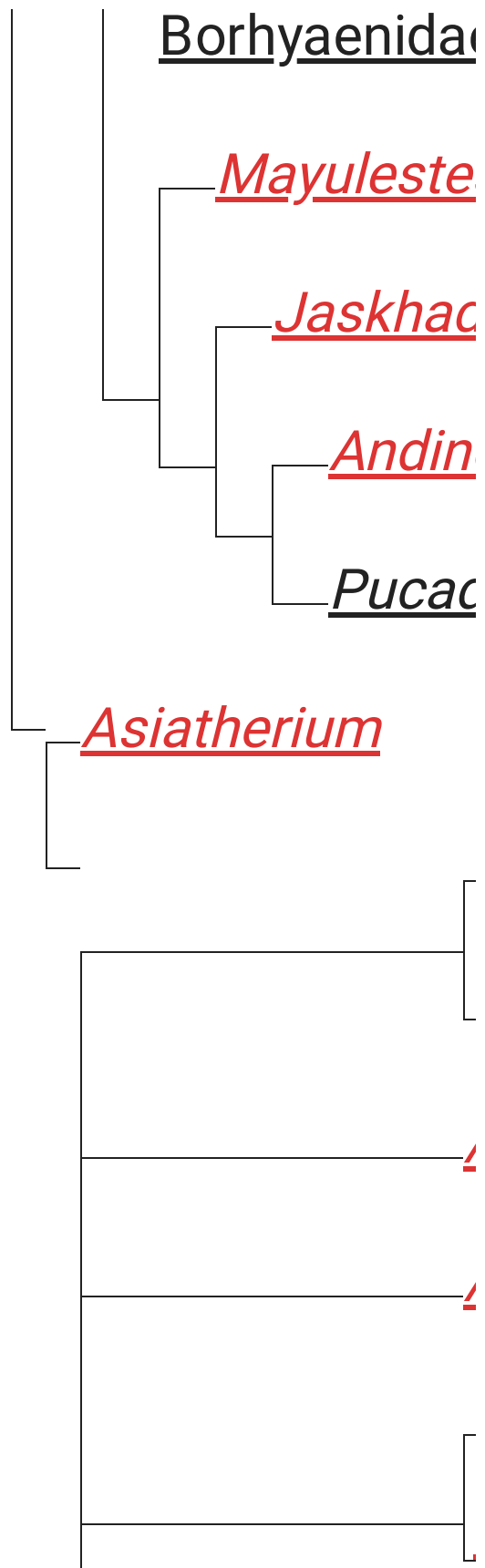
Pappotheriidae *P₂*

Deltatheroidea

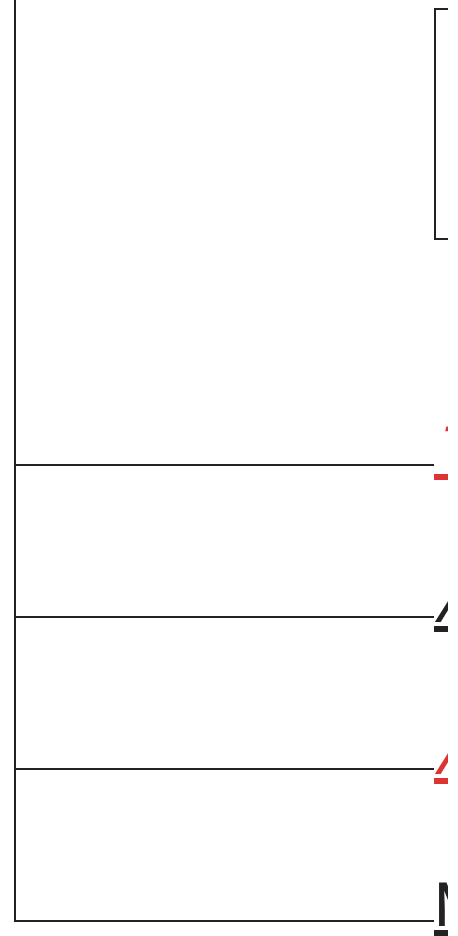
Deltatheridiidae

Marsupialiformes

Gurlin Tsav sku



Stagodontidae



Below is a listing of metatherians that do not fall readily into well-defined groups.

Basal Metatheria

- † *Archaeonothos henkgodthelpi* Beck
2015
- † *Esteslestes ensis* Novacek et al. 1991
- † *Ghamidtherium dimaiensis* Sánchez-
Villagra et al. 2007
- † *Kasserinotherium tunisiense* Crochet
1989
- † *Palangania brandmayri* Goin et al. 1998
- † *Perrodelphys coquinense* Goin et al.
1999

Ameridelphia incertae sedis:

- † *Apistodon exiguus* (Fox 1971) Davis
2007
- † *Cocatherium lefipanum* Goin et al.
2006
- † *Dakotadens morrowi* Eaton 1993
- † *Iugomortiferum thoringtoni* Cifelli
1990b
- † *Marambiotherium glacialis* Goin et al.
1999
- † *Marmosopsis juradoi* Paula Couto
1962 [Marmosopsini Kirsch & Palma
1995]
- † *Pascualdelphys fierroensis*

- † *Progarzonia notostylopense* Ameghino
1904
- † *Protalphadon* Cifelli 1990
 - † *P. lulli* (Clemens 1966) Cifelli
1990a
 - † *P. foxi* Johnson 1996

Marsupialia incertae sedis:

- † *Itaboraidelphys camposi* Marshall & de
Muizon 1984
- † *Mizquedelphys pilpinensis* Marshall &
de Muizon 1988

- † *Numbigilga ernielundeliusi* Beck et al. 2008 {Numbigilgidae Beck et al. 2008}

Evolutionary history

The relationships between the three extant divisions of mammals (monotremes, marsupials, and placental mammals) was long a matter of debate among taxonomists.^[8] Most morphological evidence comparing traits, such as the number and arrangement of teeth and the structure of the reproductive and waste elimination systems, favors a closer evolutionary relationship between

marsupials and placental mammals than either has with the monotremes, as does most genetic and molecular evidence.^[9]

Around the end of the Triassic period, a Therapsid developed traits or characteristics that are diagnostic of the class Mammalia. This class gave rise to Multituberculata (herbivorous mammals), Triconodonta and Symmetrodonta (carnivorous and insectivorous mammals). However, these are not seen after the end of the Early Cretaceous and by the Late Cretaceous marsupials and placentals had

evolved from a common eupantotherian ancestor.^[6] The Mammalia class probably saw its first eutherian in the early Cretaceous Jehol biota in China called *Acristatherium yanesis*. This eutherian was determined to be the most basal based on a phylogenetic analysis that used a data matrix of many other species.^[10] Metatherians probably evolved to take advantage of open arboreal niches. Adaptive radiation of marsupials excluded competition with their terrestrial placental counterparts.

Fossil metatherians are distinguished from eutherians by the form of their teeth: metatherians possess four pairs of molar teeth in each jaw, whereas eutherian mammals (including true placentals) never have more than three pairs.^[11] Using this criterion, the earliest known metatherian is *Sinodelphys szalayi*, which lived in China around 125 million years ago (mya). This 2003 study presents a new fossil from the early Cretaceous Yixian formation in China called *Sinodelphys szalayi* that gives enough morphological data to possibly be a basal metatherian in its didelphid-like

morphology; it shares derived traits, such as dental formation and wrist and ankle structures. The fossil is about 125 million years old, making it one of the oldest metatherian fossils found and gives support to the claim that Asia was probably the center for diversification during the early Cretaceous. The researchers hypothesize that the divergence of Metatheria from Eutheria occurred in Asia no later than 125 million years ago, followed by the evolution of deltatheroidian-like taxa in Asia and North America about 120-100 million years ago

and then the Paleocene diversification of relatives to the crown marsupials in South America.^[12] This makes it a contemporary to some early eutherian species that have been found in the same area.^[10] However, Bi *et al.* (2018) reinterpreted *Sinodelphys* as an early member of Eutheria.^[3] They state that the oldest known metatherians are now the 110 million years old fossils from western North America.

The oldest metatherian fossils are found in present-day China.^[13] About 100 mya,

the supercontinent Pangaea was in the process of splitting into the northern continent Laurasia and the southern continent Gondwana, with what would become China and Australia already separated by the Tethys Ocean. From there, metatherians spread westward into modern North America (still attached to Eurasia), where the earliest true marsupials are found. It is difficult to identify which fossils are marsupials, as they are characterized by aspects of the reproductive system that do not normally fossilize (such as pouches) and by subtle

changes in the bone and tooth structure that show a metatherian is part of the marsupial crown group (the most exclusive group that contains all living marsupials). The earliest definite marsupial fossil belongs to the species *Peradectes minor*, from the Paleocene of Montana, dated to about 65 million years ago.^[1] From this point of origin in Laurasia, marsupials spread to South America, which was connected to North America until around 65 mya. Laurasian marsupials eventually died off; traditionally this has been assumed to be due to competition with

placental mammals, but generally this is no longer considered to be the case, as metatherian diversity doesn't seem to be correlated to placental diversity.^{[14][15]}

Indeed, it appears metatherians suffered the heaviest mammalian casualties in the KT event, taking longer to recover than other groups.^[16] In Laurasian landmasses, herpetotheriids and peradectids remained alive until the mid to late Miocene, with the peradectids *Siamoperadectes* and *Sinoperadectes* being the youngest Laurasian metatherians.

See also

- List of prehistoric mammals
- List of placental mammals (living species)
- List of monotremes and marsupials (living species)

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