



Clade Laurasiatheria

Clade Laurasiatheria is made up of both living and extinct animals. There are eight traditional, living Linnaean orders within the clade.

Scientists hypothesise laurasiatherians shared a common ancestor approximately 90 million years ago. Laurasiatheria is thought to have originated on the northern supercontinent, Laurasia, that comprised North America, Europe and most of Asia.

Evidence for Laurasiatheria emerged from molecular work conducted in 2001. Further research has resulted in additional changes to taxonomic groupings, including merging orders Cetacea and Artiodactyla into order Cetartiodactyla.

Before molecular evidence was available, some members of Laurasiatheria were considered to share evolutionary relationships with different groups of animals. Now, many of these relationships are considered to represent convergent evolution.

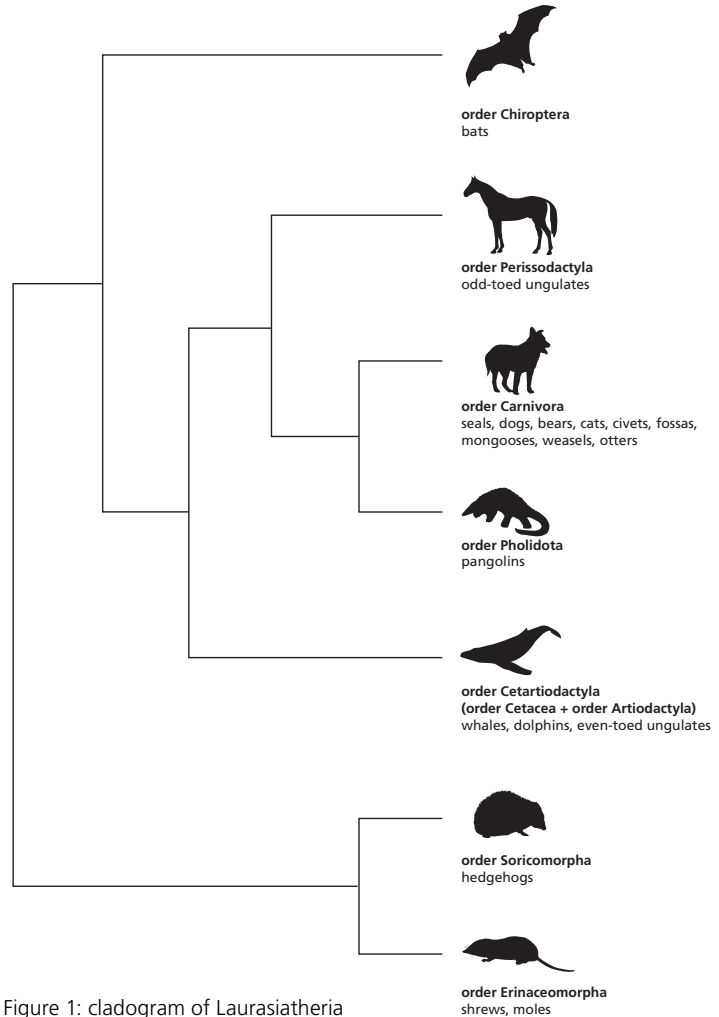


Figure 1: cladogram of Laurasiatheria
This cladogram represents only one of many competing hypotheses, as relationships within Laurasiatheria remain unresolved.

Table 1: examples of previous organisation of clade Laurasiatheria

MAMMALS	CLASSIFICATION/ORGANISATION
bats	Bats were formerly linked with primates, tree shrews, elephant shrews and flying lemurs (colugos) in the order Archonta. This association is not supported by molecular evidence. Some recent molecular studies suggest a relationship with moles.
pangolins	Pangolins were linked with other toothless, ant-eating mammals, such as armadillos in order Edentata. This association is not supported by molecular evidence and Edentata is now defunct. Currently, pangolins are considered to share a sister relationship with Carnivora.
whales, dolphins	Order Cetacea has been merged with order Artiodactyla (even-toed ungulates) to form order Cetartiodactyla. Within Cetartiodactyla, whales are hypothesised to share a common ancestor with hippopotami.
hedgehogs, shrews, moles	These animals were previously placed in order Insectivora with other small insect-eaters, such as golden moles, tenrecs and colugos. Lack of anatomical evidence, and new molecular evidence, resulted in the order Insectivora being disbanded. Relations between hedgehogs, moles and shrews remain unresolved.

Clade Euarchontoglires

Euarchontoglires consists of five traditional, living Linnean orders. The clade is made up of subgroups: **Euarchonta** and **Glires** – consistently supported by molecular evidence.

Scientists believe Euarchontoglires shared a common ancestor around 90 million years ago. This clade’s proposed place of origin is the northern supercontinent, Laurasia.

Euarchontoglires is considered a sister group to Laurasiatheria; scientists believe both clades evolved in Laurasia. Together they comprise clade Boreoeutheria.

The only evidence linking this clade is molecular; currently, no morphological similarities between the two subgroups Euarchonta and Glires have been found.

Lagomorphs and rodents are grouped together on the basis of dental similarities. Some evolutionary biologists argue this may represent convergence rather than common ancestry, as not all molecular studies support this relationship. Prior to molecular evidence, many members of Euarchontoglires were arranged in different taxonomic groupings.

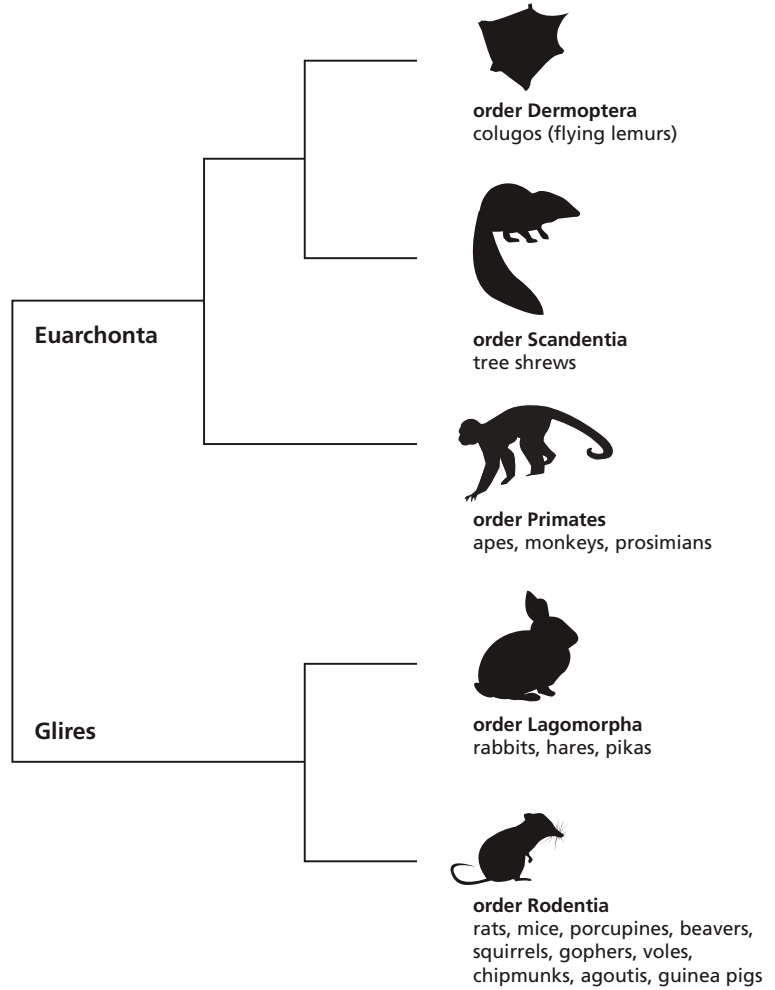


Figure 2: cladogram of Euarchontoglires. Relationships within this clade are not settled; indeed relations within both subgroups remain uncertain.

Table 2: examples of previous organisation of clade Eurarchontoglires

ORDER	CLASSIFICATION/ORGANISATION
colugos (flying lemurs)	Flying lemurs were linked with bats on the basis of morphological similarities, such as elongation of forelimbs and fusion of arm bones for flight. This linkage has been rejected by molecular evidence.
tree shrews	On the basis of anatomical similarities, tree shrews were previously part of order Primates. In the 1970s, they were removed and placed in their own order, Scandentia – confirmed by molecular evidence.
primates	Proposed in 1910, order Archonta included primates, tree shrews, elephant shrews, bats and colugos. Elephant shrews were removed from this group in the 1970s. Molecular evidence consistently finds bats aren’t linked with this group and they’re now placed in clade Laurasiatheria.

Clade Afrotheria

Clade Afrotheria groups diverse mammals from six living orders.

Around 100 million years ago, afrotherians are hypothesised to have shared a common ancestor. The clade evolved in Africa after the breakup of Gondwana. It probably diversified when Africa underwent a period of isolation between 105 and 25 million years ago.

Afrotheria is a clade united solely on strong molecular evidence. Anatomical evidence supports relationships amongst some clade members, but not all members share these features.

The relationship between hyraxes, sirenians and proboscideans has been recognised since 1945 on the basis of fossil evidence and morphological similarities such as abdominal testes, modified incisors forming tusks, and absent clavicles.

Other afrotherians – hyraxes, golden moles and tenrecs – share physiological features. These include low core body temperature, primitive reproductive systems and low metabolic rates.

However, there is no fossil or anatomical evidence that links all clade members. Without molecular evidence it is unlikely Afrotheria would have been recognised.

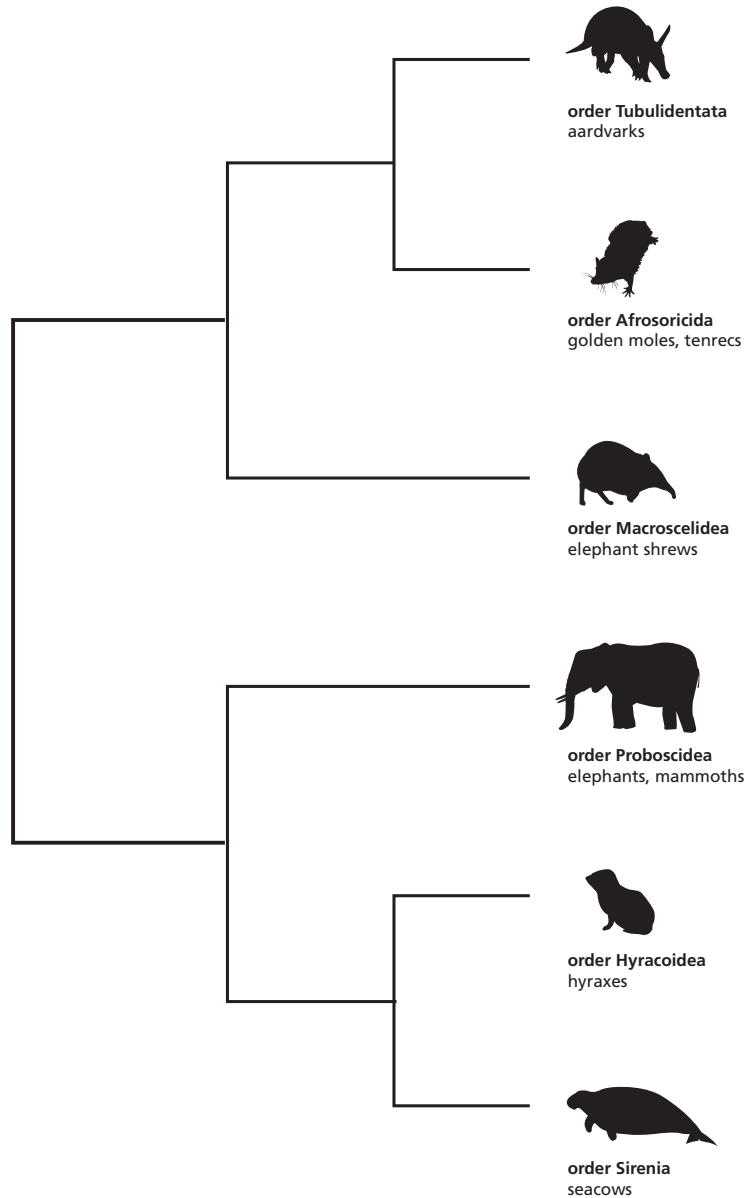


Figure 3: cladogram of clade Afrotheria
Although strongly supported by molecular evidence, relationships between clade members remain unclear.

Table 3: example of previous organisation of clade Afrotheria

ORDER	CLASSIFICATION/ORGANISATION
golden moles, tenrecs	On the basis of morphological similarities, tenrecs and golden moles were linked with other insectivorous northern hemisphere mammals, such as moles, hedgehogs and shrews, in order Insectivora. This order was disbanded as a result of molecular evidence, placing tenrecs and golden moles in order Afrosoricida.
aardvarks	On the basis of diet (termites) and reduced number of teeth, aardvarks were previously linked with ungulates (hoofed mammals), pangolins and xenarthrans. Molecular evidence rejects these relationships and places them within Afrotheria.
elephant shrews	On the basis of anatomical similarities, elephant shrews were originally classified in order Insectivora, with shrews, moles and hedgehogs. They were also linked with hares and rabbits in order Lagomorpha. Current molecular evidence places them in their own order within Afrotheria.
hyraxes	On the basis of dental and skeletal similarities, hyraxes were linked with rhinos and horses, in order Perissodactyla. Both fossil and anatomical evidence connects hyraxes with elephants and sea cows – supported by molecular evidence.

Clade Xenarthra

Clade Xenarthra includes two living mammalian orders – supported by both anatomical and molecular evidence.

Around 100 million years ago, xenarthrans are believed to have shared a common ancestor. They evolved in South America.

After the breakup of the supercontinent, Gondwana, South America underwent a long period of isolation. It's hypothesised that xenarthrans diversified during this time.

They're often considered to be a sister group to clade Afrotheria, which similarly evolved in the southern hemisphere after the split of Gondwana.

Xenarthrans are united on the basis of unique morphological characteristics such as presence of a double posterior vena cava, low metabolic rate and reduced dentition. The name, 'xenarthra', means 'strange joints' and refers to specialised articulation of the lumbar vertebrae of xenarthrans.

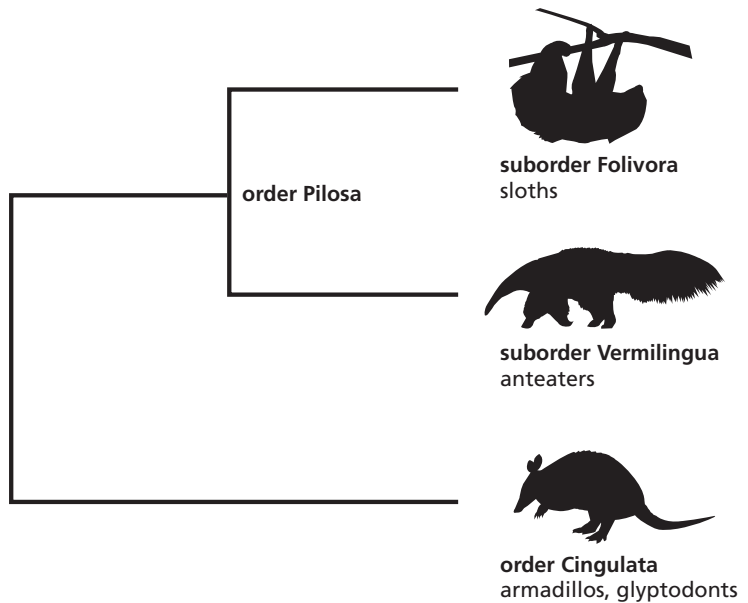


Figure 4: cladogram of clade Xenarthra

Table 4: example of previous organisation of clade Xenarthra

ORDER	CLASSIFICATION/ORGANISATION
sloths, anteaters and armadillos	Xenarthrans were previously grouped in order Edentata along with pangolins and aardvarks. This grouping was based on anatomical similarities such as: lack or reduced number of teeth, diet predominantly of ants or termites, and skeletal modifications for digging. Molecular evidence rejected placement of pangolins and aardvarks with xenarthrans. Order Edentata has since fallen from use.