

Primates

(animal group that contains prosimians and simians)



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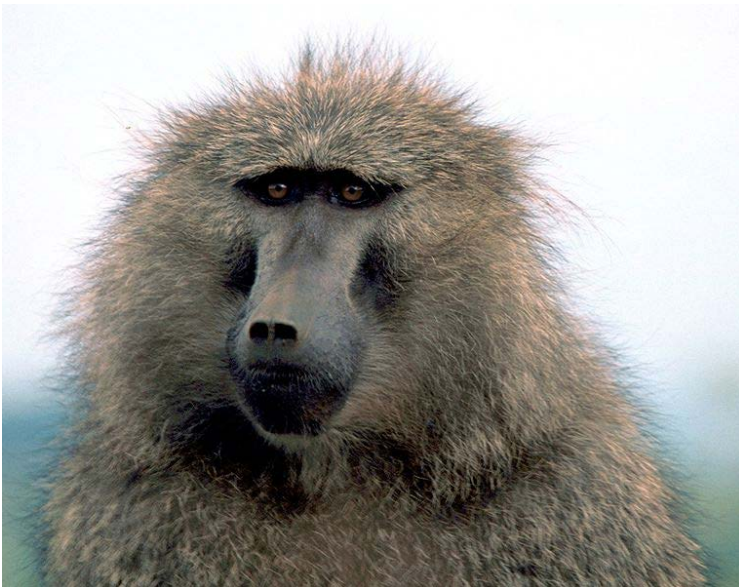
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Primate

Primates

Fossil range: Late Paleocene–recent



Olive Baboon, *Papio anubis*

Scientific classification

Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Infraclass: Eutheria
Superorder: Euarchontoglires
Order: **Primates**
Linnaeus, 1758



Range of the non-human primates (green)

A **primate** is a member of the biological order **Primates**, the group that contains prosimians (including lemurs, lorises, galagos and tarsiers) and simians (monkeys and apes). With the exception of humans, who inhabit every continent on Earth, most primates live in tropical or subtropical regions of the Americas, Africa and Asia. Primates range in size from the Madame Berthe's Mouse Lemur, which weighs only 30 grams (1.1 oz) to the Mountain Gorilla weighing 200 kilograms (440 lb). According to fossil evidence, the primitive ancestors of primates may have existed in the late Cretaceous period around 65 million years ago, and the oldest known primate is the Late Paleocene *Plesiadapis*, c. 55–58 million years ago. Molecular clock studies suggest that the primate branch may be even older, originating in the mid-Cretaceous period around 85 mya.

The Primates order has traditionally been divided into two main groupings: prosimians and simians. Prosimians have characteristics most like those of the earliest primates, and included the lemurs of Madagascar, lorisiforms and tarsiers. Simians included the monkeys and apes. More recently, taxonomists have created the suborder Strepsirrhini, or curly-nosed primates, to include non-tarsier prosimians and the suborder Haplorrhini, or dry-nosed primates, to include tarsiers and the simians. Simians are divided into two groups: the platyrrhines ("flat nosed") or New World monkeys of South and Central America and the catarrhine (narrow nosed) monkeys of Africa and southeastern Asia. The New World monkeys include the capuchin, howler and squirrel monkeys, and the catarrhines include the Old World monkeys (such as baboons and macaques) and the apes. Humans are the only catarrhines that have spread successfully outside of Africa, South Asia, and East Asia, although fossil evidence shows many species once existed in Europe as well.

Considered generalist mammals, primates exhibit a wide range of characteristics. Some primates (including some great apes and baboons) do not live primarily in trees, but all species possess adaptations for climbing trees. Locomotion techniques used include leaping from tree to tree, walking on two or four limbs, knuckle-walking, and swinging between branches of trees (known as brachiation). Primates are characterized by their large brains, relative to other mammals, as well as an increased reliance on stereoscopic vision at the expense of smell, the dominant sensory system in most mammals. These features are most significant in monkeys and apes, and noticeably less so in lorises and lemurs. Three-color vision has developed in some primates. Most also have opposable thumbs and some have prehensile tails. Many species are sexually dimorphic, which

means males and females have different physical traits, including body mass, canine tooth size, and coloration. Primates have slower rates of development than other similarly sized mammals, and reach maturity later but have longer lifespans. Some species live in solitude, others live in male–female pairs, and others live in groups of up to hundreds of members.

Evolutionary history

The Primates order are a part of the clade Euarchontoglires which is nested within the Eutheria clade of the class Mammalia. Recent molecular genetic research on primates, colugos, and treeshrews has shown that the two species of colugos are more closely related to the primates than the treeshrews, even though the treeshrews were at one time considered primates. These three orders make up the Euarchonta clade. This clade combines with the Glires clade (composed of the Rodentia and Lagomorpha) to form the Euarchontoglires clade. Variousy, both Euarchonta and Euarchontoglires are ranked as superorders. Some scientists consider Dermoptera a suborder of Primates and call the "true" primates the suborder Euprimates.

Evolution

The primate lineage is thought to go back at least 65 mya, even though the oldest known primate from the fossil record is *Plesiadapis* (c. 55–58 mya) from the Late Paleocene. Other studies, including molecular clock studies, have estimated the origin of the primate branch to have been in the mid-Cretaceous period, around 85 mya.

In modern cladistic reckonings, the Primates order is monophyletic. The suborder Strepsirrhini, the curly-nosed or "wet-nosed" primates, is generally thought to have split off from the primitive primate line about 63 mya (million years ago), although earlier dates are also supported. The seven strepsirhine families are the five related lemur families and the two remaining families that include the lorisisds and the galagos. Older classification schemes wrap the Lepilemuridae into the Lemuridae and the Galagidae into the Lorisidae, yielding a three-two family split instead of the five-two split as presented here. During the Eocene, most of the northern continents were dominated by two groups, the adapiforms and the omomyids. The former is considered a member of Strepsirrhini, but it does not have a toothcomb like modern lemurs; recent analysis has suggested *Darwinius masillae* fits into this grouping. The latter was related closely to tarsiers, monkeys, and apes. It is unclear exactly how these two groups relate to extant primates. Omomyids perished about 30 mya, while Adapids survived until about 10 mya.



Ring-tailed Lemur, a strepsirrhine primate

According to genetic studies, the lemurs of Madagascar diverged from the loriforms approximately 75 mya. These studies, as well as chromosomal and molecular evidence, also show that lemurs are more closely related to each other than to other strepsirrhine primates. However, Madagascar split from Africa at 160 mya and from India at 90 mya. For lemurs to be more closely related to each other than other strepsirrhine primates, it is thought that a very small ancestral population came to Madagascar via a single rafting event between 50 and 80 million years ago. Other colonization options have been examined, such as multiple colonizations from Africa and India, but none are supported by the genetic and molecular evidence.

Until recently the Aye-aye has been difficult to place within Strepsirrhini. Theories had been proposed that its family, Daubentoniidae, was either a lemuriform primate (meaning its ancestors split from lemur line more recently than the lemurs and lorises split) or a sister group to all the other strepsirrhines. In 2008, the Aye-aye family (Daubentoniidae) was confirmed to be mostly closely related to the Malagasy lemurs, likely having descended from the same ancestral population that colonized the island.

The suborder Haplorrhini, the simple-nosed or "dry-nosed" primates, is composed of two sister clades. The prosimian tarsiers in family Tarsiidae (monotypic in its own infraorder Tarsiiformes), represent the most primitive division at about 58 mya. The Simiiformes infraorder emerged about 40 mya, and contains the two clades: the parvorder Platyrrhini that developed in South America and contains New World monkeys, and the parvorder Catarrhini that developed in Africa and contains the Old World monkeys, humans and the other apes. A third clade, which included the eosimiids, developed in Asia but went extinct millions of years ago.

Like the lemurs, the New World monkeys have unclear origins. Molecular sequence studies based on concatenated sequences have yielded wide variations in the estimated date of the divergence between platyrrhines and catarrhines, ranging from 33 to 70 mya, while studies based on mitochondrial sequences suggest a more consistent date of 35 to 43 mya. It has been postulated that there is a single origin for the anthropoids in Africa some migrated and subsequently speciation occurred. It is possible that the anthropoid primates traversed the Atlantic ocean during the Eocene, facilitated by Atlantic Ocean ridges and a lowered sea level, then island-hopped to South America. Once again, a rafting event may explain this transoceanic colonization. Due to continental drift, the young Atlantic Ocean was not nearly as wide as it is today, and research suggests that a small 1 kg (2.2 lb) primate could have survived 13 days on a raft of vegetation. Given estimated current and wind speeds, this would have provided enough time to make the voyage between the continents.

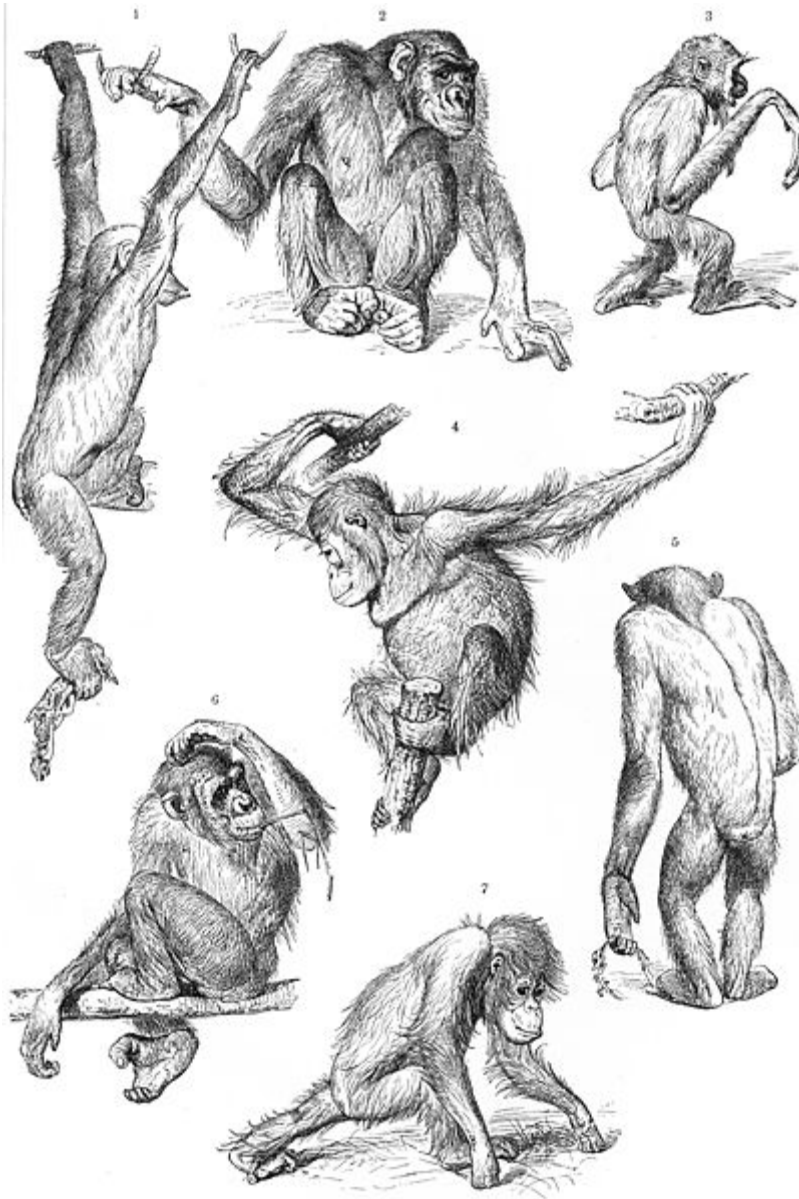


Emperor Tamarin, a New World monkey

Apes and monkeys spread from Africa into Europe and Asia starting in the Miocene. Soon after, the lorises and tarsiers made the same journey. The first hominid fossils were discovered in Northern Africa and date back 5–8 mya. Old World monkeys disappeared from Europe about 1.8 mya. Some molecular and fossil studies generally show that modern humans originated in Africa 100–200 tya (thousand years ago).

Although primates are well studied in comparison to other animal groups, several new species have been recently discovered; genetic tests on some populations have revealed previously unrecognised species. *Primate Taxonomy* listed about 350 species of primates in 2001, the author, Colin Groves, increased that number to 376 for his contribution to the third edition of *Mammal Species of the World* (MSW3). However, MSW3 falls short of current understanding as its collection was completed in 2003; a number of publications have since pushed the number to 424 species, or 658 including subspecies.

Classification of living primates



A 1927 drawing of chimpanzees, a gibbon (top right) and two orangutans (center and bottom center). The chimp in the upper left is brachiating; the orang at the bottom center is knuckle-walking.



Homo sapiens, a member of the order Primates

The following is the listing of the various families of primates:

- **Order Primates**
 - **Suborder Strepsirrhini:** non-tarsier prosimians
 - Infraorder Lemuriformes
 - Family Cheirogaleidae: dwarf lemurs and mouse-lemurs (32 species)
 - Family Daubentoniidae: Aye-aye (1 species)
 - Family Lemuridae: lemurs (22 species)
 - Family Lepilemuridae: sportive lemurs (26 species)
 - Family Indriidae: woolly lemurs and allies (19 species)
 - Infraorder Lorisiformes
 - Family Lorisidae: lorises, pottos and allies (9 species)
 - Family Galagidae: galagos (19 species)
 - **Suborder Haplorrhini:** tarsiers, monkeys and apes
 - Infraorder Tarsiiformes
 - Family Tarsiidae: tarsiers (9 species)
 - Infraorder Simiiformes
 - Parvorder Platyrrhini: New World monkeys
 - Family Callitrichidae: marmosets and tamarins (42 species)

- Family Cebidae: capuchins and squirrel monkeys (17 species)
- Family Aotidae: night or owl monkeys (douroucoulis) (10 species)
- Family Pitheciidae: titis, sakis and uakaris (42 species)
- Family Atelidae: howler, spider and woolly monkeys (28 species)
- Parvorder Catarrhini
 - Superfamily Cercopithecoidea
 - Family Cercopithecidae: Old World monkeys (135 species)
 - Superfamily Hominoidea
 - Family Hylobatidae: gibbons or "lesser apes" (13 species)
 - Family Hominidae: great apes, including humans (7 species)



Philippine Tarsier, once considered a prosimian, now predominantly considered a haplorrhine

The order Primates was established by Carl Linnaeus in 1758, in the tenth edition of his book *Systema Naturae*, for the genera *Homo* (humans), *Simia* (other apes and monkeys), *Lemur* (prosimians) and *Vespertilio* (bats). In the first edition of the same book (1735), he had used the name *Anthropomorpha* for *Homo*, *Simia* and *Bradypus* (sloths). In 1839, Henri Marie Ducrotay de Blainville, following Linnaeus and imitating his nomenclature, established the orders Secundates (including the suborders Chiroptera, Insectivora and Carnivora), Tertiates (or Glires) and Quaternates (including Gravigrada, Pachydermata and Ruminantia), but these new taxa were not accepted.

Before Anderson and Jones introduced the classification of Strepsirhini and Haplorhini in 1984, (followed by McKenna and Bell's 1997 work *Classification of Mammals: Above the species level*), the Primates were divided into two superfamilies: Prosimii and Anthropoidea. The Prosimii included all of the prosimians: all of Strepsirrhini plus the tarsiers. The Anthropoidea contained all of the simians.

Hybrids

Primate hybrids usually arise in captivity, but there have also been examples in the wild. Hybridization occurs where two species' range overlap to form hybrid zones; hybrids may be created by humans when animals are placed in zoos or due to environmental pressures such as predation. Intergeneric hybridizations, hybrids of different genera, have also been found in the wild. Although they belong to genera that have been distinct for several million years, interbreeding still occurs between the Gelada and the Hamadryas Baboon.

Distinguishing features

Primates have diversified in arboreal habitats (trees and bushes) and retain many characteristics that are adaptations to this environment. They are distinguished by:

- retention of the collar bone in the pectoral girdle;
- shoulder joints which allow high degrees of movement in all directions;
- five digits on the fore and hind limbs with opposable thumbs and big toes;
- nails on the fingers and toes (in most species);
- a flat nail on the hallux (in all extant species);
- sensitive tactile pads on the ends of the digits;
- orbits encircled in bone;
- a trend towards a reduced snout and flattened face, attributed to a reliance on vision at the expense of olfaction (most notably in haplorrhines, and less so in strepsirrhines);
- a complex visual system with stereoscopic vision, high visual acuity and color vision;
- a brain having a well developed cerebellum with posterior lobe and a Calcarine fissure;
- a large brain in comparison to body size, especially in simians;
- differentiation of an enlarged cerebral cortex;