2.4: The Human Animal

"Cousins"

Relative to all animals, this child and monkey are practically "cousins." From genes to morphology to behavior, they are similar in many ways. That's because both of them are primates, and they share an evolutionary past.

Figure \(\PageIndex{1}\): Child and monkey
How Humans Are Classified

You probably know that modern humans belong to the species *Homo sapiens*. But what is our place in nature? How are our species classified? A simple classification is represented in Figure \(\PageIndex{2}\). Humans can move on their own and are placed in the animal kingdom. Further, humans belong to the animal phylum known as chordates because we have a backbone. The human animal has hair and milk glands, so we are placed in the class of mammals. Within the mammal class, humans are placed in the primate order.

Humans as Primates

Living members of the primate order include monkeys, apes, and humans; and any member of this order of mammals is called a **primate**. At some point in the distant past, we shared ape-like ancestors with all these modern groups of primates. We share between 93 percent and almost 99 percent of our DNA sequences with them, providing hard evidence that we have relatively recent common ancestors. Besides genes, what traits do we share with other primates? Primates are considered generalists among mammals. A **generalist** is an organism that can thrive in a wide variety of environmental conditions and make use of a variety of different resources, such as consuming many different types of food. Although primates exhibit a wide range of characteristics, there are several traits that are shared by most primates.

Primate Traits

Primates have five digits (fingers or toes) on each extremity (hand or foot). The fingers and toes have nails instead of
claws and are covered with sensitive tactile pads. The thumbs (and in many species the big toes as well) are opposable, meaning they can be brought into opposition with the other digits, allowing both a power grasp and a precision grip. You can see these features of the primate extremities in the capuchin monkey pictured below.

![Capuchin Monkey](image)

Figure \(\PageIndex{3}\): The five fingers, opposable thumb, and other primate features of the hand give this capuchin monkey great manual dexterity. This is the primary reason these primates are trained to assist quadriplegic human beings with daily tasks.

The primate body is generally semi-erect or erect, and primates have one of several modes of locomotion, including walking on all four legs (quadrupedalism), vertical clinging and leaping, swinging from branch to branch in trees (brachiation), or walking on two legs (bipedalism), the last of which applies only to our own species today. The primate shoulder girdle has a collar bone (clavicle), which is associated with a wide range of motion of the upper limbs.

Relative to other mammals, primates rely less on their sense of smell. They have a reduced snout and relatively small area in the brain for processing olfactory (odor) information. Primates rely more on their sense of vision, which shows several improvements over that of other mammals. Most primates can see in color. Primates also tend to have large eyes with forward-facing placement in a relatively flat face. This results in an overlap of the visual fields of the two eyes, allowing stereoscopic vision, or three-dimensional, vision. Other indications of the importance of vision to primates are the protection given to the eyes by a complete bony eye socket and the large size of the occipital lobe of the brain where visual information is processed.

Primates are noted for their relatively large brains, high degree of intelligence, and complex behaviors. The part of the brain that is especially enlarged in primates is the cerebrum, which analyzes and synthesizes sensory information and transforms it into motor behaviors appropriate to the environment. Primates tend to have longer lifespans than most other mammals. In particular, there is a lengthening of the prenatal period and the postnatal period of dependency of infants on adults, providing an extended opportunity for learning in juveniles. Most primates live in social groups. In fact, primates are among the most social of animals. Depending on the species, adult nonhuman primates may live in mated
pairs or in groups of up to hundreds of members.

**Life in the Trees**

Scientists think that many primate traits are adaptations to an arboreal, or tree-dwelling, lifestyle. Primates are thought to have evolved in trees, and the majority of primates still live in trees. For life in the trees, the sense of vision trumps the sense of smell, and three-dimensional vision is especially important for grasping the next branch or limb. Having mobile limbs, a good grip, and manual dexterity are matters of life and death when one lives high above the ground. While some modern primates are mainly terrestrial (ground-dwelling) rather than arboreal, all primates possess adaptations for life in the trees.

Figure \( \PageIndex{4} \) shows the present distribution of nonhuman primates around the world. Tropical forests in Central and South America are home to many species of monkeys, including the capuchin monkey pictured above. Old World tropical forests in Africa and Asia are home to many other species of monkeys, including the crab-eating macaque pictured above, as well as all modern apes.

![Map showing the present worldwide distribution of nonhuman primates.](https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_(Wakim_and_Grewal)/02%3A_Introduction_to_Human_Biology/Figure_\PageIndex{4})

**Humans as Hominids**

Who are our closest relatives in the primate order? We are placed in the family called *Hominidae*. Any member of this family is called a **hominid**. Hominids include four living genera: chimpanzees, gorillas, orangutans, and humans. Among these four genera are just seven living species: two in each genera except humans, with our sole living species, *Homo sapiens*. The Orangutan mother pictured in figure \( \PageIndex{5} \) cradling her child shows how similar these hominids are to us.
Hominids are relatively large, tailless primates, ranging in size from the bonobo, or pygmy chimpanzee, which may weigh as little as 30 kg (66 lb), to the eastern gorilla, which may weigh over 200 kg (440 lb). Most modern humans fall somewhere in between that range. In all species of hominids, males are somewhat larger and stronger, on average, than females, but the differences may not be great. Except for humans, hominids are mainly quadrupedal, although they can get around bipedally if need be to gather food or nesting materials. Humans are the only habitually bipedal species of living hominids.

The Human Genus

Within the hominid family, our species is placed in the genus \textit{Homo}. Our species, \textit{Homo sapiens}, is the only living species in this genus. Several earlier species of \textit{Homo} existed but have since gone extinct, including the species \textit{Homo erectus}. An artist's reconstruction of a \textit{Homo erectus} individual is shown in figure \ref{fig:5}.
By about 2.8 million years ago, early *Homo* species such as *Homo erectus* were probably nearly as efficient at bipedal locomotion as modern humans. Relative to quadrupedal primates, they had a broader pelvis, longer legs, and arched feet. However, from the neck up, they were still quite different from us. They typically had bigger jaws and teeth, a sloping forehead, and a relatively small brain.

**Homo sapiens**

During the roughly 2.8 million years of the evolution of the *Homo* genus, the remaining features of *Homo sapiens* evolved. These features include:

- small front teeth (incisors and canines) with relatively large molars, at least compared to other primates.
- a decrease in the size of the jaws and face, and an increase in the size of the cranium, forming a nearly vertical forehead.
- a tremendous enlargement of the brain, especially in the cerebrum, which is the site of higher intellectual functions.

The increase in brain size occurred very rapidly as far as evolutionary change goes, between about 800,000 and 100,000 years ago. During this period, the size of the brain increased from about 600 cm$^3$ to about 1400 cm$^3$ and the earliest *Homo sapiens* appeared. This was also a period of rapid climate change, and many scientists think that climate change was a major impetus for the evolution of a larger, more complex brain. In this view, as the environment became more unpredictable, bigger, "smarter" brains helped our ancestors survive. Paralleling the biological evolution of the brain was the development of culture and technology as behavioral adaptations for exploiting the environment. These developments, made possible by a big brain, allowed modern humans and their recent ancestors to occupy virtually the entire world and become the dominant land animals.

Our species *Homo sapiens* is the most recent iteration of the basic primate body plan. Because of our big, complex brain, we clearly have a much greater capacity for abstract thought and technological advances than any other primate, even chimpanzees who are our closest living relatives. However, it is important to recognize that in other ways, we are not as adept as other living hominids around the world. We are physically weaker than gorillas, far less agile orangutans, and arguably less well-mannered than bonobos.
Feature: Human Biology in the News

Imagine squeezing through a seven-inch slit in rock to enter a completely dark cave full of lots and lots of old bones. It might sound like a nightmare to most people, but it was a necessary part of a recent exploration of human origins in South Africa as reported in the *New York Times* in September 2015. The cave and its bones were actually first discovered by spelunkers in 2013, who reported it to paleontologists. An international research project was soon launched to explore the cave. The researchers would eventually conclude that the cave was a hiding place for the dead of a previously unknown early species of *Homo*, whom they gave the name *Homo naledi*. Members of this species lived in South Africa around 2.5 to 2.8 million years ago.

*Homo naledi* individuals were about 5 feet tall and weighed around 100 pounds, so they probably had no trouble squeezing into the cave. Modern humans are considerably larger on average. In order to retrieve the fossilized bones from the cave, six very slender female researchers had to be found on social media. They were the only ones who could fit through the crack to access the cave. The work was difficult and dangerous but also incredibly exciting. The site constitutes one of the largest samples for any extinct early *Homo* species anywhere in the world, and the fossils represent a completely new species of that genus. The site also suggests that early members of our genus were intentionally depositing their dead in a remote place. This behavior was previously thought to be limited to later humans.

Like other early *Homo* species, *Homo naledi* exhibits a mosaic of old and modern traits. From the neck down, these early hominins were well adapted for upright walking. Their feet were virtually indistinguishable from modern human feet (see image below), and their legs were also long like ours. *Homo naledi* had relatively small front teeth but also a small brain, no larger than an average orange. Clearly, the spurt in brain growth in *Homo* did not occur in this species.

![Figure](https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_(Wakim_and_Grewal)/02%3A_Introduction_to_Human_Biology/2.1%3A_Human_Biology_in_the_News/feature-human-biology-in-the-news).

Figure (PageIndex(7)). The reconstructed foot bones of *H. naledi* are virtually the same as our own.

Watch the news for more exciting updates about this early species of our genus. Paleontologists researching the cave site estimate that there are hundreds if not thousands of fossilized bones still remaining in the cave. There are sure to be many more discoveries reported in the news media about this extinct *Homo* species.

**Review**

1. Outline how humans are classified. Name their taxa, starting with the kingdom and ending with the species.
2. List several primate traits. Explain how they are related to life in the trees.
3. What are hominids? Describe how living hominids are classified.
4. Discuss species in the genus Homo.
5. Relate climatic changes to the evolution of the genus Homo within the last million years.
6. What is the significance of the fact that we share 93 to 99 percent of our DNA sequence with other primates?
7. Which species do you think we are more likely to share a greater amount of DNA sequence with — nonprimate mammals or nonmammalian chordates? Explain your answer.
8. What is the relationship between shared DNA and shared traits?
9. Compared to other mammals, primates have a relatively small area of their brain dedicated to olfactory processing. What does this tell you about the sense of smell in primates compared to other mammals? Why?
10. The part of the brain in primates that is specially enlarged is the:
   A. cerebrum
   B. cerebellum
   C. clavicle
   D. brainstem
11. Why do you think it is interesting that nonhuman primates can use tools?
12. True or False. All primates are primarily quadrupedal.
13. True or False. Homo erectus was in the same family as modern humans.
14. True or False. Humans are superior in all ways to other primates.
15. Explain why the discovery of Homo naledi was exciting.

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