SECTION 3

Humans and Other Primates

Have you ever heard someone say that humans descended from monkeys or apes? Well, scientists would not exactly say that. The scientific theory is that humans, apes, and monkeys share a common ancestor. This common ancestor probably lived more than 45 million years ago.

Most scientists agree that there is enough evidence to support this theory. Many fossils of organisms have been found that show traits of both humans and apes. Also, comparisons of modern humans and apes support this theory.

READING WARM-UP

Objectives

- Describe two characteristics that all primates share.
- Describe three major groups of hominids.

Terms to Learn

primate
hominid
Homo sapiens

READING STRATEGY

Discussion Read this section silently. Write down questions that you have about this section. Discuss your questions in a small group.

Primates

What characteristics make us human? Humans are classified as primates. **Primates** are a group of mammals that includes humans, apes, monkeys, and lemurs. Primates have the characteristics illustrated in **Figure 1.**

primate a type of mammal characterized by opposable thumbs and binocular vision

The First Primates

The ancestors of primates may have co-existed with the dinosaurs. These ancestors were probably mouselike mammals that were active at night, lived in trees, and ate insects. The first primates did not exist until after the dinosaurs died out. About 45 million years ago, primates that had larger brains appeared. These were the first primates that had traits similar to monkeys, apes, and humans.

Figure 1 Characteristics of Primates

Both eyes are located at the front of the head, and they provide binocular, or three-dimensional, vision.

Almost all primates, such as these orangutans, have five flexible fingers—four fingers and an opposable thumb. This thumb enables primates to grip objects. Most primates besides humans also have opposable big toes.

Apes and Chimpanzees

Scientists think that the chimpanzee, a type of ape, is the closest living relative of humans. This theory does not mean humans descended from chimpanzees. It means that humans and chimpanzees share a common ancestor. Sometime between 5 million and 30 million years ago, the ancestors of humans, chimpanzees, and other apes began to evolve along different lines.

Hominids

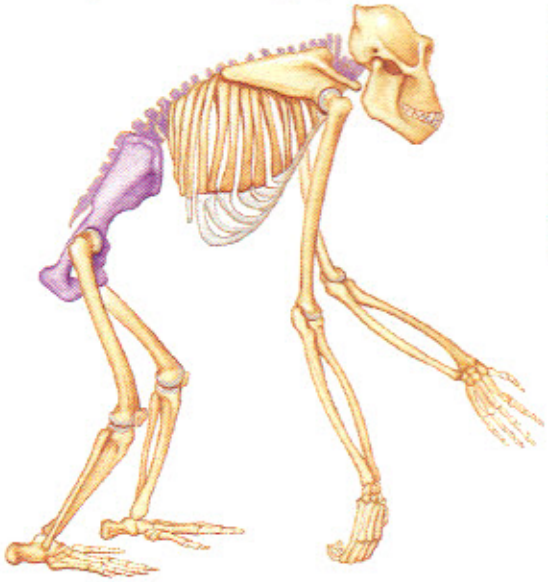
Humans are in a family separate from other primates. This family, called **hominids,** includes only humans and their human-like ancestors. The main characteristic that separates hominids from other primates is bipedalism. *Bipedalism* means "walking primarily upright on two feet." Evidence of bipedalism can be seen in a primate's skeletal structure. **Figure 2** shows a comparison of the skeletal features of apes and hominids.

hominid a type of primate characterized by bipedalism, relatively long lower limbs, and lack of a tail

Reading Check **In which family are humans classified?**
(See the Appendix for answers to Reading Checks.)

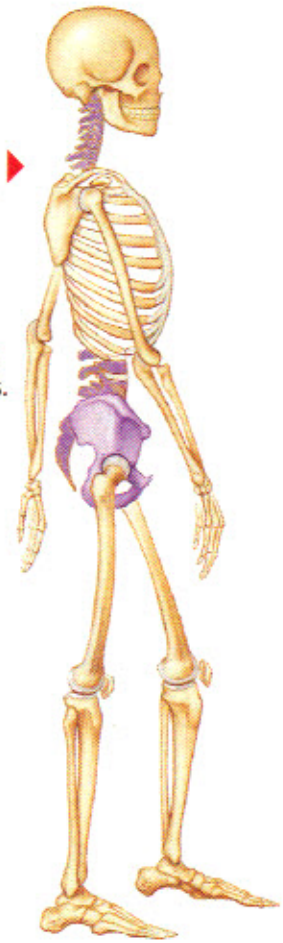
Figure 2 Comparison of Primate Skeletons

The bones of gorillas (a type of ape) and humans (a type of hominid) have a very similar form, but the human skeleton is adapted for walking upright.



▲ The gorilla pelvis tilts the ape's large rib cage and heavy neck and head forward. The gorilla spine is curved in a C shape. The arms are long to provide balance on the ground.

The human pelvis is vertical and helps hold the entire skeleton upright. The human spine is curved in an S shape. The arms are shorter than the legs. ▶



Hominids Through Time

Figure 3 *This skull was found in the Sahel desert in Chad, Africa. The skull is estimated to be 6 million to 7 million years old.*

Scientists are constantly filling in pieces of the hominid family picture. They have found many different fossils of ancient hominids and have named at least 18 types of hominids. However, scientists do not agree on the classification of every fossil. Fossils are classified as hominids when they share some of the characteristics of modern humans. But each type of hominid was unique in terms of size, the way it walked, the shape of its skull, and other characteristics.

The Earliest Hominids

The earliest hominids had traits that were more humanlike than apelike. These traits include the ability to walk upright as well as smaller teeth, flatter faces, and larger brains than earlier primates. The oldest hominid fossils have been found in Africa. So, scientists think hominid evolution began in Africa. **Figure 3** shows a fossil that may be from one of the earliest hominids. It is 6 million to 7 million years old.

Reading Check **Where are the earliest hominid fossils found?**

Australopithecines

Many early hominids are classified as *australopithecines* (AW struh LOH PITH uh SEENS). Members of this group were similar to apes but were different from apes in several ways. For example, their brains were slightly larger than the brains of apes. Some of them may have used stone tools. They climbed trees but also walked on two legs.

Fossil evidence of australopithecines has been found in several places in Africa. The fossilized footprints in **Figure 4** were probably made by a member of this group over 3 million years ago. Some skeletons of australopithecines have been found near what appear to be simple tools.

Figure 4 *Anthropologist Mary Leakey discovered these 3.6 million year old footprints in Tanzania, Africa.*

A Variety of Early Hominids

Many australopithecines and other types of hominids lived at the same time. Some australopithecines had slender bodies. They had humanlike jaws and teeth but had small, apelike skulls. They probably lived in forests and grasslands and ate a vegetarian diet. Scientists think that some of these types of hominids may have been the ancestors of modern humans.

Some early hominids had large bodies and massive teeth and jaws. They had a unique skull structure and relatively small brains. Most of these types of hominids lived in tropical forests and probably ate tough plant material, such as roots. Scientists do not think that these large-bodied hominids are the ancestors of modern humans.

Global Hominids

About 2.3 million years ago, a new group of hominids appeared. These hominids were similar to the slender australopithecines but were more humanlike. These new hominids had larger and more complex brains, rounder skulls, and flatter faces than early hominids. They showed advanced tool-making abilities and walked upright.

These new hominids were members of the group *Homo*, which includes modern humans. Fossil evidence indicates that several members of the *Homo* group existed at the same time and on several continents. Members of this group were probably scavengers that ate a variety of foods. Some of these hominids may have adapted to climate change by migrating and changing the way they lived.

An early member of this new group was *Homo habilis* (HOH moh HAB uh luhs), which lived about 2 million years ago. In another million years, a hominid called *Homo erectus* (HOH moh i REK tuhs) appeared. This type of hominid could grow as tall as modern humans do. A museum creation of a member of *Homo erectus* is shown in **Figure 5.** No one knows what early hominids looked like. Scientists construct models based on skulls and other evidence.

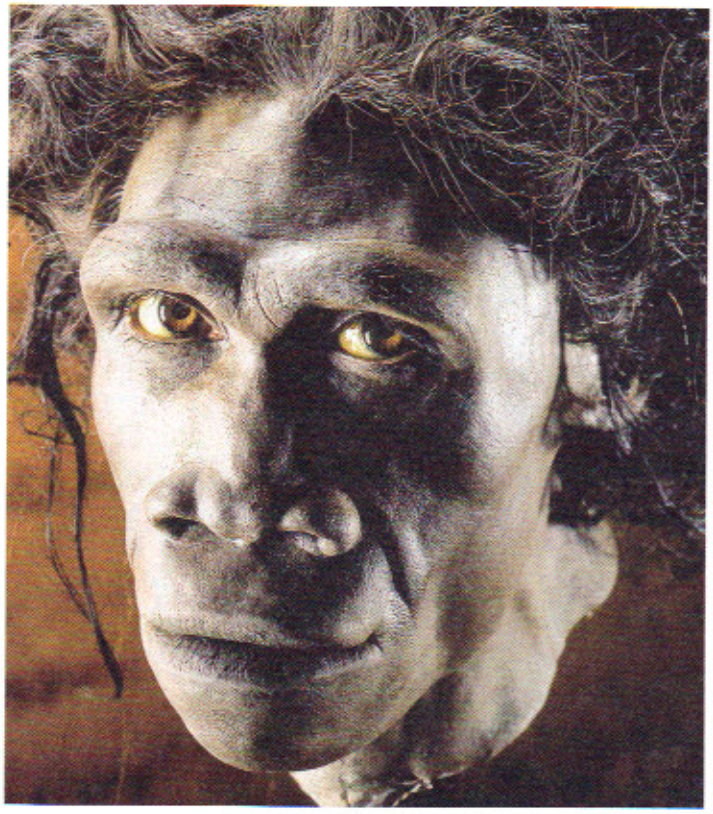


Figure 5 *Fossils of a hominid known as* Homo erectus *have been found in Africa, Europe, and Asia.*

SCHOOL to HOME

Thumb Through This

1. Keep your thumbs from moving by attaching them to the sides of your hands with **tape.**
2. Attempt each of the following tasks: using a **pencil sharpener,** using **scissors,** tying your **shoelaces,** buttoning **buttons.**
3. After each attempt, answer the following questions:
   - **a.** Is the task more difficult with an opposable thumb or without one?
   - **b.** Do you think you would carry out this task on a regular basis if you did not have an opposable thumb?

ACTIVITY

Recent Hominids

As recently as 30,000 years ago, two types of hominids may have lived in the same areas at the same time. Both had the largest brains of any hominids and made advanced tools, clothing, and art. Scientists think that modern humans may have descended from one of these two types of hominids.

Neanderthals

One recent hominid is known as *Neanderthal* (nee AN duhr TAWL). Neanderthals lived in Europe and western Asia. They may have lived as early as 400,000 years ago. They hunted large animals, made fires, and wore clothing. They also may have cared for the sick and elderly and buried their dead with cultural rituals. About 30,000 years ago, Neanderthals disappeared. No one knows what caused their extinction.

Homo sapiens the species of hominids that includes modern humans and their closest ancestors and that first appeared about 100,000 to 160,000 years ago

Early and Modern Humans

Modern humans are classified as the species ***Homo sapiens*** (HOH moh SAY pee UHNZ). The earliest *Homo sapiens* existed in Africa 100,000 to 160,000 years ago. The group migrated out of Africa sometime between 40,000 and 100,000 years ago. Compared with Neanderthals, *Homo sapiens* has a smaller and flatter face, and has a skull that is more rounded. Of all known hominids, only *Homo sapiens* still exists.

Homo sapiens seems to be the first to create art. Early humans produced sculptures, carvings, paintings, and clothing such as that shown in **Figure 6.** The preserved villages and burial grounds of early humans show that they had an organized and complex society.

Figure 6 *These photos show museum recreations of early* Homo sapiens.

Drawing the Hominid Family Tree

Scientists review their hypotheses when they learn something new about a group of organisms and their related fossils. As more hominid fossils are discovered, there are more features to compare. Sometimes, scientists add details to the relationships they see between each group. Sometimes, new groups of hominids are recognized. Human evolution was once thought to be a line of descent from ancient primates to modern humans. But scientists now speak of a "tree" or even a "bush" to describe the evolution of various hominids in the fossil record.

Reading Check What is likely to happen when a new hominid fossil is discovered?

SECTION Review

Summary

- Humans, apes, and monkeys are primates. Almost all primates have opposable thumbs and binocular vision.
- Hominids, a subgroup of primates, include humans and their humanlike ancestors. The oldest known hominid fossils may be 7 million years old.
- Early hominids included australopithecines and the *Homo* group.
- Early *Homo sapiens* did not differ very much from present-day humans. *Homo sapiens* is the only type of hominid living today.

Using Key Terms

1. Use each of the following words in the same sentence: *primate*, *hominid*, and *Homo sapiens*.

Understanding Key Ideas

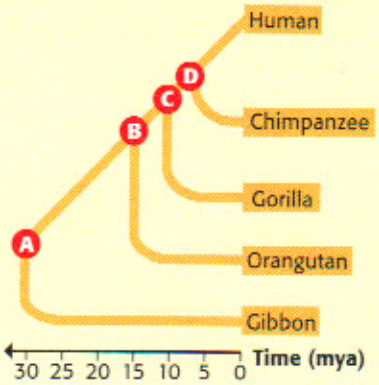
2. The unique characteristics of primates are
   - **a.** bipedalism and thumbs.
   - **b.** opposable thumbs.
   - **c.** opposable thumbs and binocular vision.
   - **d.** opposable toes and thumbs.
3. Describe the major evolutionary developments from early hominids to modern humans.
4. Compare members of the *Homo* group with australopithecines.

Critical Thinking

5. **Forming Hypotheses** Suggest some reasons why Neanderthals might have become extinct.
6. **Making Inferences** Imagine you are a scientist excavating an ancient campsite. What might you infer about the people who used the site if you found the charred bones of large animals and various stone blades among human fossils?

Interpreting Graphics

The figure below shows a possible ancestral relationships between humans and some modern apes. Use this figure to answer the questions that follow.



7. Which letter represents the ancestor of all the apes?
8. To which living ape are gorillas most closely related?

Chapter Review

USING KEY TERMS

Complete each of the following sentences by choosing the correct term from the word bank.

Precambrian time	Paleozoic era
Mesozoic era	Cenozoic era

1. During ___, life is thought to have originated from nonliving matter.
2. The Age of Mammals refers to the ___.
3. The Age of Reptiles refers to the ___.
4. Plants colonized land during the ___.

For each pair of terms, explain how the meanings of the terms differ.

5. *relative dating* and *absolute dating*
6. *primates* and *hominids*

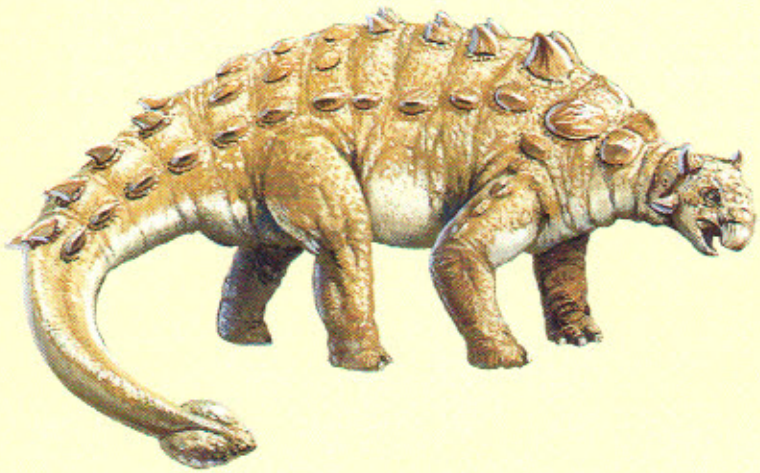
UNDERSTANDING KEY IDEAS

Multiple Choice

7. If the half-life of an unstable element is 5,000 years, what percentage of the parent material will be left after 10,000 years?
   - **a.** 100%
   - **b.** 75%
   - **c.** 50%
   - **d.** 25%
8. The first cells on Earth appeared in
   - **a.** Precambrian time.
   - **b.** the Paleozoic era.
   - **c.** the Mesozoic era.
   - **d.** the Cenozoic era.
9. In which era are we currently living?
   - **a.** Precambrian time
   - **b.** Paleozoic era
   - **c.** Mesozoic era
   - **d.** Cenozoic era
10. Scientists think that the closest living relatives of humans are
    - **a.** lemurs.
    - **b.** monkeys.
    - **c.** gorillas.
    - **d.** chimpanzees.

Short Answer

11. Describe how plant and animal remains can become fossils.
12. What information do fossils provide about the history of life?
13. List three important steps in the early development of life on Earth.
14. List two important groups of organisms that appeared during each of the three most recent geologic eras.
15. Describe the event that scientists think caused the mass extinction at the end of the Mesozoic era.



16 From which geologic era are fossils most commonly found?

17 Describe two characteristics that are shared by all primates.

18 Which hominid species is alive today?

CRITICAL THINKING

19 **Concept Mapping** Use the following terms to create a concept map: *Earth's history, humans, Paleozoic era, dinosaurs, Precambrian time, land plants, Mesozoic era, cyanobacteria,* and *Cenozoic era.*

20 **Applying Concepts** Can footprints be fossils? Explain your answer.

21 **Making Inferences** If you find rock layers containing fish fossils in a desert, what can you infer about the history of the desert?

22 **Applying Concepts** Explain how an environmental change can threaten the survival of a species. Give two examples.

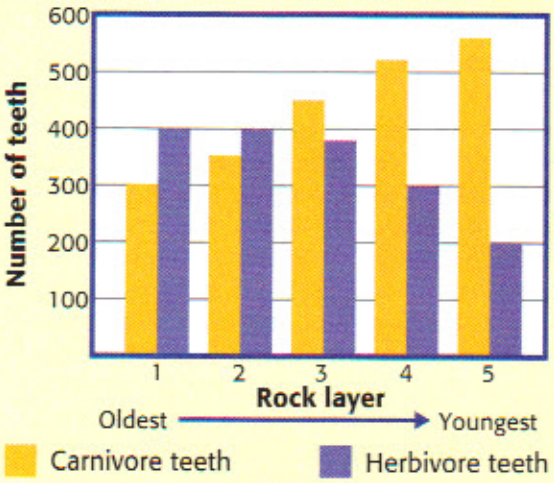
23 **Analyzing Ideas** Why do scientists think the first cells did not need oxygen to survive?

24 **Identifying Relationships** How does the extinction that occurred at the end of the Mesozoic era relate to the Age of Mammals?

25 **Making Comparisons** Make a table listing the similarities and differences between australopithecines, early members of the group *Homo*, and modern members of the species *Homo sapiens*.

INTERPRETING GRAPHICS

The graph below shows data about fossilized teeth that were found within a series of rock layers. Use this graph to answer the questions that follow.



26 Which of the following statements best describes the information presented in the graph?

- **a.** Over time, the number of carnivores decreased and the number of herbivores increased.
- **b.** Over time, the number of carnivores increased and the number of herbivores increased.
- **c.** Over time, the number of carnivores and herbivores remained the same.
- **d.** Over time, the number of carnivores increased and the number of herbivores decreased.

27 At what point did carnivore teeth begin to outnumber herbivore teeth?

- **a.** between layer 1 and layer 2
- **b.** between layer 2 and layer 3
- **c.** between layer 3 and layer 4
- **d.** between layer 4 and layer 5