Human Evolution 19

Their footprints, preserved in 3.5-million-year-old volcanic ash, tell a story: Two upright-walking early humans walked across the dusty African plain. Their tracks cross, and are crossed by, the tracks of other animals. Some of the animals may have been their prey, and some perhaps preyed on them. At one point the walkers stopped and perhaps looked back. Did they hear something? What were they thinking? More than any of the animals around them, these small creatures lived by their wits. Did they have a concept of who they were, where they came from, where their path had started, or where it might lead? These early humans were our ancestors. Perhaps they did not wonder about their origins, but we do. The origin and evolution of human beings is the subject of this chapter.

Organizing Your Knowledge

Exercise 1 (Module 19.1)

You are a primate. Review the characteristics of primates, and then explain which of these characteristics enables you to do each of the following.

1. Reach in and find a quarter among a pocketful of coins.

2. Catch a ball that is thrown to you.

3. Throw the ball back.

4. Pick up a postage stamp from your desktop.

5. Do a handspring.

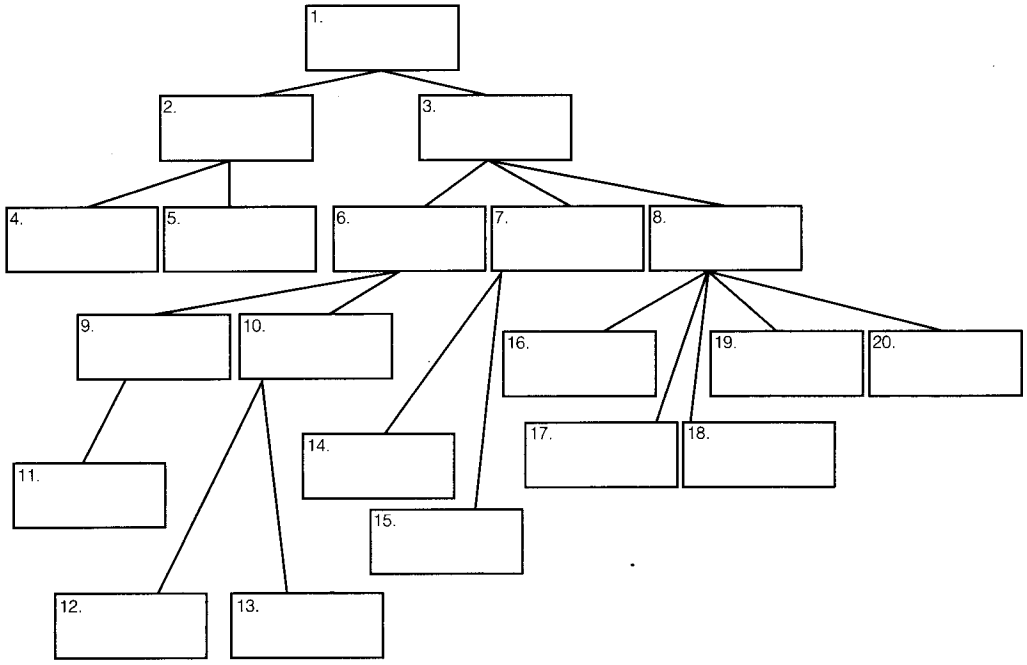
6. Thread a needle.

7. Shoot a basketball.

Exercise 2 (Modules 19.1 - 19.3)

Web/CD Activity 19A *Primate Diversity*

Complete this diagram to show the relationships among the various kinds of primates. Fill in the blanks, using the following names: **apes, Old World monkeys, primates, spider monkey, bonobo, prosimians, hominids, langur, orangutan, New World monkeys, australopithecines, lemurs, baboon, modern human, chimpanzee, loris, anthropoids, monkeys, gorilla,** and **gibbons.**



Exercise 3 (Modules 19.3 - 19.6)

Web/CD Activity 19B *Human Evolution*

Review hominid evolution by matching each of the phrases on the right with a name from the list on the left. Answers may be used more than once.

A. modern *Homo sapiens*
B. *Homo habilis*
C. Neanderthals
D. *Australopithecus africanus*
E. *Homo erectus*
F. *Australopithecus afarensis*
G. *Ardipithecus ramidus*
H. *Australopithecus anamensis*

_____ 1. First hominid associated with stone tools
_____ 2. Sometimes called "archaic *Homo sapiens*"
_____ 3. A hominid that preceded the genus *Australopithecus*
_____ 4. "Lucy"
_____ 5. The immediate ancestor of *Homo sapiens*
_____ 6. May have been the first hominid with monogamous pair bond
_____ 7. Thought to be the first hominid to leave Africa
_____ 8. Probably the immediate ancestor of *Homo erectus*
_____ 9. May have left 3.5-million-year-old footprints
_____ 10. Our own species
_____ 11. Coexisted with australopithecines for perhaps a million years
_____ 12. Lived 1.8 million to 500,000 years ago
_____ 13. Fossils 3 to 4 million years old
_____ 14. DNA indicates they may have spread "out of Africa" 100,000 years ago
_____ 15. The first hominids known to live in huts, wear clothes, use fire
_____ 16. The oldest fossil that is unambiguously human

Exercise 4 (Modules 19.5 - 19.6 and Introduction)

Where did modern humans come from? Experts are still piecing together the story. Summarize the controversy surrounding the classification of Neanderthals and other descendants of *Homo erectus* by filling in the blanks.

Experts in [1]_____—the study of human origins—mostly agree that *Homo erectus* was the first human ancestor to spread out of Africa. But how are regional descendants of *Homo erectus*, such as the [2]_____ who lived in Europe 200,000 to 40,000 years ago, related to modern humans? Some paleoanthropologists believe that these fossil descendants of *Homo erectus* are the ancestors of our own species, and refer to them as [3]_____ *Homo sapiens*. These experts would identify the regional variants as subspecies of our species. For example, the name they assign to the [4]_____ is *Homo sapiens neanderthalensis*. Other researchers view the archaic types differently, and give separate species names, such as *Homo neanderthalensis*, to the regional types.

This "name game" reflects disagreement over how and where modern humans arose. Proponents of the [5]_____ hypothesis contend that modern human populations on different continents evolved over a million years out of a diversity of local [6]_____ populations. According to this view, archaic *Homo sapiens* fossils on each continent represent the descendants of the *Homo erectus* populations who lived there a million years ago, and the [7]_____ of the humans who live there today. This would mean that *Homo sapiens neanderthalensis* gave rise to the modern humans of Europe.

Proponents of the [8]_____ hypothesis disagree. They believe that all modern *Homo sapiens* populations are the descendants of a second major migration out of [9]_____ that occurred about 100,000 years ago. According to this view, this wave of *Homo sapiens* "out of Africa" replaced all the archaic *Homo sapiens* populations that had lived on each continent. This would make modern Europeans the descendants of these recent African migrants, and *Homo neanderthalensis* an evolutionary dead end.

As things stand now, the [10]_____ data seem to support the replacement hypothesis. Using mitochondrial and nuclear [11]_____ as a molecular "clock," researchers estimate that various populations of modern humans diverged from a common ancestor about 100,000 years ago. They have even analyzed DNA from Neanderthal skeletons and found it to be very [12]_____ from the DNA of modern humans. Also, studies of [13]_____, which are passed from father to son relatively unchanged, point to a common African ancestor less than 100,000 years ago. However, the [14]_____ evidence is more ambiguous, and offers some support for the multiregional hypothesis. For example, the 24,000-year-old remains of a child from a cave in Spain seem to show a combination of modern and Neanderthal traits. This may indicate [15] _____ between Neanderthals and modern humans—and a possible connection between the Neanderthals and the modern humans who succeeded them.

Exercise 5 (Modules 19.3 and 19.7)

These modules list five major features (three of them considered major milestones) of human evolution that distinguish us from our hominoid ancestors. List them.

1.

2.

3.

4.

5.

Exercise 6 (Modules 19.7 - 19.10)

Our culture has enabled humans to alter nature. Which of the three stages in cultural evolution is reflected in each of the phrases below?

_____ 1. Permanent settlements first arose

_____ 2. The current stage in cultural evolution

_____ 3. Still practiced by the !Kung people of Africa

_____ 4. Probably caused the extinction of saber-toothed cats and other large animals

_____ 5. Began 10,000 to 15,000 years ago

_____ 6. Led to significant acceleration in population growth

_____ 7. Turned areas of the Middle East and North Africa into desert

_____ 8. People migrated to cities in search of factory jobs

_____ 9. The way of life of the earliest hominids

_____10. First allowed people to specialize in different occupations

Testing Your Knowledge

Multiple Choice

1. The lemurs of Madagascar are examples of
   a. Old World monkeys.
   b. anthropoids.
   c. prosimians.
   d. New World monkeys.
   e. apes.
2. Which of the following spends the most time in the trees?
   a. gibbon
   b. baboon
   c. gorilla
   d. orangutan
   e. chimpanzee
3. The most persuasive evidence for the replacement ("out of Africa") hypothesis for the origin of modern humans comes from
   a. genetics.
   b. comparisons between humans and living apes.
   c. fossils.
   d. behavioral studies of chimps.
   e. all of the above.
4. Biochemical evidence indicates that _____ are more closely related to humans than to other apes.
   a. the gorilla and the orangutan
   b. the chimpanzee and the baboon
   c. the orangutan and the chimpanzee
   d. the gorilla and the chimpanzee
   e. the orangutan and the gibbon
5. The earliest hominid fossils so far discovered are about _____ years old.
   a. 40,000
   b. 100,000
   c. 1 million
   d. 3 million
   e. 6 million
6. Fossil evidence suggests that humans evolved in
   a. Europe.
   b. South America.
   c. Asia.
   d. the Middle East.
   e. Africa.
7. Which of the following steps in human evolution appears to have occurred first?
   a. development of language
   b. large brain
   c. bipedalism
   d. development of culture
   e. use of tools
8. The oldest fossils of fully modern humans like ourselves are about
   a. 35,000 years old.
   b. 100,000 years old.
   c. 300,000 years old.
   d. 3 million years old.
   e. 4 million years old.
9. Several different species of _____ coexisted with early *Homo erectus*.
   a. *Homo habilis*
   b. archaic *Homo sapiens*
   c. australopithecines
   d. Neanderthals
   e. *Australopithecus africanus*
10. Which is thought to be the first hominid to use fire?
    a. *Homo erectus*
    b. *Homo habilis*
    c. *Australopithecus africanus*
    d. the Neanderthals
    e. *Ardipithecus ramidus*

Essay

1. List the specialized characteristics of primates.
2. Which primate is the closest living relative of humans? What is the evidence for this close relationship?
3. Describe the characteristics that separate each of the paired groups:
   a. anthropoids—prosimians
   b. Old World monkeys—New World monkeys
   c. monkeys—apes
   d. apes—humans
4. What were three main milestones in the evolution of *Homo sapiens*?
5. The industrial revolution of the last three centuries has had major impacts on the biosphere. Did the earlier scavenger-gatherer-hunter and agricultural stages of cultural evolution cause any widespread, lasting environmental changes?

6. Compare the rates of human biological and cultural evolution over the last 100,000 years. How has the evolution of culture contributed to our success? How has it caused problems?

Applying Your Knowledge

Multiple Choice

1. Which of the following is least closely related to the others?
   a. human
   b. lemur
   c. gorilla
   d. squirrel monkey
   e. baboon

2. At the zoo, Tom saw a species of primate he had never even heard of before. He said, "It was called a white-faced saki. It had long, dark, spiky fur, a long fluffy tail, forward-facing brown eyes, a white forehead, and yellow cheeks." Based on this information, the white-faced saki could *not* be
   a. an ape.
   b. a prosimian.
   c. a New World monkey.
   d. an Old World monkey.
   e. an anthropoid.

3. Suppose researchers were to find that mitochondrial DNA from modern human populations of Asia and Australia differed greatly from DNA from archaic *Homo sapiens* fossils found in Asia and Australia. This would
   a. undermine the multiregional hypothesis for the origin of modern *Homo sapiens.*
   b. support the multiregional hypothesis.
   c. undermine the replacement hypothesis for the origin of modern *Homo sapiens.*
   d. support the replacement hypothesis.
   e. both a and d.

4. Trina saw an old Tarzan movie on television. The movie supposedly took place in Africa, but Trina easily spotted that it was not really filmed there. Which of the following could have tipped her off?
   a. Chimps like Cheetah do not live in Africa.
   b. The monkeys in the jungle all had prehensile tails.
   c. There were no prosimians shown in the forest.
   d. Tarzan wrestled with a gorilla.
   e. Only Old World monkeys were shown.

5. Which of the following categories includes all of the others?
   a. apes
   b. Old World monkeys
   c. anthropoids
   d. hominids
   e. New World monkeys

6. Which of the following probably coexisted for a time with archaic *Homo sapiens*?
   a. *Australopithecus robustus*
   b. *Homo erectus*
   c. *Australopithecus afarensis*
   d. *Homo habilis*
   e. *Australopithecus africanus*

7. Most known species of hominids
   a. were the ancestors of modern humans.
   b. evolved during the last million years or so.
   c. had large brains.
   d. lived primarily in trees.
   e. are extinct.

8. Which of the following is a hominoid, but not a hominid?
   a. *Homo neanderthalensis*
   b. lemur
   c. *Australopithecus africanus*
   d. gorilla
   e. squirrel monkey

9. The bonobo, an ape closely related to the chimpanzee, displays behaviors very similar to those of humans, and some anthropologists have suggested that the bonobo is the living primate most closely related to humans. Which of the following would be the easiest way to try to substantiate this idea?
   a. Look for fossils of bonobos, chimps, and humans.
   b. Study the DNA of bonobos and chimps.
   c. Determine which of the species are anthropoids.
   d. Compare the DNA of bonobos and humans.
   e. Compare the DNA of bonobos, chimps, and humans.

10. Paleontologists have found fossils of several kinds of australopithecines. What is their place in human evolution?
    a. They are all thought to be ancestors of modern humans.
    b. They are all extinct side branches of the human family tree.
    c. Some evolved into humans, others into apes.
    d. They are the ancestors of various modern apes.
    e. Some may have been our ancestors, others offshoots of our family tree.

Essay

1. Suppose you wanted to trace the migration of people between Pacific islands by studying genetics of native islanders. What kinds of comparisons could you make? What would tell you that the populations of two islands were closely related?

2. Language, use of tools, and self-awareness are often cited as human characteristics—traits that set us apart from other members of the animal kingdom. Do these characteristics really appear to be unique to humans? Explain.

3. Finding which of the following would require anthropologists to change their current ideas about human evolution the most? Why?
    a. A large-brained, knuckle-walking hominid 2.5 million years old
    b. A small-brained, bipedal hominid 4.0 million years old

4. What are some of the debated and unanswered questions about human evolution?

Extending Your Knowledge

1. Scavenging-gathering-hunting was the first stage in human culture, and it was the dominant mode of existence for all humans until very recently. Some modern humans—the !Kung of Africa, for example—still practice this way of life. But in most parts of the world, the scavenging-gathering-hunting lifestyle has been displaced by modern, machine-age industrial/urban culture. People such as the aborigines of Australia, who until recently lived off the land, have all but disappeared. European immigrants quickly overran the continent of North America and displaced most of the Native American scavenger-gatherer-hunters, in little more than a hundred years. Were there Native Americans in your vicinity when the continent was settled? Who were they? Are their descendants still present, and do they retain elements of their traditional way of life? How could you find out more about them?

2. Some experts suggest that we are unable to deal effectively with environmental problems because our Stone Age minds are unable to see and cope with the dangers created by our accelerating technology. Neurobiologist Robert Ornstein and ecologist Paul Ehrlich present this idea in their book *New World, New Mind.* They think that evolution has shaped our brains to be better at identifying obvious, immediate dangers like saber-toothed tigers than subtle changes in the environment like pollution. Does anthropological evidence support this view? Can you think of other ways in which our behavior lags behind our technology? How might we get around this limitation?