Investigations for Chapter 20
Human Evolution

Investigation 20A ◆ Interpretation of Fossils

How do anthropologists learn about evolution? Fossil remains form a record of the evolution of early humans, hominids, and other primates. Even

TABLE 20A.2
Ratios of Brain Mass to Body Mass

Mammal	Ratio of brain mass to body mass
Tree shrew	1:40
Macaque	1:170
Blue whale	1:10,000
Human	1:45
Squirrel monkey	1:12
House mouse	1:40
Elephant	1:600
Porpoise	1:38
Gorilla	1:200

of the face, jaw, tongue, and upper part of the throat. If a person is injured in Broca's area, normal speech is impossible. What might the presence of Broca's area indicate?

4. Convert the ratios of brain mass to body mass shown in Table 20A.2 to decimal fractions. Draw a bar graph of the fractions. On your graph, the x-axis should represent the five species; the y-axis, the ratio of brain mass to body mass.

Analysis

1. Based on your graph, what could you infer is the relationship between evolution in primates and the ratio of brain mass to body mass?
2. What major portion of the brain has enlarged most noticeably during the course of primate evolution?
3. Do you think the cranial cast of *Australopithecus* indicates that this hominid could have had a Broca's area in its brain? Explain your answer.
4. Does the presence or absence of Broca's area alone determine the language capabilities of a hominid? Explain your answer.
5. How does your bar graph affect your answer to question 1? Are brain size and ratios of brain mass to body mass reliable indicators of the course of primate evolution? Why or why not?

PART A Skeletal Comparisons

Procedure

5. Examine the three primate skulls in Figure 20A.2 and the drawings of lower jaws and the pelvises in Figure 20A.3. Imagine you are an anthropologist and the fossils have been placed before you for identification. Complete this hypothesis in your logbook: "If the skulls, jaws, and pelvises are significantly different, then . . . "
6. In your logbook, prepare a table similar to Table 20A.3, or tape in the table your teacher provides. Your task is to determine which skull, jaw, and pelvis belong to a human, which belong to an

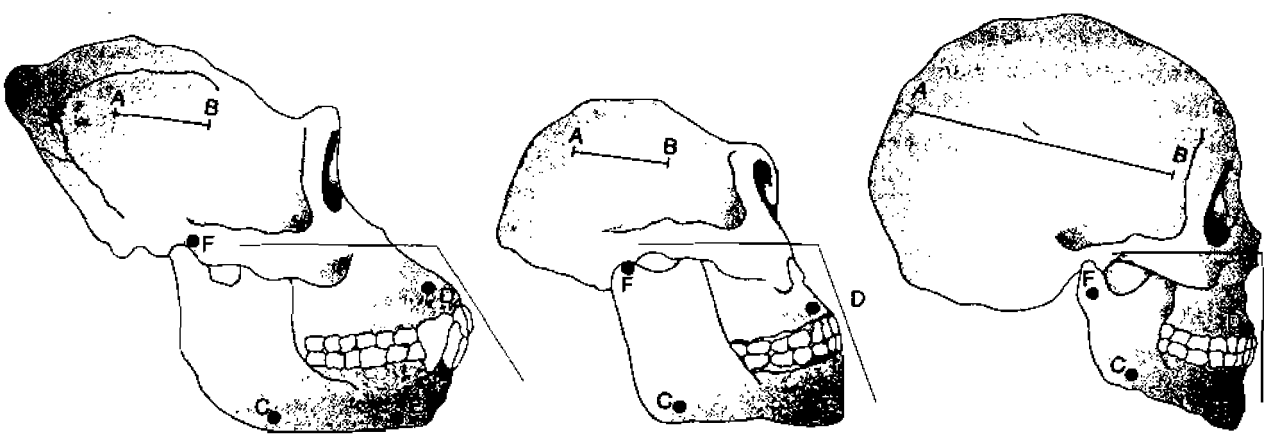

FIGURE 20A.2
A variety of primate skulls.

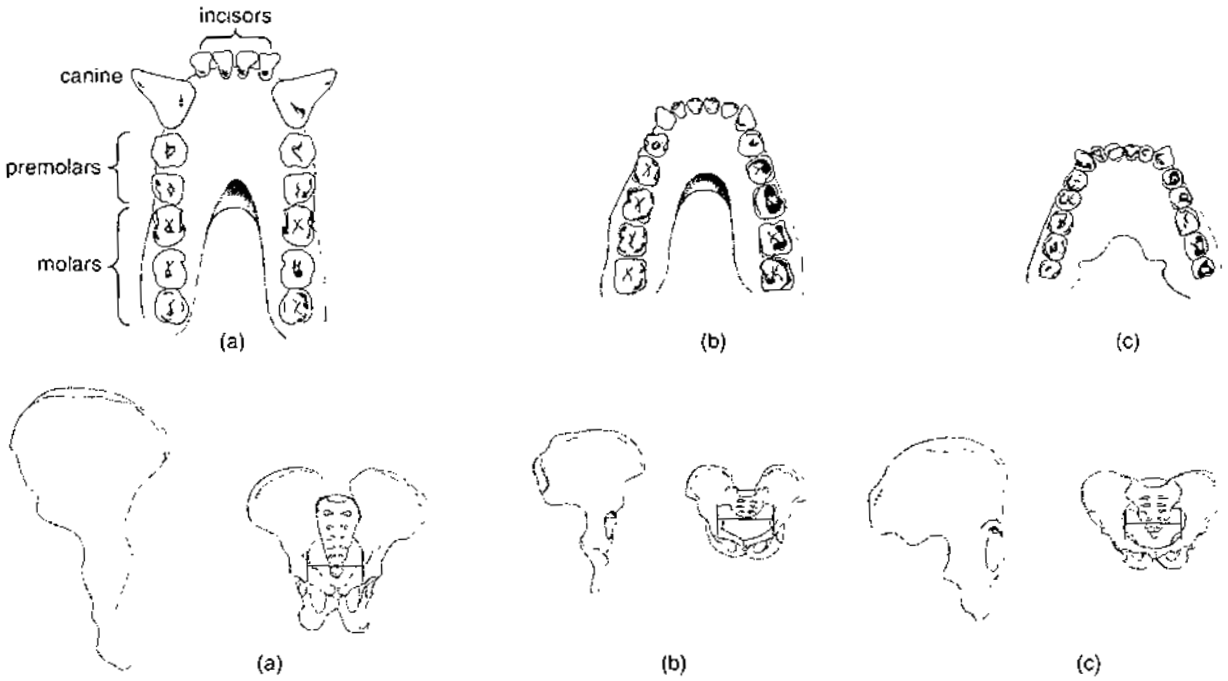

FIGURE 20A.3
Primate lower jaws and pelvises.

early hominid, and which belong to a gorilla. Record all observations and measurements in your table.

7. **Cranial volume:** The straight line drawn on each skull represents the brain volume for each primate. Measure in centimeters the distance from point A to point B for each skull. Multiply by 175 to approximate the cranial volume in cubic centimeters.
8. **Facial area:** Measure in centimeters from points C to D and from E to F on each skull. Multiply the measurements of each skull to determine the approximate area of the lower face. What might you infer about how the size of the facial area has changed through primate evolution?
9. **Facial projection:** Use a protractor to determine the angles created by the colored lines. What can you infer from these measurements?
10. **Brow ridge:** This is the bony ridge above the eye sockets. Record the presence or absence of this feature for each skull. Also note the relative sizes.
11. **Teeth:** Study the drawings of the jaws that are shown in Figure 20A.3. Record the number of teeth and the number of each type of tooth. Also look at the relative sizes of the different types of teeth.
12. **Pelvis:** Study the drawings of the pelvises in Figure 20A.3. Notice their relative sizes and whether the flange, or lower portion, projects to the rear. Measure in millimeters the diameter of the pelvic opening at the widest point.
13. Read these additional data.

    a. A larger cranial volume is characteristic of humans.

    b. A smaller lower facial area is characteristic of humans.

    c. A facial projection of about 90 degree is characteristic of humans.

    d. Modern humans have lost most of the brow ridge.

    e. All primates have the same number of teeth and the same number of each type.

TABLE 20A.3
Comparison of Primate Characteristics

Characteristic	Fossil A	Fossil B	Fossil C
Cranial volume			
Facial area			
Facial projection			
Brow ridge			
Number of teeth (lower jaw)			
Number of each type of teeth (lower jaw)			
Relative size of teeth (lower jaw)			
Relative size of pelvis			
Direction of flange			
Width of pelvic opening			

f. Humans and other hominids have smaller canine teeth than do gorillas.
g. A smaller pelvis, with a broad blade, a flange extending to the rear, and a wider opening, is characteristic of primates that walk on two feet.
h. As brain size increased, the width of the pelvic opening increased to accommodate the birth of offspring with a larger head-to-body ratio.

Analysis

1. Compare the data you have assembled for each specimen. Which ones are hominid? Which characteristics are similar in all three primates? Which characteristics are similar in a and b?
2. Compare your data with the additional data. On the basis of your observations and measurements and the additional data, which fossil remains would you say are human, which are gorilla, and which are early hominid?
3. What might an anthropologist infer from the size of the pelvic opening?
4. Write a few paragraphs discussing the methods anthropologists use to determine human ancestry. Which of the characteristics you examined were most helpful? Which were least helpful? List any other additional observations or measurements that could be made for these specimens. Would having a more complete skeleton be helpful? Why?

Investigation 20B ◆ Archaeological Interpretation

Because we cannot travel through time to see how people worked and lived thousands of years ago, we can never be sure that we understand the details of earlier cultures. Archaeologists search for clues among the remains of ancient peoples and civilizations. When they have found, dated, and studied the evidence, they formulate hypotheses to explain their findings. What emerges is a picture of life in a particular place hundreds or thousands of years ago. It is impossible to create a complete, detailed picture, but many reasonable and logical conclusions can be drawn. Some findings, however, can be interpreted in a variety of ways, and archaeologists may disagree about which interpretation is correct.

This investigation requires analysis of data found in archaeological digs. In nearly every case, several interpretations are possible. Think of as many interpretations as you can. Remember that your interpretations should account for all, not just some, of the existing data. In the final section of this investigation, you will predict how archaeologists far in the future might interpret evidence of today's cultures and lifestyles.

Materials (per team of 3)
paper and pencils

PART A A Native American Cemetery in Newfoundland

Procedure
Read the following paragraphs, and answer the Analysis questions.