Comparing Primates

Introduction
In *The Descent of Man*, the English naturalist Charles Darwin formulated the hypothesis that human beings and other primates share an ancestor. A hypothesis is a suggested explanation for observed facts. All scientific hypotheses, including this one, are based on observations.

Darwin observed that human beings and other primates differ in many important ways. All primates have opposable thumbs. However, the human hand is capable of more exact movements than those of other primates. The human brain is larger and heavier than those of other primates. In addition, human beings are bipedal, or able to walk on two limbs. Other primates use all four limbs for locomotion. Being bipedal frees the arms and hands for other tasks, such as toolmaking. Darwin saw these human traits as adaptations, resulting from natural selection. The adaptations of other primates, he suggested, evolved differently.

Scientists have also found fossils that provide evidence that all primates came from a common ancestor. This and other observations lend support to Darwin’s hypothesis of human origins.

In this investigation, you will observe and interpret some primate skeletons.

Problem
How can skeletal evidence be used to help classify primates?

Pre-Lab Discussion
Read the entire investigation. Then, work with a partner to answer the following questions.

1. How will you compare primates in this investigation?

2. How will you find the area of the lower jaw for each primate?

3. How many types of teeth will you count to fill in Data Table 2?

4. What does bipedal mean?

5. How will you measure the angle of the jaw for each primate?
**Materials** *(per student)*

metric ruler
protractor

**Procedure**

1. Determine the relative size of the lower jaw of each primate by measuring the length in millimeters of lines $ab$ and $bc$ in Figure 1. Record these lengths in Data Table 1 on page 211. Record the product of these lengths in Data Table 1.

2. Determine the angle of the jaw by using a protractor to measure the angle $xy$ in each primate skull in Figure 1. Record your observations in Data Table 1.

3. Examine the teeth of each of the three primates in Figure 2.
4. Count the number of incisors, canines, premolars, and molars of each primate in Figure 2. Record your observations in the appropriate columns in Data Table 2 on page 212.

5. Examine the two skeletons in Figure 3.

6. Compare both views of skeleton A with those of skeleton B. Answer the questions in steps 7 and 8.

Data Table 1

<table>
<thead>
<tr>
<th>Skull</th>
<th>Length of Lower Jaw (mm) (ab)</th>
<th>Depth of Lower Jaw (mm) (bc)</th>
<th>Area of Lower Jaw (mm$^2$) (ab $\times$ bc)</th>
<th>Angle of Jaw (degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Data Table 2

<table>
<thead>
<tr>
<th>Type of Teeth</th>
<th>Number of Teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Incisors</td>
<td></td>
</tr>
<tr>
<td>Canines</td>
<td></td>
</tr>
<tr>
<td>Premolars</td>
<td></td>
</tr>
<tr>
<td>Molars</td>
<td></td>
</tr>
</tbody>
</table>

7. Describe three differences between skeleton A and skeleton B.

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8. Which primate skeleton in Figure 3 is bipedal?

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Analysis and Conclusions

1. a. Observing Figure 1 shows the skulls of a chimpanzee, a human, and a gorilla. Which of the three primates shown in Figure 1 has the largest brain? What do you think is the name of this primate?

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b. Observing Which of the three primates shown in Figure 1 has the smallest brain? What do you think is the name of this primate?

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2. Analyzing Data What is the relationship between jaw size and brain size in these three primates?

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3. Comparing and Contrasting From your observations in Data Table 2, what dental characteristics do the primates have in common?

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4. Inferring Reexamine Figure 2. How would the diet of primate A differ from the diet of primate C?

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5. **Inferring** From your observations of Figure 2, which of these primates are more closely related? Is one primate intermediate between the other two?

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6. **Inferring** What is an advantage of being bipedal?

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7. **Drawing Conclusions** Many primates use tools. For example, chimpanzees often use sticks to probe ant hills when searching for food. They also use leaves as sponges to collect drinking water. How is the use of tools by humans different from that of other primates?

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8. **Drawing Conclusions** The brain of the human being is larger than that of other primates. How would this relate to the different methods of communication displayed by humans and other primates?

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9. **Drawing Conclusions** Certain fossil evidence indicates that the primate ancestors of humans lived in areas where trees were scattered instead of clustered together. How might this type of environment have affected the development of bipedalism in humans?

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10. Drawing Conclusions  Describe three physical characteristics that are unique to human beings.

Going Further
Visit a local zoo to observe the behavior of gorillas, chimpanzees, baboons, and other primates. Observe the ways in which the animals communicate and interact with one another. What similarities and differences do you notice between the behaviors of the primates you observed and those of human beings? Use a notebook to record your observations.