The Origins and Evolution of Human Bipedality

Introduction

Quick! Think of three animals that walk all the time on two legs. Got them? You thought of a human and two birds, right? There really aren't that many other animals besides us and our feathered friends that are **bipedal**, meaning that they move around all the time on just two limbs. As Plato observed way back in ancient Greece, humans are strange in the animal world in that we are "featherless bipeds." (*Biped* is the noun-form of *bipedal*, so it means an animal that walks on two legs.) Our closest living relatives, chimpanzees, are **quadrupedal**, meaning that their normal way of walking uses four limbs, as shown in **Figure 1.** While walking on two legs makes buying pants easier, it comes at a cost. In this lesson, you'll explore the evolution of human bipedality and come to understand the costs and benefits of walking like a human.

Figure 1. Quadruped and Biped. Chimpanzees *can* walk on two legs, but it's not their normal way of moving. They almost always move on the ground using four limbs. Humans, on the other hand, are almost always bipedal, after the first year or two of life. *Source:* Eamon Callison [altered from online image]

What To Do

Step 1. Watch this video from the Smithsonian, paying close attention to the segment around the one-minute mark that shows humans and chimpanzees walking on two legs.

Step 2. With a partner, discuss and answer these questions:

- Compare a chimpanzee walking bipedally to a human walking bipedally. Identify at least two differences **and** two similarities.

- If an animal was walking on two legs behind a screen so all you could see is its shadow, how could you tell, based on its walking movement, if it was a chimpanzee or a human?

Step 3. Watch this video from the Chimpanzee Sanctuary Northwest near Seattle, Washington. With your partner, describe how a chimp's running gait compares to their bipedal walking gait. List at least **two** specific differences.

- After watching this video, do you think you could run faster than a chimpanzee?

Step 4. Watch this clip that teaches you how to walk bipedally like a chimpanzee. Pay attention to each of the three "steps" they go over and write them below.

Step 1:

Step 2:

Step 3:

Step 5. Your teacher has marked off the "Start" and "Finish" of a walking track in the hall. Your job is to walk bipedally like a chimp from start to finish. If you need to see the walking video again before you begin, watch it one more time. When you walk in the hallway, try to imitate the chimp's bipedal gait instead of your own.

Step 6. Share your personal observations with the class. How would you describe the experience of walking like a chimp? Was it comfortable and easy? Was it difficult and uncomfortable? How do you think bipedalism might feel to the chimp?

Step 7. STOP & read Science Bite: These Genes Were Made for Walkin'!

Step 8. Answer the analysis questions below.

Analysis Questions

1. The Science Bite mentions the last common ancestor or (LCA) that chimps and humans shared. In your own words, what is an LCA?

2. Your classmate says to you, “Did you know that humans are descended from chimps?” Explain why this classmate is right or wrong, using your definition of LCA.

3. Make an inference about how the LCA of chimps and humans walked. Do you think it was more like modern humans, more like modem chimps, or something different? Explain your reasoning.

4. What role might climate, or environmental change, have played in the evolution of bipedalism?

5. Thinking about scientific study design…

   a. Why do you think the scientists used five chimpanzees for the study instead of just one?

b. Why did the scientists use a group of humans to do the same exercises that the chimpanzees were doing?

6. Based on what you know about cellular respiration, why did the researchers make the connection between less oxygen contained in the air exhaled by the subject to being a more energetically expensive activity?

Refer to **Table 1** in the Science Bite and answer the following questions.

7. What did the data show with regards to the comparison of chimpanzees walking on two legs vs. human walking?

8. Describe, using natural selection, how a human gait could have evolved.

9. So far, you've thought about the advantages of bipedalism, but humans are the only fully bipedal primates. Why didn't they all evolve bipedalism? Connect your ideas to what you know about evolution and natural selection. (*Hint:* Think about environments and what makes a trait an advantage.)

10. Humans are likely to have many issues, such as back pain, knee pain, and foot problems that are a direct result of our upright, bipedal stance. What does this suggest about the tendency of evolution to result in "perfectly adapted" species?

11. Compare **Figure 2** in the Science Bite to **Table 1**. Which format, the table or the graph, do you think conveys information better? Do they both show the same information, or different information?

12. **Connect to the Big Question**. How can studies like the one you have learned about today help us understand why it is a mistake to think that humans are somehow better or more evolved than chimps and other primates?