# Investigating Common Descent

Name:_____ Period:_____

Purpose: In this activity you will use models of DNA sequences from the hemoglobin proteins of humans, gorillas, chimpanzees and apes. You will also use the DNA of a common ancestor, which has been hypothesized for the purpose of this lab. Using that information you will infer evolutionary relationships between the organisms.

Background Information: Modern research techniques allow biologists to compare the DNA that codes for certain proteins and to make predictions about the relatedness of the organisms from the DNA. Scientists show this evolutionary relatedness by building cladograms. A cladogram is like an evolutionary family tree.
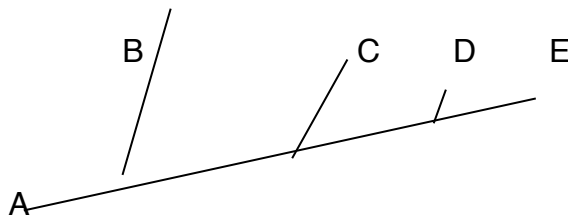
In the example above organisms D and E share a commonality that organisms C does not have. Organisms C, D, and E share a different commonality that B does not have. Organism A is the common ancestor of B, C, D, and E.

Prediction: Work with a partner and develop three hypotheses to explain how gorillas, chimpanzees and humans are related. Diagram your hypotheses below by drawing a cladogram including all of the following organisms: G=gorilla, C=chimpanzee, H=human, A=common ancestor

Procedure:
1. Working in groups of four, decode your strands of DNA according to the following specifications. Each different color of paper clip represents one of the four nucleotide bases of DNA:

    black = adenine (A)   **green = guanine (G)**
    white = thymine (T)   **red = cytosine (C)**

2. Fill in the data table with the code. Each gene starts with A G.
3. Each strand should be labeled according to the organism from which it is said to come from. These strands represent a small section of the gene that codes for the hemoglobin protein in blood.

4. Compare the human DNA to the chimpanzee DNA by matching the strands base by base (paper clip by paper clip).
5. Count the number of bases that are not the same. Record the data in Table1.
6. Repeat these steps with the human DNA and gorilla DNA.
7. Assume that the common ancestor DNA synthesized in Part II represents a section of the hemoglobin gene of a hypothetical common ancestor. Compare this common ancestor DNA to all three samples of DNA (gorilla, human, and chimpanzee), one sample at a time.
8. Record the data in Table 2. Draw a cladogram based on your data.

Data:
Table 1:

Hybridization data for Human DNA		
Human DNA compared to:	**Number of matches**	**Unmatched bases**
Chimpanzee DNA		
Gorilla DNA		

Table 2:

Data for common ancestor DNA		
Common ancestor DNA compared to:	**Number of matches**	**Unmatched bases**
Human DNA		
Chimpanzee DNA		
Gorilla DNA		

Data: Draw the cladogram your data supports:

Analysis Questions:
1. How does the hemoglobin DNA of the gorilla and the chimpanzee compare with the human's hemoglobin DNA?

2. What do these data suggest about the relationship between humans, gorillas, and chimpanzees?

3. Do the data support any of your hypotheses? Why or why not?

4. What kinds of data might provide additional support for your hypotheses?

5. Which DNA is most similar to the common ancestor DNA?

6. What two DNA's were most similar in the way that they compared to the common ancestor DNA?

7. Do your findings prove that this hypothesis is **correct**? Why or why not?

8. Based on the hypothesis that your data best supported, which of the following statements is most accurate? Explain your answer.
> (a) Humans and apes have a common ancestor

> (b) Humans evolved from apes.

9. According to all the data collected, which of the following statements is most accurate? Explain your answer.

(a) Chimpanzees and humans have a common ancestor.

(b) Chimpanzees are the direct ancestors of humans.

10. A comparison of many more DNA sequences indicates that human DNA and chimpanzee DNA are 98.8 percent identical. What parts of your data support this result?

11. What criteria did you use to classify organisms in this lab? What are additional criteria scientists use to classify organisms?

Conclusions: Please explain 2 concepts you learned in complete sentences below.