

Analyzing Amino-Acid Sequences to Determine Evolutionary Relationships

Name _____

You are a zoologist who specializes in the classification of vertebrates according to their evolutionary relationships. In your research, you examine the amino acid sequences of particular protein molecules found in vertebrates to determine the degree of similarity between species. Today you will compare portions of human cytochrome c (used in cellular respiration) and hemoglobin (oxygen carrying molecule in red blood cells) molecules with other vertebrate species. Your goals are to determine the differences in amino acid sequences and to determine the evolutionary relationships among the species.

Background: Proteins consist of amino acids. Sequences of amino acids determine the nature of the protein. In turn, the sequence of amino acids in a protein is determined by the nucleotides in a gene. A change in the DNA nucleotide sequence (mutation) of a gene that codes for a protein may result in a change in the amino acid sequence of the protein. Researchers

believe that the greater the similarity in the amino acid sequences of two organisms, the more closely related they are in an evolutionary sense. In turn, the greater the differences, the less related they are in an evolutionary sense.

Procedure: Use the amino acid sequence charts to compare different vertebrates. Record your observations in the table.



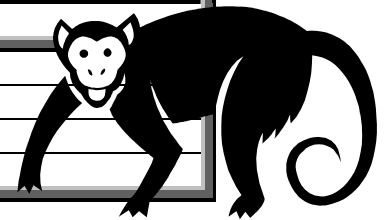
Cytochrome c Amino-Acid Sequence Differences Between Humans and Other Vertebrate Species

Species	Number of differences from Human cytochrome c
Horse	Ex. 46,47,50,58,60,62=6
Chicken	
Tuna	
Frog	
Shark	
Turtle	
Monkey	
Rabbit	

1. List all 8 in order from most similar (least differences) to least similar (most differences).

Hemoglobin Amino-Acid Sequence Similarities Between Humans and Other Vertebrate Species

Species	Number of Differences from Human Hemoglobin
Chimpanzee	
Gorilla	
Monkey	
Horse	



2. List all 4 in order from most similar (least differences) to least similar (most differences).

3. List 4 things that scientists use as evidence for evolution.

4. Examine the cytochrome c data table on the front of your lab sheet. The turtle and the frog both have 8 differences from humans. Does this mean that the turtle and frog are closely related? Explain your answer.