Predicting Evolutionary Relationships

Nova Science Now

Bird Brains || **Student Handout**

On the surface, mushrooms and monkeys don't seem
to have much in common. But at the genetic level, these two organisms aren't so different after all. Monkeys, mushrooms, and just about all other living
creatures have a gene that codes for a protein called
Cytochrome C, which plays a central role in releasing
energy from food. Genes and proteins that govern

Questions
Write your answers on a separate sheet of paper.
1 Based on the amino acid sequence data you collected, which organism are humans most closely related to? Which organisms are humans most distantly related to? Explain your reasoning.

2 What additional data or information might help you confirm the statement you made above?

3 Does your answer to Question 1 above match the prediction you made in Step 2 of the Procedure? Explain your answer.

4 Explain how amino acid sequence data can help scientists infer patterns of evolutionary relationships between species.
According to evolutionary theory, species that recently shared a common ancestor have more similarities in their DNA than ones that last shared a common ancestor long ago. By comparing the order of amino acids that make up the protein Cytochrome C and noting the differences in the arrangement, scientists can infer relationships among species. In general, the
more amino acids two species share, the more closely related they are in evolutionary time. Such basic survival functions tend to be shared by many organisms, making them an ideal tool for scientists who want to learn more about relationships among species. In this activity, you will use Cytochrome C data to predict evolutionary relationships between humans and six other species.

Procedure

1 Brainstorm some of the similarities and differences between humans and each of the organisms below. What are some of the criteria scientists might use to determine how closely related, in evolutionary time, two organisms are? Discuss with a partner and share your ideas with the class.

2 Predict how recently humans shared a common ancestor with each organism listed below. Write your predictions in a paragraph and explain your reasoning, including the criteria you discussed in Step 1 above. Consider features that humans share with each organism, as well as ways in which humans differ from each one.

3 Compare the Cytochrome C amino acid sequence in humans to each of the organisms listed below. You will find amino acid data on the *Amino Acids in the Protein Cytochrome C* table on the next page.
For each organism, circle each amino acid that differs from the human sequence.
Note: "*" indicates an amino acid that is missing in some species. In places where one species has "*" and the other has a letter, count that as a difference.

4 Write down the number of differences between a human and a:

Tuna _____

gray whale _____

snapping turtle _____

rhesus monkey _____

chicken/turkey _____

Neurospora (a type of bread mold)
_____