

INVESTIGATION 3

COMPARING DNA SEQUENCES TO UNDERSTAND EVOLUTIONARY RELATIONSHIPS WITH BLAST

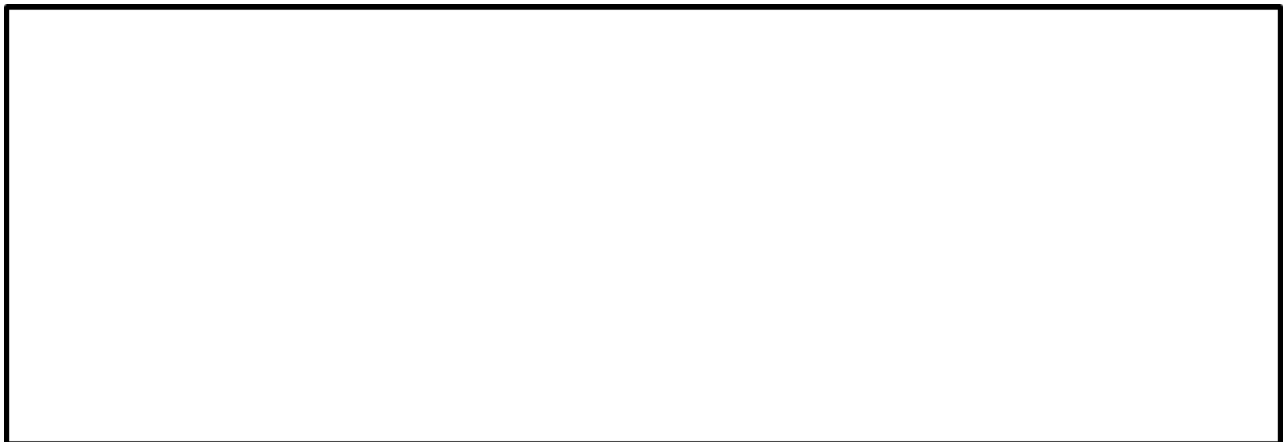
BACKGROUND

1. Which organisms have lungs? _____
2. What three structures do all lizards possess? _____
3. According to the cladogram, which structure — dry skin or hair — evolved first?(cicle)
4. Draw a cladogram that depicts the evolutionary relationship among humans, chimpanzees, fruit flies, and mosses?



THE INVESTIGATIONS

1. Use the following data to construct a cladogram of the major plant groups:



2. Why is the percentage similarity in the gene always lower than the percentage similarity in the protein for each of the species?
3. Draw a cladogram depicting the evolutionary relationships among all five species (including humans) according to their percentage similarity in the GAPDH gene.



Online Activities

You can also prepare for the lab by working through the following online activities:

- "The Evolution of Flight in Birds"

<http://www.ucmp.berkeley.edu/education/explorations/reslab/flight/main.htm>

This activity provides a real-world example of how cladograms are used to understand evolutionary relationships.

1. Powered flight has evolved in: _____
2. Archaeopteryx was an amazing find because: _____
3. Scientists agree that birds actually are dinosaurs because: _____
4. Because of the many shared skeletal features, birds can be considered to be: _____

Stop after Quiz

Procedure

A team of scientists has uncovered the fossil specimen in Figure 3 near Liaoning Province, China. Make some general observations about the morphology (physical structure) of the fossil, and then record your observations.

Draw your hypothesis on Figure 4.

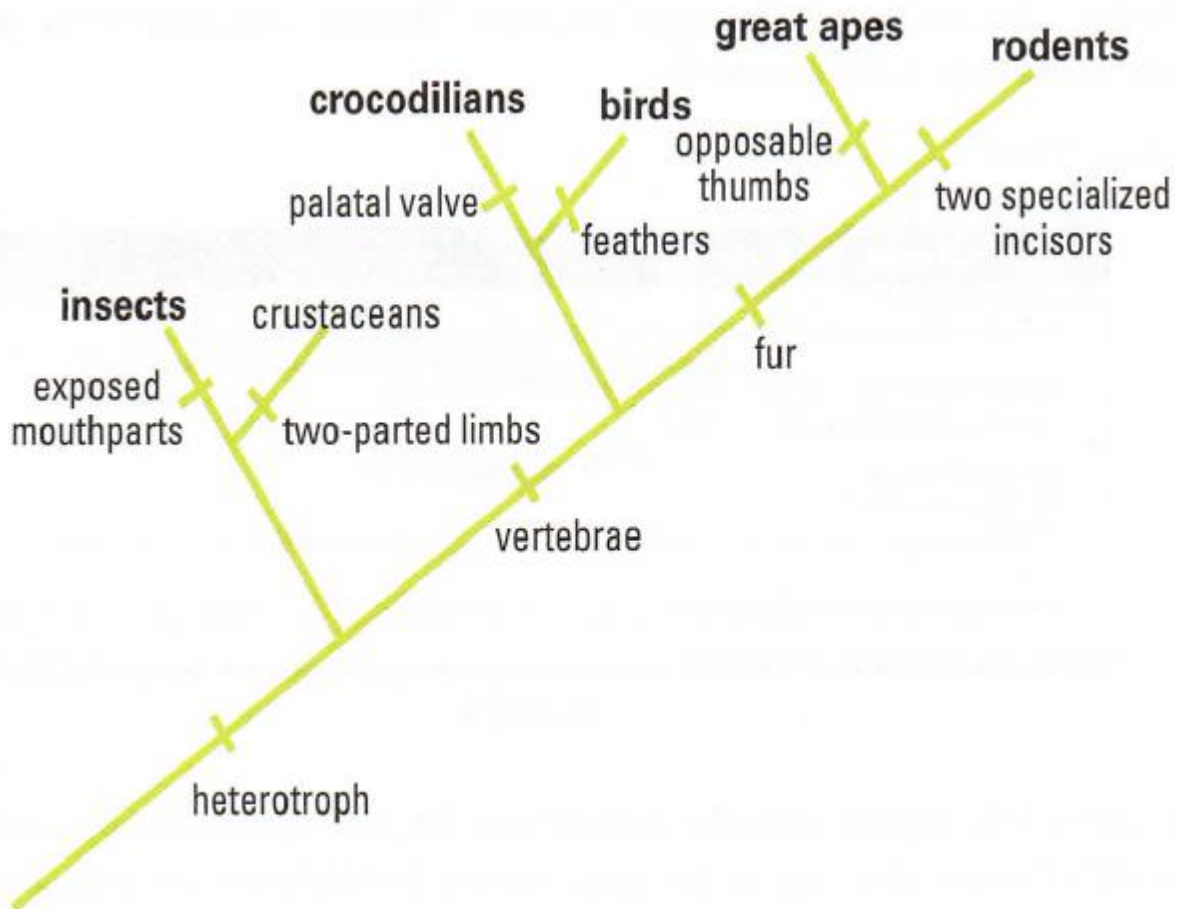


Figure 4. Fossil Cladogram

Analyzing Results

1. What species in the BLAST result has the most similar gene sequence to the gene of interest?
2. Where is that species located on your cladogram?
3. How similar is that gene sequence?
4. What species has the next most similar gene sequence to the gene of interest?
5. Based on what you have learned from the sequence analysis and what you know from the structure, decide where the new fossil species belongs on the cladogram with the other organisms. If necessary, redraw the cladogram you created before.

Evaluating Results

Compare and discuss your cladogram with your classmates. Does everyone agree with the placement of the fossil specimen? If not, what is the basis of the disagreement?

On the main page of BLAST, click on the link "List All Genomic Databases,"

How many genomes are currently available for making comparisons using BLAST? _____

How does this limitation impact the proper analysis of the gene data used in this lab?

What other data could be collected from the fossil specimen to help properly identify its evolutionary history?

Answer these Questions for Your Gene of Interest

What is the name of your gene? _____

What is the function in humans of the protein produced from that gene?

Would you expect to find the same protein in other organisms? If so, which ones?

Is it possible to find the same gene in two different kinds of organisms but not find the protein that is produced from that gene?

If you found the same gene in all organisms you test, what does this suggest about the evolution of this gene in the history of life on earth?

Does the use of DNA sequences in the study of evolutionary relationships mean that other characteristics are unimportant in such studies? Explain your answer.