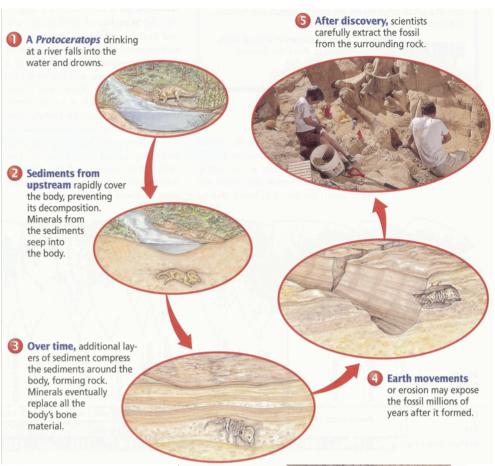
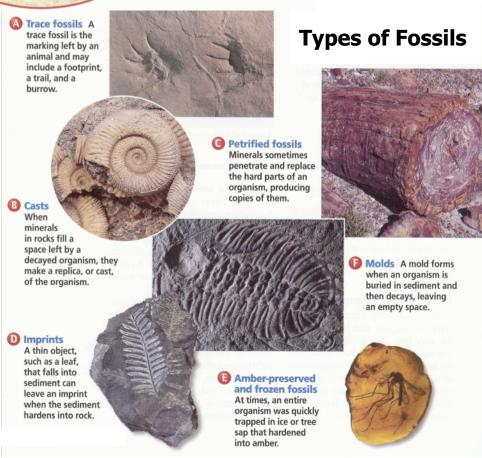
Na	me(s):Biology
	Evidence from Evolution Activity 75 Points
	ssils e your textbook and the diagrams on the next page to answer the following questions.
1.	What are fossils? How are most fossils formed?
2.	Describe how the movements of Earth might expose a fossil.
3.	What type of rock are fossils most commonly found in?
4.	What do paleontologists learn from fossils?
5.	Distinguish between relative dating and radiometric dating.

7. Suppose you are examining layers of rock. In one layer, you discover the remains of an alligator. In a deeper layer, you discover the fossil of a polar bear. What can you hypothesize about the changes in this environment over time?

6. The fossils located in upper layers of a rock column are \_\_\_\_\_ (older, younger) than the fossils in the lower layers.

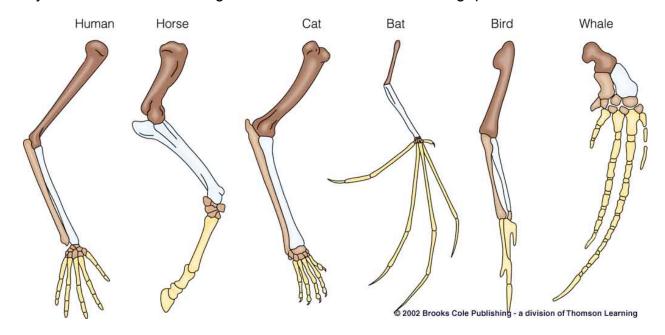


# The Fossilization Process



### **Homologous Structures**

Use your textbook and the diagram below to answer the following questions.



Analogous Structures: structures that do not have a common evolutionary origin but are

similar in function (example: wings of birds and insects)

**Homologous Structures:** structures with common evolutionary origins (can be similar in

structure, function, or both)

8. How are the limbs of the organisms pictured above similar? How are they different?

9. Which limbs perform similar functions?

10. Are the wings of a bat and bird homologous or analogous? Explain.

11. Are the wings of a bat and butterfly homologous or analogous? Explain.	
12. How do homologous structures provide evidence for evolution?	
13. Which is a better indicator of the relationship between two organisms – structure or function? Explain your reasoning.	
Vestigial Structures Use your textbook to answer the following questions.  14. What is a vestigial structure?	
15. Some snakes have vestigial legs. Why is this considered evidence for evolution?	
16. Blind cave fish have eyes but do not use them to find prey. Explain what this shows.	
Comparative Embryology	
17. Cut out the illustrations of the embryos provided being careful to include the number the bottom left corner. Correctly match the embryos with the animals in the grid on t next page, placing them in order from earliest to latest stages of development.	

	fish	chick	pig	calf	human
stage 1					
stage 2					
stage 3					

18. When you are done, write an explanation of why you ordered the drawings the way you did. What similarities do the drawings have? What differences?

19. What, if any, trends do you see as you go from stage 1 to stage 3?

- 20. How does comparative embryology provide evidence for evolution?
- 21. Fruit fly embryos and frog embryos differ from each other more than frog embryos and human embryos. What does this tell us about how closely related the species are? Explain.

### **Comparative Biochemistry**

22. Find the human, rhesus monkey, kangaroo, snapping turtle, bullfrog, and tuna on the "Amino Acid Sequences in Cytochrome-C Proteins from 20 Different Species" chart provided and underline their names.

Compare the human amino acid sequence with each of these five animals by counting the number of times an amino acid in that animal's cytochrome c is different from the amino acid in that same position of the human sequence. For example, the number of differences between human and dog=10.

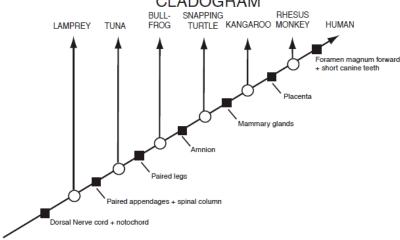
### Write that information below:

Number of amino acid differences between human and

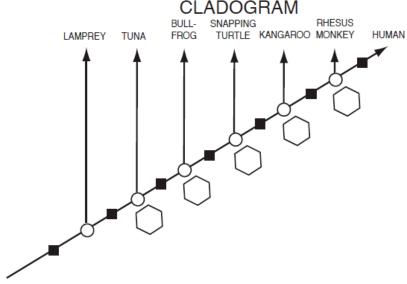
- Rhesus monkey=
- Kangaroo=
- · Snapping turtle=
- Bullfrog=
- Tuna=

The cladogram diagram below shows the relationship of selected animals based on their shared anatomical features. For example, out of seven key traits, all of these animals have a dorsal nerve cord, but only humans, monkeys and kangaroos have mammary glands.

CLADOGRAM



23. Record the total number of amino acid differences between humans and each animal shown below. Write your answer in the hexagon below the arrow pointing to the name of that animal.

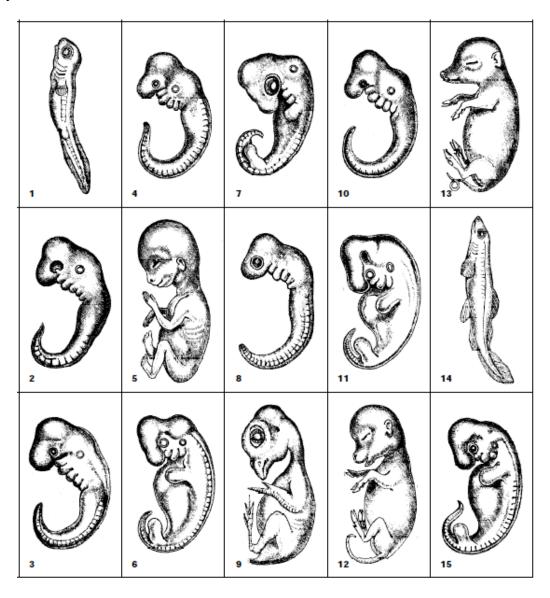


- 24. Does the data from the amino acid sequence generally agree with the anatomical data that was used to make the cladogram?
- 25. Do organisms with fewer shared anatomical traits also have more amino acid differences?
- 26. Based on the molecular data, how does the "human-monkey" relationship compare to the "duck-chicken" relationship (which shows three amino acid differences)?
- 27. If the molecular data, the structural similarities, and the fossil record all support the same pattern of relationships, can we be fairly confident that the pattern is accurate? Why or why not?

28.	Chickens and turkeys are both birds and have the same sequence of amino acids in their cytochrome-c protein. Explain how two species can have identical cytochrome-c and still be different species.
29.	Neurospora (bread mold) and Saccharomycetes (bakers yeast) are both fungi. Chickens and turkeys are both birds. What can you say about the inferred evolutionary relationships between the two birds compared to the relationship between the two fungi? Explain your reasoning.
30.	Write a short paragraph summarizing the important information that can be obtained from cladograms (not the information used to make them).

## **Comparative Embryology**

Cut out the illustrations of the embryos below being careful to include the number in the bottom left corner. The illustrations are required for #17 in the Evidence from Evolution Activity.



# AMINO ACID SEQUENCES IN CYTOCHROME-C PROTEINS FROM 20 DIFFERENT SPECIES

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EDLIAYLKKATNE	E = Glutamic acid
EDLIAYLKKATNE	F = Phenylalanine
ADLIAYLKKATKE	G = Glycine
ADLIAYLKKATNE	H = Histidine
ADLIAYLKKATNE	I = Isoleucine
ADLIAYLKKATNE	K = Lysine
VDLIAYLKDATSK	L = Leucine
ADLIAYLKDATSK	M = Methionine
ADLIAYLKDATAK	N = Asparagine
ADLIAYLKDATSK	P = Proline
QDLIAYLKSACSK	Q = Glutamine
QDLVAYLKSATS-	R = Arginine
GDLIAYLKSATK-	S = Serine
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