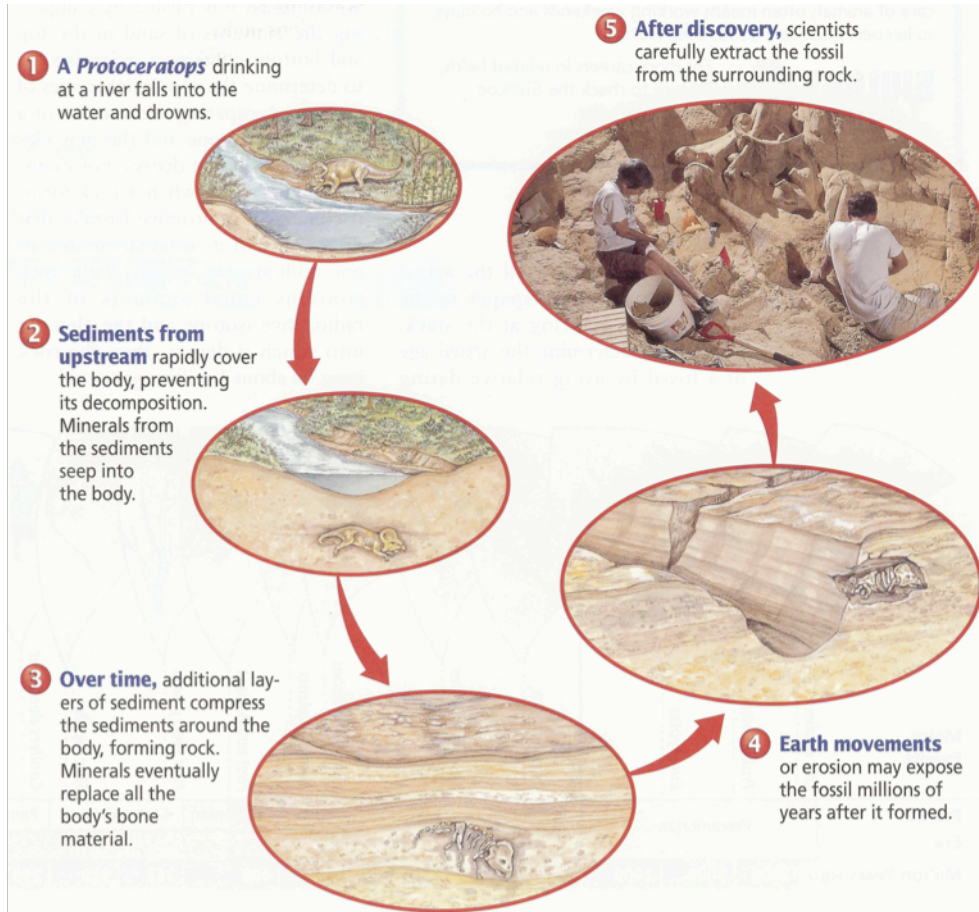


The Fossilization Process



Types of Fossils

A Trace fossils A trace fossil is the marking left by an animal and may include a footprint, a trail, and a burrow.



B Casts When minerals in rocks fill a space left by a decayed organism, they make a replica, or cast, of the organism.



C Petrified fossils Minerals sometimes penetrate and replace the hard parts of an organism, producing copies of them.



D Imprints A thin object, such as a leaf, that falls into sediment can leave an imprint when the sediment hardens into rock.



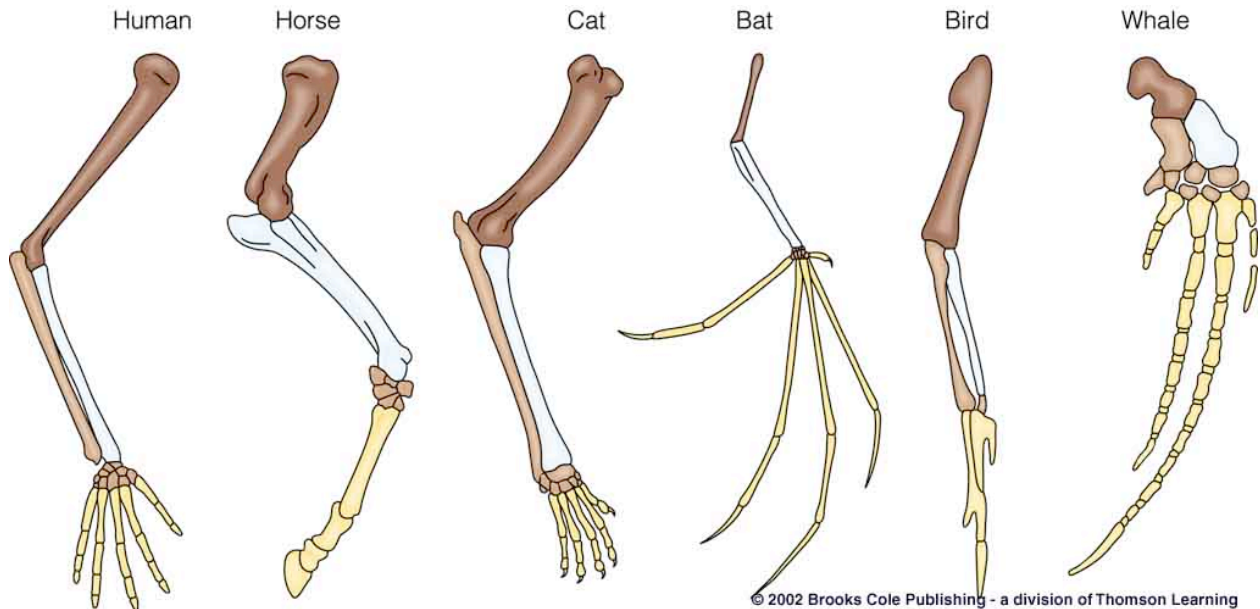
E Amber-preserved and frozen fossils At times, an entire organism was quickly trapped in ice or tree sap that hardened into amber.



F Molds A mold forms when an organism is buried in sediment and then decays, leaving an empty space.

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 in the bottom left corner. Correctly match the embryos with the animals in the grid on the 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.

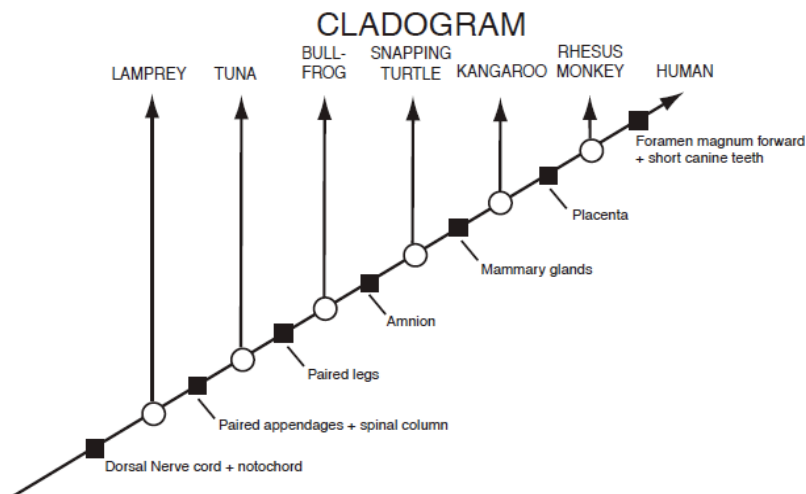
Compare the human amino acid sequence with each of these five animals by counting the number of times an amino acid in that animal's cytochrome c is different from the amino acid in that same position of the human sequence. For example, the number of differences between human and dog=10.

Write that information below:

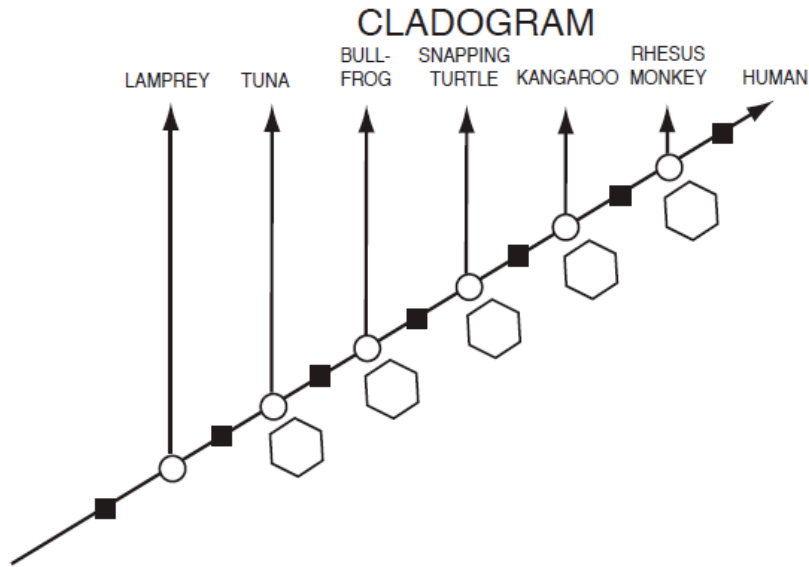
Number of amino acid differences between human and

- 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.



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 Saccharomyces (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.

