

Chapter Review



28

Study Outline

28–1 Evidence From the Past

- The study of fossils provides the strongest evidence for organic evolution.
- In most fossils, only the hard parts of organisms are preserved. Sometimes, entire organisms may be fossilized in amber or ice. Most fossils are formed when organisms are buried under layers of sediment on the bottoms of lakes and seas.
- The relative age of fossils found in sedimentary rock can be determined in relation to the order of rock layers.
- Relative dating determines the order in which events occurred. Absolute dating methods, such as radioactive dating, determine how long ago events occurred.

28–2 Interpreting the Fossil Record

- The process of correlation involves matching similar layers of rock formations to show the relative ages of rock layers and fossils.
- Index fossils are fossils of organisms that lived for a well-defined period of time over wide regions of the earth. They permit the relative dating of rocks within a narrow time span.
- Patterns in the fossil record show that organisms have evolved from simple to more complex forms over thousands or millions of years.

28–3 Evidence from Living Organisms

- Certain types of anatomical similarities, such as homologous, analogous, or vestigial structures, provide evidence of evolutionary relationships between species.
- Embryological similarities, and similarities in DNA and protein, provide additional evidence of evolutionary relationships.

28–4 The Origins of Life—Early Hypotheses

- According to the theory of spontaneous generation, living organisms could arise naturally in a short time from nonliving matter.

- Redi's and Spallanzani's experiments demonstrated that organisms do not arise spontaneously.

- Pasteur's experiments with microorganisms conclusively disproved the theory of spontaneous generation.

28–5 The Origins of Life—Modern Hypotheses

- According to the heterotroph hypothesis, the conditions of the primitive earth produced organic substances that gave rise to heterotrophic organisms.
- Miller's experiment showed that organic substances could have been produced naturally under the conditions of the primitive earth. Fox's work showed that proteins could form by non-biological means.
- By releasing oxygen, photosynthetic organisms changed the quality of the atmosphere. The presence of oxygen led to the development of organisms with the ability to carry on aerobic respiration.

Vocabulary Review

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|--------------------------|------------------------------|
| geologic evolution (571) | geologic time scale (578) |
| organic evolution (571) | extinct (580) |
| fossil (571) | homologous structures (582) |
| petrification (573) | analogous structures (582) |
| mold (573) | vestigial structures (583) |
| cast (573) | spontaneous generation (585) |
| imprint (573) | biogenesis (589) |
| sedimentary rock (573) | heterotroph hypothesis (589) |
| relative dating (575) | coacervates (592) |
| fossil record (575) | |
| absolute dating (575) | |
| radioactive dating (575) | |
| correlation (577) | |
| index fossils (578) | |

A. Multiple Choice—Choose the letter of the answer that best completes each statement.

1. An impression, such as a footprint, left in mud is called a(n) (a) cast (b) petrification (c) mold (d) imprint.

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2. The determination of how long ago an event occurred is called (a) relative dating (b) absolute dating (c) correlation (d) petrification.

3. The slow change of the earth itself is called (a) geologic evolution (b) spontaneous generation (c) biogenesis (d) organic evolution.

4. The process whereby the original substances of an organism are replaced by minerals from water is called (a) geologic evolution (b) biogenesis (c) correlation (d) petrification.

5. The timetable of the earth's history is known as the (a) fossil record (b) correlation (c) geologic time scale (d) imprint.

6. The human hand and the wing of a bird are examples of (a) vestigial structures (b) analogous structures (c) index fossils (d) homologous structures.

7. Louis Pasteur disproved the theory of (a) spontaneous generation (b) coacervates (c) biogenesis (d) correlation.

B. Sentence Completion—Fill in the vocabulary term that best completes each statement.

8. Any remains or trace of an organism that has been preserved by natural processes is called a(n) _____.

9. A species that is _____ is one that no longer exists today.

10. The remains of organisms, such as trilobites, that permit relative dating within a narrow time span are called _____.

11. The most widely accepted hypothesis of the origin of life is called the _____.

12. _____ is the process of continual change that occurs in species over time.

13. The theory that living organisms originate only from other living organisms is called _____.

14. _____ are nonfunctional remnants of structures in modern animals that were functional in ancestral forms.

15. _____ is formed on the bottoms of shallow seas or on ocean bottoms near shorelines of continents.

Content Review

16. What is the difference between geologic evolution and organic evolution?

17. Explain how fossils help scientists understand organic evolution.

18. Explain the process of petrification.

19. What is the relationship between a mold and a cast?

20. Describe how sedimentary rock is formed.

21. How does relative dating differ from absolute dating?

22. How can the absolute age of sedimentary rock be determined through radioactive dating?

23. Explain the process of correlation.

24. Explain why trilobites are good examples of index fossils.

25. What information is illustrated in the geologic time scale?

26. How are gaps in the fossil record explained?

27. How do homologous structures differ from analogous structures?

28. What could you conclude from information that cats and dogs have more homologous structures than do cats and bats?

29. What is the significance of vestigial structures?

30. How do patterns of embryological development provide evidence of evolutionary relationships?

31. How are similarities in biochemical makeup interpreted in the study of evolutionary relationships?

32. Did Redi conclusively disprove the theory of spontaneous generation? Explain your answer, and identify what Redi showed in his experiments.

33. How did van Leeuwenhoek's discovery of microorganisms affect scientists' belief in spontaneous generation?

34. Describe Pasteur's experiment with flasks of nutrient broth. Explain why his experiment finally put an end to the idea of spontaneous generation.

35. According to the heterotroph hypothesis, what were the chemical and physical conditions characterizing primitive earth?

36. How were organic compounds synthesized under the primitive conditions of early earth?

37. How did the activities of living organisms change the earth's environment?

Graphic Organizing

For information on graphic organizers, see Appendix G at the back of this text.

38. **Scale:** Construct a scale of the Paleozoic era. Use the geologic time scale on page 579 as a reference. Plot “millions of years ago” on the scale and label the periods.

39. **Concept Map:** Construct a concept map showing the formation of fossils. Put “Formation of Fossils” in a circle at the top center of your page. Include important concepts from section 28–1. As you link the concepts, do not forget the lines and linking words.

Critical Thinking

40. How do biologists use the fact that fossils exist to support the theory of evolution? (*Reasoning Conditionally*)

41. Why do scientists regard the presence of homologous structures as evidence about evolutionary relationships among organisms? (*Identifying Reasons*)

42. What would serve as an appropriate index fossil for the age of amphibians? For the Cambrian period? For the Cretaceous period? (Refer to the geologic time scale on page 579.) (*Judging Usefulness*)

43. What was the probable effect of the development of photosynthetic autotrophs on anaerobic organisms? What effect did this development have on the evolution of aerobic land animals? (*Predicting*)

Creative Thinking

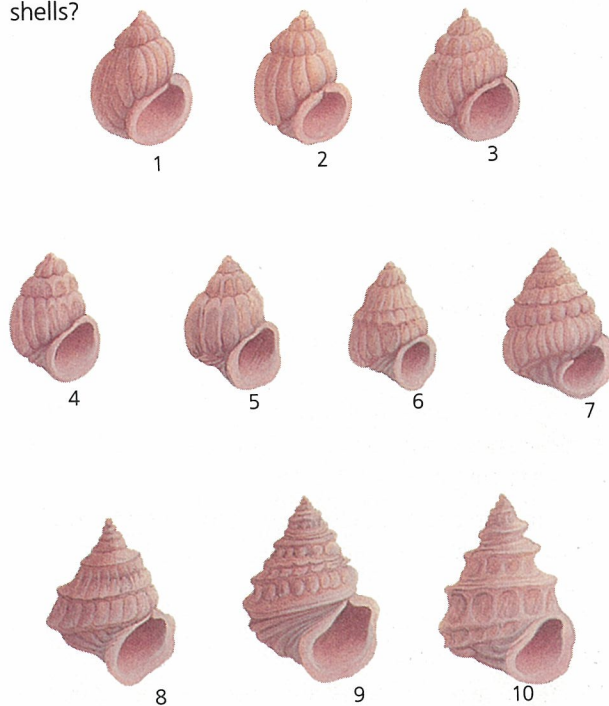
44. Because evolution occurs so gradually, it is difficult for biologists to predict changes in particular species. Suggest some ways that biologists could overcome this difficulty.

Problem Solving

45. On a fossil-hunting expedition, a biologist finds at a vertical depth of 135 m on an exposed rock face the fossil skeleton of an adult bird that had a wing span of 48 cm. On the same rock face, but at a depth of only 40 m, the biologist finds a fossil skeleton of another adult bird, similar in appearance to the first one except for its wing span, which is only 22 cm. Based on these data, propose a hypothesis as to the relationship of the two birds. Describe the evidence for the hypothesis and the best way to test it.

46. A scientist studying a fossil determines that it contains only one-eighth the amount of carbon-14 that was originally present in it. The half-life of carbon-14 is 5730 years. Approximately how old is the fossil?

47. The 10 fossil snail shells depicted below were removed from successive rock layers. The oldest (1) was fossilized 10 million years ago. The most recent (10) is 3 million years old. Put yourself in the position of a biologist preparing a scientific paper, and attempt to answer the following questions: How are the snail shells similar? How do they differ? How do the shells demonstrate evolution? If specimens 3, 4, 5, and 6 were missing, what might you conclude about the remaining shells?



Projects

48. Visit a natural history museum. Observe a fossil display that shows the fossil history of a group of organisms or relates one group of organisms to another. Make notes, sketches, or photographs for a poster, oral report, or written report.

49. Make a cast of leaves, twigs, footprints, or bones, using plaster of Paris or clay. In a short oral report relate this process to fossil formation.

50. Using library resources, research *Archaeopteryx*, a fossil bird, or the *Ginkgo* tree, a “living fossil.” Write a report on your findings in the form of a magazine or newspaper article.

