

CHAPTER 15—THEORY OF EVOLUTION

MULTIPLE CHOICE

1. Which of the following are examples of fossils?
- shells or old bones
 - any traces of dead organisms
 - insects trapped in tree sap
 - All of the above

ANS: D DIF: 1 OBJ: 15-2.1

2. Animal fossils may form when
- an animal is buried by sediment.
 - an animal is buried on the ocean floor, in swamps, in mud, or in tar pits.
 - an animal's tissue is replaced by harder minerals.
 - All of the above

ANS: D DIF: 2 OBJ: 15-2.1

3. Darwin drew ideas for his theory from observations of organisms on
- the Samoan Islands.
 - Manhattan Island.
 - the Hawaiian Islands.
 - the Galápagos Islands.

ANS: D DIF: 1 OBJ: 15-1.3

4. The species of finches that Darwin observed differed in the shape of their beaks. According to Darwin, all of these species probably
- had a common ancestor.
 - had migrated from Africa.
 - had descended from similar birds in Africa.
 - ate the same diet.

ANS: A DIF: 1 OBJ: 15-1.4

5. Darwin thought that the animals of the Galápagos Islands were similar to those of the nearby coast of South America because
- the animals' ancestors had migrated from South America to the Galápagos Islands.
 - the animals had all been brought to the islands by humans.
 - the islands had slowly drifted away from the mainland.
 - the animals in both places had evolved in nearly identical environments

ANS: A DIF: 1 OBJ: 15-1.3

6. The process by which a population becomes better suited to its environment is known as
- accommodation.
 - variation.
 - adaptation.
 - acclimation.

ANS: C DIF: 1 OBJ: 15-1.5

7. According to Darwin, evolution occurs
- only through artificial selection.
 - during half-life periods of 5,715 years.
 - because of natural selection.
 - so rapidly that it can be observed easily.

ANS: C DIF: 1 OBJ: 15-1.5

8. When Darwin published his first book about evolution, he included all of the following ideas *except*
- the idea that species change slowly over time.
 - the idea that some organisms reproduce at a greater rate than others.
 - the idea that species are permanent and unchanging.
 - the idea that some species become better suited to their environment than others.

ANS: C DIF: 1 OBJ: 15-1.4

9. The major idea that Darwin presented in his book *The Origin of Species* was that
- species change over time and never compete with each other.
 - animals change, but plants remain the same over time.
 - species may change in small ways but cannot give rise to new species.
 - species change over time by natural selection.

ANS: D DIF: 1 OBJ: 15-1.3

10. Natural selection is the process by which
- the age of selected fossils is calculated.
 - organisms with traits well suited to their environment survive and reproduce more successfully than organisms less suited to the same environment.
 - acquired traits are passed on from one generation to the next.
 - All of the above

ANS: B DIF: 1 OBJ: 15-1.5

11. Natural selection could not occur without
- genetic variation in species.
 - stable environments.
 - competition for unlimited resources.
 - gradual warming of the Earth.

ANS: A DIF: 2 OBJ: 15-1.4

12. Populations of the same species living in different places
- do not vary.
 - always show balancing selection.
 - are genetically identical to each other.
 - become increasingly different as each population becomes adapted to its own environment.

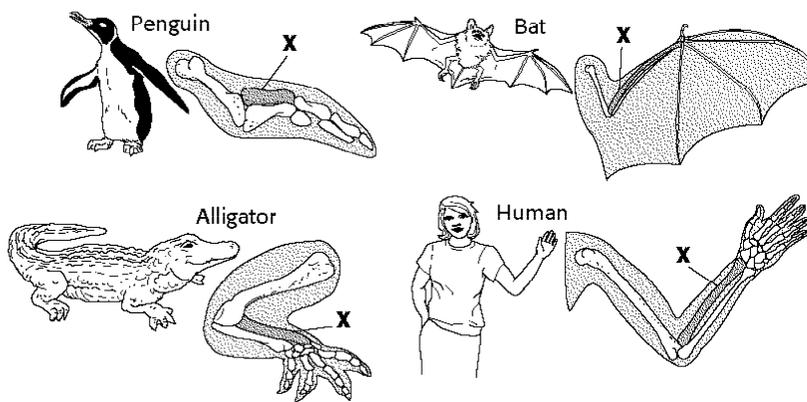
ANS: D DIF: 1 OBJ: 15-1.4

13. Scarcity of resources and a growing population are most likely to result in
- decreased homology.
 - increased genetic variation.
 - increased competition.
 - convergent evolution.

ANS: C DIF: 1 OBJ: 15-1.5

14. Since natural resources are limited, all organisms
- must migrate to new habitats.
 - must compete for resources.
 - display vestigial structures.
 - have inherited characteristics.

ANS: B DIF: 1 OBJ: 15-1.5



15. Refer to the illustration above. An analysis of DNA from these organisms would indicate that
- they have identical DNA.
 - they all have the same number of bones.
 - their nucleotide sequences show many similarities.
 - they all have the same number of chromosomes.

ANS: C DIF: 2 OBJ: 15-2.4

16. Refer to the illustration above. The similarity of these structures is one form of evidence that the organisms
- share a common ancestor.
 - all grow at different rates.
 - evolved instantaneously.
 - live for a long time.

ANS: A DIF: 2 OBJ: 15-2.3

17. Refer to the illustration above. The bones labeled “X” can be referred to as
- vestigial structures.
 - sequential structures.
 - homologous structures.
 - fossil structures.

ANS: C DIF: 2 OBJ: 15-2.3

18. Which of the following is most likely a vestigial structure?
- a. the human tailbone
 - b. the beak of a finch
 - c. flower color
 - d. a fossil of a snail

ANS: A DIF: 1 OBJ: 15-2.3

19. Homologous structures in organisms provide evidence that the organisms
- a. share a common ancestor.
 - b. must have lived at different times.
 - c. have a skeletal structure.
 - d. are now extinct.

ANS: A DIF: 1 OBJ: 15-2.3

20. Anatomical structures that appear to be derived from a functional structure in an ancestor, but that currently do not serve an important function, are called
- a. inorganic.
 - b. mutated.
 - c. fossilized.
 - d. vestigial.

ANS: D DIF: 1 OBJ: 15-2.3

21. The beak of a bird and the beak of a giant squid evolved independently and serve the same function. The beaks are
- a. divergent structures.
 - b. homologous structures.
 - c. analogous structures.
 - d. hybrid structures.

ANS: C DIF: 2 OBJ: 15-2.3

22. The occurrence of the same blood protein in a group of species provides evidence that these species
- a. evolved in the same habitat.
 - b. evolved in different habitats.
 - c. descended from a common ancestor.
 - d. descended from different ancestors.

ANS: C DIF: 1 OBJ: 15-2.4

23. Evidence that evolution occurs includes all of the following *except*
- a. acquired characteristics.
 - b. similarities and differences in proteins and DNA sequences between organisms.
 - c. the fossil record.
 - d. homologous structures among different organisms.

ANS: A DIF: 1 OBJ: 15-1.2

24. The modern synthesis of evolutionary theory predicts that
- a. closely related species will show similarities in DNA sequences.
 - b. if species have changed over time, their genes should have changed.
 - c. closely related species will show similarities in amino acid sequences.
 - d. All of the above

ANS: D DIF: 1 OBJ: 15-2.4

25. Cytochrome *c* is a protein that is involved in cellular respiration in all eukaryotic organisms. Human cytochrome *c* contains 104 amino acids. The following table compares human cytochrome *c* with cytochrome *c* from a number of other organisms.

Organism	Number of cytochrome <i>c</i> amino acids that differ from human cytochrome <i>c</i> amino acids
Chickens	18
Chimpanzees	0
Dogs	13
Rattlesnakes	20
Rhesus monkeys	1
Yeasts	56

Which of the following is *not* a valid inference from these data?

- Chimpanzees are more closely related to humans than yeasts are.
- The cytochrome *c* of chimpanzees differs from that of rhesus monkeys by only one amino acid.
- Dogs are more closely related to humans than chickens are.
- All of the proteins produced by chimpanzees and humans are identical.

ANS: D DIF: 2 OBJ: 15-2.4

26. The accumulation of differences between populations that once formed a single population is called
- coevolution.
 - adaptation.
 - divergent evolution.
 - cumulative differentiation.

ANS: C DIF: 1 OBJ: 15-3.2

27. The process in which two or more species become more adapted over time to each other's presence is called
- divergence.
 - radiation.
 - coevolution.
 - competition.

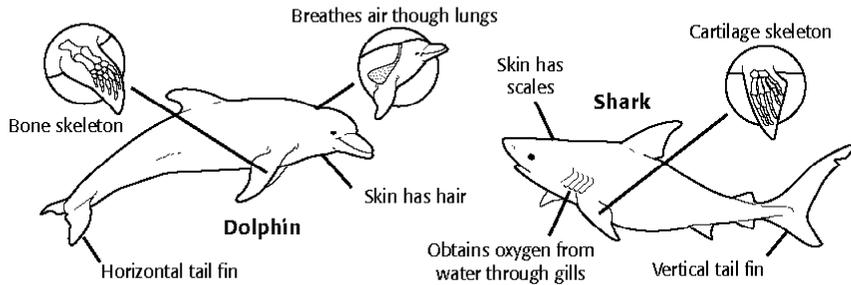
ANS: C DIF: 1 OBJ: 15-3.4

28. Over millions of years, plants and their pollinators have
- coevolved.
 - crossbred.
 - become parasites.
 - become competitive.

ANS: A DIF: 1 OBJ: 15-3.4

29.

A Comparison of Dolphins and Sharks



Refer to the illustration above. While the shark and dolphin are similar in appearance, dolphins evolved from ancestors that were very different from sharks. The current similarity between sharks and dolphins is an example of

- a. coevolution.
- b. biogeography.
- c. convergent evolution.
- d. divergent evolution.

ANS: C DIF: 2 OBJ: 15-3.1

30. A biologist analyzes the DNA sequences in three different primates. The biologist finds that primates A and B have nearly identical DNA sequences. The DNA sequences in primate C are significantly different from those of primate A. From this information, the biologist may infer that
- a. primates A and B are more closely related to each other than either is to primate C.
 - b. all three primates appeared on Earth at about the same time.
 - c. either primate A or primate B must be a direct ancestor of primate C.
 - d. primate C must have been the ancestor of both primate A and primate B.

ANS: A DIF: 1 OBJ: 15-3.2

31. What is the idea developed by Charles Lyell which states that the geologic processes that shaped Earth in the past continue to operate in the same way today?
- a. inheritance of acquired characteristics
 - b. catastrophism
 - c. uniformitarianism
 - d. descent with modification

ANS: C DIF: 1 OBJ: 15-1.2

32. Artificial selection has been used by humans to
- a. speed up the process of divergent evolution.
 - b. slow down the process of convergent evolution.
 - c. stop evolution in domestic animals.
 - d. study the process of coevolution.

ANS: A DIF: 2 OBJ: 15-3.3

33. The idea of inheritance of acquired characteristics was proposed by
- a. Charles Darwin.
 - b. George Cuvier.
 - c. Jean-Baptiste Lamarck.
 - d. Charles Lyell.

ANS: C DIF: 1 OBJ: 15-1.2

COMPLETION

1. Any preserved trace of an ancient life form is a(n) _____.

ANS: fossil

DIF: 1 OBJ: 15-2.1

2. A species that has disappeared permanently is said to be _____.

ANS: extinct

DIF: 1 OBJ: 15-2.1

3. A heritable change in a species over time is called _____.

ANS: evolution

DIF: 1 OBJ: 15-1.1

4. The process by which organisms with traits well suited to an environment survive and reproduce more successfully than organisms less suited for that environment is called _____.

ANS: natural selection

DIF: 1 OBJ: 15-1.5

5. According to Darwin, the _____ limits the rate at which organisms survive and reproduce.

ANS: environment

DIF: 1 OBJ: 15-1.4

6. _____ structures are similar because they originated in a common ancestor.

ANS: Homologous

DIF: 1 OBJ: 15-2.3

7. Closely related species show more _____ in nucleotide sequences than distantly related species.

ANS: similarities

DIF: 1 OBJ: 15-2.4

8. _____ occurs as two or more species change over time due to each other's influence.

ANS: Coevolution

DIF: 1 OBJ: 15-3.4

9. Scientists today use fossil evidence, anatomical evidence, DNA, and other molecular evidence to model _____, the relationships by ancestry among groups of organisms.

ANS: phylogeny

DIF: 1 OBJ: 15-2.5

PROBLEM

1. You are a biologist accompanying other scientists on an expedition in a region that has not been studied intensively. In your explorations, you come across a colony of small vertebrates that do not look familiar to you. After conducting electronic searches of worldwide databases, you arrive at the tentative conclusion that this organism has never been observed before. Now your job is to determine what kind of vertebrate it is by identifying its closest relatives. Identify three types of data that you would collect and describe how you would use the data to draw your conclusions. Write your answer in the space below.

ANS:

- 1) You could analyze anatomical structures of the organism and compare them to similar structures of other vertebrates. For example, the skeleton of your organism could be compared to the skeletons of other vertebrates. Those vertebrates having the greatest number of similar (homologous) anatomical structures to those of your organism could be inferred to be its closest living relatives.
- 2) You could analyze the DNA of this organism and/or a protein it produces and compare this material to that of other vertebrates. Those vertebrates sharing the most similarities in DNA and/or protein sequences with your organism could be inferred to be its closest living relatives.
- 3) You could analyze embryonic development and compare the patterns of development and structures present at different stages of development with the patterns and structures of other vertebrates. For example, a comparison could be made between the persistence of a particular trait in embryos of this organism until late in embryonic development and the persistence of the same trait in the embryos of other vertebrates.

DIF: 3 OBJ: 15-2.5

ESSAY

1. Why did Darwin think that the finches he observed and collected in the Galápagos Islands shared a common ancestor? Write your answer in the space below.

ANS:

Although there were several external differences among these finch species, the species had many internal traits in common. The internal similarities among these species led Darwin to conclude that they had a common ancestor.

DIF: 2 OBJ: 15-1.4

2. Suppose that you are a zoologist studying birds on a group of islands. You have just discovered four species of birds that have never before been seen. Each species is on a separate island. The birds are identical to each other except for the shape of their beaks. How can you explain their similarities and differences? Write your answer in the space below.

ANS:

It is likely that the four species evolved from a common ancestor, with each species adapting to the conditions on its island. The differences in beak shape may be the result of differences in available food among the islands. Each bird species adapted to the food that was available on its island.

DIF: 2 OBJ: 15-1.5

3. Why is competition among individuals of the same species generally so intense? Write your answer in the space below.

ANS:

Individuals of the same species require the same resources for survival. Because resources are generally limited, only those individuals able to secure sufficient amounts of those resources will survive.

DIF: 2 OBJ: 15-1.5

4. According to Darwin's theory, what role does the environment play in natural selection? Write your answer in the space below.

ANS:

According to Darwin's theory, those organisms that have traits best suited to the environment most successfully survive and reproduce.

DIF: 2 OBJ: 15-1.5

5. To control its wild rabbit population, the Australian government introduced the viral disease myxomatosis. At first the virus was very deadly to the rabbits, but over the years, the virus became less deadly. Explain what might have happened to the rabbit population and why the virus became less deadly. Write your answer in the space below.

ANS:

At first the virus was very deadly, but the rabbits that survived tended to be those that were resistant to the virus. Over time, more and more of the rabbit population was resistant to the virus. Also, the virus became less deadly because viral infections that kill their hosts too quickly are not able to spread to as many other rabbits. The rabbits and the virus coevolved.

DIF: 3 OBJ: 15-3.4

6. How does biogeography contribute to an understanding of evolution? Write your answer in the space below.

ANS:

Biogeography studies how organisms are distributed in time and space. For example, it may study how similar animals that are closely related have adapted to different environments in nearby areas. Also, it may study how animals that are unrelated have adapted in similar ways to similar environments in separate areas.

DIF: 2

OBJ: 15-2.2