

Review: The Evidence for Evolution

1. Natural selection can produce _____ change
2. Sickle-cell anemia (Ch. 21), industrial melanism, and beak shapes of Darwin's finches are three well-documented cases of _____ in action.
3. In lab experiments scientists have used _____ selection to gain evidence supporting the theory of evolution.
4. One of the major "experiments" that humans have performed over many centuries, that has demonstrated evolutionary change in response to (artificial) selection pressure is _____
5. _____ is a term used to describe the evolutionary process in which darker individuals come to predominate over the lighter individuals since the industrial revolution as a result of increased air pollution and the process of natural selection by predators.
6. The most direct evidence for _____ is found in the fossil record.
7. _____ are the preserved remains, tracks, or traces of once-living organisms.
8. When fossils are arranged according to their age, from oldest to youngest, they often provide evidence of successive _____ change.
9. Some of the most dramatic evidence for evolution has come from human agriculture. Some of the best studied organisms are
 - A. peas
 - B. tomatoes
 - C. wheat
 - D. corn
 - E. rice

Use the following information for Questions 10 and 11

In the laboratory fruit flies (*Drosophila*) were artificially selected for the number of bristles on their bodies. One population (R) was selected for low numbers of bristles, a second population (S) for high numbers of bristles.

10. Within 35 generations (about 1 year's time), the two populations R and S were studied. Researchers found
 - A. no change was seen; it's much too soon
 - B. some slight increase of bristle numbers was already evident
 - C. a vast, overlapping range of bristle numbers was seen
 - D. a slight increase in bristles in S, a slight decrease in R, with a little overlap in the middle ranges
 - E. a huge increase in S, a huge decrease in R, with no overlap whatsoever

11. The implications for this study of *Drosophila* include
 - A. absolutely no data to prove or disprove the theory of evolution
 - B. it takes thousands to millions of generations to see evolutionary change, if it all
 - C. dramatic variation may be present within a population, but may not be seen unless strong selection occurs
 - D. dramatic mutations may occur within a population under strong selection
 - E. none of the above

12. Natural selection adjusts the shape of the beaks among Darwin's finches in response
 - A. to the available food supply
 - B. to the available nest building material supplies
 - C. to the availability of potential mating partners
 - D. to remove ectoparasites from their feathers
 - E. to improve their feather preening abilities

13. A technique used in dating a rock can be used to accurately predict the age of the fossils occurring in the rocks. This technique involves
 - A. fossil dating
 - B. successive rock layering
 - C. radioactive isotope decay
 - D. structural geology
 - E. developmental geology

14. The evolution of similar forms in different lineages when exposed to the same selective pressures is
 - A. called divergence
 - B. called convergence
 - C. referred to as successive homologies
 - D. referred to as descent
 - E. also known as natural selection

15. Domestication of dogs has led to
 - A. a variety of homologous structures
 - B. a variety of phenotypes
 - C. a variety of mutations
 - D. a variety of analogous structures
 - E. all of the above

16. Industrial melanism is a term describing
- A. the color change in humans working in the industrialized world
 - B. the tendency of individuals containing higher proportions of melanin to work in industries more
 - C. the evolutionary process in which initially light-colored organisms become dark as a result of natural selection
 - D. the darker moths having higher reproductive success because of their pigmentation
 - E. the widespread implementation of pollution controls
17. The evidence for industrial melanism as being due to an increase in the dark allele was provided from field tests carried out by
- A. Kettlewell
 - B. Tutt
 - C. Darwin
 - D. Lamarck
 - E. Wallace
18. The shape of the beaks of Darwin's finches, industrial melanism, and sickle-cell disease are often cited as examples of the process of _____ leading to evolutionary change
- A. artificial selection
 - B. coevolution
 - C. scientific creationism
 - D. founder effect
 - E. natural selection
19. The fossil record, today,
- A. can be dated only with one layer in relation to older layers below and younger layers above, no actual dates can be estimated
 - B. can be dated reasonably well, using Uranium decay and half-life positrons
 - C. can be dated reasonably well, using radioactive isotopes with known half-lives
 - D. can be dated precisely, to within a single year, using radioactive isotopes
 - E. can be dated precisely, to within a single year, using cyclotrons and positron emitters
20. Regarding vertebrate evolution, the gaps in the fossil record
- A. are far fewer today, giving us a fairly complete picture
 - B. are nonexistent where vertebrates are concerned – we have a complete picture
 - C. are still huge, forcing us to guess about many areas
 - D. are still huge, we may never have any idea about most areas
 - E. will never be filled–there is no evidence at all for vertebrate evolution

21. Natural selection has favored the dark form of the peppered moth in areas subject to severe air pollution, perhaps because on darkened trees they are less easily seen by moth-eating birds. As pollution abated the light forms were favored because of
- A. selection
 - B. migration
 - C. mutation
 - D. genetic drift
 - E. bottleneck effect
22. Darwin concluded that evolution was at work by studying the shapes of
- A. seeds
 - B. malarial parasites
 - C. peppered moths
 - D. hemoglobins
 - E. beaks of finches
23. Evidence for evolution includes all of the following except
- A. the fossil record
 - B. homologous structures
 - C. the molecular record
 - D. point mutation
 - E. vestigial structures
24. Evidence for evolution can be obtained by examining presently-existing species through studies on
- A. early development
 - B. vestigial structures
 - C. patterns of distribution
 - D. convergence
 - E. all of the above
25. Progressive changes in fossils of different ages provides one of the strongest lines of evidence for
- A. extinction
 - B. evolution
 - C. coevolution
 - D. adaptation
 - E. mutation

26. The molecular record suggests that a series of evolutionary changes is tied to a progressive accumulation of
- A. extinctions
 - B. alterations of DNA sequences
 - C. modifications of the environment
 - D. somatic mutations
 - E. structural modifications
27. In the case of the toothed whales, the fossil record
- A. shows they evolved from fish
 - B. shows they evolved from swimming dinosaurs
 - C. shows they evolved from a land mammal
 - D. has fragmentary evidence that cannot be explained
 - E. has no evidence about how they evolved
28. Which of the following embryonic developmental features of the human suggest evolution from other vertebrates?
- A. lanugo, fine fur
 - B. gill slits
 - C. long bony tail
 - D. a, b, and c
 - E. a and b only
29. Structures which are derived from the same body part in a common ancestor but may have different appearances and functions are called
- A. analogous structures
 - B. homologous structures
 - C. vestigial structures
 - D. embryonic structures
 - E. homozygous structures
30. The reasons that 'scientific creationism' should not be labeled as science include
- A. it is not supported by any empirical observations
 - B. it does not obtain its principles from observation, as does science
 - C. its assumptions lead to no hypotheses that could be tested and possibly disproven
 - D. the idea of creation by a supernatural agency lies outside the realm of science
 - E. all of the above

31. The wings of birds and butterflies are examples of structures that resemble each other and have similar function, but are the result of parallel evolution in separate lineages. These structures are called
- A. analogous structures
 - B. homologous structures
 - C. vestigial structures
 - D. embryonic structures
 - E. homozygous structures
32. Which of the following is not a vestigial trait in humans?
- A. ear-wiggling muscles
 - B. muscles that make body hairs stand on end
 - C. fingers
 - D. appendix
 - E. wisdom teeth
33. Which of the following illustrate shared ancestry by anatomical comparison studies?
- A. same organ has evolved to carry out different function
 - B. organ loses its function altogether
 - C. different organs evolve in similar ways when subjected to the same selective pressures
 - D. a, b, and c
 - E. a and b only
34. Many organisms possess structures that have no apparent function, but they resemble structures of presumed ancestors. This is the study of
- A. the fossil record
 - B. the molecular record
 - C. homology
 - D. development
 - E. vestigial structures
35. The observation that different geographical areas sometimes exhibit plant and animal communities of similar appearance, even though the individual plants and animals are not closely related, is called
- A. the fossil record
 - B. homology
 - C. convergent evolution
 - D. divergent evolution
 - E. adaptation

36. Which of the following is an example of convergent evolution?
- A. Australian marsupials and placental mammals of other continents
 - B. analogous organs of horses, antelopes, and deer
 - C. homologous organs of apes and humans
 - D. skull bones of vertebrates
 - E. all of the above
37. The evolution of different forms in the same lineage when exposed to different selective pressures is called
- A. convergence
 - B. homology
 - C. phylogeny
 - D. analogy
 - E. divergence
38. 'Scientific creationism' view includes all of the following except
- A. Biblical account of the origin of the earth is literally true
 - B. the earth is much younger than most scientists believe
 - C. all species of organisms were individually created
 - D. the organisms did not change from their original appearance
 - E. extinct species are replaced with new ones

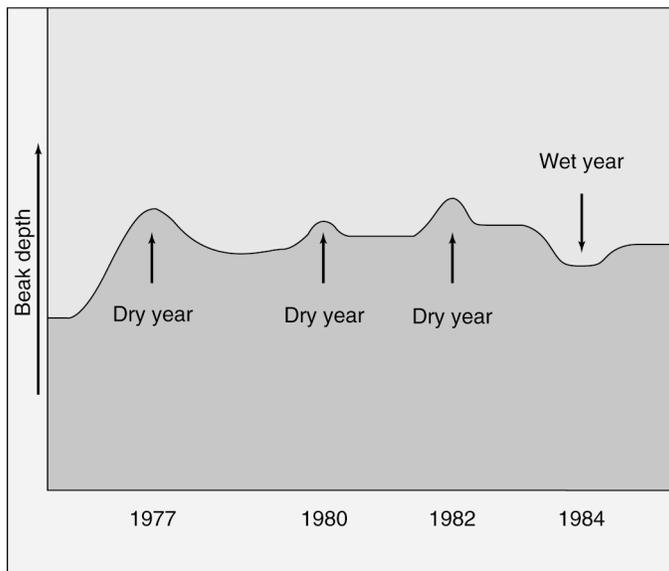
Use the following information to answer Questions 39–40

Marsupials are a very old form of mammal, evolving before placental mammals over 70 million years ago. Today Australian marsupials can be compared to placental mammals on other continents.

39. When you compare Australian marsupials to placental mammals today
- A. the marsupials are all very primitive, having changed very little during the last 70 million years
 - B. the marsupials are very similar to placental mammals in the ways they have adapted to similar ecological niches
 - C. the marsupials have evolved much more rapidly than placental mammals and are more highly adapted
 - D. the marsupial fossils look remarkably similar to the placental mammals of today
 - E. none of the above
40. It could be said that today's Australian marsupials and today's placental mammals have
- A. undergone divergent evolution
 - B. undergone selective advantage
 - C. undergone heterozygote advantage
 - D. undergone convergent evolution
 - E. undergone artificial selection

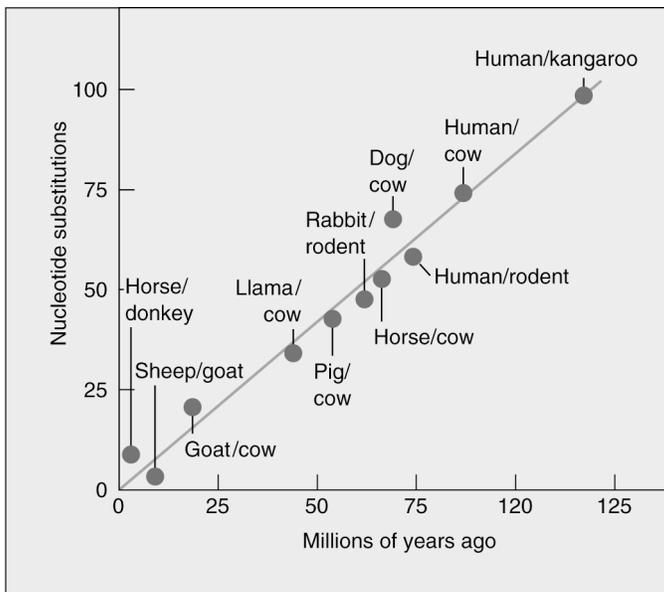
41. Peppered moths are cited as examples of natural selection that has been observed in the last one hundred years. Which statement best describes why?
- Peppered moths exhibit two distinct morphological types (dark and light colored wings). The dark ones are favored by birds and are thus selected against in nonpolluted forests.
 - Peppered moths exhibit two distinct morphological types (dark and light colored wings). The dark ones are not liked by birds and are thus safe in nonpolluted forests.
 - Peppered moths exhibit two distinct morphological types (dark and light colored wings). The light ones are favored by birds and are thus selected against in nonpolluted forests.
 - Peppered moths exhibit two distinct morphological types (dark and light colored wings). Birds favor the dark ones and light ones and neither morph has an advantage.

Use the following graph to answer Questions 42-43



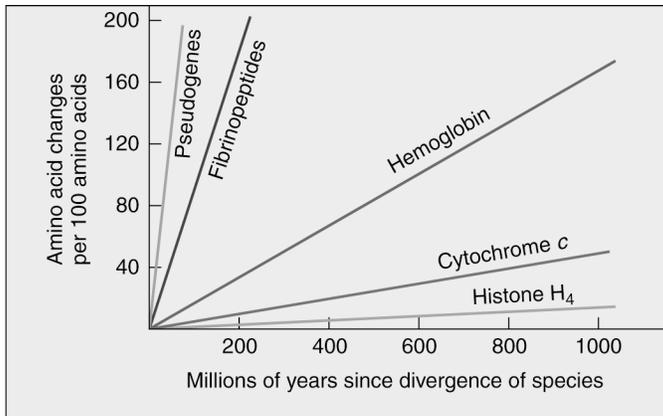
42. Which statement best describes the correlation between beak depth of *Geospiza fortis* on Daphne major Island and the environment?
- birds with large beaks are favored during a wet year
 - birds with small beaks are favored in dry years
 - birds with large beaks are favored during dry years
 - birds with either size beak (large or small) favored equally

43. The pattern shown, of wet years and dry years, will probably push the birds toward
- having larger beaks, over time
 - having smaller beaks, over time
 - having intermediate size beaks, over time
 - having two populations, over time
 - maintaining both phenotypes in one population
44. Which of the following statements best interprets the graph relating time and nucleotide substitutions in cytochrome c? (Note that the graph illustrates the number of nucleotide changes between two organisms, given the number of millions of years since they diverged evolutionarily.)



- Cytochrome c is found in humans more than in rabbits or rodents.
- Cytochrome c is evolving at a constant rate through time.
- Cytochrome c has slowed down in its evolution between rodent/rabbit point and human/cow point on the line.
- Cytochrome c is speeding up in its evolution, especially in humans and kangaroos.
- There is not enough data to make any interpretations of this graph.

45. Which of the following statements best interprets the graph relating time to amino acid substitutions in proteins?



- A. Amino acid substitutions occurred at a much faster pace in Histone H-4 than in any of the other three proteins on the graph.
- B. Amino acid substitutions occurred at the same rate for all four proteins on the graph. Some were just earlier than others.
- C. Amino acid substitutions occurred at a much faster rate in Fibrinopeptides than in Hemoglobin.
- D. Amino acid substitutions occurred at a much faster rate in Hemoglobin than in Fibrinopeptides.
46. A friend of yours is trying to understand the concept of convergent evolution. Which of the following choices would you choose to give as an acceptable answer?
- A. Convergent evolution occurs when two species living in the same area become reproductively isolated.
- B. Convergent evolution occurs when two species living in different areas become reestablished and are able to reproduce.
- C. Convergent evolution occurs when two species living in the same area are competing for the same resource thus causing one to evolve away from the other.
- D. Convergent evolution occurs when two species living in different areas evolve similarities through natural selection acting on those characteristics.
47. As a biologist if you were to see a sign describing evolution as “just a theory,” you would think that
- A. evolution is a theory that is supported with a tremendous amount of evidence
- B. evolution is just a collection of facts without a central theme and this is not a theory
- C. evolution is what Darwin proposed to account for all the changes he observed in the finches so it is a hypothesis of his, not a theory
- D. evolution occurred in the past, but it is not occurring in the present, so it cannot be a theory

48. You see a sign on a door that reads “Homologous Structures Inside.” You go in and find
- structures of animals that appear to have evolved from different parts of their bodies
 - structures of animals that have difference appearances and functions but seems to have evolved from the same body part in a common ancestor
 - structures of animals that have the same appearances and functions but obviously no common ancestor
 - structures of animals that have different appearances and functions but different ancestors
49. Radioactive isotopes are used in dating materials from the distant past. Which of the following statements is accurate about radioactive dating techniques?
- It gives relative ages of rock strata.
 - It gives exact ages of rock strata.
 - It uses a technique in which the degree of radioactive decay is measured, the younger the rock the more radioactive decay.
 - It uses a technique in which the degree of radioactive decay is measured, the older the rock the more radioactive decay.
 - It does not work well with fossil remains that have not absorbed radiation because scientists cannot measure the radiation with any degree of certainty.
50. Match each of the following.
- | | |
|---|-----------------------------|
| _____ A. Inhabitants of oceanic islands resemble forms of the nearest mainland but show some differences, which suggests that they have evolved from mainland migrants. | 1. fossil record |
| _____ B. When ancient rocks are arranged in the order of their age, a progressive series of changes are seen. | 2. homology |
| _____ C. During growth in the mother’s uterus, human embryos and fetuses exhibit characteristics of other vertebrates, which suggests that humans are related to the other forms. | 3. convergent evolution |
| _____ D. All vertebrates contain a similar pattern of organs, indicating that they are related to one another. | 4. patterns of distribution |
| _____ E. The marsupials in Australia closely resemble the placental animals of the rest of the world, which argues that parallel selection has occurred | 5. development |

Answer Key

| No. on Test | Correct Answer |
|-------------|-----------------------|
| 1 | evolutionary |
| 2 | evolution (selection) |
| 3 | artificial |
| 4 | agriculture |
| 5 | industrial melanism |
| 6 | evolution (selection) |
| 7 | fossils |
| 8 | evolutionary |
| 9 | D |
| 10 | E |
| 11 | C |
| 12 | A |
| 13 | C |
| 14 | B |
| 15 | B |
| 16 | C |
| 17 | A |
| 18 | E |
| 19 | C |
| 20 | A |
| 21 | A |
| 22 | E |
| 23 | D |
| 24 | E |
| 25 | B |
| 26 | B |
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| 35 | C |
| 36 | A |
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| 38 | E |
| 39 | B |
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| 41 | A |
| 42 | C |
| 43 | E |
| 44 | B |
| 45 | C |
| 46 | D |
| 47 | A |
| 48 | B |
| 49 | D |
| 50 | 1-B, 2-D, 3-E, 4-A, 5-C |