

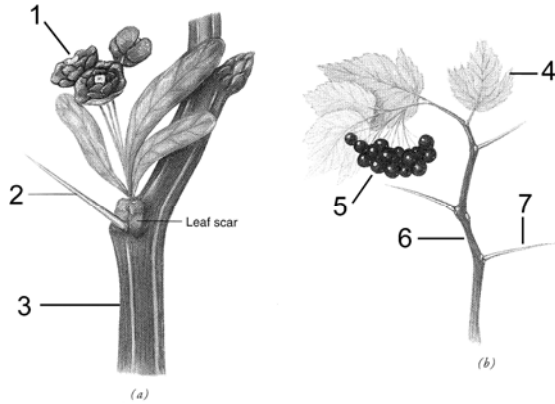
MULTIPLE CHOICE QUESTIONS

- The rapid evolution of bacteria and fungi in certain environments is used in the field of:
 - bioremediation.
 - human disease genetics.
 - medical diagnostics.
 - human genome sequencing.
 - plant genomics.
- Fossil evidence shows that giraffes living 1000 years ago had much shorter necks than the giraffes seen today. Which of the following statements best explains this observation?
 - The two groups of giraffes are not related.
 - The two groups of giraffes arose as a result of convergent evolution.
 - The giraffes acquired longer necks through the continuing process of natural selection.
 - The difference in neck length supports Lamarck's hypothesis.
 - The difference in neck length is evidence for homoplastic inheritance.
- Who proposed that the Earth's geological features formed slowly over time, creating long periods for evolution?
 - Charles Darwin
 - Aristotle
 - Lamarck
 - Charles Lyell
 - Erasmus Darwin
- Individual species will continually evolve as a result of:
 - coevolution.
 - convergent evolution.
 - punctuated equilibrium.
 - natural selection.
 - gradualism.
- Breeds of dogs, such as German Shepherds and Saint Bernards, occur as a result of:
 - polyploidy.
 - artificial selection.
 - hormones.
 - mutation.
 - natural selection.
- Food supplies that sustain animal populations have the capacity to increase:
 - arithmetically.
 - by accumulation and deduction.
 - geometrically.
 - symmetrically.
 - migration rates.

7. Evolutionary modifications that improve the survival and reproductive success of an organism are called:
 - A. mutations.
 - B. vestigial structures.
 - C. homoplastic traits.
 - D. artificial traits.
 - E. adaptations.
8. Whose findings of evolution by natural selection were presented with those of Darwin?
 - A. Alfred Wallace
 - B. Carolus Linnaeus
 - C. Charles Lyell
 - D. Gregor Mendel
 - E. Thomas Malthus
9. Which of the following does *not* contribute to limits on population growth?
 - A. snakes feeding on mice in a cornfield
 - B. bears having two cubs
 - C. the amount of light for photosynthesis
 - D. a disease-causing organism entering a population
 - E. an increase in the total rainfall in a normally dry environment
10. Overproduction, variation, limits on population growth, and differential reproductive success are components of:
 - A. evolution by natural selection.
 - B. evolution by inheritance of acquired characteristics.
 - C. punctuated equilibrium.
 - D. genetic inheritance.
 - E. gradualism.
11. Which of the following ideas is *not* part of Darwin's concept of evolution?
 - A. A population is capable of producing more offspring than the environment can support.
 - B. Individuals that are best adapted to their environment are more likely to survive and reproduce.
 - C. A struggle for existence exists among individuals of a population.
 - D. Traits acquired during an individual's life are passed on to its offspring.
 - E. Individuals in a population are genetically variable.
12. Darwin might have made even greater advances in his theory if he had:
 - A. understood the work of Gregor Mendel.
 - B. read the works of Malthus.
 - C. done experiments in plant structure.
 - D. read of the work of Charles Lyell.
 - E. understood the theories of Jean Baptiste de Lamarck.
13. During the 1920s to 1940s, biologists combined Mendelian genetics with Darwin's theory to form a unified explanation of evolution that is referred to as:
 - A. classical Darwinism.
 - B. evolutionary genetics.
 - C. genetic evolution.
 - D. neo-evolution.
 - E. the synthetic theory of evolution.

14. The synthetic theory of evolution emphasizes:
- A. natural selection of individuals.
 - B. population genetics.
 - C. differential reproduction.
 - D. overproduction of individuals.
 - E. homologous versus vestigial structures.
15. What process provides the genetic variability that natural selection acts on during evolution?
- A. adaptation
 - B. artificial selection
 - C. fitness
 - D. mitosis
 - E. mutation
16. The differential distribution of wing length in *Drosophila*, with larger wings in northern areas and smaller wings in southern climates, provides evidence that:
- A. chance is the most important agent in evolutionary change.
 - B. natural selection is the most important agent in evolutionary change.
 - C. wing length is not a heritable trait.
 - D. the fossil record is usually inaccurate.
 - E. the molecular clock cannot be applied to fruit fly traits.
17. Perhaps the most direct evidence for evolution comes from:
- A. biogeography.
 - B. comparative anatomy.
 - C. developmental biology.
 - D. the fossil record.
 - E. molecular biology.
18. The most important finding from the fossil record which supports the theory of evolution is:
- A. that life has evolved over time.
 - B. that life evolved in the ocean.
 - C. that most species are extinct.
 - D. that ancient species differed from those alive today.
 - E. All of the above support the theory of evolution.
19. Which of the following would be least likely to form a fossil?
- A. an animal with an exoskeleton
 - B. an animal with an endoskeleton
 - C. a marine organism
 - D. an organism in the tropical rain forest
 - E. an organism living in a lake
20. Which of the following methods is *not* used to date fossils?
- A. the amount of radioisotopes remaining
 - B. index fossils
 - C. the relative position in rock strata
 - D. uranium-235
 - E. nitrogen-14

21. Which of the following statements about radioisotopes is *false*?
- A. The half-life of a radioisotope does not vary with temperature or pressure.
 - B. Carbon-14 is typically used to date the rocks in which fossils are found.
 - C. The ratio of carbon-14 to carbon-12 is used in dating fossils.
 - D. Potassium-40 has an extremely long half-life.
 - E. The nucleus of a radioisotope can change into that of a different element during decay.
22. Bird wings and insect wings are considered to be:
- A. homologous structures.
 - B. homogenous structures.
 - C. vestigial structures.
 - D. divergent structures.
 - E. homoplastic structures.
23. The front limbs of birds and bats, both wings, are considered to be:
- A. homologous structures.
 - B. homozygous structures.
 - C. divergent structures.
 - D. vestigial structures.
 - E. homoplastic structures.
24. When populations with separate ancestors adapt in similar ways to similar environmental constraints, it is referred to as:
- A. biogeography.
 - B. coevolution.
 - C. convergent evolution.
 - D. homologous evolution.
 - E. natural selection.
25. Bird wings and insect wings are considered to be examples of:
- A. divergent evolution.
 - B. homoplastic evolution.
 - C. vestigial structures.
 - D. convergent evolution.
 - E. coevolution.
26. If two species have homologous structures:
- A. the structures have the same function.
 - B. the structures are identical.
 - C. the species are related by a common ancestry.
 - D. the species have very different ancestors.
 - E. the structures have the same function and they are identical.
- 27. Use the figure to answer the corresponding question.**
27. Which of the following correctly pairs two homoplastic features from the accompanying figure?
- A. 1 and 4
 - B. 2 and 7
 - C. 3 and 6
 - D. 2 and 4
 - E. 1 and 5

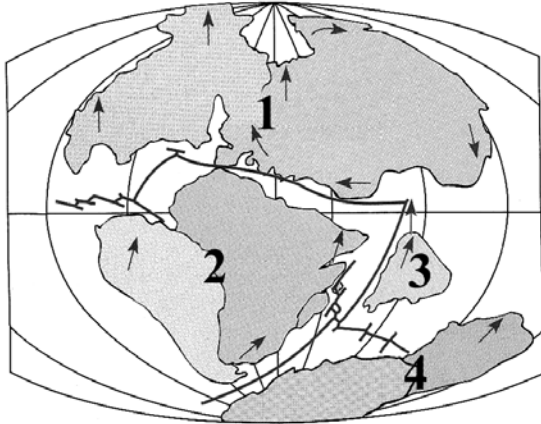


28. You have identified a new mammal species. You are surprised to find that it has a pelvis, but there is no evidence the species has legs. However, as a scientist you will most likely conclude:
- A. the pelvic bones are present because the animal is a mammal.
 - B. that this is a very young animal.
 - C. that you have found a mutant species.
 - D. the pelvic bones are analogous to the pelvic bones found in other mammals.
 - E. that the pelvis is a vestigial structure.
29. The indigenous plants and animals of the Galapagos Islands and Cape Verde Islands:
- A. are the same species as those found on the nearby mainland.
 - B. are the same species on the two islands, but are different from those on the mainland.
 - C. are the same species on the two islands and on the mainland.
 - D. are similar to one another, but quite different from either adjacent mainland.
 - E. resemble the nearest mainland species, but have evolved into new species.
30. The study of past and present distributions of organisms on Earth is termed:
- A. biodistributogeography.
 - B. organismal geography.
 - C. biogeography.
 - D. geographical ecology.
 - E. biological ecology.
31. Australia has distinctive organisms, such as egg-laying mammals and pouched mammals (marsupials), because they have:
- A. an unusual climate that has triggered natural selection.
 - B. selective conditions that have been relaxed.
 - C. been separated and isolated from other land masses for a long period of time.
 - D. experienced a significantly slower rate of evolutionary change.
 - E. fewer species of organisms than most continents.

32. Use the figure to answer the corresponding question.

32. Based on the accompanying figure, the two present day continents that should have the most closely related plant and animal species are:

- A. North and South America.
- B. Africa and Australia.
- C. Africa and South America.
- D. Australia and India.
- E. Eurasia and India.



33. Which of the following early embryos would be the easiest to distinguish from the others?

- A. bird
- B. honey bee
- C. human
- D. snake
- E. catfish

34. The genetic code demonstrates the universality of living things because it is common to virtually all:

- A. eukaryotes.
- B. autotrophs.
- C. plants and animals.
- D. bacteria.
- E. organisms.

35. DNA sequencing data suggest that evolutionary changes are related to an accumulation of:

- A. changes in DNA nucleotide sequences.
- B. homologous structures.
- C. index fossils.
- D. vestigial organs.
- E. convergent structures.

36, 37. Use the table to answer the corresponding questions.

36. Based on the data in the accompanying table, which of the following primates is the most distantly related to humans?

- A. chimpanzee
- B. gorilla
- C. rhesus monkey
- D. gibbon
- E. orangutan

Species Pairs	Percent Divergence in a Selected DNA Sequence
Human–chimpanzee	1.7
Human–gorilla	1.8
Human–orangutan	3.3
Human–gibbon	4.3
Human–rhesus monkey (Old World monkey)	7.0
Human–spider monkey (New World monkey)	10.8
Human–tarsier	24.6

37. Based on the data in the accompanying table, which of the following primates has the most recent common ancestor with humans?

- A. rhesus monkey
- B. gibbon
- C. tarsier
- D. gorilla
- E. orangutan

38. When it is said that the genetic code is universal, it means that all organisms share the same:

- A. genes.
- B. mitochondrial DNA.
- C. coding mechanism.
- D. ribosomal structure.
- E. nuclear composition.

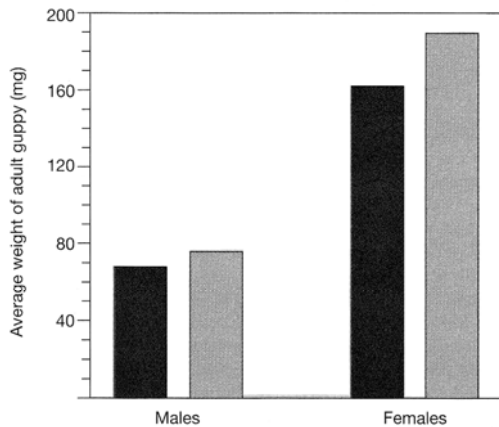
39. Molecular clocks:

- A. will soon replace geological estimates of speciation and divergence.
- B. are based on a standard rate of mutation for all genes.
- C. are based on the average rate at which a particular gene evolves.
- D. to date have always corroborated findings based on fossil evidence.
- E. are used to examine biogeographical relationships among organisms.

40, 41. Use the figure to answer the corresponding questions.

40. The results in the accompanying figure support the conclusion that:

- A. natural selection does not occur in guppies.
- B. natural selection can occur in guppies within a few generations.
- C. predation is not a selective force in determining the average size of guppies.
- D. male body weight increased proportionately more than female body weight.
- E. in the experimental setting, the guppies produced fewer, larger offspring.



- Average initial weight of guppies (control)
- Average weight of guppies 18 generations after being transferred to stream with different selective predation (experimental)

41. The average weight of a female guppy in the experimental group was:

- A. 70 g.
- B. 80 mg.
- C. 170 mg.
- D. 180 g.
- E. 190 mg.

42. Bacteria evolve antibiotic resistance through all of the following mechanisms *except*:

- A. mutations.
- B. intense predation.
- C. acquiring new genes from viruses.
- D. acquiring new genes from plasmids.
- E. acquiring new genes from other bacteria that survive antibiotic treatments.

DISCUSSION OR THOUGHT QUESTIONS—please type on a separate sheet of paper.

1. Explain this statement: “There is bias in the fossil record.”

MULTIPLE CHOICE QUESTIONS

43. If an animal population is diploid, each individual possesses:

- A. one allele for each locus.
- B. two alleles for each locus.
- C. three or more alleles for each locus.
- D. a complete set of alleles found in each chromosome.
- E. a partial set of alleles found in each cell.

44–46. Use the table to answer the corresponding questions.

44. The frequency of the Dd phenotype is:

- A. 0.1.
- B. 0.2.
- C. 0.3.
- D. 0.4.
- E. 0.5.

Genotype	Number
DD	200
Dd	500
dd	300

45. If the expression of alleles in the preceding question is simple dominance (D) and recessive (d), then the frequency of the recessive phenotype is:

- A. 0.
- B. 0.1.
- C. 0.2.
- D. 0.3.
- E. 0.5.

46. The frequency of the recessive allele, d, is:

- A. 0.15.
- B. 0.25.
- C. 0.35.
- D. 0.55.
- E. 0.75.

47. If a population of 1000 individuals has 160 aa genotypes, the genotype frequency of the aa genotype is:

- A. 0.016.
- B. 0.08.
- C. 0.16.
- D. 0.8.
- E. 1.0.

48. If a population of 1000 individuals has 160 aa genotypes, assuming simple dominance by the A allele, the phenotype frequency of the dominant phenotype is:

- A. 0.08.
- B. 0.16.
- C. 0.42.
- D. 0.84.
- E. 1.0

49. If a population of 1000 individuals has 160 aa genotypes, 320 Aa genotypes, and 520 AA genotypes, the allele frequency of the dominant allele (A) is:
- A. 0.16
 - B. 0.42.
 - C. 0.52.
 - D. 0.68.
 - E. 0.89.
50. A population in which the allele and genotype frequencies do not change over time is said to be in:
- A. genetic stasis.
 - B. genetic equilibrium.
 - C. population stability.
 - D. allelic disequilibrium
 - E. allelic balance.
51. What is the correct equation for the Hardy-Weinberg principle?
- A. $p^2 + 2pq^2 + q^2 + q^2 = 100$
 - B. $p^2 + 2p + 2q + q^2 = 1$
 - C. $p^2 - 2pq + q^2 = 1$
 - D. $2p^2 + 2pq + 2q^2 = 1000$
 - E. $p^2 + 2pq + q^2 = 1$
52. If all of the alleles of a given locus are the same in a population, then the frequency of that allele is assigned a value of:
- A. 0.1.
 - B. 1.0.
 - C. 10.0.
 - D. 100.0.
 - E. 1000.0.
53. In the Hardy-Weinberg equation, the term q^2 refers to the frequency of:
- A. the recessive allele at a given locus.
 - B. the homozygous recessive genotype at a given locus.
 - C. the recessive alleles in a given population.
 - D. the heterozygotes in a population.
 - E. None of these.
54. The Hardy-Weinberg principle is useful because:
- A. it explains the existence of variation in populations.
 - B. it proves that Mendel was correct for populations.
 - C. it describes most populations.
 - D. it explains the existence of a large number of species.
 - E. it identifies those factors that can change allele or genotype frequencies.
55. The Hardy-Weinberg principle does *not* assume:
- A. no net mutations occur in a population.
 - B. a large population size.
 - C. artificial selection is occurring.
 - D. random mating is occurring.
 - E. no gene flow is occurring.

56. In a certain population, 40 of every 1,000 births results in an individual that suffers from cystic fibrosis. What is the allele frequency for the recessive allele that causes cystic fibrosis?
- A. 0.004
 - B. 0.02
 - C. 0.2
 - D. 0.4
 - E. 0.8
57. In a certain population, the allele causing sickle cell anemia has an allele frequency of 0.2. If the population is in genetic equilibrium for this allele, what fraction of the population would be carriers for the allele?
- A. 0.24
 - B. 0.32
 - C. 0.42
 - D. 0.48
 - E. 0.80
58. In a certain population, the allele frequencies of the M and N blood group alleles are 0.6 and 0.4, respectively. How many of a population of 500 would be expected to have MN blood type if the population is in genetic equilibrium for the MN locus?
- A. 200
 - B. 220
 - C. 240
 - D. 260
 - E. 300
59. Which of the following causes changes in allele frequencies?
- A. genetic drift
 - B. mutation
 - C. natural selection
 - D. gene flow from migration
 - E. All of these.
60. Evolution that involves changes in allele frequencies over just a few successive generations is referred to as:
- A. natural selection.
 - B. microevolution.
 - C. macroevolution.
 - D. stabilizing selection.
 - E. directional selection.
61. _____ is thought to be due to increased homozygosity.
- A. The founder effect
 - B. Genetic drift
 - C. Inbreeding depression
 - D. Heterozygote advantage
 - E. Gene flow

62. Which of the following statements is *not* true about natural selection?
- A. Offspring of individuals that are better adapted will make up a larger proportion of the next generation.
 - B. Natural selection directs evolution by preserving traits acquired during an individual's lifetime.
 - C. Natural selection depends on the genetic variability in a population, which arises through mutations.
 - D. Natural selection acts to preserve favorable traits and eliminate unfavorable traits.
 - E. Natural selection leads to adaptive evolutionary change.
63. Positive assortative mating in a population will:
- A. produce more mutations each generation.
 - B. cause natural selection.
 - C. change allele frequencies.
 - D. stabilize genotype frequencies.
 - E. increase homozygosity.
64. The only source of all new alleles is:
- A. natural selection.
 - B. genetic drift.
 - C. gene flow.
 - D. mutation.
 - E. genetic polymorphism.
65. Mutations that are *not* passed on from one generation to the next:
- A. result from disruptive selection.
 - B. are balanced polymorphisms.
 - C. arise in somatic cells.
 - D. result from the founder effect.
 - E. None of these.
66. Due to a rapid change in the environment, a population of ants was reduced from 1 million to 1 thousand. What type of genetic drift will occur in the gene pool of this population when it expands again?
- A. the founder effect
 - B. migration
 - C. a genetic bottleneck
 - D. gene flow
 - E. natural selection
67. Random evolutionary changes in a small breeding population is known as:
- A. gene flow.
 - B. genetic drift.
 - C. disruptive selection.
 - D. natural selection.
 - E. mutation.
68. The migration of breeding individuals between populations causes a corresponding movement of alleles, which is referred to as:
- A. genetic drift.
 - B. directional selection.
 - C. natural selection.
 - D. gene flow.
 - E. mutation.

69. You might expect to see an example of the founder effect in:
- A. the Hawaiian Islands.
 - B. Central Africa.
 - C. states along the Mississippi River.
 - D. a tropical rain forest.
 - E. Munster, Indiana-Mrs. Laux's hometown. GO HOOSIERS!
70. Which of the following can produce a population of individuals with a relatively high frequency of a deleterious allele?
- A. natural selection
 - B. mutation
 - C. migration between large populations
 - D. the founder effect
 - E. artificial selection
71. The overuse of antibiotics has led to a form of antibiotic resistant tuberculosis. This has occurred as a result of:
- A. directional selection within the bacterial population.
 - B. stabilizing selection within the bacterial population.
 - C. disruptive selection within the bacterial population.
 - D. a heterozygote advantage within the bacterial population.
 - E. balanced polymorphism within the bacterial population.
72. In _____ selection, individuals with a phenotype near the mean are favored over those at the phenotypic extremes.
- A. directional
 - B. disruptive
 - C. stabilizing
 - D. frequency-dependent
 - E. natural

Keep going onto #73...

73. The distribution of phenotypes for human birth weight is a good example of:
- A. the founder effect.
 - B. genetic drift.
 - C. directional selection.
 - D. disruptive selection.
 - E. stabilizing selection.
74. In the human species, a heterozygote advantage is demonstrated by which condition?
- A. hemophilia
 - B. sickle cell anemia
 - C. Down syndrome
 - D. Klinefelter syndrome
 - E. albinism
75. The presence of two or more different alleles in a population for a given locus is termed:
- A. heterozygosity.
 - B. genetic polymorphism.
 - C. polygenic stasis.
 - D. a gene pool.
 - E. frequency independent selection.
76. Balanced polymorphism can be maintained by the combined actions of:
- A. the founder effect and genetic drift.
 - B. heterozygote advantage and genetic drift.
 - C. heterozygote advantage and the founder effect.
 - D. heterozygote advantage and frequency-dependent selection.
 - E. frequency-dependent selection and the founder effect.
77. With respect to the alleles for sickle cell anemia, which genotype(s) is (are) at a disadvantage to persons residing in tropical areas of Africa?
- A. homozygous recessive
 - B. homozygous dominant
 - C. heterozygous
 - D. both heterozygous and homozygous dominant
 - E. both homozygous dominant and homozygous recessive
78. Frequency-dependent selection acts to decrease the frequency of which phenotype in a population?
- A. the least common phenotype
 - B. the phenotype at an extreme of the normal distribution
 - C. the most conspicuous phenotype
 - D. the most common phenotype
 - E. the most camouflaged phenotype
79. _____ is a gradual variation in phenotypes and genotypes over a geographic span.
- A. A cline
 - B. An ecotone
 - C. A realm
 - D. A biosphere
 - E. A community

DISCUSSION OR THOUGHT QUESTIONS-please type on the same sheet of paper as question #1.

2. Why is the Hardy-Weinberg principle important, since genetic equilibrium seldom occurs in nature?
3. Bacterial populations have been exposed to an antibiotic and have developed resistance to the antibiotic over time. Would this be an example of stabilizing selection, directional selection, or disruptive selection? Explain your reasoning.