Name _____ Period _____

Chapter 13: How Populations Evolve

Guided Reading Activities

Big idea: Darwin's theory of evolution

Answer the following questions as you read modules 13.1–13.7:

- 1. The famous biologist who is considered the father of evolution is Charles Darwin.
- While on his voyage, Darwin made many specific observations and was influenced by many factors that aided him in his thinking about evolution. List two specific observations or factors that influenced Darwin during his voyage.
 Darwin was influenced by a book by Charles Lyell called *Principles of Geology*. He was also influenced by an earthquake he observed while in Chile.
- 3. A scientist is doing a field study in the Mojave Desert. She observes a type of rabbit that has very large and wide ears loaded with blood vessels. She hypothesizes that the large surface area of the ears aids in heat dissipation, thus cooling the rabbit off. What would the specialized ears of this rabbit be considered? Briefly explain your answer. It would be considered an adaptation because it allows the rabbit to be better suited for life in that desert environment.
- True or false: The bones and teeth of organisms are capable of not decaying and often become fossils. If false, make it a correct statement. True
- 5. Would a jellyfish be likely to leave behind a fossil? Briefly explain your answer. No, because it is all soft tissue.
- 6. What would be true regarding any fossils found in strata at the top versus fossils found in lower strata? Refer to Figure 13.2C on page 258 of your textbook. The fossils found closer to the surface are expected to be younger.
- 7. Charles Darwin reasoned that fossils must exist that link two seemingly very different types of organisms. These fossils are termed <u>transitional forms</u>.

8. Complete the following table, which illustrates the relationship between the transitional species from land animals to modern cetaceans.

	Pakicetus	Rodhocetus	Dorudon	Cetaceans
Structure of	Had strong	Limbs that were	Hind limbs not connected	Have flippers for
hind limbs	hind limbs	flipper-like but could be used for walking	to the vertebral column; forelimbs could not have been used for walking	swimming and no hind limbs
Function	Walking on land	Swimming or walking	Swimming	Swimming

- 9. The similarities seen in certain species that result from common ancestry is known as <u>homology</u>.
- All organisms, from humans to bacteria, use DNA as their molecule of heredity. What conclusion can be drawn from this observation? It can be concluded that all organisms descended from a common ancestor.
- 11. A cat's forelimb and a human's forelimb are examples of ______.
 - a. homologous structures
 - b. strata
 - c. vestigial structures
 - d. pseudogenes
- True or false: Evolutionary trees show patterns of descent and are supported by homologous structures. If false, make it a correct statement.
 True
- What do all organisms after point 2 have in common? Refer to Figure 13.5 on page 261 of your textbook. Tetrapod limbs
- 14. Darwin used the practice of <u>artificial selection</u> to gain insight into his ideas about a mechanism for descent with modification.
- 15. List three key points about evolution by natural selection.
 (1) Individuals do not evolve; populations do. (2) Natural selection works only on heritable traits. (3) There is no overall directed goal of natural selection.





17. An argument against evolution by natural selection is that it is not observable on a human time scale. However, this is not exactly true. List two examples of evolution by natural selection that have been documented. Evolution by natural selection can be observed in insects after repeated exposure to pesticides

and in bacteria after repeated exposure to antibiotics.

18. People have the misconception that pesticide resistance in insects and antibiotic resistance in bacteria are examples of artificial selection and not natural selection. Briefly explain why they are examples of natural selection.

They are examples of natural selection because people are not actively choosing to make bacteria and insects more problematic. The antibiotic or pesticide is an environmental factor that is selecting for resistance in the existing population.

Big idea: The evolution of populations

Answer the following questions as you read modules 13.8–13.11:

- 1. Which of the following can be passed on to offspring from their parents?
 - a. Muscles from body building
 - b. A tattoo
 - c. A deep tan from constant tanning
 - d. Blonde hair
- 2. Briefly explain how mutation allows for variation achieved by sexual reproduction. Mutations create all of the genetic diversity found in organisms. These mutations can be passed from parent to offspring as long as the mutations occur in the gametes.
- 3. List the three components of sexual reproduction that account for genetic variation. Crossing over of genes between homologous chromosomes, independent assortment of chromosomes, random fertilization

- True or false: Catfish living in two different rivers would be considered members of the same population. If false, make it a correct statement.
 False, because they would be unable to breed with each other.
- 5. What is meant by the following statement? Population has a "shallow" gene pool. This is referring to this specific population having a low amount of diversity in the population's genes.
- 6. A population of bacteria sees an increase in the number of bacteria resistant to a certain antibiotic over a number of generations. This is known as <u>microevolution</u>.
- 7. The frequency of alleles in a population should remain constant unless there are other factors at work. This principle is known as the <u>Hardy-Weinberg Principle</u>.
- 8. A population of dogs has two different coat colors coded for by two different alleles. The character of coat color follows Mendel's rules. The frequency of one of the alleles for coat color is 250/1150. What is the frequency of both alleles in the population of dogs? What is the population of dogs is 575 because there are a total of 1150 alleles. The frequency of the two alleles is .22 and .78.
- 9. Complete the following table, which outlines the five conditions that must be met if a population is to remain in Hardy-Weinberg equilibrium.

	Large population	No gene flow	No mutation	Random mating	No natural selection
Description	A large	Individuals moving	Mutations	Random	This can alter allele
	population	into or out of	modify the gene	mating	frequencies through the
	limits	populations add or	pool by changing	ensures	unequal reproductive
	chance	remove alleles from	alleles or	mixing of the	success created by
	fluctuation.	the gene pool.	removing them.	alleles.	natural selection.

Big idea: Mechanisms of microevolution

Answer the following questions as you read modules 13.12–13.18:

- 1. True or false: The three main agents of evolutionary change are: natural selection, genetic drift, and nonrandom mating. If false, make it a correct statement. False, they are natural selection, genetic drift, and gene flow.
- 2. Complete the following table, which compares the different mechanisms of microevolution.

	Natural selection	Genetic drift	Gene flow
Description	The ability of some	Chance events can create changes	When individuals move into
	organisms to leave more	in the frequency of alleles in a	or out of a population
	offspring than others due	population. This can have a profound	
	to an advantageous trait	effect on small populations.	
Example	A group of birds having a	A forest fire wipes out a national	Prairie chickens from other
	beak that enables them to	forest and creates a bottleneck	states being added to the
	crack open available seeds	effect on certain populations.	population of prairie chickens
	on an island		already found in Illinois

- 3. A few persons go boating in the boundary waters of Minnesota. They pulled their own boat to and from their campsite. Without their knowledge, a small population of aquatic organisms is in/on the boat. As soon as they get home, they put their boat back in the pond behind the house. There are no other members of this species in the pond. Which mechanism is this? This is an example of the founder effect, which is a type of genetic drift.
- 4. It is possible for mutation, genetic drift, and gene flow to cause microevolution. However, only by a(n) chance event could they lead to that population of organisms becoming better adapted to their environment.
- Which of the following best describes relative fitness? 5.
 - a. The creation of new gene combinations
 - b. Individuals migrating into and out of an area
 - c. The ability to produce healthy offspring
 - d. The change in a population's gene pool over generations
- 6. A man wins the National Bodybuilding Association's Man of the Year award. However, he never has any children due to a personal choice. What is his relative fitness within the population? Briefly explain your answer.

His fitness is zero because he had no children.

- True or false: Natural selection can alter the variation of phenotypes within a population in 7. three ways. If false, make it a correct statement. True
- 8. Complete the following table, which compares the three ways in which natural selection can alter a population's phenotypes.

	Stabilizing selection	Directional selection	Disruptive selection
Description	Favors intermediate phenotypes; reduces variation and maintains an intermediate trait	Shifts the population by acting against one of the phenotypes at the extremes	When conditions exist that favor phenotypes at the extremes and not intermediate phenotypes
Example	Human birth weight	Bacteria exposed to an antibiotic	Small and large-billed African black-bellied seedcracker finches

9. A classic example of microevolution is the shift in a population of moths from light colored to dark colored during the industrial revolution in England. This shift in moth color was brought about by an accumulation of soot on the trees and other vegetation around the factories of the cities. This is an example of what type of selection? Directional selection

- 10. The plumage of peacocks is an example of <u>sexual dimorphism</u>.
- 11. What kind of sexual selection is demonstrated when the peahen selects her mate? Sexual selection
- 12. A population of bacteria contains no members with resistance to penicillin. Several generations pass with the bacteria reproducing. A researcher adds penicillin to the population of bacteria and discovers a few bacteria remain after the application of the antibiotic. Assume no new bacteria were introduced to the population. What can explain this? Mutation occurred in one or more of the bacteria, which enabled them to resist the antibiotic.
- List three ways in which human practices are contributing to the creation of antibioticresistant strains of bacteria.
 Overprescription of antibiotics by physicians, patients stopping their prescriptions before the prescribed dosage is completed, and use of antibiotics in cattle by ranchers
- Briefly explain how a heterozygous individual "protects" the recessive allele from elimination within the population.
 Because the heterozygous individual will carry the recessive allele while displaying the domi-

nant phenotype, which keeps the recessive allele in the gene pool

15. Complete the Venn diagram that compares the two different types of balancing selection.



16. List the reasons why natural selection does not create perfect organsisms. Natural selection only works on alleles that are present; evolution is limited by historical constraints; adaptations are usually a trade-off; chance, natural selection, and the environment interact.

CONNECTING THE BIG IDEAS

Use your knowledge of the information contained within this chapter's "Big Ideas" to answer this question.

How has our knowledge of evolution changed since the time of Darwin?