Chapter 16  Evolution of Populations

Section 16–1 Genes and Variation (pages 393–396)

Key Concepts
- What are the main sources of heritable variation in a population?
- How is evolution defined in genetic terms?
- What determines the numbers of phenotypes for a given trait?

Introduction (page 393)
1. Is the following sentence true or false? Mendel’s work on inheritance was published after Darwin’s lifetime. ________________
2. Which two important factors was Darwin unable to explain without an understanding of heredity? __________________________

How Common Is Genetic Variation? (page 393)
3. All organisms have additional __________________________ that is “invisible” because it involves small differences in biochemical processes.

Variation and Gene Pools (page 394)
4. A group of individuals of the same species that interbreed is a(an) __________________________.
5. All of the genes in a population are called a(an) __________________________.
6. Is the following sentence true or false? A gene pool typically contains just one allele for each inheritable trait. ________________
7. The number of times that an allele occurs in a gene pool compared with the number of times other alleles for the same gene occur is called the __________________________ of the allele.

Sources of Genetic Variation (pages 394–395)
8. What is a mutation? __________________________

9. Why do mutations occur? __________________________
10. Complete the concept map.

Sources of Genetic Variation

include

11. Circle the letter of each choice that is true about mutations.
   a. They do not always change an amino acid.
   b. They always affect lengthy segments of a chromosome.
   c. They always affect an organism’s phenotype.
   d. They always affect an organism’s fitness.

12. Is the following sentence true or false? Most heritable differences are due to gene shuffling that occurs during the production of gametes. __________

13. Circle the letter of each choice that is true about sexual reproduction.
   a. It is a major source of variation in many populations.
   b. It can produce many different phenotypes.
   c. It can produce many different genetic combinations.
   d. It can change the relative frequency of alleles in a population.

Single-Gene and Polygenic Traits (pages 395-396)

14. Is the following sentence true or false? The number of phenotypes produced for a given trait depends on how many genes control the trait. __________

15. Is the following sentence true or false? Most traits are controlled by a single gene. __________
16. Label the two graphs to show which one represents a single-gene trait and which one represents a polygenic trait.

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**Reading Skill Practice**

When you read about related concepts, making a graphic organizer such as a Venn diagram can help you focus on their similarities and differences. Make a Venn diagram comparing and contrasting single-gene and polygenic traits. For more information on Venn diagrams, see Appendix A of your textbook. Do your work on a separate sheet of paper.
Section 16–2 Evolution as Genetic Change  
(pages 397–402)

Key Concepts
- How does natural selection affect single-gene and polygenic traits?
- What is genetic drift?
- What five conditions are needed to maintain genetic equilibrium?

Natural Selection on Single-Gene Traits  
(pages 397–398)
1. Is the following sentence true or false? Natural selection on single-gene traits cannot lead to changes in allele frequencies.
2. If a trait made an organism less likely to survive and reproduce, what would happen to the allele for that trait?
3. If a trait had no effect on an organism’s fitness, what would happen to the allele for that trait?

Natural Selection on Polygenic Traits  
(pages 398–399)
4. List the three ways that natural selection can affect the distributions of phenotypes.
   a. 
   b. 
   c. 

Match the type of selection with the situation in which it occurs.

<table>
<thead>
<tr>
<th>Type of Selection</th>
<th>Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Directional</td>
<td>a. Individuals at the upper and lower ends of the curve have higher fitness than individuals near the middle.</td>
</tr>
<tr>
<td>6. Stabilizing</td>
<td>b. Individuals at one end of the curve have higher fitness than individuals in the middle or at the other end.</td>
</tr>
<tr>
<td>7. Disruptive</td>
<td>c. Individuals near the center of the curve have higher fitness than individuals at either end.</td>
</tr>
</tbody>
</table>

8. An increase in the average size of beaks in Galápagos finches is an example of ________ selection.
9. Is the following sentence true or false? The weight of human infants at birth is under the influence of disruptive selection.

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10. Draw the missing graph to show how disruptive selection affects beak size.

**Disruptive Selection**

Largest and smallest seeds become more common.

![Graph](image)

**Genetic Drift** (page 400)

11. Is the following sentence true or false? Natural selection is the only source of evolutionary change.

12. Random change in allele frequencies in small populations is called

13. A situation in which allele frequencies change as a result of the migration of a small subgroup of a population is known as the

14. What is an example of the founder effect?

**Evolution Versus Genetic Equilibrium** (pages 401–402)

15. What does the Hardy-Weinberg principle state?

16. The situation in which allele frequencies remain constant is called

17. List the five conditions required to maintain genetic equilibrium.
   a. 
   b. 
   c. 
   d. 
   e. 

18. Why is large population size important in maintaining genetic equilibrium?
Section 16–3 The Process of Speciation
(pages 404–410)

Key Concepts
- What factors are involved in the formation of new species?
- Describe the process of speciation in the Galápagos finches.

Introduction (page 404)
1. What is speciation?

Isolating Mechanisms (pages 404–405)
2. Is the following sentence true or false? Individuals in different species can have the same gene pool. ____________
3. What does it mean for two species to be reproductively isolated from each other?

4. What must happen in order for new species to evolve? ____________

5. List three ways that reproductive isolation occurs.
   a. ____________
   b. ____________
   c. ____________

6. When does behavioral isolation occur? ____________

7. Is the following sentence true or false? Eastern and Western meadowlarks are an example of behavioral isolation. ____________

8. When does geographic isolation occur? ____________

9. Abert and Kaibab squirrels in the Southwest are an example of ____________ isolation.

10. Is the following sentence true or false? Geographic barriers guarantee the formation of new species. ____________

11. What is an example of temporal isolation? ____________

12. Is the following sentence true or false? The basic mechanisms of evolutionary change cannot be observed in nature. ____________
13. Circle the letter of each hypothesis about the evolution of Galápagos finches that was tested by the Grants.
   a. The finches' beak size and shape has enough inheritable variation to provide raw material for natural selection.
   b. The different finch species are the descendants of a common mainland ancestor.
   c. Differences in the finches' beak size and shape produce differences in fitness that cause natural selection to occur.
   d. The evolution of the finches is proceeding slowly and gradually.

**Speciation in Darwin's Finches** *(pages 408–409)*

14. Complete the flowchart to show how speciation probably occurred in the Galápagos finches.

```
  Founders arrive
      ↓
  1
      ↓
  2
      ↓
  3
      ↓
  4
      ↓
Continued evolution
```

15. How could differences in beak size lead to reproductive isolation?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

**Studying Evolution Since Darwin** *(page 410)*

16. Why is the study of evolution important?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Reading and Study Workbook 185
Chapter 16  Evolution of Populations

Vocabulary Review

Interpreting Diagrams  The diagrams show the distribution curves for time of mating in a population of insects. The diagram on the left represents the starting population. The diagram on the right represents the population several generations later. Study the diagrams and answer the questions below.

1. What type of natural selection has occurred?

2. Which phenotypes are selected against?

3. Which phenotypes have higher fitness?

4. If natural selection continues in this way, what may eventually happen to the population?

Completion  Fill in the blanks with terms from Chapter 16.

5. Any change in the relative frequency of alleles in a population is called

6. A gene pool consists of all the genes in a(n)

7. The two main sources of genetic variation are gene shuffling and

8. A random change in allele frequency is called

9. When birds cannot interbreed because they have different mating songs, they are characterized by isolation.

10. A situation in which allele frequencies change as a result of the migration of a small subgroup of a population is known as the

11. Research on Galápagos finches by Peter and Rosemary Grant showed that a type of natural selection called selection was occurring.

12. Two related species that live in the same area but mate during different seasons are separated by isolation.