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Objectives

- **Identify** traits that vary in populations and that may be studied.
- **Explain** the importance of the bell curve to population genetics.
- **Compare** three causes of genetic variation in a population.

Variation of Traits Within a Population

- *Population biologists* study many different traits in populations, such as size and color.

Variation of Traits Within a Population, *continued*

- **Causes of Variation**
  - Traits vary and can be mapped along **a bell curve,** which shows that most individuals have average traits, whereas a few individuals have extreme traits.
  - Variations in genotype arise by *mutation, recombination*, and the *random pairing of gametes*.

Chapter 16

The Gene Pool

- The total genetic information available in a population is called the **gene pool.**

Chapter 16

The Gene Pool, *continued*

- **Allele frequency** is determined by dividing the total number of a certain allele by the total number of alleles of all types in the population.

Chapter 16

The Gene Pool, *continued*

- **Predicting Phenotype**
  - Phenotype frequency is equal to the number of individuals with a particular phenotype divided by the total number of individuals in the population.

Chapter 16

Objectives

- **List** five conditions under which evolution may take place.
- **Explain** how migration can affect the genetics of populations.
- **Explain** how genetic drift can affect populations of different sizes.
- **Contrast** the effects of stabilizing selection, directional selection, and disruptive selection on populations over time.
- **Identify** examples of nonrandom mating.

Mutation

- Evolution may take place when populations are subject to genetic mutations, gene flow, genetic drift, nonrandom mating, or natural selection.
- **Mutations** are changes in the DNA.

Gene Flow

- **Emigration** and **immigration** cause **gene flow** between populations and can thus affect gene frequencies.

Genetic Drift

- **Genetic drift** is a change in allele frequencies due to random events.
- Genetic drift operates most strongly in small populations.

Nonrandom Mating

- Mating is nonrandom whenever individuals may choose partners.

Nonrandom Mating, *continued*

- **Sexual Selection**
  - **Sexual selection** occurs when certain traits increase an individual's success at mating.
  - Sexual selection explains the development of traits that improve reproductive success but that may harm the individual.

Natural Selection

- **Natural selection** can influence evolution in one of three general patterns.

Natural Selection, *continued*

- **Stabilizing Selection**
  - **Stabilizing selection** favors the formation of average traits.

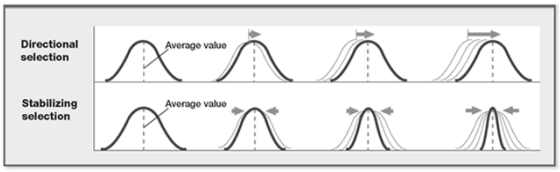
Natural Selection, *continued*

- **Disruptive Selection**
  - **Disruptive selection** favors extreme traits rather than average traits.

Natural Selection, *continued*

- **Directional Selection**
  - **Directional selection** favors the formation of more-extreme traits.

Two Kinds of Selection



Objectives

- **Relate** the biological species concept to the modern definition of species.
- **Explain** how the isolation of populations can lead to speciation.
- **Compare** two kinds of isolation and the pattern of speciation associated with each.
- **Contrast** the model of punctuated equilibrium with the model of gradual change.

The Concept of Species

- According to the biological species concept, a species is a population of organisms that can successfully interbreed but cannot breed with other groups.

Chapter 16

Isolation and Speciation

- **Geographic Isolation**
  - **Geographic isolation** results from the separation of population subgroups by geographic barriers.

Chapter 16

Isolation and Speciation, *continued*

- **Allopatric Speciation**
  - Geographic isolation may lead to **allopatric speciation.**

Chapter 16

Isolation and Speciation, *continued*

- **Reproductive Isolation**
  - **Reproductive isolation** results from the separation of population subgroups by barriers to successful breeding.

Chapter 16

Isolation and Speciation, *continued*

- **Sympatric Speciation**
  - Reproductive isolation within the same geographic area is known as **sympatric speciation.**

Chapter 16

Rates of Speciation

- In the gradual model of speciation **(gradualism),** species undergo small changes at a constant rate.
- Under **punctuated equilibrium,** new species arise abruptly, differ greatly from their ancestors, and then change little over long periods.