Section Summary

There are four factors that can change the allele frequencies of a population. Natural selection works by selecting for alleles that confer beneficial traits or behaviors, while selecting against those for deleterious qualities. Mutations introduce new alleles into a population. Genetic drift stems from the chance occurrence that some individuals have more offspring than others and results in changes in allele frequencies that are random in direction. When individuals leave or join the population, allele frequencies can change as a result of gene flow.

Exercises

1. One of the original Amish colonies originated from a single ship of colonists that came from Europe. The ship's captain, who had polydactyly, a rare dominant trait, was one of the original colonists. Today, we see a much higher frequency of polydactyly in the Amish population. This is an example of:
    a. Natural selection
    b. Founder effect
    c. Bottleneck effect
    d. Mutation

2. When male lions reach sexual maturity, they leave their group in search of a new pride. This can alter the allele frequencies of the population through which of the following mechanisms?
    a. Natural selection
    b. Gene flow
    c. Population bottleneck
    d. Random mating

Answers

1. (b)
2. (b)

Glossary

bottleneck effect: the magnification of genetic drift as a result of natural events or catastrophes

founder effect: a magnification of genetic drift in a small population that migrates away from a large parent population carrying with it an unrepresentative set of alleles

gene flow: the flow of alleles in and out of a population due to the migration of individuals or gametes

genetic drift: the effect of chance on a population's gene pool

migration: the movement of individuals of a population to a new location; in population genetics it refers to the movement of individuals and their alleles from one population to another, potentially changing allele frequencies in both the old and the new population

mutation: a change in the DNA sequence

natural selection: the greater relative survival and reproduction of individuals in a population that have favorable heritable traits, leading to evolutionary change

speciation: a formation of a new species

11.3 Evidence of Evolution

Learning objectives

By the end of this section, you will be able to:

- *Explain evidence that supports the theory of evolution*
- *Define homologous and vestigial structures*
- *Be prepared to define and explain all bolded terms*

The evidence for evolution is compelling and extensive. Looking at every level of organization in living systems, biologists see the signature of past and present evolution. In this section students will learn about data that supports the theory of evolution.

Fossils

Fossils provide solid evidence that organisms from the past are not the same as those found today; they show a progression of evolution. Fossils are mineralized, or preserved remains of organisms from the past. Scientists can determine the age of fossils and then categorize them to determine when organisms lived relative to each other. The resulting fossil record tells the story of the past and shows the evolution of form over millions of years. For example, both whales and modern horses have highly detailed fossil records (Figure 11.13).

The fossil record of horses in North America is especially rich and contains many transition fossils. Transitional fossils are those showing intermediate anatomy between earlier and later forms. The fossil record extends back to a dog-like ancestor some 55 million years ago. This dog-like ancestor gave rise to the first horse-like species 42 to 55 million years ago in the genus *Eohippus*. The series of fossils tracks the change in anatomy, which was most likely a result of changing environmental conditions. A gradual drying trend is thought to have changed the landscape from forests to prairies. Successive fossils show the evolution of teeth size, feet shapes, and leg anatomy. For example, *Mesohippus* found from 30 to 40 million years ago had adaptations, such as longer limbs compared to earlier ancestors. This would have been useful when evading predators in open environments, such as prairies. Later species showed gains in size, such as those of *Hipparion*, which existed from about 2 to 23 million years ago. The fossil record shows several adaptive radiations in the horse lineage, which is now reduced to only one genus, *Equus*, with several different species.