Chapter 8

Natural Selection

Summary of Terms

- **Adaptations** Evolved traits that make organisms well suited to living and reproducing in their environments.
- **Evolution** Inherited changes in populations of organisms over time.
- **Fitness** The number of offspring an organism produces in its lifetime compared to other organisms in the population.
- **Genetic variation** Differences in the inherited traits of different individuals.
- **Natural selection** The process in which organisms with inherited, advantageous traits leave more offspring than organisms with other traits, causing these advantageous traits to become more common in a population over time.

Detailed Chapter Summary

How did life originate? At present, scientists do not know exactly how life originated, but they have some clues. The experiments of Miller and Urey suggest that organic molecules could form spontaneously under conditions present on early Earth. Organic molecules may also have been brought by meteorites or formed in deep-sea environments similar to the hydrothermal vent habitats still in existence today. Liposomes are structures that form spontaneously from certain lipids and may have served as early cell membranes. Liposomes show a variety of behaviors similar to those of cells. The first genetic material was probably RNA rather than DNA. RNA has the ability to spontaneously assemble into short strands that can reproduce themselves.

For thousands of years, people believed that life on Earth did not change. The discovery of fossils raised questions, however. Lamarck was one of the strongest early proponents of evolution. He argued that organisms evolve through the inheritance of acquired characteristics. This turned out to be incorrect.

Charles Darwin defined evolution as inherited changes in populations of organisms over time. Darwin's theory of evolution grew out of his experiences on board the H.M.S. *Beagle*, which sailed around South America. Darwin was also influenced by the work of two contemporaries, Lyell and Malthus. Lyell was a geologist who argued that the Earth's geological features arose through gradual processes that

produced their effects over long time periods. Darwin argued that gradual processes acting over long time periods could also account for changes in populations of organisms. Malthus was an economist who observed that human populations grew much faster than their food supplies, and that famine was therefore an inevitable feature of human existence. This led Darwin to his idea of natural selection.

Darwin argued that natural selection is the driving force behind evolution. In any population of organisms, individuals show genetic variation in many traits. Organisms with advantageous inherited traits survive better and reproduce more than organisms with other traits. As a result, these advantageous inherited traits become more common in the population. This is natural selection. As a result of natural selection, organisms evolve to become better adapted to their environments.

We next looked in detail at two examples of natural selection. The first example was the evolution of peppered moth coloration during the Industrial Revolution. As the environment became polluted, the number of dark peppered moths increased. Experiments performed by Bernard Kettlewell showed that birds tended to eat more moths that were *not* camouflaged in their habitat – that is, birds ate more dark moths in unpolluted habitats and more light moths in polluted habitats. The second example was the evolution of antibiotic resistance in bacteria. Heavy use of antibiotics has resulted in the evolution of resistance in many different bacterial populations, with serious consequences for our ability to control disease-causing bacteria.

Adaptations can relate to different aspects of an organism's existence. For example, they can help organisms survive, acquire more mates (sexual selection), or more successfully raise offspring. One specific set of adaptations relates to maintaining an appropriate body temperature in hot and cold environments. Mammals in cold habitats tend to be larger, with smaller appendages, compared to their close relatives. Mammals in hot habitats tend to be smaller, with larger appendages, compared to their close relatives. This is due to the observation that these features result in favorable surface-area-to-volume ratios.