Chapter 9

Evidence of Evolution

Summary of Terms

- **Biogeography** The study of how species are distributed on Earth.
- **Artificial selection** The selective breeding of organisms with desirable traits in order to produce offspring with similar desirable traits.
- **Gene flow** The evolution of a population due to the movement of alleles into or out of the population.
- **Genetic drift** The evolution of a population due to chance.
- **Speciation** The formation of new species.
- **Species** A group of organisms whose members can breed with one another but not with members of other species.

Detailed Chapter Summary

At the genetic level, evolution can be described as changes in the allele frequencies of genes over time. Four mechanisms of evolution are:

1.) Natural selection: the frequency of an advantageous allele increases over time due to its positive effects on survival and reproduction.

2.) Mutation pressure: the tendency of alleles to mutate in one direction more than the other direction, causing a change in allele frequencies.

3.) Genetic drift: the evolution of populations due to chance. Genetic drift is especially significant in small populations.

4.) Gene flow: the evolution of a population due to the movement of alleles into or out of the population.

A species is a group of organisms whose members can breed with one another but not with members of other species. Speciation describes the formation of new species. Speciation relies on the evolution of reproductive barriers between groups. A prezygotic reproductive barrier prevents mating or prevents the formation of a fertilized egg. A postzygotic reproductive barrier acts after fertilization has taken place. There are two types of speciation, allopatric and sympatric. In allopatric speciation, new species are formed after a geographic barrier divides a population. In sympatric speciation, there is no such barrier. Allopatric speciation is much more common than sympatric speciation, but hybridization and polyploidy are examples of the latter.

Many types of evidence support evolution, which is inherited changes in populations of organisms over time. These include:

1.) Observations of natural selection in action, as seen in resistance to myxoma virus in Australian rabbits, peppered moth coloration, evolution in Darwin's finches, and other examples.

2.) Artificial selection, as seen in many domesticated animals and crops, including dogs and corn.

3.) Fossils that show the evolution of organisms over time, such as fossil whales.

4.) Similarities in body structures, as seen in the forelimbs of mammals.

5.) Vestigial organs, such as the eyes of blind species and tiny limbs in some snakes.

6.) Patterns of development, as seen in the tails of human embryos, among other examples.

7.) DNA evidence, such as sequence similarities among species in parts of the genome with no known function.

8.) Hierarchical organization of living things.

9.) Biogeography, as seen in Arctic vs. Antarctic species and the distribution of species on islands, among other examples.

Humans are hominids. Many hominid fossils have been found. "Lucy," an early hominid of the genus *Australopithecus*, had an upright stance. *Homo habilis*, a tool maker, is the earliest known member of the genus *Homo*. *Homo erectus* evolved from large male-female size difference to more equal sizes, suggesting a more human-like social system. *Homo erectus* was also the first hominid to move out of Africa. Neanderthals were larger and more muscular than modern humans, but had the same brain size. Neanderthals coexisted for a while with modern humans and interbred with them, but ultimately went extinct. Most modern humans have some Neanderthal DNA. The earliest fossils of our species, *Homo sapiens sapiens*, were found in Ethiopia and are 195,000 years old.