

Chapter 10: Principles of Evolution

- Evolution is the process of biological change by which descendants come to differ from their ancestors. Natural selection is one *mechanism* by which evolution may occur.
- A species is a group of organisms that can mate and have fertile offspring.
- Theories of geologic change – uniformitarianism, gradualism, catastrophism – contributed to Darwin's theory.
- Darwin observed the environment and conducted experiments to develop his theory of natural selection.
- Variation is the difference in the traits of an individual from those of other individuals in the group to which it belongs. Adaptations are features that allow an organism to better survive in its environment.
- Artificial selection – humans breed species for desirable traits; natural selection – individuals with beneficial adaptations produce more offspring than do other individuals
- There are 4 principles to the theory of natural selection – (1) variation in a population is the basis for natural selection, (2) overproduction of offspring results in competition for resources, (3) adaptations allow some individuals to better survive and produce more offspring, and (4) over time, through the process of descent with modification, species become well suited for survival and reproduction in their environment
- Fitness is the measure of one's ability to survive and produce more offspring than other members of a population
- Evidence of evolution came from several sources, including – fossils, biogeography, embryology, anatomical similarities (ex. homologous structures indicate shared ancestry, but analogous structures do not)
- Vestigial structures are remnants of structures that once had a function in an ancestor

Chapter 11: The Evolution of Populations

- A gene pool is all of the alleles found in a population. Allele frequency refers to how common certain alleles are.
- Genetic variation may occur due to mutation or recombination of genes.
- Natural selection can lead to different distributions of a trait – (1) directional selection (selecting for 1 extreme phenotype), (2) stabilizing selection (selecting for the intermediate phenotype), and (3) disruptive selection (selecting for both extreme phenotypes)
- The movement of alleles from one population to another is gene flow.
- Genetic drift occurs from changes in allele frequencies due to chance (population is usually small). Two processes may lead to genetic drift – (1) the bottleneck effect, and (2) the founder effect.
- Sexual selection occurs when specific traits increase mating success. This may be either (1) intrasexual or (2) intersexual.
- The Hardy-Weinberg equilibrium describes populations that are NOT evolving. These conditions must be present: (1) a very large population, (2) no emi-/immigration, (3) no mutations, (4) random mating, and (5) no natural selection. (The opposite of at least 1 of these conditions leads to evolution.)
- Hardy-Weinberg equation is as follows – $p^2 + 2pq + q^2 = 1$
- Isolation of a population – reproductive, behavioral, geographic, or temporal – can lead to speciation.
- Convergent vs. divergent evolution.
- Coevolution occurs when 2 or more species evolve in response to changes in the other (ex. symbiotic relationships).
- Punctuated equilibrium vs. gradualism. Know how these theories differ.
- Adaptive radiation is the diversification of 1 ancestral species into many descendant species.

Chapter 17: The Tree of Life

- Taxonomy is the science of naming and classifying organisms. A group of organisms in a classification system is a taxon
- Binomial nomenclature is a system that gives each species a 2-part scientific name. A genus (1st part of this name) includes 1 or more physically similar species that are thought to be closely related.
- Linnaeus developed one of the first classification systems, which had 7 levels (taxa). This has since been modified to reflect recent scientific findings and research data.
- A phylogeny represents the evolutionary history of a species.
- Cladistics is classification based on common ancestry; a cladogram is an evolutionary tree that proposes how species may be related to each other. Derived characters are used to construct cladograms.
- Molecular clocks are models that use mutations to estimate evolutionary time. mtDNA (mutates quickly) and rRNA (mutates slowly) are 2 clocks that have been used.
- Living things are now classified into 3 domains (and 6 kingdoms within those domains) – Bacteria (Bacteria), Archaea (Archaea), and Eukarya (Protista, Fungi, Plantae, and Animalia).
- Domains Bacteria and Archaea consist of all living prokaryotes, and all are unicellular. Domain Eukarya consists of all eukaryotes; these organisms may be uni- or multicellular.
- Be able to recognize the differences between the domains and kingdoms of life!