

## Learning Objectives:

1. Describe how selection acting on individuals can result in evolution of populations
2. Describe the sources of genetic variation in a population
3. Explain how examining the Hardy-Weinberg equilibrium can tell us about evolution in a population
4. Describe how natural selection can function to drive evolution

## Chapter 21 Notes

What is the difference between a species and a population?

**Population** is a group of species within a special area

**Gene Pool:** all alleles present in all individuals of a species

**Biological Evolution:** A change in the frequencies of the alleles in the gene pool

### **Genetic Variation**

Some genetic variation is phenotypically detectable in easy to observe traits. Some can only easily be detected at the level of molecules

**Mutations:** a new allele and the ultimate source of genetic variation. Only **germ line** (sex cells) mutations can be passed on to the next generation.

- Could be advantageous resulting in a better adapted phenotype- rare
- Deleterious results in a less well adapted phenotype- common
- Neutral have no adaptive effect- common

**Recombination:** the reshuffling of mutations into new combinations

Measuring Variations:

- Observe traits-first way to do it- works well for traits controlled by one gene or not influenced by the environment
- Gel electrophoresis- Can use blood or tissue samples to look for variation in proteins and you see the protein patterns
- DNA Sequencing- Allows us to look directly at any DNA sequence variations

Allele Frequencies= # of copies of an allele/total # of alleles in population

Evolution

- A change in species or population over time
- A change in allele or genotype frequency in a population over time
- Populations that are not evolving are in Hardy-Weinberg Equilibrium

Hardy-Weinberg Conditions

- **All genotypes are equally well adapted-** no differences in the survival and reproductive success of individuals
- **No “gene flow”-** populations must not be added to or subtracted from by migration
- **No mutation-** no new alleles arising
- **No “genetic drift”-** population must be sufficiently large to loss of allele by chance events
- **Random Mating-** no mate preference

The Hardy-Weinberg relation describes the expected frequency of genotypes from allele frequencies ( $p+q+1$ ).  
 $100/100=1$

What force causes populations to evolve?

- Darwin's Theory of Natural Selection
  - It is not just random luck
  - Some individuals have a better chance at surviving
  - More offspring produced than survive to adulthood (overproduction)
  - Inheritable variation among individuals of a species
  - Best adapted individuals survive and reproduce (Unequal reproductive Success)

Adaptation:

- Any characteristic that improves the survival or reproductive success of an organism
- Organisms abilities to closely match the challenges of their environment
- Often is the result of natural selection

Fitness: Contribution an individual makes to the gene pool of the next generation relative to the contributions of others.

- Dominant male phenotype produces 300 male offspring in the next generation
- Small male phenotype produce 5 male offspring
- Female mimic phenotype produce 50 male offspring in the next generation