

Chapter 23

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March 16, 2021

- One misconception is that organisms evolve during their lifetimes
- Natural selection acts on individuals, but only the population as a whole will evolve
- Microevolution — Change in the allele frequencies of a population over generations
- Five Agents of Evolutionary Change:
 1. Mutation
 2. Gene Flow
 3. Non-random Mating
 4. Genetic Drift
 5. Selection
- A population is a localized group of interbreeding individuals
- Gene pool is a collection of alleles in a population
 - Remember the difference between alleles and genes
- Allele frequency is how common an allele appears in a population
 - How many A vs. a in a whole population
- Evolution — Change in allele frequencies in a population
- Hypothetical: What conditions would cause allele frequencies to not change? Examples:
 1. A very large population (no genetic drift)
 2. No migration (no gene flow in or out)
 3. No mutation (no genetic change)

4. Random mating (no sexual selection)
 5. No natural selection (everyone is equally fit)
- Hardy-Weinberg Equilibrium — A hypothetical, non-evolving population
 1. Natural populations rarely in Hardy-Weinberg Equilibrium
 2. Measures if forces are acting on a population (evolutionary change)
 - Counting Alleles
 1. Assume 2 alleles: B and b
 2. Frequency of dominant allele (B) = p
 3. Frequency of recessive allele (b) = q
 4. Frequencies must add to 1 (100%), so: $p + q = 1$
 - Counting Individuals
 1. Frequency of homozygous dominant: $p \cdot p = p^2$
 2. Frequency of homozygous recessive: $q \cdot q = q^2$
 3. Frequency of heterozygotes: $p \cdot q + q \cdot p = 2pq$
 4. Frequencies must add to 1 (100%), so: $p^2 + 2pq + q^2 = 1$
 - Major Causes of Evolution:
 1. Genetic Drift:
 - (a) Small populations have a greater chance of fluctuating in allele frequencies from one generation to another
 - (b) Founder Effect — A few individuals are isolated from larger populations. Certain alleles become over or under represented
 - (c) Bottleneck Effect — Sudden change in environment drastically reduces population size. By chance, certain organism, and, therefore alleles, survives
 2. Gene Flow
 - (a) Movement of individuals between populations
 - (b) Alleles are lost or gained
 3. Natural Selection
 - (a) Fitness — The contribution an individual makes to the gene pool of the next generation
 - (b) Directional Selection — A shift to an extreme of a phenotype (e.g. larger black bears survive extreme cold better than smaller ones)
 - (c) Disruptive Selection — A shift to both extremes of a phenotype (e.g. small beaks for small seeds; large beaks for large seeds)

- (d) Stabilizing Selection — A shift to the center, stable point of phenotypes (e.g. narrow range of human birth weight)
- 4. Sexual Selection
 - (a) Form of natural selection — certain individuals more likely to obtain mates
 - (b) Sexual dimorphism: difference between 2 sexes (can be in size, color, ornamentation, etc.)
- 5. Genetic Mutation
 - (a) Mutations in genes can lead to new alleles