

Deoxyribonucleic Acid (DNA)

- Trait variation is encoded in DNA
 - DNA is composed of **base pairs** of nucleotides (A-T, G-C)
- If base pairs differ among individuals for a particular trait, may lead to different trait expressions

Chromosomes (Composed of DNA)

- Regions on chromosome that we characterize are genes, with each gene representing different base pairs
 - Genes code for how a particular trait is going to be expressed
 - However, genes cannot have alternate forms based upon base pairs they are composed of
 - Known as alleles (forms of the same gene with different base pairs)
 - Different alleles can lead to different trait expressions
 - Example: Giraffe neck length.
 - Imagine the giraffe neck length coded by one gene, allele A and allele B
 - Allele A: if it is present, then the giraffe has a long neck
 - Allele B: if it is present, then the giraffe has a short neck
 - **Genotype**: the underlying genetic code for a trait
 - Allele A and allele B are a **phenotype**: outward expressions for the trait

Evolution

- Definition: change in living organisms over time → (can also mean) → change in allele frequency in a given population over time

Individuals are selected for/against based on their traits

- However, individuals do not evolve

Populations evolve

- Trait expressions/allele frequency change with selective pressures

Natural Selection

- Only mechanism to result in adaptive change
- Populations change is not random
 - Allele frequency changes in response to selective pressures
- Natural selection does not generate NEW trait expressions
 - It can only act on existing variation in a particular trait

Mutation

- Very rare, can be negative, positive, or neutral
- Ultimate source for all genetic variation → new alleles are produced within an individual
 - Can be spontaneous (no direct cause)
 - During egg/sperm production, spontaneous changes occur in DNA

- o Can be caused by external forces (mutagens)
 - Cause changes in underlying DNA of an individual
 - Chemical radiations
 - An increase in mutations in an environment means that there is something wrong in the environment itself (usually mutagens)

Gene Flow (a mechanism of evolution)

- Very common, populations can exchange alleles through dispersal movement of genetic material that lead to new alleles in a particular population
- Can occur through organismal movement, pollination, human movement
 - o Usually not random, but can be (such as wind pollination)

Nonrandom mating

- Can be inbreeding
 - o Can occur from self-fertilization
 - Common in hermaphrodites (an organism that posses both male and female reproductive parts)
 - o Can occur through mating by closely related organisms (such as siblings)
 - o Results in reduced genetic allelic diversity within that population

Genetic Drift

- Completely random process
 - o Changes in allele frequency due to accidental events in many cases, random mating, separating of the population
 - o Very common, potentially problematic in small populations (because there isn't much diversity)
 - **Small gene pool**
 - Represents all alleles in a population
 - o Can happen through random mating
 - Some individuals don't mate

Founder Effect (allelic diversity/gene pool)

- Determined by individuals that move/are moved to a new population and then breed

The Bottleneck Effect

Due to some event, only a small number of individuals survive and they better represent the gene pool for their population.

- Small group = small gene pool

Northern elephant seal:

- Through hunting, ended up with one population
- Protected over time
- All allelic diversity comes from one population
 - o They have recovered. Although there is a large population, they have a small gene pool and a low genetic diversity because it doesn't allow for variation upon reproducing