Natural Selection on Single Gene Traits

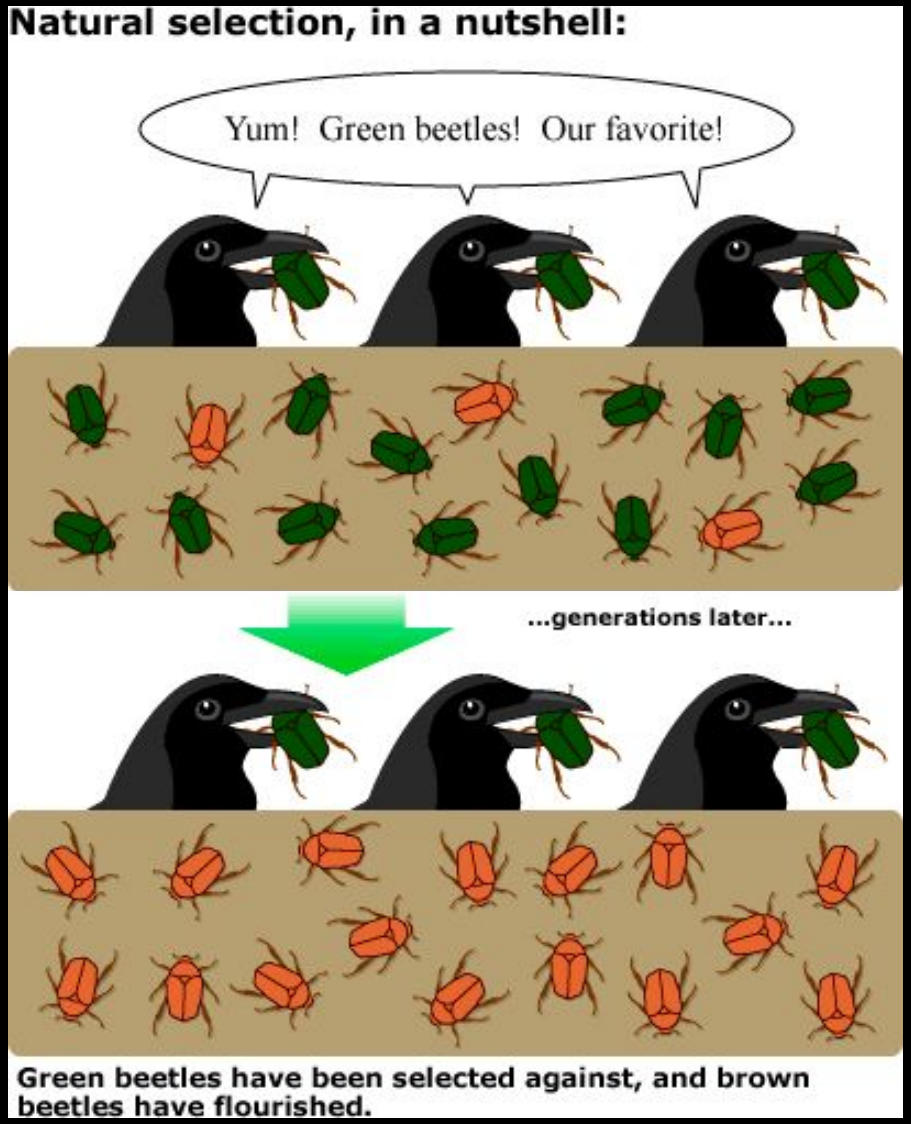
Learning Objectives

- Explain how natural selection affects single-gene traits
- Describe genetic equilibrium

Genetic Equilibrium

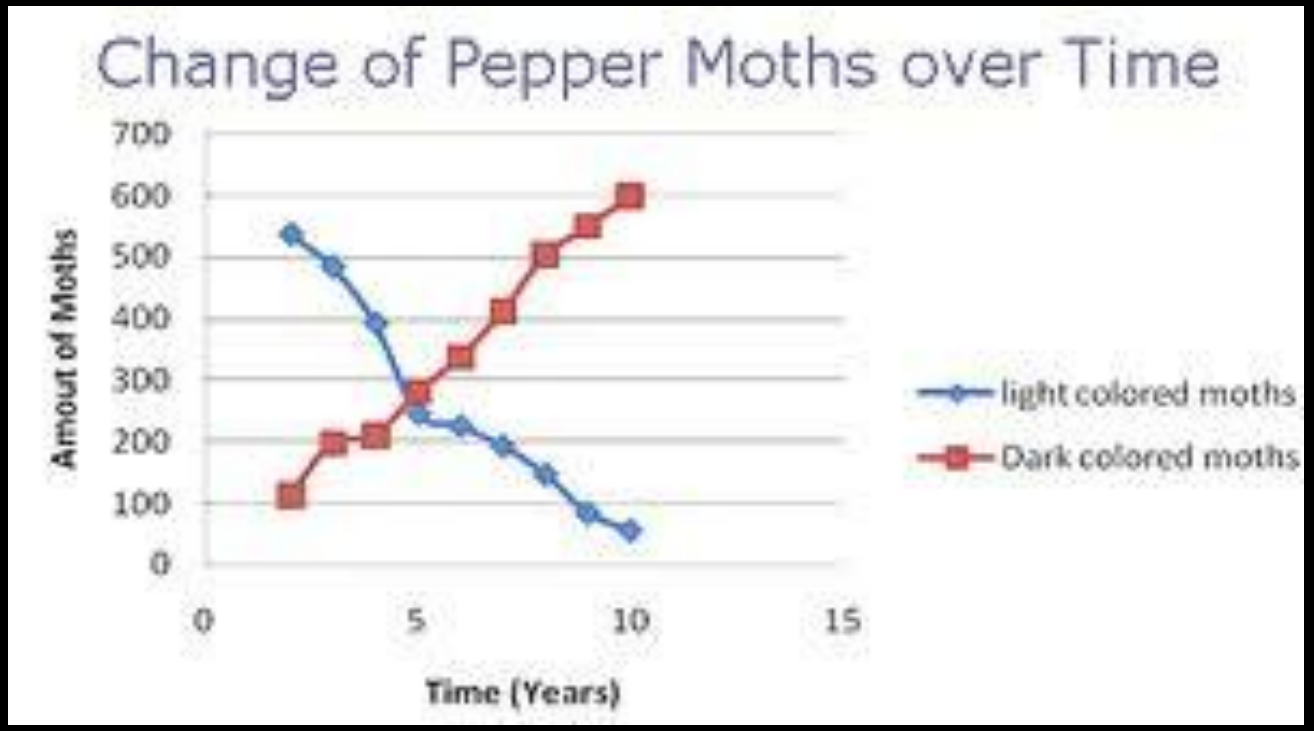
Genetic equilibrium - allele frequencies remain constant

Natural Selection



- Natural selection never acts directly on genes, only the entire organism
- If an individual dies without reproducing, it does not contribute its alleles to the gene pool

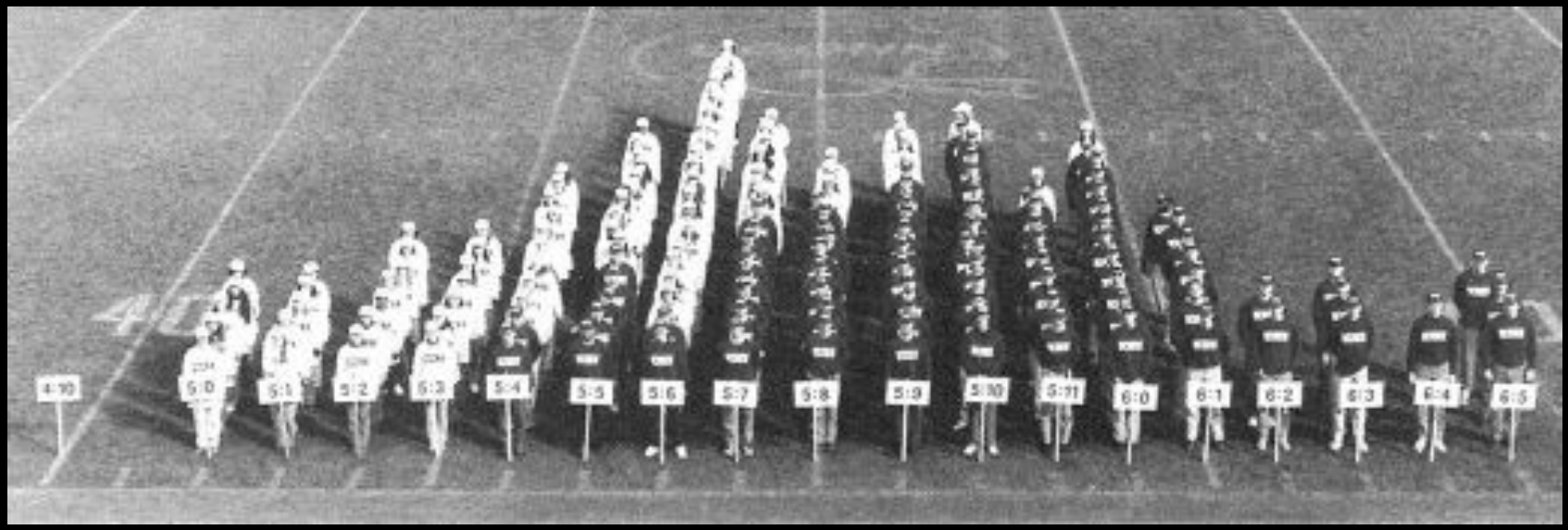
Natural selection on single-gene traits can lead to changes in allele frequency and evolution



The allele for dark colored moths become more common in the gene pool

Stop Here

Natural Selection on Polygenic Traits

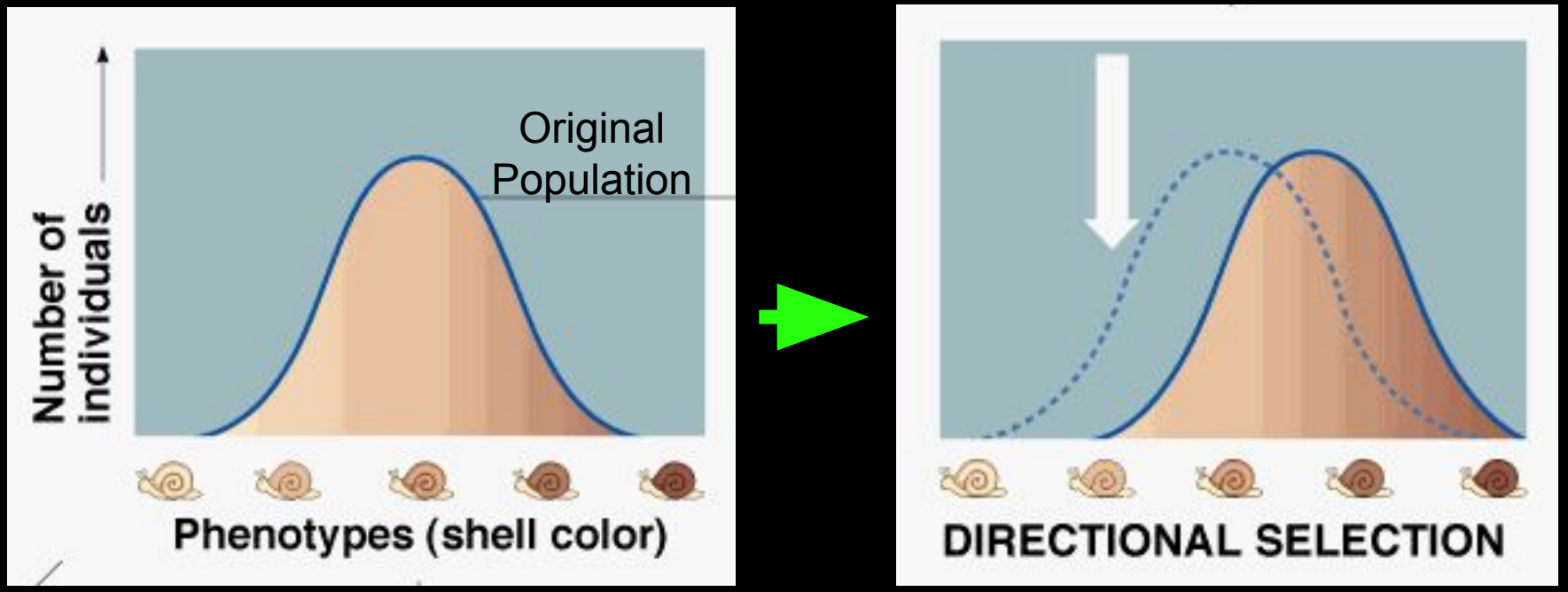


Natural Selection on Polygenic Traits

Natural selection can affect the distribution of phenotypes in any of three ways:

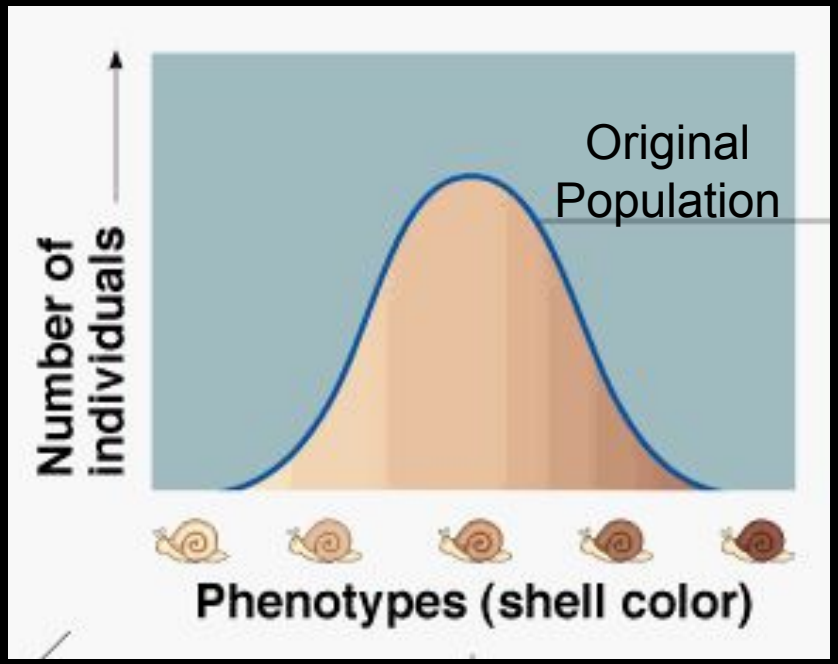
1. Directional Selection
2. Stabilizing Selection
3. Disruptive Selection

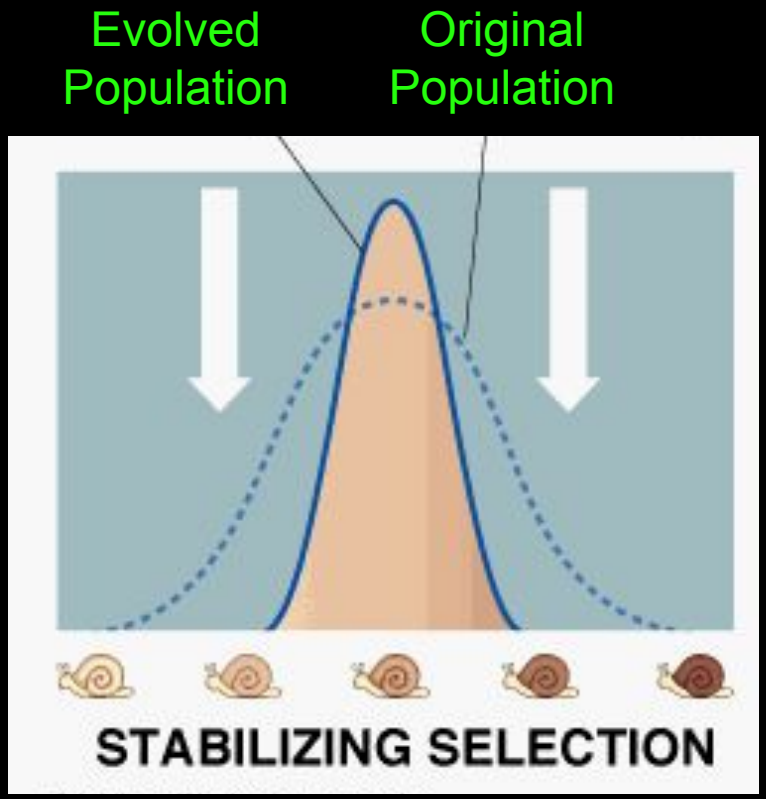
Directional Selection



Individuals at one end of the bell curve have higher fitness than individuals in the middle or at the other end.

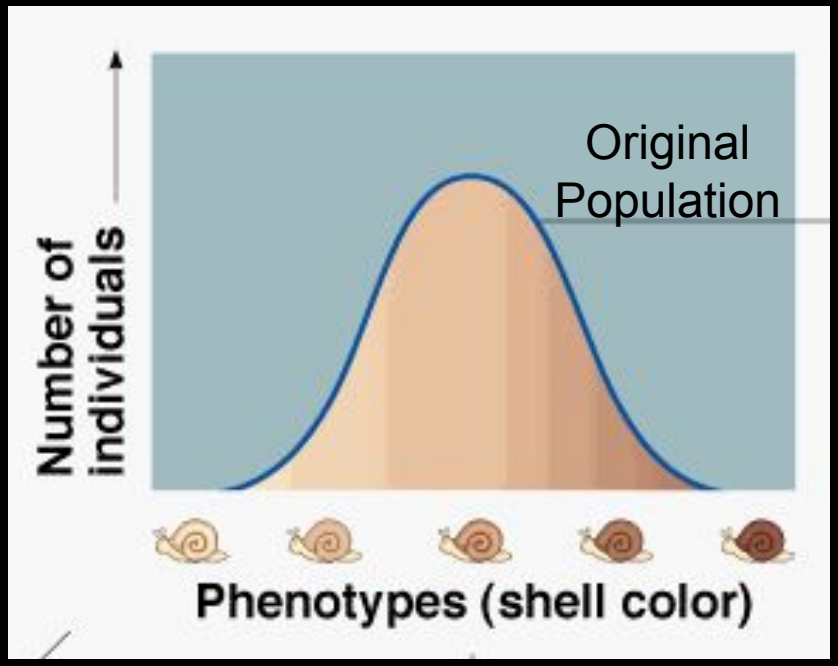
Stabilizing Selection

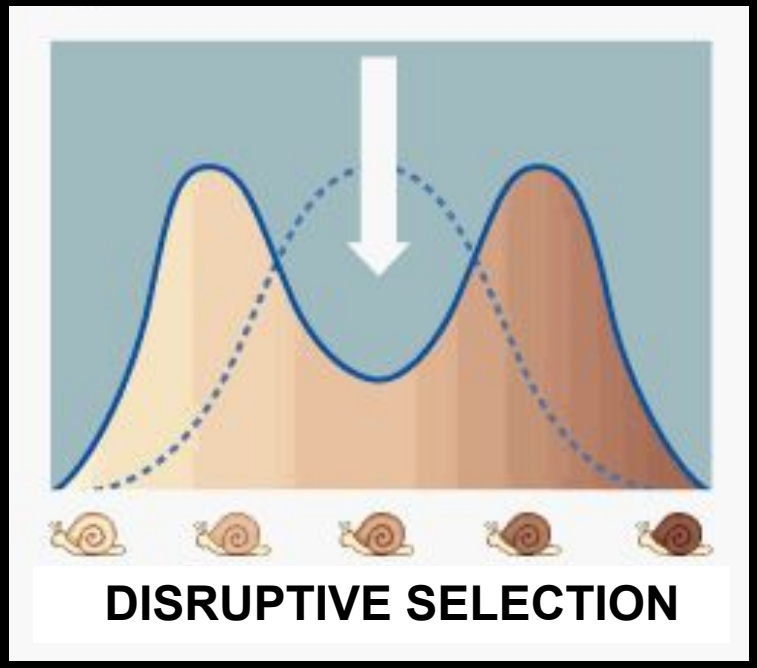




Individuals near the center of the bell curve have higher fitness than individuals at either end

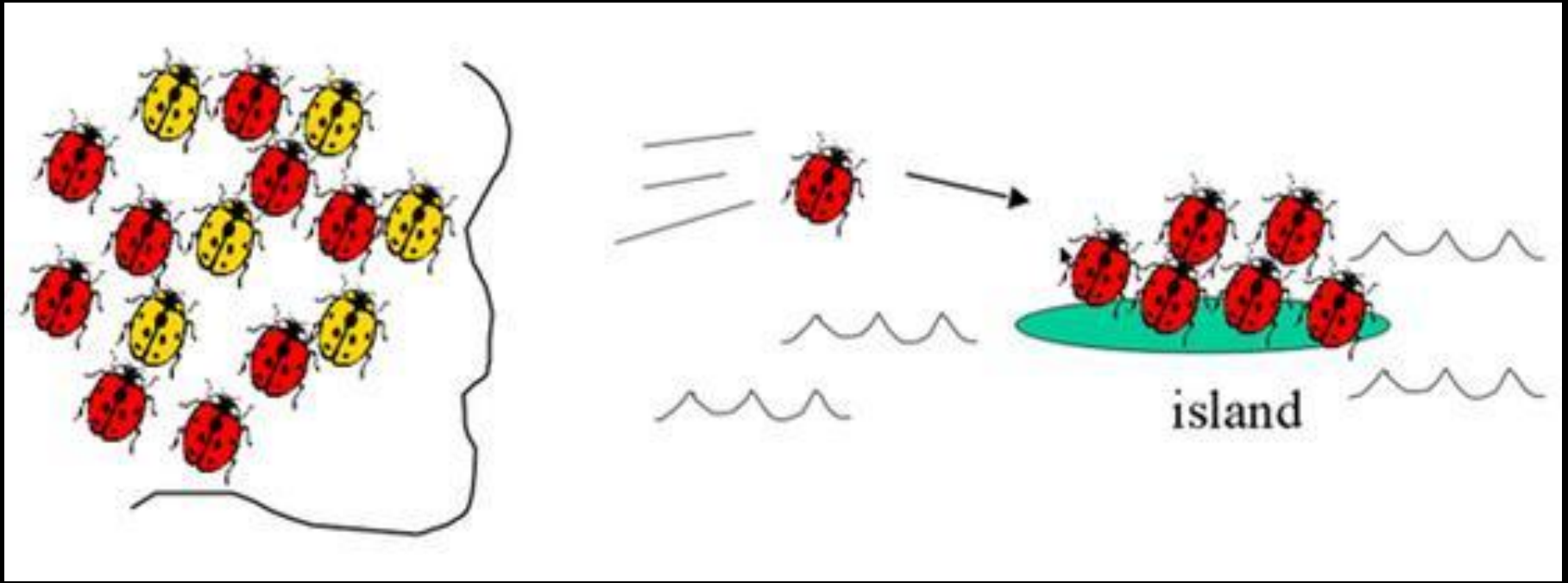
Disruptive Selection





Individuals at the upper and lower ends of the bell curve have higher fitness than individuals near the middle.

Founder Effect



Newly founded populations have allele frequencies different from original population.
Not the cause of natural selection, but chance.

Genetic Drift

In small populations, an allele can become more or less common simply by chance rather than through fitness.

Stop Here

Learning Objectives

- Explain how natural selection affects single-gene and polygenic traits
- Describe genetic drift
- List the five conditions needed to maintain genetic equilibrium

Genetic Equilibrium

Genetic equilibrium - allele frequencies remain constant

5 Factors Required to Maintain Genetic Equilibrium

1. There must be random mating
2. The population must be very large
3. There can be not movement in or out of the population
4. No mutations
5. No natural selection

Hardy-Weinberg Principle

Allele frequencies in a population will remain constant unless one or more factors cause those frequencies to change.

Hardy-Weinberg Principle

p = the frequency of the dominant allele (represented here by *A*)

q = the frequency of the recessive allele (represented here by *a*)

For a population in genetic equilibrium:

$p + q = 1.0$ (The sum of the frequencies of both alleles is 100%.)

$(p + q)2 = 1$

so

$p2 + 2pq + q2 = 1$

The three terms of this binomial expansion indicate the frequencies of the three genotypes:

$p2$ = frequency of *AA* (homozygous dominant)

$2pq$ = frequency of *Aa* (heterozygous)

$q2$ = frequency of *aa* (homozygous recessive)