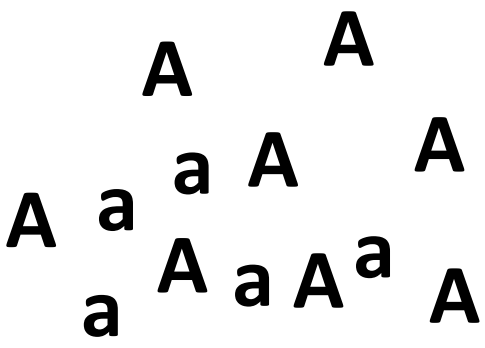
Section 9.1: Mechanisms of Evolution and Effect on Populations

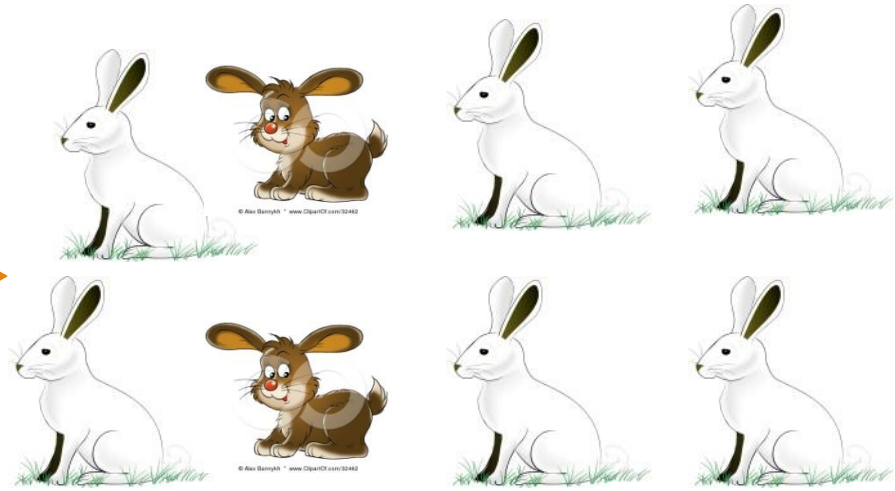
SBI3U1

Evolution of the population

Although individual organisms with a selective advantage survive and reproduce, it is the populations that evolves not the individual organism.

One must consider the genes within a population to understand how it may evolve. The ***higher % of a certain allele*** the more prominent the characteristic.





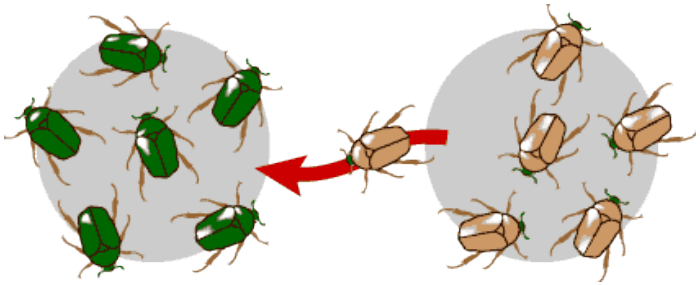
Evolution of the population – Key Terms

Allele Frequency:

Microevolution: small changes that occur over time that may lead to a change in allele frequency.

Factors that Affect Allele Frequency

1. Mutation
2. Gene Flow
3. Non-Random Mating
4. Genetic Drift
5. Natural Selection



1) Mutations

Mutations tend to introduce new alleles into a gene pool and thus In turn introduce new variations into a population.

Warafin (rat poison) resistant rats in Norway caused increase in rat population.

More genetic variation the greater the chance for selective advantage.

Recall: peppered moths, antibacterial resistance

2) Gene Flow

The movement of alleles from one population to another due to the migration of individuals

If the grey wolf finds another mate in the new population, it will introduce new genes into that gene pool. Thus increasing genetic diversity.

3) Non-Random Mating

Non Random Mating: based on preferred phenotype (or due to inbreeding). This will lead to less variations of alleles within the population.

Random Mating: partners are randomly chosen. There is no likelihood that one organism will be chosen over another. This enables there to be greater variation of alleles in the population.

3) Non-Random Mating

Peacocks choose mates based on the tail/dance

Humans choose mates based on characteristics/values

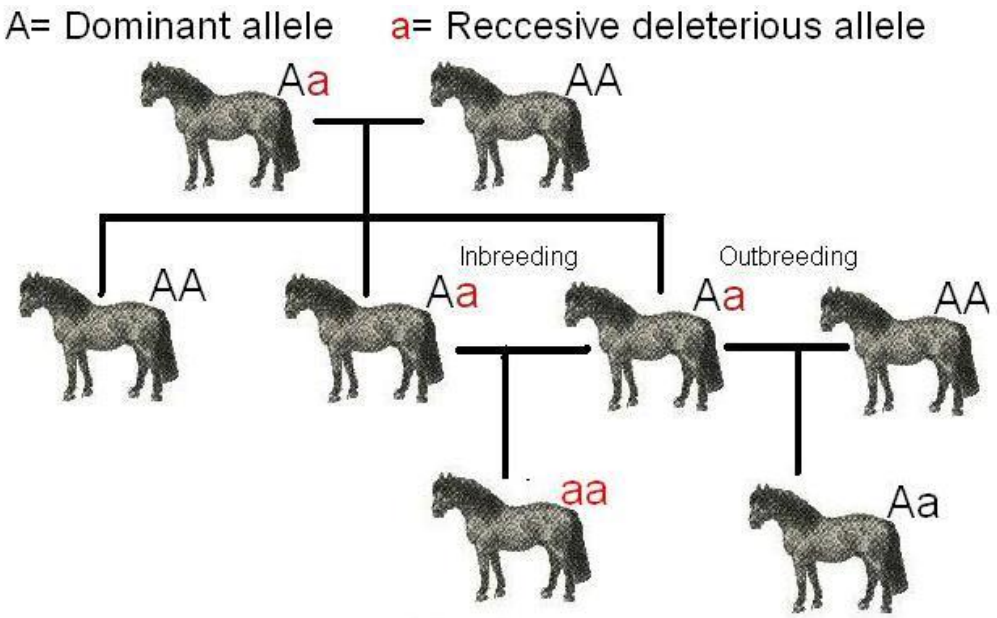
Male Caribou spar for a mate

3) Non-Random Mating

Inbreeding: closely related individuals breed

- *E.g. Self fertilization in plants, purebred dogs*

Inbreeding may cause the homozygous recessive traits to be more prominent in a population.



3) Non-Random Mating - Inbreeding

Inbreeding increase frequency of homozygous genotypes

- Harmful recessive alleles can be expressed
- E.g. Pandas experience high infant mortality rates/poor fertility
- E.g In dogs = lower immune system function, hip dysplasia, respiratory problems

4) Genetic Drift

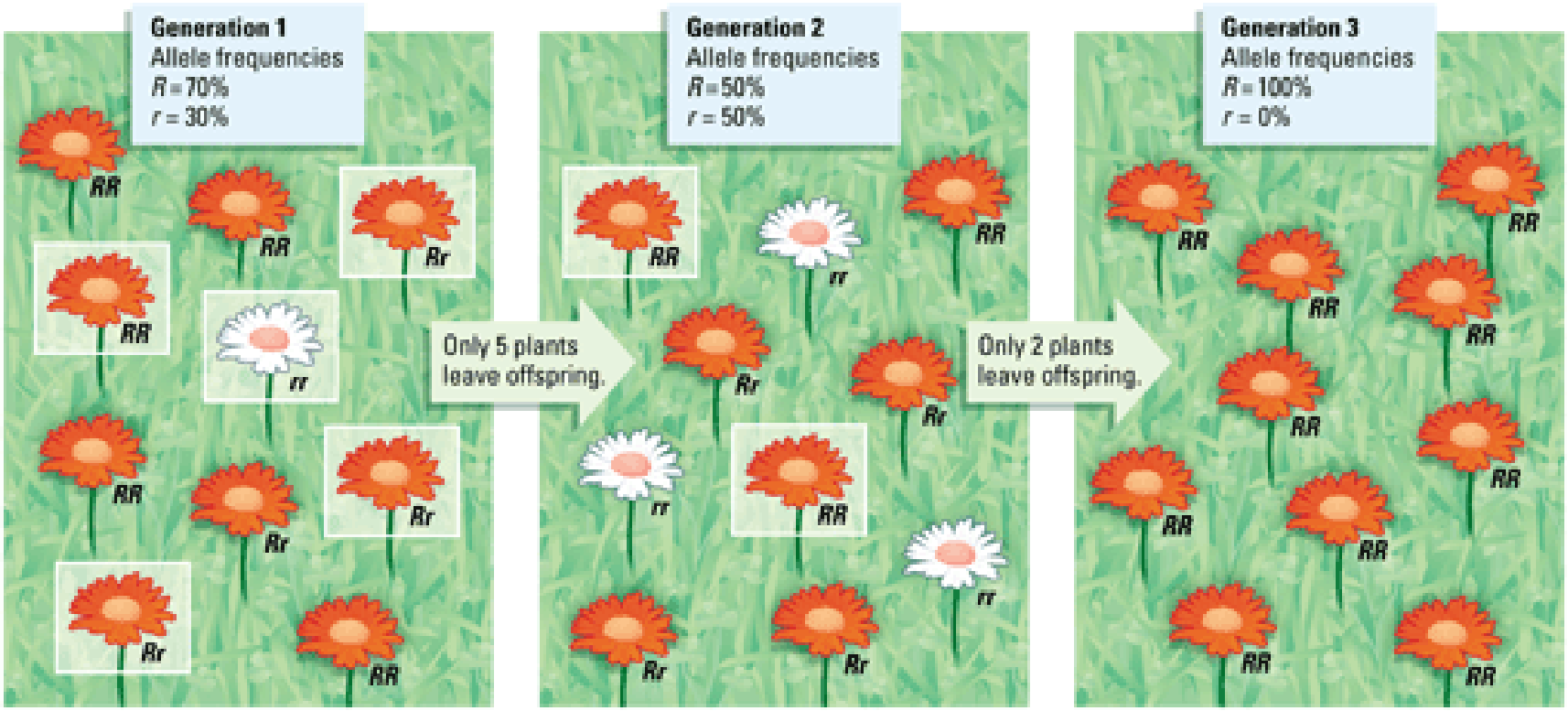
Genetic Drift:

Smaller populations are more susceptible to changes from genetic drift

- Due to rapid loss of alleles
- Leads to fixation (one allele for a gene)

The smaller the population, the less likely that the parental genotype will appear in the population.

4) Genetic Drift - Flowers



4) Genetic Drift

Large populations are less susceptible to the effects of genetic drift

Two situations that can lead to significant genetic drift in large populations:

1. Founder Effect
2. Bottleneck Effect

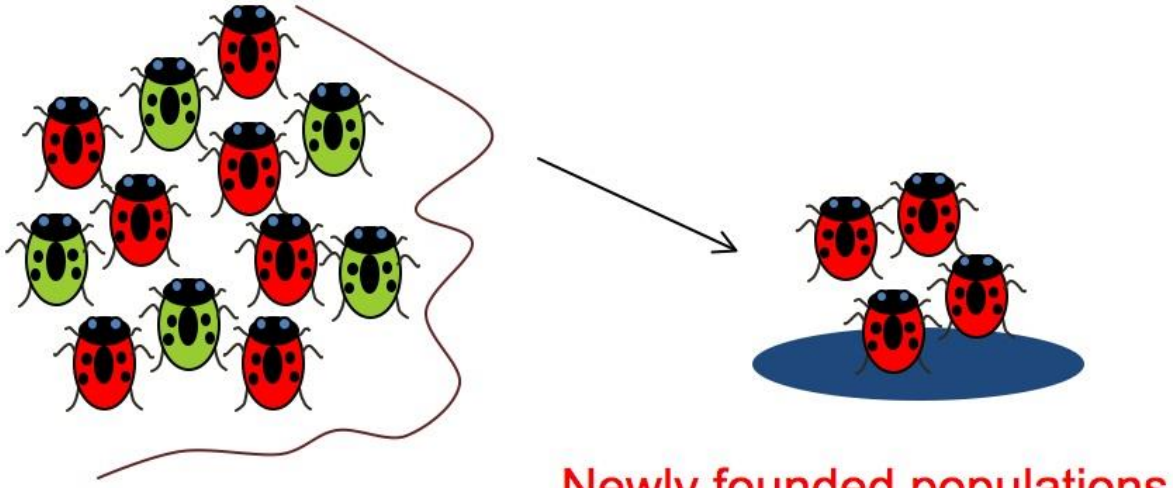
4) Genetic Drift – Founder Effect (large populations)

Founder Effect:

Example: Polydactylism in Philadelphia Amish Community was founded by a few families. Inbreeding lead to minimal genetic diversity

The founders of the new population only carry a few of the genes from the original population, thus there are limited genes in the population.

4) Genetic Drift – Founder Effect (large populations)

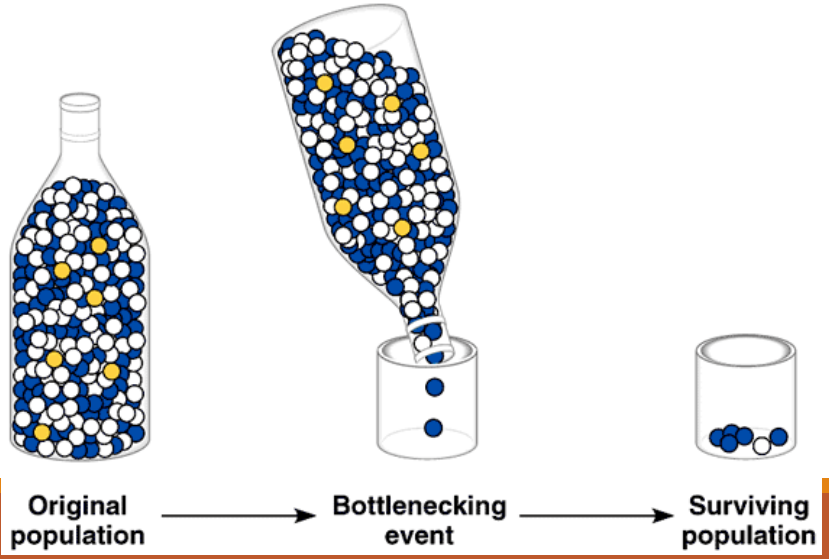


Newly founded populations don't always represent the genetic diversity in their sources.

4) Genetic Drift – Bottleneck (large populations)

Bottleneck Effect:

Genetic variation is reduced. When the population begins to rebuild, it is only representative of the original population that survived the disaster.



Northern elephant seals were hunted in 1890s, this reduced population to 20 individuals. The genes are representative of the remaining 20

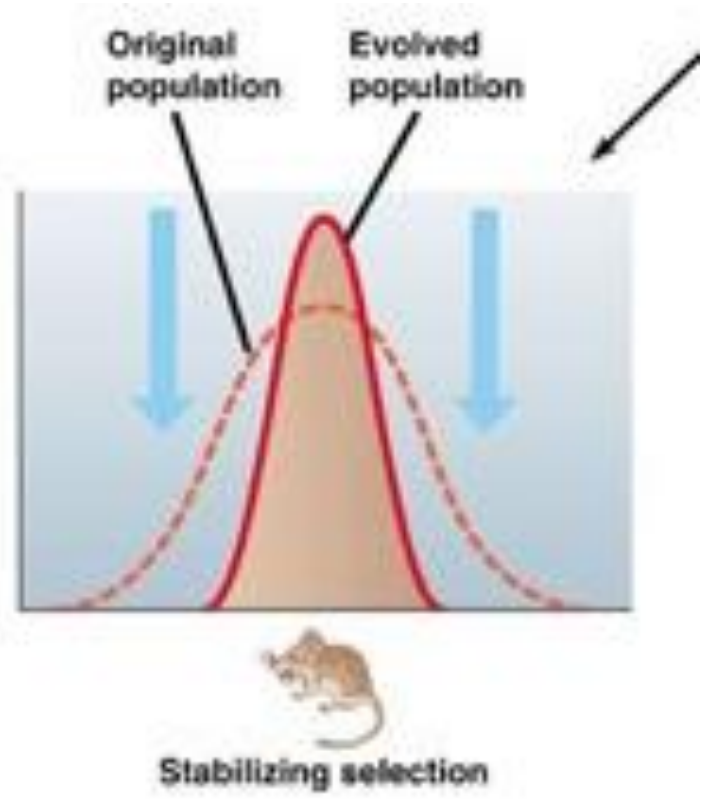
5) Natural Selection

Types of natural selection that affect frequencies of heritable traits:

1. Stabilizing selection
2. Directional selection
3. Disruptive selection

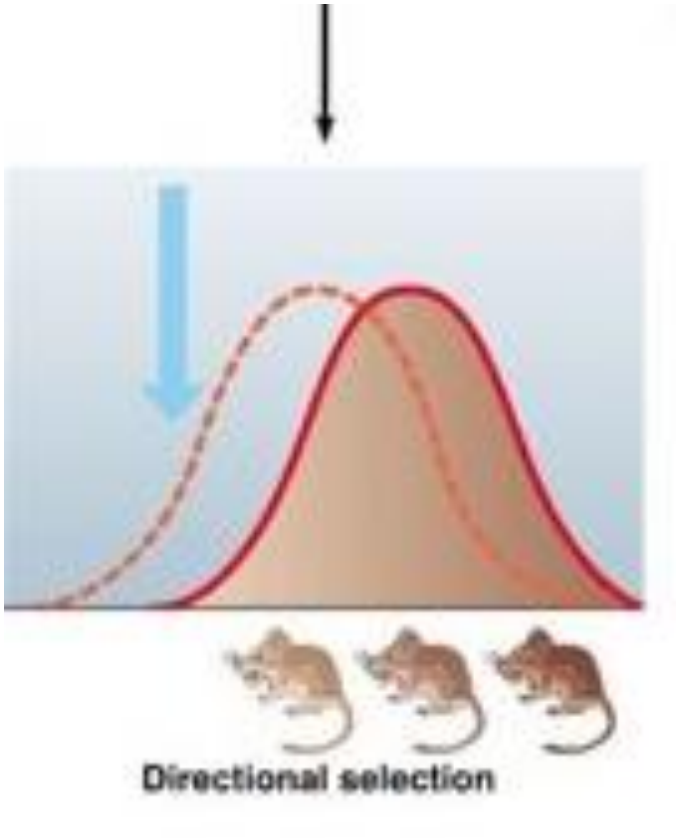
5) Natural Selection – Stabilizing Selection

***Stabilizing Selection**: favours intermediate phenotypes and acts against extreme variants of the phenotype*



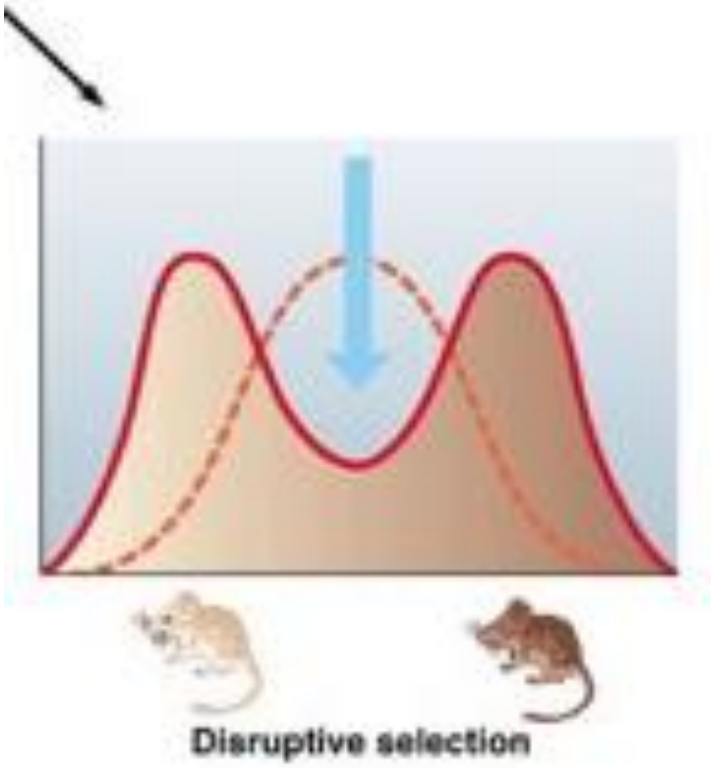
5) Natural Selection – Directional Selection

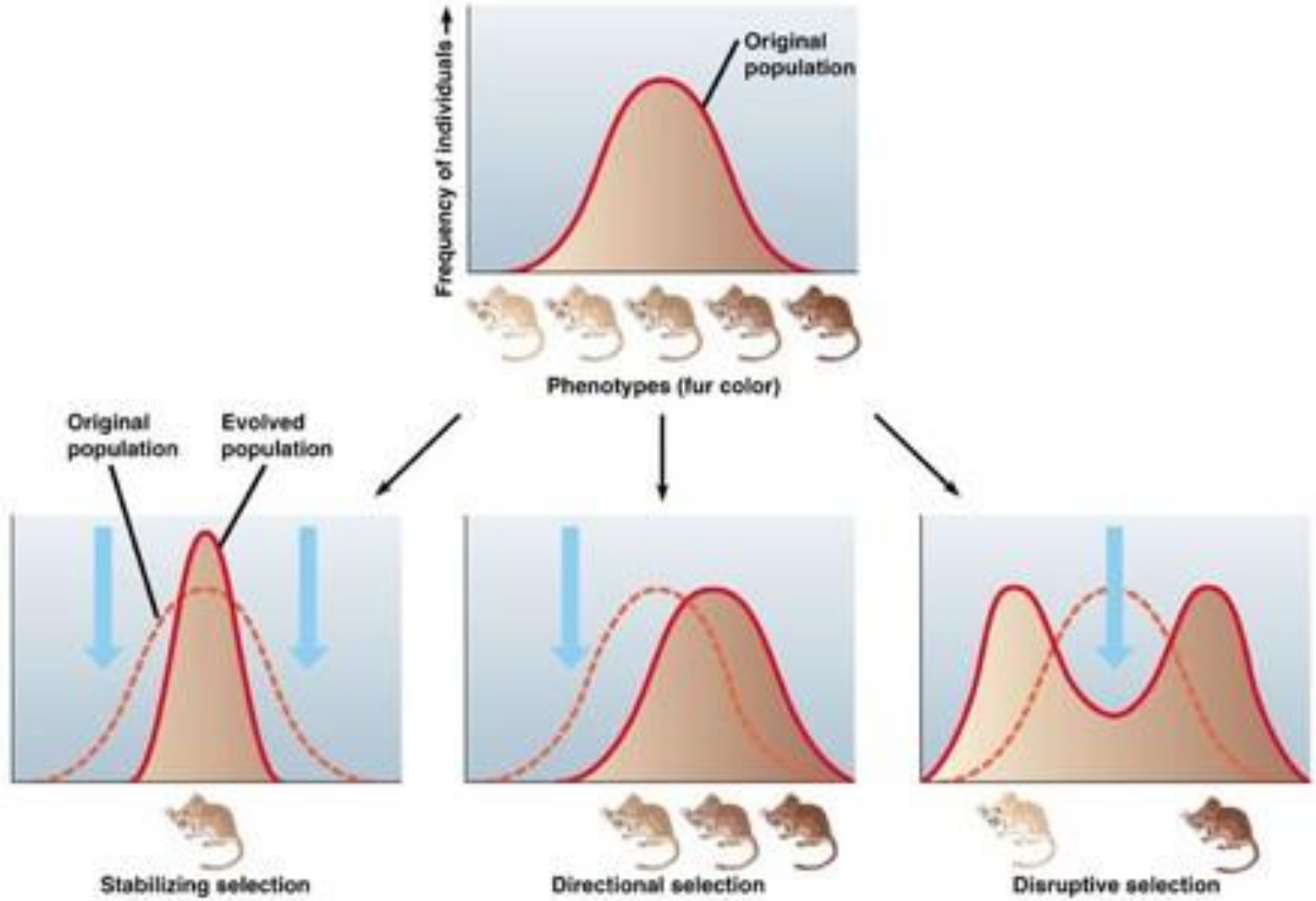
Directional Selection: *favours phenotypes at one extreme over the other.*



5) Natural Selection – Disruptive Selection

Disruptive Selection: *extremes of a range of phenotypes rather than intermediate are favoured*




Frequency of individuals
Original population
Phenotypes (fur color)
Original population
Evolved population
Stabilizing selection
Directional selection
Disruptive selection

5) Natural Selection

E.g Visual display (Peacocks)

***Sex Selection**: competition for mates between males and choices made by females*

***Sexual dimorphism**: difference in appearance between males and females*

E.g. Green head in male mallard ducks and antlers on male deer

Homework

Textbook p. 359 : # 2, 6 , 8 & 9