

UNIT 8: EVOLUTION

Theory of Evolution

What is evolution?

- ⦿ Involves changes in populations, species, or groups of species
- ⦿ Process by which the frequency of heritable traits (alleles) in a population changes from one generation to the next
 - i.e. the gene pool changes, individuals do not evolve

Jean-Baptiste Lamarck

- ◎ Theory included two main ideas:
 1. **Use and disuse** – body parts can develop with increased use, unused parts weaken
 - Turned out to be correct
 2. **Inheritance of acquired traits**- body features acquired during the lifetime of an organism could be passed onto offspring
 - Turned out to be incorrect – only changes in genetic material can be passed on

Charles Darwin

- Published his ideas 50 years after Lamarck in *The Origin of Species*
- Theory- Natural selection or “survival of the fittest” was the driving force of evolution

Natural Selection

- ⦿ Differences in survival and reproduction among individuals in a population
 - i.e. some individuals possess alleles that generate traits that enable them to cope more successfully in their environment than other individuals

Natural Selection

- More successful individuals produce more offspring
- Superior inherited traits are adaptations to the environment and increase an individual's fitness
 - Fitness – relative ability to survive and produce offspring

Darwin used the following arguments for Natural Selection:

- Populations have an enormous reproductive potential
- Population size remains stable
- Resources are limited
- Individuals compete for survival
- There is variation among individuals in a population
- Most variation is heritable
- Only the most fit individuals survive
- Evolution occurs as favorable traits accumulate in a population

Variation is key!

What are the sources of variation?

- Mutations
- Sexual Reproduction
 - Crossing-over
 - Independent assortment of homologous chromosomes
 - Random joining of gametes

GENETIC DRIFT

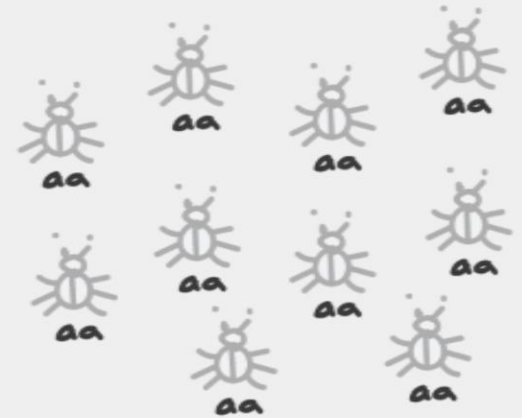


Freq. of A = 0.3
Freq. of a = 0.7

Due to chance events, only these 3 beetles leave offspring



Next generation



Freq. of A = 0.0
Freq. of a = 1.0

Three Types of Natural Selection:

1. Stabilizing selection-

- Eliminates individuals that have extreme or unusual traits
- Individuals that have the most common form of a trait are best adapted

Summary: stabilizing selection maintains the existing populations frequency of common traits and selects against all other traits

Three Types of Natural Selection:

2. Directional selection-

- Favors traits that are at one extreme
- Traits at the opposite extreme are selected against
- E.g. insecticide resistance, peppered moth, Darwin's finches

Summary: If directional selection continues for many generations, favored traits become more and more extreme = distinct changes in allele frequencies

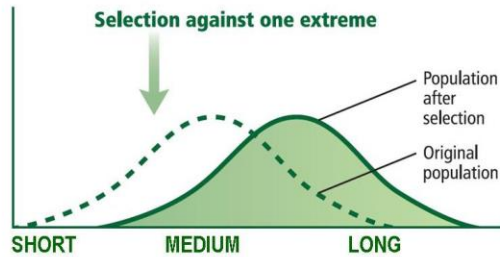
Three Types of Natural Selection:

3. Disruptive selection-
 - The environment favors extreme or unusual traits and selects against common traits

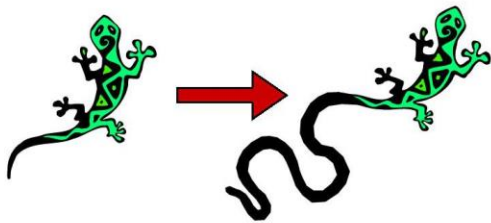
Summary: selection against the mean

HOW does the trait change?

Directional Selection

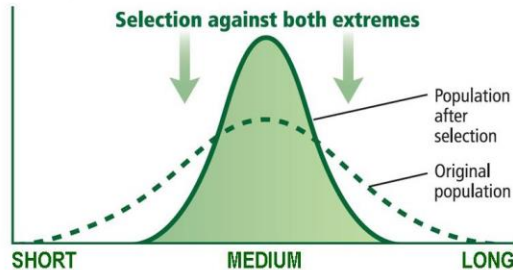


FOR: one extreme trait
AGAINST: the other extreme

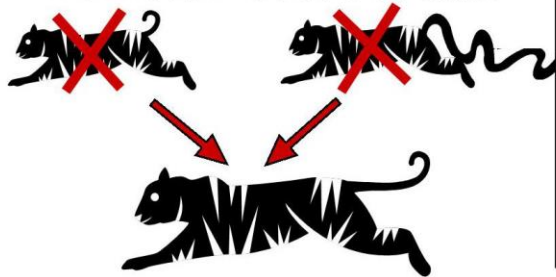


EX. Long wiggly tails look like a snake and scare predators. The longer the tail, the more it looks like a snake.

Stabilizing Selection

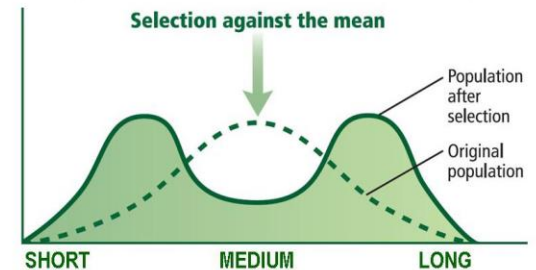


FOR: moderate traits
AGAINST: both extremes

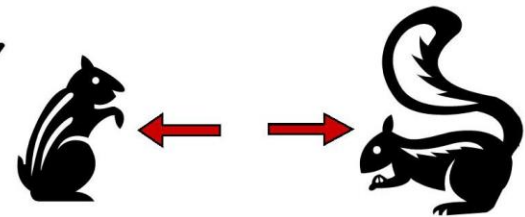


EX. Short tails mess up the cat's balance. Long tails drag on the ground. Medium tails are best.

Disruptive Selection



FOR: both extremes
AGAINST: moderate traits



EX. Short tails help keep predators from catching you on the ground. Long tails are good for balance in the trees. Medium tails don't help.