



Introduction to Natural Selection

EVO-1.C.1

Natural selection is a major mechanism of evolution.

EVO-1.C.2

According to Darwin's theory of natural selection, competition for limited resources results in differential survival. Individuals with more favorable phenotypes are more likely to survive and produce more offspring, thus passing traits to subsequent generations.



Introduction to Natural Selection

EVO-1.D.1

Evolutionary fitness is measured by reproductive success.

EVO-1.D.2

Biotic and abiotic environments can be more or less stable/fluctuating, and this affects the rate and direction of evolution; different genetic variations can be selected in each generation.

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TOPIC

7.1



Who is the “father of evolution”

- A. Aristotle**
- B. Darwin**
- C. Lamarck**
- D. Mendel**

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Who is the “father of evolution”

B. Darwin



On the Origin of Species (or, more completely, On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life), published on 24 November 1859, is a work of scientific literature by Charles Darwin that is considered to be the foundation of evolutionary biology. Darwin's book introduced the scientific theory that populations evolve over the course of generations through a process of natural selection. The book presented a body of evidence that the diversity of life arose by common descent through a branching pattern of evolution. Darwin included evidence that he had collected on the Beagle expedition in the 1830s and his subsequent findings from research, correspondence, and experimentation. - Wikipedia

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What is Darwin's theory of natural selection?



What is Darwin's theory of natural selection?

Individuals with more favorable traits for their environment will be

- > more likely to survive to reproduce**
- > leave more offspring for the next generation**

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Which of the following evolves?

- A. Individuals**
- B. Populations**

Which of the following evolves?

B. Populations



Individuals are selected for or against based on their phenotypic characters. That selection causes certain phenotypes to be more likely to survive and thus the frequency of the trait in the population will change. This means that the population has evolved not the individuals.

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**What does it mean if an organism is “more fit”?
(what does fitness mean?)**

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7.1

**What does it mean if an organism is “more fit”?
(what does fitness mean?)**



Fitness is reproductive success

So... how many individuals do you leave for the next generation (and, of those, how many can reproduce?)

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A mule is a hybrid between a horse and donkey. What is the reproductive fitness of a mule?

- A. 0**
- B. 0.25**
- C. 0.5**
- D. 1.0**

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A mule is a hybrid between a horse and donkey. What is the reproductive fitness of a mule?

A. 0



The mule is sterile. This means that the mule is unable to reproduce. Since it is unable to reproduce, it does not contribute to the next generation thus its reproductive fitness is zero.

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What are the three types of selection?

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What are the three types of selection?



- > **Directional**
- > **Disruptive**
- > **Stabilizing**

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Describe the three types of selection.

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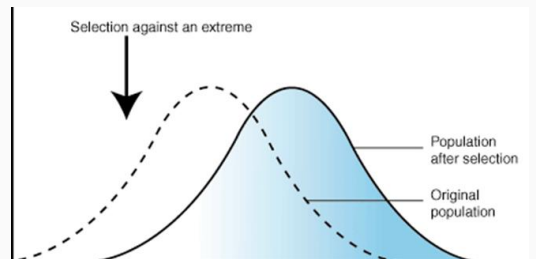
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Describe the three types of selection

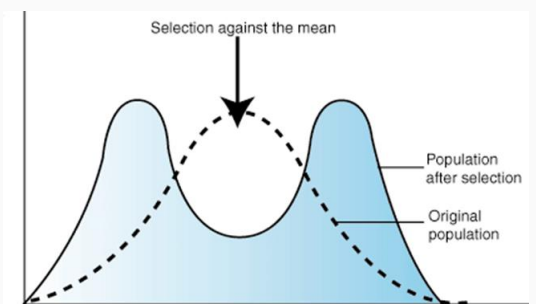
Directional Selection:

The phenotype at one extreme is selected leading to the population shifting in a direction



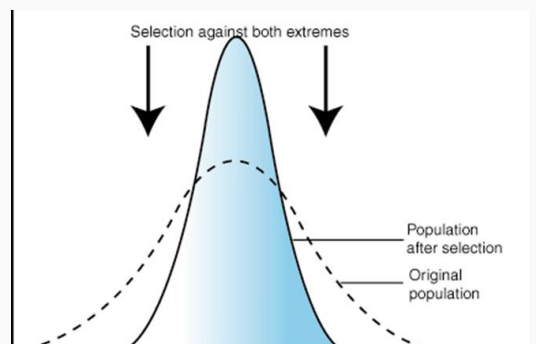
Disruptive Selection:

Phenotype at two extremes is selected for leading to a shift towards the two extremes



Stabilizing Selection:

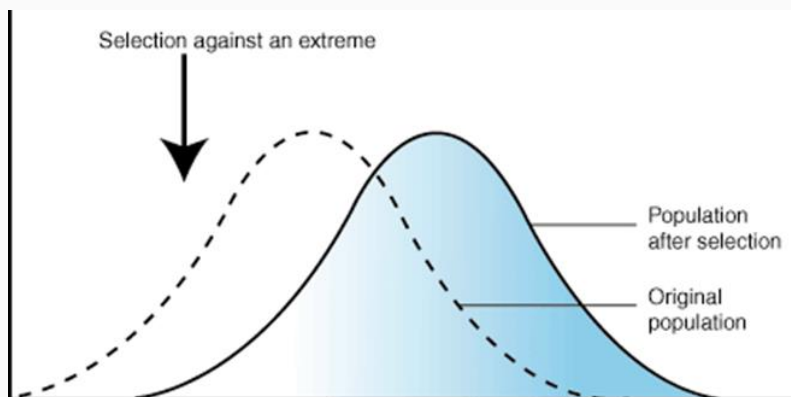
The intermediate is selected for leading to an increase in the intermediate phenotype



Describe the three types of selection



Directional Selection:

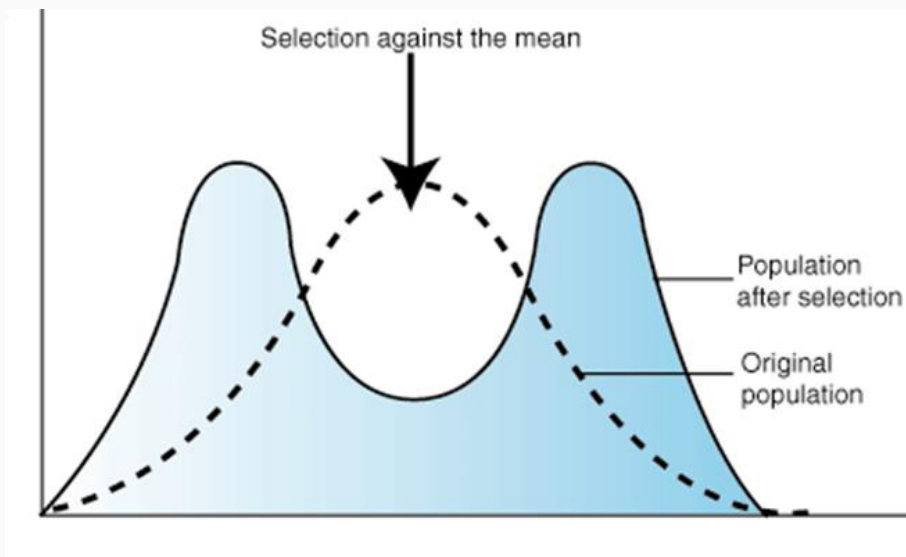


The phenotype at one extreme is selected leading to the population shifting in a direction

Describe the three types of selection



Disruptive Selection:

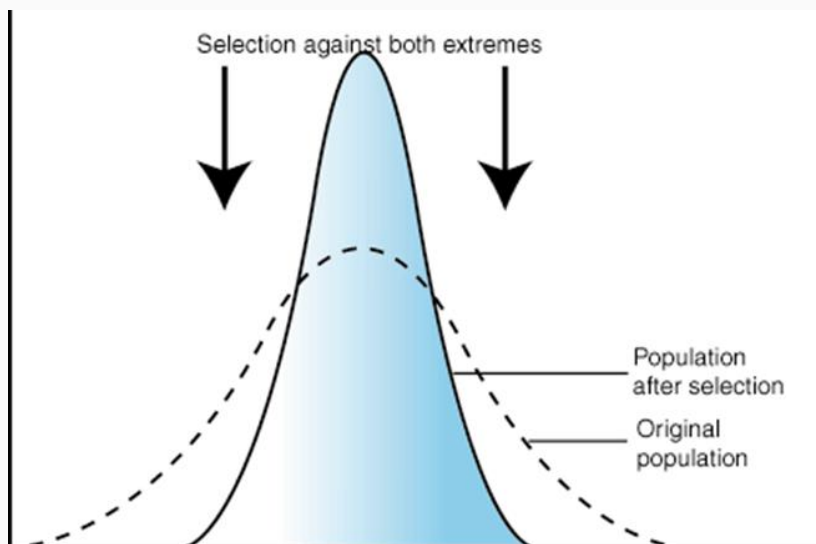


Phenotype at two extremes is selected for leading to a shift towards the two extremes

Describe the three types of selection



Stabilizing Selection:



The intermediate is selected for leading to an increase in the intermediate phenotype

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Peppered moths became darker during the industrial revolution due to the trees becoming darker. What type of selection describes the peppered moth population?

- A. Directional**
- B. Disruptive**
- C. Sexual**
- D. Stabilizing**

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7.1

Peppered moths became darker during the industrial revolution due to the trees becoming darker. What type of selection describes the peppered moth population?



A. Directional

Before the industrial revolution, the moths were light. After the industrial revolution, the moths were dark. The frequency of the dark phenotype has increased; thus, it is **DIRECTIONAL** selection as phenotype has shifted towards **ONE** phenotype.

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Birth weight averages between 6 to 8 pounds. Which type of selection describes birth weight of humans?

- A. Directional**
- B. Disruptive**
- C. Sexual**
- D. Stabilizing**

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7.1

Birth weight averages between 6 to 8 pounds. Which type of selection describes birth weight of humans?

D. Stabilizing



The frequency of birth weights have maintained between 6 to 8 pounds. Since the weight has stabilized to the intermediate phenotype, this is **STABILIZING** selection.

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Drought causes an absence of food for medium beaked birds. Which type of selection describes the bird population?

- A. Directional**
- B. Disruptive**
- C. Sexual**
- D. Stabilizing**

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7.1

Drought causes an absence of food for medium beaked birds. Which type of selection describes the bird population?

B. Disruptive



As the food for the medium (intermediate) beaked birds decreased, these birds are less likely to survive. There is a decrease in the intermediate phenotype and an increase in the TWO extreme phenotypes, so this is **DISRUPTIVE selection.**



What is natural selection?

- A. Organism with less favorable traits are more likely to live
- B. Organism with more favorable traits are more likely to live
- C. Nature selects for the less favorable traits
- D. Nature selects against the most favorable traits.

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What is natural selection?

B. Organism with more favorable traits are more likely to live



Individuals with more favorable traits will be more likely to survive.

Since they are more likely to survive, they are more likely to leave offspring (and those offspring are more likely to survive). So, nature selects for the more favorable traits and against less favorable traits.

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Describe Darwin's theory of natural selection

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**Describe Darwin's theory
of natural selection**



**Organism with more favorable
traits are more likely to survive
and leave more offspring to the
next generation.**

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7.1



Horse and donkey have unequal number of chromosomes, so the offspring has an odd number of chromosomes and is sterile. What is the fitness of the offspring?

- A. 0**
- B. $\frac{1}{2}$**
- C. 1**
- D. Cannot be determined**

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7.1

Horse and donkey have unequal number of chromosomes, so the offspring has an odd number of chromosomes and is sterile. What is the fitness of the offspring?

A. 0



Fitness refers to the ability to survive to reproduce and that offspring surviving to reproduce. Since the offspring has an odd number of chromosomes, it is unable to pair homologous chromosomes and is sterile. The offspring is unable to reproduce and does not contribute to the gene pool thus its fitness is zero.

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Evolution produces perfect organisms

A. True

B. False

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Evolution produces perfect organisms

B. False



The environment is constantly changing thus the favorable traits are constantly changing. In addition, natural selection can only select from available phenotypes. If the mutation does not exist, it cannot be selected for.

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Note:



Evolution can only act on the current phenotypes available, so it select for the most favorable but as the environment changes the “favorable” traits can also change so a different trait is selected for