

Modes of Natural Selection

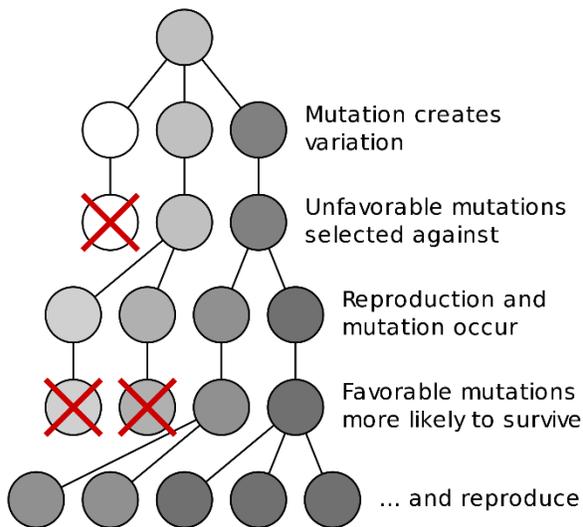
Guided Notes

What is Natural Selection?

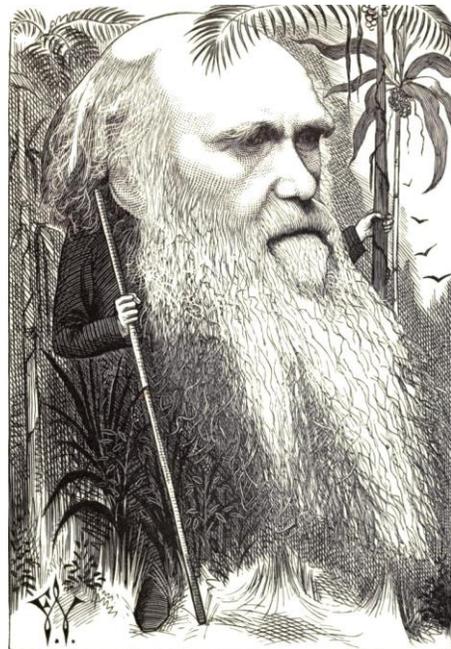
Natural selection is a random process in which an organism containing some desirable traits are most likely to survive and can reproduce in the environment in which it is living.

Key Points of Natural Selection

1. Natural selection leads to adaptive evolution that provides the organism with some beneficial traits.
2. Adaptation occurs in an organism that helps the organism to _____ in adverse environmental conditions.
3. Darwin's theory for evolution talks about divergence of species. It suggests that all living organisms evolved from _____.



Natural Selection



Charles Darwin

Modes of Natural Selection: Darwin's theory of evolution is based on natural selection that occurs in many forms. The three modes of natural selections are as follows:

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

These are also considered as examples of the **adaptive evolution**.

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Stabilizing Selection

In this type of natural selection, the genetic diversity decreases with the stabilization of population. Here the genetic diversity in a population is decreased and selection is stabilized. It favors the major and well-suited phenotype in a population. Stabilizing selection is the **most common** mode of natural selection in evolution. This mode of selection does not lead to any **adaptive change** or evolution.

A classic example of stabilizing selection is **birth weight of human babies**. The extremities of birth weight that is too low and too high weight both are considered _____. If the human baby underweight, she is too weak and the baby who is overweight will have problems while passing through the birth canal. Thus, average weight of human baby is considered normal.

Another example can be **length of flower with nectars (nectary)**. If the flowers are positioned too high, the insects will not be able to reach at that height. If the flower is present too low, the insects will not be able to meet anthers and no pollination will occur.



Insect Feeding on Nectar

Height of a plant is also an example of stabilizing selection. Height of a plant might act as a stabilizing natural selection where the extreme conditions may not favor the plant. If the plant is _____, it will not get enough sunlight and will not be able to compete with other tall plants for survival. If the plant is _____, it will be susceptible to wind and might get damaged due to strong wind. Thus, the plants with **medium height** will be extremely likely to survive even in adverse climatic conditions.

Stabilizing Selection Curves: These curves are bell shaped with no skews. The peak here is _____ than the normal peak. _____ shows stabilization selection curve where blending of traits occurs.

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Directional Selection

In this mode of selection, _____ is favored and leads to shift in the allele frequency in **one direction**. This type of selection occurs in one direction where one trait is more successful over the other. This leads to shifting of population in one direction. Directional selection can also lead to increase in the biomass of the seed production. This is the most talked about mode of selection in evolution.

A classic example for directional selection is the evolution of black moth during _____ in England. Before industrial revolution occurred, two varieties of peppered moth were found light colored and dark colored. The number of light colored moth were more because the branches of the trees were also light colored, and the moth used to blend with the trees and could not be spotted by the predators. Due to industrial revolution, soot from industries got deposited on the tree branches and they became darker in color. This favored the dark colored moth and the _____ moth were easily spotted by the _____.



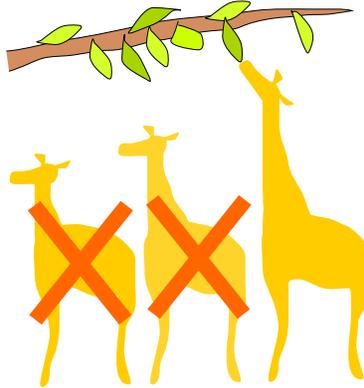
Light and Dark Colored Peppered Moth (*Biston betularia*)



Directional Selection Due to Change in Color of Environment

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Another example is the **neck length of giraffe**. Due to environmental pressure the giraffes with long necked giraffes are favored that could reach tall trees for food. The giraffes with short necks could not reach the top of the tall trees and will be slowly eliminated from the population. Both long and short necks are extreme parameters but only one is favored that is long neck.



Directional Selection Due to Tall neck of Giraffe

Directional Selection Curves: The curve obtained in case of directional selection is _____ when all the individual traits are plotted on the graph. The bell curve moves on one direction either on the left side or right side. These curves are depend upon color of population and type of food available in the environment.

Disruptive Selection

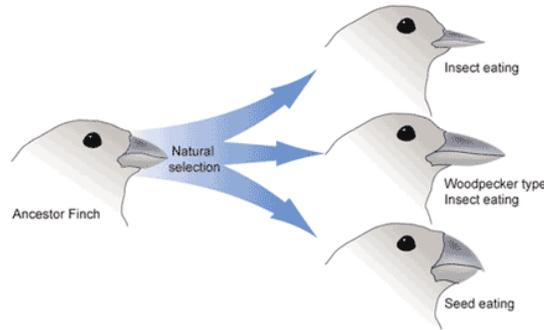
It is also called _____ where the extreme values for a trait are favored rather than the intermediate values. In this type of natural selection, the individuals of both the extremities such as low and high values exist. It also plays role in **speciation** or _____. It is often considered opposite of _____. It occurs in population with high-density where the resources are scarcer, and competition is more.

_____ are classic example of disruptive selection. Darwin's finches have different kinds of beaks that differed in their shapes and sizes depending upon the availability of food. In case of the finches, the birds with small beaks and bigger beaks, both exist.

Another example of disruptive selection is plants with different traits such as color of pea pods that is controlled by individual genes. _____ in late 1960s proposed this mode of selection for plant speciation. In this case, the heterozygous individual consists of different alleles for a gene while the homozygous individual contains two alleles

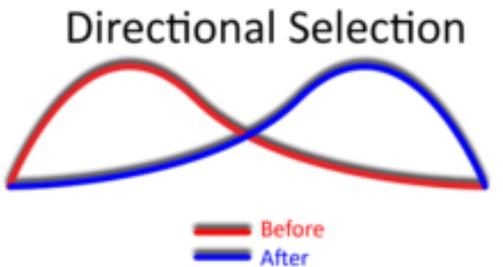
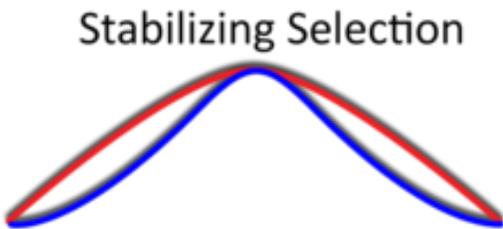
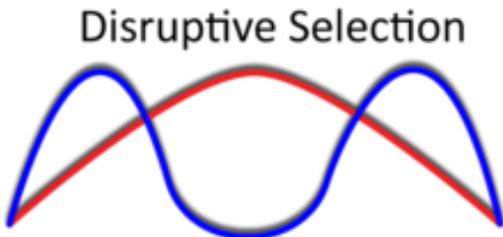
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of one trait. Two of the same allele will produce extreme end phenotypes that may reproduce more but become reproductively isolated after a period. Only the intermediates will survive and reproduce.

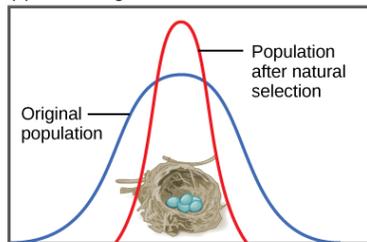


Darwin's Finches

Disruptive Selection Curves: These curves are also bell shaped but the curves skew in the middle when individuals are plotted on the graph. The characteristics of these curves are that these have _____ and one valley in the middle.

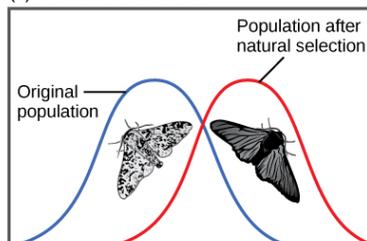


(a) Stabilizing selection



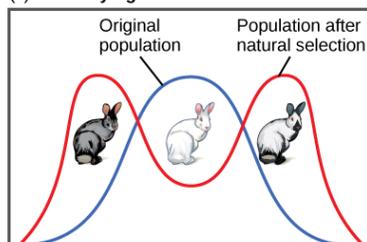
Robins typically lay four eggs, an example of stabilizing selection. Larger clutches may result in malnourished chicks, while smaller clutches may result in no viable offspring.

(b) Directional selection



Light-colored peppered moths are better camouflaged against a pristine environment; likewise, dark-colored peppered moths are better camouflaged against a sooty environment. Thus, as the Industrial Revolution progressed in nineteenth-century England, the color of the moth population shifted from light to dark, an example of directional selection.

(c) Diversifying selection



In a hypothetical population, gray and Himalayan (gray and white) rabbits are better able to blend with a rocky environment than white rabbits, resulting in diversifying selection.

Bell Curves of Modes of Natural Selection