Natural selection

Natural selection is defined as a process or a "force" that allows for organisms better adapted to their environment to better survive and produce more offspring. The theory of natural selection was first founded by Charles Darwin. The process of natural selection is important and is a driving force for evolution. For organisms to evolve, there needs to be differences in traits between organisms that provide certain advantages or disadvantages, and it is these traits that natural selection acts upon.

Natural selection works against all organisms, and it can be thought of as the environment and forces acting to stop organisms from surviving and reproducing. Therefore, organisms which are able to survive can also pass on their DNA to the next generation. This "selects" for those DNA sequences. Luckily for all organisms, genetic variability causes each individual to be slightly different. These slight differences in performance can lead to differences in the amount each individual reproduces. By reproducing more, an individual creates more of the genetic variations that helped it succeed. The offspring of these individuals will also benefit from the genetic variations that allowed their parents to succeed. Organisms without these genetic adaptations will not reproduce as much, and in this way, their lines will someday cease to exist. Nature constantly exerts a selective force on the different genetic combinations that try to reproduce, and in this way, natural selection is the major driving force of evolution.

When it comes to natural selection, there are three different types of selection that can occur. These types include the following:

Type 1: **Stabilizing Selection**:

Most traits in the animal kingdom can be described by a bell curve, in terms of their distribution. Most animals of a certain species tend to show the same trait or feature, of relatively the same size. There are always some exceptions of larger or smaller traits in certain individuals, but generally, most individuals sit somewhere in the middle.

Stabilizing selection is a form of natural selection that screens against the outliers, or exceptions to the trait. The screen prevents those animals from reproducing as much as the "normal" or more regular individuals. More babies are born that are "normal" and fewer outliers are seen in each consecutive generation because of this bias. It is in this way that species can become very distinct from other species, yet all members of a species will look exactly alike.

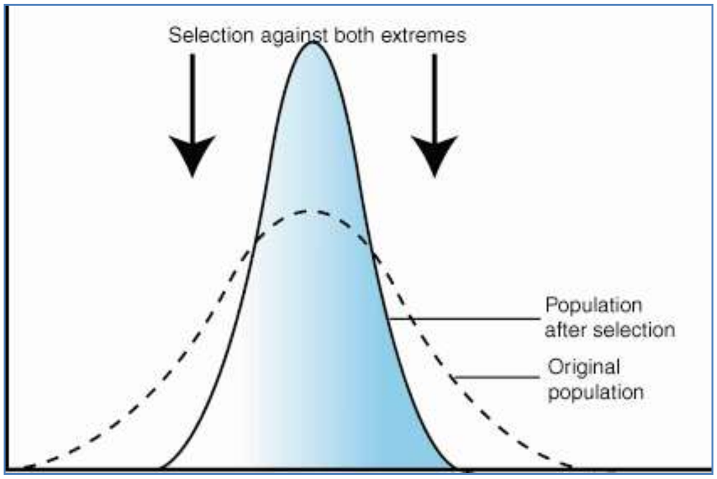

Fig: Stabilizing selection

When selective pressures select against the two extremes of a trait, the population experiences stabilizing selection. For example, plant height might be acted on by stabilizing selection. A plant that is too short may not be able to compete with other plants for sunlight. However, extremely tall plants may be more susceptible to wind damage. Combined, these two selection pressures select to maintain plants of medium height. The number of plants of medium height will increase while the numbers of short and tall plants will decrease.

Type 2: **Directional Selection:**

Directional selection is a type of natural selection that occurs when one side of the spectrum of a certain trait is favored over the other. For instance, if the smallest organisms get eaten, and larger organisms are totally protected, the population will tend to get much larger. If the opposite is true, the population will decrease in size over time.

It is also using directional selection artificially that humans can create "miniature" breeds of animals, which look like tiny copies of their larger counterparts. However, artificial selection only focuses on a single trait. This allows many negative traits to become present in the population, which would have naturally been selected against.

In directional selection, one extreme of the trait distribution experiences selection against it. The result is that the population's trait distribution shifts toward the other extreme. In the case of such selection, the mean of the population graph shifts. Using the familiar example of giraffe necks, there was a selection pressure against short necks, since individuals with short necks could not reach as many leaves on which to feed. As a result, the distribution of neck length shifted to favor individuals with long necks.

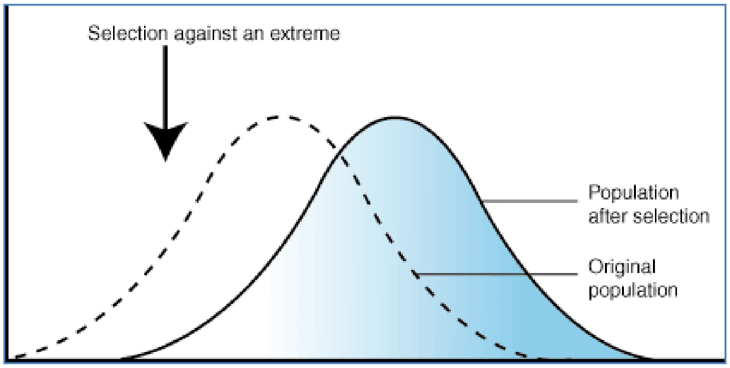

Fig: Directional selection

Type 3: **Diversifying Selection:**

Much like directional selection, diversifying selection pushes the population towards the extremes of the trait. This type of selection is also called **disruptive selection**. Diversifying selection, in contrast to directional selection, pushes the trait both ways. This can happen in a variety of ways, but it often leads to speciation because the populations can become so different. If only diversified for short times, however, the selection can lead to a variety of traits that can be shared by one species.

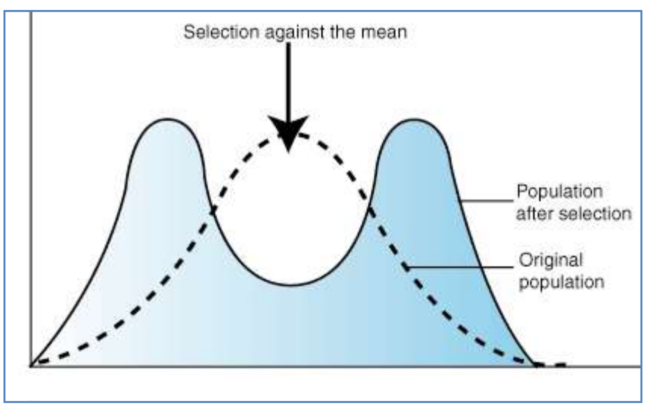

Fig: Diversifying selection

In diversifying selection, selection pressures act against individuals in the middle of the trait distribution. The result is a bimodal, or two-peaked, curve in which the two extremes of the curve create their own smaller curves. For example, imagine a plant of extremely variable height that is pollinated by three different pollinators, one that was attracted to short plants, another that preferred plants of medium height and a third that visited only the tallest plants. If the pollinator that preferred plants of medium height disappeared from an area, medium height plants would be selected against and the population would tend toward both short and tall, but not medium height plants. Such a population, in which multiple distinct forms or morphs exist is said to be polymorphic.

Key Points:

- Stabilizing selection results in a decrease of a population 's genetic variance when natural selection favors an average phenotype and selects against extreme variations.
- In directional selection, a population's genetic variance shifts toward a new phenotype when exposed to environmental changes.
- Diversifying or disruptive selection increases genetic variance when natural selection selects for two or more extreme phenotypes that each have specific advantages.
- In diversifying or disruptive selection, average or intermediate phenotypes are often less fit than either extreme phenotype and are unlikely to feature prominently in a population.

By: Dr. Bibha Kumari, Department of Zoology, Magadh Mahila College, Patna University Patna. Email: bibhak136@gmail.com