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Selection in Action

Additional Information

The Theory of Evolution

The theory of evolution allows us to explain similarities between organisms and to understand how life has changed from simple to more complex forms. Evolution is a process that happens to all life on Earth, from bacteria, the first life forms to exist on Earth over three billion years ago, to the diversity of plants and animals seen in the world today. The theory of evolution is a very important concept that unifies all biology. As such, it is highly beneficial for students to begin to explore biological evolution from an early age. Students should understand how species adapt to changing environments and how evolutionary change is restricted to traits that already exist.

Definition of Species

The biological species concept states that a species is a group of organisms that interbreed in nature. Individuals in a species do not evolve; the entire population, over many generations, evolves more complex features and behaviours over time. Present-day species evolved from earlier species.

Genetic Diversity Among Individuals in a Species

The gene pool is the total collection of genes in a population at any one time. If a species has a large degree of genetic diversity, the process of natural selection has a greater variety of genetic material to work with. If a species has little genetic variation, there is a greater risk that it may become extinct. Genetic diversity is very important if there is environmental change. In a genetically diverse population, at least some of the individuals are likely to possess traits that enable them to survive in the new environment.

Natural Selection and Darwin

Charles Darwin was a famous English naturalist who lived in the nineteenth century. Darwin realized that within a species, each individual is different and has traits that might be advantageous or disadvantageous for survival. Individuals who are well-suited to their environment are more likely to survive and pass on their traits to offspring. Over time, species become better suited to their environment. The advantageous traits that existed in only a few individuals may become widespread throughout the population.

Within a given population all individuals will vary genetically from one another. Natural selection works upon this variation; however, it can only act on variation that already exists.

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Environment and Natural Selection

Natural selection can only work on the genetic variation that is already present and genetic variation occurs randomly, not in response to the needs of an organism. Species adapt to their environment over generations while individuals do not.

As an example, giraffes do not stretch their necks in order to reach the leaves high up in the trees and then pass this trait on to their offspring. Rather, there were some individuals in the population who happened to have slightly longer necks, providing them with an advantage in acquiring food. These individuals were more likely to survive and pass along that advantageous trait to their offspring. Subsequent generations contained more individuals who possessed this trait.

Genetic Recombination

For a long time, many people believed that offspring were a "blend" of both parents. However, Gregor Mendel, a nineteenth-century Austrian Monk, proved otherwise. Using peas, Mendel showed that genes from a mother and father do not blend, but instead remain distinct and separate.

If genes were blended, then a large amount of genetic diversity would be lost in only a few generations. For example, given a short mother and a tall father, it might be assumed that they will automatically have a medium height child. However, if that were always the case then in a few generations everyone would be of medium height and there would be no genetic diversity within the population. Looking at the range of heights that exists among humans, it is clear that blending definitely does not take place.

In sexually reproducing species, each offspring inherits a unique combination of genes from both parents. This results in a great amount of variation among the population. For example, a child may inherit a gene from his mother for brown eyes and a gene from his father for curly hair.