

Evolution by Natural Selection

Darwin's next insight was to compare processes in nature to artificial selection. By doing so, he developed a scientific hypothesis to explain how evolution occurs. This is where Darwin made his greatest contribution—and his strongest break with the past.

The Struggle for Existence Darwin was convinced that the process like artificial selection worked in nature. But how? He recalled Malthus's work on population growth. Darwin realized that high birth rates and a shortage of life's basic needs would eventually force organisms into a competition for resources. **Struggle for existence** means that members of each species compete regularly to obtain food, living space, and other necessities of life. In this struggle, the predators that are faster or a particular way of ensnaring other organisms can catch more prey. Those prey that are faster, better camouflaged, or better protected, such as the porcupine shown in **Figure 15-11**, can avoid being caught. This struggle for existence was central to Darwin's theory of evolution.

Survival of the Fittest A key factor in the struggle for existence, Darwin observed, was how well suited an organism is to its environment. Darwin called the ability of an individual to survive and reproduce in its specific environment **fitness**. Darwin proposed that fitness is the result of adaptations. An **adaptation** is any inherited characteristic that increases an organism's chance of survival. Successful adaptations, Darwin concluded, enable organisms to become better suited to the environment and thus better able to survive and reproduce. Adaptations can be anatomical, or structural, characteristics such as a porcupine's sharp quills. Adaptations also include an organism's physiological processes, or functions, such as the way in which a plant performs photosynthesis. More complex features such as behavior in which some animals live and hunt in groups can also be adaptations.

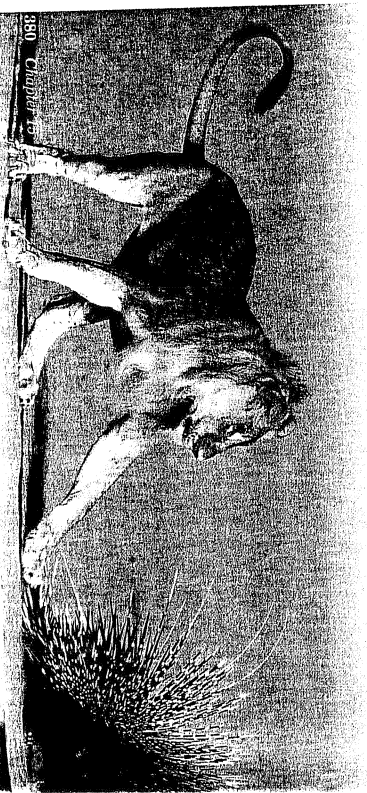


Figure 15-12 Each of these baby tanagers has its own set of inherited traits that affect its survival. A stronger bird may take food from a weaker sibling. A faster bird may escape predators more easily. Only those birds that survive and reproduce have the chance to pass their traits to the next generation. **Over time**, natural selection results in changes in the inherited characteristics of a population.

The concept of fitness, Darwin argued, was central to the process of evolution by natural selection. Generation after generation, individuals compete to survive and produce offspring. The baby birds in **Figure 15-12**, for example, compete for food and space while in the nest. Because each individual differs from other members of its species, each has unique advantages and disadvantages. Individuals with characteristics that are not well suited to their environment—that is, with low levels of fitness—either die or leave few offspring. Individuals that are better suited to their environment—that is, with adaptations that enable fitness—survive and reproduce most successfully.

Darwin called this process **survival of the fittest**. Because of its similarities to artificial selection, Darwin referred to the survival of the fittest as **natural selection**. In both artificial selection and natural selection, only certain individuals of a population produce new individuals. However, in natural selection, the traits being selected—and therefore, increasing over time—contribute to an organism's fitness in its environment. Natural selection also takes place without human control or direction. **Over time**, natural selection results in changes in the inherited characteristics of a population. These changes increase a species' fitness in its environment. Natural selection cannot be seen directly; it can only be observed as changes in a population over many successive generations.

Interpret What did Darwin mean when he described certain organisms as "more fit" than others?

Descent With Modification Darwin proposed that over long periods, natural selection produces organisms that have different structures, establish different niches, or occupy different habitats. As a result, species today look different from their ancestors. Each living species has descended, with changes, from other species over time. He referred to this principle as **descent with modification**.

"The Most Dangerous Game" and Natural Selection

Answer the following question in 7-10 COMPLETE SENTENCES. Please use a topic sentence and SPECIFIC supporting details from the article "Evolution by Natural Selection" and the short story.

Talk about the concept of natural selection and survival of the fittest that Zaroff makes reference to on page 49. Then, explain how Zaroff justifies hunting humans.