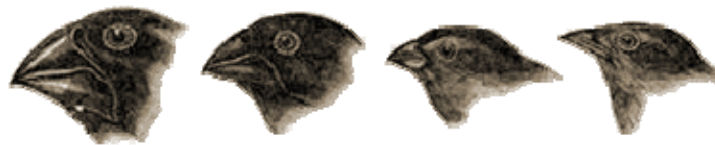


WHAT IS EVOLUTION AND HOW DO WE KNOW IT'S HAPPENING?

“Evolution” describes the process by which the diversity of life on earth developed over time from common ancestors. Within a population of organisms, there is variation in hereditary traits resulting from changes in the genetic code of individual organisms. These changes occur either by random mutation or by the shuffling of genetic material during sexual reproduction. One mechanism by which evolution, or change in populations occurs, is through natural selection. Evolution occurs with a population because individuals have different sets of these traits that affect their ability to survive and reproduce. For example, some individuals may be better at finding food, hiding from predators, or attracting mates. Those organisms with traits that help them to survive and reproduce are more likely to pass genes responsible for those traits to the next generation, a process termed natural selection. Over time, the distribution of characteristics in the population change, reflecting a change in the genetic makeup of the population. This process helps to account for the differences we see within species (microevolution) as well as the emergence of new species (macroevolution). [Click here for a demonstration of natural selection.](#)

The scientific evidence for evolution is overwhelming. Volumes of data collected in the field and the laboratory show that all species arose from common ancestors and that species change over time. A classic example is the finch population on the Galapagos Islands. Galapagos finches have a variety of beak types adapted for cracking open different kinds of seeds. Changes in weather patterns have been shown to affect the kinds of seeds available—for example during drought, tough seeds that are difficult to crack are more abundant than soft seeds. Researchers found that finches with large beaks capable of cracking open those seeds were more likely to survive than finches with small beaks. As a result, these large beak finches became more abundant compared to finches with smaller beaks.



Geologists and paleontologists have documented systematic changes in organisms over hundreds of millions of years. By uncovering the fossil remains of once living organisms trapped in sedimentary rock layers, they find clear evidence that life forms have changed through time and that species have both emerged and disappeared. For example, mammalian fossils are evident in relatively recent rock layers, not in older layers; the oldest layers show no evidence of animals at all. Changes are evident within the human lineage as well, where the fossil record documents a number of intermediary forms between present day humans and now extinct non-human primates.

Evolution accounts for the similarities among diverse life forms. All species are remarkably alike at the cellular, molecular, and genetic levels, and all use DNA as the basic mechanism of heredity. Even distantly related animals show similar patterns of development and striking anatomical similarities that are best accounted for by inferring a common ancestry. For example, even though their functions are different, there are clear structural similarities in the forelimbs of birds, frogs, and humans. [Click here for an example of anatomical similarities among organisms.](#)

Evolution is not a phenomenon of the past. It is an active process occurring even now. The emergence of new strains of influenza, drug-resistant cancer cells, and pesticide-resistant insects demonstrate that the genetic makeup of populations changes over time by the process of natural selection. Within the population of influenza viruses, for example, some viruses are naturally resistant to the drugs used to treat them. As a result, the resistant viruses survive and reproduce and new influenza vaccines must be created to treat the newly evolved strain. Laboratory experiments also demonstrate evolution in action. Using rapidly reproducing species such as bacteria, yeast, and fruit flies, scientists have shown that altering the environmental conditions in which these organisms exist can induce genetic changes within the population.

The scientific evidence showing that evolution has happened and continues to happen is overwhelming.

Resources and References

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