

## Is Evolution FACT or THEORY?

Both. In Darwin's day, and before, many naturalists theorized that living things were somehow related in a manner beyond that of their obvious common differences from non-living matter. These speculations, including those of Darwin, are appropriately termed theories: speculations about nature that were informed by observation and subject to test by additional observations.

Over the years since the introduction of a theory of evolution by Charles Darwin and Alfred Russell Wallace, biologists and geologists have continuously tested the ideas of descent with modification and have obtained no contradictory observations. Indeed, we recognize today that this aspect of biological evolution is not properly a theory at all, it is an observation.

This is analogous to the Copernican theory in astronomy. Copernicus initially proposed the theory that the Earth rotates around the Sun, and not vice versa. The innumerable observations consistent with this theory which we have accumulated in the meantime make the assertion that the Earth rotates around the Sun a well-established fact.

We have observed that life on Earth, at the present and in the past, is related by descent through a common ancestry. Closely related species resemble each other because they are related through a relatively recent common ancestor; and more distantly related organisms resemble each other in general proportion to their historical distance from a common ancestor. Thus this piece of the concept of biological evolution is an observed fact.

But mechanisms are another matter. Darwin's primary contribution was that he not only suggested that all living things are related by descent, he also proposed a mechanism. The mechanism that Darwin emphasized is natural selection. By this he meant that variation among individuals within a population renders some individuals likely to leave larger numbers of offspring than others.

These more numerous offspring are thus 'selected' by nature by virtue of the superior genetic endowment of their parents which the offspring also inherited. There are other theories and variations as well, differing for example in the degree of emphasis on the rapidity of change. It is these speculations concerning modes of evolution that are accurately described as evolutionary theories.

In its most common and familiar usage evolution is simply change over time. Thus technologies, political and economic systems, languages, even landscapes and galaxies are said to evolve or change over time. Biological evolution is an entirely different concept, and it applies to populations, not individual organisms.

Biological evolution is the genetic change in populations of living things through time that lead to differences among populations. This process has two important components: genetic continuity and change across generations. A simpler phrase for these two, the one employed by Charles Darwin and every bit as applicable today, is descent with modification.

# EVOLUTION

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