



Evolution is Only a Theory

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Those who favor teaching alternatives to evolution in public school science classes often argue that evolution is "only a theory". The argument probably stems from a misunderstanding of the meaning of "theory" and "fact" in science, as opposed to the meaning in everyday life.

In everyday life, a "theory" often means a vague fuzzy concept with a suggestion of uncertainty and guesswork. "Theory" can imply an impractical idea that does not always work out. However, in science a theory is a consistent framework that explains observed facts and predicts other facts. A scientific theory must be consistent with all relevant facts. If a theory makes a prediction that is contrary to observation, then the theory must be revised or abandoned. An acceptable scientific theory is falsifiable; that is, we must be able to imagine an event that would disprove the theory if it was observed under certain circumstances. If the falsifying event cannot be observed, but events predicted by the theory are observed, then the theory is given higher credence.

In ordinary usage, a "fact" is considered to be absolutely true and undeniable. There is often an implication of eternal truth. An assertion of "fact" is considered to be either true or false with no intermediate gradation. However, science does not give an assurance of complete, undeniable truth. Assertions of fact in science have varying degrees of credibility. For example, the assertion that the "earth is flat" is very near the bottom of the credibility scale. The evidence against this proposition is so overwhelming that it would be silly or perverse to assign it a high credibility. The assertion that "apples fall downward" is very near the top of the credibility scale; it would be silly or perverse to deny the credibility of this proposition.

Scientists infer the credibility of facts or propositions in several ways. Direct observation is used whenever possible. However, direct observation of past evolution is not possible because there were no scientists living millions of years ago. Another method of determining credibility is "constructive" or "circumstantial" inference. If a large constellation of data points to the construct and few or no data negate the construct, the credibility is high.

Most scientists assign evolution as a fact, because an enormous body of data points to the occurrence of evolution and no data call it into serious question. Some of the data supporting the fact of evolution are:

(1) All living things are offspring of parents; offspring may differ from parents, and small differences may accumulate.

- (2) Most animals and plants alive today did not exist hundreds of millions of years ago.
- (3) Most animals and plants living hundreds of millions of years ago don't exist today.
- (4) The stratification of fossils is orderly, by time period, by complexity, and by species. Simplest species predominate at earliest times and more complex species appear at later times.
- (5) Observable relationships between many species point to common ancestry. For others, the relationship is more circumstantial and many relationships have yet to be worked out.
- (6) Change and new species have been observed, both in the fossil record and in modern times.

These data point strongly to the occurrence of evolution, and most scientists assign high credibility to the proposition that evolution has occurred, nearly as high as "apples fall downward". Most scientists assign very low credibility to the proposition that the earth is only a few thousand years old, and that all existing species came into being suddenly and simultaneously, nearly as low as "the earth is flat".

A widely accepted theory that explains how evolution has occurred is Charles Darwin's "Theory of Natural Selection", which presents a logical, plausible mechanism for evolution. The theory says that differences between parents and offspring may or may not be advantageous for the offspring's survival. Differences that enhance survival confer a reproductive advantage, and offspring with those characteristics will tend to predominate. Disadvantageous characteristics tend to die out. Advantageous differences between parents and offspring may accumulate through many generations, giving rise to new species. When the environment changes, as has repeatedly happened in Earth's history, different characteristics become adaptive, and species either change or become extinct. . The theory of natural selection predicts that observations (whether of fossils or of life today) will be in accordance with the theory, that is, that more adaptive characteristics will predominate, and observations do indeed agree with the predictions.

The theory of natural selection is falsifiable. If manifestly disadvantageous life forms were often observed to proliferate at the expense of manifestly advantageous life forms, the theory would have to be drastically reformulated or abandoned. This falsifying event has not been observed, leading to enhanced acceptance of the theory.

Details of the theory -- for example, whether evolution is more often gradual or more often by "fits and starts", or whether daughter species have coexisted for long periods with parent species -- are warmly debated by specialists. The debates do not indicate disagreement among scientists about the fact of evolution. Most scientists, and virtually all biologists, agree that evolution has occurred.

Summary

There are differences in the meanings of "fact" and "theory" in science and every day life. "Theory" in science does not imply guesswork or impracticality. Evolution is a fact in the scientific view. Natural selection is a potent theory that explains the fact of evolution and predicts the data that will be observed in the future. Although some scientists debate the details of the theory, the overwhelming majority accepts the basic concept.