

Scientific hypothesis

Adapted from:

<http://www.livescience.com/21490-what-is-a-scientific-hypothesis-definition-of-hypothesis.html>

Hypothesis basics

A hypothesis is a suggested solution for an unexplained occurrence that does not fit into current accepted **scientific theory**. The basic idea of a hypothesis is that there is no pre-determined outcome. For a hypothesis to be termed a scientific hypothesis, it has to be something that can be supported or refuted through carefully crafted experimentation or observation. This is called falsifiability and testability, according to the Encyclopedia Britannica.

Testing a hypothesis

The primary trait of a hypothesis is that something can be tested and that those tests can be replicated. It is often examined by multiple scientists to ensure the integrity and veracity of the experiment. This process can take years, and in many cases hypotheses do not go any further in the scientific method as it is difficult to gather sufficient supporting evidence.

A **null hypothesis** is the name given to a hypothesis that is possibly false or has no effect. Often, during a test, the scientist will study another branch of the idea that may work, which is called an alternative hypothesis.

During a test, the scientist may try to prove or disprove just the null hypothesis or test both the null and the alternative hypothesis. If a hypothesis specifies a certain direction, it is called one-tailed hypothesis. This means that the scientist believes that the outcome will be either with effect or without effect. When a hypothesis is created with no prediction to the outcome, it is called a two-tailed hypothesis because there are two possible outcomes.

Example: *During lab in a later part of Citizen Science we will isolate bacteria from the environment:*

- A one-tailed hypothesis:- Student A's shoes are dirtier (have more bacteria) than student B's shoes.
- A two-tailed hypothesis:- One pair of shoes is dirtier than the other (either A's shoes is dirtier than B's, or that B's shoes are dirtier than A's).
- The null hypothesis: Both students' shoes are as dirty as the other.

Upon analysis of the results, a hypothesis can be rejected or modified, but it can never be proven to be correct 100 percent of the time. For example, relativity has been tested many times, so it is generally accepted as true, but there could be an instance, which has not been encountered, where it is not true. For example, a scientist can form a hypothesis that a certain type of tomato is red. During research, the scientist then finds that each tomato of this type is red. Though his findings confirm his hypothesis, there may be a tomato of that type somewhere in the world that isn't red. Thus, his hypothesis is true, but it may not be true 100 percent of the time.

The evolution of a hypothesis

Most formal hypotheses consist of concepts that can be connected and their relationships tested. A group of hypotheses comes together to form a conceptual framework. As sufficient data and evidence are gathered to support a hypothesis, it becomes a working hypothesis, which is a milestone on the way to becoming a theory. Though hypotheses and theories are often confused, theories are the result of a tested hypothesis. While hypotheses are ideas, theories explain the findings of the testing of those ideas.

"Theories are the ways that we make sense of what we observe in the natural world. Theories are structures of ideas that explain and interpret facts," said Tanner.

Let's be clear; ideas that are designated as theories in science have been tested over and over, and they are close to certainty, based on all available SCIENTIFIC evidence. The common criticism that something is 'only a theory' reflects a fundamental misunderstanding of the nature of science. As an example, the theory of evolution reflects work done by thousands of scientists in many different fields for over 160 years (On the Origins of Species, Charles Darwin was published in 1859), all of which supports the theory that life-forms evolve from one another.