



Theory vs Law

Note, too, that there are no “laws” when we’re discussing literature or cultural representations, so just pay attention to how the experts define “theory.” The difference between a law and a theory is interesting, but it’s a bit irrelevant when it comes to your assignment, so don’t worry about it.

Voila a collection of observations about laws and theories.

“Evolution by natural selection, the central concept of the life's work of Charles Darwin, is a theory. It's a theory about the origin of adaptation, complexity, and diversity among Earth's living creatures. If you are skeptical by nature, unfamiliar with the terminology of science, and unaware of the overwhelming evidence, you might even be tempted to say that it's "just" a theory. In the same sense, relativity as described by Albert Einstein is "just" a theory. The notion that Earth orbits around the sun rather than vice versa, offered by Copernicus in 1543, is a theory. Continental drift is a theory. The existence, structure, and dynamics of atoms? Atomic theory. Even electricity is a theoretical construct, involving electrons, which are tiny units of charged mass that no one has ever seen. Each of these theories is an explanation that has been confirmed to such a degree, by observation and experiment, that knowledgeable experts accept it as fact. That's what scientists mean when they talk about a theory: not a dreamy and unreliable speculation, but an explanatory statement that fits the evidence. They embrace such an explanation confidently but provisionally—taking it as their best available view of reality, at least until some severely conflicting data or some better explanation might come along.”¹

LAW

1) An empirical generalization; a statement of a biological principle that appears to be without exception at the time it is made, and has become consolidated by repeated successful testing; rule (Lincoln *et al.*, 1990).

2) A theoretical principle deduced from particular facts, applicable to a defined group or class of phenomena, and expressible by a statement that a particular phenomenon always occurs if certain conditions be present (Oxford English Dictionary as quoted in Futuyma, 1979).

3) A set of observed regularities expressed in a concise verbal or mathematical statement. (Krimmsley, 1995).

THEORY

1) The grandest synthesis of a large and important body of information about some related group of natural phenomena (Moore, 1984).

2) A body of knowledge and explanatory concepts that seek to increase our understanding ("explain") a major phenomenon of nature (Moore, 1984).

3) A scientifically accepted general principle supported by a substantial body of evidence offered to provide an explanation of observed facts and as a basis for future discussion or investigation (Lincoln *et al.*, 1990).

¹ <http://ngm.nationalgeographic.com/ngm/0411/feature1/>

4) 1. The abstract principles of a science as distinguished from basic or applied science.
2. A reasonable explanation or assumption advanced to explain a natural phenomenon but lacking confirming proof (Steen, 1971). [NB: I don't like this one but I include it to show you that even in "Science dictionaries" there is variation in definitions which leads to confusion].

5) A scheme or system of ideas or statements held as an explanation or account of a group of facts or phenomena; a hypothesis that has been confirmed or established by observation or experiment, and is propounded or accepted as accounting for the known facts; a statement of what are held to be the general laws, principles or causes of something known or observed. (Oxford English Dictionary, 1961; [emphasis added]).

6) An explanation for an observation or series of observations that is substantiated by a considerable body of evidence (Krimmsley, 1995).

Regardless of which definitions one uses to distinguish between a law and a theory, scientists would agree that a theory is NOT a "transitory law, a law in waiting". There is NO hierarchy being implied by scientists who use these words. That is, a law is neither "better than" nor "above" a theory. From this view, laws and theories "do" different things and have different roles to play in science. Furthermore, notice that with any of the above definitions of law, neither scientists nor nature "conform" to the law. In science, a law is not something that is dictated to scientists or nature; it is not something that a scientist or nature has to do under threat of some penalty if they don't conform.²

Scientific Law: This is a statement of fact meant to describe, in concise terms, an action or set of actions. It is generally accepted to be true and universal, and can sometimes be expressed in terms of a single mathematical equation. Scientific laws are similar to mathematical postulates. They don't really need any complex external proofs; they are accepted at face value based upon the fact that they have always been observed to be true.

Specifically, scientific laws must be simple, true, universal, and absolute. They represent the cornerstone of scientific discovery, because if a law ever did not apply, then all science based upon that law would collapse.

Some scientific laws, or laws of nature, include the law of gravity, Newton's laws of motion, the laws of thermodynamics, Boyle's law of gases, the law of conservation of mass and energy, and Hook's law of elasticity.

Hypothesis: This is an educated guess based upon observation. It is a rational explanation of a single event or phenomenon based upon what is observed, but which has not been proved. Most hypotheses can be supported or refuted by experimentation or continued observation.

Theory: A theory is what one or more hypotheses become once they have been verified and accepted to be true. A theory is an explanation of a set of related observations or events based upon proven hypotheses and verified multiple times by detached groups of researchers. Unfortunately, even some scientists often use the term

² <http://science.kennesaw.edu/~rmatson/3380theory.html>

"theory" in a more colloquial sense, when they really mean to say "hypothesis." That makes its true meaning in science even more confusing to the general public.

In general, both a scientific theory and a scientific law are accepted to be true by the scientific community as a whole. Both are used to make predictions of events. Both are used to advance technology.

The **biggest difference between a law and a theory is** that a theory is much more complex and dynamic. A law describes a single action, whereas a theory explains an entire group of related phenomena. And, whereas a law is a postulate that forms the foundation of the scientific method, a theory is the end result of that same process.

Some scientific theories include the theory of evolution, the theory of relativity, the atomic theory, and the quantum theory. All of these theories are well documented and proved beyond reasonable doubt. Yet scientists continue to tinker with the component hypotheses of each theory in an attempt to make them more elegant and concise, or to make them more all-encompassing. Theories can be tweaked, but they are seldom, if ever, entirely replaced.³

³ <http://wilstar.com/theories.htm>