

**READING: WHAT SCIENCE IS...AND ISN'T**  
(inspired by "Sunsets, Souls, and Senses,"  
[www.indiana.edu/~ensiweb](http://www.indiana.edu/~ensiweb))

What is science? Let's start with a few definitions.

Science is

- Knowledge that's obtained and tested through the scientific method (adapted from *merriam-webster.com*).
- Knowledge of the physical or material world gained through observation and experimentation (adapted from *dictionary.com*)
- A systematic activity that builds and organizes knowledge in the form of testable explanations and predictions (from *Wikipedia*).

As all of these definitions point out, science is a search for understanding about the natural universe. But what makes science different from religion or astrology, which are also systems of ideas that search for understanding?

To begin with, science is limited. Science can only study things that are a part of the natural (as opposed to the supernatural) world. Things that are beyond nature (God, demons, ghosts, Spirits) are outside of what can be scientifically studied. Whether or not you believe in God, demons, or ghosts is your choice. But all of these are outside of the boundaries of scientific explanation.

Why? It's because science is based upon ideas that can be proved to be correct through observation and experimentation. If you can't perceive something, either directly with your senses, or indirectly through instruments (like microscopes, telescopes, light or sound sensors, chemical sensors, and so on), then it's not something that you can scientifically study. A good rule of thumb is this: if you can measure it, then it's probably something that you can study scientifically.

Note that a single observation isn't enough. Many people, for example, claim to have observed miracles, or demons, or UFOs. But in science, valid evidence requires observations that can be repeated on demand. The gold standard for scientific observation is the experiment. Experiments involve observations that occur under carefully controlled conditions. During an experiment, the goal is to see if something can bring about an effect in a predictable, repeatable way.

The evidence that comes out of experiments can be used to develop or confirm a scientific explanation. For an explanation to be

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scientific, it must be capable of being proved wrong. Think about it like this: a scientific explanation makes a testable prediction. As long as that prediction turns out to be correct, the explanation will stand. However, if the prediction fails, then the explanation will have to be modified to match this new observation.

To hone our ideas about what science is, let's look at some things that science is *not*.

- Science is not based on belief. A belief is a feeling, something that you know inside. Scientific ideas, by contrast, need to be objective—they have to come from evidence outside of you.
- Science is not based on authority. It doesn't matter whose explanation it is. The only thing that matters in science is whether the evidence gained through observation and experimentation.
- Science is not democratic: the vast majority can hold an idea that is completely wrong.
- Science is not fair: you can spend your whole life supporting an idea that turns out to be wrong.
- Science is never absolute or certain. Some very well established explanations have, in the past, been found to be incorrect, and it's a sure thing that some explanations that we think are correct now will prove to be incorrect in the future. Given changing observations and evidence, scientific ideas have to be modified or sometimes entirely overthrown. And as disorienting as that might be, it's a good thing: it gives us better understanding of the world.

INITIAL SUMMARY: Condense this article into about three key ideas.

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