

The OHIO ACADEMY of SCIENCE

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Fostering curiosity, discovery and innovation to benefit society.



What is science?

SCIENCE IS A SYSTEMATIC METHOD of continuing investigation, based on observation, hypothesis testing, measurement, experimentation, and theory building, which leads to more adequate explanations of natural phenomena, explanations that are open to further testing, revision, and falsification, and while not “believed in” through faith may be accepted or rejected on the basis of evidence.

Science is the study of the natural world that includes observable and measurable phenomena within the universe. The conclusions of scientific inquiry are objective because scientific statements can be verified or disproved by independent observers. Scientific inquiry is restricted to knowledge that can be reduced to simple declarative sentences with observable action or actions that are logically connected to observable results by valid, intermediate logic.

What is an hypothesis?

A SCIENTIFIC HYPOTHESIS is a declarative statement within the realm of nature in the broadest sense of this term. The proposition is therefore true or false. Scientific research establishes, confirms, verifies or validates the truth or falsity of hypotheses. Hypotheses address basic questions about the natural world and are tested by using methods that yield valid

results or findings: observations and data that either confirm or deny (falsify) the declarative statement or proposition (hypothesis).

In contrast to scientific hypotheses, value statements include categories such as right or wrong, good or bad, beautiful or ugly, wise or unwise, desirable or undesirable—all of which are outside the scope of science. These are categories of ethics and values, and when combined with a belief structure, are the bases of religion. Values are the beliefs, mores and morals that hold society together because they condition and guide behavior, and may give meaning to humanity. These are areas of opinion and belief. Value statements can be used as moral imperatives such as “love thy neighbor” or as a way of expressing delight such as “What a beautiful rainbow!” Such statements are outside the realm of science.

What is a theory as used in science?

A THEORY AS USED IN SCIENCE is not a weak, tentative, or abstract explanation of natural phenomena. A theory is the current, highest level of scientific explanation or confidence that explains and predicts the future appearance of natural phenomena. Derived from repeated observations and hypothesis testing, a scientific theory is a robust assembly of related laws, concepts and conceptual models that objectively describe, predict, and explain

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natural phenomena. This definition contrasts sharply from the common vernacular use of the term theory as speculation or supposition.

Scientific theories result from repeated application of the scientific method and help to organize or explain our knowledge in a particular field. Established theories may stand for hundreds of years until new facts are discovered, tested and verified or a new hypothesis, which more closely explains the data, is developed and tested. The overthrow of settled theories or established science is popularly called a scientific revolution or a paradigm shift. For example, the popular depiction of an atom structured like a miniature solar system is a recent victim of such a revolution in scientific theory. Now quantum physics explains that electrons are more like probability clouds surrounding an atomic nucleus than like planets orbiting a central point.

Why is science important?

SCIENCE IS MORE THAN A COLLECTION of what humankind knows. Science is a tool to objectively understand the ever-changing, natural world in which we live. Science provides a systematic way to determine when to accept or reject a theory or concept. Scientific progress is made by applying the tenets of the scientific method—observation, experimentation, repeated hypothesis testing, and establishment of scientific theory. The application of the scientific method has enabled humanity to develop and improve our understanding of the natural world by using the pragmatism of

demonstration, the rigor of mathematical and statistical analyses, and the creative insight of people from all races and cultures.

Science has changed the way we view the world and universe. When coupled with engineering, technology, and the economic system, the methods and results of scientific inquiry have profoundly affected humankind's material and societal progress. Science provides the tools to understand and master the natural world around us. Science is a knowledge ratchet that builds upon facts, principles, laws, and theories, by advancing one or more clicks, thus enhancing and preserving knowledge for our collective human use and betterment.

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About the Academy

THE MISSION OF THE OHIO ACADEMY of Science—a non-profit organization of those interested in science, engineering, education and technology—is to foster *curiosity, discovery* and *innovation* by stimulating interest in the sciences, engineering and technology, promoting and supporting research, improving science education, disseminate scientific knowledge, and recognizing and publicizing high achievement in attaining these objectives. The Academy provides support activities, conducts annual meetings and science days, and publishes, worldwide, a journal and other media that report developments in science, engineering and technology.