

## Reporting Scientific Work

Whether scientific research is basic science or applied science, scientists must share their findings for other researchers to expand and build upon their discoveries. Communication and collaboration within and between sub-disciplines of science are key to the advancement of knowledge in science. For this reason, an essential aspect of a scientist's work is disseminating results and communicating with peers. Scientists can share results by presenting them at a scientific meeting or conference, but this approach can reach only a few individuals who are present. Instead, most scientists present their results in peer-reviewed articles that are published in scientific journals. **Peer-reviewed articles** are scientific papers that are reviewed, usually anonymously, by a scientist's colleagues, or peers. These colleagues are qualified individuals, often experts in the same research area, who judge whether the scientist's work is suitable for publication. The process of peer review helps to ensure that the research described in a scientific paper is original, significant, logical, and thorough.

There are many journals and the popular press that do not use a peer-review system. Results of any studies published in non-peer reviewed forums are not always reliable, and caution should be used when examining the validity of the work. Sometimes information can be portrayed as scientific fact but lack objective, repeatable data. **Pseudoscience** is claims or beliefs that are represented as scientific fact but cannot be evaluated using the scientific method. For example, astrology is based on a set of beliefs that connect an individual's personality traits with their astrological sign. Scientists using the scientific method have not been able to generate any data that supports these claims and connections. As a result, astrology can be used as an example of pseudoscience.

Today, data and information are readily accessible online through the internet. The internet offers a unique platform to share information across the world, which can help advance both scientific discovery and knowledge. However, it is always important to consider when looking at information online, where the data is coming from, and how valid this information is.

## Section Summary

Biology is the science that studies living organisms and their interactions with one another and their environments. Science attempts to describe and understand the nature of the universe in whole or in part. Science has many fields; those fields related to the physical world and its phenomena are considered natural sciences.

A hypothesis is a tentative, testable explanation for an observation or question. A scientific theory is a well-tested and consistently verified explanation for a set of observations or phenomena that has been universally accepted by the scientific community. A scientific law is a description, often in the form of a mathematical formula. Two types of logical reasoning are used in science. Inductive reasoning uses results to produce general scientific principles. Deductive reasoning is a form of logical thinking that predicts results by applying general principles. The common thread throughout scientific research is the use of the scientific method. Scientists present their results in peer-reviewed scientific papers published in scientific journals.

Science can be basic or applied. The main goal of basic science is to expand knowledge without any expectation of short-term practical application of that knowledge. The primary goal of applied research, however, is to solve practical problems.

## Exercises

1. In the example below, the scientific method is used to solve an everyday problem. Which part of the example below is the hypothesis? Which is the prediction? Based on the results of the experiment, is the hypothesis supported? If it is not supported, propose some alternative hypotheses. Jose notices that all the trees in his backyard are dying. They are having a usual dry summer with very little rainfall. His mom also applied fertilizer to the lawn in the early spring. Jose is curious, "why are the trees are all dying?" Jose thinks that because there has been very little rainfall that explains why the trees are dying. If he waters the trees, then they should begin to grow and stop dying. After watering the trees every day for two months, Jose notices that the trees still seem to be dying.
2. \_\_\_\_\_ claims or beliefs that are portrayed as scientific fact but cannot be evaluated using the scientific method.
  - a. Hypothesis
  - b. Variable
  - c. Pseudoscience
  - d. Theory
3. The type of logical thinking that uses related observations to arrive at a general conclusion is called \_\_\_\_\_.
  - a. deductive reasoning
  - b. the scientific method
  - c. hypothesis-based science
  - d. inductive reasoning
4. Explain the difference between a hypothesis and a theory.

## Answers

1. The hypothesis is the trees are dying because of the lack of water, and the prediction is if he waters the trees, then they should stop dying. The original hypothesis is not supported, because although he waters the trees, they continue to die. Alternative hypotheses maybe because his mom added fertilizer to the lawn; the trees are dying.
2. (c)
3. (d)
4. A hypothesis is a testable explanation for a scientific question or an observation, which should be both falsifiable and lead to predictions. Once a hypothesis has undergone rigorous testing by many different scientific groups who have drawn the same or similar conclusions, it is referred to as a scientific theory. A scientific theory, therefore, is also testable, leads to predictions, and is falsifiable; however, it has been thoroughly tested and supported with substantial amounts of data. A scientific theory is the foundation of scientific knowledge.

## Glossary

**biology:** the study of life

**control:** a part of an experiment that does not change during the experiment

**deductive reasoning:** a form of logical thinking that uses a general statement to forecast results

**dependent variable:** the variable that will change when the independent variable is altered; this is what the researcher will measure or observe during the experiment

**experimental group:** the group where the independent variable is applied

**falsifiable:** it can be shown to be false by experimental results

**hypothesis:** a suggested explanation for an event, which can be tested

**independent variable:** is the variable that is being altered or changed by the researcher; it is the variable being tested

**inductive reasoning:** a form of logical thinking that uses related observations to arrive at a general conclusion

**peer-reviewed article:** a scientific report that is reviewed by a scientist's colleagues before publication

**predictions:** statements that describe what should happen if the hypothesis is supported

**pseudoscience:** claims or beliefs that are portrayed as scientific fact but cannot be evaluated using the scientific method

**qualitative data:** data that is descriptive

**quantitative data:** data that is numerical

**science:** the knowledge that covers general truths or the operation of general laws, mainly when acquired and tested by the scientific method

**scientific method:** a method of research with defined steps that include experiments and careful observation

**scientific theory:** a thoroughly tested and confirmed explanation for observations or phenomena

**standardized variable:** variables that must be kept consistent otherwise they can affect the outcome or results of the experiment