

Scientific Method

Anth103 • Section #16631 • Fall 2015

**What are the characteristics of the scientific method?
Explain the characteristics of hypotheses, theories, and laws? How do anthropologists apply the scientific method in research?**

The scientific method is an empirical approach to gaining information through the use of systematic and explicit techniques.

Because biological anthropologists are engaged in scientific pursuits, they adhere to the principles of the scientific method, whereby a research problem is identified and information is then gathered in order to solve it (Jurmain 2005: 15)

The scientific method is a process of explaining natural phenomena using an empirical approach of observation, forming a research question and collecting data to answer it. The scientific method is a process of discovery following these steps:

1. **Research question** is defined.
2. **Research** is done to collect information about the topic
3. **Hypothesis** is formulated.
4. **Research methodology** is formed to operationalize how the data will be collected which either proves or falsifies the hypotheses. Data is collected via either **experiment or observation** or both.
5. **Analysis** of the data is made that either **verifies or falsifies** the hypothesis.
6. **Conclusion** is made that either proves or disproves the hypothesis

Hypothesis: A hypothesis is a provisional answer (or prediction) for the research question. A hypothesis must be falsifiable (be disproved) with empirical data, which contradicts it. The hypothesis should be formatted in order to have the potential to be re-tested and falsified. In other words, the experiment must be reproducible. Any proposition that's stated as absolute and/or doesn't allow the possibility of falsification (through scientific experimentation) is not a scientific hypothesis.

Empirical data: Data are facts based on empirical evidence from which a conclusion can be drawn. Empirical data is data, which can be quantified and sensed with at least one of the five senses (sight, hearing, touch, smell, or taste) The data must be quantifiable (e.g. measurable). The word "empirical" means that it is an assertion based on experimental or observed data.

Theory: If a hypothesis is not falsified, it becomes accepted as a theory. Theories attempt to explain why phenomenon occurs. In scientific terms, a theory is much more than mere speculation because it has been repeatedly tested and scientists have not been able to disprove it.

Theories not only help organize current knowledge, but they also predict how new facts may fit into the established pattern.

Law: A law is generalization of a body of observations with no known empirical contradictions. While theories can attempt to explain why phenomenon happens, **laws will predict that they do occur.**

Bias: Sources of Scientific Bias..

1. How the investigator was trained and by whom
2. What particular questions interest the researcher
3. What specific skills and talents he or she possess
4. What earlier results (if any) have been established in this realm of study
5. By whom (e.g. the researcher, close colleagues, or those with rival approaches or even rival personalities)
6. What sources of data are available (e.g. accessible countries or museums) and thus what samples can be collected

Physical Anthropologists apply the scientific method rigorously in order to explain human life in regards to evolutionary science and current biological diversity of human life.

- a. Physical anthropologists are often limited in the degree and manner in which the phenomena being studied can be repeated for the sake of experimentation.
- b. Minimal control over the variables that affect the phenomena.
- c. Explanations are multicausal – due to the nature of studying complex humans.
- d. Anthropology **approaches its hypotheses from numerous angles**. Think of evolution: It is validated from many different types of data: fossil records, comparative anatomy, molecular biology....

Archaeologists apply the scientific method in order to explain the conditions of human life in the past.