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What is Science?

It continues to amaze me how many "educated" people do not understand what Science* is or what is meant by the term "scientific method." The statements of Nobel Prize physicist Percy W. Bridgman¹ shows that such ignorance shows no regard for academic stature when he states, "No working scientist, when he plans an experiment in the laboratory, asks himself whether he is being properly scientific, nor is he interested in whatever method he may be using *as method*." What arrogance!²

One of the best descriptions and explanations of the current concept of scientific method is interestingly found in the [Appendix E of Frank Wolfs' website](#).³

1. Observation and description of a phenomenon or group of phenomena.
2. Formulation of a hypothesis to explain the phenomena. In physics, the hypothesis often takes the form of a causal mechanism or a mathematical relation.
3. Use of the hypothesis to predict the existence of other phenomena, or to predict quantitatively the results of new observations.
4. Performance of experimental tests of the predictions by several independent experimenters and properly performed experiments.

But in order to realize whether this is a valid concept or not, we need to understand what Science really is. Here is a typical dictionary definition of Science: "The observation, identification, description, experimental investigation [scientific method], and theoretical explanation of phenomena. Such activities restricted to a class of natural phenomena. Such activities applied to an object of inquiry or study."⁴

Science on the other hand is an interesting definition in that it previously has applied to those fields of study which utilize the scientific method. For physics and chemistry, this is easy, but when we get into archeology, psychology, geology, environmental studies, and so on, the use of scientific methodology becomes less applicable but yet aren't these still Science? What about archeology where even though one can not perform repeatable experiments we can yet validate hypotheses?

Let's say that I am an archeologist and that I hypothesize that an ancient culture "X" existed based upon a piece of pottery that I had found and I further hypothesize various characteristics of this culture. Later it is found that I was correct in my hypothesis through continued validation from other findings. I then hypothesize that any culture that can make such pottery will have a high lead content in their remains. Again this is found to be true. These hypotheses have now become theories as they have been verified yet they did not follow the definition of scientific method nor could they. This is Science.

Some may say that in archeology, we use carbon-14 dating (or similar process) which does follow the scientific method. Though archeology does utilize some aspects of other sciences that do follow the scientific method, this is archeology's use of physics. It is the physics that is following the scientific method in this case, not archeology.

The scientific method is fine for experimentation but it is inadequate in determining what is Science. In the past if a discipline could not be subject to the scientific method, it was not Science. Therefore, I would like to propose that **the scientific method should only be applied to experimentation when appropriate and not be used in the determination of what is or is not science, nor should it have any application in defining what is a hypothesis, theory, fact, or law.****

In terms of the definition of what is or is not a Science, we need to find a definition that is timeless and few could argue against. One of the best way to understand the current definition of something is to look at its history (ignorance of the past will lead to mistakes of the future⁵) but I will leave that for a book on the subject because even though it is engrossing reading, it can get lengthy. I would like to

propose that we define **Science as the "the field of study which attempts to describe and understand the nature of the universe in whole or part."*** Though simple, it is an encompassing and elegant definition, as we will see.

Therefore those fields of study which attempt to describe and understand the nature of the universe on a "whole" scale such as physics and chemistry would fit our definition but so would those fields which study it in "part" such as biology whose field has been limited to only those life forms on Earth. Archeology attempts to describe and understand the fossil and archeological record (a part of the universe) and this understanding includes what its function, purpose, state of existence, etc. was. The archeological example previously given also shows how a hypothesis, theory, and fact can develop in the field of archeology...all without using the scientific method.

Why do I think that it is important that we all be on the same page in our definition of Science?

- I am a stickler for being exact in our communications because if we do not have the same definitions then we can not communicate accurately and if we can not accurately communicate then we can not progress.
- By defining Science accurately, it is easy to see that scientific theory, fact, and law can be developed and verified totally outside the walls of the academic experimentalist and the scientific method.
- By knowing what academic disciplines are Sciences, we can better approach or attempt to describe and the universe in a more organized manner thereby maximizing the progress that mankind can make in developing his knowledge base.
- It shows us that hypothesis and theories are not the sole purview of the experimentalist with his/her scientific method.
- It is only through the field of Theoretics that we can get a logical overview of Science from which we can all get on the same page and allow Science to progress in all of its facets.

I only hope that all will become involved in Theoretics so that we can all be on the same page in our definitions, coherent and logical in our arguments and theory development, and rather than being petty, look at what is the best for Science and Mankind.

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* Definitions

(Every article, book, paper, etc. should always include definitions as well as a bibliography or reference section.)

describe: to understand the nature of something in the universe and define it in a manner that allows it to be studied and communicated.

fact: a theory that has been validated close to certainty.

hypothesis: a tentative or working assumption which scientific study has yet to validate.

For instance, I can make the hypothesis that fire is hot. I put my hand into a fire and find it is hot. Now it is a theory. If it is validated by many to the point of certainty then it is a fact. Technically, there is nothing that is 100% certain. For instance, I could be existing in a dream world where fire is hot while in my real world fire is cold. Though this is highly unlikely, it still could be so. But when something seems to be confirmed by every reasonable method, then we can call it a fact.

law: a characteristic of the universes that seems fundamental to the workings of the universe.

part: any component of the universe.

Science: the field of study which tries to describe and understand the nature of the universe in whole or part. The field of study or discipline that we call Science is spelled with a capital "S" as it is a proper noun in this use while science with a small "s" is the application of this discipline.

theory: a hypothesis or group of hypotheses which have been validated but not to the point of near certainty.

universe: that which exists and in its entirety. This includes all that exists whether it can be perceived or not.

whole: something that permeates the universe at large. e.g. gravity.

Note: The definitions used here and in the article above are those of the author's unless otherwise referenced.

******In addition to the above definitions of hypothesis, theory, fact, and law, below is an example of their appropriate use.

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A Law on the other hand is not a fact, but rather it is something that seems fundamental to the workings of the universe. As we have seen, Laws are subject to revision (as Einstein did to Newton, and Siepmann has done to Einstein⁶).

References

1. Bridgman PW, "On Scientific Method," *Reflections of a Physicist*, 1955
2. "Ignorance reveals itself through arrogance." JP Siepmann quote 1997
3. http://teacher.nsrj.rochester.edu/phy_labs/AppendixE/AppendixE.html
4. Excerpted from *The American Heritage Dictionary of the English Language, Third Edition* 1996.
5. JP Siepmann quote 1998
6. Siepmann JP, "[The Laws of Space and Observation](#)," *Journal of Theoretics*, April/May 1999, Vol.1-No.1.

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