***Science***

The word Science comes from Latin word "scientia" meaning "knowledge" and in broadest sense it is any systematic knowledge-base or prescriptive practice being capable of resulting in prediction. This is why science is termed as highly skilled technique or practice.

However, in more contemporary terms, science is a system of acquiring knowledge based on scientific process or method in order to organize body of knowledge gained through research.

Science remains a continuing effort on the part of human being to discover and increase knowledge through research. Scientist make observations, record measureable data related to their observations, analyze the information in hand in order to construct theoretical explanations of phenomenon involved.

According to Webster's New Collegiate Dictionary, the definition of science is

"Knowledge attained through study or practice,"

Or

"Knowledge covering general truths of the operation of general laws, esp. as obtained and tested through scientific method [and] concerned with the physical world."

Carl Sagan echoed the same sentiment when he remarked:

“Science is a way of thinking much more than it is a body of knowledge.”

Albert Einstein observed:

”One thing I have learned in a long life: that all our science, measured against reality, is primitive and childlike — and yet it is the most precious thing we have.”

The methods involve in scientific research include making hypothesis and do experimentation to test the hypothesis under controlled conditions. In this process, scientists publish their works so other scientists can do similar experiments in may be different conditions to further strengthen the reliability of results.



**Kinds of Science:**

Though there are many ways to look at science, one of the most common is to divide it into three broad categories, each of which contains numerous sub-disciplines: formal science, natural science, and social science.

**Formal Science**

Formal science represents those disciplines that deal with symbols and theoretical ideas and their applications in the real world. Its inclusion as a science is often contested, but aspects of it are used in all other scientific disciplines. Formal science includes computer science, mathematics, and statistics.

**Natural Science:**

Natural science is the science that people usually think of when they hear the term. Those studying it use the scientific method to understand nature and the physical world. Natural science and its sub-disciplines are sometimes referred to as “hard sciences” by their proponents, and it includes biology, chemistry, geology, and physics.

**Social Science:**

Social science is the study of societies and the interactions within them, be they on a group or individual basis. It is sometimes referred to as a “soft science” by detractors. Social science includes anthropology, psychology, and sociology.

***Scientific Method:***

The scientific method, as defined by various scientists and philosophers, has a fairly rigorous structure that should be followed.

In reality, apart from a few strictly defined physical sciences, most scientific disciplines have to bend and adapt these rules, especially sciences involving the unpredictability of natural organisms and humans.

In many ways, it is not always important to know the exact scientific method, to the letter, but any scientist should have a good understanding of the underlying principles.

If you are going to bend and adapt the rules, you need to understand the rules in the first place.

**1. Empirical**

Science is based purely around observation and measurement, and the vast majority of research involves some type of practical experimentation.

This can be anything, from measuring the Doppler Shift of a distant galaxy to handing out questionnaires in a shopping center. This may sound obvious, but this distinction stems back to the time of the Ancient Greek Philosophers.

Cutting a long story short, Plato believed that all knowledge could be reasoned; Aristotle that knowledge relied upon empirical observation and measurement.

This does bring up one interesting anomaly. Strictly speaking, the great physicists, such as Einstein and Stephen Hawking, are not scientists. They generate sweeping and elegant theories and mathematical models to describe the universe and the very nature of time, but measure nothing.

In reality, they are mathematicians, occupying their own particular niche, and they should properly be referred to as theoreticians.

Still, they are still commonly referred to as scientists and do touch upon the scientific method in that any theory they have can be destroyed by a single scrap of empirical evidence.

**2. The Scientific Method Relies Upon Data**

The scientific method uses some type of measurement to analyze results, feeding these findings back into theories of what we know about the world. There are two major ways of obtaining data, through measurement and observation. These are generally referred to as quantitative and qualitative measurements.

Quantitative measurements are generally associated with what are known as ‘hard' sciences, such as physics, chemistry and astronomy. They can be gained through experimentation or through observation.

For Example:

* At the end of the experiment, 50% of the bacteria in the sample treated with penicillin were left alive.
* The experiment showed that the moon is 384403 km away from the earth.
* The pH of the solution was 7.1

As a rule of thumb, a quantitative unit has a unit of measurement after it, some scientifically recognized (SI) or SI derived unit. Percentages and numbers fall into this category.

Qualitative measurements are based upon observation and they generally require some type of numerical manipulation or scaling.

As an example, a social scientist interviewing drug addicts in a series of case studies, and documenting what they see, is not really performing science, although the research is still useful.

However, if he performs some sort of manipulation, such as devising a scale to assess the intensity of the response to specific questions, then he generates qualitative results.

* On average, the subjects showed an anxiety level of four.
* 91% of respondents stated that they preferred Hershey bars.

Generally, qualitative measurements are arbitrary, a scale designed to measure abstract responses and constructs. Measuring anxiety, preference, pain and aggression are some examples of concepts measured qualitatively. For a small group of long-established tests, the results are often regarded as quantitative, such as IQ (Intelligence Quotient) and EQ (Emotional Quotient).

Both types of data are extremely important for understanding the world around us and the majority of scientists use both types of data.

A medical researcher might design experiments to test the effectiveness of a drug, using a placebo to contrast.

However, she might perform in depth case studies on a few of the subjects, a pilot study, to ensure that her experiment has no problems.

**3. The Scientific Method is Intellectual and Visionary**

Science requires vision, and the ability to observe the implications of results. Collecting data is part of the process, and it also needs to be analyzed and interpreted.

However, the visionary part of science lies in relating the findings back into the real world. Even pure sciences, which are studied for their own sake rather than any practical application, are visionary and have wider goals.

The process of relating findings to the real world is known as induction, or inductive reasoning, and is a way of relating the findings to the universe around us.

For example, Wegener was the first scientist to propose the idea of continental drift. He noticed that the same fossils were found on both sides of the Atlantic, in old rocks, and that the continental shelves of Africa and South America seemed to fit together.

He induced that they were once joined together, rather than joined by land bridges, and faced ridicule for his challenge to the established paradigm. Over time, the accumulated evidence showed that he was, in fact, correct and he was shown to be a true visionary.

**4. Science Uses Experiments to Test Predictions**

This process of induction and generalization allows scientists to make predictions about how they think that something should behave, and design an experiment to test it.

This experiment does not always mean setting up rows of test tubes in the lab or designing surveys. It can also mean taking measurements and observing the natural world.

Wegener's ideas, whilst denigrated by many scientists, aroused the interest of a few. They began to go out and look for other evidence that the continents moved around the Earth.

From Wegener's initial idea of continents floating through the ocean floor, scientists now understand, through a process of prediction and measurement, the process of plate tectonics.

The exact processes driving the creation of new crust and the subduction of others are still not fully understood but, almost 100 years after Wegener's idea, scientists still build upon his initial work.

**5. Systematic and Methodical**

Scientists are very conservative in how they approach results and they are naturally very skeptical.

It takes more than one experiment to change the way that they think, however loud the headlines, and any results must be retested and repeated until a solid body of evidence is built up. This process ensures that researchers do not make mistakes or purposefully manipulate evidence.

In Wegener's case, his ideas were not accepted until after his death, when the amount of evidence supporting continental drift became irrefutable.

This process of changing the current theories, called a paradigm shift, is an integral part of the scientific method. Most groundbreaking research, such as Einstein's Relativity or Mendel's Genetics, causes a titanic shift in the prevailing scientific thought.

**Summary**

The scientific method has evolved, over many centuries, to ensure that scientists make meaningful discoveries, founded upon logic and reason rather than emotion.

The exact process varies between scientific disciplines, but they all follow the above principle of observe - predict - test - generalize.