**The natural sciences**

The story of the natural sciences is a story of the progress and success. The real progress in science started in the seventeenth century with the scientists like Galileo, Newton and Boyle. They started the scientific revolution which marks a progress that lasts till today. Since then science has discovered basic laws of physics, the structure of DNA, etc. Science also enabled us to split atom, to clone a sheep, to put men on the moon.

Because of the success of the natural sciences some people think that science is the model for all knowledge. Some people even think that if you cannot prove something scientifically then you don’t really know it.

But, is science God: is it all-knowing, unmistakable?

“Science is a way of describing reality; it is therefore limited by the limits of observation, and it asserts nothing which is outside observation.”

Jacob Bronowski, 1908-74

Seems that the science, like every other area of knowledge, has its weaknesses and limitations. We must remember that the natural sciences do not have a monopoly on the truth. There may be some other ways of knowledge that can lead us to the truth.

Recently some critics of science have drawn attention to the dangers as well as the benefits of scientific knowledge. In some quarters, there is a feeling that science is ‘out of control’, and that scientists are ‘playing God’ and meddling with things they do not fully understand. Alarming predictions about nuclear war or the harmful effects of cloning may lead us to question whether in the long-term the benefits of science outweigh the costs.

Questions:

1. What connotation does the word ‘science’ have for you? Are they positive, negative or mixed?
2. Has the technology made the world become a better place for living?
3. What do you think about Tolstoy’s sentence: “Science does not tell us how to live”?
4. Has scientific progress changed men for better?

**The scientific method**

According to the traditional picture of the scientific method, which is known as inductivism, science consists of five key steps:

1. Observation
2. Hypothesis
3. Experiment
4. Law
5. Theory

A scientist begins by observing and classifying the relevant data. He then looks for a pattern in the data and formulate a hypothesis. He then makes a prediction, which he tests by experiment. Experiment can be repeated by other people who will be able to confirm results. If experimental results confirm hypothesis, then scientist may have discovered a scientific low. If experimental results disconfirm a hypothesis, then scientist will need to go back and think again…

Finally, s scientist may develop a theory which explains and unifies various laws in terms of some underlying principles. A good theory explains why the lows are the way they are and provides a focus for further research.

**Criticism of Karl Popper (1902-1994)**

Falsification (false hypotheses): Popper thinks that scientists should not waste their time trying to prove that their hypothesis is true. For the problem of induction shows that this is impossible. We cannot be sure that the low is true no matter how many confirming observation we have made because it is always possible that some other example will not follow the rules.

Scientists should spend their time trying to prove that their hypotheses are false.

Popper’s scientific method is based on conjectures and refutations (baziran na pretpostavkama i pobijanju). A conjecture is an imaginative hypothesis but Popper thinks that there is no mechanical way of coming up with good hypotheses on the basis of the observational data.

Scientists often have their best ideas in a flash of intuition (Mendeleev’s idea for the periodic table came to him in a dream).

Conclusion: scientific theories cannot be conclusively verified or falsified. They cannot be conclusively verified because of the problem of induction, and they cannot be falsified because, when an observation contradicts a theory, it is always open to us to reject the observation rather than the theory.

The concept of proof is only relevant to mathematics and logic and we cannot speak of science proving things in any absolute sense. In science, as in every other area of knowledge, we have to make do with something less than certainty.

**The concept of a paradigm – Thomas Kuhn (1922-1996)**

A paradigm is an overarching theory shared by a community of scientists which is used to make sense of some aspect of reality. (Important paradigms: atomic theory in chemistry, evolutionary theory in biology..)

A scientific revolution takes place when scientists become dissatisfied with the prevailing paradigm, and put forward a completely new way of looking at things. If their ideas triumph, the new paradigm will replace the old one and will become another period of normal science.(The shift from the geocentric to the heliocentric model of the universe.)

However, it seems reasonable to suppose that science will continue to progress in a cumulative way in the future. Some theory may be replaced by a better theory in the future but it seems reasonable to think that as one theory follows another we can get closer to the truth.

**Scientism** is a view that science is the only way we can make sense of reality and discover the truth. Science can find all the answers to all the questions, and if something is non-science then it is little different from nonsense.

**Pseudo – science**

* ***Acupuncture*** – the belief that by inserting needles into various parts of the body you can restore normal energy balance to relieve pain and cure various disorders.
* ***Astrology*** – the belief that our characters are determined by the celestial bodies (sun, moon, planets and stars) at the time of our birth.
* ***Creationism*** – the belief that the theory of evolution is false and that each species was uniquely created by God.
* ***Crystology*** - the belief that crystals have magical healing powers.
* ***Feng shui*** – the belief that the positioning and physical characteristics of your home can affect the balance and harmony of your life.
* ***Graphology –*** the belief that by analyzing a person’s handwriting you can learn about their character.
* ***Homeopathy*** – the belief that an extremely small quantity of a substance that can cause certain symptoms in a healthy person can cure similar symptoms in an unhealthy person.
* ***Phrenology*** – the belief that the structure of a person’s skull determines their character and mental ability.

**The difference between science and pseudo – science**

The main difference between science and pseudo – science is that scientific hypotheses are testable, whereas pseudo-scientific ones are not. There are at least two ways in which pseudo-scientific hypotheses protect themselves from being testable:

1. ***Vagueness***: if a statement is sufficiently vague, it will be impossible to verify or falsify it. A claim such as ‘quartz crystals can restore the balance and energy of your life’ is, as it stands, virtually meaningless. To turn it into a genuinely scientific claim, we would need some kind of criteria – preferably measurable ones – to determine the meaning of words like ‘balance’ and ‘energy’. We might also want to know the time period within which these improvements are supposed to take place.
2. ***Ad hoc exceptions***: a statement may be protected by various kinds of ad hoc exceptions. For example, if someone says ‘All swans are white’ and you show them a black one, they may qualify their statement by saying ‘All swans are white except that mutation.’ A good scientific hypothesis is one that is general in nature and does not keep making exceptions every time it meets counter-examples.

**Human sciences: summary of problems**

“I am more interested in how a man lives than how a star dies.”

Sherwin Nuland, 1930-

“We need more understanding of human nature, because the only real danger that exists is man himself.”

Carl Jung, 1875 – 1961

All human sciences or social sciences (psychology, economics, anthropology and sociology) are based on observation and seek to discover laws and theories about a human nature.

Since human beings seem to be different from other natural phenomena, we may wonder to what extent they can be studied in a purely scientific way.

Among the problems that arise in trying to get information about other people are that is difficult to frame questions in a neutral way and that observing people may affect the way they behave. We cannot directly observe other people’s minds.

Some important phenomena in the human sciences are difficult to measure, and this can make it difficult to study them scientifically.

In human sciences we have a problem to make a hypothesis because the act of prediction may affect the behavior predicted.

Human sciences study complex social situations in which it is difficult to run controlled experiments. Various moral considerations limit our willingness to experiment.

Human sciences are not very good at predicting things. They usually uncover trends rather than laws. Science laws are probabilistic in nature.

Since we typically explain human behavior in terms of its meaning and purpose, we may never be able to reduce the human sciences to the natural sciences. A question that continues to perplex both scientists and philosophers is how the mental is related to the physical.