Science as a Culture Its Implications

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1 Introduction

Science as a methodology for probing the secrets of nature is well known. During the last four hundred years science has created a gigantic storehouse of exact knowledge of the physical world. On the other hand science as a technology has maximised the use of scientific knowledge to transform the economic condition of the society.

There is a third aspect of science, which is mostly overlooked and rarely discussed. This is science as a culture. It has deep and important implications, though not as clearly manifested as the other two. In India, ours is a scattered and mostly ineffective scientific community. So far our community needs are, to a large extent, met by the Western society. I believe one reason for this is, we are lacking, collectively speaking, in scientific culture.

2 Science as a Culture

In 1874 Francis Galton, the father of biometry, carried out a survey of 180 top ranking scientists of England and Wales. The result was published in a book entitled "English Men of Science Their Nature and Nurture". Some of his findings on the religious belief of scientists were as follows. (1) Eight out of ten scientists were members of the conventional Church of England. (2) Most of them showed a concern for human welfare much above the average people. (3) Even those, who categorically stated, they had a religious bend, did not believe in the Christian doctrine of original sin and the doctrine of life after death. A typical answer was though I believe in Christian religion, I do not accept the authority of church to teach me how I can attain emancipation. I strongly deny any interference with my freedom of thought and the freedom of my conscience. It was clear, the study of science was changing the outlook of scientists in matters not directly connected with science. This we call cultural aspects of science. The study of science affects a scientist's thinking on life in general, his judgement his value system. However, such an effect seems possible only if the pursuit of science is inspired at least partly, by the primary motivation. Today particularly in developing countries like India. Many persons take to science because of money, fame, power or for some other secondary reason. In such case it is possible to develop a compartmentalised approach, not allowing scientific thinking to percolate into one's religious or cultural beliefs. A scientific community can tolerate only a limited number of such workers. If the number is large the community ceases to be effective. Primary motivation to science starts from a natural curiosity about the objective world and if properly nurtured, turns into a passion for problem solving. Inability to arrive at a solution is sometimes so discomforting that if some one else gives the solution, one feels relieved and delighted, even though one misses the credit. When one really enjoys scientific activity, solution of a problem becomes of primary importance, *who solves the problem* is relegated to the second place. One need not be a selfless idealist to achieve this cultural state of the mind. It seems natural when one is working in the right atmosphere of a scientific community where the primary

emphasis is on knowledge rather than on the individual. Max Mueller beautifully expresses this aspect of the scientific culture in connection with a controversy on the theory of evolution as applied to the development of language. According to Max Mueller facts clearly show that there is a sharp discontinuity in this development which contradicts Darwin's theory of gradual evolution. Darwin himself declined to offer any opinion. Many linguists however opposed Max Mueller's contention. Writing to such a colleague, Max Mueller observed,

> "I believe we both care far more for what is right than for who is right ... . Facts and correct deductions from facts are all we ought to care for; who discovered them and who made them is of very little consequence"
> (Scholar Extraordinary N. C. Chowdhury, Orient paperback, 1974 page 256).

Those who contribute to scientific knowledge are important, but the totality of this knowledge is far more significant. As Edwin Hubble remarked, in his book, The Realm of the Nebulae,

> "Today the least of the men of science commands a wider prospect (than Newton). Even the giants are dwarfed by the great edifice in which their achievements are incorporated".

A reversal of the relative emphasis between knowledge and the discoverer of knowledge will spell a disaster for the development of science. The result will be a stagnant scientific community and an oppressive atmosphere in which the natural joy in scientific activity will almost disappear and it is the credit which everybody will hanker after.

In this connection we mention an interesting episode. About publicity of scientists, Born writes,

> "Only when great discoveries are made did brief factual reports appear in the newspapers. I can remember the way Roentgen's discovery in 1896 was reported by the press; he himself was hardly mentioned. I myself committed a minor offence against the rule in my book, Einstein's theory of relativity. The first edition of 1920 contains a photo facing the title page, and at the end a short biography of Einstein ... . Immediately after the publication I received a letter from Max V. Laue, in which he wrote that he and many other of my colleagues objected to the photo biography. Such things did not belong in a scientific book. Impressed by this I left out both their personal details from the new edition published soon afterwards"
> (The Born-Einstein Letters, McMillan 1971,p 42).

It is true, as Born himself commented, in later years things changed to some extent and individual scientists were given some publicity. But in the scientific community the emphasis on the priority of knowledge remained unchanged.

The emergence of such an objective mind is an important contribution of science to human culture. To such a mind facts are sacred and statements based on facts are the only ones worthy of examination. Accurate and reproducible facts are the basic elements on which the grand cumulative edifice of scientific knowledge stands. Conceptual and theoretical notions about the objective world undergo abrupt changes as theories advance. But facts do not change; they are made more and more accurate. Alteration, distortion or selective choice of facts to fit a particular theory or idea is highly unethical in the culture of science. Those statements may appear obvious and simplistic. But it is extremely difficult to follow them in practice. I would request the reader to recall what happens in practical classes even in our best colleges and universities; recall the ease with which data are attuned to fit the expected results. After such training over a period of six or seven years, it is doubtful if a student will ever be able to appreciate the culture of respect for facts.

The habit of objective thinking has overtones beyond the realm of science. For example, it offers anew perspective to look at outstanding scientists (or personalities in other sphere) such that their image can never be moulded in pattern with the spiritual concept of an infallible guru. A successful scientist is highly respected for his achievement but this does not prevent the community to reject or criticise his other ideas which are not supported by facts. Galileo's brilliant studies in mechanics do not justify his theory that tides are caused by earth's rotation. Success of Newton's gravitational theory does not justify his corpuscular theory of light. Nobody is infallible and authority cannot be cited as proof, indeed the ideas mark a big step forward in the domain of human culture.

Coming to the group of talented scientific workers who constitute the core of the scientific community, objective attitude makes it possible for two or more persons to collaborate in solving a problem, though they may not like each other because of difference in temperament. This is possible only when all the collaborators agree that the solution of the problem is urgent and important. Without such collaborative efforts a meaningful scientific community cannot be created and it would have been impossible for science to make the gigantic progress we see now. The science community acting as a wonderful sieve has allowed only the objective contributions from individual scientists to enter the palace of scientific knowledge, leaving out their oddities and subjective inclinations. When we think of Kepler constructing a horoscope of the cosmos, Newton spending a huge lot of time on theology and Einstein preoccupied with pure mathematical constructions of the mind as gateway to understanding nature, then only can we appreciate the true significance of the important role played by the science community.

We have mentioned about ethics in science in connection with importance of facts. As science was growing slowly in Europe, a well-defined ethical standard was also emerging. This standard is not implemented by law, indeed there is no codified statement about the ethical principles to be observed. These evolved as conventions and were implemented through community reactions. An unethical referee, may reject a good paper and steal the idea to write a paper himself. But the community reaction would be so strong that few venture to take the risk. A few years back *Nature* published a paper, reporting highly doubtful experimental results, on *Water has Memory*. The scientific community reacted so strongly that the editor had to institute an enquiry committee and ultimately he expressed regret and declared regard the paper as unpublished. Similar reactions were generated when supposed results of cold fusion experiments were first declared, not in a paper, but in a press conference. Weakness of out scientific community is shown by the fact that the departure from ethical norm in India is quite frequent and go mostly unpunished. This is why some years ago a society for scientific values was set up by Professor A. S. Paintal.

Commitment to hard work is another important cultural element in science. Normally one performs hard work for some gains. But scientists in the days of Copernicus, Kepler and other, performed hard work primarily due to their fascination and passion for science. Even an uneducated scientist like Leeuwenhock put in tremendous hard work to satisfy his curiosity when Einstein met Michelson in Pasadena in 1931,he asked why Michelson had spent so much effort on high precision measurement of the light velocity, Michelson replied "Because I think it is fun".(A Pais, "Subtle is the Lord," Oxford University press, 1982 p 216). Even to day when so much gains are associated with scientific research, Leon M. Lederman addressed the newly admitted students of the Chicago University in a talk entitled 'Long Hours and Low Pay' the fate of those who would take up science as a career! Curiosity about the physical world seems a natural trait us human beings. When study of science turns this into a passion then only the spontaneous hard work becomes possible and science becomes an adventure. We do not go into further details. It is hoped that from the brief discussion given above the reader can develop a broad understanding of the nature of scientific culture.

3 Implications

Our assertion is not that science is such a distinct culture that successful studies of science cannot be carried out in the background of the culture of our society. In fact science has spread beyond the realm of Western culture, as in Japan. The point is, essential elements of scientific culture have to be integrated within the existing culture for developing an effective scientific community in the country. May be, in the long run interaction between the two would modify both to some extent.

1900 to 1930 is the so called golden age of physics in India. A few Indian physicists, starting with Professor J. C. Bose, achieved remarkable success and received international acclaim. Considering the Indian background, the whole phenomenon seemed a miracle. This dazzling event boosted our national pride and deeply impressed young Indian physicists of subsequent generations. Unfortunately there was also a different fall out. Instead of interpreting the event as exceptional, we developed the notion that this is the normal way discoveries in science are made. As Professor Chandrasekhar puts it,

> "... .it gave a false picture, that making discoveries is easy. It had a distorting effect, I mean it was all right in the twenties, but extended into later period, it was not. I started with a totally glamorous view of science that persisted so long as I was in India. But going to England was a shattering experience"
> (Chandra K.C.Wall, Penguin, 1991, p246-47).

The normal and continuous development of scientific knowledge occurs through the efforts of a competent and dedicated community of scientists. It is in the background of such a community alone that a genius can flower into full glory. Unfortunately, neither the scientists of the golden era nor any subsequent group gave much thought to this problem. To day we have so many people doing physics in our country, but to most of them it is an entirely individualistic pursuit. We miss the sense of adventure in our work, instead there is isolation and frustration. This is well reflected in a letter Professor K. S. Krishnan wrote to Chandrasekhar in 1936 on the question of latter's return to India from USA.

> "On this side at any rate, I know the conditions and with all my optimism and enthusiasm for science, I feel the present scientific atmosphere in India quite oppressive and it may be an advantage if you can postpone your return to India by one or two years"
> (Chandra, K.C. Wall (Penguin) 1992, p 234).

Andre Weil, an eminent French mathematician of this century, came to India at a very young age and joined Aligarh Muslim University as head of the department of mathematics in 1930 and stayed for two years, He also visited Dacca University and met Professor S.N.Bose there. In a recollection in 1970 (recorded by Dr. H.Banerjee) Professor Weil commented

> "The early thirties in India was a disturbed period, due to noncooperation movement. Many of us hoped that the upheaval, initially with a political content, could be an occasion for the national leaders for creating a condition for the flourishment of new ideas and foundation of scientific studies and research in the country, I am sorry to say that this expectation has not been fulfilled. As I found then, the atmosphere of intrigue that reigned in the universities was paralysing in every sense. I am now retired as a professor, and in my long career I have seen many examples of intrigues and personal rivalry in University spheres in various continents. But believe me, what I have witnessed during two years in India exceed by far what I have seen during the rest of my life."

[We quote Weil's comment at some length because he developed it serious interest in India and its culture. He met, among many Indian readers both Tagore and Gandhi . He learnt Sanskrit to read Gita and Mahabharata in the original. This comment made in connection with his reminiscences of Professor S.N.Bose is as yet unpublished. I thank Dr. Purnima Sinha, a student of Prof. Bose for sending me a copy of the interview].

Has the atmosphere changed radically after independence? There is hardly any indication. When Professor Chandrasekhar was requested to be the chairman of Atomic Energy Commission, after Bhabha's death, he came to India and visited several scientific institutions and also met many scientists. Ultimately he declined the offer and before leaving India commented, the problem is not with money, it is the atmosphere which is discouraging.

In 1985, in an address before IPA, Professor Virendra Singh in his address as the chairman, said, "Presently the physics community in the country is rather fragmented a feeling of isolation is felt by most of the member."

The above discussion reveals the true significance of science as a culture. We cannot create the right atmosphere for basic scientific activities, both teaching and research unless we have imbibed scientific culture, i.e., unless our minds are genuinely involved with the problems of the objective world, the problems which we discuss either in the classrooms or in research seminars. How this transformation can be achieved is a different and complex problem. It is not within the scope of the present discussion.

We conclude by mentioning another important implication of scientific culture. Most of the existing cultures are based on religion and they originated at a time when little exact knowledge of the physical world existed. After the spectacular advance of modern science it has become more and more difficult to accept these elements of a culture which are based on objective falsehood. It is not surprising, that this impact is strongest on the Christian culture. A few years back, Galileo's case was reopened by the Pope and the mistake in the judgment was admitted. In the case of shroud of Turin, a shroud believed to be used to cover the body of Jesus Christ after it was removed from the cross, scientists in 1978 wanted a small piece of the shroud to do carbon dating to establish its age. The cardinal of the church refused but in 1988, the cardinal, of his own accord, sent pieces of the shroud to three laboratories. After testing it was definitely established that the date of origin was later than 1200 AD. Most probably between 1260 to 1390 AD. The myth was exploded.

Some years ago the newly appointed Archbishop in England declared that a person could remain a devout Christian without believing any of the numerous miracles described in the New Testament. Initially there were angry protests with a demand for removal of the Archbishop. But nothing serious happened. Very recently on 23rd July 1999, Pope Paul redefined the concept of heaven. It is not a place above the clouds. It is a state of being close to God, as hell is a state of being separated from God. It seems objective truths create a psychological pressure on all thinking men which can be relieved only by getting rid of the objectively false beliefs. The process is definitely very slow at present. But may be at some critical stage it would be much faster.

Some day in the distant future, we hope all cultures of the world would free themselves of elements of faith which contradict the objective knowledge of science. Then all the cultures will come closer and communication across the cultural barriers will be easier. The age-old conflict between the cultures may then be resolved with much less difficulty. Perhaps this would be the greatest contribution of science to human civilization.