Cultivating a scientific temper

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A FEW months ago, in an article in a national newspaper, Professor C.N.R. Rao expressed anguish at the declining support for science in the country. The figures quoted in the article are depressing. While support in terms of the GNP is increasing in several Asian countries, in India it is actually diminishing.

And what about private support from industrial houses, business empires and rich individual donors? Barring a handful of exceptions, the picture here is even more disappointing. Despite hundred per cent tax exemption on donations to institutions doing scientific research, private funding forms a negligible fraction of the budgets of such institutions. Sponsored research, whether in government laboratories or as part of the industry's own establishment, is nowhere near what it is in the more advanced countries.

Take the example of astronomy and astrophysics—subjects dealing with the highest intellectual endeavour but believed to be remote from practical use. Here some of the greatest discoveries came from privately sponsored research in the US. Fred Hoyle's famous Institute of Theoretical Astronomy at Cambridge in England owed its origin to private foundations. Yet invitations to business houses in India to lend even modest support to the activities of the Inter-University Centre for Astronomy and Astrophysics at Pune (a new institution that is rapidly acquiring international repute) have so far yielded nothing.

Supporting basic science apart, the industry's record of R&D support too is disappointing. Indian industry, by and large has not appreciated the role of technology as an instrument of growth. Out of the total industrial production, barely 10 per cent can be attributed directly to R&D efforts in the country.

The apathy towards science is seen in the celebrated 'man in the street' too, in the public organizations he has created and in the leaders he has elected. In some cases, there are even anti-science views gaining ground, and situations where the dictates of a rational scientific temper are set aside in favour of emotions, blind faith and obscurantism. Let us take a look at a few generic examples:

Science and astrology. Every year there are at least a couple of national-level meets of astrologers in which a minister or two blesses the occasion with profound sounding statements extolling the virtues of astrology and calling for further research in this 'extraordinary science'. Newspapers and magazines regularly publish astrological forecasts. The solar eclipse of 1980 was able to empty the streets of Bombay more effectively than a bandh or a curfew.

The confusion between 'astrology' and 'astronomy' is very common—the jet set yuppies are as confused as illiterate villagers. Once, when I was describing our computer centre with its latest astronomy software and remote logging of foreign astronomical databases, an urban well-educated lady asked me if the centre produces computerised horoscopes! And what is more, even at the forum of the Indian Science Congress, a lecture of astrological content was presented this year.

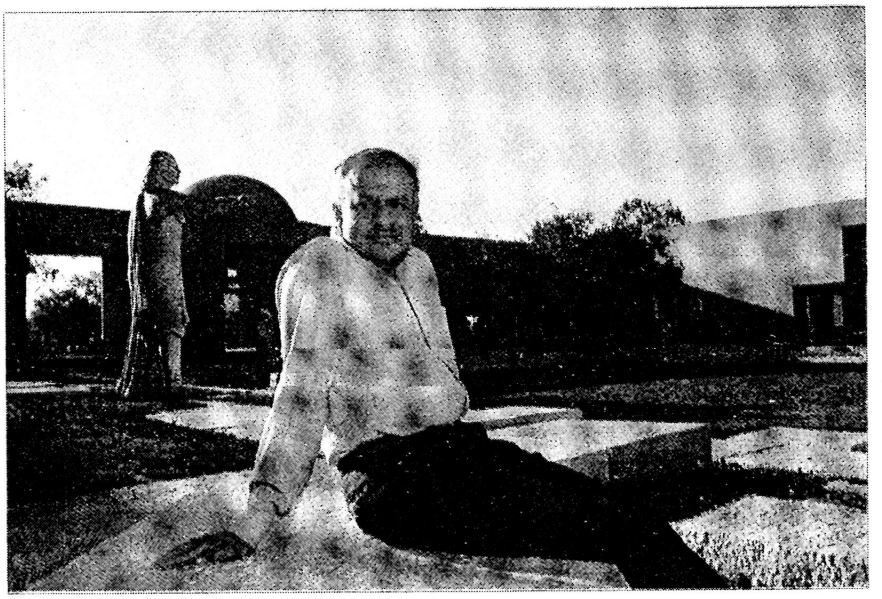
There are two aspects of the situation that concern us here. First, is astrology a science? Second, can we afford to regulate our lives by it?

The first question has been answered in the negative many times over by scientists who have performed numerous controlled experiments to test the validity of astrological forecasts. Science has a methodology, a discipline that regulates its assumptions, experiments and predictions. Astrology has been tried on the same anvil and has failed to make the grade.

The second question should also be answered with a resounding 'No'. The response to any situation should depend on the exigency, on a rational assessment of the pros and cons and proper planning. If important action is postponed because 'the planets so dictate' then we lose ill-affordable time.

Science and religion. Often science in the country suffers because it is seen as anti-religion. A conflict between science and religion need not arise if we recognise their respective non-intersecting spheres and methodologies.

Science deals with facts and theories of nature. Facts have to be explained and understood in terms of as few basic assumptions as possible. Theories come and go, as the perception of facts improves and the sphere of human knowledge expands. Thus, Einstein may succeed Newton, Maxwell may follow Faraday, Feynman may



Science, not superstition should guide us, says Narlikar

take over where Dirac left off. But, in spite of the important contributions individuals have made to science from time to time, science itself remains objective. Its theories may be tested by anybody against available facts and used for making predictions to be verified in the future. As such, all scientific theories are always 'on trial'. And no statement can be accepted from any scientist just because he has been a great achiever. Even Einstein's objections to some fundamentals of quantum theory (despite his getting a Nobel Prize for discovering a quantum

Scientific research needs more support

effect) had little effect on the development of the subject.

Repeatability of experiments is another hallmark of science. Professor X may get a Nobel Prize for an important pioneering experimental discovery. But thereafter that same experiment can be performed with the same result by anybody who follows the procedure laid down for performing that experiment.

Despite its progress, science never claims to have solved everything at any given time. There are always new questions to answer, new frontiers to explore. For example, gravity still remains an enigma, despite Newton and Einstein. Today we know how atoms are constituted but we also know that they are not the ultimate basic micro-structure of matter. Nor do we know what that micro-structure is, even whether one exists. Today's telescopes bring information from hitherto unexplored regions of the universe but new information inevitably brings new questions.

And, of course, science is still in the dark about mind, consciousness, emotions, etc, even though it may have made some progress about understanding intelligence. These areas have been the traditional strongholds of religions. All major religions have prophets and saints who have attempted to pass on their wisdom to others. Unlike a scientific experiment, however, the experiences of these seers are unique to themselves: as a rule they have not been repeatable by others. Lesser mortals can share those experiences only through their gurus' discourses and writings. This necessarily requires faith, which has never been a sufficient qualification in science. Nevertheless, this faith, and the wisdom it believes in, has served to occupy a place in the human mind that science has not so far managed to do. Thus, there need be no conflict between science and religion if each person manages to strike a balance (the level of which is entirely individual to him) between the incontrovertible facts provided by science and the wisdom of traditional religions.

UNFORTUNATELY, today, instead of seeing a union of science and religion, we see a conflict of science versus religion. On the one hand, we see religious wisdom giving way to rituals, dogma and communalism, while, on the other, we see scientific facts unscrupulously used to produce technological disasters like nuclear weapons and industrial pollution.

Radiation leakage from a nuclear power plant, a Bhopal-type tragedy, an oil slick spoiling the beaches, the crash of an airliner, the bursting of a dam, the destruction of forests, are all laid at the doors of science. These disasters are not the fault of science but are symptoms of bad management of science. They are not confined to our country: it is a worldwide phenomenon.

Likewise, misuse of religion has also become a worldwide phenomenon. From the extreme forms of religious fundamentalism to the more subtle and no less dangerous miracles of the godmen, we only see examples of mind-manipulation instead of the mind-elevation which all great religions aspire for.

Science and society. So where do we go from here? All countries are facing future shock—trying desperately to adjust to the rapid advances of science and technology. While the developed countries have their own brand of problems, India is in a more difficult situation. Consider the generic case of a student who has not studied for his course. He is worried as the exams draw near. As part of his last-ditch attempts to get good marks, he queues up at Siddhi Vinayaka. He hopes to please the god by an offering, so that he may get good marks in spite of a poor performance. Suppose, for a moment, that the god is pleased by the offering to 'do the needful'. In what way is the god different from a suitably bribed municipal official who helps you take short-cuts? If, on the other hand, the god is above all this nonsense, why approach him this way? Wouldn't the student be more usefully occupied studying rather than standing for hours in a queue?

The reader's sensibilities may be shocked by this argument. He should examine why. For, the argument is based on the much-needed scientific temper which is becoming a rare commodity today.

A rich man can afford to be wasteful; he has ample resources to draw upon. A poor man must think twice before deciding how best to use his limited resources. The same holds for rich and poor countries. We cannot afford wastages of any kind—time, manpower, property and human values. Our very survival as a nation makes this axiomatic.

The scientific temper guides us on how best to use our limited resources, how to assimilate the beneficial gifts of science and technology while avoiding the harmful ones and how to retain our traditional wisdom without succumbing to dogma and superstition.

Will we ever learn to cultivate it?