scientist wanted to publish a paper, he/she would send it to the editor of a scholarly journal for publication and generally it would be published. A new, unpublished scientist was required to obtain the endorsement of a published scientist before submitting a manuscript.)

There is a major flaw in the blanket application of anonymity. If anonymity leads to greater truthfulness, then it could be put to great advantage in the courts. Courts have in fact utilized anonymity – in the infamous Spanish Inquisition and in virtually every totalitarian regime – and the results are always the same: People denounce others for a variety of reasons and corruption becomes rampant.

For decades, the use of anonymity within the National Science Foundation, NASA, and elsewhere has been gradually corrupting American science. Unethical reviewers – secure, camouflaged, masked and hidden through anonymity – all too often make untrue and/or pejorative statements to eliminate their professional competitors. It is a pervasive, corrupt system that encourages and rewards the darker elements of human nature. Under adverse conditions, humans adapt to their environment if they want to survive. And, survival in this corrupt environment has led to a 'consensus only' mentality. Scientists are quick to realize that citing work that challenges the 'consensus view' might well result in their own reports not being published and their proposals for grant aid receiving only lukewarm reviews. Consequently, publications of important scientific contradictions, if they can be published at all, are selectively ignored in many instances. *SCI* data in such a corrupt environment may be of little administrative value, except for possible use in documenting scientific fraud.

In the 1970s, there was a movement in American universities to make use of students' evaluations of their classroom teachers and teaching assistants. In some instances, a team would come into the classroom to collect students' evaluation forms, while the teacher and teaching assistant were required to leave the room. Those evaluations would then be analysed and used for administrative purposes, especially in promotion and tenure decisions.

People are the same worldwide. Generally, they want to earn a living and be successful and secure in doing so. From personal experience, I know the response of some teachers to students' evaluations. The teachers became less demanding, lowered their expectations, and, consequently, received more glowing reviews from many of their students. Teachers adapt and scientists adapt. As knowledge of the administrative use of *SCI* data spreads, scientists will adapt and shift to research on popular subjects to elicit greater numbers of citations, rather than take the paths less trodden where important scientific discoveries may be waiting.

Beyond the use and misuse of *SCI* data, Roy[5,7] and I[8,9] are in agreement that emerging India should chart her own course and not simply parrot a system that has been mal-administrated to the point of corruption.

1. Arunachalam, S., *Curr. Sci.*, 2005, **89**, 1450.
2. Cardona, M. and Marx, W., arXiv.org/physics/0601113, 2006.
3. Soler, J. M., arXiv.org/physics/0608006 1 August 2006, 2006.
4. Meho, L. I., arXiv.org/physics/0701012 30 December 2006, 2007.
5. Roy, R., Roy, N. R. and Johnson Jr., G. G., *Scientometrics*, 1983, **5**, 117–124.
6. Roy, R., *Phys. Today*, 2005, 12–13.
7. Roy, R., *Curr. Sci.*, 2006, **91**, 16–17.
8. Herndon, J. M., *Curr. Sci.*, 2005, **88**, 1714.
9. Herndon, J. M., *Curr. Sci.*, 2005, **89**, 425.

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Indian science and technology at crossroads

Sen[1] has raised many issues and described the historical background in which science grew in India since independence. It is certainly of some concern to note that in the world-wide ranking, India has slipped over the years in the growth of science, when measured with *Science Citation Index* as a parameter of performance. Perhaps of even more importance, and yet to be defined by an index, is the extent to which the Indian scientific community has really contributed to the technological and economic growth of the country. One would suspect that in this regard, their contributions are even less, perhaps not entirely their fault. This is due to the fact that much of our high-technology industrial production is based on licenses from abroad. The licensors give only production technology 'know-how', and rarely the underlying design principles. Such production failed to establish a self-generating high-technology economy, in which scientists tend to play a crucial role. It is this alone that would enable us to join the cadre of the developed world.

It must be appreciated that when scientists spend public funds, they are implicitly trustees for public good, and cannot betray that trust by taking up research that does not contribute in a tangible manner to the country's welfare. If we use this criterion, one would suspect that the Indian scientific community has not really lived up to the standards set by scientists in the developed world. It is true that a lot of money is spent in the US for open-ended basic research. But when considered as percentage of the US federal budget for R&D, it is apparently not more than 15% of it. The rest of it is for directed research, technology development and R&D programmes resulting from them.

For example, when the Pentagon wanted the turbine entry temperatures of fighter aircraft jet engines to be increased by 50°C to obtain higher thrust, it supported several R&D programmes, both applied and basic. When the cooled turbine blade technology was successfully developed, all the other ongoing associated programmes were stopped. In other words, the government desired to achieve a specific technological objective, and it supported many project-specific programmes towards this end, including many in academic institutions also. This is not an isolated instance. One has to dig in deep to find similar instances in India. As the Chairman of the Technology Advisory Board (which was recently abolished) for engineering a group of laboratories of the CSIR many

years ago, I proposed that the plan allocations to its laboratories should be project-specific, apart from the external cash flow, as a measure of the utility of the outputs from the laboratories. The idea was received with thundering silence, as it would have meant accountability on part of the CSIR headquarters also. So much for building accountability.

Robert Sollow, Nobel laureate, has pointed out that the benefits to the US from targetted high science and high technology research and their spin offs, have been immense and materially helped the US economy. Typically, the outputs of such research in academic and research institutions, including those generated through consultancy work, tend to become inputs to the industry, resulting in the development of new spin-off technologies and new products, again resulting in new research programmes. In essence, the loop of knowledge is closed and opened again with new forward-looking research programmes, with substantial benefits to the country at all levels. Except possibly in atomic energy and space, one has to search in-depth to find similar instances of high science and high technology research being conducted with public funds to directly support the technological base of the country. Production based on 'know-how' from abroad would still seem to have a decisive influence on the country's economy, with the academic and research institutions and the industry each going their own way. Their research does not seem to be making any tangible impact on developing a self-generating technology base for the country.

One would get the uneasy feeling that the bulk of research in the academic institutions is more inspired by what is going on in the developed world, never mind even if it is not of much relevance to respond to our own needs. Self-generating technology bases that will be directly benefited by research, as for example, in fields like superconductivity or nanotechnology, have not been really established. Without such foundations, such research and the money spent on it becomes infructuous and is a wasteful expenditure. Apparently, as mentioned by a former S&T Secretary, something like Rs 50 crores (500 million) was spent on superconductivity research. What benefit did the country receive? Also, one wonders which is more important: a mission to the moon and similar programmes or a more aggressive Anganwadi programme for children and greater investments in education across the board? Without a broad base for education at all levels and self-generating high science–high technology bases, our dream of joining the developed world is a non starter.

One wonders if the S&T departments do any cost-benefit analysis of their investments. It is this that the scientific community and the S&T departments of the government funding scientific research, need to ponder deeply. Whatever happened to the concept of S&T missions? Do the S&T departments believe in such projects, or do they prefer to dole out funds based mainly on committee recommendations and forget about them afterwards? We are not rich enough to afford the luxury of research as an end in itself. When seeking public funds, scientists owe an answer to the public to the question: 'if they succeed in their proposed research programme supported by public funds, who is going to be benefited downstream by their research?' If not, they are seeking public funds for their research to satisfy their intellectual curiosity, such as it is. The government will then not be obliged or inclined to give higher salaries to the scientific community, except possibly in isolated instances of outstanding performance. If IT professionals in the private sector draw high salaries, it is based on supply and demand and there is inbuilt accountability. They would be unceremoniously fired if they do not deliver the results. In government service, nobody is ever fired except for moral turpitude. In many S&T departments, scientists take their promotions for granted, and not necessarily on vacancy basis only. In any case, they, like all other governments employees, are assured of periodic upward revision of salaries.

It is not the hundreds of research papers inspired by articles in foreign journals which our scientists produce that will benefit the country, but those that lay strong, self-generating S&T foundations that will enable us to join the cadre of the developed world. I believe, it was this objective that prompted Jawaharlal Nehru, Indira Gandhi and Rajeev Gandhi and even the present Indian Prime Minister to give unstinted support to the cause of science in India. We have to live up to their dreams. If not, even President Kalam's 'Vision 2020' will simply remain unrealized.

1. Sen, B. K., *Curr. Sci.*, 2007, **92**, 171–173.

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Sacred groves for biodiversity conservation in Uttarakhand Himalaya

In India, biodiversity outside the protected area system is rich because of a close relationship between religious, sociocultural beliefs and conservation. These informal protected areas are important from the conservation point of view. These areas include sacred groves, which exhibit rich floral and faunal diversity with some rare and threatened plant species present in them and indicate an ecosystem with various life forms[1].

However, at present, respect and reverence for traditional practices have been diminishing. In this respect a study conducted in Almora district, Uttarakhand concluded that traditional practices have diminished over time[2]. In our country there is increased vulnerability of sacred groves to various forms of degradation and it becomes necessary to protect them from fragmentation[3] and changing belief systems[4].

Uttarakhand (earlier Uttaranchal) State located between 28°43′–31°27′N and 77°34′–81°02′E, also called as 'Dev Bhumi' or the abode of gods is unique in this regard. The landscape in the State is dotted with many holy places of worship. These places are often of small-to-medium size with natural vegetation as a sacred grove of the deity.

There have been several studies on sacred groves in India. However, studies on this