

research record, as do the benefits associated with them in areas such as health and national security. Sustained public trust in the research enterprise also requires confidence in the research record and in the processes involved in its ongoing development'.

What do these developments in the US signify to us? After four and a half years of study of the problem of misconduct in scientific research, *the President of the United States issues this finding for compliance by all bodies receiving federal R&D support*. The President's findings and the associated definitions are comprehensive and leave no scope for misinterpretation.

The contrast in India is striking. The best thing that could happen would be that the Indian ORI under CVC would have no work as scientific misconduct would be nipped in the bud at the agency and institutional levels! Conduct of scientific research in India is replete with instances of malpractices. It would appear that an ORI is more urgently needed in India than its counterpart, NSTCIG, in the US.

By being unwilling to create such a body, we are implicitly stating that our

research scientists are either pure as driven snow or that the system has become too rotten to be amenable for any corrective action. No honest Indian scientist could agree with either of these conclusions. The most common instances of scientific malpractice in India are senior scientists taking unfair credit for research work to which they have not contributed in any manner, and plagiarism, although falsification in scientific papers is getting to be known more and more. Why then the reluctance among scientists with professional integrity to bring formally into existence a corrective course of action? Is the scientific community too afraid to accept voluntarily a formal honour code and subordinate its conduct to it? A simple question arises. If it is not willing to provide leadership to set our house right, who shall do so? Should it be imposed, as is being done in the US President's finding on misconduct in scientific research? It is time that a formal code for practice and management at the level of S&T agencies is brought into existence as soon as possible with an Office of Research Integrity under CVC treated as the ultimate ap-

pellate authority. CVC is helpless unless the S&T Agency heads take the initiative in the matter. Its non-creation is bound to reflect on their own value systems in this matter.

Our academies and other professional bodies must recognize formally that unethical actions in the practice and management of S&T are numerous and also actively help CVC create an ORI and set up systems and procedures to ensure compliance with an honour code formulated by them. If not, Indian science is doomed and with it Indian technology. Given the present situation, our scientific community can only continue to complain about the scant attention it receives from that of the developed world, if it does not set its house in order.

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Something is rotten in the state of education

Much has been said in these columns about falling standards in our educational system, the lack of demand for courses in science subjects, the need to popularize science among youngsters and to inculcate the scientific temper among the general public. While we scientists continue to ponder about these worthwhile issues in a decent manner, I fear that many of us may be living in a fool's paradise.

By chance, I happen to live in a state which has really advanced in terms of alternative educational scenarios. I refer, of course, to the current and seemingly endless craze for an engineering degree. The state of Andhra Pradesh is home to many innovations in this regard. All of coastal Andhra is dotted with residential outfits that train students to

take the engineering and medical common entrance tests. Here, the day begins at 4.00 a.m. and ends at 10.00 p.m. To my knowledge, the only other institution that worked successfully according to these hours was Auschwitz.

Continuing with the theme of *Arbeit macht frei*, let us consider a popular operation in Hyderabad, wherein of the 125 students who are trained each year, around 110 routinely clear the IIT-JEE. Recently, 7000 students appeared for a test for entry into this study circle – a test to write another test. This number is close to half the number of students who appear for the entrance tests of all the programmes of study offered by the University of Hyderabad. The attrition rate in this test is, therefore, much higher than that in IIT-JEE itself. This is not all.

Several colleagues from IIT-Madras have complained to me about the very limited ability of these students to cope with the B Tech curriculum there.

This craze, or shall I term it insanity, to acquire an engineering degree has spread everywhere. No one is exempt. A non-teaching employee in my department expressed concern about putting his child through this monkey mill. He was scared. Indeed, he had absolutely no idea as to even what the word engineering meant. The daughter of one of my colleagues told me that the only reason she was trying for an engineering seat was because she felt that she could not get married if she did not become an engineer.

The story goes on and the examples are endless. That the levels of despera-

tion are so high and that the gullible public will rush like lemmings to charlatans, often at considerable costs in terms of money, time and energy, only indicates that traditional education in this country has collapsed almost completely. Unless we are honest enough and admit this staggering failure caused by ill-founded policies and actions over the decades, there is little hope for a proper education for a young person in this country in science or for that matter, in any other subject. Indeed, the sorry

state of science education is only a small part of the much deeper systemic rot.

A colleague in IIT-Kanpur cynically remarked to me that IIT did not even need to teach the B Tech students anything. They knew everything. All IIT would need to do was to provide a certificate that the candidate had cleared the IIT-JEE. This in itself would be sufficient to get a software job in Bangalore or a visa to the USA.

Of course, we all know that engineering degrees lead to H1-B visas to the

USA, even though one might be only a computer coolie there. This might well be the prevalent opinion today, in which case I am happy to retire hurt, saying that I have already seen too much.

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Reference problems

A few months ago I happened to take note of a very simple matter generally considered as inconsequential by scientists. I was trying to find out the meaning of a scientific term from a very thick book with over 500 pages. As usual, I saw the index first, took note of the page number and flipped back to the indexed page. There the keyword was printed in blue colour (a rare utility feature). Within a few seconds I got the meaning. I could save at least 5 min by not searching the full page, since the word was printed in blue. Now let me show the difficult side, a book with poor indexing and non-detailed contents page. It can take tens of minutes to find out the needed item.

Now take the case of scientific articles published in journals, books, etc. In almost all references in the lists at the end of the papers, the specific page number to which the citation is made is

absent. All journals print only the range of pages for research papers cited in the article and published earlier. This takes away considerable amount of research time if scientists want a verification of referred items. Also, referring ways are different from journal to journal. Hence, it is necessary to state in the references the exact page number or numbers (separated by commas) in the cases of books, reports, chapters in edited books, review papers and other papers. This measure can save time for researchers (as illustrated earlier) who study the published papers with verifications of cited articles and takes only a few minutes more for authors when they prepare their manuscripts. A conservative estimate of possible time and money saved is 5 million research hours and 400 million rupees per year for India alone. This is about 5% of CSIR's annual budget. (This takes into consideration

only 50,000 seriously working scientists out of a total research and teaching staff of over 0.4 million in CSIR, ICAR, ICMR, universities, etc.). Following are some good examples for referring to books and reports:

1. Constantine, G., in *Biology of Bats* (ed. Wimsatt, W. A.), Academic Press, New York, 1970, vol. 1, p. 320, pp. 319–322.
2. Ramage, C. S., *Monsoon Meteorology*, Academic Press, New York, 1971, p. 75, p. 82.
3. Chundawat, R. S., Technical Report No. RR-1, Wildlife Institute of India, Dehra Dun, 1990, p. 27.

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