Research and teaching: inventing a connection

I have taken the liberty of copying the title of the 10 July 2009 *Current Science* editorial but with a slight change. As stated in the editorial, 'India finds itself in a curious situation. There are a large number of national laboratories, well funded and well staffed, where there is research but no teaching.... Is there an academic case for promoting teaching in research institutions and to embed undergraduate programmes in a research environment?'. Growth of national laboratories and research institutes outside the universities is a historical fact, but their future growth can be made dependent on their active teaching programmes by stated government policies that will benefit not only these laboratories by providing them large number of well-educated research students but also the industry and the nation tremendously.

On 22 January 2007, I wrote a letter to Manmohan Singh, Prime Minister (PM) of India, with copies to Arjun Singh, Kapil Sibal, C. N. R. Rao, T. Ramasami, K. Kasturirangan, A. Kakodkar and some others; the contents of which are reproduced here.

'I would like to request you to personally look into the following two bold yet highly practical suggestions that would require action at the highest level.

'(1) Nurturing a large number of science and engineering faculties for higher education: We should use extensive facilities of hundreds of our national laboratories, who unfortunately do not participate in the undergraduate or even post B.Sc./B.Tech. level education at present. Cost of equipment and infrastructure in leading 100 or so national science and engineering laboratories of CSIR, DAE, DST, DBT, DRDO and ISRO are likely to exceed Rs 50,000 crores. Nation must utilize this vast scientific manpower and facilities in order to supplement efforts of IITs, IISERS and universities. I would like to suggest that you may write to all the science agencies for directing the national laboratories and institutes to take a large number of students for a 5 year integrated Ph.D. degree after their B.Sc./B.E. examinations for nurturing a large number of high quality faculties. Most research workers in India say that teaching will slow down their research that is in contrast to active participations in teaching programmes by scientists in the developed countries. "Research gains by teaching." Only a dedicated monitoring cell in the PMO's office can correct this historical situation.

'(2) Providing good education to talented and motivated underprivileged students in India: Young students from underprivileged section of our society, particularly those from semi-urban and rural India, face a serious handicap compared to those studying in the central schools and private schools. It is suggested that the central government may open 1000 residential schools across India in selected semi-urban and rural areas for talented and motivated underprivileged students for standards 6 to 10 admitting 50 students in each class. The scheme will cost less than Rs 1500 crores over the next 5 years. It will result in a large number of well trained students (extension of the Navo-vidyalaya scheme by the late Shri Rajiv Gandhi). To ensure its success it may be managed under the scheme of the central schools in association with science agencies, selected universities and leading industries.'

With the proposed rapid expansion of many IISERS, IITs, central universities, etc., there would be a large demand for well-trained faculties particularly in experimental areas. In my view, the national laboratories can and should take major new initiatives towards active teaching programmes for sufficiently large number of students soon after their B.Sc./B.E./B.Tech. degrees. Perhaps, *Current Science* should invite a debate on the pros and cons of this subject.

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Vituperative book review?

After reading the correspondence with the above title[1], I went through the review by L. V. Krishnan[2], the book in question[3] and also the recent letter by one of its authors[4]. The book may make interesting reading for rank outsiders but for persons with any acquaintance with power reactor technology, it is an atrocity. The book abounds with factual errors, unsubstantiated statements attributed to unknown experts and anonymous public and pompous, biased judgements. Lest I am also accused of the same, let me briefly cite a few examples.

On p. 8, it is said that 'Indian engineers have used MOX fuel in a prototype fast breeder reactor with success'. We do not have any prototype fast breeder reactors in the country yet and it is under construction only now. On p. 27, it is stated that 'PHWR uses heavy water under pressure as moderator and coolant'. The moderator is at normal pressure only. This makes all the difference in the design and operation. On p. 32, it is said that 'KAMINI is a thermal breeder reactor'. KAMINI is a simple, low powered research reactor like APSARA. Neither we nor anybody else in the world have any thermal breeders as yet. On p. 73, it is said that carbide fuel elements failed in operation. Carbide fuel elements in FBTR have given superb performance with a burnup of more than 150,000 MWd/tonne without any failure which is beyond all expectations. On page 96, it is said that 'pipes carrying sodium have to be kept at around 600°C at all times to prevent sodium from freezing'. Melting temperature of sodium is only 98°C and you do not need 600°C to keep it molten. As a matter of fact, in FBTR, under cold shut down conditions, sodium is maintained only around 200°C.

Starting at the bottom of p. 5, it is said that Sarabhai shifted the emphasis to space research reducing the importance of the nuclear programme. Again, on p. 69 it is said that appointment of Sarabhai as AEC Chairman downgraded the importance of the nuclear programme. These statements are absolutely without any evidence. It was during his short tenure that IGCAR, our nation's second premier

research establishment and the fast reactor programme took concrete shape. It is known that he was also working on other major schemes such as the agro-industrial complex with nuclear energy as the driving force and much ahead of his times he tried to bring in modern management practices in the Department of Atomic Energy. To say that he neglected the nuclear programme is a malicious statement. On p. 8, it is said that the Indian government has given greater importance to weapons development rather than production of electricity. There is nothing to show, in terms of money, manpower or effort, that the weapons programme took precedence over the nuclear power programme. On p. 34, it is said that construction of Tarapore Atomic Power Station commenced in 1964 but could be completed only in 1969, an year later than was scheduled. But on p. 58, the authors say that power station at Tarapore was delayed by more than 5 years! On p. 40 it is said, '... although experts believe the useful life of a nuclear power reactor is about 30 years'. Which experts are they talking about? 30 years is taken only for costing purposes and it is well established now that with 'extension of life exercises' carried out, power reactors can safely operate for 50 years and more. On p. 41, it is said that the engineers of DAE claim that adequate safety measures to withstand any seismic disturbances have been taken in the design of Narora power plant but their optimism remains to be proven. DAE's claim is not without basis. The power plant design is based on a very thorough study by the nation's top experts in earthquake engineering. On p. 68, the authors say the slow progress made in the atomic energy programme throughout the 1950s and early 60s invited strong criticism from many quarters. On the contrary, during that period the progress in the Indian atomic energy programme was considered to be remarkable and unparalleled. Starting from scratch, with the primitive infrastructure of a developing country, the programme built APSARA, the first atomic reactor in Asia, CIRUS, a powerful research reactor and a reprocessing plant, which very few countries in the world possessed then. It is only in the field of atomic energy, India was ranked amongst the leading developed countries in the world.

What is given above is just indicative. The list in both the categories can go on and on. Lastly, both Raghavan and the author have said that Krishnan seems to be unaware of the fact that one of the authors worked in BARC. I am aware that Sarma was in the group making some neutronic measurements at APSARA. I am also aware that BARC is the nation's premiere, multidisciplinary research centre with over 15,000 persons working on a whole lot of subjects ranging from quarks and gluons to genomes. Not all of them are experts in reactor technology. In any case, a book has to be judged by what it contains and not by the claimed connections of its authors.

Considering all the above, Krishnan's review of the book is quite moderate, even magnanimous. The word 'vituperative' used by Raghavan seems to be applicable to the book itself rather than Krishnan's review of the book.

1. Raghavan, A. K., *Curr. Sci.*, 2009, **96**, 752.
2. Krishnan, L. V., *Curr. Sci.*, 2008, **95**, 1747–1748.
3. Sarma, N. and Banerjee, B., *Nuclear Power in India*, Rupa & Co, New Delhi, 2008.
4. Nataraja Sarma, *Curr. Sci.*, 2009, **96**, 1435.

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Delinking incentives from the age of Fellows of scientific academies and SSB awardees

A strong case for delinking incentives for innovation from age of Fellows and SSB awardees has been made by Saidapur[1]. He has discussed the issue in detail and suggested modification of UGC Circular Clause 3.3 of UGC guidelines dated 24 March 2009. He has delineated the whole issue effectively. Fellows working in state universities retire at 60 years of age. These schemes should be broad based and linked with performance rather than with more emphasis on age and remove anomalies/disparities. It is worth mentioning here that recently MHRD has enhanced retirement age from 60 to 65 for teachers of IIT and central universities. The main purpose of this action was to retain experienced teachers and good established researchers for the benefit of a large number of brilliant youngsters and also to maintain/accelerate the quality of research activities.

Fellows of prestigious science academies and SSB awardees have set novel precedents in attaining much higher academic achievements and have been pursuing to sustain it. Their vast accumulated knowledge and experience is an impetus towards this effort. The national consensus is to enhance the academic quality of our institutions, especially state universities, which will be met if suitable measures are introduced on priority. Universities should attract and retain a pool of talented and committed scientists to work in various departments and influence younger colleagues to imbibe high quality research and teaching. The primary requirement of a university is to engage in knowledge creation with wider and lasting impact on learners and on society as a whole[2]. It is quite apt to note that eminent scientists are embarking on US universities after superannuation to contribute to the overall academic development whereas in India the policy is quite contrasting.

When sufficient care is not taken, while sending circulars, many teachers and researchers from various institutes (especially state universities) will be deprived of these benefits and the very purpose of the scheme is defeated and it amounts to a kind of discrimination. It is necessary for the UGC and CSIR to modify and send the revised guidelines for implementation uniformly all over India immediately.

1. Saidapur, S. K., *Curr. Sci.*, 2009, **97**, 467–468.
2. Yashpal, *Yojana*, 2009, **53**, 8–12.

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