Indian Science Experiment

Fifty years on, Indian science needs a much-needed reevaluation. While scientific progress has been laudable, the vacuum likely to set in among the current top scientific establishments is worrying. To nurture young scientific leadership, it is necessary to encourage interaction between science institutes and university science departments. Younger scientists especially need to be encouraged to intervene in broader societal concerns.

NARESH DADHICH

If we consider independence as a significant phase of transition in the country's life and affairs, Indian science too is 50 plus and that is a substantial period of time on the human scale. It is therefore pertinent to reflect on the path and progress we have made in this very important sphere of life. We have the third largest scientific and technical manpower in the world. We have very strong space and atomic energy programmes. Demonstratively, we can make and launch satellites and are talking of putting man on the moon; we can also produce atomic power and have also exploded atom bombs.

All this is some feat of sorts. Leaving aside for a moment the ideological question, which is very important though, of desirability of atomic bomb and power, the real question is how do we fare in terms of achievements against what was projected. When we began the atomic energy programme in the mid-1950s, the projection was for 20 per cent of the total power by the turn of the century, it has barely touched dismal 2 per cent. That is we do things but these are not up to the mark. Hitting the mark is the new challenge.

We have crossed the preliminary stage of spread and infrastructural build up in our scientific development. While we have done it pretty well on this count because there is hardly any discipline howsoever eupherial or sophisticated may it be that is not being pursued in the country. Now comes the next stage of depth and consolidation as well as of strict scrutiny. This is certainly very difficult and asks for abiding adherence to critical review and for harder decisions and greater discipline.

I
Journey So Far

Right from 1920s, we have had our share of internationally recognised scientists in J C Bose, S Ramanujam, C V Raman, S N Bose, M N Saha, Homi Bhabha, Shanti Swaroop Bhatanagar, P C Mahalnobis, P C Ray, Birbal Sahni, Vikram Sarabhai and others. We thus did not begin from zero level but there were pegs on which things could be hung and built on. With Nehru's enthusiasm for science and technology, there was an organised and concerted effort put into action. Homi Bhabha championed the cause of atomic energy, Bhatnagar organised the Council of Scientific and Industrial Research (CSIR) by setting up laboratories which have now grown in numbers to 50 or more and Vikram Sarabhai initiated the space programme. All of them got full support from Nehru and all the governments that followed him. With no hesitation, I can say that if we have not done well in science, it is not for want of governmental support but rather for want of scientific leadership and management.

All the major research facilities were established outside the university sector and were supported adequately, for instance the TIFR has world class facilities comparable to the best anywhere. On the other hand the universities were allowed to slip into academic slumhood, the phrase used by one of the leading scientists of the country to describe the factual situation some years ago. Naturally the institutes are the first choice of a talented young scientist: Now, there is little in the university sector to attract talent.

The conditions in the universities are precarious. As many as 70 per cent of the universities may not be getting even a single research journal, their laboratories are obsolete and depleted, the infrastructure is non-existent, and to top it all the faculty is indifferent and faction-ridden. However, no university goes without a convocation function with much pomp and show at considerable cost once or for some twice a year. The economy measures are only effected very tightly on library, laboratories and other academic facilities while the acrimonious and meaningless meetings go unabated.

Gone are the days when Mohan Singh Mehta asked in early 1960s to Homi Bhabha to recommend a good physicist to head the Physics department at Jaipur. The good faculty recruitment seems to be the least concern of today's vice-chancellors, deans and the department heads. In the present environment when all roads lead to courts, it is not unthinkable that wooing good candidates by a well meaning university academic could be considered unfair. Further there is the issue of reservations which has completely paralysed the recruitment in many universities. If one takes the overall stock, I would expect that a good 30 per cent positions have remained vacant over more than five years (there is a ban on new recruitment in many state universities). When professorial positions are being reserved, the intention is clearly not to help the underprivileged but rather just to block positions. I think it is time that the beneficiaries of reservation should raise their voice against such blocking. The affirmative action is certainly called for but it should be objective and effective. Reserve only those positions where competent candidates are available.

Plagued with all this, it is therefore no surprise that universities are starved both of good people and facilities. But they have large pools of young talented students. On the average, even in such dire conditions, a good 40 per cent of the faculty is averagely good but most of them remain inactive owing to overall apathy, intrigue and bureaucratic hassles. This is however a good latent pool which could and should be activated.

There are however some glorious exceptions where people have chosen a job in university/college in preference to an institute. But these are few and far between. In this regard, I cannot help

but mention the case of Milind Watve. In preference to IISc, Bangalore he chose to join the Garware College, Pune and has carried on excellent research with undergraduate students which has been commented upon by leading journals like *Science* and *Nature*. Today he attracts students from all over the country, he has become identified with a good undergraduate biology course. This is by no means a small achievement.

It is heartening to see that the tradition of the legendary A K Raychaudhuri and Shyamal Sengupta, of Presidency College, Kolkata, who had inspired and shaped a galaxy of leading world class physicists, continues in some measure at Garware College, Pune. They were however never offered positions in Kolkata university. There are many other such examples, for instance Ashok Goyal, who is one of the most active physicists working in a Delhi college (and Delhi university following the example of the Kolkata university), but other examples are few and far between for our large number system.

On the occasion of A K Raychaudhuri entering his 80th year, his students and friends, who included the Fellow of the Royal Society, Ashoke Sen, the present TIFR director, S Bhattacharya, IUCAA director, Jayant Narlikar, CV Vishveshwara, Probir Roy and others, had come together in the AKR80 meeting between February 21-24, 2003 at the Presidency College, Jadavpur University and SN Bose Centre for Basic Sciences. It was a warm and affectionate tribute to a great teacher and scholar.

The institutes on the other hand have good faculty and excellent facilities, and are free to recruit good people as and when they find them but are starved of young students. In most advanced countries like US and UK, there are no or very few separate research institutes, they are always integral part of university. This is a healthy situation where there is an interaction between talented people both young and experienced. A fair amount of teaching is always good, as it provides an opportunity to refresh one's perception and understanding of the basics which feeds in positively to research and above all one's intellectual build up. For a complete and true academic teaching and research should be inseparable and should rather be an integral part of her person.

This divide between teaching and research, and between students and the best minds is most unfortunate and is nothing short of an educational crime. Imagine talented students in their formative years at undergraduate level not having the benefit of interaction with leading scientists like Ashoke Sen, Jayant Narlikar, TV Ramakrishnan and so on, even when they are all around here in the country. Unless we break this divide, we are not letting students have the benefit of the best of minds. This is bad for either of them and also for the country's overall scientific and educational effort.

It is therefore necessary to do something radical to bring together research and teaching and thereby also bring together excellent minds young and accomplished. Without this, there is no future for science in particular and academic pursuit in general. This has been realised and talked of for quite a while but no perceptible action has come forth. The only honourable exception is UGC's experiment of inter-university centres which has been very successful. That is to create world class facility at a place and make university scientists and students use that. IUCAA (Pune), NSC (Delhi) and C-DAEF (Indore) are such common facilities, and their intervention is quite visible in the research being done in these fields by university/college academics.

This is however not the best option but considering the overall university setup and work culture perhaps the only option available.

II
Reversals Urgently Needed

A new and courageous scientific as well as political leadership is urgently required to bring back universities in the centre stage of academic activity. This is the first and foremost question to address in right earnest. It is of course going to be difficult. There are however some right indications.

Some institutes (IISc, Bangalore and SN Bose Centre for Basic Sciences, Kolkata) have taken up inducting students after BSc for the PhD programme. This is no substitute for a full-fledged undergraduate teaching programme. What we need to do is to persuade all research institutes to have undergraduate programmes. I hear that TIFR, Mumbai is seriously considering taking over the Institute of Science.

The best thing to do would be that all institutes link themselves actively with universities and participate in teaching as well as take up collaborative research projects with university faculty and students. If a laboratory as a whole is not able to interact with a university, what could perhaps be done is scientists in a group or individually should identify and interact both in teaching and research with a university actively.

Second, we should facilitate closer interaction between universities and the institutes through exchange of faculty. The

university faculty should be able to come for a sabbatical to the institute, and similarly one semester involving three months of teaching in a university could be made obligatory for the institute faculty. This would automatically encourage institute faculty to visit the universities. It is now quite doable with easy access to internet, online communication as well as availability of other facilities like schools, cooking gas, telephone and housing, etc. A modest provision for the development of required infrastructure and making travel and stay of visiting faculty hassle-free would bear rich fruit.

Third, from over 250 universities and 10,000 colleges, we would have to select say around 100 people who could sustain a good graduate programme and they should be critically supported. The rest of them could concentrate on good teaching programmes. It is heartening to hear that UGC is indeed taking a step in this direction. It has selected some universities that have potential for excellence and each has been given a grant of 30 crore for five years. It further proposes to select 100 colleges with potential for excellence and give them each a development grant of one crore.

Fourth, UGC has taken another very welcome step for providing access to current literature through e-subscription of journals. This is indeed a great step forward. Universities suffer most from access to journals that have indeed become prohibitively expensive. My colleague, Ajit Kembhavi has brought to realisation through another UGC's inter university centre, Inflibnet, Ahmedabad, this scheme of e-subscription. Through which all important journals in sciences as well as in humanities will be accessible to begin with first to over 100 universities, and soon to all universities. The current literature will hence be freely accessible to students and faculty of many of the universities.

Fifth, all university faculty should be assessed and graded according to their research performance. Based on this grading, a faculty could be allotted a subsistence research grant to support research student(s), postdoctorate(s), visitors and travel for the group. This should be done without hassle like a big project report with 25 copies, etc, but purely based on one's performance. Every three years, one could be peer-reviewed and the grade could be enhanced/continued/lowered depending upon the review. With some cooperation from university administration in not creating hurdles in the use of the grant, it could greatly help in activating good 40 per cent of latent faculty power as referred earlier in the universities. I should mention here that such a scheme is in operation in South Africa through the National Research Foundation. Once the idea is acceptable, the details could be worked out. I have in fact submitted to the chairman, UGC a proposal for the scheme,[1] and he has also acknowledged that he would put it before the new two research councils, one each for sciences and social sciences, which he proposes to constitute soon.

The present system is too cumbersome and time-consuming. The turn around time is not in months but in years. The management of a research project with reports and accounts is trivial. The overall result is that an average faculty who has good potential remains unhooked and inactive. The proposed scheme tries is to make the research support easily accessible and user-friendly.

Let us hope that this scheme does come in operation soon which will give a big boost to research in universities. One of the remarkable features of Pune University is the absence of academic hierarchy and 'bossism' in many departments. All this has happened because a lecturer also has his research grant and hence he does not have to look for a favour from the head/dean/VC for attending a conference or for any other academic expense. From my own experience, I can say that though I had no promotion and remained a lecturer for 17 years, in the period I spent with Pune University, I had no problem in getting grants and organising and attending conferences.

I am sure such a scheme would greatly boost the confidence and drive of the university faculty and would go long way in transforming the overall academic ambience in universities.

I have broadly listed some of the important points which can facilitate the much-required reversal of current trend. It is encouraging to see some right indications and let us hope that the trend will indeed reverse.

III
Coming of Age

The most important thing to adopt is a stricter scrutiny of our work. Rarely has a project been completed and performed to required specifications and in the given time frame. There is no point in glorifying the engineering feat achieved by smoothness of the metallic surface, but which fails to achieve the required accuracy of observation in time. Though nothing goes waste in science for one always learns something. The question is of efficiency and purposefulness. This is a challenge solely to scientific leadership. There is an urgent need for an imaginative and responsive leadership.

The editor of *Current Science* wrote an editorial some time back on the 'Missing Generation'[2] which raised a controversy but not enough to develop into a wider and meaningful discourse. The point he made was that there was suddenly a vacuum at the top in science establishment because the older leadership had held fort for a good bit longer than what was healthy and conducive for developing new leaders. Howsoever much uncomfortable and unkind this question may be, it is a hard fact which cannot be wished away. We have to address it squarely and responsibly. It will be a challenge for new leaders to evolve stricter norms of scrutiny and review.

We should now graduate from problem solving (from being good students) to the problem-posing stage, and particularly problems which are relevant to us. We are excellent in creating structures which are solely export-oriented like our IITs. There is a scope for major reorientation there. We are still focused on the west for recognition. The true sign of coming of age would be when we attain confidence in our own capability and merit that we do not have to look for recognition outside. This is a long and winding road, at this juncture what we need is to put up the right sign board.

I find it astounding to read proclamations like, one good result, one hydrogen bomb, superpower by 2025, and so on by the most respected scientists of the country. History has taught us that no one great individual or no one profound result can change the overall ambience. It is the ambience that matters and determines progress. While, as I have mentioned in the beginning, we did have good share of great scientists, it is time to come out of the delta peaks, though they do serve a useful purpose in motivation to a point. The true gauge of scientific progress is in reducing the gap between what is done in lab and in factory, between the PUSA experimental farm and the farm just outside the PUSA fence.

In this regard, two events are worth mentioning. One, the revolution in telecommunication, from an interior tribal village you can call an equally isolated place on the other side of the globe effortlessly; what Sam Pitroda achieved about 15 years back was by all means remarkable. Second, the recent IT super-power phenomenon has happened without any committed Pitroda-like effort. This has happened because in over 50-odd years we have built up a large pool of scientifically and technically trained young women and men. It couldn't have happened by a Raman or Bose alone. The former event shows, given the right leadership and mission, we have the capability to achieve the best and the second event shows that we have latent potential which could emerge spontaneously whenever an opportunity crops up.

The time now is for consolidation and building up, over and above the wide framework of scientific base which has come to stay. This should mark change of gears, and a phase transition: from spread to consolidation and depth in the planning of science and technology. For that we need new leaders with proper vision and orientation.

IV
Science and Society

Essentially science provides a true and objective method for probing nature and universe in its entirety encompassing social interactions as well. Knowledge obtained through the scientific method is meaningful and useful for the society and people at large. The most crucial requirement for analysis of any phenomenon or event is first to define or formulate a relevant measure. Science provides a reliable and honest measure of all things physical and social. It is however true that measures are not as sharp in the social plane as they are in physical plane but day by day they are becoming sharper and more rigorous.

I would like to propose that science should promote the adoption of a certain measure of things in our social living as well. This will make our social interactions truer and more honest, and would certainly help in resolving and understanding inter-personal as well as inter-community/group problems. A detached and rational analysis of the mandir-masjid issue should certainly help resolve the problem. On the other hand we do however see what happens when emotions are allowed to fly high.

Adherence to the scientific method in a true sense asks for the fundamental principle that nothing is above study and enquiry. What cannot be questioned has no place in the universe one wishes to probe and comprehend. We should therefore not hesitate in questioning emotions and emotional issues and what gives rise to them? It is the cultural and social sensibilities that shape one's emotional world. The cultural and social world has two aspects, one which transcends cultures and is universal while the other is what is specific to a group or community. The former has a sound invariant base while the latter is relative and hence should always be questioned to keep its truth value intact and relevant. It is this which is largely at the root of one emotional world and provides what could be termed as cultural identity. The question of identity has been very enigmatic and volatile. That is all the more reason for it to be subjected to reason in an objective and detached way. I would strongly plead that this important sphere of social life needs to be probed. That is, the true value of the emotional world should continuously be questioned and verified. In the true scientific spirit it should always remain open. Its measure is not absolute.

For all this to happen, it is necessary that the tendency of measuring all things should be adopted as a new social value. This will make our living more true and honest which in itself, I believe, should be satisfying and liberating as well as harmony enhancing. I am not however pleading for lack of empathy and fraternity but instead for a true measure of them all. We should learn to measure things howsoever tentative the criterion of measurement be. In the absence of this attitude, we always hear people saying that something is nice. Only when you ask the question why and how only then does one gives serious thought and then she finds it hard to justify why she felt things were nice? The pronouncements that have not been subject to the measure of why and how add very little to meaningful knowledge base. Measuring things determines the measure of true understanding of things and it is that which measures the intellectual and rational depth of a society.

You may say that if I assess everything I see and do, I will lose the fun of living. No, on the contrary knowing and understanding would make fun enlightened and richer. Man is a rational being and exercise of the rational faculty would rather be liberating and entertaining than taxing. This is however a hypothesis which should also be subjected to rigorous scrutiny and whatever the answer is, we will still learn something to go forward to more learning. This is how we go on.

Finally, I would like to appeal to my fellow scientists that we must as persons of learning and scientific training take part in discourses on issues of wider social concern. It is our duty and responsibility to give educated, informed and wise counsel to people at large who have been supporting our upkeep and facilities adequately for letting us do what we like most. In return, if they do expect some advice and guidance, it would be more than fair. One does not see many of us participating in debate on wider issues like atomic bomb and power, big dams, and the overall development paradigm. It is not enough just to pursue one's own specific discipline dexterously, which one must at any rate do. We are part of a larger intellectual community and as intellectuals our concerns must not remain within the narrow confines of our disciplines.

To sum up, I would say that science needs a new leadership to meet the challenge of stricter scrutiny and consolidation while society needs to gear up to adopting the measurement of things as a new value in the social interactions. This will certainly lend profundity, truth and richness to living. EPW

Address for correspondence:
nkd@iucaa.crnet.in

Notes

[This is an expanded version of what first appeared in N Dadhich, 'Indian Science Coming of Age', *Current Science* (2003) 83, 675; Bulletin of Indian Association of Physics Teachers, July 20, 2003. Much has also been derived from the author's two articles: (i) 'Faith Sustainable and Non-Sustainable' and (ii) 'Science: Vision and Method' which have in parts been published some time back in *Deccan Herald*.]

1 Dadhich, N, 'Threshold Research Support for University Scientists', *Current Science* (2003) 85, 1511.

2 'Requiem for a Missing Generation', Editorial, *Current Science*, December 10, 2002, Vol 83.