What ails Indian science

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Twenty years ago when we were young and fresh out of our universities we seemed to know precisely what was wrong with Indian science—our graying bosses and the way they conducted and administered science. Twenty years later (and various vacuous achievements to our individual credits) the youngsters of today know exactly what ails Indian science—we who have stepped into our elder's shoes! And if the scientific community does not wake up to its own prejudices and malpractices and set its house in order the tale will be no different twenty years hence.

Many of the maladies facing Indian science are glaring. They stem from one source—a lack of scientific culture in our country. Science was born and nurtured in Western Europe. Both its birth and growth were painful events for it strived to create a unique culture of its own within societies then dominated by religious dogmas. Science survived because of the collective courage, dedication, and discipline shown by its pioneers, bold leaps of imagination in unlocking nature's secrets, and on the sufferings and heroic deeds of individual scientists. Public support for science came only after scientific achievements became notably valuable. Massive government support to science, in any country, is a fairly recent phenomenon. The point is: the scientists had to earn their respect and the unusual privileges they enjoy today. It was an arduous struggle.

Indian scientists, barring rare exceptions (like Satyendranath Bose, Meghnad Saha, C. V. Raman), have seldom understood the spirit behind the scientific revolution and the culture it bred, not being a party either to its birth or its long evolution. They have consequently substituted scientific culture with what they understood best—our social culture. So gray hairs are venerated over gray matter, socially acceptable views find greater credence than new or innovative ideas, good relations with the boss is notably healthier than doing good science, and similar gems that promote mediocrity in the larger interests of communal harmony. All these have led to the obvious outcome of scientific establishments turning into day care centres for those with degrees in science. The scientific community, therefore, needs to introspect and decide whether it wants to promote science or just harmonious scientists.

It does not escape a true scientist that brilliant ideas do not require government funding, insight does not come from research grants but they do thrive in a certain cultural environment and the creation of that environment is the task, indeed the prime responsibility, of the scientific community. Newton's contributions to science did not come from government funding. Einstein, Planck, Raman, Curie, Bose, Watson, Feynman, and many others made their epoch-making contributions without pots of gold. The best in science ultimately resides in the ideas it spawns. If our scientists lack ideas then perhaps they are at fault, perhaps they lack courage and imagination.

Implanting science on Indian soil was a brilliant idea, failing to nurture it was not. And nurturing begins with the early education of our scientists. Nowhere in our country is a young person, willing and eager to embark upon a career in science, ever told about the birthpangs that ushered in science, the scientific culture as it has evolved, and the scientific community's code of conduct. So scientific interactions occur on lines similar to social interactions. And as we show feelings of diffidence in socially dealing with our western counterparts, so do we in our scientific dealings with them. We instinctively know that there is a culture gap and the average scientist's reaction is to feel embarrassed and find fault elsewhere, usually the government. Our social culture encourages it! A government can create universities—and we have perhaps too many of them—but the privilege of creating a culture within their confines lies with their respective academic communities. So perhaps the fault lies with our professors and teachers.

So long as the Indian scientific community does not begin a cleansing exercise, no amount of government funding will set things right. The scientific community is expected to be self-policing, but look at the way we conduct ourselves: promotions are far too often given on the basis of seniority and sycophancy than on merit (so no wonder that good ideas hardly ever surface), our selection and promotion committees are packed with ubiquitous groups of perennial universal experts (who seem to be experts of all trades and jack of none) whose most endearing quality is their pliant (if not always supplicant) nature, an astonishing lack of incentives in the form of awards and recognition, a surprising lack of good refereed journals, an extraordinary refereeing system in which the blind judge the one-eyed, and the immoral manner in which authorships are bartered for career growth leaves one gasping for breath. Small wonder our scientific community understands itself best on the basis of mutual contempt!

But it would be unfair to paint the entire Indian scientific community by such broad strokes. There have been achievements too—our atomic energy programme, the space programme, the integrated missile development programme, etc.—which justifiably fill us with pride as do some of our best universities and institutions. In a country of 850 million people these are not enough but they do provide the proverbial ray of hope for the future.

Now after four and a half decades since independence it is perhaps time that the government asked the scientific community what it has contributed to science to justify its continued funding. Encouragement of meaningless repetition of work done (and well documented along with computer programmes) abroad, simply because our scientists lack the courage to select and solve problems on their own, is a luxury the country can hardly afford. This malady is particularly widespread in the computational branches of science. But most of all, such examples are a demoralizing influence on the promising younger scientists. That our scientific activities are widely and thinly spread has very little to do with the government or the funding it provides but more to do with our compulsive need to promote *harmonious* scientists and provide them with ostentatious trappings of power. The scientific contents of national conferences are, by and large, a national disgrace and a perfect cover for public-funded jamborees.

But the government too has a responsible role to play, specially in nurturing basic science. Basic science is the mother of all science, the fountainhead of man's knowledge about nature. It is a means by which he can use nature to modify and control his environment through appropriate interactions with it. This knowledge, by common consent, is the common heritage of mankind. Such noble endeavours deserve state patronage as they have always deserved since ancient times.

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A report on the 35th DAE symposium on solid state physics

The Solid State Physics Symposium is an annual national symposium organized under the auspices of the Board of Research in Nuclear Sciences of the Department of Atomic Energy. This year's symposium, hosted by Sri Venkateswara University, Tirupati, had nearly 500 papers scheduled for presentation. There were also oral presentations of some 50 papers. Well over 300 papers were presented in the Poster Sessions covering a variety of topics like phonon physics, electronic properties, transport properties, magnetism, superconductivity, semiconductors, disordered materials, liquids and liquid crystals, surface and interface physics, phase transitions, resonance studies, solid state devices, techniques and instruments, etc. The seminar on '*thin films*' was chosen keeping in view the interest of students and staff of the Physics Department of the host University. This was very appropriately preceded by an invited talk by Jayarama Reddy on 'thin film solar cells'.

The technical sessions started with the *seminar on magnetism* which was coordinated by L. Madhav Rao. In magnetic systems showing spin glass behaviour one is interested in a domain of phase diagram where ferromagnetism coexists with spin · glass behaviour. Several Indian researchers like Abhijit Mukherjee have made valuable theoretical contributions to this area. A variety of systems like intermetallic compounds, amorphous metals and insulators exhibit anomalous magnetic behaviour at low temperatures. In his introduction to re-entrant spin glasses, Madhav Rao referred to occurrence of two transitions; one given by T_c and the other by T_{xy} (where transverse components freeze) and how this T_c and T_x define phase diagram changes with concentration of say any one element in a binary system.

S. B. Roy gave one important message that experimenters must make as many macroscopic and microscopic measurements as possible on the same system to unravel the mystery of such complex magnetic systems. Through well-known examples, he showed how neutron scattering experiments were very crucial to decide the nature of re-entrant spin glass. He also cautioned against fitting data indiscriminately to some fashionable theoretical models without sufficient introspection.

S. N. Kaul discussed several theoretical models developed during 1975–90 and referred to results of computer simulation studies where 'spin melting' is not seen. Then he showed how small angle neutron scattering and inelastic neutron scattering were necessary to clear some of the model results.

In essence, Roy and Kaul tried to raise basic questions like whether the so-called spin-glass existed at all? and whether one can refer to observation of anomalous behaviours associated with observations related to this as phase transitions in the thermodynamic sense?

S. K. Dhar dealt with a larger variety of experimental data in heavy fermion systems carried out by him and his colleagues at TIFR. Although a large amount of experimental data exist, theoretical understanding is far from satisfactory. He also referred to measurements of correlation lengths via neutron scattering.

For experimental physicists in the field of neutron scattering, it was pleasing to see the importance of neutron scattering studies which was brought out in all these three talks by persons who have not used the technique. Obviously, there is a case for strengthening collaborative research programmes using our own reactor facilities.

Many of the invited talks were of interdisciplinary nature bordering technological applications. For example, in his lecture on thin film solar cells, Jayarama Reddy reviewed the technological status of bulk photovoltaics like Si and α-Si:H which are currently being used. He then elaborated on the currently pursued research in the areas involving thin film solar cells based on systems like CdTe and $CuInSe_2$ (CIS). Conversion efficiencies achieved over areas of about a cm^2 by a few companies in these materials are in the neighbourhood of 10% reaching out to 15% whereas theoretical maximum estimates are in the neighbourhood of 35%, which is why it is important to vigorously pursue this effort. Sri Venkates-