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EDITORIAL

Scientific collaboration

Most research papers in the scientific literature today are multi-authored, with authors being drawn from different laboratories, institutions, countries and continents. As research becomes an increasingly complex exercise, purposeful attack on many scientific problems requires collaborative efforts, with the participants bringing diverse skills and techniques to bear on the issue being addressed. In some fields, large collaborative research efforts are the norm, with experimental particle physics providing an extreme example. In modern biology too, large teams have become common; areas like genome sequencing rival the mega projects in physics for the level of coordinated effort (and funding) involved. Even when we move away from the realm of 'big science', collaborations are common. Indeed, the number of papers featuring one or two authors is rapidly diminishing in most fields.

Collaboration, of course, brings in its wake a host of problems that did not exist at a time when science was simpler. How is the credit for a scientific contribution to be shared? Whose name should appear first on the author's list in a published paper? These are mundane questions; but many collaborations end on a bitter note when the work is finished and the authors begin to write their papers for eventual publication. Human nature being what it is, heartburn is almost always inevitable. It is therefore not surprising to find footnotes in the best of journals which say '... these authors contributed equally to this work', sometimes leaving the reader to wonder what share could be attributed to the remaining authors. The importance of credit sharing increases dramatically with the perceived importance of the work. After all the Nobel Prize cannot be shared by more than three persons. In many areas distinct groups compete for the prizes and each group has but one or two visible leaders.

The problem of credit sharing inexorably percolates down, even to the bottom of the scientific pyramid. How does one compare a fresh Ph D applicant for a postdoctoral fellowship, who has a dozen publications each sporting half a dozen authors, with one who has a couple of publications authored only with his or her Ph D supervisor. Unfortunately, assessments of scientific capabilities must often be made with little data to judge the candidates, other than their lists of publications. In the extraordinarily competitive environment that we find ourselves in, the number of authors on a paper becomes yet another parameter in a complex 'evaluation equation', which includes journal impact factors and citation counts.

In the context of science in India, the problems of scientific collaborations assume new dimensions. Here, collaborations between different research laboratories are relatively uncommon, although the necessity of using diverse techniques is slowly forcing interactions between normally insular groups. Interactions with laboratories abroad are also rare, with very few long term arrangements, where both sides make nearly equal intellectual and material contributions. Many collaborative programmes are holdovers from postdoctoral periods; major interactions occur only when the Indian partner visits the foreign laboratory. The local perceptions of such collaborations are varied. There is a strong 'swadeshi' school which decries all ties with overseas scientists. At the other end of the spectrum are the 'internationalists', who forcefully argue that science transcends geographical and political boundaries. Normally, this polarization would only be a matter of mild academic interest. Instead, it has become a contentious issue in most committees which decide awards and rewards across the country. Should there be a special 'handicap' (in golf parlance) for those who forswear collaboration – both foreign and Indian? Even when collaborative efforts are between Indian laboratories, many committees seem uncomfortable in decisively giving credit where it is due. Matters are not helped by the relatively low credibility of most decision-making groups involved in the rewards process.

Scientific collaboration has come to stay. In order to move purposefully towards the solution of important problems, we must create a climate where collaborations are encouraged. Large areas of science require broad interdisciplinary efforts, which can hardly be fostered in an academic setting, where the most raucous debates involve issues of credit sharing. As a first measure, committees charged with the responsibility of evaluating science and scientists must apply their mind to the problem of ensuring fair assessments. The results of scientific collaborations must not be summarily discarded, because evaluation committees find this approach expedient. Building bridges between laboratories in India will promote the sharing of scarce resources of equipment and materials. Cooperation may indeed be a painless and pleasant way of enhancing the quality of our science.

P. Balaram

Scientists and foreign travel

This is regarding the editorial 'Staying home' by P. Balaram. While I agree with many of the points made in this article, I cannot but disagree with some of them.

1. Balaram says that the denial of a visa to R. Chidambaram, Chairman AEC by the US, and the possibility that Germany and UK might also similarly deny visas to Indian nuclear scientists 'appears to have sent a shiver down the spines of many, for whom the practice of science necessarily involves extensive traveling abroad'. I believe this statement is rather uncharitable and unnecessarily sarcastic. Even those who do not entertain any ambition of traveling abroad have reacted with abhorrence to the apparent politicization by the US government (and perhaps UK and Germany as well) of conference travel by Indian scientists connected with the nuclear program. One need not believe that 'the practice of science necessarily involves extensive traveling abroad' in order to react negatively to the denial of a visa to Chidambaram.

2. Balaram asks: 'Is it really necessary or useful for some scientists to *always* be abroad, (emphasis added) attending one conference after another?' This sentence sounds a little like sour grapes. Surely even if Chidambaram had been permitted to attend the Crystallographers' Conference in the US, it would be stretching things beyond credulity to state that he or other similar senior scientists are 'always abroad, attending one conference after another'.

The above misdirected implied criticism of Chidambaram's attempts to obtain a visa to the US and the reaction to the denial unfortunately distracts the reader's attention (or at any rate, *this* reader's attention) from other relevant issues raised in the editorial. For instance:

- 'How important is foreign travel to the practice of science in India?'
- 'Must important scientists, engaged in critical research in establishment (sic) like defence and atomic energy, have to travel abroad to attend conferences and meetings, to which researchers in academic institutions have little chance of going?'

I shall now state my views on the above points.

There can be no two opinions that, given the smallness of our scientific community (notwithstanding tall claims about the 'third largest pool of manpower' etc.), exposure to the international community at large is an essential ingredient of calibrating one's own work against the world standard, getting inspired by interacting (or even gazing from a distance) with the world leaders in one's field, having an opportunity to discuss research ideas *in the formative stage* (in contrast to journal papers which focus only on *completed work*), and so on. Indian science would not collapse if we were to be prevented from interacting personally with our colleagues, but there would definitely be some effect. From what I have seen, many of our young scientists suffer from a misplaced inferiority complex, because our culture does not encourage outright bragging and exaggeration of one's own achievements as in some foreign countries, especially the US. It takes only very little *face to face* interaction for a good young Indian researcher to see that he/she is as good as the overseas counterpart; but without such interaction the inferiority complex is likely to persist and increase. If *enough persons* go abroad and spread the message that 'we are as good as anyone else', this complex will disappear – it is not necessary for *everyone* to have an overseas trip. One can already see this happening in the software industry. But a 'stay at home' strategy will reinforce this inferiority complex, and prevent Indian science from realizing both its own current worth as well as its true potential.

Rather than advocating greater opportunities for academics, especially young scientists to attend overseas meetings, Balaram seems to question the wisdom of government scientists travelling abroad. It may perhaps be true that some senior scientists in the so-called strategic departments have greater access to funds for international conference travel than those in academics. The question is: How is the situation to be equalized? By preventing even government scientists from travelling overseas, or by increasing the opportunities for academics to travel abroad? For fifty years our country has been mired in poverty and backwardness because successive governments have followed the practice of equalizing wealth by making the rich poorer, and not the other way around. As the noted jurist Nani Palkhiwala has said, we have perfected the technology for keeping India poor. It is rather disappointing to note that Balaram seems to be advocating a sort of universal impoverishment of travel opportunities to bring government scientists and academics to the same level. I should have thought that philosophy is discredited by now.

At least part of the difficulties faced by academics attempting to attend foreign conferences can be traced to strange funding policies adopted by various government agencies. As of now, agencies such as DST, CSIR, INSA etc. fund *50% of the air fare.* Given that all of these agencies receive their funds from the Consolidated Fund of India, it is difficult to fathom *why 50%?* The only thing achieved by this arcane procedure is that the poor aspirant is sent from pillar to post in search of funds. A 'deadlock situation' where Agency A is waiting for the decision of Agency B and vice versa cannot also be ruled out. Instead, if every agency were to take a decision that it would fund 100% of travel cost, or not at all, then the amount of paper work would be reduced considerably. The standard agency response is: 'But we will be able to send only half as many persons!' Yes – but since the sets of persons being sent by various agencies *would be disjoint, the total number of persons would be unaffected.* It might even increase, since I know that some persons just don't bother to apply because they are put off by the amount of running around they have to do.

A couple of years ago both DST and DBT made a proposal whereby each PI of a grant would be able to attend one international conference during the course of the grant (I am oversimplifying slightly). The Finance Ministry agreed with the proviso that the expense shall be limited to Rs 15,000, which barely covers the cost of a Bangalore–Delhi round trip these days!

Ultimately the real source of the problem is that many in the government still