

## Structure of Indian science: a re-appraisal

M. Vijayan

*Science and the associated technology have come to the centre stage of national discourse on account of Covid. The time is now appropriate for an appraisal of the structure of Indian science. We need a support system which is an elaboration of the support provided by Lakshmanaswami Mudaliar to G. N. Ramachandran who has been arguably the greatest scientist of Indian origin to have worked in the post-independence era.*

For a long time until the advent of Covid, science had substantially disappeared from the main stream national discourse, including in the media. In the context of Covid, science is receiving attention now. It would appear that biological science and the technology based on it are perceived to have acquitted well. In any case, time is perhaps appropriate to dwell on some aspects of Indian science.

In the opinion of many including myself, the most outstanding among Indian scientists, including scientists of Indian origin working abroad, in the post-independence era has been G. N. Ramachandran (GNR). Unfortunately he did not receive a Nobel Prize, partly because he was ahead of his time. Furthermore, he competed with and beat no less a person than Francis Crick on the structure determination of collagen, for which he does not appear to have been forgiven by some. Initially there was some hesitation even in crediting GNR with the discovery of the triple helical coiled coil structure of collagen. However, as Hartmut Michel, a Nobel Laureate, mentioned in response to a comment of mine, many Nobel Prize winners have been forgotten, but GNR is still a vibrant presence in the literature.

The Indian scientific community celebrated the achievements of GNR and honoured him with all the awards and fellowships at their disposal. This was not true about the Government. He did not receive any Padma Award while GNR was truly a Bharat Ratna. Governmental recognition in India most often goes to those who hold or have held high administrative positions. The absence of such recognition to GNR is an index of the hierarchical nature of Indian science.

In the long run, awards and recognition, including the Nobel Prize, are not of much consequence. What the community remembers are the scientific contributions made by the person. This is certainly true about GNR. How could he make such monumental contributions in

a comparatively short span of time? GNR was obviously a genius, but there should be a favourable atmosphere for a genius to thrive. That atmosphere was provided by A. Lakshmanaswami Mudaliar, the long term Vice Chancellor of Madras University. It was a unique relationship between an administrator and a scientist<sup>1</sup>. Mudaliar treated GNR as his ward. He provided GNR with all the financial and administrative support. In effect, Mudaliar freed GNR from the Indian reality involving chasing funds and wrestling with bureaucracy. With right support systems, India would probably have produced more GNRs.

The centre of gravity of science is still in the advanced West. Some training in the West is useful. The training could be in the form of doctoral work or, more frequently, as post-doctoral fellows. Many remain in the West after training, while many others return to India. The choice between the two is dictated by several personal and professional factors. Indian scientists who are doing well abroad should be left alone to pursue their good work. Their help and goodwill are always welcome, as indeed those of our other friends abroad. Indian science has been and will continue to be built up by resident Indians. The point is enabling them to do so, as indeed GNR was enabled by Mudaliar. The case involving Mudaliar and GNR has been one of one administrator supporting one scientist. What we need is a whole administrative system supporting the entire scientific community.

Indian science presents a light and shade picture. There are many things wrong with it; there are also many things to be proud of. The greatest assets of Indian science are scientists themselves. The vibrancy of the long intellectual tradition still endures. I spent a life time at the Indian Institute of Science (IISc), Bengaluru. The only other Institution where I have worked for a long time is Oxford University. The intellectual

ambience in the two institutions is very comparable (although achievements are not). One reason why Indian scientists could perform reasonably well in spite of heavy odds, is the resilience exhibited by them. The approach of many of us has been to take full advantage of the positive features of Indian science, while trying to eliminate (it turns out rather unsuccessfully) the negative features.

Funds are important for much of modern scientific research. In India, R&D expenditure as a proportion of GDP never exceeded 1%. Currently it is substantially less than 1% (ref. 2). This is grossly inadequate. Not only in advanced western countries, but even in countries like China, which in many ways is comparable to India, a much higher percentage of GDP is spent on R&D<sup>3</sup>. There is an urgent need for substantially increasing the budgetary provision for R&D expenditure. Private contribution to R&D efforts should be encouraged. However, that should be in addition to, and not instead of, the contribution of the Government.

Enhanced funding is a necessary, but not a sufficient, condition for making a qualitative difference to the R&D sector in the country. In order to unleash the creative potential of Indian science, we need a vibrant and responsive system which is more autonomous, more participatory, less hierarchical and less bureaucratic. I have dealt with the issue in a couple of contributions to *Current Science*<sup>4-6</sup>. I need not repeat the arguments here except to highlight some of them briefly for the sake of completion. Autonomy, accountability and participatory democracy should go hand in hand at all levels of hierarchy. For one thing, there is no reason why the autonomy granted to the so called strategic departments of the Government, should not be extended to all science departments. Biotechnology, for example, is no less strategic than atomic energy. There has been considerable erosion in the autonomy of scientific institutions and programmes.

Autonomy of an institution does not mean only that of the head of the institutions or the governing body. It should percolate to all levels within the constraints of the mandate of the institution. For instance, the nature and the level of autonomy and accountability cannot be the same for a faculty member of the IISc and a scientist of ISRO.

Bureaucracy is a bane of Indian science. This is particularly true about financial bureaucracy. As a noted historian has remarked, the financial bureaucracy still has the colonial mindset. During the colonial period, the British rulers wanted to spend as little as possible for the welfare of India. Therefore a primary function of financial bureaucracy was to raise objections. Presumably unconsciously, this tradition continues. The problem is compounded by the fact that, unlike other officers, the financial officer of the department reports to the finance ministry, and not the secretary of the concerned department. This is an unsatisfactory situation as it leads to unnecessary conflicts of interest and needless interference. The efficiency of the system would substantially improve if the finance person also reports to the secretary of the concerned department.

It is often less difficult to have a project approved than to have funds periodically released. In a major granting agency with which I am very familiar, funds for the first year are released soon after the project is approved. In the following years funds are released, after following sluggish and tortuous processes, often only towards the end of the concerned year. This seriously affects the work in the project in addition to causing agony to the investigator. To me, the old Science and Engineering Research Council of the Department of Science and Technology (DST-SERC) is the gold standard. Happily, the new Science and Engineering Research Board (DST-SERB) has by and large adopted the procedures of DST-SERC. I do not know any reason why the extramural research wing of the Department of Biotechnology (DBT) cannot adopt these procedures. After all, DST and DBT belong to the same Ministry. If the DBT wishes to stick to the current procedures, there should be an additional provision for releasing part, say half, of the year's grant in the beginning of the year itself. The rest of the grant can be released after

proper evaluation. The comments made here in relation to DBT are applicable to other science departments as well. In addition to improving the ease with which sponsored projects can be operated, it is important to ensure that the proportion of the extramural components of departmental budgets are maintained and, wherever possible, enhanced. Competitive research grants are central to the progress of science in any country.

Our scientific institutions and universities exhibit widely different qualities. It is important to protect those with proven track record, while striving to improve the quality of the others. This is true of the science departments of the Government also. The recent attacks mounted on a couple of excellent universities are too well known to be dealt with here. I have had the good fortune to be closely associated with the three components of the Ministry of Science and Technology. Of the three, the Council of Scientific and Industrial Research (CSIR) sometimes receives unfavourable attention. This is unfortunate. For reasons I cannot understand, CSIR is an under rated organization. It has served the country well for several decades and contributed to almost all areas of national scientific endeavour. It straddles the so called strategic and non-strategic sectors. The achievements of CSIR deserve to be better known. The establishment of DST in 1971 was a major event in the history of Indian science. DST grew into the primary scientific agency of the country. Many of the major scientific and technological programmes were made possible with the support of DST. The establishment of DBT in the 1980s was a timely step. DBT has made a difference to Indian biology, although the impact would have been greater had the administration of the department been more streamlined. Most of the institutions supported by the science departments have done well. A majority of them are director-centric and are too small for administrative systems to be put in place. They could do with some expansion for greater impact. Larger and well established institutions like the IISc, Tata Institute of Fundamental Research and the Indian Institutes of Technology function based on systems. Even they are only of moderate size by global standards.

Multiplicity of sources for research grants is necessary for the healthy development of science in any country. In this

respect, the situation in India is satisfactory, although most of the sources are riddled with bureaucracy. A threat against this situation was mounted more than a decade ago. The threat, at least the perception about it, involved the combining of all the avenues for research grants to be operated by a single agency. The move was stoutly resisted and eventually resulted only in converting DST-SERC into DST-SERB. However the community should be always vigilant against such moves.

It is desirable to practise, to the extent possible, participatory democracy at the national level also. The initiation of any major scientific programme should be preceded by extensive discussion in the community. The Science Academies can play a major role in this respect. The fellowships of the Academies constitute only a small fraction of the scientific community. However, they have served, and spoken on behalf of, the whole community. Academies are prestigious institutions. This prestige is not adequately converted into influence. Academies need to function as independent think tanks in the service of the nation. Their autonomy should be jealously guarded. The amount the Government spends on Academies is small. The budget of each Academy would be comparable to a large sponsored project. Academies are low cost, high value Institutions.

To reiterate by way of conclusion, Indian science should be supported by a vibrant and responsive system which is more autonomous, less bureaucratic, less hierarchical and more participatory. Such support would be an elaboration of the support provided by Mudaliar to GNR.

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*M. Vijayan is in the Molecular Biophysics Unit, Indian Institute of Science, Bengaluru 560 012, India.  
e-mail: mv@iisc.ac.in*