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EDITORIAL

## Research facilities

Modern scientific research in many disciplines is critically dependent on the availability of sophisticated instruments and major research facilities. In disciplines like physics, chemistry and biology, the range of equipment necessary to conduct contemporary and competitive research is growing at an alarming rate. For example, high field NMR spectrometers (with proton frequencies as high as 800 MHz), X-ray diffractometers equipped with CCD detectors, tandem mass spectrometers, confocal and atomic force microscopes, cell sorters and automated DNA sequencers are becoming commonplace in biological laboratories across the world. Synchrotrons provide the most powerful X-ray sources for probing biological crystals. The unparallelled spatial and temporal resolution provided by pulsed lasers has allowed chemical and biological phenomena to be addressed in a manner that could not have been anticipated a few years ago. Early watchers of the genome sequencing programs could hardly have forseen the enormous technological advances that would bring genomics to its present, preeminent position, in such a short time.

This increasing sophistication in the tools of science has resulted in a widening of the gap in performance between the well-endowed laboratories of the developed world and the institutions located in the less developed countries. Even as we search for global competitiveness in various fields, many difficult issues concerning science need to be addressed in India. We need to ask if our laboratories can be modernized; not so much with regard to their superficial appearances, but with respect to the research facilities that they house. It is all too easy to build new buildings, quite often elegantly designed by well-known architects, when new institutions are conceived; it is however, far more difficult to raise resources for cutting-edge research facilities and even more difficult to maintain and use them to yield competitive research results. Modernization is, unfortunately, associated with hefty costs and in the present climate a fresh infusion of substantial funds for capital equipment does not seem a realistic possibility.

Any plea for a relook at the 'true infrastructure' for science in our major institutions is likely to be misunderstood by those who hold the purse strings. Do we not already have many wonderful laboratories, with imposing facades, which have been steadily funded for many years? Is it not true that the performance of many major facilities has been woefully inadequate in scientific terms? Did not C. V. Raman carry out his, now legendary, experiments on a shoestring budget? Will a critical cost–benefit analysis of half a century of government-supported science yield a 'positive' balance sheet? Are scientists, like Oliver Twist, always asking for more? These are legitimate questions, all of which can be addressed.

After the first flush of enthusiasm, most newly created laboratories do not have sufficient inputs for capital equipment, which will permit constant renewal. There have been major research facilities in India, distinguished, principally, by their lack of usage; but these black sheep cannot be used to tar everyone with the same brush. It would indeed be wonderful to be back in Raman's times; unfortunately even the theoretical physicists, who need little money, cannot recreate the golden days in Gottingen. Finally, the apparent benefits of much of scientific research are hard to quantify; there is undoubtedly an undeniable case for scientific institutions as training grounds for generating the people, who will absorb and implement the technologies of the future. While basic science has few friends in places that matter, even the rare well wishers of science are sometimes unable to comprehend the importance of quickly and decisively upgrading the facilities for research.

In the 1970s the Department of Science and Technology, in a youthful flush of enthusiasm, created the Regional Sophisticated Instrumentation Centres (RSICs) and related units housing expensive equipment, that would cater to a large number of researchers. Traditionally, these centres housed spectrometers of various kinds and provided analytical services primarily for chemists who were generally drawn from Universities and local industries. With time, some major research

facilities, like high field NMR ('midfield' by today's standards) became available at a few places, dispersed across the country. The major influx of research funds in the 1980s ensured that similar sophisticated instruments became available even in some individual laboratories. Over the years, the RSICs house equipment that can hardly be called sophisticated and there is a growing perception that they may have outlived their usefulness. What is forgotten in the critical analyses that are made is the invaluable service that these centres rendered, which indeed made it possible for a large number of researchers from poorly endowed institutions to access essential analytical facilities. The availability of centralized instruments, managed and maintained by dedicated staff contributed immeasurably to raising the general level of research in many areas of chemistry and biology. If the present level of funding to RSICs is continued, there will be a steady erosion in their capabilities to perform sophisticated experiments, inevitably leading to their complete decline. There is clearly a need to consider enhanced support for central facilities. The DST's FIST program is a most welcome new initiative.

There is another side to the story. For the dismal state of availability of major facilities, the scientific community must also share the blame. We have failed to create a culture of shared instrumentation, efficiently managed and optimally available to a large cross-section of users. Even occasionally-used equipment must often be unnecessarily duplicated in our laboratories, because of a lack of professionalism in interpersonal dealings. Departments and institutions instead of investing in a diverse portfolio of facilities, duplicate fairly expensive instruments. The almost complete absence, in our laboratories, of trained, competent and willing technicians makes the maintenance and efficient use of facilities difficult. Matters are not helped by the fact that almost all sophisticated instruments are imported and that spares and trained troubleshooters often have to fly in from overseas. Budgets for equipment maintenance are vanishingly small and funding agencies look askance at requests for annual maintenance grants. In this scenario, it is not surprising to find scientists jealously guarding equipment under their charge; every potential user is viewed with suspicion that should be reserved for saboteurs. Acquisition of major equipment is sometimes an end in itself, creating islands of scientific affluence surrounded by a sea of poverty. There is nothing more frustrating than to find that a major facility, located nearby, is completely inaccessible. Research students in India are also rarely allowed to handle major equipment themselves. As a consequence, many chemists and biologists (and physicists too) go through a Ph D program, with almost no feeling for the nuances of the measurements that they report in their theses and papers. Even more importantly, this situation legitimizes the 'black box' approach to science and trains yet another generation to be blissfully unaware of the importance of learning to nurse and maintain major research facilities.

The inexorable march of science has ensured that the tools for modern research will become increasingly complex and expensive. We need to prepare to wage a war on two fronts. Firstly, we must collectively ensure that pleas, for a major modernization plan of our scientific infrastructure for basic research, do not go unheard. Secondly, we must gear our institutions to develop mechanisms for acquisition, maintenance and optimal and equitable use of sophisticated research facilities. This will go a long way in raising the level of scientific research in India.

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