package offering tools for management of seedbank data. Biolit offers tools for management of publications of an institution in digital form. Fungal Database Meliolales comprises information on 400 species of Meliolales reported from India. The database on sacred groves provides information on the sacred groves of Kerala. Usage of the web portal site BTISNet publication and Library, connecting all bioinformatics centers under BTISNet was also demonstrated. The software package LitFriend unveiled during the inaugural session, offers tools for easy management of personal literature collection. The important tools with this software package include user-friendly literature reference data entry interface, advance search facility, formatting tools for easy documentation of data, files attaching facility (image and text files), standard data format for documenting more than 20 categories of references, security provided by user id and password, single and multi-user facility, tools to sort out reference citation sequence for printout, reference style customizing tools and selected reference list exporting/printing facility. All software packages and database models mentioned here are available on the URL www.tbgri.org.

Fifteen participants including ten scientists, professors/teachers representing various research institutions/universities/colleges and five scientists from TBGRI participated in the workshop. The major outcome of the workshop was the decision taken jointly by the participants and organizers is to initiate collaborative programmes with TBGRI and the participants' institutions for digitizing the biodiversity data. TBGRI will take the responsibility to initiate follow-up programmes. The institute will also develop a common web portal for integrating the databases of different institutions and make them available to users.

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MEETING REPORT

India's competitiveness and preparedness in Science & Technology for the coming decades*

This conference was probably the first forum bringing together all stakeholders in S&T, including science and technology institutes, government laboratories, universities and private industries. It was an attempt to bring to a common platform younger scientists with their senior counterparts along with women scientists to discuss this important issue.

The conference opened on a right note with Kapil Sibal, Union Minister for S&T, GOI, pointing out that the scientific community in India is an endangered species. The keynote address by C. N. R. Rao recalled that meetings of this kind were organized earlier, but the last one held was in 1985. He drew attention to the fact that if India needs to be competitive in science, an honest, inward-looking approach and an urgency to take harsh measures is needed rather than invoke incremental changes in policy, administration and institutions, if India as a country (and not as individuals) has to be on the radar of world science today.

The conference was organized into five panels: Is Indian science competitive?; Science in the world and in India: some experiences; Science and technology institutions; collaborations and partnerships; and Science as a career. Its charter was to take stock of the current situation by taking into cognisance the findings of the recent reports[1] and develop strategies to enhance India's competitiveness in S&T.

Going by the presentations, it appears that the prospects for Indian science are bleak, since capacity building of institutions has not occurred in universities and institutes over the past several decades. Unnecessary personalization, lack of transparency in procedure and over-bureaucratization have led to a culture based on ad-hoc decision-making and a mistrust of younger faculty, both of which have prevented healthy institutionalization, according to Sundar Sarukkai (NIAS, Bangalore) and T. Jayaram (MatScience, Chennai). Although such attitudes characterize the larger Indian culture, they can and must be addressed at an institutional level for science. As was reiterated, individual creativity does not lead to scientific excellence, as institutions are always more important than individuals. What clearly came out was that the leading scientists of the country were forerunners in their forties. Unfortunately, this cannot be said about the scientists in today's context. The lack of opportunities for young scientists to be leaders of science today in the Indian context was seen as a possible factor of Indian science not being competitive. The absence of broad basing the ownership of goals even amongst the scientific community could be another significant contributing factor.

The panel on 'Science in the World and India' drew upon the experiences of Japan and China, which have not backed their science policy first with money, but more importantly, have a clear strategy about how to go about increasing their presence in, and impact on, world science. Their strategies have been based on clear long-term and short-term goals. What stands out in Japan is that research planning is an elaborate and systematic affair, where education in S&T with a focus on internationalization (K. Chattopadhyay,

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IISc, Bangalore). China is unique in its openness to ideas and their execution. The ability of the Chinese Government to pay attention to average people and feed into the policy is remarkable, as brought out by S. Arunachalam (MSSRF, Chennai).

Indian science needs to institutionalize structural reforms to involve all S&T stakeholders in policy formulation, strategy and delivery by devising a process that is comprehensive and more participatory than it currently is. Speaking on the Indian experience, Srikanth Sastry (JNCASR) said that Indian science needs an updated vision, which reflects newer ideas on the nexus between S&T, business and politics. He suggested that science institutes model themselves on academies rather than on government organizations and integrate themselves with universities along the lines of the CNRS laboratories in France. His co-panelist G. V. Shivashankar (NCBS, Bangalore) drew attention to the lack of peer pressure in India, owing as much to the lack of postdocs and unfocused recruitment as to the larger culture of mediocrity and complacency. He made a strong case for increasing funds and the value ascribed to table-top science as a way to encourage innovation in science.

In the panel on S&T institutions, it was pointed out that outside of a few elite research institutes, infrastructure in S&T institutions is of poor quality. Elite institutes do require enhanced infrastructural facilities to be competitive in science with their international counterparts. However, doing this at the cost of neglect of universities which produce the future scientists in this country will eventually result in paying a huge cost. Drawing a careful balance in this regard will have to be worked out. Gautam Desiraju (Univ. of Hyderabad) drew attention to the sorry state of universities in the country, particularly the teaching laboratories (at the 12th standard/pre-university level coaching them to take the entrance examination to professional courses), and the numbers of junk Ph Ds that are churned out, thanks to the UGC promotion policy. Students exposed to science in such an environment cannot be expected to be attracted to it, especially when high school and undergraduate college education have persistently been neglected. While revamping the teaching laboratories in these institutions is critical, the role of research institutes in improving the quality of science education in this regard was also brought up. Structural linkages between research institutes and universities need to be developed either by offering undergraduate teaching programmes on existing campuses of the former or promoting a two-way interaction, where universities access the laboratories facilities of research institutes and faculty of these elite institutes engage in teaching students at the universities. This interaction will go a long way in attracting quality students. The introduction of the National Institutes of Science in selected cities along the lines of IITs and IIMs to promote science education from the undergraduate level, is yet another response to this pressing problem.

Perhaps we need to start locating research institutes on university campuses themselves for better synergy, as was suggested by VijayRaghavan (NCBS). One of the benefits is that it would enable faculty to move to university teaching after a stipulated period of 5–15 years and continue their research while maintaining their laboratories and receiving their salaries from the institute.

However, simple solutions do not attract too much support among scientists, whose suggestions were rather tilted towards the 'massive infusion of funds' argument. Considering that this conference was also directed towards making recommendations to the government, this was an important arena to ask for more funds. However, accountability in the context of this increased funding would be a key problem, according to P. Balaram (IISc). Scientists, much like artists seeking sponsorship, want funds but also want the freedom to work without constraints, questions or pressures to produce. In this context, evaluating the work of scientists is important but problematic, as the mixed response to establishing a Science Observatory proposed by Arunachalam (MSSRF) indicated. Perhaps developing parameters in addition to the citation index is necessary, as is broadening the scope of the observatory by also including the sociology of science.

Collaborations with industry may make scientists more aware of real world constraints and needs, and hence increase competitiveness, as the panel on collaborations and partnerships brought out. In these presentations, there seemed to be a change in tenor from complete hopelessness about the future of S&T to some measure of optimism. All the speakers discussed projects which had some degree of success, such as the IIT-Chennai's initiatives on transferring technology to society through S&T-supported corporate entities (Ashok Jhunjhunwala, IIT-Chennai); the importance of transnational collaborations (Bikash Sinha, SINP, Kolkata) and the spin-offs for S&T in the country from the IT experience (N. Balakrishnan, IISc). However, one will have to see if these isolated examples are too few for a country as large as India to show any visible impact.

It was probably the last panel on 'Science as a career' that brought the focus on the nature and complexity of the problem regarding the future of science. India needs a change in education policy and practice from 'teaching' to 'learning', one which focuses on 'process' over 'information', as Amitabh Mukherjee (Univ. of Delhi) suggested. Science education must encourage and incite excitement in early education, perhaps through scientists engaging with school children and acting as active role models, as S. Dattagupta (S.N. Bose Institute, Kolkata) stressed. Indian science also needs to grapple with the problem of 'the disappearing women in science' – why do their numbers decline as they move farther in their career'? While this is true, Vineeta Bal (NIM, Delhi) brought to focus the point that the trend in the recent past shows that there is an increase in the number of women taking science as a career. With further relaxation of immigration rules to developed nations, the day may not be too far when Indian science will be forced to address the problems of women scientists, whose proportion amongst the scientific community in the country is significantly growing.

The action plan that emerged from this conference (based on the recommendations that can be developed for presentation to the government) is as follows:

At the level of human resources, embark on massive and sophisticated PR campaign for changing the image of S&T in the minds of the general public, so as to attract the best of minds into science as a career choice. Involve younger faculty (below 45), as well as women and other disenfranchised groups, in every facet of institutional building and science policy making in order to create a sense of ownership and retain young scientists in the country.

Grants and funding is an area that merits attention. Forming an autonomous agency comprising scientists representing all

fields, ages and gender to make funding decisions is also important to ensure professional reviews of proposals by experts in their respective fields. Identifying thrust areas such as biotechnology, nanotechnology, pharma, alternate sources of energy and providing adequate resource support; increased funding for table-top research to encourage tinkering and innovation, funding research on issues and themes connected with women in science that ask fundamental questions beyond participation also are important.

Institutionalization is yet another area that beckons reforms. Establishing a science laboratory to study, evaluate and monitor science along with an active promotion of open access archiving at the institutional level cannot be further delayed. Promotion of quality undergraduate teaching programme is central to attracting the best minds to science career at this level. This will in turn enhance the quality of postgraduates who are the building blocks on which must rest the mandate of making Indian science competitive. Institution of the equivalent of Bhatnagar award for undergraduate college teachers and providing them with additional funds for innovating teaching methods will help revitalise undergraduate teaching. Mentoring programmes through academies is a useful mechanism to harness the talent of rural students and other disenfranchised groups like women, which will go a long way in making Indian science creative.

To reform administration and improve the work environment, there is a need to enforce transparency, uniformity of rules and consistency in their application at all levels of career advancement in S&T, in accordance with the right to information bill 2005. Teaching of science in schools needs to be critically reviewed, particularly in the context of early training in science learning. A conscious transformation from 'teaching' to 'learning' is essential, shifting emphasis from information cramming to analysis and creative thinking.

The action plan is the articulation of the recommendations raised in a more specific form. A committee from diverse backgrounds can treat the entire document along with action plan as a draft, which needs further thought and action. The conference indicated that although there are specific issues which need to be addressed at an institutional level such as transparency and accountability, it is equally clear that we need to focus on developing a larger culture of excellence and promoting synergies among different stakeholders in order to better leverage our capabilities in S&T for the future.

In that sense, the conference can be seen as an initiative to create a wider network and draw out a long-term inter-institutional programme.

1. Inventing a better future – A strategy for building worldwide capacities in science and technology, IAC, 2003.

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