

Workshop on biodiversity informatics and interlinking of databases*

Application of bioinformatics in biodiversity data management and its impact on biological research are now well demonstrated. Biodiversity informatics developed using computational tools represents the collective research efforts and products of the life sciences community throughout the world. At present, some information is accessible through the web, and more is being added regularly. However, currently scientists do not find it easy to exploit the information because of a variety of semantics, interfaces, and data formats used by the underlying data sources. To harness the information resources, their authentication and integration are the main tasks currently faced by the biologists. The present workshop was organized with a view to empower scientists to exploit the available information effectively and generate awareness about digitization and interlinking of biodiversity databases.

The workshop was inaugurated by A. E. Muthunayagam (Kerala State Council for Science Technology and Environment). In his inaugural address, Muthunayagam emphasized the importance of biodiversity informatics and pointed out that major developments in this line are greatly hampered due to lack of trained manpower. He also unveiled a software package CD, 'LitFriend'.

After the inaugural session S. Seeni Tropical Botanic Garden and Research Institute (TBGRI), Thiruvananthapuram delivered a lecture on medicinal plant bioprospecting and bioproduction. The importance of biodiversity databases and their applications in bioprospecting and secondary metabolite production through biotechnological intervention and conservation and sustainable utilization of natural resources were emphasized. Hari Sankar (TBGRI) delivered a lecture cum hands-on-session on database designing and creation. M. P. Nayar (formerly Botanical Survey of India) convened an interactive

discussion on essentials of biodiversity databases. It was pointed out that biodiversity data should be categorized into three forms, namely data for common man, data for selling purpose and unpublished indigenous knowledge for protection. G. M. Nair (University of Kerala) delivered a lecture on current developments in bioinformatics, biodiversity and biotechnology. Hands-on-session on website designing was also provided to the participants.

On the third day in a discussion, A. G. Pandurangan (TBGRI) shared his plant exploration experience in the Western Ghats with the participants. The major point stressed in the discussion was the need to organize a centralized digital database of plant diversity of the Western Ghats. After his presentation S. Sreekumar (TBGRI) convened an interactive discussion on biodiversity information resources on the web and its easy exploration. He pointed out that although the number of URLs on the web providing biodiversity information is steadily increasing, it is difficult to find authenticated information sources. On the fourth day, there was a lecture-cum-demonstration by Santhosh J. Eapen (Indian Institute of Spices Research (IISR, Calicut)). He explained the database organization initiatives of IISR and demonstrated the database, Spice Genes. This database includes passport data of black pepper, turmeric and nutmeg diversity. He also explained the database PIR (*Phytophthora* Information Resources) and Piper Base developed by IISR. M. Maheswaran (Tamil Nadu Agricultural University) delivered a lecture on agricultural diversity vs crop diversity. The points discussed in his presentation were: biodiversity and its relationship to the way ecosystems function; factors affecting current levels of biodiversity; biodiversity magnitude and distribution, and biodiversity based on use and non-use value. It was emphasized that now bioinformatics means something related to genomics and proteomics, but bioinformatics will be meaningful only when it crosses this boundary and is utilized in other areas of life sciences like biodiversity. Roji P. Thomas (Net Asset Management Pvt Ltd), presented an in-

teractive session on database designing and its interlinking. On the last day, Bindhu Sreekesh (National Informatics Centre Cell, Department of Biotechnology, New Delhi) presented an overview of Biotechnology Information System Network (BTISNet). She informed that in 1987 the BTISNet programme was started by DBT and in 1988 the first nine Distributed Information Centres (DICs) were established. From 1989 onwards, establishment of Sub-Distributed Information Centres (Sub-DICs) started. Currently, the BTISNet consists of an apex centre, 10 DICs, 48 Sub-DICs and 5 Centres of Excellence, distributed in various research institutions/universities in different parts of India. Thus the BTISNet provides a common platform for interaction and sharing of scientific knowledge. S. Ganeshan (TBGRI) presented a lecture on data mining. There was a demonstration of software packages such as Plant Info, Garden Info, Seed Pack, Biolit and databases such as Fungal Database Meliolales, Sacred Groves of Kerala and Wild Ornamental Plants of the Western Ghats developed by TBGRI. Plant Info is an on-line database software package developed for organizing a comprehensive centralized information system of the native plant wealth of our country. Some of the key features of Plant Info are user-friendly advance search facility, powerful and flexible query wizards, navigation tools to access information, mouse-over fingertips information on reference, user name and password protection, on-line interaction platform, on-line data submission wizard, photo-gallery, etc. Garden Info offers tools for management of germplasm collection and monitoring data of botanic gardens and its networking. It also offers tools for easy storage, sequencing, analysis, interpretation and sharing of all types of data, including taxonomic details, plant collection and locality details (passport data), day-to-day monitoring and maintenance data in the garden such as growth and phenology details, treatment of pesticide, fungicide, manuring, irrigation, economic use and information about the plant maintainer. It also provides tools for easy access to information. Seed Pack is an on-line software

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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 BTIS-Net 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.tbgrj.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 reports¹ 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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