

The draft action plans were drawn from women, youth and media from suggestions made by the six forum parallel round table sessions as well as the GK-II plenary sessions. Essentially the recommendations were for development of standards and guidelines for *increasing access* using new technologies integrating with existing ones for content management, free flow of information and knowledge and regulation, policy and innovative financing to create an enabling environment for this to happen; creating education to employment strategies and promoting domestic and international ICT interships and establishing electronic alert networks as a means to *empowerment* and providing training and education in *governance* and sharing this knowledge. With reference to sharing local knowledge it was recommended that a national

strategy be supported to use local knowledge in the development process. A discussion list for the youth and ICT replication and learning funds for women entrepreneurs and finally for effective dissemination community media and community media networks also need to be supported.

GK-II provided an excellent opportunity to share the experience that has already been accumulated and learn from each other's failures as well as successes. Participation from the Indian side was hardly felt. Except for a few partners who were present (mostly the NGOs), participation from the government and private sectors was meagre. To exploit the opportunities, which this vibrant field offers, it should be realized that the assembling of such tools is only part of the tasks for the countries as they design new or improved National

ICT strategies. Unless social reforms are introduced and reinforced with supportive measures that enable all strata of society to be included in this revolution, technological innovations actually work against the development goal of breaking down inequalities. The recent Vision Statement jointly issued by the Prime Minister of India and the President of the United States of America, emphasized the need to harness knowledge for meeting basic needs of poverty alleviation and health. This might be just the beginning towards such partnerships to focus on issues of common concern and activities.

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## Biology today: Urgent need for an integrative approach\*

The need for re-integration of the various sub-divisions of biology with each other and of biology with other branches of science has begun to be increasingly felt, particularly during the past one decade or so. The International Union of Biological Sciences (IUBS) has, accordingly, adopted a new initiative called 'Towards an Integrative Biology' (TAIB).

The Indian National Science Academy organized a seminar with a view to involve a wider section of our academic community to understand what is integrative biology and how this approach can be implemented in our research and teaching programmes.

The two sessions on 13 March were devoted to research while the sessions on 14 March concentrated on aspects of teaching biology. S. C. Lakhota (BHU, Varanasi) introduced the theme of the seminar and explained that integrative biology is not a new discipline but a philosophy as well as a mechanism to integrate not only the various sub-

disciplines within biology but also to integrate biology with other branches of science in research and teaching. Although integrative biology may have different meanings in different contexts, essentially it aims to incorporate 'organismic biology' and 'molecular biology' with each other and with other branches of science, conceptually as well as methodologically, so that a holistic view of life processes can be obtained.

In the first session on 'Integrative Biology in Research', N. R. Jaganathan (AIIMS, New Delhi) and M. Vijayan (IISc, Bangalore) illustrated the integrative approach inherent in biophysical methods. Vijayan emphasized that although the reductionist approach has already been providing some integration, parochialism that seems to exist in some areas of biology needs to be avoided. As he stated, different areas of biology are complementary rather than competitive.

In the second session, Anupam Varma (IARI, New Delhi) highlighted the success of an integrative approach being practiced in agricultural sciences. U. Bhalla (NCBS, Bangalore) and S.

Rama Kumar (IISc, Bangalore) emphasized the role of computational biology and bioinformatics in contributing to the integrative nature of today's biology. Bhalla proposed some novel and practical ideas to tap the Indian advantage in software to promote non-classroom teaching of biology: the expertise available in some of the leading research and teaching institutions in the country can be utilized to develop illustrative materials for distribution to even remote areas through CDs and the internet. Speakers as well as the discussants all emphasized the need for developing more interactive research programmes. R. Gadagkar (IISc, Bangalore) pointed out that the Central Board of Secondary Education has, of late, stopped providing opportunity for biology stream students to study computer science and vice versa. Given the significant role of computers and bio-informatics in biology, such exclusiveness is detrimental. N. K. Ganguly (ICMR, New Delhi) in his summing-up remarks, pointed out that a major cause for the present unsatisfactory situation in biological research was the 'straight-jacketed' university system with restricted employment

\*Report on a Seminar on Integrative Biology at the Indian National Science Academy, New Delhi, during 13-14 March 2000.

conditions resulting in 'single track' careers with little 'transgression'.

The session on 'Integrative Biology in Teaching' included two lead lecturers followed by discussion lecturers by seven other speakers. Lakhota discussed the dichotomy between the so-called 'classical' and 'modern' biology in our teaching programmes and suggested that the disrespect for 'classical' ('organismic') biology as well as the euphoria over 'modern' ('molecular') biology are more a result of our own limitations rather than irrelevance or greater relevance of any given sets of disciplines. The so-called 'classical' subjects in biology have suffered because of the archaic and indifferent teaching rather than those subjects themselves having become 'archaic'. The undue rush to introduce the so-called 'modern' biology courses with extremely poor infrastructure is seriously harming students as well as the existing 'traditional' departments. It is in this context that there is an urgent need to adopt the philosophy of integrative biology. H. Y. Mohan Ram (Delhi University, Delhi) emphasized the relevance of sub-disciplines like biodiversity, ecology, environmental biology, etc. to the basic understanding of biology as well as to exploiting the benefits of molecular biology and biotechnology to the full. The absence of competent 'taxonomists' in present times is alarming and he suggested that creation of biodiversity databases would help generate jobs in this area which would promote integrative teaching in biology.

N. Sathyamurthy (IIT, Kanpur), emphasizing the need for integration,

stated that biology-related courses were some of the most popular modules at IIT, Kanpur: the flexibility in curriculum and its modular organization were the key factors and must be emulated by other educational organizations. H. K. Jain (IARI, New Delhi) made some practical suggestions like 'one-time catch-up' grants to 'traditional' departments in universities to let them rebuild their infrastructure as required in the present context. He further suggested that bright students from traditional departments should be provided with adequate opportunities through one year 'conversion' courses at 'well-endowed' institutions/universities to make them uptodate in current topics. Jain opined that the 'American graduate school' model with its modular course system is ideal for achieving integration.

G. Govil (TIFR, Mumbai) used the biophysics course as an example of integration. Physicists and chemists generally find it difficult to comprehend the non-equilibrium situations common in biological systems and, therefore, there is a need for teaching of biology to students in these disciplines. While summing up this part of the session, P. N. Tandon (New Delhi) observed that the university system in our country has generally failed to recognize the needs of time which has resulted in its being under-valued today. K. N. Ganesh (NCL, Pune) emphasized the need for a greater use of the internet and web-sites for teaching and for an urgent need to break the 'language' barrier between different disciplines and sub-disciplines. S. S. Agrawal (SGPGI, Lucknow) discussed teaching of biology in relation to medicine and lamented the fact that

while teaching medicine is all biology, practising medicine is not biology. He also pointed out that while the medical curriculum includes 'modern' disciplines in biology like genetics, molecular biology, etc., the teachers are not ready or competent to teach them. He presented the structure of the 5-year integrated M Sc course in biological sciences proposed to be introduced at the Manipal Academy of Higher Education and suggested that this may be a model to promote integrative biology.

K. Muralidhar (Delhi University, Delhi) discussed the structure of courses in biology proposed to be introduced at the under-graduate level in Delhi University as a way to provide integrative training. P. N. Srivastava (JNU, New Delhi) while emphasizing the urgent need for integrative biology disclosed that nearly thirty years ago a committee set up by the University Grants Commission had already highlighted the concerns being voiced at this meeting and had made many far-reaching recommendations. What we need is a strong commitment and action in implementing the ideas emerging at such meetings.

R. C. Mahajan (PGI, Chandigarh) while summing up the deliberations at the seminar hoped that the awareness generated through this initial discussion would lead to more focused meetings and implementation of the emerging ideas.

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## Annual meeting of the Mycological Society of India\*

The 26th Annual Meeting of the Mycological Society of India (MSI) was accompanied by a National Symposium on 'Mycology at 2000 and beyond', organized by I. L. Kothari of the Department of Biosciences, Sardar Patel University. Forty-one oral and thirteen poster

presentations were made during the symposium organized in three sessions – biotechnology, agriculture and environment/diversity.

The session on biotechnology comprised papers on varied topics, including fungal parasites of mosquito, cellulase, alkaline protease, auxin production by fungi and fungi as biocontrol agents.

Mechanisms of stress mediation by fungi, such as to metals and salinity,

enzymatic capabilities, evolution, dye decolourization and taxonomy-related papers were discussed under environment/diversity.

Papers presented in the session on agriculture were related to rhizosphere, natural herbicides and mycorrhizae. In keeping with current trends in mycology, many of the papers addressed issues related to molecular biology.

The symposium reflected the status and directions of mycology in India. It

\*A report on the annual meeting of the Mycological Society of India held at Sardar Patel University, Vallabh Vidyanagar, from 21 to 23 December 1999.