

Annual Report

April 2001 – March 2002



**Indian Academy of Sciences
Bangalore**

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1 INTRODUCTION

The Academy was founded in 1934 by C.V. Raman with the main objective of promoting the progress and upholding the cause of science (both pure and applied). It was registered as a Society under the Societies Registration Act on 24 April 1934.

It commenced functioning with 65 fellows. Its formal inauguration took place on 31 July 1934 at the Indian Institute of Science, Bangalore. On the afternoon of that day its first general meeting of Fellows was held at which C.V. Raman was elected its President and the draft constitution of the Academy was approved and adopted. The first issue of its proceedings was published in July 1934.

The present report covering the period April 2001 to March 2002 represents the sixty-eighth year of the Academy since its founding.

2 THE FELLOWSHIP

2.1 2001 elections

A total of 358 nominations received for fellowship in different disciplines were considered first by the eight sectional committees and later by the council. Following postal balloting, twenty one new fellows were elected, the fellowship effective from 1 January 2002. A list of their names follows while Annexure 1 gives their particulars. Also elected was a new Honorary Fellow.

Fellows:

- | | |
|------------------------|------------------------------|
| 1. Balasubramanian K A | 2. Banerjee, S |
| 3. Dhurandhar, S V | 4. Jagannathan, N R |
| 5. Krishna, K S | 6. Kumara Swamy, K C |
| 7. Mayor, S | 8. Murty, S V S |
| 9. Murty, T G K | 10. Ramakrishnan, S |
| 11. Ramasubramanian, S | 12. Sankara Rao, K |
| 13. Sastry, M | 14. Sharma, A |
| 15. Surolia, Namita | 16. Vankar, Y D |
| 17. Varshney, U | 18. Veluthambi, K |
| 19. Venkataramana, T N | 20. Vishveshwara, Saraswathi |
| 21. Watve, M G | |

Honorary Fellow

1. Zewail, Ahmed H

2.2. In memoriam

The Academy regrets to report the death of the following Fellows and an Honorary Fellow during the period up to March 2002. Annexure 2 gives additional information about them.

Fellows

- | | |
|------------------------|--------------------------|
| 1. Anantharamaiah, K R | 2. Baliah, V |
| 3. Dhar, M L | 4. Dhawan, S |
| 5. Govindachari, T R | 6. Krishna Murty, K |
| 7. Anna Mani | 8. Menon, T R |
| 9. Pant, Divya Darshan | 10. Paul, R C |
| 11. Ramachandran, G N | 12. Ramalingaswami, V |
| 13. Ramaswamy, G S | 14. Ranganathan, Darshan |
| 15. Rangaswami, S | 16. Rao, P S |
| 17. Sadasivan, T S | 18. Sinha, S K |
| 19. Viswamitra, M A | |

Honorary Fellow

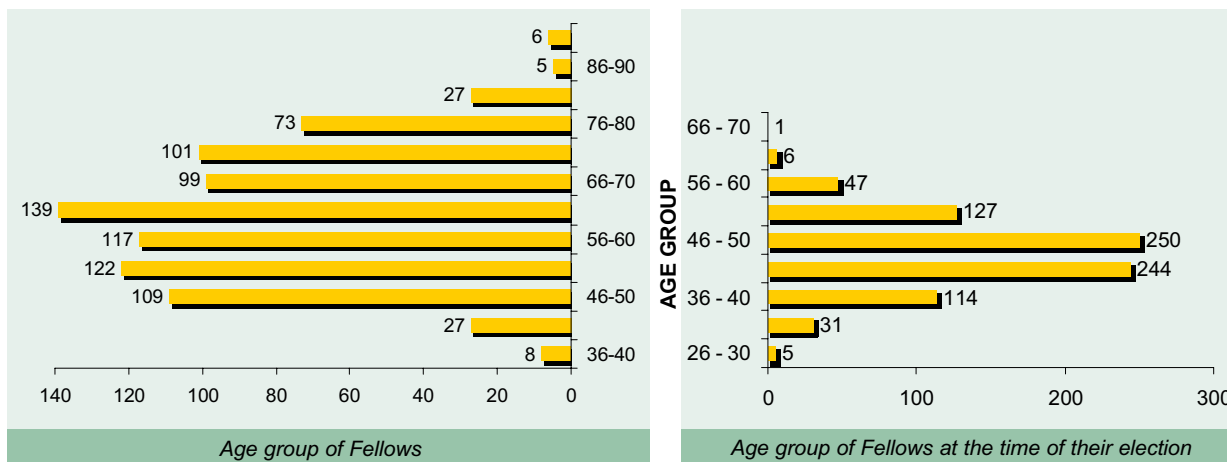
1. Brown, Robert Hanbury

2.3 Strength of the fellowship

	Fellows	Honorary Fellows
1 April 2001	830	44
Elected (Dec. 2001)	21	1
Deceased (Apr. 2001 – Mar. 2002)	19	1
1 April 2002	832	44

2.4 Fellowship analysis

Continuing with our analysis, the bar charts produced below show the age group of Fellows currently on the roll (left) and the age group at the time of election (right).



3 COUNCIL

The council reconstituted for the triennium 2001–2003 with K. Kasturirangan as the president was in office. Two statutory meetings of the council were held in Bangalore on 21 July and 8/9 December 2001.

4 ASSOCIATES

Only 12 nominations were received from Fellows, of which, the following four were selected as Associates in 2001 (see also Annexure 3). The selections continue to be restricted to those below the age of 32 and the tenure ceases after five years of after the Associates attain the age of 35 whichever is earlier.

1. Dhar, Abhishek
2. Narayanan, E.K.
3. Satheesh, S.K.
4. Shenoy, Vijay B.

Since inception of this programme in 1983, a total of 183 Associates have been selected, 55 of whom have since been elected to the fellowship.

5 PUBLICATIONS

5.1 Journals

Publications continue to be the major activity of the Academy and the eleven journals have appeared on their due dates. Tables 1 and 2 give relevant particulars of the 11 journals. Table 3 gives the journal circulation figures for the year 2001.

5.2 Special issues of journals

Several journals brought out special issues on chosen topics as part of their regular numbers. A description of these follows:

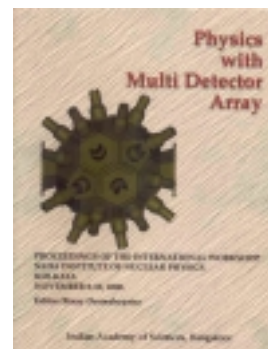
(a) Physics with multi-detector array

Guest Editor: B. Dasmahapatra

Pramana, Vol. 57, No.1, July 2001, pp. 1–234.

Research in nuclear physics, earlier being done with single or two detectors, has now considerably changed. In order to extract new, important and interesting specific information from the background of huge unwanted events, arrays of detectors with increasing granularity are being used both in nuclear spectroscopy and reaction. The success of gamma detector array at the Nuclear Science Centre, New Delhi using 12 Compton suppressed HPGe detectors has given a boost to develop multidetector array in our country. This has initiated the proposal of the development of MEGHNAD (multielement gamma heavy ion and neutron array of detectors). There have been discussions and plans to set up a national array using the available Clover detectors and associated electronics of the national institutes. With this background, a workshop entitled 'Physics with multidetector array' was held at the Saha Institute of Nuclear Physics in December 2000 which celebrated its golden jubilee during the year. There were some interesting talks on the development of new detectors and arrays as well as data acquisition and reduction relevant to such arrays.

This volume contains 29 invited and contributed articles in nuclear spectroscopy, nuclear reactions, and other related areas.

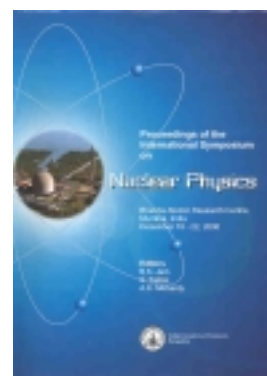


(b) International symposium on nuclear physics

Guest Editors: B.K. Jain, S. Kailas and A.K. Mohanty

Pramana, Vol. 57, Nos.2/3, August/September 2001, pp. 237–682.

The biggest endeavour of humankind during the 20th century had been the search for the ultimate structure of matter. Nuclear physics undoubtedly has contributed a great deal to it. This year's nuclear physics symposium, held at Mumbai in December 2000, being the last of the century, acquired a special importance. To represent the world view of current trends in nuclear physics at the turn of this century, the symposium was elevated to the level of an international symposium. The topics were chosen so as to represent the present research interest and the future projections. The format of the symposium comprised 43 invited talks and 250 presentations in the poster sessions. This volume contains 37 of the papers presented at the symposium.



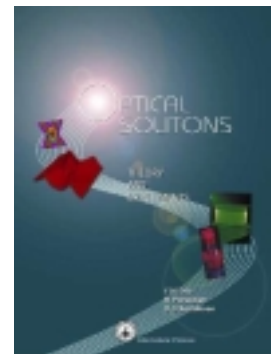
(c) Optical solitons: Theory & experiments

Guest Editors: K. Porsezian and V.C. Kuriakose

Pramana, Vol. 57, Nos. 5/6, December 2001, pp. 839–1162.

After the invention of lasers, nonlinear optics has emerged as the most sought after subject in all the frontiers of science by both theoreticians and experimentalists. Nonlinear optics has stirred many phenomena like fabrication of new nonlinear materials, harmonic generations, optical solitons, parametric amplification, stimulated Raman scattering, self-induced transparency, modulational instability, etc., which find a myriad of applications ranging from high data transmission in optical communication, switching, amplifiers, pulse reshaping, pulse compression, tunable lasers to encoded message transmission. Notable among these exciting phenomena is the concept of optical solitons, pioneered by Hasegawa of Japan which revolutionized the scope of telecommunication world, mainly optical fibre communication (OFC). Solitons are perceived to be the carriers of communication signals in the near future. In recent years optical soliton fibre communication has attracted much interest. In fact, the continuous pursuit of both methodological and technological innovation has led to the realization that conventional linear models of real systems suffer from severe limitations. Today the potential of soliton engineering is recognized worldwide with research groups actively working on this topic. Perhaps, solitons are the most elegant and complex structures produced by nature in the realm of nonlinearity, which in fact attract theoreticians. On the other hand, for experimentalists, the main appeal is the prospect of applications of solitons in telecommunication, pulse compression, logic gates, optical switching and so on.

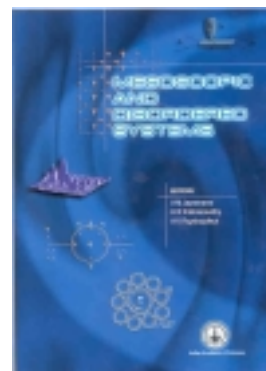
This special issue is intended for beginners, research workers and experts in general who specialize in nonlinear dynamics/nonlinear optics as well as telecommunications. It is also meant for others interested in the latest developments in optical soliton applications and those from technological environment who are interested in a first but in-depth look at the improvements that soliton-based OFC can bring to existing systems. Articles cover a wide range of topics such as temporal and spatial solitons, nonlinear optical materials, nonlinear Schrödinger systems, dark solitons, and so on.



(d) Mesoscopic and disordered systems

Guest Editors: A.M. Jayannavar, H.R. Krishnamurthy and A.K. Raychaudhuri
Pramana, Vol.58, No.2, February 2002, pp. 151–442

A small discussion meeting of physicists from around the world working in the general area of mesoscopic and disordered systems was held in Bangalore in December 2000. The motivation was the intrinsic fascination of the field, which abounds in interesting and subtle physics issues. While on the one hand it is directly related to the fast emerging area of mesoscopic and nanoscopic devices, on the other, it leads to theoretical developments which have general application in a large number of other areas of condensed matter physics. This volume contains twenty-six of the talks presented at the meeting and the editors hope that the condensed matter physics community will find this volume of some value.



(e) Solid state and materials chemistry

Guest Editors: J. Gopalakrishnan and Ram Seshadri
Proc. Chem. Sci., Vol. 113, Nos. 5/6, October/December 2001, pp. 361–702.



This special volume brought out to mark the silver jubilee of the Solid State and Structural Chemistry Unit, (SSCU) of Indian Institute of Science, Bangalore contains articles describing a variety of research activities in solid state science which are at the very frontiers of current international activity. The topics covered include: self-assembly of complex inorganic solids having open architectures, nanotubes and nanowires, relaxation in binary mixtures, electron-electron interactions in chemical bonds, lithium-ion conducting perovskite oxides, *ab initio* structure determination using powder X-ray diffraction, epitaxial oxide films, quantum phenomena in magnetic nanoclusters, real space visualization of bonding effects of s^2 lone pair electrons, vibrational spectroscopic studies of glasses with NASICON chemistry, properties of ferromagnetic double perovskite $\text{Sr}_2\text{FeM}_2\text{O}_6$, impedance behaviour of metal hydride electrodes, conformations of hydrocarbon chains in intercalates of layered solids, diffusion of hydrocarbons in confined media, simulation study of water, effects of hydrogen bonds on the dynamics of water, dielectric properties of Mg/Nb/Ta oxides, self-assembling bilayers in palladium thiolates, morpholinium intercalated vanadophosphates, synthesis and properties of MoSi_2 -based engineering ceramics, ceria-zirconia solid solutions, applications of self-assembled monolayers, and anionic clays. The diversity, depth and range of topics are remarkable, reflecting the interdisciplinary nature of research activity of the faculty and alumni of SSCU.

(f) Spectral and inverse spectral theory

Guest Editors: Peter D. Hislop and M. Krishna

Proc. Maths. Sci., Vol. 112, No.1, February 2002, pp. 1–256

This is the second special issue devoted to the *spectral theory of Schrödinger operators*, after the first one brought out by the journal in 1996, and is devoted to articles presented at the *Indo-US Workshop* held at Goa in December 2000.

The identification of the spectral types of Schrödinger operators is one of the main interests in this area. The spectral types of Schrödinger operators are studied for different families of deterministic potentials, random potentials, magnetic fields, and time-dependent potentials. Other issues of interest are the asymptotic properties of time evolution, the behaviour of eigenfunctions, and the finer properties of the density of states related to random potentials. The seventeen articles in this volume contain both original research results as well as review articles on the subject.



(g) Recent researches in petrology and geochemistry

Guest Editors: Samarendra Bhattacharya and Jibamitra Ganguly

Proc. Earth & Planet Sci., Vol. 110, No.4, December 2001, pp. 267–454.

This special issue is a tribute to Professor Sisir Kumar Sen for his contributions to petrology and geochemistry and for his efforts in educating a generation of Indian petrologists. He was instrumental in promoting the idea of applying the concepts of equilibrium thermodynamics to the field-oriented problems of metamorphic petrology, especially to the problem of element partitioning among coexisting minerals. This led to a series of papers showing how a specific distribution coefficient varies systematically with metamorphic grade. These papers were important to the subsequent quantitative formulations of what are known today as exchange geothermometers. He continued his work on reconstructing the P-T paths of metamorphic rocks and fluid buffering during metamorphism. Granulites and the role of fluids during metamorphism have been life long passions of Sen. Most of the 12 articles in this volume therefore pertain to topics in these areas along with a few from other areas.

(h) Indian language document analysis and understanding

Guest Editors: P.S. Sastry and M. Narasimha Murty
Sadhana, Vol. 27, No.1, February 2002, pp. 1–126.

Advances in information technology and the wide reach of internet are radically changing all spheres of activity in our society. Consequently, an increasingly large number of people are required to interact more frequently with computer systems. To make the man–machine interaction more effective in such situations, it is desirable to have machines capable of handling inputs in a variety of forms such as printed/handwritten paper documents, speech, etc. The field of document analysis and understanding is concerned with developing techniques to facilitate computers to effectively handle (scanned images of) printed documents as input. Despite widespread use of computers, paper documents continue to be important and hence it is useful to have computer systems that can seamlessly integrate paper documents with other electronically created ones. There are also other important applications of document image analysis: e.g. public digital libraries may require many classical literary works to be processed and made available in digital form.

In a multi-lingual country like India, it is particularly important to develop computer systems that allow users to interact with them in Indian languages. Due to peculiarities of Indian scripts (and languages), solutions that work well for languages, say English, may not apply to Indian languages. Also, in the Indian context, many documents contain text of more than one script and hence recognition and segmentation of different scripts from a multilingual document is important. Thus issues such as recognition of scripts and characters in Indian languages, pre- and post-processing techniques tailored for Indian languages and user-friendly interfaces for better utilization of the output of document analysis systems, all need attention. This was what motivated this special issue.

This special volume contains eight articles, and constitutes a fairly representative sample of the state-of-the-art in this field today. Some of the papers deal with complete systems for processing printed documents in an Indian language. Such systems will hopefully reach a stage where they are routinely used in various applications. The techniques used should form a good basis for researchers to undertake work on processing of documents in other Indian languages. If this volume motivates design and development of systems for processing documents in every Indian language, the effort would have been worthwhile.

(i) Fatigue and fracture of glasses, ceramics and composites

Guest Editor: B.K. Sarkar

Bulletin of Materials Science, Vol. 24, No.2, April 2001, pp. 95–256.

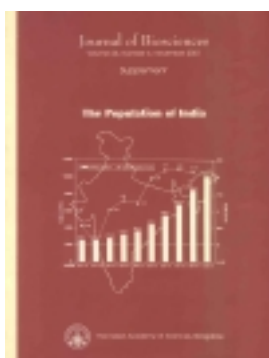
The unique properties of glasses, ceramics and composites such as corrosion resistance, high specific strength, transport behaviours ranging from those of insulators to superconductors etc have made these materials very attractive for a wide variety of applications in automobiles, prosthetics, sports goods, electronics, and aerospace structures. Yet their potential has not been fully realized because of their brittle nature and susceptibility to sudden catastrophic failure under stress due to the absence of dislocation-assisted plasticity. The brittle behaviour arises more due to the nature of the consolidation processes and this limitation has shifted the attention of designers away from these materials. While great strides have been made in investigations of brittle phenomena, complete understanding of it remained elusive. The growing importance of the subject has induced several scientists to undertake fatigue and fracture-related studies of such materials.

An international conference was organized by the Materials Research Society of India at Kolkata in September 1999 to enable the scientific community to share experiences and give a purposeful direction for further research. This special section of the journal contains 21 of the papers presented at the conference.

(j) The population of India

Guest Editors: Partha P. Majumder and A. Jagannadha Rao

Journal of Biosciences, Vol. 26, No.4, November 2001, pp. 391-546



There is a resurgence of interest in the population of our country for two major reasons. First, in spite of the existence of a family planning programme for several decades, we have recently hit the one-billion mark. The demographic growth rate has not shown any notable decline, but there has been a decline in the infant mortality rate and an increase in life expectancy at birth. The burden of growing numbers impacts significantly on our environment, epidemiological profile, nutrition, food, security and development. Secondly, thanks in part to a major paradigm shift that has occurred in human genetics, isolated ethnic populations of India have recently attracted international attention, the hope being to map genes for complex diseases using linkage disequilibrium statistics.

An evaluation of family planning in India reveals the main drawbacks in the programme. This volume attempts to provide 'state of the art' information on fertility control methods

and a critical evaluation of how successful they have been. The ten articles in this volume deal with issues such as population and fertility control methods, contraceptive development, vaccines, male infertility, Indian epidemiological profile, declining biological resources, nutrition, prehistoric human colonization and ethnic population of India.

(k) Genome analysis

Guest Editor: Alok Bhattacharya

Journal of Biosciences, Vol. 27, No.1, February 2002, pp. 1-70.

The last decade witnessed major changes that will affect the way in which much of biological research is carried out. Until recently, one could study only one or a few genes at a time and it took about three years even in well-equipped laboratories to understand the structure and function of a gene. It was not possible rapidly to work out how different gene-products interacted physically and functionally. The advent of high throughput sequencing methods and advances in computational techniques have made it possible to 'look' at the genome in its entirety. Along with improvements in sequencing technology, there have been major advances in the way the expression of genes is measured or, mutations in genomes are mapped. High throughput methods allow one to analyse large numbers of genes within a short period. What does all this mean for the average biologist working in our country? Has he or she become redundant and been swept aside by the strong currents of high technology? Many of us feel helpless looking at the sheer scale of the present-day research and are not sure how we can contribute significantly any more.

Despair, however, can quickly turn to enthusiasm if one realizes that the amount of information available today on the Internet can help anyone to conceive projects involving molecular tools. For example, full genomic sequences of a large number of organisms are already available and a PCR reaction can result in the desired fragment. Databases and bioinformatics tools available on the Internet allow a researcher to find mutations, build three-dimensional structures of encoded proteins, get the relevant information and literature related to genes of interest, and so on. Genome sequencing projects eventually throw up lists of genes with predicted functions with different degrees of certainty. A list usually contains a sizable number of genes that have unknown functions. Traditional genetic and biological methods may have to be used to investigate and confirm the putative functions. This is particularly relevant for the vast majority of genes whose products do not work in isolation. After all, genetic circuits consisting of interacting gene products are the basis of cellular functions.



Unfortunately, many organisms are not amenable to biological approaches and their genetic systems have not been defined (though their genome may have been sequenced). Exploitation of the genomic data in these organisms may not be feasible due to lack of amenable systems to study the functions of their genes *in vivo*. Small laboratories can contribute significantly by developing genetic approaches such as methods for transfection, knockouts, expression blocking, etc for different organisms. Judicious use of bioinformatics tools coupled with an insight into the biological properties of the system will help us to exploit genomic information. Any laboratory, however small or big, can contribute significantly.

This journal supplement is a collection of papers on different aspects of genomics pertaining to analysis of genomes and application of genomic information in basic biology, diagnosis and clinical research. They give us a glimpse of what is going on in this area, mainly in India.

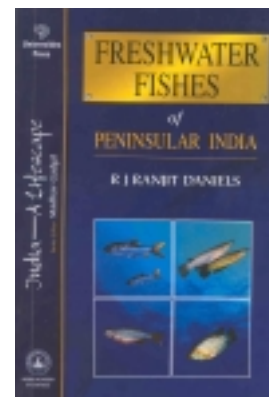
5.3 Special publication

1. Freshwater fishes of peninsular India

R. J. Ranjit Daniels, pp. 320, Rs. 290/-
co-published and distributed by Universities Press

This book represents the second fascicle to be published under Project Lifescape, the first one brought out in 2000 related to butterflies in Peninsular India. Freshwater fishes of India are probably better known to rural folk than to many of our professional biologists and students. This is because our textbooks rarely carry examples of our own species of fishes. While some biology textbooks include species that have been popular in fisheries and laboratory studies, a majority of the 750 species of freshwater fishes in India remain unknown to us. The literature available is too technical for students and non-specialists. Also, many of the standard reference books are not readily available in libraries and bookstalls; when available, the prices are usually unaffordable for the average Indian student. There is, therefore, a crying need for field guides written in a style accessible to both students and non-specialists. Our biology education could also greatly benefit from students undertaking first-hand studies of organisms in their own surroundings, addressing issues of scientific interest. This book is an attempt to provide such easily accessible information and to throw up ideas for field-oriented student projects.

A total of 75 taxa of fishes that commonly inhabit the freshwaters of peninsular India have been described in this book. Most of these are native Indian fish. A few species whose natural distribution lies outside peninsular India but are widespread due to



introductions, aquaculture, and the aquarium trade have also been included. With the exception of a few taxa that are based on the early works of Francis Hamilton and Francis Day, the illustrations are based on published and unpublished photographs of live, freshly-killed and preserved specimens. The black-and-white illustrations included in the text depict the variations between the sexes, adults, and juveniles. Around 50 taxa related to those described have also been illustrated.

6 **ELECTRONIC PUBLISHING**

The idea of reviewing Academy's effort in electronic publishing originated after the second ICSU-UNESCO International Conference on Electronic Publishing in Science held in Paris in February 2001. It was clear that while Latin America had made admirable strides in electronic publication of scientific journals and a journal server had been set up that hosted several biomedical journals from a 'developing country' region, there were no similar initiatives from Asia.

At a subsequent Academy meeting of journal editors and invitees, this point was emphasized. It was then suggested that Academy, which was already making its journals available on the Internet, might organize a workshop for the benefit of other Indian journals and publishing organizations. The workshop was conceived with the help of Subbiah Arunachalam of the MS Swaminathan Research Foundation, Chennai. The Academy managed to get two excellent resource persons from abroad: Leslie Chan of the University of Toronto, Canada, and Bioline International, and Barbara Kirsop of the Electronic Publishing Trust for Development in the UK, who both had considerable experience in producing electronic versions of developing country journals, and were already working with Indian journals.

It was decided to accommodate at least 40 participants and the initial plan therefore was to have two workshops, one in Bangalore and the second elsewhere. However, it was difficult to find a suitable venue elsewhere and we ended up holding both workshops in the Indian Institute of Science in Bangalore, at the Internet School facility of the Digital Information Services Centre.

The two workshops were held during 8 to 10 March and 13 to 15 March and were intended for editors/editorial support staff/computer support staff of Indian nonprofit science, technology and medicine journals and publishing organizations. The participants consisted of 10 from medical journals, three from INSA, each from ICAR, CSIR, *Sankhya*, *Indian Journal of Physics*, Bombay Natural History Society, Geological Society of India, and one each from *Madras Agricultural Journal*, Indian Mathematical Society, Tata Energy Research Institute, *Bulletin of the Astronomical Society of India*, and the mathematics journal *Samasya*. The rest of the participants

represented the journals of the Academy and *Current Science*.

The aim of the workshops was to address issues that relate to establishing electronic editions of journals in parallel with existing print editions, and to make participants aware of the rationale, economics, procedures, and technologies of electronic publishing, and open archives. The workshop curriculum was prepared by Chan and Kirsop, who gave most of the presentations. Participants themselves came up with a few topics. Considerable time was devoted to hands-on sessions at PCs for creating a simple Web version of a journal paper, and for adding metadata elements to it. The workshops were enriched by presentations from G. Misra and V. Pati of ISI, Bangalore and D. P. Patil of IISc, Bangalore on topics relevant to mathematics and physics publishing, and by T. B. Rajasekhar, also of IISc, on metadata.

The overarching concern behind the idea of the workshops was the urgent need to increase visibility of Indian journals by making them available on the Internet in formats that take advantage of search and retrieval procedures. While that is not an easily achieved objective, the cooperative model that SciELO (Scientific Electronic Library Online of Brazil) adopted has apparently produced a measurable positive outcome. One can only hope that the Academy workshops will have played the catalytic role that was intended for them.

The Academy website has a section devoted to the workshops at <http://www.ias.ac.in/epubworkshop/>, including the curriculum and the presentations. The topic list mentioned above that participants came up with is a fair pointer to issues that one must address: Web journals and visibility, partnerships with institutions in developed countries, pre-printing workflow and document management, tools for electronic publishing, search engines, advertisements, copyright issues, XML, cost of website maintenance, access and control, archiving and long-term access, role of libraries, lack of electronic access in many regions, file formats and conversions, pricing and economics, persistence of print editions, and impact on subscriptions to print journals.

The workshops were made possible by generous funding assistance from DBT, CSIR, and INASP (International Network for the Availability of Scientific Publications, Oxford). The International Development Research Centre (IDRC) in Canada and the British Council supported the travel of Leslie Chan and Barbara Kirsop.