Annual Report

April 2001 – March 2002

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Bangalore
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Contents

1. Introduction 5
2. The Fellowship 5
3. Council 7
4. Associates 7
5. Publications 7
6. Electronic Publishing 16
7. Academy Discussion Meetings 18
8. Academy Public Lectures 20
9. Mid-Year Meeting 2001 24
10. Tirupati Annual Meeting 28
11. Science Education Programme 36
12. Academy Finances 42
13. Acknowledgements 43
   Tables 1-3 45
   Annexures 1-8 47
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

<table>
<thead>
<tr>
<th></th>
<th>Fellows</th>
<th>Honorary Fellows</th>
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<tbody>
<tr>
<td>1 April 2001</td>
<td>830</td>
<td>44</td>
</tr>
<tr>
<td>Elected (Dec. 2001)</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>Deceased (Apr. 2001 – Mar. 2002)</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>1 April 2002</td>
<td>832</td>
<td>44</td>
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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


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


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


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


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


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 $\text{Sr}_2\text{FeM}_6\text{O}_{16}$, 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

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

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

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


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


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


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 fasicle 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.
7  

ACADEMY DISCUSSION MEETINGS

7.1 The architecture of materials

2–5 December 2001, Orange County, Coorg

The design and functionalization of engineering materials depend critically on the architecture of materials covering length scales from nano dimension to meters. The evolution of architecture depends on the energetics, chemistry as well as the kinetics of the materials processing. The possibility of influencing the development of the architecture at different scales provides the modern materials scientists and engineers unique opportunity of developing newer materials with enhanced properties. The unravelling of the physics behind the arrangements of atoms, defects and grains not only provides insight to the materials behaviour but also opens up new possibilities. As the modern materials science is unfolding, we are increasingly discovering some basic underlying principles of nature playing central role at different length scales as well as at different processing conditions. The objective of this meeting was for scientists working in the fields of physical metallurgy and materials science to come together to discuss these issues which can lead to some new thinking which in turn can lead to newer developments.

This meeting was attended by 21 participants representing various institutions in India. The sessions were organised around the following five themes.

1. Architecture of materials at atomic level
2. Materials build-up from liquid and vapour phases
3. Solid state transformations
4. The defect structure of solids
5. Self-assembly at molecular level

Annexure 4 gives the programme of lectures at the meeting which was marked by intense and high level of discussions after each talk. Convergence of ideas and knowledge from people with diverse background made the discussion both lively and stimulating.
7.2  Selected topics in genetics and molecular biology

5–9 December 2001, Orange County, Coorg

This discussion meeting was the first of what might be a series of such meetings between the Turkish and the Indian scientific community. The aim was to explore avenues for collaboration between biologists in the two countries. The participants were a mix of scientists from universities and research institutions, college teachers and graduate students. Inevitably, the areas touched on in the meeting were rather diverse — as is evident from the title. A rough framework was that the issues discussed were related to the evolution and function of genes, proteins and protein products as agents of signalling within and between cells. Both theoretical and experimental approaches were treated. The topics discussed were evolution, diversity and multifunctionality, transport and motility, secondary metabolites, and other general topics.

The Turkish delegation consisted of seven scientists and there were 14 from the Indian side. Annexure 5 lists the participants and the topics discussed. The meeting was successful in terms of getting to know people. A few specific projects for collaboration were discussed. Some practical suggestions emerged concerning a possible mutual exchange of students (the college teachers who participated were enthusiastic about this) and of research scientists. It remains to be seen how effectively and how soon these plans get implemented.

7.3  Genomics approach to biology

24–27 February 2002, Orange County, Coorg

Sequencing of entire human genome plus those of various model organisms and many important microbial pathogens has propelled functional genomics solidly into the context of academic research, biotechnology, drug discovery and intellectual property rights. Despite impressive developments in large-scale sequencing of genomes and data acquisition, a major portion of the genome(s) of all organisms remains to be assigned function. The situation is more striking in multicellular organisms. Consequently, the next step in this biological revolution is the combined structural and functional genomics approach that will contribute greatly to our understanding of gene function in the post genomic era and disease processes in humans. It is not a coincidence that many research institutes and universities worldwide have made major investments in understanding the structure-function relationship of many proteins encoded by the genome of an organism at once. An important component of this effort is the blending of cross-functional project team work focused at understanding the biology of an organism(s).
A number of independent research groups in India, and mostly in the academic set up, have been focusing on genomics of a variety of organisms. In recent years, a series of meetings and workshops contained one or more presentations on genomics, but a meeting devoted exclusively to functional genomics has never been held in India. The present discussion meeting was aimed at bringing together scientists with diverse research interests and expertise in functional genomics of microbial, plants and animal systems. This focused meeting was useful to review the current state and future plans of functional genomics in India. The topics covered include cryptic genes in E. coli, eukaryotic type adeny cyclases in mycobacteria, transcription, DNA repair and recombination processes in mycobacteria, flavobacterium metabolism, Zymomonas genetics, SMC proteins, orphan genes and stress response in yeast, transgenic plants with variety of traits, molecular mechanism of blood vessel formation, cancer genomics, genetics of Mendelian disorders, etc. Presentations on proteomics, tools for protein structure prediction and analysis, and genomics approaches to drug discovery complemented other talks. Annexure 6 is a list of participants.

8

ACADEMY PUBLIC LECTURES

8.1 Somanatha: Representations of an event

Romila Thapar, Jawaharlal Nehru University
23 July 2001, 5.00 PM, NIAS Auditorium

This lecture was an attempt to look afresh at an historical event and how it was represented in the texts of the subsequent periods. The event is Mahmud of Ghazni’s raid on the temple at Somanatha. The representations of this event and associations with Somanatha come from a variety of sources—Turkish-Persian chronicles, Jaina narratives, Sanskrit inscriptions, the debate in the British House of Commons and a nationalist reading of the event. The analyses in this lecture demonstrated the complexities and nuances of historical events and the need for those interested in the event to be aware of these.

8.2 The Hubble space telescope: Its impact on our understanding of the universe

Steven V.W. Beckwith, Space Telescope Science Institute,
Baltimore, Maryland, USA
31 August 2001, 5.00 PM, NIAS Auditorium

The Hubble space telescope has had a profound effect on our understanding of the universe, from the most distant galaxies
created near the beginning of time to nearby stars and planetary systems that may serve as birth sites for extra-terrestrial life. Its impact is like that of the telescopes of Galileo in the early 17th century, which proved that the Earth was not the centre of the universe overturning centuries of doctrine, and the 100-inch Hooker telescope that Edwin Hubble used to show that the galaxy is only one of millions and the universe as a whole is expanding, a discovery that gave rise to the Big Bang theory. This talk illuminated several of the great discoveries made with the Hubble space telescope and touched on the many areas of astrophysics where our understanding of the cosmos grew enormously through its observations.

8.3 Unexpected connections in mathematics

Gerald B. Folland, University of Washington, Seattle, USA
29 October 2001, 4.00 PM, RRI Auditorium

One of the pleasures of mathematics is discovering that a concept invented in one context has applications in others, or that the solution to a problem involves a combination of ideas from different fields. This lecture, intended to be accessible to a general scientific audience surveyed some of these unexpected connections.

8.4 The search for intelligent life

Arnold W. Wolfendale, University of Durham, UK
3 January 2002, Indian Institute of Astrophysics, Bangalore

This lecture was an attempt to find an answer to one of the great problems of the age, and one on which everyone has a view: “Are we alone?”. The lecture, in a not too technical way, looked at the history of this question, and the science involved in present day searches.

8.5 Stellar mass black holes

E.P.J. van den Heuvel (Academy Honorary Fellow), Astronomical Institute, Amsterdam, The Netherlands
4 January 2002, Indian Institute of Science, Bangalore

During the past one and a half decade the existence of stellar mass black holes in X-ray binary systems the galaxy has become well established. At present about a dozen such systems are known. Several of them are the so-called “galactic micro-quasars” which on a much smaller scale show many of the properties
observed in quasars and active galaxy nuclei (AGNs); mass ejection in the form of bi-polar relativistic jets, apparent superluminal motions and copious X-ray emission. The masses of the stellar black holes in our galaxy are, however, only between 3 and about 20 solar masses, whereas those in quasars and AGNs are between a million and a billion solar masses. Strong evidence has been found recently that the formation events of stellar mass black holes are a particular type of supernova explosions, so-called “hypernovae” or “collapsars”, which presumably mark the death of stars more massive than about 25 solar masses.

8.6 Some extensions of the binomial theorem and applications

Richard A. Askey (Academy Honorary Fellow), University of Wisconsin, Madison, USA
8 January 2002, Raman Research Institute, Bangalore

We all know the binomial theorem. However, some extensions of it found in the 19th and 20th centuries are surprising and have even more surprising consequences. Some of these were described, from how to refine the counting of lattice paths to how to explain the first derivation of the Rogers-Ramanujan identities. Ramanujan did some work in this area, including finding a formula which was missed by all of the great mathematicians who worked on elliptic functions in the 19th century. He could have done much more if he had learned a few things which were discovered in the late 19th century but not fully appreciated until after he died. For the scientific community, however, he left some things to find.

8.7 Current trends in the conservation of biodiversity

Ghillean T. Prance, University of Reading, UK
10 January 2002, NIAS Auditorium, Bangalore

The lecture discussed the roles of ex situ versus in situ conservation of biodiversity with an emphasis on the merit of in situ conservation. The important role of botanical gardens and seed banks was discussed with examples from the work of the Royal Botanic Gardens, Kew. Earlier work tended to focus more on single endangered species. The current emphasis on habitat and ecosystem conservation is likely to be much more effective. It is essential to maintain the web of interactions between the different elements of biodiversity, pollination, dispersal, mutualisms etc. The advantage of thinking in terms of biodiversity is that species, habitat and genetic diversity are all taken into consideration. Conservation today cannot be achieved without an equal emphasis on the sustainable use of biodiversity and examples of the move to sustainability was given from experience. The Convention on Biological Diversity has
had a considerable influence on current thought about conservation and its pros and cons was discussed in the lecture. The speaker felt that it is essential to bring on board those few countries that have not yet ratified the Convention.

8.8 The quantum-mechanical world view: A remarkably successful but still incomplete theory

Elliott H. Lieb, Princeton University, Princeton, USA
24 January 2002, Indian Institute of Science, Bangalore

This talk was about some important, unsolved problems of a mathematical nature connected with the quantum mechanical many body theory. It centred on the stability of matter problem and how this is connected to the largely unsolved problem of quantum electrodynamics. The historical background and the present status of the subject were reviewed.

8.9 Does the everyday world really obey quantum mechanics?

Anthony J. Leggett, University of Illinois, Urbana, USA
25 February 2002, Raman Research Institute, Bangalore

Quantum mechanics has been enormously successful in describing nature at the atomic level and most physicists believe that it is in principle the “whole truth” about the world even at the everyday level. However, such a view prima facie leads to a severe problem: in certain circumstances, the most natural interpretation of the theory implies that no definite outcome of an experiment occurs until the act of “observation”. For many decades this problem was regarded as “merely philosophical”, in the sense that it was thought that it had no consequences which could be tested in experiment. However, in the last dozen or so years the situation has changed very dramatically in this respect. This lecture discussed the problem, some popular “resolutions” of it, and the prospects for meaningful experimental input.

8.10 Quantum information

Charles H. Bennett, IBM Thomas J. Watson Research Center, New York, USA
26 February 2002, Indian Institute of Science, Bangalore

One of the foundations of the information revolution is the robustness of digital information: its ability to be read, copied
and transferred from one medium to another without degradation. But the information in microscopic bodies like atoms or photons, which obey the laws of quantum physics, is more delicate and cannot be copied or observed without disturbing it. Until recently these quantum effects were thought of mainly as a nuisance, causing small devices to be less reliable than their larger cousins, but now they have led to a profound generalization of our notions of what information is and what can be done with it, with applications to the art of designing unbreakable codes and vastly speeding up certain otherwise intractable computations.

9 MID-YEAR MEETING 2001

The 2001 Mid-Year Meeting, twelfth in the series, was held at the Faculty Hall of the Indian Institute of Science on 20/21 July. It was attended by 197 Fellows, 6 Associates and 25 teachers from various parts of the country, besides faculty and students from institutions in Bangalore. As usual there were two special lectures to start each day’s sessions, an evening public lecture on the first day and thirteen 30-min semi-technical presentations by newly elected fellows and associates. The full programme is in Annexure 7.

1. Special Lecture: R. Chidambaram (Bhabha Atomic Research Centre, Mumbai)
   Scientific objectives of Pokhran II – Design and realization

According to Chidambaram, the nuclear devices had performed exactly as planned. The thermonuclear device had a modern design wherein a fusion-boosted mechanism is employed to achieve an increased yield of 60 kilotonnes. With this success, Indian scientists are now looking forward to designing thermonuclear devices of upto 200 kilotonnes or more.

2. Special Lecture: P.N. Tandon (All India Institute of Medical Sciences, New Delhi)
   Neural basis of memory – New insights

During the last two to three decades the study of memory has acquired the status of objective science, utilizing a host of new technologies including EEG and event related potentials (ERP), functional magnetic resonance imaging (fMRI) and magnetoencephalography (MEG), position emitting tomography (PET) in conscious cooperating human beings and supplementing these with biochemical, molecular, genetic and electrophysiological investigations in cell cultures, brain slices, laboratory animals including those with specific gene knock-outs unprecedented information has accumulated.
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The earlier prevailing concept that memory is a single entity that could be assigned to a single structure or location in the brain has proved to be false. The formation of memory not only involves multiple anatomical regions but a complex set of cellular and molecular events, involving a variety of neurotransmitters, second messenger pathways, post-translational modification of protein in the cytoplasm and regulation of gene expression in the nucleus. Thus the neural substrate for short-term or working memory, and long implicit or associative memory have been localized to diverse regions of the memory.

This accumulating knowledge has already helped to explain diverse clinicopathological states, thus opening new prophylactic and therapeutic possibilities. At the same time this information is helping computer scientists and those interested in creating artificial intelligence to improve their artifacts.

Utilizing some illustrative cases from personal clinical experience, Tandon attempted to summarize the current state of knowledge and future direction of research.


Living with earthquakes

Earthquakes – literally, abnormal shaking of the ground often exact a heavy toll of life and property by shattering human works and dwellings, They, in turn, are caused by the sudden rupturing of the earth’s brittle crust along narrow zones where slow but persistently accumulating elastic strains, created by the dynamics of its rocky outer layer, eventually raise the resulting stresses to criticality.

Six major earthquakes have rocked the Indian continent over the past 13 years, making this epoch one of higher seismic activity than the average of the past half century. As major earthquakes change the stress regimes in connected areas thereby accelerating or retarding seismic activity, it would be imprudent to ignore the question as to whether the 2001 Republic Day earthquake, the most fatal so far in India’s history, will be the last of the series or merely an intimation of enhanced stress environment preparatory to the occurrence of a stronger successor elsewhere. One simple message, however, that these and the earthquakes of the first half of the 20th century deliver, is that the Indian crust continues to exist in a state of high stress at no time far from criticality. The likelihood of major and great earthquakes continuing to occur in the interior of the Indian continent and along its Himalayan collision front with Eurasia, in the future, will therefore always remain high.
Although short term processes that trigger an earthquake still remain obscure, long term stress loading preparatory to an earthquake is now reasonably well understood in the framework of Plate tectonics. Co-seismic strains released by major and great earthquakes estimated by geodetic and seismological methods are found to be in the range of 0.00003 to 0.0003. These figures when divided by the rate of strain accumulation now measurable with high precision using GPS and VLBI, yield an estimate of the return period of major earthquakes. Together with estimates of ground motion time histories, they enable one to estimate the exceedence probabilities (P) of the intensity of ground shaking (I max) expected to occur at a site over a prescribed future time window (t). The P values denote a quantitative estimate of seismic hazard faced by a region and furnish the basic figure for designing engineering and administrative measures to create a hazard resilient society: classifying land for different uses, design of building codes, regulatory measures, and above all investigating vulnerabilities of existing structures and systems, particularly those involving large numbers, and evolving engineering and economic designs for their retrofitting. Earthquake hazard is rooted in the natural rhythm of a vibrant energetic planet which alone amongst the 4 sisters that began their existence with similar genetic material, was able to organize itself into a system of rock, water, air and life. Earthquakes are therefore going to be with us for ever. With deeper understanding of their pulse and purposive action, however, we can prevent disasters from being generated in their wake.

4. Presentations by new Fellows/Associates

There were 13 presentations by newly elected Fellows and Associates spread over the 1½ days. **Vijayalakshmi Ravindranath** (National Brain Research Centre, New Delhi) talked on the pathogenesis of neurogenerative disorders. A group of brain-related disorders, the neurodegenerative diseases, so called because of the progressive and irreversible nature of diseases in this category, afflict significant sections of population. Such diseases include among others, Parkinson’s, Alzheimer’s, and motor neuron disease, where specific cell populations within specialized regions of the brain are affected leading to selective loss of function. Very little is known about the causative factors. The speaker described the efforts by her group to study the molecular mechanisms using animal models that mimic the neuropathological features of the diseases. Alteration in protein thiol homeostasis leading to mitochondrial dysfunction was identified as one of the events. The studies also suggest that estrogen regulates some of the early events that occur following the initial stressor. **Girish Sahni** (Institute of Microbial Technology, Chandigarh) talked about the challenges and surprises in the design of an improved clot-buster drug. Investigations by his
group led to the identification of a novel protein co-factor role in the proteolytic activation of blood plasminogen, a key step in the dissolution of clots during treatment with streptokinase. Using a variety of unconventional yet simple techniques, such as Peptide Walking, protein fragment complementation, limited proteolysis, as well as site-directed mutagenesis, his group was able to identify the most important sites, or ‘hot spots’, whereby streptokinase interacts with plasminogen, its ‘target’ protein in the blood. A novel protein-engineered streptokinase derivatives with vastly improved clot specificity and time-delayed kinetics has been designed and prepared and the first industrial production of streptokinase will be shortly launched in the market. **G. Marimuthu** (Madurai Kamaraj University) reported on his studies as to how the Indian false vampire bat *Megaderma Lyra* captures frogs by employing a ‘listening in’ method on the ground and echolocation on the surface of water for detection. **Vidita A. Vaidya** (Tata Institute of Fundamental Research, Mumbai) presented a talk on stress, depression and hippocampal damage. Stress is an event that leads to the disruption of physiological and psychological homeostasis. Responses to stress are well conserved in mammals and help an animal adapt to stress. Exposure to prolonged severe stress plays an important role in the pathogenesis of psychiatric disorders, such as depression. Amongst the main targets of stress in the brain is the hippocampus, a region central to mood-related circuitry. Chronic stress is known to induce hippocampal neuronal atrophy and also to inhibit adult hippocampal neurogenesis. The hippocampus is damaged under conditions of stress and hippocampal volumetric loss has also been observed in patients suffering from recurrent major depression. The parallel vulnerability of the hippocampus to stress and in depression suggests that similar mechanisms may contribute to this damage. Vaidya discussed some of the molecular and cellular mechanisms that underlie the actions of stress on the hippocampus. **R. Nagarajan** (Tata Institute of Fundamental Research, Mumbai) spoke about the discovery of quaternary borocarbide superconductors. **Anil Kumar** (National Chemical Laboratory, Pune) delivered a talk on ionic solutions, which play a significant role in various natural and man-made processes, which influence our life in many ways. Vast bodies of sea water, minerals, and human serum include multicompontent ionic mixtures. Several organic reactions, including Diels-Alder are greatly accelerated in presence of these ionic solutions. The ultra high pressure requirements can now be obviated, if these ionic systems are employed as ionic media. **Ram Sagar** (Uttar Pradesh State Observatory, Nainital) spoke of star clusters which are groups of dynamically associated stars presumably created from the same molecular cloud at about the same time. All the cluster members are therefore located at the same distance, have almost the same primordial chemical composition and move together through the star fields of their galaxy. He described the distribution of stellar mass in young star clusters of our Galaxy and nearby galaxies
derived from the recent observations including Hubble Space Telescope. These results are being used to investigate the universality of initial mass function and presence of mass segregation in these systems. Nitin Nitsure (Tata Institute of Fundamental Research, Mumbai) in his lecture entitled “Existence, truth, and proof: Modern foundations of mathematics” reviewed historical ideas due to Russell, Hilbert, Goedel, etc. and described some of the modern interaction between logic and geometry, which has come from the work of Grothendieck, Lawvere, and others. Ramesh Hariharan (Indian Institute of Science, Bangalore) in his lecture entitled “Algorithms and computational complexity” gave an overview of computational complexity starting with the notions of P and NP, which broadly define classes of problems that can or cannot be solved fast. He then introduced the notion of an Approximation Algorithm, which seeks to find a quick but approximate solution to a hard problem. Finally, several examples of such approximation algorithms and brief survey of related results were presented. S.V. Bhat (Indian Institute of Science, Bangalore) in his lecture “Resonating and non-resonating with electrons” described the excitement of resonating and non-resonating with electrons by focusing on one way of observing the electrons closely and through them on obtaining insights into some physical phenomena of continuing interest. In the last lecture of the meeting, Vijay V. Patel (Centre for Artificial Intelligence & Robotics, Bangalore) spoke of the challenges encountered in the design and development of a flight control system for a relaxed static stability of a modern manned aircraft and the key role that flight simulation tools play in this task. R. Ramesh (Physical Research Laboratory, Ahmedabad) spoke on high resolution palaeomonsoon reconstruction from cave deposits. Bhaskar G. Maiya (University of Hyderabad) discussed the synthetic and photochemical aspects of a few new multichromophoric systems recently developed by his group.

10 TIRUPATI ANNUAL MEETING

The Sri Venkateswara University invited the Academy to hold its sixty-seventh annual meeting in Tirupati from 9–11 November 2001 in Tirupati. The meeting was attended by over 200 fellows and others consisting of Associates, invited speakers and teachers. The Vice-Chancellor of the University G. Sudhir opened the meeting with his welcome remarks and the President of the Academy K. Kasturirangan introduced to the audience the Academy fellows present. This was followed by his presidential address. The following is a summary of the scientific programme and other events.
10.1 Presidential address

Science and technology of imaging from space
K.Kasturirangan, Department of Space, Bangalore

Impact of developments in science is not limited to their own immediate sphere, but transcend into areas originally not even imagined. Science of imaging is an ample example. Though the major impetus for the use of aerial and space imagery was for gathering military intelligence, the science and technology of imaging has matured as a tool for quantitative measurement of radiance.

In the visible and IR region the natural radiation — solar reflection and the emission from the earth — is the source for imaging. However, the molecular absorption and scattering by aerosols totally transforms the spectral and spatial characteristics of the incident solar radiation and the radiation detected by the space cameras. Extracting reliable and quantitative information of the radiation emanating from the earth’s surface calls for modelling of the atmosphere and understanding the radiative interactions in the atmosphere. Further, the ‘signal’ from the earth is an integration of ‘signal and noise’ from the earth–atmosphere system and can be modelled as a radiative transfer equation with the earth’s surface as a boundary.

The development of a space imaging system calls for inputs from a multidisciplinary team covering different disciplines. Computer optimization techniques, combined with optical design tools, have matured to enable design of optical systems close to the theoretical diffraction limit. Computer-controlled optical fabrication techniques, with online interferometric monitoring techniques, have enabled to translate the design into final hardware. Alignment of multiple components is based on innovative interferometric techniques and analysis of wavefronts using Zernike polynomials to establish the cause of misalignment.

Realizing space cameras requires special attention on the choice of the materials, both for optics and for mechanical assembly, to meet launch loads and in-orbit thermal variations. Based on detailed thermal modelling active/passive thermal controls are used to keep thermal gradient of optical components within a few degrees and the detector systems need to be controlled within one-tenth of a degree. Realizing high spatial resolution systems requires careful design of high-speed electronics, data compression and high data rate transmission. Finally, to get a radiometrically corrected
imagery, properly oriented to an earth coordinate system, sophisticated image processing techniques are adopted.

A platform in space carrying an imaging system enables large synoptic coverage and repetitive observation of an area at near-identical illumination conditions in a very cost-effective way, which earlier was not possible. This, along with the capability of the imaging system to produce reliable quantitative information, has opened a new vista of science — remote sensing.

10.2 Special Lectures

(a) Controlling light by light-stoppage, storage and superluminal propagation of light

G.S. Agarwal, Physical Research Laboratory, Ahmedabad

It is now becoming increasingly clear that coherent fields can control the fundamental properties of a medium like dispersion and absorption. In particular, one could get distortionless propagation of pulses even through an absorbing medium. Appropriate management of the dispersive and absorptive properties of a medium has led to remarkably very large number of applications. For example it is now possible to produce ultraslow light and to even stop the light. It is also possible to store light in atomic coherences and to retrieve the light on demand. Furthermore the coherent control can also produce superluminal propagation of light as well as cloning of light pulses. This talk reviewed many of these new ideas and experiments.

(b) Soft computing, machine intelligence and data mining

S.K. Pal, Indian Statistical Institute, Kolkata

Different characteristics of soft computing and its relation with machine intelligence and pattern recognition were explained in this lecture. Emergence of data mining and knowledge discovery from pattern recognition point of view was illustrated. Significance of integrating various soft computing tools for efficient learning was described. Two examples demonstrating such integration of fuzzy sets, artificial neural networks, genetic algorithms and rough sets for efficient classification, rule generation and rule evaluation, and for granular case generation, were provided along with their application-specific merits on real life data. The talk concluded with the explanation of the relation of neuro-fuzzy granular case generation with the recently emerged computational theory of perception (CTP) and the future scope of research.
10.3 Public Lectures

(a) Information science and molecular biology

*Albert Libchaber, Rockefeller University, New York, USA*

We have entered a fully connected information world where computation is ubiquitous. At the same time, the use of the computer has advanced the decoding of the human genome, simulations are replacing experiments, and biological research is becoming quantitative. To understand how this revolution came by, the speaker presented a historical survey showing the parallel development in the 1950s of molecular biology and information theory. The talk concentrated on what seems to be the essence of genetics, the concept of computation. Examples from Libchaber’s laboratory were presented. The role of scientists like Delbrück, Avery, Crick and Watson for Genetics and Schrödinger, von Neumann and Turing for Computation was highlighted. In summary, a short course on genetics and computation with some speculations on future developments.

(b) Science, history and anthropology – a perspective on Prof. D.D. Kosambi’s works and their impact

*K. S. Singh, formerly Director General of Anthropological Survey of India, Kolkata*

The transformation of a mathematician into a social historian is a rare event, and that it occurred in the case of the late D. D. Kosambi, a fellow of the Academy (1935-66) could be traced to a number of factors, including the formidable tradition of Indological research in the family; influence of his father, who was a renowned Buddhist scholar; the proclivities of an independent Marxist; the commitment of a compassionate social activist; his knowledge of Sanskrit, Pali and many other languages, and interest in Sanskrit literature and literary criticism; access to original texts; exposure to field situations and a passion for field work. The speaker had the benefit of close interaction with Kosambi. The lecture covered the following: (a) the combined methodology based on field work and textual material which had their limitation; the use of statistical method in numismatics; stress on field work for all periods of history and for all social sciences; the spirit of scientific inquiry and style of history writing; (b) contemporaneity of history, the past being a part of the living present, and different phases and strata of history lying cheek by jowl in the present; ethno-archaeology and living prehistory; (c) role of technology in transformation of society; (d) relationship of ecology and society; (e) people’s history to be reconstructed out of archaeology, linguistics, anthropology, reinterpretation of myths, etc.; and (f) concept of race and its obsolescence.
Kosambi’s influence on a whole generation of historians and other social scientists was profound. Apart from his personality and the electrifying impact of an encounter with him, his ideas on methodology, his vision of history and society, his exposition of the eclectic and syncretic nature of historical processes and of secular and scientific traditions continue to provoke and stimulate scholars generally, even though today they may not find themselves in agreement with all that he had said.

10.4

(a) Symposium on Radar and microwave remote sensing in atmospheric science

VHF and UHF radars detect echoes caused by Bragg scatter from refractive index fluctuations due to variations in humidity and temperature in both clear air and cloudy atmosphere, and they have now become accepted in the radar meteorology community as a valuable complement to the weather radar measurement techniques. These radars typically operate in the frequency range from the low VHF band (40–50 MHz) to the upper UHF band (3 GHz). In the low VHF band, Bragg scatter from electron density variations in the mesosphere can also be detected.

Woodman and Guillean demonstrated that it is possible to explore atmospheric dynamics up to a height of about 100 km by means of a high power VHF backscatter radar. It led to the concept of MST (mesosphere – stratosphere – troposphere) radar. An MST radar is a highly sensitive, high-resolution pulse coded phase coherent radar, operating in the lower VHF band, typically around 50 MHz, with an average power aperture product exceeding about 5 multiply 10⁷ Wm². Radars operating at higher frequencies or smaller average power aperture products are termed ST radars. A number of ST/MST radars have been established all over the world and this class of radars have come to dominate the atmospheric scene. An extensive growth and development in coherent-backscatter radar techniques for studying the structure and dynamics of the troposphere and stratosphere has occurred in the past two decades. MST radar provides wind information with excellent spatial and temporal resolutions and has the unique capability of directly measuring vertical winds. The vertical velocities are very useful to study gravity waves, monsoon dynamics, mesoscale convective systems etc.

A major MST radar system has been established as a national facility at Gadanki near Tirupati. The Indian MST radar is a highly sensitive, pulse coded, coherent VHF phased array radar and is a major national facility to carry out research in middle atmospheric dynamics.
MST/ST radars have several applications such as study of turbulence parameters, jet streams, gravity waves, momentum flux etc. Meteorological applications include study of precipitating system and drop size distributions. MST/ST radars are also used to retrieve vertical profiles of temperature and humidity. The half-day symposium was organized to provide a platform for discussing the present and future trends in the atmospheric research using radars. The five topics covered in the symposium were: global precipitation observation by spaceborne radar; Indo-French satellite mission Megha-Tropiques to study tropical convective systems; MST radars for middle and upper atmospheric studies, as well as for scientific applications; and multiparameter radar observation of the lower atmosphere.

(b) Symposium on Challenges of infectious diseases

India is now faced with a disease spectrum ranging from old diseases such as tuberculosis, leprosy and rheumatic fever to emerging diseases caused by newer pathogen strains as in water borne diseases and AIDS. Malaria which was conquered earlier has reemerged with drug resistance and dual infection. Moreover, diseases earlier thought to have biochemical basis such as peptic ulcer and cardiovascular diseases are now being shown to have an infective origin. These infections require newer technologies to understand both the quantum of the disease in the country and strategies to combat them. The present symposium was organized with a view to understanding the challenges that such diseases pose for health care in India. Many aspects of infectious diseases were covered in the symposium. These include gastro-intestinal infections, hepatitis, cardiovascular diseases, tuberculosis, HIV/AIDS and malaria vaccines.

10.5 Lecture presentations by new Fellows/Associates

Raghavan Varadarajan (Indian Institute of Science, Bangalore) presented a lecture on understanding and quantitating protein stability. Hydophobic effect refers to the observation that nonpolar molecules are more soluble in nonpolar organic solvents than in water. During protein folding, several nonpolar groups are buried in the protein interior. This burial is believed to be one of the most important driving forces for protein folding. However, most quantitative estimates of its magnitude are obtained from transfer thermodynamics of small molecules. The thermodynamic and structural changes associated with large to small substitutions in several proteins were analysed by Varadarajan and his group. In order to obtain insight into factors responsible for stabilizing proteins at high temperatures, an analysis of sequences and structures of
proteins from several complete bacterial and archaeal genomes was also carried out and these results were briefly summarized. Umesh V. Waghmare (Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore) presented a theoretical approach in which ab initio calculations based on density functional theory were used in developing microscopic models that focus on the fundamental physics of ferroelectric materials and phase transitions. Simulations of these models yielded macroscopic behaviour of these materials and it helped to understand how it links with the microscopics. Applications to simple perovskites and complex relaxor ferroelectrics were presented for illustration. Amitabha Chattopadhyay (Centre for Cellular and Molecular Biology, Hyderabad) described a novel fluorescence approach to monitor organization and dynamics of organized molecular assemblies. The focus of his talk was the application of REES (red edge excitation shift) and other related techniques (collectively termed as the wavelength-selective fluorescence approach) to monitor organization and dynamics of probes and peptides bound to membranes, micelles and reverse micelles. Dinakar M. Salunke (National Institute of Immunology, New Delhi) presented a talk on molecular mimicry in biology occurring in diverse physiological conditions in terms of immune responses. In his talk on growth mechanism and thermal properties of ultra-thin films, Milan K. Sanyal (Saha Institute of Nuclear Physics, Kolkata) focussed attention on recent results on growth and structure of nanoparticles formed by suitable chemical processes within the ordered matric of LB films. The work done on melting of LB films and its implications in our understanding of melting process in lower dimensions was discussed. The results of energy dispersive X-ray reflectivity measurements carried out at BESSY-II synchrotron on polystyrene and polyacrylamide films as a function of temperature were discussed. P.K. Chattaraj (Indian Institute of Technology, Kharagpur) spoke on chemical reactivity and density functional theory. Variation of chemical reactivity indices like electronegativity, hardness and polarizability associated with various physicochemical processes has been studied within a density-based quantum mechanical framework. Corresponding electronic structure principles such as principles of electronegativity equalization, maximum hardness and minimum polarizability are now understood better. A. Jayakrishnan (Sree Chitra Tirunal Inst. for Medical Sciences and Technology, Trivandrum) described a simple, novel surface modification technique that involves substitution of the chlorine atoms on the surface of plasticized PVC using sulphide ions via phase transfer catalysis in aqueous media to completely prevent the migration of plasticizer and at the same time improve its blood-contacting properties. Diptiman Sen (Indian Institute of Science, Bangalore) in his talk on conductance of quantum wires introduced the idea of conductance quantization in one-dimensional mesoscopic systems, discussed some recent experimental results including a temperature-dependent renormalization of the quantized conductance in
some quantum wires, resonances appearing at lower temperatures on some of the plateaus, and the odd–even effect in moderate magnetic fields. He then described a Tomonaga–Luttinger liquid model for the quantum wire which can qualitatively explain some of these results. The new feature of this model is that the contacts between the wire and its leads are treated as separate Luttinger liquids. R.B. Bapat (Indian Statistical Institute, New Delhi) recounted the pleasures of counting trees, of course not in the literal sense. A tree is a connected graph without cycles. According to a classical result of A. Cayley, the number of labelled trees on \( n \) vertices is \( n \) to the power \((n–2)\). One among the many proofs of this result uses the Kirchhoff Matrix-Tree Theorem that relates the number of spanning trees (or skeletons) of a graph to a certain determinant. Bapat discussed various extensions of the Kirchhoff Theorem that interpret determinants as tree counts. Applications include formulae for the stationary distribution of a Markov chain and the Wiener index in chemical graph theory. In his talk on “Antarctica: a continent of scientific frontiers”, P.C. Pandey (National Centre for Antarctic and Ocean Research, Goa), presented an overview of the Indian Antarctic programme and the possibility of doing exciting science using various enabling technologies from the Pole. Currently about 70 national laboratories participate in the expeditions, covering a wide range of basic and applied research. The biogeography and biodiversity of the Himalaya was presented by R. Raghavendra Rao (National Botanical Research Institute, Lucknow) in the last lecture of the meeting. While the region supports biodiversity of a high magnitude, the region is also experiencing severe habitat destruction, both in the name of regional development and by the shifting cultivation practised by local tribes. The severity of the loss of biodiversity in the region was outlined. Biodiversity conservation essentially demands inputs like (a) what, where and why conserve biodiversity, and (b) what are the threats against which the biodiversity needs to be conserved. The need to undertake immediate research programmes on bioprospection making use of the available expertise in the field of molecular biology was stressed. Scanning biodiversity among medicinal plants for useful molecules having potential for commercial application would be rewarding. In view of the possibilities of gene transfer from one organism to another, the scientific community should safeguard not only the rich and unique biodiversity but also the total gene pool of the Himalayan region against any unauthorized foreign agencies.

The business meeting of Fellows was held on the afternoon of the last day at the National MST Radar Facility at Gadanki about 40 kms from Tirupati. Besides, transacting statutory business, the Fellows were treated to brief informal presentations on Bose-Einstein condensation (N.Kumar, RRI), information warfare (N. Balaram), and stem cell research (T.C. Anand Kumar). The participants were later taken round the impressive radar facility.
The participants were treated to a cultural programme of classical songs, *kuchipudi* and classical dance, and magic show on the evening of 10 November.

The annual meeting owes its success due to the tremendous organizational efforts by the local organizing committee under the leadership of D. Narayana Rao of the University's physics department. The full programme is in Annexure 8.

11 **SCIENCE EDUCATION PROGRAMME**

As part of its continuing efforts to improve the quality of science education and its teaching four main activities are being carried out and these are (a) summer fellowships (b) participation of teachers in meetings (c) refresher course for teachers (d) lecture series for student/teachers.

11.1 **Summer fellowships**

Summer fellowships are awarded to bright students and motivated teachers to work with Fellows of the Academy on research-oriented projects. During the year 2001, 93 students and 26 teachers were awarded two-month fellowships to work with Fellows at different parts of the country.

11.2 **Participation of teachers in Academy meetings**

The Academy maintains a database of over 800 bright and motivated teachers around the country largely based on recommendations received from the Fellows of the Academy. This list is constantly updated and contains names of teachers mainly from colleges and university departments in different disciplines. A few of these teachers are invited at the Academy mid-year and annual meetings every year to give them an opportunity to attend scientific lectures and to meet and interact with Fellows. At the two meetings held in 2001, 70 teachers attended the lectures, at the end of which an interaction session was held where teachers presented their views and the problems they faced in their teaching work.
11.3 Refresher courses for teachers

This important programme for teachers is designed to help motivated teachers to improve their knowledge and teaching skills. The course is of a two-week duration and consists of lectures, discussion sessions and tutorial sessions. During the year the following refresher courses were held.

(a) Refresher course in genetics and evolution
University of Mysore, Mysore, 10–22 September 2001

No. of participants: 28


The topics covered include natural selection, population genetics, gene duplication and evolution, behaviour, biological rhythms, structure and function of chromosomes, molecular basis and genetics of recombination, gene expression and regulation, dosage compensation, genetic analysis of development, genetic diseases and genomics. The course contained twenty-eight lectures of 90-min duration and 8 laboratory sessions each lasting 3½ hours. The practical sessions included experiments concerned with genetics and evolution with *Drosophila* as the model system.

The teacher participants were from Bangalore, Belgaum, Burdwan, Challakere, Calicut, Delhi, Erode, Gyanpur, Hassan, Hyderabad, Jodhpur, Mysore, Nanded, Palakkad, Santiniketan, Tirunelveli, Tripura and Vallabh Vidyanagar.

(b) Refresher course in experimental physics
Goa University, Goa, 29 October–12 November 2001

No. of participants: 18


This course in experimental physics held in Goa was
the first of its kind organized by the Academy for university and college teachers from all over India. The broad aim was to help teachers to improve their background knowledge and teaching skills. It was planned for exposing teachers to some aspects of experimental physics mainly centred around solid state physics experiments and to build some general purpose instruments for carrying out measurements of various material properties. The formal programme started with talks on the background physics with the slated experiments. The experiments were carefully selected so as to cover most areas of solid state physics and few aspects of optics and electronics. Each experiment or project was carried out individually by each participant. The selected experiments were as follows: (1) resistivity of metal and semiconductor by four-probe method; (2) measurement of Hall coefficient and mobility of a semiconductor; (3) paramagnetic susceptibility of a solid by Gouy's method and verification of Curie law; (4) B-H loop and Curie temperature of ferrite; (5) electron spin resonance: determination of g value; (6) composite piezoelectric oscillator: determination of elastic constant; (7) measurement of dielectric constant of a ferroelectric material; (8) thermoluminescence: study of defects/colour centres in alkali halides; (9) X-ray diffraction (Debye scherrer method): determination of lattice constant of a material; (10) X-ray spectroscopy: emission spectrum of tungsten: (11) analysis of sodium spectrum; (12) simulation of electronic circuits using SPICE. In addition a few more experiments were set up for interested participants which included: (1) lattice dynamics kit for study of vibrational modes in monatomic and diatomic lattices; (2) Geiger Muller counting system; (3) Zeeman effect. The project work done by participants included building of (1) constant; (2) furnace; (3) power supply for the furnace; and (4) temperature controller with Pt-100 as sensor.

There were evening seminars on a variety of topics that were of interest to physicists. The laboratory sessions and project work were conducted by K.R. Priolkar and R.K. Kamat and their colleagues from the university. The teachers were from colleges/ institutions in Ahmedabad, Anantapur, Bangalore, Bhubaneswar, Bilaspur, Dakshin Dinajpur, Goa, Jabalpur, Khammam, Mavelikara, Muzaffarnagar, Mysore, Ranchi, Sidhi, and Udaipur.

The participants showed a lot of enthusiasm in completing the projects and experiments and felt that the course was successful in emphasizing the continued need for hands-on training in the laboratory and for constructing low-cost instruments for laboratory use. The general feeling was that such refresher courses should be organized more frequently in other branches of physics.
(c) **Refresher course in theoretical physics**  
*University of Hyderabad, Hyderabad, 18–30 November 2001*

No. of participants: 26


The topics covered include classical and quantum mechanics, electrodynamics, special relativity, mathematical modes, and statistical physics. There were three hours of lectures and three hours of tutorials every day. In addition, there were two special lectures. The teachers represented institutions from Bangalore, Bhavnagar, Courtallam, Delhi, Ernakulam, Golaghat, Hyderabad, Kanjirapally, Kolkata, Kurnool, Pala, Pantnagar and Sambalpur.

(d) **Refresher course in Mathematics**  
*Harish-Chandra Research Institute, Allahabad, 3–15 December 2001*

No. of participants: 50


The topics covered include: Two notions of simplicity and canonical form for matrix; K-theory; infinite linear groups; classical groups and representation theory of finite groups; Jordan–Chevalley decomposition and its applications; applications of linear algebra to combinatorics; zero-sum problems in combinatorial number theory with linear algebraic flavour, matrix analysis; the sensuous quadratic form by Conway; Cartan–Dieudonne theorem; and non-negative generalized inverses. There were four lectures and a discussion class every day in addition to special lectures and problem-solving sessions.

The teacher-participants were from Allahabad, Bangalore, Belgaum, Chandigarh, Chennai, Chinsurah, Coimbatore, Gondia, Guwahati, Jabalpur, Jharkhand, Kanpur, Kolkata, Lakhimpur, Lucknow, Mumbai, Nainital, New Delhi, Pune, Sagar, Vallabhb Vidyanagar and Varanasi.
(e) Workshop on analysis, probability and statistics
C.M.S. College, Kottayam, 10–21 December 2001

No. of participants: 29


This workshop was intended to give an opportunity to teachers on probability and statistics to go into some of the fundamental aspects of analysis and for teachers of analysis to see how their subject is applied in probability and statistics. There were three hours of lectures and one discussion session every day.

In all there were ten lectures each on the topics of analysis, probability and statistics. The 29 teacher participants covered the cities of Ambavadi, Coochbehar, Kochi, Kolloorkad, Kolkata, Kottayam, Madurai, Nagpur, Nasik, New Delhi, Pachora, Pala, Pune, Satara, Vallabh Vidyanagar and Warangal.

11.4 Lecture series for students/teachers

(a) Current developments in molecular biology
Karnatak University, Dharwad, 17–18 August 2001

No. of participants: 150


The participants included postgraduate students, research scholars and teachers of various departments of Karnatak University as well as various colleges in Hubli, Dharwad and Gadag. The topics covered included structure of DNA, replication, transcription, protein synthesis, cell cycle and regulation of developmental processes, gene regulation, biotechnology and recombinant vaccines. Each lecture was followed by a discussion. The participants suggested that handouts of each lecture be provided and that a workshop on reproductive biology would be useful.
(b) Emerging frontiers in chemistry
Guru Nanak Dev University, Amritsar, 29–30 October 2001

Speakers: N. Sathyamurthy, R.N. Mukherjee, Y.D. Vankar

There were six lectures entitled “Watching molecules live”, “Carbohydrates: much more than a mere source of energy”, and “Molybdenum: its biological importance”. The participants included students and faculty from the Guru Nanak Dev University and local colleges in Amritsar.

(c) Ecology and conservation
Mangalore University, Mangalore, 7–8 December 2001

No. of participants: About 90

Speakers: Uma Shaanker, K.N. Ganeshaih, Ullas Karanth, B.V. Shetty, A.R.V. Kumar and Manjunath Hegde

There were 10 lectures of 60 min each and the topics of the lectures were parent – offspring conflict in plants; fig wasp mutualism; chemical composition of seeds; seed chemicals in plants – their evolutionary significance, self organization.

(d) Current trends in life sciences
St. Xavier’s College, Mumbai, 12 January 2002


There were five lectures on stress, genes in development, drug design and structural biology, gene therapy, and stem cells.

(e) Lectures on theoretical physics
C.M.S. College, Kottayam, 14–16 January 2002

Speakers: Arup K. Raychaudhuri, Diptiman Sen, Vasanth Natarajan, Reghu Menon

The topics covered Bose–Einstein condensation, nanomaterials, superconductivity, and molecular and polymer electronics.

(f) Quantum chemical calculations and their uses in teaching
St.Joseph’s College, Irinjalakuda, 18–20 February 2002

Speakers: K.L. Sebastian, Manoj Mishra, E.Arunan

The participants included college and university teachers and research scholars from
all the southern states and the objective was to help teachers and students to familiarize themselves with recent advances in the field of quantum chemistry and to explore computer-aided methodology for teaching the subject. The topics included variational method and molecular orbital theory, time-dependent perturbation theory and Hartree-Fock approximations, semi-empirical methods and *ab-initio* method of calculation, quantum mechanical approach to spectroscopic transitions and finally quantum chemical applications to molecular models. The lectures were interspersed with demonstration sessions where all the participants were provided with computer access.

12  

**ACADEMY FINANCES**

The activities of the Academy are carried on under two heads: Non-Plan and Plan. Non-Plan consists of publications activity while Plan includes science education, annual/mid-year/discussion meetings, and construction of a new building. A summary of the income and expenditure for 2001-2002 follows:

(a) Non-Plan

<table>
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<tr>
<th>Income</th>
<th>(Rs. in lakhs)</th>
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<th>(Rs. in Lakhs)</th>
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<tr>
<td>Grants: DST</td>
<td>80.00</td>
<td>Journal Printing</td>
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<td>Grants: MHRD</td>
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<td>Postage</td>
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<td>Subscriptions</td>
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<td>Others</td>
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<td>Salaries</td>
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(b) Plan

The expenditure on Plan activities is as follows.

<table>
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<th>(Rs. In lakhs)</th>
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<td>Grants: Dept. of Space</td>
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ACKNOWLEDGEMENTS

The Academy’s publication activities are largely due to the voluntary and unpaid services of editors, members of editorial boards and the large number of reviewers who examine and comment on manuscripts sent to them for opinion. Several fellows also contributed their services in other Academy activities such as organizing annual meetings and discussion meetings and conducting programmes on science education, etc. The Department of Science and Technology, the Department of Space and the Ministry of Human Resource Development and others have made available generous financial assistance to the Academy and have thus contributed to the activities undertaken by the Academy. The local organizing committee at the Sri Venkateswara University, Tirupati and the Academy staff in Bangalore have ensured a large participation at the scientific meetings of the Academy.
### Table 1

Information about published pages in journals (January to December 2001)

|                | Vol. No. | No. of issues | No. of Papers | Total No. of pages 2001 | **  
|----------------|----------|---------------|---------------|-------------------------|----------------
| 1. Proc. (Chem. Sci.) | 113      | 6             | 61            | 702 (↑60)               |
| 2. Proc. (Math. Sci.)  | 111      | 4             | 33            | 514 (↑42)               |
| 4. Sadhana          | 26       | 6             | 37            | 618 (↓22)               |
| 5. Pramana          | 56,57    | 12            | 284           | 2020 (↑156)             |
| 8. J. Biosci.       | 26       | 5             | 72            | 698 (↑282)              |
| 9. J. Genetics      | 80       | 3             | 22            | 168 (↑28)               |
| 10. Resonance       | 6        | 12            | 147           | 1224 (↓68)              |
| 11. Current Science | 80,81    | 24            | 724           | 3272 (↑186)             |
|                |          |               |               | 1544                  |

* including briefer items such as news, correspondence  ** As compared to last year’s figures

### Table 2

Information on papers submitted for publication (January to December 2001)

|                | Accepted | Rejected | Pending | Total | **  
|----------------|----------|----------|---------|-------|----------------
| 1. Proc. (Chem. Sci.) | 56       | 51       | 7       | 114 (↑17) |       |
| 2. Proc. (Math. Sci.)  | 17       | 89       | 8       | 114 (12)  |     
| 3. Proc. (Earth Planet. Sci.) | 19    | 5        | 27      | 51 (↓37)  |     
| 4. Sadhana          | 41       | 18       | 11      | 70 (↑19)  |     
| 5. Pramana          | 78       | 49       | 47      | 174 (↓55) |     
| 7. J. Astrophys. Astron. | 6      | 13       | 4       | 23 (↓63)  |     
| 8. J. Biosci.       | 87       | 75       | 6       | 168 (↑42) |     
| 9. J. Genetics      | 19       | 8        | 2       | 29 (↑12)  |     
| 10. Resonance       | 46       | 65       | 50      | 161 (↑19) |     
| 11. Current Science | 558      | 664      | 136     | 1358 (↑18) |     
| Total               | 1038     | 1064     | 331     | 2433 (↓23) |     

* including briefer items such as news, correspondence  ** As compared to last year’s figures
### Table 3

**Circulation details of journals (January to December 2001)**

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<td>91</td>
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<tr>
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<td>85</td>
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<tr>
<td>5. Pramana</td>
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<td>49</td>
</tr>
<tr>
<td>8. J. Biosci.</td>
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<td>80</td>
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<tr>
<td>9. J. Genetics</td>
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<td>114</td>
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<tr>
<td>10. Resonance</td>
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<td>11. Current Science</td>
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<td>160</td>
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*a. includes about 1470 MRSI members in India and abroad  
b. includes about 2000 personal subscribers  
c. includes about 2150 personal subscribers*
NEW FELLOWS — 2001
(effective 1 January 2002)

1. K.A. Balasubramanian
   (b. 6-4-1945)
   Christian Medical College and Hospital, Vellore
   Sp: oxidative stress, gastrointestinal mucosa, and pathophysiology

2. Sunanda Banerjee
   (b. 20-7-1952)
   Tata Institute of Fundamental Research, Mumbai
   Sp: experimental high energy physics

3. S.V. Dhurandhar
   (b. 29-11-1951)
   Inter-University Centre for Astronomy and Astrophysics, Pune
   Sp: gravitational waves, general relativity, and theoretical astrophysics

4. N.R. Jagannathan
   (b. 23-6-1954)
   All India Institute of Medical Sciences, New Delhi
   Sp: biomedical NMR, MR imaging and In-vivo MR spectroscopy in living systems, and structure & conformation of biomolecules

5. K.S. Krishna
   (b. 15-10-1958)
   National Institute of Oceanography, Goa
   Sp: structure and tectonics of continental margins of India, lithosphere deformation, of central Indian Ocean, and structure & evolution of volcanic ridges of Indian Ocean.

6. K.C. Kumara Swamy
   (b. 1-1-1957)
   University of Hyderabad, Hyderabad
   Sp: chemistry of the main group elements, and organophosphorus chemistry

7. Satyajit Mayor
   (b. 26-1-1963)
   National Centre for Biological Sciences (TIFR), Bangalore
   Sp: cell biology, biophysics, and chemistry.

8. S.V.S. Murty
   (b. 10-10-1952)
   Physical Research Laboratory, Ahmedabad
   Sp: early solar system and pre-solar processes, cosmochemistry of nitrogen & noble gases, and mass spectrometry.

9. T.G.K. Murty
   (b. 11-2-1944)
   Dept. of Space, Bangalore
   Sp: optical engineering, thin film technology, and electro-optical instrumentation.

10. S. Ramakrishnan
    (b. 22-12-1956)
    Tata Institute of Fundamental Research, Mumbai
    Sp: low temperature physics.

11. S. Ramasubramanian
    (b. 3-3-1952)
    Indian Statistical Institute, Bangalore
    Sp: probability theory and stochastic processes: diffusions and stochastic calculus.
12. K. Sankara Rao  
(b. 15-12-1939)  
Indian Institute of Science, Bangalore  
Sp: developmental biology of plants, and plant biotechnology.

13. Murali Sastry  
(b. 10-6-1959)  
National Chemical Laboratory, Pune  
Sp: surface physics, hybrid materials, and nanomaterials.

14. Anurag Sharma  
(b. 7-5-1955)  
Indian Institute of Technology, New Delhi  
Sp: fibre and integrated optics, gradient-index optics, and applied optics.

15. Namita Surolia  
(b. 2-4-1953)  
Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore  
Sp: molecular parasitology, biochemistry, and molecular biology.

16. Y.D. Vankar  
(b. 5-12-1950)  
Indian Institute of Technology, Kanpur  
Sp: synthetic organic chemistry, carbohydrate chemistry, and asymmetric synthesis.

17. Umesh Varshney  
(b. 26-10-1957)  
Indian Institute of Science, Bangalore  
Sp: molecular biology, protein biosynthesis, and DNA repair.

18. K. Veluthambi  
(b. 7-3-1953)  
Madurai Kamaraj University, Madurai  

19. T.N. Venkataramana  
(b. 14-2-1958)  
Tata Institute of Fundamental Research, Mumbai  
Sp: rigidity and arithmeticity, cohomology of arithmetic groups, and Shimura varieties.

20. Saraswathi Vishveshwara  
(b. 30-4-1946)  
Indian Institute of Science, Bangalore  
Sp: quantum chemistry, computational biology, and biomolecular structure & interaction.

21. Milind G. Wate  
(b. 12-12-1957)  
M.E.S. Abasaheb Garware College, Pune  
Sp: wildlife ecology & animal cognition, evolutionary biology, computational biology, and microbial diversity

NEW HONORARY FELLOW

Ahmed H. Zewail  
California Institute of Technology Pasadena, California USA  
Sp: Developments of ultrafast lasers and electrons for studies of dynamics with atomic-scale resolution
Annexure 2

FELLOWS DECEASED

1. K.R. Anantharamaiah
   (b. 2-9-1952, d. 29-10-2001)
   Elected: 1994
   Sp: radio astronomy, interstellar medium, and galaxies

2. V. Baliah
   (b. 15-8-1917, d. 26-9-2000)
   Elected: 1974
   Sp: physical organic chemistry, organosulphur compounds, and heterocyclic compounds

3. M.L. Dhar
   (b. 29-10-1914, d. 20-1-2002)
   Elected: 1975
   Sp: medicinal chemistry

4. Satish Dhawan
   (b. 25-9-1920, d. 3-1-2002)
   Elected: 1970
   Sp: aerospace engineering, and fluid mechanics

5. T.R. Govindachari
   (b. 30-7-1915, d. 28-12-2001)
   Elected: 1951
   Sp: chemistry of plant products, and organic synthesis

6. K. Krishna Murty
   (b. 13-11-1926, d. 10-5-2001)
   Elected: 1981
   Sp: internal medicine, cardiology, and haematology

7. Anna Mani
   (b. 23-8-1918, d. 16-8-2001)
   Elected: 1960
   Sp: atmospheric physics and instrumentation

8. T.R. Menon
   (b. 17-4-1925, d. 29-5-2001)
   Elected: 1963
   Sp: fibre Science, textile physics, and textile testing

9. Divya Darshan Pant
   (b. 18-10-1919, d. 9-5-2001)
   Elected: 1968
   Sp: plant morphology, palaeobotany, palynology, pollination ecology, cycads, and conifers

10. R.C. Paul
    (b. 20-10-1919, d. 16-2-2002)
    Elected: 1974
    Sp: inorganic and physical chemistry

11. G.N. Ramachandran
    (b. 8-10-1922, d. 7-4-2001)
    Elected: 1950
    Sp: crystallography, biophysics, biomolecular structure, theoretical physics, and mathematical logic

12. V. Ramalingaswami
    (b. 8-8-1921, d. 28-5-2001)
    Elected: 1974
    Sp: nutritional disorders and liver diseases in the tropics, medical education, medical research administration, and health policy at national & international levels
13. G.S. Ramaswamy  
(b. 3-10-1923, d. 9-3-2002)  
Elected: 1974  
Sp: structural engineering

14. Darshan Ranganathan  
(b. 4-6-1941, d. 4-6-2001)  
Elected: 1991  
Sp: organic chemistry, bio-organic chemistry, and supramolecular chemistry

15. S. Rangaswami  
(b. 14-6-1912, d. 8-11-2000)  
Elected: 1943  
Sp: organic chemistry, medicinal chemistry, and chemistry of natural products

16. P.S. Rao  
(b. 1-9-1914, d. 9-1-2002)  
Elected: 1943  
Sp: organic chemistry and plan biochemistry

17. T.S. Sadasivan  
(b. 22-5-1913, d. 18-8-2001)  
Elected: 1945  
Sp: plant pathology

18. S.K. Sinha  
(b. 18-7-1934, d. 17-3-2002)  
Elected: 1983  
Sp: agricultural sciences, and rural development

19. M.A. Viswamitra  
(b. 14-11-1932, d. 10-4-2001)  
Elected: 1979  
Sp: x-ray crystallography and molecular biophysics

HONORARY FELLOW DECEASED

Robert Hanbury Brown  
(b. 31-8-1916, d. 16-1-2002)  
Elected: 1975  
Sp: radio astronomy

Annexure 3  
NEW ASSOCIATES — 2001

1. Abhishek Dhar  
(b. 31-8-1970)  
Raman Research Institute, Bangalore  
Sp: nonequilibrium statistical physics

2. E.K. Narayanan  
(b. 30-5-1973)  
Indian Statistical Institute, Bangalore  
Sp: harmonic analysis

3. S.K. Satheesh  
(b. 1-5-1970)  
Indian Institute of Science, Bangalore  
Sp: atmospheric aerosols, clouds, radiation, and climate

4. Vijay B. Shenoy  
(b. 7-1-1971)  
Indian Institute of Science, Bangalore  
Sp: computational materials science, thin films, nanomechanics, and composite materials
DISCUSSION MEETING

The architecture of materials
(2–5 December 2001, Orange County, Coorg)

List of participants

**Session 1 – Architecture of materials at the atomic level**

1. S. Ranganathan, IISc, Bangalore
   - Variations on a structure: The body centered cubic lattice
2. S. Lele, BHU, Varanasi
   - Thermodynamic modelling of materials using CVM
3. U.D. Kulkarni, BARC, Mumbai
   - Atomic structure of short range ordered alloys

**Session 2 – Materials build-up from the liquid and vapour phases**

4. P. Ramachandra Rao, NML, Jamshedpur
   - Thermodynamics of solidification and melting
5. A. Upadhyay, IIT, Kanpur
   - Role of microstructure in building dense parts
6. V. Jayaram, IISc, Bangalore
   - How many types of amorphous arrangements exist at a given composition?

**Session 3 – Solid state transformations**

7. T.A. Abinandanan, IISc, Bangalore
   - Spinodal decomposition in fine grained materials

**Session 4 – Glasses and their crystallization**

8. G.K. Dey, BARC, Mumbai
   - Ultrafine microstructures in Zr based glass forming alloys
9. B.S. Murty, IIT, Kharagpur
   - Nanocrystallization of Zr and Mg based metallic glasses

**Session 5 – The defect structure of solids**

10. Samajdar, IIT, Mumbai
    - Indian Institute of Technology, Mumbai
    - Texture and microtexture – On the relative role and possible applications
11. P. Veysiere, CNRS-ONERA, France
    - Dislocation patterning and glide recovery in single slip
12. V. Shenoy, IIT, Kanpur
    - Pattern formation in thin films

**Session 6 – Self assembly at the molecular level**

13. A. Nangia, University of Hyderabad, Hyderabad
    - Self-assembly of nanostructures
14. A. Sinha, NML, Jamshedpur
    - Biogenic synthesis of nano-particles through self assembly
15. K.P.N. Murthy, IGCAR, Kalpakkam
    - Interacting growth walks in the context of polymer and protein structures
## Annexure 5

**DISCUSSION MEETING**

*Selected topics in genetics and molecular biology*

(5–9 December 2001, Orange County, Coorg)

### LIST OF LECTURES

**List of Participants**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Topics discussed</th>
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<tr>
<td>1. Hasan Korkaya, ICGEB, New Delhi</td>
<td>Biochemical and functional characterization of Hepatitis E virus ORF3 protein</td>
</tr>
<tr>
<td>2. Sandeep Krishna, IISc, Bangalore</td>
<td>Self organisation</td>
</tr>
<tr>
<td>3. Benan Dinçtürk, Istanbul Technical University, Istanbul, Turkey</td>
<td>Archaeal glutamate synthase: gene organisation and evolutionary implications</td>
</tr>
<tr>
<td>4. Shelley Bhattacharya, Visva Bharati, Santiniketan</td>
<td>Induction of proteins in animals by xenobiotic signals with an evolutionary approach</td>
</tr>
<tr>
<td>5. Durgadas P Kasbekar, CCMB, Hyderabad</td>
<td>Genetic analysis of RIP Sterol reductase: genetic, molecular and cellular studies</td>
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<td>6. Surendra Ghaskadbi, Agharkar Research Institute, Pune</td>
<td>Insulin as a multifunctional protein: role of insulin signaling during morphogenesis</td>
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<td>7. S. Mahadevan, IISc, Bangalore</td>
<td>How cryptic are “cryptic” genes of bacteria?</td>
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<td>8. Hakan Bermek, Istanbul Technical University, Istanbul, Turkey</td>
<td>Lignin degradation and pulp bleaching by laccase, manganese peroxidase and xylanase</td>
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<td>9. Manjari Mazumder, NCBS, Bangalore</td>
<td>Protein motors</td>
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<td>10. Gopal Pande, CCMB, Hyderabad</td>
<td>Modulation of integrin signalling by membrane lipids</td>
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<td>11. Onder Peckan, Istanbul Technical University, Istanbul, Turkey</td>
<td>Formation, swelling and drying of Acrylamide (PAAm) gels</td>
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Annexure 6

DISCUSSION MEETING
Genomics approach to biology
(24–27 February 2002, Orange County, Coorg)

List of participants

1. Arun Kumar, IISc, Bangalore
2. S. Dayananda, S.K. University, Anantapur
3. P. Dwarakanath, Astra Zeneca India, Bangalore
4. George Thomas, SPIC Science Foundation, Chennai
5. K.P. Gopinathan, IISc, Bangalore
6. P. Gunasekaran, Madurai Kamaraj University, Madurai
7. P. Jayadeva Bhat, IIT, Mumbai
8. S. Mahadevan, IISc, Bangalore
9. Maneesha S. Inamdar, JNCASR, Bangalore
10. K. Muniyappa, IISc, Bangalore
11. V. Nagaraja, IISc, Bangalore
12. Parag Sadhale, IISc, Bangalore
13. H.A. Ranganath, University of Mysore, Mysore
14. K. Sathyavelu Reddy, Sri Venkateswara University, Tirupati
15. Shikha Laloraya, IISc, Bangalore
16. N. Srinivasan, IISc, Bangalore
17. Tapas K Kundu, JNCASR, Bangalore
18. T.G. Umesh, Bangalore University P.G. Centre, Kolar
19. Utpal S Tatu, IISc, Bangalore
20. Umesh Varshney, IISc, Bangalore

Annexure 7

TWELFTH MID-YEAR MEETING
(20 – 21 July 2001, Bangalore)

A. Special Lectures

1. R. Chidambaram, BARC, Mumbai
   Scientific objectives of Pokhran II — Design and realization

2. P.N. Tandon, AIIMS, New Delhi
   Neural basis of memory — New insights

B. Public Lecture

Vinod K. Gaur, IIA, Bangalore
Living with earthquakes
C. Lecture Presentations by Fellows/Associates

1. Vijayalakshmi Ravindranath, National Brain Research Centre, New Delhi
   Towards understanding the pathogenesis of neurodegenerative disorders

2. Girish Sahni, Institute of Microbial Technology, Chandigarh
   Challenges and surprises in the quest for designing an improved clot-buster drug

3. G. Marimuthu, Madurai Kamaraj University, Madurai
   ‘Echo-locating’ and ‘listening’ modes of capturing frogs by the Indian false vampire bat
   Megaderma lyra

4. Ram Sagar, UP State Observatory, Nainital
   Star clusters

5. Nitin Nitsure, TIFR, Mumbai
   Existence, truth, and proof: Modern foundations of mathematics

6. R. Nagarajan, TIFR, Mumbai
   Quaternary borocarbide superconductors – The discovery and overview

7. Anil Kumar, NCL, Pune
   Ionic solutions: From organic reactions to biomolecules

8. Vidita A. Vaidya, TIFR, Mumbai
   Stress, depression and hippocampal damage

9. R. Ramesh, PRL, Ahmedabad
   High resolution palaeomonsoon reconstruction from cave deposits

10. Bhaskar G. Maiya, University of Hyderabad, Hyderabad
    Multichromophoric molecular assemblies based on porphyrin building blocks

11. S.V. Bhat, IISc, Bangalore
    Resonating and non-resonating with electrons: Excitement unlimited

12. Ramesh Hariharan, IISc, Bangalore
    Algorithms and computational complexity

13. Vijay V. Patel, CAIR, Bangalore
    Challenges in control law design for modern manned aircraft
Annexure 8

SIXTY-SEVENTH ANNUAL MEETING, 2001

(9–11 November 2001, Tirupati)

A. Presidential Address

1. K. Kasturirangan, Department of Space, Bangalore
   Science and technology of imaging from space

B. (a) Symposium on Radar and Microwave Remote Sensing in Atmospheric Science

1. Kenji Nakamura, Nagoya University, Nagoya, Japan
   Global precipitation observation by spaceborne radar

2. J. Srinivasan, IISc, Bangalore
   Megha Tropiques: Indo-French satellite to study tropical convective systems

3. P. Balarama Rao, National MST Radar Facility, Gadanki
   Radar scattering mechanisms

4. D. Narayana Rao, SV University, Tirupati
   MST Radar and scientific applications

5. P.R. Mahaputra, IISc, Bangalore
   Multiparameter radar observation of the lower atmosphere

(b) Symposium on Challenges of Infectious Diseases

1. Indira Nath, AIIMS, New Delhi
   Scope of the symposium

2. M.K. Bhan, AIIMS, New Delhi
   Developments in gastro-intestinal infections: Some unconventional associations

3. S.K. Acharya, AIIMS, New Delhi
   Clinical and molecular aspects of Hepatitis in India

4. K. Srinath Reddy, AIIMS, New Delhi
   Infections and cardiovascular diseases — The expanding spectrum

5. P.R. Narayanan, Tuberculosis Research Centre, Chennai
   Tuberculosis, a continuing problem with newer challenges for India

   HIV/AIDS challenge in the new era

7. N.K. Ganguly, ICMR, New Delhi
   Future technologies for epidemiology
C. Special Lectures

1. G.S. Agarwal, PRL, Ahmedabad
   Controlling light by light-stoppage, storage and superluminal propagation of light

2. S.K. Pal, ISI, Kolkata
   Soft computing, machine intelligence and data mining

D. Public Lectures

1. Albert Libchaber, Rockefeller University, New York, USA
   Information science and molecular biology

2. K.S. Singh, formerly Anthropological Survey of India, Kolkata
   Science, history and anthropology – A perspective on Prof. D.D. Kosambi’s works and their impact

E. Lecture presentations by Fellows/Associates

1. Raghavan Varadarajan, IISc, Bangalore
   Understanding and quantitimating protein stability

2. Umesh Waghmare, JNCASR, Bangalore
   Ab initio theory of ferroelectric materials

3. Amitabha Chattopadhyay, CCMB, Hyderabad
   A novel fluorescence approach to monitor organization and dynamics of organized molecular assemblies

4. D.M. Salunke, NII, New Delhi
   Molecular mimicry in biology

5. M.K. Sanyal, SINP, Kolkata
   Growth mechanism and thermal properties of ultra-thin films

6. P.K. Chattaraj, IIT, Kharagpur
   Chemical reactivity and density functional theory

7. A. Jayakrishnan, SCTIMST, Thiruvananthapuram
   Immobile plasticizer in flexible PVC

8. Diptiman Sen, IISc, Bangalore
   Conductance of quantum wires

9. R.B. Bapat, ISI, New Delhi
   The pleasures of counting trees

10. P.C. Pandey, National Centre for Antarctic & Ocean Research, Goa
    Antarctica: A continent of scientific frontiers

11. R. Raghavendra Rao, NBRI, Lucknow
    Biogeography and biodiversity of the Himalaya: Conservation and utilization