

Annual Report

APRIL 2003 – MARCH 2004



Indian Academy of Sciences
Bangalore



POSTAL ADDRESS

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1. INTRODUCTION

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

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

The present report covering the period April 2003 to March 2004 represents the seventieth year of the Academy since its founding.

2. THE FELLOWSHIP

2.1 A total of 339 nominations received for fellowship in different disciplines were considered first by the eight sectional committees and later by the council. Following postal balloting, twenty four new fellows were elected, the fellowship effective from 1 January 2004. A list of their names follows while Annexure 1 gives their particulars. Also elected were three new Honorary Fellows.

Fellows:

- | | |
|---------------------------------|-------------------------------|
| 1. Agrawal, Manindra | 13. Murthy, MVN |
| 2. Ahmad, Talat | 14. Nageswara Rao, Gullapalli |
| 3. Bachhawat, Anand K | 15. Palaniandavar, M |
| 4. Bhakuni, Vinod | 16. Pillai, M Radhakrishna |
| 5. Bhanu Sankara Rao, Kota | 17. Radhakrishnan, TP |
| 6. Chattopadhyay, Dhruvajyoti | 18. Ramdorai, Sujatha |
| 7. Chowdhury, Debashish | 19. Shanbhag, Bhagyashri A |
| 8. Goswami, Sreebrata | 20. Sinha, Bikash C |
| 9. Kant, Tarun | 21. Tyagi, Akhilesh K |
| 10. Kulkarni, Sulabha Kashinath | 22. Umapathy, Siva |
| 11. Kumar, G Ravindra | 23. Vrati, Sudhanshu |
| 12. Kumar, Makarla Udaya | 24. Yegnanarayana, B |

Honorary Fellows:

- | | |
|-------------------------|---------------------------|
| 1. Griffiths, Phillip A | 3. Varadhan, Srinivasa SR |
| 2. Livage, Jacques | |

2.2 In memoriam

The Academy regrets to report the death of the following fellows during the period up to March 2004. Annexure 2 gives additional information about them.

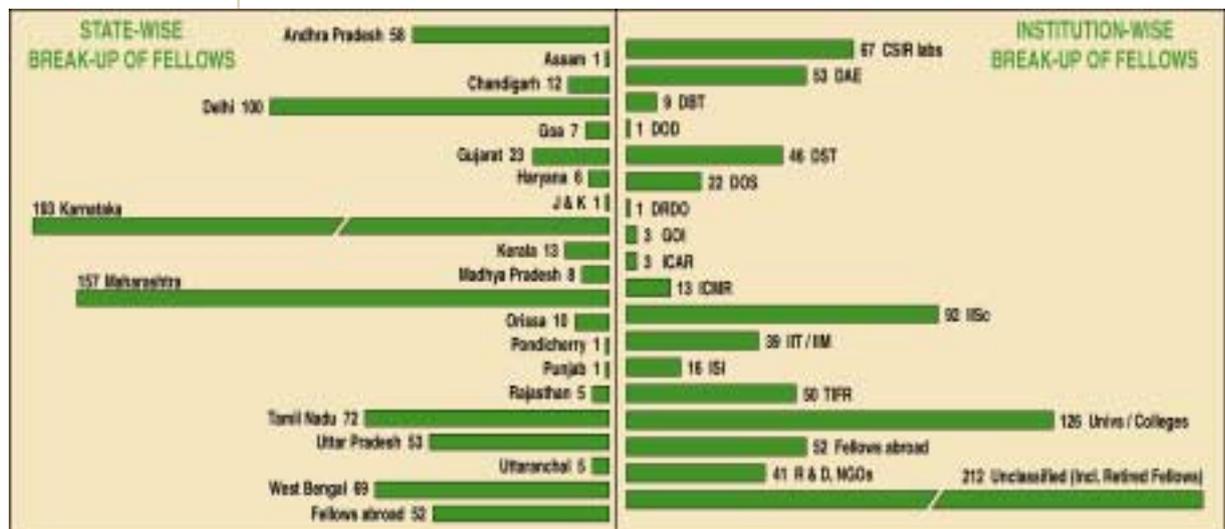
- | | | |
|-----------------------|------------------------|----------------------|
| 1. Asundi, MK | 8. Kalbag, SS | 14. Natarajan, R |
| 2. Bhaduri, AN | 9. Krishnamurti, D | 15. Patel, JC |
| 3. Chandrasekhar, S | 10. Mahadevan, PR | 16. Ramamurthi, B |
| 4. Chandrasekharan, V | 11. Maiya, BG | 17. Ramanathan, KG |
| 5. Das, MR | 12. Mitra, Sujit Kumar | 18. Ramaseshan, S |
| 6. Ghosh, Asok | 13. Murty, BR | 19. Rao, A Sambasiva |
| 7. Hattiangdi, GS | | |

2.3 Strength of the fellowship

	Fellows	Honorary Fellows
1 April 2003	844	44
Elected (Dec. 2003)	24	3
Deceased (2003 – 2004)	19	-
1 April 2004	849	47

2.4 Fellowship analysis

Continuing with our analysis of the fellowship, this year, we deal with the distribution of Fellows between institutions and between cities. Annexure 3(a) is the distribution institution-wise under broad headings and Annexure 3(b) is the state-wise distribution. Annexure 3(c) gives the number of women fellows on the rolls.



3 . COUNCIL

The council with K. Kasturirangan as the President was in office until December 2003. In January 2004, a new council under the presidentship of T.V. Ramakrishnan assumed office for the triennium 2004–2006. Two statutory meetings of the council were held in Bangalore on 19 July and 6/7 December 2003. Also, an additional meeting of the new council took place on 6 March 2004.

4 . ASSOCIATES

Twenty nominations were received and the following seven were selected as Associates in 2003 (see also Annexure 4). The selections continue to be restricted to those below the age of 32 and the tenure ceases after five years or after the Associate attains the age of 35 whichever is earlier.

1. Bhattacharya, Siddhartha
2. Gadgil, Siddhartha
3. Ghosh, Saurabh
4. Goswami, Debashish
5. Mohanty, Bedangadas
6. Nagendra, Harini
7. Sheth, Hetu C

5 . PUBLICATIONS

5.1 Journals

Publications continue to be one of the major activities of the Academy and the eleven journals have appeared more or less on their due dates. One of the journals (Proceedings: Chemical Sciences) was renamed from January 2004 as Journal of Chemical Sciences. The format of the journal has also been changed to A4 size with double column printing. The frequency of the journal continues to be six issues a year appearing every alternate month.

Table 1 gives journal-wise data on the number of pages published during the calendar year 2003, Table 2 gives information on papers submitted for publication and Table 3 gives the journal circulation figures for the calendar year 2003.

5.2 Special issues of journals

Many special issues of topical importance were published as part of the regular numbers of some of the journals. A description of these follows:

Frontiers in materials science

Guest Editors: Baldev Raj and K Bhanu Sankara Rao

Sādhanā, Vol. 28, Nos.1–4, February/April 2003, June/August 2003, pp. 17–864

Over the last few decades of the twentieth century, great advances were made in further development of established materials by improved and novel processing routes. It was also a period of discovery of a range of new materials such as high temperature superconductors, intermetallic compounds, conducting polymers, metal-matrix composites, ceramic-matrix composites, nanostructured materials, advanced ferritic steels, high nitrogen steels, directionally solidified and single crystal superalloys, functionally graded materials, biomaterials, intelligent and smart materials, to name a few. The new materials together with advances in processing methodology compete with evolutionary progress in existing materials and processes. The two special volumes of *Sadhana* running to 850 pages reflect on the developments, over the last decade, in materials science and related technologies.

Based on the coverage and technical contents of the papers, the articles have been grouped into the following sections: nanocrystalline materials; mechanical behaviour of advanced materials; development and processing of intermetallics, composites and ceramics; recent advances in welding science and technology; corrosion and surface engineering; science and engineering of bio-materials; advanced metallic and intermetallic materials; computational materials science; solidification cracking; steam turbine components; post-weld heat treatment; hydrogen embrittlement; laser processing of materials; biomimetics; bulk metallic glasses; thermomechanical processing of alloys; and teaching of materials science and engineering.

Viral evasion of host responses

Guest Editor: S Jameel

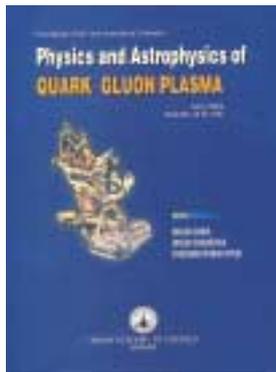
Journal of Biosciences, Vol. 28, No.3, April 2003, pp. 249–358

Besides being important pathogens of humans and animals, viruses are obligate intracellular parasites that require host functions to replicate and propagate. This intimate dependence, and the millions of years of co-evolution of viruses and their hosts, are responsible for elaborate attack, defense and counter-attack strategies. The small size of a virus necessitates a small genome. Conservation of sequence space demands a lean (and often mean) viral proteome in which every protein is essential. Some of these proteins often perform more than one function during the viral life cycle, features that make viruses ideal models for more complex living systems, namely vertebrates.

Many viruses are associated with one or the other disease. Following an acute infection, the clearance or persistence of viral infection will depend on how successfully the virus is



able to regulate the immune response and cell death (apoptosis) pathway of the host. Both these pathways depend critically on signal transduction. The study of host-virus interactions has yielded rich dividends in terms of basic biological information and intervention strategies. This special issue a collection of reviews by prominent workers in this area of research, contains nine articles which provide a glimpse into the fascinating world of viruses and their regulatory mechanisms in the quest for survival, replication and propagation.



Physics and Astrophysics of Quark-Gluon Plasma

Guest Editors: BC Sinha, DK Srivastava and YP Viyogi
Pramāna, Vol. 60, Nos.4/5, April/May 2003, pp. 575–1125

The search for quark gluon plasma, a deconfined state of strongly interacting matter, is one of the most notable examples of what the collaboration of international community of physicists can achieve in a very short time. To many it seems like yesterday when the proposals for building or modifying the present accelerators to produce relativistic heavy ions were being discussed. It also feels like yesterday when some of the largest experiments ever mounted in the history of nuclear physics like STAR, PHENIX, and ALICE were proposed, discussed and approved.

Yet the unfolding story of the success of the experiments has the uncanny markings of determinism, where events have proceeded with precision and inevitability of a well-made clock. This adventure has become possible due to the dedication of hundreds of accelerator physicists, computer personnel, some of the best engineers and technicians of the world, and a large body of students who carried out simulation, design, and development and whose outcomes were to be tested well after they were to finish their PhDs.

This series of International Conferences on Physics and Astrophysics of Quark Gluon Plasma, started in 1988 at a convenient interval of about four years and chosen to intersperse the much more frequent and regular series of quark matter conferences, played a significant role in building a vibrant community of scientists engaged in this front line area of nuclear physics. The earlier meetings were held at Mumbai, Kolkata and Jaipur. The present one was held in Jaipur in November 2001.

This special issue of proceedings, in two successive issues of *Pramāna*, contains 59 articles including invited talks and oral presentations

Bay of Bengal Monsoon Experiment (BOBMEX) 1999

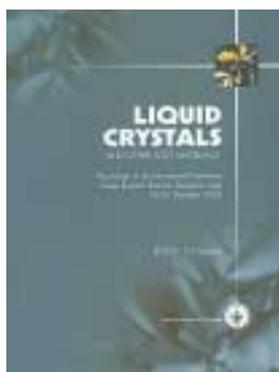
Guest Editor: DR Sikka
Proceedings Earth and Planetary Sciences, Vol. 112, No. 2, June 2003,
 pp. 129–312

Systematic studies on the Indian summer monsoon began in 1875 with the establishment of the India Meteorological Department (IMD). Almost a century later, between 1963 and 1979, several international field programmes were conducted to understand the role of the Indian Ocean in the monsoon. These experiments included the International Indian Ocean Expedition (IIOE) during 1963–65, Monsoon-73 in 1973, Monsoon-77 in 1977,

and Monsoon Experiment–1979 (MONEX–79). Indian researchers played an active role in all these experiments.

By the 1980s the atmosphere-ocean science community in India had sufficient infrastructure to conduct large scale ocean-atmosphere experiments on its own. This was possible because of the initiatives taken by several agencies in the country. The ‘Monsoon Trough Boundary Layer Experiment’ (MONTBLEX) was conducted during 1989–90 and the ‘Land surface processes experiment’ (LASPEX) in 1997–98. The successful completion of these experiments motivated the science community to propose the formulation of the Indian Climate Research Programme (ICRP) in 1995. ICRP consists of different research components. One of these is process-oriented field observation programmes on the monsoon system. The first in the proposed series of experiments was the Bay of Bengal Monsoon Experiment (BOBMEX) implemented in two stages: BOBMEX–Pilot in 1998 and BOBMEX–1999 in 1999. BOBMEX focused on intraseasonal variability of organized convection in the atmosphere and on the role played by ocean-atmosphere interactions in monsoon variability. Special observational platforms like deep water meteorology-oceanography buoys, research ships, weather radars and satellites were used together with conventional meteorological observatories to collect data on the variability of the monsoon ocean-atmosphere system. The oceanographic data collected are available from the Indian National Oceanographic Data Centre, the National Institute of Oceanography and the meteorological data are available from IMD, Pune.

The results of BOBMEX–Pilot were earlier published in the Academy Proceedings (June 2000). A workshop was organized at the National Institute of Oceanography, Goa in February 2001 to discuss the results of BOBMEX–1999 where 30 papers were presented. This special issue contains 12 papers presented at the workshop.



Liquid crystals and other soft materials

Guest Editor: BK Sadashiva

Pramāna, Vol. 61, No.2, August 2003, pp. 189–481

To commemorate the silver jubilee of the discovery of the columnar phase at the Raman Research Institute, an international conference on “Liquid crystals and other soft materials” was held in Bangalore during December 2002. This special volume of the journal contains twentyfive of the papers presented at the conference. The topics include liquid crystals and a few other areas of soft condensed matter including a plenary talk on ‘from antiferroelectricity to ferroelectricity in smectic mesophases formed by bent-core molecules’.

The Bhuj earthquake, Gujarat, India, 2001

Guest Editors: Roger Bilham and SK Srivastav

Proceedings: Earth and Planetary Sciences, Vol. 112, No.3, September 2003, pp. 315–484

This special issue of the Proceedings is based on 16 papers presented at the International Conference on Seismic Hazard held at New Delhi during 2001 with particular reference to

the Bhuj earthquake of January 2001. This earthquake measuring 7.6 was the third in 8 years to occur in the interior of the Indian continent and was one of the most devastating in India's history. Over 20,000 people were killed and a larger number rendered homeless followed by prolonged disruption of socio-economic activities.

The articles in this special volume include the effects of flexure in imposing a stress system throughout India that is presumably fundamental to the earthquake process; strain changes that occurred in the 200 km region surrounding the Bhuj epicentre; the geographical distribution of ground shaking intensity based on eye-witness, media and ground truth accounts of the Bhuj earthquake; various aspects of aftershock activity that shed light on their space-time patterns and focal mechanisms; response of elevated water tanks and other masonry structures to intense ground shaking of the area, important aspects of specific site responses.

Precision machining

Guest Editor: VC Venkatesh

Sādhanā Vol. 28, No.5, October 2003, pp. 865–974

This special volume is devoted to precision engineering. Recent progress in this field clearly indicates the transition of precision technology to precision science. Merchant's new theory on the mechanics of metal cutting in 1944 heralded a new approach, moving away from the empirical work of Taylor (1906) that resulted in a new cutting tool material (high speed steel), the Taylor tool life equation $V T_n = C$, and the Taylor Gantt bar charts. Gene Merchant's theory was considered the start of a golden era in understanding machining. Merchant's contemporary Milton Shaw introduced new theories in the area of grinding, one of which is the size effect. Both Merchant and Shaw utilized Bridgman's work on large plastic flow and fracture to shape their theories. These are well presented in this volume, the size effect being explained in detail. Way back in 1961 Merchant predicted the imminent use of numerical control in machining that has changed manufacturing globally.

The papers presented in this volume report on various aspects of this field such as: size effect in metal cutting; precision grinding; free-form laser printer mirrors; diamond-coated tools made by plasma torch, microwave, and hot filament techniques; nano-finish grinding of brittle materials.

Proceedings of the Workshop on Quantum Chromodynamics

Guest Editors: P Jain, SD Joglekar and V Ravishankar

Pramana, Vol. 61, No.5, November 2003, pp. 785–1054

Quantum chromodynamics (QCD) continues to be an important area of research in high energy physics. Proper understanding of perturbative QCD is essential for interpretation of signals at future colliders. There is also considerable effort in the understanding of nonperturbative aspects of QCD. Facilities such as Jefferson Laboratory have already provided many new results in the medium energy aspects of QCD. Furthermore RHIC has

also given considerable impetus to research in quark gluon plasma. Many of the results obtained at these experimental facilities have not agreed with cherished theoretical ideas.

The second quantum chromodynamics (QCD 2002) workshop was held at IIT Kanpur in November 2002. This was an international meeting and had several (theoretical and experimental) invited talks along with many contributed papers. The workshop covered many aspects of quantum chromodynamics including perturbative QCD, structure functions, quark gluon plasma, lattice QCD, topological aspects, chiral perturbation theory, effective field theories, applications to nuclear physics, spin physics and exclusive processes. This volume contains 14 of the invited talks presented at the workshop as also 17 contributed papers.

Emerging directions in chemical sciences

Guest Editors: GU Kulkarni, B Bagchi and J Gopalakrishnan

Proceedings: Chemical Sciences, Vol. 115, Nos.5/6, October/December 2003, pp. 319–806

This special issue of the *Proceedings* contains a collection of articles contributed by the participants of the international conference on *Emerging Directions in Chemical Sciences* held in Bangalore during November 2003. The issue contains 43 articles on a myriad range of topics in chemical sciences, which lie at the frontiers of current international activity. The topics include: fullerenes as building blocks for nanoclusters, metal-mediated chemical transformations, electrical conduction in nanostructured composites, mesoporous materials as catalysts for organic reactions, peptide design, synthesis of a variety of solids in various states of aggregation—single crystals, fine powders and thin films, nanomaterials, phase transitions, electron density distribution and aromaticity, and last but not the least, theoretical investigations of several interesting topics, as for example, multiphoton vibrational interaction in NO molecule, *ab initio* study of ferromagnetic perovskites, one-dimensional Bose–Hubbard model, magnetoresistance of manganites and free energy landscape of small proteins. The diversity and range of topics are indeed remarkable, and the guest editors believe that the special issue will be of use to many practitioners of chemical science.

Evolutionary genetics: the *Drosophila* model

Guest Editor: Amitabh Joshi

Journal of Genetics, Vol. 82, No.3, December 2003, pp. 77–223

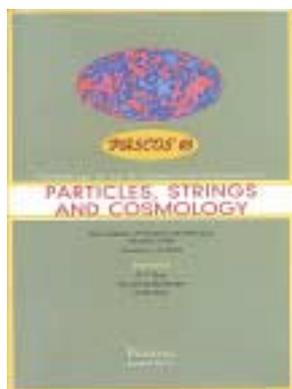
Evolutionary genetics straddles the two fundamental processes of life, development (the transition from egg to adult) and reproduction (the generation of eggs from adults), and scrutinizes, from an evolutionary perspective, the nature and consequences of the twin genomic attributes of expression and replication, respectively.

Today, with increasing ability to empirically study the sequences and temporal patterns of expression of entire genomes, we are finally at the threshold of a 'complete' evolutionary genetics, encompassing both the expression and replication aspects of genomes.

Fruit flies of the genus *Drosophila* have been used extensively as model systems in experimental studies of genetics, development and evolution for almost a century. While *D. melanogaster* has reigned supreme as a laboratory system, especially for classical evolutionary and developmental genetics, other *Drosophila* species have been used extensively for more ecologically oriented evolutionary studies in the wild. Given the immense backdrop of relevant information we already possess about *Drosophila* genetics and development, together with more recently obtained information on ecology, physiology, genome sequence and gene expression patterns, it seems reasonable to assume that *Drosophila* species will continue to be major model systems for the 'new' evolutionary genetics that will mature in the years to come. This special issue brings together a sampling of papers—all reporting studies on some species of *Drosophila*—that span several different areas of evolutionary genetics. The guest editor believes that this collection of papers serves to highlight several conceptually important issues in evolutionary genetics, as well as to underscore the continuing relevance of *Drosophila* species as model systems for evolutionary-genetics research in the post-genomics era.

Particles, Strings and Cosmology

Guest Editors: DP Roy, Sunanda Banerjee and K Sridhar
Pramana, Vol. 62, Nos.2/3, February/March 2004, pp. 149–801



One of the greatest achievements of twentieth century science is the unification of the microcosm with the macrocosm, i.e. the discovery of a close link between the world of subatomic particles and the Universe. This follows from the basic principles of quantum mechanics and relativity — the uncertainty principle and mass energy equivalence. These principles imply that when we probe deeper into the subatomic space we come across states of higher mass and energy. These are the states which abounded the Universe in its very early history, immediately after the Big Bang, when the energy density of the Universe was very high. In the last two decades, particle accelerator experiments have discovered the weak gauge bosons, which are the carriers of the weak nuclear force responsible for radioactive decay, and the top quark, which is the heaviest of the basic constituents of matter. These are very heavy and short-lived particles that abounded the Universe a few pico-seconds (trillionth of a second) after its creation. Recreating these particles in the laboratory is like recreating the Dinosaurs *a la* Jurassic Park but fundamentally more significant, for it helps us trace back the history of the Universe to within a few pico-seconds of its creation. Moreover one hopes to discover soon the other heavy particles predicted by the quantum field theory — i.e. the Higgs boson and the supersymmetric particles. They will help us understand the nature of the phase transition that the Universe went through during those first few pico-seconds and the nature of the invisible matter that pervades throughout the Universe today as a relic of that early history. But this is not the end of the story. One would like to retrace the history of the Universe right into the instant of the Big Bang and even beyond it, where the standard tool of quantum field theory breaks down. The recent developments in string theory offer us the first hope of addressing these issues.

Thus the interface of particle physics, string theory and cosmology is a highly active field of current research at the frontier of human knowledge. The series of international symposia started in USA a decade ago brings together researchers from the three important and inter-related fields on a common platform to facilitate their mutual interaction and cross-fertilization of ideas. The latest symposium the ninth of this series and the first to be held outside USA, was held at TIFR, Mumbai in January 2003. The symposium consisted of about thirty plenary talks in particle physics, string theory and cosmology. This was supplemented by four sets of parallel sessions for contributed papers in the areas of particle physics theory, particle physics experiment, string theory and cosmology. These two special issues of *Pramana* contain written versions of 88 of the plenary talks and parallel session presentations at the conference.

Intermolecular interactions

Orange County, Coorg

30 November – 3 December 2003

The meeting held at Orange County, Coorg was attended by 20 participants from diverse disciplines such as organic, inorganic and computational chemistry, biology and biochemistry, crystallography, crystal engineering, supramolecular chemistry, and materials science. The meeting discussed the nature of hydrogen bonds and other non-covalent interactions. Weak halogen...halogen, C-H...O and van der Waals interactions, *p-p* interactions, strong O-H...O and N-H...O hydrogen bonds, and metal...ligand bonding were debated and their use in constructing meso- and nanoscale assemblies was illustrated by several speakers. Charge density analysis, electrostatic surface potential maps, database analysis and individual crystal structure examples confirm the electrostatic origin of halogen...halogen/oxygen interaction and O-H...O, C-H...O hydrogen bonds. Structural motifs, or supramolecular synthons, in small molecule and macromolecular crystal structures were highlighted in several lectures. The same 'structural units' that mediate self-assembly in host-guest architectures and interpenetrated networks are responsible for protein folding and determining the 3D structure of peptides. Supramolecular self-assembly is controlled by the interplay, concerted stabilization and competition between intermolecular interactions covering a wide energy range: from very weak interactions of about 2–4 kcal/mol to strong hydrogen bonds of 8–15 kcal/mol to very strong hydrogen bonds and metal...ligand bonds of 30–60 kcal/mol. One of the main objectives of this meeting, was to encourage discussion and scientific interaction between practitioners of hydrogen bonding in chemistry, biology and materials science, as well as research areas. This seems to have been effectively fulfilled in the scenic valley where the meeting was held.

Cosmic microwave background radiation

Orange County, Coorg
22–26 February 2004

The announcement of results from the Wilkinson microwave anisotropy probe (WMAP) is considered a watershed in contemporary cosmology and this discussion meeting was considered appropriate to get a set of people to discuss its implication. The meeting, attended by about dozen participants, discussed the recent developments in the study of cosmic microwave background radiation (CMBR). The meeting focussed on various aspects of the study of CMBR, from theoretical to observational, and the future prospects. The meeting began with an overview by T. Padmanabhan. K. Subramanian discussed the basic theoretical concepts behind the generation of CMBR anisotropy, and T. Souradeep dealt with various subtleties in interpreting the data. T. Seshadri and S. Sethi talked about polarization of CMBR, R. Srianand discussed the physics of the intergalactic matter and its relevance to the study of CMBR, J. Bagla discussed gravitational lensing of CMBR, and B. Nath reviewed the Comptonization of CMBR. S. Trivedi discussed the connections between string theory and cosmology and U. Yagnik talked about the mechanism of inflation which has important implications for the study of CMBR.

The meeting was fruitful as experts from different areas—from astrophysics to particle physics—gathered to exchange their ideas and is likely to foster collaborative efforts between various groups in the country working on different aspects of cosmology.

7. ACADEMY PUBLIC LECTURES

The rise and decline of modern science in India

Rajesh Kochhar

*National Institute of Science, Technology and Development Studies, New Delhi
13 May 2003, Indian Institute of Science, Bangalore*



The British could not have established an empire in India without the help of science and the natives themselves. This brought Indians into contact with modern science. There have been three nested stages of development in the advent and growth of modern science in India, each stage leading to the next and partly coexisting with it: (i) a colonial tool stage, (ii) a peripheral native stage, and (iii) an Indian response stage. India was the first country outside extended Europe to take to modern science, with J C Bose and P C Ray being the world's first non-white 'mainstream' scientists. The dazzle created by Raman's Nobel prize has blinded practitioners of science and analysts to the inherent shortcomings of the Indian pursuit of science which have been present from day one, even though the consequences are obvious only now. Indian science was not integrated into

the Indian economy; it remained a middle-class intellectual activity; it was never self-assessing. Scientific activity in India has varied in step with the role which has been assigned to the middle class or which it has perceived for itself. One can distinguish between three phases in the 100 years of modern science in India: a nationalist (not national) phase (Raman), an international phase (Bhabha) and a globalization phase.

Atmospheric brown clouds: South Asian and tropical impacts



V Ramanathan

*Scripps Institution of Oceanography, University of California, San Diego, USA
28 July 2003, Indian Institute of Science, Bangalore*

The Indian Ocean Experiment (INDOEX) provided one of the best and well-known evidences for how long-range transport of man-made aerosols transforms the so-called urban haze into a regional and continental scale brown “cloud”. The recently launched TERRA satellite not only confirmed INDOEX findings, but has also revealed the presence of widespread pollution haze layer downwind of many other continents.

This lecture summarized INDOEX findings on the South Asian haze and compared these with the impacts of anthropogenic haze in other parts of the world. It illustrated with model studies the unique vulnerability of the South Asian and tropical hydrological cycle to the radiative forcing by the absorbing aerosols within the haze layer.



Issues in planetary exploration

Jacques Blamont

*French Space Agency (CNES), Paris, France
19 November 2003, Raman Research Institute, Bangalore*

X-rays, synchrotron radiation, and the properties of matter: A continuing revolution



Martin Blume

*The American Physical Society and Brookhaven National Laboratory, USA
1 December 2003, Raman Research Institute, Bangalore*

An immediate scientific and public sensation followed the discovery of X-rays in 1895. It is indeed difficult to think of a major development in science since that time that has not been made possible or significantly affected by experiments using X-rays. In this talk the development of X-ray sources and the new uses made possible by these sources were discussed and illustrated, and some considerations on the future put forward.



Scary: Does it frighten you?

Marshall Stoneham

*Centre for Materials Research, University College London, UK
8 January 2004, Raman Research Institute, Bangalore*

As scientists, we sometimes have to give views on matters of direct importance to the general public, as well as to ourselves. The issues may be those regarded as matters of life and death. Often, the reason our advice has been sought is a scare story, one of those threats that sounds plausible, but may or may not be true. The story may be backed by statistics used in unconventional ways. The speaker discussed some of the contrasts between those things that frighten and those things that are actually dangerous, the parallels between statistics in science and in public perception, and the rules followed by successful writers of scare stories.



The standard model of cosmology, dark matter and dark energy: is it correct?

JP Ostriker

*Princeton University, Princeton, NJ, USA
9 January 2004, Raman Research Institute, Bangalore*

A standard model for cosmology has emerged, sometimes called the concordance model, which is apparently consistent with a broad suite of observations. The universe begins as a hot big bang, goes through an inflationary phase, and then follows a path that is well verified by current data. Ordinary baryons represent a small fraction (~5%) of the critical density at the present time, dark matter of some unknown kind(s) is more abundant (~25% of the critical density) and a still more puzzling dark energy dominates the matter energy density (~70% of the critical density) with the total corresponding to the flat universe expectation: $\Omega_{\text{tot}} = 1$. Fluctuations in the gravitational potential at about the level of 10^{-5} obey an initial distribution that is nearly self-similar, with amplitudes distributed in a Gaussian random fashion about the mean. Structure grows initially *via* gravitational instabilities with energy feedback from stars and accreting black holes (“feedback”) playing a minor role. Observations of the cosmic background radiation field and the distribution of galaxies are the two principal components in establishing this picture. But there are pieces of evidence that contradict the picture. Most difficulties are seen on small scales and may indicate either gross problems or only the need for relatively minor refinements of the model. But even if the picture is basically correct, our knowledge is woefully incomplete as we still have little or no understanding of the origin and nature of the dominant components of the universe.



The Universe of Hubble Space Telescope

Robert Williams

Space Telescope Science Institute, Baltimore, USA

22 January 2004, Raman Research Institute, Bangalore

One of the largest scientific projects in history, the orbiting Hubble Space Telescope was developed by astronomers and NASA over more than twenty years. Immediately after its launch in 1990 it was found to suffer serious optical distortion. A historic servicing mission executed by NASA astronauts in 1993 corrected this problem, and the Hubble has been performing superbly since that time, with its beautiful images of the universe making it one of the most important scientific tools of modern times, and known throughout the world.

The Hubble telescope carries out a wide-ranging programme of observations by astronomers from all countries. During the past few years it has made important discoveries in a number of different areas which have advanced our understanding of the birth and death of stars, stellar explosions, planetary activity, black holes, and the formation of galaxies. The Hubble's greatest legacy may turn out to be the stunning views it has given us of the distant universe, providing a much clearer picture of the formation of the first structures in the universe after the initial Big Bang. The lecture illustrated the recent discoveries and servicing missions to the telescope, and described how the Hubble has changed the way we perceive the universe. Several spectacular photographs enriched this lecture.

Forensic seismology: Earthquakes and atomic energy

Bruce A Bolt

University of California, Berkeley, USA

11 February 2004, Raman Research Institute, Bangalore

It is the business of seismologists to measure and study earthquakes, in order to understand their physics, to assist in building safer structures, and perhaps predict earthquakes reliably. Another and more recent business of seismologists is to monitor compliance with nuclear test ban treaties. Of structures that earthquakes might affect, few prove as worrisome as nuclear power stations, otherwise promising sources of energy. Their seismic design safety is a major concern of seismologists, who use computer modelling and observations of strong ground-shaking to assess their response to earthquakes.

Like earthquakes, nuclear energy can be of great destructive potential and a Comprehensive Nuclear Test Ban Treaty has been drafted to deter the proliferation of nuclear weapons. Seismologists, by remote surveillance of underground weapons' tests, have now developed effective methods of discriminating between these and natural earthquakes.

The speaker who has been involved with the scientific side of safety in structural designing and in the monitoring of underground tests discussed both these topics.





What impact, if any, has feminism had on science?

Evelyn Fox Keller

Massachusetts Institute of Technology, USA

19 February 2004, Indian Institute of Science, Bangalore

A written version based on this lecture has appeared in the *Academy Journal of Biosciences* (Vol. 29, No.1, March 2004, pp. 7–13). This talk drew extensively on two previously published essays by the author (Keller EF, *Drosophila* embryos as transitional objects: The work of Donald Poulson and Christiane Nusslein-Volhard; *History of Studies in Physical and Biological Sciences*, Vol. 26, pp. 313–346, 1996; Keller EF 2001, Making a difference: Feminist movement and feminist critiques of science, in *Feminism in 20th century science, technology and medicine*, (eds) A Creager, E Lunbeck and L. Schiebinger (Chicago University Press, 2001).



Polymer blends – mixing and de-mixing them

Julia Higgins

The Royal Society of London, UK

16 March 2004, Indian Institute of Science, Bangalore

In many applications mixtures of polymers are required in order to obtain the desired properties. Some blends are thermodynamically miscible – at least in some range of temperature and composition – and some are immiscible. Interest in the former centres on partially miscible systems where molecular chemistry and architecture govern both the miscibility limits and the phase separation processes which ensue when these limits are crossed. Shear flow also affects miscibility limits and can either enhance or inhibit mixing in different circumstances. Immiscible systems often require the addition of copolymers as interfacial agents which modify the structure of the interface and its mechanical strength. The rheology during processing of such systems can have an important influence on the resulting morphology and properties.

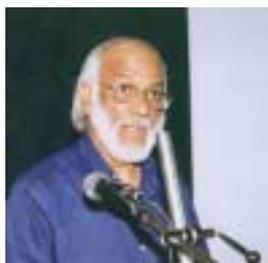
8 . RAMAN CHAIR

Dr Robert Eugene Williams visited India as the twenty-first Academy Raman Professor in December 2003 and January 2004. As Director of the Space Telescope Science Institute from 1993 to 1998 he was responsible for defining the science programme and operation of the Hubble Space Telescope, whose spectacular results have benefitted the international astronomical community.

During his stay in Bangalore, Williams interacted with the students and faculty of the Raman Research Institute and the Indian Institute of Astrophysics, the Indian Institute of Science and the ISRO Satellite Centre and delivered several lectures including an Academy public lecture. He also visited Pune and Mumbai and delivered lectures at the National Centre for Radio Astronomy, the Inter-University Centre for Astronomy and Astrophysics, and the Tata Institute of Fundamental Research.

9 . MID-YEAR MEETING 2003

The 14th Mid-Year Meeting of the Academy was held at Bangalore from 17 to 19 July, 2003. As a novel departure from previous practice the session was extended to 2½ days and the first day's session – lasting an afternoon – was arranged in the Bangalore University campus, to celebrate the 50th anniversary of the 1953 discovery by James Watson and Francis Crick of the double helical structure of DNA. This session was devoted entirely to presentations on various aspects of genetics, and was very well attended. Inaugurating the session, G Padmanaban gave a special lecture on 'Molecular medicine' in which he explained that the title signified using the body's own macromolecules as therapeutic agents to treat genetic disorders, cancers, cardiac myopathies etc. Several protein pharmaceuticals – insulin, interferons — are already being used in this way, and the proof of principle for such disease-combating uses of genes is well established. However, there are important issues to be resolved before all this can become routine clinical practice – efficiency and sustained expression of gene delivery and resulting products, control of side effects, and addressing ethical problems that could arise out of misuse of these methods. This lecture was followed by five presentations by newly elected Fellows and Associates on various aspects of genetics.



G Padmanaban

Special Lecture: JP Mittal (Bhabha Atomic Research Centre, Mumbai) Excitement in radiation research

The subject of radiation chemistry deals with effects of ionizing radiations such as X-rays and gamma rays and high energy charged particles. Due to their high energy content, ionizing radiations interact with all the substances in their path



irrespective of their molecular structure generating variety of highly reactive species – in short a big messy affair to unravel. However, by using fast techniques like pulse radiolysis, it has become possible to study the spectral identity and dynamics of species such as hydrated electron (e_{aq}^-), hydroxyl radicals (OH), H-atoms and a variety of secondary radicals in aqueous solutions. Fundamental information on structure-reactivity correlations, spectral, acid-base and redox properties of various substances/species have been generated. Radiation chemistry contributes a lot in understanding the basis of radiation biology and of late in research on antioxidants. Unusual oxidation states of metals as well as nanoparticles of metals have been prepared by radiation chemical means. High energy radiations have found a variety of applications in polymer modifications and also in preparing special types of polymers. Radiation-produced hydrogel for wound dressing is such an example. In sterilization of medical products and preservation of food and spices, radiation technology is becoming increasingly favourable. Even in hygienization of municipal waste, radiation is finding application. By now it is established that high energy radiation can be used in a variety of beneficial ways. However, for this to be realized, fundamental radiation chemical changes taking place in a variety of systems has to be well understood at molecular level. In this presentation, an attempt was made to share the excitement of participating in the endeavour of taming the high energy photons/charged particles for practical use for the benefit of mankind.

Special Lecture: Ashok Sahni (Panjab University, Chandigarh)

Dinosaurs of India: dead but alive



Scientific interest in Indian dinosaurs is robust and growing. First reported in 1828 from Jabalpur, research during the last 170 years has shown that Indian dinosaurs provide significant information on: the origins of the gigantic herbivorous sauropods as exemplified by the two magnificent mounted Jurassic specimens at the Indian Statistical Institute, Kolkata and the Birla Science Centre, Hyderabad; extinction scenarios, both volcanic and asteroid-impact related; nesting behaviour and environments; and the contiguity of the Indian landmass with Madagascar and South America until about 80 million years.

In two localities in the Indian subcontinent namely Anjar, Kutch and Um Shorengkew, Meghalaya, iridium-rich levels precisely demarcate the Cretaceous-Tertiary Boundary when the dinosaurs and nearly 65% of all earthly life suddenly perished. Iridium-rich levels are related to a 10 km diameter asteroid impact in the Yucatan Peninsula in Central America 65 million years ago associated also with high pressure and temperature minerals such as stishovite, spinel and microdiamonds. At about the same time, 67 to 65 million years ago, one of the most extensive and intense geologically known volcanic episodes, the Deccan Traps, was taking place across most of peninsular India and beyond. Both these global events are believed to have contributed to the end Cretaceous mass extinctions.

Current interest in dinosaurs in general and Indian dinosaurs in particular has led to more research funding and the popularization of science through the establishment of Science Cities and museum displays.

Public Lecture: Indira Nath (All India Institute of Medical Sciences, New Delhi)
SARS – 21st century virus connects the world



Severe acute respiratory syndrome (SARS) is the first of a global epidemic of the 21st century. It is not likely to be the last. It presents like a pneumonia with unusual features and may lead to death in some of the patients. It is caused by a novel mutant virus which belongs to the family of the common cold virus, the coronavirus. Patients develop high fever, headache, cough and breathlessness. It may progress to severe breathlessness when X-rays of lungs show typical features. It is evident that most people recover and only a small fraction of the infected people die. The mortality rate is around 15%. It is transmitted by droplets from close contact with patients. It seems to have first made its appearance in Guangdong province in southern China on 1st November 2002. Within 3 months it spread to many countries of South East Asia with Hong Kong and Taiwan maximally affected. Though reports of cases in Europe and US were first given, Canada is the only country outside Asia to have seen deaths and where it is still ongoing. As of May 2003, a total of 8221 cases with 735 deaths have been reported from 28 countries. The worry is that countries which had apparently controlled SARS such as Vietnam, are now seeing a spurt of new cases.

What makes SARS a topic of discussion across the globe? First of all it draws attention to the fact that we live in a global village where a disease in one corner reaches a distant country within days. Secondly SARS emphasizes that infectious organisms do not respect geographical or political barriers. They travel along with man by air, sea or land undetected by national authorities. Moreover, the mutant nature of the organism reflects on the evolutionary capacity of organisms to survive on this planet. They arrived long before man and like man are adapting to changing threats and altered environmental scenarios. SARS virus could have jumped from animals to man. Therefore, we as a race live not only in a global village but also within a natural habitat consisting of a whole variety of biologically diverse species including newly evolving organisms. We are not the sole inheritors of this planet but have to evolve mechanisms to ensure a balance amongst all living beings.

Diseases like SARS and HIV/AIDS teach us that cooperation between countries is the only way to survive epidemics. No single country, hi or low tech, can survive alone in its fight against infections. International cooperation has been exemplary in the case of SARS after the initial cover-up by the health authorities of China. Unified activities by various countries have arrested the spread of the disease and we can say with some confidence that a pandemic of SARS is unlikely. This is an amazing achievement when seen against the backdrop of the 1918 epidemic of influenza which killed 50 million people. Even more recently, progress in HIV/



Teacher participants at the mid-year meeting

AIDS was adversely affected due to international rivalry.

The bad news is that such epidemics cause fear psychosis which adversely affects the economy of the affected nations as well as the world. Thus not only tourism but also exports and outsourcing services have been affected severely in SE Asia, with economic loss running into billions of dollars. An ugly scenario that emerges is that not only the feared weaponization of microbes (new, old or bioengineered) is a threat to nations but also the destruction and arrest of economic progress can be affected by man-made laws and restrictions. Nations and international agencies wishing to limit epidemics find it natural and just to impose restrictions on travel and movement of people. This may lead to economic disaster in emerging nations as is being witnessed with SARS affected China. International mechanisms need to be put in place whereby the rich and the poor share the burden of disease control. Health/disease is no longer an individual choice but is poised to become a political means to control nations.

Besides the session on genetics, the public lecture and special lectures, there were sixteen 30-minute presentations by Fellows and Associates recently inducted into the Academy. The full programme is in Annexure 5.

The mid-year meeting was attended by about 200 fellows and associates and 42 invited teachers from around the country. A full-day programme for the benefit of teachers was arranged on 1 July, the day prior to the mid-year meeting. The programme included joint and subject-wise meetings of teachers with members of the Science Panel and invited Fellows, and visits to laboratories and institutions in Bangalore.

10. 2003 ANNUAL MEETING - GUWAHATI

The Academy held its 2003 annual meeting in Guwahati from 21 to 23 November at the invitation of the Indian Institute of Technology, Guwahati. This was the first time in sixty-nine years that the annual meeting was held in the north-east of the country. Besides the presidential scientific address, there were two half-day symposia, two public and special lectures each, and lecture presentations by new Fellows and Associates. All the scientific sessions, except one public lecture, were held at the just-completed Senate Hall of IIT. Gautam Barua's brief welcome address was followed by the traditional introduction of Fellows and Associates.



Dr Gautam Barua welcoming delegates



Presidential Address:

Precision positioning: Science and Applications

K Kasturirangan, Department of Space, Bangalore

The satellite-based navigation system, evolved since 1970 — known as Global Positioning System (GPS) — has made it possible to use a constellation of satellites as reference points to establish the locations anywhere on earth through

trilateration. Apart from various techniques involved in the phase measurement, to determine the distance between the receiver and satellite, a good understanding of the science of propagation of EM radiation in a medium is required to generate accurate position. The applications of satellite navigation technology, though first developed for military needs, have later expanded to many areas of civilian applications such as land transport, trekking, remote sensing, geo-mapping, personnel use and any application where precise position in real-time is to be determined. Apart from positioning applications, GPS is used for many other basic scientific studies such as atmospheric sounding and ocean altimetry.

Special Lectures:

The love triangle between single-stranded RNA and double-stranded DNA: R-loops and their consequences in bacteria

J Gowrishankar, Centre for DNA Fingerprinting and Diagnostics, Hyderabad

The R-loop is a three-stranded structure in which RNA invades, and hybridizes with one strand of a DNA molecule leading to displacement of the complementary DNA strand. R-loops are physiological intermediates in plasmid replication, but recent evidence suggests that they are also prone to occur pathologically during mRNA transcription and, if not prevented or dissipated, can be toxic.



Search for a unified theory

Ashoke Sen, Harish-Chandra Research Institute, Allahabad

String theory is a proposal for a unified theory of all matter and their interactions. In this talk the speaker reviewed the basic ideas behind string theory and the current status of the subject.



Public Lectures:

Manned space flight and earth's environment

Rakesh Sharma, Automated Workflow Pvt. Ltd., Bangalore

The talk covered the whys and wherefores of space flight training with particular emphasis given on training methodologies which were followed during the Russian manned space programme. Later, the speaker covered the Indo-Soviet manned space mission itself and rounding off the interaction by projecting a 20-minute video clip which conveyed the concerns of The Association of Space Explorers on the environmental degradation of Planet Earth.



Seeds and civilization

HY Mohan Ram, University of Delhi, Delhi

Can you think of a meal in a middle-class Indian family today without potato, chillies and tomato? These as well as maize, tapioca, sweet potato, kidney bean, ground nut, cashewnut, guava, cocoa, papaya and rubber are from the Middle America and South America (New World). Likewise, wheat, rice, soya bean, coconut, banana, apple, citrus, grapes, chick-pea, sugar cane, black pepper and coffee originated in the Old World. The lecture highlighted the value and role of seeds in the origin of agriculture, the significance of determining the Centres of Primary Diversity of economically important plants, the romantic stories of plant introduction and their impact on civilization

Symposium on “Nanomaterials and nanoscience”

Nanoscience is a truly interdisciplinary area encompassing physics, chemistry, biology, materials science and engineering. There has been tremendous interest in this field in the last decade not only from the fundamental scientific point of view but also from possible technological applications in many areas. Significant progress has been made in recent years in developing new methods of synthesis of nanomaterials as well as new tools for characterization and manipulation. New understanding of size-dependent electrical, optical and magnetic properties of individual nanostructures and their assemblies is now emerging. There were five talks at the symposium. AK Sood (IISc, Bangalore) talked about carbon nanotubes which have potential applications such as nano-scale electronics, sensors, actuators, hydrogen storage, field-induced emission and superstring polymer composites. Synthesis of nanomaterials, particularly using biological systems such as fungi, actinomycetes, and extracts from plant parts was discussed by Murali Sastry (NCL Pune). Tailoring properties of nanoparticles by tuning sizes due to quantum confinement effects were discussed by DD Sarma (IISc, Bangalore). Nanolithography discussed by AK Raychaudhuri (IISc, Bangalore) summarized the methods to make materials of sub-micron dimensions and the problems involved in making measurements on these objects. The last talk by GU Kulkarni (JNCASR, Bangalore) described studies to determine size-dependent electronic properties of metal nanocrystal and the synthesis and properties of free-standing nanocrystals films of gold, silver and copper, where the electrical behaviour of these films could be fine-tuned from metallic to insulating by varying the temperature during synthesis.

Symposium on “Emerging trends in communication technologies”

The second symposium on “Emerging trends in communication technologies” was jointly organized by Gautam Barua (IIT, Guwahati) and N Balakrishnan (IISc, Bangalore) and contained five talks: optical networks (KN Sivarajan, Tejas Networks, Bangalore), satellite and wireless communication (KS Das Gupta, SAC,

Ahmedabad), connecting rural India with special emphasis on North-East (Ashok Jhunjhunwala, IIT, Chennai), the need for a change from voice telephony to broadband internet in rural or remote environments that needed community approach to defray costs (Bishnu Pradhan, IIT, Mumbai) and the challenges facing the North-East region, such as under-development and the tyranny of geography (Gautam Barua, IIT, Guwahati). At the end of the symposium, the message that came out was that those parts of the country that are not properly connected electronically will tend to stay away from the mainstream of growth, both ideologically and otherwise, causing a digital divide. States like Assam also pose a challenge to network designers and policy-makers, in view of the mountainous terrain. The focus of the symposium was to take a hard and close look at possible technology options that will make bandwidth available in abundance all over the country in general and for states like Assam in particular so that the nation can enjoy a uniform and sustained economic growth.

Lecture presentations by new Fellows/Associates

The rest of the programme of the annual meeting covered 30-min presentations by new Fellows and Associates on a range of topics. About 100 Fellows and Associates from around the country participated in the Guwahati meeting. Besides, a large number of local students and teachers from the North-East region of the country were invited to meeting as guest participants.

The excellent arrangements made at IIT, Guwahati for holding the annual meeting, were due to Gautam Barua, Mihir K Chaudhuri and their colleagues. The full programme is in Annexure 6.



Dr Kasturirangan felicitating the artist Shri Khagen Mahanta at the cultural programme arranged during Guwahati Annual Meeting

Four main activities are being carried out as part of the efforts to contribute to the improvement of science education in the country. These are (a) summer fellowships (b) participation of teachers in meetings (c) refresher courses 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. Since the start of this programme in 1995, there has been a progressive increase in the number of applications received and the fellowships offered both to teachers and students. During the year 2003, summer fellowships were offered to 39 teachers and 109 students from all over the country.

11.2 Participation of teachers in Academy meetings

Over the years, with the help of its Fellowship, the Academy has built up a database of teachers from colleges and universities all over the country. 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. About 70 teachers attended the Academy meetings in Bangalore and Guwahati.

11.3 Refresher courses for teachers

This is an all-India programme to help motivated teachers improve their background knowledge and teaching skills. The course is for two weeks and teachers selected from all over the country undergo a rigorous course of lectures, discussions and tutorial sessions. During the last 5 years refresher courses on a variety of topics have been organized throughout the country. The following refresher courses were held during the year. A summary of the report by the respective course co-ordinators wherever available is also included in the annexures.

(a) Molecular and Developmental Genetics

Banaras Hindu University, Varanasi, 2–14 July 2003

No. of participants: 15

Resource persons: P Maruthi Mohan (Osmania University), MM Chaturvedi (Delhi University), K Subramaniam (IIT, Kanpur), SC Lakhotia, Mercy J Raman, R Raman, JK Roy and Madhu G Tapadia (all of BHU, Varanasi).

Extracts from the report are given in Annexure 7.

(b) Statistics, Probability and Stochastic Processes

SN Bose National Centre for Basic Sciences, Kolkata, 4–21 August 2003

No. of participants: 5

Resource persons: KB Sinha, RL Karandikar, A Dasgupta, Probal Chaudhuri, BV Rao and Rahul Roy (all of ISI, Kolkata); SS Manna and S Dattagupta (all of SN Bose National Centre, Kolkata)

The teacher participants were from Chennai, Kolkata, Siliguri and Thane.

The speakers covered wide-ranging and inter-related topics of probability and statistics. Using these topics as base-material, selected themes on stochastic processes e.g. Markov Chains, Chapman-Kolmogorov-Smoluchowski equation, Gaussian Processes, etc. were also dealt with. The participants were given hands-on-experience on computers in the subject of Monte Carlo simulations. Although

the quality of lectures was high, the enthusiasm of the lecturers was somewhat dampened due to depleted attendance at the meeting following last-minute dropouts of selected teachers.

(c) Experimental Physics

Goa University, Goa, 28 October–10 November 2003

No. of participants: 13

Course Director: R Srinivasan; *Course Co-ordinator:* PR Sarode

Resource persons: AW Joshi and VH Raybagkar (Sardar Patel University), AB Bhattacharyya (Noida), BA Dasannacharya (Mumbai), CS Sundar (IGCAR, Kalpakkam), R Srinivasan (RRI, Bangalore), RB Prabhu, PR Sarode, JAE Desa, and KR Priolkar and others (of Goa University).

The teacher participants were from Calicut, Chennai, Goa, Kannur, Kolkata, Madurai, Nagpur, Nuvem Goa, Tirunelveli, Trichy and Trivandrum. Extracts from the report on the course are in Annexure 8.

(d) Earth Sciences



Jawaharlal Nehru Technological University, Hyderabad, 3–15 November 2003

No. of participants: 13

Course Directors: U Aswathanarayana and KV Subbarao; *Course Co-ordinator:* B Venkateswara Rao

Resource persons: U Aswathanarayana (Mahadevan Int. Centre for Water Resources Management, Hyderabad); KV Subbarao (IIT, Mumbai); B Venkateswararao and

faculty from JNTU (Hyderabad); ICRISAT (Patancheru), Universities of Mangalore, Andhra and Pune.

The teacher participants were from Burdwan, Eluru, Gulbarga, Guntur, Hyderabad, Kurnool, Nagaur, Pune, Sagar, Warangal. Extracts from the report are given in Annexure 9.

(e) Experimental Physics



Saurashtra University, Rajkot, 3–16 November 2003

No. of participants: 13

Course Director: MK Mehta; *Course Co-ordinator:* DG Kuberkar

Resource persons: SK Malik (TIFR, Mumbai); AK Raychaudhuri (IISc, Bangalore); RG Kulkarni (Shivaji University); MK Mehta (Ahmedabad)

Teacher participants working in the project laboratory

and faculty from Universities of Marathwada, Bhavnagar, Saurashtra, etc.

The teacher participants represented institutions from Amravati, Anantapur, Datia, Gondia, Gwalior, Junagadh, Nanded, Pune, Rajkot. Extracts from the report are in Annexure 10.

(f) Physics of the Atmosphere and the Ocean



CAOS, Indian Institute of Science, Bangalore, 1–12 December 2003

No. of participants: 16

Course Director: BN Goswami

Resource persons: R Narasimha (NIAS, Bangalore); Sulochana Gadgil, J Srinivasan, BN Goswami, RN Iyengar, GS Bhat, D Sengupta, R Nanjundiah, PN Vinayachandran, SK Satheesh *et al* (all of IISc, Bangalore) and PV Joseph (Cochin).

Teacher participants were from Agra, Bangalore, Bhopal, Chittor, Cochin, Coimbatore, Gulbarga, Guwahati, Kanpur, Mangalore, Rourkela, Sambalpur, Silchar, Sitapur, Solapur, Trivandrum. Extracts from the report are given in Annexure 11.

(g) Mathematical Analysis and Applications



Berhampur University, Berhampur, 1–13 December 2003

No. of participants: 30

Course Director: V Kannan;

Course Co-ordinator: TC Panda

Resource persons: V Kannan (Univ. of Hyderabad); BV Rao and BS Dandapat (ISI, Kolkata); faculty from Universities in Utkal, Berhampur and Andhra and SAC, Ahmedabad.

The teacher participants were from Adoor, Aska, Berhampur, Bhismagiri, Bhubaneswar, Chikiti, Chirala, Cuttack, Ganjam, Hazaribagh, Hinjicut, Hyderabad, Khalikote, Mahuda, Nagpur, Puttur, Sriperumbudur, Vadlamudi, Warangal.

This course was aimed at providing an up-to-date exposure of the latest techniques and mission mode developments in mathematics, and to create awareness and strong motivation among teachers and researchers. The topics covered included: Real analysis, conditional probability and Markov Chains, fuzzy logic, equivalences of axiom of choice and axiomatic set theory, differential equations, dynamical systems, mathematical modelling in meteorology and physical processes, turbulence, air pollution, satellite sensors and orbits for earth

observations and applications in atmospheric sciences, remote sensing and geographical parameters, rough sets, and Banach algebra and symbolic calculus and real sequence.

(h) Frontiers in Inorganic Chemistry



Indian Institute of Technology, Kanpur, 18–31 December 2003

No. of participants: 17

Course Director: RN Mukherjee

Resource persons: R Murugavel (IIT, Mumbai); AJ Elias (IIT, New Delhi); S Goswami (IACS, Kolkata); S Sarkar, PK Bharadwaj and RN Mukherjee (all of IIT, Kanpur).

The teacher participants covered the cities of Banda, Bangalore, Belgaum, Chennai, Dharwad, Jhalda, Kanpur, Mahishadal, Patiala, Raja Rammohunpur. Annexure 12 gives extracts from the report on the course.

(i) Lasers and Applications in Chemical Processes



University of Madras, Chennai, 19–31 January 2004

No. of participants: 21

Course Director: P Natarajan;

Course Co-ordinator: P Ramamurthy

Resource persons: P Ramamurthy and P Natarajan (Madras University); PK Das and S Umapathy (IISc, Bangalore); N Periasamy (TIFR, Mumbai); BG Maiya (University of Hyderabad); PK Palanisamy (Anna University, Chennai).

The teachers were from Bhilai Nagar, Bhilai, Chennai, East Tambaram, Hubli, Kollam, Madurai, Pune, Trichy, Visakapatnam.

The lectures covered the broad area of lasers, techniques, detection and applications in chemistry and also included fundamentals of spectroscopy including lasers, vision, photodynamic therapy and medical applications. There were three lectures of 90 min duration each followed by 60 min of demonstration practicals.

The participants were given books on “Laser fundamentals” by William T Silfvast, and “Laser technology and applications” by Mukunda Rao and a digital form of the resource and lecture materials.

Lecture series for students/teachers

(a) Statistics in theory and practice



St. Thomas College, Pala, 1–3 October 2003

Participants: 100 students and faculty from statistics, botany and zoology departments of colleges in Pala.

Speakers: AP Gore and SA Paranjpe (Univ. of Pune); T Krishnan (Systat. Software, Bangalore); S Ramasubramanian (ISI, Bangalore) *et al.*

Lectures delivered: Statistics of animal abundance estimation; statistics and design of experiments in forestry; statistical analysis of clinical trial data; crossover designs; statistics in business and management; index construction; Markov chain Monte Carlo; population dynamics in microbiology; statistical issues in the measurement of biodiversity; statistical sample survey on plantation crops.

(b) Nonlinear Dynamics and its Applications



AVVM Sri Pushpam College, Poondi, 9–11 October 2003

Participants: 140 students and teachers from Bharathidasan and other universities in Tamil Nadu.

Speakers: M Lakshmanan, (Bharathidasan University); V Balakrishnan and Neelima Gupte (IIT, Chennai); and others from IIT, Chennai, Universities of Madras and Tirunelveli, NIT (Tiruchirappalli), Pushpam College, etc.

Topics covered: Nonlinear dynamical systems; stability analysis; theory of solitons; local stability analysis and application to population models; logistic map and duffing oscillator; fractals and multifractals; linear and nonlinear oscillators; nonlinear electronics chaos and its characterization; computational methods and demonstration; nonlinearity in Bose–Einstein condensation.

(c) Frontier Lectures in Biology

University of Mysore, 5–6 November 2003

Participants: 250 students and faculty from University of Mysore

Speakers: G Padmanaban, Usha VijayRaghavan, MRN Murthy, AJ Rao, RR Dighe (all of IISc, Bangalore); Gaiti Hasan (NCBS, Bangalore); J Nagaraju (CDFD, Hyderabad); V Prakash (CFTRI, Mysore).

Topics covered: Malaria parasite biology; genetic regulators of the rice inflorescence and flower development pathway; TIM barrel proteins: cellular differentiation: glycoprotein hormones: IP₃ signaling in drosophila; RNA interference-mediated baculovirus resistance in *Bombyx mori*; innovations in biology leading to career development.

(d) Frontiers in Chemical Sciences

Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilayam, 10–12 November 2003

Participants: Students and faculty from the chemistry department of Sri Sathya Sai Institute of Higher Learning

Speakers: P Natarajan (National Centre for Ultra Fast Processes, Chennai); S Chandrasekaran (IISc, Bangalore); BG Maiya (University of Hyderabad); R Ramaraj (MKU); T Ramasami (CLRI, Chennai) and others from Dr Reddy's Research Foundation, NCL, Pune and Sathya Sai Institute.

Topics covered: Chemistry of photochemical processes; green chemistry; natural products in drug discovery; chemistry of tetrathiomolybdate; photoelectrochemistry; preparation of fascinating porous solids; supramolecular chemistry; determination of aldehydes and ketones in the atmosphere; science of human development; redox chemistry of chromium in industrial chemistry. There were also a few student presentations.

(e) Life Sciences

Aurora's Degree College, Hyderabad, 27–28 November 2003

Participants: About 300 students and faculty from universities and colleges in Hyderabad.

Speakers: D Balasubramanian (LV Prasad Eye Inst, Hyderabad); S Mahadevan and D Chatterjee (IISc, Bangalore); Ch Mohan Rao and U Bhadra (CCMB,

Hyderabad); J Nagaraju and J Gowrishankar (CDFD, Hyderabad); TP Radhakrishnan (University of Hyderabad).

Topics covered: Decoding human genome; the operon model protein folding; bacterial transcription; silk worm; gene silencing and RNA interference; renaissance of plastic age; the love triangle between SS RNA and DS DNA.

(f) Biological Sciences: now and beyond

St. Xavier's College, Mumbai, 12–13 January 2004

Participants: About 150 students and faculty from St. Xavier's College.

Speakers: V Nanjundiah (IISc, Bangalore); Shubha Tole, Sudipta Maiti and KS Krishnan (TIFR, Mumbai) and others from IIT and BARC, Mumbai.

Topics covered: Molecular to systems biology, development and social behaviour of a simple microorganism; humans as big flies; gal regulon of yeast; a paradigm for eukaryotic gene regulation; dynamic microtubules and cancer chemotherapy; new microscopes; making the invisibles visible in neurobiology; potions from poisons.



V Nanjundiah

(g) Quantum information theory

SB College, Changanacherry, 26 –28 January 2004

Participants: More than 30 students and faculty from SB College.

Speakers: R Simon (IMSc, Chennai), N Mukunda and AD Patel (IISc, Bangalore)

(h) Current concepts in biological research

Bharathidasan University, Tiruchirappalli, 27-28 February 2004

Speakers: S Mahadevan, DN Rao, D Chatterji, P Sadhale, U Varshney, PN Rangarajan (IISc, Bangalore); N Gautham (Univ. of Madras).

Topics covered: DNA structure and transcription; regulation of protein synthesis; restriction-modification systems; gene expression and regulation in prokaryotes and eukaryotes; genomics and proteomics in drug discovery; expression profiling using microarrays; gene therapy; advances in developmental biology; and bioinformatics for biologists.



12 . ACADEMY FINANCES

The activities of the Academy are carried out under Non-Plan and Plan. Non-Plan mainly consists of publications activity while Plan includes programmes on science education, annual/mid-year meetings/discussion meetings etc. A summary of the income and expenditure for 2003–2004 follows:

(a) Non-Plan (Publications activity)

Income	Rs. in lakhs	Expenditure	Rs. in lakhs
Grant – DST	71.25	Journal Printing	39.74
Grant – MHRD	12.50	Postage	16.52
Grant – DAE	1.00	Editorial/Sectional	
Subscriptions	48.12	Committee Meetings	12.25
Others	10.83	Salaries	53.07
(Deficit	4.70)	Others (maintenance of building, equipment etc.)	26.82
	148.40		148.40

(b) Plan

Income	Rs. in lakhs	Expenditure	Rs. in lakhs
Grant – DST	132.00	New building construction	36.40
Grant – Department of Space	15.00	Science Panel	36.08
Grant – DAE	0.75	Annual/mid-year meetings	17.57
		Others (special publications, pension fund, modernization)	57.21
		(Surplus	0.49)
	147.75		147.75

13 . 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 IIT, Guwahati 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 2003)

	Vol.No.	No. of issues	No. of papers	Total No. of pages 2003	**
1. Bulletin of Materials Science	26	7	121	774	(↑98)
2. J. Astrophys. Astron.	24	4	8	114	(↓150)
3. Journal of Biosciences	28	8	88	789	(↑59)
4. Journal of Chemical Sciences	115	6	76	806	(↑15)
5. Journal of Genetics	82	3	20	231	(↑119)
6. Pramana	60,61	12	255	2528	(↑201)
7. Proceedings (Earth Planet Sci.)	112	4	46	608	(↑98)
8. Proceedings (Math. Sci.)	113	4	34	464	(↓200)
9. Resonance	8	12	188	1200	-
10. Sadhana – Engg. Sci.	28	6	63	1060	(↑325)
11. Current Science	84,85	24	860	3526*	(↑398)
Total			1759	12100	↑1380

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

TABLE 2

Information on papers submitted for publication (January to December 2003)

	Accepted	Rejected	Pending	Total	**
1. Bulletin of Materials Science	88	45	44	177	(↓43)
2. J. Astrophys. Astron.	9	5	14	28	(↑14)
3. Journal of Biosciences	60	116	11	187	(↓22)
4. Journal of Chemical Sciences	79	51	10	140	(↑16)
5. Journal of Genetics	25	13	2	40	(↑17)
6. Pramana	222	89	60	371	(↓16)
7. Proceedings (Earth Planet Sci.)	27	8	9	44	(↓19)
8. Proceedings (Math. Sci.)	20	108	16	144	(↑21)
9. Resonance	111	103	29	243	(↑11)
10. Sadhana – Engg. Sci.	77	27	20	124	(↑59)
11. Current Science	854	601	64	1519*	(↑35)
Total	1572	1166	279	3017	↑73

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

TABLE 3

Circulation details of journals (January to December 2003)

	Subscription		Complimentary		Fellows & Associates	Total	
	India	Foreign	India	Foreign			
1. Bulletin of Materials Science	2578 ^a	31	79	30	129	2847	(↑462)
2. J. Astrophys. Astron.	494	131	66	26	98	815	(↑21)
3. Journal of Biosciences	1118	56	72	101	282	1610	(↑131)
4. Journal of Chemical Sciences	698	51	64	83	175	1071	(↑65)
5. Journal of Genetics	777	112	68	56	182	1195	(↑101)
6. Pramana	937	45	77	49	238	1346	(↑91)
7. Proceedings (Earth Planet Sci.)	508	55	66	99	95	823	(↑28)
8. Proceedings (Math. Sci.)	710	79	66	89	127	1071	(↑80)
9. Resonance	4430 ^b	34	199	8	-	4671	(↑482)
10. Sadhana – Engg. Sci.	650	23	64	28	144	909	(↑64)
11. Current Science	4814 ^c	91	160	58	82	5205	(↑395)

a. includes about 1339 MRSI members in India and abroad

b. includes about 2497 personal subscribers

c. includes about 2508 personal subscribers

ANNEXURE 1

NEW FELLOWS – 2003

(effective 1 January 2004)

**1. Manindra Agrawal**

Indian Institute of Technology, Kanpur

Sp: Computational complexity theory, and computation number theory

**2. Talat Ahmad**

University of Delhi, Delhi

Sp: Igneous petrology (geochemistry), and Himalayan geology

**3. Anand K Bachhawat**

Institute of Microbial Technology, Chandigarh

Sp: Microbial genetics, molecular genetics, and microbial biochemistry

**4. Vinod Bhakuni**

Central Drug Research Institute, Lucknow

Sp: Protein folding and stability, and molecular biophysics

**5. K Bhanu Sankara Rao**

Indira Gandhi Centre for Atomic Research, Kalpakkam

Sp: Mechanical metallurgy, physical metallurgy, and materials development

**6. Dhruvajyoti Chattopadhyay**

Calcutta University, Kolkata

Sp: Transcription, molecular virology, and oxidative stress response

**7. Debashish Chowdhury**

Indian Institute of Technology, Kanpur

Sp: Statistical physics, condensed matter physics (theory), and biological physics (theory)

**8. Sreebrata Goswami**

Indian Association for the Cultivation of Science, Kolkata

Sp: Inorganic chemistry, chemical reactions with metal mediation, and polymetallic systems

**9. Tarun Kant**

Indian Institute of Technology, Mumbai

Sp: Structural mechanics, mechanics of polymer composites, and finite element methods

**10. Sulabha K Kulkarni**

University of Pune, Pune

Sp: Surface physics, materials science, and nanoscience

**11. G Ravindra Kumar**

Tata Institute of Fundamental Research, Mumbai

Sp: Interaction of intense light with matter, and nonlinear optical properties of novel materials

**12. M Udaya Kumar**

University of Agricultural Sciences, Bangalore

Sp: Molecular basis of stress resistance, physiology of water use efficiency in plants, and canopy photosynthesis

**13. MVN Murthy**

The Institute of Mathematical Sciences, Chennai

Sp: Particle physics phenomenology, quantum statistics (semi-classical methods).



14. G Nageswara Rao

LV Prasad Eye Institute, Hyderabad

Sp: Cornea, community eye health, and eye care policy and planning.



15. M Palaniandavar

Bharathidasan University, Tiruchirappalli

Sp: Bioinorganic chemistry, activation of molecular oxygen, and structure, bonding & electron transfer in small molecules.



16. M Radhakrishna Pillai

Regional Cancer Centre, Thiruvananthapuram

Sp: Tumour biology, molecular biology, and drug development.



17. TP Radhakrishnan

University of Hyderabad, Hyderabad

Sp: Materials chemistry, and computational chemistry.



18. Sujatha Ramdorai

Tata Institute of Fundamental Research, Mumbai

Sp: Algebra, quadratic forms, number theory, and Iwasawa theory



19. Bhagyashri A Shanbhag

Karnatak University, Dharwad

Sp: Comparative endocrinology and reproduction (vertebrates), herpetology, and animal behaviour



20. Bikash C Sinha

Variable Energy Cyclotron Centre and Saha Institute of Nuclear Physics, Kolkata

Sp: Nuclear physics and high energy physics, quark gluon plasma, and early universe cosmology



21. Akhilesh K Tyagi

University of Delhi South Campus, New Delhi

Sp: Plant gene expression, genomics, and biotechnology



22. Siva Umapathy

Indian Institute of Science, Bangalore

Sp: Laser spectroscopy, photochemistry, and ultrafast dynamics



23. Sudhanshu Vрати

National Institute of Immunology, New Delhi

Sp: Molecular virology, vaccinology, and biotechnology



24. B Yegnanarayana

Indian Institute of Technology, Chennai

Sp: Signal processing, speech and vision, and artificial neural networks

NEW HONORARY FELLOWS

**1. Phillip A Griffiths**

Institute for Advanced Study, Princeton,
NJ

Sp: Differential equations, algebraic and
differential geometry

**3. Srinivasa SR Varadhan**

Courant Institute of Mathematical
Sciences, New York University, NY

Sp: Random phenomena

**2. Jacques Livage**

Chimie de la Matiere Condens'ee,
Universite Pierre et Marie Curie, Paris

Sp: Materials science and technology

ANNEXURE 2

FELLOWS DECEASED

**1. MK Asundi**

(b. 1-5-1930, d. 1-12-2003)

Elected: 1975

Sp: Physical metallurgy, and structural
and mechanical properties of materials

**5. MR Das**

(b. 2-7-1937, d. 1-4-2003)

Elected: 1985

Sp: Molecular biology, and molecular
virology.

**2. AN Bhaduri**

(b. 12-11-1935, d. 5-6-2003)

Elected: 1989

Sp: Biochemistry, molecular
enzymology, and parasite
biochemistry.

**6. Asok Ghosh**

(b. 20-1-1927, d. 29-9-2003)

Elected: 1982

Sp: Endocrinology, histochemistry, and
histology.

**3. S Chandrasekhar**

(b. 6-8-1930, d. 8-3-2004)

Elected: 1962

Sp: Liquid crystals, and condensed
matter

**7. GS Hattiangdi**

(b. 15-12-1921, d. 16-5-2003)

Elected: 1963

Sp: Colloid science, industrial
chemistry, vedic mathematics, and
astronomy.

**4. V Chandrasekharan**

(b. 12-11-1925, d. 5-9-2003)

Elected: 1973

Sp: Spectroscopy and crystal physics

**8. SS Kalbag**

(b. 23-10-1928, d. 30-7-2003)

Elected: 1974

Sp: Technology, technical and science
education, and chemical and food
engineering



9. D Krishnamurti
(b. 30-3-1929, d. 14-5-2003)

Elected: 1958

Sp: Raman and infrared spectroscopy, and solid state physics.



15. J.C. Patel
(b. 2-8-1908, d. 11-5-2003)

Elected: 1956

Sp: Diabetes, internal medicine, and tetanus



10. P.R. Mahadevan
(b. 20-5-1928, d. 27-4-2003)

Elected: 1973

Sp: Molecular biology, mycobacteria, leprosy, and industrial biotechnology



16. B. Ramamurthi
(b. 30-1-1922, d. 12-12-2003)

Elected: 1972

Sp: Neurology, neurosurgery, and neurosciences



11. B.G. Maiya
(b. 20-6-1956, d. 22-3-2004)

Elected: 2001

Sp: Bioinorganic and bioorganic chemistry, photochemistry, and supramolecular chemistry



17. K.G. Ramanathan
(b. 1-3-1923, d. 20-8-2003)

Elected: 1956

Sp: Solid state physics, low temperature physics, and interrelation between fundamental physical constants



12. Sujit Kumar Mitra
(b. 23-1-1932, d. 18-3-2004)

Elected: 1990

Sp: Mathematical statistics



18. S. Ramaseshan
(b. 10-10-1923, d. 29-12-2003)

Elected: 1955

Sp: Materials science, crystallography, and solid state physics



13. B.R. Murty
(b. 4-4-1928, d. 15-5-2003)

Elected: 1975

Sp: Genetics, biometry and mutation



19. A. Sambasiva Rao
(b. 20-9-1914, d. 31-10-2003)

Elected: 1974

Sp: Electronics



14. R. Natarajan
(b. 9-7-1930, d. 2-12-2003)

Elected: 1981

Sp: Coastal area studies (biology, ecology, microbiology, biodegradation, and pollution effects)

ANNEXURE 3 (a) : INSTITUTION-WISE BREAK-UP OF FELLOWS

CSIR laboratories	67	ICMR	13
Institutions of/funded by		Indian Institute of Science	92
Dept. of Atomic Energy	53	Indian Institutes of Technology/Management	39
Dept. of Biotechnology	9	Indian Statistical Institutes	16
Dept. of Ocean Development	1	Tata Institute of Fundamental Research	50
Dept. of Science and Technology	46	Universities and Colleges	126
Department of Space	22	Fellows abroad	53
Defence Research Development Organization	1	Private R&D Establishments, NGOs etc	41
Government of India	3	Unclassified (including retired Fellows)	212
ICAR	3		

ANNEXURE 3 (b) : STATE-WISE BREAK-UP OF FELLOWS

Andhra Pradesh	58	Madhya Pradesh	8	Uttar Pradesh	53
Hyderabad	56	Indore	5	Lucknow	16
Prasanti Nilayam	1	Narasinghpur	1	Kanpur	14
Vijayawada	1	Bhopal	1	Ghaziabad	2
Assam	1	Sagar	1	Allahabad	3
Guwahati	1	Maharashtra	157	Aligarh	1
Chandigarh	12	Nagpur	3	Meerut	1
Delhi	100	Navi	11	Varanasi	13
Goa	7	Mumbai	93	Sultanpur	1
Gujarat	23	Pune	47	Noida	1
Ahmedabad	19	Kolhapur	1	Haldwani	1
Vadodara	1	Sindhudurg	1	Uttaranchal	5
Gandhinagar	3	Thane	1	Srinagar	1
Haryana	6	Orissa	10	Nainital	1
Gurgaon	2	Bhubaneswar	10	Roorkee	2
Hisar	1	Pondicherry	1	Dehra Dun	1
Panchkula	2	Punjab	1	West Bengal	69
Manesar	1	Amritsar	1	Kolkata	65
J & K	1	Rajasthan	5	Kharagpur	2
Karnataka	193	Jaipur	4	Kalyani	1
Bangalore	185	Udaipur	1	Haldia	1
Mysore	5	Tamil Nadu	72		795
Dharwad	2	Chennai	48	Fellows abroad	52
Manipal	1	Vellore	3	Total:	847
Kerala	13	Kalpakkam	3		
Eriyad	1	Madurai	10		
Trivandrum	9	Nagercoil	1		
Kottayam	1	Salem	1		
Calicut	1	Coimbatore	4		
Ernakulam	1	Tiruchirappalli	2		

ANNEXURE 3 (c) : WOMEN FELLOWS SUBJECT-WISE

	Math Sci.	Physics	Chemistry	Engineering	Medicine	Earth Planet	Anim Sci.	Plant Sci.	General Biology	Total
Women Fellows	4	3	2	-	13	1	5	2	9	39
Total Fellows	72	179	133	127	68	72	43	56	99	849

ANNEXURE 4
NEW ASSOCIATES – 2003



Bhattacharya, Siddhartha

Tata Institute of Fundamental
Research, Mumbai

Sp: Rigidity theory of dynamical
systems



Mohanty, Bedangadas

Variable Energy Cyclotron Centre,
Kolkata

Sp: Experimental high energy heavy
ion collisions



Gadgil, Siddhartha

Indian Statistical Institute, Bangalore

Sp: Topology



Nagendra, Harini

Ashoka Trust for Research in Ecology
and the Environment, Bangalore

Sp: Landscape ecology



Ghosh, Saurabh

Indian Statistical Institute, Kolkata

Sp: Statistical genetics



Sheth, Hetu C

Indian Institute of Technology, Mumbai

Sp: Igneous petrology and
volcanology



Goswami, Debashish

Indian Statistical Institute, Kolkata

Sp: Noncommutative geometry and
noncommutative probability

ANNEXURE 5
FOURTEENTH MID-YEAR MEETING

(17–19 July 2003, Bangalore)

A. Special Lectures

1. G Padmanaban, IISc, Bangalore
Molecular medicine
2. JP Mittal, BARC, Mumbai
Excitement in radiation research
3. Ashok Sahni, Panjab University, Chandigarh
Dinosaurs of India: dead but alive

B. Public Lecture

1. Indira Nath, AIIMS, New Delhi
SARS – 21st century virus connects the world

C. Lecture Presentations by Fellows/Associates

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. S Mahadevan, IISc, Bangalore
<i>Cryptic genes — a case of the dog that did not bark</i> 2. Arjula R Reddy, University of Hyderabad, Hyderabad
<i>Functional genomics of drought tolerance in rice: candidate gene discovery, mapping, and SNPs</i> 3. J Nagaraju, CDFD, Hyderabad
<i>The silkworm, <i>Bombyx mori</i> — a treasure-trove for genetical research</i> 4. Pijush K Das, IICB, Kolkata
<i>Brain-like organized signalling network in lower eukaryote</i> 5. Anand Ranganathan, ICGEB, New Delhi
<i>Conscious evolution of proteins</i> 6. UK Misra, SGPIMS, Lucknow
<i>Encephalitis: a continuing challenge</i> 7. S Ramakrishnan, TIFR, Mumbai
<i>Coexistence, competition of charge density wave with superconductivity or magnetism in $RE_5Ir_4Si_{10}$ compounds</i> 8. Anil Kumar Singh, IIT, Mumbai
<i>Biomolecular caging — strategies and applications</i> 9. Rahul Mukerjee, IIM, Kolkata
<i>On the existence of orthogonal arrays</i> 10. Shobhona Sharma, TIFR, Mumbai
<i>Towards understanding acquired immunity to malaria</i> 11. Anurag Sharma, IIT, New Delhi
<i>Guided wave optics: recent progress in wave propagation methods</i> | <ol style="list-style-type: none"> 12. Rajiv V Gavai, TIFR, Mumbai
<i>Re-creating the big bang</i> 13. G Venkateswara Rao, VSSC, Thiruvananthapuram
<i>Five-digit accuracy or five percent error — role of analysts and test engineers dealing with real life structures</i> 14. Vikram Jayaram, IISc, Bangalore
<i>Novel amorphous alumina-based ceramics that are plastic at low temperatures</i> 15. V Chandrasekhar, IIT, Kanpur
<i>Phosphonates and stannoxanes — building bridges between main-group and transition metal chemistry</i> 16. NR Jagannathan, AIIMS, New Delhi
<i>Functional and pathophysiological study of disease processes in human and animal systems: Role of magnetic resonance imaging (MRI) and in-vivo MR spectroscopy</i> 17. Subrata Sinha, AIIMS, New Delhi
<i>Tumour suppressors in human glioma: a tale of two loci</i> 18. GVR Prasad, University of Jammu, Jammu
<i>Biogeographic origins of late cretaceous biota of India</i> 19. TK Chakraborty, IICT, Hyderabad
<i>Designing molecules based on sugar amino acids</i> 20. YI Holla, TIFR, Mumbai
<i>Principal bundles on algebraic varieties</i> 21. BC Das, Inst. of Cytology and Preventive Oncology, New Delhi
<i>Transcriptional control of human papillomavirus (HPV) infection</i> |
|---|---|

ANNEXURE 6

SIXTY-NINTH ANNUAL MEETING, 2003

(21–23 November 2003, Guwahati)

A. Presidential Address

1. K Kasturirangan, Department of Space, Bangalore
Precision positioning: science and applications

B. (a) Symposium: Nanomaterials and nanoscience

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. AK Sood, IISc, Bangalore
<i>Recent excitements in carbon nanotubes</i> 2. Murali Sastry, NCL, Pune
<i>New methods for the synthesis of nanomaterials</i> 3. DD Sarma, IISc, Bangalore
<i>Tailoring properties by tuning sizes</i> | <ol style="list-style-type: none"> 4. Arup K Raychaudhuri, IISc, Bangalore
<i>Playing with small objects: nanolithography and its applications</i> 5. GU Kulkarni, JNCASR, Bangalore
<i>Size-dependent electronic properties of metal nanostructures</i> |
|--|--|

(b) Symposium: Emerging trends in communication technologies

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. N Balakrishnan, IISc, Bangalore
<i>Introduction and overview</i> 2. Kumar N Sivarajan, Tejas Networks India Ltd, Bangalore
<i>Trends in optical networks</i> 3. KS Das Gupta, SAC, Ahmedabad
<i>Satellite and wireless communication prospects and the future</i> | <ol style="list-style-type: none"> 4. Ashok Jhunjhunwala, IIT, Chennai
<i>Connecting rural India with special emphasis on North East</i> 5. Bishnu Pradhan, IIT, Mumbai
<i>From voice telephony to broadband Internet in the rural/remote environments — a reflection</i> 6. Gautam Barua, IIT, Guwahati
<i>The challenges in communication - a perspective from the North East</i> |
|--|--|

C. Special Lectures

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. J Gowrishankar, Centre for DNA Fingerprinting and Diagnostics, Hyderabad
<i>The love triangle between single-stranded RNA and double-stranded DNA: R-loops and their consequences in bacteria</i> | <ol style="list-style-type: none"> 2. Ashoke Sen, Harish-Chandra Research Institute, Allahabad
<i>Search for a unified theory</i> |
|--|--|

D. Public Lectures

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Rakesh Sharma, Automated Workflow Pvt. Ltd., Bangalore
<i>Manned space flight and earth's environment</i> | <ol style="list-style-type: none"> 2. HY Mohan Ram, University of Delhi, Delhi
<i>Seeds and civilization</i> |
|--|---|

E. Lecture presentations by Fellows/Associates

1. Dipankar Bhattacharya, Raman Research Institute, Bangalore
The enigmatic superstrong magnetic fields of neutron stars
2. Probal Chaudhuri, Indian Statistical Institute, Kolkata
Statistical learning in molecular evolution using distributions of DNA words
3. Saraswathi Vishveshwara, Indian Institute of Science, Bangalore
Graph theory and biomolecular structure
4. SB Krupanidhi, Indian Institute of Science, Bangalore
Quantum well infrared photo detectors
5. Anunay Samanta, University of Hyderabad, Hyderabad
Fluorescence signalling of molecular environment
6. Shalivahan, Indian School of Mines, Dhanbad
Electrical anisotropy of asthenosphere in a region of window to mantle
7. R Pitchappan, Madurai Kamaraj University, Madurai
Genomic diversity and disease susceptibility – Indian scenario
8. V Purnachandra Rao, National Institute of Oceanography, Dona Paula
Towards understanding the genesis of phosphorite deposits

ANNEXURE 7

REFRESHER COURSE IN MOLECULAR AND DEVELOPMENTAL GENETICS

(2–14 July 2003, Varanasi)

Extracts from the report by the course coordinator:

The schedule of the course included one lecture of 90 min. duration followed by laboratory session of 8 to 9 hours on each day. For better interaction and to make participants work with their own hands, they were divided into 3 batches, each batch having 5 participants.

Lectures

The lectures covered wide areas of basic, molecular and developmental genetics. The objective was largely to update the participants on the topics covered in their curricula. The following lectures were delivered:

The power of genetics; modern techniques in genetics and molecular cell biology (i); modern techniques in genetics and molecular molecular cell biology (ii); neurospora – the model organism for genetic and biochemical studies; genetic understanding of body pattern formation; genetic basis of sex determination; genetic regulation of cell division cycle; conformational flexibility in DNA; signal transduction; *Caenorhabditis elegans* – a model system for developmental and genetic studies; recombination and gene conversion and genetic basis of cancer.

Laboratory exercises

- i) Neurospora culture and tetrad analysis
- ii) *Drosophila* handling, identification of sex, setting up culture, observation of various types of mutants, observation of F2 progeny of specific crosses and interpretation of results, polytene chromosome preparation and observation of inducible puffs.

iii) Computer application in biology

iv) In situ hybridization on polytene chromosomes of *Drosophila*, studies on developmental gene expression by X-gal and immunostaining, observation of homeotic mutants

v) A. Air-dried chromosome preparation from bone marrow of mouse and study of different stages of meiosis in cells from grasshopper testis

B. Human cytogenetics: setting up and harvesting lymphocyte culture, G-banding, karyotyping

vi) Study of growth pattern of *E. coli* host, transformation of *E. coli DH5a* with desired plasmid, plasmid and genomic DNA extraction, agarose gel electrophoresis.

vii) Culturing *Caenorhabditis elegans* and studying the different stages of development

viii) Restriction digestion and resolving the fragments on agarose gel

ix) Southern transfer, hybridization and detection by non-radioactive method

The following demonstrations were conducted:

- i) SDS-polyacrylamide gel electrophoresis for proteins
- ii) Polymerase chain reaction

The participants were given a complimentary copy of the book "Principles of Genetics" by Snustad and Simons (Wiley 2003).

ANNEXURE 8

REFRESHER COURSE IN EXPERIMENTAL PHYSICS

(28 October–10 November 2003, Goa)

Extracts from the report by the Course Coordinator:

This course was aimed at exposing teachers to some new low-cost and simple experiments in addition to standard experiments in solid state physics. The teachers were required to build a few instruments necessary to carry out many simple experiments in physics.

The programme started with talks on the underlying physics of the selected experiments and projects. The participants were divided into two batches. While one carried out experiments, the other worked on their projects. The following experiments were developed by KR Priolkar and SM Sadique and their efforts were aided by Preeti Bhoje, Neeta Kole and Pratima Dhuri, students of the department: (1) measurement of the Stefan-Boltzmann constant; (2) study of the Wiedermann-Franz relation; (3) determination of dielectric constant and dipole moment of an organic molecule.

Project work and experiments:

Study of Hall effect; electrical resistivity of a semiconductor by the four-probe method; susceptibility of a paramagnetic solid; study of electron spin resonance; study of hysteresis loop; x-ray diffraction pattern of copper. The projects carried out by participants included a constant current source and dielectric constant measurement circuit; a temperature controller and a sine wave generator using IC 8038.

Special lectures were arranged in the area of experimental physics. In his lecture AW Joshi (Sardar Patel University) talked about difficulties in learning experimental physics and wave diffraction. With VH Raybagkar (Wadia College) he demonstrated some

simple mechanics and laser-based experiments. Participants were encouraged to get hands on experience during these demonstrations. AB Bhattacharyya discussed microelectromechanical systems (MEMS). Ameeta Chimulkar demonstrated the use of SPICE software for design and simulation of electronic circuits. Each participant was given a CD containing the software downloaded from the internet public domain. CS Sunder spoke on the course conducted at IGCAR, Kalpakkam in October 2002. BA Dasannacharya shared his experiences of his scientific career in designing new instruments at BARC. RB Prabhu talked about the basics of magnetism to cover Guoy's balance and experiments on the B.H.Loop, resistivity and Hall effect. PR Sarode talked on electron spin resonance and x-ray diffraction experiments. JAE Desa spoke on the treatment of errors in measurements. SM Sadique spoke on the design and construction of dielectric constant circuit and sinewave generator while Efreem Desa covered design and construction of the constant current source and temperature controller.

Towards the end of the course R Srinivasan explained to the participants the basic concepts behind each experiment and talked on the philosophy of the experimental physics course and some aspects of designing new experiments in physics.

The participants, although small in number, showed keen interest and enthusiasm in completing the projects and performing the experiments. The project and experimental sessions extended late into the night on some days. The project kits developed by the participants were donated to their respective teaching departments for use.

ANNEXURE 9

REFRESHER COURSE IN EARTH SCIENCES

(3–15 November 2003, Hyderabad)

Extracts from the report:

Geoscience instruction finds itself in a predicament today because of lack of students interested in the subject. The objective of the course was to broadbase geoscience education and the participants therefore included, besides teachers in geoscience, those from civil engineering, environment and economics. The themes were therefore chosen to address the twin objectives of broad-basing and employment orientation of geoscience instruction. Each lecturer was specifically

asked in advance to indicate how teaching in his/her area of expertise could be so oriented as to lead to jobs. The topics thus included Internet-based geoscience instruction, linkage subjects such as geomorphology, meteorology, coastal resources management, land-use planning, remote sensing, agriculture, geophysical approaches, water resources management, soil resources management and mineral resources management.

There were evening lectures and colloquia on geoscience

topics, which are of public interest. These included international cooperation in teaching and research in geosciences, east coast gas deposits, paradigm of knowledge-driven economic development, ocean development, and geosciences, are large scale water transfers necessary?, how to use R&D in geosciences to create new jobs etc. A full-day field excursion related to water and soil issues in Kothapalli Watershed was organized. This is a joint programme of ICRISAT and the Andhra Pradesh government and is known for effective implementation of various water and soil conservation works. Another full-day excursion was organized to the Robosand plant on the outskirts of Hyderabad to help the teachers understand environmentally sustainable, no-waste technologies in the mineral industries.

A roundtable discussion on “natural resources management, geoscience instruction and jobs” was arranged which was also attended by Arun Nigavekar (Chairman, UGC, New Delhi), Umberto Cordani (International Union of Geological Sciences, Sao Paulo, Brazil) and Claudio Caponi (World Meteorological Organization, Geneva). Several decisions of far-reaching importance were made at the discussion for consideration by UGC and other agencies. These included: how to make geoscience education broad-based and employment-oriented; possible curricular structures; co-ordination mechanisms; institutional mechanisms, and who pays for them; syllabus for UGC/CSIR/GSI etc competitive examinations; role of earth sciences in the newly proposed National Institute of Sciences, etc.

ANNEXURE 10

REFRESHER COURSE IN EXPERIMENTAL PHYSICS

(3–16 November 2003, Rajkot)

Extracts from the report by the Course Coordinator:

The refresher course was aimed at motivating physics teachers to improve their experimental skills and develop insight for designing and setting up of physics experiments in college and university laboratories. There were lectures on recent developments in physics and laboratory experiments in selected areas of condensed matter physics, nuclear physics and electronics. In addition emphasis was also on the design, building and testing of four experimental projects namely DC regulated power supply, constant current source, ON/OFF temperature controller, and high temperature tubular furnace.

A comprehensive laboratory manual and data book was given to all participants for understanding various aspects related to particular experiments conducted

during the course. The experiments included in the laboratory work were:

Nuclear Physics: To determine the characteristics of G.M. tube and dead time of a G.M. counter; to study the intensity of gamma rays as they pass through different thicknesses of Al-foils and to determine the linear absorption coefficient; to study gamma ray spectra using scintillation counting system.

Material Science: Resistivity measurements by d.c. four-probe technique, determination of specific heat of graphite, Hall effect, determination of dielectric constant of solids

Electronics: Combinational and sequential logic design by using analog to digital (ADC) & digital to analog converter (DAC), Characteristics of DIAC and TRIAC and their applications.

ANNEXURE 11

REFRESHER COURSE ON PHYSICS OF THE ATMOSPHERE AND THE OCEAN

(1–12 December 2003, Bangalore)

Extracts from the report by the Course Director:

As teaching of atmospheric and oceanic sciences is not widespread in the country, the philosophy of this course was to introduce important physical concepts and theoretical and observational tools to understand complex phenomena in the atmosphere and the ocean and to prepare background to develop models for prediction of weather and climate.

In his inaugural talk VK Gaur highlighted the feedbacks that lead to climate variability and importance of the global carbon cycle. The Course began with some basics such as observing techniques by SK Satheesh and fundamentals of fluid mechanics by R Narasimha followed by observed state of the general circulation of the atmosphere by BN Goswami and the ocean by PN Vinayachandran and geophysical fluid dynamics by D Sengupta. This was followed by atmospheric thermodynamics and clouds by GS Bhat and

atmospheric radiation by SK Satheesh. With this background R Nanjundiah introduced the complexities of developing three-dimensional general circulation models for prediction of weather and climate. PN Vinayachandran introduced general circulation models of the ocean. They also highlighted the challenges in developing more accurate models for prediction of weather and climate. Synthesis of observations through large scale modeling was emphasized throughout. As statistical techniques are essential in bringing out physical signals of atmospheric and oceanic phenomena from large volume of atmospheric and oceanic data, two lectures were arranged by RN Iyenger on basics of statistical techniques used in atmospheric and oceanic sciences. Some special topics such as Indian monsoon and its variability by S Gadgil, El Nino and Southern Oscillation (ENSO), global warming, tropical cyclone (TC) and thunderstorms were also discussed in order to provide a flavour of interesting physical processes involved in some of the important and challenging weather and climatic phenomena.

The afternoon sessions were devoted to demonstrations and laboratory work.. Some fluid dynamics movies illustrating some basic fluid dynamics processes (e.g. drag, vorticity etc) were shown to the participants. An introduction to principles involved in remote sensing techniques was given by J Srinivasan who also illustrated the usefulness of the Earth Radiation Budget Experiment (ERBE) data. Highly accurate with high spatial resolution sea surface temperature (SST) data obtained by the microwave

imager on board the TRMM satellite as well as the surface wind measurements by the scatterometer on board the QuickSCAT satellite were demonstrated by D Sengupta. The participants were also given demonstration on actual running of atmospheric GCM's and oceanic GCM's. SK Satheesh demonstrated the working of the automatic weather station (AWS) stationed at CAOS and the radiometer used for measurement of aerosol. GS Bhat demonstrated certain unique properties of rotating fluids (e.g. Taylor columns) using a rotating table. He also demonstrated inter-tropical convergence zone (ITCZ) like phenomenon in the rotating table using a line heating.

Quantitative aspects of atmospheric and oceanic sciences were emphasized throughout the course. In order for participants to carry forward quantitative aspects of the training, they were given a book entitled "Meteorology for Scientists and Engineers" by Roland Stull and a hand-held instrument to measure temperature and relative humidity and time. It is envisaged that the teacher participants will involve students in their respective places to maintain regular record of these important climatic variables. This is expected to not only provide good records of climatic data over a number of places but also enthuse some young students to get into this field.

Two special lectures on "New frontiers in meteorology" by RR Kelkar and "Physical basis for prediction of seasonal climate" by Jerome Vialard were arranged.

ANNEXURE 12

REFRESHER COURSE ON FRONTIERS IN INORGANIC CHEMISTRY

(18–31 December 2003, Kanpur)

Extracts from the report by the Course Director:

The course was organized to enable participants to incorporate modern inorganic chemistry topics into the curricula of their respective institutions. Lectures at the course would hopefully demonstrate the strong interrelationship between different branches of modern inorganic chemistry.

The course started with a general mixer where the expectations and requirements of the course were discussed. Every morning there were three lectures (60 minutes) on various aspects of inorganic chemistry while in the afternoon practical sessions were held. In all lectures emphasis was on fundamentals. The following topics were considered by resource persons: Transition metal chemistry, bioinorganic chemistry, supramolecular chemistry, main group chemistry and organometallic chemistry. Special lecture topics included: Magnetism and absorption spectra of coordination complexes,

variable-valence of transition metal ions, bioinorganic chemistry, EPR spectroscopy.

The practical sessions (2½ hours duration) demonstrated how a few simple inorganic chemistry experiments can be carried out in a college laboratory using bare minimum laboratory facilities. The experiments conducted include: extraction and identification of DNA from green peas, determination of calcium in milk powder by EDTA, preparation and photochemistry of tris (oxalato) iron (III), blue printing by photochemical reduction of tris (oxalato) iron (III), preparation of $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$ and use of UV-vis spectroscopy for characterization, iodine in iodized common salt, preparation of acetylferrocene and its purification by column chromatography and characterization by IR and UV-vis spectra.

A book titled "General chemistry experiments" by AJ Elias was distributed to each participant.

STATEMENT OF ACCOUNTS
2003 - 2004

STATEMENT OF ACCOUNTS
2003 - 2004

RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31 MARCH 2004

(Amount in Rupees)		
RECEIPTS	2003 - 2004	2002 - 2003
I Opening Balances		
a) Cash in hand	18,158	22,837
b) Bank Balances		
Savings Account	28,73,079	31,36,778
II Grants Received		
a) From Govt.of India	2,36,25,000	2,12,75,000
b) From other sources	47,000	23,000
III Income on Investments from		
a) Earmarked/Endowment Funds	Nil	Nil
b) Own Funds	38,98,215	20,92,351
IV Interest Received		
a) On Bank Deposits(SB)	1,07,353	1,82,900
b) Loans, Advances etc	30,488	12,000
V Other Income	67,14,581	82,52,813
VI Amount Borrowed	Nil	Nil
VII Any other receipts		
Contribution to corpus fund	4,18,070	2,54,813
VIII Investments matured	1,82,00,000	56,80,000
TOTAL	5,59,31,944	4,09,32,492
PAYMENTS		
I Expenses		
a) Establishment Expenses	89,44,943	50,11,517
b) Administrative Expenses	1,83,60,399	1,83,75,385
II Payments made against funds for various projects	Nil	Nil
III Investments and deposits made out of own funds	2,39,00,000	85,00,000
IV Expenditure on		
a) Fixed assets	13,73,879	6,54,353
b) Capital Work in Progress	30,00,000	55,00,000
V Refund of Surplus money/Loans	1,94,100	Nil
VI Finance Charges (Interest)	Nil	Nil
VII Other payments	3,14,369	Nil
VIII Closing Balances		
a) Cash in Hand	13,488	18,158
b) Bank Balance	(-) 1,69,234	28,73,079
TOTAL	5,59,31,944	4,09,32,492

As per our report of even date annexed
For B R V GOUD & CO
Chartered Accountants

Place:Bangalore Date: 22.6.2004	Sd/- (TV Ramakrishnan) President	Sd/- (N Balakrishnan) Treasurer	Sd/- (G Madhavan) Executive Secretary	Sd/- (B R V GOUD) Partner
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NEW COUNCIL
FOR THE TRIENNIUM 2004-2006

T.V. Ramakrishnan (*President*)
K. Kasturirangan (*Previous President*)
N. Balakrishnan (*Treasurer*)
D. Balasubramanian (*Vice-President*)
S. Chandrasekaran (*Secretary*)
S. Dattagupta (*Vice-President*)
J.N. Goswami
S.E. Hasnain
Indira Nath
N. Kumar
R. Kumar (*Vice-President*)
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N. Mukunda (*Vice-President and Editor of Publications*)
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Veronica F. Rodrigues
N. Sathyamurthy
A.K. Sood (*Secretary*)
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V.S. Sunder

Indian Academy of Sciences

Participants at the Guwahati Annual Meeting - 2003

