No. 47

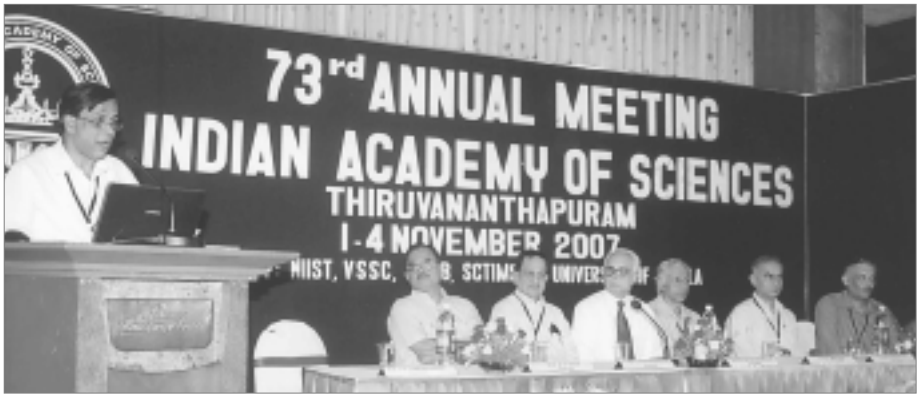
Patrika

March 2008

Newsletter of the Indian Academy of Sciences

2007 Annual Meeting

The seventy-third Annual Meeting of the Academy was held at Thiruvananthapuram during 1– 4 November 2007. It was a return to this location after twenty six years, and the hosting institutions this time were the National



Institute for Interdisciplinary Science and Technology, Vikram Sarabhai Space Centre, Rajiv Gandhi Centre for Biotechnology, Sree Chitra Tirunal Institute for Medical Sciences and Technology, and University of Kerala. About 130 Fellows and 41 invited teachers attended the meeting.

In a departure from past practice, the inaugural session, including introduction of Fellows and the President's address, was held on the evening of the opening day. The Presidential address by D. Balasubramanian was titled "Approaches to understand and treat eye diseases". He dealt with both the avoidable kinds of blindness in the Indian population – about nine millions – and those which have no ready solutions – some three millions. The former include cataract cases and uncorrected refractive errors, the latter cover corneal dystrophies, glaucomas

Inside...

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Forthcoming Events – 2008

19th Mid-Year Meeting, Bangalore
(4–5 July 2008)

74th Annual Meeting, Delhi
(31st October– 2 November 2008)

Refresher Courses

Experimental physics
Bharathiar University, Coimbatore
16–31 May 2008

Experimental physics
Pondicherry University
7–23 July 2008

Lecture Workshops

Mathematics
Pondicherry University
3–5 April 2008

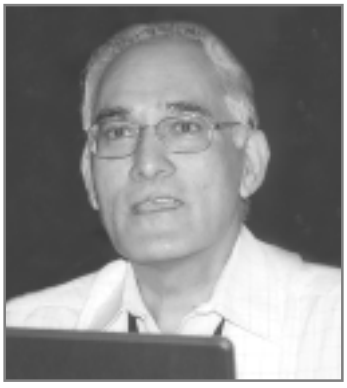
Frontiers in chemistry
St. Thomas College, Pala
10–11 April 2008

Medical biotechnology
NMKRV College, Bangalore
10–11 April 2008

Molecular biology
Mangalore University, Madikeri
11–12 April 2008

Probing electronic states in molecular materials, Bharathidasan Univ, Tiruchirappalli, 24–27 September 2008

and retinal disorders. Work at the LV Prasad Eye Institute is at the molecular genetic and biochemical levels, and goes even as far as the use of adult stem cells to repair damaged corneas. It was very moving to see how much can be done to relieve such distressing afflictions, how much is being done, and yet remains.



M.L. Munjal's special lecture on "Towards quieter automobiles' was in many ways an 'ear-opener'. He described the range of the human ear – much larger in a sense than the eye – and the harmful effects of excessive noise. The 1997 EU limits on automobile noise levels are now in force in India, and by 2010 the current EU limits will be enforced. The sources of automobile noise, design of mufflers to bring down noise levels, and the counter intuitive idea that all noise generating machines should be located near one another rather than far apart, were explained beautifully.

Sulochana Gadgil's special lecture 'Foretelling the monsoon' gave a historical-cum-technical account of a notoriously difficult subject, often the target of humour. The enormous economic consequences of the quality of the monsoon are well known even to lay persons. Paradoxically, while the Indian monsoon is a quite reliable event in the tropics, swings within the normal 10% variations can go from drought conditions to disastrous flooding, over and above spatial variations. Modelling is also extremely difficult, evidence the absence of predictions of the 2002 and 2004 droughts. There are efforts currently to generate forecasts at the district level. The influences of the El Nino Southern Oscillation over the Pacific and the Equatorial Indian Ocean Oscillation over the Indian Ocean, and our improved understanding of these global scale phenomena, were brought out in dramatic fashion. There is hope that in the near future we may see substantial improvement in simulation skills and quality of predictions of our monsoon.

Adoor Gopalakrishnan's Public Lecture 'Dance of the Enchantress' was a brief spoken introduction to his

recent documentary film on the classical dance form *Mohiniyattam*, followed by a screening of the film. The latter was a visual treat, the unobtrusive camera capturing in a lyrical manner the grace, dignity and elegance of the movements of this dance form and its musical and rhythmic accompaniments. The lush background scenery of the region also made a striking impression.

There were two symposia, one on 'Space sciences and applications' and another on 'Re-emerging infections in India'. The first one covered solar system studies, space transportation systems, earth viewed from space, and the numerous societal contributions of our thriving space programmes. The second symposium dealt with the Chandipura encephalitis, re-emergence of chikungunya in India, the malaria problem, and the problems of prediction and control of recurring infections. The earlier cases of chikungunya involved the Asian genotype, mainly in urban areas; the more recent 2005–2006 occurrence affected about 13.6 million persons mainly in rural areas, and was caused by the African genotype.

The S. Ramaseshan Memorial Public Lecture delivered by Lotika Varadarajan described the 'Seafaring traditions of the Indian West Coast'. This was a fascinating journey in both space and time, with splendid visual material, highlighting the different kinds of seagoing vessels crisscrossing the Arabian Sea, the Persian Gulf and the Red Sea. One could see the great differences as compared to the Eastern Coast, the cultural features and continuity of skills over centuries.

The meeting included a good number of presentations by recently elected Fellows and Associates, covering a wide variety of subjects: symmetry of solutions of differential equations; prospects of India becoming a leader in wireless technology; lopsided spiral galaxies; the faunal response to India's northward drift and collision with Asia; and several others.

As has become normal, the quality of presentations and of logistic arrangements were both extremely high, and all participants felt this was a rewarding and memorable meeting.

Cultural Programme during Annual Meeting

2008 ELECTIONS

Fellows:

Anil Kumar
National Geophysical Research Institute, Hyderabad
Areas of interest: Earth sciences; isotope geochemistry; palaeomagnetism

Apte, Shree Kumar
Bhabha Atomic Research Centre, Mumbai
Molecular biology; biotechnology; physiology, biochemistry; stress biology of bacteria and plants

Bhalla, Upinder Singh
National Centre for Biological Sciences, Bangalore
Systems biology; computational neuroscience; systems neurobiology

Chandy, Mammen
Christian Medical College Hospital, Vellore
Hematology; bone marrow transplantation; molecular genetics of blood diseases

Chattopadhyay, Joydev
Indian Statistical Institute, Kolkata
Mathematical modelling on ecology; epidemiology; eco-epidemiology

Chaudhuri, Arabinda
Indian Institute of Chemical Technology, Hyderabad
Organized surfactant assemblies; bioorganic chemistry; liposomal delivery systems

Das, Puspendu Kumar
Indian Institute of Science, Bangalore
Physical chemistry; laser spectroscopy and dynamics; nonlinear optics

Dey, Gautam Kumar
Bhabha Atomic Research Centre, Mumbai
Phase transformations in metals and alloys; electron microscopy; metallic glasses and nanocrystalline materials

Goswami, Ravinder
All India Institute of Medical Sciences, New Delhi
Autoimmune endocrine disorders; sporadic idiopathic hypoparathyroidism; metabolic bone disorders in India

Gupta, Anil Kumar
Indian Institute of Technology, Kharagpur
Paleomonsoon; paleoclimatology; paleoceanography

Gupta, Yashwant
National Centre for Radio Astrophysics, Pune
Astronomy and astrophysics; radio astronomy instrumentation; signal processing

Karanth, K Ullas
Centre for Wildlife Studies, Bangalore
Carnivore ecology; animal population analysis; conservation biology

Kesavan, Srinivasan
The Institute of Mathematical Sciences, Chennai
Partial differential equations; homogenization; isoperimetric inequalities

Krishnakumar, E
Tata Institute of Fundamental Research, Mumbai
Atomic collision processes; molecular dynamics; electron-controlled chemistry

Krishna Kumar, K
Indian Institute of Tropical Meteorology, Pune
Monsoon dynamics; predictability and prediction; climate change and impacts; climate applications

Kundu, Tapas K
Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore
Mechanisms of transcriptional regulation; nonhistone chromatin proteins in genomic integrity; chemical biology

Manna, Indranil
Indian Institute of Technology, Kharagpur
Structure-property correlation of engineering materials; nanostructured materials; surface engineering

Nangia, Ashwini
University of Hyderabad, Hyderabad
Organic chemistry; crystal engineering; supramolecular chemistry

Panda, Dulal
Indian Institute of Technology, Mumbai
Biochemistry; cell biology; biophysics

Pandit, Aniruddha B
Institute of Chemical Technology, Mumbai
Design of multiphase reactors, cavitation phenomena; environmental engineering

Parnaik, Veena K
Centre for Cellular and Molecular Biology, Hyderabad
Cell biology; molecular biology

Roy, Sujit
Indian Institute of Technology, Kharagpur
Organometallic chemistry; catalysis for fine chemicals; C-H functionalization

Sarkar, Utpal
Physical Research Laboratory, Ahmedabad
Theoretical high energy physics; particle physics and cosmology; astroparticle physics

Sharma, Surinder Mohan
Bhabha Atomic Research Centre, Mumbai
Condensed matter physics under high pressures; synchrotron beamlines; molecular dynamics and first principles calculations

Sharma, Yogendra
Centre for Cellular & Molecular Biology, Hyderabad
Biophysics; biochemistry; protein structure and function

Siddiqi, Imran
Centre for Cellular & Molecular Biology, Hyderabad
Genetics; plant development; genetic recombination

Singh, Mewa
University of Mysore, Mysore
Animal behaviour; wildlife ecology; sociobiology

Somasundaram, Kumaravel
Indian Institute of Science, Bangalore
Cancer biology; genetics; virology

Srianand, Raghunathan
Inter-University Centre for Astronomy and Astrophysics, Pune
QSO spectroscopy; cosmology; structural formation

Suresh, Venapally
University of Hyderabad, Hyderabad
Algebra; quadratic forms and division algebras; arithmetic geometry

Thomas, K George
National Institute for Interdisciplinary Science & Technology, Thiruvananthapuram
Photochemistry and photophysics; nanostructured materials; photoresponsive materials

Tyagi, Jaya S
All India Institute of Medical Sciences, New Delhi
Molecular biology; mycobacteriology; genetic engineering

Vijayamohanan, K
National Chemical Laboratory, Pune
Electrochemistry/physical chemistry; nanotechnology; materials chemistry

Waghmare, Umesh Vasudeo
Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore
Multi-functional oxide materials; nano-structures and their properties; applications of geometric phases in materials science

Honorary Fellows

Chakravarti, Aravinda
Johns Hopkins University School of Medicine
Baltimore, Maryland, USA

Jansen, Martin
Max-Planck-Institut für Festkörperforschung
Stuttgart, Germany

SPECIAL ISSUES

Transportation research

Guest Editor: Dinesh Mohan
Sadhana, Vol. 32, No. 4, August 2007, pp. 279–478

Most large cities in the world are already located in low and middle income countries and many more cities in these countries are expected to have populations of ten million or more in the next few decades. All these cities are faced with serious problems of inadequate mobility and access, vehicular pollution, road traffic crashes and crime on their streets. Increasing use of cars and motorized two-wheelers adds to these problems and this trend does not seem to abate anywhere. However, many recent reports suggest that improvements in public transport and promotion of non-motorized modes of transport can help substantially in alleviating some of these problems. Current evidence shows no success in reducing the use of personal motorized transport for long distance trips anywhere in the world and for urban trips in most locations. Most efforts to reduce environmental pollution due to road transport, therefore, focus on the control of exhaust emissions. This has produced some successes in reducing CO, SO_2 and NO_x, in a few locations, but not CO_2 anywhere. As long as we use fossil fuels for combustion this problem is unlikely to be resolved unless we can shift modal shares towards non-motorized and public transport.

Most cities in the world are not successful in doing this. Even worse, transportation issues are so complex that there is little agreement internationally on what policies will help reduce vehicle-dependent travel without

sacrificing social welfare. This volume of *Sadhana* contains a set of eleven articles that posit the problem and illustrate the complexity of analysis and expertise necessary to deal with sustainable transport issues. They deal with health hazards of road transport traffic planning, the question of subsidy for quality transport, and traffic safety.

Sustainable transport concerns involve many more technical and scientific issues than included in this volume. However, they inform us that transportation policies that may result in reducing the adverse health impacts of road transport will require sophisticated interdisciplinary research efforts, and a great deal of cross-disciplinary communication. At present there are no educational or research institutions in India or other low and middle income countries that have given adequate importance to developing this expertise. The expertise that exists works mostly on individual initiative without enabling institutional frameworks and funding mechanisms. The purpose of this volume is to demonstrate that such work can only be done in an interdisciplinary set-up involving a high level of scientific expertise. This will need policy decisions at the highest level in each country.

Theoretical chemistry symposium

Guest Editors: Sourav Pal and P Venuvanalingam
J. Chem. Sci. Vol. 119, No. 5, September 2007, pp. 325–580

Theoretical chemistry is experiencing rapid growth in recent years and has become multifaceted. Development of newer methodologies and novel applications in materials, life sciences and other areas have contributed to this enormous growth.

This special issue of the Journal contains 29 original papers presented at the Theoretical Chemistry Symposium (TCS 2006) held at Bharathidasan University in Tiruchirapalli during December 2006, which is the tenth of the series. This meeting formed part of the silver jubilee celebrations of the University.

The papers presented in this issue cover several important areas such as theoretical and computational methodologies, density functional and wave function-based quantum chemistry, statistical mechanics and its applications, classical and quantum simulation of complex systems, electronic structure and spectroscopy of molecules and clusters, chemical dynamics, reactivity and catalysis, chemistry at surfaces and interfaces, nonlinear phenomena and dynamics, molecular materials and nano-systems, soft condensed matter, biology-inspired theoretical chemistry, equilibrium and nonequilibrium processes in condensed phase, chemo and bioinformatics, and modelling.

LCWS 06

Guest Editors: Rohini M Godbole and Atul Gurtu
Pramana, Vol. 69, Nos.5/6, November/December 2007, pp. 693–1225

The first International Linear Collider (ILC) Workshop was held in Bangalore in March 2006 under the aegis of World-Wide Study for Future Linear Colliders. These conferences have been the main international fora for developing the physics case and reviewing detector designs and techniques for an electron-positron linear collider. These workshops started in 1991 have travelled all around the world. History has taught us that electron and hadron accelerators are complementary in the exploration of new physics frontiers. The high energy physics community in the world has reached an accord that a linear collider operating at 0.5–1.0 TeV would provide both unique and essential scientific opportunities; it has endorsed with the highest priority the construction of such a machine. A major milestone towards this goal was the approval by the International Committee on Future Accelerators of the recommendation of the International Technology Recommendation Panel for the cold technology of the future International Linear Collider. LCWS 06 was the first International Linear Collider Workshop after the choice of this technology was announced.

This volume containing the proceedings of the Workshop brought out in two issues of *Pramana* include some of the plenary talks such as the overview of

the physics and experiments at the ILC, the detector concepts, as well as a large number of talks presented in the parallel sessions. A large number of contributions related to detectors and the machine design interface and $\gamma\gamma$, $e\gamma$ option are some of the special features of these proceedings.

CRSI Anniversary

Guest Editors: S Chandrasekaran and V Krishnan
Journal of Chemical Sciences, Vol. 120, No.1, January 2008, pp. 1–222

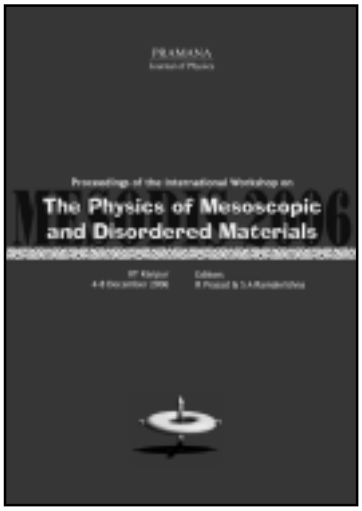
The Chemical Research Society of India (CRSI) established in 1999 completed its tenth year during the Tenth National Symposium in Bangalore in February 2008. The society has been providing a forum for chemists to discuss and share their research contributions with colleagues and foster the growth of chemical research and education. CRSI has grown steadily over the years to more than thousand active members and remains vibrant in all its activities. It has established links with UK and Italy and organizes annual meetings at different places in the country with the active participation of large number of members. Many distinguished chemists from abroad are associated with CRSI as Honorary Members and take part in the deliberations of NSC. This symposium has many integral components — mini-symposia on focused themes (nanomaterials, theoretical chemistry, conducting polymers, catalysis, weak interactions in chemistry, chemical education and others), joint CRSI-RSC symposia for young scientists of the two countries, medal lectures, distinguished named-lectures and others.

The special issue brought out to mark the successful completion of a decade of CRSI showcases the excellent research contributions of a representative group of members of the chemistry community in the country. The volume covers a range of topics randomly chosen to provide a flavour of chemical research pursued by the members in the country.

MESODIS 2006

Guest Editors: R Prasad and SA Ramakrishna
Pramana, Vol. 70, No.2, February 2008, pp. 191–380

This special issue consists of some of the papers presented at the International Workshop on the Physics of Mesoscopic and Disordered Materials (MESODIS–2006) held at Indian Institute of Technology, Kanpur in December 2006. The aim of the workshop was to review the recent progress in the areas of mesoscopic physics and disordered materials, and explore emerging directions in both basic physics and technological applications of the materials. The lectures at the workshop covered a wide variety of topics such as nanomaterials, mesoscopic physics, disordered materials, superconductivity, computational and simulation methods etc. The workshop was intended to bring theorists and experimentalists to a common platform to foster multidisciplinary research and cross-fertilization of ideas.



New emerging areas such as spintronics, new ideas in the study of nonequilibrium statistical properties of mesoscopic systems and new materials such as graphene and photonic metamaterials were also discussed in the workshop. Novel nanoscale fabrication and characterization techniques as well as the tremendous enhancement of computational power have made possible accurate comparison between experiments and theory. The enhanced computational power has made it possible to include electron-electron interaction effects in the study of disordered materials. New theoretical and computational approaches have been evolved to study strongly correlated electronic systems and there have been great advances in the areas of electronic structure calculations and density functional theory. The discussions in the workshop explored connections between these varied areas and indicated future directions of research likely to emerge. The twenty papers contained in these proceedings, consisting of both invited papers and contributed papers, represent these discussions.

PUBLIC LECTURES

The orphan tsunami of 1700 — A transoceanic detective story

Brian Atwater
University of Washington, Seattle, USA
3 October 2007, Indian Institute of Science, Bangalore

Brian Atwater is known for uncovering earthquake and tsunami hazards at the Cascadia subduction zone, which extends 1100 km along the pacific coast of North America. As part of this year's IRIS/SSA distinguished lecture series, In this lecture Atwater traced the geologic detective story of the 1700 Cascadia earthquake, which attained magnitude 9 as judged from Japanese accounts of the associated tsunami. He also presented new geologic findings about tsunami hazards on Indian Ocean shores.

To the fifth dimension and back

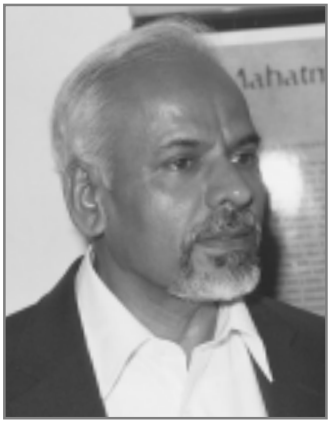
Raman Sundrum
Johns Hopkins University, Baltimore, Maryland, USA
18 December 2007, Indian Institute of Science, Bangalore

Physicists studying the microscopic laws of Nature have been drawn to the idea that there are extra dimensions of spacetime, hidden from everyday experience (and intuition) by their extremely small size. In recent times, theories of higher-dimensional spacetime have been proposed that can elegantly explain some current mysteries of the Standard Model of fundamental physics. Particle collider experiments are now approaching the power and resolution to be able to put some of these ideas to the test. This talk explained how to think about higher dimensions without higher mathematics, and reviewed how they fit with the twin pillars of modern physics: quantum mechanics and relativity. What an experimental discovery of an extra dimension in the near future would look like, and what it would mean were also explained.

Sundrum has made many significant contributions to high-energy physics, especially at the interface between string theory and phenomenology. He is famous for his pioneering work on possible observable consequences of extra dimensions of space-time.

A dialogue on science and mathematics in India

K.R. Sreenivasan
The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
28 December 2007, Indian Institute of Science, Bangalore



There has been much discussion on the state of science in India. The speaker presented a perspective even as he realized the difficulties in adding new substance to the debate. His perception was shaped by three factors: personal interest in the subject, a broad understanding of the state of science in other parts of the world, and numerous discussions with Indian scientists visiting ICTP. These visitors are both seasoned and novice, and come from premier research institutions as well as universities in remote parts of the country. The speaker hoped that some new elements will emerge from the dialogue.

Photonic band gap materials: Engineering light-matter interactions

Sajeev John
University of Toronto, Ontario, Canada
3 January 2008, Indian Institute of Science, Bangalore

Photonic band gap materials are microstructured materials that "cage" or trap light, controlling light in a manner more versatile than how electronic microchips

process electrical signals. These "semiconductors of light" mould the flow of light through a spectral range called the "photonic band gap" (PBG) in which the usual interactions of light with atoms (quantum dots) or other elementary excitations can be partially or completely suspended, but restored where desired. PBG materials have applications in optical communications, provide the world's smallest lasers, and offer hollow-core fibers for life-saving laser surgery. They are also platform for advances in basic science. The speaker presented an overview of history of this subject, described the underlying physics, and pointed out some new directions in this burgeoning field.

DISCUSSION MEETING

Phenotypic and developmental plasticity

Estuary Island, Thiruvananthapuram
16–20 December 2007

Increasingly, biologists are making use of approaches based on physics and mathematics to understand the organization and functioning of living systems. This is especially true with regard to studies that look at group-level traits in terms of the properties of the interacting units that make up the group — whether they be networks of genes within a cell, developmental modules in an organism or cooperating individuals that form a social group. Since they are free of the traditional fixation on specific organisms, these attempts also carry obvious implications for an evolutionary understanding of complex biological systems. Indeed it is becoming apparent that such studies, often clubbed under the head of 'systems biology', or 'evolutionary developmental biology', define the thrust of what will be truly significant in basic biological research for the next few decades. All this makes it vital for researchers who are specialists in different areas of biology to get together periodically in small groups to exchange information on recent advances made by using techniques from other areas, and more importantly, theoretical insights that are made available by those advances.

The attempt to understand the basis of variation in traits exhibited by cells, groups of cells and individual organisms is among the most exciting areas of research in contemporary biology. Until recently, the only significant source of variation for evolution, and by implication for all of biology, was genetic variation. Because it was assumed that non-genetic variation was of no relevance for evolutionary change, this attitude persisted in spite of the long-standing evidence for the existence of variation due to environmental causes or different developmental outcomes. It has become increasingly obvious that such a viewpoint is no longer tenable. Indeed, what is referred to as the plasticity of the phenotype is occupying centre stage with regard to a large number of major issues in biology. In cellular and behavioural biology, these issues include: the ability of stochastic gene expression, and the structure of the dynamical systems by which genes and their products interact, to lead to more than one stable outcome in terms of cellular states; the possibility that such outcomes can be complementary to each other; and the further possibility that this can de-link cooperative group behaviour from a requirement for shared genes. In developmental biology, phenotypic plasticity has been invoked as the central concept necessary for an understanding of the evolution of pattern formation. In order to discuss these themes a discussion meeting on "Phenotypic and developmental plasticity" was organized.

There were 24 formal presentations and 10 posters. The total number of participants was 44, out of whom 8 were students. The participants were from ten countries and had rather varied backgrounds. Both factors helped in making the proceedings lively. In order to allow time for debate, and as was the practice at previous meetings, the number of persons invited to make formal presentations was relatively small; but they covered a wide range of topics within the broad theme of phenotypic and developmental plasticity. The participants took part actively in the discussions that followed each oral presentation and, less formally, at poster viewings.

It would be worth trying to run meetings such as this on a regular basis, say every two years. Their broad aim would be to clarify conceptual issues in our understanding of how developmental forms have evolved. Within this overall framework, one can cover

a large number of sub-themes; only a small fraction of them can be taken up in any one meeting. There is no doubt that the need exists and that they are extremely useful. Both students and research workers can benefit enormously from them.

REFRESHER COURSES

Jointly sponsored by IASc (Bangalore), INSA (New Delhi) and NASI (Allahabad)

Marine geology and geophysics

National Institute of Oceanography, Dona Paula, Goa
22 October–2 November, 2007

No. of participants: 37 teachers and scientists from Allahabad, Chennai, Goa, Hyderabad, Jaipur, Kadapa, Kharagpur, Mumbai, Nagpur, Salem, Thiruvananthapuram, Tirupati, Trichi, Vadodara, and Vishakhapatanam

Course Directors: V Purnachandra Rao/KS Krishna (National Institute of Oceanography, Dona Paula)

Resource Persons: MM Sarin and R Ramesh (PRL, Ahmedabad); Arun Bapat (Central Water and Power Research Station, Pune); KM Sivakholundu (NIOT, Chennai); Masood Ahmad and Kalachand Sain (NGRI, Hyderabad); Meloth Thamban (NCAOR, Goa); IV Radhakrishna Murthy (Andhra University); Shiva K Patil (KS Krishnan Geomagnetic Research Laboratory, Allahabad); SWA Naqvi, Dileep Kumar, Satish Shenoi, AR Gujar, JN Pattan, B Chakraborty, R Nigam, PD Naidu, Unni Krishnan, AL Paropkari, MV Ramana, MVS Gupta, Rahul Sharma, Shyam Prasad, KH Vora, GC Bhattacharya, AK Chaubey, K Sree Krishna, T Ramprasad, BN Nath, V Purnachandra Rao (all from NIO, Dona Paula, Goa).

Extracts from the report: The birth of oceanography, especially 'the marine geology and geophysics' began with the HMS Challenger expedition (1972-76) to the World Ocean. Although Andhra University, Waltair made pioneering marine investigations in 1950s, the International Indian Ocean Expedition (1962-65) was the landmark for marine geology and geophysical studies in the Indian Ocean. Subsequently in 1966 the National Institute of Oceanography (NIO) was established for understanding the seas surrounding the country. Since then systematic studies have been carried out in and around the seas of India and enormous knowledge has been generated in different branches of oceanography. NIO felt the need to disseminate knowledge generated by its scientists for betterment of society and to inspire the younger generation to undertake research in marine sciences. This Refresher Course is part of our efforts to meet this obligation.

The course consisted of lectures under different areas. Eight lectures were delivered on physical oceanographic processes around Indian margins, marine hazards on the Indian coast, dating of rocks and position fixing at sea. Ten lectures were on 'minerals and mineral deposits'. The topics included the environment of formation of marine minerals on the continental margins and deep sea, gas hydrates and its applications, volcanogenic and hydrothermal minerals in the vicinity of sub-marine ridges and plate boundaries. Six lectures were on 'Sea level and global change'. These included observed sea level rise in the past century and inferred sea level and neo-tectonic activity along the Indian continental margins since Last Glacial Maximum (18,000 ^{14}C years BP), bio-geochemical processes and ocean-land and atmospheric interactions and global change. Thirteen lectures were delivered under 'Palaeoceanography'. The lectures included the basics of stable isotopes (C, N, O), applications of stable isotopes in land and oceans, cyclicity of monsoons and forcing mechanisms, applications of radiogenic isotopes (Sr, Nd) for the sediments of Bay of Bengal and Andaman Sea, Neogene ocean circulation, climate and deep-sea Hiatusses and DSDP/ODP accomplishments, principles and instrumentation of environmental magnetism and their applications in understanding palaeoclimate, and the role of Antartica and Southern Ocean in the present and past global climate changes. Under 'applied aspects of marine geology' three lectures were delivered; these included marine archeological investigations in inferring shoreline/ sea level changes and applications of multibeam bathymetry and underwater photography in

understanding sea floor. Under 'marine geophysics' eleven lectures were covered. These included magnetic, gravity and seismic measurements of the continental margins, demarcation of continent-ocean boundary, tectonic readjustments within the lithosphere, etc. Also included were lectures on ambiguity in interpreting potential field data and geophysical evidences for demarcation of new Exclusive Economic Zone.

The participants were each given a book *The Indian Ocean, Vol. 2* (eds R Sengupta and E Desa) as it contained several state-of-art reviews on marine geology and geophysics of the Indian Ocean. They were also given detailed lecture notes prepared by the Resource Persons.

Experimental physics

Mar Ivanios College, Thiruvananthapuram
22 October–2 November, 2007

No. of participants: 35 teachers and 15 MSc students

Course Director: R Srinivasan (Bangalore)

Course Co-ordinators: VK Vaidyan (University of Kerala) and VS Jayakumar (Mar Ivanios College)

Resource Persons: R Srinivasan (Bangalore), KRS Priolkar (Goa University), JBC Efrem D'Sa (Carmel College, Goa), SB Gudennavar (Christ College, Bangalore), SM Sadique (Goa University).

Experiments covered: Construction of voltage regulator using LM317; dielectric constant of liquids; electrical and thermal conductivity of copper; measurement of mutual inductance (lock-in amplifier); measurement of relaxation time constant (signal generator); self-inductance AC bridges; series, parallel resonance circuits and inexpensive AC bridge; Stefan's constant and emissivity; temperature coefficient of resistance and band gap of a semiconductor; thermal diffusivity of brass.

Unlike other courses in experimental physics which were of an all-India character, the present course was intended only for the teacher participants from the affiliated colleges of Kerala University. The Board of Studies of the Kerala University had introduced ten of these experiments in their BSc and MSc curricula. The course was designed to train the teachers in carrying out these experiments.

Vistas in zoological teaching

University of Allahabad, Allahabad
30 January–13 February, 2008

Course Director: UC Srivastava (University of Allahabad)

Participants: Teachers from Agra, Amaravati, Bharawari, Bhilai, Bhopal, Dehradun, Faizabad, Gholaghat, Guwahati, Hyderabad, Kanpur, Khammam. Kushinagar, Lalitpur, Malappuram, Meerut, Mumbai, Pithoragarh, Rewa, Rishikesh, Sagar, Saidabad, Satna, Sikkim, Sultanpur, and Trichi. There were also 29 participants from the University of Allahabad.

Resource Persons: Pratima Gaur, UC Srivastava, Krishna Kumar, Anita Gopesh, RR Tiwari, Banlata Mohanty, Abhay Pandey, Anjana Pandey (all from University of Allahabad), Niraj Kumar (Institute of Applied Sciences, Allahabad) and Vimlesh Chandra (Allahabad)

Topics of lectures: General trends and theories in evolution; concept building in zoology; analytical appraisal of linkages between traditional and modern concept of evolution; systemic division of animal diversity; evolution through the ages; radiation in animal kingdom; antioxidants: a boon for the life of human beings; ultrastructure of cytoplasmic inclusions; exotic fishes of Allahabad; gene organization; microbial gut interaction; anatomical evolution with physiological adaptation; physico-chemical evolution on nutritional pattern in man; biochemical evolution; diversity in fish; transition of life from water to land; lessons from studies on molecular endocrinology of water buffaloes; bioinformatics in biology; structure and physiology of male and female reproductive organs; molecular biology; new dimensions of vector-borne diseases and its control; biodiversity and conservation; global warming.

Besides lectures, there were practical sessions on specimen preparation and preservation, HRP-TMB reaction, Barr-body by methylene blue and mitochondria,

random-amplified polymorphic DNA–polymerase chain reaction (RAPD-PCAR), preparation of chromosomal slides, anthropometric measurements and BMI interpretation in terms of health index, preparation of karyotype, and DNA probe and slicing.

There were also interactive sessions and group discussions in which the participants and resource personnel took part. The participants were taken to the Zoological Museum in Allahabad and the Aqua-bioreserve and *Magh Mela.*

LECTURE WORKSHOPS

Jointly sponsored by IASc (Bangalore), INSA (New Delhi) and NASI (Allahabad)

Statistical thermodynamics

University of Mysore, Mysore
September 7–9, 2007

Convener: R Srinivasan (Mysore)
Co-ordinator: D Revannasiddaiah (University of Mysore)

Speakers: AV Gopala Rao (Univ. of Mysore), Gautam Menon (IMSc, Chennai); NS Vidhyadhiraja (JNCASR, Bangalore) and SR Shenoy (Univ. of Hyderabad).

Participants: 141 students and faculty from the Department of Physics of University and colleges in and around Mysore.

Topics of lectures: foundations of statistical mechanics; classical statistical thermodynamics and applications; Fermi–Dirac statistics and applications; Bose–Einstein statistics.

Modern trends in chemistry

Vivekananda College, Tiruvedakam (Madurai Dist.)
September 19–20, 2007

Convener: R Ramaraj (Madurai Kamaraj University)
Co-ordinator: T Rajendran (Vivekananda College, Tiruvedakam)

Speakers: M Palaniandavar (Bharathidasan University, Tiruchirapalli); S Rajagopal and K Pitchumani (Madurai Kamaraj University); P Ramamurthy (Univ. of Madras, Chennai); D Ramaiah (NIIST, Thiruvananthapuram); N Chandrakumar (IIT, Chennai).

Participants: 250 undergraduate students and faculty from Tiruvedakam and other colleges.

Topics of lectures: Bio-inorganic chemistry; photoinduced intramolecular processes in bimetallic system; greener solvents for the future; fluorescence spectroscopy; photodynamic therapy; photochemistry of lasers; electron sharing and the covalent bond; and NMR imaging.

Science workshop for teachers

Christ College, Bangalore
September 22, 29, 2007

Co-ordinator: Mayamma Joseph (Christ College, Bangalore)

Speakers: Mythily Ramaswamy (TIFR-CAM, Bangalore), AS Vasudeva Murthy, B Ananthanarayan, N Ravishankar, N Srinivasan and Usha Vijayraghavan (all of IISc).

Participants: 103 students and faculty from various colleges in Bangalore.

Topics of lectures: Vector calculus; line and multiple integrals; integral theorems and applications; high energy physics; nanoparticles; bioinformatics; and transgenic organism.

Advances in basic sciences and mathematics

MES College, Bangalore
September 24–27, 2007

Convener: TN Guru Row (IISc, Bangalore)
Co-ordinator: TT Srinivasan (MES College, Bangalore)

Speakers: Anil Kumar, SA Shivashankar, G Rangarajan, DN Rao, V Venkataraman, MK Ghosh, MRN Murthy, TN Guru Row, Siddharth Gadgil, PN Rangarajan, G Mugesh, V Nagaraja, Diptiman Sen and Gautam Bharali (all of IISc, Bangalore); G Srinivasan and NV Madhusudana (RRI, Bangalore).

Participants: 250 students and teachers from MES and other local colleges.

Topics of lectures: NMR; nanomaterials; chaos and synchronization; restriction-modification enzymes; physics of semiconductor heterostructures; probability; fascination of proteins; amazing world of symmetry; what is topology; traditional, modern and futuristic vaccines; the accelerating universe; bioinorganic chemistry; central dogma; superconductivity; liquid crystals; Euclid's fifth postulate.

Concepts in chemistry

Ramananda College, Bishnupur
September 28–30, 2007

Convener: BM Deb, IISER, Kolkata
Co-ordinator: Kartick Gupta, Ramananda College, Bishnupur

Speakers: BM Deb; DS Ray (IACS, Kolkata), R Biswas (SN Bose Centre, Kolkata), PK Chattaraj (IIT, Kharagpur).

Participants: 152 students and faculty from colleges in West Bengal.

Topics of lectures: Symmetry in chemistry; excitement in nonlinear dynamics; solvent dynamics in chemical events, chemical reactivity.

Frontier lectures in chemistry

VV Pura College of Science, Bangalore
November 5–6, 2007

Convener: HA Ranganath (Bangalore University)
Co-ordinator: KG Srinivasa Murthy (VV Pura College, Bangalore)

Speakers: KJ Rao, N Suryaprakash, SA Shivashankar, K Muniyappa, G Mugesh, MS Hegde and S Chandrasekaran (all of IISc, Bangalore), Arun Kumar (GE–JFWTC, Bangalore), MRS Rao (JNCASR, Bangalore), Ila Junjappa (Jubilant Biosys, Bangalore).

Participants: 150 M.Sc students and teachers from the Chemistry Department of Bangalore University

Topics of lectures: Excitement of nanoscience; analysis of NMR spectra; materials in microelectronics; DNA structure, polymorphism and topology; metalloproteins; separation science; solid state chemistry and auto exhaust catalysis; human genomics; aromatic and heteroaromatic annulation; and green chemistry.

Trends in medical biotechnology

VIT University, Vellore
November 27–29, 2007

Convener: A S Balasubramanian (Vellore)
Co-ordinator: G Anilkumar, (VIT University, Vellore)

Speakers: A S Balasubramanian, Nihal Thomas, B S Ramakrishna (CMC, Vellore), K A Balasubramanian, (Meenakshi Medical College, Chennai), T Subramoniam (NIOT, Chennai), Arun Balakrishnan (Nicholas Piramal, Mumbai), David S Durica (University of Oklahoma, USA).

Participants: 354 students and faculty from VIT University, and other colleges.

Topics covered: Technological advances in DNA sequencing: inherited lysosomal storage disorders; immunogenetics of inflammatory bowel diseases; stem cell biology and its applications; high through robotics in screening of bioactive and understanding combinatorial drug mechanism; bacterial peritonitis in liver cirrhosis; recent advances in the assessment of the energy expenditure and body composition; evolution of nuclear receptors and endocrine signalling.

Frontiers in biosciences

Sophia College for Women, Mumbai
November 29–30, 2007

Conveners: Tarala Nandedkar (National Inst. for Research in Reproductive Health, Mumbai) and Roshan D'Souza (Sophia College, Mumbai)

Speakers: D Modi (NIRRH, Mumbai); J Bellare (IIT, Mumbai); KB Sainis (BARC, Mumbai); V Mangoli (Fertility Clinic, Mumbai); GR Raman (Nicholas Piramal, Mumbai); Indira Ghosh (IBB, Pune).

Participants: 300 students and faculty from colleges in Mumbai.

Topics covered:.Nanotechnology; vaccines and immunotherapy; assisted reproductive technologies in human; genomics and proteomics; bioinformatics; industrial application of biosciences.

Frontiers in neurosciences

Sophia College for Women, Mumbai
January 4–5, 2008

Convener: Veronica Rodrigues (TIFR, Mumbai)
Co-ordinator: Yasmin Khan (Sophia College, Mumbai)

Speakers: Shubha Tole and Vidita Vaidya (TIFR, Mumbai), Neeraj Jain and Rema Velayudhan (NBRC, Manesar), Sumantra Chaterjee (NCBS, Bangalore), MC Arunan (Sophia College, Mumbai), Probal Banerjee (Coll. of Staten Island, USA).

Participants: 169 students and faculty from colleges and institutions in Mumbai.

Topics covered: Signals and responses: how the brain is built; principles of organization of sensory systems; plasticity in the rat somatosensory cortex; adult neurogenesis and adult neural stem cells; learning and memory: synapses, cells & circuits; neuroscience education; target the flippase, label as 'trash', or pull the trigger.

Frontier topics in physics

NGM College, Pollachi
January 22–24, 2008

Convener: M Lakshmanan (Bharathidasan University, Trichy)
Co-ordinator: K Anandan (NGM College, Pollachi)

Speakers: M Lakshmanan and S Selvaraj (Bharathidasan University, Trichy) D Mangalaraj and P Kolandaivel (Bharathiar University, Coimbatore), V Balakrishnan (IIT, Chennai), K Porsezian (Pondicherry University), H S Mani (IMSc, Chennai), K Ganesan (Vellore Institute of Technology).

Participants: 157 students and staff from colleges and institutions in Coimbatore.

Topics covered: Relevance of equations in physics; nonequilibrium statistical physics; introduction to biophysics; nanostructured materials/ thin films for gas sensing applications; optical fiber communications; India-based neutrino observatory; need of density functional theory; nonlinear dynamics of spin currents in nanoferromagnets and novel memory devices; chaos-based encryption systems.

Mathematical analysis and applications

Maharani Lakshmi Ammani College for Women, Bangalore
January 31–February 2, 2008

Convener: Mythily Ramaswamy (TIFR-CAM, Bangalore)

Co-ordinator: Sandhya JV (Maharani Lakshmi Ammani College, Bangalore)

Speakers: Alladi Sitaram (IISc, Bangalore), Prashanth K Srinivasan, Mythili Ramaswamy, AS Vasudeva Murthy, Amit Apte (TIFR-CAM, Bangalore), Joseph Samuel (RRI, Bangalore)

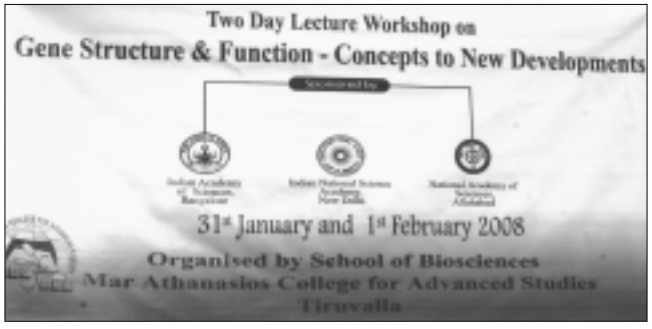
Participants: 150 students and staff from colleges and institutions in Bangalore.

Topics covered: Differential calculus of one dimension; integral calculus of one dimension; differential calculus of multi dimension; vector calculus; multiple integrals; surface integrals; integral theorems; applications to physics; applications of differential equations.

Gene structure and function—concepts to new developments

Mar Athanasios College, Thiruvalla, Kerala
January 31–February 1, 2008

Convener: V Nagaraja (IISc, Bangalore)
Co-ordinator: Biju Dharmapalan (MACFAST, Thiruvalla, Kerala)



Speakers: Umesh Varshney, S Mahadevan, Debnath Pal, V Nagaraja, DN Rao (all of IISc, Bangalore)

Participants: 339 students from colleges in Thiruvalla.

Topics covered: Nucleic acid structure and sequencing; from double helix to gene regulation; introduction to thermodynamics in molecular biology; problems in DNA replication; microbial survival strategies; enzymes: principles in catalysis and kinetics; analytical methods to determine gene structure and function; introduction to computational biology and systems biology; enzymes: concepts and promises; microbial diversity and metagenomics.

Frontier topics in physics

Bishop Heber College, Tiruchirappalli
February 4–5, 2008

Convener: M Lakshmanan (Bharathidasan University, Tiruchirappalli)
Co-ordinator: T Kanna (Bishop Heber College, Tiruchirappalli)

Speakers: G Baskaran, R Simon, Rahul Sinha (IMSc, Chennai), N Gautham (University of Madras), M Lakshmanan (Bharathidasan University, Tiruchirappalli), CS Sundar (IGCAR, Kalpakkam)

Participants: 178 students and staff from colleges and institutions in Tiruchirappalli

Topics covered: Excitements in nanoscience; entanglement in polarization optics; protein structure, prediction and protein folding; the quest for the building blocks of the universe; nanomaterials; relevance of equations in physics.

Pharmaceutical chemistry and drug design

Sri Kaliswari College, Sivakasi
February 11–12, 2008

Convener: R Ramaraj (MKU, Madurai)
Co-ordinator: S Alagappan (Sri Kaliswari College, Sivakasi)

Speakers: Uday Maitra (IISc, Bangalore), M Palaniandavar (Bharathidasan University), H Surya Prakash Rao (Pondicherry University), V Subramanian (CLRI, Chennai)

Participants: 213 students and staff from colleges and institutions in Sivakasi.

Topics covered: Enzyme inhibitors as drugs; metallodrugs; development of small molecules as drugs; molecular modelling and drug design.

Novel materials

University of Mysore, Manasagangotri
February 22–24, 2008

Convener: R Srinivasan
Co-ordinator: T K Umesh (University of Mysore)

Speakers: K J Rao, Anil Kumar, K K Nanda (IISc, Bangalore)

Participants: 100 students and staff from colleges and institutions in Mysore.

Topics covered: Ceramic oxide materials and amorphous materials; GMR and spintronic materials; nanomaterials.

Computational chemistry

Mar Ivanios College, Thiruvananthapuram
March 7–8, 2008

Convener: MS Gopinathan (Indian Institute of Information Technology, Thiruvananthapuram) and Abraham George (Mar Ivanios College, Thiruvananthapuram)

Speakers: MS Gopinathan, TK Manojkumar, KR Srivasthan (all of IITM-K); TP Radhakrishnan (University of Hyderabad); CH Suresh (NIST, Thiruvananthapuram); ED Jemmis and SS Ramasesha, (IISc, Bangalore), Abraham George.

Topics covered: Quantum chemistry; molecules in materials; computing reaction paths; computational chemistry: web resources, variational and perturbational methods; chemoinformatics; virtual advanced school in chemistry; Gaussian programmes.

Foundations of chemistry

VYT PG Autonomous College, Durg, Chhattisgarh
March 7–9, 2008

Convener: PK Chattaraj, IIT, Kharagpur
Co-ordinator: Ajai Kumar Pillai (VYT College, Durg)

Speakers: PK Chattaraj (IIT, Kharagpur), S Bhattacharaya (Jadavpur University, Kolkata), Amit Basak (IIT, Kharagpur), [illegible]Biswas (SN Bose Centre, Kolkata), P Chakrabarti (Bose Institute, Kolkata).

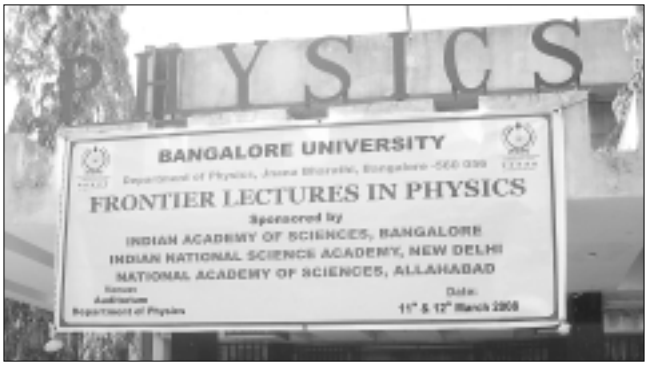
Participants: 149 students and staff from colleges from Durg, Rajnandgaon, Vaishali Nagar and Bhilai.

Topics covered: Physical chemistry; electron spin resonance; organic chemistry; reaction dynamics and spectroscopy; aspects of biochemistry and drug design.

Frontier lectures in physics

Bangalore University
March 11–12, 2008

Convener : HA Ranganath (Bangalore University)
Co-ordinator: Ramani (Bangalore University)



Speakers: SV Bhat, GS Bhat, S Ramasesha, J Srinivasan, Diptiman Sen (all of IISc, Bangalore), N V Madhusudana (RRI, Bangalore)

Participants: 169 students and staff from the University and colleges in Bangalore

Topics covered: Fascination of manganite magnetism; liquid crystal research; clouds; molecular electronic, magnetic and optic materials; science of climate change; electrical transport in low dimension.

Frontier lectures in biology

Bangalore University, Bangalore
March 19–20, 2008

Convener: HA Ranganath (Bangalore University)
Co-ordinator: RM Ranganath (Bangalore University)

Speakers: R Gadagkar, DN Rao, MRN Murthy, Usha VijayRaghavan (all of IISc, Bangalore), K VijayRaghavan (NCBS, Bangalore), TS Raju and V Ravi (NIMHANS, Bangalore)

Topics covered: insect societies; how fly assembles the machinery that allows it to walk; brain and behaviour; traditional, modern and futuristic vaccines; restriction-modification enzymes; structural biology; genetic regulators of the rice flowering stem and floral organs; HIV infection.

OBITUARIES

Asoke Mookherjee (elected 1990) was born on 23 May 1931 in Gopalpur of West Bengal. He secured his B.Sc (Hons) in Geology in 1952 with a distinction and M.Sc in Geology in 1954 with a first-class-first, both from Calcutta University. In 1963 he obtained his Ph.D in Geology from IIT, Kharagpur. His research career started in 1960 at Princeton University as a Ridgefield Foundation Fellow. In 1965 he moved over to the Leigh University as an NSF visiting scientist, and between 1966 and 1967 he worked in Canada as an NRC visiting scientist at the University of Western Ontario. Returning to India in 1967 he joined the Indian Institute of Technology at Kharagpur and served at IIT for 32 years retiring in 1991 as Professor of Geology, after which he joined the Jadavpur University as an Emeritus Scientist.

Mookherjee is among the earliest workers in India to initiate research in modern ore-geochemistry. Application of phase equilibrium relationships among ore mineral phases, elucidation of physico-chemical nature of ore fluids and their environment of deposition, and linking regional metallogeny to the geologic history of crustal evolution of Precambrian tracks constitute the thrust area of his research activities. He is well known among ore-geologists in India and abroad for his singular contribution towards understanding the modifying, creative and destructive roles of metamorphism in ore genesis. He discovered a new mineral (Rayite) and described several rare minerals from Indian deposits. He is credited for introducing the term *metamorphogenic* ores, distinct from those that are *metamorphic*. In 1970, he proposed formation of sulphide neo-magmas due to post-ore intrusion of dykes into sulphide ore bodies.

Now to some details of Mookherjee's contributions. His work on Zawar constitutes the earliest attempt in this country to reconstruct the physico-chemical environment of mineralization. It was demonstrated that, contrary to the prevailing notion, metal-zoning in ore bodies is no simple function of temperature alone. Another intriguing problem during the fifties was: How does the ore-forming fluid perform the seemingly impossible task of holding both metal ions and sulphide ions together, avoiding precipitation? Complexing of metal ions was considered as a possible answer. He furnished a vital clue by demonstrating through radioactive tracer technique that partitioning of Cd, between a solution and crystals of sphalerite (Zns) precipitating from the solution, is markedly changed when the solution is chloride-free and chloride-rich, implying thereby a significant difference in stabilities of zinc and cadmium chloride complexes.

Most ore deposits in ancient shield areas (like those in the Indian, Canadian and Scandinavian shields) have a long, billion-year post-depositional history. Post-ore geologic events like deformation metamorphism and igneous activities had left their marks on such deposits, often to blur their pristine characteristics almost beyond recognition. Surprisingly, recognition of the imprints of later events on ore deposits — unlike the case of metamorphism and deformation of common rocks — had been slow. Some of the earliest work on metamorphism of sulphide ores stands to the credit of Mookherjee. Work along these lines generated some new ideas on regional metallogeny of the Indian shield; it also involved investigations in minute details that led to the discovery of one new and several extremely rare sulphide/sulphosalt minerals from Indian deposits. The earliest attempt in this country in applying trace element geochemistry to solve problems of ore genesis was due to him with increasing sophistication of analytical and theoretical approach.

Interpretation of ore textures has always been a tricky problem. Mookherjee showed refreshingly original approach in this field by considering thermodynamic aspects and chemical mass-balance phenomenon involved in the evolution of some ore-textures. Characterization of the progressively-changing physico-chemical variables that influence hydrothermal

mineralizing systems, through thermodynamics and analytical formulation approach, was also taken up by Mookherjee.

Mookherjee was elected to the Fellowship of Indian National Science Academy and the Geological Society of India. He was a recipient of the GSI Narayanaswamy Award (1985), National Mineral Award (1987–88), the NN Chatterjee Medal of Asiatic Society (1964) and the IIT Silver Jubilee Research Award.

He passed away on 17 February 2006 after a prolonged illness. Unfortunately this information reached the Academy only recently.

Bal Krishan Anand (elected 1975) was born on 18 September 1917 in Lahore when he received his early education at the DAV High School and Government College. He was a brilliant student and recipient of various distinctions, medals, honours, and merit scholarships. After qualifying for the MBBS degree from KE Medical College in Lahore in 1940, he moved to Amritsar in 1943 as a teacher in physiology and obtained the M.D. degree of Punjab University in 1948. At the age of 32, he was appointed Professor and Head of the Department of Physiology at the Lady Hardinge Medical College in New Delhi, which became the first medical college in the country to introduce human and mammalian experiments in physiology in 1953. He held this till 1957, when the All India Institute of Medical Sciences, New Delhi chose him as the Head of its Physiology Department. He continued at AIIMS from 1957 to 1974 during when he was also its Vice Dean (1966–69) and Dean (1969–74). At AIIMS he demonstrated his dynamic leadership by helping to structure the MBBS course to three phases of three semesters, each followed by a year of internship that included three months of rural posting. This pattern was followed by other Universities in the country. In 1974 he became an Adviser of the WHO South-East Asia region and in 1975 became the Assistant Director of Health Services in WHO until September 1977 when he rejoined AIIMS as an Emeritus Professor. Concurrently he served as the Director of Sher-i-Kashmir Institute of Medical Sciences in Srinagar until 1982. In 1977 he was also appointed as Vice-Chanceller of BHU but could not take it up due to health reasons.

Anand was the first to describe the presence of a "feeding centre" (which refers to the existence of a neural substrate responsible for regulating food intake) and "satiety centre" in the hypothalamic region of brain in 1951. Later he made extensive studies to establish the mechanisms involved in their regulation of feeding behaviour. He established the regulation of various visceral responses from the limbic system of brain linking emotional and aggressive behaviour with these responses, which explain certain psychosomatic disorders. He studied the hypothalamic regulation of some endocrinal responses, especially involved in reproductive behaviour. He pioneered investigations on meditative 'yogis' especially on their central nervous responses. He assisted Indian Defence Services in working out adaptation and acclimatization to high altitude.

Besides his research, Anand was credited with several other contributions. He established the Association of Physiologists and Pharmacologists of India and the *Journal of Physiology* and *Pharmacology*, that is considered one of best medical journals in the country. He received several awards (ICMR Amir Chand Awards 1955 and 1962; GJ Watumull Award 1961; Shanti Swarup Bhatnagar Award 1964; *Padma Shri* 1969), and fellowships including the Indian National Science Academy, the National Academy of Medical Sciences in which he served also as President, Neurological Society of India (President) and the Indian Association for Advancement of Medical Education (President).

He passed away on 2 April 2007.

Ashesh Prosad Mitra (elected 1974) passed away on 3 September 2007 after a month's illness. Only a few months earlier, his eightieth birthday had been celebrated at NPL, the institution with which his name had been inseparably associated for the last half a century.

Mitra was born on 21 February 1927 in Calcutta where he received his early education. He obtained his Masters

degree in physics in 1948 securing a first-class-first from Calcutta University from where he also obtained his D.Phil in 1955. After a brief stint as a Colombo Plan Fellow at the CSIRO Division of Radiophysics (1951) and a visiting professorship at the Pennsylvania State University (1952–54) he joined the National Physical Laboratory in 1954 as a scientist heading the Radio Science Division. He continued at NPL for 32 long years and finally became its Director from 1982 to 1986. In 1986 he was appointed the Director General of CSIR for a 5-year term. After retiring from CSIR he rejoined NPL as a Bhatnagar Fellow. In 1996, he was appointed the Director of the South Asia Regional Research Centre in Delhi.

Mitra's contributions cover atmospheric environment, radio communication, ionospheric physics, atmospheric chemistry and space research. His pioneering work on the use of cosmic radio noise for studies of the upper atmosphere resulted in a whole series of scientific discoveries in ionosphere, solar physics and cosmic rays. He introduced new techniques of detecting solar flares including the use of cosmic radio noise, set up at NPL a radio flare system that in the sixties was one of the most extensive anywhere in the world, introduced new techniques of analysis of flare effects of the atmosphere, and in a pioneering work showed that atmospheric chemistry changes during a flare. These resulted in a comprehensive book that is only one of its kind. He developed an atmospheric model from observations of satellite drag and initiated new D region rocket experiments. Mitra's work on ion and neutral chemistry in the upper atmosphere, and especially on the minor constituent nitric oxide, provided the basis for much of our present knowledge of the lower ionosphere. At NPL he introduced a method of ionospheric prediction that has been the base of radio forecasts for HF and MF communication systems. He set up in early 1970 a school on tropospheric monitoring and propagation systems and on microwave radiometry and established an International Spacewan System and International Ursigramme and World Day Service. In late seventies his group introduced for the first time in this part of the world an acoustic radar (SODAR) and carried out work on atmospheric ducting, pollution and instability.

Mitra's contributions to atmospheric science started with the International Geophysical Year (IGY). He was the driving force behind the Indian programme of IGY in 1957–58; the International Quiet Sun Year (IQSY) 1964–1965; the Middle Atmosphere; IGBP; LGAS (Asian Low Cost Greenhouse Gas Strategies) 1997–1998; INDOEX (Indian Ocean Experiment) 1998–1999; the methane campaign in India 1991 and the methane Asia campaign 1998.

The areas in which Mitra made outstanding contributions in global and climate change and atmospheric chemistry include (a) the first effort to examine global change signals over the entire atmospheric environment from surface to 1000 km ; (b) the pioneering and path-breaking measurements of methane emission from paddy fields, and (c) the INDOEX programme. His initiatives made an impact on the global discussions about the responsibility of various countries with regard to greenhouse gas inventories, current emissions and likely future scenarios.

In a monograph brought out in 1992, Mitra discussed for the first time the question of effects of human activities over the entire atmospheric environment extending from the surface to 1000 km. This was at that time the only work of its kind covering not only the troposphere and the stratosphere but also the middle and upper atmosphere and the ionosphere. Reference ozone atmosphere over India as well as reference profiles of minor constituents (surface to 100 km) were formulated. A totally new perspective was the recognition of the role that ions play even at stratospheric and tropospheric levels. Human activities included not only the use of fossil fuels in landuse and land cover change (resulting in GHG emissions) but also the use of highpower radiowave heating and spacecraft effluents. This approach of considering the total atmospheric environment, after a lull of some two decades, led to vigorous international efforts on changes in middle and upper atmosphere.

In the eighties Mitra led a very extensive middle atmosphere programme in India as part of the international programme. A major aim was to evolve a first-order reference middle atmosphere over India. This was achieved through the use of over hundred rocket experiments and establishment of new facilities (such as the laser heterodyning facility at Delhi). On minor constituents, measurements of ozone were the most comprehensive providing several key results: low ozone content at equational regions and anomalies associated with passing weather disturbances.

A campaign initiated in 1991 and later continued as part of the ALGAS (Asian Lowcost Greenhouse Gas Strategy) programme and MAC-98 (Methane Asia Campaign, 1998/1999 in which he was the leader) led to a downward revision of the estimate of methane flux (from India and globally) and led to the formulation of the revised IPCC methodology of 1996. This emission in India was found to be in nearly 1/10th of the early US-EPA estimates. This work led to new global efforts, including those in several countries in Asia (such as China, Vietnam, Thailand, and Indonesia.

A major international event which substantially modified the perspective of climate change at regional and sub-regional levels was the INDOEX (Indian Ocean Experiment) campaign of 1999 in which Mitra led the Indian scientific team. INDOEX was an international programme involving several hundred scientists from the USA, Europe, India and the island countries of Maldives, Mauritius and Reunion. The experiments revealed the existence of an extensive brownish layer of pollutants and particles resulting from biomass burning and fossil fuel use. This has been followed up as an UNEP Assessment Report on "The South Asian Brown Cloud: Climate and other Environmental Aspects " by an International Panel chaired by Mitra.. A major consequence has been the recognition that greenhouse gas warming, urban pollution and atmospheric ozone are all inter-related problems. There are serious impacts of such clouds on hydrological cycle, on health and on agriculture.

Spanning over five decades Mitra's activities covered different components of the atmospheric environment at different times, but all orchestrating to provide a picture of the changing atmosphere over India.

Among the large number of recognitions that he received includes: Fellowships of the Royal Society (1988) and the three national Science Academies as well as the Third World Academy; Padma Bhushan (1989), Shanti Swarup Bhatnagar Fellowship (1991–1996) and Award (1968), C V Raman Award (1982), S. K. Mitra Centenary Medal (1995) and Vasvik Award (2002). He was elected President of the International Union of Radio Sciences (1984–87).

He is survived by his wife Sunanda and two daughters.

Birendra Singh Chauhan

(elected 1952) was born on 2 May 1915 at Hoshangabad in Madhya Pradesh. After obtaining his B.Sc in 1937 and M.Sc in 1939, he joined the Indian Council of Agricultural Research to work in one of their schemes to work out the parasitic (helminth) infestors and infestations particularly of domestic pets. Simultaneously he worked for his Ph.D and secured the degree from Nagpur University in 1944. In 1945 he joined the Zoological Survey of India (ZSI) as a superindent zoologist and was placed in charge of the General Invertebrate Division covering the animal groups of Protozoa Porifera, Coecenterate, Platyhelminthes, Nemathelminthes, Armelida, Echinodermata, Protochordata etc.

In 1956 he also obtained a DSc degree from the Nagpur University. Chauhan published over 80 original research papers in helminthology and systematic and general zoology, many of which are of monographic nature. Subjects of his special interest have been parasitology (general helminthology), medical and veterinary with special reference to trematodes, cestodes, nematodes, Acanthocephala, Temnocephala, fish parasites and diseases, fisheries, systematic zoology, morphology, zoo-geography, wild life fauna, conservation of natural resources, ecology and enviromnental studies and pollution. He was the first in the country to study *Monogenetic* trematode parasites of Indian marine fishes from the Bombay coast. The guidelines laid down by him have revolutionized research on Human Schistosomiasis in India resulting in his discovery of a new molluscan intermediate host *Feressia tunis* of the human blood fluke *Schistosoma haematobium.* Similarly he made a singular contribution by discovering a new intermediate mite host *Schelerobates chauhani* named after him.

In 1968 he became the Director of the Zoological Survey of India and in 1973 was appointed the Vice-Chancellor of the University of Saugar.

Chauhan was awarded the Dorabji Tata Gold Medal, and the GD Bhalerao Memorial Gold Medal for his contributions to Indian Zoology and helminthology. A festschrift publication in his honour was brought out by the Zoological Survey of India. He served as Editor of

journals published by ZSI and Helminthological Society of India, the two societies which he had the honour of acting as the President.

Chauhan passed away in Narsinghpur (MP) on 4 February last year but the information became known to the Academy only recently.

India has a rich tradition in astronomy and mathematics which goes back to the period of the Vedas. **Krishna Damodar Abhyankar** got attracted by the stars in his childhood when his father Damodar Keshav Abhyankar pointed out to him the *Saptarishis* (the Great Bear), *Dhruva* (the Polaris) and the 27 *Nakshatras* (lunar mansions) which have been in use in India for thousands of years since Vedic times. He later said, "It is these *Nakshatras* and not the right ascensions of stars which still help me to orient myself in the sky".

Abhyankar (elected 1974) was born on 21 June 1928 in Indore in Madhya Pradesh. He was always an outstanding student. He received gold medals for securing the first rank in both high school and intermediate examinations. He received his M.Sc. degree in physics from Agra University in 1951. He then worked for a short while at Holkar College, Indore as a Junior Lecturer. He was greatly interested in research and got the opportunity to work at the Kodaikanal Observatory during 1952–1954. During this period he worked on the problems of the Sun and studied basic astrophysics. He determined the difference between the Sun's temperature at the pole and at the equator using Wooley's method of Ca ionization. He also determined the excitation temperatures of sunspots for Fe 1 and Cr 1 by a curve of growth procedure.

Abhyankar then got a scholarship at the University of California in Berkeley to do his Ph.D. degree. His thesis was on "A study of some close binary systems" in which he studied some close binary stars to understand stellar evolution. He discovered a short period variable AD CMi. He was awarded the Ph.D. degree in astronomy in 1959. He spent another year at Berkeley as a Junior Astronomer and worked on the problem of the stability of the straight line solutions in the restricted 3-body problem.

On his return from USA, he rejoined the Kodaikanal Observatory before taking up the position of Reader at Osmania University in 1960. In Osmania he introduced teaching of astronomy at both B.Sc. and M.Sc. levels. He also spent considerable time and effort in installing a new 48-inch telescope, which was then the largest in India.

Abhyankar then spent a year 1963–1964 at David Dunlop Observatory, Toronto, Canada as a post-doctoral fellow where he carried out theoretical work on the Schuster problem for moving stellar atmospheres. He was made a full Professor in Astronomy in Osmania on his return from Canada in 1964, a post which he held with distinction until his retirement in 1988. Abhyankar also worked at the NASA Jet Propulsion Laboratory in Pasadena, USA from 1967 to 1970 when he wrote a series of papers (in collaboration with A. Fymat) on the theory of scattering in inhomogeneous and imperfect Rayleigh scattering atmospheres. The technique was later used in the study of planetary atmospheres.

Abhyankar worked largely on stellar atmospheres and binary stars. His theoretical work on stellar atmospheres has been widely published and well recognized. His work in binary stars was also of a high standard and inspired many others to adopt this line of research. Abhyankar was a good observational astronomer and theoretical astrophysicist. He published over 150 research papers and numerous popular articles. The following are his important contributions: (a) photometric, spectroscopic, spectrophotometric and period studies of about three dozen eclipsing and variable stars with a view to determine their orbital parameters, absolute dimensions and evolutionary status; (b) solved several problems in radiative transfer in moving inhomogeneous and imperfectly scattering semi-infinite and finite atmospheres; (c) calculated the intensity and polarization line profiles in planetary and terrestrial atmospheres; (d) made MK morphological study of Am stars which led to the discovery of a transitional class between Ap and Am stars as well as classification of the Am stars into subgroups; (e) developed a method of using the Fourier transform spectroscopic method for determining the Stokes parameters of polarization as a function of wavelength in the optical region.

Abhyankar wrote 4 books *Astrophysics — Stars and Galaxies* (1922) and *Astrophysics of the solar system* (1999). The third book on *Pre-Siddhantic Indian Astronomy* was released after he passed away. The

fourth on *An overview of basic theoretical physics* written in collaboration with A.W. Joshi is under publication.

Teaching of astronomy was dear to Abhyankar. His lucid exposition made his lectures interesting. He always emphasized on broadbased training in all branches of astronomy instead of concentrating on one or two topics that are of interest to the teachers. He also tried to stimulate interest in the field of ancient Indian astronomy among active astronomers in India. He was the national representative of India to IAU Commission on Teaching of Astronomy for many years. He emphasized that astronomy should be taught in schools and colleges. He gave talks on All-India Radio and wrote popular articles in Marathi.

After retirement, he worked as UGC Emeritus Professor from 1989–1991. During 1995–1998 he worked on the INSA project: "New light on *Pre-Siddhantic* astronomy". Abhyankar initiated the formation of Astronomical Society of India and served as its Secretary, Treasurer and President (1980-1982). He was a member of the International Astronomical Union, Royal Astronomical Society, and Astronomical Society of the Pacific, and a Fellow of the Indian National Science Academy. He was founder member of Andhra Pradesh Academy of Sciences and Maharashtra Academy of Sciences. He also served as the Chairman of the Advisory Committee of the Positional Astronomy Centre in Kolkata.

He received the Best Teacher Award from the Andhra Pradesh Government; NSSA Award for patent rights on a new technique of measuring optical polarization; INSA Vainu Bappu Award, and the M.P. Birla Award.

He developed kidney problems after a knee operation and passed away in Hyderabad on 8 November 2007.

Shyam Lal Yadava (elected 1999) was born on 5 July 1953 at Ghanshyampur, Uttar Pradesh to Tahalal Yadava and Lakhani. During his early days in middle/high school he was more interested in wrestling than in studies! He was a regular trainee in his village Akhara (wrestling camp). He suffered a fracture in his left leg due to a fall from a tree. As a result he could not pursue his primary interest for a long time. During this period he started taking interest in his studies and never looked back. He completed his BSc in 1974 from Gorakhpur University. He then joined the Banaras Hindu University (BHU) and completed his MSc in mathematics in 1977 with record marks. In BHU he worked for his PhD in differential geometry. He completed his doctoral work in two years and in 1979 joined the TIFR Centre in Bangalore as a participant of the joint IISc–TIFR programme in Appications of Mathematics. After completing this programme successfully he became a staff member of TIFR in 1981. From 1981 to 2007 he served in TIFR at various positions: Research Assistant: 1981–1987; Research Associate: 1987–1990; Fellow: 1990–1992; Reader: 1992–1997; Associate Professor: 1997–2000; and Professor from 2000. He also held several visiting positions across the globe.

He initially took interest in stochastic processes and did some work in stochastic calculus in locally convex spaces. After a brief stay in the world of stochastic processes, his research interest shifted to partial differential equations (PDE) in which he made outstanding contributions to the theory becoming an international expert. His major contributions were in the area of semilinear elliptic equations in a bounded domain. These equations have tremendous applications in diverse areas such as differential geometry, mathematical biology, astrophysics, etc. At the same time they are also challenging from a mathematical point of view and attracted the attention of leading mathematicians. He, along with his collaborators, proved existence/non-existence and uniqueness results for these equations satisfying critical growth conditions on the nonlinearity with various types of boundary conditions. In this context he obtained relevant connection between the concentration points of minimal energy solutions and the critical points of the mean curvature of the boundary of the domain. He solved a well-known conjecture in this area. This body of work earned him a name as one of the leading researchers in this area. In recognition of his landmark contributions he was elected Fellow of the Indian Academy of Sciences in 1999 and the Indian National Science Academy in 2002.

Yadava was Convener of the TIFR Centre during 1999–2001 when he introduced several novel initiatives. To promote training and development of mathematics in India he organized several workshops/symposia for research students and teachers.

Yadava was a strong person both physically and mentally. He was expert in Yoga. He used to demonstrate very difficult yogic exercises with relative ease. His enthusiasm for sports and other activities was indeed contagious.

In 2001 Yadava fell ill and succumbed to his prolonged illness on 7 June 2007. His wife, Krishnavati, pre-deceased him in 2004. He is survived by a son.

Thekkepat Ramakrishnan (elected 1974) passed away on 15 February 2008 in Bangalore. He was suffering from Parkinson's disease for the past few years and the syndrome reached an advanced state before his demise, although the cause of his death was pneumonia. In his demise, the country has lost an excellent scientist with great vision.

Born in Bangalore on 14 March 1922, Ramakrishnan was the son of late K Karunakaran Nair, a Professor of Zoology and Principal of the prestigious Maharaja's College at Ernakulam in Kerala. Brought up by the strict disciplinarian father (he lost his mother at an young age), he was an extremely studious and disciplined individual. He obtained his BA degree in 1943 from the Maharaja's College in Kerala (then affiliated to Madras University), securing distinction in all three parts (English, Sanskrit and the subjects). His M.Sc in 1950 was from Madras University by carrying out research at the Department of Biochemistry, Indian Institute of Science. He pursued his doctoral research at the University of British Columbia in Vancouver obtaining a Commonwealth Fellowship and a Ph.D in biochemistry in 1955.

Returning to India he joined as a Lecturer in the erstwhile Pharmacology Laboratory (presently the Microbiology and Cell Biology Department) at Indian Institute of Science (IISc) Bangalore in 1957, following a one-year stint as an INSA post doctoral fellow. TR, as affectionately referred to by his associates and colleagues, started the pioneering work on *Mycobacterium tuberculosis*, the causative organism for TB. By far, his largest scientific contributions have been on the metabolism and molecular biology of *M. tuberculosis*, for which he was internationally recognized. In the initial years, his research group explored the major metabolic differences between the virulent and avirulent strains of *M. tuberculosis*. His major contention was that the failure of avirulent strains to cause infection in the host should correlate to the metabolic differences between them. The operations of all the metabolic pathways involved in the breakdown of carbohydrates were documented in Mycobacteria by his team and several of the enzymes in these pathways were purified and characterized. The enzyme isocitrate lyase, which provides a link between the carbohydrate and lipid metabolism from Mycobacteria, was first reported by his group, and this enzyme found an important place as a potential drug target. TR's research group worked on other metabolic pathways including purine and pyrimidine biosynthesis, amino acid biosynthesis and catabolism, nucleic acid and protein synthesis in Mycobacteria. All these analyses were from the point of view of understanding the mechanisms of action of known antitubercular drugs as well as for identifying potential targets for drug action and the development of drug resistance by the bacterium.

A particularly notable contribution from TR's group was the isolation of a transducing mycobacteriaphage, the first ever reported transducing phage for Mycobacteria. This discovery opened up the possibilities of carrying out genetic analysis of Mycobacteria, which was till then considered to be nonamenable to genetic studies. This phage was subsequently exploited by his other associates to understand the unique susceptibility of Mycobacteria to the potent drug Isoniazid.

TR was a great academician and a visionary way ahead of his times. He was the first to initiate molecular biology research at IISc notwithstanding the opposition posed by conventionalists. He also introduced a formal teaching and training programme in microbial genetics and molecular biology at IISc. Towards this goal, he organized two international laboratory workshops in the emerging areas of molecular genetics with support from UNESCO and invited some of the most leading

international scientists in that area to conduct the workshop.

TR was courageous to start research activities on the tubercle bacillus at a time when it was not considered a fashionable area and the containment facilities for working with pathogenic organisms at best were primitive. He had realized the importance of tuberculosis as a public health problem in this country. In fact, when the Centre for Genetic Engineering was established at IISc in the 1980s, it was agreed that a thrust area of research at this centre would be on Mycobacteria, making use of the more powerful experimental tools that became available through the advances in recombinant DNA research.

Ramakrishnan also initiated for the first time at IISc an animal tissue culture laboratory for carrying out research on animal viruses. The initial studies were on rinderpest virus, an important pathogen of veterinary significance in India, and *Rous sarcoma* virus, as an experimental model system. TR also brought the Rotavirus system to the department after a brief sabbatic stint in Australia. This activity served as the core for nucleating the molecular virology programme at IISc. Around the same time he also set up a plant tissue culture facility in association with C S Vaidyanathan, which also became a major area of research in the department in subsequent years.

Ramakrishnan was a strict disciplinarian, which he enforced on his students and associates, and pursued his own activities in a disciplined manner. He was highly academic and studied scientific literature with passion. He guided over 20 students for their Ph.D degree before officially retiring from the department in 1982. He received international grants from the Nuffield Foundation, Watumull Foundation and Rockefeller Foundation with which he equipped the department and extended the facilities to all other colleagues. He published nearly 100 research papers during his career. He was a fellow of the Indian National Science Academy, New Delhi and was the recipient of the Watumull award in microbiology (1966), the FIE Foundation award (1982) and the Ranbaxy award (1985).

Ramakrislman's wife Devi passed away in November 2007 due to cancer. He is survived by two sons and a daughter.

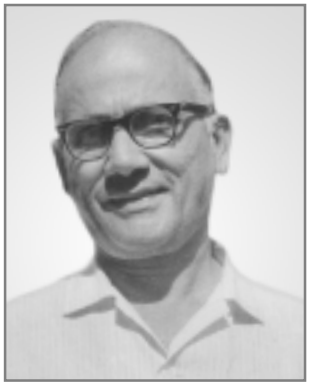
Sipra Guha-Muherjee (elected 1988), a widely respected member of the plant biology community, died rather suddenly on 15 September 2007 on account of cancer of the brain. She was born in Calcutta on 13 July 1938 and did her bachelors and masters in science from Delhi University in 1957 and 1959 respectively. She obtained her Ph.D in 1963, also from Delhi. Her research career as a post-doctoral fellow started in 1963 at the Delhi University. Between 1966 and 1968, she joined as a research associate in the Michigan State University and worked on isozyme patterns in peroxidases. Returning to India in 1968, she joined IARI as a Pool Officer (1968–69) where she worked on the production of haploids in rice and observed the genotypic differences in response to culture of haploids. In 1970 she joined as a faculty at the West Virginia University where she mainly worked on production of mutants developing a new replica plating technique for isolation of mutants. Returning to India, she joined the Jawaharlal Nehru University (JNU) at New Delhi initiating the work on plant tissue and protoplast culture and starting work on regulation of enzyme synthesis in higher plants. At JNU, she started as an Assistant Professor (1970–72), was promoted as Associate Professor (1972–79) becoming a full professor in 1979.

Guha-Mukherjee worked on the physiology and biochemistry of cultured cells mainly on the biochemistry of cell division and regeneration in tissue culture. With her colleagues she reported the presence of an enzyme glyoxalase-1 in plants for the first time. This enzyme was found to control cell division in *Datura* callus. She also worked on various aspects of protoplast culture, fusion of protoplasts and carrying on mutation experiments in cultured cells. She also did research to understand the biochemistry and differentiation of plant cells in tissue culture. Working on the lipids of the plasma membrane which is related to regeneration she found a correlation between phosphotidyl inositol content and regeneration of cells in culture. These studies helped in understanding and controlling regeneration of cells and protoplasts, a major problem in genetic engineering.

Her work on the production of haploids in tissue culture had an impact on genetics and agriculture throughout the world and the technique was successfully adopted for plant breeding purposes in many countries. She worked not only on the technique of production of haploids but also on the constraints and genotypic differences which impede regeneration. Her work on biochemistry of regeneration of protoplasts and plant cells also received great attention as this can ultimately provide an insight as to why all cells do not regenerate in culture. Her work is of great importance in national development since the success of genetic engineering of plants depends on successful regeneration of engineered cells, and the haploid will provide the important system for genetic manipulation of economic plants.

Sipra's work is cited in almost every book of plant tissue culture. She received many honours and awards. She received the Om Prakash Bhasin award in biotechnology, and the Kanishka award of the Lions Club. She served on several committees and governing councils of various institutions. Specially noteworthy are her contributions as member of the Task Force and Scientific Advisory Committees and University Grants Commission.

Sipra is survived by her husband N. P. Mukherjee and twin daughters.



Manakkal Ganesa Varadarajan (elected 1974) was born in Pudukottah in Madras on 9 November 1917 to M Ganesa Ayyar and Mangalammal. He obtained his MBBS in 1944 MD in 1947 and a Diploma in Medical Radiology in 1948 from the Madras University. He then underwent special training in various hospitals in England under the Colombo Plan. He began his professional career in 1944 as a venereologist at the Military General Hospital in Madras and then joined the Madras Medical College Department of Radiology, first as a Radiologist (1947–61), Tutor (1961–64), Lecturer (1964–67) finally becoming Professor of Radiology and Director-in-charge, before retiring in 1973. After formal retirement he joined as an Emeritus Professor of Radiology at UGC in 1973 and in 1981 went back to Madras as the Neuro-Radiologist-in-chief at the Madras Neurological Research Institute.

Varadarajan did original and useful research work in soft tissue radiography in localization of placenta. His research also included myodil ventriculography, soft-tissue placentography in pregnant women, percutaneous transhepatic cholangiography in cases of jaundice and thyroid lymphography in thyroid gland disorders. His studies on the physiological intracranical calcification in Indian subjects have also been critically acclaimed. He has also done original research on X-ray of optic foraminal in optic atrophy. He published over 140 research articles in radiology journals in India and abroad and read a number of papers at conferences in India. He also wrote a monograph on cranial and intercranial epidermoids.

Although he passed away more than 3 years ago on 5 October 2004, this information reached the Academy only recently.

Jacob Chandy (elected 1961) was born on 23 January 1910 in Kottayam in Kerala. After his graduation in 1931, he secured his MBBS from the Madras Medical College in 1936. In 1939 he had a stint of practice at the American Mission Hospital in Bahrain. At the height of the second world war in 1944, he left India in a troop ship going to the Trans Pacific infested with torpedos and landed at the west coast of America for training in neurosurgery at the Montreal Neurological Institute under Wilder Penfield. He also worked as a chief resident in neurosurgery at the University of Chicago in 1948. Returning to India in 1949 he started the Department of Neurological Sciences at the CMC Hospital in Vellore, then the first department of its kind in India. It attracted talents countrywide blooming into a premier centre of training and teaching in neurosciences where postgraduate training in neurology, neurosurgery and allied sciences started in 1960s. A pioneer of neurosurgery in India, Chandy published several outstanding papers on the nature and prevalence of neurological conditions.

Chandy was the founder president of Neurological Society of India which has given roots to subspeciality societies for neurotrauma, paediatric neurosurgery, as well as the Society of Cerebrovascular Surgery and Stereotoxic and Functional Neurosurgery.

His academic pursuits attracted worldwide attention. He was honoured by the American College of Surgeons, W.H.O and the World Council of Churches. In 1989 the World Federation of Neurosurgical Societies felicitated him by bestowing the medal of honour. The Government of India honoured him with *Padma Bhushan*.

After retirement he became an Emeritus Professor of Neurosurgery at the Kerala Medical College and pursued teaching programmes. Jacob Chandy was elected to the Academy in 1961 and served in its Council from 1962 to 1970. In 1971, unable to continue paying the fellowship after retirement, he withdrew from the fellowship of the Academy. In 1981, the Council of the Academy reinstated his fellowship making him a life member without payment of any dues.

He passed away on 23 June 2007, leaving behind two sons and a daughter.

Archana Sharma, (elected 1977), a leading cytogeneticist and cytotoxicologist, passed away in sleep on 14 January 2008. Archana was born on 16 February 1932 in Pune in the family of academicians (her father and grandfather were Professors) and had early education in Rajasthan. After completing B.Sc. from Bikaner, she joined for higher studies at the Botany Department of the University of Calcutta and obtained M.Sc. (1951), Ph.D. (1955) and D.Sc.(1960). She had a brilliant academic career throughout and was only the second lady to have secured D.Sc. degree from the University. Archana joined the faculty of the University of Calcutta in 1967 and became Professor of Genetics in 1972 and the Head of the Department of Botany in 1980.

A passionate teacher and a dedicated researcher, Archana developed newer staining and pre-treatment techniques for studying chromosome structure that are now used throughout the world. One of her landmark findings published in a series of high quality publications including *Nature* is the elucidation of a new concept of speciation and fixity of chromosome number in obligatory vegetatively reproducing plants. Based on exhaustive analyses of somatic chromosome behaviour on a large array of monocot taxa she deducted evidences for regular occurrence of inconsistency in chromosome complement and participation of genetically balanced but chromosomally variant cell into new daughter shoot that gives way to new genotype/cytotype/cryptic species in vegetatively reproducing plants in the absence of sexual mechanisms of variation. Her other studies relate to induction of division in adult nuclei and cause of polyteny in differentiated tissue in plants; cytotaxonomic investigation on flowering plants; assessment of chromosomal and genetical polymorphism in normal human populations in eastern India and their comparison with pathological conditions; differentiated patterns in human fibroblasts in relation to polyteny as a factor in aging; genetic polymorphism in relation to environmental agents on living systems; clastogenic and mutagenic effects of various pesticides and metals on multiple test systems; assessment of genotoxic and clastogenic activity of environmental agents in subtoxic doses in exposed populations in relation to different modifying factors like diet, genetic predisposition, drug, etc; and use of dietary factors and plant products in modulating the cytotoxicity of known pollutants–metals and pesticides.

A rare combination of brain, beauty and affection, she trained a large band of researchers in cytogenetics, human genetics, and environmental mutagenesis; supervised the Ph.D work of over 50 students and published over 300 research and review papers, written eight books including *Chromosome techniques — Theory and practice* published in three editions. *Manual of chromosomes* (1944), *Plant chromosomes — Analysis, manipulation and engineering* (1999), *The chromosomes* (1976, 1985, 1991) and *Handbook of clinical genetics* (1979); *Chromosome painting* (2001); *Plant genome — Biodiversity and evolution* (Vols 1–7 2003–2008).

For her scientific contributions she was recognized by several learned and professional societies and was elected to all the three Science Academies of India. She was also elected President of the Indian Botanical

Society (1989); the Biological Section of the National Academy of Sciences (India); and the Indian Science Congress Association (1986–1987). She was awarded the Shanti Swarup Bhatnagar Prize (1976); the J.C. Bose Award (1974) and as UGC National Lecturer (1980), FICCI Award (1983); Birbal Sahni Medal (1984) by the Indian Botanical Society; Platinum Jubilee Lecture (1989) and the Ashutosh Mukherji Medal (1999) of the Indian Science Congress Association, and India's civilian honour *Padma Bhushan* (1984).

She is survived by her husband Arun Kumar Sharma, himself a distinguished cytogeneticist and her collegue in the University of Calcutta.

Pramod Karan Sethi (elected 1989) was born on 28 November 1927 in Varanasi. He did his MBBS from Sarojini Naidu Medical College in 1949 with an honors in surgery and six other subjects, and in 1952 passed his MS in general surgery from the same institution. In 1954 he became a Fellow of the Royal College of Surgeons. On his return to India, Sethi obtained the position of Lecturer in Surgery at the SMS Medical College and Hospital at Jaipur, and rose to become its Professor and head of Department of Orthopaedics, and Director of the Rehabilitation Research Centre, which position he held till his superannuation in 1982.

Sethi not only acquired an outstanding reputation as a teacher in orthopaedic surgery and made Jaipur as one of the major teaching and research centres in this speciality in India but his contribution towards the welfare of the physically handicapped has been remarkable. The lot of amputees and paralytics from polio and leprosy is especially cruel among rural poor in the developing world where substitutes for missing or withered limbs and for alternative means of livelihood are few. Witness to this condition is the prevalence of crippled beggars. Amputation of a foot or leg frequently follows accidents with cars, trains and in factories. Also amputations to halt gangrene result from poisonous snakebites - a hazard of barefooted farmers. Elaborate artificial limbs developed in industrialized countries did not fit the needs of rural Indian amputees. The prostheses were too expensive, difficult to get and required shoes. Also they were frequently discarded because users could not sit crosslegged, squat or walk on uneven ground.

While investigating each of the foreign designs of artificial feet and legs, Sethi's group began to improvise an artificial foot that would respond more like a real one. A breakthrough came when a craftsman using age-old sandcasting methods, produced a die for a natural appearing foot with a separate big toe, which could readily be cast in any size. When large manufacturers refused to try, small Jaipur entrepreneurs who retread truck tyres used their scarp to vulcanize and shape differing hardnesses of rubber poured into the die and holding the iron shank reaching up to the leg stump. Eventually the firm-gripping, adaptable "Jaipur foot" was even made in light, medium or dark brown. Life-like legs were made by villagers while amputees watched. For polio patients inexpensive, lighter calipers also were fabricated quickly by skilled but unlettered local artisans who are proud to be socially useful.

Although all relatively cheap, the new devices were still beyond the means of penniless cripples who began desperately making their way to Jaipur as the word spread. Then in 1975 the Mahaveer Society for Physically Handicapped offered to Sethi, monies raised during a large Jain religious festival. Endowment funds were established so that each gift of Rs.2,500 earns annually enough interest to buy an artificial limb plus help on a railway ticket for those with a long journey home. The number thus assisted each year considerably grew over the years.

While trying to demystify the medical profession, Sethi and his associates continued to devise better artificial lower limbs; patients already can again farm and climb trees. In the Rehabilitation Research Centre in the hospital servants quarters amputees join in literacy classes while learning together to walk with fitted limbs and find new comradeship. When a formerly legless man bicycles off to his village, he is a new man with an opportunity to become a productive participant in his community.

Sethi's work has shown that it is not the technical virtuosity of its design features which is exciting.

Better designs could overrun it. It is valued because it represents the first major departure in our thought processes and our value system. Instead of looking to the West for our inspiration, it has enabled us to look to our poor peasant for approval. It has taught us to tap creativity, innovation and participation from our humble and under-rated but highly skilled craftsmen. We realize that education should not be confused with institutional learning and that creativity is not a prerogative of the elite. The lack of financial resources is not always an obstacle to useful work and the response of the community can be startling once they realize that their work is meaningful and relevant to their needs.

Sethi received numerous honours and awards. A few of them are Padma Shri (1981), Ramon Magsaysay Award (1981), Guinness Award for Scientific Achievement (1982), RD Birla Award for outstanding Medical Research (1983), Knud Jansen Medal and Oration of World Congress in Prosthetics and Orthotics (1989), BC Roy National Award as Eminent Medical Man (1989).

He passed away on 6 January 2008 leaving behind his wife Sulochana, three daughters and a son.

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