

Newsletter of the Indian Academy of Sciences

2004 Mid-Year Meeting

The 15th Mid-Year Meeting of the Academy was held at the Indian Institute of Science, Bangalore on July 2 and 3, 2004. The programme included two special lectures, a public lecture and seventeen presentations by recently elected Fellows and Associates.

This time as many as 45 university and college teachers – more from places as far apart as Amritsar, Gorakhpur, Imphal, Jammu and Silchar – attended the meeting as guests of the Academy, along with over 200 Fellows and Associates from across the country.



Invited teachers at
2004 mid-year meeting

Samir Bhattacharya (IICB, Kolkata) gave a special lecture on the work of his group on “Insulin signalling defects and diabetes type-2”. This form of diabetes has been declared by the WHO as an epidemic disease, accounting for 90–95% of all diabetics. In this form, the insulin level is normal or higher, but its action on target cells is decreased because of a defect in the signal transduction pathway. The work at IICB has led to a molecule derived from a plant which causes significant increase in insulin activity, which may help to ameliorate this form of the disease.

The second special lecture titled “Why the difference in climates of India and Arabia? An oceanographer’s perspective” was given by Satish R. Shetye of the NIO, Goa. Most of the rainfall during the Indian summer monsoon derives from the Bay of Bengal, much less from the Arabian Sea. Monsoon-related cyclonic storms too are generally found along the eastern coast of India, and Bangladesh. As the speaker brought out, the Bay is able to give rise to low pressure systems

Inside...

1. 2004 Mid-Year Meeting	1
2. Varanasi Annual Meeting	3
3. Associates – 2004	3
4. Special issues of journals	4
5. Public Lectures	6
6. Discussion Meeting	6
7. Summer Fellowships	6
8. Obituaries	7

EDITOR

N. Mukunda

Published by

Indian Academy of Sciences
Bangalore 560 080, India
Phone: (080) 2361 2546, 2361 4592
email: office@ias.ernet.in

This newsletter is available on the
Academy website at : www.ias.ac.in/patrika/

*To receive a regular copy of the
Newsletter, please write to the
Executive Secretary of the Academy*

Forthcoming Events- 2004/05

Annual Meeting

70th Annual Meeting, Banaras Hindu
University, Varanasi
25–27 November 2004
(see tentative programme on p.3)

Refresher Courses

Experimental Physics
Bhavnagar University
25 October – 7 November 2004

Experimental Physics
University of Mysore, Manasagangotri
1–15 November 2004

Plant Genetic Engineering
Madurai Kamaraj University
7–21 December 2004

Animal Behaviour
Madurai Kamaraj University
8-21 December 2004

Developmental Biology and Neurobiology
Bangalore, December 2004

Experimental Physics, IIT, Guwahati
May 2005

Theoretical Physics, Changanassery
Physiology and Biochemistry
Goa University

Lecture Workshops

Physics
Marthoma College, Thiruvalla
November 2004

Animal Sciences
Mangalore University, December 2004



Samir Bhattacharya



Satish R. Shetye

(LPS) leading to precipitation because its sea surface temperature manages to go above 28°C. This is a necessary condition for LPS's to form, and this does not happen over the Arabian Sea which stays relatively cool on account of the 'Findlater Jet', a strong pattern of winds. And what causes this Jet? It is the East African mountain range in Somalia. And so by this complex combination of effects, Arabia ends up with an arid climate while India is blessed with enough precipitation to support an agrarian population. Shetye concluded by suggesting that it will soon be possible to numerically simulate this entire system of wind and water in interaction, to see that the explanation sketched by him is indeed valid.

The public lecture on "Redeeming the idea of India" was delivered by the Bangalore-based writer and historian C. Ramachandra Guha. This lecture drew a large and very appreciative audience. The speaker dwelt upon the four principal figures involved in his view in the creation of modern India – Rabindranath Tagore, Mahatma



The audience at Ramachandra Guha's (inset) talk

Gandhi, Jawaharlal Nehru and BR Ambedkar — and also picked out four defining or crucial events in this context. He tried to analyse how even on insecure foundation involving large scale poverty and cultural diversity these founding fathers were able to construct a united and largely democratic India, which has endured so far in spite of many difficulties. The lecture was delivered with interest and conviction, and was followed by a very lively discussion.

Some of the other presentations at the meeting were devoted to such diverse topics as glutathione homeostasis in yeast by AK Bachhawat (IMTECH, Chandigarh), molecules-to-materials and molecules-in-materials by TP Radhakrishnan (University of

Hyderabad), dark matter as relics of the early universe — quark hadron phase transition by BC Sinha (SINP, Kolkata), eye care delivery model for developing countries by G Nageswara Rao (L.V. Prasad Eye Institute, Hyderabad), lizard reproductive strategies by Bhagyashri A. Shanbhag (Karnatak University, Dharwad), and the case history of the deadly Chandipura virus by Dhruvjayoti Chattopadhyay from the BC. Guha Centre in Kolkata.

On 1 July the day prior to the meeting, special programmes were arranged for the teacher invitees. These included general and separate subject-wise group discussions, visits to institutions in Bangalore and special lecture in mathematics.

Varanasi Annual Meeting

(25–27 November 2004)

Scientific Programme

25 November 2004

0930–1100: Inauguration and Presidential address by **T.V. Ramakrishnan**, BHU, Varanasi

1130–1300: **Lectures by Fellows/Associates**

Akhilesh Kumar Tyagi, University of Delhi, New Delhi
Genetically anchored sequence of rice genome, gene discovery and functional analysis

S. Umamathy, IISc, Bangalore
Capturing molecules in action by Raman Spectroscopy

Siddharta Gadgil, ISI, Bangalore
Symmetries of spheres

1430–1730: **Symposium**
A new look at traditional medicine (Convener: **M. S. Valiathan**)

1800–1900: **Public Lecture**

26 November 2004

0900–1000: Special Lecture
Rajaram Nityananda, NCRA, Pune
High ambitions at low frequencies: the GMRT and beyond

1030–1300: **Symposium**
Genetics and health (Conveners: **N. Appaji Rao** and **Rajiva Raman**)

1430–1530: **Lectures by Fellows/Associates**
Sudhanshu Vrat, NII, New Delhi
Japanese encephalitis vaccine: moving away from mouse brain

G. Ravindra Kumar, TIFR, Mumbai
A brief, yet intense affair with light
1615–1715: **Public Lecture**

27 November 2004

0900–1000: Special Lecture
S. C. Lakhotia, BHU, Varanasi
Non-coding DNA: junk, or a necessity for origin and evolution of biological complexity

1030–1200: **Lectures by Fellows/Associates**
B. Yegnanarayana, IIT, Chennai
Person authentication from voice: The search for new features in speech

M. V. N. Murthy, IMSc, Chennai
Fractional exclusion statistics: A generalized Pauli principle

Sreebrata Goswami, IACS, Kolkata
Carbon-nitrogen bond fusion reactions with metal mediation

Associates – 2004

Ramakrishna, S. Anantha
Indian Institute of Technology, Kanpur
Area of Interest: Nonlinear optics and quantum optics



Chakrabarti, Subhabrata
L.V. Prasad Eye Institute, Hyderabad
Molecular genetics of ocular diseases, development of molecular diagnostics



Gupta, Anjan Kumar
Indian Institute of Technology, Kanpur
Experimental condensed matter physics



Patwardhan A. W.
Univ. of Mumbai, Mumbai
Computational fluid dynamics, design of multiphase reactors



Shankar V.
Indian Institute of Technology, Kanpur
Stability of fluid flows, rheology of complex fluids



Raghavan, N. R. Srinivasa
Indian Institute of Science, Bangalore
Decision sciences and technologies, manufacturing systems and grid computing



Special Issues of Journals

Evolutionary genetics: the *Drosophila* model

Guest Editor: Amitabh Joshi

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

Evolutionary genetics straddles the two fundamental processes of life — development (the transition from egg to adult) and reproduction (the generation of eggs from adults) — and scrutinizes, from an evolutionary perspective, the nature and consequences of the twin genomic attributes of expression and replication, respectively. Moreover, development and reproduction in the living world occur in, and are shaped by, the context of the ecology of organisms. Given this vast domain of evolutionary genetics, it is not surprising that its practitioners often work on very different issues, using varied approaches and methodologies. Historically, the early focus of evolutionary genetics was on heredity, more specifically on deducing the population-level consequences of Mendelian inheritance within families. The descendent lineages of these early studies in population and quantitative genetics can be categorized, for heuristic purposes, as efforts to understand the consequences of natural selection, and these lineages constitute a major ‘tribe’ within evolutionary genetics. These lines of investigation address the broad issue of how the distribution of genotypes in a population changes under the influence of a given fitness function acting on it. A contrast to this focus on the consequences of natural selection is provided by studies—sometimes characterized as evolutionary ecology—that attempt to understand how and why particular fitness functions are defined on the distribution of phenotypes in a population by its ecology. Studying how the interaction between phenotype and environment results in a fitness function is essentially an exercise in understanding the causes of natural selection. Connecting the causes and consequences of natural selection, or, to put it another way, extrapolating a fitness function defined on a distribution of phenotypes to the corresponding underlying distribution of genotypes, is important to a fuller understanding of the evolutionary process. Basically, making this extrapolation requires not only a detailed understanding of the genome, but also an understanding of how genomes direct the development of phenomes through their expression in a given ecological context, also referred to as understanding the genotype-to-phenotype map. Approaches addressing this issue constitute a relatively young ‘tribe’ within evolutionary genetics, and rudimentary empirical tools required to study genotype-to-phenotype mapping have only recently become available.

In the past, the domains of evolutionary genetics and evolutionary ecology were separated by a conceptual and empirical gulf owing to the paucity of information about, and understanding of, the genotype-to-phenotype map.

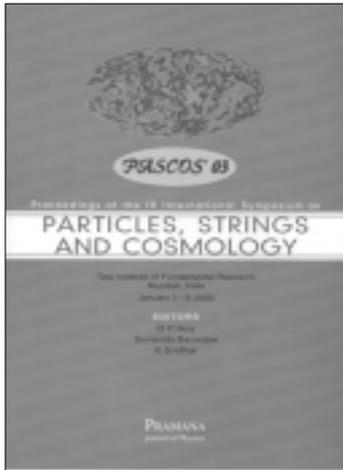
Classical quantitative genetics was, in a sense, a clever and useful way of bypassing the expression aspect of the genome (genotype-to-phenotype map) by treating it as a black box, although with time the shortcomings of this approach have become clearer. Classical developmental genetics tended to focus on the genotype-to-phenotype map for exclusively morphological traits, and has led to a greatly refined understanding of the ontogeny of form. What has been lacking is an understanding of the ontogeny of function, and through it the ontogeny of life histories in meaningful ecological contexts, an approach that has been termed developmental evolutionary biology, or devo-evo. Today, with increasing ability to empirically study the sequences and temporal patterns of expression of entire genomes, we are finally at the threshold of a ‘complete’ evolutionary genetics, encompassing both the expression and replication aspects of genomes.

Fruit flies of the genus *Drosophila* have been used extensively as model systems in experimental studies of genetics, development and evolution for almost a century. While *D. melanogaster* has reigned supreme as a laboratory system, especially for classical evolutionary and developmental genetics, other *Drosophila* species have been used extensively for more ecologically oriented evolutionary studies in the wild. Given the immense backdrop of relevant information we already possess about *Drosophila* genetics and development, together with more recently obtained information on ecology, physiology, genome sequence and gene expression patterns, it seems reasonable to assume that *Drosophila* species will continue to be major model systems for the ‘new’ evolutionary genetics that will mature in the years to come. This special issue brings together a sampling of papers—all reporting studies on some species of *Drosophila*—that span several different areas of evolutionary genetics. Some papers deal with broad and classical issues like speciation, the evolution of genetic architecture and the imprints of history, chance and adaptation on phenotypes and genotypes that were not often addressed experimentally in the past. Other papers focus on more specific problems such as quantifying the extent of genetic variation for sexual size dimorphism, genotypic and environmental effects on bilateral asymmetry and the role of a heat shock protein in hormesis. The remaining papers attempt to integrate knowledge from the laboratory with studies of adaptation in the wild, by looking at geographical distribution and genetic variation for thermal adaptation, local abundance and life-history variation, and patterns of allelic, cytogenetic and physiological variation underlying latitudinal clines in body size. The guest editor believes that this collection of papers serves to highlight several conceptually important issues in evolutionary genetics, as well as to underscore the continuing relevance of *Drosophila* species as model systems for evolutionary-genetics research in the post-genomics era.

Particles, strings and cosmology

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

One of the greatest achievements of twentieth century science is the unification of the microcosm with the macrocosm, i.e. the discovery of a close link between the world of subatomic particles and the Universe. This follows from the basic



principles of quantum mechanics and relativity — the uncertainty principle and mass energy equivalence. These principles imply that when we probe deeper into the subatomic space we come across states of higher mass and energy. These are the states which abounded the Universe in its very early history, immediately after the Big Bang, when the energy density of the Universe was very high. In the last two decades,

particle accelerator experiments have discovered the weak gauge bosons, which are the carriers of the weak nuclear force responsible for radioactive decay, and the top quark, which is the heaviest of the basic constituents of matter. These are very heavy and short-lived particles that abounded the Universe a few pico-seconds (trillionth of a second) after its creation. Recreating these particles in the laboratory is like recreating the Dinosaurs *a la* Jurassic Park but fundamentally more significant, for it helps us trace back the history of the Universe to within a few pico-seconds of its creation. Moreover one hopes to discover soon the other heavy particles predicted by the quantum field theory — i.e. the Higgs boson and the supersymmetric particles. They will help us understand the nature of the phase transition that the Universe went through during those first few pico-seconds and the nature of the invisible matter that pervades throughout the Universe today as a relic of that early history. But this is not the end of the story. One would like to retrace the history of the Universe right into the instant of the Big Bang and even beyond it, where the standard tool of quantum field theory breaks down. The recent developments in string theory offer us the first hope of addressing these issues.

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

Multi-source multi-sensor information fusion

Guest Editor: Jitendra R Raol
Sadhana, Vol. 29, No.2, April 2004, pp. 143–248

The human brain routinely carries out information processing and fusion. The objective is to collect observations from various

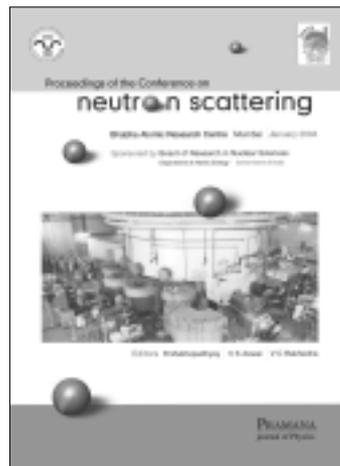
similar or dissimilar sources and sensors, extract the required information (inferences) and combine/fuse these to obtain an enhanced status and identity of a perceived object. This process is crucial for survival and growth not only of human beings but of most other living creatures and can be termed as multi-source multi-sensor information fusion (MUSSIF).

MUSSIF is rapidly finding ever-increasing applications in biomedical, industrial automation, aerospace systems and environmental engineering. This is expected to give better spatial coverage, redundancy, robustness and accuracy. The complete process of MUSSIF can involve study of several allied disciplines: signal/image processing, numerical algorithms, statistical estimation, sensor management, control and optimization, neural networks, fuzzy systems, and database management. Many principles and techniques from these fields carry over to the process of MUSSIF.

This special issue aims at consolidating some recent efforts in this area. There are six papers, which elucidate data fusion strategies and algorithms, performance evaluation, and achievable accuracy, mainly for aerospace applications.

Neutron Scattering

Guest Editors: R Mukhopadhyay, VK Aswal and VC Rakhecha
Pramana, Vol. 63, Nos. 1/2, July/August 2004, pp.1–471



A conference on neutron scattering was held at the Bhabha Atomic Research Centre, Mumbai during January 2004. The participants were from Austria, France, Germany, Japan, South Korea, Spain, Switzerland and UK. This special issue contains two articles on neutron beam research in India, 18 invited articles, and 48 contributed papers

presented at the conference.

The topics covered different aspects of structure (diffraction and SANS), dynamics (inelastic and quasielastic scattering), neutron optics and neutron interferometry, neutron activation analysis and neutron scattering techniques. The variety of materials studied being quite wide is attributable to strong collaborations within India between BARC and the university system, mediated the by Inter-University Consortium for DAE facilities. Given a sizeable neutron scattering community in India that will continue to grow, the guest editors hope that it will be beneficial to more frequently hold such conferences in India at suitable intervals.

Public Lectures

Polymer blends – mixing and de-mixing them

Julia Higgins

The Royal Society of London
16 March 2004,
Indian Institute of Science,
Bangalore



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

Discussion Meeting

Intermolecular interactions

Orange County, Coorg
30 November – 3 December 2003

The meeting held at Orange County, Coorg was attended by 20 participants from diverse disciplines such as organic, inorganic and computational chemistry, biology and biochemistry, crystallography, crystal engineering, supramolecular chemistry, and materials science. The meeting discussed the nature of hydrogen bonds and other non-covalent interactions. Weak halogen...halogen, C-H...O and van der Waals interactions, *p-p* interactions, strong O-H...O and N-H...O hydrogen bonds, and metal...ligand bonding were debated and their use in constructing meso- and nanoscale assemblies was illustrated by several speakers. Charge density analysis, electrostatic surface potential maps, database analysis and individual crystal structure examples confirm the electrostatic origin of halogen...halogen/oxygen interaction and O-H...O, C-H...O hydrogen bonds. Structural motifs, or supramolecular synthons, in small molecule and

macromolecular crystal structures were highlighted in several lectures. The same 'structural units' that mediate self-assembly in host-guest architectures and interpenetrated networks are responsible for protein folding and determining the 3D structure of peptides. Supramolecular self-assembly is controlled by the interplay, concerted stabilization and competition between intermolecular interactions covering a wide energy range: from very weak interactions of about 2–4 kcal/mol to strong hydrogen bonds of 8–15 kcal/mol to very strong hydrogen bonds and metal...ligand bonds of 30–60 kcal/mol. One of the main objectives of this meeting was to encourage discussion and scientific interaction between practitioners of hydrogen bonding in chemistry, biology and materials science, as well as research areas. This seems to have been effectively fulfilled in the scenic valley where the meeting was held.



Summer Fellowships

The summer fellowship programme of the Academy seems to have become quite popular in the country. Started on a relatively small number of just 3 fellowships awarded in 1995, the programme has grown in size both in terms of the number of applications received and the number of fellowships awarded. While many institutions have their own summer programmes, the ones conducted by the Academy and the Jawaharlal Nehru Centre in Bangalore only have an all-India character in that the selected summer fellows work in institutions around the country. The Academy programme is characterized by two other features. The applicants can indicate their preference of Academy Fellows with whom they would like to work and secondly, besides bright students, motivated teachers are also awarded fellowships to do brief projects during the summer.

The number of applications received in 2004 has exceeded 1700 from students and nearly 200 from teachers. The programme appears more popular in Tamil Nadu with nearly 35% of the applications coming from that State from

students and an almost equal number from teachers. Karnataka and Andhra are the next popular destinations. Life sciences is as usual popular as over 50% of the applicants wanted to work in this area, followed by physics, chemistry, engineering/computer sciences, and mathematics in that order.

Get-together with the 2004 Summer Research Fellows in Bangalore



The data on the number of fellowships awarded in 2004 are as follows:

	Students	Teachers
Biology	75	15
Chemistry	29	10
Physics	32	4
Engineering	11	4
Earth Sciences	8	1
Mathematics	12	3
Total	167	37

These summer fellows worked with Academy fellows at the following places:

Bangalore	77	Hyderabad	29
Kolkata	17	Mumbai	14
Pune	14	New Delhi	9
Ahmedabad	7	Chennai	6
Kanpur	6	Mysore	4
Lucknow	3	Madurai	3
Dona Paula	2	Kalpakkam	2
Varanasi	2	Aligarh	1
Bhubaneswar	1	Calicut	1
Chandigarh	1	Haryana	1
Jaipur	1	Kharagpur	1
Nainital	1	Vellore	1

OBITUARIES

Sivaramakrishna Chandrasekhar, the well-known liquid crystal physicist died on 8 March 2004 after a brief illness.

Chandrasekhar was born on 6 August 1930 in Calcutta. He received his M.Sc degree in physics with first rank from Nagpur University in 1951. He then joined the Raman Research Institute (RRI) to work for his Ph.D under the guidance of his maternal uncle, C.V. Raman. The main topic of research



was on optical rotatory dispersion measurements on several crystals. After obtaining his D.Sc degree from Nagpur University in 1954 he went to the Cavendish Laboratory as an 1851 exhibition scholar and obtained a second doctorate degree from Cambridge for his work on the corrections for extinction in neutron and X-ray scattering from crystals. His subsequent post-doctoral work in the University College and the Royal Institution in London also dealt with crystallographic problems. He returned to India in 1961 to head the Physics Department of University of Mysore which had just been started. It was here that he turned his attention to liquid crystals, a subject which at that time was just coming out of a long hibernation.

Liquid crystals made of rod-like molecules had been discovered in 1888, and many compounds had been synthesized in Halle in Germany in the 1920s and 30s. Some physical studies had been undertaken by the German and Russian schools in that era, but the subject later languished till the mid-fifties. Starting in the late fifties, the systematic synthetic effort by Gray in the UK and the physical studies by Maier in Germany (including the well-known Maier-Saupe or MS theory) started a revival of the subject. Chandrasekhar and his colleagues contributed to the application of the dynamical theory of reflections to study the fascinating optical properties of cholesteric liquid crystals which have a helical structure with a pitch which is usually $\sim 0.5 \mu\text{m}$, and to the extensions of the molecular theory of nematic liquid crystals beyond the MS model.

In 1971, Chandrasekhar was invited to set up a liquid crystal laboratory at RRI. With a couple of former students who moved with him to RRI, he developed a laboratory with all facilities essential for research in the

chosen area. Realizing that cutting-edge research would not be possible without an in-house capacity to produce new materials, a synthetic organic chemistry laboratory was also added. Soon many new experimental and a few theoretical results emerged and the Liquid Crystal Laboratory of RRI became one of the leading centres of research in the world.

The twisted nematic liquid crystal display was invented in Europe in 1971 and recently LCDs have displaced CRTs as commercially the most important displays. Chandrasekhar and colleagues along with engineers of Bharat Electronics in Bangalore developed an indigenous know-how for the manufacture of simple LCDs for the domestic market.

The pinnacle in Chandrasekhar's scientific career came in 1977 when a new type of liquid crystal made of a new type of molecules was discovered. These molecules had the shape of discs rather than the well-studied rods. The discs exhibit columnar liquid crystals which have a two-dimensionally periodic order. This paper published in *Pramana* is one of the most highly cited papers in liquid crystals. A few thousand compounds with disc-like molecules have been synthesized since then. The columnar liquid crystals are being explored for their highly anisotropic conducting properties, which may be useful in some device applications.

After retiring from RRI in 1990, Chandrasekhar founded the Centre for Liquid Crystal Research in a building made available by Bharat Electronics. Several international conferences were organized by him, starting with one in 1973 on the occasion of the Silver Jubilee of the founding of the Raman Research Institute.

Chandrasekhar was largely responsible for placing India on the international map in the field of liquid crystals. The subject had yet another resurgence in 1996 when some Japanese scientists discovered new types of liquid crystalline phases exhibited by compounds made of another new type of (banana-shaped) molecules which have bent-cores. Many such compounds exhibit columnar liquid crystalline phases. He hailed from the most illustrious family of physicists of our country. His younger brother S. Pancharatnam (of the Pancharatnam phase) died at a young age. His elder brother S. Ramaseshan, the well-known materials scientist and the past-president of the Academy had died a couple of months earlier.

His scientific achievements brought him many honours. He was elected fellow of all the three Academies in India, of the Royal Society of London, of the Institute of Physics (London) and of the Third World Academy of Sciences. He was a member of several international and national committees on science and education.

He was the founder president of the International Liquid Crystal Society (1990–1992) and edited the journal *Molecular Crystals and Liquid Crystals* for the past 20 years. He was the recipient of the Bhatnagar Prize (1972), Homi Bhabha (1987) and Meghnad Saha (1990) medals of INSA, C.V. Raman Centenary Medal (1998), the Royal Medal of Royal Society (1994), Niels Bohr Gold Medal of UNESCO (1998), and the Fredericksz Medal of the Russian Liquid Crystal Society (2000). He was also the recipient of the Karnataka Rajyotsava Award (1986), the Padma Bhushan Award (1998) and the 'Chevalier dans L' order des Palmes Academiques' of the French Government (1999).

He was elected to the Academy in 1962 at the young age of 32 and served in its council. He leaves behind his wife Ila, a son and a daughter.

Joy David (elected 1982) passed away peacefully at her home in Bangalore. A chronic type-II diabetic patient, the long-term effects of the disease affected her heart and the cardiac myopathy which resulted had made her weak and dependent for several months. Born on 3 May 1927 at Palghat in Kerala, Joy David had a remarkable and highly productive scientific and professional career, starting with an MBBS degree in 1952 from the Christian Medical College, Vellore.



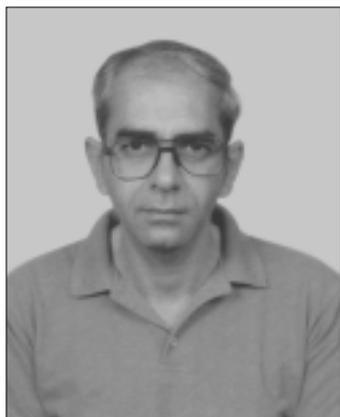
She later did her post-graduate training with some of the stalwarts of the medical field including Jacob Chandy and Baldev Singh in neurosurgery and J.C. David in pharmacology. It would appear that J.C. David had the most influence on her young mind (she later married Singaram, J.C. David's son), since she opted for super-specialization in that field. A Rockefeller Foundation Fellowship took her to the Montreal Neurology Centre where she laid the foundation for her foray into epilepsy research by developing a reliable model simulating Jacksonian epilepsy in *Macaca radiata*. A seminal piece of work followed when she moved to the University of Illinois Medical School in Chicago (1957–63) where she developed a mathematical model to quantify EEG responses to drug effects and characterized the cholinergic neurotransmitter in the lateral geniculate body. She returned to India, starry-eyed and full of hopes, to contribute towards the establishment for the first time in India, a state-of-the-art research centre in Bombay in 1964. At the CIBA-Geigy Research Centre where she headed the Pharmacology Department for the next two decades, she set up outstanding facilities including a primate laboratory with an implanted electrode model of Petit Mal Epilepsy.

While her major job at the centre was screening of molecules for discovery of new drugs, she did alongside, fundamental research for understanding the finer nuances of the functioning of the brain and developing models for several neurological diseases including depression, psycho-motor diseases, schizophrenia, anxiety neurosis and neuroleptosis. While her contribution to the development and marketing of the first ever anti-depressant drug from Indian research, namely, *Sintamil*, has been well recognized, what is not known to many is the fact that she was perhaps one of the first ones to identify the role of selective serotonin uptake inhibitors in depression, long before the blockbuster drug Fluoxetine was launched in the global market.

After retirement from CIBA-Geigy Research Centre in 1985, she continued her research efforts as a consultant to the Department of Pharmacology at St. John's Medical College in Bangalore. She guided students for M.D. and Ph.D. degrees in Pharmacology and was involved in several projects including pre-clinical and clinical development of anti-epileptic drugs. She continued her active interest in academic and applied research on drug discovery and development almost till the last days of her life. She published over 80 original papers and a number of review articles in areas of her speciality in National and International Journals.

She lost her husband, Singaram David in 2001 and leaves behind her son Ranjit David.

Anil Kumar Lala (elected 1993) died on 17 July 2004, following a stroke that he suffered three weeks earlier. Born on 13 January 1950, Lala did his B.Sc. from Delhi University and obtained his Ph.D in 1974, working under the supervision of A.B. Kulkarni at Bombay University. His doctoral work was on steroid chemistry, introducing him to the areas of NMR spectroscopy and mass spectrometry. Following a year at CDRI, Lucknow, Lala moved to the State University of Ghent, Belgium, to work with Marc Anteunis. In 1976, he went to Harvard University to work with Konrad Bloch and it is this period, which



sparked his lifelong interest in membranes, specifically lipid-protein interactions. Lala joined IIT, Mumbai in 1979 and spent the remaining 25 years of his scientific career at the chemistry department.

By the 1970s, chemistry in India had a long tradition; organic chemistry was a bastion of synthetic and natural products chemistry.

Biochemistry too was a well-established discipline, with a strong base in classical enzymology. Lala was among the first of a new generation of converts from chemistry, who turned to problems of biological interest, labelling himself as a bioorganic chemist. New religions do not take root easily; Lala's early years at IIT saw him struggle with great tenacity to establish work at the borders of chemistry and biology, as an integral part of activity in a major chemistry department in India. Today the term 'chemical biology' is both fashionable and respectable in our academic institutions, a recognition that chemistry is indeed the 'engine that drives biology'. Lala contributed in no small measure to this transformation, influencing large numbers of students trained in traditional chemistry to seek the greener pastures of biology.

Lala's early work at Bombay built upon his interests acquired at Harvard, studying the effect of modified cholesterol derivatives on yeast sterol auxotrophs and probing sterol-phospholipid interactions. But he also began to develop a new area, photolabelling, in which he was to make major contributions in the years to come.

Lala was quick to recognize the opportunity to develop highly reactive carbenes, capable of rapid insertion into neighbouring chemical bonds, upon generation by photolysis. His work on diaza-fluorene as a 'new fluorescent photochemical reagent' provided an alternative to light activable radiolabels. Over the last twenty years, Lala and an extraordinarily dedicated band of graduate students developed photolabelling into an important and powerful tool for analysing the organization of proteins in membranes, using the human erythrocyte glucose transporter, *Staphylococcus aureus*, a-toxin and diphtheria toxin as examples, where the utility of this method was clearly demonstrated. Lala sensed opportunities to exploit the techniques he developed to the characterization of protein folding intermediates and depth probing in phospholipid bilayers. He had begun moving into new areas, the systematic characterization of scorpion neurotoxins and drug design over the last few years.

Anil Lala was an excellent organizer. He was the main architect of the Biotechnology Masters programme at IIT and the Biosciences and Engineering Group, set up in 1983. He also played a major role in the Regional Sophisticated Instrumentation Centre (RSIC) for many years. Most recently, he was the driving force in setting up a mass spectrometry facility to strengthen the area of protein chemistry. He single-handedly championed the cause of setting up an Indian Protein Society, successfully bringing together an international gathering of protein chemists and structural biologists at a

symposium in Mumbai in October 2002. Anil Lala was an enthusiastic teacher, his words and ideas sometimes flowing too fast for the slow listener. But, in teaching it is the passion for the discipline that makes the greatest impact on a beginning student. Anil possessed this passion in full measure, successfully inspiring many students to enter research careers.

Anil Lala was also elected to the Indian National Science Academy and served on the editorial board of *Protein Science*. He was a warm and generous friend and an enthusiast for science. He will be greatly missed by his family, wife Krishna and son Vishal, and a host of friends and colleagues.

Bhaskar Gundmi Maiya (elected 2001), an eminent chemist and teacher, passed away on 21 March 2004 in Hyderabad.

Born on 20 June 1956 in the South Kanara District of Karnataka, he completed his school and college education in Udupi. He joined the University of Mysore in 1977 to pursue his postgraduate degree in chemistry.



In 1979, he joined the Department of Inorganic and Physical Chemistry, Indian Institute of Science, Bangalore as a Research Scholar and completed his Ph.D. degree in 1986. After a brief stint at the Tata Institute of Fundamental Research, Mumbai, he spent two years as a postdoctoral fellow at the University of

Houston (1987–1988) and the University of Texas at Austin (1988–1989) and came back to India to join the University of Hyderabad as a lecturer in 1989 rising to the rank of professor in 2001.

Maiya, a disciplined chemist, made significant contributions in bioinorganic chemistry, supramolecular chemistry and photochemistry. Using porphyrin molecule, popularly known as pigments of life, as a probe, he addressed many complex issues involving photoinduced electron transfer, donor-acceptor interactions and cation-induced dimerization reactions as a part of his thesis work. At Houston, he mastered the application of electrochemical techniques to follow the electron transfer reactions of various porphyrin systems. At Austin, he mainly worked on photochemical reactions using ultrafast kinetic techniques and gained experience in the use of porphyrins as photosensitizers for photodynamic therapy for the treatment of cancer.

As an independent researcher at Hyderabad, Maiya was responsible for creating state-of-the-art facilities for carrying out fundamental and applied research in the area of porphyrin and supramolecular chemistry. He developed the concept of axial building blocks to generate supramolecular systems capable of recognizing specific anions and cations. His papers on axial dimers involving metal-ligand axial interactions received considerable attention and he was invited to organize a symposium on “Molecular recognition” at the International Conference on Porphyrins and Phthalocyanins in Dujon, France in 2000.

Another area of his expertise was in the medicinal applications of porphyrin systems essentially as photosensitizers for photodynamic therapy. In this endeavour, many photosensitizers based on porphyrins linked to another aromatic dye molecule and some Ru-bipyridyl complexes were evaluated for their photosensitizing activity and some of them showed excellent binding properties. His excellent research contributions are evident from his 80 publications in reputed international peer reviewed journals, three patents and about 8 Ph.D theses supervision.

In addition to research and teaching, Maiya was interested in popularizing science and with untiring zeal inculcated scientific spirit and temper among young students. He organized several scientific workshops and his general articles on principles of photodynamic therapy in *Resonance* were popular. He was fond of teaching young students and his amazing inspirational ability could ignite the imagination of even an average student.

A warm hearted, generous human being, Maiya lived a simple life. He leaves behind his wife and two sons.

Sujit Kumar Mitra (elected 1990) was born on 23 January 1932 in Kolkata. He had his early education in Jajpur, Orissa. His first motivation and inspiration in mathematics came from his mother and his school teacher. Sujit was good in both mathematics and sanskrit. He almost decided in grade IX to opt for Sanskrit as the additional subject. But his father persuaded him to opt for mathematics. He finished his metriculation at the age of 12 and did his Intermediate science from St. Pauls College, Calcutta and B.Sc.(Hons.) in statistics from Presidency College, Calcutta. He completed his M.Sc. in statistics from Calcutta University in 1951 standing first in his batch. It was during this period that he was particularly motivated into research in statistics



and mathematics by his teachers, CR Rao and HK Nandi and by another famous statistician D Basu who happens to be his uncle. D Basu persuaded him to join the Indian Statistical Institute (ISI) soon after his M.Sc. In 1954 he went to the University of North Carolina at Chapel Hill to pursue his Ph.D in statistics. His thesis was on categorical data analysis.

Mitra made important contributions to categorical data analysis, linear models, statistical quality control, sample surveys, statistical inference, multivariate analysis and design of experiments. His greatest contribution is to the field of matrices and in particular to the generalized inverses of matrices. His research on generalized inverses started in 1967 while refereeing a paper of CR Rao on generalized inverses for *Sankhya*. In the process he came up with an alternative equivalent definition of a generalized inverse. From then on there was a steady flow of papers in this area. His major contribution in this field is the development of a unified theory of matrix partial order through generalized inverse which also impacted application in linear models, multivariate analysis, control theory and electrical network theory. He wrote a full length monograph, Generalized inverse of matrices and its applications jointly with CR Rao which even today is considered a classic. Mitra published about 100 research papers and compiled the statistical tables "Formulae and tables for statistical work" jointly with CR Rao, A Mathai and KG Rama Murthi. He also prepared lecture notes on matrices for non-mathematicians.

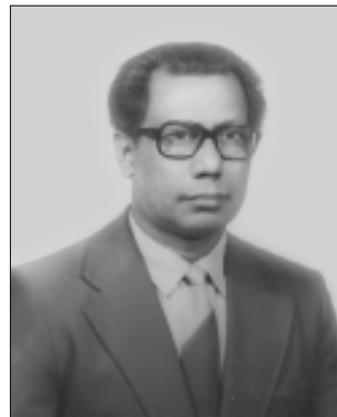
Mitra's teaching style was unconventional. Instead of writing down lengthy proofs he used to carefully motivate a topic and clearly explain the steps involved in a proof or a method. He strongly believed that if the motivation is proper the students can supply the proof themselves looking at the books if necessary; and anything learned that way would never be forgotten. After his Ph.D., Mitra joined ISI but for a brief period remained with ISI until retirement. He was the acting Head of the Delhi centre for a few years from 1976. He was a visiting professor in Indiana University, Bloomington and a visiting scientist in several other Universities in North America and Japan. After retirement from ISI he became a Professor Emeritus at ISI through CSIR and INSA fellowships.

Mitra was also elected to the Indian National Science Academy. He was a member of the International Statistical Institute and a fellow of the Institute of Mathematical Statistics, USA. He was the president of statistics section of the Indian Science Congress in 1988. He was the editor of *Sankhya* for a long period and was an associate editor of the *Journal of Indian Society of Agricultural Statistics*.

After a long battle with Parkinson's disease Mitra breathed his last on 18 March 2004. He leaves behind his wife Sheila and three daughters and a son.

Biswaranjan Nag

(elected 1984), a pioneer in the field of semiconductor physics, passed away in Kolkata on 6 April 2004. Born in 1932 in Comilla (now Bangladesh) he was a brilliant student of Presidency College (B.Sc 1949–51) and the Institute of Radio-physics and Electronics,

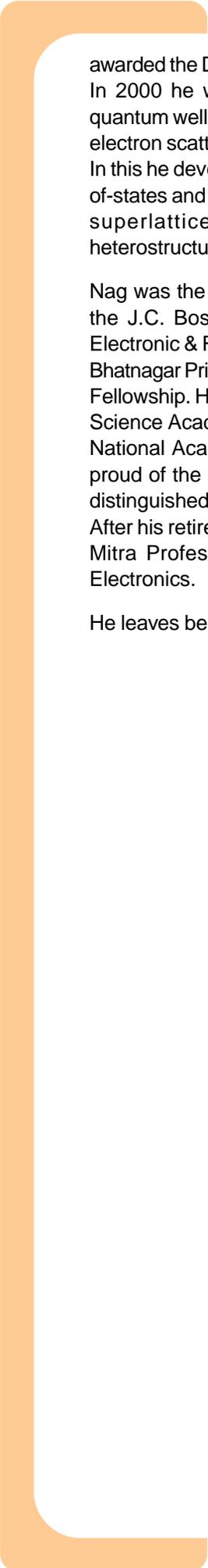


Kolkata in its formative years. He was one of the major figures contributing to the eminence of the Institute as a Centre for Advanced Study in the field of Electronics.

After his M.Sc (Tech) in 1954 Nag was appointed lecturer at the Institute in 1956. He was a legendary teacher with an unique and distinctive style and excellent rapport with his students. His doctoral research was on the study of harmonic, ultra- and sub-harmonic electronic oscillators and the invention of multi-state devices, which earned him the Ph.D. degree (Calcutta University) under the guidance of Arun K Choudhury. In 1959 he obtained his M.S from the University of Wisconsin after which his research interests shifted to the physics of the semiconductors.

He and his students made pioneering contributions through both experimental and theoretical investigations on microwave measurements of the properties of semiconductors. His métier was the study of hot-electron effects due to high electric fields in semiconductors, of great interest for the generation of microwave radiation through the Gunn Effect which was discovered in 1962. His group was also active in the study of free carrier absorption in non-parabolic semiconductors and the study of the acousto-electric effect. Among other outstanding contributions were experiments for the study of hot electron galvanomagnetic transport coefficients in Ge and Si including developing the relevant theory.

The study of electron scattering processes in semiconductors was a subject of great importance to which Nag's group made very significant contributions using the Monte Carlo and other techniques. Besides numerous papers in reputed journals, his research activities were summed up in the two authoritative monographs he wrote on 'Theory of electron transport in semiconductors' (Pergamon 1972) and 'Electron transport in compound semiconductors' (Springer Verlag 1980). The latter became a Bible for researchers in the subject. For these comprehensive researches he was



awarded the D.Sc degree of Calcutta University in 1972. In 2000 he wrote another book on 'The physics of quantum well devices' (Kluwer) embodying his work on electron scattering in superlattices and quantum wells. In this he developed methods for evaluation of density-of-states and electron effective mass in semiconductor superlattices and the theory of tunnelling in heterostructures.

Nag was the recipient of numerous awards including the J.C. Bose Memorial Prize from the Institute of Electronic & Radio Engineers, U.K, the Shanti Swarup Bhatnagar Prize, both in 1975, and the Jawaharlal Nehru Fellowship. He was also a Fellow of the Indian National Science Academy and a Founder Fellow of the Indian National Academy of Engineering. He was justifiably proud of the achievements of his students who have distinguished themselves in various parts of the world. After his retirement he remained active as Sisir Kumar Mitra Professor in the Institute of Radiophysics & Electronics.

He leaves behind a son and a daughter.
