

Newsletter of the Indian Academy of Sciences

SEVENTY-NINTH ANNUAL MEETING, CHANDIGARH

8–10 NOVEMBER 2013

The 79th Annual Meeting 2013 of the Academy was held at Chandigarh. This was the third time, after 1979 and 2002, that Chandigarh was the venue again. This year coincided with the 125th birth anniversary of the Academy's founder, Nobel Laureate Sir C. V. Raman and 150th Birth Anniversary of Ruchi Ram Sahni. To commemorate Ruchi Ram Sahni's 150th Birth Anniversary, a postal stamp was released on 24 October 2013 at the Panjab University by the Government of India.

The meeting began with **Dipankar Chatterji's** Presidential address. In his talk, he explained how bacteria respond



to stress, adapt to changes that occur in gene expression and their various survival pathways. He pointed out that under nutritional limitations, bacteria adopt a highly conserved stress survival mechanism called stringent

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Published by

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

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Newsletter, please write to the
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Forthcoming Events

Twenty-fifth Mid-Year Meeting, Bangalore 4–5 July 2014

Refresher Courses

- Bioinformatics in modern biology 5–17 May 2014
Manipal University, Manipal
- Quantum mechanics 5–18 May 2014
Bishop Moore College, Mavelikara
- Materials preparation and properties measurement 6–21 May 2014
Indian Academy of Sciences, Jalahalli, Bangalore
- Experimental physics – LVIII 12–27 May 2014
Goa University
- Experimental physics – LIX 27 May – 11 June 2014
Government College, Rajahmundry
- Experimental physics – LX 3–18 June 2014
University of Mumbai, Mumbai
- Experimental physics – LXI 16 June – 1 July 2014
Amrita Vishwa Vidyapeetham, Kollam
- Experimental physics – LXII 5–21 August 2014
Noorul Islam University, Kumaracoil

Lecture Workshops

- Himalayan biodiversity and bioresources: Mapping, utilization and conservation 1–3 May 2014
University of Kashmir, Srinagar
- Recent advances in chemical and environmental sciences 5–6 May 2014
ABES Engineering College, Ghaziabad
- Recent trends in synthesis of chemical compounds 5–7 May 2014
NIT, Silchar
- Recent advances in chemistry 2–4 June 2014
Mizoram University, Aizawl
- Progress and prospects of biotechnology 26–27 June 2014
St. Joseph's College, Irinjalakuda
- Physics of electronic materials 8–9 August 2014
St. Xavier's College, Kolkata

response, which is characterised by the synthesis of small nucleotide derivatives known as alarmones. The young bacteria have nomadic lifestyle, which later transforms to a sedentary lifestyle with ageing. During this stage the bacteria behave collectively. Each bacterium then receives, responds and passes on the information to its neighbour through a cascade of signal transmissions, known as quorum sensing. Chatterji, later in his talk, discussed the role of DNA-binding protein from starved cells (Dps) synthesised under oxidative stress in *Mycobacterium smegmatis*.

In a special lecture, **Girish Sahni** (CSIR – Institute of Microbial Technology, Chandigarh) spoke about the success story of developing India's first bio-therapeutic molecule, a protein-based clot buster.



The clot-buster drugs such as tissue plasminogen activator (tPA), urokinase (UK) and streptokinase (SK) are all plasminogen activator drugs that have revolutionised the treatment of myocardial infarction in

recent years. A two-step novel process for the purification of natural Streptokinase from *Streptococcus* was developed by IMTECH, which has been successfully transferred to Cadila Pharmaceuticals, Ahmedabad, and is being sold in the market since 2003 under the brand name of 'STPase'. In 2006, the US-based Nostrum Pharma was given a licence to clinically develop it for commercial use. The efficacy has been tested on crab-eating monkeys. He said India lacks affordable clot busters, especially in rural areas. According to the Infographic 2012 report, younger people are at risk of developing CVD due to change in lifestyle. As per World Health Organization (WHO), nearly 20 million people die of CVD worldwide and 1 million in India. Sahni said that if protein chemists and R&D align with pharmaceutical companies, a global impact could be made by manufacturing affordable drugs or molecules. He estimated that therapeutic proteins will have a market share worth 100 billion dollars and that the future of protein chemistry is an opportunity for India.

India unveiled the National Cyber Security Policy 2013 on 2 July 2013 to build a secure and resilient cyberspace for citizens, business and government. In a symposium on 'Cyber Security and Privacy', the challenges faced by India were discussed. Supplemented with succinct examples, **N. Balakrishnan's** (IISc, Bangalore) talk highlighted the importance of cyber security and its impact on the security of a nation. He mentioned that although social media has a cascading effect on dealing with societal issues, it could pose a threat to national security; for example, some of the recent events, like (i) the North-East exodus in 2012; (ii) Muzaffarnagar



Inauguration of the 79th Annual Meeting, Chandigarh

riots (2013); (iii) people gathering at Jantar Mantar protesting against Nirbhaya gangrape case in 2012 and others. He further discussed the techniques for monitoring social media and trends in the use of analytics software to aid national security. **Gulshan Rai** (Indian Computer Emergency Response Team, New Delhi) emphasised the need to promote R&D on cyber security to secure e-governance services. He said that although the government is self-sufficient to handle security issues, public-private partnership is the way forward to tackle cyber security. He said that India needs a DNS security and router protection to deal with malwares. The attacks on cyber space have exploded in a variety of ways. To tackle the challenge, **R. K. Shyamasundar** (TIFR, Mumbai) said cryptography is one of the building blocks of cyber security; there is need to develop a scientific roadmap. **P. K. Agarwal** (Power System Operation Corporation Ltd., New Delhi) emphasised the need to deal with cyber security issues emerging due to expansion of power systems. The expansion is a result of rapid changes in communication technology, GPS, signal processing and computer technology.

In a symposium on 'Food and Nutritional Security', **B. S. Dhillon** (Punjab Agricultural University, Ludhiana) focussed his talk on innovations for adding value to agriculture with special reference to north-western India. He said that innovation in agriculture was the key to ensure food security, livelihood and a driver for growth, which could be done by improving the crops using technology. Climate variability is a challenge that blocks the road to crop improvement. The way out is to use conventional breeding and biotechnology. He said there is need to reform the Agriculture Produce Marketing Committee (APMC) Act, bring changes in marketing methods, foster research collaborations and follow precision agriculture. **V. Prakash** (JSS Group of Technical Institutions, Mysore) focussed his talk on malnutrition, a grave problem in India. He said that earlier, 70,000 traditional foods were available, which have now shrunk to 400. To address this problem, a nutritional intervention is required. **T. R. Sharma** (Indian Agricultural Research Institute, New Delhi) discussed how Next Generation Sequencing (NGS) technologies have enabled rapid identification of genes. For example, the rice genome information has been extensively used for the positional cloning and characterisation of disease resistance gene Pi54, imparting resistance to rice blast. **Rakesh Tuli** (National Agri-Food Biotechnology Institute, Mohali) spoke about how new technologies can be used for better yield and crop improvement. He said that although productivity in increasing in India,

production has reached a plateau. To increase productivity and bring commercial success, there is need to create awareness to overcome the fear associated with GM crops. He said one of the reasons behind the delay in releasing crop plants was the inability of seed companies in India to tackle safety issues. Citing several examples, like the embargo on cultivating Bt Brinjal in India and others, he stressed that India should make a decision based on its objectives and need.

The lectures by Fellows and Associates ranged from climate change, quantum computation, functional materials and therapeutics to importance of protein chemistry. Some of the talks are presented below. **Madan Rao** (RRI and NCBS, Bangalore) spoke on how molecules on the cell surface are organised because of strong coupling with cortical matter, as there exists an interplay between the cell membrane and the cortex. His research looks at how the dynamics and organisation of many cell surface molecules can be understood by its coupling to an active cytoskeletal layer. He also discussed the physical principles underlying the Active Composite cell surface that provide a natural language for discussing the mechanics of computation and information processing. **Sujith K. Ghosh** (IISER, Pune) spoke about the functional properties of porous co-ordination polymers (PCPs) that have been found to have wide range of applications in gas storage, chemical separation, drug delivery, catalysis, chemo-sensing, etc. **Arun K. Pati** (HRI, Allahabad) presented his work on weak measurement and quantum correlation. Weak measurements cause small changes in quantum states, opening up new ways to manipulate and control them. Weak-measurement-induced quantum discord called "super quantum discord", is larger than the quantum discord captured by strong measurement, said Pati. **Kirti Chandra Sahu** (IIT, Hyderabad) spoke about instability due to double diffusivity in stratified viscous flows and discussed the results from linear stability analyses and direct numerical simulations. **Krishnendu Sengupta** (IACS, Kolkata) spoke on the surface quasi particles of topological insulators which obey a Dirac-like equation. He also discussed the transport properties of junctions of materials and the spin momentum locking of the Dirac quasi particles leading to a novel transport phenomenon. **Sharad S. Sane** (IIT, Mumbai) delivered a talk on combinatorics of block designs and finite geometries. Block designs are configurations useful in mathematical branches like coding theory and finite group theory. The focus of the talk was on classification theorems related to symmetric designs and quasi symmetric designs. **Bhim Singh**

(IIT, New Delhi) spoke on the major causes of power quality problems such as reactive power burden, unbalanced loading, etc., and finding solutions to these by using custom power devices, power filters and improved power quality ac–dc converters. **Vijayakumar S. Nair's** (Vikram Sarabhai Space Centre, Thiruvananthapuram) talk examined the effect of black carbon (BC) on snow in the Himalayan region. He showed how snow darkening caused due to deposition of soot and dust on snow cover reduces the reflecting power of snow, accelerating seasonal snow melting leading to floods in the foothills and the plains. **S. A. Haider** (PRL, Ahmedabad) discussed the similarities of the ionosphere of Earth and Mars. Earth's ionosphere has three layers, S-layer, E-layer and D-layer, while the Mars ionosphere is composed of F, E and S layers. The F-layer is produced by UV radiations and X-rays. Around 100 organic and inorganic compounds are known in the Martian atmosphere. He mentioned future missions to Mars, of which India's first Mangalayan was launched on 5 November 2013, which is expected to reach the Martian atmosphere in September 2014.

The Japanese scientist Nario Taniguchi was the first to use the term 'nanotechnology'. Later, in 1991 carbon nanotubes (CNTs) were discovered. CNTs have applications in different areas because of the remarkable properties they exhibit, such as (i) enormous stiffness, (ii) high thermal conductivity, (iii) better electrical property, (iv) low density, (v) high temperature resistance and (vi) propagation of waves at the density of Hertz. **S. Gopalakrishnan** (IISc, Bangalore) delved into history of nanostructure modelling and wave propagation. He said that understanding wave propagation in these structures is necessary to design next-generation nano devices such as Nano Electro Mechanical Systems (NEMS), Nano Opto Mechanical Systems (NOMS), nano resonators and others. In a special lecture, **Anil Kumar** (IISc, Bangalore) spoke on the theoretical aspects of quantum computation

and quantum information processing and the challenges faced in its experimental aspects. He spoke in detail of the recent developments in the field including the experimental proof of the Quantum No-Hiding theorem, using Nearest Neighbour Heisenberg XY interaction to entangle a linear chain of 3-qubits, to study the frustration dynamics in a quatumising spin system in a triangular configuration and the use of genetic algorithm in NMR QC. **G. Narahari Sastry** (IICT, Hyderabad) spoke on how a pair of non-covalent interactions mutually influence each other's strength, through computational and structural analyses. He also spoke on the concept of co-operativity in hydrogen bonded clusters and aromatic clusters, in addition to explaining the effect of cation- π interaction on hydrogen bonded clusters and π - π clusters. **Avesh K. Tyagi** (BARC, Mumbai) spoke about functional materials, a new class of materials that are being developed and have wide applications. Inducing functionality and stabilising these materials is a problem that researchers are now trying to address. Tyagi mentioned that by using combustion method and vacuum heating in a reduced atmosphere, a range of materials, like CeCrO_3 , could be synthesised. CeCrO_3 is used to degrade Rhodamine, a toxic dye.

Hormones play an important role in the regulation of reproduction and overall physiology. They are of interest to protein chemists, said **Rajan Dighe** (IISc, Bangalore). The antibodies against hormones and their receptors are pivotal to probe the mechanism of hormone action at both the physiological and molecular levels. The receptor antibodies help in elucidating the mechanisms of activation of glycoprotein hormone receptors and can have applications in cancer immunotherapy. **Souvik Maity** (IGIB, Delhi) explained the in vitro screening method using DNA-based molecular beacon to identify inhibitors of miR27 from a library of 14 aminoglycosides. Further, screening of the library revealed that streptomycin had the inhibitory capacity to silence miR-21 oncomir by structural perturbation of the dicing process, making it a potential anti-cancer agent. **Debashis Mitra** (NCCS, Pune) said that 30 years after the discovery of HIV, a vaccine is yet to be developed. His group has been able to identify and characterise a few novel HIV-1 inhibitors that may functionally block the proteins inside the cell that enhance virus replication. The ongoing study may take two years to complete. He said that these specific inhibitors may help solve the mystery of drug resistance in HIV patients. He said that although 27 FDA-approved inhibitors exist, none have been developed further. These inhibitors can keep



the virus away, but the virus tends to rebound once the inhibitors are withdrawn.

Sourendu Gupta (TIFR, Mumbai) discussed how relativistic heavy ion collisions explore the phase space diagram of the standard model of particle physics and, in particular, how it is constrained by theory, and where theory and experiment can be compared.

Jaya N. Iyer (IMSc, Chennai) spoke on tertiary classes in the Chern-Simons theory. **Sangita Mukhopadhyay** (CDFD, Hyderabad), spoke on how PPE18 protein functions as a virulence factor during *Mycobacterium tuberculosis* infection. Studies on PPE18 have revealed that it plays crucial roles in the survival and multiplication of Mtb bacilli during infection.

G. Mugesh (IISc, Bangalore) spoke on deiodination of thyroid hormones. He discussed various bioinorganic, bioorganic and medicinal chemistry aspects of thyroid hormones. **Subi J. George** (JNCASR, Bangalore), in his talk on supermolecular synthesis of functional materials, presented details of the designs of functional materials using electronic and optical functionalities of π -conjugated organic systems. He also discussed multi-component molecular self-assembly for the design of various donor-acceptor conducting nanostructures with controlled molecular organisation and for the luminescent silicate-chromophore based soft-hybrids.

In the first public lecture, **Jayati Ghosh** (JNU, Delhi) raised some important issues on whether India is prepared to (i) productively employ the growing number of youth; (ii) provide skill; (iii) bridge the gender gap;



(iv) increase women workforce participation; and (v) take care of its elderly. Figures suggest that by 2020 an average Indian will be only 29 years of age compared to 37 in China and the US, 45 in Western Europe and 48 in Japan. Although the figures are not great, a significant rise has been noticed in higher education. Unfortunately, tertiary education is dominant in private institutions (90 per cent) and half of it is offered through distance learning. She said it is important to have a regulatory framework to monitor incentivised education. The good news is that across South Asia, women's participation in the workforce has doubled, but recently women dropout rates are becoming evident. With technological intervention, improved public health and nutrition, child survival rate has increased and the death rate has declined. Therefore, the number of women over 80 years is expected to increase by 2050. Hence, it is necessary to make changes in the social and political policies to address the needs of the country's future elderly population. She concluded by saying that India, like Thailand, should learn from its rural health system where rural doctors are paid higher wages than urban doctors.

The second public lecture was given by **Shivshankar Menon** (National Security Advisor, PMO, New Delhi). He stressed the need to safeguard technologies to achieve a better security system for the country. Before



there were nuclear weapons, the main purpose was to win war; now the main contention is to avoid war. He also spoke about cyber security as being a part of national security and added that India was fortunate to have the support of world class scientists.

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TWENTY-FIFTH MID-YEAR MEETING

4 – 5 JULY 2014

Tentative Programme

4 July 2014 (Friday)

- 0930–1010 **Session 1A – Special Lecture**
Arun K Grover, Panjab University, Chandigarh
Spin-ferromagnets with zero-magnetization – novel functional materials and their physics
- 1010–1300 **Session 1B – Lectures by Fellows/ Associates**
- 1010 **Asit K Chakraborti**, NIPER, SAS Nagar
Supramolecular assemblies: on the origin of catalysis by ionic liquids and molecular basis for rate acceleration in aqueous medium
- 1030 **M Krishnamurthy**, TIFR, Mumbai
Making a compact laser driven plasma accelerator for megaelectronvolt energy neutral atoms
- 1120 **Tanvi Jain**, University of Delhi, Delhi
Averaging operations on matrices
- 1140 **Zhumur Ghosh**, Bose Institute, Kolkata
Regulatory networks modulating stem cell biology – key players behind the screen
- 1200 **KSMS Raghavarao**, CFTRI, Mysore
Food and bio-process engineering – research contributions
- 1220 **Susanta Mahapatra**, University of Hyderabad, Hyderabad
Nonadiabatic chemical dynamics
- 1240 **Priya Mahadevan**, SN Bose National Centre for Basic Sciences, Kolkata
Engineering non-vanishing dipoles in transition metal oxides
- 1430–1720 **Session 1C – Lectures by Fellows/Associates**
- 1430 **SK Sikdar**, IISc, Bangalore
Understanding neuronal mechanisms of epilepsy: electrophysiological approaches

- 1450 **M Jayananda**, University of Delhi, Delhi
Archean crust formation and continental growth in the Dharwar craton, southern India
- 1510 **GV Pavan Kumar**, IISER, Pune
Surface plasmon nanophotonics
- 1600 **Manikuntala Kundu**, Bose Institute, Kolkata
Deciphering stress response pathways in mycobacteria
- 1620 **Sudip Chattopadhyay**, National Institute of Technology, Durgapur
HY5bZIP protein regulates its expression by a feedback loop mechanism in Arabidopsis seedling development
- 1640 **Sumantra Mandal**, IGCAR, Kalpakkam
Towards comprehensive crystallographic and property characterization of grain boundaries
- 1700 **T Govindaraju**, JNCASR, Bangalore
Novel diagnostic and therapeutic tools for Alzheimer's disease
- 1800–1900 **Session 1D – Public Lecture**
Aruna Roy, Mazdoor Kisan Shakti Sangathana, Rajsamand (Rajasthan)
Scientific temper – the “missing link” in the evolution of Indian Society
- 5 July 2014 (Saturday)
- 0930–1300 **Half-day symposium on CV Raman**
- 0930 **G Venkataraman**, Prasanthi Nilayam
Raman the man, his contribution and his message: What they mean for us in the 21st century
- 1100 **Dipankar Bhattacharya**, Inter-University Centre for Astronomy & Astrophysics, Pune
Rhythm and harmony: Raman on the physics of musical instruments
- 1140 **S Umapathy**, IISc, Bangalore
Time and space resolved Raman spectroscopic applications to chemistry and biology
- 1220 **AK Sood**, IISc, Bangalore
Raman effect in contemporary physics

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ELECTIONS – 2014

Jitendra K Bera

Indian Institute of Technology, Kanpur
Area: Organometallic Chemistry; Small Molecule Activation; Catalysis



Asit K Chakraborti

National Institute of Pharmaceutical Education & Research, SAS Nagar
Area: Synthetic Organic Chemistry; Green Chemistry; Medicinal Chemistry



Sumantra Chattarji

National Centre for Biological Sciences, Bangalore
Area: Neurobiology; Biophysics; Physiology



Naveen Garg

Indian Institute of Technology, New Delhi
Area: Approximation Algorithms; Combinatorial Optimisation; Graph Theory and Algorithms



Eknath Ghate

Tata Institute of Fundamental Research, Mumbai
Area: Automorphic Forms; Number Theory; Galois Representations; Arithmetic Geometry



M Jayananda

University of Delhi, Delhi
Area: Solid Earth Geochemistry; Archean Magmatism; Continental Growth; Tectonics



M Krishnamurthy

Tata Institute of Fundamental Research, Mumbai
Area: Atomic and Molecular Physics; Intense Laser Plasma Physics; Optical Sciences



Giridhar U Kulkarni

Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore
Area: Nanomaterials; Nanolithography and Fabrications; Molecular Crystals and Properties



Manikuntala Kundu

Bose Institute, Kolkata
Area: Stress Response in Mycobacterium tuberculosis; Immunology of Host Cell Response to Helicobacter pylori



Giridhar Madras

Indian Institute of Science, Bangalore
Area: Polymers; Supercritical Fluids; Catalysis



Priya Mahadevan

SN Bose National Centre for Basic Sciences, Kolkata
Area: Electronic Structure of Materials; Magnetism; Nanostructure Materials



Subeer S Majumdar

National Institute of Immunology, New Delhi
Area: Animal Biotechnology; Transgenic Animals; Endocrinology



Gautam Mandal

Tata Institute of Fundamental Research, Mumbai
Area: Quantum Field Theory; Gravity; String Theory



Pradeep Mujumdar

Indian Institute of Science, Bangalore
Area: Hydrology; Climate Change Impacts; Uncertainty Quantification



Mitali Mukerji

CSIR – Institute of Genomics & Integrative Biology, New Delhi
Area: Functional Genomics; Population Genomics; Ayurgenomics



Shailesh Nayak

Ministry of Earth Sciences, New Delhi
Area: Coastal and Ocean Processes; Oceanography



K S M S Raghavarao

CSIR – Central Food Technological Research Institute, Mysore
Area: Food Engineering, Biotechnology; Chemical Engineering



C V Ramana

CSIR – National Chemical Laboratory,
Pune

Area: Total Synthesis; Carbohydrate
Chemistry; Transition Metal Catalysis



Ravi A Rao

Tata Institute of Fundamental Research,
Mumbai

Area: Classical Algebraic K-Theory,
Commutative Algebra, Linear Algebra



Syamal Roy

CSIR – Indian Institute of Chemical
Biology, Kolkata

Area: Immunology; Parasitology;
Vaccine Research



Susanta Roychoudhury

CSIR – Indian Institute of Chemical
Biology, Kolkata

Area: Cancer Biology; Human Genetics;
Genomics



Annapurni Subramaniam

Indian Institute of Astrophysics, Bangalore

Area: Stellar Population; Nearby
Galaxies; Star Clusters; Stellar
Evolution; Galactic Dynamics



V Subramanian

CSIR – Central Leather Research
Institute, Chennai

Area: Computational Chemistry;
Non-Covalent Interactions;
Biomolecular Simulations



Nikhil Tandon

All India Institute of Medical Sciences,
New Delhi

Area: Endocrinology; Chronic Disease
Epidemiology



Honorary Fellows

Arogyaswami J Paulraj

Stanford University, Stanford, USA



Veerabhadran Ramanathan

University of California, San Diego, USA



Brian P Schmidt

Mount Stromlo Observatory,
The Australian National University,
Australia



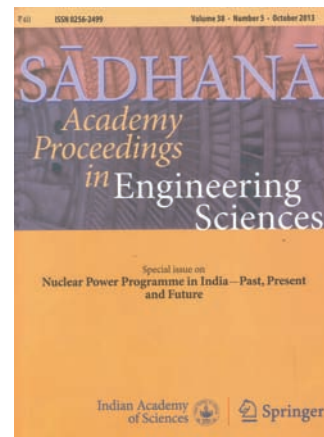
SPECIAL ISSUES OF JOURNALS

Nuclear Power Programme in India – Past, Present and Future

Editors: AK Nayak and BK Dutta

Sādhanā, Vol. 38, No. 5, October 2013, pp. 773–1064

India has been among the frontrunners to have an elaborate nuclear programme since its inception immediately after independence. At present, India is among the few countries recognised to have mastered all aspects of nuclear fuel cycle and is a leader in heavy water reactor technology. India is poised for multifold



growth in nuclear power generation to match the needs of sustained economic growth and improving the standard of living for the masses. Nuclear power is currently the fourth largest source of electricity in India after thermal, hydroelectric and renewable sources of electricity. Thorium utilization for large-scale power production and associated technology development are the important aspects of the Indian nuclear power programme. This is important because of its security in terms of fuel reserves, since India has one of the largest reserves of thorium. Operation in closed nuclear fuel cycles, which involves reprocessing and recycling of fissile materials, is thus inevitable for India. A three-stage nuclear energy programme based on the closed cycle is the flagship of the Indian atomic programme. Stage one aims at developing natural-uranium-fuelled pressurised heavy water reactors; the second stage aims at utilising plutonium-based fuels in fast breeder reactors. The third stage focuses on the development of advanced nuclear power systems for utilisation of thorium. Currently, India has 20 nuclear reactors in operation, generating approximately 4,780 MWe and 7 other reactors are under construction which are expected to generate an additional 5,300 MWe. Apart from the currently operating water-cooled reactors, the country plans to build innovative nuclear reactors such as the Advanced Heavy Water Reactor, Prototype Fast Breeder Reactor, High Temperature Reactor and Molten Salt Breeder Reactor. The country has set up R&D programmes towards development of accelerator-driven system (ADS) and fusion reactor concepts. Important

objectives of future designs would be not only burning of thorium but also minimising the need for the exclusion zone so that new reactors can be located in close proximity to large populations. In view of this, the new designs would be practically safe and would satisfy the design requirements for 'no impact in public domain'. While the country was smoothly proceeding on the planned three-stage programme, the Fukushima accident has been a temporary setback to the nuclear industry because of public apprehension on the safety of nuclear reactors.

In this special issue, emphasis has been laid to bring out the design and safety aspects of the Indian operating reactors as well as future ones. The special issue also discusses how extreme events are prevented in the design or mitigated in Indian nuclear power plants, which require development of appropriate materials, control and instrumentation systems, and technologies. Apart from safety, this special issue discusses the management of radioactive waste and preparedness in the Indian fusion reactor programme. Since India has an elaborate nuclear power programme based on the closed fuel cycle, development of skilled nuclear scientists and engineers, who should not only be ready to take present responsibility but can also dream for a better tomorrow, are very important. This special issue brings out this aspect of development of human resources for the nuclear power programme. The articles in this issue are primarily review articles and targeted at public education.

Frankineae and Actinorhizal plants

Editor: Arvind K Misra

Journal of Biosciences

Vol. 38, No. 4, November 2013, pp. 675–824

Nitrogen is an integral part of nucleic acids and proteins, the key **b i o - m o l e c u l e s** orchestrating the information storage, retrieval and use for metabolic processes. However, nitrogen, even though it is abundant in the atmosphere, does not readily combine with other elements. High energy input is required for formation of ammonia from nitrogen and hydrogen. Therefore, it is not easy for living organisms to convert readily available atmospheric dinitrogen to usable form. In fact only few prokaryotes seem to have developed expertise in 'fixing'



atmospheric dinitrogen. The rest of the living world relies on nitrogen thus fixed in the soil and in the oceans. While higher life forms acquired the ability to fix carbon by 'adopting' prokaryotic system in an obligate manner in the form of chloroplasts, no such system seems to have developed for fixing nitrogen. So far we do not know of any obligately symbiotic cellular endobiont capable of fixing atmospheric dinitrogen. This makes us wonder why nature did not let eukaryotic cells 'adopt' another prokaryote in an obligate manner to ensure a steady supply of fixed nitrogen.

In nature we have some free living bacteria fixing atmospheric dinitrogen in the soil, or a few others that can form symbiotic associations with some plants. These symbiotic associations ensure a steady supply of fixed carbon and other nutrients for the micro-symbiont and in return a steady supply of fixed nitrogen for the host. The best known associations of this type involve legumes as hosts and *Rhizobium* or related bacteria as micro-symbionts. This association has been extensively studied primarily because of the agricultural importance of legume crops. However, there is another similar, but much less celebrated, association between *Frankia* and some plants called actinorhizal plants. *Frankia* belongs to the family Frankiaceae of Frankineae, a group of Actinobacteria.

Unlike *Rhizobium*, which has specialised in forming symbiotic nitrogen fixing root/shoot nodules with members of a select family of angiosperms, *Frankia* is more versatile. It has been found to form symbiotic nodules with about 23 genera belonging to 8 different angiosperm families. Most of these are woody forest trees and shrubs. Another surprising feature of this association is that not all members of a given plant family can harbour *Frankia*. For example, in the family Betulaceae, *Betula* does not enter into symbiotic association, while *Alnus* forms root nodules with *Frankia*. This observation has been investigated by many scientists and most support the possibility of multiphyletic origin of actinorhizal symbiosis with an initial predisposition to root symbioses in the Rosid clade.

Man gives more importance to activities that give visible returns in the near term. It is therefore not surprising that substantial funds are made available for research in anything even remotely connected to agriculture. But we miss a significant point. It is imperative to have a sound, vibrant and stable forest cover to support sustainable agriculture. Actinorhizal symbiosis is important from the point of view of providing such forest support for our agriculture in the long term.

Realising the importance of actinorhizal associations, closely knit groups of workers have been conducting research into various aspects of this symbiotic association. Since 1978, when the first gathering of scientists shared their experiences with actinorhizal symbiosis at Harvard Forest, USA, seventeen such gatherings have taken place so far. The historical developments in this field have been nicely summed up by Normand in this special issue.

North-Eastern Hill University, Shillong, India, was the proud host of the seventeenth such gathering in the form of a Conference on Frankineae and Actinorhizal Plants. The present issue of *Journal of Biosciences* is a collection of research papers and review articles arising out of three days of deliberations at Shillong.

A wide range of topics from field applications of actinorhizal associations to genetic transformation studies were discussed. Zhong *et al.* have made a case for *Casuarina glauca* as a model host for the study of molecular mechanisms driving actinorhizal associations. Ganguli and Kennedy from Australia and Karthikeyan *et al.* from India also highlighted the significance of *Casuarina*. On the other hand, Tobita and co-workers from Japan have reported their findings on growth and nitrogen fixation in another important actinorhizal genus, *Alnus*. Oshone and co-workers reported the effect of salt stress on physiology of *Frankia*. Richau and co-workers reviewed the hydrogenase uptake system in *Frankia* and report their own findings. Carro *et al.* described elaborate experiments to demonstrate the generalised presence of another actinobacterium, *Micromonospora*, as a frequent co-inhabitant in actinorhizal nodules. Nouioui and co-workers reported presence of cluster 2 *Frankia* strains in Tunisian soils, where compatible host plants are not normally found.

In addition to these basic studies, Tisa and co-workers discussed the results of analysing *Frankia* genomes. Bioinformatics tools have been used by Sur *et al.* in characterising pseudogenes, Bhattacharya and co-workers in characterising haemoglobin of actinorhizal plants, and Thakur *et al.* for studying evolution of novel protein function in NifH/BchL protein family. Kucho *et al.* have reported the use of codon optimised antibiotic resistance gene as an aid in studies aimed at transformation of *Frankia*. Yanthan and Misra report association between Amplicon Restriction Patterns and level of nitrogenase activity in root nodules of *Myrica*.

The high point of the Shillong deliberations was the increasing realisation of the medicinal importance

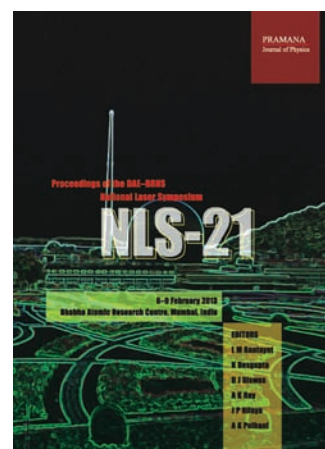
of some actinorhizal genera. Two such notable genera are *Myrica* and *Hippophae*. While Goyal *et al.* have reported phytochemical analyses of some actinorhizal plants, Middha and co-workers have reported molecular docking studies of GSK-3 α and GK inhibitors of *Hippophae*. The finding of anti-diabetic compounds in *Hippophae* by Middha *et al.*, augurs well for the future of research on actinorhizal symbiosis.

Proceedings of the DAE–BRNS National Laser Symposium (NLS-21) – Parts I and II

Editors: LM Gantayet, K Dasgupta, DJ Biswas, AK Ray, JP Nilaya and AK Pulhani

***Pramana – Journal of Physics*, Vol. 82, Nos. 1–2, January–February 2014, pp. 1–462**

The DAE–BRNS National Laser Symposium, held under the auspices of the Board of Research in Nuclear Sciences, Department of Atomic Energy, is an annual event that brings together eminent scientists and engineers from India and abroad for intense discussions on science and technology related to



lasers. The 21st edition of National Laser Symposium (NLS-21) was organised by the Bhabha Atomic Research Centre, and was held in Mumbai during February 6 to 9, 2013.

Ever since the NLS was held for the first time at IIT–Madras in 1992, it has been growing both in size and stature. As a matter of fact, a record number of manuscripts were submitted this year for consideration for presentation in NLS-21. The symposium was inaugurated by Shri Sekhar Basu, Director, Bhabha Atomic Research Centre, and the keynote address was delivered by Dr Ajoy K Ghatak, formerly Professor of Physics, Indian Institute of Technology, Delhi, an eminent laser physicist and author of many books that have become popular among students and research communities. The symposium this year had 10 regular scientific sessions comprising 7 plenary and 17 invited talks by both senior and young researchers, 3 poster sessions consisting of a total of 277 contributory papers selected through a rigorous process of reviewing from the submitted 348 papers, 2 PhD thesis sessions with

a total of 11 oral presentations of recent PhD theses on related topics, and an industrial session with 6 presentations made by industrial participants dealing with lasers and related products.

This special issue of *Pramana – Journal of Physics* has stemmed from the summary of plenary and invited talks and 48 contributed papers selected from those presented as posters during the symposium. The Symposium Organizing Committee, in its first meeting itself, recommended publication of the symposium proceedings as it was felt that this would stimulate improvement in the scientific and the technical content of the contributions. The authors and their institutions also stand to benefit from a wider exposure of their

work to both national and international communities. Needless to say, this special issue of *Pramana* would also serve as a reference for future research that has its genesis in this symposium.

The selection of the contributory papers for the proceedings was carried out in two steps. Papers were first shortlisted by the scientific committee, which were then critically reviewed by a panel of experts constituted in consultation with Dr. SM Sharma, editorial board member of *Pramana*. The reviewer panel comprised Prof. AK Nath (IIT Kharagpur), Prof. G Ravindra Kumar (TIFR) and Prof. DN Rao (University of Hyderabad), who selected these 48 contributory papers for publication.

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DISCUSSION MEETINGS

Numerical Many Body Methods in Quantum Chemistry and Physics

Orange County, Coorg
2–7 December 2013

Convener: S. Ramasesha (IISc, Bangalore)

The discussion meeting on “Numerical Many Body Methods in Quantum Chemistry and Physics” was held in Orange County, Coorg, from December 2 to 7, 2013. The meeting was attended by 20 participants, which included 4 students, and 16 participants made oral presentations. There were 4 participants with affiliations outside India, comprising one Italian, one Japanese, one British and one American scientist. Five women scientists attended the meeting.

The oral presentations were for 1 hour and 15 minutes each, and very productive and lively discussions were interspersed during this long presentation. Approximately half the speakers were theoretical chemists and the remaining, condensed matter theorists. The topics covered involved developments in techniques and interesting applications of the numerical many body methods. The spectrum of methods ranged from exact diagonalisation methods, density matrix renormalisation group methods, quantum Monte Carlo methods, beyond the density functional methods such as the GW method and some conventional quantum chemical methods. The applications discussed were

quantum phase transitions in spin, Fermionic and Bosonic lattices, neutral-ionic transitions in one-dimensional systems with strong correlations and electron–phonon interactions, development of new methods, etc.

The Orange County also had cultural programmes in the evenings and one of the mornings was spent in bird watching and a village tour, and an evening was spent in a plantation tour.

Probability, Functional Analysis and Related Topics

Orange County, Coorg
26 February – 1 March, 2014

Convener: Kalyan B. Sinha (JNCASR, Bangalore)

Probability and functional analysis are intimately connected areas of mathematics. Traditional probabilists are often wary of functional analysis; however, more recently there has been considerable cross-fertilisation between these two areas of mathematics. Thus, this workshop is very topical. It was organised by members



of faculty of Jawaharlal Nehru Centre for Advanced Scientific Research, the Department of Mathematics of the Indian Institute of Science and Stat-Math Unit of Indian Statistical Institute, Bangalore. In the salubrious atmosphere of Orange County, there were eight talks of an hour each. We mention here some of the talks by young students and post-doctoral fellows: Kartick Adhikari and Tulsi Ram Reddy talked on determinantal point processes and discussed about the spectrum. Jaydeb Sarkar and Bata Krishna Das discussed the Hardy space on the polydisc and the multiplication operators on them. This is a rich area in functional analysis, and probabilists have been very interested in this for decision theory problems. Arup Chattopadhyay spoke on majorisation and its relation to eigenvalue inequalities for matrices. Haripada Sau spoke on the symmetrised bidisc. These talks on different aspects of probability and functional analysis generated a synergy which will continue.

Foundations of Evolutionary Theory: The Ongoing Synthesis

Orange County, Coorg
23–26 February 2014

Conveners: L.S. Shashidhara (IISER, Pune), Sutirth Dey (IISER, Pune) and Amitabh Joshi (JNCASR, Bangalore)

This discussion meeting was organised to bring together a group of people interested in evolutionary biology, representing the diversity of evolutionists (and some from other fields) in India, in order to have extensive and somewhat free-wheeling discussions on some aspects of how recent work on the concepts of fitness, concepts of species and phylogenetic trees, epigenetic inheritance, cultural inheritance, phenotypic plasticity and evo-devo might or might not necessitate major changes to the foundational theories of evolution, collectively often referred to as the Modern Synthesis.

The meeting consisted of five sessions devoted to one theme each: (i) foundational concepts in evolution: species, descent with modification and fitness,

(ii) cultural inheritance and cultural evolution, (iii) evolutionary developmental biology, (iv) epigenetic inheritance and neo-Lamarckism, and (v) phenotypic plasticity. Each session had two 30-minute seed talks, followed by at least 2–3 hours of free format discussion about the implications of recent findings in each field to the foundations of evolutionary theory. The discussions were extremely vigorous and extensive, and most participants thoroughly enjoyed the meeting. A few papers based on discussions at the meeting may be considered for a possible Special Section in the *Journal of Genetics*.

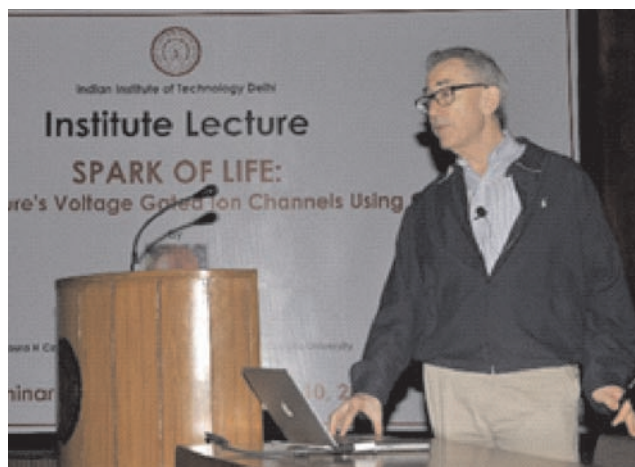
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RAMAN PROFESSOR

Michael L. Klein, FRS, currently occupies the Raman Chair of the Academy. Klein is the Laura H. Carnell Professor of Science and Director of the Institute for Computational Molecular Science. He is also the Dean of the College of Science & Technology at Temple University at Philadelphia. His research interests involve probing the structure and dynamics of macromolecular systems using computer simulation techniques; topics span from soft matter and biophysics to chemical biology, with special emphasis on understanding nature's designs of ion channels. Klein is a Fellow of several academic societies, including the Royal Society of London, the Royal Society of Canada, United States National Academy of Sciences and the American Academy of Arts and Sciences.

During his tenure as the Raman Professorship of the Academy, Klein visited IIT–Delhi, on 10 February 2014, IIT–Kanpur during 13–15 February 2014, and Indian Academy of Sciences, Bangalore, on 15 February 2014.

On 10 February 2014, at IIT–Delhi, the February month Institute Lecture was delivered by Prof. Michael L. Klein



on "Spark of life: Understanding Nature's Voltage Gated Ion Channels Using Computation". In the seminar, Prof Klein addressed the role of voltage-gated ion channels in the propagation of action potentials in excitable cells. He also emphasised the unique ability of computer simulations to exploit the atomic details of ion channels

in a hydrated membrane environments. During his visit to IIT-Delhi, Prof. Klein interacted with several faculty members and undergraduate and graduate students. He discussed how computer simulations can be used as integration tool to address various inter- and intracellular processes in biological systems.

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ACADEMY PUBLIC LECTURES

The story of the discovery of quasars

**Ron Ekers, Federation Fellow, CSIRO, Australia
Telescope National Facility, Australia**

3 January 2014

Indian Institute of Science, Bangalore

Fifty years ago, on 16 March 1963, the discovery of the first quasar, 3C273, was published in *Nature*. The discovery was based on the lunar occultation observed at the Parkes radio telescope in Australia and a red-shift measurement of the identified star obtained at the Mt Palomar optical observatory in California.



The unexpected discovery of quasars resulted in a paradigm shift in astronomy as it was realised that the violent explosions in the nuclei of galaxies could be seen to the edge of the universe and that it would take a black hole to provide the energy. The role of the nuclei of galaxies had been ignored until this time and black holes were considered an exercise in abstraction. Professor Ekers discussed why these unexpected discoveries were missed by some of the top astronomers at the time, and provided an interesting

glimpse into scientific sociology and the nature of scientific progress.

Drainage and dewetting of the tear film

Gerald G. Fuller, Chemical Engineering, Stanford University, Stanford, USA

21 January 2014

Indian Institute of Science, Bangalore

The tear film that protects the ocular surface is a complex, thin film comprising a collection of proteins and lipids that come together to provide a number of important functions. Of particular interest in this presentation is the meibum, an insoluble layer that is spread from glands lining our eyelids. Past work has focussed on the role of this layer in reducing evaporation, although conflicting evidence on its ability to reduce evaporative loss has been published. Professor Fuller discussed the beneficial effects that are derived through the interfacial viscoelasticity of the meibomian lipid film, which is a duplex film comprising a complex mixture of phospholipids, long-chain fatty esters and cholesterol. Using grazing incidence x-ray diffraction, it has been found that this mixture self-assembles into a highly structured layer with strong, interfacial viscoelasticity. By measuring the drainage and dewetting dynamics of thin aqueous films from hemispherical surfaces, where those films are laden with insoluble layers of lipids at



controlled surface pressure, it is evident that these layers strongly stabilise the films because of their ability to support surface shearing stresses. This alternative view of the role of meibum can help explain the origin of meibomian gland dysfunction, or dry eye disease, where improper compositions of this lipid mixture do not offer the proper mechanical resistance to breakage and dewetting of the tear film.

Spark of life

Michael L. Klein, Temple University, USA

28 February 2014

Indian Institute of Science, Bangalore

Professor Michael L. Klein, Raman Professor, Indian Academy of Sciences and Laura Carnell Professor of Science, Temple University, delivered a Public Lecture on the occasion of National Science Day on 28th February 2014, organised by the Indian Academy of Sciences at Indian Institute of Science, Bangalore.

Crystal structures of bacterial analogues of voltage-gated Na⁺ and K⁺ channels have enabled computer simulation to providing insights into the workings of these nano-machines. Now we can even rationalise



how mutations in channel voltage-sensor-domains give rise to diseases. However, much research is still needed to understand eukaryotic ion channels.

Professor Klein in his lecture said that since the release of the first crystal structure of a mammalian voltage-gated K⁺ channel, Kv1.2 in 2005, theoretical and computational methods have been used to gain insights into the molecular level function of these ubiquitous proteins. Starting from the open/activated state crystal structure, he and his team have presented different protocols that have been devised to uncover the resting/closed state structure and, in some occurrences, the conformation of kinetic intermediate states. They also have shown how these models may be tested and validated against experimental data such as the gating

charge value, molecular contacts, etc., and how such molecular level insights may help reconcile diverging views derived from different sets of experimental data. Also, he discussed how the availability of these computational-based models has enabled one to tackle questions with direct biological or pharmacological implication, i.e. to look into the molecular details of the appearance of leak currents, which follow from genetic mutations involved in inherited diseases.

He concluded with the following words “as a crystal structure of the first bacterial voltage-gated Na⁺ channel was released in the year 2013, modellers have already started to take a serious interest in unraveling the structure/function behaviour of Na⁺-selective channels. Such an achievement opens up a whole new world that should enable, together with the results on voltage-gated K⁺ channels, to explain the basis of cellular excitability at a molecular level”.

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‘WOMEN IN SCIENCE’ PANEL PROGRAMMES

1. Panel Discussion with Jocelyn Bell Burnell (11 January 2014)

The Women in Science (WiS) Panel of the Indian Academy of Science (Bangalore) and Students’ Council, IISc (Bangalore), on 11 January 2014, organised an Interactive Discussion Session with Prof. Dame Jocelyn Bell Burnell, Visiting Professor at the University of Oxford, UK, and a Fellow of Mansfield College. Prof. Bell discovered pulsars, pulsating radio stars, in 1968. She has received several honours including Fellow of



the Royal Society and Dame Commander of the Order of the British Empire. She has served as President of the Royal Astronomical Society and the Institute of Physics. Throughout her career she has consistently encouraged women to pursue science and is passionate about the cause. During the interactive session, issues such as stereotype biases, gender discrimination and covert methods were discussed.

2. Seminar on "Women in Science: Career in Science" (11 March 2014)

A lecture workshop was held at SRN Adarsh College, Bangalore, on International Women's Day. The workshop was organised in collaboration with the Women in Science panel, Indian Academy of Sciences, Bangalore. The workshop convener was Prof. Rohini M. Godbole, Centre for High Energy Physics, Indian Institute of Science, Bangalore. The programme was inaugurated by Hon. President Shri V. Premraj Jain; Hon. Secretary Shri Jetendra Mardia; Principal Dr. Bharatish Rao; Programme Convener Prof. Rohini M. Godbole and Programme Co-ordinator Dr. Vijaya B.

In the preliminary address by Prof. Godbole, she emphasized that participation of women students in schools and colleges was high and their level of achievement was also high. She also deliberated on the book *Leelavati's Daughters*, which can be a source of inspiration to all women. She said introduction of women into science was necessary to bring in more diversity, which always improved the quality of science and technology.

The technical session began with Dr. Ranjini Bandyopadhyay from Raman Research Institute, who deliberated on the topic "The Curious Case of Soft Materials". She spoke about soft plastics, and gave an insight on how these soft materials had their application in drug delivery also.

The following session was by Dr. Gurpreet Kaur, Scientist at Novozymes South Asia Pvt. Ltd, who gave a lecture on "Biotechnology in Applied Research". She explained the challenges of the biotechnology in applied research, on how to make a right enzyme and its delivery in the commercial application.

The third speaker for the day was Dr. Urbasi Sinha from Raman Research Institute, who spoke on quantum mechanics. She also talked about quantum computers.

The fourth speaker was Dr. Prajval Shastri from Indian Institute of Astrophysics, who spoke on "Harnessing Gravity to Glow and Grow: Galaxies and Their Blackholes".

The post-lunch session was a Panel Discussion on "Women in Science" by eminent speakers, including Dr. Vidyanand Nanjundiah from Indian Institute of Science, Dr. Mukund Thatti from National Centre for Biological Sciences, Dr. Sheela K. Ramasesha from Indian Institute of Science, Dr. Prajval Shastri from Indian Institute of Astrophysics and Dr. Mahua Ghosh from the Physics Department of Mount Carmel College. In this interactive session, many girl students spoke about gender-bias problems. The panelists shared their experiences and motivated the students.

Over 90 students and many teachers from 12 colleges participated in the workshop.

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NATIONAL SCIENCE DAY 2014

Every year National Science Day is celebrated on 28th February in India to mark the discovery of the Raman Effect by Sir C.V. Raman in 1928. The Government of India initiated this programme with the following objectives: to widely spread the message about the significance of scientific applications in daily life; to display all the activities, efforts and achievements in the field of science for human welfare; to discuss all issues and implement new technologies for the development of science; to give an opportunity to the scientific minded citizens in the country and to encourage the people as well as to popularise science and technology. The theme for the year 2014 was "Fostering Scientific Temper".



On this occasion, Indian Academy of Sciences (IAS) in association with Agastya International Foundation (AIF) organised a demonstration of scientific models/projects for students from various schools in Bangalore. The event, held in the premises of the Academy, began with the inaugural ceremony presided by the president of the Academy, Dipankar Chatterjee, who in his inaugural address introduced C.V. Raman and his research to



the students gathered. Ramji Raghavan, Founder and Chairman of AIF, shared his views on the joys of learning and discovery. The students of Poornapragna High School and Government High School, IISc, demonstrated their scientific models in an interesting way. After this, the students were escorted to the Raman Museum at Raman Research Institute. Later in the evening a Public Lecture was organised by IAS at the Faculty Hall, IISc. The Public Lecture was delivered by Professor Michael L. Klein, the well-known scientist from Temple University, USA, and Raman Professor, IAS.

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SUMMER RESEARCH FELLOWSHIP PROGRAMME FOR STUDENTS AND TEACHERS – 2014

This is the eighth year of the Summer Research Fellowship Programme jointly conducted by the three National Science Academies of the country.

The 2014 Programme was announced in September 2013 and the last date for receiving applications was 30 November 2013. Selection Committees consisting of experts in different areas met during the third week of December 2013 to scrutinise and make the selections. The following table indicates, subject-wise, the numbers of applications received from students and teachers and the fellowships offered.

Subjects	No. of applications received		Shortlisted for selection	
	Students	Teachers	Students	Teachers
Life Sciences	4093	279	626	75
Engineering & Technology	12881	268	462	58
Chemistry	1997	159	247	63
Physics	2021	105	280	31
Earth & Planetary Sciences	912	16	147	10
Mathematics	1010	42	189	24
TOTAL	22914	869	1951	261
GRAND TOTAL	23783		2212	

In the next issue of *Patrika*, the number of fellowships actually availed and some analysis of the data will be included.

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REFRESHER COURSES

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

Two-week Refresher Courses are aimed at helping teachers add value to their teaching and are designed to have direct relevance to the study material covered in the graduate and undergraduate syllabi followed in universities and institutions in the country. The following Courses were held during the last six months.

A. Refresher Courses in Experimental Physics

The Refresher Courses in Experimental Physics were held under the supervision of R Srinivasan, who was instrumental in the conceptualisation and designing of the experiments. He has so far held 56 Courses in different parts of the country since 1999. These experiments are useful for laboratory programmes at BSc and MSc levels and many universities in the country have adopted these experiments as part of

their curricula. In order to conduct the Refresher Courses, a user-friendly kit containing several components has been developed and manufactured under licence by a company in Bangalore: M/s Ajay Sensors and Instruments.

The following is a list of five Experimental Physics Courses held from October 2013 to March 2014.

1. LII. Shri Mata Vaishno Devi University, Katra, J&K (SMVDU)

8–24 October 2013

Co-ordinator: Sunil K Wanchoo (SMVDU)

No. of Participants: 23 participants from Bijnor, Jaipur, Jammu, Katra, Mumbai, Nagpur, Talcher



Resource Persons: R Srinivasan, TG Ramesh, Sunil K Wanchoo, KK Bamezai, Rajini Ashrita, Yugal Khajuria

2. LIII. Indian Academy of Sciences Annexe, Jalahalli, Bangalore

7–23 November 2013

No. of Participants: 19 participants from Ahmednagar, Alappuzha, Bhopal, Delhi, Itarsi, Jaipur, Karunagappaly, Kollam, Kozhikode, Mysore, Patna, Rajahmundry, Rajkot, Satara, Thiruvapur



Resource Persons: R Srinivasan, TG Ramesh, Seeta Bharati, Ramachandra Sapkal, Mahesh Vedpathak, Anil Pugalia

Special Lectures: KBR Varma and Arun M Umarji

3. LIV. Indian Institute of Science Education and Research, Pune (IISER)

9–24 December 2013

Co-ordinator: Ashna Bajpai (IISER)

Resource Persons: R Srinivasan, TG Ramesh, Elankumaran Kannan, Efrem D'Sa, Sadique, KRS Priolkar, Manohar Naik, Manohar Nyayte

Special Lectures: SB Ogale, Arving Gupta, CV Dharmadhikari

4. LV. University of Kota, Kanpur (UV)

9–25 January 2014

Co-ordinator: NK Jaiman/Saurabh Dalela (UV)



5. LVI. Panjab University, Chandigarh (PU)

11–26 February 2014

Co-ordinator: Devinder Mehta (PU)

B. Other Refresher Courses

6. Statistical Mechanics

Homi Bhabha Centre for Science Education, TIFR, Mumbai

6–19 November 2013

Course Director: Deepak Dhar (TIFR)

Course Co-ordinator: Anuradha Misra (UM)

No. of Participants: 37 participants from Ahmednagar, Bhubaneswar, Burdwan, Burhanpur, Changanacherry,



Dindigul, Gurgaon, Jamshedpur, Kilakarai, Kurukshetra, Mangalore, Mumbai, Ranchi, Tiruchirapalli, Vidyavihar

Resource Persons: Deepak Dhar, SH Patil, Sourendu Gupta, Anuradha Misra, Radha Srinivasan, M Barma, Dibyendu Das, Praveen Pathak, Kedar Damle, Vijay Singh, Sahana Murthy

Topics of Lectures: Basic concepts of statistical physics; probability theory; dimensional analysis; quantum statistics; theory of stochastic processes; phase transitions and critical phenomena.

Special Lectures: M Barma (Away from the average: fluctuations big and small); Sahana Murthy (Teaching methods); Deepak Dhar (A simple model of proportionate growth)

7. Evolutionary Ecology of Plants and Animals

PSGR Krishnammal College for Women, Coimbatore (PSGRKCW)

11–26 November 2013

Course Director: KN Ganeshiah (UAS, Bangalore)

Course Co-ordinator: W Suganya (PSGRKCW)

No. of participants: 19 participants from Belgaum, Chennai, Coimbatore, Dehradun, Kamuthi, Mumbai, Sivakasi, Vaniyambadi



Resource Persons: KN Ganeshiah, P Bala-subramanian, R Uma Shaanker, MNV Prasad, K Padmakumar, M Sanjappa, S Paulsamy,

D Narasimhan, VS Ramachandran, Ramakrishnan, N Thajuddin, C Kunhikannan, Vijay Kumar Sharma, S Murugesan, TJ Pandian, P Pramod

Topics of Lectures: Linnaeus and Darwin; Evolution of insect plant interactions; do plants behave like animals; self-organisation in plant growth and animal behaviour; bird–plant interaction; sexual selection in plants; data mining, genetics and plant breeding; cosmic evolution of life; molecular evolution and protobiology; seaweed chemical defenses; cues from marine chemical ecology for discovering drugs and pharmaceuticals; plant–plant interactions; plant–insect interactions; floristic diversity in India; Kas Plateau – a botanical paradise; biodiversity; biology of carnivorous plants; Galapagos Islands; cladistics; plants and pollinators; role of elephants and its conservation problems; morphological, biochemical and molecular phylogeny of cyanobacteria; rhythms of fruit flies in nature; entrainment of fruit flies; studies of wiring diagrams in the fruit fly brain; bio-prospecting of natural products as sources of pest management agents; plant–animal interaction; biodiversity in India in evolutionary and conservation perspective.

8. Quantum Mechanics

Indian Institute of Technology, Roorkee (IIT)

28 November–12 December 2013

Course Director: Deepak Kumar (JNU)

Course Co-ordinator: Ishwar Singh Tyagi (IIT)

No. of Participants: 48 participants from Adipur, Awantipora, Bhubaneswar, Gorakhpur, Hamirpur, Haridwar, Hisar, New Delhi, Jatni, Kangra, Kurukshetra, New Delhi, Patiala, Pauri, Roorkee, Saharanpur, Srinagar, Tehri, Uttarkashi, Varanasi

Resource Persons: Saiket K Ghosh, Arvind, DG Kanhere, Debajyoti Chaudhury, IS Tyagi, Deepak Kumar, S Auluch

9. Quantum Mechanics

JSS Educational Institutions, Suttur, Mysore District (JSS)

2–14 December 2013

Course Director: G Rajasekaran (IMSc, Chennai)

Course Co-ordinator: Vijaya Manjuantha Guru (JSS)

No. of Participants: 23 participants from Chamarajanagar, Chennai, Chintamani, Chitradurga, Coimbatore, Hassan, Jabalpur, Jaipur, Karaikal, Kollam,



Mandya, Mysore, Mumbai, Sulthan Bathery, Thiruvananthapuram, Tiruchirapalli, Ujire

Resource Persons: HS Mani, Govind Krishnaswami, KS Malleth, G Rajasekaran

Topics of Lectures: Module 1: Physical basis of quantum mechanics, Schrödinger equation, hydrogen atom; Module 2: Basic postulates, linear vector space, angular momentum, atoms and molecules; Module 3: Perturbation theory, scattering theory; Module 4: Quantum theory of radiation, relativistic quantum mechanics.

Special Lectures: Life and Work of Paul Dirac; Pancharatnam, Bargmann and Berry Phases: A retrospective (N Mukunda)

10. Theoretical Physics

Assam University, Silchar (AU)

2–15 December 2013

Course Director: Sudhakar Panda (HRI, Allahabad)

Course Co-ordinator: Atri Deshamukhya (AU)

No. of Participants: 37 participants from Algapur, Chumukedima, Dharmanagar, Haflong, Joysagar, Kailashahar, Silchar, Ujjain

Resource Persons: Indrani Bose, Somendra Mohan Bhattacharjee, Sudhakar Panda, Anirban Basu



Topics of Lectures: Statistical mechanics; thermodynamics; critical phenomena; phase transitions and Ising model; Fermi and Bose systems; Bose-Einstein condensation; quantum field theory; tensor algebra; Dirac and electromagnetic field quantisation; symmetry breaking and Higgs mechanism; classical mechanics.

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LECTURE WORKSHOPS

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

1. Current Trends and Directions in Computer Science Research

Dr NGP Arts and Science College, Coimbatore (NGPASC)

3–5 October 2013

Convener: R Krishnan (Amrita University, Coimbatore)

Co-ordinator: N Ananthi (NGPASC)

Participants: 168 participants from various colleges, universities and institutions in Coimbatore



Topics Covered: Research issues in high-resolution image processing and image analysis and computer vision; current trends in advanced computing and recent trends in high-performance computing; research issues in information retrieval; mathematical foundation for computer science research (linear algebra) and research issues in optimisation techniques; classification using genetic programming and POS tagging using sequence labelling and SVM tool; research issues in cloud computing.

2. Cell Differentiation in the context of Cancer & Stem Cell Biology

Chinmaya Arts and Science College for Women, Kannur (CASCW)

8–9 October 2013

Convener: T Subramoniam (NIOT, Chennai)

Co-ordinator: PA Valsalakumari (CASCW)

Participants: 172 participants from neighbouring colleges and university departments in Kannur



Topics Covered: An introduction to stem cell biology; aberrant signaling pathways in cancer; creating functional blood vessels from adult stem cells; acute lymphoblastic leukemia and haematopoietic stem cell transplantation; mechanisms & control of vitellogenesis in crustacean; understanding cancer and its management; gamete cell differentiation in crustacea; spermatogenesis; steroid receptors and cancer.

3. Mathematical Methods for Science

AES National Degree College, Gauribidanur (AES)

11–12 October 2013

Convener: Gadadhar Misra (IISc)

Co-ordinator: KS Gayathri (AES)

Participants: 170 participants from various colleges in Gauribidanur, Kolar



Topics Covered: Game theory; counting and tiling; power of matrix; role of linear algebra in Google search; searching and sorting million needles in zillion haystacks; binary ternary.

4. Bioprospecting and Bioresources: From Molecules to Products

VIT University, Vellore

21–23 October 2013

Convener: R Uma Shaanker (UAS, Bangalore)

Co-ordinator: Siva Ramamoorthy (VIT)

Participants: 145 participants from colleges in Chennai, Chidambaram, Erode, Kanchipuram, Thiruvannamalai, Tirupathi, Vellore



Topics Covered: Documenting, mapping, digitising bioresource; prospecting drugs from bugs-potential antibiotics for human health and agriculture; bioprospecting: use of niche modelling tools; using fungal endophytes; random to non-random approaches; ecological niche modelling tools; dyes from plants.

5. Psycho-disorders & Role of Neuro-protective Nutrition in Decision Making

University of Allahabad, Allahabad (UA)

24–26 October 2013

Convener: UC Srivastava (UA)

Co-ordinator: Niraj Kumar (NASI)

Participants: 200 participants from various colleges, institutions in and around Allahabad

6. Selected Topics in Astrophysics

St. Joseph's College, Bangalore (SJC)

25–30 October 2013

Convener: G Srinivasan (Bangalore)

Co-ordinator: Rabbi Akkiba Angiras (SJC)

Participants: 64 participants from various colleges in Bangalore

Topics Covered: Stars; radiative processes; x-ray astronomy; galaxies; between the stars; white dwarfs; ultraviolet astronomy; pulsars.

7. New Vistas in Topology and Analysis

St Joseph's College, Irinjalakuda (SJC)

6–8 November 2013

Convener: T Thrivikraman (CUSAT, Kochi)

Co-ordinator: Sr Christy (SJC)

Participants: 131 participants from various colleges in and around Irinjalakuda in Kerala



Topics Covered: Basic Topology; algebraic topology; analysis.

8. Modern Trends in the Development and Characterization of Materials

Maharani's Science College for Women, Bangalore (MSCW)

12–13 November 2013

Convener: TN Guru Row (IISc)

Co-ordinator: G Ramagopal (MSCW)



9. Advances in Molecular Spectroscopy

University of Calicut, Calicut (UC)

20–21 November 2013

Convener: E Arunan (IISc)

Co-ordinator: P Raveendran (UC)

Participants: 170 participants from various institutions in and around Calicut



Topics Covered: Advances in magnetic resonance spectroscopy; why molecules absorb/emit radiation; infrared spectroscopy for the study of molecular conformations and weak intermolecular interactions; laser spectroscopy; molecular beam microwave spectroscopy.

10. Modern Trends in Chemistry

Tezpur University, Tezpur (TU)

20–22 November 2013

Convener: PK Das (IISc)

Co-ordinator: RC Deka (TU)

Participants: 166 participants from Rajiv Gandhi University, Arunachal Pradesh and Tezpur University



Topics Covered: Green chemistry; physical chemistry; organometallic chemistry; chemical education and organic chemistry; bioinorganic chemistry; biochemistry; material science; theoretical chemistry; inorganic chemistry.

11. Biowaves: The Pulse of Biology

St. Xavier's College, Mumbai

29–30 November 2013

Convener: Tarala D Nandedkar (NIRRH, Mumbai)

Co-ordinator: Nandita Mangalore (St. Xavier's College)

Participants: 235 participants from colleges, institutions in and around Mumbai



Topics Covered: Amazing nanotechnology and its applications in health care; impairment of cell division and growth of malaria parasites; reciprocity as a regulatory principle of biological process; the immune system: past, present and future; G-protein coupled receptors: structure-function relationship of gonadotropin receptors; in vivo imaging techniques.

12. Trees of Life

Jai Hind College, Mumbai (JHC)

11–12 December 2013

Convener: LS Shashidhara (IISER, Pune)

Co-ordinator: Yasmina Dordi Avari (JHC)

Participants: 150 participants from colleges, institutions in and around Mumbai

Topics Covered: Evolutionary-developmental biology; human evolution, health and disease; experimental evolution in the laboratory; evolution, trees of life and species in inquiry-oriented biology education; extended evolutionary synthesis; evolution, behavior and complex disorders.

13. Sense and Sensibility

Sophia College, Mumbai (SC)

20–21 December 2013

Convener: Tarala D Nandedkar (NIRRH, Mumbai)

Co-ordinator: Hema Subramaniam (SC)

Participants: 156 participants from different colleges and institutions in Mumbai

Topics Covered: The role of environmental sounds on the development of auditory system; connecting the retina to the brain; how those not like us perceive the world; visible and invisible messages: how plants communicate with each other and with insects; non-neuronal perception of the environment; neuroscience.

14. Advanced Topics in Mathematics

Bengal Engineering and Science University, Shibpur (BESU)

22–24 December 2013

Convener: Asok Kumar Mallik (BESU)

Co-ordinator: Murari Mitra (BESU)

Participants: 66 participants from various colleges and universities



Topics Covered: Prime numbers—theorems, conjectures and applications; geometric methods for first and second order ordinary differential equations; density functional theory; continued fractions: from non-random to random; the completeness axiom in real analysis; variational methods and its applications; random walks and Markov chains; convergence concepts in probability theory.

15. Dynamical Systems

PSGR Krishnammal College for Women, Coimbatore (PSGRKCW)

26–28 December 2013

Convener: M Lakshmanan (Bharathidasan University, Tiruchirapalli)

Co-ordinator: P Meena (PSGRKCW)

Participants: 152 participants from colleges and universities in Coimbatore, Gobichettipalayam, Pollachi, Udumalpet, Tiruppur



Topics Covered: Dynamics and Lagrangian formulation; small oscillations and normal co-ordinate analysis; free and forced oscillations including continuous systems; Hamiltonian dynamics; central force motion; problem solving in dynamics.

16. Recent Progress in Chemistry

Bengal Engineering and Science University, Shibpur (BESU)

26–28 December 2013

Convener: Sabyasachi Sarkar (BESU)

Co-ordinator: Shyamal Kumar Chattopadhyay (BESU)

Participants: 110 participants from various colleges and institutions in Howrah, Kolkata, Narendrapur



Topics Covered: Inorganic chemistry in biology: metalloenzymes of life; bio-inspired electrodes; infrared and Raman spectroscopy; time resolved and sum-frequency vibrational spectroscopy; applications of scanning probe microscopy in chemistry, biology and materials; systematic development of organic reactions dealing with the C-C bond and C-X bond formations in acyclic, carbocyclic and heterocyclic systems; designing organic molecules for a useful purpose; nonlinear optics; thermodynamics; nucleic acids and their structure, function and applications in research.

17. Excursions in Mathematics

Jain University, Bangalore (JU)

27–28 December 2013

Convener: BV Rajarama Bhat (ISI, Bangalore)

Co-ordinator: JV Ramana Raju (JU)

Participants: 128 participants from different colleges in Bangalore

Topics Covered: Algebra, analysis, statistics, number theory and geometry; colouring of maps and polyhedra; power of matrix; an inquisitive look at tilings, art and optimality; the world of Diophantine equations; probability and sampling; function algebras; notions of curvature.

18. Recent Trends in Functional Analysis

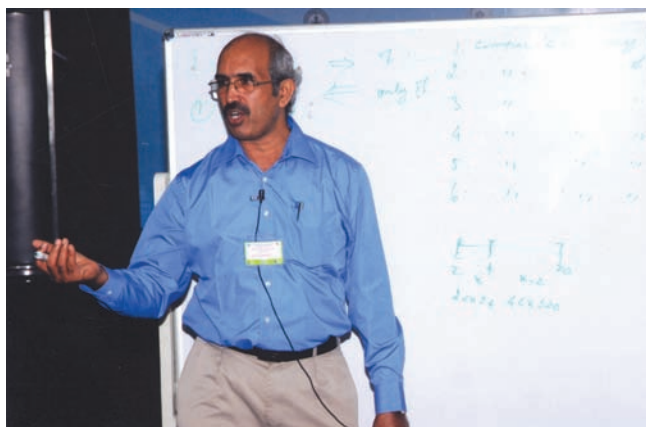
PSGR Krishnammal College, Coimbatore (PSGRKCW)

2–4 January 2014

Convener: Geetha Srinivasa Rao (University of Madras)

Co-ordinator: K Sumathi (PSGRKCW)

Participants: 217 participants from various colleges in Coimbatore



Topics Covered: Geometric properties of Banach spaces; Hilbert spaces of holomorphic functions; visual cryptography; fixed points of generalised weakly contractive maps in orbitally complete metric spaces; compatible and weakly compatible mappings with fixed points; almost contractions, condition (B), generalised almost weakly contractive maps; length inequalities for vectors in normed linear spaces; tools and techniques in approximation theory.

19. Cryptology

Aurora's Degree & PG College, Hyderabad

3–4 January 2014

Convener: S Chaturvedi (UOH, Hyderabad)

Co-ordinator: Satyanarayana Kota (Aurora's College)

Participants: 183 participants from graduate and post-graduate colleges in Secunderabad and Hyderabad

Topics Covered: Elliptic cryptography and its applications; nano materials; coding theory; journey of cryptography; applications and advancements in cryptography.

20. Recent Advances in Corrosion Engineering

College of Engineering, Pune

6–8 January 2014

Convener: KA Natarajan (IISc, Bangalore)

Co-ordinator: ST Vagge (CEP)

Participants: Faculty, research scholars, PG and UG students from colleges/institutions in and around Pune



Topics Covered: Corrosion engineering; materials selection for corrosion prevention; corrosion of stainless steels; microbial corrosion; corrosion failure analytics; coating for corrosion protection; pipeline corrosion and its prevention; corrosion testing, monitoring and standards; high temperature corrosion; corrosion control management.

21. Fluid Dynamics

PSG College of Technology, Coimbatore (PSGCT)

7–9 January 2014

Convener: P Kandaswamy (Bharathiar University, Coimbatore)

Co-ordinator: Sai Sundara Krishnan (PSGCT)

Participants: 115 participants from various colleges in Coimbatore



Topics Covered: Energy conversion with supercritical CO₂; Lattice-Boltzman method; scaling in fluid dynamics; stokes flow; double diffusive convection; stability of fluid flows.

22. Fascinating Chemistry

Malda College, Malda

20–21 January 2014

Convener: Uday Maitra (IISc, Bangalore)

Co-ordinator: Abul Hassan (Malda College)

Participants: 200 participants from various colleges in Malda, North Dinajpur



Topics Covered: Chemical kinetics and reaction rate theories; coordination chemistry of the transition metal ions; neighbouring group participation; learning chemistry in computer age; domain of colloid and interface science with special reference to nanostructured systems; organometallic complexes of the platinum metals: synthesis, structure and catalytic application; a different way to look at thermodynamics; molecules defy rules.

23. Physics 2014

S.B. Arts and K.C.P. Science College, Bijapur (SBAKCPSC)

20–22 January 2014

Convener: KA Suresh (CSMR, Bangalore)

Co-ordinator: Suresh C Pattar (SBAKCPSC).

Participants: 185 participants from various colleges in Bijapur.



Topics Covered: Recent milestones in physics; from physics to biology and medicine: the story of evolution of NMR; semiconductor prisms: an introduction to heterostructures; soft matter: liquid crystals, membranes, gels and thin films; Cohen-Tannoudji or Anatole Abragam: understanding quantum mechanics and spin physics; multi-functionality of GaN nanostructures; glimpses into the 'coloured' secrets of nature: the spectroscopic perspectives; nano-science: a fleeting look; understanding molecular vibrations to graphene to art; applications of nanomaterials; structure and assembly of sesbania mosaic virus; mature science: crystallography in the 21st century.

24. Contemporary Issues in Biology

Parvatibai Chowgule College, Margao, Goa (PCC)

20–22 January 2014

Convener: HA Ranganath (Bangalore)

Co-ordinator: Dileep K Tikare (PCC)

Participants: 140 participants from various colleges in Goa



Topics Covered: Biological science: its past, present, future; evolutionary biology; evolution and human health; ethnobotany; bioprospection: floristic diversity in India with particular reference to medicinal and aromatic plants; genetics and molecular biology; RNA no longer a poor cousin of DNA; biology of telomeres.

25. Life Sciences: Enkindle Intelligentsia

CMR Institute of Management Studies, Bangalore (CMRIMS)

22–23 January 2014

Convener: Dipshika Chakravorty (IISc, Bangalore)

Co-ordinator: DB Beena (CMRIMS)

Participants: 100 participants from colleges in Bangalore



Topics Covered: Bacterial pathogenesis; genetic engineering; innate and adaptive immunity.

26. Nonlinear Physics

Bishop Heber College, Tiruchirapalli (BHC)

23–25 January 2014

Convener: M Lakshmanan (Bharathidasan University, Tiruchirapalli).

Co-ordinator: T Kanna (BHC).

Participants: 166 participants from institutions in and around Tiruchirapalli.



Topics Covered: Nonlinear dynamics; application of nonlinear physics in spin systems; application of nonlinear physics: Bose–Einstein condensates, biological systems; nonlinear electronics; super-symmetry in quantum mechanics; nonlinear optics; optical solitons, rogue waves, similaritons and their applications.

27. Techno Materia 2014: A Chemical and Physical Perspective of Trend Setting Engineering Materials

NSS College of Engineering, Palakkad (NSSCE)

24–25 January 2014

Convener: KR Gopidas (NIIST, Thiruvananthapuram)

Co-ordinator: S Mayadevi (NSSCE)

Participants: 151 participants from various colleges in and around Palakkad



Topics Covered: The strange and beautiful world of quantum mechanics; magneto dielectric properties of some double perovskites; organic photovoltaics; use of Raman Spectroscopy from MOFs to proteins; spintronics; material science under extreme pressures; fundamentals of nano-fabrication; photoresponsive materials.

28. Recent Advances in High Energy Physics

St. Joseph's College, Irinjalakuda (SJCI)

28–29 January 2014

Convener: MVN Murthy (IMSc, Chennai)

Co-ordinator: Mary Gisby Poulouse (SJCI)

Participants: 180 participants including PG students, research scholars and faculty from various colleges in Irinjalakuda



Topics covered: Standard model, Higgs Boson; physics of strong interaction; Higgs discovery at LHC; neutrinos; neutrino oscillations; mysterious dark matter.

29. Recent Trends in Biology and Biotechnology

Jamal Mohammed College, Tiruchirapalli (JMC)

29–31 January 2014

Convener: G Marimuthu (MKU, Madurai)

Co-ordinator: T Nargis Begum (JMC)

Participants: 252 participants from various universities and colleges in Tiruchirapalli



Topics Covered: Power of evolution; power of bacterial genetics; connecting genes to behaviour circadian clocks; biology and behaviour of bats; adaptive significance of circadian rhythms; biology: some insights; molecular mechanism of olfactory learning and memory; asexual reproduction, coeloms, and embryonic stem cells; primordial germ cells and sexuality; microalgae from biodiversity to biotechnology; Lipophorin: a targeted protein for drug designs.

30. Ordinary Differential Equations: An Overview of its Applications and Various Methods of Solutions

Christ University, Bangalore (CU)

30–31 January 2014

Convener: Mythily Ramaswamy (TIFR-CAM, Bangalore)/AK Nandakumaran (IISc, Bangalore)

Co-ordinator: Mayamma Joseph (CU)

Participants: 100 participants from various colleges in Bangalore

Topics covered: Ordinary differential equations: introduction, examples and models; linear first and second order equations; general theory, examples and importance of theoretical study of existence, uniqueness; numerics – its importance and modern perspective.

31. Recent Advances in Biology

Christ University, Bangalore (CU)

31 January–1 February 2014

Convener: Umesh Varshney (IISc, Bangalore)

Co-ordinator: VL Vasantha (CU)

Participants: 145 participants from 13 colleges in Bangalore



Topics Covered: What can we learn from insect societies; synthetic DNA devices in living systems; genomics of restriction modification system; the role of DNA polymerases in replication and evolution; two big problems of HIV research today; the importance of micro RNAs in disease and development; population dynamics.

32. Recent Developments in Physical Chemistry

St. Joseph's College, Irinjalakuda (SJCI)

31 January–1 February 2014

Convener: ED Jemmis (IISc, Bangalore).

Co-ordinator: Rosabella K Puthur (SJCI).

Participants: 143 participants from colleges in Irinjalakuda.



Topics Covered: Nobel laureates in chemistry 2013; insights into some exactly solvable problems in quantum mechanics; semi-empirical and *ab initio*; chemistry with computers; density functional theory; how to think of problems in chemistry; molecular mechanics and force fields.

33. Contemporary Research Issues in Life Sciences

SDM College, Ujire (SDMC)

3–4 February 2014

Convener: RR Rao (UAS, Bangalore)

Co-ordinator: Keshava Hegde Korse (SDMC)

Participants: 205 participants from different colleges in Bantwaal, Karkala, Moodbidre, Puttur, Udupi and Ujire



Topics Covered: Power of evolution; evolution and human health; biology of telomeres; RNA is no longer a poor cousin of DNA; pollination biology; importance of low-tech research for effective management and conservation of our biodiversity; role of ethno-botany in search of newer and effective drug plants; current problems in taxonomic teaching and research in India.

34. Interdisciplinary Sciences and Modern Biology

M.K. Ponda College of Business & Management, Bhopal (MKPCBM)

14–15 February 2014

Convener: Shekhar Mande (NCCS, Pune)

Co-ordinator: Manju Tembhre (MKPCBM)

Participants: 125 participants from different educational institutions and research organisations of Bhopal

Topics Covered: Interdisciplinary sciences and modern biology; genome to epigenome; networks in biology; optical traps in biology and their applications; microbiome and metagenomics; gut microbiome.

35. Insights in Evolutionary Biology

M.E.S. Degree College of Arts, Commerce & Science, Bangalore (MES)

14–15 February 2014

Convener: SK Saidapur (Bangalore)

Co-ordinator: Sheela Menon (MES)

Participants: 100 participants from various colleges in Bangalore



Topics Covered: Power of evolution; pollination, fertilization and dispersal of diaspores in flowering plants; sexual selection; adaptive radiations in angiosperm pollination biology; insectivorous plants; co-evolutionary arm race between bacteria and viruses; evolutionary drifts in protein domain superfamilies.

36. Plant Taxonomy

PSGR Krishnammal College for Women, Coimbatore (PSGRKCW)

17–18 February 2014

Convener: M Sanjappa (UAS, Bangalore)

Co-ordinator: W Suganya (PSGRKCW)

Topics Covered: Biodiversity of Western Ghats; orchid biology; the art and science of botanical illustrations and biology of carnivorous plants; medicinal plants of India: diversity, conservation and bioprospection; adaptive radiation in angiosperms: pollination biology; biodiversity of Tamil Nadu; taxonomy in conservation.

37. Current Trends in Chemistry

Vivekananda Mahavidyalaya, Burdwan (VM)

17–18 February 2014

Convener: Anunay Samanta (UOH, Hyderabad)

Co-ordinator: Basudeb Haldar (VM)

Participants: 113 participants from twenty different colleges and institutions in Bhirbhum, Burdwan, Hooghly, Sonapat

Topics Covered: Inorganic supramolecular chemistry: a copper mono-nuclear coordination complex to trinuclear iron carboxylates through multinuclear polyoxometalates; carbohydrates; understanding the ionic liquids using fluorescence spectroscopy; chemistry of metal dithiolato coordination complexes; diversity oriented asymmetric synthesis of bio-active natural products; coordination chemistry; synthesis and characterization of metal nanoparticles incorporated films by the sol-gel process; olefin metathesis mediated synthesis of α -amino acids and α,β -diamino acids; design of functional nanomaterials and coatings.

38. Recent Trends in Materials Science and Materials Research

Sree Siddaganga College of Arts, Science & Commerce, Tumkur (SSCASC)

21–22 February 2014

Convener: KJ Rao (IISc, Bangalore).

Co-ordinator: C Narayanareddy (SSCASC).

Topics Covered: Modern applications of magnetic materials; composite materials – the core of material applications; the expanding world of smart materials; a shy group of materials namely glasses; the challenge of energy storage: batteries; sensor materials; nature of the chemical bond: perspective from electron density analysis; small can be both beautiful and exciting.

39. Differential Equations and its Applications

Indian Academy Degree College, Bangalore

21–22 February 2014

Convener: Mythily Ramaswamy (TIFR-CAM, Bangalore)

Coordinator: PK Lakshmikanthamma (IADC)

Topics covered: Ordinary differential equations and its applications; string equation; heat equation.

40. New Challenges in Plant Taxonomy

Jiwaji University, Gwalior (JU)

21–22 February 2014

Convener: RR Rao (UAS, Bangalore)

Coordinator: AK Jain (JU)

41. Recent Research in Biological Sciences

Madurai Kamaraj University, Madurai (MKU)

27–28 February 2014

Convener: G Marimuthu (MKU)

42. Modern Trends in Chemistry and its Biological Applications

Sikkim Government College, Gangtok (SKC)

27–28 February 2014

Convener: Anunay Samanta (UOH)

Co-ordinator: Bhaskar Chakraborty (SKC)

Participants: 143 participants from Sikkim University, Sikkim Government College, Himalayan Pharmacy Institute, Siliguri College, University of North Bengal.

Topics Covered: How protein molecule moves as like snake for respiration in our cell; recent advances in



femto second and single molecule spectroscopy; design of sensitizers for photodynamic therapy; biomembranes; design of cyclophanes as molecular probes; fluorescence signaling of guests and complex environments; history and chemistry of a blockbuster drug; physics and chemistry of the interfaces with special reference to the synthesis and characterisation of nanoparticles; catalyst and catalysis; organisation and dynamics of biomembranes from slow solvent relaxation.

43. Spectroscopy

Christ University, Bangalore (CU)

28 February–1 March 2014

Convener: E Arunan (IISc, Bangalore)

Co-ordinator: Sunaja Devi KR (CU)



Topics Covered: Why molecules absorb/emit radiation; time and space resolved Raman spectroscopy; solid state spectroscopy; multiphoton spectroscopy; NMR spectroscopy; Brillouin scattering; light–matter interactions.

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Ram Ramaswamy and the Repository Team

Do send your views on this matter to eprints@ias.ernet.in.

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HINDI WORKSHOPS

Two Hindi workshops were held in the last six months, one on 17 December 2013 and the other on 7 March 2014. These workshops were jointly organised by the Indian Academy of Sciences and the Raman Research Institute. The two workshops entitled "Two Words" were by Sri Mahadev G Savdatti, Assistant Director (Retd.), Department of Official Language, Bangalore.

DAINIK BHASKAR NATIONAL EDUCATION LEADERSHIP AWARD 2013



The Dainik Bhaskar National Education Leadership Award recognises institutions that are innovative, modern and industry-related in their curriculum, marketing, advertising, marketing communications, engineering and technology.

The Indian Academy of Sciences was honoured with the Dainik Bhaskar National Education Leadership Award 2013 in recognition of leadership in education. The award was presented on 23 October 2013 at Mumbai.

ADDITIONAL HOSTEL FACILITY AT JALAHALLI

The Academy has begun the construction of a new hostel block in its Fellows Residency at Jalahalli. Prof. Dipankar Chatterji, President of the Academy, along with other Office Bearers Profs. Ajay Sood, Uday Maitra and Raghavan Varadarajan initiated the construction work on 24 January 2014. The new hostel block will be a three-storey building with a total area of 1228 sq. ft. with 24 rooms. The entire civil work is expected to be completed by early next year.



OBITUARIES



Supriya Roy
(elected 1986)

S. Roy, a Geoscientist, Researcher and Academician of international repute, passed away on 22 August 2013 at the age of 82 after a brief illness. In the post-Renaissance era of Bengal, many scholars, mainly from the Presidency College of the University of Calcutta, spread across the country and nucleated several small intellectual centres, glowing like stars in different institutions. Roy was one among those who ventured out during the early sixties in a new direction.

After completing BSc (Geology Hons.) in 1950 and MSc (Geology) in 1952 from the University of Calcutta, Roy joined Jadavpur University in the mid-fifties of the last century as a research scholar. He was awarded DPhil degree in 1957. After finishing his post-doctoral work in the National Research Council, Canada, he returned to India, and became a member of permanent faculty in Jadavpur University in 1959. He was awarded DSc degree from Jadavpur University in 1963. He served the Geoscience Department of Jadavpur University in different capacities till his retirement in 1996. After retirement he continued his research and other academic activities at the University as Indian National Science Academy Senior Scientist until 2001, and thereafter as Professor Emeritus till his last days.

At the time when Roy joined Jadavpur University, the geoscience centre was yet to crystallise in the

form of a well-structured department. He played a key role in the development of a complete academic department, equipped with advanced laboratories, course curricula and a good research ambience. His efforts laid the foundation for the faculty of later generations to reach new heights in the world of geosciences we see today. He greatly facilitated earth sciences in India to achieve global visibility. He was the first Indian geologist to initiate a research school of economic geology with an analytical approach. In the beginning, his interest was aimed at understanding the genesis of iron ores based on their mineral chemistry and textures. Later he focused his research exclusively on different aspects of manganese ore deposits, a subject that remained his great passion till his last breath.

His main intent was to understand the genetic aspects of manganese ore deposits keeping in mind the pristine depositional environments of synsedimentary deposits controlled largely by the effects of tectonically related sea level and climate changes. He tried to work out the cause-and-effect relationship between the evolution of the atmosphere–hydrosphere system and the global metallogeny of synsedimentary manganese deposits in different stages of geological history. Making a little digression from his studies on terrestrial deposits, he successfully determined the post-depositional changes in deep sea transition metal-bearing ferromanganese nodules of the Indian Ocean to explain the growth history of the nodular manganese deposits. The models he worked out constituted the subject matter of a number of his erudite publications.

Some of his landmark publications are: (1) *Syngenetic manganese formations of India* (Jadavpur University, 1966); (2) *Manganese deposits* (Academic Press, London, 1981; translated to Russian by MIR Publication, Moscow, 1986); (3) *Manganese metallogenesis: a review* (*Ore Geology Reviews*, 1988, 4); (4) *Genetic diversity of manganese deposition in the terrestrial geological record* (Geological Society of London, Special Publication, 1997, 119); (5) *Late Archaean initiation of manganese metallogenesis: its significance and environmental controls* (*Ore Geology Reviews*, 2000, 17) and (6) *Sedimentary manganese metallogenesis in response to the evolution of the Earth system* (*Earth-Science Reviews*, 2006, 77). Even today, it is hard to find any good work on manganese without citation of Roy's book *Manganese Deposits*. His

research on the manganese deposits of India will be remembered by generations to come.

His life-time dedication to research on manganese deposits placed Roy in the list of global leaders in economic geology. He received a host of awards and honours for his contribution to earth science. He was elected a Fellow of the Indian National Science Academy in 1972 and the Indian Academy of Sciences in 1986. He was invited to deliver the Sir L. L. Fermor Lecture at the Geological Society of London in 1994, and the D.N. Wadia Medal Lecture of INSA in 1998. He has also left a mark in the field of academic leaderships as (i) Chairman, UGC Geoscience Panel (1980–82); (ii) Chairman, Research Council of National Institute of Oceanography, Goa (1989–91); (iii) President, Commission on Manganese, International Association of Genesis Ore Deposits (IAGOD) (1994–82) and (iv) Global Leader of UNESCO-IGCP Projects No. 111 & 226 (1978–90) on the genesis of manganese deposits.

Coming from a family of long academic heritage, Roy developed a multifaceted academic constitution, displaying his deep interest in literature, art and philosophy. He was an eloquent speaker and would design thought-provoking deliberations with his sonorous voice. This special quality worked very well in classroom teaching and enabled students to grasp a picturesque presentation of the scientific content through his lectures. On many occasions Roy used to share light moments with his colleagues, especially with Subir Kumar Ghosh, a renowned structural geologist who had long association with him since his student days at the Presidency College. Their informal discussions over a cup of tea covered serious topics, like contemporary literature and music, as well as day-to-day mundane affairs, such as the results of cricket matches played in Eden Gardens.

Roy had a fine sense of humour, which could be explored only through personal interactions. He was a very friendly person and was affectionate to young teachers, helping them in varied issues, either family problems or applications for research projects. Over the years he earned a place of deep love and respect among his colleagues. Supriyo Babu, as he was popularly known to all near and dear to him, is survived by his wife (Chitra), daughter (Sucharito), son-in-law and granddaughters.

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Vallurupalli Sita Raghavendra Rao
(elected 1974)

V.S.R. Rao led the polysaccharide group at the Madras Centre successfully through his pioneering contributions and steered the conformational aspects of carbohydrates to new heights. He passed away on 26 September 2013 quietly, typical of his way of doing things.

During his postdoctoral tenure with Joseph Foster at Purdue University, Rao published some important papers based on the experimental work on carbohydrates, including the one in *Nature* (1963, 57, 200). After this, G.N. Ramachandran chose Rao to pursue the experimental line of studies on polysaccharides. Rao also applied the computational methods to address some of the basic, unanswered questions in carbohydrate chemistry. At that time, there was still an unanswered question on whether D-glucose prefers ${}^{41}\text{C}$ chair or one of the boat forms. It was argued by some of the notables that the former would be improbable for α -D-glucose in view of steric conflict that it would encounter due to the axial disposition of the glycosidic C-O bond with 1,4 linkages. Then there was the question of whether amylose chains exhibit helical or totally random coil conformation in solution. While most argued for the random coil, Rao's NMR work during his postdoctoral tenure suggested that the chain is a random coil with helical segments. He employed computational approaches to resolve these and other unexplored avenues in carbohydrates.

Computational methods were evolving at that time, and the Madras group was making seminal contributions to polypeptide, protein and nucleic acid conformations. Perhaps inspired by the novel and successful approach to decipher conformational aspects of proteins at the Centre, Rao made the decision to switch to computational approaches. Rao came out with several novel research findings, and G.N. Ramachandran, along

with Rao and C. Ramakrishnan, published in the proceedings of an international conference held in 1967 at Chennai.

By a quirk of fate, Rao's first exposure to research began with Aneesur Rahman, albeit only for short while, when he joined him as a graduate student in Osmania University, Hyderabad. Later he came under the influence of S. Bhagavantam, who was then the Vice Chancellor and later left to join Indian Institute of Science (IISc) as its director. This enabled Rao to access experimental facilities at IISc to complete his research work on synthetic high polymers and obtain his PhD in 1960. Incidentally, Rahman was the first to carry out (1964) a realistic molecular dynamics simulation.

Rao's exemplary work on stereochemistry of pyranose sugars, their derivatives and a host of $1 \rightarrow 2$, $1 \rightarrow 3$ and $1 \rightarrow 4$ linked polysaccharides have stood the test of time and are widely referred. Rao was particularly elated when he was able to show that the random coil conformation of amylose is comprised of largely left-handed helical segments interspersed with short right-handed helical segments to account for its low value for unperturbed end-to-end dimension, notwithstanding the extremely limited conformational space. Apparently, he got this idea when he was taking a stroll on the Marina Beach in Chennai in a perturbed mood. He often rejoiced the exciting and pleasant phase at the University of Madras.

Rao relocated to IISc in 1973 at the invitation of Ramachandran who established the Molecular Biophysics Unit during 1970–1971. Rao's group indigenously developed docking strategies and used these to explain how lectins recognise the subtle configurational differences in saccharides. The effectiveness of this approach was amply demonstrated when the predicted binding modes were indeed observed in the X-ray crystallographic structures of concanavalin A and pealectin. Those were the days when there were no graphics-user-interface-driven molecular modelling and docking software. Rao's significant contributions on cell-wall polysaccharides and betalactam compounds include conformation-based rationalisation to the action of penicillin and cephalosporin.

Rao published over 150 peer-reviewed research articles and guided 22 PhD students. He is the key author and spirit behind the book *Conformation of Carbohydrates* (Harwood Academic Publishers, 1998). This book is the only one of its kind and was written when he was the visiting scientist at National Institute of Health, USA, during 1992–1997. He served on the editorial board of *Carbohydrate Polymers* and the *International Journal of Biological*

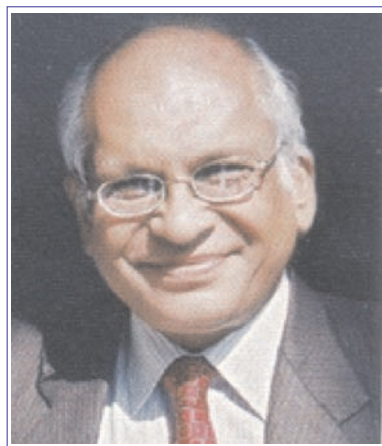
Macromolecules. His work was recognised by his election to the Indian Academy of Sciences in 1974 and the Indian National Science Academy in 1981. He was also the recipient of the JC Bose Award for Life Sciences of UGC in 1977. He was ASTRA Professor in Biological Sciences (1988–1990). He served as the Chairman of Molecular Biophysics Unit and later as Dean at IISc.

Rao was lucky to pursue science in an era when recognition and acceptance by peers around the world were the only indicators of the quality of one's work. Rao was ahead of his time and realised the importance of molecular modelling of carbohydrates when working on proteins and nucleic acids were considered fashionable. A 2012 report published by the American National Academy of Sciences has listed glycosciences as one of the five major thrust areas. In 1990, the American Chemical Society brought out a volume on computer modelling of carbohydrates as part of its ACS symposium series and the editors Alfred D. French and John W. Brady acknowledged Rao's ambitious computational approach to predict polysaccharide conformations.

Rao was self-effacing and mild mannered almost to a fault. He was a great mentor, and a patient teacher who ensured the progress of students and subordinates. He was very accessible to all students, who will remember him for his kindness, simplicity and compassionate outlook besides his academic achievements. He was a gentle person, who respected everyone and was respected by all.

He leaves behind his wife and son, both accomplished scientists.

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Shyam Swarup Agarwal
(elected 1985)

S.S. Agarwal, former Director, Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGI-

MS), Lucknow, passed away on 2 December 2013 following a massive heart attack. He was a legendary figure in medical sciences who excelled in whatever he did and was as a role model for his students and colleagues.

Agarwal was born in Bareilly, Uttar Pradesh, on 5 July 1941 to Satya Swarup Agrawal and Shyam Dubari. After obtaining his BSc in 1958 from Lucknow University, he qualified for MBBS (Hons) with distinction in 9 out of 10 subjects in 1963 and MD (Hons) in medicine in 1966. He was awarded the Chancellor's Gold Medal for the best student of Lucknow University in 1963. In 1967, he was awarded a postdoctoral fellowship of the International Agency for Cancer Research, and proceeded to work at Fox Chase Cancer Centre in Philadelphia, USA, where he specialised in the fields of genetics and immunology. His major research contribution was the discovery of the role of DNA polymerase in initiation of DNA synthesis in resting human lymphocytes upon stimulation with phytohemagglutinin. He also made significant contributions to studies on fidelity of DNA polymerases and DNA repair.

Agarwal returned to India in 1970 and started his teaching career as a lecturer (1970–73) in medicine at his alma mater, the King George Medical College (KGMC), Lucknow and then became a reader (1973–86). Soon after joining KGMC, he set up the Medical Genetics Unit in the department and started spreading the importance of genetics in medicine. This led to the department getting several multi-centric ICMR Task Force projects in the field of medical genetics, such as study of genetic effects of MIC gas leak in Bhopal and delineation of Handigodu disease, which has peculiar geo-ethnic traits from Shimoga district and few talukas in Chikmagalur district of Karnataka. Agarwal's studies identified Handigodu disease to be a unique type of autosomal dominant spondylo-epiphyseal dysplasia, which has been recognised in the international classification on skeletal dysplasias as a separate entity. Another of his major contributions during this period was the clinical trial of gugulipid, a product developed by the Centre Drug Research Institute (CDRI), Lucknow, as a hypolipideamic agent, based on gum guggul (an important drug of Ayurveda). His efforts led to the marketing of gugulipid in India as a modern phytopharmaceutical. Agarwal thus emerged as a highly reputed and respected teacher and researcher in the department.

In the early 1980s, the UP Government decided to set up SGPGI-MS in Lucknow and Agarwal played an active role in its planning. He was a member of the team that was sent by the UP Government to various leading medical institutions world over to draw up a

blueprint for the institute. He also actively participated in discussions with the expert teams from the Japanese Government, which provided a generous grant-in-aid for equipping the new Institute. When the institute was established in 1986, Agarwal moved there as Professor and Head, Department of Medical Genetics and Clinical Immunology (1986–1997). His vision of establishing the specialties of medical genetics and clinical immunology, the first of their kind in India at that time, led to their spread to the rest of the country. Not only is Agarwal considered the father of medical genetics and immunology education in India, but he also became the steering force for research in these specialties in the country. He headed various task-force committees of ICMR, DBT and DST for thalassemia control, lysosomal storage disorders, newborn genomic screening, stem-cell research, etc. Agarwal served as the Director of SGPGI during 1993–1997 and 2000–2001. He greatly expanded the research landscape of the institute and emphasised that medical research is needed to back up the clinical contribution of the physicians to provide full benefits of the knowledge available for the benefit of the patients. He also gave full administrative support to the academic and clinical work of the faculty. He fully integrated basic research and clinical studies and set an example on how these two facets of a clinician should be integrated. In addition to his studies on Handigodu syndrome, his research included characterisation of mutations of β -thalassemia in the population of UP, studies on Indian childhood cirrhosis, evaluation of genotoxic effects following the Bhopal gas tragedy of 1984, genetic causes of mental retardation in India, prevalence and spectrum of congenital malformations, delineation of genetic syndromes, albumin variants in North American Indians, familial hyperlipidemia in coronary atherosclerotic heart disease, studies on the immunogenetics of recurrent spontaneous abortion, evaluation of indigenous plant products and synthetic peptides for immunomodulatory activity, seroepidemiology of malaria, studies on lymphocyte biology and so on.

Following his superannuation from SGPGI in 2000, Agarwal accepted another challenging task of activating the newly established Advanced Centre for Treatment, Research & Education in Cancer (ACTREC), a research wing of the Tata Memorial Centre at Kharghar, Navi-Mumbai. He was its founding Director from 2001 to 2004, and made the institute functional before he returned to Lucknow to become an advisor at CDRI as a Senior Scientist and Honorary Director, Research and Academics, Vivekanand Polyclinic and Institute of Medical Sciences, which kept him fully occupied till the last day of his life.

Agarwal was the recipient of almost all the prestigious science awards of the country, including

the Shanti Swarup Bhatnagar Prize, the Ranbaxy Award for clinical research and the Vigyan Ratna Award of the UP Government. He was elected a Fellow of the Indian Academy of Sciences, Bangalore (1985), Indian National Science Academy, New Delhi (1995); National Academy of Sciences, Allahabad (1998), and National Academy of Medical Sciences, New Delhi. He was also a Founder Fellow of the Indian College of Physicians, Mumbai. He delivered several prestigious national lectures, including the Glaxo Oration; Gen. Amir Chand Oration of the National Academy of Medical Sciences, New Delhi; Jawaharlal Nehru Birth Centenary Lecture and T.S. Trimurti Memorial Lecture of the Indian National Science Academy; B.C. Guha Memorial Lecture of the Indian Sciences Congress Association; J.B. Chatterjee Memorial Oration and J.B. Parekh Memorial Oration of the Indian Society of Hematology and Blood Transfusion; Bhatia-Misra Oration, Mathur-Mehrotra Oration and Krishnamurthy Oration.

Agarwal is survived by his wife, daughter and son. He has left behind a rich legacy of contribution to medical genetics and immunology and his demonstration of integrating medical research and patient care, which will keep his memory alive for generations to come.

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Satyendra Kumar Bhattacharjee
(elected 1973)

S.K. Bhattacharjee, a distinguished nuclear physicist of the country, passed away in Mumbai on 28 April 2013. He was a true gentleman scientist. A person of high integrity, he did not use his position to force his views on others and always encouraged his juniors to explore new directions. Bhattacharjee was born in Murshidabad, West Bengal, on 2 October 1926 and studied at Calcutta University, completing his Master's degree in 1948. During this period he came under the influence of Meghnad Saha and

Satyendranath Bose. He subsequently got his PhD in nuclear physics from the University of Notre Dame, USA, in 1953. He joined the Tata Institute of Fundamental Research (TIFR), Mumbai, during the late 1950s and set up a productive group of researchers for nuclear structure studies. He used the available radioactive sources for beta decay studies while developing the necessary equipment and electronics in-house. Some of the important contributions made by his group during that period have gone into textbooks of advanced nuclear physics. These are: understanding the sudden change in nuclear shape from near-spherical to highly deformed as the neutron number changes from 88 to 90 through the measurement of static and transition moments; clarifying the role of K-selection rule in beta decay of highly deformed nuclei using the only known case of ^{172}Tm and establishing that isospin is a fairly good quantum number for the low-lying states of medium and heavy nuclei. He maintained his professional contact with colleagues abroad throughout his career and had been a Weizmann Fellow at Weizmann Institute, a Senior Research Fellow at California Institute of Technology, a Senior Research Associate at State University of New York (Stony Brook), Visiting Professor at the Institut fuer Strahlen und Kernphysik (Bonn), Laboratoire Rene Bernas, University of Paris (Orsay), Johannes Gutenberg Universitaet (Mainz) and a Visiting Scientist at the Lawrence Berkeley Laboratory (Berkeley). His collaborations with the Mainz University group on measurements of charge radii of even-even mercury isotopes using collinear fast-beam laser spectroscopy at ISOLDE, CERN, led to the observation of a very large isomer shift in ^{185}Hg isotope and large odd-even staggering that were at odds with theoretical models.

During the difficult period in the late 1970s when the facilities for experimental nuclear studies in India had dried up for lack of resources, Bhattacharjee's leadership helped successfully diversify the activities of the group into areas of hyperfine interactions, atomic physics and tests of symmetry laws. He encouraged self-reliance and development of the necessary state-of-the-art detectors and instruments in the laboratory. Even with the modest resources at its disposal, the group was successful in mastering the technology of fabricating silicon surface barrier detectors, lithium drifted silicon detectors, lithium drifted germanium detectors, multi-wire proportional counters, Bragg curve ionisation chambers, etc. Almost all the required pulse processing electronics was also designed and fabricated by the group during that period. A successful programme for the measurement of magnetic field and electric field gradients in solids was pursued using nuclei with known moments. In the programme on atomic physics, which Bhattacharjee had planned with

S.K. Mitra, K and L X-ray production cross-sections using protons and alpha particles were measured, in which the effect of multiple vacancies on Coster-Kronig transitions was observed. The best available experimental limit on charge non-conserving decay of a nucleon was obtained by his group using the decay of $^{85}\text{Rb} \rightarrow ^{85}\text{Sr} + \text{neutrals}$ and $^{113}\text{Cd} \rightarrow ^{113}\text{In} + \text{neutrals}$. A limit on the existence of a heavy neutrino was determined from the beta decay of ^{35}S .

He took a child-like pleasure in each and every small success in the experiments. He retired from TIFR in 1986 and kept himself occupied with his varied interests in literature, music, films and plays. Although he did not participate in active research thereafter, he evinced keen interest in all aspects of science and would discuss about the recent findings with those visiting him.

Bhattacharjee was elected a Fellow of the Indian Academy of Sciences in 1973 and was a member of the American Physical Society since 1951. His interests were not confined to science but spanned the world of literature, music and fine arts. He was well versed in both English and Bengali literature. He was a connoisseur of Western classical music and an able exponent of Rabindra sangeet. Although it usually took a lot of persuasion to get him to sing, listening to his duets with his wife (Sabita) was always a treat.

Bhattacharjee is survived by two sons, a daughter and their families.

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Chintala Raja Ram Mohan Reddy
(elected 1980)

C.R.R.M. Reddy, retired DME, Government of Andhra Pradesh, passed away on 12 December 2012.

Born on 16 January 1929 in Chittoor District, he completed his MD at Visakhapatnam in 1952. He

obtained his PhD in Pathology in 1972 from Andhra University. He worked on cancer palate in tobacco reverse smokers to obtain his DSc in 1976 from Andhra University.

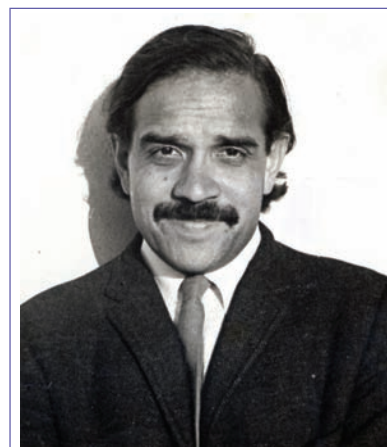
He did extensive work on tobacco smoking and oral cancer and reverse smoking, and was nominated member of the WHO expert panel and referee for oral cancer. He became the first Professor of Pathology in 1960 at the Kurnool Medical College, Kurnool. He was the builder of the Pathology Department at Kurnool Medical College.

He has published over 234 papers and has been cited in over 31 books. He developed the research methodology of T and B lymphocytes studies and in liver pathology on hepatitis. He demonstrated Shikata cells in liver pathology.

In 1981 he was appointed the Additional DME and continued as Professor and Head of Pathology at Visakhapatnam. After his retirement in 1989, he started the Laboratory Services at Care Hospital, Banjara Hills, Hyderabad, where he worked for 8 years.

He is survived by his son and daughter.

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Anand Sarabhai
(elected 1981)

A. Sarabhai, Director of Sarabhai Enterprises, Ahmedabad, passed away on 2 February 2013.

Born on 3 April 1938, he obtained his PhD in molecular biology from Cambridge University, UK. He made important contributions to the development of molecular biology – he demonstrated the co-linearity of the gene with polypeptide chain, which was the first experimental confirmation of a major tenet

of the theory of genetic code. He also contributed to the study of the dynamics of protein synthesis and genetics and molecular biology of bacteriophages.

He has over 13 important papers and held faculty positions in Cambridge, Oregon and California. He was responsible for the organisation and management of industrial research at Sarabhai Enterprises for electronics, pharmaceuticals and chemicals.

He was awarded the Scholar of the Medical Research Council of England from 1959 to 1963. He was the Jane Coffin Childs Memorial Fellow from 1967 to 1969.

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Thekke Curupathe Narendran
(elected 2000)

T.C. Narendran was born on 24 February 1944, in Trichur, Kerala. In 1967, he earned his Bachelor's in Zoology from the Kerala University and completed his Master's in 1968 from St. John's College of Agra University. After a brief spell as instructor and lecturer in the Department of Zoology at St. Aloysius College, Trichur, he joined the Calicut University as a Research Officer (1969–1972) and then was employed by the Insect Identification and Foreign Parasite Introduction Section of the US Department of Agriculture to study the biology and systematics of oriental *Brachymeria*. He later continued his research on parasitic wasps and obtained his doctorate from Calicut University in 1975 based on his studies on biology, morphology and host–parasite relationships of *Brachymeria lasus* (Walker) in 1975, under the guidance of K.J. Joseph. In 1975, Narendran became a lecturer at the University of Calicut, where he continued his systematic research on parasitic wasps and taught insect diversity, insect

morphology, systematic entomology and principles of taxonomy.

During his MSc days at Agra, Narendran initiated research on reproductive biochemistry. However, his passion for insect classification and evolution grew under the influence of the renowned Indian entomologist, M.S. Mani, who was then at Agra University. Following his doctoral research on the biology of *Brachymeria lasus*, Narendran continued his correspondence with experts on parasitic wasps, especially Z. Bouček (CAB International, London), who is considered the father of modern chalcidology. Narendran's persistent queries on oriental chalcids flooded Bouček's letter box until he joined him as a postdoctoral fellow in 1980 at the British Natural History Museum, London. During his stay in London, he procured references and information about the oriental chalcids and collaborated on two publications on the chalcid genera *Dirhinus* (Chalcididae) and *Leucospis* (Leucospidae) from India.

After his return from London, the US Department of Agriculture granted him a PL 480 project (1984–1987) for his research on the biosystematics of Chalcidoidea. Later, he received financial assistance from the Department of Science and Technology (DST), New Delhi, to study the systematics of Eurytomidae and Torymidae (1986–1990), during which period he visited the US National Museum of Natural History and worked in collaboration with the world renowned eurytomid expert Eric E. Grissell. His research on the taxonomy of parasitic hymenopterans continued and the Ministry of Environment and Forests (MoEF), New Delhi, funded a project on Eulophidae (2003–2005) during his final years of service as the Professor and Head of the Department of Zoology at the University of Calicut. Even after retirement in 2004, he continued to work in the same laboratory and collaborated with Nasser on the biology and taxonomy of chalcidoids of the rice ecosystem and biosystematics of Eupelmidae of Southern Western Ghats (2006–2009). In 2005, the Department of Science and Technology awarded him an Emeritus Professorship for his research on Tetrastichinae and then a USERS grant in 2008 for taxonomic studies of Eulophidae. The Harvard University also awarded him the Ernst Mayr Grant to continue his work at the Natural History Museum, London, in 2008.

Narendran published over 394 articles in Indian and international journals and 10 books including 7 monographs, mostly describing the chalcids of the Indo-Malayan and Middle East region, and often in collaboration with others. In addition to one new tribe he proposed a total of 1091 species names and 55 generic names. His main contributions to chalcidology include taxonomic revisions of oriental Chalcididae, Leucospidae, Torymidae, Ormyridae, Eurytomidae,

Eulophidae, Eucharitidae, Pteromalidae, Perilampidae, Tetracampidae and Eupelmidae. Apart from chalcids, he advised his students on their taxonomic investigations on Braconidae, Ichneumonidae, Formicidae, Platygasteridae, Proctotrupidae, Diapriidae, Stephanidae, Scelionidae, Mymaridae, Bethylinidae, Sphecidae, Vespidae and Apidae.

Narendran collaborated with experts around the world, but the most fruitful of them was with Mohammad Hayat of Aligarh Muslim University and exchanged materials of chalcid families of interest and with John S Noyes of Natural History Museum, London. He collaborated with Damir Kovac (Germany) on *Tetramesa Walker* (Eurytomidae), with Kees van Achterberg (National Museum of Natural History, Leiden) on Vietnamese and Borneo specimens of Chalcididae and Eulophidae, with Antonius van Harten on Middle East Chalcids, and with Loffalizadeh on *Eurytoma* parasitic on *Eulecanium rugulosus* in Iran.

Even after formal retirement he continued to work at Calicut and guide his students to taxonomy until 2012. Narendran was elected a Fellow of the Royal Entomological Society of London in 1980, the Indian Academy of Sciences, Bangalore in 2000, and was a founder fellow of the Indian Academy of Entomology since 1999. He also received many other awards and honours, including the highest honour of the Ministry of Environment and Forests of the Government of India, the E. K. Janaki Ammal National Award, in 2004 in recognition of his outstanding contribution to systematic entomology; and the Government of Kerala's *Swedeshi Shastrapuraskaram* (2008). The USDA, Washington,

awarded him an 'Appreciation Certificate' for his accomplishments in research on Chalcididae in 1988. The National Biodiversity Authority, Government of India, selected Narendran as a member of the Expert Committee on Collaborative Research (2005) and he was a member of the Research Monitoring Committee of Centre for Ecological Sciences at the Indian Institute of Science, Bangalore. He was a member of UGC's National Accreditation Committee and the Research Coordination Committee of the Central Silk Board (Government of India). He was also Chairman of Programme Advisory Committee of Zoological Survey of India and Vice President of the Ethological Society of India, Bangalore.

In 2004, Narendran founded a Trust in his name for animal taxonomy to help small-scale funding of taxonomic research, organising short-term entomology courses, offering insect identification consultancy services and acknowledging young taxonomists in India. He was prompt and quick in giving identification assistance to researchers who worked on aspects involving parasitic wasps. He was the only source of taxonomic expertise in many chalcid families for at least the biocontrol laboratories of agricultural institutions in India. He was chief editor of the journal *Biosystematica* and served on the Editorial Board of *Oriental Insects*, *Journal of Bombay Natural History Society* and *Entomon*. He guided 26 PhD students and developed a School of Entomology with taxonomic expertise in various families of Hymenoptera. Narendran died on 31 December 2013, of a heart failure. He is survived by his wife (Mangalabhai) and two sons (Rajeev Menon and Ranjit Menon).

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