No. 63

Patrika

March 2016

Newsletter of the Indian Academy of Sciences

EIGHTY-FIRST ANNUAL MEETING, PUNE

6–8 NOVEMBER 2015

The 81st Annual Meeting of the Indian Academy of Sciences was held at IISER–Pune. The meeting was hosted by IISER – Pune in association with CSIR–NCL and NCCS, during 6 to 8 November 2015. The three-day meeting began with the Presidential Address, followed by two mini-symposia – one on "Light and Matter" and the other on "General Relativity", two public lectures, two special lectures, as well as lectures on various topics by Fellows and Associates of the Academy. This meeting was attended by 130 Fellows and Associates of the Academy and by 40 teachers.

On 5th November, members of the Science Education Panel met with the invited teachers in an interactive session. This meeting was also attended by the Fellows of the Academy who were present on that day at the meeting venue.

In his Presidential Address, **Dipankar Chatterji** (IISc, Bengaluru) spoke on the social behaviour of bacteria. It is known that bacteria exhibit several responses under stress which are intimately related to community behaviour;

Inside...

EDITOR
K N Ganesh

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Bengaluru 560 080, India
Phone: (080) 2266 1200, 2361 3922
email: office@ias.ernet.in

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Forthcoming Events

Twenty-seventh Mid-year Meeting, Bengaluru

1 – 2 July 2016

Refresher Courses

- Experimental Physics – 75
  Goa University, Goa — 10 – 25 May 2016

- Mathematics
  The Maharaja Sayajirao University of Baroda, Vadodara — 6 – 18 June 2016

- Experimental Physics – 76
  K L University, Guntur — 14 – 29 June 2016

- Differential equations and their applications in science and engineering
  Indian School of Mines, Dhanbad — 4 – 16 July 2016

- Experimental Physics – 77
  Thiagarajar College of Engineering, Madurai — 5 – 20 July 2016

  Refresher Course in Experimental Physics
  Government Helkar Science College, Indore — 13 – 28 October 2016

Lecture Workshops

- Internet of things: A research perspective for smart environment
  Dr GRD College of Science, Coimbatore — 15 – 16 April 2016

- Chemistry and biology interface
  Vidyasagar University, Midnapore — 21 – 22 April 2016

- Emerging technologies based on nanoscience – a popularization workshop
  Mody University of Science and Technology, Sikar — 22 – 23 April 2016

for example, quorum sensing in bacteria in the context of formation of biofilms, which could lead to antibiotic tolerance. Elaborating on the molecular mechanism of quorum sensing and biofilm formation, he described the role of *RNA polymerase* and secondary messengers such as *guanosine pentaphosphate* (ppGpp) and *cyclic di-guanylate* (c-di-GMP) in biofilm formation. ppGpp, for example, was found to bind to the Rel enzyme, thus regulating the stringent response induced in bacteria when in hostile environments (such as those found in the host cell). The take-home message was that bacteria are arguably the toughest survival artists on the planet. That these microorganisms can even be immune to antibiotics is ascribed to their ability to re-organise themselves through cooperation. If we can understand how they cooperate, we may succeed in outwitting these tiny, but tough and social creatures and combat the peril of antibiotic resistance.

This was followed by a talk by **Rama Kant** (University of Delhi, Delhi) on the theories for anomalous responses in disordered electrodes. He combines experimental techniques like scanning electron microscopy with theoretical modelling in nano-electrochemistry to study the properties of electrode surfaces. The nano-level topology of electrode surfaces affects local work function, which in turn affects charge transfer, adsorption and other electronic properties. He also showed that properties like exchange current density can be controlled with electrode shape and roughness.

The use of atomically thin membranes in solid state physics has surged over the last 10 years. These layers, just one atom thick, are flexible, resistant to mechanical strain, biocompatible and can function at room temperatures. These properties have led to the emergence of flexible opto-electronic devices for a range of functions, such as light emitting diodes and photodetectors. **Arindam Ghosh** (IISc, Bengaluru) and his colleagues have developed one of the most highly sensitive photodetectors known till date. They developed a binary hybrid of graphene and molybdenum disulphide which is capable of photodetection of illumination as low as 5×10^{-10} A/W.

Susanta Roychoudhury (Saroj Gupta Cancer Center and Research Institute, Kolkata) presented his group's studies on mitotic stress in cancer. He explained the role of the spindle assembly check point (SAC), which constitutes a protein complex that regulates cell division. He hypothesised that mutation or absence of tumour suppressor proteins like p53 and Rb leads to overexpression of two proteins of the complex, CDC20 and E2F1, which leads to aneuploidy. There exists a delicate balance between mitotic cell division and aneuploidy, where an excess of aneuploidy leads to cell death, while aneuploidy up to a certain level leads to excess proliferation. He also explained the role of the microRNA miR-125b, which inhibits cell proliferation by transiently activating SAC.

Kaushal Varma (IISc, Bengaluru) presented his work on quadrature domains and potential theory. Based, among others, on the Aharonov-Shapiro Theorem, he explained the conditions for identifying other quadrature domains.

The year 2015 was the **Centennial Year of General Relativity**. Also, the UN General Assembly in its 68th Session proclaimed this year as the **International Year of Light and Light-based Technologies (IYL 2015)**. To commemorate these mileposts and bring together scientific minds to review the current scenario and future directions in these fields, the 81st Annual Meeting of the Academy included symposia on general relativity and on light and matter.

The symposium on 'Light and Matter' comprised three lectures detailing the use of light-based technologies in areas ranging from physics and botany to medical sciences. The opening lecture by **G Ravindra Kumar** (TIFR, Mumbai) was on high-intensity lasers in physics. The talk focused on two basic themes – one dealing with how light couples to plasmas and the other with the consequence of such coupling, namely, the production of hot electrons and the transport of their mega-ampere currents through dense matter. He presented the work from his laboratory: creation of gigantic magnetic fields, ultrafast plasma dynamics, passage of relativistic particles through dense, hot matter and the interesting consequences in terms of electron and ion accelerations, ultrafast hard x-ray emission laser fusion and laboratory astrophysics. The second lecture in the symposium, by **Anunay Samanta** (University of Hyderabad, Hyderabad), dealt with employing light as an initiator and a probe. His talk focused on the core research activities of his team: mechanism of radiative and non-radiative deactivation of a variety of photo-excited systems, spectral and temporal characterisation of short-lived species, and dynamics of various ultrafast processes in different media. **G Krishnamoorthy** (Anna University, Chennai) delivered the last talk of this symposium in which he emphasised the role of light in molecular biophysics. He spoke on the usefulness of various time-domain fluorescent techniques for addressing issues related

to dynamics of proteins, protein–DNA complexes, bio-membranes and single living cells. He also discussed some of his team's work such as the motional dynamics of side chains used to obtain structural information on protein folding, the continuous nature of protein folding brought out in the time evolution of structural change during folded-unfolded transition, which was revealed by rotational dynamics, the internal structure of protein fibrils revealed by site-specific side-chain dynamics, the correlation between protein side chain motion and solvent dynamics, local and segmental dynamics of DNA used to reveal mechanistic aspects in DNA recombination and DNA replication error identification, site-specific dynamics used in revealing the mechanism of action of an RNA switch, etc.

The first day concluded with a public lecture by **C N R Rao** (JNCASR, Bengaluru). He recalled his early career when he picked the then little known field of solid state chemistry, which would later develop into the vast field of materials chemistry. He advised students 'to pick the lonely road'. He advised

students to pick good problems to work on, and do the best work possible with the resources available to them as the quality of science depended on the quality of the scientific question chosen. He also called for a greater chunk of the nation's GDP to be invested in scientific research as well as an increased contribution from the industry.

The meeting also witnessed two special lectures in the fields of neurosciences and physical chemistry. The second day began with the first special lecture, titled "Sensational barrels in the brain: the circuitry of sensory resolution" by **Shubha Tole** (TIFR, Mumbai). She elaborated on the ability of the sensory system to discriminate, at a very high resolution, signals coming in from various sensory modalities. This ability depends on the precise wiring of the

circuitry that enables the brain to perceive two points as physically distinct. In rodents, the whiskers on the snout act as 'fingers' that sense the environment and communicate to the brain using an intricate circuitry called 'barrels'. She presented the work from her laboratory, which discovered that the loss of a single protein, the transcription factor Lhx2, results in a complete loss of the barrels. Surprisingly, they found that nerves bringing in the signals from the whiskers do make connections with the sensory cortex, although the circuitry that brings about resolution and discrimination is profoundly defective when Lhx2 is lost. These results place Lhx2 as a central regulator of circuit formation in the brain.

The efforts towards the total synthesis of bioactive molecules were presented by **K R Prasad** (IISc, Bengaluru). He stressed the importance of total synthesis of natural products for producing therapeutically significant molecules on a large scale.

The challenges and opportunities in the field of visible light communications and associated technologies were elaborated by **A Chokalingam** (IISc, Bengaluru). He spoke about his team's contribution in the area of multiple LED wireless communications.

The second day included a symposium on 'General Relativity'. **Ghanashyam Date** (IMSc, Chennai) summarised the successes and challenges of the theory of relativity a hundred years since it was first proposed. He elaborated on some spectacular successes of General Relativity in explaining all the gravitational phenomena we know so far, *viz.* precession of planetary orbits, the bending of light near massive bodies, gravitational lensing, and the emission of gravitational waves from binary stars. Although the theory has survived a century of tests of its validity, it remains young in spirit, as some of its predictions are still to be confirmed, notably the prediction of gravitation waves, singularities in black holes and cosmology, the meaning of the cosmological constant, thermodynamic connections of general relativity and, most importantly, a correct quantum theory of gravity. The next speaker of the

symposium, **R Gopakumar** (ICTS, Bengaluru) addressed the quantum gravity problem. He described early attempts to formulate quantum gravity as a quantum field theory (QFT) of gravitons. Analysis of this field theory leads to several problems, and the amplitude of scattering of gravitons is not calculable. A resolution of these problems comes from string theory, whose fundamental constituent is a string, not a particle. Yet, the lowest excitation of a closed string is the massless spin-2 graviton. String theory predicts higher curvature corrections to general relativity. The scattering amplitude for gravitons can be computed in this theory, and is finite. The downside of this remarkable success is that for its consistency, string theory needs super-symmetry and extra dimensions. There is no evidence of this as yet in the Large Hadron Collider. Recent advances have been made in quantum gravity on anti-de Sitter (AdS) space-time. **Shiraz Minwalla** (TIFR, Mumbai) started on this note. In his talk on applied gravity, he outlined how gravity in AdS space-time could be used to understand the non-gravitational conformal field theory (CFT) on its boundary, a maximally super-symmetric version of quantum chromo-dynamics. This correspondence can be used to obtain answers to questions common to many CFTs. For example, in the long wavelength limit, many interactive CFTs are described by the equations of hydrodynamics. Via the gravity-CFT correspondence, Einstein gravity can be used to obtain the constitutive relations of this fluid. The last talk, 'Gravity and/of Cosmos', was by **T Padmanabhan** (IUCAA, Pune), who presented intriguing observations on the cosmological constant problem. Seventy per cent of the energy in the universe is in the form of a dark energy or cosmological constant, whose (small) value needs to be explained. The parameters describing the universe can be written as the energy density during inflation, dark energy density, energy density during matter–radiation equality, and the scale factor in this epoch. With the exception of dark energy, high energy physics can be used to estimate the remaining.

Defining porphyrins as pigments of life, **M Ravikanth** (IIT, Mumbai) described electron transfer observed in various life processes such as photosynthesis, O_2/CO_2 transport, and metabolism. Synthesis of highly fluorescent systems of polyarylated boron-dipyrromethenes (BODIPY) and multi-polyarylated BODIPY that could be used as sensors for pH, cyanide and flouride studies was outlined. He also discussed potential applications of using such molecules in health and medicine and the challenges therein.

Sumantra Chattarji (NCBS, Bengaluru) started his lecture by recalling an experiment performed by Edouard Claparede in 1911 on an amnesic patient with short-term memory to emphasise the difference in factual and emotional memories. It has since been established that long-lasting emotional memories are formed in the amygdala and factual memories are formed in the hippocampus. Through experiments with rats, this group has shown changes in synaptic functions of even single neurons in the amygdala in stressed versus non-stressed subjects. Importantly, they were able to demonstrate that with Pavlovian fear conditioning, neurons would fire indiscriminately even in the presence of non-threatening stimuli in order to play safe. This information is important for the treatment of post-traumatic stress disorders and similar conditions by the design of drugs targeted to the amygdala and not the hippocampus neurons.

A C Anil (NIO, Goa) highlighted the importance of bio-communication in ocean ecosystems through the example of red abalone larvae which metamorphose only in the presence of coralline red algae. Therefore, each organism and its population dynamics are affected through chemical recognition. He described studies that focused on inter-tidal and sub-tidal regions that experience most changes in conditions during the day due to tides. Thus, coastal ecosystems serve as useful markers for changes in climatic or environmental conditions. In temperate regions, seasonal variations play a major role in the changing coastal ecosystems; for example, phytoplankton bloom in the spring and other populations follow their cue. In tropical areas, minimal water-temperature variations mean sustenance of a uniform ecosystem. However, in India, the monsoons affect salinity via rainfall and river discharge, which influence the growth of organisms. The speaker's study of the population dynamics of barnacles with specific reference to monsoonal ecosystems and their perturbations was highlighted.

Quantisation of the notion of isometric group when C*algebra in question is endowed with special data was discussed by **Jyothishman Bhowmick** (ISI, Kolkatta).

Human health in the era of sustainable development was described by **K Srinath Reddy** (Public Health Foundation of India, New Delhi) in a public lecture at the end of the second day. His talk indicated that that society's health and well-being are profoundly dependent on the health of our environment and of our planet. The new United Nations Sustainable Development Goals (2015 – 2030) placed health firmly within the framework of sustainable economic, social and environmental development. Health and

sustainability are tightly woven into a multi-sectoral matrix that must factor in issues such as air pollution, energy and water security, nutrition-sensitive agriculture and food systems, climate change, education, poverty reduction, urban planning and gender equity. There is an urgent need for trans-disciplinary scientific approaches to find and design sustainable solutions. Even in human biology, new understandings of the role of the microbiome, the ecological basis of zoonotic diseases, and the evolutionary biology of antimicrobial resistance underscore the interdependence of life forms and the connectivity of human and planetary health. This lecture made a case for such cross-domain research.

On the third day, **Kankan Bhattacharyya** (IACS, Kolkatta), in a special lecture, spoke on 'Single molecule spectroscopy of a single live cell'. He discussed some of the applications of single molecular spectroscopy. In a confocal microscope, the size of the focused spot (~200 nm) is one-hundredth the dimension of a cell. Thus, one can probe different regions/organelles in a cell using this. For example, substantial differences between a cancer cell and a normal cell can be observed: Gold nano-clusters preferentially enter or stain a cancer cell rather than a non-malignant cell. The red-ox processes (thiol-disulphide inter-conversion) lead to intermittent structural oscillations, which in turn lead to fluctuations in fluorescence intensity in a single live cell. Such oscillations are absent for a cancer cell. The number of lipid droplets is much higher in a cancer cell than in a non-malignant cell.

Arpita Patra (IISc, Bengaluru) spoke about using multipatiry cryptography for secure communications to keep data private and its use, an area which has immense applications such as in satellite positioning, e-voting, e-auction, and data mining.

Describing a new approach to treat severe acute malnutrition (SAM) in children, **Nita Bhandari** (Centre for Health Research and Development, New Delhi) described the results from one of the largest such studies undertaken. The study compared the efficacy of three different methods of treating SAM (augmented home food), commercial ready-to-use-therapeutic-food (RUTF) and locally prepared RUTF, and found that locally prepared RUTF was the most effective of these methods.

Ranjani Vishwanatha (JNCASR, Bengaluru) spoke about the synthesis of uniformly doped semi-conductor nanocrystals with the constructive use of diffusion of dopants out of the nanocrystals with a wide range of dopants such as Mn, Fe, Co and Ni.

Evolvability of chromosomes with respect to the bacterial genome was explored in a talk by **Aswin Seshasayee** (NCBS, Bengaluru). Adaptation in bacteria arises by the change of genome and genome expression. This is dependent on specific triggers arising from the 'cost' versus 'benefit' of acquiring changes in genome organisation. Horizontal gene transfer occurs when genes are transferred from one organism to another in the same generation. In the fast-growing bacterial population, genes required for growth are highly expressed while horizontally acquired genes are expressed at lower levels. Such xenogene silencing is contrasted with loss of gene silencing by gene acquisition. Chromatin organisation and convergence of gene regulatory networks determine the gene expression homoeostasis in the evolving bacterial cell.

Sharmila Bapat (NCCS, Pune) drew attention to minimal residual disease cells found in cancer patients after treatment that are found to be drug resistant. This drug refractory behaviour is attributed to molecular heterogeneity due to presence of cancer stem cells. Her work on tumours developed from ovarian cancer stem cells in rats analysed this behaviour and identified discrete cell populations using several functional assays. Drug refractory behaviour was also

analysed with observations of shift in cell populations in response to various drug designs. This opens up possibilities for personalised drug design.

The puzzle of the Higgs boson mass and the speculations of physics Beyond the Standard Model were discussed by **Gautam Bhattacharyya** (SINP, Kolkatta)

Mitali Mukherji (IGIB, New Delhi) described the basic premise of Ayurveda that individuals have differential basal levels of three 'doshas' – vaata, pitta and kapha – that define their 'prakriti', or well-being. If a perturbation in any of these levels occurs, diseased state occurs and therapy should be directed towards restoration of the individual's basal levels. Due to genomic variations in humans, it is difficult to genetically define a healthy individual. Her study hypothesises that genomic homogeneity could be identified through prakriti methods in order to categorise individuals into groups that are likely to show similarities in response to specific therapy. Characteristics associated with the doshas were used to define the groups of individuals that were then tested for genomic variation.

In a Special Open Lecture, **James Jackson** (University of Cambridge) discussed how variations in the

structure and rheology of the lithosphere affect surface geology. Over the last decade, advances in earthquake seismology have allowed us to make increasingly detailed maps of the variations in lithosphere (plate) thickens. He spoke in detail of the 2015 Gorkha (Nepal) earthquake and emphasised that mere prediction accuracy was insufficient. He spoke of the need of better knowledge of the earth-quake hazards and their context, as well as effective pathways to improve resilience.

On 6 November, a vocal recital by Dr Ashwini Bhide Deshpande, a Hindustani classical music vocalist from Mumbai who pursues the Jaipur-Atrauli Gharana, was held.

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COUNCIL

Until December 2015, the Council under the Presidentship of Prof. Dipankar Chatterji was in office. In January 2016, a new Council assumed office with Prof. R Ramaswamy as the President.

The members of the Council for the period 2016 to 2018 are:

- Prof. R. Ramaswamy (President)
- Prof. Dipankar Chatterji (Previous President)
- Prof. Manindra Agrawal (Vice-President)
- Dr. Sunil Bajpai
- Prof. Sudha Bhattacharya
- Prof. Deepak Dhar
- Dr. Madhu Dikshit
- Prof. K. N. Ganesh (Vice-President)
- Prof. Arun K. Grover (Vice-President)
- Prof. Chanda J. Jog
- Prof. Lalit Kumar
- Prof. Uday Maitra (Secretary)
- Prof. Partha P. Majumder
- Prof. K. H. Paranjape
- Prof. R. Ramesh
- Dr. V. V. Ranade
- Prof. D. D. Sarma
- Prof. K. L. Sebastian (Vice-President)
- Prof. R. Varadarajan (Treasurer)
- Prof. Umesh V. Waghmare (Secretary)

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TWENTY-SEVENTH MID-YEAR MEETING

1–2 July 2016

Venue: Faculty Hall, Indian Institute of Science, Bengaluru

Programme

1 July 2016 (Friday)

0930–1010 **Special Lecture**
Dipankar Bhattacharya, IUCAA, Pune
The astrosat mission

1010–1300 **Lectures by Fellows/Associates**

1010–1030 **P B Sunil Kumar**, IIT, Chennai
Mechanisms governing shape changes in biological membranes

1035–1055 **T Punniyamurthy**, IIT, Guwahati
Carbon-carbon and carbon-heteroatom bonds formation and their application for medicinally significant heterocycles

1120–1140 **K N Uma**, VSSC, Thiruvananthapuram
Tropical mesoscale convective systems and its associated dynamics

1145–1205 **Suman Chakraborty**, IIT, Kharagpur
Liquid water may stick on hydrophobic surfaces

1210–1230 **Mahak Sharma**, IISER, Mohali
Molecular mechanisms regulating endosome-lysosome tethering and fusion

1235–1255 **Shantanu Chowdhury**, IGIB, Delhi
Knotty DNA: Another dimension to gene regulation

1415–1500 **Lectures by Fellows/Associates**

1415–1435 **Debashish Goswami,** ISI, Kolkata
Quantum group symmetry of classical and noncommutative geometry

1440–1500 **Kanishka Biswas,** JNCASR, Bengaluru
Origin of ultra-low thermal conductivity in complex chalcogenides: Effect of lone pair, anharmonic rattling and bonding asymmetry

1520–1730 **Symposium on 'Gravitational Waves'**

1520–1530 **Tarun Souradeep**, IUCAA, Pune
Introduction

1530–1550 **Bala Iyer**, ICTS, Bengaluru
From prediction to detection: Highlights of the fascinating history of gravitational waves

1555–1615 **Sukanta Bose**, IUCAA, Pune
In the era of gravitational wave astronomy

1620–1640 **Sendhil Raja**, RRCAT, Indore
Interferometric gravitational wave detectors: Technological challenges

1645–1705 **P Ajith**, ICTS, Bengaluru
Testing general relativity using gravitational-wave observations

1710-1730 **Varun Bhalerao**, IUCAA, Pune
Multi-messenger astronomy with gravitational waves

1800–1900 **Public Lecture**
Pratap Bhanu Mehta, Centre for Policy Research, New Delhi

2 July 2016 (Saturday)

0900–094 **Special Lecture**
K N Ganeshaiah, Bengaluru
Feeling the 'pulses' for protein revolution

0940–1240 **Lectures by Fellows/Associates**

0940–1000 **Amalendu Krishna**, TIFR, Mumbai
Algebraic K-theory and algebraic cycles

1005–1025 **Saman Habib**, CDRI, Lucknow
A relict organelle that changed the way we thought of malaria

1030–1050 **R Prabhu**, IIT, Patna
A glimpse into quantum information science

1120–1300 **Lectures by Fellows/Associates**

1120–1140 **Subhra Chakraborty**, NIPGR, New Delhi
Understanding biomolecular networks modulating nutrient response and immunity in plant

1145–1205 **Sunil K Singh**, PRL, Ahmedabad
Biogeochemistry of trace elements and isotopes in the Indian Ocean

1210–1230 **K V Venkatesh**, IIT, Mumbai
Systems engineering perspective of human metabolism: A multi-scale model for disease analysis

1235–1255 **D S Pandey**, BHU, Varanasi
Aggregation induced emission: Optical and morphological insights

ELECTIONS – 2016

FELLOWS

G C Anupama
Indian Institute of Astrophysics, Bengaluru
Time Domain Astronomy, Cataclysmic Variables, Supernovae, Gamma-Ray Burst Sources, Active Galactic Nuclei

K N Balaji
Indian Institute of Science, Bengaluru
Immunology, Infectious Diseases

Tirthankar Bhattacharyya
Indian Institute of Science, Bengaluru
Functional Analysis, Hilbert Space, Operator Theory, Several Complex Variables

Subhra Chakraborty
National Institute of Plant Genome Research, New Delhi
Nutritional & Stress Genomics, Plant Proteomics, Molecular Biology, Biotechnology

Suman Chakraborty
Indian Institute of Technology, Kharagpur
Thermal & Fluid Science, Micro & Nanoscale Transport, Interfacial Phenomena & Phase Change

Arun Chattopadhyay
Indian Institute of Technology, Guwahati
Nanoscience & Technology

Kedar S Damle
Tata Institute of Fundamental Research, Mumbai
Condensed Matter Theory

Suman K Dhar
Jawaharlal Nehru University, New Delhi
DNA Replication, Cell Cycle Control, Molecular Parasitology, Bacteriology

S Ganesh
Indian Institute of Technology, Kanpur
Human Molecular Genetics, Neurobiology of Disease, Stress Biology (Medicine)

Pradyut Ghosh
Indian Association for the Cultivation of Science, Kolkata
Chemical Sensing of Ions, Anion & Ion Pair Recognition Chemistry, Interlocked Molecular Systems & Self-Assembly

Saman Habib
CSIR – Central Drug Research Institute, Lucknow
Parasitology, Molecular & Cell Biology

Ramesh Hariharan
Strand Life Sciences, Bangalore
Computational Biology, Molecular Diagnostics, Design & Analysis of Algorithms

Krishna P Kaliappan
Indian Institute of Technology, Mumbai
Organic Synthesis, Medicinal Chemistry, Natural Products

Amalendu Krishna
Tata Institute of Fundamental Research, Mumbai
Algebraic Cycles, Algebraic K-Theory, Algebraic Geometry

Pawan Malhotra
International Centre for Genetic Engineering and Biotechnology New Delhi
Malaria Parasite Biology, Molecular Biology, Drug & Vaccine Development (Medicine)

D S Pandey
Banaras Hindu University, Varanasi
Co-ordination Chemistry, Organometallic Chemistry, Bio-inorganic Chemistry

Amitava Patra
Indian Association for the Cultivation of Science, Kolkata
Nanoscience, Spectroscopy Photophysics

V K Paul
All India Institute of Medical Sciences, New Delhi
Paediatrics, Newborn Health (Medicine)

T Punniyamurthy
Indian Institute of Technology, Guwahati
Synthetic Organic Chemistry

S C Raghavan
Indian Institute of Science, Bengaluru
DNA Double-Strand Break Repair, Genomic Instability, Cancer Therapeutics, Cancer Genetics

A Raghuram
Indian Institute of Science Education and Research, Pune
Number Theory, Representation Theory, Automorphic Forms

Pratap Raychaudhuri
Tata Institute of Fundamental Research, Mumbai
Superconductivity Magnetism, Low Temperature Scanning, Tunneling Spectroscopy, High Frequency Measurements in Superconductors

Sanjay Kumar
Banaras Hindu University, Varanasi
Condensed Matter Theory, Biological Physics, Statistical Physics

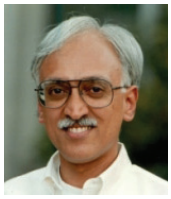
Sunil K Singh
Physical Research Laboratory, Ahmedabad
Low Temperature Elemental & Isotope Geochemistry, Biogeochemistry of Trace Elements & Isotopes, Earth Surface & Ocean Processes

P B Sunil Kumar
Indian Institute of Technology, Chennai
Soft Condensed Matter Physics, Biological Physics, Computational Physics

K V Venkatesh
Indian Institute of Technology, Mumbai
Biosystems Engineering, Synthetic Biology, Metabolic Engineering

HONORARY FELLOW

Ramesh Narayan
Harvard University, USA
Gravitational Lensing; Accretion Disks; Black Holes; Gamma-Ray Bursts



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SPECIAL ISSUES OF JOURNALS

Special Issue on Spectral Line Shapes in Astrophysics

Editors: Milan S Dimitrijević and Luka Č Popović

***Journal of Astrophysics and Astronomy,* Vol. 36, No. 4, December 2015, pp. 421–703**

The analysis of spectral lines from various astrophysical sources can be a powerful tool to collect data on various properties of objects from the solar system to the most distant quasars. To understand the physical environment in which spectral lines are originating from cosmological sources, astronomers need corresponding reliable atomic and molecular data and precise laboratory measurements of spectral line properties. Therefore, interaction between astrophysicists and laboratory physicists who investigate spectral lines originating from cosmological sources can increase our understanding of the universe. Accordingly, the main objective of the X Conference on 'Spectral Line Shapes in Astrophysics' at Srebrno Jezero, Serbia, from 15 to 19 June 2015 was to bring astronomers and physicists together.

This Special Issue of the *Journal of Astrophysics and Astronomy* comprises selected papers presented at this conference. This international conference was attended by 69 participants from Algeria, Austria, Bulgaria, Croatia, France, Greece, Israel, Italy, Japan, New Zealand, Poland, Republic of Srpska (Bosnia and Herzegovina), Russia, Saudi Arabia, Serbia, Spain, Tunisia, UK, Ukraine and USA. There were 27 invited lectures, 19 progress reports and 32 posters. As part of the conference, two special sessions entitled "Line Shifts in Astrophysics" and "Spectral Lines and Compact Stars" within the frame of the COST Action MP 1304 "Exploring Fundamental Physics with Compact Stars" were also organized.

The papers in this special issue have been arranged subject-wise in three groups. Papers of the first group investigate shapes of spectral lines formed in galaxies. In the second group, there are two papers dealing with spectral line shapes from geocosmical plasmas, while the papers of the third group are devoted to laboratory astrophysics. They deal with spectral line shapes and consider theoretical aspects and the influence of atomic and molecular collisional processes on spectral line profiles.

This special issue contains valuable reviews which are of interest to specialists and PhD students. It also includes scientific papers with results of new research on the topics related to the subject matter. The results of investigations presented in this issue will therefore contribute to the development of our understanding of spectroscopy of active galactic nuclei, spectra connected with black holes and interstellar hydrogen clouds. Results of modelling of spectral lines presented in this special issue may be very useful for future investigations of compact stars, in particular of white dwarfs. Similarly, new theoretical Stark broadening parameters of spectral lines of Ne I, O I, Lu III and Xe VI could be important not only for modelling, analysis and synthesis of stellar spectra but also for various applications in laboratory plasma research as well as for inertial fusion and plasmas in technology, such as laser welding and piercing of metals and light sources based on plasma.

Pattern Recognition and Machine Intelligence

Editors: Sanghamitra Bandyopadhyay and Rajat K De

***Journal of Biosciences,* Vol. 40, No. 4, October 2015, pp. 667–828**

Computational methods are essential for analysing biological data because major developments in molecular biology and advances in high-throughput genomic technologies have led to explosive growth in the amount and complexity of information that is routinely collected. Computational biology, bio-informatics and systems biology have evolved in response to this challenge, to cater to various tasks related to exploration, and thereby to generate knowledge or hypotheses. Many problems in the above areas are closely related to different tasks of pattern recognition and machine learning. Much of the

biological data is noisy and has missing values. Data-cleaning and missing-value estimation are essential in such situations.

Gene expression data need efficient feature selection methods for identifying a few genes that are of interest, thereby reducing the problems of dimensionality. For the purpose of decision-making, classification, clustering and prediction methodologies are necessary. Examples include gene function prediction, protein classification and microRNA target prediction. Clustering is used as one of the basic exploratory data-processing methods for problems such as sequence grouping, identification of coexpressed genes, and protein module extraction. Similarly, there are optimisation problems galore in drug design and many other areas.

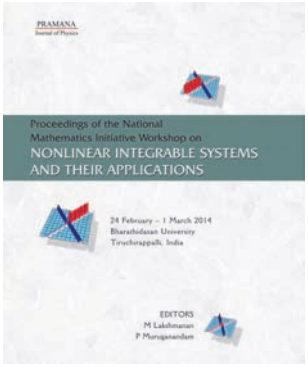
In this special issue of the *Journal of Biosciences* we have focussed on the design and application of new and improved techniques of pattern recognition and machine learning. They are important for gaining deeper biological insights from the large amount of data collected. The issue provides a wealth of information for academicians, practitioners and students working in computational biology and bioinformatics, systems biology, pattern recognition, and machine learning. Extended versions of some selected articles of PReMI-2013 (the 5th International Conference on Pattern Recognition and Machine Intelligence, Kolkata, December 2013) have been considered for review, in addition to other invited ones. Topics considered include pattern recognition and machine-learning approaches for sequence analysis, microarray data analysis, biochemical pathway analysis, NGS data analysis, microRNA data analysis, classification of diseases and analysis of comorbid diseases and of data related to evolutionary biology. All submissions have undergone the journal's peer-review procedures.

There are 13 papers in this special issue, highlighting the effectiveness and methodologies of pattern recognition and machine intelligence for solving a wide range of problems in molecular biology. We hope that the articles in this special issue will not only help the readers appreciate the importance of pattern recognition and machine intelligence approaches for solving biological problems, but will also inspire them to come up with novel algorithms and approaches.

Proceedings of the National Mathematics Initiative Workshop on Nonlinear Integrable Systems and their Applications

Editors: M Lakshmanan and P Muruganandam

***Pramana – Journal of Physics*, Vol. 85, No. 5, November 2015, pp. 753– 1062**



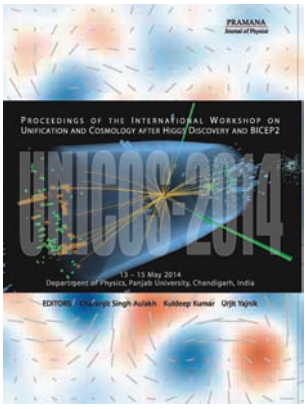
Nonlinearity is pervasive in the description of all natural phenomena. The underlying dynamical description leads to many novel concepts, including integrable systems, solitons, bifurcations, chaos, complexity, patterns and so on. A workshop on 'Nonlinear Integrable Systems and their Applications' was organised during February 24 – March 1, 2014, at the Centre for Nonlinear Dynamics, School of Physics, Bharathidasan University, Tiruchirappalli. The meeting was organised as one of the five activities under the year-long programme of National Mathematics Initiative (NMI) by the Indian Institute of Science (IISc), Bengaluru, on Integrable Systems. The main focus of this workshop was on the integrability aspects of both finite-dimensional and continuum nonlinear dynamical systems, modelled by difference, ordinary and partial differential equations and their applications in diverse areas such as hydrodynamics, nonlinear optics, magnetism, spintronics, field theory, quantum systems, and Bose–Einstein condensates. About 20 experts from within the country and abroad delivered lectures on various theoretical aspects of nonlinear integrable systems and their applications.

This issue is a collection of articles on nonlinear integrable systems and their applications. The first nine articles provide critical reviews on the basic theory and analytical methods of solutions applicable to nonlinear ordinary and partial difference and differential equations of contemporary interest. The remaining nine articles focus on the progress made in the applications of the concepts of integrable nonlinear systems including solitons in diverse areas of physics, biology and engineering. We do hope that the reviews and articles explaining the state-of-the-art of the various topics will provide impetus to make further progress in the field.

Proceedings of UNICOS-2014 International Workshop on Unification and Cosmology after Higgs Discovery and BICEP2

Editors: **Charanjit Singh Aulakh, Kuldeep Kumar and Urjit Yajnik**

***Pramana – Journal of Physics*, Vol. 86, No. 2, February 2016, pp. 193–494**



The last few years have seen a number of experimental results that substantially confirm the interrelated paradigms within which particle physics and cosmology have advanced over the past half a century, while at the same time raising very challenging questions about the same paradigms. The announcement in March 2012 by the Daya Bay Collaboration confirmed that leptonic CP violation would be amenable to experimental investigation. Just a few months later, in July 2012, we witnessed the epochal confirmation of a Standard Model Higgs-like particle with a relatively large mass of ~125 GeV by the ATLAS and CMS groups at CERN. The announcement in March 2014 that the BICEP-2 experiment at the South Pole had actually measured a large value for the ratio of power in tensor to power in scalar perturbations (at the level of some parts per million) away from homogeneity of the cosmic microwave background also caused a wave of excitement to sweep across builders of unified models which supported inflation since the claimed value would put the mass scale controlling inflation at almost exactly the value of the scale of grand unification.

Panjab University – Chandigarh is one of the major Indian centres for experimental high energy physics, with longstanding participation in major experiments at FERMILAB, CERN, KEK, etc. UNICOS-2014 was organised in Panjab University, Chandigarh, during 13 –15 May, 2014 on the occasion of the super-annuation of a faculty member (CSA). Researchers from Asia, USA and Europe in the fields of super-symmetric grand unification, at the meeting point of the hyperactive fields of unification, Higgs physics, cosmology and neutrino physics, participated in UNICOS-2014 and shared their expertise with many young graduate students from all over the country. The contributions in this special issue have been reviewed by a panel of referees mostly drawn from the speakers at the conference itself.

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PROMOTION OF ACADEMY JOURNALS

As part of promotion of the Academy's journals, the Academy participated in 18th CRSI National Symposium on Chemistry held at Panjab University, Chandigarh, from 5 to 7 February 2016, where the *Journal of Chemical Sciences*, *Bulletin of Materials Science*, *Journal of Biosciences*, and *Resonance* were displayed.

On behalf of the *Journal of Chemical Sciences*, the Academy awarded two prizes for the best posters.

A similar event was also organised in association with Springer at the International Conference on Nano-science and Technology 2016 (ICONST-2016) held at IISER, Pune, from 29 February to 2 March 2016.

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DISCUSSION MEETINGS

1. Probability and Analysis

Orange County, Coorg
21 – 24 February 2016

Convener: Mrinal Ghosh
(Department of Mathematics,
Indian Institute of Science, Bengaluru)

At this meeting, there were eleven talks of which six were on probability and the remaining were on analysis. The talks related to random matrices, random polynomials, etc., described in detail the hole probabilities in the infinite Ginibre ensemble, asymptotic equality of eigenvalues and singular values for products of isotropic random matrices, and the distribution of zeroes of random polynomials.

A generalisation of a classical stochastic model of a library on a shelf (Tsetlin library) was discussed and results on the stationary distribution of this model were explained. Random geometric graphs were discussed along with three asymptotic regimes, namely, the sparse, thermodynamic and connectivity regimes. Some applications were presented. In the study of non-zero sum stochastic games existence of Nash equilibrium in stationary strategies was established.

A fresh perspective on Hilbert module approach to multivariable operator theory was presented. Study of dynamics of holomorphic correspondence led to a dichotomy result. In harmonic analysis, study of non-linear Schrodinger equations and Hardy-Sobolev inequality associated to the special Hermite operator along with mixed norm estimates for various associated eigenfunction expansions were presented. The talk on Green's function and Robin metric revived interest in some old classical topics in function theory.

2. The 7th IACS-APCTP-Academy Joint Meeting on Multiferroics and Emergent Phenomena in Novel Oxide Materials and Low Dimensional Systems

Orange County, Coorg
29 November – 2 December 2015

Convener: Jaejun Yu (SNU, Korea)

The meeting was organised in two parts, with the first part (November 29 – 30) being devoted to multiferroics and the second (December 1 – 2) to oxides and low-dimensional materials.

The conference began with the opening remarks by Professor D.D. Sarma. There were 6 sessions, on the topics such as magnetoelectric coupling through the spin flop transition in Ni_3TeO_6, models for ferroelectricity, stability of magnons in multiferroic $RMnO_3$, magnetic correlations induced ferroelectricity, multiferroic order in elemental Se, multiferroicity in α-$Cu_2V_2O_7$, magnetoelectric coupling in Fe_3O_4 nanoparticles and dipole into an incipient ferro-electric.

In the second part of the meeting, there were 15 invited talks and 8 short presentations by young PhD students. The talks covered a variety of subjects including new Fe-based superconductors, graphene, topological insulators, iridates, and multifunctional oxides (both bulk and interfaces). In addition to theoretical talks there were talks on experimental methods as well.

Participants got involved with many questions and discussions, both during and after the talks. There was also presentation by PhD students. The conference ended with a round table discussion which touched upon future directions and open issues.

3. Indo-US Workshop on Ceramic Coatings and Multilayers

Orange County, Coorg
25-28 February 2016

Conveners: Ashutosh S. Gandhi (IIT, Bombay), Vikram Jayaram (IISc, Bengaluru), Shrikant V. Joshi (University West, Sweden), Carlos G. Levi (University of California, Santa Barbara, USA) and Sanjay Sampath (Stony Brook University, USA)

This bilateral workshop was convened to bring together scientists and practitioners in the field of thermo-structural and functional ceramic coatings and

multilayers. These advanced engineered surfaces find widespread applications in energy and propulsion systems, especially in gas turbine engines, and emerging areas of solid oxide fuel cells. Coatings have now become crucial to the economic and safe operation of advanced engine systems and this has motivated extensive research and development in the field. These systems experience a multitude of degradation mechanisms, from oxidation – induced delamination to erosion and chemical attack. A multidisciplinary research strategy is required not only to elucidate the operational mechanisms but also to develop a framework for selection of new materials and multilayer architectures. Of further importance are the synthesis and processing of the layered assemblages whose parameterisation is critical to coating design, and reliable manufacturing. Finally, advanced characterisation and performance evaluation of these layered anisotropic materials remains a critical challenge from both academic and industrial perspectives. Hence, a workshop that brings multidisciplinary experts together to discuss these aspects is timely and useful.

Experts presented their perspective of the field through presentations on the topics highlighted below:

- Challenges in developing higher temperature coatings for gas turbines: Phase stability, fracture toughness, environmental attack, new TBC materials
- Environmental barrier coatings
- Simulations of failure modes in multilayered systems
- Miniaturized and *in situ* testing of thin films for fracture toughness and other mechanical properties
- High-temperature mechanical measurements at nanometer length scale
- Thermodynamic and first principle modelling of systems relevant to ceramic coatings
- Thermal spray techniques for ceramic coatings and multilayers: Plasma spray synthesis of multilayer oxides
- Coatings technologies for structural component repair
- New plasma spray techniques including suspension and precursor plasma spraying
- Nanocomposite hard and tough coatings by magnetron sputtering
- Perovskite solar cells for cheap, efficient, clean energy
- Solid oxide fuel cell materials: Interface dynamics, microstructure, fabrication techniques and mechanistic understanding of performance

The Indo–US bilateral workshop has opened opportunities for collaboration. The workshop featured participation of students from both countries, fostering future collaborations. The workshop will have served its purpose if it encourages expanded research in this emergent field.

Financial support was also provided by the Indo–US Science and Technology Forum for travel expenses of US and Indian participants. The International Center for Materials Research at University of California, Santa Barbara, supported the participation of five US students in the workshop.

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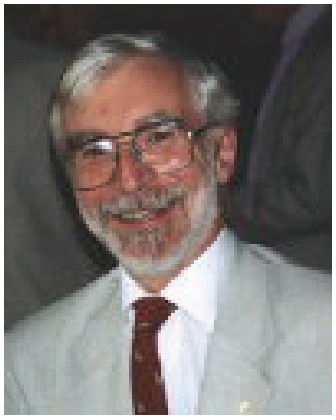
RAMAN PROFESSOR



Timothy John Pedley, G.I. Taylor Professor of Fluid Mechanics at the Department of Applied Mathematics and Theoretical Physics, University of Cambridge, UK, the Academy's 31st Raman Professor, was in India in February 2016 for three weeks to take up the chair. He visited the TIFR Centre for Interdisciplinary Sciences (TCIS), Hyderabad, from 21–25 February 2016 and participated in a focussed seminar on 'Spherical squimers: Models for swimming micro-organisms' and then in a general one on 'Micro-organisms swimming: Individual and collective behaviour' at the University of Hyderabad.

He had interactive session and research discussions with the students and faculty of Engineering Mechanics Unit of Jawaharlal Nehru Centre for Advanced Scientific Research, and the Chemical Engineering Department if Indian Institute of Science during his stay in Bengaluru. He delivered an Academy Publlic Lecture titled 'Micro-organisms swimming: Individual and collective behaviour' on 29 February 2016 at IISc, Bengaluru.

He has planned his next visit for November 2016 for his second phase as Raman Professor.

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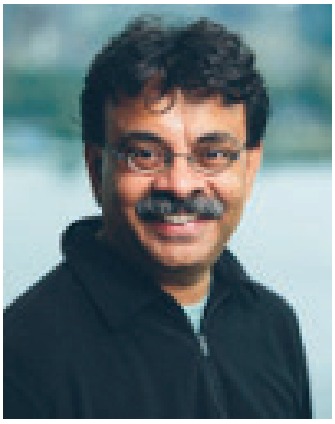
JUBILEE PROFESSOR



Madhu Sudan, Gordon Mckay Professor of Computer Science, Harvard, John A. Paulson School of Engineering and Applied Sciences, Harvard University, Cambridge, Massachusetts, USA, was the Platinum Jubilee Professor of the Indian Academy of Sciences during December 2015 – January 2016.

He visited India from 27 December 2015 to 9 January 2016. The lectures he delivered during his visit varied from in-depth expositions of current areas of research aimed at experts in the field to public lectures exposing the role of mathematics in applied fields such as computer science and communication.

The lectures included a series on "Property Testing and Affine Invariance" at IIT, Bombay; a lecture on 'Communication Amid Uncertainty' at TIFR as part of the BITS Bombay Information Theory Symposium honouring the 100th anniversary of Claude Shannon, and Public Lectures on 'Reliable Meaningful Communication' hosted by IISER, Pune, and on 'Mathematics, Proofs and Computation' at CBS in Mumbai.

His interactions with the Indian scientific community were with established researchers within his discipline as well as with those from other fields for interdisciplinary research, and with students and junior researchers.

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ACADEMY PUBLIC LECTURES

Gravitation and the Cosmos: 100 Years after Einstein's Discovery of General Relativity

Abhay Ashtekar

Institute for Gravitation and the Cosmos, and Department of Physics, Penn State University, USA

9 October 2015, Indian Institute of Science, Bengaluru

This public lecture was organised as part of the celebrations commemorating the Centenary of Einstein's Discovery of General Relativity. Ashtekar is an Honorary Fellow of the Academy and held the Raman Chair Professorship from December 2004 to January 2005.

Ashtekar began his talk with a brief account of the discovery of general relativity and the birth of modern cosmology. He discussed the concept of black holes and the major role they have played in astrophysics and fundamental physics, and finally dwelt upon the notion of gravitational waves. He pointed out that they will soon open a new window on the universe which offers an exceptional opportunity for India to play a major role in the international network of gravitational wave observatories through the LIGO-India initiative. With many historical anecdotes, Ashtekar illustrated a centenary of successive triumphs of general relativity and explained why researchers who study general relativity in a serious manner continue to be enchanted by its magic even a century after its discovery.

Micro-organisms Swimming: Individual and Collective Behaviour

T J Pedley

Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Cambridge (UK)

29 February 2016, Indian Institute of Science, Bengaluru

T J Pedley, FRS, is the the Raman Chair Professorship of the Academy from February to March 2016. Pedley is Emeritus G. I. Taylor Professor at the University of Cambridge.

Pedley said that swimming micro-organisms are everywhere: inside people (sperm and gut bacteria) and outside (algae and bacteria in bioreactors, lakes, oceans). In this talk, he surveyed the fluid mechanics of micro-organism swimming, from the low-Reynolds-number locomotion of individuals to the not-necessarily-low-Reynolds-number flows that they collectively generate in suspensions. The survey for individuals started from the analyses of Taylor and Lighthill in the 1950s and finished with the very recent demonstration that fluid mechanics alone is enough to coordinate the beating of multiple cilia into metachronal waves, at least on Volvox. The survey for suspensions started from studies of gyrotaxis in the 1990s and went on to the coherent structures driven by cell swimming stresslets, discovered in the 2000s, and concluded with some simulations of relatively concentrated suspensions.

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'WOMEN IN SCIENCE' PANEL PROGRAMMES

Women in Science: A Career in Science

Karnataka State Women's University, Bijapur
8 March 2015

A seminar on 'Women in Science (WiS): A Career in Science' was organised on 8 March 2015, International Women's Day, with the following goals: (i) to expose postgraduate and women PhD students to new and exciting ideas and directions in different areas of science; (ii) to equip them with basic conceptual and technological tools to ask and answer relevant research questions; (iii) to inspire and motivate young women to take up career in science and (iv) to create an awareness on various career options available to young women scientists.

Two-hundred and thirty-nine participants (postgraduate students, research scholars and young faculty) mainly from different departments of the Karnataka State Women's University (KSWU), Bijapur, attended the seminar. A team of six scientists and teachers gave lectures and interacted with the participants.

Meena R Chandawarkar, Vice Chancellor, KSWU, delivered the inaugural address and mentioned that this seminar was the most effective and meaningful way of celebrating International Women's Day. She said that many women were deterred from pursuing a career in science at the highest levels. The reasons behind this potential waste of human talent must be addressed. She also said that the presence of eminent women scientists and their presentations would definitely inspire women students and help shape their careers. She offered unconditional assistance to promote science in the region.

Lalitha Guruprasad, University of Hyderabad, Hyderabad, in her lecture on "Making the Most from a Protein Sequence", said that the correlation from protein sequence to structural and functional information is more valuable in the current genomic era. Using computational methods, one can identify novel domains, repeat and predict their protein structure and function. As a complement to her computational studies, some of the hypotheses are validated experimentally. She discussed her research results during her presentation.

P Ramadevi, Department of Physics, IIT, Bombay, in a lecture titled "Fun with Knots", spoke on the knot theory and connections to topological string theories, matrix models, and supersymmetric gauge theories in physics. She explained the properties of knots and the computation of Jones' polynomials with some examples. She showed an elegant method of obtaining polynomials and more generalised polynomials for these knots.

In a lecture titled "Chemistry, Biology and Physics of Stars and Galaxies", Annapurni Subramanian, Indian Institute of Astrophysics, Koramangala, Bengaluru, started by asking: Is there anyone who is not fascinated by the beauty of a starry sky in the night? Why do we study the stars and galaxies up there in the sky? She introduced the fascinating topic of astronomy and why it was necessary for us to understand the universe, its chemistry, biology and physics. She also talked about the new challenging projects in the making and women's contribution.

"Shape Optimization Problems via the Problem of Queen Dido" was the title of the lecture by Anisa Chorwadwala, Indian Institute of Science Education and Research, Pune. She spoke on the shape optimization problems, calculus of variations and geometric analysis. She talked about one such shape optimization problem in the Euclidean space and its generalization to certain other Riemannian manifolds and other configurations.

Suhita Nadkarni, Indian Institute of Science Education and Research, Pune, in her talk titled "Eavesdropping on Chitter Chatter at a Synapse Using Computational Simulations", shed light on the biophysics of synaptic transmission in normal function and pathological states. She explained how neurons talk to each other via a special junction called a synapse. She talked about her *in silico* experiments on a small synapse in the hippocampus, a part of the brain crucial for learning and memory and some interesting insights on synaptic plasticity that was gathered from her studies.

In the panel discussion, the participants asked questions regarding how to balance career and responsibilities at home and how to manage family while doing research in science. The panelists (Riddhi Shah, all invited speakers, Renuka Meti and MS Jogad) shared their experiences and views and provided guidance to the participants.

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NATIONAL SCIENCE DAY 2016

The Academy in association with The Academy Trust and Agastya International Foundation celebrated National Science Day on 29 February 2016 in its premises. The focal theme was 'Make in India: Technology-Driven Innovations'. Many science awareness activities were held. A popular science talk on 'Indigenous Developments in Aeronautical Engineering' by Sudhindra Haldodderi, Retired Scientist, DRDO, and Faculty, Jain University, was followed by a hands-on session on making paper gliders by VSS Sastry.

A demonstration on 'Flying Drones' was conducted by the Aerospace Department of IISc, which was followed by a display and demonstration of various science models by Agastya International Foundation. Students' visit to the Raman Museum at Raman Research Institute concluded the events of the day. Over 100 students from neighbouring schools participated in these activities.

REPOSITORY OF SCIENTIFIC PUBLICATIONS OF ACADEMY FELLOWS

The following are some numbers from the repository of publications of Fellows.

The numbers of publication records in the repository of publications that were published in the last three years: 9 in 2016, 57 in 2015, 121 in 2014, and 251 in 2013 (numbers as in March 2016). These numbers can be seen in the 'Browse by year' page on the repository website.

The numbers of publication records added to the repository: 109 in 2016, 465 in 2015, 709 in 2014, and 1270 in 2013 (numbers as in March 2016). The idea of institutional and other repositories of scholarly publications was born in the Open Access (OA) movement, whose main arena was and remains.North America and Europe. Many institutional repositories have been set up in India, and the Academy's repository is a kind of third-party repository. Still, the primary aim of an OA repository, which is to make some version of all scholarly publications available freely to all, was addressed by Indian research institutions and funding agencies until only last year, when DST and DBT jointly announced their OA policy and mandate (http://www.dbtindia.nic.in/wp-content/uploads/APPROVED-OPEN-ACCESS-POLICY-DBTDST12.12.2014.pdf).

The IASc repository can be a true OA repository only when all publication records in it include a full-text file of the publication. Given publishers' policies and the fact that much research is and may continue to be published in closed-access journals, the way to OA continues largely to be via deposit of author version of accepted publications in OA repositories. Funding agency and institutional OA mandates only help this cause.

Do you think an Academy OA mandate is appropriate? Do you think also that Academy journals should go OA? Please send your opinion to eprints@ias.ernet.in.

And of course, please inform the Eprints team (eprints@ias.ernet.in) in the Academy office about your publications not included in the repository.

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SUMMER RESEARCH FELLOWSHIP PROGRAMME FOR STUDENTS AND TEACHERS – 2016

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

The 2016 Programme was announced in September 2015 and the last date for receipt of applications was 30 November 2015. Selection Committees in six disciplines met during the second week of December 2015 to scrutinise the applications and make selections. The following table indicates the number of applications received from students and teachers and the subject-wise shortlist.

Subjects	No. of applications received		Shortlisted for selection	
	Students	Teachers	Students	Teachers
Life Sciences	2954	121	571	73
Engineering & Technology	8488	155	738	58
Chemistry	1735	78	311	34
Physics	1935	75	337	36
Earth & Planetary Sciences	748	07	167	04
Mathematics	810	18	145	11
TOTAL	**16670**	**454**	**2269**	**216**
GRAND TOTAL	**17124**		**2485**	

The next issue of *Patrika* will include the number of fellowships offered, those actually availed and some analysis of the data.

REFRESHER COURSES AND LECTURE WORKSHOPS

Jointly conducted by IASc (Bengaluru), INSA (New Delhi) and NASI (Allahabad)

Two-week Refresher Courses are aimed at helping teachers to add value to their teaching and are designed to have direct relevance to the study materials covered in the graduate and undergraduate syllabi followed in universities and institutions in the country. The following Courses were held from October 2015 to March 2016.

A. Refresher Courses in Experimental Physics

The Refresher Courses in Experimental Physics were held under the direction of R Srinivasan, who was instrumental in the conceptualization and designing of the experiments. He has so far held 74 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 M/s Ajay Sensors and Instruments, Bengaluru. The following is the list of Experimental Physics Courses held from October 2015 to March 2016.

1. Experimental Physics – 74

Tripura University, Tripura

8–23 March 2016

Co-ordinator: Anirban Guha

No. of Participants: 25

B. Other Refresher Courses

Sl. No.	Title	Venue	Duration	Course Director	Coordinator	No. of Participants	Topics Covered
1	Water	Field Marshal K M Cariappa College, Madikeri	16-11-2015 to 29-11-2015	Srikanth Sastry	Jagannath Nettar	16	Basic science of water (physical, chemical and biological aspects), water in clouds and the atmosphere, ocean physics, hydrology and water resources, the cryosphere and climate change, surface science of water, clean water: issues and nanotechnology solutions, water management and harvesting, water in the solar system and space
2	Developmental Biology	Sophia College, Mumbai	16-11-2015 to 28-11-2015	Tarala D. Nandedkar	Nafisa Balsinor	30	Progress in developmental biology: from past to present, how to make a gonad: lessons from mouse and man, regulation of ovarian function, folliculogenesis and steroidogenesis, perspectives of early mammalian development, orientation to bioinformatics, embyo implantation, basic concepts in testis biology, reproductive toxicology, molecular cytogenetics, hormone-receptor interaction, biomedical research, etc.
3	Crystallography, Mineralogy, Igneous Petrology and Thermodynamics, Sedimentology and Economic Geology	Indian Academy of Sciences, Jalahalli, Bangalore	11-12-2015 to 24-12-2015	Alok K. Gupta	T.D. Mahabaleswara	20	Thermodynamics, phase equilibria relations, mineralogy, sedimentology: introduction to some basic concepts, ore petrology and genesis
4	Refresher Course in Recent Advances in Chemistry	A.S. College, Deoghar	14-12-2015 to 26-12-2015	P.K. Chattaraj	Bijoy K. Choudhary and S.S. Majhi	30	Basic quantum chemistry, symmetry and group theory, spectroscopy, NMR, FTIR, mass spectrometry and their applications, density functional theory and molecular modeling, computational chemistry and weak interactions, computer simulations, reaction dynamics, thermodynamics and kinetics, electrochemistry, green chemistry, nanomaterials, nanomaterials as catalyst in organic synthesis

continued

Sl. No.	Title	Venue	Duration	Course Director	Coordinator	No. of Participants	Topics Covered
5	Physics Training and Talent Search	Kuvempu University, Shankarghatta	17-12-2015 to 30-12-2015	–	G. Rajasekaran and M. Sivakumar	–	Quantum mechanics, classical physics, experimental physics
6	Applications of Quantum Mechanics: Atoms, Molecules and Radiation	University of Mumbai, Mumbai	21-12-2015 to 04-01-2016	Deepak Dhar	Anuradha Misra	45	Basics of quantum mechanics: historical remarks, mathematical background, Schrodinger equation, abstract formulation, Dirac notation, representations and pictures, linear oscillator, perturbation theory, atoms: hydrogen atom, fine structure, helium atom, multi-electron atoms, orbital and spin angular momentum, addition of angular momenta, l-s and j-j coupling, ortho and para hydrogen, interaction of electromagnetic radiation with matter: quantum theory of radiation, spontaneous, stimulated emission and absorption probabilities, electric dipole selection rules, Einstein a and b coefficients, Rabi coefficients, Thomson scattering, Jaynes-Cummings model, molecules: different types of chemical bonds, hydrogen molecular ion, hydrogen molecule, diatomic molecules, basics of molecular orbital and valence bond theories, rotational and vibrational spectra, basic theory of NMR
7	Environmental Biology	University of Punjab, Bathinda	01-02-2016 to 15-02-2016	R.K. Kohli	Felix Bast	30	Recent advances in fields such as RNAi technology, soil and rhizosphere health, biogeochemistry, environmental pollution, functional genomics, plant genomics and biochemistry, and molecular medicine

Sl. No.	Title	Venue	Duration	Course Director	Coordinator	No. of Participants	Topics Covered
8	Quantum Mechanics	Government Arts College, Melur	08-02-2016	G. Rajasekaran	A. John Peter	40	Origin of quantum physics, mathematical tools of quantum mechanics, general formulism of quantum mechanics, one dimensional problems and angular momentum, three dimensional energy Eigen value problems, Heisenberg method- linear harmonic oscillator- matrix method, rotations and addition of angular momenta, approximation methods for stationary states, time-dependent perturbation theory, scattering theory.
9	Material Science and Measurement of Properties	Indian Academy of Sciences, Jalahalli Bangalore	09-02-2016 to 24-02-2016	T. G. Ramesh	T.D. Mahabaleswara	25	Thin film preparation by evaporation and sputtering, making pelletsof materials and attaching contacts, and measurement of thermal conductivity, thermal diffusivity, electrical resistivity of alloys of metals, thermoelectric, dielectric, piezoelectric, ferroelectric and magneticproperties, superconductivity, phase transitions and differential thermal analysis
10	Advanced Molecular Techniques in Cell and Molecular Biology	Manipal University, Manipal	29-02-2016 to 12-03-2016	V. Nagaraja	K. Sathyamoorthy	22	Isolation of DNA and proteins, restriction enzyme digestion, polyacralamide gel electrophoresis (PAGE), PCR, RT-PCR, comet assay, micronuclei assay, chromosome preparation and aberrations assay, bacteria growth curve, bacteria mutant generation, lymphocyte culture, observation of plant chromosomes by squash and enzymatic methods, absolute cell count, ploidy measurement and antigen detection by flow cytometry

C. Lecture Workshops

Sl. No.	Title	Venue	Duration	Course Director	Coordinator	No. of Participants	Topics Covered
1	Advances in Wireless Communications and Networking	Amal Jyothi College of Engineering, Kanjirapally	23-07-2015 to 24-07-2015	A. Chockalingam	Satheeshkumar K.G.	150	Introduction to wireless communications and next generation wireless, convex optimization, wireless networking, next generation WiFi, visible light wireless communication
2	Advances in Chemistry Education and Research	University of Gour Banga Malda	23-07-2015 to 24-07-2015	Subrata Ghosh	Mohabul Alam Mondal	150	Recent developments in methodologies for the construction of carbocyclic compounds, importance of chirality in drug molecules, nanocatalysis.
3	Analysis and Topology	MS University of Baroda Baroda	01-08-2015 to 03-08-2015	V. M. Shah	Haribhai R. Kataria	120	Role of definitions in the development of new areas in mathematics, development of wavelets from line segments, computational methods in geometry, two- manifolds (surfaces) and their classification, quantum computing: zero and the one, differentiation, integration and their extension to fractional order, weights on semigroups, some preliminaries on Riemann surfaces proof of the Riemann-Roch theorem for compact Riemann surfaces.
4	Integrated Research Approaches in Biology	Nirmala College for Women, Coimbatore	07-08-2015 to 08-08-2015	T. J. Pandian	Pawlin Vasanthi Joseph	125	Biopolymers with potential biomedical applications, structural biology, translation of genetic code and enzyme mechanisms, immunology, cell biology and apotosis, chronobiology, evolution and animal behaviour, research in ecological sciences
5	Future Perspective and Emerging Technologies for Sustainable Energy Resources	Tumkur University Tumkur	18-08-2015 to 19-08-2015	K. J. Rao	Ramesh T.N.	150	Overview on sustainable energy resources - utilities and limitations, bio-diversity in India with special reference to bioenergy plants, water and civilization, biofuels-source of alternative renewable energy, for future energy demands, turn to hydrogen, exploration of sustainable sources of energy, conjugated polymer based solar cells, the Renaissance in battery development

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6	Green Revolution to Gene Revolution	Telangana University, Nizamabad	20-08-2015 to 22-08-2015	Appa Rao Podile	Praveen Mamidala	150	Green revolution to gene revolution, molecular approach to develop disease resistant rice, innate immunity responses in plants, language of four alphabets driving biotechnology, crop improvement by RNA silencing, genetically engineered insect resistance in crop plants, host induced RNA interference (HI-RNAi) for disease and pest resistance in crop plants, genetic engineering for male sterility in crop plants, green genes: their role in improving photosynthetic productivity in higher plants, movements in plants: fascinating example, movements in plants: fascinating example, genetic engineering for biotic and abiotic stress tolerance
7	Supramolecular Assemblies: Synthesis and Application	Guru Ghasidas Vishwavidyalaya, Bilaspur	20-08-2015 to 21-08-2015	Partha Sarathi Mukherjee	Gautam Kumar Patra	150	Self-assembled discrete structures, supramolecular chemistry: concepts and functions, the making of a new family of trinuclear Ni(Ii) single-molecule magnets: strategy, failure, success and serendipity, supramolecular chemistry of coordination compounds, supra-molecualar chemistry of metal oxa cluster, crystal engineering: design principles and funtional materials, hetero-metallic complexes: facile synthesis, nuclearity, isomerization, catalytic activity and magnetic properties, dithiolence based metal coordination complexes as functional materials: a supramolecular approach, supramolecular systems in chemistry and biology: a general approach, functional molecular architectures

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Sl. No.	Title	Venue	Duration	Course Director	Coordinator	No. of Participants	Topics Covered
8	Spectroscopy and Perspectives	Sacred Heart College Tirupattur	10-09-2015 to 12-09-2015	P.K. Das	S.A. Martin Britto Dhas	100	Molecular spectroscopy, molecular beams in spectroscopy, fluorescence spectroscopy and analytical fluorimetry of multi fluorophoric system, amorphous semiconductors and applications, fibre Bragg grating sensors and their applications, non-linear optics, non-linear optics of semiconductor hetero-structures
9	Recent Trends in Physics	Guru Nanak Dev University, Amritsar	18-09-2015 to 19-09-2015	Arvind	Ravi Chand Singh	150	Modelling proportionate growth, rocks, rivers and sand: simple models for complex systems, gravity, equivalence principle and a glimpse of general relativity, evolving universe: Hubble expansion, relic radiation and dark energy, science in north west India: A historical perspective, spin-orbit mott insulators: an emerging frontier, unraveling nanoscale photon momentum effects on water droplet, quantum physics and Schroedinger's cat, experiments for physics pedagogy, classical and quantum cryptography
10	Recent Developments on the Theoretical and Experimental Aspects of Advanced Materials	North Bengal University, Darjeeling	18-09-2015 to 19-09-2015	Swapan K. Ghosh	Amiya Kumar Panda	150	Concept of orbital in chemistry, kinetic isotope effect and reaction mechanism, drug design - is it really that easy?, study of short-lived species, eletronic structure of transition metal-coordination organic radicals, eletronic structure of transition metal-coordination organic radicals, concept of density in chemistry and materials modelling
11	Emerging Trends in Chemical Sciences	VHNSN College, Virudhunagar	09-10-2015 to 11-10-2015	M. Palaniandavar	Prof. N. Raman	120	Structure and function of metallo-biomolecules I, organic transformations in confined space, iron-based ParaCEST MRI agents, Lewis octet, 18 electron rule and isolobal analogy, spices to medicines: the role of organic synthesis, importance of isolobal analogy in organometallic chemistry, Diels-Alder reaction: an evergreen solution to form

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							polycycles, hard and soft acids - the relevance in inorganic chemistry, low melting mixtures as novel reaction medium, luminescent metal-based nanoaggregates, recent advances in nano-based targeted drug delivery systems for cancer, domino synthesis of biologically active molecules
12	Recent Advances in Electrochemistry	NMKRV College for Women, Bangalore	28-10-2015 to 29-10-2015	S. Sampath	Y. Venkataramanappa	125	Study of electrified surface/Interface, the principle, applications and operations of dye - synthesized solar cells, Scanned probe microscopy an indispensible tool in nanotechnology, electrochemically prepared nanostructural thin films and their application, electrochemical synthesis of Inorganic materials, Information's on polymorphism and morphogenesis of various types of electrochemically synthesized inorganic compounds
13	Spectroscopic Techniques and Applications	Bishop Moore College, Mavelikara	11-11-2015 to 13-11-2015	Chandrabhas Narayan	Merin George	125	UV-Vis spectroscopy, NMR spectroscopy, highly resolution microscopic techniques: discovery to applications, Raman spectroscopy, Mossbauer spectroscopy
14	Taxonomy and Evolution	Mangalore University, Mangalore	23-11-2015 to 24-11-2015	R.R. Rao	G. Krishnakumar	150	Pollen biology, floristic diversity in india - an overview, taxonomy in the changing world - emerging challenges and tasks for future, why frequent changes in botanical names? - some aspects of botanical nomenclature, role of botanical gardens in conservation, taxonomic research and education, conserving the biological diversity in india: need for identifying smaller hot spot pockets of biodiversity in different eco-geographic zones, conservation of plant diversity - why India doesn't have a success story?

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Sl. No.	Title	Venue	Duration	Course Director	Coordinator	No. of Participants	Topics Covered
15	Statistical Mechanics and Thermodynamics	JSS College of Arts, Commerce and Science, Mysore	25-11-2015 to 27-11-2015	G. Srinivasan	Vijaya Manjunathaguru	120	Introduction to statistical physics, classical statistics of Maxwell and Boltzmann, some applications of classical statistics, introduction to quantum statistics, Fermi–Dirac statistics, some applications of Fermi–Dirac statistics, Bose–Einstein statistics, some applications of Bose–Einstein statistics, cooling of atoms using laser beams. super fluidity in helium
16	Functional Materials and their Applications in Devices	Sri Sathya Sai Institute of Higher Learning, Puttaparthi	26-11-2015 to 28-11-2015	S. Ramasesha	Siva Sankar Sai	120	Quantum Dots for electronic applications, organic materials for electronic devices, quantum dots, their composition and properties, materials for energy storage - batteries and super-capacitors, nonlinear optical properties of organic molecules in communication, current dependence of society on non-renewable resources, solar energy harvesting
17	Advances in Molecular Techniques	GITAM University, Vishakhapatnam	27-11-2015 to 28-11-2015	Sekhar Mande	S. V. Raja Gopal	150	Traditional, modern and futuristic vaccines, regulation of yeast metabolism: studies with Pichia pastoris, dissecting cell biology using proteomics, engagement, reception and breakup: the concept of cell motility, cell-cell communication in bacteria
18	Emerging Trends in Chemistry	St. Joseph's College, Tiruchirappalli	18-12-2015 to 20-12-2015	M. Palaniandavar	S. Britto	120	Molecular spectroscopy, some recent trends in fluorescence spectroscopy and analytical fluorimetry of multi-fluorophoric system, amorphous semiconductors and applications, Fibre Bragg grating sensors and their applications, non-linear optics, electronic states in molecules and solids, optical absorption and photoluminescence spectra of semiconductor

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19	Special Functions and their Applications	PSGR Krishnammal College for Women, Coimbatore	22-12-2015 to 23-12-2015	K. Srinivasa Rao	K. Sumathi	120	Applications of mathematics in defense research – an overview I, Special functions and legacy of Srinivasa Ramanujan, special functions and numerical integration, q and (p,q) generalizations of special functions and their applications I, applications of mathematics in defense research – an overview II, q and (p,q) generalization of special functions and their applications I, applications of special functions and concluding remarks
20	Fluid Flow through Porous Media and its Applications	Indian School of Mines, Dhanbad	25-12-2015 to 27-12-2015	B.V. Rathish Kumar	M.K. Singh	125	Modelling of electron kinetic force and colloid separation in a permeable gel medium, Fourier and non Fourier flux laws for studying heat transfer problems, on stability analysis with applications to convection in porous media, migration of diamond bearing kimberlitic fluid through cracks, non-Darcy flow through a fluid saturated porous medium, application of ADE, nano-fluid through micro-channel
21	Biological Sciences	RMVC College, Kolkata	05-01-2016 to 06-01-2016	Aparna Dutta Gupta	P. K. Medda	120	How to discover the function of a gene, multidisciplinary approaches to decode Plasmodium biology, strategies of increasing food productivity for growing population in the context of climate chande, assisted reproductive technology (ART) – an overview, fascinating world of insects and their management, TIITS- from bench of beside, animal models for human diseases, observing the plant signalling behaviour during plant pathogen interaction

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Sl. No.	Title	Venue	Duration	Course Director	Coordinator	No. of Participants	Topics Covered
22	Advances in Biology	Goodwill Christian College for Women, Bangalore	07-01-2016 to 08-01-2016	S.K. Saidapur	M.S. Gayathri	125	Science of biology: a short journey, pollination in flowering plants, microbiology and human welfare, sexual selection, bioprospecting: drug discovery from plants, epigenome: in health and sickness.
23	Recent Developments in Chemistry	Madurai Kamaraj University, Madurai	27-01-2016 to 28-01-2016	R. Ramaraj	V.S. Vasantha	150	Chemistry for sustainable development, li-battery materials, prediction of vibrational spectra of small molecules using computational chemistry tools, all-metal aromaticity and hydrogen storage: a conceptual DFT approach, quantum potential based approaches towards quantum dynamics, prediction of nuclear magnetic resonance and electronic spectra of small molecules using density functional theory, application of 2d NMR spectroscopy for structure analysis of organic compounds
24	Time and again: Challenging Science	Sophia College, Mumbai	08-01-2016 to 09-01-2016	Tarala D. Nandedkar	Medha S. Rajadhyaksha	125	To what extent biology as an autonomous science?, neuroscience then and now: a walk through the history of neuroscience, why science education needs history of science, scientific breakthroughs and the quantitative tradition - their validity versus relevance to society, landmarks in early years of biochemistry in India, broad implications of the history of biology for society
25	Electronic Structure and Spectroscopy of Atoms and Molecules	Fakir Chand College, Diamond Harbour	20-01-2016 to 22-01-2016	T. Chakraborty	Prajnamoy Pal	100	Fundamentals of quantum mechanics, atomic structure, atomic spectroscopy, molecular spectroscopy
26	Scope of Medical Biotechnology	Dr Hari Singh Central University, Sagar	21-01-2016 to 22-01-2016	Shekhar Mande	Subodh K. Jain	150	–

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27	Recent Trends in Biological Sciences	The American College, Madurai	21-01-2016 to 22-01-2016	G. Marimuthu	K. Navaneetha Kannan	100	Sucrase inhibitor from sugarcane for controlling the calorie intake, thermogenic food: uncouplers of mitochondrial oxidative phosphorylation, reproduction and stem cells, sex and germ cells, biology of stem cells and their applications in regenerative medicine, population demes of India: the grandest biological experimentation of nature, gene targeting in rice, HLA, haplotypes and human health.
28	Trends in Plant Taxonomy	Yogi Vemana University, Kadapa	21-01-2016 to 22-01-2016	R. R. Rao	A. M. Reddy	150	Changing trends in plant taxonomy: the concept of species and speciation
29	Frontiers in Material Sciences	Ravenshaw University, Cuttack	22-01-2016 to 23-01-2016	Ashok Kumar Mishra	Alekha Kumar Sutar	150	Design, synthesis and applications of organic and metal-organic hybrids stable bimetallic phase synthesis of quantum dots using solid state chemical and dynamic methods, fundamentals of NMR spectroscopy, library to laboratory: a concept of hybrid natural product synthesis of twin ZnO nanorods for electron-exciton coupling related applications lammelar double hydroxides: layered materials with versatile applications, use of fluorescence in understanding structure and properties of materials, opportunities and challenges in the world of GPCRs embedded in soft matter like environment, comparative account of plasmonic photocatalysis under visible light irradiation, inorganic-organic hybrid materials: applications in solar cell

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Sl. No.	Title	Venue	Duration	Course Director	Coordinator	No. of Participants	Topics Covered
30	Recent trends in Nanobiotechnology	K. S. Rangasamy College of Technology, Tiruchengode	25-01-2016 to 27-01-2016	T. J. Pandian	V. Rajendran	150	Introduction to nanobiotechnology, metal nanostructures for biological application and biosensors, investigating nanoscale motions in lipases by molecular dynamics simulations and investigating Pseudomonas aeruginosa biofilms by atomic force microscopy, interaction between nano-materials and biomolecules and studies on the structure and dynamics of collagen like peptides with matrix metalloproteinas
31	Biotechnology – Present and Future	Vijaya College, Bangalore	29-01-2016 to 30-01-2016	Manju Bansal	Gopalakrishna	150	Biological data and bioinformatics, biotechnology in human health and disease, stem cell research and its applications, microbial technology, bristol meyer squib, biotechnology in drug discovery
32	Emerging Trends in Environmental Biology	D.Y. Patil University, Navi Mumbai	29-01-2016 to 30-01-2016	Tarala D. Nandedkar	Manish R. Bhat	100	Environmental sustainability, environ-mental carcinogenesis, metagenomics, nuclear waste degradation, application of biotechnology towards minimization, remediation and monitoring of environmental pollutants
33	Environmental Biotechnology	Auxillium College, Vellore	04-02-2016 to 05-02-2016	E. Vijayan	Regina Mary	150	Environmental biology, chemical and physical factors influencing the environment, protection of environment using biotechnology
34	Recent Developments in Chemistry	Seethalakshmi Ramaswami College, Tiruchirappalli	05-02-2016 to 06-02-2016	R. Ramaraj	Dr M. Vasuki	150	–
35	Recend Trends in Machine Learning	PSGR Krishnammal College for Women, Coimbatore	10-02-2016 to 11-02-2016	B. L. Deekshatulu	M. S. Vijaya	100	Machine learning with decision trees, probabilistic methods in image processing, computational intelligence – trends and research ideas, cognitive modelling – research trends, image in-painting, image super resolution, deep learning, tensor flow for machine learning – demo, machine learning on hadoop framework, machine learning on hadoop framework case studies, machine learning using R

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36	Bioprospecting and Bioresources	St. Joseph's College, Tiruchirappalli	10-02-2016 to 12-02-2016	R. R. Rao	Francis Xavier	150	Current problems in taxonomy teaching and research in India - a plea for urgent resurrection of the dwindling subject, role of plant taxonomy and ethno-botany in promoting medicinal plants research in India , floristic diversity in India: an overview, botanical nomenclature and endangered species, Charles Darwin and origin of species, fundamentals of NMR spectroscopy biology of carnivorous plants, fundamental and applied aspects of pollination biology, pollen - pistil interaction: a prerequisite for fertilization, evolution of human health, synthesis of twin ZnO nanorods for electron-exciton coupling related applications, use of fluorescence in understanding structure and properties of materials ,opportunities and challenges in the world of GPCRS embedded in soft matter like environment, comparative account of plasmonic photo-catalysis under visible light irradiation
37	Frontiers on Corrosion Engineering and Technology	Bannari Amman Institute of Technology, Sathyamangalam	12-02-2016 to 13-02-2016	K. A. Natarajan	Arvind Singh	150	Basics of corrosion, major forms of corrosion, biofouling and microbially influenced corrosion: part I, environ-mental cracking process, corrosion of concrete structures, biofouling and microbially influenced corrosion: part II.
38	Recent trends on Cellular Mechanisms and Gene Expression	St. Joseph's College, Bangalore	12-02-2016 to 13-02-2016	D. J. Bagyaraj	Betty Daniel	150	Dissecting cellular and phenotypic environment through metagenomics, the roof of the matter how rice plants cope with drought and salt, dysregulated gene expression through post-translational modifications in human brain tumors, understanding the role of host factors in regulating viral gene expression, regulation of gene expression in tumor angiogenesis, hetero genous gene expression in crop plants.

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39	Biotechnology Tools and Techniques in Solving Environmental Problems	K.S. Rangasamy College of Technology, Tiruchengode	16-02-2016 to 17-02-2016	Rama Shankar Verma	P. Ponmurugan	150	Global challenges and solution to emerging issues through biotechnology towards green growth, perspectives of biotechnology tools and techniques to prevail over environmental issues, biotechnology for sustainable agriculture and emerging trends of biological sciences, potential of environmental biotechnology for clean and green environment, societal and economic issues of waste water treatment technologies and recent advancements, current issues and future trends of environmental biotechnology and bioreactor optimization, interdisciplinary research for accelerated bioremediation technologies and biofilm kinetics
40	Spectroscopic Techniques and Applications in Material Characterization	S.V. University, Tirupati	15-02-2016 to 17-02-2016	Siva Umapathi	C. Venkata Rao	150	Introduction to spectroscopy, advanced topics and introduction to ultraviolet and infrared spectroscopy, nuclear magnetic resonance spectroscopy, 2-D NMR spectroscopy mass spectrometry practical applications of structure elucidation techniques, hands-on skill on latest software, used for data analysis, interpretation and analysis, focused on structure elucidation of small and macromolecules, quantitative analysis
41	Frontiers in Nanoscience and Technology	St. Xaviers College, Aluva	18-02-2016 to 19-02-2016	E. Vijayan	Linda Louis	150	Applications of nanotechnology in biology, optical and magnetic properties of metallic nanostructures, Nano-technology in healthcare, theragnostics based on nanocrystals
42	Recent Advances in Chemistry	V.O. Chidambaram College, Tuticorin	19-02-2016 to 20-02-2016	S. Natarajan	A. Mathavan	150	The role of coordination chemistry in stable inorganic pigments, hard-soft acids-bases (HSAB) in the synthesis of inorganic compounds, nanoscience, nanomaterials and their applications (metal nanoparticles), photoelectro-chemistry and solar energy conversion, fluorescence: basics, fluorescence: interesting developments from our laboratory

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43	Exploring Developments in Chemical Sciences	Sant Gadge Baba Amaravati University, Amaravati	19-02-2016 to 21-02-2016	Sourav Pal	A. S. Aswar	150	Organic synthesis, catalysis, green chemistry, nanomaterials, coordination chemistry, quantum chemistry, solid state chemistry, energy studies, polymer chemistry, drug and supramolecular chemistry.
44	Innovations in Bioscience	Bharathiar University, Coimbatore	21-02-2016 to 22-02-2016	T. J. Pandian	S. Suja	100	Reproduction and stem cells, sex and germ cells, nanotechnology for evergreen revolution in india, arbuscularmycorrhizal fungi in sustainable agriculture, discovering immunogenome of india, microbial inoculants and crop productivity
45	Recent Breakthrough in Plant Sciences	Central University of Punjab, Bathinda	22-02-2016 to 24-02-2016	R. K. Kohli	Felix Bast	110	Breakthroughs in plant ecology, RNAi technology, rhizosphere biology, plant biochemistry, plant biotechnology, plant molecular biology, plant breeding, photobiology, genetics and genomics, systematic, biogeography, evolutionary biology, crop improvement
46	Modern Aspects of Chemical Research	Christ University, Bangalore	22-02-2016 to 23-02-2016	S. Umapathy	Prasad Pralhad Pujar	150	Discussion on the theory and applications of Raman spectroscopy and lasers, hard and soft acid base theory in synthetic inorganic chemistry, chemistry of permanent colours, characterization methods in nanoscience, materials for hydrogen storage and generation, organic electronics - issues and challenges.
47	Synergy between Computational and Experimental Chemistry	Uday Pratap College, Varanasi	26-02-2016 to 27-02-2016	M. S. Singh	Ashutosh Gupta	150	Computational chemistry, DNA and its applications in materials science, cation-interactions, multicomponent synthesis, synthetic chemistry, metal-DNA chemistry
48	Fourier Series, Fourier Transforms in Applications	Indian Academy Degree College, Bangalore	26-02-2016 to 27-02-2016	Mythily Ramaswamy	P. K. Lakshmikanthamma	150	Introduction to Fourier series, Fourier series and convergence, introduction to Fourier transforms, applications to differential equations
49	Recent Developments in Chemistry	Central University of Tamilnadu, Tiruvarur	02-03-2016 to 03-03-2016	V. Subramanian	T. Mohan Das	150	–

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Sl. No.	Title	Venue	Duration	Course Director	Coordinator	No. of Participants	Topics Covered
50	Chemistry at the Interface of Biology	Central University of Rajasthan, Ajmer	02-03-2016 to 04-03-2016	C. P. Rao	Sunil G. Naik	125	Bioinorganic chemistry, biophysical chemistry, chemical biology and its applications, biological aspects of organic chemistry, mass spectroscopy
51	Modern Chemistry and its Applications	Guru Nanak Dev University, Amritsar	03-03-2016 to 05-03-2016	P. K. Das	Vandana Bhalla	100	New paradigms of catalysis in organic synthesis, an alternative way of looking at thermodynamics, stereochemistry and conformation, molecularly designed architectures: lessons learnt from supramolecular chemistry, supramolecular aggregates: sensing and catalytic activity, nonlinear optical properties of molecules, learning chemistry in the computer age and drug discovery – is it really easy?, fluorescence spectroscopy: an overview and molecular diffusion, coordination variability of thiose micarbozones towards coinage and other metals
52	Genetically Modified Organism – Pros and Cons	The Oxford College of Science, Bangalore	03-03-2016 to 04-03-2016	Dipshikha Chakravortty	S. Bharathi	150	Why India needs biotechnology in agriculture, how bacteria became pathogen, GM crops-draught gene discovery, life and functions of microRNA in development and diseases, genetically modified mice in cardiovascular research
53	Advances in Biosciences	Lady Doak College, Madurai	03-03-2016 to 04-03-2016	K. Veluthambi	R. Shenbagarathai	150	Molecular and clinical proteomics, genetic engineering, virology, cell and molecular biology, eukaryotic gene expression: control of infectious diseases, microbial biotechnology, signaling in bacterial systems, bioprospecting in microorganisms, developmental biology
54	New Frontiers in Plant Sciences and Biotechnology	Nehru Memorial College, Tiruchirappalli	03-03-2016 to 05-03-2016	T. J. Pandian	M. Meenakshisundaram	150	Acqua culture, animal biotechnology, silkworm biotechnology, medicinal plants, biodiversity india - concerns and strategies, molecular breeding for improving abiotic stress tolerance and nutritional quality in rice, emerging trends in plant biotechnology, recent advances in immunological techniques

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55	Nano Science and Nano Technology	Alvas Institute of Engineering and Technology, Moodbidri	10-03-2016 to 12-03-2016	G. U. Kulkarni	A. T. Ramprsad	125	Nanoscience and technology: concepts and materials, thermal and energy nanomaterials for fast processes., organic nanoelectronics: issues and challenges, drug delivery through carbon and silica-based nanostructures, template DNA technology, nano-technology to overcome materials challenges for sustainable energy systems, nobler than the noblest: non-FCC Au crystallites, nanoporous materials, bioinspired nanoarchitectonics, anti-microbial applications of silver nano-particles
56	Plant Ecology and Systamatics	Telangana University, Nizamabad	10-03-2016 to 11-03-2016	K. N. Ganeshaiah	Vidyavardhini	125	–
57	Advances in Plant and Biomedical Sciences	Bishop Cottons Women's Christian College, Bangalore	10-03-2016 to 11-03-2016	D. J. Bagyaraj	Jacquiline Rajamathi	100	Microbial inoculants and plant growth, challenges in developing magic bullets for cancer, medicinal and aromatic plants in india : prospects and problem, NMR spectroscopy - versatile technique for structure determination of biomolecules, transgenic approaches to crop improvement, how crop plants survive salt and drought?, understanding cancer biology: basics, enigmas and prospects
58	Recent Developments in Chemistry	PSGR Krishnammal College for Women, Coimbatore	11-03-2016 to 12-03-2016	R. Ramaraj	K. Parameswari	125	Inspirations from the molecules of living systems, organic synthesis in the wellness of mankind, inorganic pigments, acids, bases and compounds, nanoscience, nanomaterials and their applications (metal nanoparticles) and photoelectro chemistry and solar energy conversion, fluorescence spectroscopy: fundamentals, prediction of vibrational spectra of small molecules using computational chemistry tools, and prediction of nuclear magnetic resonance and electronic spectra of small molecules using density functional theory

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Sl. No.	Title	Venue	Duration	Course Director	Coordinator	No. of Participants	Topics Covered
59	DNA Repair and Diseases	Christ University, Bangalore	11-03-2016 to 12-03-2016	Umesh Varshney	V. L. Vasantha	150	DNA structure and excision repair, mechanism of mismatch and nucleotide excision repair pathways, repair of DNA breaks by homologous recombination, DNA repair, aging and aging-related diseases, our genes and cancer, DNA double-strand breaks: the good, the bad and the unknown
60	Excitements in Chemistry and Physics	Dinabandhu Mahavidyalaya, Bongaon	16-03-2016 to 17-03-2016	Uday Maitra	Sudeshna Lahiri	150	A different way to learn thermodynamic, mysterious space time, a the wonderland of elementary particles, basic concepts of nonlinear optics/spectroscopy, Fe-Cu dioxygen chemistry of biological relevance, plastic story: history repeats, drug discovery: is it really easy?, plasma for society, learning chemistry in the computer age
61	Current Trends and Directions in Cryptography and Cyber Security	Coimbatore Institute of Engineering and Technology, Coimbatore	18-03-2016 to 19-03-2016	R. Krishnan	D. Brindha	150	Mathematical foundation for cryptography, cryptography and steganography, network security and information security, intrusion detection and prevention, encryption techniques like triple DES, AES, RSA, mobile security and internet security, cybercrime and digital forensics, ethical hacking and laws and acts on cybercrime
62	Emerging Trends in Applied Physics	Devanga Arts College, Aruppukottai	18-03-2016 to 19-03-2016	K. Porsezian	B. Ravikumar	150	–

Sl. No.	Title	Venue	Duration	Course Director	Coordinator	No. of Participants	Topics Covered
63	Theoretical and Computational Fluid Dynamics	S.V. University, Tirupati	21-03-2016 to 22-03-2016	P. Kandaswamy	S. Sreenadh	150	Mathematical modelling in fluid mechanics, a factorization theorem for operators occurring in the stokes, Brinkman and Oseen equations, stability of fluid flows, gravity waves theory in fluid dynamics, internal gravity waves theory in computational fluid dynamics, concepts of modelling in human immune system, modeling of biofluid flows, numerical analysis of viscous flows
64	Frontier Lectures in Biology	Jayaraj Annapackiam College for Women Periyakulam	21-03-2016 to 22-03-2016	S. K. Saidapur	K. Nirmala	150	Evolution and human health-I, Mendellan genes to synthetic genomes -I, pollen biology, mendelian genes to synthetic genomes-II, pollen-PIstI I interaction, evolution and human health-II, reproduction and stem cells, the Indian microbiology a zoologist's view
65	Applications of Biotechnology	Telangana University, Nizamabad	21-03-2016 to 22-03-2016	Tarala D. Nandedkar	P. Samanta	110	Nanomedicine and toxicity, conservation of wild animals of India using biotechnological approaches I and II, applications of microarray, biotechnology - the technology of hope, genetic engineering for crop improvement

OBSERVANCE OF VIGILANCE AWARENESS WEEK

Vigilance Awareness Week (VAW) was observed from 26 to 31 October 2015 at Indian Academy of Science, Bengaluru. The pledge message was sent to all the staff members to read and the pledge copies were displayed along with Vigilance Slogans on all the notice boards of the Academy. As part of the Vigilance Awareness Week, a special lecture was arranged jointly by Indian Academy of Sciences and Raman Research Institute on 30 October 2015 at the RRI Auditorium. Justice Dr M Rama Jois (former Chief Justice of Punjab and Haryana High Court, former Governor of Jharkhand and Bihar, and former Rajya Sabha Member) spoke on 'Trivarga Ensures Good Governance'.

HINDI WORKSHOPS

The Indian Academy of Sciences and the Raman Research Institute jointly conducted a Hindi Workshop on 18th December 2015. The workshop was conducted by Mr Maltesh (OL Officer-in-Charge, Microwave Tube Research and Development Centre, Bengaluru) on 'Practical issues of Official Language Implementation and its Suggestions'.

The Quarterly Hindi Workshop was conducted jointly by the Indian Academy of Sciences and the Raman Research Institute on 29 March 2016. A Quiz Competition in Hindi was held, and Professor Pratibha R. Mudliar (Chairperson, Department of Studies and Research in Hindi, Mysore University) gave a talk on 'Functional Hindi and Translation in the Perspective of Official Language' on this occasion.

SUPERANNUATED ACADEMY STAFF

B. Krishna

B. Krishna joined the Academy on 16 July 1981 and superannuated on 31 December 2015, after completing 34 years of regularised service. She served in various departments of the Academy, before moving to the Accounts department, from where she retired.

Hema Wesley

Hema Wesley joined the Academy on 1 April 1990 as Copy editor. She superannuated on 31 July 2014 as Executive Editor after 24 years of regularised service. She continued as Consultant Editor until 31 December 2015.

B. Sethumani

B. Sethumani, who joined the Academy on 17 July 1981, superannuated on 29 February 2016, completing 34 years of regularised service. He served in various capacities in the Administration department, and retired as Assistant Executive Secretary.

OBITUARIES

Chirayathumadom Venkatachalier Subramanian
(elected 1955)

CV Subramanian, the celebrated mycologist and plant pathologist, who had served as Head of the Centre of Advanced Study (CAS) in Botany at the University of Madras (1973–1985), passed away in Bangkok, Thailand, on 5 February 2016. A full article prepared by his former students – DJ Bhat, J Muthumary, C Rajendran, S Raghu Kumar and BPR Vittal – has appeared in *Current Science* (2014, **106**(10), 1438–1444) under the series 'Living Legends in Indian Science'. CVS, as he was known to the biologists of his generation, was a broad-based scientist and a scholar with deep roots in philosophy and music. His first appointment as Senior Lecturer in the University of Madras in 1951 was followed by a Readership. He was then appointed to the newly created Chair in Plant Pathology at the Indian Agricultural Research Institute, New Delhi (1958). On invitation, he organised the new Department of Botany in the University of Rajasthan at Jodhpur and then at Jaipur, where he became Professor and Head of the Department. He then returned to the University of Madras in the newly upgraded CAS in Botany.

His specialization was in the Hyphomycetes, their diversity and taxonomy, which required extensive surveys in various parts of India and in Southeast Asia. He discovered a large number of new taxa, especially genera. The fungal specimens were examined under the microscope and illustrated systematically. He had a unique principle of nomenclature, which was the use of Sanskrit root words rather than Latin or Greek, an approach appreciated by scientists both in India and abroad. A few genera are *Angulimaya*, *Dwayabeeja*, *Kutilakesa*, *Nalalanthamala*, and *Tharoopama*. An example of the binomial would be *Angulimaya sundaram* Subram. He made substantial addition to our knowledge of these fungi, culminating in the publication of a monumental *Monograph on Hyphomycetes* in 1971. A comprehensive book authored by him *Hypho-mycetes: Taxonomy and Biology* was published by Academic Press, London, in 1983. This book was released by the then Prime Minister of India, Indira Gandhi.

In recognition of his contributions to mycology, Subramanian was elected President of the International Mycological Association in 1977 at Tampa, Florida, USA. He was President of the International Mycological Congress, Tokyo, Japan (1983). He founded the Mycological Society of India in 1973 and launched the journal *KAVAKA* (the Sanskrit word for fungi), of which he was the Chief Editor from its inception until 1998. CVS was awarded the Shanti Swarup Bhatnagar Prize in 1965 and the Rafi Ahmad Kidwai Award of the ICAR (1972–1973). The Indian Botanical Society honoured him with the Birbal Sahni Medal (1972) and Lifetime Achievement Award (2009). His lasting contributions to plant taxonomy were recognised by the Ministry of Environment and Forests, Government of India, by the award of the prestigious Dr EK Janaki Ammal Award (2000). Subramanian was elected to the Fellowship of the Indian Academy of Sciences (1955), Indian National Science Academy (1960), Corresponding Member, Belgian Royal Academy of Foreign Sciences (1978) and National Academy of Agricultural Sciences (1978). He was elected President, Botany Section, Indian Science Congress (1975), Jawaharlal Nehru Fellow (1976–1978) and Member, University Grants Commission (1979–1982). The other prestigious positions CVS occupied have been listed by Bhat *et al*. in their *Current Science* article.

CVS had deep interest in both Carnatic and Hindustani styles of music. He played the *mridangam* and was a good singer. Few could match him in the intricacies of Hindustani classical music, the various *gharanas* and their exponents. He was a great believer and follower of Swami Vivekananda and Ramakrishna Paramahamsa.

CVS is survived by his wife and two sons.

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Subramania Ranganathan
(elected 1975)

With the passing away of Subramania Ranganathan (Ranga to most) on 8 January 2016 in New Delhi, we have lost a truly great enquiring mind, one who represented an era of organic chemistry itself. Sadly, it is hardly 13 months since Sathyamurthy wrote an eminently informative account of Ranga in the series 'Living Legends in Indian Science' in the 10 December 2014 issue of *Current Science* that this epilogue has to follow. Until the 1950s, organic chemistry was in the 'classical' phase, where practitioners isolated and identified molecules from natural sources and attempted to synthesise them in the laboratory using conventional methods. Synthesis of complex molecules was a challenge. It was in the 1950s that understanding the mechanisms behind molecular structures and reactions began getting clearer (using physical chemistry), and analysis of the details of the structures and shapes of molecules became easier thanks to advances in spectroscopy. And Ranga took to them eagerly and with success. Sathyamurthy describes Ranga's influence in some detail including his work on vitamin B12 synthesis and on a reaction mechanism that actually and crucially led to the establishment of the eponymous Woodward – Hoffmann Rules (for which Hoffman received the 1981 Nobel Prize). Such a feel for Ranga's teaching and practicing science is best illustrated in his monograph *Metamorphosis of Camphor to Vitamin B12*.

Ranga himself created complex molecules – some spherical, some knotted and some twisted into double helices – for the fun of it. He used pre-sculpted (clay kind) molecules as building blocks (called 'synthons') to make such complex ones. While his mentor Woodward used camphor as the synthon for vitamin B12, Ranga used the components of castor oil and sculpted them into prostaglandins, and found ways to understand how plants solubilize and use the silicon there for growth, and was able to reproduce this in the lab and propagate it in field trials. No wonder he was an enthusiast and practitioner of the Japanese art of paper folding called Origami. Many of his origami-based articles appeared in *Resonance* in 2000, 2002 and 2003. No account of Ranga can be complete without mentioning his wife, the late Darshan Ranganathan, whom he married in 1970. Together they made an inseparable couple, each inspiring the other, and admired by all. She became an equally outstanding molecular architect after 1994, when she moved as a scientist at the Regional Research Laboratory (now renamed as the National Institute of Interdisciplinary Science and Technology or NIIST) in Thiruvanathapuram (thanks to MV George), while Ranga took on a senior scientist position there. The couple later moved to the Indian Institute of Chemical Technology (IICT) at Hyderabad during 1998–99, continuing their outstanding researches.

The loss of Darshan to cancer in 2001 broke Ranga both in body and spirit. He became a saintly recluse, taking some comfort only in the research that he continued to carry out. It was at this time that the then Director of IICT, KV Raghavan made the remarkable move of offering Ranga an apartment in the campus, a laboratory and facilities to carry on his research for as long as he wanted.

Ranga and Darshan's son, Anand Ranganathan, has followed their footsteps and after obtaining his doctoral degree in bioorganic chemistry from Cambridge, UK, has moved on into the area of molecular biology and drug design (at the International Centre for Genetic Engineering and Biotechnology and now at the Jawaharlal Nehru University, both in New Delhi). And in the tradition of the family, he too sculpts molecules, but this time shuffling triplet codon pairs of the DNA molecule in order to generate protein and polypeptide chains that are drug candidates against malaria and tuberculosis. Anand and his wife Sheetal rushed to Hyderabad on 28 December 2015 when Ranga fell in his apartment and broke a bone. They took him to the hospital to fix this and later flew him to Delhi to stay with them but, alas, right in the recovery room at the hospital in Delhi, Ranga breathed his last in the afternoon of 8 January 2016.

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Venkataraman Jagannathan
(elected 1974)

In science, it is not always necessary to achieve great success, but also important to conceptualize new ideas which can be taken forward by others to achieve the distinction. This philosophy was practised by Venkataraman Jagannathan, who passed away on 2 December 2015 at the age of 94. In 2001, Jagannathan was one of the pioneers to start bio-technology in India. Jagannathan and GN Ramachandran used to work on the utilization of cellulosic biomass for the production of single-cell protein and alcohol.

Jagannathan graduated in chemistry from Madras University, and did his postgraduation from the Indian Institute of Science, Bengaluru (1944). He was awarded Government of Madras scholarship to work for a PhD in Stanford University under the guidance of J Murray Luck. For his doctoral research, Jagannathan worked on purification and characterization of an enzyme, phosphoglucomutase, which converts glucose 1-phosphate to glucose 6-phosphate, a known constituent of various animal tissues, in this case rabbit muscle. After his PhD, Jagannathan received the Heart Foundation Fellowship from NIH, Washington, and worked on pyruvate oxidase of pigeon breast muscle in Dr David Green's Enzyme Institute, Madison, for a year. He then joined NCL in 1951. His group in NCL discovered several new enzymes. For the first time, enzymes such as brain hexokinase, acetylcoline esterase and hydrogenase were extensively studied. He was Head of the Biochemistry Division from 1956 to 1981, until his superannuation. Another research area he started in NCL is plant tissue culture and the contributions of his group included the first successful micropropagation of mature teak and eucalyptus, virus elimination from sugarcane, propagation of elite cardamom, turmeric and others. In 1978, he was aptly honoured with the Vasvik Award for Biological Sciences and Technology by Vividhlakshi Audyogik Samshodhan Vikas Kendra (VASVIK), a non-profit NGO for the development of high-yielding virus-free sugarcane through tissue culture. During 1960–1985 Jagannathan along with late JC Sadana and C Siva Raman took enzymology research to its pinnacle at NCL.

He was also invited to set up a laboratory for plant genetic engineering at the Tata Energy Research Institute, New Delhi, where he worked as Head of Biotechnology from 1985 to 1992. He has published over a 100 research papers, and more than 30 students obtained MSc by research and PhD degrees under his guidance. He was on the editorial board of the *Indian Journal of Biochemistry and Biophysics* and *Biochimica Biophysica Acta.* In 1988, Jagannathan received the Shri Om Prakash Bhasin Award. He was a Fellow of the Maharashtra Academy of Sciences, Pune; Indian Academy of Sciences, Bengaluru, and Indian National Science Academy, New Delhi. With the demise of Jagannathan, we have lost a pioneering enzymologist.

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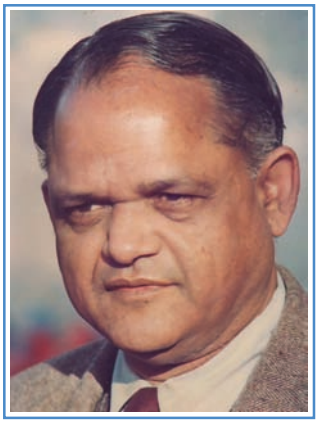

Vinod Prakash Sharma
(elected 1998)

Born on 6 April 1938 in the village Kailwal in Bulandshehar district of Uttar Pradesh, Sharma did his schooling in Dehradun. He went to Agra University for his Bachelor's degree in science and to Allahabad University for his Master's as well as Doctoral degree (D Phil), which he completed in 1964. A year later, in 1965, he went as a postdoctoral fellow to the University of Notre Dame in USA. This was followed by a senior postdoctoral fellowship at Purdue University, where he was joined by his scientist wife, Manju Sharma, who later went on to become Secretary, Department of

Biotechnology, Government of India. At both Notre Dame and Purdue, Sharma's postdoctoral research and training focused largely on entomology. Back in India in 1968, Sharma also obtained the degree of Doctor of Science (D Sc) from Allahabad University in 1974.

He started his scientific research career as a pool officer at the Forest Research Institute in Dehradun, where he worked for a year before joining the Indian Council of Medical Research (ICMR) as senior scientist in a WHO-sponsored project involving the study of genetic control of culicine mosquitoes, where he worked from 1970 to 1975. These were times when malaria had re-emerged in the Indian subcontinent with a vengeance. Confronted with the challenge, Sharma moved to the Vector Control Research and Malaria Research Unit of the ICMR as its Deputy Director and worked there for two years.

After this, in 1978, having gained considerable experience in different aspects of research in vector-borne diseases in general, and in malaria in particular, he upgraded the Malaria Research Centre which, to begin with, was an upshot of the 'Genetic Control of Mosquitoes Project' at ICMR. It was a small and humble beginning, with only a few scientists available for the mammoth task, but Sharma not only managed to consolidate the ongoing activities at the centre, he also got relentlessly engaged in modernizing it. Never hesitant to use new technologies, though never at the expense of time-tested methods of vector and disease control, he developed the centre along with a number of field stations at different key locations in the country for trying out newer methods of vector control and reducing malaria infections. It was mostly through his vision and leadership that malaria research was to gain impetus and soon brought into focus. Today India is one of the largest contributors to malaria research in the world and Sharma can be accredited as being one of the key leaders to have had the vision to reignite the concern in difficult times. Malaria Research Centre was renamed National Institute of Malaria Research (NIMR) and is now one of the leading institutions that carries out research in all aspects of malaria, besides being a leading contributor to policy decisions regarding the issue of combating malaria in India. These outstanding efforts and relentless focus on various aspects of malaria control quite naturally led to his appointment as its first Director, a post he held till he retired from service in 1998, and then he took up the position of Additional Director General, ICMR.

Sharma underscored the vital connect between malaria, other vector-borne diseases and agriculture. He strongly advocated that malaria vector control and Krishi Vigyan Kendra of the Indian Council of Agricultural Research (ICAR) come together to transport new technical advances to rural India. He was a highly respected malariologist and was invited to serve on many international committees on malaria control efforts including 'Roll Back Malaria' in India, and more recently, in the eradication of malaria. His international commitments, among many, included chairmanship of WHO/FAO/ UNCHS/UNEP panel of experts on environmental management of vector control, and membership of the world expert committee on malaria in India. Sharma was internationally recognised as one of the leaders in malaria control research. His own research interests in malaria included epidemiology, urban malaria, insecticide resistance in malaria vectors, sterilisation of male mosquitoes by various methods, development of new techniques for sex separation of mosquitoes, bio-environmental control of malaria and vector biology.

His hard work, research output and leadership has been recognised through prestigious awards, and memberships of science academies including the National Academy of Sciences, Allahabad, where he served as its President during 1999–2000; the Indian Academy of Sciences, Bengaluru, and the Indian National Science Academy, New Delhi. He was recipient of high civil honours – the Padmashree (1992) and Padmabhushan in (2014). After his retirement in 1998, he was nominated as the Meghnad Saha Distinguished Fellow of NASI at the Centre for Rural Development and Technology at IIT, Delhi. During his time at the Centre, VP continued to be seriously involved in international programmes such as Roll Back Malaria and malaria eradication along with conservation, availability and access to water, as well as environment protection. He led the Safe Water Campaign started by NASI and wrote extensively on this important subject. Sharma was seriously concerned about issues regarding water resource management in India. He was the key figure in organising several brainstorming workshops on safe water and sanitation, which led to several publications like *Safe Water and Community Health.* His interest in environmental issues becomes evident from the fact that he delivered the lecture on 'Sunlight and human health' four days before he went to the hospital for the last time. Essentially a field person, he

was deeply interested in seeing and making things materialise in field situations. Some of his endeavours include rejuvenation of *baolies* (water bodies) in rural areas and development of a mosquito-proof byepass desert cooler. Sharma loved writing and editing and encouraged others to do so as well. It was primarily through his efforts and drive that the *Indian Journal of Malariology,* later rechristened as the *Journal of Vector Borne Diseases*, was restarted. He published more than three hundred research papers and authored several books. His writing output showed no decline even when his health did. He has left behind several books in their final stages of publication. Sharma was a cheerful communicator and was prepared to talk about subjects of interest at any level; he gave talks at schools, at colleges and universities and continued this even when his health was compromised during the last few months of his life.

Sharma breathed his last on 9 October 2015 after his health deteriorated suddenly and rapidly. He leaves behind his wife Manju Sharma, his son Amit Sharma, himself a noted malaria structural biologist, his daughter-in-law Divyani and two grandchildren.

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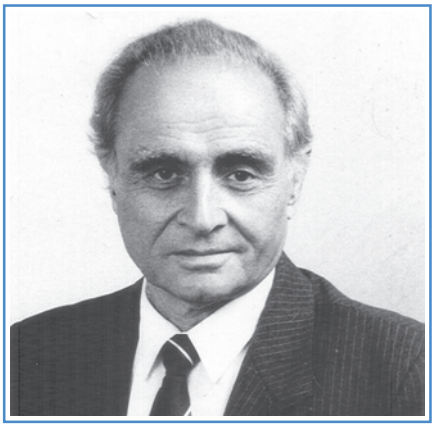

Syed Zahoor Qasim
(elected 1976)

Syed Zahoor Qasim, 88, passed away on 20 October 2015 at his residence in New Delhi. He leaves behind his wife Nawabzadi Begum Sahiba Rampur and three daughters. Qasim was born on 31 December 1926 in Allahabad. He studied at Majidia Islamia Intermediate College, Allahabad, and then at Aligarh Muslim University, where he obtained a BSc degree in 1949. In 1951 he stood first in MSc (Zoology) from the same university and was awarded the University Gold Medal. During the next couple of years he was a lecturer in the Department of Zoology at Aligarh. He proceeded to United Kingdom for higher studies in 1953. In 1956 he completed his DSc and PhD degrees from the University College of North Wales, UK. After returning to India he served as Lecturer (1956) and Reader (1957) in the Department of Zoology, Aligarh Muslim University. He then occupied a number of increasingly important positions in education and research institutions of the country: Professor, Central Institute of Fishery Education, Mumbai (1962); Assistant Director, International Indian Ocean Expedition, Kochi (1964); Director, Central Marine Fisheries Research Institute, Kochi (1970); additional charge of Director, Central Institute of Fisheries Technology (1973); Director, National Institute of Oceanography (NIO), Goa (1974).

At these institutions he made pioneering contributions in a number of areas including marine biology, fishery and oceanography of the waters around India. He was also associated with demonstration of potential for aquaculture in the country, and promotion of technology for cultured pearls. Qasim's own work and his support to others at these institutions earned him the reputation as a progressive leader of science, ever willing to help productive researchers, particularly the young ones. The institutions he led saw significant development of infrastructure to conduct research. NIO acquired its first research vessel, a basic requirement of any oceanographic institution, during Qasim's tenure (1974–81) as Director – *RV Gaveshani* was acquired by the institute in 1977. NIO also saw launching of long-term programmes of research. The most important of these, initiated by Qasim with his close associate H. N. Siddiquie, aimed at exploration of deep sea polymetallic nodules in the Indian Ocean. Qasim led the first expedition under the programme on board *RV Gaveshani*. The programme was completed successfully for India to claim rights of a pioneer country for mining of nodules (rich in iron, manganese, copper, nickel and cobalt) in the Central Indian Ocean. The programme had another beneficial impact. Well funded, the programme sustained multidisciplinary research – biology, chemistry, geology and physics – of the North Indian Ocean for almost three decades. It helped NIO get an identity as an oceanographic institution dedicated to the study of oceanography of the North Indian Ocean. This basin experiences the winds and precipitation associated with the annual cycle of the monsoon and exhibits features that are strikingly different from those in the North Atlantic and the North

Pacific that experience the steady trades. There was now, for the first time, a capable institution located close to the basin to study it.

In 1981 Qasim moved from Goa to New Delhi to serve as Secretary, Ministry of Environment, Forest and Wildlife (1981–82), where he led India's first expedition to the Antarctica. The expedition initiated research of an entirely new genre, study of the icy polar continent of Antarctica, by researchers from India, a tropical country. The media in India covered the expedition widely to a favourable response from the country – Antarctica had caught the imagination of the country.

An important instrument in Qasim's hands to support such growth, both of Antarctic research and of oceanography of the North Indian Ocean, was the Department of Ocean Development (DOD) (which subsequently became a part of Ministry of Earth Sciences), Government of India, Qasim became DOD's founding Secretary in 1982 and served there till 1988. Five decades ago the global oceanographic community launched the International Indian Ocean Expedition (IIOE) whose most intense phase was during 1962–1965. The expedition was one of the largest international, interdisciplinary oceanographic research efforts ever conducted in which 40 oceanographic research vessels belonging to 13 countries surveyed the Indian Ocean and collected data that provided the first comprehensive look at oceanography of the ocean.

Following his tenure at DoD, Qasim served as Vice-Chancellor of Jamia Milia Islamia Central University during 1989–1991 and as Member of the Planning Commission during 1991–1996. After leaving the Planning Commission he continued his association with science institutions in the country and abroad. He kept himself occupied with writing, lecturing and interacting with institutions dedicated to the fields of his interest. Qasim's work brought him many laurels. He was awarded Padma Shri (1974), Rafi Ahmed Kidwai Award (1978), Lal Bahadur Shastri Award (1988), Padma Bhushan (1982), Oceanology International Lifetime Achievement Award, UK (1999), First National Ocean Science and Technology Award by Government of India (2003–04), Asian Society Gold Medal (2005), SOFTI Biennial Award (2007) and Lifetime Achievement Award, Indian Science Congress (2008). He was elected to all the three national science academies of the country and to The World Academy of Sciences. He was President, National Academy of Sciences, India (1983–84) and General President, Indian Science Congress (1992–93).

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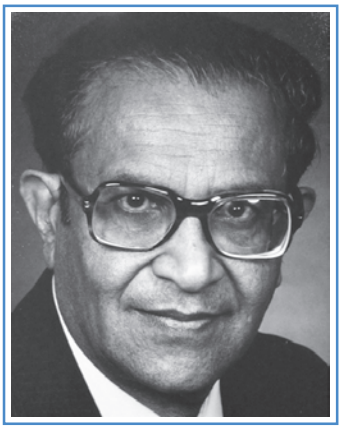

Parameswaran Hariharan
(elected 1972)

Parameswaran Hariharan, known to many of his colleagues and friends as Hari, passed away in Berkeley, California, on 26 July 2015. Hariharan was born on 26 December 1926 in Madras (now Chennai). He went to school in Madras and then Thiruvananthapuram. He obtained his MSc degree in physics in 1948 from the University of Travancore. Hariharan joined the National Physical Laboratory (NPL), New Delhi, in 1949. Sponsored by the Colombo Plan, he spent three years at the National Research Council (NRC), Ottawa, Canada. There he published some of his earliest papers in the *Journal of the Optical Society of America*, including one in which he studied the diffracted light emanating from an annulus. Another paper from this time was on the resolving power of photographic emulsions.

Upon his return to NPL in 1955, Hariharan was awarded a PhD by the University of Kerala in 1958. At NPL, he published a series of papers on interferometry, many of them in collaboration with D. Sen. From 1962 to 1971, Hariharan was Director of the laboratories at Hindustan Photo Films (HPF), Ootacamund. With support from the Managing Director of HPF, M. A. S. Rajan, he carried out research on photographic materials. It was here that he started working on holography. Dhawan recruited him as a Senior Professor at IISc, to be based in the Central Instruments and Services Laboratory (CISL). At IISc, his work focused on holography and speckle patterns. Hariharan was elected Fellow of the Indian Academy of Sciences in 1972 and the Indian National Science Academy in 1973. In the summer of 1972, Hariharan spent three months at the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Sydney, Australia, at the invitation of W. H. ('Beattie') Steel, an expert in interferometry. During that stay, Hariharan was offered

a permanent position, which he accepted, and spent the remainder of his career in Australia, where he made important contributions to the fields of holography and interferometry. Hariharan continued to visit scientific institutions in India and to collaborate with Indian scientists, especially after his retirement from CSIRO in 1991. He visited a number of laboratories in India as part of the UNESCO-sponsored TOKTEN (Transfer of Knowledge Through Expatriate Nationals) programme. He was a Jawaharlal Nehru Professor at the University of Hyderabad (1993), and a Visiting Scholar sponsored by the International Centre for Theoretical Physics (ICTP), Trieste, and at the Raman Research Institute (RRI), Bengaluru (1996–98) where he collaborated with several scientists.

As Director of the laboratories at HPF, he became an expert in photographic emulsions, which, combined with his optical expertise, gave him a background perfectly suited to the technically and artistically demanding field of holography. Hari's early contributions included the design of a new three-beam interferometer, the double-passed Fabry–Perot interferometer, and the first practical radial shear interferometer. This background in interferometry led naturally to his interest in holography. His expertise in processing photographic emulsions (the principal recording medium for the highest quality holograms) led to innovations that dramatically improved the diffraction efficiency and brightness of holograms as well as their stability. The artistic community was quick to recognise the value of his work; he collaborated with artists, including Paula Dawson (http://www.pauladawson.com/), Alexander (http://www.art-alexander.com/), and Margaret Benyon (http://holowiki. nss.rpi.edu/wiki/Margaret_Benyon). Along with his deep knowledge of classical optics, Hari was an innovative cross-disciplinary thinker. He recognised very early the power of modern electronics and microprocessors in optics, and in 1981, with colleagues at CSIRO, developed a novel holographic exposure control system which combined the power of modern electronics and clever opto-mechanical devices to enable efficient and accurate holograms to be recorded each time. It was in interferometry, however, where this cross-linking bore the best fruit. The principles of phase-shifting interferometry were in their early stages of development, and Hari worked with his colleagues at CSIRO to develop the hardware needed to shift the phase of the interferometer and the CCD-based detection to record the intensity patterns used by the phase-recovery algorithms. Concurrently with this experimental work, Hari developed more sophisticated algorithms that were less susceptible to phase-shift errors and capable of greater accuracy in phase measurement. The optical workshop at CSIRO was at that time manufacturing optical surfaces whose deviation from form (flat or spherical) was so small that quantitative measurement was increasingly difficult. Hari's innovations in digital interferometry were perfectly timed; with the principle of 'if you can measure it, you can make it', the interferometers designed and built by Hari and his CSIRO colleagues allowed his co-workers to produce optical components and assemblies that in subsequent years found their way into the LIGO interferometer, NASA instruments, optical solar observatories and into industry as reference optics for commercial interferometers. Hari retired from CSIRO in 1991 as Chief Research Scientist, the Organisation's highest scientific rank. He continued his work as an Honorary Research Fellow at CSIRO and an Honorary Visiting Professor at Sydney University. Hari also expanded his circle of research associates and institutions to a number of countries including USA, UK, Japan, India, Mexico and Australia.

During the following 20 or so years, Hari continued his prolific innovation and publication programme with the support of his old and new-found associates. His interests broadened as well; for example, he was the first to demonstrate achromatic phase shifting using the geometric phase, and made significant contributions to the study of quantum effects in optical interference.

Hari's lifetime contributions and achievements have spanned an amazing period of more than 60 productive years, during which he published more than 200 journal articles, wrote four highly regarded books and five major reviews, as well as book chapters and articles for non-peer-reviewed publications. Hari achieved notable international recognition for his original scientific contributions in interferometry, holography and other areas.

Hari's awards are too numerous to mention, but possibly those that meant much to him personally were the Gold Medal of SPIE in 2001, SPIE Dennis Gabor Award in 1992, and the Joseph Fraunhofer Award from the Optical Society of America in 1989.

In the latter years of his life Hari moved to the US to be closer to his children and grandchildren.

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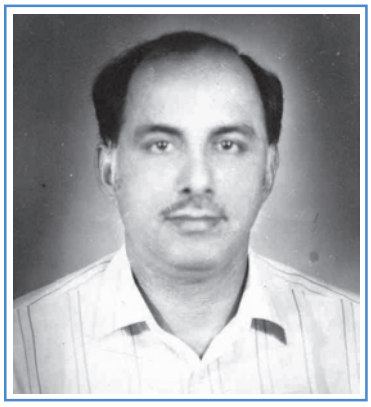

Suhas Chandra Sanyal
(elected 1992)

Born on 1 January 1942, Suhas Chandra Sanyal passed away on 5 August 2015. A detailed obituary note will appear in a future issue of *Patrika*.

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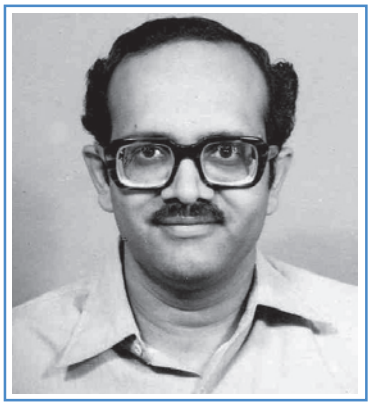

Deepak Kumar
(elected 1987)

Deepak Kumar, born on 3 April 1946, passed away on 25 January 2016. A detailed obituary note will appear in a future issue of *Patrika*.

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Paramasivam Natarajan
(elected 1987)

Born on 17 September 1940, Paramasivam Natarajan passed away on 18 March 2016. A detailed obituary note will appear in a future issue of *Patrika*.

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Charusita Chakravarty
(elected 2006)

Charusita Chakravarty, born on 5 May 1964, passed away on 29 March 2016. A detailed obituary note will appear in a future issue of *Patrika*.

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