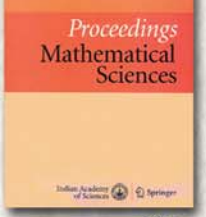
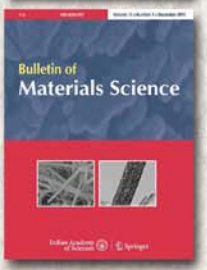
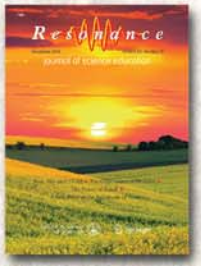
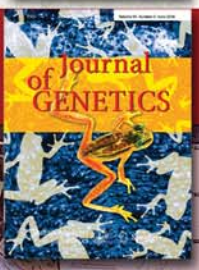








ANNUAL REPORT

2015 - 16

INDIAN ACADEMY OF SCIENCES

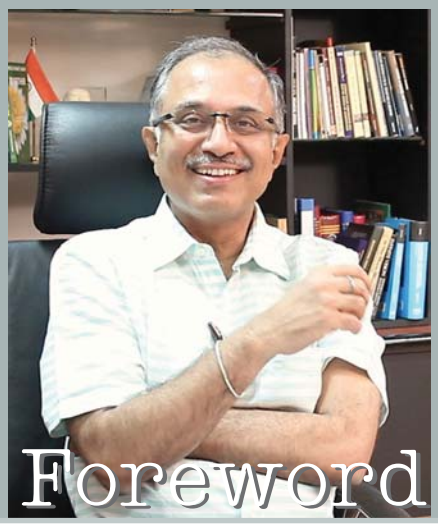
BENGALURU

Address

Indian Academy of Sciences
C.V. Raman Avenue
Post Box No. 8005
Sadashivanagar P.O.
Bengaluru 560 080
Telephone (EPABX): 91-80-2266-1200
Fax: 91-80-2361-6094
Email: office@ias.ac.in
Website: www.ias.ac.in

Editorial Team

Contents



Foreword

As envisioned by its founder – Sir C V Raman – The Indian Academy of Sciences has been devoted to the promotion of science in the country, through diverse activities. In the last 82 years, the Academy has achieved several milestones and these are outlined in the Annual Report of each year.

At present the Academy has 1053 Fellows, 56 Honorary Fellows and 37 Associates, and the various scientific activities of the Academy draw heavily on them. From the beginning the Academy has been involved in dissemination of scientific knowledge and starting with the publication of the *Proceedings of the Indian Academy of Sciences A&B* in July 1934, today we publish *ten* journals in various scientific disciplines.

The Academy appreciates the crucial role of science education in building up a cohort of qualified researchers. For the past two decades, we have been reaching out to young students and teachers through the Summer Research Fellowship Programme. In addition we have conducted 189 Refresher courses and 558 Lecture Workshops.

We were pleased to welcome the Hon'ble Union Minister for Science & Technology & Earth Sciences, Dr. Harsh Vardhan to the Academy premises on 21st August, 2015. We also conducted a Capacity Building Workshop for the publication staff and have implemented the Continuous Article Publishing mode for *Journal of Astrophysics and Astronomy* and *Pramana – Journal of Physics* from this year onwards.

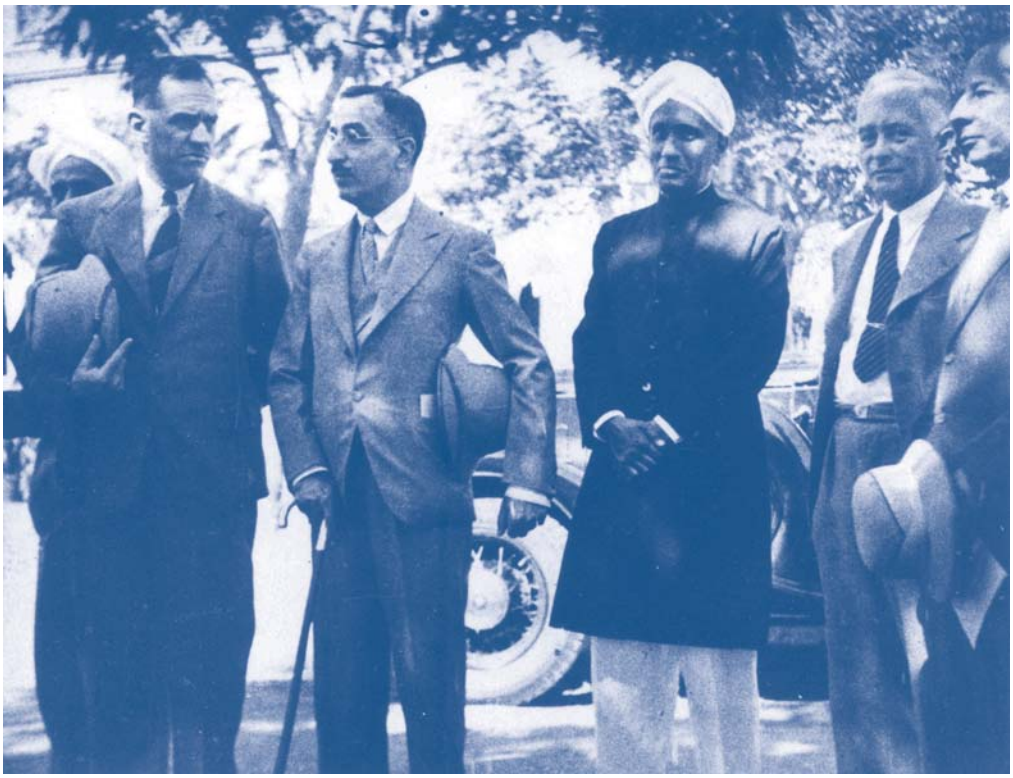
The mid year meeting was held in Bangalore during 3-4 July 2015 and the 81st Annual Meeting of the Academy was organized at IISER, Pune, during 6-8 November 2015. Two important scientific sessions, on 'Light and Matter' and 'General Relativity' which marked the International Year of Light and a century of Einstein's Theory of Relativity respectively were a notable feature of the Annual meeting. A full report appears inside.

It is a pleasure to acknowledge the efforts of the Fellows of the Academy as well as the larger scientific community and the staff of the Indian Academy of Sciences in carrying out the activities of the Academy and bringing out this report.

15 September 2016

RAM RAMASWAMY
President
Indian Academy of Sciences

1 Introduction



The Academy was founded in 1934 by Sir C V Raman with the main objective of promoting the progress and upholding the cause of science (both pure and applied). It was registered as a Society under the Societies Registration Act on 24 April 1934. The Academy commenced functioning with 65 Fellows and the formal inauguration took place on 31 July 1934 at the Indian Institute of Science, Bangalore. On the afternoon of that day, the first general meeting of Fellows was held during which Sir C V Raman was elected its President and the draft constitution of the Academy was approved and adopted. The first issue of the Academy Proceedings was published in July 1934.

The present report covering the period from April 2015 to March 2016 represents the eighty-first year of the Academy.

2 Overview

The Academy strives to meet its objectives through promotion of original research and dissemination of scientific knowledge to the community via a variety of activities that include meetings, discussions, seminars, symposia and science education programmes. The Academy publishes reputed scholarly scientific journals that contain high-quality papers and articles by scientists from India and abroad.

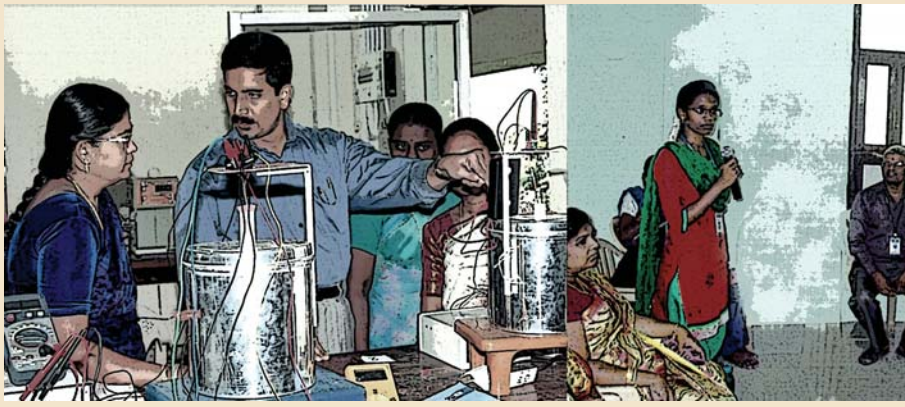
Highlights

Publication of scientific journals

During the year 2015–16, a total of 77 issues were published in 10 thematic journals. The contents are available in open access platform. Of the total number of 7760 articles submitted, 1342 were published. The total number of journal pages published was 15393. Over 24500 individuals/universities/other institutions received print versions of these journals. Worldwide visibility to Academy journals increased, as did the submission of articles. Journals citations have enhanced over years.

Science Education Programmes

A total of 1234 students and 112 teachers availed the Summer Research Fellowship. 18 refresher courses in Physics, Life Sciences, Engineering and Earth & Planetary Science were conducted for university science teachers in different parts of the country. 67 Lecture Workshops were held in Physics, Life Sciences, Engineering, Earth & Planetary Science, Mathematics and Chemistry in different parts of the country.



Important collaborations (national and global) established

The Academy continued its collaboration with the other two National Science Academies in the country, viz., INSA, New Delhi, and NASI, Allahabad, for implementing Science Education Programmes. The Academy collaborated with Springer for marketing the online versions of Academy journals overseas.

The following publishing collaborations were continued: *Current Science* in association with Current Science Association; *Pramana – Journal of Physics* in association with INSA and Indian Physics Association; and *Bulletin of Materials Science* with Materials Research Society of India.

Election of Fellows and Associates

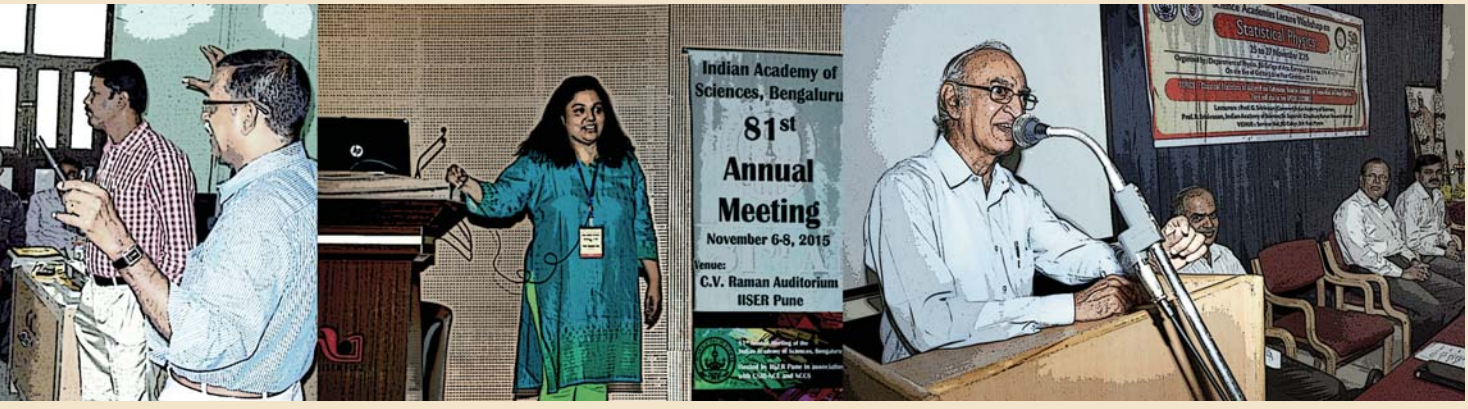
458 nominations were considered out of which 26 were elected for the Fellowship; under the Associateship programme, 57 nominations were considered and 11 were selected.

Fellows' Repository

Through this initiative, 92757 metadata of important researches in all branches of science carried out by Fellows of Academy is freely made available online. The number of full-texts made available as of now is 20788.

Organizing Scientific Meetings

The Mid-Year meeting was organized during 3–4 July 2015 at Indian Institute of Science, Bengaluru. The Annual Meeting was organized at IISER–Pune during 6-8 November 2015; Symposia, public lectures and scientific talks by Fellows/Associates were held in these meetings.



3 Council

There were two statutory meetings of the Council on 4 July and 5–6 December 2015.

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 K N Ganesh
(Vice-President)

Prof. Manindra Agrawal
(Vice-President)

Prof. Umesh V Waghmare
(Secretary)

Prof. Sunil Bajpai

Dr. Madhu Dikshit

Prof. Partha P Majumder

Dr. V V Ranade

Council 2013 to 2015:

Seated (L to R):

1. Dr. G Sundararajan (Vice-President)
2. Prof. R Ramaswamy (Vice-President & Editor of Publications)
3. Prof. K N Ganesh
4. Prof. D Chatterji (President)
5. Prof. A K Sood (previous President)
6. Prof. J Srinivasan (Treasurer)
7. Prof. Chitra Sarkar
8. Prof. R Varadarajan (Secretary)
9. Prof. Uday Maitra (Secretary)

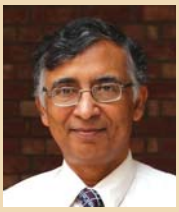
Standing (L to R):

10. Prof. M R S Rao (Vice-President)
11. Prof. S R Wadia
12. Prof. R Bhatia
13. Prof. R K Shayamasundar
14. Prof. T K Chandrashekar
15. Dr. Chandrima Shaha
16. Dr. S S Rai

Prof. K L Sebastian
(Vice-President)

Prof. Arun K Grover
(Vice-President)

Prof. R. Varadarajan
(Treasurer)



Prof. Uday Maitra
(Secretary)

Prof. Sudha
Bhattacharya

Prof. Deepak Dhar

Prof. Chanda J Jog

Prof. Lalit Kumar

Prof. K H Paranjape

Prof. R Ramesh

Prof. D D Sarma

4 Fellowship

The Academy has been receiving nominations for the Fellowship in large numbers. Each year, on an average, about 475 nominations are considered under the Fellowship.

Starting 2016, there has been a paradigm shift in the processing system for the Fellowship nominations. Since the introduction of this new system wherein proposers can upload the nomination papers directly online, the number of nominations received during 2016 has gone up significantly. The new system has been lauded by the entire Fellowship. In addition, the compiled version of the nominees' write-up (consolidated list) has been made available online for easy access to the Fellowship.

Apart from e-processing of nominations, e-balloting is now being considered, starting 2017, thus envisaging a remarkable shift from the conventional postal balloting. The new system would not only save time but also would contribute significantly towards conservation.

4.1 2016 Fellowship Elections

A total of 458 nominations for Fellowship in eight different disciplines were considered by the Sectional Committees. Following postal balloting, 26 new Fellows were elected, the fellowship being effective from 1 January 2016. A list of their names with particulars follows. Also elected was one Honorary Fellow.

New Fellows

(effective 1 January 2016)

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

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

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

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

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

Arun Chattopadhyay
Indian Institute of Technology, Guwahati
Sp: Nanoscience & Technology, Physical Chemistry

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

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

S Ganesh
Indian Institute of Technology, Kanpur
Sp: Human Molecular Genetics, Neurobiology of Disease, Stress Biology

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

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

Ramesh Hariharan
Strand Life Sciences, Bengaluru
Sp: Computational Biology, Molecular Diagnostics, Design & Analysis of Algorithms

Krishna P Kaliappan
Indian Institute of Technology, Mumbai
Sp: Organic Synthesis, Medicinal Chemistry, Total Synthesis of Natural Product-like Molecules

Amalendu Krishna
Tata Institute of Fundamental Research, Mumbai
Sp: Algebraic Cycles, Algebraic K-Theory, Equivariant cohomology

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

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

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

V K Paul
All India Institute of Medical Sciences, New Delhi
Sp: Paediatrics, Newborn Health

T Punniyamurthy
Indian Institute of Technology, Guwahati
Sp: Synthetic Organic Chemistry

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

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

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

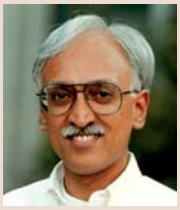
Sanjay Kumar
Banaras Hindu University, Varanasi
Sp: Condensed Matter Theory, Biological Physics, Statistical Physics

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

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

K V Venkatesh
Indian Institute of Technology, Mumbai
Sp: Biosystems Engineering, Systems & Synthetic Biology, Metabolic Engineering

Honorary Fellow



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

4.2 In Memoriam

The Academy regrets to place on record the death of the following 16 Fellows during the period up to March 2016.

Fellows Deceased

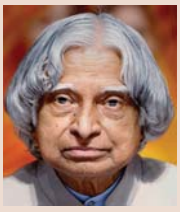
Taracad Narayanan Ananthakrishnan
(b. 15 December 1925, d. 7 August 2015)
Elected: 1975
Sp: Entomology, Cecidology, Chemical Ecology

Charusita Chakravarty
(b. 5 May 1964, d. 29 March 2016)
Elected: 2006
Sp: Chemical Physics, Theoretical & Computational Chemistry

Kumar Deepak
(b. 3 April 1946, d. 25 January 2016)
Elected: 1987
Sp: Condensed Matter Physics, Quantum Mechanics, Statistical Mechanics

Parameswaran Hariharan
(b. 26 December 1926, d. 26 July 2015)
Elected: 1972
Sp: Optics

Venkataraman Jagannathan
(b. 15 June 1921, d. 2 December 2015)
Elected: 1974
Sp: Biochemistry, Plant Tissue Culture

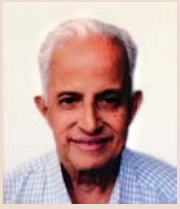


Avul Pakir Jainulabdeen Abdul Kalam
(b. 15 October 1931, d. 27 July 2015)
Elected: 1984
Sp: Composite Material Technology, Rocket Technology

Sethunathasarma Krishnaswami
(b. 21 May 1945,
d. 20 July 2015)
Elected: 1986
Sp: Nuclear Oceanography, Low Temperature Geochemistry

Paramasivam Natarajan
(b. 17 September 1940,
d. 18 March 2016)
Elected: 1987
Sp: Inorganic Photochemistry, Laser Flash Photolysis, Chemical Conversion of Solar Energy

Syed Zahoor Qasim
(b. 31 December 1926,
d. 20 October 2015)
Elected: 1976
Sp: Oceanography



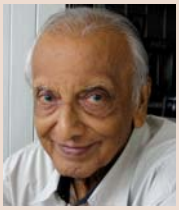
Subramania Ranganathan
(b. 2 February 1934,
d. 8 January 2016)
Elected: 1975
Sp: Organic & Bio-Organic Chemistry

Suhas Chandra Sanyal
(b. 1 January 1942,
d. 5 August 2015)
Elected: 1992
Sp: Medical Microbiology, Pathogenicity, Nosocomial Infections, Infection Control, Antimicrobial Therapy

Govindaswamy Shanmugam
(b. 18 December 1938,
d. 15 April 2015)
Elected: 1991
Sp: Molecular Virology, Cancer Biology, Medicinal Plants

Kamal Nath Sharma
(b. 17 November 1929,
d. 21 June 2015)
Elected: 1972
Sp: Neurophysiology, Behaviour, Biocontrols, Hospital Planning

Vinod Prakash Sharma
(b. 6 April 1938,
d. 9 October 2015)
Elected: 1998
Sp: Malariology, Vector Biology & Control



Chirayathumadom Venkatachalier Subramanian
(b. 11 August 1924,
d. 5 February 2016)
Elected: 1955
Sp: Mycology, Plant Pathology, Evolution

Somenahalli Venkatesarao Subramanyam
(b. 3 September 1943,
d. 1 August 2015)
Elected: 1991
Sp: Condensed Matter Physics, Low Temperature Physics, High Pressure Physics, Carbon Films, Conducting Polymers

4.3 Strength of the Fellowship

	Fellows	Honorary Fellows
1 April 2015	1043	55
Elected (Dec. 2015)	26	1
Deceased (2015–2016)	16	0
31 March 2016	1053	56

5 Associates

The Associateship programme was initiated by the Academy in 1983 to identify and encourage promising young scientists. The Associateship is tenable for a maximum period of 5 years until the age of 35 or a minimum period of 3 years.

In 2015, 57 nominations were received and the following 14 were selected as Associates, the associateship being effective from 1 July 2015.

New Associates (effective July 2015)

B Anand
IIT, Guwahati
Sp: RNA Biology, Structural and Computational Biology, Genome Engineering

P Anbasaran
IIT, Chennai
Sp: New Synthetic Methodologies, Natural Products, Carbon-dioxide Fixation

Abhishek Banerjee
IISc, Bengaluru
Sp: Noncummutative Geometry, Algebraic Geometry, Number Theory

Subhra Jana
S.N. Bose National Centre for Basic Sciences, Kolkata
Sp: Catalysis, Spectroscopy, Experimental Materials Science

Ankur A Kulkarni
IIT, Mumbai
Sp: Game Theory and Optimisation, Stochastic Control, Information Theory

Chandan Mukherjee
IIT, Guwahati
Sp: Bioinorganic Chemistry, Biomedicinal Chemistry, Co-ordination Chemistry

Uma K Narasimhan
VSSC, Thiruvananthapuram
Sp: Tropical Mesoscale Convective Systems, Stratosphere–Troposphere Exchange Processes, Ground and Space-Based Remote Sensing

TN Narayanan
TIFR Centre for Interdisciplinary Sciences, Hyderabad
Sp: Materials Science, Nanomagnetism, Electrochemistry

Aseem Paranjape
IUCAA, Pune
Sp: Cosmology, Large Scale Structure, Gravitation

Arpita Patra
IISc, Bengaluru
Sp: Cryptography, Secure Distributed Computing, Information Security

6 Publications

Publication of scientific journals has been a major activity of the Academy since its formation in 1934 and the Proceedings of the Indian Academy of Sciences Parts A and B began publication that very year. The Academy today publishes 10 journals (listed in section 6.1), several of which grew out of the original Proceedings.

In keeping with the current trends in science publishing, as a first step, the *Journal of Astrophysics and Astronomy* was moved to Continuous Article Publishing mode from January 2016.

Starting 2015, the Academy organised workshops on different themes of digital publishing annually as a capacity building measure for the editorial staff. The first workshop, on the emerging trends in journal publishing, was held this year (see section 6.4). In an effort to build capacity of the publication staff, a Latex training workshop was organized.

In-house style-files were created for journals *Sadhana* and *Pramana* to facilitate the authors.

In the Chief Editors' meeting held in April to discuss general publication aspects, it was decided to print the digital object identifier (doi) for all research articles in all journals.

The Academy website was upgraded in keeping with the new developments in technology to be more dynamic and to have a robust database.

Prasad Perlekar
TIFR Centre for Interdisciplinary Sciences, Hyderabad
Sp: Fluid Dynamics, Nonlinear Dynamics, Condensed Matter Physics

R Prabhu
Harish-Chandra Research Institute, Allahabad
Sp: Quantum Information Theory, Many-Body Physics, Quantum Optics

Mahak Sharma
IISER, Mohali
Sp: Cell Biology, Molecular Biology, Host-Pathogen Interactions

Gyana Ranjan Tripathy
IISER, Pune
Sp: Re-OS Geochronology, Weathering and Erosion, Isotope Geochemistry

Resonance – Journal of Science Education featured the following scientists in the year 2015: Asima Chatterjee, Richard Buckminster Fuller, Edward Norton Lorentz, Joseph L Doob, Arnold Sommerfeld, Alxeander Grothendieck, Sir Asutosh Mukherjee, Louis Leakey & Mary Leakey, Shyamadas Chatterjee, Jan Hendrik Oort, Felix Bloch, Edward Mills Purcell, E K Zavoisky, and Charles H Townes.

Brochures for some journals (*Journal Astrophysics and Astronomy, Journal of Chemical Sciences*, and *Sadhana*) and journal posters (*Resonance, Bulletin of Materials Science, Journal of Astrophysics and Astronomy, Journal of Chemical Sciences*, and *Sadhana*) and two posters giving information about all the ten IASc journals were brought out to promote and popularize the journals for submissions and subscriptions within India.

Patrika, Newsletter of the Academy, was brought out in the months of March and September 2015 covering the activities and events of the year 2015.

In addition to the ten scientific journals that are brought out by the Academy, there are a number of books and reports that are published each year. The *Masterclass* series was started this year (see section 6.3).

6.1 Journals

The following journals continue to be published by the Academy:

1. Bulletin of Materials Science
2. Current Science (in association with Current Science Association)
3. Journal of Astrophysics and Astronomy
4. Journal of Biosciences
5. Journal of Chemical Sciences
6. Journal of Earth System Science
7. Journal of Genetics
8. Pramana – Journal of Physics
9. Proceedings – Mathematical Sciences
10. Resonance – Journal of Science Education
11. Sadhana – Academy Proceedings in Engineering Sciences

Journal-wise information on papers submitted for publication, the number of pages published and circulation figures of journals for the calendar year 2015 are given in Tables 1–3 (see pages 66–68).

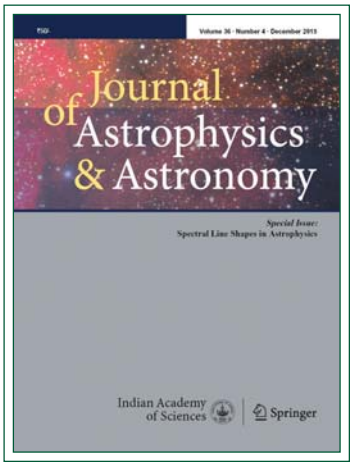
6.2 Special Issues of Journals

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 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.

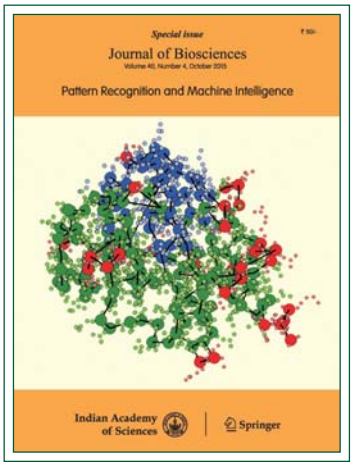
This issue contains valuable reviews which are of interest to specialists and Ph D students. It also includes scientific papers with results of new research on

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 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

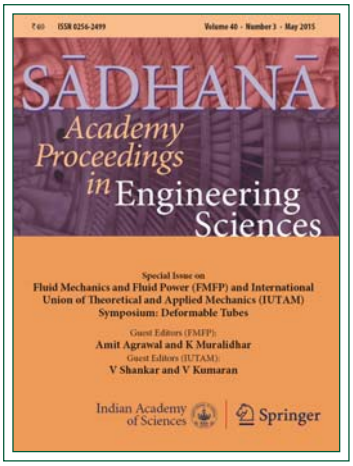


Computational methods are essential for analysing biological data because major developments in molecular biology and advances in high-throughput genomic technologies have led to explosive growth in the amount and complexity of information that is routinely collected. Computational biology, bioinformatics 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.

This special issue of the *Journal of Biosciences* focusses 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.

Fluid Mechanics and Fluid Power (FMFP) and International Union of Theoretical and Applied Mechanics (IUTAM) Symposium: Deformable Tubes

Editors: Amit Agrawal and K Muralidhar (FMFP); V Shankar and V Kumaran (IUTAM)

Sadhana, Vol. 40, No. 3, May 2015, pp. 623–1048

This special issue of *Sadhana* contains selected papers from a conference and a symposium related to fluid mechanics: Fluid Mechanics and Fluid Power conference at National Institute of Technology, Hamirpur, held from 12 to 14 December 2013, and the International Union of Theoretical and Applied Mechanics (IUTAM) symposium at Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru, held from 20 to 23 January 2014. The articles in this special issue exemplify the wide spectrum that fluid mechanics and its study represent.

Section 1 carries selected articles from the Fluid Mechanics and Fluid Power conference at NIT, Hamirpur, under the

auspices of the National Society of Fluid Mechanics and Fluid Power. The section includes three review articles and nine original research articles. These were selected on the basis of their topicality and relevance, particularly in emerging areas of fluid mechanics and fluid power.

Section 2 is more focused, and contains selected papers from the talks presented during the IUTAM Symposium related to flows in deformable tubes, which find application in biological systems. Research in biofluid mechanics has seen tremendous growth recently, partly to address important questions in biological systems, like clogging of arteries, and partly to see if new engineering systems mimicking natural ones can be developed.

Theme Issue on Hot and Dense Matter

Editors: Bedangadas Mohanty and Sourendu Gupta

Pramana – Journal of Physics, Vol. 84, No. 5, May 2015, pp. 669–942

We are now at the beginning of the second decade after the discovery of quark matter at the RHIC in Brookhaven, and a little after the beginning of the LHC heavy-ion programme. During this decade, questions about heavy-ion collisions have become more pointed. The earlier assumptions of early thermalization, long hydro-dynamic evolution, and abrupt freeze-out are being tested, probed, and improved.

Is matter thermally equilibrated, or does the initial condition influence even the late evolution of the fireball? A theoretical model for describing strongly coupled QCD-like theories (but not exactly QCD) has emerged and is being widely used. Can experiments be made precise enough that they test more than the generic features of strongly coupled systems?

Lattice QCD gives a few quantitative predictions about the properties of thermally equilibrated matter. Can these be tested? These are some of the questions that become interesting in the modern context of heavy-ion collisions. Lattice QCD also has predictions about the phase structure of QCD. Are they precise enough? Can the existence of a critical point be tested at colliders? Are there improved computational methods which may give quantitative answers to a wider variety of questions? Is local parity violation visible in experiments? These are new questions being asked, and the partial answers available are already extremely intriguing.

The classic questions now probe deeper: these are questions about photons and dileptons, about jets and heavy-quarkonia, and about the

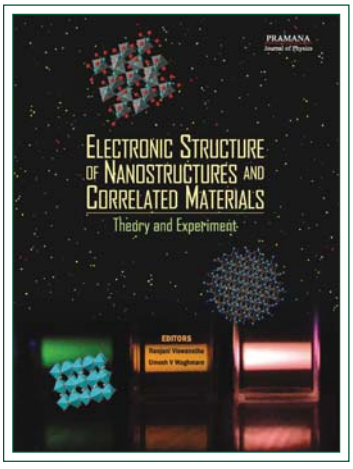
possible existence of quark matter in neutron stars. This special issue contains a collection of reviews on the state of the field, which gives context and longer answers to these questions, and poses others.

Nanostructures and Correlated Nanomaterials: Theory and Experiment

Editors: Ranjani Viswanatha and Umesh V Waghmare

Pramana – Journal of Physics, Vol. 84, No. 6, June 2015, pp. 945–1128

In this issue, invited reviews on the electronic structure of materials including strongly correlated electronic materials and nanoscale structures are included. Maiti's article provides a review of the experimental analysis of electronic structure of superconductors coupled with a magnetic element like Fe. Paul and Raj discuss the metal–insulator transition in sodium tungsten bronzes using experimental methods like ARPES and first principles calculations based on full potential LAPW methods. Stimulated by many debates, efforts to understand the effects of the insulating tunnelling barrier on the magneto resistance of double perovskites are reviewed by Nag and Ray. The physics of magneto-caloric effect in materials with coupled electronic spins and lattice degrees of freedom, specifically in rare-earth intermetallics is reviewed by Nirmala *et al.* The correlation between a cation dopant site of perovskite $SrTiO^3$ and its dielectric properties is discussed by Choudhury using complementary analysis based on experimental and theoretical tools. Manju's article presents a review of the evolution of the correlation effects on the two-dimensional surface alloys. Mahantha and Menon review the effects of quantum confinement on the growth of Cu, Ag and Au on a graphite substrate using ARPES and LEED. Topwal's article provides an analysis of the effects of electron confinement in ultrathin films and nanowires on semiconductor and metallic substrates through band mapping. Das and Mahadevan's article presents first-principles calculations to determine the effect of strain on the electronic structure and possible metal-semi-conductor transition in monolayer of $MoSe_2$. Various mechanisms of the deformation of nanoparticles are reviewed by Gerard and Pizzagalli. The growth of CdTe nanocrystals using digestive ripening is reviewed by Mittal and Sapra. Viswanatha reviews the effects of 3*d* transition metal dopant on the electronic structure of three dimensionally confined nanocrystals. Mahadevu *et al.* discuss the progress



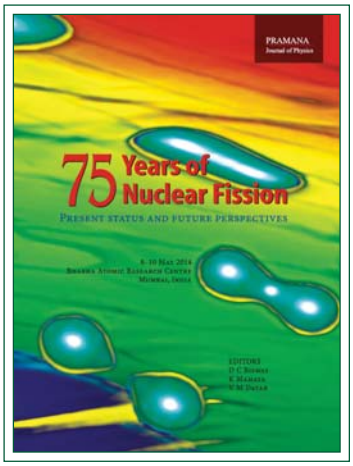
made towards assembling nanoscale building blocks into functional materials. Following these reviews on the fundamental understanding of electronic behaviour, there are reviews dedicated to its applications. Nanda *et al.* discuss the role of size in revolutionizing the electrochemical energy storage in Li ion based batteries. Tandon *et al.* review the introduction of new transparent conducting oxide nanocrystals for plasmonic applications. The use of carbon-based nanostructures for electromagnetic shielding is reviewed by Joshi and Datar.

Proceedings of the Conference on 75 years of Nuclear Fission: Present Status and Future Perspectives, Parts I & II

Editors: D C Biswas, K Mahata and V M Datar

Pramana – Journal of Physics, Vol. 85, Nos 2 and 3, August and September 2015, pp. 187–566

Nuclear fission was discovered 75 years ago and is considered to be one of the most important scientific discoveries in basic and applied nuclear research. It has played a key role in the understanding of statistical and dynamical properties of nuclei, in the production of nuclear power, development of nuclear instrumentation and evolution of other related fields. In order to commemorate this occasion, a conference was organized on "75 Years of Nuclear Fission: Present Status and Future Perspectives" by the Bhabha Atomic Research Centre, Mumbai, during 8–10 May 2014. The main goal of the conference was to review the progress in the understanding of nuclear fission during the past 75 years and also to indicate the direction of future research in fission. Nuclear fission occupies a prominent place in the context of global energy resources, and has given impetus to scientists and engineers to look for advanced reactors for the production of cost-effective nuclear power. The research work reported in the conference covered the topics in the field of fission process, fission fragment spectroscopy, radiochemical studies in fission, cluster radioactive decay, super heavy element studies and various applications of fission data. The role of nuclear fission in the design of advanced nuclear reactors, radioactive ion beam production and development of sophisticated experimental techniques were highlighted. This special issue contains the papers of the talks provided by the invited speakers.

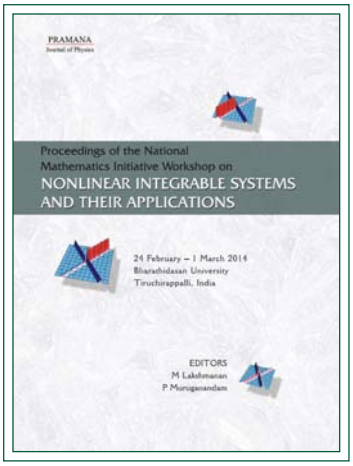


Proceedings of the National Mathematics Initiative Workshop on Nonlinear Integrable Systems and their Applications

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.



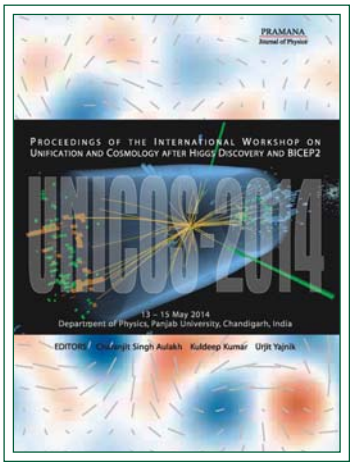
This issue is a collection of articles on nonlinear integrable systems and their applications. The first nine articles provide critical reviews on the basic theory and analytical methods of solutions applicable to nonlinear ordinary and partial difference and differential equations of contemporary interest. 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

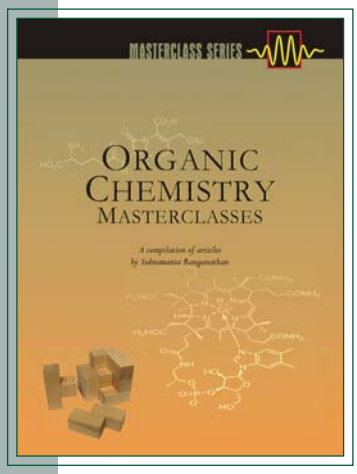
Pramana – Journal of Physics, Vol. 86, No. 2, February 2016, pp. 193–494

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 Higgslike 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 during 13 –15 May, 2014 on the occasion of the superannuation of a faculty member. Researchers from Asia, USA and Europe in the fields of supersymmetric 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.

6.3 Masterclass Series



The *Masterclass* series of eBooks to be published by the Indian Academy of Sciences, Bengaluru, brings together pedagogical articles on single broad topics reproduced from *Resonance – Journal of Science Education*.

The first ebook titled *Organic Chemistry Masterclasses*, Articles by Subramania Ranganathan is now available on the website http://www.ias.ac.in/Publications/e-Books/.

It is fitting that the first book in the series is by a legendary teacher, Professor Subramania Ranganathan. A highly acclaimed and distinguished organic chemist from IIT Kanpur, was a regular contributor to *Resonance* and his articles enjoy wide popularity among the journal's readership.

While the book is primarily available in digital format, there will also be a limited print run to augment visibility.

6.4 Workshop on 'Emerging Trends in Journal Publishing'

A workshop on 'Standards, global practices and the emerging trends in journal publishing' was held for the editorial board members and the editorial staff of the Academy on 29th June 2015 at the Academy auditorium. Participants also included publishing professionals from INSA. The objective was to train and familiarize the publishing staff of the Academy with global standards and the emerging trends in publishing by providing insight into the present day practices in journals' publication across the world.

The workshop included talks by Harry Blom, Vice President, Publishing Development, Springer, on 'Latest developments in the publishing Industry'; Inga Schildmann, Journal Coordination Manager, Physical Sciences and Engineering, Springer, on 'Continuous Article Publishing (CAP) – The new buzz word in journal publishing'; and a Webinar by a team in Springer on the E-proofing tool. This was followed by an interactive session between the publishing staff and the Springer team on issues related to the production of the Academy journals.

6.5 Promotion of Academy Journals

As part of promotion of the Academy's journals, the Academy participated in the 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 Nanoscience and Technology 2016 (ICONST-2016) held at IISER, Pune, from 29 February to 2 March 2016.

Repository of Scientific Publications of Academy Fellows

In 2009 and 2010 there were calls for Indian Academy of Sciences to set up a repository of publications of its Fellows. This was to be, at minimum, a collection of metadata records of Fellows' publications, of both its present and deceased Fellows.

During the year 2015–2016, the number of records (publications) listed in the Repository was 92867, and the number of records added in this period is 580. Of these, 71 have full text. The total number of records with full text at the end of the period 2015–2016 was 20,832 out of 92,895 total records.

On the 'Ranking Web of repositories' website (http://repositories.webometrics.info/en), managed by Cybermetrics Lab, a research group of a public research body in Spain, the IAS repository is currently ranked 1st in India, 17th in Asia, and 229th in the world. The website has details on the ranking methodology.

The Repository is at *http://repository.ias.ac.in*. Repository content can be viewed by year, by subject (sectional name), and by Fellow name (names as in Academy Year Book).

8 Discussion Meetings

Held at Orange County Resort Coorg

The Academy supports discussion meetings of small groups of scientists from within India and outside organised by a Fellow of the Academy. Orange County Resort in the picturesque hill district of Coorg near Bengaluru, where Academy has two time slots in every calendar year, is the preferred venue for these meetings.

1. Probability and Analysis

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 Schrödinger equations and Hardy–Sobolev inequality associated to the special Hermite operator along with mixed norm estimates for various associated eigen function 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

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 ferroelectric.

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 were 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

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 thermostructural 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.

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.

26th Mid-Year Meeting 2015

The 26th Mid-Year Meeting of the Indian Academy of Sciences was held from 3rd to 4th July 2015 at the Indian Institute of Science, Bengaluru. The programme of lectures held at this meeting is as follows:

A. Special Lectures

1. **V Nagaraja**, IISc, Bengaluru
   Our strategies to counter resurgent tuberculosis
2. **N Sathyamurthy**, IISER, Mohali
   Symmetry and pattern formation in flowers

B. Public Lecture

Madhav Gadgil, Goa University, Goa
Sahyachala: A love story

C. Lectures by Fellows / Associates

1. **Tapas Chakraborty**, IACS, Kolkata
   Light-induced coupled proton-electron transfers in model chemical systems
2. **Avinash Khare**, University of Delhi, Delhi
   Gravitational equilibrium and the mass limit for dust clouds
3. **V Mohan**, Dr Mohan's Diabetes Specialities Centre, Chennai
   The time has come to marry genomics with clinical diabetes
4. **U Kodandaramaiah**, IISER, Thiruvananthapuram
   Reading DNA to infer ancient flight
5. **Giridhar Madras**, IISc, Bengaluru
   Ionic catalysts for syngas production
6. **Pulak Sengupta**, Jadavpur University, Kolkata
   Long term climatic cycle – a petrologists perspective
7. **Ravi A Rao**, TIFR, Mumbai
   The theory of Suslin matrices
8. **U Mabalirajan**, IGIB, Delhi
   Airway epithelia: An overlooked borderline security force of the lung
9. **Gautam Mandal**, TIFR, Mumbai
   Thermalization in integrable models and conformal field theories
10. **Chandan Srivastava**, IISc, Bengaluru
    Graphene oxide-Fe_3O_4 nanoparticle composite with high proton relaxivity value
11. **K Thangaraj**, CCMB, Hyderabad
    Complex origin of Indian populations and its profound medical implications
12. **Tanmaya Pathak**, IIT, Kharagpur
    Small molecules, diversity and great expectations
13. **B L V Prasad**, NCL, Pune
    New synthetic approaches for the preparation of metal nanoparticle dispersions and assemblies in different solvent media
14. **Rajan Jha**, IIT, Bhubaneswar
    Photonic crystal fiber modal interferometer based highly sensitive sensor
15. **Parthanil Roy**, ISI, Kolkata
    Branching random walks with displacements coming from a power law
16. **Syamal Roy**, IICB, Kolkata
    History of Leishmania research in India – then and now
17. **M K Bera**, IIT, Kharagpur
    Revisiting the linkage between Himalayan orogenesis and climate change
18. **R S Swathi**, IISER, Thiruvananthapuram
    Modelling the energetics of encapsulation of atoms and atomic clusters into carbon nanotubes: Insights from analytical approaches

A detailed description of the lectures is as follows:

The meeting began with a special lecture on 'Strategies to counter resurgent tuberculosis' by **V Nagaraja** (IISc, Bengaluru). Tuberculosis (TB) is an epidemic disease that ravaged Europe and North America during the 18th and 19th centuries. Historical evidence of this disease can be found in Egyptian mummies and fossils. Nagaraja spoke of the menace of tuberculosis, which is a major global health problem – more than one-third of the world's population is infected with *Mycobacterium tuberculosis*, and new infections occur in about 1% of the population ever year. There are about 20 million chronic cases of active TB globally and 2 million associated deaths. It is the most formidable pathogen mankind has faced. *Mycobacterium tuberculosis* (Mtb) can stay dormant inside a healthy individual and become dormant and phenotypically drug resistant when it encounters multiple stresses within the host. Multiple, extensive and total-drug-resistant TBs have emerged. Various strategies used the world over to combat the emergence of resistant strains were discussed. The supercoiling and compaction of DNA within the cell and the catalytic activity of topoisomerases enzymes, which are responsible for gene duplication or gene expression, are attractive targets for lead molecule development. The molecular machines in mycobacteria and nucleoid-associated proteins (NAPs) of mycobacteria were the central theme. Genetic, molecular, cell biology and structural probing are essential to study the proteins in mycobacteria which can reveal hidden secrets of the pathogen's success. He argued that greater understanding of this could facilitate better intervention strategies.

V Nagaraja

Recently elected Fellows and Associates of the Academy presented their scientific research:

Tapas Chakraborty (IACS, Kolkata) in his talk titled 'Light-induced coupled proton-electron transfers in model chemical systems' spoke about the chemical reactions with coupled proton-electron transfers (PCET) which are essential for respiration, photosysnthesis and even artificial solar energy devices, wherein acid-base and redox reactions take place with effective transfer of hydrogen atoms. A significant example in which PCET mechanism is highly relevant is the oxidation of a phenolic

moiety to phenoxy radicals (PhO*). The light-induced PCET processes of different dimeric molecular complexes involving phenol and analogous systems studied by his group was discussed, as well as the measurements performed under different physical conditions, and probed by means of electronic spectroscopy.

Avinash Khare (University of Delhi, Delhi) spoke on 'Gravitational equilibrium and the mass limit for dust clouds'. In dust clouds, the self-gravity of the dust is balanced by the force from shielded electric fields on the charged dust. If the total mass of the dust is less than the mass limit, equilibrium can be achieved. Khare derived an equation of state for such a cloud and compared the physics of this mass limit to Chandrasekhar's mass-limit for compact objects (neutron stars, white dwarfs). The answer to these questions will impact the role of dust in planet and star formation. Further studies should take into account the effect of magnetic fields collisions coupling between the plasma background and dust.

V Mohan (Dr Mohan's Diabetes Specialities Centre, Chennai) spoke on 'The time has come to marry genomics with clinical diabetes'. The most significant clinical applications of genetics in the diagnosis of neonatal diabetes with single gene defect, occurring in the first 6 months of life, was presented. Type 2 diabetes is a polygenic disorder, whereas diabetes such as maturity onset diabetes of youth (MODY) and neonatal diabetes have single gene defects. He spoke of the different types of MODY, which are inherited and diagnosed before the age of 25, having predominantly beta cells dysfunction defects and with different gene mutations. An accurate genetic diagnosis of monogenic forms of diabetes helps to tailor the antidiabetic treatment and define the prognosis for the family. Genomics of monogenic forms of diabetes are easier to study and have direct clinical application as sulphonylurea treatment can be considered, he added. He mentioned that his group had discovered a new MODY gene and that novel mutations in neonatal diabetes have also been identified in India. He also mentioned that genetics of polygenic forms of diabetes did not have any clinical approach.

U Kodandaramaiah (IISER, Thiruvananthapuram) spoke on 'Reading DNA to infer ancient flight'. He touched upon the importance of dispersal and vicariance in allopatric speciation, which is the process by which new species evolve from ancestral species in geographic isolation. He pointed out that historical biogeographers invoked dispersal to explain distributions, whereas the advent of phylogenetic systems and the acceptance of the plate tectonic theory made vicariance gain importance. However, with examples of the butterfly family Nymphalidae, he argued, on the basis of molecular phylogenic data, that

dispersal is fundamental to diversification and is more important than vicariance in many groups, as the data shows that speciation occurred after the continents had split.

Giridhar Madras (IISc, Bengaluru) spoke on 'Ionic catalysis for syngas production'. Syngas, a mixture of H2, CO and CO_2 in various proportions, is a prime petrochemical feedstock traditionally produced by reforming natural gas. The development of new catalysts for syngas production, unresolved problems in this area and water gas shift reactions were highlighted. Whether the noble metal ions and/or base metal ions subsititued could serve as better active sites than the corresponding metal atoms (zero valent) was the novel idea of Madras' group.

Pulak Sengupta (Jadavpur University, Kolkata) gave a talk on 'Long-term climatic cycle – A petrologist's perspective'. The emission of anthropogenic CO_2 due to industrialization has led to global warming, a cause for serious concern. It is also important to understand the contribution of non-anthropogenic CO_2 and the variation in the earth's climate over the past several hundred million years, Sengupta stressed. He stated that the long-term climatic cycle was controlled by metamorphic de-carbonation-carbonation reactions that occur in deep-seated geological reservoirs. This requires comprehensive understanding of the chemical reactions in carbonate-silicated systems and the role of clinopyroxene on carbonation and decarbonation reactions. The reaction topology proposed by Sengupta and Raith shows how the metamorphosis of silicate-carbonate rocks can act as a source or sink of CO_2 at the convergent boundaries and hence control the climatic cycle over geological times.

Ravi A Rao (TIFR, Mumbai) spoke on 'The theory of Suslin matrices'. Suslin's construction of the matrices and their properties were described. Some open questions and applications regarding these matrices were also discussed.

U Mabalirajan (IGIB, Delhi) spoke on 'Airway epithelia: An overlooked borderline security force of the lung'. The airway is a lengthy air pipe that consists of larger and smaller bronchi. The airway epithelia of these bronchi in the form of continuous layers from the nose to the alveolus act as a borderline security force against air pollutants, bacteria, viruses, etc., through various physical, chemical and biological processes. Mabalirajan stated that sneezing and coughing are the primary barrier mechanisms to protect the lungs. He elaborated that the additional housekeeping phenomena of mitochondria (the power house of cells), autophagy and DNA repair determine the immune status of the lung. Airway epithelia have determining roles and therefore epithelial protecting agents are essential for lung diseases treatment.

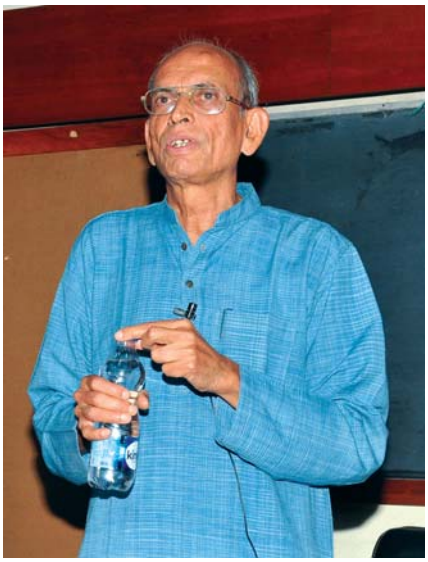
Gautam Mandal (TIFR, Mumbai) spoke on 'Thermalisation in integrable models and conformal field theories'. Thermalisation could occur in integrable models, especially in 1+1 dimensions. Analytical and numerical evidences were provided to show that some universal results can be proved in integrable conformal models concerning thermalisation. The results can be interpreted in terms of gravitational collapse to a certain class of black holes where they have infinite number of conserved charges.

Chandan Srivastava (IISc, Bengaluru) delivered a talk on 'Graphene oxide–Fe_3O_4 nanoparticle composite with high proton relaxivity value'. The investigation on the graphene oxide–Fe_3O_4 nanoparticle (GO–Fe_3O_4) composite as an image-contrast-enhancing material in the field of magnetic resonance imaging was presented. This technique is helpful in detecting cancer cells in the human body and to kill the affected cells as Fe_3O_4 particles have affinity to cancer cells. The results have shown that GO–Fe_3O_4 composites exhibited good biocompatibility with normal cell lines and considerable toxicity towards breast cancer cells.

K Thangaraj (CCMB, Hyderabad) presented interesting data on 'The complex origin of Indian populations and its profound medical implications'. India, he said, is an ethnic museum with social stratification of castes, subcastes, religious groups, etc. India represents the largest sources of human diversity both genetically and phenotypically, with more than four and a half thousand anthropologically well-defined populations. India was inhabited by the descendants of modern humans who migrated Out-of-Africa about 60,000 years ago. Thangaraj's group established that there were only two founding populations: (1) Ancestral North Indian (ANI), distantly related to Middle East, Central Asia and Europe and (2) Ancestral South Indian (ASI), not related to groups outside India. Owing to endogamy marriages practiced for thousands of years, genetic mutations were introduced that were unique to each population. Their results showed that genetic patterns in Indian populations have been shaped by a long history of genetic isolation. The talk focussed on how Indian genetics is different from that of the rest of the world and its implications to health and disease. This complexity of diverse populations with higher genetic drift predicted can have tremendous implications on health and regional specific diseases (such as Madras motor neuron disease deficiency, etc.).

Tanmaya Pathak (IIT, Kharagpur) gave a lecture on 'Small molecules, diversity and great expectations'. There is an ever-increasing demand for new chemical entities, which require synthetic strategies involving molecules of skeletal complexity and stereochemical diversity. Synthetic methodologies for generating sugar-modified nucleosides were presented.

These new compounds found applications as spacers for hybrid molecules, ligands for metal complexation, building blocks for gels, etc., and some were shown to possess biological activities. These modified nucleosides turned out be inhibitors of enzymes belonging to ribonuclease family. He said his group was trying to develop the chemistry for designing small molecules having stereochemical and scaffold diversities.



Madhav Gadgil

The first day's meeting was concluded with a public lecture in the evening by **Madhav Gadgil** from Goa University on 'Sahyachala: A love story'. A fascinating study spanning five decades of the natural world of the Western Ghats was narrated. Some of the pertinent questions addressed by Gadgil over the years were the following: Why are the Western Ghats so rich in endemic species of frogs but so poor in birds? The answer lies in the geological history, he said, elaborating on the continental drift which brought about speciation. Why has the supposedly sustainable and scientific management of the forests so completely devastated the Western Ghat's biomass and biodiversity resources? He emphasized this by citing the Goa mining and bamboo forest case studies. Scientific management calls for reliable estimation of the stocks, sound understanding of the dynamics of stocks including mortality / regeneration, and knowledge of growth pattern of individual plants, all of which were missing in the case studies mentioned. Why are sacred groves the sole repositories of primeval patches of vegetation in many parts of the Western Ghats? In an impassioned talk he cited several examples of forests being treasured and guarded by the local people, such as the sacred grove of Gupta Bhima and Pachgaon, whereas many sensitive areas, such as the Bhimashankar Wildlife Sanctuary, have been misrepresented by forest officials and mining and windmill construction have been allowed. He concluded by saying that conservation and development can go hand in hand, the benefits of development can reach out to all segments of society, and local communities can guide the course of development – conservation does not mean excluding people.

N Sathyamurthy (IISER, Mohali) began the second day of the meeting with a special lecture on 'Symmetry and pattern formation in flowers'. Quoting Darwin, he said, observing the intricate functioning of nature is always a sheer pleasure but to understand the mechanism is a challenge. He explained

with many examples different patterns and symmetries exhibited by flowers. The chemicals present in the flowers and fruits as well as the medicinal values of plants, flowers and seeds are of interest to the drug industry. The origin of the symmetry in flowers was also traced to prehistoric times. He explained about possible factors that could be responsible for the pattern formation in *Passiflora incarnata* (passion flower) by invoking the reaction diffusion theory of Turing and an activator – inhibitor model of Meinhardt. The video clip of the opening of passion flowers attracted the attention of the audience. One can study the radial opening, dynamics, pattern/structure, colour, pigments, etc., he said.

N Sathyamurthy

B L V Prasad (NCL, Pune) spoke on 'New synthetic approaches for the preparation of metal nanoparticle dispersions and assemblies in different solvent media'. The efforts in preparing size-controlled nanoparticles in organic non-polar solvents using chemical molecules as controlling tools, the utility of sophorolipids as nanoparticle capping agents for the preparation of water-dispersible nanoparticles, and the self-assembling characteristics of sophorolipids were presented.

Rajan Jha (IIT, Bhubaneswar) gave a talk on 'Photonic crystal fibre modal interferometer-based highly sensitive sensor'. Photonic crystal fibres (PCFs) are considered the new-generation fibre optics technology in the field of fibre optic sensing. A simple and compact modal interferometer for detection of volatile organic compounds, nano-displacement, and refractive index of a given medium was presented. Sensors based on PCF modal interferometer are economical, compact, user-friendly and easy to fabricate as they require just splicing and cleaving of the fibre. These can be used for accurate detection of physical, chemical and biological parameters. They can be used in harsh environments such as in high-temperature measurement for space applications and fire safety alarms. Food degradation analysis and structural health monitoring are other applications.

Parthanil Roy's (ISI, Kolkata) talk on 'Branching random walks with displacements coming from a power law' started with a definition of a branching random walk wherein a collection of particles that start from a single point,

diffuse and branch independently of their positions and those of other particles. This model is very important in statistical physics, mathematics, and biology. Assuming that the underlying displacement distribution is a power law, Roy's group studied the limiting behaviour of such a system. Roy described their results and the contributions made so far.

Syamal Roy (IICB, Kolkata) spoke on 'History of leishmania research in India – then and now'. The history of leishmania in India, the discovery of the causative agent and preparation of pentavalent antimonial compound in a small laboratory in Calcutta were presented. Although this disease in the 1960s became a rare clinical entity with clinical success of the drug, it has again emerged in India. The evolution of drug-resistant cases is further compounding the problem. Over the years Roy's group has been involved in studying the mechanism of immune suppression, resistance and vaccine development. So far there is no effective vaccine against leishmaniasis.

M K Bera (IIT, Kharagpur) gave a talk on 'Revisiting the linkage between Himalayan orogenesis and climate change'. Although Himalayan orogenesis is attributed to global climate change through increase in silicate weathering and consumption of atmospheric CO_2, field-based geological observations are missing. Two important questions are unanswered: When did Himalayan exhumation, erosion start? And when was the South Asian monsoon initiated? The results of his group's detailed study of sedimentology, sequence stratigraphy, stable oxygen and carbon isotopic studies were presented. The analysis, the clast composition, Sr and Nd isotopic data suggest that Himalayan weathering started at approximately 31 Ma. This raises questions about the tectonic-induced climate change at approximately 34 Ma.

R S Swathi (IISER, Thiruvananthapuram) spoke on 'Modelling the energetics of encapsulation of atoms and atomic clusters into carbon nanotubes: Insights from analytical approaches'. Carbon clusters are of great interest to astrophysicists and molecular spectroscopists. These clusters are highly reactive and difficult to prepare. Her group's studies on the energetics of encapsulation of noble gas atoms and monocyclic carbon rings into carbon nanotubes using analytical models were presented. Encapsulation of atoms and molecules into carbon nanotubes has an important role in sieving and separation of gases, drug delivery, etc. The analytical models employed by this study are computationally cheap and could provide insights into the encapsulation process.

10 Annual Meeting 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. The programme of lectures held at this meeting is as follows:

A. Presidential Address

Dipankar Chatterji, IISc, Bengaluru
Social behaviour in bacteria

B. Symposiums

(a) Light and Matter (International Year of Light)

1. **G Ravindrakumar,** TIFR, Mumbai
   High-intensity lasers in physics
2. **Anunay Samanta,** University of Hyderabad, Hyderabad
   Employing light as an initiator and a probe
3. **G Krishnamoorthy,** Anna University, Chennai
   Light in molecular biophysics
4. **Deepak Nair,** IISc, Bengaluru
   Super-resolution imaging and signal processing at synapse

(b) General Relativity (Centenary of the discovery)

1. **Ghanashyam Date,** IMSc, Chennai
   Hundred years of general relativity: Achievements and challenges
2. **R Gopakumar,** ICTS, Bengaluru
   The quantum dynamics of General Relativity
3. **Shiraz Minwalla,** TIFR, Mumbai
   Applied gravity
4. **T Padmanabhan,** IUCAA, Pune
   Gravity and/of cosmos

C. Public lectures

1. **C N R Rao,** JNCASR, Bengaluru
   Doing science in India
2. **K Srinath Reddy,** Public Health Foundation of India, New Delhi
   Pulse to planet: Human health in the era of sustainable development

D. Special Lectures

1. **Shubha Tole,** TIFR, Mumbai
   Sensational barrels in the brain: The circuitry of sensory resolution
2. **Kankan Bhattacharyya,** IACS, Kolkata
   Single molecule spectroscopy of a single live cell

E. Special Open Lecture

James Jackson, Cambridge University, Cambridge
Probing the continents: How variations in the structure and rheology of the lithosphere affect surface geology

A detailed description of the lectures is as follows:

On 5th November, members of the Science Education Panel met with the invited teachers in an interactive session. This meeting was also attended by a few Fellows of the Academy.

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; 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*

F. Lectures by Fellows / Associates

1. **Rama Kant,** University of Delhi, Delhi
   Theories for anomalous response in disordered electrodes
2. **Arindam Ghosh,** IISc, Bengaluru
   Multifunctional electronics with atomically thin membranes
3. **Susanta Roychoudhury,** Saroj Gupta Cancer Center and Research Institute, Kolkata
   Mitotic stress in cancer: Tipping the balance
4. **Kaushal Verma,** IISc, Bengaluru
   Quadrature domains and potential theory
5. **KR Prasad,** IISc, Bengaluru
   Synthesis of natural products of therapeutic significance
6. **A Chockalingam,** IISc, Bengaluru
   Visible light communications: An emerging area in wireless
7. **M Ravikanth,** IIT, Mumbai
   Boron-dipyrromethene dyes for ion recognition studies
8. **Sumantra Chattarji,** NCBS, Bengaluru
   To be or not to be afraid
9. **A C Anil,** NIO, Dona Paula, Goa
   Biological interactions in the sea
10. **Jyotishman Bhowmick,** ISI, Kolkata
    Quantum isometry groups
11. **Arpita Patra,** IISc, Bengaluru
    Secure multiparty computation
12. **Nita Bhandari,** Centre for Health Research and Development, New Delhi
    A new approach to treating severe acute malnutrition in children
13. **Ranjani Viswanatha,** JNCASR, Bengaluru
    Dilute magnetic semiconducting nanomaterials: Theory to reality
14. **Aswin Sai Narain Seshasayee,** NCBS, Bengaluru
    Evolving chromosomes and their convergence with gene regulatory networks
15. **Sharmila A Bapat,** NCCS, Pune
    Cancer stem cells and stress induced evolution: Understanding the drug recalcitrance phenomenon
16. **Gautam Bhattacharyya,** SINP, Kolkata
    The hierarchy problem and physics beyond the Standard Model
17. **Mitali Mukerji,** IGIB, New Delhi
    Ayurgenomics: Understanding human individuality through integration of Ayurveda and genomics for stratified medicine

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.

Dipankar Chatterji

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 nanoelectrochemistry 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 Verma (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 choose the less travelled path. He urged 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.

C N R Rao

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.

Shubha Tole

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 supersymmetric 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 borondipyrromethenes (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.

K Srinath Reddy

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

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 transdisciplinary 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, Kolkata), 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 (thioldisulphide 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.

Kankan Bhattacharyya

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 semiconductor 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 Bhattacharya** (SINP, Kolkata).

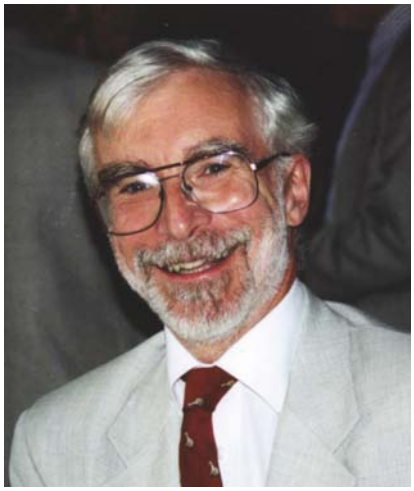
Mitali Mukherji (IGIB, New Delhi) described the basic premise of Ayurveda that individuals have differential basal levels of three '*doshas*' – *vaata, pitta* and *kapha* – that define their '*prakriti*', or wellbeing. If a perturbation in any of these levels occurs, diseased state occurs and therapy 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.

James Jackson

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 earthquake 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.

Raman Professor



T J Pedley

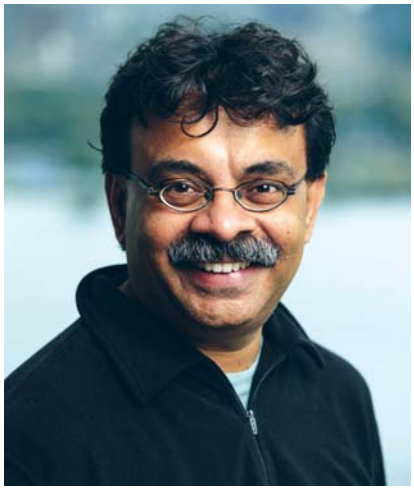
The Raman Chair was instituted in 1972 by the Government of India to commemorate the founder of the Academy, Prof. Sir C.V. Raman. Eminent scientists are invited by the Council of the Academy to occupy the Chair, for periods between 6 weeks and 6 months.

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 'Microorganisms 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.

12 Jubilee Professor



Madhu Sudan

The Jubilee Professorship was instituted in 2009 during the Platinum Jubilee Year of the Academy to commemorate the completion of 75 years of the Academy. Eminent scientists from India and overseas are invited to take up this prestigious professorship.

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.

13 Academy Public Lectures

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

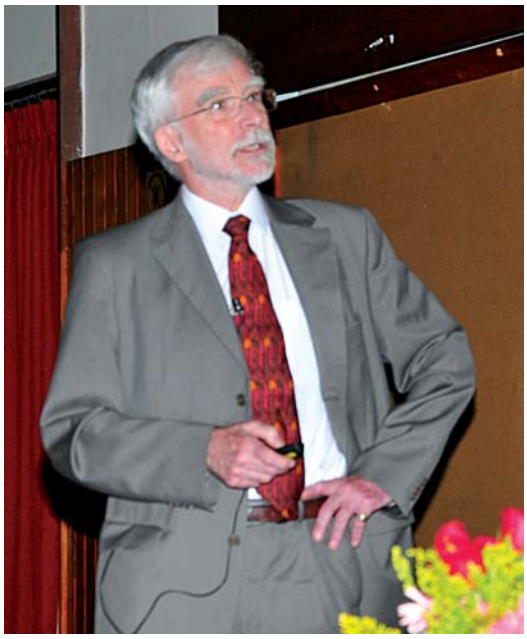
Abhay Ashtekar

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.

14 Science Education Programmes

Since 2007, the three National Science Academies of the country have been conducting, in a formal and well-structured manner, a variety of programmes to improve science education for the benefit of students and teachers all over the country. These are planned and coordinated by a Joint Science Education Panel. The three main programmes of the Panel are: summer fellowships, refresher courses, and lecture workshops.

14.1 Summer Fellowships

Summer Fellowships are awarded to bright students and motivated teachers to work with Fellows of the Science Academies and other scientists on research-oriented projects for a period of two months. The programme was started in the year 1995 by Indian Academy of Sciences with the main objective to expose them to the joy of doing science. In 2007, the other two Science Academies – INSA, New Delhi, and NASI, Allahabad – joined this programme. In recent years, it has grown enormously in size and reputation. Approximately 2000 fellowships are now offered to students and teachers a year, with travel and living expenses included. Announcements inviting applications appear in *Resonance* and *Current Science* during September. Selection Committees in six disciplines meet during December, and the selected applicants notified by February-March. The selected candidates can avail the fellowships any time during the calendar year, preferably during the summer. Since inception, about 9600 students and 1360 teachers have availed these fellowships.

In 2015, the number of fellowships was 1746, of which 1346 were availed in 2015. Table 4 (page 69) gives the subject-wise break-up of applications received, fellowships offered and availed.

14.2 Refresher Courses

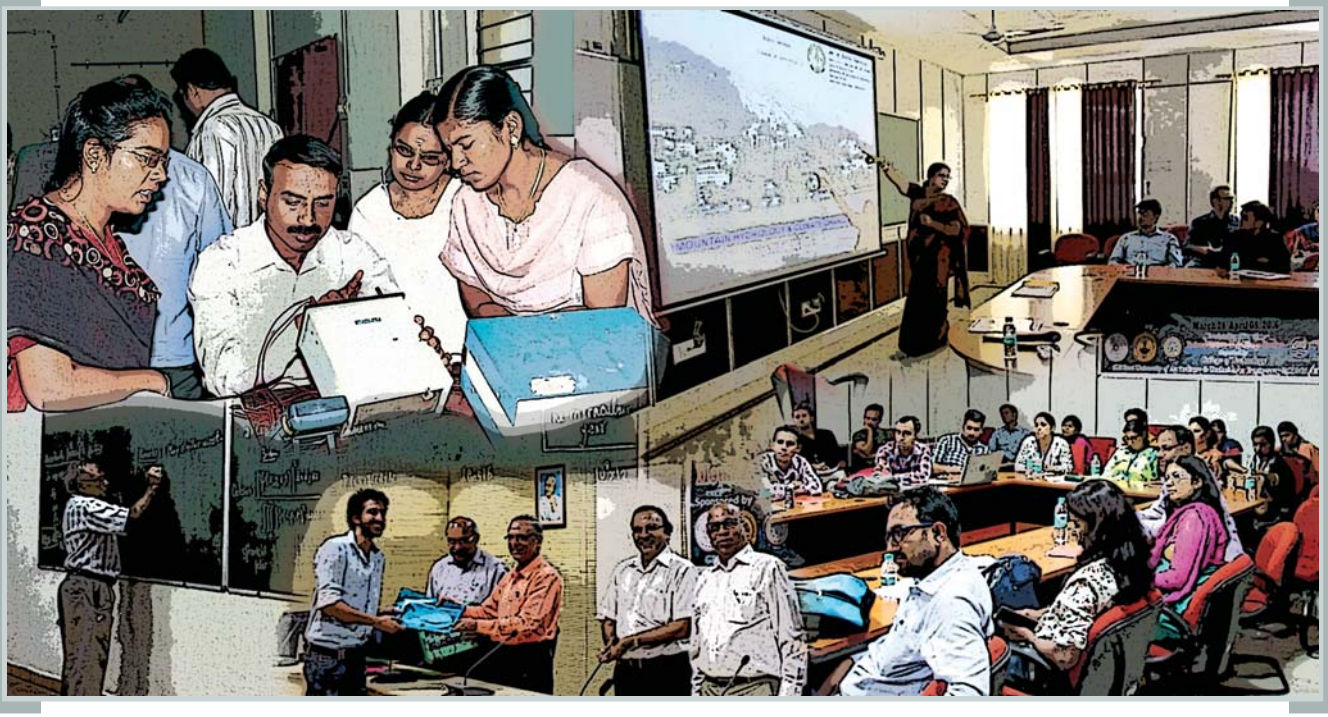
This is an all-India programme to help motivated teachers improve their background knowledge and teaching skills. It is normally of two-week duration, and teachers selected from all over the country undergo a rigorous course of lectures, discussions, laboratory experiments, and problem-solving sessions. During the last 16 years, 189 courses have been held in several parts of the country on a variety of subjects: experimental and theoretical physics, experimental and theoretical chemistry, biotechnology, mathematics, atmospheric science, animal and plant tissue culture, experimental nonlinear dynamics, vistas in zoological teaching, marine geology and geophysics, tensors, phylogenetic biology, stochastic process, etc. During the year 2015–2016, 18 refresher courses have been held in Experimental Physics as well as other subjects.

A. Refresher Courses in Experimental Physics

In 2015–2016, 6 Refresher Courses were held on Experimental Physics. These were held under the direction of R Srinivasan, who was instrumental in the conceptualisation and designing of the experiments. 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.

The list of Experimental Physics Refresher Courses held since April 2015 with R Srinivasan as the Course Director form course numbers 69 to 74 in this series.

No.	Title	Venue	Duration	Co-ordinator
1	Experimental Physics-69	Indian Academy of Sciences Jalahalli, Bengaluru	14-04-2015 29-04-2015	T. D. Mahabaleswara
2	Experimental Physics-70	NIT Mizoram, Aizawl	07-05-2015 22-05-2015	Alok Shukla
3	Experimental Physics-71	Goa University, Goa	13-05-2015 28-05-2015	K. Priolkar
4	Experimental Physics-72	Panjab University, Chandigarh	16-06-2015 01-07-2015	J. S. Shahi
5	Experimental Physics-73	Kurukshetra University Kurukshetra	13-09-2015 28-09-2015	R.K. Moudgil
6	Experimental Physics-74	Tripura University, Tripura	08-03-2016 23-03-2016	Anirban Guha



B. Refresher Courses in Other Subjects

The total number of Refresher Courses in other subjects held from April 2015 to March 2016 was 12. A list of these courses with a few details is provided below. A detailed list with all relevant information is provided in our website *http://web-japps.ias.ac.in:8080/SEP/refresher_course__completedlist.jsp*.

No.	Title	Venue	Duration	Director	Co-ordinator
1	Advanced Molecular Techniques in Cell and Molecular Biology	Manipal University, Manipal	29-02-2016 12-03-2016	V. Nagaraja	K. Sathyamoorthy
2	Material Science and Measurement of Properties	Indian Academy of Sciences, Jalahalli, Bengaluru	09-02-2016 24-02-2016	T.G. Ramesh	T.D. Mahabaleswara
3	Quantum Mechanics	Government Arts College, Melur	08-02-2016 20-02-2016	G. Rajasekaran	A. John Peter
4	Environmental Biology	University of Punjab, Bathinda	01-02-2016 15-02-2016	R.K. Kohli	Felix Bast
5	Applications of Quantum Mechanics: Atoms, Molecules and Radiation	University of Mumbai	21-12-2015 04-01-2016	Deepak Dhar	Anuradha Misra
6	Physics Training and Talent Search	Kuvempu University Shankarghatta	17-12-2015 30-12-2015	G. Rajasekaran	M. Sivakumar
7	Refresher Course in Recent Advances in Chemistry	A.S. College, Deoghar	14-12-2015 26-12-2015	P.K. Chattaraj	Bijoy K. Choudhary S.S. Majhi
8	Crystallography, Mineralogy, Igneous Petrology and Thermodynamics, Sedimentology and Economic Geology	Indian Academy of Sciences, Jalahalli, Bengaluru	11-12-2015 24-12-2015	Alok K. Gupta	T.D. Mahabaleswara
9	Water	Field Marshal K M Cariappa College, Madikeri	16-11-2015 29-11-2015	Srikanth Sastry	Jagannath Settar
10	Developmental Biology	Sophia College, Mumbai	16-11-2015 28-11-2015	Tarala D. Nandedkar	Nafisa Balsinor
11	Quantum Mechanics	Loyola College, Chennai	11-05-2015 23-05-2015	H. S. Mani	Joseph Prabagar
12	Thin Films and Nanoscience	Tripura University, Suryamaninagar	04-05-2015 18-05-2015	Tanusri Saha-Dasgupta	Syed Arshad Hussain

14.3 Lecture Workshops

Two- or three-day lecture workshops are held on carefully chosen topics in physics, mathematics, chemistry and life sciences at selected college and university departments for the benefit of local students and teachers. Speakers include Fellows and scientists from nearby institutions. Since inception, 558 Workshops have been held. During this financial year up to 31 March 2016, 66 Workshops were held on various topics at different institutions in the country. The following gives some information on the Lecture Workshops held from April 2015 to March 2016.

Lecture Workshops held from April 2015 to March 2016 broadly covered mathematics, life sciences, engineering, chemistry and physics. The states covered includes Andhra Pradesh, Tamil Nadu, West Bengal, Karnataka, Punjab, Rajasthan, Uttar Pradesh, Maharashtra, Odisha, Madhya Pradesh, Jharkhand, Kerala, Uttarkhand, Chhattisgarh and Gujarat. Over 10,000 participants including teachers and students of various colleges have benefitted from these Lecture Workshops. A list of these courses with a few details is provided below. The lecture Workshops held April 2015 to March 2016 are listed below. Complete information is provided in our website *http://web-japps.ias.ac.in:8080/SEP/lecture_workshop_completedlist.jsp*.

No.	Title	Venue	Duration	Convener	Co-ordinator
1	Emerging Trends in Applied Physics	Devanga Arts College, Aruppukottai	25-03-2016 26-03-2016	K. Porsezian	B. Ravikumar
2	Theoretical and Computational Fluid Dynamics	S.V. University,Tirupati	21-03-2016 22-03-2016	P. Kandaswamy	S. Sreenadh
3	Frontier Lectures in Biology	Jayaraj Annapackiam College for Women, Periyakulam	21-03-2016 22-03-2016	S. K. Saidapur	K. Nirmala
4	Applications of Biotechnology	Telangana University, Nizamabad	21-03-2016 22-03-2016	Tarala D. Nandedkar	P. Samata
5	Current trends and Directions in Cryptography and Cyber-security	CIET, Coimbatore	18-03-2016 19-03-2016	R. Krishnan	D. Brindha
6	Excitements in Chemistry and Physics	Dinabandhu Mahavidyalaya, Bongaon	16-03-2016 17-03-2016	Uday Maitra	Sudeshna Lahiri
7	Recent Developments in Chemistry	PSGR Krishnammal College for Women,Coimbatore	11-03-20161 2-03-2016	R. Ramaraj	K. Parameswari
8	DNA Repair and Diseases	Christ University,Bengaluru	11-03-2016 12-03-2016	Umesh Varshney	V.L. Vasantha
9	Nanoscience and Nanotechnology	Alvas Institute of Engineering and Technology, Moodbidri	10-03-2016 12-03-2016	G.U. Kulkarni	A.T. Ramprsad
10	Plant Ecology and Systematics	Telangana University,Nizamabad	10-03-2016 11-03-2016	K.N. Ganeshaiah	Vidyavardhini
11	Advances in Plant and Biomedical sciences	Bishop Cottons Women's Christian College, Bengaluru	10-03-2016 11-03-2016	D.J. Bagyaraj	Jacquiline Rajamathi
12	Modern Chemistry and its Applications	Guru Nanak Dev University, Amritsar	03-03-2016 05-03-2016	P.K. Das	Vandana Bhalla
13	Genetically Modified Organism - Pros and Cons	The Oxford College of Science, Bengaluru	03-03-2016 04-03-2016	Dipshikha Chakravortty	S. Bharathi
14	Advances in Biosciences	Lady Doak College, Madurai	03-03-2016 04-03-2016	K. Veluthambi	R. Shenbagarathai
15	New Frontiers in Plant Sciences and Biotechnology	Nehru Memorial College, Tiruchirappalli	03-03-2016 05-03-2016	T.J. Pandian	M. Meenakshi-sundaram
16	Chemistry at the Interface of Biology	Central University of Rajasthan, Ajmer	02-03-2016 04-03-2016	C.P. Rao	Sunil G. Naik
17	Recent Developments in Chemistry	Central University of Tamilnadu,Thiruvarur	02-03-2016 03-03-2016	V. Subramanian	T. Mohan Das
18	Synergy between Computational and Experimental Chemistry	Uday Pratap College, Varanasi	26-02-2016 27-02-2016	M.S. Singh	Ashutosh Gupta
19	Fourier Series, Fourier Transforms in Applications	Indian Academy Degree College,Bengaluru	26-02-2016 27-02-2016	Mythily Ramaswamy	Lakshmikanthamma P.K.
20	Recent Breakthrough in Plant Sciences	Central University of Punjab, Bathinda	22-02-2016 24-02-2016	R.K. Kohli	Felix Bast
21	Modern Aspects of Chemical Research	Christ University, Bengaluru	22-02-2016 23-02-2016	S. Umapathy	Prasad Pralhad Pujar
22	Innovations in Bioscience	Bharathiar University, Coimbatore	21-02-2016 22-02-2016	T.J. Pandian	S. Suja
23	Recent Advances in Chemistry	V.O. Chidambaram College, Tuticorin	19-02-2016 20-02-2016	S. Natarajan	A. Mathavan

No.	Title	Venue	Duration	Convener	Co-ordinator
24	Exploring Developments in Chemical Sciences	Sant Gadge Baba Amaravati University, Amaravati	19-02-2016 21-02-2016	Sourav Pal	A.S. Aswar
25	Frontiers in Nanoscience and Technology	St. Xaviers College, Aluva	18-02-2016 19-02-2016	E. Vijayan	Linda Louis
26	Biotechnology Tools and Techniques in Solving Environmental Problems	K.S. Rangasamy College of Technology, Tiruchengode	16-02-2016 17-02-2016	Rama Shankar Verma	P. Ponmurugan
27	Spectroscopic Techniques and Applications in Material Characterization	S.V. University, Tirupati	16-02-2016 17-02-2016	Siva Umapathi	C. Venkata Rao
28	Frontiers on corrosion Engineering and Technology	Bannari Amman Inst. of Technology,Sathyamangalam	12-02-2016 13-02-2016	K.A. Natarajan	Arvind Singh
29	Recent Trends on Cellular Mechanisms and Gene Expression	St. Josephs College, Bengaluru	12-02-2016 13-02-2016	D.J. Bagyaraj	Betty Daniel
30	Bioprospecting and Bioresources	St. Josephs College, Tiruchirappalli	10-02-2016 12-02-2016	R.R. Rao	Francis Xavier
31	Recent Trends in Machine Learning	PSGR Krishnammal College for Women,Coimbatore	09-02-2016 11-02-2016	B.L. Deekshatulu	M.S. Vijaya
32	Bioinformatics	IWSA and KBP College, Mumbai	06-02-2016 07-02-2016	Tarala D. Nandedkar	Rita Mukhopadhyay
33	Recent Developments in Chemistry	Seethalakshmi Ramaswami College, Tiruchirappalli	05-02-2016 06-02-2016	R. Ramaraj	M. Vasuki
34	Environmental Biotechnology	Auxillium College, Vellore, Vellore	04-02-2016 05-02-2016	E. Vijayan	Regina Mary
35	Biotechnology - Present and Future	Vijaya College, Bengaluru	29-01-2016 30-01-2016	Manju Bansal	Gopalakrishna
36	Emerging Trends in Environmental Biology	D.Y. Patil University, Navi Mumbai	29-01-2016 30-01-2016	Tarala D. Nandedkar	Manish R. Bhat
37	Recent trends in Nanobiotechnology	K.S.Rangasamy College of Technology, Tiruchengode	25-01-2016 27-01-2016	T.J. Pandian	V. Rajendran
38	Frontiers in Material Sciences	Ravenshaw University,Cuttack	22-01-2016 23-01-2016	Ashok Kumar Mishra	Alekha Kumar Sutar
39	Scope of Medical Biotechnology	Dr Hari Singh Central University, Sagar	21-01-2016 22-01-2016	Shekhar Mande	Subodh K. Jain
40	Recent Trends in Biological Sciences	The American College, Madurai	21-01-2016 22-01-2016	G. Marimuthu	K. Navaneetha Kannan
41	Trends in Plant Taxonomy	Yogi Vemana University, Kadapa	21-01-2016 22-01-2016	R.R. Rao	A. M. Reddy
42	Electronic Structure and Spectroscopy of Atoms and Molecules	Fakir Chand College, Diamond Harbour	20-01-2016 22-01-2016	T. Chakraborty	Prajnamoy Pal
43	Recent Developments in Chemistry	Madurai Kamaraj University, Madurai	08-01-2016 09-01-2016	R. Ramaraj	V.S. Vasantha
44	Time and Again: Challenging Science	Sophia College, Mumbai	08-01-2016 09-01-2016	Tarala D. Nandedkar	Medha S. Rajadhyaksha
45	Advances in Biology	Goodwill Christian College for Women, Bengaluru	07-01-2016 08-01-2016	S.K. Saidapur	M.S. Gayathri

No.	Title	Venue	Duration	Convener	Co-ordinator
46	Biological Sciences	RMVC College, Kolkata	05-01-2016 06-01-2016	Aparna Dutta Gupta	P.K. Medda
47	Fluid Flow through Porous Media and its Applications	Indian School of Mines, Dhanbad	25-12-2015 27-12-2015	B.V. Rathish Kumar	M.K. Singh
48	Special Functions and their Applications	PSGR Krishnammal College for Women, Coimbatore	22-12-2015 23-12-2015	K. Srinivasa Rao	K. Sumathi
49	Emerging Trends in Chemistry	St. Josephs College, Tiruchirappalli	18-12-2015 20-12-2015	M. Palaniandavar	S. Britto
50	Advances in Molecular Techniques	GITAM University, Vishakhapatnam	27-11-2015 28-11-2015	Sekhar Mande	S.V. RajaGopal
51	Functional Materials and Their Applications in Devices	SSSIHL, Puttaparthi	26-11-2015 28-11-2015	S. Ramasesha	Siva Sankar Sai
52	Statistical Mechanics and Thermodynamics	JSS College of Arts, Commerce and Science, Mysore	25-11-2015 27-11-2015	G. Srinivasan	Vijaya Manjunathaguru
53	Taxonomy and Evolution	Mangalore University, Mangalore	23-11-2015 24-11-2015	R.R. Rao	G. Krishnakumar
54	Spectroscopic Techniques and Applications	Bishop Moore College, Mavelikara	11-11-2015 13-11-2015	Chandrabhas Narayan	Merin George
55	Recent Advances in Electrochemistry	NMKRV College for Women, Bengaluru	28-10-2015 29-10-2015	S. Sampath	Y. Venkataramanappa
56	Emerging Trends in Chemical Sciences	VHNSN College, Virudhunagar	09-10-2015 11-10-2015	M. Palaniandavar	N. Raman
57	Recent Trends in Physics	Guru Nanak Dev University, Amritsar	18-09-2015 19-09-2015	Arvind	Ravi Chand Singh
58	Recent Developments on the Theoretical and Experimental Aspects of Advanced Materials	North Bengal University, Darjeeling	18-09-2015 19-09-2015	Swapan K. Ghosh	Amiya Kumar Panda
59	Spectroscopy and Perspectives	Sacred Heart College, Tirupattur	10-09-2015 12-09-2015	P.K. Das	S.A. Martin Britto Dhas
60	Green Revolution to Gene Revolution	Telangana University, Nizamabad	20-08-2015 22-08-2015	Appa Rao Podile	Praveen Mamidala
61	Supramolecular Assemblies: Synthesis and Application	Guru Ghasidas Vishwavidyalaya, Bilaspur	20-08-2015 21-08-2015	Partha Sarathi Mukherjee	Gautam Kumar Patra
62	Future Perspective and Emerging Technologies for Sustainable Energy Resources	Tumkur University,Tumkur	18-08-2015 19-08-2015	K. J. Rao	T.N. Ramesh
63	Integrated Research Approaches in Biology	Nirmala College for Women, Coimbatore	07-08-2015 08-08-2015	T. J. Pandian	Pawlin Vasanthi Joseph
64	Analysis and Topology	MS University of Baroda, Baroda	01-08-2015 03-08-2015	V. M. Shah	Haribhai R. Kataria
65	Advances in Wireless Communications and Networking	Amal Jyothi College of Engineering,Kanjirapally	23-07-2015 24-07-2015	A. Chockalingam	K.G. Satheeshkumar
66	Advances in Chemistry Education and Research	University of Gour Banga, Malda	23-07-2015 24-07-2015	Subrata Ghosh	Mohabul Alam Mondal

15 '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 scholars 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 panellists (Riddhi Shah, all invited speakers, Renuka Meti and MS Jogad) shared their experiences and views and provided guidance to the participants.

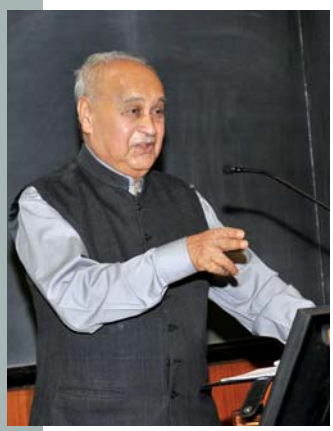
16 Hindi Workshops

The Indian Academy of Sciences and Raman Research Institute jointly conducted the following programmes:

1. A Workshop titled 'How to use Hindi on Computer' by Shri Ananda, OL Officer, HAL Engine Division, Bengaluru, on 12th June 2015.
2. Hindi Fortnight from 14th to 28th September 2015. During this fortnight, various competitions were held, such as a quiz, singing competition, essay writing, dictation and administrative terminology. On 18th September, there was a talk on *'Bharatheey sahithyeke nirman main Hindi'* by Prof TG Prabhashankar (Retired Professor, Bangalore University).
3. Hindi Day was celebrated on 28th September, with a talk by Dr Narayana Singh, Joint Director, Central Translation Bureau, Official Language Department, GOI, Bengaluru. The celebrations concluded with prize distribution to the winners of the various competitions.
4. A Workshop on 18th December 2015 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'.
5. The Quarterly Hindi Workshop was on 29 March 2016. A Quiz Competition in Hindi was held, and Prof. 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.

17 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'.



18 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 and origami by Shri 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.

19 Union Science Minister's Visit

Dr Harsh Vardhan, Hon'ble Union Minister for Science & Technology and Earth Sciences, interacted with the Office Bearers and Fellows of the Academy on 21 August 2015.

Prof Dipankar Chatterji, President of the Academy, welcomed the Minister and gave a presentation of the Academy's programmes and activities. Commending the work of the Academy, the Minister said that science should be made a 'People's Movement' and that the Academy should function as a facilitator in involving the scientific community in this endeavour. He welcomed the suggestion that the Science Academies should be involved in planning science policies for the future of India.

20 Academy Finances

The accounts for the financial year 2015–16 were audited by a firm of Chartered Accountants. A summary of the income and expenditure follows:

Income	Plan/Non Plan Rupees(in lakhs)	Expenditure
Grant – DST	1703.61	Journal printing
Subscriptions	113.06	Science education programmes
Interest earned on Plan grant	22.79	Salaries
Others	12.26	Medical expenses
Deficit under Non-Plan	Nil	Transfer to Raman Chair
		Annual/mid-year meetings
		Postage
		Others (Expenses on retirement benefits, bonus, maintenance of building, equipment, stationery, packing, pension fund, furniture & equipment, library books, discussion meeting expenses etc.)
		Surplus
TOTAL	1851.72	TOTAL
Surplus under revenue grant	435.74	Capital expenditure
Capital grant	100.00	
Interest on Capital grant	1.86	Surplus

Budget Performance for the year 2015-2016

No.	Grant-in-aid category	Revised budget estimates	Surplus carried forward from previous year	Funds allocated and received from DST	Interest earned on grant	Actual expenditure
		(Rs. In Lakhs)	(Rs. In Lakhs)	(Rs. In Lakhs)	(Rs. In Lakhs)	(Rs. In Lakhs)
1	Plan-General	1076.00	0.00	1192.99	15.35	1002.60
2	Plan-Capital	319.00	0.00	100.00	1.86	166.82
3	Plan-Salary	350.00	199.53	249.01	7.22	227.54
4	Plan-Salary of SC Component	58.00	4.07	8.00	0.23	10.52
5	Non-Plan	175.32	0.00	50.00*	4.85	175.32
	TOTAL	**1978.32**	**203.60**	**1600.00**	**29.51**	**1582.80**

21 Acknowledgements

The Academy's publication activities are largely due to the voluntary and honorary services of Editors, Members of Editorial Boards and the large number of reviewers who examine and comment on manuscripts sent to them for opinion. Several Fellows also contributed their services to other activities of the Academy such as mentoring students under SRFP, organising annual meetings and discussion meetings and conducting programmes on science education, etc. The grant-in-aid support by the Department of Science and Technology has greatly contributed to the success of the activities undertaken by the Academy. The Academy acknowledges the support of the Department of Science and Technology, Government of India.

Plan/Non Plan Rupees(in lakhs)
222.72
453.08
273.67
12.74
10.00
65.27
39.39
339.11
435.74
1851.72
166.82
370.78

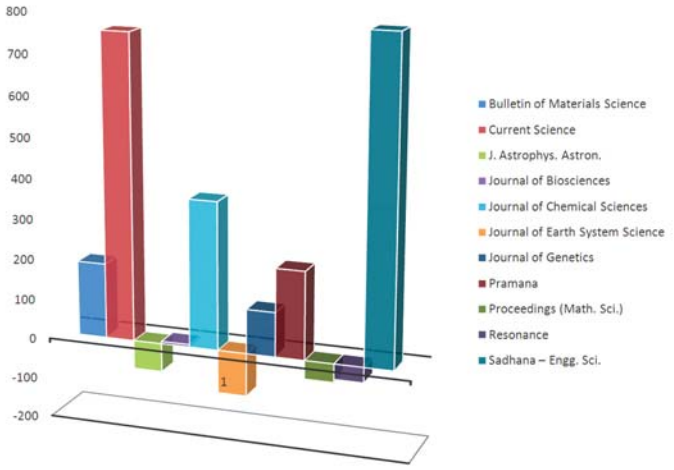
Surplus/ Deficit (Rs. In Lakhs)	Percentage of actual expenditure to revised BE	Percentage of actual expenditure to funds received from DST
205.74	93.18	84.04
–64.96	52.29	166.82
228.22	65.01	50.73
1.78	18.14	87.16
0.00	100.00	100.00
370.78		

Table 1

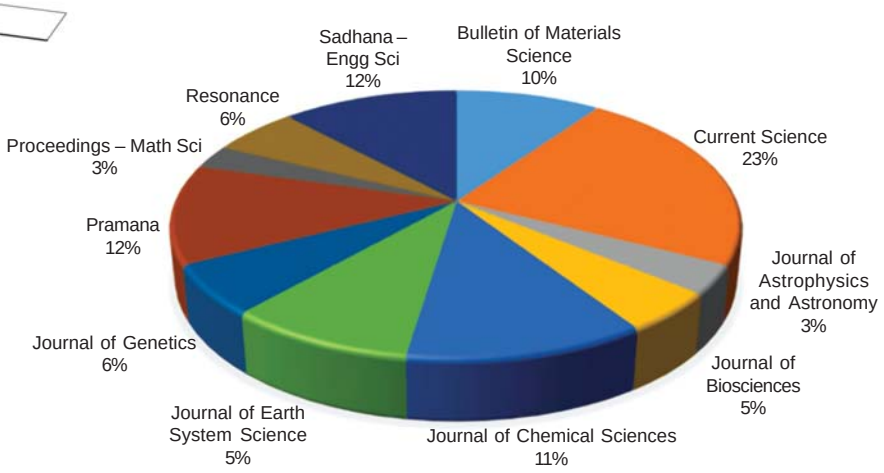
Information about published papers in journals (January to December 2015)

		Vol. no.	No. of issues	No. of papers	Total no. of printed pages	(**)
1.	Bulletin of Materials Science	38	7	256	1968	186↑
2.	Current Science	108/109	24	858	4614*	754↑
3.	J. Astrophys. Astr.	36	4	47	703	71↓
4.	Journal of Biosciences	40	5	83	968	6↑
5.	Journal of Chemical Sciences	127	12	238	2354	366↑
6.	Journal of Earth System Science	124	8	125	1850	107↓
7.	Journal of Genetics	94	4	115	1221	110↑
8.	Pramana	84/85	12	183	2408	218↑
9.	Proceedings (Math. Sci.)	125	4	45	578	46↓
10.	Resonance	20	12	98	1170	38↓
11.	Sadhana – Engg. Sci.	40	8	140	2410	789↑
	Total	-	-	2188	20244	2167↑

* Including briefer items such as news, correspondence, etc.
** As compared to last year's total no. of pages



Change in total number of pages as compared to last year



Comparison of the total number of pages published in all the journals

Table 2

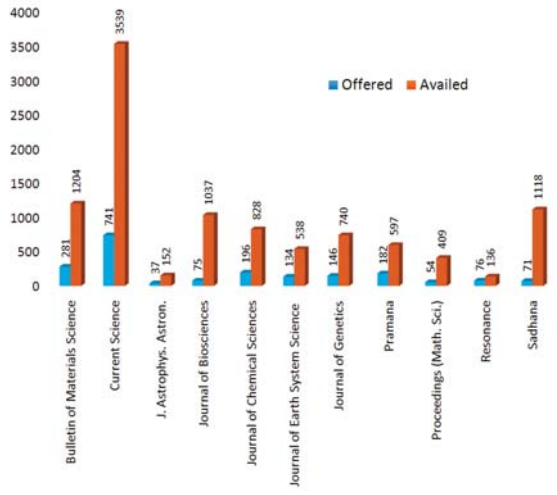
Information on papers submitted for publication (January to December 2015)

		Accepted	Rejected	Pending	Total	(**)
1.	Bulletin of Materials Science	281	848[+]	35	1204	296↑
2.	Current Science	741	2366	432	3539*	218↑
3.	J. Astrophys. Astr.	37	115[+]	-	152	34↑
4.	Journal of Biosciences	75	959[+]	3	1037	143↓
5.	Journal of Chemical Sciences	196	630	2	828	290↓
6.	Journal of Earth System Science	134	393	11	538	85↑
7.	Journal of Genetics	146	562[+]	8	740	56↓
8.	Pramana	182	326[+]	74	597	213↓
9.	Proceedings (Math. Sci.)	54	334[+]	16	409	2↑
10.	Resonance	76	48	12	136	55↓
11.	Sadhana – Engg. Sci.	71	749	298	1118	230↑
	Total	1993	7330	891	10298	108↑

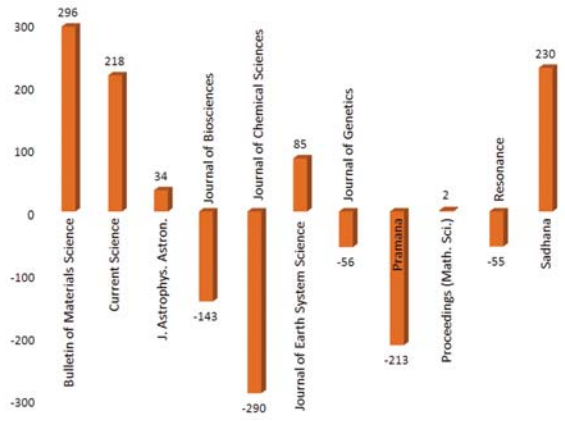
[+] Withdrawn (BMS: 40, JAA: 4, JB: 4, JG: 24, Pram: 15, Math Sci: 5)

* Including briefer items such as news, correspondence, etc.

** As compared to last year's figures



Comparison of the number papers accepted versus the number submitted for each journal



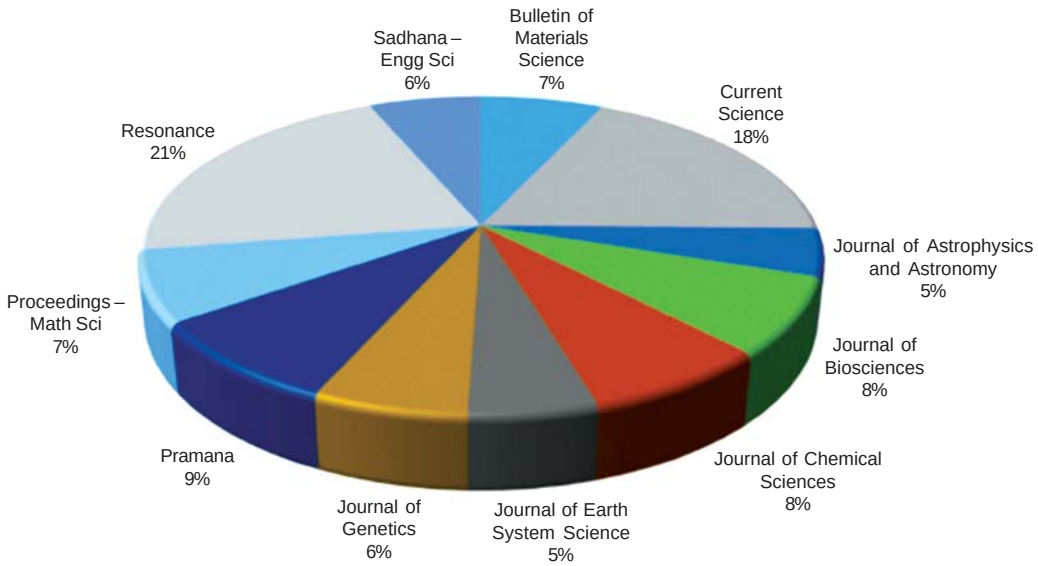
Change in total number of papers as compared to last year

Table 3

Circulation details of journals (January to December 2015)

	Subscription		Complimentary		Fellows & Associates	Total
	India	Foreign	India	Foreign		
1. Bulletin of Materials Science	1625	-	46		36	1707
2. Current Science	4326[a]	7	115		21	4469
3. J. Astrophys. Astr.	1124	-	47		17	1188
4. Journal of Biosciences	1716	-	73		97	1886
5. Journal of Chemical Sciences	1725	-	58		61	1844
6. Journal of Earth System Science	1167	-	55		42	1264
7. Journal of Genetics	1400	-	65		53	1518
8. Pramana	1979	-	60		62	2101
9. Proceedings (Math. Sci.)	1688	-	53		26	1767
10. Resonance	4994[b]	-	148		-	5142
11. Sadhana – Engg. Sci.	462	-	80		31	1573
Total	22206	7	800		446	24459

a. Includes about **912** personal subscribers
b. Includes about **1344** personal subscribers

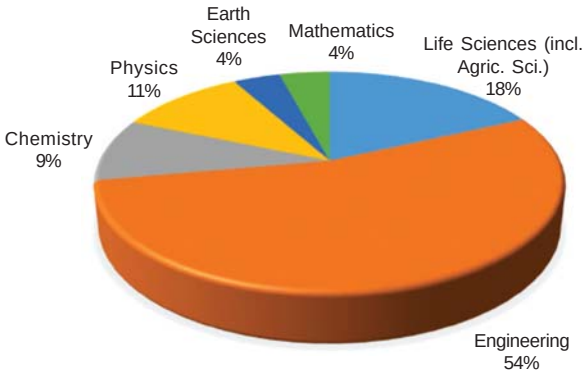


Comparison of the total subscriptions of all journals

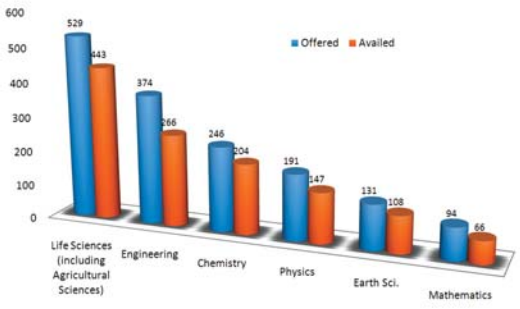
Table 4

Details of 2015 Summer Fellowships

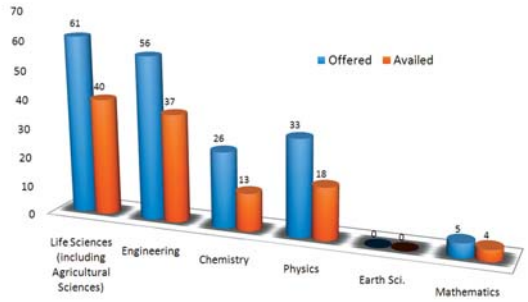
Subjects	STUDENTS			TEACHERS		
	Applications received	Offered	Availed	Applications received	Offered	Availed
1. Life Sciences (incl. Agric. Sci.)	4326	529	443	172	61	40
2. Engineering	12925	347	266	172	56	37
3. Chemistry	2221	246	204	117	26	13
4. Physics	2517	191	147	88	33	18
5. Earth Sciences	933	131	108	11	00	00
6. Mathematics	998	94	66	33	05	04
Total	23920	1565	1234	593	181	112



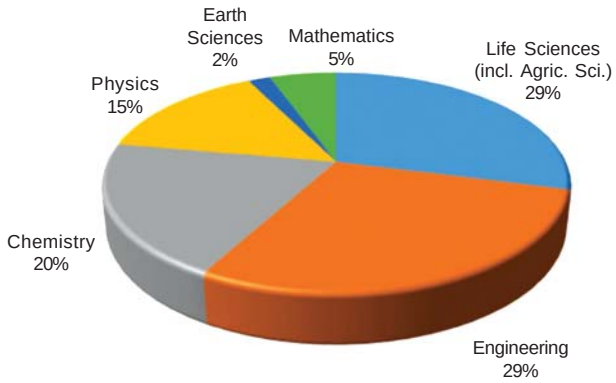
Subject-wise distribution of applications received from students



Numbers offered and availed by students



Numbers offered and availed by teachers

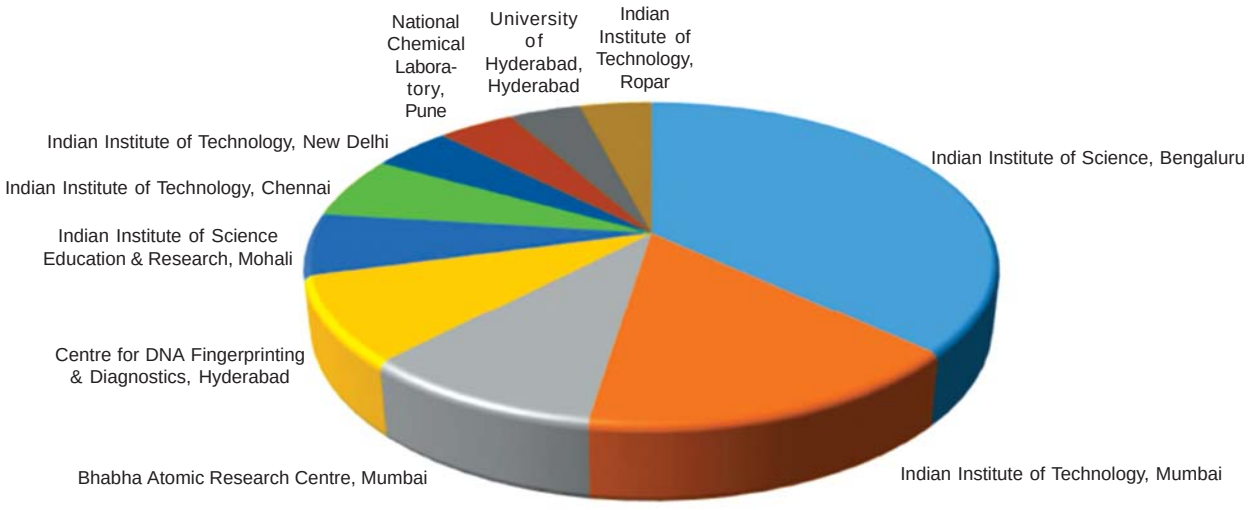


Subject-wise distribution of applications received from teachers

Table 5

Top 10 institutions which hosted Science Academies' Summer Research Fellows (SRFP-2015)

No.	Institution	Number of guides	Total Candidates	Students	Teachers	Male	Female
1.	Indian Institute of Science, Bengaluru	129	191	179 (M-89 F-90)	12 (M-8 F-4)	97	94
2.	Indian Institute of Technology, Mumbai	49	80	70 (M-35 F-35)	10 (M-5 F-5)	40	40
3.	Bhabha Atomic Research Centre, Mumbai	37	50	47 (M-19 F-28)	3 (M-3 F-0)	22	28
4.	University of Hyderabad, Hyderabad	31	45	38 (M-18 F-20)	7 (M-6 F-1)	24	21
5.	Indian Institute of Science Education & Research, Mohali	22	32	31 (M-13 F-18)	1 (M-1 F-0)	14	18
6.	Indian Institute of Technology, Chennai	18	32	24 (M-14 F-10)	8 (M-8 F-0)	22	10
7.	Indian Institute of Technology, New Delhi	13	23	18 (M-9 F-9)	5 (M-3 F-2)	12	11
8.	National Chemical Laboratory, Pune	19	22	21 (M-9 F-12)	1 (M-1 F-0)	10	12
9.	Centre for DNA Fingerprinting & Diagnostics, Hyderabad	20	21	20 (M-9 F-11)	1 (M-0 F-1)	9	12
10.	Indian Institute of Technology, Ropar	9	21	19 (M-9 F-10)	2 (M-1 F-1)	10	11



Top 10 institutions that hosted Summer Research Fellows

23 Academy Staff

Personnel as on 31.03.2016

A. Administration

No.	Name	Designation
1	G Chandramohan	Executive Secretary
2	N Maheshchandra	Deputy Executive Secretary
3	C S Ravi Kumar	Assistant Executive Secretary/ Co-ordinator, Science Education Panel, Summer Research Fellowship
4	N Thirumalai	Senior Administrative Assistant
5	L Chikkahanumanthappa	Office Assistant
6	B R Nalini	Office Assistant
7	M Vanitha	Administrative Assistant
8	Meghana B Yadav	Administrative Assistant
9	N N Brahmanandha	Administrative Assistant
10	N Venkata Rathnam	Administrative Assistant
11	H Channaiah	Literate Attender
12	M Ravindra	Guest House Attender
13	R P Vijayakumar	Literate Attender
14	N Manjunatha	Guest House Attender
15	J Govindaswamy	Literate Attender
16	N Rathnamma	Helper
17	H Gangadharaiah	Guest House Attender

B. Editorial

1	M Srimathi	Executive Editor
2	Sudarshana Dhar	Asst. Executive Editor
3	Cicilia Edwin	Copy Editor
4	Usha Susan Philip	Copy Editor
5	Mary J Mathai	Copy Editor
6	K Nagesh	Copy Editor
7	Jai Benjamin	Editorial Assistant
8	R A Gracy Rani	Editorial Assistant
9	N Padmaja	Copy Editor
10	K S Shylaja	Copy Editor
11	Sushila Rajagopal	Copy Editor
12	R Pushpavathi	Office Assistant

Temporary

13	Ambika Vanchinathan	Publications' Manager
14	M Raj Lakshmi	Assistant Editor
15	Sujatha Mohankumar	Assistant Editor
16	M Naresh Kumar	Editorial Assistant

C. Current Science Association

No.	Name	Designation
1	G Madhavan	Executive Secretary
2	M S Venugopal	Executive Editor
3	Chandrika Ramesh	Executive Editor
4	V Rajitha	Copy Editor
5	D L Geetha	Editorial Assistant
6	R Anuradha	Copy editor
7	V Venkateshwari	Office Assistant
8	H R Ananthamurthy	Attender

Temporary

9	N Subashini	Copy Editor
10	B Sandhya Rani	S Ramaseshan Science Writing Fellow
11	Rajashree Ramaswamy	S Ramaseshan Science Writing Fellow
12	Swetha Gopal	S Ramaseshan Science Writing Fellow

D. Accounts

1	A Shashidhar	Accounts Officer
2	Ranjini Mohan	Senior Accounts Assistant
3	A Jayakumar	Junior Office Assistant
4	B S Asha	Accounts Assistant
5	T M Tejeswini	Administrative Assistant

Temporary

6	R Lakshminanda	Accounts Assistant

E. SCIENCE EDUCATION PANEL

1	T D Mahabaleshwara	Co-ordinator, Science Education Panel-Lecture Workshop & Refresher Course/ Executive Editor/Vigilance Officer
2	M S Roopashri	Office Assistant
3	K Geetha	Administrative Assistant
4	H Chethana	Administrative Assistant

F. Technical

1	N A Prakash	Deputy Executive Editor
2	K S Sumesh	IT Support Engineer
3	P Rajesh	Technical Assistant

G. Retirement

No.	Name	Post held	Retirement
1	C Vedamurthy	Sr. Administrative/Accounts Assistant	30.06.2015
2	Peter Jayaraj	Sr. Administrative/Accounts Assistant	31.07.2015
3	B Krishna	Sr. Administrative/Accounts Assistant	31.12.2015
4	B Sethumani	Assistant Executive Secretary	29.02.2016

INDIAN
ACADEMY
OF SCIENCES
BENGALURU

STATEMENT OF ACCOUNTS

2015 - 16

B.R.V. Goud & Co.
Chartered Accountants

AUDITOR'S REPORT

To the Members of Indian Academy of Sciences

Report on the Financial Statements

We have audited the financial statements of the **"INDIAN ACADEMY OF SCIENCES" ,** P.B No.8005, C.V Raman Avenue, Sadashiv Nagar,Bangalore – 560 080, which comprise the Balance Sheet as at 31st March, 2016 and the Statement of Income and Expenditure Account for the year then ended and a summary of significant accounting policies and other explanatory information.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation of the financial statements. This responsibility includes the design, implementation and maintenance of internal control relevant to the preparation of the financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on the financial statements based on our audit. We conducted our audit in accordance with the Standards on Auditing issued by the Institute of Chartered Accountants of India. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of the accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

...2

No 37/1, 1st Floor, M.N.K. Rao Road
Basavanagudi, Bangalore - 560 004
Phone: 080 - 26566448, 26577448

TeleFax: 080 - 26566337
E-mail: audit@brvgoud.co.in
Website: www.brvgoud.co.in

Opinion

In our opinion and to the best of our information and according to the explanations given to us, the said accounts give the information required and give a true and fair view in conformity with the accounting principles generally accepted in India:

1) In the case of the Balance Sheet, of the state of affairs of **INDIAN ACADEMY OF SCIENCES,** as at 31st March, 2016.

2) In the case of the Income and Expenditure Account, of the Excess of Income over Expenditure, for the year ended on that date.

We further report that:

a) The Balance Sheet and Income and Expenditure Account dealt with by this report, are in agreement with the books of accounts.

b) In our opinion, proper books of account as required have been kept by the Academy, so far as appears from our examination of those books.

for B.R.V. GOUD & CO.,
Chartered Accountants,
FRN No. 000992S

B.R.V. GOUD & CO. CHARTERED ACCOUNTANTS B'LORE-4

(A.B.SHIVA SUBRAMANYAM)
PARTNER
M No. 201108

Place: Bangalore
Date: 15-06-2016

INDIAN ACADEMY OF SCIENCES

C.V.RAMAN AVENUE BENGALURU-560 080

BALANCE SHEET AS AT 31ST MARCH 2016

(Amount in Rupees)

I CORPUS/CAPITAL FUND AND LIABILITIES	SCH	As at 31.3.2016	As at 31.3.2015
Corpus/Capital fund	1	19,48,38,125	17,03,05,493
Reserves and surplus	2	-	-
Earmarked/endowment funds	3	13,95,23,314	7,55,91,732
Secured loans and borrowings	4	-	-
Unsecured loans and borrowings	5	-	-
Deferred credit liabilities	6	-	-
Current liabilities and provisions	7	5,44,26,831	2,36,31,302
TOTAL		**38,87,88,270**	**26,95,28,527**
II ASSETS/APPLICATION OF FUNDS			
Fixed assets	8	9,87,07,191	8,78,78,876
Investments - from earmarked/endowment funds	9	9,78,58,641	7,48,09,187
Investments - others	10	7,73,27,322	6,47,91,946
Current assets, loans, advances etc.	11	11,46,37,116	4,20,48,518
Miscellaneous expenditure (to the extent not written off or adjusted)		2,58,000	-
TOTAL		**38,87,88,270**	**26,95,28,527**
Significant accounting policies	24		
Contingent liabilities and notes on accounts	25		

Place: Bengaluru
Date: 15.06.2016

(R Varadarajan)
Treasurer

(N Maheshchandra)
Executive Secretary

(A Shashidhar)
Accounts Officer

As per our Report of even date
(for B R V Goud & Co)
Chartered Accountants

B.R.V. GOUD & CO. CHARTERED ACCOUNTANTS B'LORE

(A B Shiva Subramanyam)
Partner
M. No.201108

INDIAN ACADEMY OF SCIENCES

C.V.RAMAN AVENUE BENGALURU-560 080

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2016

(Amount in Rupees)

A. INCOME	Sch	2015-16		2014-15	
		Plan	Non Plan	Plan	Non Plan
Income from sales/services	12	-	-	-	-
Grants/subsidies	13	16,53,60,894	50,00,000	12,96,09,474	17,52,000
Fees/subscriptions	14	-	1,13,06,292		73,11,172
Income from investments (income on investments from earmarked /endowment funds transferred to funds)	15	-	2,65,69,985	-	-
Income from royalty, publications etc.	16	-	5,25,19,627	-	2,15,47,059
Interest earned	17	22,79,463	4,85,072	26,56,258	5,02,200
Other income	18	-	2,97,077	-	4,20,667
Increase/Decrease in stock of finished goods and works-in-progress	19	-	-	-	-
TOTAL (A)		16,76,40,357	9,61,78,053	13,22,65,732	3,15,33,098
B. EXPENDITURE					
Establishment expenses	20	3,21,15,713	61,53,184	2,39,47,410	78,77,139
Other administrative expenses etc.	21	8,50,97,009	1,13,78,497	9,48,93,971	26,68,185
Expenditure on grants, subsidies etc.	22	-	-	-	-
Interest	23	-	-	-	-
Depreciation (Net Total at the year end - Corresponding to Schedule 8)		58,53,446	-	-	-
TOTAL (B)		12,30,66,168	1,75,31,681	11,88,41,381	1,05,45,324
C. Transfer to JASP Fund (Springer royalty)		-	5,20,76,387		2,09,88,774
D. Transfer to Raman Chair Fund		10,00,000	-	5,00,000	-
E. Transfer to Earmarked funds (Being Interest)					
a. Raman Chair		-	7,15,581	-	-
b. Life Composition Fee		-	45,308	-	-
c. Jubilee Chair		-	5,31,674	-	-
d. Research Fund		-	26,594	-	-
e. JASP		-	1,08,36,101	-	-
		10,00,000	6,42,31,645	5,00,000	2,09,88,774
F. Balance Surplus transferred to Capital Fund 1			1,44,14,727	-	(1,000)
G. Balance Surplus Plan Grant carried forward to next financial year		4,35,74,189		1,29,24,351	
Significant accounting policies	24				
Contingent liabilities and notes on accounts	25				

Place: Bengaluru
Date: 15.06.2016

(R Varadarajan)
Treasurer

(N Maheshchandra)
Executive Secretary

(A Shashidhar)
Accounts Officer

As per our Report of even date
(for B R V Goud & Co)
Chartered Accountants

(A B Shiva Subramanyam)
Partner
M. No.201108

INDIAN ACADEMY OF SCIENCES

C.V.RAMAN AVENUE, BENGALURU-560 080

RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2016

(Amount in Rupees)

Receipts	2015-16	2014-15	Payments	2015-16	2014-15
I Opening balance			I Expenses		
a)Cash in hand	64,430	58,529	a) Establishment expenses (corresponding to Schedule 20)	3,82,39,575	3,19,34,984
b)Bank balances	3,26,69,961	3,97,84,916	b) Administrative expenses (corresponding to Schedule 21)	8,13,15,211	9,38,49,102
II Grants received					
a) From Govt of India	16,00,00,000	9,88,18,000			
b) From other sources	-	-	II Payments made against funds for various projects	-	-
III Income on investment					
a) Earmarked endowment funds	32,87,441	51,25,396	III Investments and deposits made	5,99,20,806	5,56,80,581
b) Own funds	-	-			
IV Interest received			IV Expenditure on		
a) On bank deposits	29,50,422	30,56,299	a)Fixed assets	1,23,60,902	10,16,628
b) Loans & advances etc	-	1,02,159	b)Capital work in progress	70,64,074	57,70,335
			c)Land	-	-
V Other income / Receipts	4,10,52,203	4,12,49,685			
			V Refund of surplus money/loans	-	-
VI Amount borrowed	-	-			
			VI Finance charges (interest)	-	-
VII Any other receipts					
			VII Other payments	79,36,648	86,51,226
a)Contribution to Scientific Research	25,000	30,000			
b) Fellowship fees	67,600	81,300	VIII Closing balances		
c)DST meetings/Inspire	-	-	a)Cash in hand	46,928	64,430
			b)Bank balances	5,75,68,889	3,26,69,961
VIII Investments matured	2,43,35,976	4,13,30,963			
TOTAL	26,44,53,033	22,96,37,247	TOTAL	26,44,53,033	22,96,37,247

Place: Bengaluru
Date: 15.06.2016

(R Varadarajan)
Treasurer

(N Maheshchandra)
Executive Secretary

(A Shashidhar)
Accounts Officer

As per our Report of even date
(for B R V Goud & Co.)
Chartered Accountants

B.R.V. GOUD & CO. CHARTERED ACCOUNTANTS B'LORE-4

(A B Shiva Subramanyam)
Partner
M. No.201108

INDIAN ACADEMY OF SCIENCES

C.V.RAMAN AVENUE BENGALURU-560 080

SCHEDULES TO FORMING PART OF BALANCE SHEET AS AT 31.03.2016

(Amount in Rupees)

SCHEDULE 1: CORPUS/CAPITAL FUND	As at 31.3.2016		As at 31.3.2015	
a. Capital Fund 1 Account				
Balance as at the beginning of the year	8,21,42,617		7,45,34,805	
Add: Interest on capital fund investments	-		79,92,812	
Add: Surplus under Non-Plan	1,44,14,727		-	
	9,65,57,344		8,25,27,617	
Deduct Deficit: Plan				
Deficit: Non-plan			(1,000)	
Expenditure met out of capital fund	67,982		3,84,000	
		9,64,89,362		8,21,42,617
b. Capital Fund 2 Account				
As per previous balance sheet	8,78,78,876		7,86,52,559	
Grant received from DST - Plan Capital	1,00,00,000			
Add: Interest on Plan Capital during the year	1,85,887			
Add: Capitalization of Grant-in-Aid (2014-15)	-		1,30,85,684	
Add: Balance of Capital Fund 3	2,84,000			
	9,83,48,763		9,17,38,243	
Less:- Depreciation	-		38,59,367	
		9,83,48,763		8,78,78,876
c. Capital Fund 3 Account				
Opening Balance	2,84,000		3,10,000	
Less: Time Share written off			26,000	
Less: Balance transferred to Capital fund 2 Account	2,84,000	-	-	2,84,000
BALANCE AS AT YEAR END		19,48,38,125		17,03,05,493

(Amount in Rupees)

SCHEDULE 2:- RESERVES AND SURPLUS	as at 31.3.2016	as at 31.3.2015
1. Capital Reserve:	-	-
As on 31 March 2015		
Addition during the year		
Less: Deductions during the year		
2.Revaluation Reserve:	-	-
As on 31 March 2015		
Addition during the year		
Less: Deductions during the year		
3.Special Reserves:	-	-
As on 31 March 2015		
Addition during the year		
Less: Deductions during the year		
4.General Reserve		
As on 31 March 2015		
Surplus during the year		
Less: Deductions during the year		
BALANCE AS AT YEAR END	-	-

(Amount in Rupees)

SCHEDULE 3: EARMARKED / ENDOWMENT FUNDS	FUND-WISE BREAKUP					TOTAL	
	LCF	RC	JC	RF	JASP	2015-16	2014-15
a) Opening balance of the funds	6,24,183	90,21,570	60,49,609	2,40,000	5,96,56,370		5,71,33,489
b) Additions to the funds:							
i.Donations /Grants		10,00,000		25,000		10,25,000	5,30,000
ii.Income from investments made on account of funds		6,45,616	3,51,172	15,728	22,74,925	32,87,441	51,25,396
iii. Accrued income from investments	45,308	69,965	1,80,502	10,866	85,61,176	88,67,817	
iv.Other additions (specify nature)					5,20,76,387	5,20,76,387	2,09,88,774
v.Entrance Fee collected from Fellows	67,600					67,600	81,300
TOTAL (a+b)	7,37,091	1,07,37,151	65,81,283	2,91,594	12,25,68,858	14,09,15,977	8,38,58,958
c) Utilisations/expenditure towards objectives of funds							
i.Donations /Grants	-	-	-	-	-	-	-
Fixed assets							
Others (Transferred to The Academy Trust a/c)							75,00,000
ii.Revenue Expenditure	-	-	-	-	-	-	-
Salaries, wages and allowances, etc.							
Rent							38,000
Purchase of Furniture & Fixtures for Hostel Block					-		
Others				12,660.00	5,39,622		7,20,316
Interest up to 31-03-2016 transferred to Capital Fund							
Expenses on Raman Professor & Jubilee Professor	-	3,74,853	4,65,528	-			8,910
TOTAL (c)	-	3,74,853	4,65,528	12,660	5,39,622.00	13,92,663	82,67,226
NET BALANCE AT THE YEAR-END (a+b)-(c)	7,37,091	1,03,62,298	61,15,755	2,78,934	12,20,29,236	13,95,23,314	7,55,91,732

Note: LCF - Life Composition Fee; RC - Raman Chair; JC - Jubilee Chair; RF- Research Fund; JASP - Journal Archives, Science Education & Publication Fund

SCHEDULE 4: SECURED LOANS AND BORROWINGS:	As at 31.3.2016	As at 31.3.2015
1.Central Government		
2.State Government (specify)		
3.Financial Institutions		
a) Term loans		
b) Interest accrued and due		
4.Banks:		
a) Terms loans	-	-
Interest accrued and due		
b) Other loans (specify)		
Interest accrued and due		
5.Other institutions and agencies		
6.Debentures and bonds		
7.Others (specify)		
TOTAL		

Note: Amounts due within one year

SCHEDULE 5: UNSECURED LOANS AND BORROWINGS	As at 31.3.2016	As at 31.3.2015
1.Central Government		
2.State Government (specify)		
3.Financial institutions		
4.Banks:		
a) Terms loans		
Interest accrued and due	-	-
b) Other loans (specify)		
5.Other institutions and agencies		
6.Debentures and bonds		
7.Fixed deposits		
8.Others (specify)		
TOTAL		

Note: Amounts due within one year

SCHEDULE 6: DEFERRED CREDIT LIABILITIES	As at 31.3.2016	As at 31.3.2015
a) Acceptances secured by hypothecation of capital equipment and other assets	-	-
b) Others		
TOTAL		

Note: Amounts due within one year

(Amount in Rupees)

SCHEDULE 7: CURRENT LIABILITIES AND PROVISIONS	As at 31.3.2016	As at 31.3.2015
A.CURRENT LIABILITIES		
1.Acceptances	-	-
2.Sundry creditors:		
a) For goods/printing expenses	1,50,639	34,394
b) Others/security deposit	12,08,670	9,35,000
c) Earnest Money deposit	9,00,000	8,29,698
d) Science Education Programme	66,831	-
e) Staff - Medical expenses & Others	43,922	-
f) Due to parties/fellows	1,81,444	63,474
g) Suspense Receipts	20,000	
3.Advances received (Subscriptions)	78,31,960	80,80,452
4.Interest accrued but not due on:		
a) Secured loans/borrowings	-	-
b) Unsecured loans/borrowings	-	-
5.Statutory liabilities:		
a) TDS- Vendors	69,373	1,21,291
b) TDS : Professional fees	7,000	5,056
6.Other current liabilities:		
a) Current Science Association		9,741
b) Due to DST	1,34,604	-
c) Unutilised Plan grants	4,35,74,189	1,29,24,351
d) Professional Tax	-	10,250
e) Group Savings Linked Insurance	76,604	4,41,646
TOTAL (A)	5,42,65,236	2,34,55,353
B.PROVISIONS		
1.For taxation	-	-
2.Gratuity	-	-
3.Superannuation / pension	-	-
4.Accumulated leave/encashment	-	-
5.Trade warranties/claims	-	-
6.DA Arrears payable to staff	1,48,959.00	1,63,559.00
7.NSDL-Tier 1 on DA Arrears	12,636.00	12,390.00
8.Others (specify)	-	-
TOTAL (B)	1,61,595.00	1,75,949.00

SCHEDULE 8:- FIXED ASSETS

(Amount in Rupees)

DESCRIPTION	GROSS BLOCK			DEPRECIATION			NET BLOCK	
	Cost as at beginning of the year	Additions\(Deletions) during the year	Cost at the year end	As at beginning of the year	Additions\(Deletions) during the year	Total up to the year end	As at the current year end	As at the previous year end
A. FIXED ASSETS:								
1. Land:								
a) Freehold	1,58,87,217	-	1,58,87,217	-	-	-	1,58,87,217	1,58,87,217
b) Leasehold								
2. Buildings								
a) On freehold land	4,39,50,699	44,47,106	4,83,97,805	14,78,753	1,11,178	15,89,931	4,68,07,874	4,39,50,699
b) On leasehold land								
c) Ownership flats/premises								
d) Superstructures on land not belonging to the entity								
3. Plant, machinery and equipment	-	-	-	-	-	-	-	-
4. Vehicles	-	-	-	-	-	-	-	-
5. Furniture, fixtures, equipment & computer/peripherals	93,35,367	67,72,395	1,61,07,762	22,91,417	7,41,500	30,32,917	1,30,74,845	93,35,367
6. Electric installations								
7. Library books	2,74,241	18,501	2,92,742	65,754	18,501	84,255	2,08,487	2,74,241
8. Tube wells & water supply								
9. Other fixed assets								
Rainwater harvesting	1,64,102	-	1,64,102	23,443	-	23,443	1,40,659	1,64,102
10. Website	-	11,22,900	11,22,900	-	11,22,900	11,22,900	-	-
TOTAL	6,96,11,626	1,23,60,902	8,19,72,528	38,59,367	19,94,079	58,53,446	7,61,19,082	6,96,11,626
B. CAPITAL WORK IN PROGRESS								
1. Hostel Block at Jalahalli	1,55,24,035	70,64,074					2,25,88,109	1,55,24,035
2. Academy Annexe Building	27,43,215	(27,43,215)					-	27,43,215
TOTAL							9,87,07,191	8,78,78,876

(Amount in Rupees)

SCHEDULE 9: INVESTMENTS EARMARKED/ENDOWMENT FUNDS	As at 31.3.2016	As at 31.3.2015
1.In Government securities		
2.Other approved securities		
3.Shares		
4.Debentures and bonds		
5.Subsidiaries and joint ventures		
6.Fixed deposits in Banks	7,18,58,641	7,48,09,187
7.Investments in UTI Schemes	2,60,00,000	
TOTAL	9,78,58,641	7,48,09,187

(Amount in Rupees)

SCHEDULE 10: INVESTMENTS - OTHERS	As at 31.3.2016	As at 31.3.2015
1.In Government securities		
2.Other approved securities		
3.Shares		
4.Debentures and bonds		
5.Subsidiaries and joint ventures		
6.Fixed deposits in Banks	5,18,27,322	6,47,91,946
7.Investments in UTI Schemes	2,55,00,000	
TOTAL	7,73,27,322	6,47,91,946

(Amount in Rupees)

SCHEDULE 11: CURRENT ASSETS, LOANS, ADVANCES ETC.	As at 31.3.2016		As at 31.3.2015	
A. CURRENT ASSETS:				
1.Inventories:				
a) Stores and spares				
b) Loose tools				
c) Stock-in-trade				
d) Stock on stamps, stationery and paper		15,31,157		12,04,593
2.Sundry debtors				
a) Debts outstanding for a period exceeding six months		39,20,643		12,63,125
b) Others		2,77,76,880		1,79,969
3.Cash balances in hand				
(including cheques/drafts and imprest)		46,928		64,430
4.Bank balances:				
a) With scheduled banks:				
On current accounts				
On savings bank accounts				
i) SBI, Sadashivnagar a/c no 10356553343		(18,64,078)		47,74,709
ii) SBI, Sadashivnagar a/c no 30712324923		31,890		8,71,274
iii) SBI, Sadashivnagar a/c no 33251454227		8,97,836		12,03,663
iv) SBI, Sadashivnagar a/c no 33251455185		2,27,035		3,09,184
v) Union Bank of India a/c no 392002010008130		56,206		56,131
On deposit accounts with UBI (includes margin money)		5,82,20,000		2,54,55,000
On savings accounts				
b) With non-scheduled banks:				
On current accounts				
On deposit accounts				
On savings accounts				
5. Post Office-savings accounts		-		-
6.Lease hold:				
Time share at Orange County as per last balance sheet			3,10,000	
Less 15th year's written off		-	26,000	2,84,000
SUB TOTAL (A)		9,08,44,497		3,56,66,078

SCHEDULE 11: CURRENT ASSETS, LOANS, ADVANCES ETC.	As at 31.3.2016		As at 31.3.2015	
B. LOANS, ADVANCES AND OTHER ASSETS				
1.Loans:				
a) Staff	3,43,266		1,66,975	
b) Other entities engaged in activities/objectives similar to that of the entity	54,09,250		55,09,500	
c) Others - Partial subsidy rent scheme	30,000	57,82,516	70,000	57,46,475
2. Advances and other amounts recoverable in cash or in kind or for value to be received:				
a) On capital account	18,00,000			
b) Prepayments	2,84,687		50,965	
c) Others	75,000		5,85,000	
		21,59,687		6,35,965
3.Income Accrued:				
a) On Investments from earmarked/endowment funds		88,67,817		
b) On investments-others		69,82,599		
c) On loans and advances				
d) Others				
4.Claims receivable			-	-
a) RRI				
SUB TOTAL (B)		2,37,92,619	39,19,956	63,82,440
TOTAL (A+B)		11,46,37,116		4,20,48,518

INDIAN ACADEMY OF SCIENCES

C.V.RAMAN AVENUE BENGALURU-560 080

SCHEDULE 12: INCOME FROM SALES/SERVICES	2015-16	2014-15
1.Income from sales		
a) Sale of finished goods		
b) Sale of raw materials		
c) Sale of scrap		
2.Income from Services	-	-
a) Labour and processing charges		
b) Professional/consultancy services		
c) Agency commission and brokerage		
d) Maintenance services (equipment/property)		
e) Others		
TOTAL	-	-

SCHEDULE 13: GRANTS/SUBSIDIES		2015-16		2014-15
(Irrevocable grants & subsidies received)				
1.Central Government				
Plan - DST (Including carry forward of 2014-15)	16,41,53,436		12,85,09,474	
Special Component Plan for Scheduled Caste	12,07,458		11,00,000	
INSA, New Delhi	-		-	
NASI, Allahabad	-		-	
Grant - Inspire	-		-	
TOTAL (A)		16,53,60,894		12,96,09,474
Non-Plan - DST	50,00,000	50,00,000	17,52,000	17,52,000
1. State Government				
2. Government agencies				
3. Institutions/welfare bodies				
4. International organizations				
5. Others				
TOTAL (B)		50,00,000		17,52,000
TOTAL (A+B)		17,03,60,894		13,13,61,474

SCHEDULE 14: FEES/SUBSCRIPTIONS	2015-16	2014-15
1.Entrance fees		
2.Annual fees/subscriptions	1,13,06,292	73,11,172
3.Seminar/Programme fees		-
4.Consultancy fees		
5.Others (specify)		
TOTAL	1,13,06,292	73,11,172

SCHEDULE 15: INCOME FROM INVESTMENTS	Investment - Earmarked funds		Investment others	
	2015-16	2014-15	2015-16	2014-15
1.Interest				
a) On Govt. securities				
b) Other bonds/debentures				
2.Dividends:		-		-
a) On shares				
b) On mutual fund securities				
3.Rents				
4.Others - Banks and other Financial Institutions	1,21,55,258		1,44,14,727	
TOTAL	1,21,55,258	-	1,44,14,727	-

SCHEDULE 16: INCOME FROM ROYALTY, PUBLICATIONS ETC.	2015-16	2014-15
1.Income from royalty received from Springer	2,43,94,655	2,10,18,725
2.Income from royalty receivable from Springer	2,76,81,732	
3.Other royalty	15,120	
4.Income from publications		
i.Special publications	4,28,120	5,28,334
ii.Off-prints	-	-
iii.Back volumes/Previous year publication	-	-
TOTAL	5,25,19,627	2,15,47,059

SCHEDULE 17: INTEREST EARNED	2015-16		2014-15	
1.On term deposits:				
a) With scheduled banks				
b) With non-scheduled banks				
c) With institutions				
d) Others				
2.On Savings accounts:				
a) With scheduled banks	22,79,463	4,85,072	26,56,258	4,00,041
b) With non-scheduled banks				
c) Post office savings accounts				
d) Others				
3.On Loans:				
a) Employees				14,346
b) Others				
4. Interest on IT Refund				87,813
5.Interest on debtors and other receivables				
TOTAL	22,79,463	4,85,072	26,56,258	5,02,200

SCHEDULE 18: OTHER INCOME	2015-16	2014-15
1.Profit on sale/disposal assets:		
a) Owned assets		
b) Assets acquired out of grants, or received free of cost		
2.Export incentives realized		
3.Fees for miscellaneous services	13,511	2,58,700
4.Licence fee receipts	2,016	4,260
5. Rent for Guest House/Council Room/Auditorium	2,28,450	
6.Miscellaneous income	53,100	1,57,707
TOTAL	2,97,077	4,20,667

SCHEDULE 19: INCREASE/(DECREASE) IN STOCK OF FINISHED GOODS & WORK IN PROGRESS	2015-16		2014-15	
	Plan	Non Plan	Plan	Non Plan
A) Closing Stock				
Finished goods				
Work-in-progress	-	-	-	-
B) Less: Opening Stock				
Finished goods				
Work-in-progress				
NET INCREASE/(DECREASE) [A-B]	-	-	-	-

SCHEDULE 20: ESTABLISHMENT EXPENSES	2015-16		2014-15	
	Plan	Non Plan	Plan	Non Plan
a) Salaries and wages	2,27,54,058	46,12,568	1,77,13,978	75,46,338
b) Special component expenditure for schedule caste	10,52,596		7,13,341	
c) Allowances and bonus		84,623		89,804
d) Contribution to provident fund				
e) Staff welfare expenses		1,81,817		2,40,997
f) Expenses on employees' retirement and terminal benefits	83,09,059		39,56,416	
g) Others				
h) Medical expenses		12,74,176	15,63,675	
TOTAL	3,21,15,713	61,53,184	2,39,47,410	78,77,139

SCHEDULE 21: OTHER ADMINISTRATIVE EXPENSES ETC.	2015-16		2014-15	
A. Plan				
a) Annual/mid year meeting/sectional committee meetings	65,27,112		63,50,397	
b) Modernization of office facilities			6,23,688	
c) Discussion meetings	11,28,552		5,11,247	
d) Library and Archives		76,55,664	5,962	74,91,294
e) Science education programme				
i) Summer research fellowships	2,30,41,871		3,17,21,351	
ii) Lecture workshops	1,22,45,607		73,90,665	
iii) Refresher courses	90,23,910		1,13,16,176	
iv) SRF selection committee expenses	9,96,117	4,53,07,505	12,19,188	5,16,47,380
g) Upgradation of internet link	6,71,893		4,06,997	
h) Wi-fi charges	1,81,396		-	
i) Plan-Transfer	73,68,561		-	
j) Property tax	1,90,504		1,90,504	
k) Publication of journals	2,22,71,581		1,49,94,240	
l) Contribution to pension fund	-		-	
m) Advertisement expenses	2,48,277		3,45,968	
n) Panel on women in science	96,048		4,46,981	
o) Public lecture expenses	65,936		20,170	
p) Expenditure on official language implementation	2,93,434		1,79,604	
q) Expenditure on Scientific Values	23,846		1,034	
r) Expenditure on Fellows repository	-		43,639	
s) Time Share in Orange County Written off	26,000		-	
t) Maintenance of guest house- Jalahalli	-		6,10,166	
u) Expenditure on software maintenance	6,96,364		4,54,712	
v) Expenditure on construction of hostel block	-		97,53,700	
w) Postage	-		37,73,916	
x) Upkeep of building	-		17,02,347	
y) Upkeep of equipment	-		88,104	
z) Expenditure on Academy Annexue Building			27,43,215	
		3,21,33,840		3,57,55,297
		8,50,97,009		9,48,93,971

SCHEDULE 21 : Continued	2015-16		2014-15	
B.Non-Plan				
a) Telephones	3,76,936		3,65,292	
b) AMC expenses	5,37,073		4,85,018	
c) Stationery	3,56,790		4,27,046	
d) Traveling/conveyance	5,49,381		6,27,016	
e) Audit fee	28,871		22,900	
f) Packing and forwarding	1,91,242		2,15,613	
g) Bank charges	31,083		18,168	
h) Miscellaneous expenses	5,56,348		4,10,846	
i) Expenditure on scientific research	4,25,052		96,286	
j) Postage	39,38,782			
k) Upkeep of building	17,93,841			
l) Upkeep of equipment	1,39,803			
m) Maintenance of guest house- Jalahalli	22,84,231			
n) Diary/Calendar	62,211			
o) IT Services	34,350			
p) NSDL Quarterly maintenance charges	7,065			
q) Quarterly filing charges of 24Q & 26Q	18,005			
r) Royalty	47,433	1,13,78,497		26,68,185
TOTAL (A+B)		9,64,75,506		9,75,62,156

SCHEDULE 22: EXPENDITURE ON GRANTS, SUBSIDIES ETC.	2015-16	2014-15
a) Grants given to institutions/organizations		
b) Subsidies given to institutions/organizations	-	-
TOTAL		

Note:- Name of the entities, their activities along with the amount of grants/subsidies are to be disclosed.

SCHEDULE 23: INTEREST	2015-16	2014-15
a) On fixed loans		
b) On other loans (including bank charges)	-	-
c) Others (specify)		
TOTAL		

INDIAN ACADEMY OF SCIENCES, BENGALURU

SCHEDULES FORMING PART OF THE ACCOUNTS FOR THE YEAR ENDED 31ST MARCH 2016

SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS:

OVERVIEW:

The Indian Academy of Sciences (IAS) is registered as a society under the Karnataka Societies Registration Act, 1960, dated 24th April 1934 and also registered under Section 12A of the Income Tax Act, 1961.It is an autonomous institution recognized by the Department of Science and Technology, Government of India.

The main objects of the Academy, inter-alia, are to promote research in pure and applied branches of science, publish work relating to scientific research initiated by the Academy, conduct/ organize seminars, lecture meetings for dissemination of knowledge on pure sciences.

SCHEDULE 24: SIGNIFICANT ACCOUNTING POLICIES:

Basis of Preparation of Financial Statements:

1. **Accounting Conventions**:

   a) The financial statements are drawn up in accordance with the historical accounting convention and on the going concern concept. Accrual system of accounting is followed to record Income and Expenditure for the year, except in case of Income from Investments in Mutual Fund, which is accounted on cash basis.

   b) The guidelines as per the Uniform Format of Accounts for Central Autonomous Institutions, as applicable and to the extent practicable, have been followed in the presentation of the financial statements of the Academy.

2. **Fixed assets**: Fixed assets are stated at Cost less Depreciation. Fixed assets are accounted at cost of acquisition, inclusive of inward freight, duties, taxes and incidental expenses related to acquisition.

3. **Depreciation:** Depreciation is provided on Straight Line Method at rates as stated in Fixed Assets Schedule. The amount of depreciation is debited to Income & Expenditure A/c during the year. Depreciation is charged at 100% on fixed assets costing less than Rs.10,000/- each during the year. Depreciation on additions is charged for the full year irrespective of the date of addition during the year.

4. **Investments**: Investments are stated at cost. Interest on Bank Fixed Deposits has been accounted on accrual basis and Income from Mutual Funds is accounted on cash basis.

5. **Government Grants**:

a) The Grants received from the DST are accounted on realization basis and the same are accounted and separately shown under Plan and Non-Plan in Annual Accounts of the Academy.

b) The Grants received from the DST for meeting recurring expenditure like Salaries and Other Administrative expenses has been credited to the Income and Expenditure account and Grants received for the purpose of meeting capital expenditure has been credited to the Capital Fund -2 Account.

c) The unutilized Grant is recognized as a liability and shown under 'Current Liabilities" as in last year.

6. **Foreign Exchange Transactions:** Subscriptions received in foreign currency during the year are accounted on realization at the rates prevailing on the date of realization.

7. **Retirement Benefits:**

a) Provident Fund contributions have been recovered and remitted as per the General Provident Fund Rules as applicable to the Govt. employees.
b) No provision has been made in respect of the Leave Encashment and Gratuity liability in the accounts as required by AS 15. However, the same is accounted on cash basis as and when the liability is discharged.

8. **Income Tax**: The Academy is registered under Section 12A of the Income Tax Act, 1961 and is eligible for exemption from tax and hence no provision has been made towards Income tax.

As per our report of even date,
For M/s B.R.V. Goud & Co
Chartered Accountants

(R Varadarajan)	(N Maheshchandra)	(A Shashidhar)	(A.B.Shiva Subramanyam)
Treasurer	Executive Secretary	Accounts Officer	Partner

Place: Bengaluru
Date: 15.06.2016

INDIAN ACADEMY OF SCIENCES, BENGALURU

SCHEDULES FORMING PART OF THE ACCOUNTS FOR THE YEAR ENDED 31ST MARCH 2016

SCHEDULE 25: NOTES ON ACCOUNTS:

01. Contingent Liabilities: Rs. Nil (Rs. Nil)

02. Claims against the Academy not acknowledged as debts Rs. Nil (Rs. Nil)

03. In respect of the retirement benefits (Gratuity, leave encashment) to the employees, the Academy is awaiting approval from DST for creation of separate funds for meeting the future liability. However, the same is accounted on cash basis as and when the payments are made on retirement of employees.

04. Figures are rounded off to the nearest rupee and figures of previous year have been regrouped and reclassified to conform to that of the current year.

05. Schedules 1 to 25 are annexed to and form an integral part of the Balance Sheet as at 31st March 2016 and the Income and Expenditure Account for the year ended on that date.

As per our report of even date,
For M/s B.R.V. Goud & Co
Chartered Accountants

(R Varadarajan)	(N Maheshchandra)	(A Shashidhar)	(A.B.Shiva Subramanyam)
Treasurer	Executive Secretary	Accounts Officer	Partner

Place: Bengaluru
Date: 15.06.2016

Indian Academy of Sciences

81st Annual Meeting

6–8 November 2015, Pune