

IISc

AT A GLANCE



INDIAN INSTITUTE OF SCIENCE



Introduction to **IISc**

The Indian Institute of Science (IISc) was conceived of by the industrialist Jamsetji N. Tata, and established in 1909 by a visionary partnership between the estate of Mr. Tata, the Maharaja of Mysore, and the Government of India. In the words of its founder, the objectives of the Institute are “to provide for advanced instruction and to conduct original investigations in all branches of knowledge as are likely to promote the material and industrial welfare of India.” Since its inception, IISc has been unwavering in its pursuit of living up to the ideals of its founder, while maintaining its position as the premier institute for advanced scientific and technological research and education in India.

2015-16 has been an eventful year for the Institute. Several of its researchers won prestigious awards and were elected to national and international science and engineering academies. Some of its faculty members, who invented new technologies in their laboratories, chose to establish startups to take their knowhow directly to the market. During this year, the Institute entered into comprehensive research collaboration agreements with major national and international companies. The Sudha Murty Distinguished Chair in Neurocomputing and Data Sciences was established, with an endowment from the Pratiksha Trust. The Office of Development and Alumni Affairs (ODAA), set up in 2014-15, has been able to tap various private sources of funds for academic and institutional development initiatives, including for the new HAL-IISc Skill Development Centre in IISc’s extension campus at Challakere, in Chitradurga district.

The year also saw IISc being ranked as India’s top university in the first ever national rankings (NIRF) brought out by the Ministry of Human Resource Development, a testament to the Institute’s continued emphasis on high quality research in diverse fields of science and engineering.

Anurag Kumar

Director, IISc
December 2016

The Institute

The Indian Institute of Science is an institution of higher learning and research established in 1909 under the Charitable Endowments Act 1890. With the establishment of the University Grants Commission in 1956, the Institute came under its purview as a Deemed University. Since 1993-94 the Indian Institute of Science receives most of its annual funding support from the Ministry of Human Resources Development. The principal authority governing the Institute is the Council, which is advised by the Court in the formulation of policies. The Director is the Chief Executive of the Institute and is assisted in its management by the Senate and the Faculties of Science and Engineering.

Visitor: THE PRESIDENT OF INDIA

President of the Court: K KASTURIRANGAN

Chair of Governing Council: P RAMA RAO

Director: ANURAG KUMAR

Deans: TN GURU ROW (SCIENCE)

MK SURAPPA (ENGINEERING)

ANJALI KARANDE (UNDERGRADUATE PROGRAMME)

Registrar: V RAJARAJAN

Deans *of Faculties*



TN Guru Row | **DEAN, FACULTY OF SCIENCE**

TN Guru Row (Professor, Solid State and Structural Chemistry Unit) obtained his PhD from IISc and did his postdoctoral work at SUNY Buffalo and Rosewell Park Memorial Institute, USA. His major area of research is in chemical crystallography and materials design. He has received several prestigious awards and honours for his research, including the JC Bose National Fellowship. Row is a Fellow of the Indian Academy of Sciences and the National Academy of Sciences. Currently, he also serves as Editor of the *Journal of the Indian Institute of Science*.



MK Surappa | **DEAN, FACULTY OF ENGINEERING**

MK Surappa (Professor, Department of Materials Engineering) obtained his PhD from the IISc. He has made important contributions to the field of Metal Matrix Composites (MMCs). He was the Founding Director of the Indian Institute of Technology, Ropar. Surappa, who has won many accolades for his research, is a Fellow of the Indian National Science Academy and the Indian National Academy of Engineering. He has also received an honorary Doctor of Literature (D.Litt.) degree from the Karnataka State Open University.

Deputy Directors



S Ramakrishnan | **DEPUTY DIRECTOR, PLANNING AND INFRASTRUCTURE**

S Ramakrishnan (Professor, Department of Inorganic and Physical Chemistry) received his PhD from the University of Massachusetts, USA. After a two-year postdoctoral stint at the Corporate Research Laboratory, Exxon Research and Engineering Company, also in the US, he joined IISc in 1990. Ramakrishnan's research interests are in the areas of highly branched polymers, self-assembled polymerizable systems and conformational control in synthetic polymers. His research accomplishments have won him several honours, including the Shanti Swarup Bhatnagar Prize, DAE Outstanding Young Researcher Award, JC Bose Fellowship and Distinguished Alumnus Award from IIT Bombay.



Jayant M Modak | **DEPUTY DIRECTOR, ADMINISTRATION AND FINANCE**

Jayant M Modak (Professor, Department of Chemical Engineering) obtained his PhD from Purdue University, USA. After a one-year stint at University of California-Irvine, USA, as a postdoctoral fellow, he joined IISc in 1989. Here, he initiated a research programme in the area of bioprocess engineering with an emphasis of modeling, optimization and control of fermentation processes and advanced oxidation technologies for waste-water treatment. Modak is a Fellow of Indian National Academy of Engineering and National Academy of Sciences, and the recipient of several prestigious awards.

Deans, *Undergraduate Programme*



Anjali Karande | **DEAN, UNDERGRADUATE PROGRAMME**

Anjali Karande (Professor, Department of Biochemistry) received her PhD from the Cancer Research Institute, then affiliated to Bombay University. She pursued her postdoctoral work at Karolinska Institute, Sweden, before joining IISc in 1987. Her research interests are in the field of immuno-endocrinology. Karande has also had several collaborations with biotech companies.



Balaji Jagirdar

**ASSOCIATE DEAN,
UNDERGRADUATE PROGRAMME**

Balaji Jagirdar (Professor, Department of Inorganic and Physical Chemistry) obtained his PhD from Kansas State University, USA. He was a postdoctoral fellow at the University of Colorado, Boulder, USA, before joining IISc in 1995. His research interests include the activation of small molecules using organometallic compounds, homogeneous and heterogeneous catalysis, and materials for hydrogen storage and generation. He is a Fellow of the Indian Academy of Sciences.



PS Anil Kumar

**ASSOCIATE DEAN,
UNDERGRADUATE PROGRAMME**

PS Anil Kumar (Associate Professor, Department of Physics) obtained his PhD from the University of Pune. He was a postdoctoral fellow at the University of Twente, Netherlands; Max-Planck Institute of Microstructural Physics, Germany and, subsequently, an Alexander von Humboldt Research fellow before joining IISc in 2004. His research interests are in spintronics, magnetic nanostructures, magnetotransport in metallic multilayers and oxides, topological insulators, magnetic properties of ultra-thin ferromagnets, etc.

IISc ranked India's top University

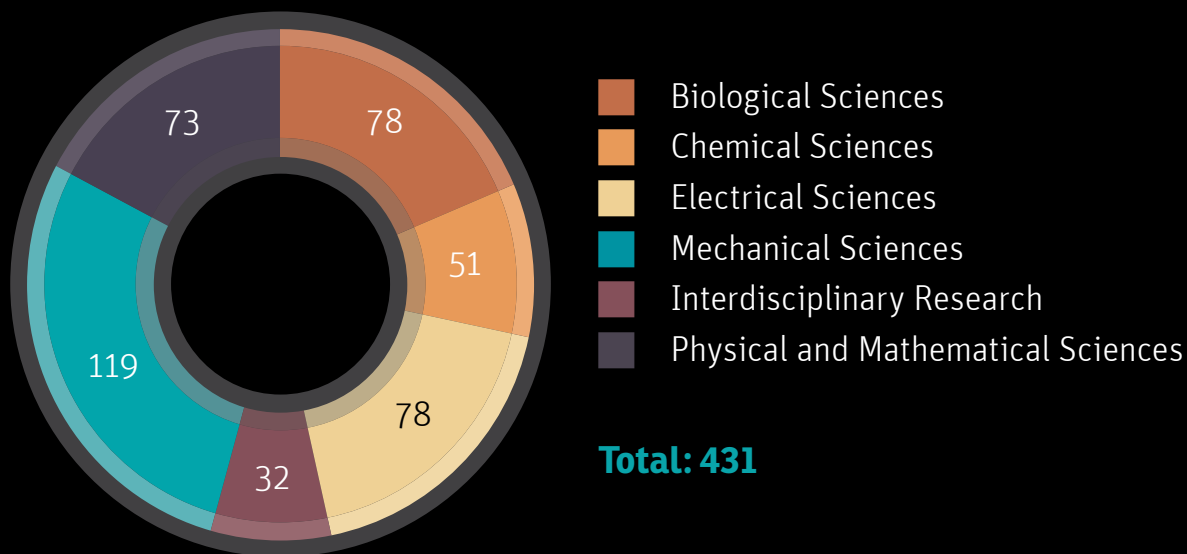


In 2016, for the first time the NIRF (National Institutional Ranking Framework), under the auspices of the Ministry of Human Resource Development, came out with rankings for Indian Universities and Institutions of Higher Education.

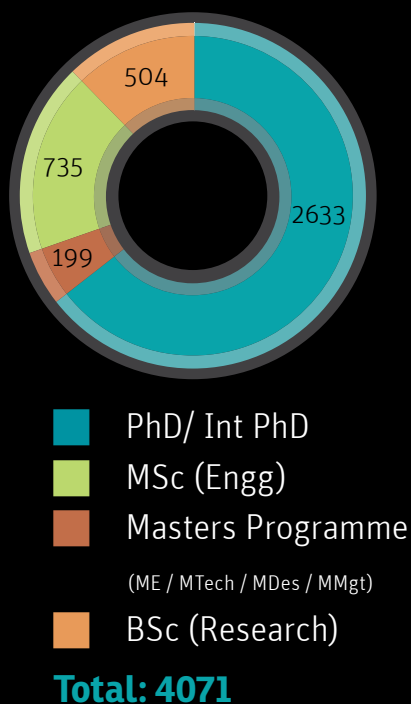
Amongst universities, IISc was ranked Number 1.

IISc in *Numbers*

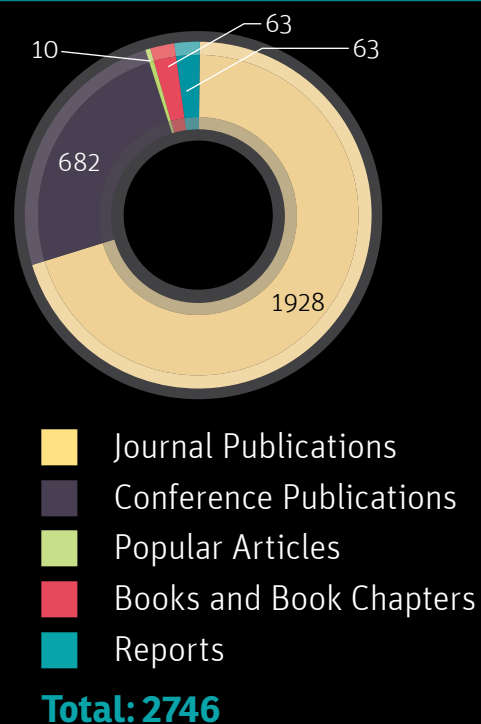
Faculty Members



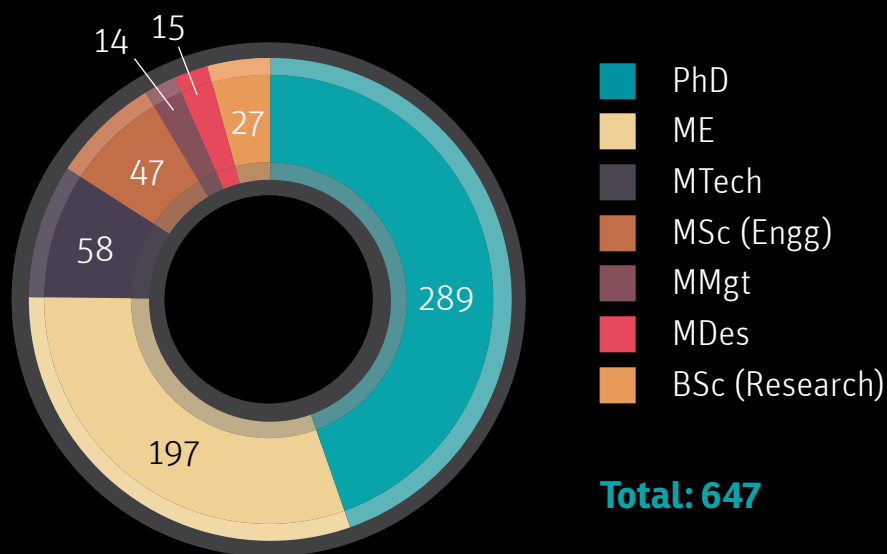
Students on Roll



Publications 2015



Degrees Awarded 2015-16



FELLOWSHIPS OF SCIENCE AND ENGINEERING ACADEMIES

Indian National Science Academy (INSA)	79
Indian Academy of Sciences (IASc)	97
National Academy of Sciences, India (NASI)	65
Indian National Academy of Engineering (INAE)	55
The Royal Society	3
National Academy of Sciences (USA)	1
The World Academy of Sciences (TWAS)	27
Institute of Electrical and Electronics Engineers (IEEE)	7

AWARDS

Padma Awards	6
Infosys Prize	3
Shanti Swarup Bhatnagar Prize	51
JC Bose Fellowship Award	68
DST – Swarnajayanti Fellowship Award	29
Wellcome Trust – DBT Fellowship	25

Divisions

The Institute comprises six Academic Divisions:

Biological Sciences
Chemical Sciences
Electrical Sciences
Interdisciplinary Research
Mechanical Sciences
Physical and Mathematical Sciences

This section offers a glimpse into the composition of and the research carried out in the six Divisions. It includes the core areas and themes of research pursued by faculty members in each of them as well as snapshots of some of the recent research emerging from these Divisions. It also captures stellar accomplishments of select research groups during 2015-16.



Division of Biological Sciences



78

FACULTY MEMBERS

84

**FELLOWSHIPS OF
SCIENCE AND ENGINEERING
ACADEMIES IN INDIA**

50

**PhD STUDENTS GRADUATED
IN 2015-16**

340

PhD STUDENTS

65

INTEGRATED PhD STUDENTS

Biochemistry

Estd: 1921 | Chair: Prof. C Jayabaskaran

Centre for Ecological Sciences

Estd: 1983 | Chair: Prof. Rohini Balakrishnan

Microbiology and Cell Biology

Estd: 1941 | Chair: Prof. Usha Vijayraghavan

Centre for Infectious Diseases Research

Estd: 2014 | Convener: Prof. Dipankar Nandi

Centre for Neuroscience

Estd: 2009 | Chair: Prof. Aditya Murthy

Molecular Biophysics Unit

Estd: 1971 | Chair: Prof. Raghavan Varadarajan

Central Animal Facility

Estd: 1971 | Chair: Prof. Kumaravel Somasundaram

Molecular Reproduction, Development and Genetics

Estd: 1989 | Chair: Prof. Sandhya S Visweswariah

Division of Biological Sciences



CHAIRPERSON:
PROF. UMESH VARSHNEY

CORE RESEARCH AREAS

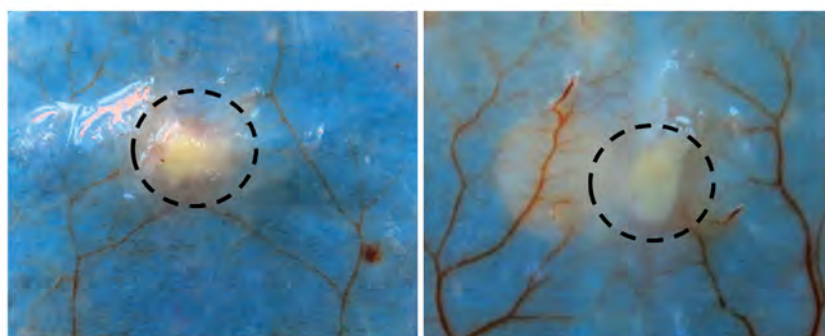
The Division of Biological Sciences forges important links between basic science and innovative research. It is committed to enhancing frontline studies in almost all aspects of modern biology: Neuroscience in health and disease, Infectious Disease, Structural Biology, Oncology, DNA Repair and Genomic Stability, Systems Biology and Bioinformatics, Immunology, Enzymology, Reproductive and Developmental Biology, Ecological Studies, etc.

THEMES

Investigators in the Division focus on numerous processes central to the understanding of life, emphasizing on areas with considerable translational potential, namely, Cognition and Neuronal Reprogramming, Infectious Diseases, Drug and Molecular Design, Diagnostics and Therapeutics in Cancer, Gene Targeting, Genetic Disorders and Genetic Diversity.

RESEARCH SNAPSHOTS

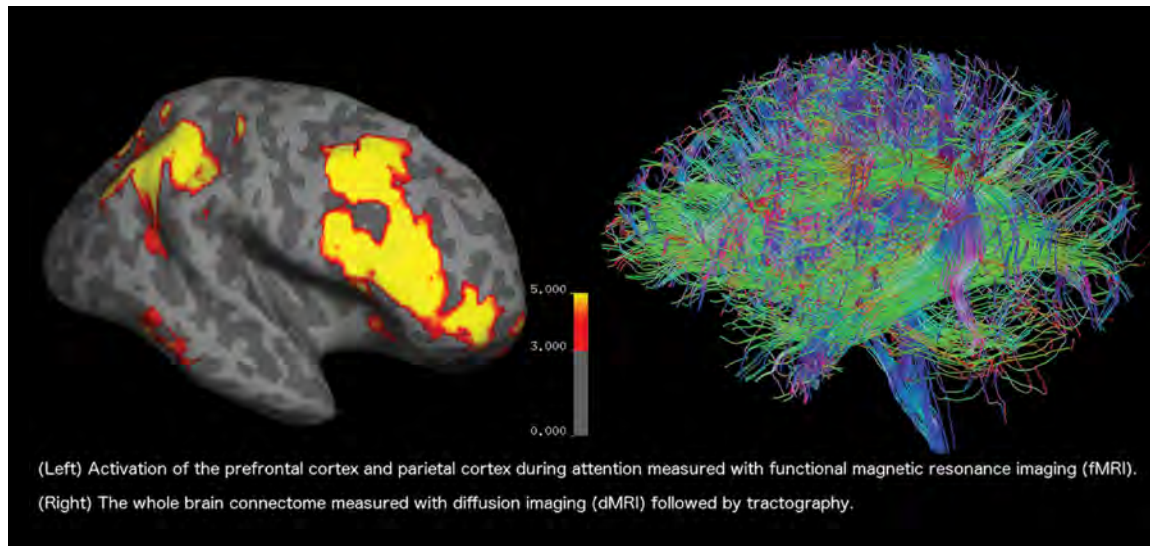
- Glioblastoma is a deadly form of brain cancer. A protein which causes the tumour to grow faster has been discovered by scientists from the Department of Microbiology and Cell Biology. This protein could therefore serve as a target for new drugs to treat this cancer. [Nijaguna MB, et al., and **Somasundaram K.** Glioblastoma-derived Macrophage Colony-stimulating Factor (MCSF) Induces Microglial Release of Insulin-like Growth Factor-binding Protein 1 (IGFBP1) to Promote Angiogenesis. *J Biol Chem.*, 2015, 290(38):23401-15]



LN229/Vector

LN229/MCSF

- A pressing question in neuroscience is to understand how the brain pays attention. Using fMRI as well as a novel brain imaging technique called diffusion MRI, researchers from the Centre for Neuroscience have identified the regions of the brain in the prefrontal and parietal cortex which are activated when the brain is being attentive. [Work in progress in **Sridharan Devarajan's** lab]



- The Asian and the African elephants may look similar, but they are distinct species which diverged about 7.6 million years ago. To explain the genetic differences between the two species, biologists from the Centre for Ecological Sciences have sequenced the genome and transcriptome of the Asian elephant. Its comparison with that of its African counterpart has revealed many novel transcripts and variants which may help us understand why they differ in many morphological and behavioral traits. [Reddy PC, Sinha I, Kelkar A, Habib F, Pradhan SJ, **Sukumar R** and Galande S. Comparative sequence analyses of genome and transcriptome reveal novel transcripts and variants in the Asian elephant *Elephas maximus*. *J. Biosci.*, 2015, 40 (5): 891-907]





Division of Chemical Sciences



51

FACULTY MEMBERS

77

**FELLOWSHIPS OF
SCIENCE ACADEMIES
IN INDIA**

49

**PhD STUDENTS GRADUATED
IN 2015-16**

287

PhD STUDENTS

62

INTEGRATED PhD STUDENTS

Inorganic and Physical Chemistry

Estd: 1909 | Chair: Prof. S Umapathy

Organic Chemistry

Estd: 1911 | Chair: Prof. N Jayaraman

Materials Research Centre

Estd: 1978 | Chair: Prof. Arun M Umarji

Solid State and Structural Chemistry Unit

Estd: 1976 | Chair: Prof. S Yashonath

NMR Research Centre

Estd: 1977 | Chair: Prof. S Vasudevan

Division of Chemical Sciences



CHAIRPERSON:
PROF. PK DAS

CORE RESEARCH AREAS

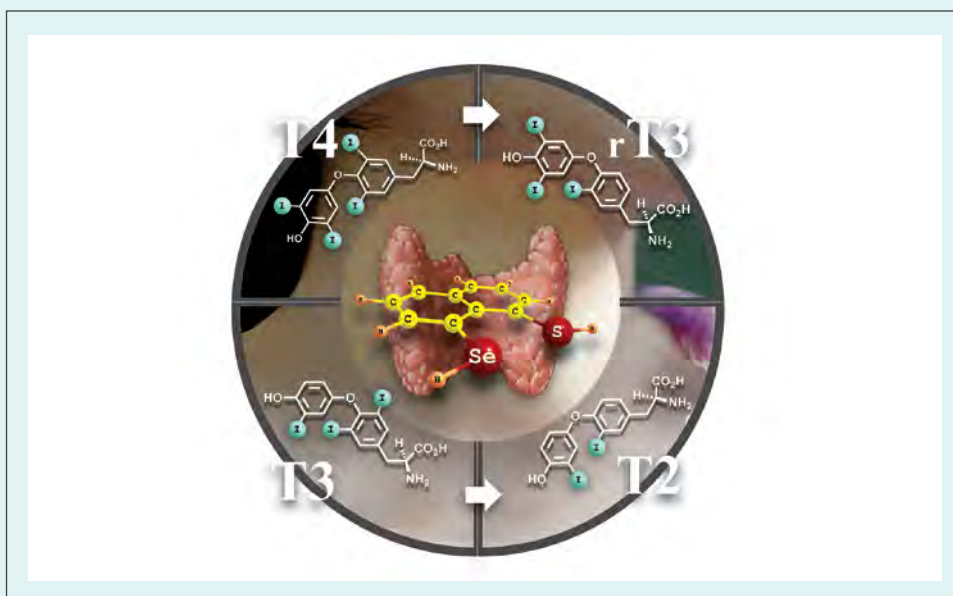
The faculty members of the Division work on all contemporary topics in chemistry, ranging from Chemical Synthesis, Drug Design, Chemical Biology, Materials Chemistry, Surface and Interface Science, Nanochemistry, Molecular Spectroscopy, Ultrafast Chemical Dynamics, Computational and Theoretical Chemistry, Solid State Chemistry and Nuclear Magnetic Resonance Spectroscopy.

THEMES

The Division of Chemical Sciences has consistently maintained its position among the top 50 chemistry departments in world rankings over the past decade. It is a globally competitive Division with clear focus on top quality research in areas such as bio-inorganic chemistry and chemical biology of drugs with a particular aim on disease control and cure, ultrafast spectroscopy and dynamics of molecules towards understanding of structure and reactivity in physical processes related to materials and interfaces, bio-materials for devices to industrial applications, computational materials science, and NMR methods for decoding complex protein structures in solution.

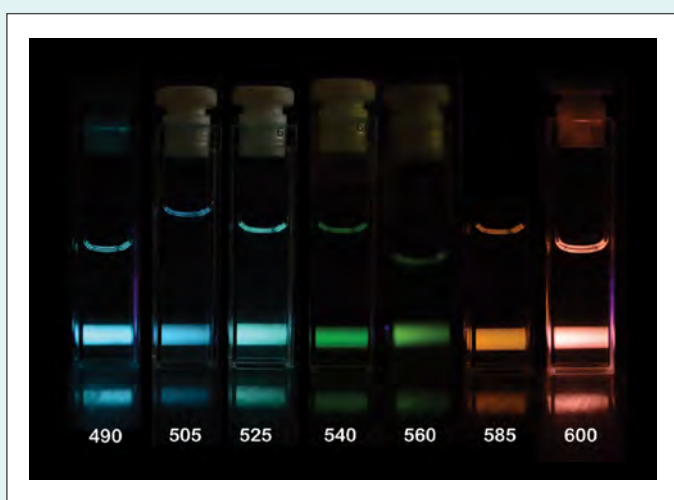
RESEARCH SNAPSHOTS

- More than 200 million people worldwide suffer from thyroid-related disorders. A team of scientists from the Department of Inorganic and Physical Chemistry has discovered a compound that can control

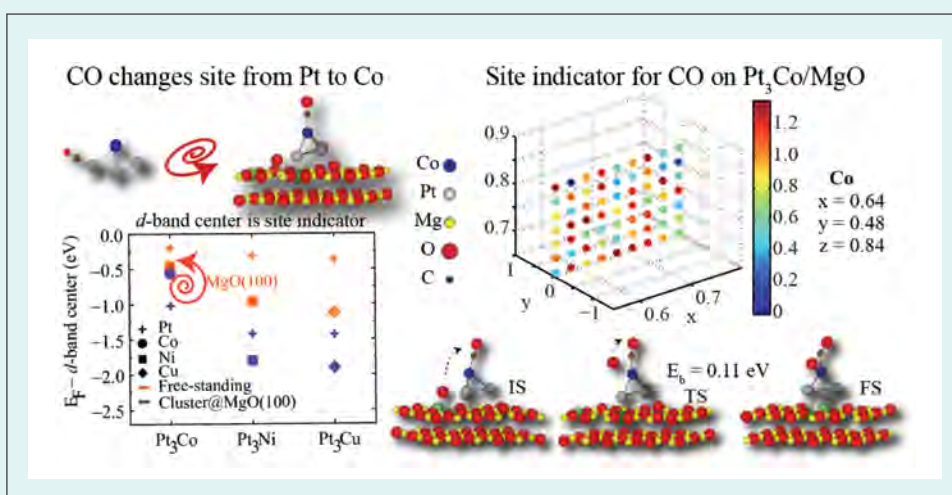


thyroxine, the hormone secreted by the thyroid gland. The discovery has potential applications in the treatment of hyperthyroidism. [Raja K and **Mugesh G.** Remarkable Effect of Chalcogen Substitution on an Enzyme Mimetic for Deiodination of Thyroid Hormones. *Angew. Chem. Int. Ed.*, 2015, 54: 7674–7678]

- Semiconductor quantum dots are promising materials for displays and lighting. But they suffer from a serious problem – they reabsorb some of the emitted light. On the other hand, manganese based phosphors have high quantum efficiency and stability, but lack emission tenability. Researchers from Solid State and Structural Chemistry Unit have developed nanocrystals doped with manganese which combine the advantages of quantum dots and conventional doped phosphorus, thus opening possibilities for a wide range of applications. [Abhijit Hazarika, **Anshu Pandey**, and **DD Sarma**, Rainbow Emission from an Atomic Transition in Doped Quantum Dots, *J. Phys. Chem. Lett.*, 2014, 5: 2208]



- Automobiles have catalytic converters which convert pollutants in the exhaust gas to less toxic substances. Typically palladium and platinum are used to convert CO to CO₂. Now materials scientists from the Materials Research Centre have developed a bimetallic Pt₃Co cluster supported on MgO which oxidizes CO more efficiently to CO₂. This paves the way to develop Pt₃Co/MgO as a next generation catalytic converter in automobiles. [R Ahmad and **AK Singh**. Pt-Poisoning-Free Efficient CO Oxidation on Pt₃Co Supported on MgO(100): An Ab Initio Study, *ACS Catalysis*, 2015, 5:1826]





Division of Electrical Sciences



78
FACULTY MEMBERS

34
FELLOWSHIPS OF SCIENCE
AND ENGINEERING
ACADEMIES IN INDIA

48 PhD AND **169** MASTERS
STUDENTS GRADUATED
IN 2015-16

401
PHD STUDENTS

442
MASTERS STUDENTS

7
IEEE FELLOWS

Computer Science and Automation
Estd: 1969 | Chair: Prof. Jayant R Haritsa

Electrical Communication Engineering
Estd: 1946 | Chair: Prof. KVS Hari

Electrical Engineering
Estd: 1911 | Chair: Prof. AG Ramakrishnan

Electronic Systems Engineering
Estd: 1974 | Chair: Prof. Joy Kuri

Division of Electrical Sciences



CHAIRPERSON:
PROF. Y. NARAHARI

CORE RESEARCH AREAS

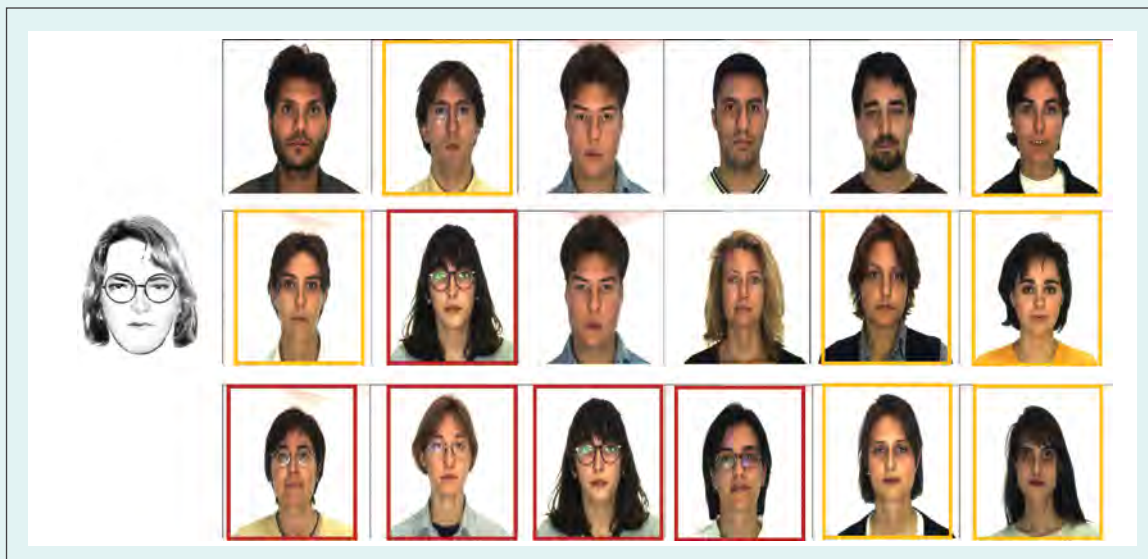
Even while working on high impact artefacts, the Division is assiduously seeking fundamental advances in the following core areas: Signal Processing, Communications, Networks, Microelectronics and Devices, Theoretical Computer Science, Computer Systems and Software, Artificial Intelligence and Machine Learning, Control and Optimization, Power Systems, Power Electronics, High Voltage Engineering, Image Processing, and Computer Vision.

THEMES

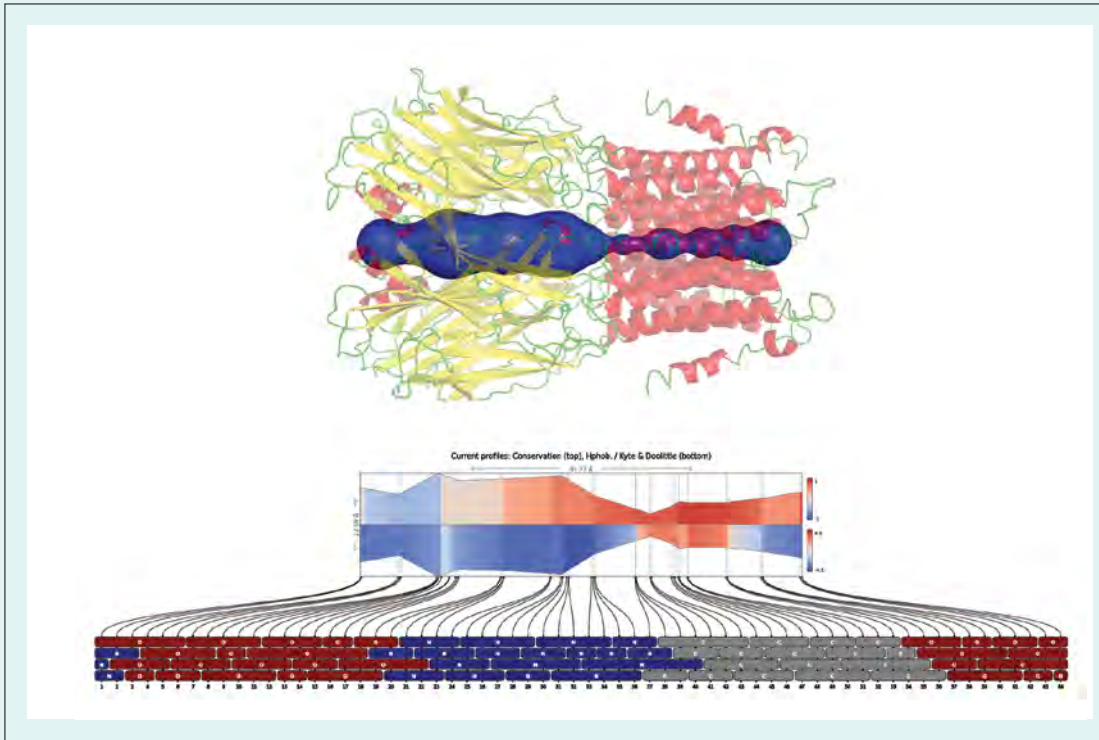
A feature of the Division's R&D activities is its focus on rigorous innovation in contemporary, interdisciplinary themes: Big Data Analytics, Internet of Things, 5G Technologies, Devices for Healthcare, Electronics for Strategic Sector, Network Science, Cybersecurity, Multicore Computing, Smart Grids, and Renewable Energy.

RESEARCH SNAPSHOTS

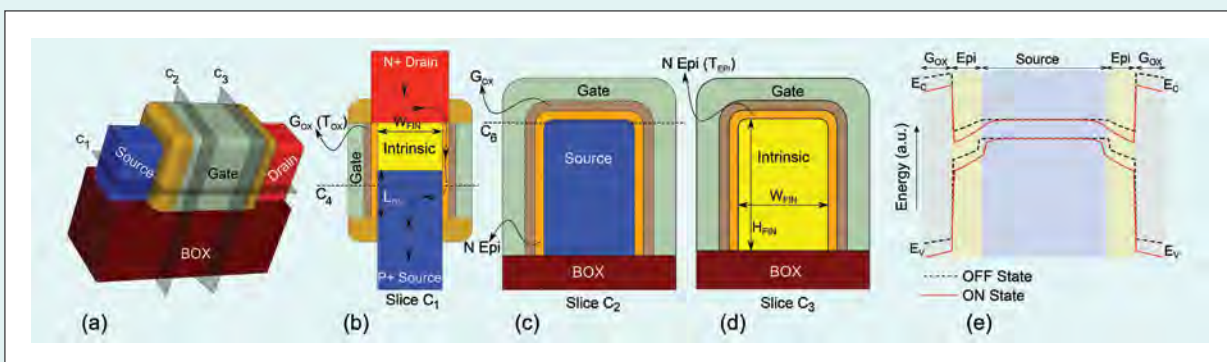
- A common security problem we face today is how to identify people using the large amounts of information we receive from videos and images. An algorithm to help match photos with images in different poses and illuminations has been developed by researchers from the Department of Electrical Engineering. This algorithm could have several applications in our fast-changing world with increasing security demands. [SP Mudunuri and Soma Biswas. Low Resolution Face Recognition Across Variations in Pose and Illumination. Accepted for publication in *IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)*, 2015]



- Marrying techniques from bioinformatics and computer science, researchers have been able to visualize an ion transport channel in a protein. To help achieve this, they developed ChExVis, a high-end tool for extraction and visualization of bio-molecular channels. [Talha Bin Masood, Sankaran Sandhya, Nagasuma Chandra and Vijay Natarajan. ChExVis: a tool for molecular channel extraction and visualization. *BMC Bioinformatics*, 2015, 16:119.]



- Engineers from the Department of Electronic Systems Engineering have patented a novel fin tunnel Field-Effect Transistor (FET), demonstrating how today's technology can be used to develop electronic devices for the future. The invention is expected to transform sub-10nm node CMOS technologies. [Kuruva Hemanjaneyulu and Mayank Shrivastava, Fin Enabled Area Scaled Tunnel FET, *IEEE Transactions on Electron Devices*, October 2015, 62:10]





Division of Interdisciplinary Research

32

FACULTY MEMBERS

12

**FELLOWSHIPS OF
SCIENCE AND ENGINEERING
ACADEMIES IN INDIA**

20

**PhD AND 49 MASTERS
STUDENTS GRADUATED
IN 2015-16**

141

PhD STUDENTS

95

MASTERS STUDENTS



Centre for BioSystems Science and Engineering

Estd: 2015 | Chair: Prof. GK Ananthasuresh

Centre for Contemporary Studies

Estd: 2004 | Chair: Prof. Raghavendra Gadagkar

**Centre for Infrastructure, Sustainable
Transportation and Urban Planning**

Estd: 2009 | Chair: Prof. JM Chandra Kishen

Centre for Nano Science and Engineering

Estd: 2010 | Chair: Prof. Navakanta Bhat

Computational and Data Sciences

Estd: 2015 | Chair: Prof. Phaneendra Yalavarthy

Management Studies

Estd: 1985 | Chair: Prof. R Parthasarathy

Interdisciplinary Centre for Energy Research

Estd: 2012 | Chair: Prof. Giridhar Madras

Interdisciplinary Centre for Water Research

Estd: 2015 | Chair: Prof. PP Mujumdar

Robert Bosch Centre for Cyber Physical Systems

Estd: 2011 | Chair: Prof. Bharadwaj Amrutur

Supercomputer Education and Research Centre

Estd: 1970 | Chair: Prof. R Govindarajan

Division of Interdisciplinary Research



CHAIRPERSON:
PROF. G. RANGARAJAN

CORE RESEARCH AREAS

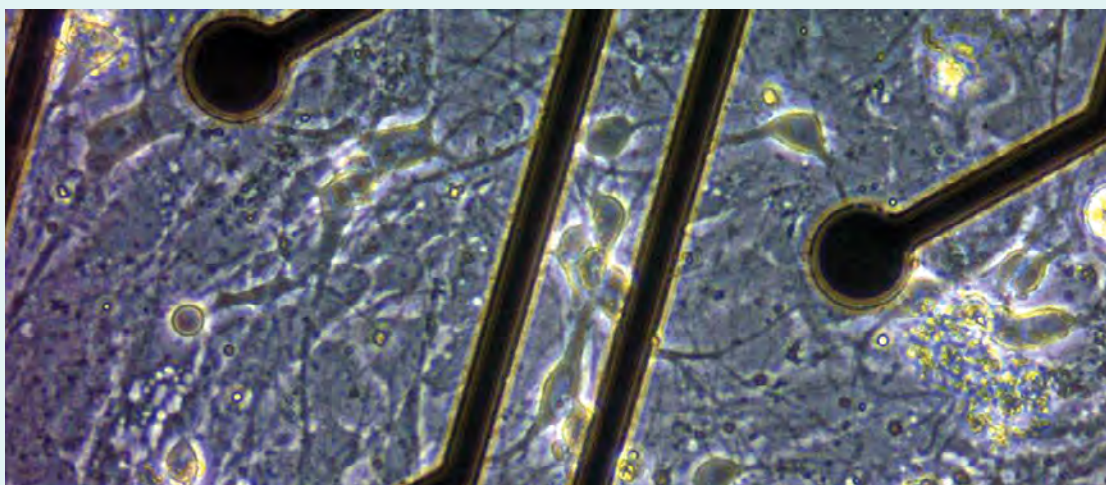
Interdisciplinarity is the characteristic feature of the research carried out in this Division. Specific research areas include Bioengineering, Urban infrastructure and transportation, Nanoscale materials, Nano devices and systems, Economics, Finance, Human resource management, Marketing, Optimization, Public policy, Energy, Water, Internet of things, Distributed sensing, Computer systems, Computational science, Data sciences and bioinformatics.

THEMES

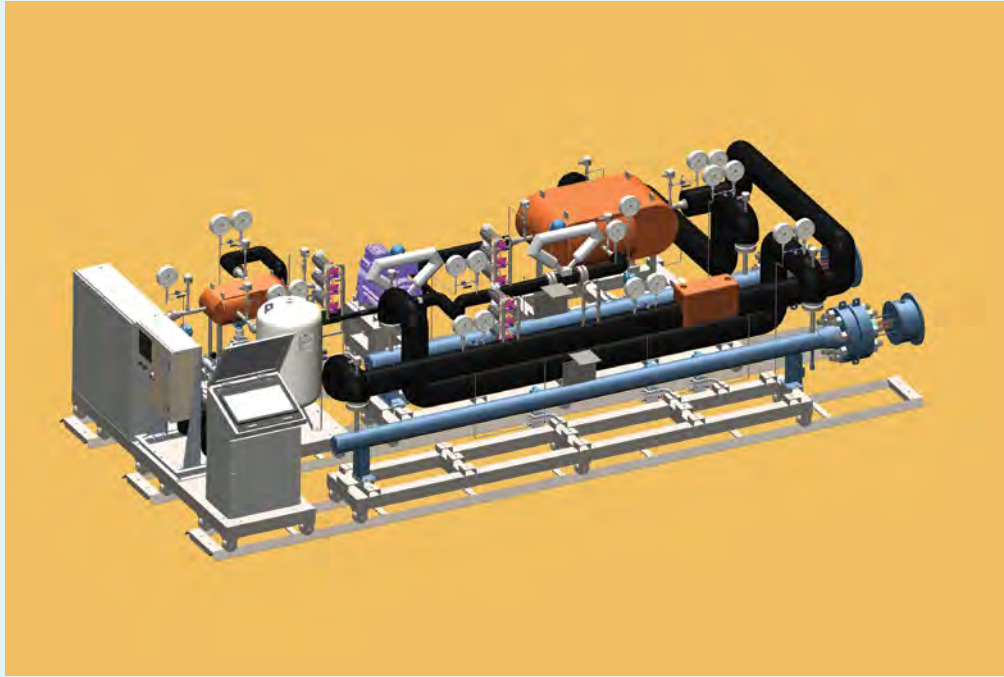
Interdisciplinary research has emerged as a crucial part of the research landscape in recent years. By breaking down departmental barriers, interdisciplinary research facilitates novel breakthroughs that may not be possible within the confines of a particular discipline. The Division of Interdisciplinary Research has a wide range of Departments/Centres with the common theme of a strong interdisciplinary focus.

RESEARCH SNAPSHOTS

- Researchers from the Centre for Nano Science and Engineering have grown a plate of brain cells of a rat on a specialized tiny glass plate covered with multiple electrodes. These electrodes interface with sensors and actuators, making it an artificial brain which can be taught to control a robot. [Jude Baby George et al. and **Bharadwaj Amrutur**. Robot navigation using neuro-electronic hybrid systems. *28th International Conference on VLSI Design and 14th International Conference on Embedded Systems*. 2015]



- Today's thermal power plants use steam to carry heat away from the source and turn a turbine to generate power. However, one could generate more power if, instead of steam, supercritical carbon dioxide (S-CO₂) is used. Scientists from the Department of Mechanical Engineering are taking steps towards making this a reality by setting up a solar plant at a laboratory-scale to more efficiently generate power. [Pardeep Garg, **Pramod Kumar, Pradip Dutta**, Thomas Conboy and Clifford Ho. Design of an Experimental Test Facility for Supercritical CO₂ Brayton Cycle. *ASME Proceedings. Geothermal, Ocean, and Emerging Energy Technologies*. doi:10.1115/ES2014-6549]





Division of Mechanical Sciences

119
FACULTY MEMBERS

84
FELLOWSHIPS OF
SCIENCE AND ENGINEERING
ACADEMIES IN INDIA

88 PhD AND **107** MASTERS
STUDENTS GRADUATED
IN 2015-16

602
PHD STUDENTS

295
MASTERS STUDENTS



Aerospace Engineering
Estd: 1942 | Chair: Prof. S Gopalakrishnan

Centre for Product Design and Manufacturing
Estd: 1998 | Chair: Prof. Amaresh Chakrabarti

Chemical Engineering
Estd: 1943 | Chair: Prof. Ganapathy K Ayappa

Materials Engineering
Estd: 1945 | Chair: Prof. TA Abinandanan

Mechanical Engineering
Estd: 1945 | Chair: Prof. Pradip Dutta

Civil Engineering
Estd: 1950 | Chair: Prof. Sudhakar M Rao

Centre for Earth Sciences
Estd: 2007 | Chair: Prof. D Nagesh Kumar

Centre for Atmospheric and Oceanic Sciences
Estd: 1982 | Chair: Prof. Ravi S Nanjundiah

Centre for Sustainable Technologies
Estd: 1974 | Chair: Prof. HN Chanakya

Divecha Centre for Climate Change
Estd: 2009 | Chair: Prof. SK Satheesh

Division of Mechanical Sciences



CHAIRPERSON:
PROF. VIKRAM JAYARAM

CORE RESEARCH AREAS

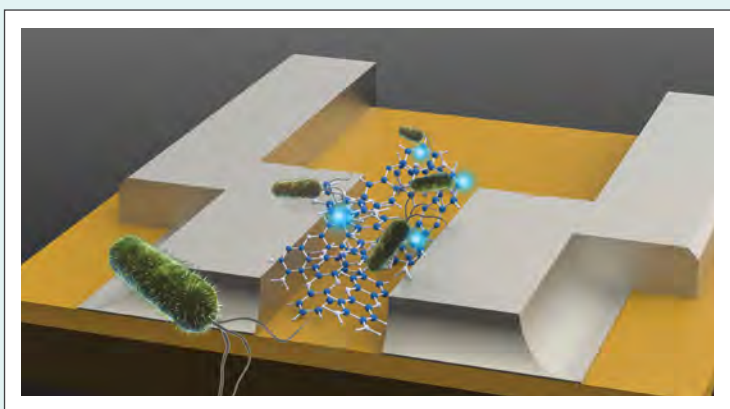
Geotechnical Engineering, Civil and Aerospace Structures, Transportation, Water Resources, Environmental Engineering and Sustainable Habitat, Climate, Structural and Functional Materials, Manufacturing, Design Theory and Methodology, Geochemistry, Tectonics, Planetary Evolution, Remote Sensing and GIS Applications, Aerodynamics, Combustion, Navigation and Guidance, Solid Mechanics, Fluid Mechanics, Thermal Sciences, Acoustics, Robotics, Dynamics, Biomolecular Engineering, Catalysis, Colloids and Interfacial Science, Nanotechnology, Thermodynamics and Simulations across length scales.

THEMES

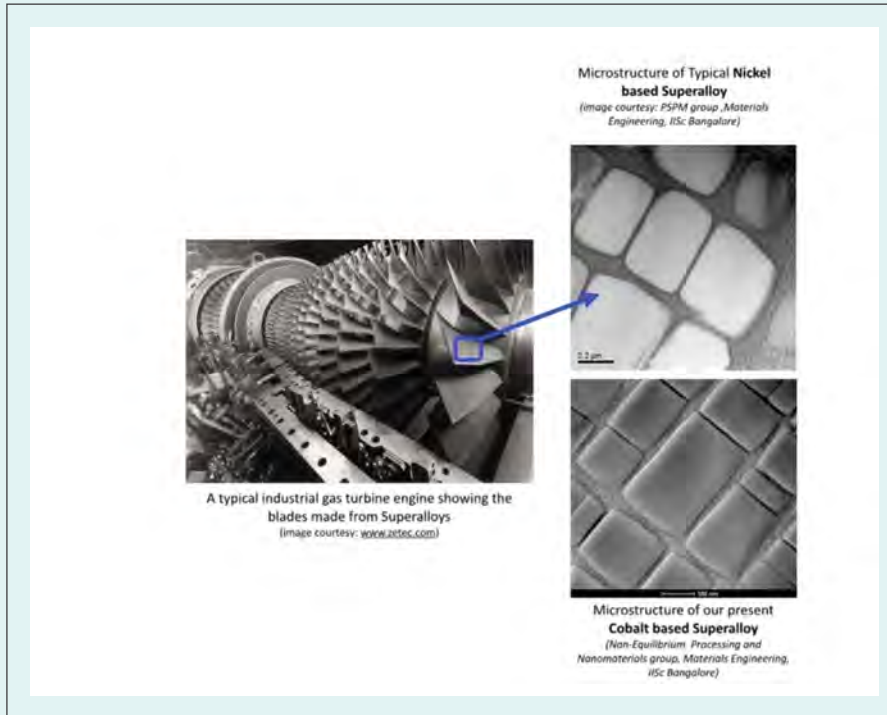
Research work in the Division encompasses diverse areas. Seismology and climate change – modelling as well as paleo studies – are focus areas, which lead naturally to work on environmentally sustainable materials and design and on waste management. The work on materials includes study and modelling of biomaterials, polymers and photovoltaics. Fluid dynamics, including shock waves and other phenomena at hypersonic speeds, is another key area of study that cuts across the various departments in this Division. Researchers in this Division also work on identifying novel drug and vaccine targets for viral infections such as HIV, hepatitis C and dengue.

RESEARCH SNAPSHOTS

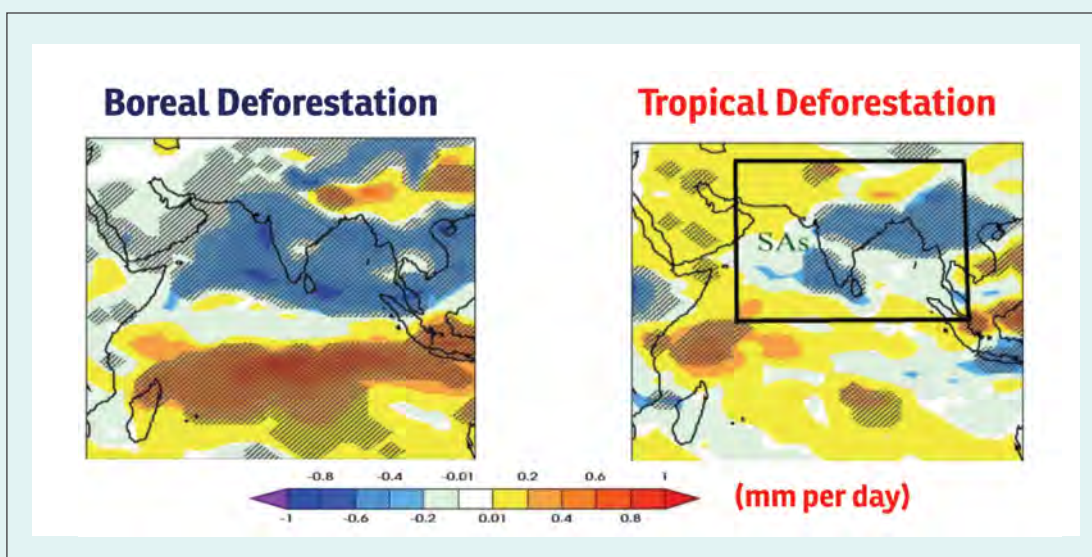
- *E. coli* is a common bacterium found in our environment which can cause serious infections in humans. Researchers from the Department of Materials Engineering have developed an *E. coli* sensor, made of a polymer whose resistance changes with minute changes in the number of *E. coli*. [Ashwini N Mallya and **Praveen C Ramamurthy**. Conjugated molecule based resistive sensor for microbial detection in water with *E. coli* as a case study. *ACS Sensors* (Communicated)]



- Turbines in jet engines have superalloys usually made from nickel to withstand very high temperatures. "Green" fuels will be the norm in the future, but these are more corrosive. Engineers from the Department of Mechanical Engineering have synthesized corrosion resistant cobalt-based superalloys for use in jet engines. [SK Makineni, B Nithin and **K Chattopadhyay**. Synthesis of a new tungsten-free γ - γ' Cobalt-based superalloy by tuning alloying additions. *Acta Materialia*, 2015, 85:85–94]

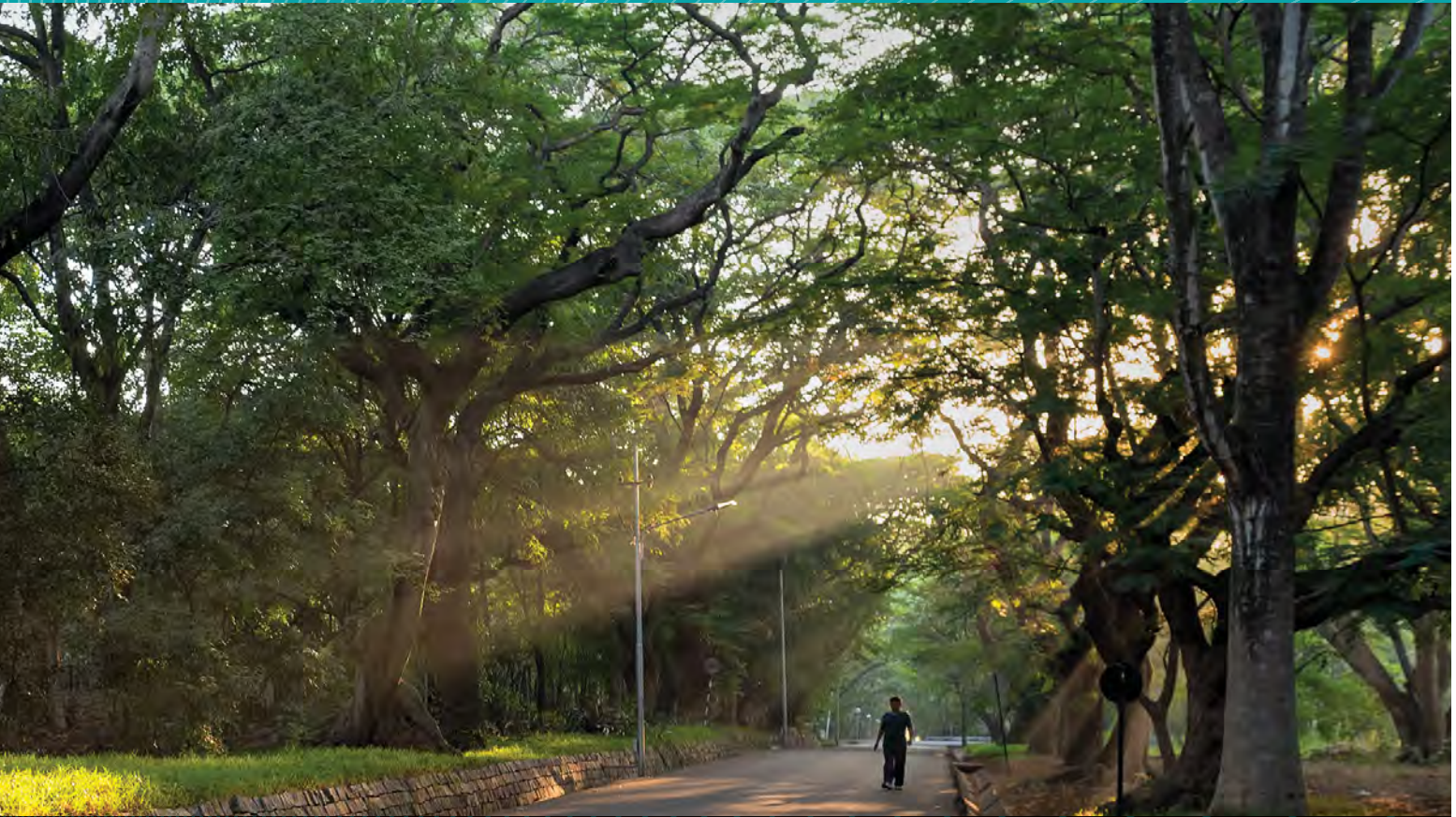


- Deforestation is among the biggest threats to our ecology as well as our long term well-being. But we are still studying the many different ways in which they could affect our ecosystems. Scientists from the Divecha Centre for Climate Change have developed a computer simulation which has demonstrated that rainfall in India is affected more by deforestation in higher latitudes than local deforestation. [N Devaraju, **Govindasamy Bala**, and Angshuman Modak. Effects of large-scale deforestation on precipitation in the monsoon regions: Remote versus local effects. *PNAS*, 2015, 112(11): 3257–3262.]





Division of Physical and Mathematical Sciences



73
FACULTY MEMBERS

58
FELLOWSHIPS OF
SCIENCE ACADEMIES IN INDIA

39 PhD AND **2** MASTERS
STUDENTS GRADUATED
IN 2015-16

262
PhD STUDENTS

16 MASTERS STUDENTS

94
INTEGRATED PhD STUDENTS

Centre for Cryogenic Technology
Estd: 1971 | Chair: Prof. V Venkataraman

Centre for High Energy Physics
Estd: 2004 | Chair: Prof. B Ananthanarayan

Instrumentation and Applied Physics
Estd: 1996 | Chair: Prof. S Asokan

Mathematics
Estd: 1956 | Chair: Prof. Gadadhar Misra

Physics
Estd: 1933 | Chair: Prof. V Venkataraman

Division of Physical and Mathematical Sciences



CHAIRPERSON:
PROF. RAHUL PANDIT

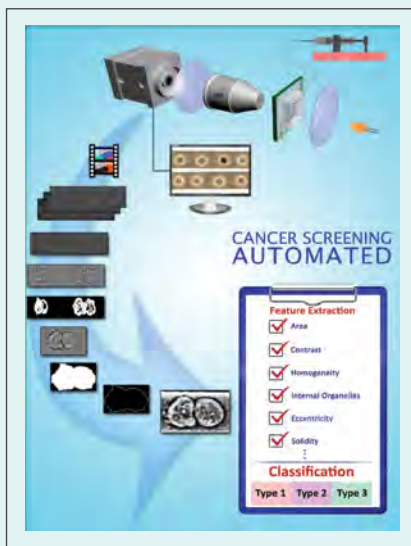
CORE RESEARCH AREAS

Research in the Division covers a wide variety of areas in the Physical Sciences, including fundamental investigations in String Theory, Particle Phenomenology, Field Theory, Condensed Matter Physics, both theoretical and experimental, Soft-Matter and Complex Systems, Biology-Inspired Physics, Biomolecular Structure and Biophysics, Atomic and Optical Physics, Astronomy and Astrophysics, and cutting-edge Applied Physics research including MEMS-based and Fibre-Optic Sensors, Multifunctional Materials, such as graphene and carbon nanotubes, Super-Resolution Fluorescence Microscopy, Nano-Scale Imaging, Optics and Microfluidics, Energy and Health Monitoring Instrumentation, and Cryogenic Technologies, including Cryocoolers, Cryogenic Instrumentation, and Cryogenic treatment on materials. Research in Mathematics covers major areas, both pure and applied, including Probability, Partial Differential Equations, Analysis, Geometry, Topology, Algebra, Algebraic Geometry, and Analytic Number Theory.

THEMES

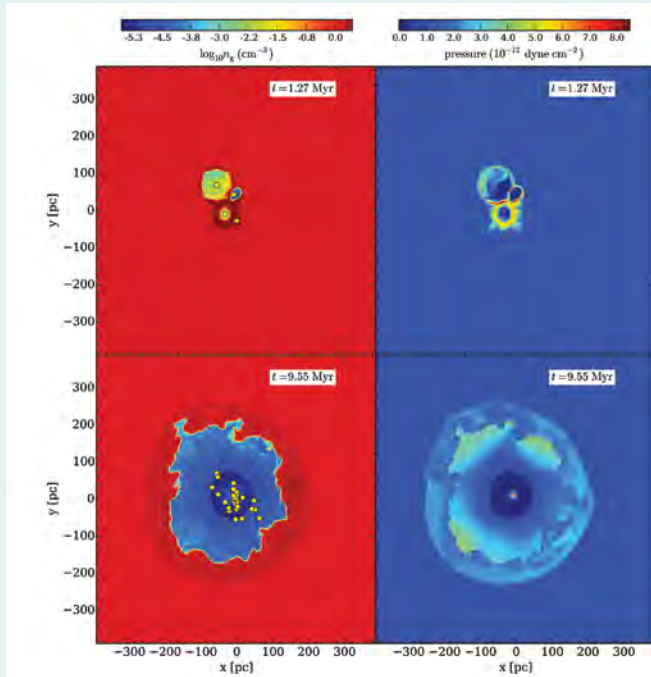
Given the diversity of this Division, there is a diversity of themes in research. These can be gleaned from the core research areas mentioned above. Many of these areas lie in the exact sciences, both theoretical and experimental. Along with these, there are growing interdisciplinary programmes, such as in Mathematical Biology and Nanoscience. Translational research is also being carried out and products, based on innovative and cutting-edge technologies, are being brought into the market by faculty entrepreneurs in the division.

RESEARCH SNAPSHOTS



- Researchers from the Department of Instrumentation and Applied Physics have combined microfluidic microscopy and digital cytology to create a malignant cell surveillance system which can be used for cancer screening. [G Gopakumar, VK Jagannadh, **SS Gorthi**, & GRKS Subrahmanyam, Framework for Morphometric Classification of Cells in Imaging Flow Cytometry, *Journal of Microscopy*, 2016, 261(3): 307-319.]

- IISc's new petaflop computer SahastraT is being used by researchers from several disciplines. For instance, astrophysicists from the Department of Physics, using SahastraT, have developed a hydrodynamic 3D model which shows how supernovae coalesce into superbubbles. [N Yadav, D Mukherjee, **P Sharma**, and BB Nath, Supernovae under microscope: how supernovae overlap to form superbubbles, arXiv:1603.00815, 2016]







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