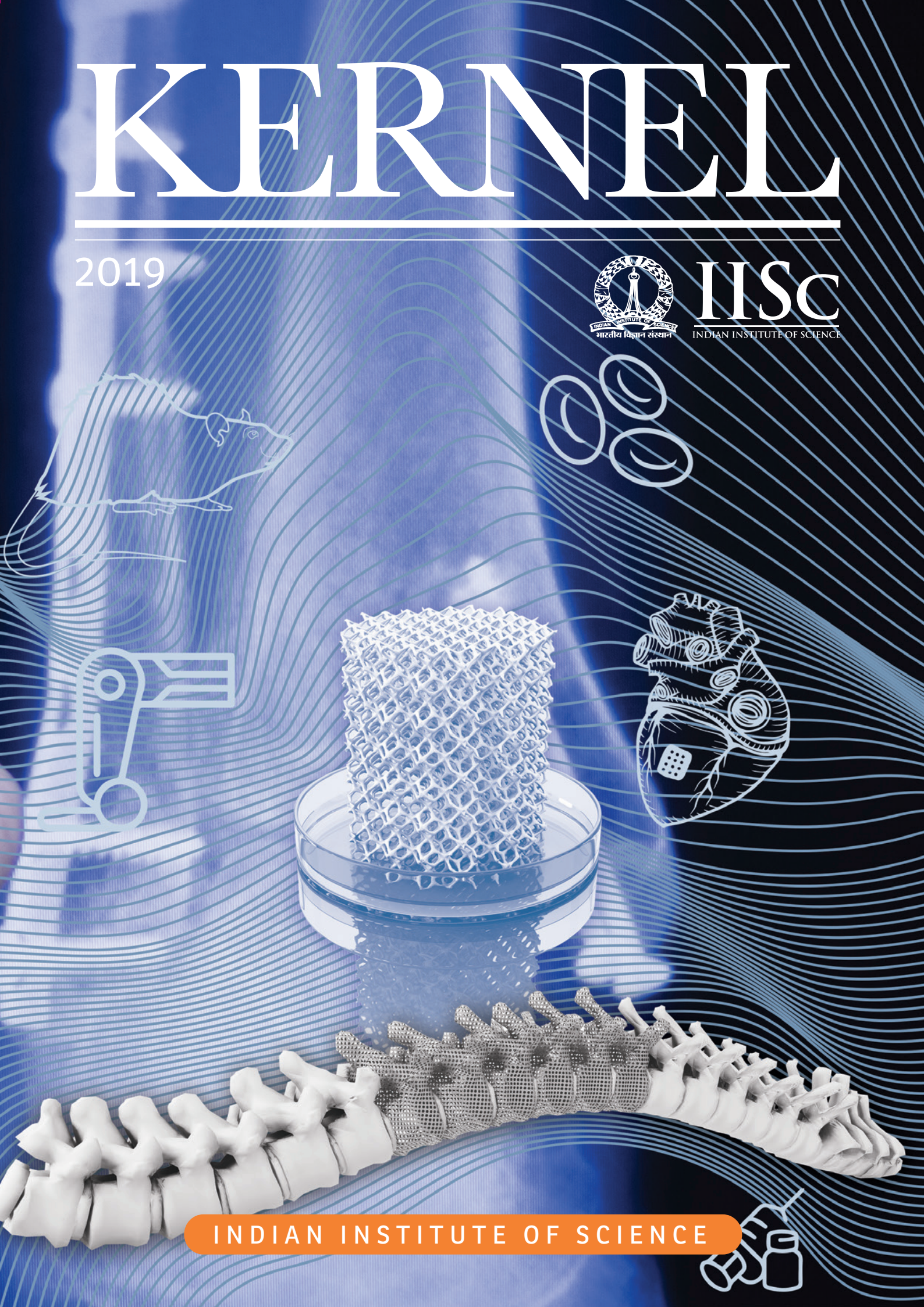
KERNEL

2019

IISc
INDIAN INSTITUTE OF SCIENCE



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The cover image of this issue of *Kernel* depicts research in biomaterials science and biomedical engineering at IISc. These research advances have various clinical applications, ranging from orthopedics to neurological and cardiovascular diseases.

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From the Director

Greetings from the Indian Institute of Science (IISc).

Established in 1909, IISc is India's leading institution of advanced education and research in the sciences and in engineering. Since its inception, IISc has laid a balanced emphasis on the pursuit of basic knowledge, as well as on the application of its research findings for industrial and societal benefit.

IISc's high reputation ensures that it attracts the best of young faculty members trained in the best laboratories around the world. Our faculty, numbering around 500, carries out research in most areas of the basic and applied sciences, publishing vigorously in premier journals. This year, as in previous years, several of them have won national and international accolades for their research.

With some of the best students in the country seeking entry into IISc, this institute places emphasis on a strong research training programme, and the pursuit of cutting-edge research by all its students. IISc has a student population of nearly 4200 students, of which there are about 2700 doctoral students, roughly 900 master's degree students in the engineering disciplines, and about 500 students in a four-year, research oriented undergraduate program in the sciences. The doctoral students are carefully selected based on their performance in national examinations, in addition to personal interviews. All the degree programmes involve exposure to research through course projects, and dissertation research.

In 2017, the Government of India announced an initiative to select a few institutions of higher education to enable them to reach higher levels in the global rankings; such institutions would be designated as Institutes of Eminence (IoE). Through a competitive process, in 2018, IISc was selected by the Ministry of Human Resource Development as an IoE. Under the IoE scheme, IISc will not only obtain greater autonomy but substantial additional funding (which will have to be matched by IISc).

The untiring efforts of our faculty, students, and administrative staff have ensured that IISc is India's top-ranked institution. However, I would be remiss if I did not acknowledge the unflinching support of the members of the Court and the Council in taking IISc to where it stands today. Their continued guidance will be crucial as we embark on a future filled with challenges and endless possibilities.

In the recent years, IISc has also made a conscious effort to reach out to other academic institutions, industry, and indeed the rest of our society. An important initiative as part of this endeavour is the publication of our annual magazine *Kernel,* which aims to reacquaint you with this institute and provide you with a flavour of the kind of research that is carried out here. This issue highlights a few examples of research in biological sciences, oceanic sciences, biotechnology, and nanotechnology.

And as in previous issues of *Kernel,* this one too describes the academic structure of the IISc and showcases its achievements through numbers.

Anurag Kumar
Director

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. 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 Court: **N Chandrasekaran**

Chair of Governing Council: **P Rama Rao**

Director: **Anurag Kumar**

Deans:
Biman Bagchi (Science)
K Kesava Rao (Engineering)
PS Anil Kumar (Undergraduate Programme)

Registrar: **V Rajarajan**

The Governing Council

The Council is the principal authority of the Institute and its membership includes nominees of the Government of India, Government of Karnataka, Tata Trusts, University Grants Commission, Parliament of India, Court of IISc, All India Council for Technical Education, Council of Scientific & Industrial Research, besides ex-officio members from IISc.

P Rama Rao
Chair of the Council
Former Vice Chancellor
University of Hyderabad
Hyderabad (Court Representative)

R Subramanyam
Secretary, Min. of Human Resource Development
Govt. of India

VLVSS Subba Rao
Economic Advisor, Min of Human Resource Development
Govt of India (GoI Nominee)

AS Kiran Kumar
Former Secretary, Dept of Space,
Govt of India (GoI Nominee)

N Nagambika Devi
Principal Secretary, Higher Education Dept, Govt of Karnataka (GoK Nominee)

ISN Prasad
Additional Chief Secretary, Finance Dept.,
Govt of Karnataka (GoK Nominee)

JJ Irani
Director
Tata Sons Ltd (Tata Trust Nominee)

R Venkataramanan
Managing Trustee
Sir Dorabji Tata Trust
(Tata Trust Nominee)

Rajendra Prasad
Director, Amity Institute of Biotechnology
Amity Univ (UGC Representative)

Murli Manohar Joshi
Member of Parliament
Lok Sabha (Parliament Representative)

Suresh C Angadi
Member of Parliament
Lok Sabha (Parliament Representative)

Narendra Jadhav
Member of Parliament
Rajya Sabha (Parliament Representative)

MK Bhan
Former Secretary, Dept of Biotechnology
Govt of India (Court Representative)

RS Bawa
Vice Chancellor
Chandigarh University (Indian Universities Representative)

Sandeep Sancheti
Vice Chancellor
SRM Institute of Science & Technology (Indian Universities Representative)

Anil D Sahasrabudhe
Chairman
AICTE, New Delhi (Rep. AICTE)

Shekhar C Mande
Director General
CSIR (CSIR Representative)

Anurag Kumar
Director (Ex-officio)

Biman Bagchi
Science Faculty Dean (Ex-officio)

K Kesava Rao
Engineering Faculty Dean
(Ex-officio)

V Rajarajan
Registrar (Ex-officio)

Deans

Biman Bagchi
Dean
Faculty of Science

K Kesava Rao
Dean
Faculty of Engineering

PS Anil Kumar
Dean
UG Programme

Nagasuma Chandra
Associate Dean
UG Programme

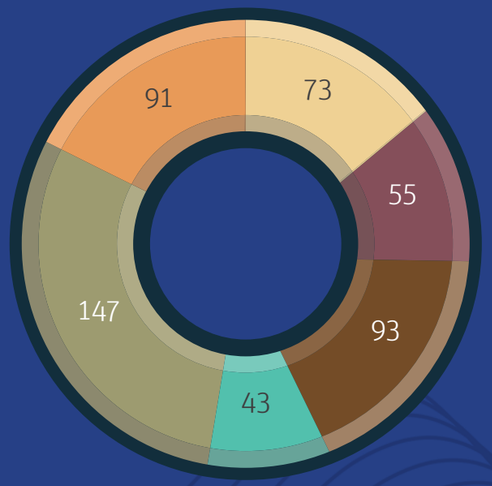
Deputy Directors

Rudra Pratap
Deputy Director
Planning and
Infrastructure

Jayant Modak
Deputy Director
Administration and Finance

IISc in Numbers

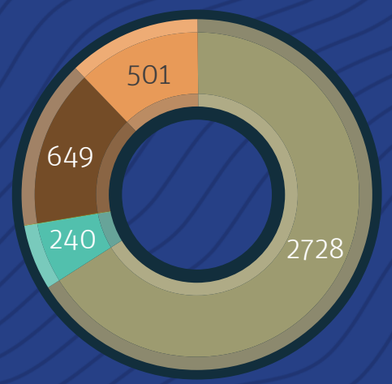
FACULTY MEMBERS AND SCIENTIFIC STAFF



- Biological Sciences
- Chemical Sciences
- Electrical, Electronics and Computer Science
- Mechanical Sciences
- Interdisciplinary Research
- Physical and Mathematical Sciences

Total: 502

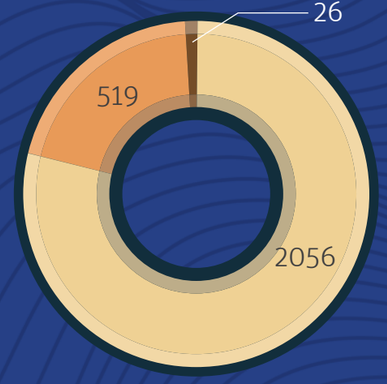
STUDENTS ON ROLL



- PhD/ Int PhD
- MSc (Eng)/MTech (Res)
- Other Master's programmes (ME / MTech / MDes / MMgt)
- BSc (Research)

Total: 4118

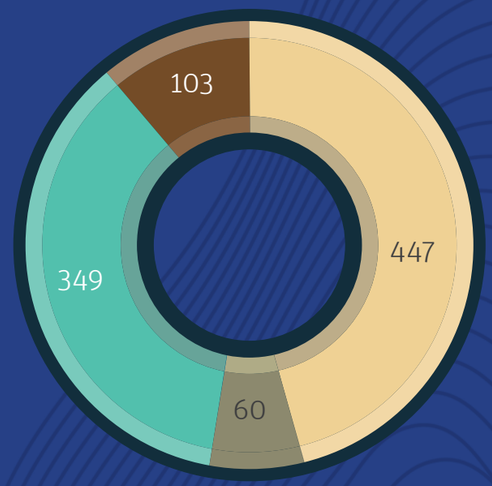
PUBLICATIONS 2018



- Journal Articles
- Conference Publications
- Books and Book Chapters

Total: 2601

DEGREES AWARDED 2018



- PhD/Int PhD
- MSc (Eng)/MTech (Res)
- Other Master's programmes
- BSc (Research)

Total: 959

AWARDS (CUMULATIVE)

Bharat Ratna	2
Padma Vibhushan	3
Padma Bhushan	14
Padma Shri	17
Shanti Swarup Bhatnagar Prize	95

AWARDS (AMONG SERVING FACULTY)

Infosys Prize	5
Swarnajayanthi Fellowship Award	31
JC Bose National Fellowship Award	68
Padma Awards	6
Shanti Swarup Bhatnagar Prize	58
WellcomeTrust-DBT Fellowship Award	28

FELLOWSHIPS OF SCIENCE ACADEMIES (AMONG SERVING FACULTY)

Indian Academy of Sciences (IASc)	102
Indian National Science Academy (INSA)	91
National Academy of Sciences, India (NASI)	74
Indian National Academy of Engineering (INAE)	59
The World Academy of Sciences (TWAS)	30
The Royal Society	1
Institute of Electrical and Electronics Engineers (IEEE)	9

IISc:
India's Best Institution

IISc was named India's best institution of higher learning in 2018 – both in the overall category and among universities, according to rankings brought out by NIRF (National Institutional Ranking Framework) under the auspices of MHRD. IISc also received the top place in 2017 and 2016, when the rankings were first introduced.


Government of India
Ministry of Human Resource Development

nirf

India Rankings 2018

(National Institutional Ranking Framework)

Indian Institute of Science, Bengaluru

ranked 1 in Overall Category

CHAIRMAN, NBA

MEMBER SECRETARY, NBA


Government of India
Ministry of Human Resource Development

nirf

India Rankings 2018

(National Institutional Ranking Framework)

Indian Institute of Science, Bengaluru

ranked 1 in University Category

CHAIRMAN, NBA

MEMBER SECRETARY, NBA

Divisions

THE INSTITUTE COMPRISES SIX ACADEMIC DIVISIONS:

Biological Sciences

Chemical Sciences

Electrical, Electronics, and Computer Science

Interdisciplinary Research

Mechanical Sciences

Physical and Mathematical Sciences

DIVISION OF BIOLOGICAL SCIENCES

Umesh Varshney
Divisional Chair

73
FACULTY AND SCIENTIFIC STAFF

4
MASTER'S STUDENTS

3
MASTER'S STUDENTS GRADUATED IN 2018

423
PhD / INTEGRATED PhD STUDENTS

79
PhD STUDENTS GRADUATED IN 2018

Biochemistry
Estd: 1921 | Chair: C Jayabaskaran

Centre for Ecological Sciences
Estd: 1983 | Chair: Rohini Balakrishnan

Microbiology and Cell Biology
Estd: 1941 | Chair: Usha Vijayraghavan

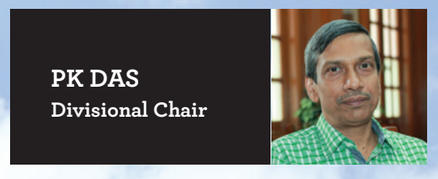
Centre for Infectious Diseases Research
Estd: 2014 | Convener: Dipankar Nandi

Centre for Neuroscience
Estd: 2009 | Chair: Aditya Murthy

Molecular Biophysics Unit
Estd: 1971 | Chair: N Srinivasan

Central Animal Facility
Estd: 1971 | Chair: Kumaravel Somasundaram

Molecular Reproduction, Development and Genetics
Estd: 1989 | Chair: Sandhya S Visweswariah



PK DAS
Divisional Chair

DIVISION OF CHEMICAL SCIENCES

55
FACULTY AND SCIENTIFIC STAFF

4
MASTER'S STUDENTS

388
PhD / INTEGRATED PhD STUDENTS

53
PhD STUDENTS GRADUATED IN 2018

Inorganic and Physical Chemistry
Estd: 1909 | Chair: E Arunan

Materials Research Centre
Estd: 1978 | Chair: KK Nanda

NMR Research Centre
Estd: 1977 | Chair: N Suryaprakash

Organic Chemistry
Estd: 1911 | Chair: N Jayaraman

Solid State and Structural Chemistry Unit
Estd: 1976 | Chair: Aninda J Bhattacharyya

DIVISION OF ELECTRICAL, ELECTRONICS, AND COMPUTER SCIENCE

Y NARAHARI
Divisional Chair

93
FACULTY AND SCIENTIFIC STAFF

411
MASTER'S STUDENTS

58
PhD STUDENTS GRADUATED IN 2018

384
PhD STUDENTS / INTEGRATED PhD STUDENTS

156
MASTER'S STUDENTS GRADUATED IN 2017

Computer Science and Automation
Estd: 1969 | Chair: Shalabh Bhatnagar

Electrical Communication Engineering
Estd: 1946 | Chair: A Chockalingam

Electrical Engineering
Estd: 1911 | Chair: G Narayanan

Electronic Systems Engineering
Estd: 1974 | Chair: Joy Kuri

G Rangarajan
Divisional Chair

DIVISION OF INTERDISCIPLINARY RESEARCH

43
FACULTY AND SCIENTIFIC STAFF

120
MASTER'S STUDENTS

43
MASTER'S STUDENTS GRADUATED IN 2018

388
PhD / INTEGRATED PhD STUDENTS

67
PhD STUDENTS GRADUATED IN 2018

Centre for BioSystems Science and Engineering
Estd: 2015 | Chair: GK Ananthasuresh

Centre for Society and Policy
Estd: 2004 | Chair: Anjula Gurtoo

Centre for Infrastructure, Sustainable Transportation and Urban Planning
Estd: 2009 | Chair: Abdul Rawoof Pinjari

Centre for Nano Science and Engineering
Estd: 2010 | Chair: Navakanta Bhat

Computational and Data Sciences
Estd: 2015 | Chair: Sashikumar Ganesan

Management Studies
Estd: 1985 | Chair: Parthasarathy Ramachandran

Interdisciplinary Centre for Energy Research
Estd: 2012 | Chair: S Dasappa

Robert Bosch Centre for Cyber Physical Systems
Estd: 2011 | Chair: Bharadwaj Amrutur

Supercomputer Education and Research Centre
Estd: 1970 | Chair: Sathish Vadhiyar

DIVISION OF MECHANICAL SCIENCES

VIKRAM JAYARAM
Divisional Chair

147
FACULTY AND SCIENTIFIC STAFF

289
MASTER'S STUDENTS

114
MASTER'S STUDENTS GRADUATED IN 2018

719
PhD / INTEGRATED PhD STUDENTS

112
PhD STUDENTS GRADUATED IN 2018

Aerospace Engineering
Estd: 1942 | Chair: Joseph Mathew

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

Chemical Engineering
Estd: 1943 | Chair: Ganapathy K Ayappa

Materials Engineering
Estd: 1945 | Chair: TA Abinandanan

Mechanical Engineering
Estd: 1945 | Chair: Pradip Dutta

Civil Engineering
Estd: 1950 | Chair: Sudhakar M Rao

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

Centre for Atmospheric and Oceanic Sciences
Estd: 1982 | Chair: Debasis Sengupta

Centre for Sustainable Technologies
Estd: 1974 | Chair: BV Venkatarama Reddy

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

DIVISION OF PHYSICAL AND MATHEMATICAL SCIENCES

RAHUL PANDIT
Divisional Chair

91
FACULTY AND SCIENTIFIC STAFF

12
MASTER'S STUDENTS

9
MASTER'S STUDENTS GRADUATED IN 2018

426
PhD / INTEGRATED PhD STUDENTS

78
PhD STUDENTS GRADUATED IN 2018

Centre for Cryogenic Technology
Estd: 1971 | Chair: Prabal Kumar Maiti

Centre for High Energy Physics
Estd: 2004 | Chair: Justin R David

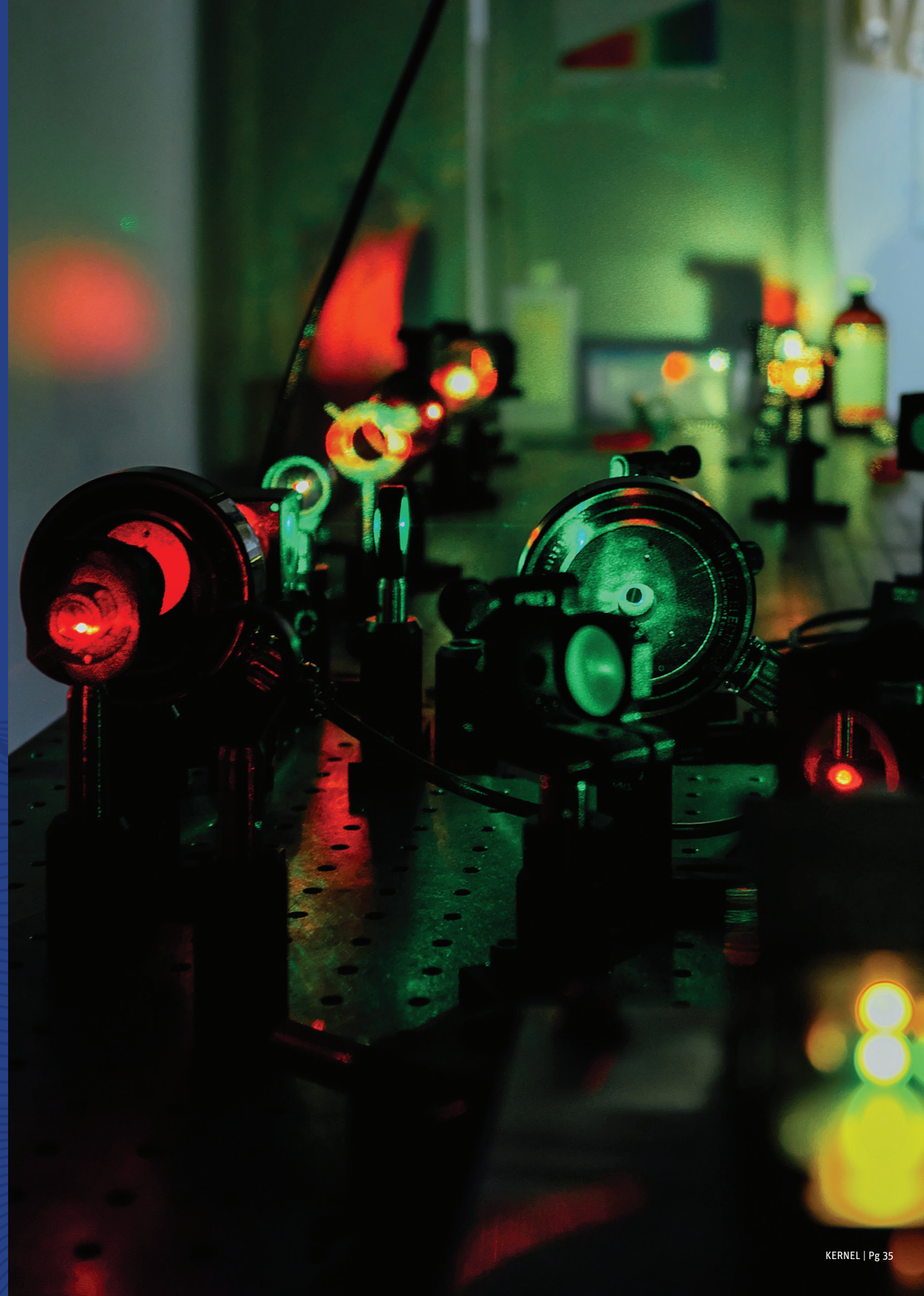
Instrumentation and Applied Physics
Estd: 1996 | Chair: S Asokan

Mathematics
Estd: 1956 | Chair: Gadadhar Misra

Physics
Estd: 1933 | Chair: Prabal Kumar Maiti

Research Highlights

Each year, the faculty members of the Institute and their students publish over 2500 research papers in internationally recognised peer-reviewed journals and conference proceedings. This section offers a glimpse of the cutting-edge research conducted during this past year at IISc in various fields of science and engineering.



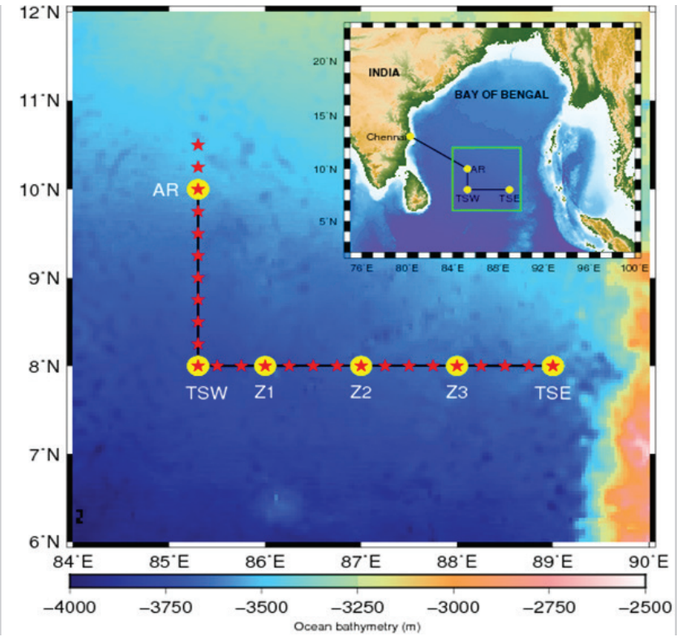
The Bay of Bengal Boundary Layer Experiment

PN Vinayachandran
Professor
Centre for Atmospheric & Oceanic Sciences

The Bay of Bengal (BoB) plays a fundamental role in controlling the weather systems that make up the South Asian summer monsoon system. The BoB Boundary Layer Experiment (BoBBLE) was jointly undertaken by India and the United Kingdom during June–July 2016, on board *RV Sindhu Sadhana,* to study the characteristics of the southern Bay of Bengal and the overlying atmosphere. Physical and biogeochemical observations were made using a conductivity–temperature–depth (CTD) profiler, five ocean gliders, an Oceanscience Underway CTD, a vertical microstructure profiler, two acoustic Doppler current profilers, Argo floats, drifting buoys, meteorological sensors, and upper-air radiosonde balloons.

The observations were made along a zonal section at 8°N between 85.3° and 89°E with a 10-day time series at 8°N, 89°E. The BoBBLE observations mapped the Sri Lanka Dome (SLD, an intense cyclonic eddy) and the Southwest Monsoon Current (SMC) in different stages of their seasonal evolution. This experiment took place during a suppressed phase of the intraseasonal oscillation. It captured two significant events: one, the warming of the ocean mixed layer and the preconditioning of the atmosphere towards the formation of monsoon clouds and two, relatively fresher water covering the surface leading to the formation of thick barrier.

Reference: PN Vinayachandran et al. 2018. BoBBLE: Ocean–Atmosphere interaction and its impact on the South Asian Monsoon, *Bull. Amer. Meteorol. Soc.,* 8:1569-1587. DOI: 10.1175/BAMS-D-16-0230.1.



Shading indicates bottom topography of the study area with the scale indicated at the bottom of the panel

BoBBLE was a joint study carried out by Indian and British researchers to better understand the role of the Bay of Bengal in South Asian Summer monsoon system

Destroying Cancer Cells by Inhibiting DNA Repair Mechanisms

Sathees C Raghavan
Professor
Department of Biochemistry

DNA repair refers to a suite of processes that have evolved to correct damage to DNA molecules which encode an organism's genome. A major kind of damage to a cell's DNA is called DNA double-strand break (DSB). In mammals, DSB is mended by two repair mechanisms: Homologous Recombination (HR) and Nonhomologous End Joining (NHEJ). And because DNA repair is upregulated, these mechanisms make an excellent target for cancer therapy.

The first breakthrough in cancer therapeutics targeting NHEJ came from Raghavan's group with the discovery of SCR7 which inhibits an enzyme called Ligase IV. SCR7 was shown to prevent tumour progression in multiple mouse models. Importantly, the amount of radiation required was reduced by about half when used in combination with SCR7. Recently, his lab has also demonstrated that SCR7 can be modified into stable forms called SCR7-cyclised and SCR7-pyrazine both of which exhibit anti-cancer properties with the former being more specific.

SCR7, already patented in India and the US (the patent application has been filed in Europe as well), has therefore become a popular small molecule inhibitor around the world among several research groups. Currently, novel derivatives of SCR7 are also being characterized for better efficacy in cancer therapeutics.

Reference: SV Vartak et al. 2018. Autocyclized and oxidized forms of SCR7 induce cancer cell death by inhibiting nonhomologous DNA end joining in a Ligase IV dependent manner. *FEBS J.* 285(21):3959-3976. DOI:10.1111/febs.14661.

The article was also chosen to be featured as the cover page article in *FEBS. J*

Raghavan's lab has shown how inhibiting DNA repair mechanisms with the help of a molecule called SCR7 can kill cancer cells

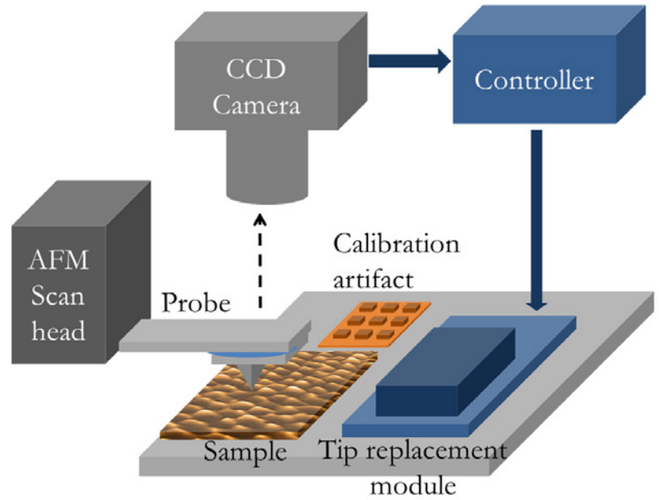
Automated tips for Atomic Force Microscopes

GR Jayanth
Associate Professor
Instrumentation and Applied Physics

The Atomic Force Microscope (AFM), invented in 1986, has facilitated several path-breaking advances at the nanometer length scale. An atomically sharp tip mounted on a micro-cantilever probe is employed to interact with samples and sense the forces of interaction. By regulating these forces while the tip moves relative to the sample, it is possible to map surface topography, measure material properties, and manipulate matter with nanometer scale precision. Every application of AFM is crucially dependent on the quality of its tip, but its quality degrades with time owing to contamination, wear and fracture. Replacement of the AFM probe in these circumstances is expensive and the instrument would be inoperative for several tens of minutes.

Jayanth and his team are developing an automated tip replacement module that can be retrofitted into commercial AFM instruments. This module improves their use in at least three ways: it brings down the cost, it dramatically reduces the down-time during tip, and finally, it enables the AFM probe to become an accessory of the instrument instead of being a consumable item.

Reference: KS Vikrant and GR Jayanth. 2019. An AFM tip-replacement system compatible with all ambient media and operation modalities. *Ultramicroscopy,* 196: 136-141. DOI: 10.1016/j.ultramic.2018.10.007



A schematic showing the Atomic Force Microscope with the tip replacement module

GR Jayanth's lab has made huge strides in developing automated tips for Atomic Force Microscopes

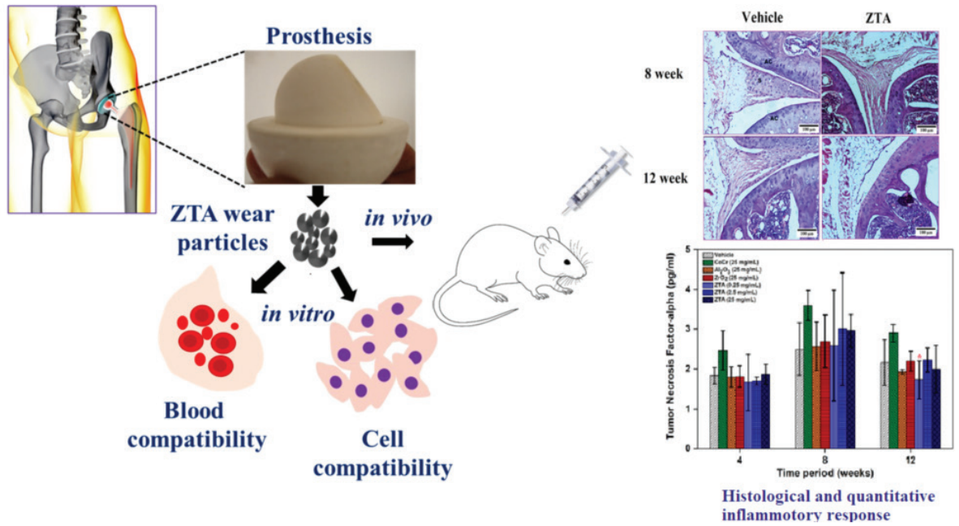
Biocompatibility of Orthopaedic Prostheses

Bikramjit Basu
Professor
Department of Materials Research Centre and Centre for Biosystems Science and Engineering

To increase the durability of orthopaedic prostheses, it is important to develop new bio-materials and to comprehensively investigate the biocompatibility properties to minimise the risk of implant failure. At present, the focus of intensive research is to fabricate various articulating bearings which generally produce less amount of wear debris. Recently in a preclinical testing with Balb/C mice, Bikramjit Basu's group has succeeded in establishing the "non-toxic nature" of finer ZrO2-toughened Al2O3 (ZTA) particles isolated from laboratory scale testing of femoral head/acetabular sockets mated surfaces of ZTA. More importantly, the group has reported an advantage of using ceramic based material over the metallic alloy (cobalt-chromium; CoCr), which is clinically being used as orthopaedic implant so far.

The study, published in *ACS Biomaterials Science and Engineering,* was also the Editor's pick and was featured on the cover of the journal.

Reference: N Bhaskar, D Sarkar, and B Basu. 2018. Probing Cytocompatibility, Hemocompatibility, and Quantitative Inflammatory Response in Mus musculus toward Oxide Bioceramic Wear Particulates and a Comparison with CoCr. *ACS Biomaterials Science and Engineering.* 4(9): 3194-3210. DOI: 10.1021/acsbiomaterials.8b00583



The experimental design and the inflammatory response of lab-scale generated wear particles of ZTA after intra-articular treatment in Balb/C mice

Bikramjit Basu's group has made significant strides in helping us understand the biocompatibility of orthopaedic prostheses which could help minimise the risk of implant failure

New Titanium Alloys for Implants

Kaushik Chatterjee

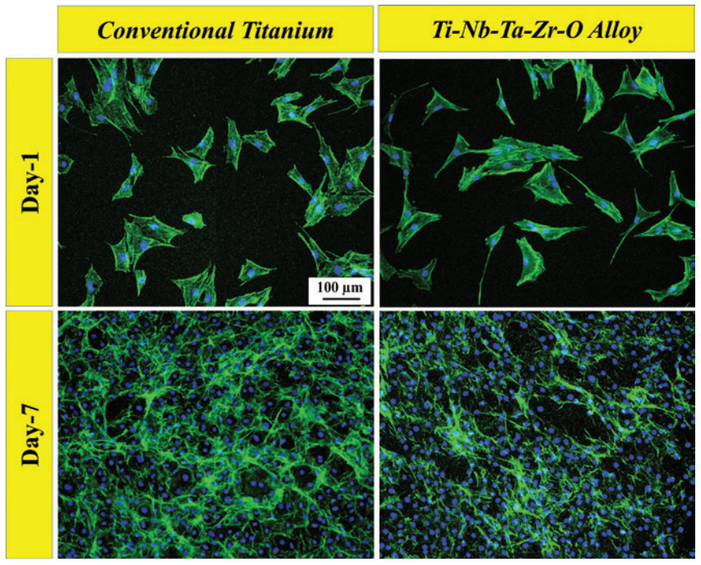
Associate Professor
Department of Materials Engineering and Center for Biosystems Science and Engineering

Orthopaedic implants for knee and hip arthroplasty are typically made of metallic alloys that contain potentially toxic elements like aluminium, vanadium and nickel. A few studies indicate that aluminium may even be associated with neurological disorders such as Alzheimer's disease. Also, the metallic alloys are much stiffer than human bones and don't bond well with them. In recent years, non-toxic titanium alloys have shown great promise in orthopaedic implants. To better enhance bonding between the bone and a titanium alloy consisting of titanium, niobium and tin, Chatterjee and his group have developed a strategy to increase the alloy's bioactivity using a technique known as surface mechanical attrition treatment (SMAT). This approach could help produce new titanium alloys that are less stiff compared to the ones used currently.

References:

1. S Bahl, SRK Meka, S Suwas, and K Chatterjee. 2018. Surface Severe Plastic Deformation of an Orthopedic Ti–Nb–Sn Alloy Induces Unusual Precipitate Remodeling and Supports Stem Cell Osteogenesis through Akt Signaling. *ACS Biomater. Sci. Eng.* 4(9): 3132-3142. DOI: 10.1021/acsbiomaterials.8b00406

2. S Acarya, AG Panicker, DV Laxmi, S Suwas, and K Chatterjee. 2019. Study of the influence of Zr on the mechanical properties and functional response of Ti-Nb-Ta-Zr-O alloy for orthopedic applications. *Materials & Design*. 164: 107555. DOI: 10.1016/j.matdes.2018.107555



Bone cells attach and grow on the newly developed alloys in a manner similar to conventional titanium

Kaushik Chatterjee's lab is developing new titanium alloys for general orthopaedic applications which are less stiff and non-toxic

Laminar–Turbulent Transition in Fluid Flows

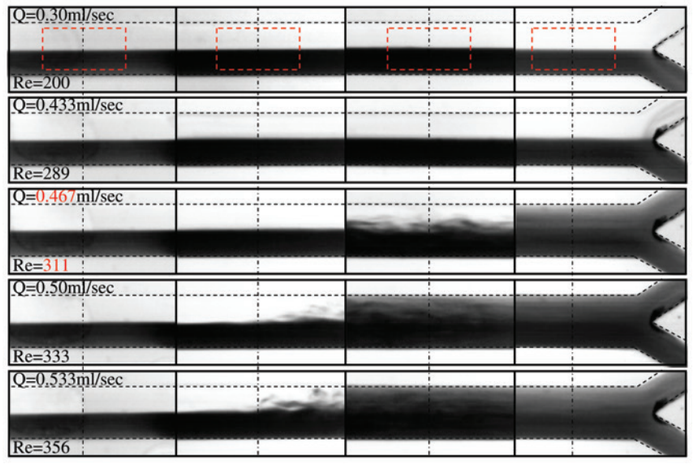
V Kumaran
Professor
Department of Chemical Engineering

There are two very distinct types of fluid flows – laminar and turbulent. Flows in configurations of small size and low speed are usually laminar, with smooth and steady streamlines. Flows that are approximately the size of humans or larger are invariably turbulent, containing fluid motion that is highly intermittent, chaotic and disordered. This transition from laminar to turbulent flow is of great practical importance, because turbulent flows result in very rapid mixing, which is necessary for large-scale processes that make our world habitable.

V Kumaran has studied the laminar–turbulent transition in flows that are relevant to physiological systems, where fluids flow through soft conduits. He has shown that the transition takes place at much lower flow velocities than expected and that the turbulence is more intense when the wall of the conduit is soft.

In the flow through a channel with soft walls, experiments in his lab have also shown that two distinct transitions – the soft-wall transition and the wall-flutter transition – exist, in addition to the hard-wall laminar–turbulent transition. He has also studied dense granular flows, and the effect of particle stiffness on the contact dynamics and rheology of such flows.

Reference: S Bharathraj and V Kumaran. 2018. Effect of particle stiffness on contact dynamics and rheology in a dense granular flow. *Phys. Rev. E* 97, 012902. DOI 10.1103/PhysRevE.97.012902



The laminar-turbulent transition in a channel with soft walls

V Kumaran has studied the laminar–turbulent transition in flows that are relevant to physiological systems, where fluids flow through soft conduits

Data Privacy in Collaborative Projects

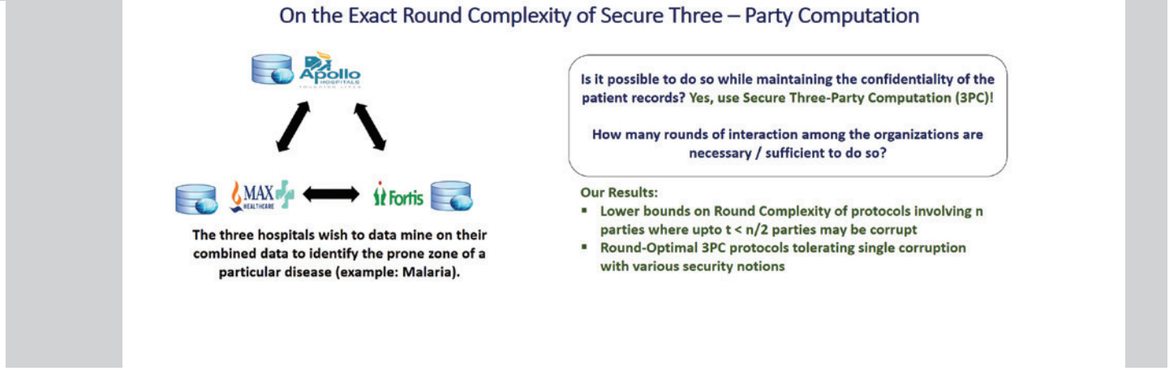
Arpita Patra
Assistant Professor
Department of Computer Science and Automation

Imagine a project where people from across the globe collaborate online – for example, different hospitals coming together to study the prevalence of disease – but without panicking about leaking of private data. And imagine if people can run this highly-secure collaboration in a short period of time, without compromising on its efficiency. Working to make this a reality is a study by Arpita Patra and her student Divya Ravi.

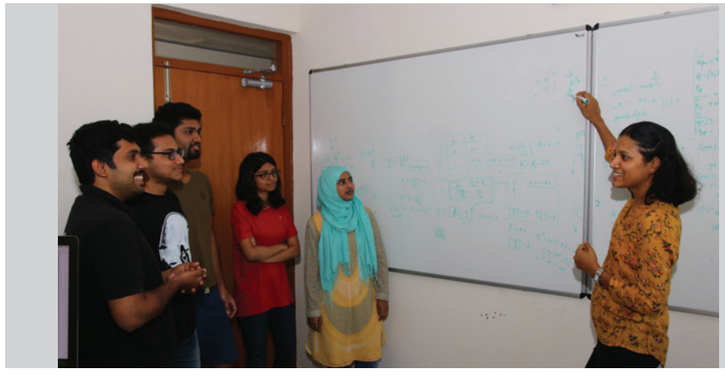
At the heart of this study is a concept called Secure Multiparty Computation (SMC), which allows different participants to work together by keeping their input data private. For example, SMC will allow two participants to find out who is older among them. Their age, which is the private data in this case, is kept private. This concept is the brainchild of Andrew Yao - a computer scientist, now a Dean at Tsinghua University, China.

Though efficient, this process can be time-consuming due to the number of rounds of communication or complexity involved. So Patra's lab has also worked on optimising the number of rounds of communication while also maintaining the privacy of the data.

Reference: A Patra and D Ravi. 2018. On the Exact Round Complexity of Secure Three-Party Computation. *Annual International Cryptology Conference – CRYPTO* 2018. 10992: 425-458



SMC can find applications in a collaborative study between hospitals



Arpita Patra's lab is studying how large collaborative efforts can be made efficient while ensuring the privacy of the data

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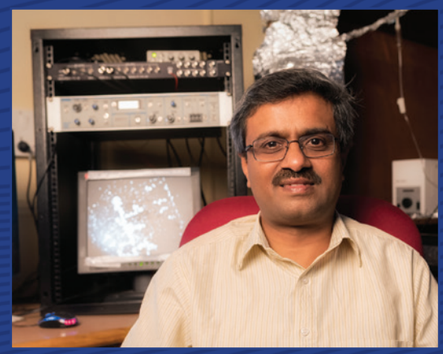
Chair Professors and Young Investigators at IISc

IISc's enduring legacy is built on the untiring efforts of its faculty members to push the frontiers of knowledge in all science and engineering fields. To recognize faculty members who have made exceptional contributions, and to incentivize bright young researchers to join IISc, the Institute has started establishing several endowed Chair Professorships (at the Professor and Associate Professor levels) and Young Investigator positions (at the Assistant Professor level). These prestigious positions provide a top-up to the faculty member's salary as well as an annual unrestricted research grant. Typically named after the donor or the contributing organization, these positions also help strengthen the Institute's ties with the donor, and boost research in specific areas.

To recognize faculty members who have made exceptional contributions, and to incentivize bright young researchers to join IISc, the Institute has started establishing several endowed Chair Professorships and Young Investigator positions.

In 2018, Mindtree Limited, a global technology services company, set up a Associate Professor Chair in the Division of Electrical, Electronics & Computer Science. This Professorship aims not only to recognize faculty members working in Artificial Intelligence and related areas, but also to encourage greater industry exposure for IISc faculty members and students. Vijay Natarajan, a Professor in the Department of Computer Science and Automation, has been selected as the first Mindtree Associate Chair Professor. His work focuses on developing data visualization methods that will provide meaningful and much needed higher-level, qualitative insights into extremely complex data sets.

Last year, IISc also received an endowment from Dr. Satya Nadham Atluri, a Distinguished Alumnus based in the US, to establish an Associate Professor Chair in the Division of Biological Sciences. Rishikesh Narayanan, an Associate Professor in the Molecular Biophysics Unit, has been selected as the first Revati and Satya Nadham Atluri Chair Professor. His lab works on understanding information processing in single neurons and their networks, with special emphasis on voltage-gated ion channels and their plasticity.



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