Friday, 4 July 2025
09:30-10:10 AM

Session 1A

Special Lecture

Chairperson: **Chandan Dasgupta**
IISc, Bengaluru

Sriram Ramaswamy
IISc, Bengaluru

Sriram Ramaswamy is an Honorary Professor in the Department of Physics of the Indian Institute of Science, Bengaluru. He received his PhD from the University of Chicago in 1983. His research areas are nonequilibrium, soft-matter, and biological physics, with a particular interest in Active Matter. He was elected Fellow of the Indian Academy of Sciences in 1996.

The strange physics of self-driven particles

My talk, aimed at a broad scientific audience, will focus on the collective behaviour of entities that continually turn a supply of free energy into work. I will summarise pre-history and classic results, emphasise the connection to living systems, and present our recent findings from theory and simulations, as well as experiments on artificial realisations. I will highlight the importance of non-mutual interactions, and close by discussing long-term challenges.

Friday, 4 July 2025
10:10-10:30 AM

Session 1B

Inaugural Lectures by Fellows/Associates

Chairperson: **Musti J. Swamy**
University of Hyderabad

Gautam Bharali
IISc, Bengaluru

Gautam Bharali is a Professor of Mathematics at the Indian Institute of Science. He earned his PhD in 2002 from the University of Wisconsin-Madison. His research interests are analysis in several complex variables, holomorphic dynamics, and metric geometry. He was elected Fellow of the Indian Academy of Sciences in 2023.

The role of geometric quotients in a problem in control theory

It is well known, in the theory of control of systems comprising interconnected devices each of whose outputs depend linearly on their inputs, that the ability to stabilize such a system is associated with a Pick–Nevanlinna-type interpolation problem into a classical Cartan domain. It was shown in the 1990s that for a system in which only a few, but not all, of the system parameters are prone to uncertainties, its stabilization is more efficiently understood in terms of a complex-analytic interpolation problem into the ``unit ball'' determined by a non-negative function called the structured singular value. These "unit balls" are non-hyperbolic, which vitiates the interpolation problem. By the work of Agler and Young, one is led to suspect that the latter type of interpolation problem, whenever the interpolation data are in general position, is equivalent to an interpolation problem on a bounded domain of much lower dimension. Such domains turn out to be categorical quotients of the above-mentioned "unit balls" under the action of a classical Lie group. In this talk, we shall elaborate on the above assertions, present the categorical (or GIT) quotients for a family of problems, and establish the equivalence of the two interpolation problems hinted at.

Friday, 4 July 2025
10:35-10:55 AM

Session 1B

Inaugural Lectures by Fellows/Associates

Chairperson: **Musti J. Swamy**
University of Hyderabad

Udita Uday Ghosh
IIT-BHU, Varanasi

Udita Uday Ghosh is an Assistant Professor in the Department of Chemical Engineering & Technology at the Indian Institute of Technology (BHU) Varanasi. She received her PhD in 2018 from IIT Kharagpur followed by a brief stint at CNRS, Lille and then at IISc Bangalore as a Raman fellow. Currently, her research group explores interfacial phenomena involving the entire umbrella of complex fluids like droplet coalescence, desiccating colloidal droplets and flow of biological fluids/polymeric solutions through porous media. She was elected as Associate of the Indian Academy of Sciences in 2023.

Complex fluids behavior at the interface: Beyond the trivialities

Complex fluids ranging from polymeric solutions, colloidal suspensions to bacterial suspensions are ubiquitous but their behavior at the solid-fluid interface are often distinctive. These distinctions will be highlighted in this talk through multiple interfacial phenomena. The journey will start with the dramatic climbing of certain viscoelastic fluids like polymeric solutions onto an immersed rotating rod. This classical effect, called the Weissenberg effect has been actively utilized in electrospinning, transporting of high viscosity solution at picolitre level and in fabrication of micro/nano structures. This phenomena will be revisited with a simple question–does replacing the immersed rod with an oil-dipped rod alter the features of the rod-climbing effect? While the effect of shear on complex fluids is explored in the first part of this talk, the second part focuses on flow dynamics of polymeric fluid through cellulosic media in capillary rise experiments. Thereafter, we proceed to probe the response of another class of complex fluids, colloidal suspensions in discrete form, i.e., as droplets subjected to evaporation. In particular, we attempt to characterise the evaporation via liquid cap evolution dynamics instead of the classical approach of evaporation modes.

Friday, 4 July 2025
11:20-11:40 AM

Session 1C

Inaugural Lectures by Fellows/Associates

Chairperson: **A. Jayakrishnan**
University of Kerala, Thiruvananthapuram

Ritika Gautam Singh
IIT Kanpur

Ritika Gautam Singh received her B.Sc. (Hons) and M.Sc. degrees in Chemistry from Banaras Hindu University and the Indian Institute of Technology Delhi, respectively. In 2012, she relocated to the United States to pursue doctoral studies at the University of Arizona. After receiving her PhD in Chemistry in August 2017, Ritika joined as a research associate at The Scripps Research Institute (TSRI), La Jolla, California. In the fall of 2019, Ritika returned to India to establish her independent research group at IIT Kanpur. Her group focuses on engineering metal-based diagnostics and therapeutics at the interface of biological inorganic chemistry, synthetic immunotherapy, and medicinal chemistry. Ritika has received notable early-career recognitions, including being named a ChemComm Royal Society of Chemistry Emerging Investigator and an American Chemical Society Organic & Inorganic Au Rising Star in 2023. She has successfully secured initial grants, including the DST INSPIRE Faculty Fellowship, SERB-SRG, CSIR ASPIRE, DST-AMR-TDP, and ICMR grants. In 2024, Ritika was inducted as an associate of the Indian Academy of Sciences, Bengaluru, marking another significant milestone in her growing career.

Theragnostic and non-apoptotic paradigms in cancer therapy: From immunogenic ferroptosis therapy to dynamin-mediated cell death

Addressing therapeutic resistance in both immune-evasive and apoptosis-resistant tumors demands innovative strategies that combine selective cytotoxicity with diagnostic capabilities. In this context, we report two mechanistically distinct, yet complementary platforms based on metal-organic and organic nanoaggregates.

The first system involves a series of redox-active iron(III) complexes, [Fe(L1–L5)$_2$], derived from adamantyl-substituted sirtinol analogs. These complexes spontaneously form nanoscale aggregates in biological media (~50–70 nm) and effectively penetrate cancer cells through energy-dependent endocytosis. The lead compound, Fe(L1)$_2$, demonstrates hallmark features of immunogenic cell death (ICD), including CRT exposure, ATP release, and HMGB1 secretion, thereby "heating up" cold tumors and stimulating antitumor immunity. Notably, Fe(L1–L3)$_2$ also exhibit strong NIR-II photoacoustic signals, marking them as potential theragnostic agents for simultaneous deep-tissue imaging and immune reprogramming.

Complementing this, we developed a novel class of delocalized lipophilic cationic (DLC) compounds that self-assemble into nanoaggregates and trigger a unique dynamin-dependent, non-apoptotic cell death in A549 lung adenocarcinoma cells. The lead molecule, L3, induces massive cytoplasmic vacuolization, mitochondrial dysfunction, and ATP depletion. It disrupts mitochondrial membrane potential, promotes mitochondrial permeability transition pore (MPTP) opening, and disturbs glutathione-mediated redox homeostasis. This mechanism of action is particularly promising against apoptosis-resistant tumors and impairs both metastasis and clonal expansion.

Together, these studies offer two robust platforms—one that integrates immune activation and imaging, and another that bypasses classical apoptotic resistance—paving new avenues for treating refractory cancers through multifunctional nanoaggregate-based therapeutic.

Friday, 4 July 2025
11:45 AM-12.05 PM

Session 1C

Inaugural Lectures by Fellows/Associates

Chairperson: **A. Jayakrishnan**
University of Kerala, Thiruvananthapuram

Saran Aadhar
IIT Jodhpur

Saran Aadhar is an Assistant Professor in the Department of Civil and Infrastructure Engineering at the Indian Institute of Technology Jodhpur. His research focuses on real-time monitoring of hydroclimatic extremes, reliable sub-seasonal to seasonal forecasting of hydroclimatic extremes, hydrological processes under changing and anthropogenic climate, and impact of climate change on water resources. Previously, he worked as a Postdoctoral Researcher in Hydrometeorology Lab at Hebrew University of Jerusalem, Israel. He received his PhD in 2021 from the Indian Institute of Technology Gandhinagar. In 2024, he was elected as an Associate of the Indian Academy of Sciences.

Understanding hydroclimatic extremes under climate change and human influence: Impact, mechanisms, and adaptation strategies

The frequency and severity of hydroclimatic extremes (such as droughts, floods, heatwaves, etc.) have significantly altered in the last few decades due to climate change and increasing human activities at both regional and global scale, and have posed significant challenges to infrastructure, water resources, agriculture, public health, and socio-economic conditions. To address and minimize the risk associated with these extremes in changing and anthropogenic climate, our research focuses on three key aspects. First, we aim to understand the impact of climate change and human activities on hydroclimatic extremes, considering the large uncertainty of various datasets, methods, and models. Second, we investigate the underlying mechanisms, processes, and drivers of these extremes using observations and modelling. Third, we work on developing effective and robust early warning systems to mitigate and reduce the risk of hydroclimatic extremes to support sustainable and resilient planning. Overall, our research aims to provide reliable information to decision-makers and stakeholders on building sustainable and resilient infrastructure and systems capable of withstanding future risk of hydroclimatic extremes in a warming world.

Friday, 4 July 2025
12:10-12.30 PM

Session 1C

Inaugural Lectures by Fellows/Associates

Chairperson: **A. Jayakrishnan**
University of Kerala, Thiruvananthapuram

Poonam Chandra
NRAO, USA

Poonam Chandra is an Astronomer currently working at the National Radio Astronomy Observatory (NRAO). She completed her PhD at the Tata Institute of Fundamental Research (TIFR), Mumbai, India under the Joint Astronomy Programme of the Indian Institute of Science, Bengaluru, India. After her PhD, she worked as Jansky Postdoctoral Fellow of National Radio Astronomy Observatory at the University of Virginia from 2005 till 2008. Since 2008 onwards, she was a Senior Research Associate and Adjunct Assistant Professor at the Royal Military College of Canada until 2012. She has been at the National Centre for Radio Astrophysics of Tata Institute of Fundamental Research (NCRA-TIFR), Pune, India from 2012 until May 2022 as Reader and Associate Professor. In 2022, she joined NRAO, Charlottesville, USA as an Associate Astronomer.

Exotic stars and their explosive demise: Connecting the dots

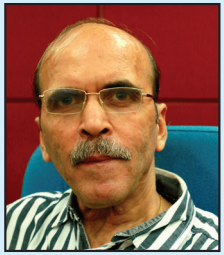
A category of stars – more massive than 8 solar mass–end their lives in big explosions, such as supernovae, gamma-ray bursts, fast blue optical transients etc., each having diverse sub-population, pointing to a rich but poorly understood diversity in their progenitors. A major challenge in stellar astrophysics lies in tracing back these explosions to their original stars. Intense mass loss during the brief and turbulent lives of massive stars often erases the evolutionary trail, leaving behind a puzzle. By examining how the post-explosion ejecta interacts with their surrounding medium, we can create a "TIME MACHINE" effect – decoding the life history of the progenitor long after its death. Armed with physics-based models and observations across the electromagnetic spectrum, and now with the emerging power of multi-messenger astronomy, we are beginning to piece together this cosmic narrative. The Giant Metrewave Radio Telescope (GMRT) in India has played a pivotal role in this endeavor, offering unique insights into the environments shaped by these enigmatic stars.

Friday, 4 July 2025
12:35-12.55 PM

Session 1C

Inaugural Lectures by Fellows/Associates

Chairperson: **A. Jayakrishnan**
University of Kerala, Thiruvananthapuram



Krithi Ramamritham

Sai University, Chennai

Krithi Ramamritham has spent almost equal lengths of time at the University of Massachusetts, Amherst, and at IIT Bombay as a Chair Professor of Computer Science and Engineering. He has served as Dean (R&D) at IIT Bombay and headed IIT Bombay's Center for Urban Science and Engineering (CUSE). He is currently a distinguished professor at Sai University, Chennai.

His current research involves applying computational approaches to energy management. This work exploits and extends the state-of-the-art in database systems, real-time computing, sensor networks, embedded systems, mobile computing and smart grids. He has guided close to 40 PhD students. Krithi's publications garnered over 25,302 citations with an h-index of 85.

He is a Fellow of the IEEE, ACM, Indian Academy of Sciences, National Academy of Sciences, India, and the Indian National Academy of Engineering. He was honored with a Doctor of Science (Honoris Causa) by the University of Sydney, Australia. He is also a recipient of the Distinguished Alumnus Award from IIT Madras. Twice he received the IBM Faculty Award. He received the 2016 Outstanding Technical Contributions and Leadership Award from the IEEE Technical Committee for real-time systems and the Outstanding Service Award from IEEE's CEDA. He has received IIT Bombay's HH Mathur Award for Excellence in Research in Applied Sciences. He was awarded the IIT Madras Robert Bosch Centre's Distinguished Fellowship and the SC Sahasrabuddhe Lifetime Achievement Award from IIT Bombay.

A SMART way to solve problems

In this talk, I will share my thoughts on problem solving using the "SMART" principle. What is this principle and how we have applied it in the energy domain to solve every-day problems to reduce energy consumption while taking care of human comfort – will be discussed. While these problems were the core of my research for over a decade and many papers and artifacts came out of our Smart Energy Informatics Lab (SEIL) at IIT Bombay, I will discuss couple of examples that all of us can relate to–with a goal of prodding you to see if this principle is applicable to your domain and how you can frame your research questions applying the SMART principle.

Friday, 4 July 2025
14:30-14:50 PM

Session 1D

Inaugural Lectures by Fellows/Associates

Chairperson: **Mitali Mukerji**
IIT Jodhpur

Anura Kurpad

St. John's Medical College, Bengaluru

Anura Kurpad is a Professor of Physiology at St John's Medical College, Bengaluru. He received his MD in 1988 and PhD in 1992. His interests are in the physiology of nutrient metabolism and requirements, and adaptations in clinical conditions. He was elected Fellow of the Indian Academy of Sciences in 2022.

Farming the microbiome for nutrition

Indians, in general, are thought to have monotonous and predominantly cereal-based vegetarian diets with very little animal-food intake. As a consequence, their intake of micronutrients, particularly the B vitamins, is low. It is possible that there is an additional and physiologically significant source of some micronutrients for homeostasis in humans, coming from de novo colonic microbial synthesis of these nutrients *in vivo*. If so, this could be relevant to adapting to marginal diets with predominantly cereal intakes in human nutriture.

Friday, 4 July 2025
14:55-15:15 PM

Session 1D

Inaugural Lectures by Fellows/Associates

Chairperson: **Mitali Mukerji**
IIT Jodhpur

Priyanka Grover

Shiv Nadar Institute of Eminence, Gautam Buddha Nagar

Priyanka Grover is an Associate Professor at the Shiv Nadar Institution of Eminence Delhi NCR. She received her PhD in 2014 from the Indian Statistical Institute Delhi. Her research interests are studying the approximation problems in Banach spaces, minimal matrices, totally positive matrices, Birkhoff-James orthogonality in Banach spaces, subdifferential of the norm function. She was elected as an Young Associate of the Indian Academy of Sciences in 2022. She has also received the DST INSPIRE Faculty Award 2015 and the SERB Early Career Research Award 2019.

Subdifferential calculus, approximations and orthogonality

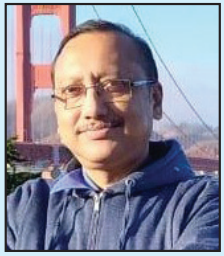
In the past few years, the study of Birkhoff–James orthogonality has geared up in various structures and also has several applications in analysis. This concept, which is a generalization of usual inner product orthogonality to normed spaces, can be viewed as an approximation problem. This further reduces to studying the differentiability properties of the norm function. The tools of convex analysis, namely subdifferential calculus, give some interesting insights as well as yield stronger characterizations. This talk shall concentrate on explaining these concepts and give a brief overview of my work in this direction.

Friday, 4 July 2025
15:20-15:40 PM

Session 1D

Inaugural Lectures by Fellows/Associates

Chairperson: **Mitali Mukerji**
IIT Jodhpur



Parthasarathi Mukhopadhyay
IISER, Berhampur

Parthasarathi Mukhopadhyay is a retired senior scientist from the Indian Institute of Tropical Meteorology, Pune and is currently at the Department of Earth and Environmental Sciences, IISER, Berhampur, Odisha. He received his PhD from SP Pune University in 2005. His research interest is in numerical weather prediction, parameterization of physical processes such as cloud, convection and improving prediction of monsoon and extreme precipitation events. He was elected Fellow of the Indian Academy of Sciences in 2023 (effective from 2024).

The Bharat forecast system: An indigenous km-scale model to improve monsoon extreme precipitation deadlock

The prediction of Indian monsoon rainfall variability, affecting a country with a population of billions, remained one of the major challenges of the numerical weather prediction (NWP) community. While in recent years, there has been a significant improvement in the prediction of the synoptic scale transients (such as monsoon depression, cyclones etc.) associated with the monsoon circulation, the intricacies of rainfall variability remained a challenge. Here, an attempt is made to develop a global km-scale model using a dynamic core of a cubic octahedral grid that provides a higher resolution of 6.5 km over the global tropics. This high resolution model has been developed to resolve the monsoon convection. Reforecasts with the Indian Institute of Tropical Meteorology's (IITM) High-Resolution Global Forecast Model (HGFM) have been run daily from June through September 2022. HGFM has a wavenumber truncation of 1534 in the cubic octahedral grid. The monsoon events have been predicted with a 10 d lead time. HGFM is compared to the operational Global Forecast System (GFS) T1534. While HGFM provides skills comparable to GFS, it shows better skills for higher precipitation thresholds. After thorough evaluation of the model, it was handed over to India Meteorological Department on 26th May 2025 as a completely "Make in India" model with a given name as "Bharat Forecast System".

Friday, 4 July 2025
15:45-16:05 PM

Session 1D

Inaugural Lectures by Fellows/Associates

Chairperson: **Mitali Mukerji**
IIT Jodhpur

Md Nasim

IISER, Berhampur

Md Nasim is an Associate Professor of Physics at the Indian Institute of Science Education and Research (IISER) Berhampur. He received his PhD in 2014 from the National Institute of Science Education and Research (NISER), Bhubaneswar. His research interest is the physics of strongly interacting matter created in heavy-ion collisions. He was elected as an Associate of the Indian Academy of Sciences in 2021.

Heavy-Ion collisions: A window into the QCD phase structure

Quantum Chromodynamics (QCD) is the fundamental theory that describes how the smallest building blocks of matter—quarks and gluons—interact. Under normal conditions, these particles are tightly confined within protons, neutrons, and other hadrons. However, at extremely high temperatures or densities, QCD predicts that quarks and gluons can become free, creating a new state of matter known as the Quark-Gluon Plasma (QGP). Relativistic heavy-ion collisions offer a powerful way to recreate and study this extraordinary state in the laboratory. By varying the energy of these collisions, experiments can explore different regions of the QCD phase diagram, which maps how strongly interacting matter behaves under extreme conditions.

In this talk, I will present recent results from the Beam Energy Scan (BES) program at the Relativistic Heavy Ion Collider (RHIC). We will focus on important observables such as collective flow, strangeness enhancement, and jet quenching, examining how these signals change with collision energy. By comparing these experimental findings with theoretical models, we aim to deepen our understanding of the various phases of matter predicted by QCD.

Friday, 4 July 2025
16:10-16:30 PM

Session 1D

Inaugural Lectures by Fellows/Associates

Chairperson: **Mitali Mukerji**
IIT Jodhpur

Gaurav Sharma
IIT Hyderabad

Gaurav Sharma is an Assistant Professor at the Department of Biotechnology, Indian Institute of Technology Hyderabad, Telangana, India. He was awarded a PhD degree from Jawaharlal Nehru University, New Delhi, India, while working with Dr Srikrishna Subramanian at the CSIR-Institute of Microbial Technology, Chandigarh. His lab works on diverse computational fields, such as microbial genomics, evolutionary biology, plant-microbe interactions, and bioinformatics tool development. He was elected as an Associate of the Academy in August 2023.

Tracing the evolutionary threads of myxobacterial flagella

Motility is a fundamental biological process enabling organisms to seek resources, explore niches, and escape unfavourable conditions. In bacteria, motility is often regulated by diverse chemosensory systems. Myxobacteria, our model organisms, are social microbes with unique traits like fruiting body formation, gliding motility, and predation, and they possess the largest genomes (>9 Mb) in the Eubacteria kingdom. To sustain a social life, these organisms encode the highest number of chemosensory systems, regulating pili-based motility and other functions. Based on genome size, respiration, and GC content, we have identified three characterized myxobacteria genus to be connecting links, providing evolutionary links between the present-world aerobic myxobacteria and the ancestral anaerobic Deltaproteobacteria.

Our evolutionary genomic analysis on all present world myxobacterial genomes and MAGs from the Tara Oceans project reveals the presence of substantial number of flagellar genes in these connecting link genera and MAGs, which are distributed within three myxobacterial families. Some organisms even have two chemosensory systems within the cluster, likely regulating flagella-based motility, with evidence pointing to F7 CSS and 36H MCP involvement. Despite the presence of these genes, key flagellar proteins are missing in these organisms, rendering the clusters insufficient to form functional flagella. However, their presence in MAGs suggests ancestral myxobacteria had complete flagellar systems regulated by F7 CSS. Overall, we hypothesize that the old-world ancestor of myxobacteria had a full-fledged flagellar system and in due course of time present-day myxobacteria have lost those flagellar genes along with the associated CSS and MCP classes.

Friday, 4 July 2025
18:00-19:00 PM

Session 1E

Public Lecture

Chairperson: **Raghavan Varadarajan**
President, IASc, Bengaluru

A. S. Kiran Kumar
Former Chairman
ISRO, Bengaluru

A. S. Kiran Kumar has served as Secretary, Department of Space and Chairman, Indian Space Research Organisation, during 2015—2018. He is currently Member of the Space Commission (GoI).

He has steered the implementation of the application-oriented Indian Space Programme, which has facilitated rapid development of the country in many important spheres of earth observation, communication, navigation, meteorology and space science, as well as the development of indigenous launch vehicles and related technologies for providing assured access to space. Further, his role in the success of Chandrayaan missions and Mars Orbiter Mission has been significant.

He was conferred Padma Shri by the President of India in 2014, Rajyostava Award by the Government of Karnataka in 2015, 2018 International von Karman Wings Award instituted by the Aerospace Historical Society, together with the Graduate Aerospace Laboratories at the California Institute of Technology, in 2018 and the Chevalier de l'Ordre national de la Légion d'Honneur – the highest civilian honour by the Government of France in 2019.

India's space programme: Challenges

India's space programme has grown from humble beginnings into a globally recognized model of self-reliance, innovation, and service to societal needs. In this lecture, Shri A. S. Kiran Kumar will delve into the current and emerging challenges — ranging from technological advancements, global competition, climate resilience, and commercial space, to the need for sustained investment in research and capacity building. Drawing from his rich experience at the helm of ISRO, the talk will provide valuable insights into the strategic direction and preparedness required to sustain and expand India's space leadership in a rapidly evolving landscape.

Saturday, 5 July 2025
09:30-10:10 AM

Session 2A

Special Lecture

Chairperson: **Anil Kumar**
Pune

A. Ajayaghosh

SRM Institute of Science and Technology Kattankulathur

A. Ajayaghosh is the Former Director of CSIR-NIIST, Thiruvananthapuram and is currently a Chair Professor of Chemistry at SRM Institute of Science and Technology, Kattankulathur, Chennai. He obtained his PhD from Calicut University in 1989. His research is mainly on organic materials such as fluorescent materials, stimuli responsive materials, organogels, supramolecular materials etc. He has been a Fellow of the Indian Academy of Sciences since 2007.

The supramolecular chemistry of smart windows

Autonomous radiative cooling by reflecting solar light and thereby reducing global energy consumption is one of the mandates of the Sustainable Development Goals (SDGs). In this context, thermoresponsive polymer-based smart windows are emerging as a viable approach towards energy efficiency. Lower Critical Solution Temperature (LCST) active polymers are widely used in smart windows for controlling the room temperature by reflecting out the heat generating IR radiation of the sunlight. We have been exploring the supramolecular chemistry of small molecular πsystems to construct smart windows for autonomous control of solar radiations. Our expertise in supramolecular self-assembly and photoprocesses helped us in designing a variety of molecular systems that can be applied to the construction of smart windows. The proposed talk will highlight some of our contributions in this topic.

Saturday, 5 July 2025
10:10-10:35 AM

Session 2B

Inaugural Lecture by Fellow

Chairperson: **B. Gopal**
IISc, Bengaluru

Sudipta Maiti
BITS-Pilani, Hyderabad

Sudipta Maiti is a Senior Professor with joint appointment in the Department of Biological Sciences and Department of Physics in the Hyderabad campus of the Birla Institute of Technology and Science Pilani, India. His current research interest spans several areas of biophysics, namely, protein aggregation, neurotransmission, membrane interactions, and the development of new techniques and instruments for studying biological phenomena. In addition to being a co-founder of the Fluorescence Society (India), he is currently the President of the International Society of Optics Within Life Sciences (Germany) and the Chair-Elect of the Fluorescence Subgroup, Biophysical Society (USA). He is a Fellow of the Indian Academy of Sciences (since 2018) and an Executive Editor of the Journal of Physical Chemistry of the American Chemical Society.

Probing molecular biophysics by building novel scientific instruments

How neurotransmission takes place in the healthy brain, and how it goes wrong in a diseased brain (such as in Alzheimer's patients), are fascinating scientific problems of our era. A molecular-level understanding of these phenomena *in vitro* and in living cells requires the most sophisticated spectroscopy and imaging tools. We have taken the approach that building one's own tools gives a scientist an unparalleled advantage, and have developed several new tools over the years for probing biological systems. Also, one key marker of the advancement of science in a country is commercial production of unique scientific stools. I will discuss both our efforts to understand the scientific problems of serotonergic neurotransmission and neurodegenerative diseases, as well as our nascent efforts to make commercially viable scientific instruments in India.

Saturday, 5 July 2025
11:00-11:30 AM

Session 2C

Symposium
Brain Function in Health and Disease

Convener: **Sumantra Chattarji**
CHINTA, Kolkata

Pratima Murthy
NIMHANS, Bengaluru

Pratima Murthy is a Director and Senior Professor of Psychiatry at the National Institute of Mental Health and Neuro Sciences (NIMHANS). A medical graduate from the Bangalore Medical College, she completed her Diploma and MD in Psychiatry from NIMHANS and has a Diploma in Psychological Medicine from the University of Manchester, UK. She is a Fellow of the Royal College of Physicians and Surgeons, Glasgow. Her clinical work and research is primarily in the area of addiction prevention and management. She has been a consultant to the WHO, ILO and UNDCP and has been involved in the preparation of national treatment guidelines for tobacco, alcohol and other substance use and behavioural addiction disorder management.

Explorations of the brain and mind at NIMHANS–Through the looking glass

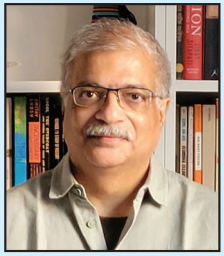
The National Institute of Mental Health and Neuro Sciences (NIMHANS) is a unique institution providing clinical care, training and research in the areas of mind and brain. The three divisions of behavioural sciences, neurosciences and basic sciences work in tandem to understand the functioning of the brain from different vantages and through the use of contemporary investigative lenses. This presentation will focus on some of the important research areas at NIMHANS and how it has contributed to the understanding of the brain and its complex function in health and in disease.

Saturday, 5 July 2025
11:30 AM-12:00 PM

Session 2C

Symposium
Brain Function in Health and Disease

Convener: **Sumantra Chattarji**
CHINTA, Kolkata



Sumantra Chattarji
Centre for High Impact Neuroscience and Translational Application, Kolkata

Sumantra Chattarji is the Founding Director of a new translational neuroscience institute called CHINTA at TCG CREST. He is a Visiting Professor at Simons Initiative for the Developing Brain, University of Edinburgh, UK. He received his PhD in Neuroscience at the Johns Hopkins University and Salk Institute. After post-doctoral research at Yale University and MIT, he started his own laboratory at the National Centre for Biological Sciences, TIFR, Bangalore, India in 1999.

His research has shown how changes in brain cells give rise to emotional symptoms of stress-related psychiatric disorders. His lab also studies the neural basis of autism, research for which he was awarded the Global Champion Award by the Fragile X Research Foundation, USA. He is a Fellow of the Indian Academy of Sciences, International Union of Physiological Sciences and European Molecular Biology Organization. He also served on the Council of the Society for Neuroscience, the first Indian to do so.

"Astro"logy in Autism

Important insights into the pathophysiology of fragile X syndrome (FXS), a common monogenic cause of autism spectrum disorder, have emerged from analyses of rodent models. These findings, however, have been less effective in developing therapeutic interventions, thereby highlighting the need for model systems of human origin. Moreover, many studies have focused on neurons, and the role of glia remains largely unexplored in FXS. We used human pluripotent stem cells to examine the potential role of astrocytes in physiological abnormalities in FXS neurons. FXS cortical neurons, co-cultured with FXS astrocytes, fired spontaneous bursts of action potentials that are more frequent, but shorter in duration, compared to control neurons co-cultured with control astrocytes. However, bursts fired by FXS neurons, co-cultured with control astrocytes, are indistinguishable from control neurons. Conversely, control neurons exhibit aberrant firing in the presence of FXS astrocytes. Thus, the genotype of astrocytes determines the physiological phenotype of neurons. Strikingly, astrocytic conditioned medium by itself, from either control or FXS astrocytes is capable of eliciting the same spontaneous burst firing patterns that would be observed if astrocytes were physically present in co-cultures. By analyzing the mechanistic basis of this effect, we identify an important cell non-autonomous contribution of astrocytes in correcting aberrant electrical activity in human FXS neurons. Thus, this work suggests a novel framework for exploring therapeutic strategies aimed at neuron-glia interactions.

Saturday, 5 July 2025
12:00-12:30 PM

Session 2C

Symposium
Brain Function in Health and Disease

Convener: **Sumantra Chattarji**
CHINTA, Kolkata

Nitin Chouhan
TIFR, Mumbai

Nitin Chouhan is a Reader in the Department of Biological Sciences at the Tata Institute of Fundamental Research, Mumbai. He received his PhD from the University of Wuerzburg, Germany in 2017. He is interested in exploring the neurogenetic basis of behavior and has made contributions to our understanding of the link between sleep, circadian rhythms, and memory consolidation. Nitin, a Wellcome-DBT India Alliance Intermediate Fellow, was elected Associate of the Indian Academy of Sciences in 2023.

The alternating nature of sleep

We sleep for a third of our lives, but why we sleep remains mysterious. For most of human history, sleep was considered useless, equated to dying every night to be born again the following day. However, we now understand that sleep plays a crucial role in the proper functioning of various biological processes, including cognitive functions such as learning and forming memories. Obtaining quality sleep is critical in maintaining optimal physical and mental well-being. However, animals like elephants, dolphins, and whales can learn and remember essential information even without sleep for extended periods. Our work demonstrated that satiated *Drosophila* form sleep-dependent memories but switch to a sleep-independent mechanism for memory consolidation when kept starved. Therefore, the role of sleep in vital biological processes adapts to the changes in environmental settings. In this talk, I will discuss our current understanding of sleep's functions and the importance of proper sleep in maintaining cognitive health. Also, I will present our recent findings in fruit flies on how heat stress, a major factor in weather-related deaths, affects the role of sleep in memory consolidation.

Saturday, 5 July 2025
12:30-13:00 PM

Session 2C

Symposium
Brain Function in Health and Disease

Convener: **Sumantra Chattarji**
CHINTA, Kolkata

S. P. Arun
IISc, Bengaluru

S. P. Arun is a Professor of Neuroscience at the Indian Institute of Science, Bengaluru. He received his PhD in 2005 from Johns Hopkins University. His research interests are in visual perception and its neural basis. He was elected Fellow of the Indian Academy of Sciences in 2025.

There is more to vision than meets the eye

We see and recognize objects effortlessly every day, but in fact vision is an extremely challenging computational problem. The best computer vision algorithms today still struggle at the simplest of vision tasks. Vision is not easy for the brain either: nearly 40% of the brain is taken up by visual processing of one kind or the other. Damage to visual processing regions in the brain causes complex disorders that are difficult to treat because we still do not understand normal visual processing. So how does the brain accomplish vision? What are the underlying mechanisms and algorithms?

Our lab has been studying how the brain solves vision by investigating perception and brain activity in humans, behavior and neural activity in monkeys, and by comparing vision in brains and machine algorithms. I will present some of our recent work demonstrating some novel computations performed by the brain to solve property-based visual tasks in humans, and also some exciting findings elucidating the neural basis of real-world vision in monkeys.

Notes