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ABSTRACTS OF LECTURES

7 July 2023: 0930–1010

Session 1A: Special Lecture

Chairperson: Basudeb Datta, Kolkata

K Kesava Rao
IISc, Bengaluru

Defluoridation of Drinking Water

Defluoridation refers to the removal of excess fluoride from water. Water and food are the main sources of fluoride ingested by people and animals. Excess fluoride intake over a prolonged period leads to a disease called fluorosis that affects many people in India and other countries. During the past eight decades, various methods such as coagulation, adsorption, reverse osmosis, solar distillation, and electrocoagulation have been used for defluoridation, but every method has drawbacks. Following a brief discussion of fluorosis and methods to combat it, some attempts to treat the rejected water from a reverse osmosis unit installed by the government at Yellampalli village will be described. Results related to rainwater harvesting will also be presented.

Speaker's Profile

K Kesava Rao is a Retired Professor from Chemical Engineering, Indian Institute of Science, Bengaluru. He received his PhD in 1982 from University of Houston. He was a faculty member in the Department of Chemical Engineering, IISc from 1983–2021. His research interests are granular flow and defluoridation of drinking water. K Kesava Rao was elected Fellow of IASc in 1992.

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Session 1B: Inaugural Lectures by Fellows/Associates

Chairperson: R R Navalgund, Bengaluru

07 July 2023: 1010–1030

Nitin Saxena
IIT, Kanpur

Algebra Powers Computation

Modern economies run on algorithms, and algebra is a natural ally in algorithm design. This work deals with the mathematics that goes inside algorithms. The results fall into two broad categories – algebraic circuit properties and fast algorithms for algebra questions.

In algebraic circuit theory, the problems of zero-testing, hitting sets, bootstrapping of variables, incidence geometry in identities, duality in circuits, sum-of-squares of univariates, and border circuits will be discussed. Among the algebraic algorithms developed, those related to primality testing, algebraic dependence, approximative roots, all-roots Newton iteration, factoring, root-finding over Galois ring, and Igusa's local zeta function will be explained.

Speaker's Profile

Nitin Saxena completed his Bachelors in Computer Science from the IIT, Kanpur in 2002 and completed PhD under Manindra Agrawal in 2006. His research interests are computational complexity theory, algebra, geometry and number theory.

He was awarded the Distinguished Alumnus Award of the IIT, Kanpur in 2003 for his work in computational complexity theory. He was appointed at the Centrum Wiskunde & Informatica (CWI) starting as a postdoc researcher from September 2006 onwards. He was a Bonn Junior Fellow at the University of Bonn from Summer 2008 onwards. He joined the Department of Computer Science and Engineering at IIT Kanpur as faculty in April 2013. Nitin Saxena was elected Fellow of IASc in 2021.

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07 July 2023: 1035–1055

Ramendra S Dey
INST, Punjab

Electrochemical Synthesis of Green Ammonia: Prospects and Challenges

Owing to the rapid depletion of non-renewable energy sources, worldwide research is inclined towards the development of alternative approaches with a long-term vision of a sustainable society. In this advent, green hydrogen/green ammonia plays a dominating role towards a safe, reliable and electrified future. Although to meet the practical demands of ammonia, the Haber–Bosch process is the sole option, it deviates from the goal of a "net-zero" society. This calls for the electrochemical approach and we have thus keenly focused to develop versatile materials to achieve significant ammonia production using nitrogen reduction reaction (NRR).

We have also developed a full NRR electrolyzer on a laboratory scale with state-of-the-art catalysts and opened up an avenue of how energy consumption could be minimized that in turn brings about a better energy-efficient ammonia synthesis. The fundamental relationships between electronic structure, adsorption energy, and apparent activity towards NRR with the goal of providing a better understanding of these emerging research directions will be described.

Speaker's Profile

Ramendra Sundar Dey is a Scientist at Institute of Nano Science and Technology, Mohali, India. Prior to this, he was a Hans Christian Ørsted postdoc Fellow at Technical University of Denmark, Denmark. He received a PhD in Chemistry at 2013 from Indian Institute of Technology, Kharagpur, India. He is involved in research in the field of electrochemistry of nanomaterials. His current research is focused on the architecture and engineering of nanomaterials for advanced energy storage technology and non-novel metal nanomaterials for electrocatalysis and hybrid energy technology. Ramendra Sundar Dey was selected as Associate in 2020.

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Session 1C: Inaugural Lectures by Fellows/Associates

Chairperson: Manju Bansal, IISc

07 July 2023: 1120–1140

Somnath Bharadwaj
IIT, Kharagpur

Cosmology with the Redshifted HI 21-cm Line

The redshifted 21-cm line originating from the hyperfine transition in the ground state of neutral hydrogen (HI) appears as a faint background at low frequencies. Observations of the spatial and angular fluctuations in this background radiation hold the potential of allowing us to study various aspects of the evolution of the Universe. In this talk, the predicted signal will be discussed, and also some efforts towards observing this with the Giant Metrewave Radio Telescope (GMRT) will be presented.

Speaker's Profile

Somnath Bharadwaj is a Professor at the Department of Physics, IIT, Kharagpur. He works in the areas of astrophysics and cosmology. His research is currently focused on using low frequency radio telescopes to study the high redshift universe using the redshifted 21-cm radiation from neutral hydrogen. Somnath Bharadwaj was elected Fellow of IASc in 2021.

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07 July 2023: 1145–1205

Soumen Chakrabarti
IIT Bombay, Mumbai

Neural Graph Representation, Retrieval and Alignment

Combinatorial graph matching problems are often intractable. We explore if suitable graph embedding can pave the way for good neural solutions in practice. Suppose we have a corpus of graphs (say, molecules), and a query graph G_q, and a 'document' graph G_c in the corpus is relevant to the extent that G_q is isomorphic to a subgraph of G_c. Unlike dot-product or cosine similarity, this notion of relevance is asymmetric. Rather than a 0/1 notion of subgraph isomorphism, we need a continuous score which can be used to rank corpus graphs in response to a query. This continuous relevance score should ideally be informed by node and edge features. A wide variety of applications, such as molecular fingerprint detection, circuit design, and many more can be modelled in this framework. We will describe IsoNet, a neural edge alignment formulation for subgraph matching. Instead of aggregating G_q and G_c into single vectors for comparison, Isonet explicitly models a (soft) assignment P between the nodes and edges of G_q and G_c and defines an asymmetric relevance surrogate as a function of G_q, G_c, and P. IsoNet is capable of returning explainable top responses using its estimated assignments P. We describe a neural gossiping gadget that approximates the size of the largest connected component in the common subgraph between G_q and G_c. The resulting neural scoring network, McsNet, can thus search for the common subgraph (MCS) between G_q and G_c while encouraging that the subgraph is also connected.

While we build IsoNet and McsNet around graph neural networks (GNNs), we recognize several pitfalls of GNNs for real text and graph applications. If time permits, we will discuss an attempt to fix the limitations of symmetric neighbourhood aggregation in GNNs. We will finally focus on knowledge graphs (KGs), where we find a rich confluence of structural, local and global features. We will describe how graph representation using complex vectors coupled with transformer-based text representation can be maximally used to solve multi-tasked KG 'completion' (extrapolation) and alignment between KGs in different languages.

Speaker's Profile

Soumen Chakrabarti is a Professor at the Department of Computer Science and Engineering at IIT Bombay. Current research interests are representation learning for graph search, better embedding representation for entities, types, relations, and time, complex multi-modal question answering and code-switched text analysis. Soumen Chakrabarti was elected Fellow of IASc in 2015.

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07 July 2023: 1210–1230

Vidya M Prasad
IISc, Bengaluru

3D Snapshots into Virus Life Cycles Using Cryo-electron Tomography and Sub-Tomogram Averaging

The need to understand how pathogenic viruses cause cellular infection has never been more amplified as in today's pandemic-affected world. The fundamental approaches to building better therapeutic strategies encompass characterizing the viral immune landscape and mechanisms by which these viruses gain host cell entry and developing ways to inhibit it. The challenge of examining heterogenous and dynamic events in viral life cycles under conditions that are amenable for high-resolution structural analysis can now be circumvented using cryo-electron microscopy (cryo-EM) methods. The near-atomic resolution structures of protein complexes in solutions can be achieved using the single-particle cryo-EM. Using cryo-electron tomography (cryo-ET) and sub-tomogram averaging (STA), we can go further and reduce our dependence on purified, homogenous biological samples. In this talk, applications of cryo-EM and cryo-ET to study complex virus systems will be discussed. The broadening spectrum of questions that can be answered using high-resolution cryo-EM and cryo-ET studies can add not only new dimensions to our understanding and assumptions about enveloped virus infections but also have broad relevance to other fundamental biological processes such as cell-to-cell fusion, synaptic vesicle signalling and membrane protein function.

Speaker's Profile

Vidya Mangala Prasad is an Assistant Professor at Molecular Biophysics Unit (MBU). She joined IISc in 2021. Her areas of research are structural biology, Cryo-EM, virology, and infectious diseases. She did her PhD at Purdue University, USA and postdoc at Purdue University and University of Washington, Seattle, USA. Vidya Mangala Prasad was selected as Associate of IASc in 2022.

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07 July 2023: 1235–1255

Narayan Pradhan
IACS, Kolkata

Light-emitting Lead Halide Perovskite Nanocrystals

Lead halide perovskite nanocrystals recently emerged as a new class of optical material extensively used for photovoltaic and light-emitting device applications. With tuning compositions, these can result in red, green and blue (RGB) colour emissions with near-unity photoluminescence quantum yields. These are tiny nanocrystals and are mostly seen as cubic shapes under an electron microscope. Then the question arises: why do these retain a cubic shape? To address this issue, the surface chemistry, their shapes, retaining stable emission, inducing phase stability and most importantly, their facet-induced change in optical properties will be presented. The interesting chemistry in cutting the facets and making new shapes and the excitement of seeing them under an electron microscope will be presented. Moreover, the importance of these materials and their facets inducing different applications will also be discussed.

Speaker's Profile

Narayan Pradhan is a Professor at the Indian Association for the Cultivation of Science. He has completed his PhD from IIT, Kharagpur in 2000. His research interests are semicomductors and doped semiconductor nanocrystals, metal-semiconductors and semiconductor-semiconductor heterostructures, photocatalysis using hetero-nanostructures, multinary semiconductor nanostructures, nucleations, growths, catalytic and diffusion-induced crystal growth mechanism, PC and PEC water splitting. Narayan Pradhan was elected Fellow of IASc in 2019.

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07 July 2023: 1430-1630

Session 1D: Symposium on Developing Chat-GPT for India: Challenges and Opportunities in Building Large Language Models

Convener: Chiranjib Bhattacharyya
IISc, Bengaluru

Chiranjib Bhattacharyya is currently Professor and the Chair of the Department of Computer Science and Automation, Indian Institute of Science (IISc). His research interests are in foundations of Machine Learning, Optimization and their applications to Industrial problems. He has authored numerous papers in leading journals and conferences in Machine Learning. Some of his results have won best paper awards. He joined the Department of Computer Science and Automation (CSA), IISc, in 2002 as an Assistant Professor. Prior to joining the department, he was a Postdoctoral Fellow at UC Berkeley. He holds BE and ME degrees, both in Electrical Engineering, from Jadavpur University and IISc, respectively, and completed his PhD from the Department of CSA, IISc. He is also a Fellow of the Indian Academy of Engineering. Chiranjib Bhattacharyya was elected Fellow of IASc in 2022.

07 July 2023: 1435–1455

Partha Pratim Talukdar
CDS & CSA, IISc and Google Research India

Large Language Models for India

Speaker's Profile

Partha Pratim Talukdar is a faculty member in the Department of Computational and Data Sciences (CDS) at the Indian Institute of Science (IISc), Bengaluru. He is also the founder of KENOME, an enterprise Knowledge graph company with the mission to help enterprises make sense of big dark data. Previously, Partha was a Postdoctoral Fellow in the Machine Learning Department at Carnegie Mellon University, working with Tom Mitchell on the NELL project. Partha received his PhD (2010) in CIS from the University of Pennsylvania, working under the supervision of Fernando Pereira, Zack Ives, and Mark Liberman. Partha is broadly interested in machine learning, natural language processing, and cognitive neuroscience, with a particular interest in large-scale learning and inference. Partha is a recipient of IBM Faculty Award, Google's Focused Research Award, Accenture Open Innovation Award, and Outstanding Paper Award at ACL. He is a co-author of a book on Graph-based Semi-Supervised Learning published by Morgan Claypool Publishers. Homepage: https://parthatalukdar.github.io. His research has focused on learning and inference over graphs, automatic knowledge harvesting from web-scale datasets, temporal information processing, and neuro-semantics.

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07 July 2023: 1455–1515

Monojit Choudhury
Microsoft Research India

Safety, Infrastructure and Language: The Three Scaling Challenges of LLMs

Speaker's Profile

Monojit Choudhury currently, is a Principal Data and Applied Scientist at Turing India. They build large universal language models that form the backbone of various Microsoft products. Prior to this, he was a Principal researcher at Microsoft Research Lab India, and he still strongly collaborates with his colleagues from MSR. His research interests cut across the areas of linguistics, cognition, computation and society. He has a BTech and PhD in Computer Science and Engineering from IIT Kharagpur, and has been at Microsoft Research since 2007.

He is interested in understanding the nature of the massively multilingual language models (such as Turing ULR, XLM-R, mBERT). As a part of Project LITMUS – Linguistically Aware Testing of Multilingual Systems, he worked on systematic evaluation and estimation of MMLM performance across languages, even in the absence of test datasets. This in turn enables them to understand the factors that affect MMLM performance and build optimal data collection strategies to ensure more equal or equitable performance.

He also collaborates on Project ELLORA, where their aim is to enable the speakers of low-resource languages through appropriate language technology. They are working with collaborators and NGOs on extremely low-resourced and lesser-known languages such as Gondi, Mundari, Idu-Mishmi, Sheng, Swahili and Igbo. Their decade-long experience in working with low-resource language communities tells us that technology is seldom the bottleneck; and more often than not, technological interventions do not work when the human and social contexts are not taken into consideration. On the other hand, participatory design and co-design, whenever possible, lead to simpler yet effective technological solutions.

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07 July 2023: 1515–1535

Vasudeva Varma
IIIT Hyderabad and Brane Enterprises Pvt Ltd

Leveraging Multilingual Large Language Models to Generate Grounded Encyclopaedic Articles in Indian Languages: Challenges and Opportunities

Speaker's Profile

Vasudeva Varma is the Head of Language Technologies Research Centre (LTRC), IIIT Hyderabad. He has served as the Dean (Research & Development), IIIT-H, and as the CEO of IIIT Hyderabad Foundation, one of the largest technology incubators in India that also managed IIIT-H's intellectual property and technology transfers. He has also co-founded Veooz Labs Pvt. Ltd, a social signal-based content discovery platform with social media search and analysis capabilities. He obtained his PhD from the Department of Computer and Information Sciences at the University of Hyderabad in 1996. Prior to joining IIIT Hyderabad in 2002, he was the President of MediaCognition India Pvt. Ltd and Chief Architect at MediaCognition Inc. (Cupertino, CA). Earlier, he served as the Director of Engineering and Research at InfoDream Corporation, Santa Clara, CA. He also worked at Citicorp and Muze Inc. in New York as a senior consultant.

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Session 1E: Public Lecture

Chairperson: Umesh Waghmare, President, Indian Academy of Sciences

07 July 2023: 1800–1900

Kavery Nambisan
A Surgeon and Novelist

Health, Education and Communities – the Future of a Nation: A Rural Surgeon's Perspective

Kavery Nambisan who has worked as a surgeon in rural India for several decades, explains how a rural career can be professionally enriching. It can also provide a unique opportunity to engage with the many urgent needs of village communities that go beyond health and encompass education and many other imaginative and enterprising pursuits. And not least, it provides a unique opportunity to create ripples of harmony and connectedness that strengthen the tenuous bonds between communities.

Speaker's Profile

Kavery Nambisan is from Kodagu district of Karnataka. She graduated from St. John's Medical College, Bengaluru. She did her higher surgical training in UK and obtained Fellowship from the Royal College of Surgeons in London. She has spent most of her career in rural India – in Bihar, UP, Tamil Nadu and Karnataka states. She was a governing council member of the Association of Rural Surgeons of India.

She is also a writer and has written several novels, essays and articles for the media on medical and literary matters. In 2007, she was part of the international writing programme in Iowa, USA. Her medical memoir, *A Luxury Called Health*, was published in 2021.

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Session 2A: Special Lecture

Chairperson: G C Anupama, Bengaluru

08 July 2023: 0930–1010

J N Chengalur
TIFR, Mumbai

Gas and Galaxy Evolution

As galaxies evolve, they convert their gas into stars. On a cosmic scale, it is well established that star formation peaked at about 10 billion years ago (redshifts ∼2–3) and the average star-formation rate of the Universe has declined sharply since then. Atomic hydrogen is the primary fuel for star formation. Stars form as gas cools to become molecular hydrogen, and then cools further and collapses under self-gravity. Hence, understanding the evolution of atomic hydrogen content of galaxies is the key to understand the evolution of star-formation rate with cosmic time. Unfortunately, because of the difficulties in detecting atomic hydrogen emission (via its best tracer, the 21-cm spectral line), until recently, very little was known about the evolution of gas content of star-forming galaxies. In this talk, the results from the ongoing atomic hydrogen surveys of star-forming galaxies using the upgraded Giant Meterwave Radio Telescope will be presented. These have significantly added to our understanding of the evolution of the baryon content of galaxies.

Speaker's Profile

Jayaram N. Chengalur obtained his B.Tech. in Electrical Engineering from IIT-Kanpur in 1987. He then moved to Cornell University for his doctoral studies, completing his PhD in 1994. Following this, he worked as a post-doctoral fellow at the Netherlands Institute for Radio Astronomy (ASTRON) in the Netherlands, before joining the National Centre for Radio Astrophysics in 1996. He is a Fellow of the Indian Academy of Sciences (2011), the National Academy of Sciences, India, and the Indian National Science Academy. His main research focus is in extragalactic astronomy, particularly studies of nearby dwarf irregular galaxies, neutral hydrogen (HI) absorption in very high redshift galaxies (the so-called "damped Lyman alpha" systems), and in general studies of the evolution of the neutral hydrogen content of the universe.

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Session 2B: Inaugural Lectures by Fellows/Associates

Chairperson: N Sathyamurthy, Bengaluru

08 July 2023: 1010–1030

Veerendra K Sharma
BARC, Mumbai

Physics of the Action Mechanism of Antimicrobial Peptides

Antibiotic resistance poses a significant threat to public health worldwide, and there is a pressing need to find novel antibacterial agents to combat this problem. Antimicrobial peptides (AMPs) are a class of promising antibiotics against drug-resistant bacteria. As the main target of AMPs is the bacterial membrane, a detailed study on the interaction between AMPs and lipid membrane is required to understand their action mechanism. This talk will focus on the physics of interaction of different AMPs with model biomembrane systems as investigated using neutron scattering techniques. The interaction of AMPs is found to be strongly dependent on the physical state and composition of the membranes. Another notable observation is the lateral segregation of lipids in the membrane elicited by the reduced lateral mobility in presence of AMP. Our studies divulge a new action mechanism of AMPs relevant in a more realistic scenario, where peptide concentration is not as high as would be required for pore formation, a traditional action mechanism. We have also shown that AMPs selectively interact with the model bacterial membrane. Interaction of other potential antimicrobial agents (ionic liquids, curcumin, etc.) with lipid membrane will also be discussed briefly in this talk.

Speaker's Profile

Veerendra Kumar Sharma is a Professor at the Solid State Physics Division, Bhabha Atomic Research Centre, Mumbai. His research interests are membrane biophysics, energy materials, soft matter physics, confined fluids, neutron scattering techniques. Veerendra Kumar Sharma was selected as Associate of IASc in 2020.

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08 July 2023: 1035–1055

B S Daya Sagar
ISI, Bengaluru

Mathematical Morphology in Geosciences and Geospatial Data Sciences

Mathematical Morphology – a robust mathematical theory that needs more attention by geoscience, remote sensing, and geospatial data science communities – is an area of geoscience that most people don't realize will change how they look at Earth and Earth-like planets! Data available at multiple spatial/spectral/temporal scales pose numerous challenges to data scientists. Of late, researchers paid wide attention to handling such data acquired through various sensing mechanisms to address intertwined topics like pattern-retrieval, pattern-analysis, quantitative reasoning, and simulation and modelling to better understand spatiotemporal behaviours of several terrestrial phenomena and processes. Various spatial algorithms that are mainly based on mathematical morphology have been developed and demonstrated. This lecture that presents fundamentals of mathematical morphology and their applications in geosciences, processing and analysis of remotely sensed satellite data and Digital Elevation Models, as well as geoinformatics, would be helpful for those with research interests in geosciences and remote sensing, geographical information sciences, spatial statistics, and mapping of earth-like planetary surfaces.

Speaker's Profile

B S Daya Sagar is a Professor of the Systems Science and Informatics Unit (SSIU) at the Indian Statistical Institute. Prof. Sagar received MSc and PhD degrees from the Faculty of Engineering, Andhra University, Visakhapatnam, India, in 1991 and 1994 respectively. His research interests include mathematical morphology, GISci, digital image processing, fractals and multifractals their applications in extraction, analyses, and modelling of geophysical patterns. B S Daya Sagar was elected Fellow of IASc in 2022.

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Session 2C: Inaugural Lectures by Fellows/Associates

Chairperson: Rajiva Raman, Varanasi

08 July 2023: 1120–1140

Jayasri Das Sarma
IISER, Kolkota

Mouse Hepatitis Virus-induced Neuroinflammation in an Experimental Animal Model Helps Better Understand the Complex Mechanism of Human Demyelinating Disease Multiple Sclerosis.

Myelin forms an insulating sheath surrounding axons/neurons in the nervous system, essential for rapidly propagating neuronal action potentials. Demyelination is an acquired neurodegenerative disorder where myelin degenerates, resulting in dysfunction of normal neuron-to-neuron communication and, in many cases, varying degrees of axonal degeneration. Multiple Sclerosis (MS) is the most common neuroinflammatory demyelinating disorder in young adults. Though demyelination is the primary manifestation, studies have clearly documented concomitant axonal loss to varying degrees resulting in long-term disability. Axonal injury may occur secondary to myelin damage (outside-in model), or myelin damage may occur secondary to axonal injury (inside-out model). Mouse hepatitis virus-induced demyelination models have provided unique insights into the cellular mechanisms of myelin destruction, illustrating mechanisms of viral persistence, latent infections, virus reactivation, and viral-induced tissue damage. These studies have also provided excellent paradigms for studying the immune and central nervous system (CNS) interactions. The current trend in CNS disease biology in our laboratory is to attempt to understand the neural-cell–immune interaction to investigate the underlying mechanism of neuroinflammation rather than focusing on peripheral immune activation. Our studies delineate the potential cellular, molecular, and immunological mechanisms of CNS axonal loss and demyelination in a viral-induced mouse model of MS.

Speaker's Profile

Jayasri Das Sarma is a Professor, Department of Biological Science, Indian Institute of Science Education and Research – Kolkata and Adjunct Associate Professor, Department of Ophthalmology, University of Pennsylvania, USA. Jayasri Das Sarma was elected Fellow of IASc in 2022.

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08 July 2023: 1145–1205

Ruchi Anand
IIT Bombay, Mumbai

Deciphering the Mechanism of Ribosomal Methyltransferase-mediated Antibiotic Resistance

Antibiotic resistance has become a silent epidemic that will result in more than 300 million deaths by 2050, if no appropriate action is taken. Repurposing of existing antibiotics and devising strategies to curb resistance is an uphill task and has become increasingly difficult. Towards addressing this grave problem, we combat the problem of origin of resistance itself and focus on understanding the mechanisms by which pathogens become resistant to existing drugs. One of the prevalent mechanisms by which resistance is conferred is by post-translationally modifying the protein synthesis machinery, the ribosome. Several antibiotics such as erythromycin bind to the ribosome and kill pathogens by selectively stalling their protein synthesis. Ribosomal modifying enzymes such as methyltransferases (Mtases) do not allow certain antibiotics to bind the ribosome by methylating select ribosomal bases and thereby cause a steric clash at the antibiotic binding site, thus result in evading their action leading to antibiotic resistance. Here, we decipher the mechanism of action and selective targeting of these resistance-conferring Mtases. We have used two enzymes KsgA and Erm both enzymes methylating adenine bases at the N6 position of select bases on 50S and 30S respectively. A combination of Cryo-EM, biochemical, fluorescence and MD approaches on both the Mtases as well as chimeric version of the enzymes revealed that apart from base flipping at the target site, that is crucial for methylation, base flipping at a distal allosteric site, within the Mtase is key in selective recognition of the target RNA. These studies serve as stepping-stone towards development of exclusive inhibitors that can aid in resisting resistance.

Speaker's Profile

Ruchi Anand is a Professor at IIT Bombay, Mumbai, She has done her PhD from Cornell University, USA. Her research interests are protein crystallography and structural biology. Ruchi Anand was elected Fellow of IASc in 2022.

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08 July 2023: 1210–1230

D Pallamraju
PRL, Ahmedabad

Aurora and Airglow: Tracers of Space Weather

Earth has a large-scale axial dipole magnetic field, a fact of historical importance Space has always fascinated humans. Although we can see the light from the stars and galaxies with the unaided eye, there is yet another light, the "airglow", in the intervening medium in the near-earth environment that gets unnoticed to an unaided eye. Understanding the brightness variations of airglow is important for fundamental investigations of the physics of sun–earth interactions. Studies of airglow and its counterpart the "aurora" serve as crucial tracers to gain fundamental knowledge of space weather. Space weather studies are also relevant for societal applications as we are increasingly dependent on space-based technologies in our day-to-day life and space weather is adversely affected by solar–terrestrial interactions. Several methods have been developed to remotely sense aurora and airglow to infer the weather (e.g., wave propagation, temperatures, winds, density variability, etc) of the atmosphere at the altitude of their origin. We have brought in innovations in the measurements of these emissions in the presence of strong daytime solar-scattered background-continuum in several spectral regions. These experiments have led to new insights into the daytime upper atmospheric dynamics. This talk will attempt to give a flavour of these new advancements.

Speaker's Profile

D Pallamraju is a Senior Professor and Dean, Physical Research Laboratory & Chair, Space and Atmospheric Sciences. His research interests are investigations of the equatorial, mid- and high-latitude upper atmospheric phenomena, investigation of coupling among various altitude regions of the earth's atmosphere, investigation of neutral and plasma dynamics during quiet and disturbed geomagnetic conditions, Space Weather effects in the Earth's upper atmosphere and exploring new methods for upper atmospheric research.

He was Managing Guest Editor of *Journal of Atmospheric and Solar Terrestrial Physics* (JASTP) Special Issue: *Atmospheric Coupling Processes in the Sun-Earth System*.
D Pallamraju was elected Fellow of IASc in 2023.

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08 July 2023: 1235–1255

Soumen Basak
NII, New Delhi

Investigating Immunoregulatory Roles of Cell Signaling Crosstalk

In their anatomical niche, mammalian cells receive signals from a variety of extracellular cues that activate simultaneously multiple intracellular pathways. However, a myriad biochemical processes link these pathways within an integrated cellular network. By combining biochemistry, mouse genetics, and computational modeling tools, we have been probing plausible crosstalk between these cell signaling pathways and elucidating the role of such cross-regulatory mechanisms in physiology and diseases. In particular, we have been examining crosstalk between the canonical and non-canonical NF-κB pathways and those beyond NF-κB signaling. Our investigation established an important immunoregulatory role of cell signaling crosstalk in instructing intestinal homeostasis and inflammation. We argue that our crosstalk studies may expand therapeutic opportunities in inflammatory human ailments in the future

Speaker's Profile

Soumen Basak currently acts as the Head of the Systems Immunology Laboratory, National Institute of Immunology. Soumen does research in immunology, cell signaling, systems biology and cancer biology. Soumen Basak was elected Fellow of IASc in 2021.

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