

## ABSTRACTS OF LECTURES

### Session 1A: Special Lecture

**Venue: Mahatma Gandhi Hall, Infosys Leadership Institute**

Chairperson: H Sharat Chandra, Centre for Human Genetics, Bengaluru

29 June 2018: 0930–1010

### **G Nageswara Rao**

L V Prasad Eye Institute, Hyderabad



#### **Research, relevance and public good**

Blindness is a major public health concern, and India shares a disproportionate share of the burden. India is home to nearly 20 per cent of the world's blind. Epidemiologic research has helped us develop an available, accessible and affordable healthcare delivery model. A comprehensive system of high-quality eye health model has been developed and implemented in three states of India. Translational research has also enhanced the quality of outcomes from cataract surgeries, while advances in stem cell transplantation of cornea have helped in treating some recalcitrant problems, offering the promise of sight restoration in cases of retinal degenerations. Increasing applications of technology have enhanced the scale, access, and quality of health care programs. Technological innovations that bring the benefits of the best of such technologies to the most marginalized will be presented.

#### **Speaker's Profile**

**Gullapalli N Rao** founded the L V Prasad Eye Institute in 1987, after a successful career in the United States as an academic ophthalmologist. An alumnus of AIIMS, New Delhi, he was trained first at Tufts University School of Medicine in Boston and later at the University of Rochester School of Medicine where he continued on the clinical faculty until his return to India in 1986. His areas of specialization include diseases of the cornea, eye banking and corneal transplantation, community eye health, eye care policy and planning. He is the recipient of several international and national awards in recognition of his services to eye care and public health. He also holds several board and leadership positions in prominent national and international organizations and was formerly the Chair and Chief Executive Officer of the International Agency for the Prevention of Blindness. He is currently the Chair of the Academia Ophthalmologica Internationalis. He was elected a Fellow of the Indian Academy of Sciences in 2004.

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**Session 1B: Lectures by Fellows/Associates**

**Venue: Mahatma Gandhi Hall, Infosys Leadership Institute**

Chairperson: Aswini Ghosh, IACS, Kolkata

29 June 2018: 1010–1030

**Ritabrata Munshi**

ISI, Kolkata



**The subconvexity problem**

Estimating the size of L-functions inside the critical strip is a central problem in the analytic theory of numbers. This problem has a long history originating in the works of Lindelf around 1908. Subconvex estimates often have deep implications. In this talk, the speaker will briefly describe the salient features of this important problem.

**Speaker's Profile**

**Ritabrata Munshi** is a Professor of Mathematics at School of Mathematics, TIFR, Mumbai and is presently on lien to ISI, Kolkata. He received his PhD from Princeton University (2006), under the supervision of Sir Andrew Wiles. During 2006–2009 he was the Hill Assistant Professor at the Rutgers University and has also spent a year (2009–2010) at the Institute for Advanced Study, Princeton University before returning to India and joining TIFR, Mumbai. He specializes in number theory and has made major contributions to the subconvexity problem, analytic aspects of L-functions and automorphic forms as well as Diophantine equations. He is the recipient of many awards including the Swarnajayanti Fellowship by DST (2012), the Birla Science Prize (2013), the Shanti Swarup Bhatnagar Prize (2015), and the Infosys Science Prize (2017). He is also an invited speaker for the International Congress of Mathematicians 2018 at Brazil. He was elected a Fellow of the Indian Academy of Sciences in 2017.

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29 June 2018: 1035–1055

**Pazhamalai Anbarasan**  
IIT Madras, Chennai



**Transition metal-catalyzed selective functionalization of metallocarbenes to *N*-heterocycles**

Transition metal-catalyzed functionalization of  $\alpha$ -diazocarbonyl compounds has found widespread application because of their ability to produce reactive metallocarbene intermediates. These metal carbenes have been proved capable of delivering a variety of useful transformations including traditional reactions like cyclopropanation, X-(C)H insertion and ylides. Recent studies focus extensively on the three component approach and functionalization of nitrogen analogue of  $\alpha$ -diazocarbonyl compounds, viz.  $\alpha$ -diazoimines, with various coupling partners. In this presentation, the speaker will describe his recent efforts in the synthesis and transition metal-catalyzed functionalization of  $\alpha$ -diazocarbonyl compounds and its nitrogen analogue.

**Speaker's Profile**

**Pazhamalai Anbarasan** is an Associate Professor of Chemistry at IIT Madras. He received his PhD from IISc, Bengaluru (2007). Subsequently, he held postdoctoral position at Leibniz Institute for Catalysis, Germany as Alexander von Humboldt Fellow and at the University of California, Berkeley, USA. He joined the faculty of IIT Madras in 2011. His research interests include the design and development of new synthetic methodologies, organometallic- and organocatalysis, synthesis of therapeutically important natural products, and trifluoromethylation and trifluoromethylthiolation. He is also interested in the chemistry of conversion of carbon dioxide into valuable chemicals and fuels. He has received the DAE-Young Scientist Research Award, Thieme Chemistry Journals Award-2013, Young Scientist Medal of INSA (2015), NASI-Young Scientist Platinum Jubilee Award (2016), and ISCB Young Scientist Award (2017). He was selected as an Associate of the Indian Academy of Sciences in 2015.

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**Session 1C: Lectures by Fellow/Associates**

**Venue: Mahatma Gandhi Hall, Infosys Leadership Institute**

Chairperson: E Arunan, IISc, Bengaluru

29 June 2018: 1120–1140

**Anuradha Dube**

CDRI, Lucknow



**Kala-azar – A neglected disease of poverty: Search for an affordable lasting cure**

Kala-azar (KA) or visceral leishmaniasis, a debilitating and potentially fatal disease, is limited to the Indian subcontinent and East Africa. The disease is transmitted anthropologically and results in periodic epidemics. Control measures for KA are heavily dependent on chemotherapy. However, specific antileishmanial drugs are limited, and besides being unaffordable and toxic, are also associated with increasing microbial drug resistance. The depressed immune system of the infected host is also a stumbling block in controlling the disease. By and large, while a small infected population develops clinical symptoms, the majority remains asymptomatic contributing to the spread of the disease. Further, some patients develop post-kala-azar dermal leishmaniasis (PKDL), which also plays an important role in KA transmission. These are the major challenges faced by the WHO initiative for the eradication of KA by 2020. The situation calls for a two-pronged strategy – killing the parasite while boosting host immunity – to win the battle against KA.

**Speaker's Profile**

**Anuradha Dube** superannuated as Chief Scientist from CSIR-CDRI, Lucknow in 2015 and is presently working as INSA Senior Scientist and J C Bose Fellow in the same lab. She works in the area of drug development and immunobiology of parasitic infections with a special focus on kala-azar. She has established the only available nonhuman primate model for preclinical evaluation of potential drug/vaccine against visceral leishmaniasis and has contributed to the identification and molecular characterization of leishmanial vital enzymes/proteins with Th1-stimulatory property as potential vaccine targets. Her group has also developed transgenic fluorescent parasite overexpressing green/ red fluorescent protein for drug screening/basic biology and has discovered non-toxic oral antileishmanial compounds from natural resources which could be potential drugs. She has published more than 170 papers in reputed journals and mentored 16 PhDs till date. She is a Fellow of the Indian National Science Academy (2013) and was elected a Fellow of the Indian Academy of Sciences in 2015.

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29 June 2018: 1145–1205

**C Narayana**  
JNCASR, Bengaluru



**Application of Raman spectroscopy from condense matter to biology**

With the advent of nanotechnology, the scope of application of Raman spectroscopy has extended beyond being a mere spectroscopic/characterization tool. Unfortunately, the full potential of Raman spectroscopy remains unexplored. Due to the ease of application and its ability to decipher interconnection with electronic states and spin states along with structural and vibrational properties, Raman spectroscopy has an edge over many other tools available and can be used to investigate the microscopic origin of molecular properties. The talk will discuss such potentials of Raman spectroscopy based on studies conducted on molecules of importance in condensed matter physics/biology. The first example is that of 1T-TiTe<sub>2</sub>, a prominent layered 2D system topological insulator. The multiple indirect signatures of electronic transition in 1T-TiTe<sub>2</sub> will be discussed in connection with the recent theoretical proposal for 1T-TiTe<sub>2</sub>, and also the possibility of an electronic topological transition from electronic Fermi surface calculations. The talk will also discuss the use of Raman spectroscopy in the investigation of molecular-level changes in the zeolitic imidazolate framework ZIF-8, as a function of temperature. Further delving into the applications of Raman spectroscopy in biology, the talk will highlight the use of surface enhanced Raman spectroscopy (SERS) in understanding the selective inhibition of oncogenic Aurora A Kinase by Felodipine.

**Speaker's Profile**

**C Narayana** is a Professor at Chemistry and Physics of Materials Unit, JNCASR, Bengaluru. He is also the Chairman, of the Unit and former Dean, Fellowships and Extension Programmes, at JNCASR. He holds a PhD from IISc, Bengaluru and a postdoc from Cornell University, New York. He specializes in Raman spectroscopy and ultra-high-pressure research. He heads the only laboratory in the country working on Brillouin Spectroscopy. He is the Coordinator of the program for developing the high-pressure X-ray diffraction facility for Indian scientists at Photon Factory, Japan and the India@DESY program of India-Germany at the synchrotron PETRA III, Germany. He has published many papers, holds patents and has received many awards. He was elected a Fellow of the Indian Academy of Sciences in 2018.

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29 June 2018: 1210–1230

**Ramesh Hariharan**

Strand Life Sciences, Bengaluru



### **Industrializing genomic diagnoses in India**

In instances of heritable disease with confounding phenotypic presentation, sequencing the genome is the only method to obtain a diagnosis. Genome sequencing in such a setting poses a number of challenges. A large number of genes have to be sequenced. The consequent data sizes are large, requiring large-scale algorithms. A large number of inconsequential mutations then have to be separated from true causative ones. This requires a number of different predictive methods, as well as the reading of the literature. All of this complexity adds cost, which is always constraining in the Indian setting. In this talk, the speaker will share his experiences in making each of these steps efficient and quick, and the consequent experiences in providing diagnoses for several thousand patients.

### **Speaker's Profile**

**Ramesh Hariharan** is the CEO and co-founder of Strand Life Sciences, Bengaluru, and an Adjunct Professor at IISc, Bengaluru. He did his B. Tech from IIT Delhi and his PhD from the Courant Institute, New York University. Following this, he moved to the Max Planck Institute as a postdoc and later spent ten years as full-time faculty working on algorithms research at IISc. At Strand, he straddles the fields of computer science and life science, working on algorithms that yield insights into biological systems and diseases. His recognitions include the MIT Technology Review TR100 list (2001), the first Devang Mehta award for IT (2002), and the Distinguished Alumnus of IITD (2015). He is also the author of *Genomic Quirks*. He is a Fellow of the Indian National Academy of Engineering and was selected as an Associate of the Indian Academy of Sciences during 2000–2004 and later elected a Fellow in 2016.

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29 June 2018: 1235–1255

**V K Gahalaut**

Ministry of Earth Sciences, New Delhi



**India plate motion and its interactions with Eurasian plate along the Himalayan and Indo-Burmese arc**

Techniques such as geological mapping, subsurface imaging, and GPS measurements have been providing valuable information towards quantification of plate tectonic forces or strain budget and configuration of subsurface faults, thus helping understand earthquakes. GPS measurements in the Indian subcontinent suggest that the India plate moves at a rate of  $\sim 5$  cm/year towards the northeast and deforms internally at a rate slower than 2 mm/year, consistent with the relatively low seismicity in the plate interior regions. Along its northern boundary in the Himalayan arc, it subducts under the Eurasian plate following a stick and slip manner resulting in frequent earthquakes along the arc. The most detailed and dense GPS measurements in the Garhwal Kumaon region of the Himalayan arc, imply a strain accumulation corresponding to a slip deficit rate of 18 mm/year. Measurements also suggest that coupling between the two plates is strong and homogeneous, making it the most vulnerable seismic segment of the Himalaya which has not released strain in the past >500 years. The speaker will discuss the GPS measurement studies performed by his team along the Indo-Burmese arc. The results of the study suggest that a large part of plate motion between the India and Sunda plate is accommodated along the Churachandpur Mao fault in a predominant strike-slip manner ruling out subduction along this boundary.

**Speaker's Profile**

**Vineet Kumar Gahalaut** is the Director of National Centre for Seismology (NCS), Ministry of Earth Sciences, New Delhi. His research is focused on earthquakes and their origin in India using crustal deformation data from GPS measurements. He has established more than 100 permanent GPS stations in various tectonic domains of India and has made major contributions in various seismic quantifications of the country. He is the recipient of several awards including the PRL award in Earth and Planetary Sciences (2011), the CSIR Young Scientist Award (2001), and the INSA Medal for Young Scientist Award (1997). He is the co-author of *Three Great Tsunamis: Lisbon (1755), Sumatra–Andaman (2004) and Japan (2011)*. He was elected a Fellow of the Indian Academy of Sciences in 2018.

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**Session 1D: Symposium on “Remembering Francis Crick: A multifaceted visionary scientist”**

**Venue: Mahatma Gandhi Hall, Infosys Leadership Institute**

Chairperson: Manju Bansal, IISc, Bengaluru

29 June 2018: 1430–1500

**Yamuna Krishnan**

University of Chicago, USA



**Quantitative chemical imaging *in vivo***

DNA can be self-assembled into molecularly precise, well-defined, synthetic assemblies on the nanoscale, commonly referred to as the designer DNA nanodevices. In this context, the speaker’s lab works on creating synthetic, chemically responsive, DNA-based fluorescent probes. In 2009 Yamuna and co-workers discovered that these designer nanodevices could function as fluorescent reporters to quantitatively image ions in real time in living systems. This marked the first-ever study on the functioning of DNA nanodevices inside a living cell without being interfered with or interfering with, the cells own networks of DNA control. In this talk, the speaker will discuss some unpublished work on how her lab has expanded this technology from ion imaging to quantitatively imaging reactive species as well as enzymatic cleavage with subcellular spatial resolution *in vivo*.

**Speaker’s Profile**

**Yamuna Krishnan** is Professor and Brain Research Foundation Fellow of Chemistry at the Grossman Institute of Neuroscience, University of Chicago. She received her PhD from IISc, Bengaluru (2002), and did her postdoctoral research at University of Cambridge, UK (2005). Research in her laboratory spans organic synthesis, nucleic acid biophysics, biochemistry, molecular biology, and cell biology. Her lab has pioneered the deployment of DNA nanodevices as quantitative fluorescent reporters of second messengers for *in vivo* imaging. She is the recipient of many awards including the Infosys Prize for Physical Sciences (2017), the AVRA Young Scientist Award (2014), the Wellcome Trust Senior Fellowship (2010), and the INSA Young Scientist Medal (2009). She is also the youngest woman recipient of the Shanti Swarup Bhatnagar Award (2013) and has featured in *Cell’s* 40 under 40 (2014). She was selected as an Associate of the Indian Academy of Sciences during 2005–2009.

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29 June 2018: 1500–1530

**Rajan Sankaranarayanan**  
CCMB, Hyderabad



**Transfer RNAs: Not merely adaptor molecules in protein synthesis**

Francis Crick proposed for the first time, in an informal manuscript submitted to the *RNA Tie Club* in 1955, the ‘adaptor hypothesis’ which filled an important gap in the information flow from DNA to proteins. While the role of transfer RNAs as adaptor molecules dominated our thinking during most part of the last century, the post-genomic era has uncovered diverse and critical cellular roles played by them. Notable among these is the very recent identification of tRNA-derived fragments involved in sperm maturation and fertilization. In addition to these totally unexpected cellular functions, the speaker will discuss the central role played by tRNAs in maintaining translational fidelity and situations that compromise faithful translation of the genetic code. In this context, the speaker will present two aspects of his recent work that focus on tRNA gene expansion in higher eukaryotes and evolutionary selection pressures that act on the ‘discriminator code’!

**Speaker’s Profile**

**Rajan Sankaranarayanan** is Chief Scientist at CSIR-CCMB, Hyderabad. He obtained his PhD from IISc, Bengaluru (1996) and was a postdoctoral research fellow at IGBMC, Strasbourg, France (1996–2002), before joining as a research group leader at CSIR-CCMB (2002). His group works on biophysical and biochemical approaches to elucidate the mechanistic basis of functioning of biomolecules and has made outstanding contributions in the area of proofreading during translation of the genetic code. He is a recipient of many prestigious awards including the Wellcome Trust International Senior Research Fellowship (2003), the Swarnajayanthi Fellowship of DST (2005–2006), and the Shanti Swarup Bhatnagar Award (2011). He is an elected Fellow of all the three major science academies of the country (FASc in 2010).

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29 June 2018: 1530–1600

**Souvik Maiti**

IGIB, Delhi



### **RNA G-quadruplex: Re-Search**

RNA G-quadruplexes in untranslated regions (UTR) are known to play an important role in translational regulation. The classic G-quadruplex motif consists of a continuous array of 3–4 guanine residues with an intermittent loop size of 1–7 nucleotides ( $G_{3-4}N_{1-7}G_{3-4}N_{1-7}G_{3-4}N_{1-7}G_{3-4}$ ). Investigating the possibilities of formation of RNA G-quadruplex with a stretch of sequence deviating from this classic motif will add to the overall conformations of RNA G-quadruplex bestowing diversity to this structure. In this presentation, the speaker will discuss the possibilities of unusual combinations of guanine residues involved in RNA G-quadruplex formation in the 5' UTR of different genes.

### **Speaker's Profile**

**Souvik Maiti** is research faculty at CSIR-IGIB, Delhi. He completed PhD (1999) from the CSIR-IICT, Hyderabad and following a postdoctoral training in USA and France, joined CSIR-IGIB (2003). He works in the area of chemical biology of nucleic acids and employs the principles of chemistry and biology to address questions of importance in biology and medicine. He is the recipient of many awards including the CSIR-Young Scientist Award, the NASI-Scopus Young Scientist Award, the AVRA Young Scientist Award in Chemistry, the Swarnajayanti Fellowship in Biological Sciences, the Shanti Swarup Bhatnagar Prize in Chemical Sciences (2014), and the DBT-National Bioscience Awards for Career Development (2016). He was elected a Fellow of the Indian Academy of Sciences in 2013.

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29 June 2018: 1600–1630

**Manju Bansal**

IISc, Bengaluru



**Francis Crick: A renaissance scientist**

Francis Crick – molecular biologist, physicist, and neuroscientist – is most known as the co-discoverer of the double helical structure of DNA in 1953, along with his ideas of ‘central dogma’, and ‘wobble hypothesis’. While his early research was focused on revealing the genetic code, his later research at the Salk Institute, focussed on theoretical neurobiology and advancing the study of human consciousness. A true ‘renaissance scientist’ indeed. However, during the 1970s, some new discoveries questioned the assumptions he and Watson had made in their original theory of unidirectional genetic information transfer. Another of Crick’s ideas, viz ‘selfish DNA’, suggesting that nonsense sequences originated as DNA parasites and were eliminated by the host cell over time, is still to be proven. Nonetheless, Crick’s contributions towards assimilation of disparate ideas and experimental results from a wide range of disciplines, and to then propose new theories and suggest experiments are unparalleled in modern science. The talk will present a bird’s eye view of some of these ideas and the recent developments in these areas.

**Speaker’s Profile**

**Manju Bansal** is INSA Senior Scientist and J C Bose National Fellow at IISc, Bengaluru. She received her PhD from IISc, under the guidance of Prof G N Ramachandran and joined the faculty of IISc in 1982. She is the Founder-Director of the Institute of Bioinformatics and Applied Biotechnology (IBAB), Bengaluru, and is serving on the Advisory Board of the World Wide Protein Data Bank. She has been an Alexander von Humboldt Fellow at EMBL, Heidelberg and the Free University of Berlin, and a Senior Fulbright Fellow at UCSF, San Francisco. Her research is primarily focused on relating protein and DNA sequences to their structures and function by developing new concepts, computational algorithms, and tools, particularly in the area of DNA promoter architecture. She is a Fellow of all the three major science academies of India (FASc in 1998).

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*Abstracts of Lectures*

**Session 1E: Public Lecture**

**Venue:** Nalwadi Krishnaraja Wadiyar Auditorium, Senate Hall, University of Mysore

**Chairperson:** R Ramaswamy, JNU, New Delhi

29 June 2018: 1800–1900

**Upinder Singh**

University of Delhi, Delhi



**Politics and violence: Ancient debates on a perennial problem**

The recognition of the pragmatic need for the king to exercise a certain amount of force while discharging his duties and the positive value attached to the principle of non-violence created an enduring and irresolvable tension in the ancient Indian political thought. Focusing on the ancient debates on political violence in general and war, punishment, and the interface with the forest in particular, this lecture argues that there is no single ‘Indian’ theory of kingship or political violence. Rather, it is highlighted that there have been intense conversations and a variety of responses to the realities and challenges of political practice. The talk explores how the kings need to use force to maintain and strengthen his position was upheld while a distinction was made between necessary force and the force that was unnecessary, disproportionate, excessive or random. The lecture further argues that political violence was justified, aestheticized, and almost invisibilized, though a window of questioning and critique remained.

**Speaker’s Profile**

**Upinder Singh** is Professor of History and National Coordinator for History at the Institute of Life Long Learning, University of Delhi. An alumna of the University of Delhi, she holds a doctorate from McGill University, Canada. She is a prolific author, and her writings range over various aspects of ancient Indian history, archaeology, and the modern histories of ancient sites and monuments. She is the author of *Kings, Brāhmaṇas, and Temples in Orissa: An Epigraphic Study* (AD 3001147) (1994), *Ancient Delhi* (1999), *The Discovery of Ancient India: Early Archaeologists and the Beginnings of Archaeology* (2004), *A History of Ancient and Early Medieval India: From the Stone Age to the Twelfth Century* (2008), *The Idea of Ancient India: Essays on Religion, Politics, and Archaeology* (2016), and *Political Violence in Ancient India* (2017). She has edited Delhi: *Ancient History* (2006) and *Rethinking Early Medieval India* (2011) and has co-edited *Ancient India: New Research* (2009), *Asian Encounters: exploring connected histories* (2014), and *Buddhism in Asia: Revival and Reinvention* (2016). She has many national and international awards and honours to her credit and was awarded the Infosys Prize in Social Sciences – History in 2009.

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**Session 2A: Lectures of Fellows/Associates**

**Venue: Mahatma Gandhi Hall, Infosys Leadership Institute**

Chairperson: Anil K Gupta, IIT, Kharagpur

30 June 2018: 0930–0950

**Manoj Kumar**

Guru Nanak Dev University, Amritsar



**Development of fluorescent probes for molecular recognition, bioimaging, and catalytic applications**

Fluorescent chemosensors have been widely explored in many diverse fields from biology and physiology to pharmacology and environmental sciences. The most explored usage of chemosensors is molecular recognition involving cation/anion sensing with applications in the development of molecular logic gates and keypad locks. With the advent of time, the applications of fluorescent probes have extended to medicine involving bio-imaging and diagnostics. The speaker will discuss the design and synthesis of an array of novel chemosensors developed by his lab. The applications of these chemosensors in diverse fields including in the detection of metal ions, logic gate based devices, detection of explosives, detection of bioanalytes *in vitro* and *in vivo* will be discussed. Furthermore, the scope of these chemosensors as a diagnostic tool by developing small molecule-based fluorescent molecules will be highlighted.

**Speaker's Profile**

**Manoj Kumar** is a Professor in Department of Chemistry, Guru Nanak Dev University, Amritsar. He received his PhD from Guru Nanak Dev University (1988) and completed his postdoc from Instituto de Quimica Medica, Madrid, Spain (1993). His research interests include the development of different types of fluorescent probes for bioimaging and diagnosis; construction of molecular switches; logic based molecular devices; and the development of novel functional materials of ultimate practical utility. He has published 176 research papers in journals of international repute with more than 4000 citations. He is the recipient of the CRSI Bronze Medal (2011) for his contributions to chemical sciences. He was elected a Fellow of the Indian Academy of Sciences in 2018.

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30 June 2018: 0955–1015

**Prabal K Maiti**  
IISc, Bengaluru



**Structure, dynamics and thermodynamics of confined water**

Water is the essence of life and various properties of water molecules have intrigued researchers from time immemorial. The speaker studies various translational and orientational dynamics of water molecules confined inside a carbon nanotube using atomistic molecular dynamics simulation and tries to understand the thermodynamics of water entering inside a hydrophobic nanotube by calculating the Helmholtz free energy of water using two-phase thermodynamic method. Based on these studies, the speaker has proposed a mechanism of water permeation in helium impermeable graphene oxide (GO) membrane using the calculation of potential of mean force (PMF). PMF calculations of the oxidized part of the GO sheets in helium and oxidized part of the GO in water will be discussed highlighting the difference in their permeation path.

**Speaker's Profile**

**Prabal K Maiti** is a Professor in the Department of Physics, IISc, Bengaluru. He received his PhD in Physics from IIT Kanpur, followed by postdoctoral stays at MPIP-Mainz, the University of Colorado at Boulder, and Caltech, USA. He primarily works in the area of multiscale modelling of soft and bio-materials. Areas of current research interest include structure and dynamics of dendrimers, DNA-based nanotechnology, DNA-dendrimer complexation, and properties of water under strong confinement. He was elected a Fellow of the Indian Academy of Sciences in 2018.

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30 June 2018: 1020–1040

**Nagasuma Chandra**

IISc, Bengaluru



**Identification of a host biomarker signature for detecting tuberculosis through a blood test**

Efficient diagnosis of tuberculosis (TB) is met with multiple challenges, calling for a shift of focus from pathogen-centric diagnostics towards the identification of host-based multi-marker signatures. Transcriptomics offer a list of differentially expressed genes, but cannot by itself identify the most influential contributors to the disease phenotype. The speaker will discuss a computational pipeline that adopts an unbiased approach to investigate host factors that are altered significantly due to TB to identify a biomarker signature. The pipeline is based on the integration of various techniques including network-mapping of RNA-Seq data of TB patients, systemic identification of variations in healthy and TB samples, sensitive network mining to shortlist gene candidates central to disease alterations, and application of a series of filters. The study has resulted in the identification of a signature comprising 10 genes that can discriminate between TB and healthy controls as well as distinguish TB from latent tuberculosis and HIV in most cases. The potential of this signature as a diagnostic marker of TB will be discussed.

**Speaker's Profile**

**Nagasuma Chandra** is a Professor in the Department of Biochemistry, IISc, Bengaluru and is additionally affiliated with Bioengineering and Mathematical Biology initiatives at the institute. She received her PhD from the University of Bristol in 1992. She works on modelling complex biological processes and applying them to study human health and disease with particular focus on tuberculosis. She is the recipient of the DST-National Bioscience Award for Career Development (2008). She was elected a Fellow of the Indian Academy of Sciences in 2018.

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**Session 2B: Lectures by Fellows/Associates**

**Venue: Mahatma Gandhi Hall, Infosys Leadership Institute**

Chairperson: H Shekar Shetty, University of Mysore, Mysore

30 June 2018: 1100–1120

**Swagata Dasgupta**

Indian Institute of Technology, Kharagpur



**The evolving story of protein–polyphenol interactions**

Protein interactions form the basis of all life processes – whether the interaction is between two proteins, a protein and a nucleic acid or a protein and a small molecule. In this context, recent years have seen increasing interest in protein–polyphenol interactions with researchers investigating the interactions of polyphenols (e.g. green tea polyphenols) with various human proteins. Such interactions affect protein functionality in various ways. For example, polyphenols present in green tea were found to be noncompetitive inhibitors of Ribonuclease A, while they also inhibit angiogenesis – the capacity to form blood vessels. Protein condensation/aggregation, the hallmark of many diseases triggered research involving human serum albumin, lysozyme, and the amyloid peptide  $A\beta_{25-35}$  that established the vital role of Cu(II) and the effect of additives on the fibrillation process. Green tea polyphenols were also observed to protect human  $\gamma$ B-crystallin from UV radiation-induced damage and aggregation. Modified  $\gamma$ -crystallin has been isolated from discarded cataractous emulsion of patients to examine changes in the protein. The eye protein isolate is being explored for nanoparticle/film preparation to be used in possible drug/compound delivery.

**Speaker's Profile**

**Swagata Dasgupta** is a Professor in the Department of Chemistry, IIT Kharagpur. She received her PhD from RPI, USA and works primarily in the area of protein chemistry. She has served as a member of the Women Scientist Committee (WOS-A) in Chemical Sciences, DST (2008–2012) and is on the Core committee of the ECRA/N-PDF scheme of SERB in Chemical Sciences. She is the recipient of many awards and honors including the Darshan Ranganathan Memorial Lecture Award of Chemical Research Society of India (2013) and the CRSI Bronze medal (2016). Her Biochemistry lectures (NPTEL, MHRD) are very well received and she regularly delivers talks to young scholars. She is a Fellow of the West Bengal Academy of Science and Technology (2014) and was elected a Fellow of the Indian Academy of Sciences in 2018.

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30 June 2018: 1125–1145

**Varun Bhalerao**  
IIT Bombay, Mumbai



**Cosmic fireworks: Shining light on gravitational wave sources!**

What happens when two neutron stars collide? Are these really the sources of most of the gold, platinum, and other heavy elements in the universe? After decades of theoretical speculation, researchers finally found the answer last August. Advanced gravitational wave detectors – LIGO and Virgo – discovered the coalescence of two neutron stars 130 million light years away from the Earth. At nearly the same time, Earth-orbiting satellites saw a flash of high energy radiation from the same direction. What followed was arguably the most frantic period of activity in modern astronomy, with over 3500 individuals from 950 institutes joining forces to pinpoint the source in the sky and uncover its secrets. In this talk, the speaker will discuss this first binary neutron star merger, how it was found and understood, and what it means for in the days to come.

**Speaker's Profile**

**Varun Bhalerao** is an Assistant Professor in the Department of Physics, IIT Bombay. He received his PhD in astrophysics from Caltech and joined as a Vaidya-Raychaudhuri Post-doctoral Fellow at IUCAA, Pune. He later obtained the DST-INSPIRE Faculty Fellowship and has since joined the Department of Physics at IIT Bombay. His research interests span astrophysical observations and instrumentation. He leads the Indian efforts for electromagnetic follow-up of gravitational wave sources. He is a part of the international GROWTH collaboration, which has been extremely successful in the study of GW170817 – the only gravitational wave source detected so far with an electromagnetic counterpart. He is also working to set up India's first fully robotic telescope at Hanle, Ladakh. He led the calibrations for Cadmium Zinc Telluride Imager, one of the telescopes on board AstroSat. He was selected an Associate of the Indian Academy of Sciences in 2017.

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30 June 2018: 1150–1210

**Maitrayee DasGupta**  
University of Calcutta, Kolkata



**Challenges in extending symbiotic nitrogen fixation beyond current host range**

Only a handful of selected plants restricted to a monophyletic clade within angiosperms are blessed with the ability to undertake symbiotic nitrogen fixation. It is a mutualistic relationship between a plant and a nitrogen-fixing bacteria and involves carbon–nitrogen exchange. Symbionts are accommodated in the intracellular organelle-like compartments in a microaerophilic niche where they convert atmospheric  $N_2$  to  $NH_3$ , thereby giving an endogenous source of fertilizer to the host plants. There is considerable interest in exploring whether similar symbioses can be engineered in our crop plants to reduce their dependence on nitrogenous fertilizers. Prime candidates that are responsible for the adaptations to symbiotic nitrogen fixation would be discussed in the backdrop of the challenges to its extension to plants outside the competent clade.

**Speaker's Profile**

**Maitrayee DasGupta** is a faculty in the Department of Biochemistry, Calcutta University since 1994. She did her PhD from Bose Institute, Kolkata, and postdoc from the University of Texas, USA. Her research aims at delineating molecular principles that underlie the symbiotic interactions between plants and nitrogen-fixing bacteria where she focuses on understanding the adaptation of receptor kinases to accommodate the beneficial bacteria in host plants. She is an elected Fellow of the National Academy of Sciences, India and the West Bengal Academy of Science and Technology. She was elected a Fellow of the Indian Academy of Sciences in 2018.

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30 June 2018: 1215–1235

**Souvik Mahapatra**  
IIT Bombay, Mumbai



**Reliability of CMOS IC chips – from atoms to processors**

Integrated circuit (IC) chips are ubiquitous in all electronic products used today. The semiconductor industry has made tremendous progress in delivering ICs with increased performance over the years, resulting in better products. However, during operation, these ICs degrade over time and eventually fail. Therefore, the industry must ensure that the reliability (or rate of failure) of these ICs is not compromised when a new technology is developed and delivered and that the products should operate over their specified usage life. In this talk, the speaker will discuss the methodologies and models for predetermining the ageing and failure of these chips – from technology (transistors) to full chip (circuits) level. These methods are helpful in accessing and rectifying potential reliability issues during CMOS (complementary metal-oxide-semiconductor) technology qualification.

**Speaker's Profile**

**Souvik Mahapatra** is a Professor of Electrical Engineering at IIT Bombay. He received his PhD from IIT Bombay in 1999 and was a researcher at the Bell Laboratories, USA, during 2000–01 before rejoining IIT Bombay in 2002. His research interests include reliability of CMOS devices and circuits. He has received many awards including the INAE-Young Engineer Award (2004), the Tan Chin Tuan Fellowship by Singapore Government (2008), the PRL-Vikram Sarabhai Award (2014), and the Erasmus Mundus Fellowship (visiting fellow at IMEC, Belgium, 2015). He is a Fellow of the Institute of Electrical and Electronics Engineers and Indian National Academy of Engineering. He was elected a Fellow of the Indian Academy of Sciences in 2018.

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30 June 2018: 1240–1300

**C T Dhanya**

IIT Delhi, New Delhi



**Hydrological extremes and hazard modeling – Exploring the intricacies and predictability of the regional hydrologic system**

Hydrological extremes, though rare, have always existed, adversely affecting the economy, in the form of floods and droughts. The rarity and intensity of such events often jeopardize the management policies undertaken. Recently, India has witnessed an increase in the occurrence of hydrologic extremes, i.e., floods, droughts, and heat waves, the impacts of which proved to be much detrimental to the Indian society and economy, especially due to the lack of any systematic early warning systems and subsequent strategic planning. These extremes increase the stress undertaken by the water sector owing to the compounding effects of climate change, growing population, and globalization, with implications for food and energy security, ecology and environment, critical infrastructures and emergency preparedness, as well as human lives, health, and economy. The talk will elaborate the research attempted to gain fundamental insights into such hydrological extremes and towards improving hydrological modeling to aid the development of early-warning methods and policies for sustainable water resources and hazard management. The two-fold approach undertaken: (i) Statistical learning from time series of observations, and (ii) Theoretical modeling hydrological and holistic models to simulate the regional hydrological cycle behavior, will be covered. Major research outputs and accomplishments, so far, will be comprehended.

**Speaker's Profile**

**Dhanya C T** is an Assistant Professor in the Department of Civil Engineering, IIT Delhi. She holds PhD in hydro-climatology from IISc, Bengaluru. She attempts to generate a fundamental scientific understanding of hydrological extremes along with improvising hydrological modeling, to provide early-warning methods and adaptation policies for sustainable water resources management. She is the recipient of numerous awards including the NASI Young Scientist Platinum Jubilee Award (2017), the Young Researcher Award – Ministry of Earth Sciences (2017), and the DAAD Faculty Exchange Scholarship to serve as a visiting faculty in Forschungszentrum Jlich, Germany. She was selected as an Associate of the Indian Academy of Sciences in 2016.

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**Session 2C – Symposium on “Blockchains and Cryptocurrency”**

**Venue: Mahatma Gandhi Hall, Infosys Leadership Institute**

Chairperson: R L Karandikar, CMI, Chennai

30 June 2018: 1430–1500

**Madhavan Mukund**

CMI, Chennai



**Introduction to blockchains**

A blockchain is a list of records or blocks that grows continuously. Blockchains can be used to implement distributed ledgers that maintain a permanent and verifiable transaction history. Blockchains are typically managed by a peer-to-peer network with decentralized updates. Distributed consensus protocols are used to maintain coherence. Integrity against tampering is ensured through cryptography. The speaker will explain the theory and technology behind blockchains as well as the implications for applications of features such as cryptography and decentralized control.

**Speaker’s Profile**

**Madhavan Mukund** is presently Professor and Dean of Studies at the Chennai Mathematical Institute (CMI). He studied at IIT Bombay (B.Tech) and Aarhus University (PhD) before joining the faculty of CMI in 1992. He is also Director of the Indo-French Research Lab in Computer Science (ReLaX) set up in CMI by the French National Centre for Research in Computer Science (CNRS) and is President of the ACM India Council. He has been the National Coordinator of the Indian Computing Olympiad since 2002 and has taught several courses in the MOOC initiatives of Microsoft Research and the National Programme for Technology Enhanced Learning (NPTEL) project of MHRD. He has served as President of the Indian Association for Research in Computing Science. His main research area is formal verification. He was elected a Fellow of the Indian Academy of Sciences in 2018.

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30 June 2018: 1500–1530

**Bimal Roy**

ISI, Kolkata



### **Cryptographic primitives for blockchains**

Anonymity, authenticity, and secrecy are the key issues in blockchain technology. To achieve these, the cryptographic primitives required are: hash functions, public key cryptography, and digital signature. The speaker will explain each of these concepts along with its strengths. Algorithms related to these also will be presented in brief.

### **Speaker's Profile**

**Bimal Roy** has served as the Director of Indian Statistical Institute during 2010–15 and is presently heading the R C Bose Centre for Cryptology and Security of ISI. He holds a PhD from the University of Waterloo, Canada, and has been on the faculty of ISI for over 30 years. He specializes in the areas of cryptology and statistics. He is Founder and General-Secretary of the Cryptology Research Society of India. He is the recipient of several awards and honors including Padma Shri from the Government of India (2015), INSA Teachers Award (2014), IBM Faculty Award, and Reliance-NASI Platinum Jubilee Award (2007).

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30 June 2018: 1530–1600

**S P Suresh**  
CMI, Chennai



**Bitcoin – economic aspects**

The talk will explore the fundamental features of Bitcoin as money. Some of the questions that will be addressed are: What gives Bitcoin its value? What are some of the fundamental choices in the Bitcoin algorithm that determine the economics of Bitcoin as a currency? How much can Bitcoin grow? Are there inherent limitations to its growth?

**Speaker's Profile**

**S P Suresh** is an Associate Professor of Theoretical Computer Science at the Chennai Mathematical Institute. He completed his MCA from REC (now NIT) Trichy (1996), holds a PhD from the Institute of Mathematical Sciences, Chennai, and has been working at CMI for the past 15 years. His research interests include logic in computer science, concurrency and distributed computing, and formal methods for security.

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30 June 2018: 1600–1630

**Rajeeva L Karandikar**  
CMI, Chennai



**Blockchains: Beyond cryptocurrency**

In this talk, the speaker will review the discussion on blockchains and bitcoins. In addition, he will also discuss the potential uses of blockchains beyond cryptocurrency, for example, for land and medical records. The talk will also highlight the pros and cons of evolving such a system.

**Speaker's Profile**

**Rajeeva L Karandikar** is currently the Director of the Chennai Mathematical Institute. He holds a PhD (1981) from ISI, Kolkata. He was on the faculty of ISI, Delhi from 1984 till 2006 and has served as the Head of the Delhi Center of ISI. During 2006–2010, he was the Executive Vice President of Cranes Software, Bengaluru. He works on various aspects of probability theory and is also interested in cryptography, finance, and psephology. He is the recipient of the Shanti Swarup Bhatnagar Prize in Mathematical Sciences and the National Award in Statistics in honour of Professor C R Rao by the Ministry of Statistics and Programme Implementation, Government of India. He is a Fellow of the Indian National Science Academy and was elected a Fellow of the Indian Academy of Sciences in 1994.

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*Abstracts of Lectures*

**Session 2D – Special Lecture**

**Venue: Mahatma Gandhi Hall, Infosys Leadership Institute**

Chairperson: N Mukunda, Bengaluru

30 June 2018: 1700–1740

**Raman Sukumar**

IISc, Bengaluru



**Thinking long-term in ecology: Insights from 3-decades of monitoring a tropical forest in Mudumalai**

The dynamics of ecosystems may vary considerably across natural ecological gradients such as elevation and rainfall, as well as over time because of interannual variability in climatic factors. Hence, spatiotemporal scales and long-term monitoring become important considerations in understanding the underlying functioning of natural ecosystems.

Mudumalai, a dry forest landscape in southern India along a sharp rainfall gradient, has been the site of long-term ecological research including floristics, forest dynamics, invasive species ecology, and fire ecology. A 50-ha permanent plot was set up in the dry-deciduous forest in 1988. This was followed in 1994 by nineteen 1-ha permanent plots spanning several vegetation types and rainfall regimes. The individual fate of over 80,000 individuals from nearly 200 species of woody plants has been monitored over nearly three decades in these sites. These long-term studies provide crucial insights in terms of the biotic and abiotic factors affecting tree diversity, growth, and survival in this forest.

The monitoring has also provided new insights into theoretical issues in ecology. Overall, the importance of environmental stochasticity has been clear not only in the low-rainfall, seasonally dry tropical forests of Mudumalai but surprisingly across a global network of tropical forest plots extending to rainforests. Such long-term studies have particular relevance to predicting tropical forest response to future climate change

**Speaker's Profile**

**Raman Sukumar**, Professor of Ecology at IISc, Bengaluru, is known for his pioneering research on the ecology, behaviour, and conservation of Asian elephants. His research interests are tropical forest ecology and climate change. In 1988 he established the country's longest-running ecological monitoring programme in the Western Ghats and has contributed extensively to Indian government policy on conservation. The author of four books on the elephant and many scientific papers, he is the recipient of several national and international awards, the most notable being the International Cosmos Prize in 2006. He also contributed to the work of IPCC that shared the Nobel Peace Prize (2007). His most recent scientific contribution is an edited volume *Tropical Conservation: Perspectives on Local and Global Priorities* (Oxford University Press, New York, 2017). Currently, he is a Visiting Professor at the Institute of Advanced Study, Kyoto University, Japan. He is an elected Fellow of TWAS and all the three major science academies in India (FASc in 2000).

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*Abstracts of Lectures*

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