**RAM RAMASWAMY**
*Jawaharlal Nehru University, New Delhi*

## The uses of chance

Chance, depending on context, can mean different things to different people. A chance event may either be a consequence of intrinsic fluctuations or may be due to incomplete or imprecise knowledge. The notion of contingency is closely tied into that of chance, and thus uncovering the underpinnings – whether this is due to underlying stochastic phenomena or underlying chaotic dynamics – is of interest.

Using examples from dynamical systems theory, the role of chance when there are several coexisting dynamical attractors, with attractor basins that are intermingled in a complex manner will be discussed. Small uncertainties in determining the initial state can lead to very large uncertainties in the outcomes. On the other hand, intrinsic noise plays a major role in small systems where the dynamics is stochastic. Both phenomena occur in biological systems and are exploited, at a systems level, in different ways. On the one hand, chance provides the possibility of complex dynamical states such as chimeras. On the other, chance allows for stochastic switching in the realm of dynamics both within a cell and within populations.

Chance is crucial in a diverse range of situations. To paraphrase Monod (1971), nature relies on chance and not on destiny. And as noted by C R Rao (1989), chance may be the antithesis of all law. But the way out is to discover the laws of chance.

*SPEAKER'S PROFILE*

*Ramakrishna Ramaswamy, President of the Indian Academy of Sciences (2016-18), has recently retired from the School of Physical Sciences, Jawaharlal Nehru University, New Delhi. His research interests are in the intersection of nonlinear science, statistical physics, and computational biology. He is also a Fellow of the Indian National Science Academy and of The World Academy of Sciences (TWAS).*

**SANJAY KUMAR**
***Banaras Hindu University, Varanasi***

## DNA inspired physics

The last decade has witnessed an intense activity in experiments involving the manipulation of single DNA. This interest has been fueled on the one hand by the desire to understand the fundamental mechanisms at play in DNA molecule, and on the other hand by the development of revolutionary single-molecule force spectroscopy experiments, which provide unprecedented insights into the strength of the inter and intra-molecular forces driving biological processes, e.g., replication and transcription. The speaker has proposed a generic model of DNA under the influence of external force and has studied different properties associated with DNA. It was shown that the proposed model is rich enough to resolve many long standing issues. Some of these issues will be briefly reviewed in this talk.

*SPEAKER'S PROFILE*

*Sanjay Kumar is currently engaged in teaching and research at Banaras Hindu University. After graduating from Bhagalpur University, he joined the M.Sc. (Physics) programme in Kumaun University. Prior to joining BHU as a faculty member in the year 1997, he was a Lecturer in Physics at the Physics Department of Tripura University (North East region) during 1991–1997. As the department was in the inception stage, he worked hard in developing the department and popularizing science in that region. He is the recipient of Indian National Science Academy Medal for Young Scientists (1996), Boyscast Fellow of Department of Science and Technology (1998) and Simons Associates of ICTP, Italy (2015). In 2016, he was elected as a Fellow of the Indian Academy of Sciences, Bengaluru.*

**S M YUSUF**
***Bhabha Atomic Research Centre, Mumbai***

## Low-dimensional spin systems and quantum magnetism

Low dimensional magnetic systems have been of great interest due to their novel, unconventional, and complex electronic and magnetic properties. Spin systems with reduced space dimension can show magnetic frustrations. Frustrated quantum magnetic systems provide a rich playground for interplay of competing exchange interactions and quantum fluctuations, and are at the forefront to explore unconventional phases of condensed matter. It is important to understand the physics of such spin systems. Spin lattices, such as triangular, square, Kagome, honeycomb and spin-trimer are of special importance. Neutron scattering is known to be an excellent microscopic probe to investigate magnetic states. The speaker and his group have revealed nature of magnetic ground states of a large variety of spin systems with reduced dimensions involving quantum fluctuations. In his talk, the speaker will present the recent experimental results of neutron scattering elucidating the microscopic nature of magnetic correlations in some of these naturally occurring low dimensional spin systems. The experimental results will be compared with the available theoretical results revealing the physics of such novel spin systems with regard to physical properties in reduced dimensions involving quantum fluctuations.

*SPEAKER'S PROFILE*

*S M Yusuf is currently Outstanding Scientist and Head of Solid State Physics Division of BARC, Mumbai. He is also a Professor at Homi Bhabha National Institute (HBNI), and Dean (Students' Affair), HBNI-BARC. Additionally, he serves as the Vice-President of Indian Physics Association, the Indian Crystallographic Association, and the President of the Neutron Scattering Society of India. He obtained his PhD in physics from the University of Mumbai, was a post-doctoral fellow at Argonne National Laboratory, USA, and a visiting scientist at the Institute of Materials Science, Spain. His expertise is in the area of advanced magnetic materials and neutron scattering. He has received many awards including D. Sc (Honorary) in 2018, MRSI-ICSC Superconductivity & Materials Science Annual Prize, DAE Homi Bhabha Science & Technology Award, MRSI Medal, DAE-SRC Outstanding Research Investigator Award, etc. He was elected as a Fellow of the Indian Academy of Sciences in 2017.*

**SWATI TRIPATHI**
*Birbal Sahni Institute of Palaeosciences, Lucknow*

## Multiproxy studies on dung of endangered Sangai (*Rucervus eldii eldii*) and Hog deer (*Axis porcinus*) from Manipur, India: Implications to paleoherbivory and paleoecology

The speaker and her group have carried out pollen and non-pollen palynomorph analyses of 16 summer and winter dung samples of two endangered deer species, Sangai (*Rucervus eldii eldii* M'clelland) and Hog deer (*Axis porcinus* Zimmermann) from Keibul Lamjao National Park of Manipur, northeast India, in order to examine the dietary preferences of these species in relation to the vegetation and ecology of the region. In her talk, the speaker will discuss the significance of her findings which will be helpful to document and understand seasonal difference in dietary preferences and ecology of the two deer species along with the other associated herbivores in the region. The palynodata is also useful in tracing the relationship between modern pollen and vegetation, which is challenging to accomplish systematically due to seasonal flooding of the region.

*SPEAKER'S PROFILE*

*Swati Tripathi is currently working as a Scientist-C in the Quaternary Laboratory of the Birbal Sahni Institute of Palaeosciences, Lucknow. Her research interests include Quaternary vegetation and climate change through pollen and non-pollen palynomorphs, examining pollen micro-morphometry of living plants, coprolite studies and melissopalynology. She received three gold medals including Birbal Sahni Memorial Gold Medal during her MSc (Botany), Lucknow University, in 2007. She received her PhD in 2011 from the Department of Botany, Lucknow University. She is also the recipient of the Dr B.S. Venkatachala Memorial Medal (2012) and the Dr Chunni Lal Khatiyal Medal (2016) for outstanding research work. She is an Associate (2017) of the Indian Academy of Sciences, Bengaluru. She has 32 research papers and has trained five MSc students including one summer research fellow through Indian Academy of Sciences (SRF-P) and is currently running a SERB-fast track young scientist project.*

## DEBANJAN BHOWMICK

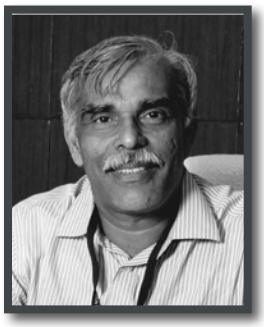
***Indian Institute of Technology Delhi, New Delhi***

### Hardware implementation of neural network algorithms, based on machine learning and neuroscience models, using spintronic devices as non-volatile memory elements

Neural Network algorithms are widely used by the machine learning and data sciences community to solve various classification, recognition and prediction tasks. These algorithms, if implemented on hardware instead of software, can provide further advantages owing to the parallel architecture and the principle of memory embedded computing inherent in these algorithms. Spintronic devices owing to their non-volatility can make excellent memory elements for the hardware implementation of Neural Networks. The speaker will discuss a few such spintronic implementations of Neural Network, which he and his team have carried out through simulations at IIT Delhi. One such implementation follows a Neural Network algorithm that is largely inspired by the functioning of the brain – Spiking Neural Network, enabled with Spike Time Dependent Plasticity. If implemented in spintronic hardware it can not only solve several problems of relevance to the machine learning community but also may help improve our understanding of the functioning of the brain in future.

*SPEAKER'S PROFILE*

*Debanjan Bhowmik is currently an Assistant Professor in Department of Electrical Engineering, Indian Institute of Technology–Delhi, working in the area of spintronics-based low-power computing. He supervises research in the area of spintronics-based hardware neural networks. He obtained his B. Tech. in Electrical Engineering from IIT–Kharagpur in 2010 and PhD from University of California–Berkeley in 2015, working in the field of nanomagnetism and spintronics. He was elected as an Associate of the Indian Academy of Sciences in 2017.*



## VIJAYAMOHANAN K PILLAI

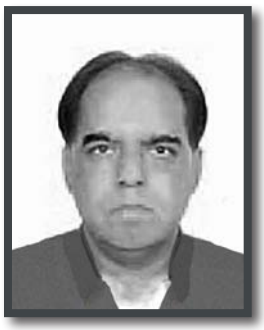
***Central Electrochemical Research Institute, Karaikudi***

### Battery materials for electric vehicles: Today and tomorrow

Electric mobility provides some respite against our increasingly deteriorating environment by deploying hybrid and electric vehicles. Affordability, however, could act as a barrier in minimizing the carbon footprint for the benefit of future generations (sustainability). This talk will explain the design of battery materials involved in zero-emission transportation after a brief history of rechargeable Li-ion batteries, examining all the options available for electric mobility. Various aspects of the National mobility programme including the plan to replace vehicles in India by 2030 using fuel cells, Li-ion, Na-ion, Li-air and other futuristic batteries will be discussed. The future of personalized as well as public transport will be examined in the light of recent innovative trends like smart battery materials, driver-less and flying cars using unprecedented technological advancements in materials science, computational capability, machine intelligence and mega-data analysis.

*SPEAKER'S PROFILE*

*Vijayamohanan K Pillai is a leading Electrochemist from India, who after receiving his PhD from IISc, Bangalore, worked in many areas of electrochemical power sources, electrochemical sensors and bio-electrochemistry for more than two decades. He has authored over 250 publications and obtained 20 patents in both electrochemistry and materials chemistry and has guided about 20 PhD students. He has received many honors and awards – MRSI Medal, CRSI Medal, National Prize for Research on Energy Materials and Devices, etc.; Fellowship of the Indian National Science Academy and the Indian Academy of Sciences (2008). He has served on the Editorial Board of many prestigious journals. He is at present the Director of CSIR-Central Electrochemical Research Institute, Karaikudi. He also held the additional charge as Director, CSIR-NCL, Pune, from June 2015 to February 2016.*



**AVESH K TYAGI**
***Bhabha Atomic Research Centre, Mumbai***

## Rational design of materials with tailored functionalities

New functional materials, with tailored functionalities, can be designed by interplay of synthesis and crystallographic structures. Of late, the focus of research has been shifted to multi-functional materials, i.e., the materials that can possess two or more synergistic or antagonistic functionalities. The synthesis of such materials has been a challenge and also an opportunity to chemists. The speaker and his team have prepared several new functional materials guided by crystallographic approach coupled with novel synthesis protocols. Some materials which will be discussed include $RE_{1-x}Ce_xCrO_3$ (materials with tunable band gap and magnetic properties), $CeScO_3$, $Ce_2Zr_2O_{7+x}$ (oxygen storage capacitors), tunable-dielectrics in hexagonal-$ABO_3$ systems and several lead free relaxor materials. The talk will focus on the role of synthesis, novel properties exhibited by these functional materials, and their crystallographic correlation.

*SPEAKER'S PROFILE*

*Avesh K Tyagi is presently heading the Nuclear & Energy Material Section, Chemistry Division, BARC, Mumbai, and is also a Senior Professor (Chemistry) and Dean-Academic (Chemical Sciences) at Homi Bhabha National Institute, Mumbai. His research interests are in the field of nanomaterials, functional materials and nuclear materials. He has been conferred with a number of prestigious awards such as DAE-Homi Bhabha Science and Technology Award, MRSI Medal; CRSI Bronze Medal; Gold Medal of Indian Nuclear Society; Rajib Goyal Prize in Chemical Sciences; DAE-SRC Outstanding Researcher Award; CRSI-Prof. CNR Rao National Prize for Chemical Sciences; ISCB Excellence Award in Chemical Sciences; MRSI-ICSC Materials Science Senior Award; Metallurgist of the Year award; CRSI-Silver Medal and MRSI-CNR Rao Prize. He is a Fellow of the Maharashtra Academy of Sciences; Royal Society of Chemistry; National Academy of Sciences, India; Indian Academy of Sciences (2013) and Asia Pacific Academy of Materials (FAPAM).*

## BIKRAMJIT BASU

***Indian Institute of Science, Bengaluru***

### Biomaterialomics: Data-driven accelerated pathways for next generation biomaterials

Conventional approaches in biomaterials science or bioengineering involve the intuitive way of tailoring process variables that often incur long development cycles and high costs. Accelerated development of patient-customized implantable biomaterials or biomedical devices to achieve the efficient bedside–bench–bedside translation cycle is the need of the hour. Building on the concepts of the Materials Genome Initiative, the speaker will define a new term, 'Biomaterialomics', that relies on a data-driven integrated understanding of biocompatibility and elements of biomaterials development, leveraging both conventional and advanced manufacturing. Newer computational approaches to establish process-structure-property (PSP) linkages, relatively well explored for structural materials, can play significant role in the development and deployment of new generation biomaterials. Studies published by the speaker's research group will be used as case studies to illustrate the formulation of PSP frameworks. The Biomaterialomics approach will significantly aid in the development of a new generation of bioimplants, whose predictive clinical performance could be closely tracked by 'digital twins'. Futuristic challenges of the field will also be discussed.

*SPEAKER'S PROFILE*

*Bikramjit Basu is currently a Professor at the Materials Research Center and holds Associate Faculty position at Center for Biosystems Science and Engineering, Indian Institute of Science (IISc), Bangalore. He served as Assistant Professor at IIT Kanpur from 2001 to 2011. He is the recipient of Shanti Swarup Bhatnagar Prize (2013). He remains the only Indian to receive the prestigious 'Coble Award for Young Scholars' (2008) from the American Ceramic Society. He is a Chartered Engineer of UK, Fellow of the American Institute of Medical and Biological Engineering (2017), National Academy of Medical Sciences (2017), Indian National Academy of Engineering (2015), Society for Biomaterials and Artificial Organs (2014) and National Academy of Sciences, India (2013). He has published over 250 peer-reviewed research papers with citation of 8,300, H-index of 50. He is leading India's major translational Center of Excellence on biomaterials with an interdisciplinary team of 50 researchers, clinicians and companies.*

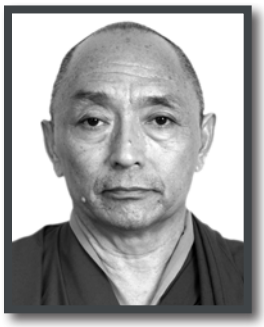
**KANISHKA BISWAS**
*Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru*

## Low thermal conductive chalcogenides for high performance thermoelectric energy conversion

One of the fundamental challenges in developing high-performance thermoelectric materials has been to achieve low lattice thermal conductivity ($\kappa L$). Intrinsic low thermal conductivity is of practical interest due to its robustness against grain size, temperature range and other structural variations. The exploration of new materials with intrinsically low $\kappa L$ along with a microscopic understanding of the underlying correlations among bonding, lattice dynamics and phonon transport is fundamentally important towards designing promising thermoelectric materials. Zintl compounds, $TlInTe_2$, exhibit ultralow $\kappa L$ due to low energy ratting modes (optical modes) of weakly bound Tl+. These low energy optic phonon modes are strongly anharmonic, which scatter the heat-carrying acoustic phonons through phonon–phonon interactions, thereby decrease the thermal conductivity. Soft phonon modes and optical–acoustic phonon coupling cause an ultralow $\kappa L$ in the room-temperature hexagonal phase of AgCuTe, while the dynamic disorder of Ag/Cu cations leads to reduced phonon frequencies and mean free paths in the high-temperature rocksalt phase. A high zT of 1.6 is achieved in the p-type AgCuTe at ~670 K. The speakers's group has recently shown that the localized vibrations of Bi bilayer lead to ultralow lattice thermal conductivity and high thermoelectric performance in weak topological insulator n-type BiSe near room temperature.

*SPEAKER'S PROFILE*

*Kanishka Biswas is an Associate Professor in the New Chemistry Unit, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru. He is pursuing research in solid state inorganic chemistry of metal chalcogenides, thermoelectrics, topological materials, 2D materials and perovskite halides. He is a Young Affiliate of The World Academy of Sciences (TWAS) and an Associate of the Indian Academy of Sciences (IASc), Bengaluru. He is a recipient of Young Scientist Medal 2016 from Indian National Science Academy (INSA), Delhi; Young Scientist Platinum Jubilee Award-2015 from The National Academy of Sciences, India (NASI), Allahabad; Materials Research Society (MRSI) of India Medal, 2017; IUMRS-MRS Singapore Young Researcher Merit Award 2016; and Young Scientist Wiley Award from IUMRS 2017 in Kyoto, Japan. He was selected as Emerging Investigator by Journal of Materials Chemistry C (2017) and Chemical Communication (2018), Royal Society of Chemistry (RSC), UK.*



## GESHE NGAWANG SAMTEN

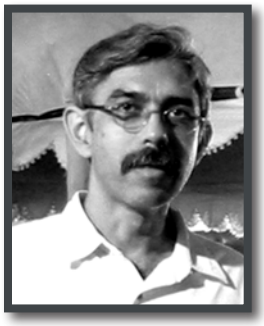
***Central Institute of Higher Tibetan Studies, Varanasi***

### Buddhism and science

Buddhism and science have striking similarities, particularly with respect to their approach to search deeper reality. Buddhism, especially in the tradition of ancient Nalanda, has a rich system of wide range of analytical philosophy, which has a strong practice of logic and epistemology as instruments for investigation and analysis. Indian philosophy in general and Buddhism in particular, explored the reality of the external world, which is inextricably associated with the inner world, the system of mind. There have been occasional dialogues between science and Buddhism in the past. However, since over three decades, interaction between Buddhism and Science has been going on intensively on regular basis with the initiatives of His Holiness the Dalai Lama. Leading scientists in the fields of physics, neuroscience, astronomy, psychology, cognitive science and clinical research have participated and many researches have shown ground breaking results. Some of the major findings in the field of neuroscience exploring into the system of the mind and emotions have changed the principles of science. Researches on emotions have become an area of great interest in the domain of science and based on these findings, practices such as Mindfulness, Regulation of Emotions and Social Emotional Learnings are being practiced widely in schools, public domain and clinical services.

*SPEAKER'S PROFILE*

*Geshe Ngawang Samten (b. 1956) is presently the Vice Chancellor of Central Institute of Higher Tibetan Studies, Sarnath, Varanasi, and has been Professor of Indian Buddhist Philosophy at the University. He is educated both in the modern system as well as in the Buddhist and Tibetan Studies in the monastic mode. He has such important publications to his credit, as a definitive critical edition of Ratnavali with commentary, Abhidhammathasamgaho; Sanskrit and Tibetan versions of the Pindikrita and the Pancakrama of Nagarjuna; Manjusri, an illustrated monograph on Tibetan Buddhist scroll paintings. He has been Visiting Professor in various universities and colleges in USA and Australia. He has also been instrumental in promoting Buddhist Studies in India. He has formulated university syllabi on Buddhist philosophy and researches. He is on numerous academic bodies, universities and expert committees of the ministries of the Government of India. In 2008, he was decorated with Padma Shri by the President of India in recognition of his distinguished services in the fields of education and literature.*



**IMRAN SIDDIQI**
*Centre for Cellular and Molecular Biology, Hyderabad*

## GM crops in the Indian context: Looking back, looking forward

The discovery of plant transformation in the early 1980s enabled enormous advances to take place over the last three decades in our understanding of plant biology at the molecular level. It has also led to major application in agricultural biotechnology through development of genetically modified (GM) crops carrying genes from other species (transgenics) that target agricultural issues such as pests and weeds. Several of these GM crops have been widely deployed and enjoyed a high degree of commercial success, but have also been associated with medium to long term ecological, environmental, and stakeholder costs which have been high in several cases. The views on GM technology cover a wide spectrum from GM being considered essential for increasing agricultural productivity to strong opposition and questioning of GM approaches on being able to deliver on safe and sustainable agriculture that takes small farmer's interests into account. What is becoming increasingly apparent is that the consequences of GM crops are determined not just by the technology itself but the context and modalities of its deployment, including socioeconomic factors and policy environments. GM technologies are rapidly evolving and it is now necessary to distinguish between GM and transgenics. The presentation will cover background information on GM crop technology, a discussion of GM crop usage in the Indian context, and possible future scenarios.

*SPEAKER'S PROFILE*

*At the Centre for Cellular and Molecular Biology in Hyderabad, Imran Siddiqi is a plant geneticist whose research has been on understanding the mechanisms by which genetic information is transmitted from parent to progeny in plants at the time of meiosis and germ cell formation. His work has provided fundamental insights into how clonal seed formation can be achieved, avoiding the variation that normally occurs as a result of the normal process of sexual reproduction. His research has important implications for agriculture as being able to engineer clonal seed formation in crop plants, which can revolutionize plant breeding and agriculture particularly in developing countries. He is a recipient of the Infosys Prize in Life Sciences in 2011, and the Distinguished Alumnus Award of the Indian Institute of Technology, Bombay, 2012. He is a fellow of the Indian Academy of Sciences (2008) and the Indian National Science Academy. He has served in an advisory capacity for a number of research organizations and is a member of the editorial boards of several leading international journals in plant sciences.*

## ANINDA J BHATTACHARYYA

***Indian Institute of Science, Bengaluru***

### Electrochemical energy storage via batteries: Prospects and limitations

Among the various possible alternatives for energy storage, the electrochemical method provides great opportunities for efficient energy storage and sustainable development. It is now widely recognized that electrochemical energy storage systems such as batteries have tremendous potential in large scale applications such as electric mobility, electric power grids and also for integration with renewables, e.g., solar and wind. The extent of energy that can be stored in a battery is largely driven by the underlying redox chemical reaction. Since the evolution of batteries, many unique redox mechanisms have been demonstrated which have led to devices ranging from mere laboratory demonstrations to successful mass scale industrial production. Despite the deep emphasis on applications, battery (electro)chemistry poses formidable basic research challenges in various fields of chemistry as well as allied areas of science. The talk will cover various scientific challenges in the context of energy storage mechanisms, materials and future prospects and limitations of rechargeable batteries.

*SPEAKER'S PROFILE*

*Aninda Jiban Bhattacharyya is Professor and Chair of the Solid State and Structural Chemistry Unit, Indian Institute of Science, Bengaluru. He also holds the position of Amrut Mody Chair Professorship. He works on frontline areas of experimental physical and materials chemistry. His research mainly focuses on studies related to diverse electrochemical processes at the interface of chemistry and biology and also specializes in the chemical design of novel and advanced multifunctional materials having very high relevance to field of energy, environment and chemical biology.*

*Bhattacharyya has been awarded the C.N.R. Rao National Prize for Chemical Research, CRSI, 2016, Materials Research Society of India (MRSI) Medal, 2013, and Indo American Frontiers of Science Award (IAFOS), 2013. He is also a member of several scientific societies within India and abroad. He was elected a Fellow of the Indian Academy of Sciences, Bengaluru in 2017.*

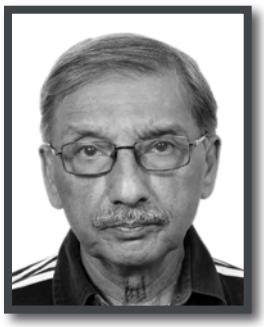
**DEEPA AGASHE**
*National Centre for Biological Sciences, Bengaluru*

## Host-microbial associations in a changing world

Eukaryotic hosts are often associated with microbes that enhance their fitness. Although faithful transmission of the microbes across generations is important to establish and maintain the relationship, in some cases the microbes are environmentally acquired. Thus, when hosts disperse to new habitats or switch to a new diet, they may not have access to the appropriate microbes, leading to reduced fitness. In such cases, can the host establish new microbial partnerships? Are such partnerships specific, and how long does the established process require? More generally, how are microbial communities assembled, and (how) does host association influence this process? In this talk, the speaker will discuss her efforts to address these questions in different insects, both in the laboratory and in the field.

*SPEAKER'S PROFILE*

*Deepa Agashe received her Bachelor's degree in Microbiology from Garware College, University of Pune, in 2003. Subsequently, she obtained her PhD from the University of Texas at Austin, in 2009. For her thesis, she conducted laboratory experiments with beetles to test the impact of genetic diversity on population dynamics and niche use. For her postdoctoral work, she went to Harvard University, Boston, where she experimentally tested the impact of synonymous mutations in bacterial genes. She returned to India in 2012 and established a research group at the National Centre for Biological Sciences in Bengaluru. Her current work focuses on understanding evolutionary and ecological process using bacterial and insect systems.*



## ALOK BHATTACHARYA

***Jawaharlal Nehru University, New Delhi***

### Genetics and biology of neuromuscular disorders: Unmet scientific need

Neuromuscular disorders cause defect in peripheral nervous system and or muscles. Unfortunately for most diseases currently there are no treatments. Over the last 2–3 decades, it has become evident that most of these disorders have a genetic origin. Currently hundreds of genes have been identified and it is expected that more disease-associated genes will be found thanks to increasing whole genome sequence data. Not all patients of neuromuscular disorders inherit the mutations – increasing number of de novo mutations is being identified. Moreover, disease-associated genes have been found in both mitochondrial and nuclear genome and are known to participate in several different pathways. In most cases it is not clear how the mutations in the respective genes affect neural and or muscle functions. There is also very little information available about mechanisms of genotype–phenotype relationship in these diseases. The speaker will broadly cover these points in his talk.

*SPEAKER'S PROFILE*

*Alok Bhattacharya is currently Professor in the Schools of Life Sciences & Computational and Integrative Sciences at Jawaharlal Nehru University. He obtained a Master's degree in Chemistry from IIT–Kanpur and PhD in Life Sciences from Jawaharlal Nehru University. He carried out post-doctoral work at National Cancer Institute and Harvard Medical School, USA. After returning to India, he spent a few years at AIIMS, New Delhi, and Tata Research Development & Design Centre, Pune, before joining Jawaharlal Nehru University as an Associate Professor. Initially he set up a lab to carry out research in immunology and infectious diseases, particularly for understanding immune response to pathogens at the molecular level. Later he developed a research program on amoebiasis, an intestinal disease highly endemic in India and one of the neglected tropical diseases. He had also set up one of the first teaching and research programs on bioinformatics and computational biology in India.*

## D BALASUBRAMANIAN

***L V Prasad Eye Institute, Hyderabad***

### Translational research approach: Primary congenital glaucoma – Prevalence, genetics and collaboration between scientists and clinicians for successful treatment

Primary congential glaucoma (PCG) is a group of diseases in which high fluid pressure in the eye damages the optic nerve. It affects children between birth and 3 years and untreated cases are a major cause of childhood blindness. Early detection and clinical treatment can save the sight of the infant. Of the several genes associated with PCG, the speaker's group has done some extensive work on the gene CYP1B1, and how the mutation R368H in CYP1B1 is seen across the world, which appears to suggest the possibility of the origin and spread of the disease itself. Molecular modeling of the protein, identification of the promoter in the expression of the gene, and treatment modes have also been worked out. A clinical colleague has successfully treated hundreds of children, followed up with them and shown how well many of these have succeeded in life. This is an example of what is referred to as Translational Research– 'lab bench to patient's bedside and on to the community'.

*SPEAKER'S PROFILE*

*D Balasubramanian has been single-mindedly involved in the promotion and enhancement of eye research in India as Director of Research, L V Prasad Eye Institute, Hyderabad, since 1998, where he encouraged ophthalmologists to not only treat but also enter into research. He helped establish the Indian Eye Research Group, established collaborative research with other centers and has started the field of stem cell research and therapy for eye diseases in India. He has contributed to the growth and expansion of the field of biochemistry and molecular biology, with special reference to the area of 'protein diseases' such as cataract of the eye, brain disorders, by pointing out how misfolding of the protein chain leads to pathology. For his contributions to popular science, he has been awarded UNESCO's Kalinga Prize in 1999, and the Indira Gandhi Prize for the Popularization of Science. He has been awarded Padma Shri in 2002, and also Civilian Honor of France, 'Chevalier de l'Ordre National du Merite', 2002. He is elected Fellow of all three scientific academies of India, and was President of Indian Academy of Sciences (2009–2012).*

## BHUDEV C DAS

***Amity Institute of Molecular Medicine & Stem Cell Research, Noida***

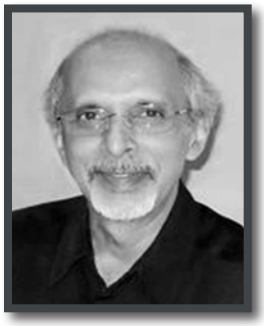
### Public health genomics to innovative targeted therapeutic approaches for relapse-free survival of cancer patients

In this talk, the speaker will discuss the application of omics-based approaches in early detection, prevalence, progression, prevention and management of human health and disease. He will also broach the subject of Human Papillomaviruses (HPVs), specifically the high-risk HPV-16 variant that was identified and employed to develop an indigenous therapeutic-cum-preventive chimeric-DNA vaccine construct for effective prevention and treatment of cervical cancer. He will also talk about a novel triple conjugate drug curcumin-folic acid-cancer drug (Doxorubicin) that was developed by his team for targeted delivery to cancer and cancer stem cells.

*SPEAKER'S PROFILE*

*Bhudev C Das has made outstanding contributions in the field of cancer research, tumor virology, human genetics and mutation research. He has published more than 210 research papers in reputed international journals and distinguished himself as a renowned Molecular Oncologist. He has worked with the Nobel Laureate, Prof. Harald zur Hausen at German Cancer Research Centre (DFKZ), Heidelberg, and later he pioneered the work in India on Human Papillomavirus (HPV) that causes cervical and other cancers. He established National and WHO Regional HPV Referral Centre for South-East Asia at ICPO. His present areas of research are transcriptional regulation, miRNA regulation, cancer stem cell and cancer drug discovery.*

*Das is the recipient of President's gold medal of the Dr. B.C. Roy National Award of MCI, Sandoz Oration Award of ICMR, among several others, including the prestigious J.C. Bose National Fellowship (2008-2016). He is a Fellow of all four major national science and medical academies (FNA, FASc, FNASc and FAMS) and of the Union for International Cancer Control (UICC), Geneva. He was WHO expert advisor of the Global HPV LabNet & HPV Vaccine Program at Geneva for several years.*



## C S YAJNIK

***KEM Hospital Research Centre, Pune***

### Early life origins of diabetes in Indians

The dogma of diabetes describes a genetic susceptibility and precipitation by obesogenic factors (diet, inactivity, stress etc). The genetic factors are non-modifiable, therefore, the diabetes prevention trials of today concentrate on treatment of precipitating factors (diet, exercise and stress). The interventions are usually done in post-reproductive adults, and therefore, do not help the next generation. Both fetal under- and over-nutrition has been found to increase susceptibility of the fetus to future disease; this process is now called 'fetal programming'. A wide range of environmental factors operating in pregnancy have the potential for fetal programming. India has a unique position, in that it is the world's capital of early life undernutrition, as well as being one of the world capitals of diabetes. Research has demonstrated a substantial role for fetal programming by maternal undernutrition, as well as diabetes, in the aetiology of diabetes. A part of this susceptibility operates through influences on body composition and both micronutrient deficiencies and macronutrient excess increase the risk. Postnatal factors that promote a catch-up growth in small babies seem to exaggerate the risk. Epigenetic factors also seem to be playing an important role, which suggests that the susceptibility to non-communicable disease could be modified. Trials are in progress to influence fetal programming by improving the health of the adolescents.

*SPEAKER'S PROFILE*

*C S Yajnik is the Director of the Diabetes Unit at the King Edward Memorial Hospital and Research Centre in Pune, India. He investigates the high susceptibility of Indians to diabetes and related disorders. He is known for his description of the 'thin-fat' Indian (high body fat percent at low BMI) and its intrauterine programming by maternal nutritional and metabolic factors.*

*He is an Honorary Visiting Fellow, MRC Lifecourse Epidemiology Unit, Southampton, UK, visiting Professor at University of Exeter UK, and of the Danish Diabetes Academy, and adjunct Professor IISER, Pune. He received Helmut Mehnert Award of International Diabetes Federation (2009), David Barker Medal of International DOHaD Society (2011), and Outstanding Investigator Award of World-India Diabetes Foundation. Yajnik is an advisor to numerous organizations including DBT, ICMR, National Institute of Nutrition (NIN), India, WHO (Geneva), and the Wellcome Trust, London, UK.*

**BHISMA K PATEL**
*Indian Institute of Technology Guwahati*

## Fluorescent, AIEgen and cytotoxic behaviour of annulated polycyclic heteroaromatics

Polycyclic aromatic hydrocarbons (PAHs) constitute an important class of molecules in material science due to their applications in electronic devices, semiconductors, solar cells, fluorescent probes and cancer cell imaging. Incorporation of heteroatoms (N, O or S) into PAHs can fine tune their chemical, physical and supramolecular properties. Transition-metal catalyzed aromatic C–H activation of arenes, hetero-arenes and alkynes has been a powerful synthetic strategy to access various polycylic heteroaromatics. The speaker will discuss Ruthenium(II) catalyzed oxidative C–H / O–H and C–H / S–H annulations that have been demonstrated by his team using different directing arenes, *viz.,* 2-arylquinolinone, 2-arylbenzoxazinone, quinoline-4(1*H*)-thiones and quinoxaline with internal alkynes. He will also talk about Regiospecific annulations that have been observed for directing arenes *via* the assistance of weaker carbonyl or thio carbonyl groups in the presence of a stronger nitrogen-directing site. Some of the synthesized polycyclic hetero-aromatics are water soluble exhibiting fluorescence and aggregation induced emission (AIE). These AIE luminogens are highly cytotoxic against HeLa cell line and some have found application as fluorescent 'light-up' probes for cell imaging.

*SPEAKER'S PROFILE*

*Bhisma Kumar Patel is presently Professor and Head – Department of Chemistry at the Indian Institute of Technology Guwahati. He holds a PhD in Chemistry from IIT Kanpur and a Postdoc from the Max-Planck Institute for Experimental Medicine, Germany. His area of research includes study of organic reaction mechanisms, synthesis of heterocycles, biosensors, green chemistry, metal catalysed oxidative functionalization, C-H bond activation (metal and metal free), and hypervalent iodine mediated organic transformations. He is the recipient of many prestigious awards including the Costal Chemical Research Society Award – 2016 and CRSI Bronze Medal – 2014. He has served as the Dean of Student's Affairs, Chairman GATE, Chairman DRDO SET and as a member of the Board of Governors at IIT Guwahati and NIT Nagaland. He is a Fellow of the National Academy of Sciences, India, and has been elected as a Fellow of the Indian Academy of Sciences in 2018.*

**S DAYANANDA**
***University of Hyderabad, Hyderabad***

## Organophosphate hydrolase exists as part of Ton complex in *Sphingobium fuliginis* ATCC27551 and plays a role in active transport of nutrients across energy deprived outer membrane

In soil bacterium *Sphingobium fuliginis*, organophosphate hydrolase (OPH) exists as part of Ton complex comprising of TonB, ExbB/ExbD. The OPH physically interacts with both ExbD and TonB. The surface exposed arginine residues (R91 and R96) of OPH facilitate its physical interaction with ExbD. A functional Ton complex forms in heterologous systems only when OPH is co-expressed with ExbB and ExbD. The OPH hydrolyzes the lactone ring present in enterobactin and facilitates the release of iron strongly bound to enterobactin. The *Sphingobium fuliginis* TonB dependent transport (SfTonBDT) system complemented *E. coli* TonBDT null mutant. The cells having SfTon complex with OPH showed better growth and enhanced iron uptake when compared to a similar strain generated without OPH. The study by the speaker and his group reveals existence of novel TonB dependent transport system in *S. fuliginis* ATCC 27551.

*SPEAKER'S PROFILE*

*Siddavattan Dayananda is presently a Professor in the Department of Animal Sciences, School of Life Sciences at University of Hyderabad. His group works in the areas of horizontal gene transfer among soil bacteria, transport of prefolded proteins across bacterial membrane and the development of bioremediation strategies useful in leather processing, insect control and detection and decontamination of nerve agents. He is a receipient of many national and international fellowships and awards inlcuding the DAAD Fellowship (1988-90), Commonwealth Academic Staff Fellowship (1995–1996), The Wellcome Trust, UK International Research Development Award and the Andhra Pradesh Scientist Award-2008 of the AP State Council of Science and Technology. He is a Fellow of all the three Science Academies in India. He was elected as a Fellow of the Indian Academy of Sciences in 2018.*

**JEEVANJYOTI CHAKRABORTY**
***Indian Institute of Technology Kharagpur***

## Diffusion, growth, and elasticity in batteries – A mathematical modelling perspective

Lithium-ion batteries are widely used in almost all portable electronic devices and most recently in electric vehicles. However, they can become commercially competitive only with much higher energy capacity – something which can be achieved with the use of electrode materials like silicon. But silicon poses a major technological difficulty because it undergoes huge volumetric growth when infused with lithium during charging. In this talk, the speaker will describe a modelling framework to understand the fundamentals of such diffusion-induced growth, and how such a framework helps in investigating possibilities of buckling as a mechanical failure together with ways to mitigate large axial deformations. The speaker will also discuss some of the immediate challenges of delving deeper into smaller length scales on one hand and upscaling the framework to the length scale of the whole battery on the other.

*SPEAKER'S PROFILE*

*Jeevanjyoti Chakraborty is an Assistant Professor in the Mechanical Engineering Department of IIT Kharagpur. He holds a PhD from IIT Kharagpur and has held postdoctoral positions in applied mathematics at the University of Oxford and the University of Birmingham. He had a three-month stint as DST-INSPIRE Faculty at IISc Bangalore before joining IIT Kharagpur. His research interests span across fluid and solid mechanics together with electrochemical effects. He is especially interested in the mathematical modelling of energy storage materials, fluid flows through deformable confinements, and certain mechanical aspects of biological cell growth. His PhD work (on micro-scale flows) was adjudged as one of the five best across all engineering disciplines by the INAE (2014). He received the Faculty Excellence Award at IIT Kharagpur (2017). He was selected as an Associate of the Indian Academy of Sciences in 2017.*

**SRUBABATI GOSWAMI**
***Physical Research Laboratory, Ahmedabad***

## Discovering CP violation in the lepton sector: Challenges and possibilities

Discovering CP violation in the lepton sector constitutes one of the most challenging tasks in the field of high energy physics. In this talk, the speaker will discuss the difficulties in determination of the leptonic CP violating phase and to what extent the future experiments can explore this. The speaker will also discuss the possible role played by the India-Based Neutrino Observatory experiment in this endeavor.

*SPEAKER'S PROFILE*

*Srubabati Goswami is currently Senior Professor at Physical Research Laboratory (PRL). She holds a PhD in neutrino physics from the University of Calcutta and has done post-doctoral research in PRL and Saha Institute of Nuclear Physics, Kolkata. She joined as a faculty at Harish Chandra Research Institute in 2002 before moving to PRL in 2008. She works on high energy particle physics with special focus on neutrinos. She has many awards and honors to her credit including the C.V. Raman Mahila Vigyan Purashkar from SVA, Karnataka (2016); Ramanujan Fellowship by DST (2008); NASI-Dr P Sheel Memorial Award for young women scientists (2006); Humboldt Fellowship (2005), Germany; JSPS fellowship (2002); and DST Fast Track Proposals for Young Scientists 2001–2002. She is a fellow of all the three Science Academies in India and a member of the India-based Neutrino Observatory collaboration. She was elected as a Fellow of the Indian Academy of Sciences in 2017.*

## SHABANA AZMI

***Actress, Social Activist, Mumbai***

### The changing face of women in Hindi cinema

Hindi Cinema has largely portrayed women in stereotypes – the sacrificing mother, the dutiful wife, the devoted sister… There was a clear divide between the heroine and the vamp. Over the years the two identities started blurring but the emergent character was a cardboard avenging angel with none of the complexities of a woman's various identities. It is only in the last decade that there is a shift in the way women are being portrayed in Hindi cinema – more full-blooded, less stereotyped, but still a long way to go…

*SPEAKER'S PROFILE*

*Shabana Azmi is an acclaimed veteran artist of Indian cinema, television and theatre. An alumna of the Film and Television Institute of India, Pune, she is iconic of parallel Indian cinema and is known for her performances in a variety of genres. Besides mainstream and independent cinema, she has also performed in several international projects. She is also a committed social and women's rights activist supporting social equality and justice, child welfare and HIV/AIDS awareness. She is a President nominated member of the Rajya Sabha and a Goodwill Ambassador of the UN Population Fund. She has several accolades to her credit, including a record of five National Film Awards for Best Actress, five Filmfare Awards and several international honors. She was honored among 'women in cinema' at the 30th International Film Festival of India. In 1988, the Government of India awarded her with Padma Shri, the fourth highest civilian honour of the country.*

## SUVENDRA N BHATTACHARYYA

***Indian Institute of Chemical Biology, Kolkata***

### Importance of cellular organelles in controlling the miRNA-mediated gene expression in mammalian cells

miRNA-mediated repression controls the expression of more than half of the protein coding genes in metazoan animals. Translation repression is associated with target mRNA degradation initiated by decapping and deadenylation of the repressed mRNAs. Earlier evidence suggests Endoplasmic Reticulum (ER) as the site where miRNPs interact with their targets before the translation repression sets in, but the subcellular location of subsequent degradation of miRNA repressed messages was unidentified. The speaker and his group has explored the subcellular distribution of essential components of degradation machineries of miRNA-target mRNAs. They have noted that interaction of target mRNAs with AGO2 protein on ER precedes the relocalization of repressed messages to Multivesicular Bodies (MVBs). The repressed messages subsequently get deadenylated, lose their interaction with AGO2 and also become decapped. Blocking maturation of endosomes to late endosome and MVBs by targeting the endosomal protein HRS, uncouples miRNA-mediated translation repression from target RNA degradation. HRS is also targeted by the intracellular parasite *Leishmania donovani* that curtails HRS level in infected cells to prevent uncoupling of mRNA–AGO2 interaction, prevent degradation of translationally repressed messages and thus stop recycling of miRNPs pre-engaged in repression. Importance of other players in this process will be discussed.

*SPEAKER'S PROFILE*

*Suvendra Nath Bhattacharyya, currently the Principal Scientist and Head of Molecular Genetics Division of CSIR-IICB, Kolkata, is an RNA biologist. He received his PhD from CSIR-IICB Kolkata and is known for his exceptional achievements in understanding the mechanism of activity modulation of miRNAs in mammalian cancer and immune cells. He has been recognised with the Shanti Swarup Bhatnagar Prize and the National Bioscience Award in Biological Sciences in 2016. His other recognitions include the NASI-Scopus Young Scientist Award and Swarnajayanti Fellowship (2015), the AAAS/Science Young Scientist Award, the INSA Young Scientist Award, and HFSPO and EMBO long-term Fellowship. He has also received the CDA Award of HFSPO and the prestigious International Senior Research Fellowship of the Wellcome Trust, London. He was selected as an Associate of the Indian Academy of Sciences in 2010 and as a Fellow in 2017.*

## NALLUR B RAMACHANDRA

*University of Mysore, Mysuru*

### Impact of copy number variations in genome organization, evolution and diseases

The speaker and his group have performed genome-wide genotyping by CNV microarray analysis and identified 44,109 CNVs from 1,715 genomes across 12 populations to unravel genomic variations in human genome organization, evolution and some complex diseases. Some of their findings, including the identification of the complexity in chromosome organization, genome organizational plasticity and the proposal of human new migration routes, establishment of the previously identified X chromosome Transposed Region (XTR) in Y-chromosome as pseudoautosomal region 3 (PAR3), and identification of the type 2 diabetes mellitus disease risk genes, Parkinson Disease risk genes and Asthma susceptibility marker genes under CNV burden in normal cohorts, will be discussed with reference to the role of CNVs in the genomic variations.

*SPEAKER'S PROFILE*

*N B Ramachandra joined the University of Mysore as a Lecturer in Zoology in 1992. He was instrumental in starting the master's course in Genetics there, and is now the Chairman of the Department of Studies in Genetics and Genomics, University of Mysore. His research interests are in the field of Drosophila and human genetics, evolution and genomics. His significant contributions include evidences for adaptive genome evolution in Drosophila, identification of SNPs and CNVs for several diseases, advanced grandmother age as a cause for Down's syndrome, identification of a new recombining region, PAR3, and establishment of University of Mysore Genome Centre database. He has published more than 200 research papers and delivered more than 200 invited lectures. His work has been recognised by many awards. In 2017, he was elected as a Fellow of the Indian Academy of Sciences, Bengaluru.*

## RIDDHIPRATIM BASU

***International Centre for Theoretical Sciences, Bengaluru***

### Large scale geometry of randomly growing interfaces

A rich class of models for randomly growing interfaces, believed to be in the so-called Kardar-Parisi-Zhang (KPZ) universality class, is expected to exhibit the same universal asymptotics that are empirically observed in the large scale geometry of many naturally occurring growing interfaces. This has been one of the exciting frontiers of probability research over the past two decades, where tremendous progress has been made in rigorous understanding of some of these models, combining tools from different areas of mathematics. The speaker will discuss some of the recent progress, and many open questions that still remain.

*SPEAKER'S PROFILE*

*Riddhipratim Basu is a Reader at the International Centre for Theoretical Sciences of Tata Institute of Fundamental Research (ICTS-TIFR). He obtained his bachelor's degree and master's degree from Indian Statistical Institute, Kolkata and subsequently joined the University of California, Berkeley where he obtained his PhD in 2015. He spent two years at Stanford University as a Szegö Assistant Professor of Mathematics before joining ICTS in 2017. His research is in probability theory, often motivated by questions coming from statistical physics. He has recently been working on first and last passage percolation, interacting particle systems, models of self-organized criticality among other topics. He was selected as an Associate of the Indian Academy of Sciences in 2018.*

**P DASTIDAR**
***Indian Association for the Cultivation of Science, Kolkata***

## From serendipity to designing molecular gels for drug delivery

In early 2000, the speaker and his team's efforts to understand crystal engineering prospects in organic salts led to the serendipitous discovery of molecular gelators derived from a simple organic salts. Since then, they have been seriously engaged in studying organic salts systematically by invoking supramolecular synthons in the context of crystal engineering. Such efforts provided better insights into the mechanism of gelation and consequently allowed them to design gelators for various applications. In this presentation, gel inducing supramolecular synthons developed by their group and its implication in designing gels for bio-medical applications such as drug delivery in a self-delivery fashion will be discussed with selected examples.

*SPEAKER'S PROFILE*

*Parthasarathi Dastidar is currently a Senior Professor at Indian Association for the Cultivation of Science, Kolkata. He received his PhD from the Indian Institute of Science, Bengaluru in 1994. After postdoctoral stints in Tel-Aviv (Israel), UNAM (Mexico), and Wayne State University (USA), he joined CSMCRI, Bhavnagar, India, in 1998 as a Scientist before moving to IACS in 2007. His research interests include crystal engineering, supramolecular gels, topical gels for drug delivery and coordination polymers/complexes based materials. He is the recipent of CRSI Bronze Medal in Chemistry, 2012 and JSPS Fellowship (Jan, 2004–Nov., 2004) by the Japan Society for the Promotion of Science. He is also the co-editor, Acta Crystallographica E, and is a life member of Indian Crystallographic Association and Chemical Research Society of India. He was elected as a Fellow of the Indian Academy of Sciences in 2018.*

**JAYANTH VYASANAKERE**
***Azim Premji University, Bangalore***

## Cold fermions in artificial gauge fields

The possibility of employing cold atomic gases as emulators of condensed matter Hamiltonians has got boosted up by the birth and growth of the field of synthetic spin-orbit coupling. The speaker's group studies interacting Fermi gas in 3D in presence of uniform synthetic non-Abelian gauge fields that induce a generalized Rashba-spin-orbit coupling (RSOC). In presence of a class of RSOC, however small, a two-particle bound state exists even for an arbitrarily small attraction. The fermion system can evolve to a Bose–Einstein condensate of a novel boson called the rashbon, whose properties are determined solely by RSOC and not by the interaction between the fermions or the fermion density. Via a study of collective excitations of the superfluid state, the rashbon–rashbon interaction has been shown to be independent of the constituent fermion–fermion interaction. By constructing a fluctuation theory, the speaker demonstrates that RSOC enhances the transition temperature of a weak Fermi superfluid to the order of Fermi temperature.

*SPEAKER'S PROFILE*

*Jayanth Vyasanakere teaches physics and mathematics in the School of Liberal Studies, Azim Premji University, Bengaluru. He has been working with APU since 2017, after teaching in Tumkur University from 2012. He also teaches in Research Education Advancement Programme at Jawaharlal Nehru Planetarium, Bengaluru. He holds an integrated PhD in Physics from the Indian Institute of Science. His research interest is in condensed matter physics and he has worked in the field of cold atoms studying the effects of artificial gauge fields on interacting Fermi systems. He is a gold medalist from Bangalore University and the recipent of Shyama Prasad Mukherjee Memorial Fellowship – 2011, Kumari L Meera Memorial award for the best Integrated PhD student during MS at IISc – 2010 and the KVPY Fellowship – 2005. He was selected as an Associate of the Indian Academy of Sciences in 2018.*

## ANISH GHOSH

*Tata Institute of Fundamental Research, Mumbai*

### An introduction to some aspects of ergodic theory

The word 'ergodic' derived from the Greek, from ergon meaning 'work' and hodos meaning 'way'. It owes its origin as a subject to the work of L Boltzmann on the kinetic theory of gases. Boltzmann coined the term 'ergodic hypothesis' to describe chaotic systems that satisfy certain desirable properties, including 'equidistribution', namely that the average time the system spends in a phase region is proportional to the volume of the region. Subsequently, ergodic theory developed into a separate branch of mathematics with extensive connections to both the pure and applied sciences. Somewhat surprisingly, ergodic theory has substantial connections to number theory, a subject christened the 'Queen of Mathematics' by none other than C F Gauss himself. These connections have been extensively studied recently and have proved to be very fruitful in understanding long standing conjectures in both subjects. In his lecture, the speaker will give an overview of ergodic theory and will also try to explain some of these connections.

*SPEAKER'S PROFILE*

*Anish Ghosh is a faculty member in the School of Mathematics at the Tata Institute of Fundamental Research in Mumbai. He received his BSc from St. Xavier's College, Mumbai in 2001 and his PhD from Brandeis University in 2006. After a brief postdoctoral stint at the University of Texas at Austin, he moved to a faculty position at the University of East Anglia, UK and then, after a few years, to the TIFR.*

*Ghosh works at the interface of ergodic theory, Lie groups, and number theory. He was awarded the NASI-Scopus young Scientist award and his work has been supported generously by several grants from the NSF, the EPSRC and the Royal Society. He is currently supported by a DST Swarnajayanti fellowship. He was elected as a Fellow of the Indian Academy of Sciences in 2018*

.

## VIJAY CHANDRU

***Indian Institute of Science, Bengaluru***

### The sciences of the artificial: Promise and reality

The natural sciences describe objects in nature, while the sciences of the artificial describe artifacts that come from human intervention in the natural world. This perspective helped the Nobel laureate Herbert Simon pioneer the integration of cognitive, mathematical and computational methods to study artificial complexity and confirm the thesis that a physical symbol system and the computer as an artifact have the necessary means for intelligent action. Ideas of machine intelligence go back to the early postwar period with Alan Turing's famous formulation of the imitation game which became known as the Turing test. Artificial and Augmented Intelligence joined hands with the decision sciences and became an integral part of the data analytics toolbox. Today Artificial Intelligence or AI is synonymous with 'deep learning'. For AI, the departure from the computer as an artifact began in the 90s with the advent of the cloud and great advances in training hardware and software for artificial neural networks. Geoffrey Hinton in Toronto has built this magnificent edifice of deep learning, which has become all pervasive.

*SPEAKER'S PROFILE*

*Vijay Chandru is currently an INAE distinguished technologist at IISc and an Adjunct / Visiting Professor of the Division of Interdisciplinary Research in Bio-Engineering and in Cyber Physical Systems. Formally trained in Electrical Engineering (BITS, Pilani), Systems Science and Engineering (UCLA) and in Decision Sciences (MIT), he has over 35 years of research experience and academic career in teaching and research in computational mathematics at Purdue University (1982–1992) and the Indian Institute of Science since 1992. As a technology entrepreneur, he was one of the inventors of the Simputer® and currently serves as the Founder Director of Strand Life Sciences, both spinoffs from IISc. He was named a Technology Pioneer of the World Economic Forum in 2006 and is a recipient of the Hari Om Trust Award from the University Grants Commission (2003) and the President's Medal of the Institute for Operations Research and Management Science (INFORMS) in 2006. He is a Fellow of INAE and ORSI (Operations Research Society of India) and is the President of ORSI. He was elected as a Fellow of the Indian Academy of Sciences in 1996.*