MEETING REPORT

Indian Academy of Sciences, Bengaluru – 30th mid-year meeting

The 30th mid-year meeting of the Indian Academy of Sciences, Bengaluru was held at Satish Dhawan Auditorium, Indian Institute of Science, Bengaluru between 28 June and 29 June 2019. The two-day meeting comprised of several scintillating talks by the elected fellows and associates, a public lecture by Tony Joseph, a symposium on P.C. Mahalanobis' scientific contributions and some special lectures among other things.

The meeting started with the launch of the second edition of the book, *C V Raman – A Pictorial Biography*. The book launch was followed by a special lecture by N. Mukunda (IASc, Bengaluru). His talk covered the vast historical ground about the creation of the field of quantum mechanics. He spoke candidly about the early period of its discovery (1920s) and gave an impressionistic account of the developments in the field. He spoke about the contributions of stewards like Werner Heisenberg, Paul Dirac and Erwin Schrodinger. While lauding the discovery and the successes of quantum mechanics, he also spoke about the many puzzling questions that still remain and continue to be pursued till today. In all, his talk gave a brief overview of the broad topic of quantum mechanics, which was delivered in a palatable and engaging manner.

Rupinder Kaur (CDFD, Hyderabad) underscored the clinical and economic burden posed by hospital-acquired fungal bloodstream infections (BSIs). Focusing particularly on the infections caused by *Candida glabrata*, the speaker highlighted the challenges involved in tackling these infections. She discussed her work on understanding the pathogenicity of *C. glabrata*, particularly in the context of drug resistance and interaction with host immune cells.

Amit Kumar (IIT, Delhi) spoke about a large class of optimization problems called packing and covering problems. He explained lucidly, using simple day-to-day examples, how online algorithms can be used to model problems where the input is revealed over time and how an optimum solution can be obtained.

Devanjan Sinha (BHU, Varanasi) in his talk, highlighted the role of specialized proteins called chaperones or heat shock proteins (Hsps) in maintaining mitochondrial health. Elaborating on his work in this area, the speaker discussed his findings on Hsp70s that are involved in the protein transport machinery in mitochondria of higher animals. He further discussed about the associated multifunctional J proteins which drive these complex machineries. The speaker's findings on J proteins have underpinnings in understanding many pathophysiological conditions such as cancer.

Rajeev Patnaik (Panjab University, Chandigarh) delivered another interesting talk. The mammalian dental enamel is an extremely resilient tissue and remains preserved for millions of years, thus preserving the history of development of that individual. His talk focused on how carbon isotope composition of the enamel could be used to elucidate the diet and water intake of that particular animal. He uses this approach to understand the diets of extinct species using fossilized enamel and has found that several herbivores have shifted consumption from C3 to C4 plants over the geological past.

Mandar Deshmukh (TIFR, Mumbai) spoke about his research on how electrons flow in 2D materials. He spoke about how interesting properties arise in graphene monolayers because of the symmetry of the honeycomb lattice. Further, he discussed how few layer graphene systems break these simple symmetries and give rise to interesting opportunities to study the effect of the interactions of these flowing electrons.

Rohini Garg (Shiv Nadar University, Gautam Buddha Nagar) spoke on abiotic stresses that impact crop production and how plants adapt to stressful environments. Focusing on her research on rice and chickpea cultivars, the speaker shared her discoveries on epigenetic differences between various cultivars that regulate various abiotic stress response networks in plants. The talk emphasized as to how such epigenetic studies have implications in crop improvement.

Smriti Mahajan (IISER, Mohali) in her talk, explored the role of the intermediate-density environments common in large-scale filament areas of galaxies in star formation and the subsequent evolution of galaxies. The speaker presented the case study involving the analysis of multi-wavelength properties of Coma supercluster, indicating that filaments are crucial to the evolution of galaxies in the nearby universe.

Jagannath Mondal (TIFC, Hyderabad) discussed an innovative simulation method for biomolecular recognition of ligands in drug discovery. The technique, which overcomes the limitations of conventional docking methods, aims to capture the end to end process of ligand diffusion to the protein cavity at atomistic resolution in real-time. The speaker shared his team's results on the simulation of T4 lysozyme/benzene and cytochrome P450/camphor systems.

Beula Christy's (L V Prasad Eye Institute, Hyderabad) talk was a slight change from other academic talks. She spoke about her work in enabling equal education opportunities for the visually impaired students. Her talk outlined the challenges involved in teaching the visually impaired and how institutional changes could help foster their inclusion in the education system. She spoke about how facilities such as availability of teaching materials in an accessible format, accommodations in laboratory procedures, teacher training programs, etc., could help lift several challenges and pave a path for their inclusion in science education.

The first day of the meeting concluded with a public lecture by Tony Joseph (Author *Early Indians: The Story of Our Ancestors and Where We Came From*). The talk focused on the four prehistoric migrations that shaped Indian demography and population structure. The speaker described in detail the migration of early humans out of Africa under the influence of climatic changes followed by the Neolithic, Bronze and Colonial Ages which has concluded in the inhabitation of the Indian subcontinent. Discussing in detail the role played by genetic mapping studies in tracing the history of mankind, the speaker empathized how various disciplines – history, archaeology, linguistics, population genetics, philology and epigraphy – have come to interlocking evidence on the origin and migration of mankind which are independent of each

other. The speaker ended on the note 'We are all Indians. And we are all migrants.'

The second day of the mid-year meeting began with a symposium on the scientific contributions of Prasanta Chandra Mahalanobis, to commemorate his birth anniversary. Poornima Paidipathy (London School of Economics, UK) touched upon the National Sample Survey launched by Mahalonobis in 1950 to provide a comprehensive picture of Indian's domestic economy. She also discussed his contributions as the architect of the second five-year plan and his role as an international network builder who brought global experts in statistics to the Indian Statistical Institute (ISI) to assist in the statistical work of economic development. His involvement in planning also led him to devise fractile graphical analysis, a statistical method which was used to compare the socioeconomic conditions of people across different groups.

Probal Chaudhuri (ISI, Kolkata) discussed the incidents in the life of Mahalanobis which led him to the field of statistical sciences. His interactions with Nelson Annandale and Gilbert Walker in 1922 led to his appointment as a Chief Meteorologist at Alipore Observatory in Calcutta, a part time position that he held in addition to his full time job as a physics professor at Presidency College Calcutta University. During his stint at the meteorology department, he became interested in agriculture, which led him to publish a paper in an agricultural journal in 1925. Renowned statistician Ronald Fisher saw this paper and this was the beginning of a very long and fruitful friendship between the two stalwarts in statistics. On Fisher's suggestion, Mahalanobis was offered a grant from the ICAR that formed the seed money for ISI. The year 1936 saw the beginning of Mahalanobis' contributions to theory and methodology for large scale sample surveys such as the jute survey of Bengal in 1940.

Partha P. Majumder (National Institute of Biomedical Genomics, Kalyani) talked about the contributions of Mahalanobis to the human genetic studies in India. In 1925, Mahalanobis raised statistical and quantitative questions on the measure of distance between population groups based on anthropometric measurements. In 1926–27, in Karl Pearson's laboratory, Mahalanobis undertook extensive analysis of anthropometric data on European population and examined Pearson's 'Coefficient of Racial Likeness' (CRL) for measuring population relationships. In 1930, the statistical shortcomings of CRL became clear to him and this led him to formulate the D^2 statistic, derive its properties and applications, which are the most profound contributions of Mahalanobis. Mahalanobis started the Indian Statistical Institute in 1931. This was followed by two large scale surveys – Anthropometric survey of the United Provinces (1941) and the Bengal anthropometric survey of (1945). With these studies, Mahalanobis realized that anthropometry has to be supplemented by physical, genetic and serological data to get the ethnic origins about Indian populations. This led to the formation of the Anthropometry and Human Genetics Unit of ISI, the contributions of which were also discussed by Majumder.

B. N. Gangadhar (NIMHANS, Bengaluru) discussed the therapeutic applications of yoga in Psychiatry, especially in the treatment of cognitive impairment and depression. Proposing a theoretical model of how the practice of yoga can be linked to molecular and physiological changes associated with cognitive improvement, the speaker presented some indirect and direct evidence to support the model. The speaker called for more support to a single comprehensive study to understand the antidepressant effects of yoga.

Subi George (JNCASR, Bengaluru) spoke on the emerging field of molecular machines and supramolecular assemblies. While supramolecular aggregates that follow biological principles and mimic biological molecules are becoming common, the speaker discussed his work on the development of chemical-fuel controlled supramolecular systems which can be regulated temporally through various molecular cues.

The last speaker of the day, Sulochana Gadgil (Pune) highlighted that understanding and predicting the monsoon and its variability is one of the most challenging problems in atmospheric science today. She discussed the physics of the monsoon variability and presented the challenges ahead for prediction of the inter-annual variation of the monsoon.

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MEETING REPORT

Artificial intelligence in plantation crops*

Agriculture plays a vital role in India's economy with over 58% of the rural households dependent on it as their principal means of livelihood. The Indian agriculture sector, currently facing challenges of climate change, population growth and food security concerns, is progressively looking towards means to leverage innovative technologies which can substantially enhance crop productivity. Artificial Intelligence (AI) is steadily emerging as a part of the technological evolution of this sector. Plantation crops are grown in India over an area of 3.7 million hectares and provide livelihood security to around 30 million people, besides contributing Rs 250 billion to the gross domestic product (GDP). To explore the gamut of applications of AI in agriculture, with special reference to plantation crops, a two-day workshop was held last year.

During the inaugural session, P. Chowdappa (ICAR-CPCRI, Kasaragod) put forward three important challenges that required AI interventions in plantation crops, viz. monitoring of pests and

*A report on the workshop entitled 'Artificial Intelligence for Plantation Crops' held on 28 and 29 September 2018 at ICAR-Central Plantation Crops Research Institute, Kasaragod.