

Current Science Editorial Meeting – Scientific sessions

The first ever full editorial board meeting of the Current Science Association was held at the Indian Institute of Science, Bengaluru on 28 and 29 November 2015. In connection with this meeting a two-day scientific session was organized in which the members of the editorial board and a member of the Working Committee of *Current Science* gave lectures. There were 15 presentations, on topics in mathematics, physics, chemistry, life sciences, science and technology, earth system sciences and archaeology. P. Balaram (previous Chief Editor) delivered a public lecture.

Some highlights of these talks are summarized below.

Mathematics

Rajaram Nityananda (Azim Premji University, Bengaluru) spoke on the ‘Many faces of information’, which essentially included irreversibility, ignorance and inference. He referred to the recent best-selling and excellent book by James Gleick titled *The Information*, as evidence that the concept had caught the popular imagination. Shannon’s key insight was that ‘information is the removal of uncertainty or ignorance’. In a very simple case, we have W equally probable options and receiving a message specifying one of them gives one information which could be measured by W . However, $\log W$ to the base 2 is a more natural measure, called the bit, and this can be generalized to the case of unequal probabilities by the Shannon entropy formula which is the sum of $-p \log p$ over all the possible options. Nityananda also emphasized that real messages contain redundancy – for example, symbols are not independent and with proper coding the message can be compressed. The Shannon entropy measures the uncertainty associated with a random variable. A message with S bits of Shannon entropy can be compressed to S bits by the coding theorem. When there is noise in the channel, there is a maximum rate C bits per second, called the channel capacity, at which (nearly) error-free transmission is possible and no useful information can be transmitted beyond it.

The existence of error correcting codes up to this limit was proved by Shannon under fairly general assumptions, but it was still left for future generations of engineers and computer scientists to devise such codes.

All this is connected to the long standing dispute in the statistics community – frequentist versus Bayesian, which shows up even in simple problems such as finding the mean of samples from a given distribution. The frequentist assumes that we have many samples taken from a known distribution, which is a deductive process. But in reality, the data are known and the underlying average is unknown, which is a problem of induction on which Bayes and Laplace wrote as early as the late 18th century. It is a flourishing school of statistical inference even today, and includes maximization of Shannon entropy as one of its tools.

Boltzmann’s statistical formulation of thermodynamic entropy anticipated the Shannon entropy in the context of the kinetic theory of gases, with microstates replacing messages. His proof of entropy increase was challenged by the notion of a Maxwell demon until Szilard conducted an exorcism. He and others after him unified the entropy associated with physical systems like a gas, and the entropy associated with gathering information about that gas, which could then be used to reduce the entropy of that system. Bennet and Landauer in particular have emphasized the role of the erasure of information in satisfying the second law.

Modern work in string theory explores the connection between black hole entropy and information loss. One increasingly popular current interpretation of quantum theory is in terms of information about one system in relation to other systems – it goes by the name of quantum Bayesianism or QBism. Such views place information at the forefront – Wheeler coined the term ‘it from bit’, which could be interpreted to mean that things exist by virtue of information. One is reminded of the philosophy of Nagarjuna, who said centuries ago that nothing exists except in relation to other things, which themselves do not have independent existence.

Physics

Sunil Mukhi (IISER, Pune) talked about ‘Goals, models, frameworks and the scientific method’. He highlighted the distinct nature of goals, models and frameworks in physics and used them to re-examine the extent to which criteria like empiricism and falsifiability can be applied to them. The contemporary frameworks of quantum fields and strings were discussed in this light.

Chemistry

E. Arunan (Indian Institute of Science (IISc), Bengaluru) delivered a lecture on ‘Intermolecular bonding’ and showed that though bonding within a molecule has been fairly well understood, it continues to attract attention nearly a century after Lewis/Langmuir defined a covalent bond. Could there be a ‘bond’ between molecules? Hydrogen ‘bonding’ was proposed as an intermolecular bond by Latimer and Rodebush in 1920, within a few years after the covalent bond was defined. It was popularized by the seminal book on chemical bond by Pauling. However, only after it was realized that the double helix in DNA is bound by ‘hydrogen bonds’ between the A–T and C–G base pairs, has there been a phenomenal interest in ‘hydrogen bonding’. There is at least one paper published on ‘hydrogen bond’ every hour of the day. Though everyone used this term, the definition of hydrogen bonding was hotly debated in the literature. In 2011, a task group chaired by Arunan and formed by IUPAC proposed a modern definition of the ‘hydrogen bond’. Since it was published, there has been a spate of publications on similar ‘intermolecular bonds’ formed by elements from all the groups of the periodic table. In 2013, Arunan’s group defined a ‘carbon bond’ which can be easily understood as an intermediate complex in the well-known S_N2 reactions. It has been suggested that ‘carbon bonding’ contributes to the ill-defined ‘hydrophobic interaction’ as well. The new definition of the ‘hydrogen bond’ and the ‘carbon bond’

addressed by him were the results of microwave spectroscopic investigations, coupled with theoretical calculations on weakly bound complexes formed in a molecular beam in his laboratory. The talk covered the history of hydrogen bonds, the experimental results on complexes formed by H₂O, H₂S and propargyl alcohol, and the evolution of 'intermolecular bonding'.

Life sciences

S. E. Hasnain (IIT, New Delhi) covered the subject of 'Tuberculosis' (TB). He described how TB caused by *Mycobacterium tuberculosis* (*M.tb*), takes one human life every 15 sec globally and remains the largest cause of death mostly in the economically productive age group. He also explained that despite the enormity of the problems, having infected one-third of the world population, there has been no new drug against TB during the last >50 years, a new vaccine in the last 75 years, or new diagnostics after TB skin test (discovered >125 years ago). While it was hoped that with the availability of *M.tb* genome sequence in the public domain, new interventions against TB would emerge, there is only a slightly improved understanding of the smart strategies adopted by this very intelligent and cunning pathogen. His presentation described efforts combining computational, functional genomics, molecular epidemiology, infection biology and clinical approaches to understand the extraordinarily clever strategies adopted by this bacterium, particularly the discovery of molecular mimicry involving intrinsically disordered regions within ORFs, including those belonging to the exclusive PE/PPE family, immune quorum sensing and strategic host-pathogen cross-talks. He also focused on TB as a 'grand challenge' that not only continued to baffle scientists, but also forced a relook at the national and trans-national political, social and economic commitments to eradicate this disease by 2050.

Gaiti Hasan (NCBS, Bengaluru) delivered her lecture on 'Invertebrate models of human disease'. The introductory notes on milestones in genetics and genomics beginning with Mendel's findings on Inheritance up to the much recent Human Genome Project laid the premise for the rest of the lecture. The challenges underlying the future of personalized medicine were discussed. Examples for

studies on genetic components of human diseases using more convenient and analogous invertebrate models were elaborated. Some key examples included studies of important cancer pathways (such as ras, wingless, hedgehog), cardiac diseases, epilepsy, deafness, microbial and viral immunity and autoimmune diseases. Key components of such pathways were discovered by genetic screens in the fruit fly *Drosophila* and the nematode *Caenorhabditis elegans*. A whopping 50% similarity between the human and fly genome makes *Drosophila* an indispensable model to employ the dual-screening strategy, wherein the identity and function of disease candidate genes in humans can be understood, aided by tools of modern genetics. Disease genes involved in Charcot-Marie-Tooth disease, retinal degeneration and some neurological disorders in humans have been identified using such strategies, to name a few. Hasan's recent work on mechanisms of calcium signalling influencing *Drosophila* flight reiterates the importance of using invertebrate models to further our understanding of cellular pathways of neurodegeneration in higher organisms. Such studies will eventually help in the discovery of potential drug targets for diseases and also in testing potential therapeutics.

Yogesh Shouche (NCCS, Pune) lectured on the Indian scenario of 'Sharing microbial genetic resources internationally in compliance to CBD norms'. The lecture began with a note on the history of culture collections which were started as early as 1911 by Frantisek Karl. In 1941, the National Collection of Type Cultures was started at IISc by M. Sreenivasaya, as suggested by Shanti Swarup Bhatnagar. In 1951, it was transferred to the Biochemistry Division of the National Chemical Laboratory, Pune, known today as the National Collection of Industrial Microorganisms. There are now 31 culture collections in India registered with the World Data Centre for Microorganisms. In total, there are 714 culture collections in 72 countries and regions, and they hold nearly 2.5 million microbial strains. India is placed at the third position after USA and Japan with 1.9 lakh cultures. Microbial culture collections are important for conservation of biodiversity, biosecurity and also for industrial, environmental and agricultural applications. Sharing microbial genetic resources internationally is vital for

educational and research purposes. The Convention on Biological Diversity (CBD) came into force from 1993 with goals such as conservation and sustainable use of biodiversity and fair, equitable sharing of benefits arising out of utilization of genetic resources. The Nagoya Protocol (adopted in 2010 in Nagoya, Japan) was a supplementary agreement to the CBD and it provides a legal framework for effective implementation of the fair and equitable sharing of benefits objective. The problems faced by Indian microbial taxonomists in depositing strains in international culture collections were briefly mentioned by Shouche. The current provisions of these Acts created problems for individual researchers as well as culture collections.

Description of novel microbial taxa necessitates the deposition of the type culture in at least one culture collection abroad. For this, permission needs to be sought from NBA and this takes several months by which time a researcher from another country may publish similar work as there is no clear-cut endemism in microbes. In the process the Indian researchers lose their claim over a novel taxa. At the same time, researchers from abroad wanting cultures from the Indian collection for taxonomic comparison, also need to seek permission from NBA and here again, the time taken and the existence of a third body, other than culture collection, is not acceptable to international bodies like International Society for Nomenclature of Prokaryotes. In recent times they have refused to recognize deposits from the Indian culture collection for publication purpose and have asked researchers to make a deposit in a third collection outside India.

All this has severely affected the microbial taxonomy research in the country, which has almost come to a standstill. It was proposed that the powers for the distribution of cultures for research purpose be delegated to designated repositories to solve this problem. A strong material transfer agreement could be developed with the approval of NBA. The presentation ended with an appeal for support from the scientific community.

Earth system sciences

Dilip Saha (ISI, Kolkata) talked on 'Growth of Eastern Dharwar craton in

the Proterozoic'. He disclosed that since the initial cratonization around 2.5–2.6 Ga, growth of the Eastern Dharwar craton (EDC) was influenced by vertical and lateral tectonic accretion. The mafic dyke swarms invading the EDC tonalite–granite gneiss basement and Neoproterozoic plutons record the earliest Palaeoproterozoic mantle upwelling and crustal extension prior to the initiation of the intracratonic Cuddapah basin. Three cycles of dominantly fluvial to shallow marine successions in the Cuddapah basin, punctuated by regional unconformities can be interpreted as due to global sea-level changes possibly triggered by supercontinent break-up in the Palaeoproterozoic and later times. The youngest cycle of sedimentation, represented by the Neoproterozoic Kurnool Group with prolific limestone deposition free of terrigenous input, indicates open sea east of the EDC margin. In this scenario, allochthonous Nallamalai Group (NFB) originally deposited outboard of EDC margin was thrust transported during late Neoproterozoic lateral accretion of terrains, including the Nellore schist belt (NSB) and Ongole domain of the Eastern Ghats. Two episodes of subduction-related crustal convergences outboard of the EDC margin are indicated by 1.9-Ga-old Kandra ophiolite complex and 1.3-Ga-old Kanigiri ophiolitic melange, now part of the NSB. Detrital zircon geochronology and Hf isotopic data from the Cuddapah basin, NFB and Ongole domain clearly show EDC as the provenance of the western Cuddapah sediments, while the allochthonous Nallamalai Group data are consistent with common source terrain for Ongole domain metapelites and the NFB.

Rajiv Sinha (IIT, Kanpur) gave a lecture on 'Geomorphic controls of aquifer distribution and geometry in Sutlej–Yamuna Plains', with a perspective on how groundwater levels of northern India are falling. He clarified that the decline in groundwater was not a result of natural climate variability, but due to overexploitation. The situation is likely to get worse and amplified by the lack of awareness in people and the absence of any serious plan to remedy the situation. According to him, the groundwater is largely hosted within buried channels in an alluvial terrain and hence there is a need to integrate geomorphic and subsurface investigations in aquifer mapping to understand the location, age and 3D

structure of the aquifer systems. He addressed several issues related to aquifer characterization in northwestern India, such as spatial distribution of groundwater and the controlling factors, the source and residence time of groundwater, and the connectivity in aquifers. He then discussed the most crucial yet challenging aspect of prediction of aquifer geometry using the available litholog data and the some simple rules based on the geomorphic setting of the terrain. He emphasized that the standard stratigraphic methods for aquifer reconstruction need to be integrated with simple, flexible and predictive models that can be easily adapted with increase in data. He concluded his talk by mentioning that although the green revolution provided impetus to agricultural growth, it failed to improve agricultural efficiency in terms of water resource utilization.

Malay Mukul (IIT, Mumbai) spoke about the 'Making and breaking of the Himalayan arc', and summarized the current understanding of the mountain building process with particular reference to the Himalaya. He pointed out that most of the Himalaya consisted of sediments that were deposited in the Tethys Ocean that coalesced into a wedge that was progressively deformed as the Ocean basin was destroyed during the collision of the Indian and the Eurasian plates. The role of climate-induced erosion in controlling the mountain-building process was also highlighted. He also talked about how topographic growth and seismicity were an integral part of the mountain-building process. Mukul ended his talk by pointing out that mountain belts evolved into segments that eventually had unique kinematic signatures and that NE Himalaya shows evidence of such segmentation.

Biswajit Mishra (IIT, Kharagpur) delivered a talk on 'The Dharwar gold: current understanding and future research', focusing on the results of metamorphic P – T pseudosection computations. EPMA monazite dating of greenstone and geochemistry of hydrothermal minerals favoured the metamorphic fluid source model for the late Archean greenstone-hosted gold deposits in the Eastern Dharwar Craton, which had immense exploration implications. Rb–Sr dating (in hydrothermal biotite and whole rocks), Sm–Nd dating (in scheelite), Re–Os dating (in sulphides), apart from $^{87}\text{Sr}/^{86}\text{Sr}$ and $\text{d}11\text{B}$ measurements in

tourmaline constitute research components to strengthen the genetic aspects of Dharwar gold.

Archaeology

Ravi Korisetar (Karnatak University, Dharwad) dealt with the 'Current advances in Indian archaeology', and illustrated how the last decade and a half witnessed significant advances in Indian archaeology. The dates of the early human settlement at Attirampakkam, Tamil Nadu, in the Lower Pleistocene suggested early expansion of hominins out of Africa (I) into the Indian subcontinent. Similarly, tephrochronology of YTT from Jwalapuram, Andhra Pradesh had also dated the Middle Palaeolithic hominin expansion out of Africa (out of Africa II) and suggested earlier expansion of *Homo sapiens* (modern humans) by tens of thousands of years before the much emphasized microlithic expansion. Excavations at a number of rock shelters and open-air sites in central and peninsular India (such as Patne [Maharashtra], Jwalapuram [Andhra Pradesh] and Mehtakheri [Madhya Pradesh] have pushed the antiquity of microliths to 50,000 years ago, and indicate that the Upper Paleolithic in India is comparable to the Late Stone Age of Africa (where microlithic invention is dated to around 60,000 years). These discoveries led to renewed debate on the timing and expansion of modern humans out of Africa, suggesting multiple expansions out of Africa. It is gratifying to note that Indian palaeolithic archaeology has been coming to the forefront of global debates on peopling of the world.

Environmental science

P. C. Kesavan (MSSRF, Chennai) spoke on 'Genetically engineered *Bt*- and *Ht*-engineered crops: not suitable for an evergreen evolution'. The salient features of the talk included the green revolution of the 1960s which changed India's image from a 'begging bowl' to a 'bread basket', thus saving Indians from Malthusian scourge. However, this came at an enormous environmental and social cost. In terms of energy input, it was quite huge and enormously adding to the emission of greenhouse gases. While the green revolution had established food security at the national level, hundreds of

millions of resource-poor farming, fishing and landless labour families in the rural areas remained hungry as they lacked access (purchasing power) to food. On the ecological side, the exploitative agriculture had greatly eroded soil structure, soil health and also the biodiversity. So, both ecologically and socially the green revolution was not sustainable. Kesavan mentioned that considering the shortcomings of the green revolution, M. S. Swaminathan developed a strategy to achieve productivity in perpetuity without the accompanying ecological and social harm and called it 'evergreen revolution'. This differed basically from the green revolution owing to its concurrent attention to ecological and social dimensions of sustainable development. In other words, it had a 'systems approach'. He then emphasized on the spread of genetically engineered *Bt* and *Ht* crops as a threat to the evergreen revolution, as these induce 'selection pressure' leading to development of resistance in the pests. Consequently, the pests necessitate even greater amounts of application of the genotoxic pesticides, completely defeating the original intention of reducing the pesticides through the development of genetically engineered pesticidal crops. He also explained how the 'selection pressure' induced by the herbicide-tolerant soy and corn in the United States alone had led to the emergence of 'superweeds', now galloping across several states and devastating over 25 m ha. The farmers were heavily compensated, which cannot be done in the Indian situation. Another important point put forward by Kesavan was the herbicide glyphosate and its commercial form Roundup, which were known endocrine disruptors supported by scores of papers clearly demonstrating the DNA damage, birth defects, kidney damage and even tumour production. He then concluded by stating that in view of the demonstrated adverse health and environmental effects, *Bt* and *Ht* transgenics were not conducive for a sustainable agricultural strategy, namely evergreen revolution.

Rengaswamy Ramesh (PRL, Ahmedabad) spoke on 'The marine nitrogen cycle: recent experiments' and reported the first direct estimates of N_2 fixation rates measured during spring 2009, using the $^{15}N_2$ gas tracer technique in the eastern Arabian Sea, which is well known for significant loss of nitrogen due to intense

denitrification. Carbon uptake rates were also concurrently estimated using the ^{13}C tracer technique. The N_2 fixation rates varied from ~ 0.1 to $34 \text{ mmol Nm}^{-2} \text{ d}^{-1}$ after correcting for the isotopic under equilibrium with dissolved air in the samples. These higher N_2 fixation rates were consistent with higher chlorophyll *a* and low $\delta^{15}N$ of natural particulate organic nitrogen. The estimates of N_2 fixation were useful towards reducing the uncertainty in the nitrogen budget.

Science and technology

S. Krishnaswamy (IMSc, Chennai) covered 'Science and Research in State Universities'. He presented an overview of the growth of universities in India as a place of enquiry and the meeting of minds from various disciplines in order to further research and teaching. It was pointed out that State Universities are crucial for research environment and catalysis of ideas in the country. A selected set of three eminent faculties from a State University was used to illustrate that exemplary research has been possible from them. The necessity of identifying and nurturing good researchers, teachers and students in State Universities was stressed upon. An example of the remarkable growth of research in a State University was used to show the importance of appointments of good Vice-Chancellors and faculty. The current condition of State Universities in Tamil Nadu was highlighted to show that the growing problems of corruption and conversion into teaching shops need to be tackled, as otherwise this cancer will spread to other educational and research institutions.

A. G. Ramakrishnan (IISc, Bengaluru) lectured on 'Technologies for Indian languages' and gave a glimpse into the research activities being undertaken at his Medical Intelligence and Language Engineering (MILE) lab at IISc. Important work such as automated book reader for the visually disabled, camera-based document analysis and recognition, text-to-speech conversion, on-line handwriting recognition and machine listening are being carried out by his group. These efforts are aimed at solving real problems of people and have achieved reasonable success, awards and media attention. The salient features of optical character recognition (OCR), on-line

handwriting recognition (OHR) and text-to-speech synthesis (TTS) work were then explained. The OCR developed by the MILE lab can support multiple image formats, handle fonts of different shapes, sizes and styles, and has an accuracy of 94% on 5000 pages printed during 1950 to 2002, which is 7–8% higher than Google's Tesseract OCR for Tamil and Kannada. Mozhi Vallaan, a Tamil OCR developed by MILE has found remarkable application in digitization of over 600 Tamil books and these Braille books are being used by hundreds of visually challenged people. In both the OCR and OHR systems, the challenge lies in using effective strategies to segment characters that get merged or broken, especially in old books. This difficulty is overcome by the unique neuroscience inspired 'attention-feedback' segmentation proposed by Ramakrishnan. Attention on script-specific information (e.g. aspect ratio) and feedback from the classifier (e.g. confidence level) are used to correctly identify the merged components and then segment them. In TTS, the Kannada text-to-speech engine Madhura Vaachaka has gained a lot of attention. The TTS is able to read out e-text in Tamil and Kannada, employing grapheme to phoneme conversion as well as text normalization modules. The screen-reader version even switches to an external English TTS by detecting the language of the text. Finally, camera-based document analysis and recognition was discussed, as well as the effective tools being developed for text extraction from scene images.

P. Balaram (IISc, Bengaluru) began his public lecture by talking about his deep-rooted bond with *Current Science*, which lasted for a quarter of a century. He illustrated the connections between 'Science, medicine and law' by relating them to the Gleevec story. He gave us his perspective on the contrast between the 'images' of doctors, clinicians and lawyers. He talked about the lapse in legal judgement regarding the use of chemicals and associated implications, especially in the decision that 'steam is not a chemical', which led to a company having to pay higher taxes than if it was deemed a chemical. He included examples like monosodium glutamate (MSG, also known as Ajinomoto), which was exaggerated paranoia, as MSG essentially has a chemical make-up similar to glutamate, and once dissolved in water it releases sodium instead of hydrogen. He

talked about India's painfully conflicting rejection of various drugs, including Pfizer's arthritis drug, making the molecules made in India itself, inaccessible to most patients because of the monetary burden. Balam then talked about the CML-turned anticancer drug Imatinib, developed by Novartis, which underwent the fastest FDA approval (for a cancer drug) of two and a half months. This showed how drugs approved in the US are immediately approved in India, which otherwise, takes an excruciatingly long amount of time. The judges dismissed the Novartis argument that this drug was patentable in India. As Novartis did not win the case, the patent was not issued, and the companies in India bene-

fited from selling generic Gleevec, thus making it available to Indian patients. He remarked that dealings with intellectual property rights only benefited the associated lawyers, thus emphasizing how the pharmaceutical industry in the current scenario has morphed into a money-generating system from a medicine manufacturing facility with considerable assistance from the inefficiency of laws. The severe need for the distinction between the terms 'invention' and 'discovery' was also spoken about because 'psychologically inventors and discoverers are different kinds of people with different needs and management'. Significant discoveries of drugs like penicillin, streptomycin, ivermectin, artemisinin,

statins and other drugs from natural plant sources were discussed in the light of Pliny the Elder's quote which reads as follows: 'Nature is to be found in Her entirety nowhere more than in Her smallest creatures'.

The general feedback by participants was that, this scientific session is a good beginning and should be continued by the Current Science Association every year.

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MEETING REPORT

India International Science Festival 2015*

The India International Science Festival (IISF) 2015 organized recently signifies a collective effort towards nurturing scientific temper at the global level. The aim behind organizing this festival was to provide a platform to thousands of young researchers and students across the nation and other neighbouring countries for discussing scientific ideas and innovations on issues of global relevance. The event was inaugurated by Harsh Vardhan, Union Minister for

Science and Technology, and Earth Sciences.

The festival focused on the major scientific achievements by youth and future prospects in the scientific arena through Young Scientists' Meet (YSM), Mega Science, Technology and Industrial Expo, International Science Film Festival, Innovation Models and 'INSPIRE' presentations, IRIS National Science Fair (Initiative for Research and Innovation in Science), Scientist-Students Interaction, workshops and interactive sessions, and the largest collective science practical session 'Catalysis' with the aim to enter the Guinness World Records. More than 10,000 participants, including about 2000 students from different corners of the country as well as from foreign countries participated in this science festival. IISF 2015 had been the first science festival organized in our country to promote the 'potential benefits of science to the society', and simultaneously inculcating and nurturing the scientific calibre. Five plenary sessions were conducted in which several eminent scientists shared their research work through a series of highly informative talks. Soumya Swaminathan (ICMR) spoke about awareness of curable diseases, followed by M. V. S. Valiathan (Manipal University) about Ayurveda and cause/prevention of vari-

ous lifestyle diseases. W. Selvamurthy (Amity University, Noida) talked about yoga lifestyle for holistic healthcare, while M. Radhakrishna Pillai (Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram) talked about his efforts towards cervical cancer prevention. Girish Sahni (CSIR) shared his experiences regarding various Indian innovations that aided in transforming the society. Vijay Bhatkar (President, Vijnana Bharati (VIBHA)), unfolded the history of electronics in India from the invention of radio till super computers. Anil Kakodkar (Atomic Energy Commission of India) spoke about the probable strategies to bridge the import/export gap through technology/R&D. YSM comprising 10 themes was a good effort to provide the scientists up to the age of 45 years to showcase their research work and achievements. Research activities related to certain innovative diagnostic aids, agricultural practices and livestock management, technologies related to climate, geo-information system, waste to wealth and make in India, green technology, sustainable development and indigenous science/technology were presented by various participants. During the YSM, parallel sessions were organized. Several topics were discussed having great relevance to the society.

*A report on 'The India International Science Festival' (IISF-2015) held at the Indian Institute of Technology, Delhi from 4 to 8 December 2015. The festival was organized jointly by the Ministry of Science & Technology (DST, DBT and DSIR/CSIR), Earth Sciences (MoES) and Vijnana Bharati (VIBHA) and supported by Indian Space Research Organisation (ISRO), Defence Research and Development Organisation (DRDO), Indian Council of Medical Research (ICMR), Department of Atomic Energy (DAE), Indian Council of Agriculture Research (ICAR), University Grants Commission (UGC), National Council of Educational Research and Training (NCERT), All India Council for Technical Education (AICTE). Indian Institute of Technology, Delhi was the host institution and Technology Information, Forecasting and Assessment Council (TIFAC), New Delhi was the nodal institution.