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INSA Council (2011)

Annual General Meeting held in Thiruvananthapuram on 4th October 2010 elected the Council for 2011.

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Professor DD Sarma (*Bangalore*)

Dr Bijay Singh (*Ludhiana*)

Dr PK Singh (*Varanasi*)

Professor A Sridharan (*Bangalore*)

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Representatives of Cooperating Academies and Govt of India

The Asiatic Society

Professor CK Dasgupta (*Kolkata*)

The Indian Science Congress Association

Professor SS Katiyar (*Kanpur)*

The National Academy of Sciences (India)

Professor CL Khetrapal (*Lucknow*)

Government of India (Department of Science and Technology)

Dr MRS Rao (*Bangalore*)

Fellows Elected (2011)

The Annual General Meeting held on 4th October 2010 at Thiruvananthapuram elected the following thirty four Fellows (list of elected Fellows with their brief citation separately enclosed).

Talat Ahmad (*Delhi*), Vishwas Anant Bapat (*Kolhapur*), Amit Basak (*Kharagpur*), Ushadevi Narendra Bhosle (*Mumbai*), Pradip Kumar Chakraborti (*Chandigarh*), Arnab Rai Choudhuri (*Bangalore*), Debashish Chowdhury (*Kanpur*), Suresh Das (*Thiruvananthapuram*), Kalyanmoy Deb (*Kanpur*), Rajan R Dighe (*Bangalore*), Balaram Ghosh (*Delhi*), Sreebrata Goswami (*Kolkata*), Sourendu Gupta (*Mumbai*), Kayyunnapara Thomas Joseph (*Mumbai*), Amitabh Joshi (*Bangalore*), Paramjit Khurana (*Delhi*), Sulabha Kashinath Kulkarni (*Pune*), Rentala Madhubala (*Delhi*), Ranjan Kumar Mallik (*Delhi*), Indranil Manna (*Kolkata*), Akhilesh Chandra Mishra (*Pune*), Sanjay Mittal (*Kanpur*), Nikhil Ranjan Pal (*Kolkata*) Varun Sahni (*Pune*), Debi Prasad Sarkar (*Delhi*), Sreedharan Krishnakumari Satheesh (*Bangalore*), Kalidas Sen (*Hyderabad*), Pulak Sengupta (*Kolkata*), Imran Siddiqi (*Hyderabad*), Nagendra Kumar Singh (*Delhi*), Vinod Kumar Singh (*Bhopal*), Ramanathan Sowdhamini (*Bangalore*), Jaya Sivaswami Tyagi (*Delhi*) and Milind Gajanan Watve (*Pune*).

Foreign Fellows Elected (2011)

At the above Annual General Meeting held the Academy elected the following 5 foreign Fellows to the Academy:

Hacker, Jörg Hinrich (*b.* 1952), President, German Academy of Sciences, Leopoldina Reinhardtstraâe 14, 10117, Berlin.

For his outstanding contributions to genetic recombination in bacteria and discovery of pathogenicity islands for the first time in bacterial pathogens.

Leggett, Anthony James (*b.* 1938), Professor of Physics, John D and Catherine T MacArthur Professor of Physics, University of Illinois, Urbana-Champaign, Urbana, Illinois, USA.

For his pioneering contributions in the area of low temperature physics and his highly innovative theory for the superfluidity of ^{3}He.

Ogawa, Seiji (*b.* 1934), Director, Ogawa Laboratories for Brain Functions Research, Humano Life Science Research Foundation, Tokyo, Japan.

For his invention of the technique known as fMRI which is one of the powerful methods to understand functional aspects of human brain.

Pisier, Gilles Jean Georges (*b.* 1950), Professeur, Classe Exceptionnelle (Distinguished Professor), Université Pierre et Marie Curie, Paris VI, France.

For his fundamental works at the confluence of three broad topics in Modern Analysis namely, Functional Analysis, Harmonic Analysis and Probability.

Polanyi, JC (*b.* 1928), University Professor, Department of Chemistry, University of Toronto, Toronto, Canada.

For his outstanding contribution in the field of molecular reaction dynamics, including transition state spectroscopy and surface aligned photochemistry.

INSA-Research Professorship

Professor HY Mohan Ram has been offered INSA Srinivasa Ramanujan Research Professorship position.

INSA Senior Scientists (2011)

Following Fellows of the Academy were offered the Senior Scientists position.

Phoolan Prasad, KN Pathak, SM Roy, DP Roy, Samaresh Mitra, AK Jain, Sudipta Sengupta, AN Lahiri Majumdar, PK Gupta, SK Saidapur, CK Das Gupta, Yadvinder Singh, Bijay Singh and S Nagarajan.

INSA Honorary Scientists (2010)

SS Krishna Murthy, PN Takkar, KP Gopinathan, RP Sharma, RS Ambasht, GSR Subba Rao, HK Das, Sushil Kumar, DK Paul, Anil Saran and Anupam Varma.

Highlights of the 76th Anniversary General Meeting held on December 28-30, 2010 in the Indian Institute of Science, Bangalore.

The 76th Anniversary General Meeting was inaugurated by Professor P Balaram, FNA, Director, Indian Institute of Science, Bangalore. Professor Balaram also released the INSA Publication: *Science & Science Policy* – Proceedings of the concluding function of Platinum Jubilee of the Academy.

Registration in progress during the AGM on 28th December 2010at IISc , Bangalore

Release of *Proceedings of the concluding function of the Academy's Platinum Jubilee* by Professors N Balakrishnan, M Vijayan and P Balaram during the AGM

A view of the Anniversary General Meeting

During the three day events, four mini symposia were organized. These are:

1) ***Macromolecular Crystallography in India. A Collage*** (Speakers: Professor TP Singh, FNA on Protein Structure Determination and Rational Structure based Drug Design at AIIMS; Professor MRN Murthy, FNA on Excursions into the wonderland of Structural Biology; Professor MV Hosur on X-ray Crystallography of HIV-1 Protease and PhoK; Professor DM Salunke, FNA on Revisiting Tenets of Specificity and Recognition in Immune System and Professor SC Mande, FNA on Understanding Allosteric Transitions in the CAMP Receptor Protein through Crystallographic and Normal Mode Analyses).

Professor Singh delivering his lecture during the mini symposia

Protein Structure Determination and Rational Structure based Drug Design at AIIMS

TP Singh, FNA

The innate immune system represents the first line of defense against infecting pathogens. In contrast to the adaptive immune response, innate immunity proteins are able to recognize conserved motifs that are present in microorganisms but are absent from the host organism. Therefore, the success of the innate immunity depends on this aspect of discrimination between pathogens and self. These conserved motifs are called pathogen associated molecular patterns (PAMPs) that include the well known peptidoglycan (PGN), lipopolysaccharide (LPS) and lipoteichoic acid (LTA). These PAMPs are specifically recognized by innate immunity molecules historically known as peptidoglycan recognition proteins (PGRPs) which bind to PAMPs with high affinity and neutralize the infecting pathogens. Other antibacterial proteins that are part of the mammary arsenal include lactoferrin, lactoperoxidase and lysozyme C. These proteins are expressed in different concentrations that varies from species to species. For example, in camels, lactperoxidase and lysozyme are absent whereas PGRP is unregulated. The structure of camel PGRP-short (CPGRP-S) has been determined which shows that it exists in tetrameric form whereas that of human (HPGRP-S) is indicated to be a disulfide linked dimmer. The binding site in CPGRP-S is formed in the interior of tetramer by utilizing the interfaces of molecules C - D and A - C. The binding site thus formed is capable of binding to various types of PAMPs belonging to both Gram-negative and – positive bacteria with similarly high affinities while the HPGRP-C binds to these PAMPs with relatively low affinities because the binding site of a monomeric protein lacks the versatility in HPGRP-C. Thus it makes the CPGRP-S, a potentially very useful protein therapeutically better than known antibiotics. There is another secreted protein of great significance which is designated as SPX-40 It is expressed during involution and functions as a protector of the viable cells during tissue remodeling when the breasts/udder tissues return to original size at the end of lactation period. A similar protein, BRP-39 is expressed during the breast cancer growth and BRP-39 surruptitiously protects cancer cells in a similar manner as SPX-40 does it to the viable cells during involution. Not knowing about BRP-39 may be the cause of the failure of the current breast cancer therapy. This suggests that SPX-40/BRP-39 should be the first protein targets for the designing of drugs against breast cancers. The binding of SPX-40 to the cells it protects involves protein-protein interactions as well as the interactions of the interdigitating glycan chains from both SPX-40 and its receptors.

Excursions into the Wonderland of Structural Biology

MRN Murthy, FNA

High resolution diffraction data collected using X-rays from rotating anode X-ray generators or synchrotron radiation and imaging plate detectors lead to electron density maps that represent the wonderland of structural biology. The polypeptide chains built on these maps often reveal unexpected features that intrigue and challenge understanding.

Professor Murthy while delivering the Mini-symposia lecture

Propionate kinase (PK) is an enzyme that reversibly converts adenosine triphosphate (ATP) and propionate to propionyl phosphate and ADP. In the electron density map computed for the complex of ATP with the PK, a density twice as large as ATP was observed. Interpretation of the density led to the discovery of a novel function for the enzyme – that of diadenosine tetraphosphate synthesis. The structures of glycine bound pyridoxal dependent enzyme serinehydoxymethyl transferase in the presence and absence of the inhibitor formyl tetrahydrofolate (FTHF) revealed unexpected differences that could represent kinetic memory of earlier interactions in proteins. Amino acid sequence of methylisocitrate synthase (MIS) bears no resemblance to that of triose phosphate isomerase (TIM). However, the structures of the two enzymes were remarkably similar suggesting a plausible common evolutionary origin of these enzymes. Often enzymes are multimeric proteins consisting of more than one polypeptide chain. The multimeric structure may be essential to key functions such as regulation of enzymatic activity. Isocitrate sythase, which is related closely in amino acid sequence and function to citrate synthase, was found to be a decamer while the latter is found to be a dimer or a hexamer. Thus, in the course of evolution, amino acid replacements that do not interfere with the structure could lead to changes in the quaternary association of protein subunits. This may be important for the evolution of novel regulatory mechanisms. Several proteins that constitute more than one polypeptide chain exhibit "domain swapping", a phenomenon believed to be significant for the evolution of multimeric proteins. In such proteins a small domain from each subunit closely associates with the other subunit. In an attempt to release domain swapping in a *Salmonella typhimurium* survival protein (SURE), key amino acid replacements were made. Although "unswapping" of domains was achieved, the mutations killed both the symmetry and function of the dimeric protein. Observation of a remarkable structure termed "â-annulus" in several viruses had suggested that the annulus is a prerequisite for the error free assembly of complex capsids in these viruses. Deletion of the residues involved in the formation of the "â-annulus" in sesbania mosaic virus did not affect the assembly of virus like particles suggesting that the annulus is a consequence rather than the prerequisite of assembly.

X-ray Crystallography of HIV-1 Protease and PhoK and facility for remote operation of beamlines on synchrotrons.

MV Hosur, FNA

The feature of closed-flaps in hexagonal crystals of unliganded HIV-1 protease has enabled us to determine, for the first time, crystal structures of HIV-1 protease in action[1,2]. High-resolution structures of drug-resistant protease mutants complexed with drugs have been determined to understand the mechanisms of drug resistance. The alkaline phosphatase(AP) from the bacterium *Sphingomonas.* sp. Strain BSAR-1 (SPAP) has properties very suited for use in molecular biology and bioremediation applications[3]. We have

Professor Hosur interacting with the audience during his symposia lecture

determined the three dimensional crystal structure of SPAP by using MAD method to solve the phase problem. The structure suggests that SPAP represents a new class of APs.

Description of the facility set up at BARC to remotely operate beamlines on synchrotrons around the world will be described.

Revisiting Tenets of Specificity and Recognition in Immune System

Dinakar M Salunke, FNA

Antigen recognition and subsequent affinity maturation interface physico-chemical principles of molecular interactions with the physiological processes associated with self-nonself discrimination. We have addressed antigen-antibody interaction in the context of breakdown in the antigenic discrimination, economy of the antibody conformational repertoire and generation of antibody diversity. These studies, applying biochemical and crystallographic approaches, have resulted in identification of intriguing new aspects of immune recognition with possibilities of novel applications.

Dr Salunke delivering his lecture on 'Immune System'

Understanding Allosteric Transitions in the Cyclic AMP Receptor Protein through Crystallographic and Normal Mode Analysis

Shekhar C Mande, FNA

cAMP receptor protein, which acts as the sensor of cAMP levels in cells, has been a well studied transcription factor, best known for allosteric changes effected by the binding of cAMP. Despite several

Professor Mande presenting his lecture during the mini-symposia

sources of genetic and biochemical data being available on the protein, the structural knowledge of the cAMP-free protein has been seriously missing. The precise atomic events that take place upon binding of cAMP, leading to conformational changes in the protein and its activation to bind DNA have therefore been elusive. I will present the cAMP-free crystal structure of the *M. tuberculosis* homolog of cAMP receptor protein at 2.9Å resolution, and Normal Mode Analysis carried out to map conformational transitions among its various conformational states. In our structure the cAMP-binding domain holds onto the DNA-binding domain *via* strong hydrophobic interactions, thereby freezing the latter in a conformation that is not competent to bind DNA. The two domains release each other in presence of cAMP, making the DNA-binding domain more flexible and allowing it to bind its cognate DNA *via* induced fit mechanism. The structure of the cAMP-free protein and Normal Mode Analyses therefore highlight an elegant mechanism of the allosteric changes effected by the binding of cAMP. A comparison of cAMP binding domains from proteins of many different functions shows that the mode of ligand binding is evolutionarily conserved, but subtle differences exist among these proteins in the allosteric mechanisms. Thus, cAMP as a secondary messenger can be seen to exert its functional role in many different structural manners.

2) ***Organic Synthesis: From Creativity to Sustainability and Human Wellbeing*** (Speakers: Professor S Chandrasekaran on Organic Synthesis and Sustainable

Development; Professor Vinod K Singh, FNA on Organic Synthesis and Natural Products/ Medicinal Chemistry; Professor Uday Maitra, FNA on Organic Synthesis and Chemical Biology; Professor Ram Vishwakarma, **Indian Institute of Integrative Medicine, Jammu on** Organic Synthesis and Drug Discovery and Professor A Ajayaghosh, National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram on Organic Synthesis and Material Science).

The summaries of the lectures delivered in the Mini Symposium 2 are as follows:

Organic Synthesis: An Introduction

S Chandrasekaran, FNA

Sir John W. Cornforth defines chemical synthesis as "the intentional construction of molecules by means of chemical reactions". Intentional: stresses the key planning aspects of every synthesis exercise. Synthesis directed by the human mind remains a most popular and respected activity among chemists. 'It permits self-expression in its creators and produces aesthetic pleasure in those who examine its products.' The greatest of synthetic chemists, Robert Woodward, won the Nobel prize in 1965 for his contributions to the 'art' of organic synthesis..

Organic Synthesis can be classified into three major categories: Diversity oriented synthesis, target oriented synthesis and methods oriented synthesis. While the diversity oriented synthesis refers to the generation of drug and catalyst libraries, target oriented synthesis deals with natural products and various designer molecules. Methods oriented synthesis revolves around strategies ,tactics, reagents and catalysts.

There are many motivations for embarking on synthesis of organic molecules; to prove their structure, to understand their structure and function, to produce them for commercial purposes and to discover new chemistry.

Starting from the synthesis of urea by Wohler, organic synthesis has evolved and grown steadily over the years. During the period 1940-80 new reactions appeared, stereochemistry of molecules was understood and the total synthesis of complex natural products was accomplished with pioneering contributions from Woodward. Solid phase peptide synthesis discovered by Merrifield opened the door to the synthesis of biomolecules.

The Corey era of logic in chemical synthesis followed which took into account facets such as choosing a target molecule , conducting a "retrosynthetic analysis" to formulate a plan, working out strategies in the form of many new chemical reactions, selecting a sequence of reactions and reagents and executing the synthesis in the laboratory

Asymmetric Synthesis of single enantiomers and development of new reagents and catalysts to achieve them became the major thrust of synthetic organic chemists during the period 1980-2000.

Need for cleaner, more sustainable chemical practices poses new challenges in the 21st century. Environmentally benign chemistry and sustainable processes require new ways of carrying out synthesis. In addition to the development of new reactions, reagents, and catalysts, novel ways to assemble molecules will be the key areas of future challenges.

Synthesis, with its facets, must persevere as a mainstay of the chemical frontier. For decades, the steady advance has been faceted in good measure by the example and excitement of organic synthesis. It is generally believed that dramatic breakthroughs in chemistry will often be made by those schooled in synthesis.

The key facets of organic synthesis are the intellectual and physical rigor, coupling with other areas of chemistry as well as other disciplines such as biology, material science, medicine, and. engineering.

In addition, the chance to directly impact human health and well being, the ability to create, and more importantly the sheer excitement of achieving the goal will be the major driving forces for the practice of organic synthesis in the years to come.

Organic Synthesis and Natural Products/ Medicinal Chemistry

Vinod K Singh, FNA

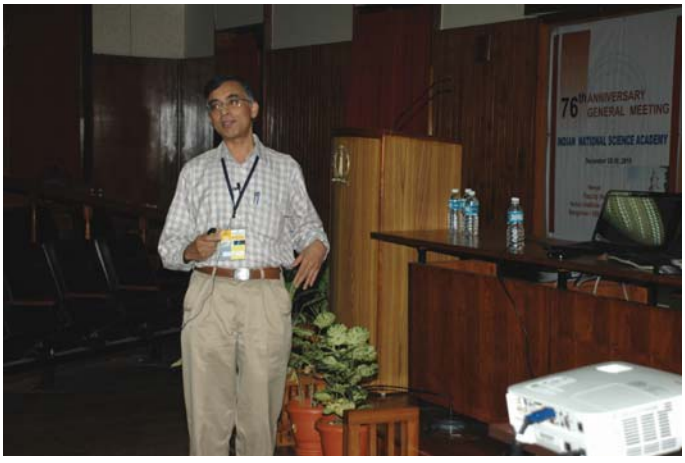
Organic synthesis plays an important role in development of drug discovery program, which is very well linked with human well-being. It is a well-thought scientific and intellectual process which is achieved using readily available starting materials.

Developing a synthetic strategy of natural products is like climbing a mountain. Since many natural products elicit biological activities, the influence of organic synthesis extends to both natural products and medicinal chemistry. Synthesis can provide economical routes for large-scale production of scarce natural products. It also enables access to analogs of natural products that may elicit significantly altered biological effects. This molecular-level manipulation can offer a detailed insight into the biological/ medicinal activity of these natural molecules and result in efficacious analogs. Creation of such novel molecules reflects the creativity of organic chemist. The advent of new diseases and evolution of drug-resistant strains of microorganisms provide sufficient impetus to undertake this exercise. Accomplishing formidable molecular architectures through elegant and simple approaches highlight the success of organic synthesis.

Organic Chemistry and Chemical Biology

Uday Maitra, FNA

Joseph Priestley (1733–1804) was perhaps first Chemical biologist who incubated mice with gases he isolated, including nitrous oxide! Chemical Biology (as distinct from Biochemistry and Bio-organic chemistry) is broadly defined as "*both the use of chemistry to advance a molecular understanding of biology and the harnessing of biology to advance chemistry*". Organic chemistry invariably plays a critical role in Chemical biology. During the past two decades, considerable advance has been made in many areas of Chemical biology leading to protein dimerizer ligands, a novel protein profiling strategy, applications of '*Click'* chemistry, etc. In all these cases, appropriate organic probes/ligands were designed, synthesized and used for understanding biological systems at a molecular level. In contrast, biological systems have also been used in recent years to carry out organic chemical transformations in unique ways (antibodies as catalysts, DNA as template, etc.). As our molecular-level understanding of complex biological systems gets better, it is expected that organic chemistry and organic synthesis will continue to play significant roles in this interdisciplinary field. The development of new types of drugs, probes and diagnostics, novel catalysis, etc., will all need a strong synergy between organic chemistry and biology.



Professor Maitra while delivering his lecture under Mini-symposia 2

Organic synthesis and drug discovery

Ram Vishwakarma, *Indian Institute of Integrative Medicine, Jammu 180001*

The journey of organic synthesis from urea (1828), passing through tropinone (1917), haemin (1929), quinine (1944), reserpine (1958), vitamin B12 (1973), gingkolide (1988), brevitoxin (1995), azadirachtin (2007) and many landmarks have been remarkable and breathtaking, enriching itself as well as the interfacing biological sciences (synthesis of nucleic acids, proteins, carbohydrates, lipids, vitamins, hormones, neurotransmitters etc) and physical sciences (new materials, catalysts and concepts). However, its greatest impact on human well-being has been in the area of new drug discovery and development. Over 90% of currently used medicines are small organic molecules discovered and enabled by the art and science of organic synthesis. In this presentation, effort will be made to highlight some recent contributions of the creativity of organic synthesis in discovery of first-in-class life-saving drugs, structural diversity of the organic pharmacophores, along-with the discussion on the new areas of interfacial sciences where organic synthesis is poised to make even bigger contributions. Some of the case studies that will be briefly discussed include fingolimod, eribulin, yondelis, velcade, alandronate, varinostat, kinase-inhibitors, ACE inhibitors/ARB antagonists etc. Also some India specific issues will be discussed.

Organic Synthesis and Material Science

Ayyappanpillai Ajayaghosh, *Chemical Sciences and Technology Division, National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram*

Organic synthesis in material science primarily means empowering molecules with functional properties and is a way to showcase the power of organic functional groups. In the area of chemistry and materials, synthesis of both small molecules and macromolecules with high purity and yields are important. While hundred of examples can be cited for the contribution of synthetic chemists to materials science, development of various polymers for commodity, automobile, packaging, biomedical and electronic applications are noteworthy. The latest challenge is design and synthesis of organic molecules for advanced application in electronics and photonics devices. In this context, synthesis of high purity polyaromatics and ð-conjugated polymers are important. Modulations of electronic properties by introducing different functional groups and easy processability have made organic molecules attractive in electronic industry. Apart from a variety of organic functional group synthesis and transformations, reactions such as Wittig, Heck and Suzuki coupling are being extensively used for the synthesis of ð-conjugated molecules. Organic light emitting diode based display devices save significant amount of energy which in turn help reducing carbon emission and global warming. A viable technology to convert the abundant solar energy to electrical energy is the only solution for sustainable clean energy. Therefore, the latest challenge to organic chemists working in the area of materials chemistry is to design molecules that are suitable for the fabrication of organic solar cells. The present talk will highlight the contributions of synthetic organic chemists to the field of advanced materials using synthetic protocols and bond formations, for a better life of mankind.

3) ***Genomics and Beyond*** (Speakers: Professor SK Brahmachari, FNA on Genome Sequencing to Drug Discovery: Need for Open Innovation; Professor Lalji Singh, FNA on Genetic Diversity in Indian Population and its Health Implications; Professor PP Majumder, FNA on Genomics and Response to Enteric Vaccines and Professor Huanming Yang, Foreign Fellow of INSA on Genomics and Personalized Medicine).

Genome Sequencing to Drug Discovery: Need for Open Innovation

SK Brahmachari, FNA

The success of human genome sequencing has established the significance of innovation through "open" collaborative channels in the field of life sciences. Without the sharing of the information pool across the globe, the project would not have delivered in short time and with such high quality. This has enabled the scientists of the whole world to contribute to the biology of human genomics. This initiative has been a major player in bringing down the cost of genome sequencing. However, despite technological advancements and availability of high-throughput data, the cost of drug discovery has remained high. This indicates the need of open

Dr Ajayaghosh delivering his symposia lecture on Chemical Science

Professor Brahmachari delivering his lecture on Genome Sequencing

innovation in drug discovery, towards both, the identification of New Chemical Entities (NCEs), as well as identification of populations likely to benefit therapeutically from orphan drugs presently not in the market. Biochemical and structural knowledge of the targets may help in designing NCEs using systems biology approach, moving further from the conventional single drug-single target approach. To this end, CSIR launched the Open Source Drug Discovery (OSDD) program as a CSIR-led Team India Consortium with global partnership to provide affordable healthcare to the developing world. Most of the drug discoveries are made in a closed door environment, where confidentiality and IPR issues result in lack of open participation of the entire academic world. OSDD program aims to capture the young and experienced minds around the globe to be a part of discovery of therapeutics for infectious diseases. OSDD, as an open collaborative model of drug discovery, is focusing on infectious diseases, with tuberculosis as the first disease target. Towards this goal, the most comprehensive annotation for *Mycobacterium tuberculosis* has been achieved by manual curation, and the biggest reactome map for the organism has been generated and hosted on a semantic web-based portal (http://sysborg2.osdd.net). Learning from the open collaborative approach of Human Genome Sequencing, it is believed, what open source Linux, WWW did for IT, the OSDD approach as a global initiative, led by India, will do for healthcare for the marginalized people of the world.

Genetic Diversity in Indian Populations and its Health Implications

Lalji Singh, FNA

India represents one of the largest human biodiversity pool in the world. There are 4,635 anthropologically well-defined populations with little or no gene flow between them. Out of these there are 532 tribes, 72 primitive tribes and 36 hunters and gatherers. Hence, study on Indian populations known for their cultural and genetic diversity, not only provides insight into their complex origin, history and relatedness, but also helps in understanding molecular pathology of genetic diseases. Therefore, our interest has been to study both population history and molecular mechanism of diseases in Indian populations.

Professor Singh while speaking on Genetic Diversity during the symposia lecture

To shed light on the genetic variability across the Indian subcontinent, 132 Indian samples from 25 groups were analyzed on an Affymetrix 6.0 array, yielding data for 587,753 SNPs after restricting to markers with good completeness. To span the widest range of ancestry in India, Tribal groups were sampled from 13 states and 6 language families (Indo-European, Dravidian, Austro-Asiatic, Tibeto-Burman, Great Andamanese and Jarawa-Onge). Some caste groups were sampled to permit comparison of traditionally "upper" and "lower" caste groups.

There is a strong evidence for two ancient and genetically divergent populations that are ancestral to most Indian groups today. The "Ancestral North Indians" (ANI), are genetically close to Middle Easterners, Central Asians, and Europeans, while the "Ancestral South Indians" (ASI), are not close to any group outside the subcontinent. By introducing methods that can estimate ancestry without accurate ancestral populations it was shown that ANI ancestry ranges from 39-71%, and is higher in traditionally upper caste groups and Indo-European speakers. Groups with only ASI ancestry may no longer exist in mainland India.

The finding that nearly all Indian groups descend from mixtures of two ancestral populations applies to traditional "tribes" as well as "castes". It is impossible to distinguish castes from tribes using the data. This supports the view that castes grew directly out of tribal-like organizations during the formation of Indian society. The one exception to the finding,

that all Indian groups are mixed, is the indigenous people of the Andaman Islands, The Andamanese appear to be related exclusively to the Ancestral South Indian lineage and therefore lack Ancestral North Indian ancestry. In this sense, they are unique.

Many groups in modern India descend from a small number of founding individuals, and have since been genetically isolated from other groups for thousands of years. It has medical implications for Indian populations. Recessive hereditary diseases are likely to be common in populations descended from so few 'founder' individuals. This helps to explain why the incidence of genetic diseases among Indians is different from the rest of the world. For example, an ancient deletion of 25 bp in the cardiac myosin-binding proteins-C gene (MYBPC3) is associated with heritable cardiomyopathies as well as with an increased risk of heart failure. Its prevalence is high (~4%) in the general populations from the Indian subcontinent. However, this mutation is completely absent among the people from the rest of the world.

The finding that a large proportion of modern Indians descended from founder events means that India is genetically not a single large population; instead it is best described as many smaller isolated populations. It is important to carry out a systematic survey of Indian groups to identify which ones descend from the strongest founder events. Further studies of these groups should lead to the rapid discovery of genes that cause devastating diseases, and thus will help in the clinical care of individuals and their families who are at risk.

Genomics and Response to Enteric Vaccines

Partha P Majumder, FNA

Differences in immunological response among vaccine recipients are determined both by their genetic differences and environmental factors. Knowledge of genetic determinants of immunological response to a vaccine can be used to design a vaccine that circumvents immunogenetic restrictions. The currently available vaccine for typhoid is a pure polysaccharide vaccine, immune response to which is T-cell independent. Little is known about whether genetic variation among vaccinees associates with variation in their antibody response to a polysaccharide vaccine. Results of a study on

Professor Majumder delivering on Enteric Vaccines during the Mini symposia

response to a currently available vaccine for typhoid,conducted on 1000 individuals who were residentsof an area at high-risk for typhoid, were presented. Polymorphic markers in 7 genes – *DEFB1, TLR1, IL1RL1, CTLA4, MAPK8, CD86* and *IL17D* – were found to be significantly associated with vaccine response. The overall picture that has emerged from this study is that (a) immune response to polysaccharide antigens is qualitatively different from that to protein antigens, and (b) polymorphisms in genes involved in polysaccharide recognition, signal transduction, inhibition of T-cell proliferation, pro-inflammatory signaling and eventual production of antimicrobialpeptides are associated with antibody response to the polysaccharide vaccine for typhoid.

Genomics and Personalized Medicine

Huanming Yang, Foreign Fellow

BGI-Shenzhen, China

2010 saw the 10th anniversary of the announcement of the first draft of the complete sequence of the human genome, which has revolutionized biomedicine by providing re-strengthened belief, novel strategy, and powerful tools, more importantly, opened the door to personalized medicine in the 21th century.

Sequencing, GWAS, and biobanking, might be regarded as the three most important breakthroughs related to genomics in the first decade of this Century. The new sequencing technology has dramatically lowed the cost, enhanced the throughput, and improved the efficiency. Numerous data have

Professor Yang speaking on Genomics and Personal Medicine during the symposium

Professor Padmanabhan speaking on Quantum Spacetime

been generated by BGI and its collaborators to help understand the human genome diversity and evolution, human pan-genome, human metagenome and host-microbe interaction, especially about human genome and diseases, as a part of the global effort for realization of the personalized medicine.

Gene manipulation, synthetic biology, stem cell and iPS tech, and animal cloning would be changing the world at molecular, cellular, tissue/organ, and individual level for "The Century of Biology", which would not be realized without the genome knowledge. BGI and its collaborators have published the genome sequences and preliminary analyses of the cucumber, potato, soybean, giant panda, ants, and other big genomes. BGI has also initiated the 1000 Chinese Genomes Project, the 1000 Animal and Plant Genomes Project, Genome 10K (10,000 vertebrates genomes), as well as the 10,000 Microbial Genomes Project including pathogens.

4) ***The Quest for Quantum Gravity*** (Speakers: Professor T Padmanabhan, FNA on Classical Lessons for Quantum Spacetime; Professor Rajesh Gopakumar, FNA on Quantum Gravity on your Tabletop? and Professor Ashoke Sen on Quantum Black Holes).

Classical Lessons for Quantum Spacetime

T Padmanabhan, FNA

Considerable amount of theoretical evidence have accumulated in recent years which suggest that the gravitational field equations in a wide class of theories — including, but not limited to, Einstein's theory — have the same status as, say, the equations of fluid dynamics or elasticity. I will discuss the strong 'internal evidence' in favour of such a point of view using essentially the classical aspects of the theory with just one quantum mechanical input, viz. the existence of temperature of horizons. These include the following facts:

(a) The field equations of gravity reduce to a thermodynamic identity on the horizons in a wide variety of theories of gravity.

(b) There are peculiar holographic relations between the surface and bulk terms in the action functionals describing several theories of gravity. It turns out that these two terms represent the entropy and energy, so that the action can be interpreted as the free energy.

(c) One can explicitly determine the number density of the microscopic spacetime degrees of freedom in any region, in any diffeomorphism invariant theory of gravity, and show that they reside on the boundary of a region.

(d) This result allows one to attribute an entropy density to the spacetime in a natural manner. It is possible to obtain the field equations of gravity — again for a wide class of theories — from extremising this entropy density.

Quantum Gravity on your Tabletop?

Rajesh Gopakumar, FNA

In his address, Professor Gopakumar described that how answers to questions in quantum gravity seem

to have surprising consequences for more down to earth non-gravitational physics. The context for this is the remarkable AdS/CFT correspondence which posits an equivalence between strongly interacting (non-gravitational) quantum gauge theories and theories of quantum gravity living in a one higher dimensional spacetime. This has been applied to infer some properties of strongly interacting quark-gluon plasma (QGP) which provides a much better qualitative understanding of experimental findings than other theroetical techniques. I also described some top-down approaches to using a classical Einstein gravity approach to learn about unusual scaling properties of non-fermi liquids, superfluids etc. The idea here was to try and gain some qualitative insights and deduce universal behviour. Finally I also mentioned some bottom-up approaches to generalising this duality to non-supersymmetric quantum field theories such as two dimensional interacting conformal field theories.

Award Lectures

The following five Award Lectures were delivered during Anniversary General Meeting at Bangalore: ***Meghnad Saha Medal Lecture (2009)*** on Global Partnerships in Scientific Research and International Mega-Science Projects by Professor VS Ramamurthy, FNA; ***Shanti Swarup Bhatnagar Medal (2010)*** **Lecture on** Factors Driving Global Evolution of Threatening Plant Viruses by Professor Anupam Varma, FNA; ***CV Raman Medal Lecture (2010)*** on Two Hundred (and More…..) Years of Diffusion by Professor S Dattagupta; ***Jawaharlal Nehru Birth Centenary Lecture (2008)*** on Harnessing Protein Folding to Counter Diabetes and other Chronic Diseases by Professor A Surolia, FNA and ***KS Krishnan Memorial Lecture (2010)*** on VDSL: Access for Future by Professor Surendra Prasad, FNA.

Meghnad Saha Medal Lecture (2009)

Professor VS Ramamurthy, FNA, Director, National Institute of Advanced Studies, Indian Institute of Science Campus, Bangalore, delivered the Meghnad Saha Medal Lecture (2009) on "Global Partnerships in Scientific Research and International Mega-Science Projects" on 30th December 2010. The summary of the lecture is as under:

Professor Ramamurthy while delivering the Meghnad Saha Medal lecture

Pursuit of knowledge has always been a global enterprise. People have moved, literally on foot, across continents in search of knowledge. Modern scientific research as our endeavor to unravel the mysteries of nature is no exception. Scientific collaborations and sharing of scientific knowledge across borders of all kinds have always thrived as enriching initiatives. Twentieth century saw the emergence of Science and Technology as tools closely linked to the economic and military strengths of the countries. Scientific and Technological knowledge is seen as Intellectual Property to be owned, protected, traded and even denied. Can open scientific collaborations be sustained in such a competitive environment, particularly among asymmetric partners? In what way such collaborations benefit the partners? India's participation in international mega science projects such as the Large Hadron Collider and the International Thermonuclear Experimental Reactor will be discussed as model global partnerships in scientific research.

Shanti Swarup Bhatnagar Medal Lecture (2010)

Professor Anupam Varma, FNA, formerly National Professor, *Advanced Centre for Plant Virology, Division of Plant Pathology, Indian Agricultural Research Institute, New Delhi*, delivered the Shanti Swarup Bhatnagar Medal Lecture (2010) on "Factors driving global evolution of threatening plant viruses" on 30th December 2010 at Indian Institute of Science, Bangalore. The summary of the lecture is as under:

Professor Varma delivering the S S Bhatnagar Medal lecture

In recent years, the viral diseases of plants have emerged as a threat to improving agricultural productivity. In the post- Green Revolution period the number of viruses affecting crop plants, particularly in the tropics and semi-tropics, has swelled enormously resulting in enormous economic losses and in many cases threatened food and nutrition security. The most destructive viruses are the whitefly-transmitted begomoviruses and thrips-transmitted tospo- and ilarviruses. Begomoviruses, also referred as whitefly-transmitted geminiviruses (WTGs), have been known to cause serious diseases even in the pre-GR period, but during the post-GR period they seem to have undergone rapid mutations and re-combinations, resulting in the fast emergence of new viruses and strains. In contrast, tospoviruses have evolved gradually, as they are less prone to rapid mutation and recombination, but have spread widely. Both these groups of viruses have evolved phylo-geographically. The factors driving evolution of the threatening plant viruses include, the development of virulent strains/isolates by recombinant events and mutations under selection pressure created by the deployment of resistant genotypes of the hosts; acquisition of satellite molecules with the ability to enhance virulence of the associated virus; introduction of host susceptibility genes; changes in the cropping systems; changes in insect vector biology; weather factors; and inadvertent movement of infected planting material across the world. The rate at which plant viral diseases are evolving is alarming. The changing scenario and some major epidemics caused by viruses will be discussed.

CV Raman Medal Lecture (2010)

Professor S Dattagupta, FNA, Professor & Director, Indian Institute of Science Education and Research, Kolkata, *NITTTR Campus, FC Block, Sector-III, Salt Lake, Kolkata*, delivered the CV Raman Medal Lecture (2010) on "Two Hundred (and more..) years of Diffusion" on 30th December 2010 at Indian Institute of Science, Bangalore. The summary of the lecture is as under:

Diffusion is a two-hundred year old subject but continues to thrive with various ramifications. Indeed it is a subject with perhaps the maximum number of interdisciplinary connections, be it in Biology, Chemistry, Earthscience, Mathematics, Physics or even Stock Markets! In this talk I will trace the evolution of Diffusion over the last two hundred years, mention two different branches of what may be referred to as Physical Diffusion and Stochastic Diffusion, and their unification through Einstein's work on Brownian motion, discuss our own work involving defect-motion, rotational diffusion, Neel relaxation in nanomagnets, pattern formation, mathematical Ecology and more recently, quantum Brownian motion.

Professor Dattagupta during the CV Raman Medal lecture

Jawaharlal Nehru Birth Centenary Lecture (2008)

Professor A Surolia, FNA, Director, National Institute of Immunology, New Delhi, delivered the Jawaharlal Nehru Birth Centenary Lecture (2008) on "*Harnessing Protein Folding to Counter Diabetes and other Chronic Diseases*" on 30th December 2010 at Indian Institute of Science, Bangalore. The summary of the lecture is as under:

Professor Surolia delivering the JLNehru Birth Centenary Lecture

To address the issue of patient compliance, we have developed a novel concept wherein Supramolecular Insulin Assembly-II (SIA-II), is used for a sustained treatment of Diabetes Mellitus Type-I. This study constitutes the first of its kind that uses the protein's (insulin in this case) folding reaction to entice it to transform into a prodrug, administration of which allows a sustained release of insulin and treatment of diabetes. Interestingly, this is achieved without the use of a chemical or a device. SIA releases biologically active insulin monomers into the blood upon subcutaneous injection, maintaining normal level of glucose for 90 days. SIA-II administration was free from harmful side effects of currently used multiple insulin injections and did not lead to the production of insulin degrading enzymes. Other complications of diabetes viz damage to the kidney & retina are also arrested. Currently type I diabetic patients need to inject themselves at least twice with various combination of insulin analogues present in the market, some of which are linked to increased risk of cancer due to the higher dosage administered. SIA is also expected to be free of such a harmful side affect. The just above basal level of human insulin released in a sustained manner from SIA-II is effective in controlling upsurge in the level of blood glucose after meals and prevents early morning hypoglycaemia, a dreadful event diabetic patients face everyday. We believe that this work bodes well for treating metabolic syndrome as well.

A Public Lecture on ***My Dream of Educating Children in a Pluralistic India*** was delivered by Professor UR Ananthamurthy, former President, Sahitya Academy (Delhi), Visiting Professor, Dr Radhakrishna Chair, University of Hyderabad.

Professor Ananthmurthy delivering the Public Lecture during the AGM

INSA Medal for Young Scientists (2010)

The Academy selected the following 30 scientists below the age of 35 years for INSA Medal for Young Scientists (2010) namely, Ranjit Prasad Bahadur (*Kharagpur*), Kanika Bajaj (*UC Berkeley, CA*), Viswanathan Baskar (*Hyderabad*), Krishanu Biswas (*Kanpur*), VK Chandrasekar (*Tiruchirappalli*), Ayan Datta (*Thiruvananthapuram*), Sutirth Dey (*Pune*), Narendra Madhukar Dixit (*Bangalore*), Prasad Suresh Hendre (*Hyderabad*), Gopaljee Jha (*Palampur*), Karanam Kishore Kumar (*Thiruvananthapuram*), Niti Kumar (*Munich, Germany*), Manoj Kumbhakar (*Mumbai*), Santanu Misra (*Switzerland*), Supriyo Mitra (*Mohanpur, Nadia*) Debdeep Mukhopadhyay (*Kharagpur*), Dhananjay Nandi (*Mohanpur, Nadia, WB*), Vijay Natarajan (*Bangalore*), Yamuna Devi Paila (*Hyderabad*), Kannan Pakshirajan (*Guwahati*), Swarup Kumar Parida (*New Delhi*), Nitin T Patil (*Hyderabad*), Amritanshu Prasad (*Chennai*), Surinder Singh Rana (*Chandigarh*), Swarup Roy Choudhury (*Kolkata*), Matheshwaran Saravanan (*Hertfordshire, UK*), Ritwick Suhas Sawarkar (*ETH Zuerich, Switzerland*), S Shankaranarayanan (*Thiruvananthapuram*), Rakesh Kumar Shukla (*Lucknow*), Tapasya Srivastava (*New Delhi*). In addition, Anil Kumar Bose memorial medal (2010) was awarded to Dhevalapally B Ramachary (*Hyderabad*), Samir Vishwanath Sawant (*Lucknow*). These young scientists were presented the award by President, INSA, Professor M Vijayan during the

Anniversary General meeting at Bangalore on 30th December 2010.

Presentation of INSA Medal for Young Scientists

Of the 30 Young Scientists selected in 2010, 25 received the INSA Medal from President INSA. In addition, Dr Dhevalapally B Ramachary and Dr Samir Vishwanath Sawant received the AK Bose Memorial Award. The LSS Kumar Memorial Award was received by Dr Rakesh Kumar Shukla.

President Professor Vijayan awarding the Young Scientists with Scroll

Presidential Address

President, INSA delivered the Anniversary address during the 16th Anniversary General meeting at Bangalore on 30th December 2010 on *A Foray into Oriented Fundamental Research. Structural Biology of*

President INSA alongwith all the Young Scientist awardees during the AGM

TB Proteins and their Homologues. A brief summary is given as under

By the end of the last century, our laboratory had well established structural programmes on plant lectins, protein hydration and supramolecular association. However, as an exercise in oriented fundamental research, X-ray work on mycobacterial proteins was initiated at that time in view of the importance of TB in India as a health hazard. Similar work was soon initiated in a few other laboratories in the country as well. On account of this somewhat concerted effort, of the structures of TB proteins determined world wide so far, more than 10% are from India. A major component of the programme on mycobacterial proteins in this laboratory has been concerned with recombination and repair. The work yielded interesting information on the plasticity and allosteric transitions of RecA, the variability in the

Professor Vijayan delivering his Presidential Address during the AGM

quaternary association of the single stranded DNA-binding protein and the structure and interactions of uracil N-glycosylase. In another effort concerned with proteins involved in translation, the internal mobility of the ribosome recycling factor has been thoroughly characterized. Also elucidated is the plasticity and its relation to enzyme action in peptidyl t-RNA hydrolase. Another component of the programme deals with proteins in the CoA biosynthesis pathway. The structure and interactions of *M. tuberculosis* PanK, the first enzyme in the pathway, have been characterized. The enzyme turned out to be unusual with dual specificity and interesting movement of ligands during enzyme action. Also studied were two DNA binding proteins produced in the stationary phase in *M. smegmatis*, which provide valuable insights into multimeric association. In addition to contributing to the understanding of the biology of mycobacteria, particularly *M. tuberculosis*, the results of the investigations are expected to be useful for structure-based inhibitor design.

Condolence at the passing away of the distinguished Fellow

The sad demise of Professor VS Rama Das distinguished Fellow of the Academy was reported. During council meeting President, INSA and all present stood in silence for a minute as a mark of respect to the deceased.

Announcement of the award of the General Medal / Lecture due for the year 2011

Professor AK Sood, Vice-President announced that the Council at its meeting decided to offer **The INSA Medal for Promotion & Service to Science** to Professor PN Tandon and **The Daulat Singh Kothari Memorial Lecture** to Professor SK Joshi.

Professor Sood announcing the Academy awards for the year 2011

Announcement of the Indira Gandhi Prize for Popularization of Science (2011)

Indira Gandhi Prize for Popularization of Science (2011) jointly awarded to:

1. Professor BN Dwivedi, Department of Applied Physics, Institute of Technology, Banaras Hindu University, Varanasi for popularizing science through print media both in Hindi and English on a wide range to subjects.
2. Professor Biman Nath, Raman Research Institute, Bangalore for popularizing science through print and visual media both in Bengali and English on a wide range to subjects.

Appointments / retirements of staff of the Academy

Professor AK Sood announced the names of the three staff members Dr AK Moitra, Executive Secretary, Shri Sunil Zokarkar, Assistant Executive Secretary-II and Sh. Karthikeyan S, Assistant Executive Secretary-III who were appointed. Two staff members Shri SK Sahni, Executive Secretary and Shri JM Gupta, Assistant Executive Secretary-II superannuated from the service.

Admission of Fellows

Professor M Vijayan, President INSA inducted 30 Fellows and one Foreign Fellow. The newly elected fellows took the oath, signed the fellowship register and received the fellowship scroll from President INSA. They were also presented with Fellowship tie and the lapel pin.

Presentation of mementos to outgoing Officers and members of the Council of INSA

Professor M Vijayan presented the shawls to the following retiring members will retire from Council: Professor AK Sood, Vice-President; Professor NK Gupta, Vice-President; Dr S Ananthakrishnan, Member; Professor BB Chattoo, Member and Professor VP Kamboj, Member (Other members:





Newly elected Fellows of the Academy while signing the Fellowship Register of the Academy and receiving the Fellowship Scroll

Professor RV Hosur, Professor A Jhunjhunwala, Professor V Ravindranath, Dr GB Nair, Professor T Ramasami were not present during this function). President, INSA profusely thanked the members of the Council for their continued support to him in carrying out the programmes during his tenure as a President of the Academy.

At this stage Dr Krishan Lal was invited to the dias. He presented the shawl to out going President and also presented an album containing representative photographs highlighting the major activities of INSA during the tenure of the President-ship of Professor Vijayan. Dr Krishan Lal profusely thanked Professor Vijayan for guiding the Academy and initiating many




Retiring Office Bearers receiving the Mememtos from the President Professor Vijayan

new programmes under his leadership. He expressed confidence that this support and guidance will be useful to the Academy for times to come.

Dr Krishan Lal, incoming President presenting an album to outgoing President Prof. M. Vijayan highlighting the major INSA activities

Dr Krishan Lal hoped that Professor Vijayan will constantly be associated with most of the major programmes of the Academy. Before he closed the meeting, Professor AK Sood expressed its gratitude for Professor Dipankar Chatterji and his team of IISc scientists who have worked sincerely in making this Anniversary and Council meeting a great success and memorable.

National Commission and Research Council Meeting and Seminar on History of Science

A two day Seminar on History of Science with special emphasis on Mathematics and Astronomy in Medieval India was organized at IIT, Madras by Indian National Science Academy in collaboration with Department of Theoretical Physics, University of Madras and Department of Physics IIT Madras on 25-26 October, 2010. The purpose of the seminar was to create awareness among the younger university

A view of the General Body Meeting in progress

A view of the INSA council Meeting in progress

A view of the attending Fellows of the AGM during the Lunch break in the IISc Campus

students towards the researches being carried out in history of science in India and to appreciate the relevance in university curriculum. This was amply highlighted by Professor R Gadagkar, Chairman, Research Council for History of Science in his introductory remark. Dr AK Bag presented a detailed account of the origin and growth of history of science in India and the researches done under the auspices of Indian National Commission for History of Science ever since its inception in 1965. He emphasized the need to cultivate and encourage the young scholars for taking up researches in this area. Professor MS Sriram, the local coordinator of the

Professor R Gadagkar, FNA, Chairman Research Council for History of Science delivering the introductory remarks

seminar gave an account of the work being done in this area in south India, specially the role of medieval astronomers and mathematicians from Kerala. A visit to KV Sarma Foundation was organized where rare and invaluable manuscripts and unpublished monographs in the area of mathematics and astronomy were displayed. These were the contributions and collections of Professor Sarma during his life time. During the two-day seminar the following papers were presented:

1. Madhava – A great Kerala Mathematician of Medieval Times: A K Bag,
2. Yuktibhasa and the case for Calculus : PP Divakaran
3. The Origin and Growth of Mathematics in India: K Ramasubramanian
4. Microbiology, Cancer and Genetics in Classical Ayurvedic Literature - A Historical perspective: P Ram Ramanohar
5. Study of Magic Squares in India: M D Srinivas
6. Narayana's treatment of varga-prakrti: Amartya Kumar Dutta,
7. Development of Combinatorics in India : From Pingala to Narayana Pandita: Raja Sridharan
8. Survey of Arabic Persian Sanskrit Sources on Astrolabe Extant in India and on the Indian School of Astrolabe-makers: S M Razaullah Ansari
9. Venvaroha from a Modern Perspective: S. Madhavan
10. Sines and Interpolations Techniques in Indian Mathematics: V Madhukar Mallayya
11. Problems of Technology change in Pre-Modern Times: Ishrat Alam

After the conclusion of the seminar the joint meeting of the Research Council and National Commission was held on 26th in the premises of IIT, Madras. It was chaired by Prof. R Gadagkar as authorized in the absence of Professor M Vijayan, Chairman, National Commission.

International Activities

Joint Meeting of FASAS and AASA

The federation of Asian Scientific Academies and Societies (FASAS) and Association of Academies of Sciences in Asia (AASA) organized an International Symposium on 'One Green Asia' the 4th AASA-FASAS Joint International Conference on 'Science Education in Asia and the Pacific' from October 18-20, 2010, at Seoul, Korea. It was followed by the FASAS Council Meeting, which was held on 21st October 2010. INSA, being a founder member of FASAS, deputed Professor IP Khurana to represent INSA in these conference and Symposia and also attend the 4th Council meeting of FASAS scheduled on October 21, 2010.

In the Opening Forum (on October 18, 2010) of the 10th Anniversary Ceremony of AASA, President of AASA, Jinghai Lee, welcomed the country representatives and participants. It was followed by an address from Anna Stabrawa, UNEP representative, who highlighted the need from 'Green and Resource Efficient Economics in Asia', keeping in view the energy demands and unsustainable patterns of consumption and production in the coming decades. Namik Aras from Turkey emphasized the

need to educate younger generation and impart courses and training in 'Environmental Science'. In the Opening Ceremony, the Korean Host, Kil-Saeng Chung, President of KAST (The Korean Academy of Science ad Technology), welcomed the members and briefly mentioned about the origin of AASA and FASAS and how the two associations are supporting activities jointly for the past few years. He also briefly remarked on how timely are the two symposia being organized and how relevant the themes are for sustainable development in Asian countries. It was followed by and opening address by President of AASA, Jinghai Lee, and congratulatory remarks by a host of other dignitaries invited for the occasion.

The Symposium on 'One Green Asia' began on the 19th October 2010, with opening remarks by the Chair and the invited dignitaries. The Plenary Session presentations highlighted the need for reducing the carbon emission by opting for nuclear energy and doing away with coal fired energy. At the same time, concerted effort is required for greater safeguards and non-proliferation, sustained R & D efforts] and public acceptance. There is indeed need for moderation of legislative framework to address issues related to climate change. Keeping in view the rapid growth, priority should be given to exploit renewable energy and biomass development. Strategies should be developed for application of green city technologies in Asia and Carbon Footprint label scheme should be implemented with sincerity. The changing weather is eclipsing decade old patterns and East Asia in particular is facing floods, melting ice, declining water resources and feverish heat. Some of these factors may also have positive impact, for example, drop in energy demand for winter heating and greenhouse maintenance, and agriculture produce may go up at high altitudes. Specific examples related to vulnerability of agro-environment and changes in biodiversity, as affected by and climate change, in some Asian countries were also discussed.

The Conference on 'Science Education in Asia and the Pacific' began on 20th October 2010 with inaugural remarks by the Korean Hosts (Soo Woo Nam and Kil-Saeng Chung) and also by the President of FASAS (Kurt Lambeck). The discussion started with posing a question: How to improve K-12 education in Asia? Suggestions like increase hours of teaching, reducing the number of subjects a student has to take, provide enquiry-based education, give importance to mathematics and science education, and improve school environment, were made. Why not to integrate Social Sciences, was also a question posed. Science Academies have a stellar role in mentorship of talented students by way of arranging summer schools. President of FASAS emphasized on five ES: Engage, explore, explain, elaborate and evaluate. In the discussion on Indian Initiative in Science Education, Professor Khurana highlighted the recent steps taken by the DST in initiating the 'INSIRE' programme kon a mega-scale, reaching to young students even to the remotest corners of India and encouraging them to take up science as a career. He also highlighted the role of the three Indian Science Academies in organizing the summer research programme for college students. The utility and the success of the other ongoing programmes like KVPY and Indian Olympiad were also highlighted. The service National Science Centres and Museums are providing in educating the young minds and even their parents was also given consideration. By and large it was realized that the Science Academies can indeed play a major role in attracting, talented students, impart them training evoking excitements of science, linking science with literacy, land the emphasis should be given right from primary education onwards. Academies can provide long term support and continuity, follow the evolution of the programme, and can launch new initiatives quietly and with modest support.

The Council meeting of FASAS was held on 21st October 2010 and was chaired by the President, Professor Kurt Lambeck. Besides the Member Country representatives, Professor Jinghal Li (President AASA) and Professor Y Muraoka (SCA) were special invitee to the meeting. At the outset, Professor Kurt Lambeck welcomed the members. He introduced the newly appointed Secretary General, Ms Nancy Pritchard from Australia, who will assist the President, FASAS. Next, the Agenda was taken up as per the programme tabled. The minutes of the meeting are attached for consideration.

Panel discussion on 'Hazardous Metals and Minerals Pollution in India: Sources, Toxicity, and Management'

The Panel discussion on 'Hazardous Metals and Minerals Pollution in India: sources, toxicity, and

Panel discussion on 'Hazardous Metals"

Prof Yu receiving JL Nehru Birth Centenary Medal from Prof Vijayan with Professor N Sathyamurthy, on his left VP (Int. Affairs)

management'was held on November 30 and December 1, 2010, at Indian National Science Academy (INSA), New Delhi. . Dr. Mahtab S. Bamji, Vice President, INSA was convener of this Panel discussion.

The purpose of the panel discussion was to examine the factors responsible for environment pollution which is an important societal problem considering its serious impact on human health and biodiversity. Since the topic is vast the focus of the proposed panel discussion was on hazardous metallic and minerals waste like lead, mercury, fluoride and arsenic.

Jawaharlal Nehru Birth Centenary Medal

Professor Dr-Ing. LU Yongxiang, President of the Chinese Academy of Sciences, New Delhi, visited INSA in December 2010 and received the Jawaharlal Nehru Birth Centenary Medal after his lecture entitled '*Enhance Cooperation for the Common Future'*. His lecture is as follows:

Since its establishing, INSA, as the highest national academic institution, has been unswervingly advancing knowledge and technology innovation, pursuing academic excellence, and disseminating scientific knowledge, promoting scientific spirit, and fostering excellent young scientific talents cultivation, and carrying forward international cooperation in S & T, playing a critical and leading role in the progress of Indian S & T undertakings and making significant contributions to the economic and social development of the nation, well-being of the people of India, and the progress of human civilization. INSA deserves admiration and respect of this among world academic community.

Both China and India are ancient civilizations with long history. People of both countries created splendid cultures in the history and made significant contributions to the human civilization in science. In recent centuries, both countries suffered invasion by imperialism and people of our two nations sympathized and supported each other while we wee striving for independence and freedom. Through extremely hard struggle, both countries won national independence during the mid of the passed century and began to develop in a self-determined way. From 1950's, through joint efforts of former state-founding premiers of both countries Zhou Enlai and Nehru, Five Principals of Peaceful Coexistence were created as critical principals of international relations, laying a concrete basis for the friendly neighborhood between our two countries. In the recent years, joint efforts were made on the fruitful cooperation in economy and trade, culture, science and technology, education and so on, indicating a positive trend of development of the bilateral relationship in all aspects. In 2005, China and India established the strategic cooperative partnership for peace and prosperity, which marked that the bilateral relation stepped into a new era of development. With a long history, bilateral cooperation between China and India has great potential and a bright future. Close cooperation of China and India would not only enhance the development of the two countries and benefit the

Prof Lu delivering the lecture

people of both countries but also would be conducive to regional and global peace, stability and prosperity in Asia and even the world.

Since their establishment, CAS and INSA define themselves as the highest national academic institution in science and technology and have been the core and leading force in our nation' science and technology innovation. CAS and INSA have also been developed as the highest authorities in science and technology consultation in our two countries and have been playing a critical role in improving national capacity in science and technology innovation, cultivating talents for science and technology innovation, disseminating knowledge of science and technology, upholding scientific spirit and improving nationals' quality in science and technology.

At present, 2 to 3 billion people in the world including china and India are in the pursue toward modernization. This brings the global development new driving force and dynamism and also poses challenges on traditional mode of industrialization and modernization. While we are looking ahead into the future, globalization, urbanization, informatization, cyberization and knowledge-orientation and irreversible trends. Science and technology are progressing rapidly. Resources and environmental issues pose more pressures on us. Global climate change has got more attention in the worldwide. We are suffering from frequent natural and anthropogenic disasters and expanding gap in wealth between the North and the South, and facing traditional and non-traditional challenges etc. The world is in a process of substantial new readjustment and reform. Global financial crisis and world economic recession will make stand out the disadvantages and unsustainability of current global financial pattern and development mode. Human being is marching from industrial civilization toward green and intelligent knowledge civilization where innovation shall be made and shared by the universe and the development shall be sustained. No single nation is able to adapt to and tackle these new challenges and opportunities, new adjustments and transformations alone. Dealing with these challenges and realizing these new adjustments and transformations require science and technology innovation and close cooperation among scientists of the whole world. Our common goal entails a common initiative to make response and a common commitment to innovation. Scientists from China and India will be a part of it to make significant contributions. Given that China and India are in the similar stage of development and facing similar and common challenges and opportunities, close collaboration between two peoples, scientists of two nations and the two academies are required in our endeavor in finding a path for green, intelligent, sustainable development toward common prosperity, jointly tackling the common challenges and contributing to the requirements of diversifying economic and social development and transformation of development mode of the two economies.

For the above purposes, I would like to make following suggestions.

First, promote the communication between our two academies and the science communities of the two countries, including those among top leaders, esteemed scientists, young scientists and undergraduate and graduate students. Mutual understanding need be deepened so as to lay a wide and concrete basis for closer collaboration.

Second, identify areas of mutual interests and develop steady and long-term strategic cooperation through holding bilateral multilateral strategic workshops and thematic innovation forums.

Third, promote the cooperation in fundamental frontier areas such as clean energy, resource saving, recycling and the clean and effective utilization, green manufacturing and process engineering technologies, bio-diversity protection and sustainable exploration, information and intelligent technologies, health care and affordable medical care, eco-agriculture and disaster prevention and mitigation, etc.

Fourth, enhance communication and coordination in international organizations like ICSU, IAP/IAC, TWAS, IPCC and so on for the purpose of promoting international communication and coop0eration in science and technology, protecting the interests of developing countries, fostering capacity building in developing countries and especially in least developed countries, contributing to the accomplishment of UN Millennium Development Goals, and actively tackling global climate change under the principle of common but differential responsibility according to the framework established in Kyoto Protocol and Bali Roadmap.

Let us join our hands to further explore and create more effective and various channels of communication and patterns of cooperation, and to strengthen and deepen the bilateral exchange of both academies and both countries in all aspects. Let us endeavor to jointly create a bright future for economic and social development of the two nations, for Science and technology innovation and for the progress of human civilization.

Visit of Overseas Scientists

Professor Torsten Wiesel, NL and Foreign Fellow, Professor of Neuroscience, President Emeritus, The Rockefeller University, New York, visited INSA on 1st December 2010.

Dr Michael Clegg, For Secretary, US National Academy of Sciences visited INSA on 15th October 2010.

Professor Clegg is seen with Prof PN Tandon, Past President, INSA during the visit

IUPAP Annual Meeting

The Annual Meeting of the IUPAP Council and Commission Chairs (CCC) was held in New Delhi during November 5-6, 2010. The meeting was jointly organized by Prof. Mustansir Barma, FNA, Vice President at large, IUPAP and Chair, INSA-National Committee of IUPAP, (Director, Tata Institute of Fundamental Research Mumbai) and Dr Pratibha Jolly, Chair, IUPAP Commission on Physics Education (Principal, Miranda House, University of Delhi).

Professor R. Rajaraman, Professor Von-Klitzing and Professor Ushioda during IUPAP Annual Meeting

Prior to the meeting, on November 4, 2010, the National Liaison Committee of IUPAP organized a day long scientific programme titled: "Indian Physics: Research on the Frontiers" at India International Centre. 34 foreign scientists including Professor Ushioda, President IUPAP, Professor Von-Klitzing, Nobel Laureate and many Indian physicists participated in the programme.

On behalf of Indian National Science Academy, a dinner was hosted by Prof. R. Rajaraman, Vice-President, INSA on November 4, 2010 in honour of the IUPAP dignitaries.

Other news under International Programme

- 5th International Nitrogen Conference held at IARI, Pusa, during 3-7th December 2010.
- International Geographical Union (IGU) Commission Seminar on "Land Use, Biodiversity and Climate Change" held during December 11-13, 2010 at Department of Geography, Cotton College, Guwahati, Assam.

- Dr Javed Iqbal, FNA, Director, Institute of Life Sciences, University of Hyderabad, Gachibowli, has been elected as Member of the ICSU Regional Committee for Asia and the Pacific (RCAP) for the period 1st January 2011 to 31st December 2013.
- Professor Pinakpani Chakrabarti, FNA, Department of Biochemistry & Bioinformataics Centre, Bose Institute, Kolkata has been elected as Vice-President of ASCA (Asian Crystrallographic Association) for the term 2010-2013.

Local Chapter Activity

Professor Darshan Ranganathan Memorial Lecture (2010)

Dr Chandrima Shaha, FNA, Deputy Director, National Institute of Immunology and Staff Scientist VII and Head, Cell Death and Differentiation Research Laboratory, National Institute of Immunology, Aruna Asaf Ali Marg, New Delhi, delivered the Professor Darshan Ranganathan Memorial Lecture (2010) on "*Life-death Decisions in Cell Survival* " on 04th October 2010 at Rajiv Gandhi Centre for Biotechnology. The summary of the lecture is as under:

The course of evolution has shaped different species for their survival during conditions of stress, natural development, differentiation and growth. While death is a negative event, cell death becomes a positive phenomenon when it is executed to save an organism from abnormal cellular functions. Continued growth would hamper survival, therefore, animal cells have evolved the capability to kill themselves by turning on gene encoded cell suicide programs. These programs not only help the organisms to survive in conditions of excessive stress but also help prevent abnormal growth. During the life-time of an organism, a crucial balance has to be maintained between cell death and cell division for proper homeostasis. A variety of death processes have evolved to ensure cell death when required and the decision of whether a particular cell will live or die are tightly regulated by many different signals originating both from within the cell and from its environment.

The big question is how and why the process of cell death evolved. Although apparently the process of cell killing in a unicellular organism is self defeating as it would be counter productive for the species, such organisms living in colonies attain the status of pseudo-multicellularity when they can switch on the programmed cell death processes for altruistic purposes. It is evident from our studies that unicellular eukaryotic parasites like Leishmania encode a program for death similar to higher eukaryotes. Calcium is a major modulator of cell death in these parasites, and its influx lead to mitochondrial disorganization and eventually death. Mitochondrial changes in response to oxidative stress in these parasites are reminiscent of mitochondrial behaviours in higher eukaryotes

Prof C Shaha, FNA receiving citation from Prof M Vijayan, President INSa after delivering Prof Darshan Ranganathan Memorial Lecture

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during initiation of death processes. This suggests that the ability to generate energy during cell death was selected very early during evolution and is visible in the first mitochondrial eukaryotes. Defensive enzymes have played a major role in survival of these parasites from oxidative stress and natural selection has worked on these enzymes to create a large repertoires essential for survival of organisms that the constantly exposed to oxidative stress and its products. These enzymes through their ability to eliminate oxidants play a mjor role in adaptation of the parasites within the host cells.

The Leishmania parasites die by apoptosis within their insect hosts as well as their mammalian host when required, either because of their own requirement or out of necessity of the host. However, they can modulate host apoptosis to ensure their own survival in a niche within the host cell and for dissemination of infection when required. It is this continuous tussle between the host and the parasite that has hugely contributed to the evolution of death pathways. The selective pressure on the pathogen to create infection and the selective pressure on the host to eliminate the infection has shaped the major death signaling modules.

Announcements

Proceedings of the Indian National Science Academy Invitation to Authors

Proceedings of the Indian National Science Academy is an inter-disciplinary journal devoted to publication of review papers, original research articles, short communications, commentaries, lateral thinking and emerging techniques in the areas of Physical, Biological, Applied Sciences and also Engineering. Four issues of the Journal are published in March, June, September and December.

Three copies of the manuscript complete with figures, tables and any other material (one original and two copies) may be submitted to the Editor-in-Chief, *Proceedings of Indian National Science Academy*, Indian National Science Academy, Bahadur Shah Zafar Marg, New Delhi 110002. A copy of the manuscript may also be submitted in the electronic form at procinsa@insa.nic.in.

History of Science

Research proposals are invited from researchers interested in taking up source and theme oriented studies by compiling important sources for study, translation of important scientific and technical works and making critical assessment in the areas like mathematics, astronomy, medicine, architecture, product, life and works of eminent scientists, institutions, science and societies etc. relating to Indian science and technology in proper historical perspective. *Application form may be obtained by sending a request to the History of Science Unit of Academy.*

Last Date for Making Nomination for Election of Fellows and Foreign Fellows

This is to draw attention of Fellows of INSA to the fact that last date for receiving nomination for election as Fellow and Foreign Fellow is 15 October 2010. The nominations received on or before October 15 will be included for consideration in the year 2011, while those received after October 15, will go to the year 2012. *The Fellowship Nomination Form will be made available only to Fellows of INSA on request.*

Visiting Scientist Programme 2011

Since 1991, the INSA is supporting scientists from less endowed institutions to conduct advance research and training in advanced research institutions/laboratories within India under Visiting Scientist Programme. The main objective of the programme is to facilitate scientist to acquire furtherance of research capabilities for undergoing training in specific techniques, or utilizing facilities not available in their own institution. The scientist holding a regular position in R&D organization including Universities or affiliated colleges in India are eligible to apply under the programme. The fellowship period varies from one month to six months depending upon the proposed work or purpose. *Interested persons may download the prescribed application form from the INSA website www.insaindia.org and submit the prescribed application.*

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Professor Vijayan with INSA staff members during his last visit to INSA Headquarters as INSA President on 22nd December 2010