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NPL — The Keeper of Indian Standard Time

At dawn of the New Year, as the world's most accurate clocks synchronized with the earth's rotation, India's timekeeper, the National Physical Laboratory (NPL),New Delhi, also tuned its atomic clocks. Clocks are machines of whimsy. Every timepiece has a personality and a character of its own. But we are not talking about mother-of-pearl *Rolexes* and titanium *Tissots* here. We are talking about the highly accurate cesium atomic clocks which are employed to maintain the nation's time.

"Once synchronized, a cesium atomic clock — which harnesses the transition of electron energy levels in cesium atoms to measure time accurately — will not miss a second in 10,000 years. It is far superior to a quartz clock, which needs tuning every few months," says Dr P. Banerjee, Head of the Time and Frequency Section at NPL in New Delhi. The keeper of Indian Standard Time (IST), NPL has five such atomic clocks, "just to be sure". Ironically, for a machine that seeks to tame the cosmic continuity of time — something that cannot be apprehended by physical senses — by gauging it down to the nanosecond, a cesium atomic clock typically has a life span of less than a decade. "It is an electronic instrument; it may fail any time," says Dr Banerjee. In fact, one of the five clocks at NPL has just been returned to the grid after being shipped to the US for repairs.

These clocks are nowhere near exotic. They are regular electronic boxes with little digital displays, stacked together in a sanitized chamber — you must leave your shoes outside — where the temperature and humidity are clinically constant at around 23^{0}C and 55%, respectively. Remembering mid-1970s, when the first atomic clock was installed at NPL, Dr Banerjee tells "when we got our first atomic clock, people flocked to NPL to take a look, but went home disappointed by its boxy appearance." But these clocks are the keeper of time, smoothening out the kinks in our measured knowledge of this most dynamic parameter.

While Dr Banerjee trusts NPL-7 — the current master clock that was installed three or four years back—the most, he has tasked research scholars working under him with developing algorithms to calculate an average of the five clocks that would have a higher degree of accuracy than individual measures.

Even a cesium atomic clock—cesium is preferred because it is a stable element that is also easy to handle—cannot be 100% correct, since it "probes" the cesium atom and disturbs it. "Let me give you an example. To a scientist, a thermometer tucked under the armpit can never reveal the exact temperature of the body, since it absorbs some of the body heat while measuring it," Dr Banerjee says. But for all practical purposes, this discrepancy is negligible. So are the micro-inaccuracies of atomic clocks.

New Projects

Modular Re-configurable Micro Manufacturing Systems (MRMMS) for Multi Material Desktop Manufacturing Capabilities

Sponsor: **CSIR;** *Sanctioned Amount*: **Rs 19 crore;** *Participating Institutes*: **Central Mechanical Engineering Research Institute (CMERI), Durgapur (Nodal Lab); Central Electronics Engineering Research Institute (CEERI), Pilani; Central Scientific Instruments Organisation (CSIO) Chandigarh; and National Aerospace Laboratories (NAL), Bangalore;** *Duration*: **5 years**

The overall aim of the project is to develop modular and flexible manufacturing systems for cost-effective manufacturing of multi-material micro systems/devices, having 3D geometries with high aspect ratio. The important components of the targeted micro factory test bed include:

- Miniature machine tools for micro milling, micro EDM and laser machining leading to micro factory test bed
- High speed air and magnetic bearings for micro-machine tools
- Intelligent controllers and diagnostic systems
- Ionic Polymer Metal Composite (IPMC) or Shape Memory Alloy (SMA) based handling system for micro factory manipulations
- Laser processing of metal and ceramics

Objectives

Different research teams in their specific areas would execute the following planned tasks, which will be integrated to demonstrate a micro factory capability. The sub-tasks identified among the participating laboratories are as follows:

- Development of multi-functional micro machine tool for tool-based manufacturing processes
- Development of multi-functional laser processing systems for micro and meso applications
- Development of oil-free bearing for micro machine tools
- Development of micro parts handling systems using IPMC and SMA
- Platinisation of Nafion polymer towards development of IPMC
- Intelligent controllers and sub-systems for micro-factory systems
- Micro factory test bed
- Development of micro fabrication methodology for ceramics
- Development of PCB based micro-generator and hearing aid

Maintaining 3" Silicon Wafer Fabrication Facility for Supporting R&D Projects

Sponsor: **National Programme on Micro and Smart Systems (NPMASS);** *Sanctioned Amount*: **Rs 3.3 crore;** *Project undertaken by*: **Central Electronics Engineering Research Institute (CEERI), Pilani;** *Duration*: **3 years;** *Expected Output*: **Training on MEMS processing under HRD and providing multi-user MEMS prototyping runs**

CEERI has been successfully fabricating various MEMS structures and prototype devices for the users in the country for quite some time. It is envisaged that MEMS structures and devices will find increasing use in strategic applications and also in commercial market for a variety of applications. There are several organizations that provide design and modeling facilities, but fabrication facilities are beyond the reach of many. CEERI has taken up the initiative of human resource development with the support from NPMASS for up-keeping of the fabrication facilities to utilize them for manpower training and to develop processes/prototypes for MEMS.

It is proposed to provide/ maintain 3" silicon semiconductor fabrication facility for the MEMS process training and MEMS prototyping runs. Typically, every month a 10-wafer batch will be initiated and training will be conducted on various process techniques and technologies involved in the fabrication of MEMS structures and devices. The basic unit processes of the semiconductor technology such as mask making, wafer cleaning, thermal oxidation, thermal diffusion, ion implantation, chemical etching, photolithography, chemical vapour deposition, reactive ion etching, bulk micro machining, electroplating and metallization will be demonstrated. Expert lectures and technical/ technological presentations on all the unit processes will be arranged to discuss the processes and their applications for MEMS devices. In addition, a standard process flow coordinated through a central agency under NPMASS will be evolved for MEMS prototyping runs and process runs will be done, as required.

Advanced Eco-friendly, Energy Efficient Processes for Utilization of Iron Ore Resources of India

Sponsor: **CSIR;** *Sanctioned Amount*: **Rs 1 crore;** *Participating Institutes*: **Institute of Minerals and Materials Technology (IMMT), Bhubaneswar (Nodal Lab), National Metallurgical Laboratory (NML), Jamshedpur, North-East Institute of Science and Technology (NEIST), Jorhat and Central Electronics Engineering Research Institute (CEERI);** *Duration*: **5 years**

Currently, conservation of iron resources is accorded top priority as the natural resources are dwindling and wastages in processing are high. Moreover, the iron ore available in India is of low quality. In order to utilize the resources optimally, a CSIR Network Project has been taken up. Participation of CEERI is divided into three activities:

(i) *Development of Impact Analysis System for Tumbling Ball Mills:* Normally, tumbling ball mills are used in the comminuting process, i.e. for breaking the crushed ore to required pellet size. It becomes the feed to the steel mills. The ball mills employ alloy steel balls for grinding the crushed ore. This

process generates sound patterns or signatures, known as impact signal, where an efficient operator would know precisely when the ore has been ground to proper size. However, the whole process is noisy and surrounded by other heavy machinery, which further complicates the identification of proper signal.

The main objective of this activity is the efficient transmission of the impact signal for further processing through a novel wireless sensor system and sensor fusion techniques.

(ii) *Pulsation Behaviour Monitoring Subsystem for Jigging Process in Iron Ore Processing:* Need for a pulsation behavior monitoring system was felt in the jigging process. This is an important step in the iron ore processing for separating and analyzing the stratified layers through the pulsation and suction cycles in the formation of concentrate, tailings and middlings.

The objective is to develop a pulsation behaviour monitoring system for the jigging process, where the mixed particles separated will be analyzed through a pulsation and suction monitoring system.

(iii) *Development of Image Processing Techniques to Measure the Pellet Size Distribution:* The aim of this activity is to develop a prototype 2D imaging and analysis system for non-contact measurement of the size of iron ore pellets on the conveyor belt. The image capturing and analysis software will be developed using high-resolution camera and accessories.

The main objectives are: development of image processing techniques to find out the size of pellets, generation of size distribution from a given image, carrying out of off-line simulation on captured images, and development of a camera-based prototype embedded system to do size distribution analysis in real-time.

Smart Pond Management System for Freshwater Aquaculture

Sponsor: **Department of Biotechnology;** *Sanctioned Amount*: **Rs 87 lakh;** *Duration*: **3 years;** *Project undertaken by*: **Central Electronics Engineering Research Institute (CEERI), Pilani**

The project aims to develop a continuous environment monitoring electronic device for freshwater ponds for identification of critical limits of important water quality parameters, providing alarm at critical points and automated remedial measures through software-hardware integration for controllable parameters. It also estimates the stress factor on the fish (on-line) by means of a suitable model realized over the years for efficient farming operation. This has been reflected as one of the priority areas of research in the Central Institute of Freshwater Aquaculture, a premier fisheries research institute in the country.

Objectives

- On-line continuous display and alarms for critical pond parameters
- History of critical pond parameters such as dissolved oxygen, pH, temperature, ammonia, carbon dioxide, conductivity, water level and transparency
- Sensor-based demand feeders
- Prediction of on-line stress factors on fish
- Networking of ponds

Appropriate Automation for CSMCRI-designed RO Plant

Sponsor: **Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar;** *Sanctioned Amount*: **Rs 12 lakh;** *Duration*: **18 months;** *Project undertaken by*: **Central Electronics Engineering Research Institute (CEERI), Pilani**

Ground water available in our country is mostly salty. Various techniques are available for converting salt water into safe drinking water and Reverse Osmosis (RO) technique is one of them. CSMCRI has developed a turnkey technology for RO and its RO plants are successfully installed all over India. The present project is aimed at providing appropriate automation to the CSMCRI-designed RO plants. The proposed system will continuously monitor, display and store all the relevant critical parameters.

Objectives:

- Design and development of appropriate automation system for the RO plant
- Monitoring, display and storage of all critical parameters such as pressure at various points, pH, temperature, total dissolved salts (TDS), water flow, turbidity and other parameters as identified by CSMCRI
- Providing alarms and history
- Providing auto/manual operation
- Design and development of GUI based interfaces
- Parameters to be derived: rate of removal of salts, rate of scaling and health of the plant
- Parameters to be controlled: final pressure, water flow and TDS

Process Analytical Technology (PAT) Methods for Standardization in Pharmaceutical Industry

Sponsor: **Department of Science and Technology, New Delhi;** *Sanctioned Amount*: **Rs 87 lakh,** *Duration*: **2 years;** *Participating Institutions*: **CEERI Centre, Chennai and M/s Elico Ltd, (a leading analytical manufacturing company), Hyderabad; M/s Orchid Health Care has come forward to get associated with this project as a user industry to facilitate experimentation**

A near infrared (NIR) diode array spectrometer will be configured and developed by M/s Elico Ltd for use in this project, with appropriate support from the CEERI Centre. The final product based on diode detector array module will be installed in the identified user industry for field trials and as a demonstration model.

Objectives

- Development of versatile online methods for Process Analytical Technology (PAT) in Pharma for raw materials compliance and standardization of unit processes viz. granulation and drying by using suitable configured NIR spectrometer with fibre optic sample probes
- To work closely with associated pharma industry to make provision for installation of NIR spectrometer in unit processes, namely granulation and drying for model building and validation
- To improve current good manufacturing practice methods for granulation and drying unit processes using online information from NIR spectrometer with fibre optic probe inserted in the process to improve product quality and yield, reduce scrap and increase speed of analysis
- To investigate appropriate pre-processing techniques and apply for model building using various chemometric techniques for qualitative/quantitative analysis
- To conduct awareness programme on PAT in pharma industries to propagate the methods developed/standardized.

New CFTRI Technologies

Continuous Press for Manufacturing Biodegradable Plates (US Patent No. 7270522)

Traditionally, plant parts such as leaves and areca palm sheaths have been used in India as a raw material for making different articles such as plates, cups and saucers for serving food. The Central Food Technological Research Institute (CFTRI), Mysore, has developed a continuous press for the manufacture of biodegradable articles from plant parts. The machine can make cups, saucers and plates from plant parts such as leaves/sheaths. The articles thus prepared are useful for various purposes, particularly for serving or holding food. The main advantage is that the device does not require application of manual force and the operation is continuous. Handling of the raw leaf is easy and material handling is less labour intensive while the heat-up time of the die is less and the gap between the die and punch set can be adjusted. The die and punch set is interchangeable (different geometry of punches and dies can be fitted on to the machine), the compressor and the pneumatic cylinders are not needed and the temperature of the die can be controlled. The production capacity is very high and casting/shaping can be carried out without vibration. Operation and maintenance of the device is easy and cost effective.

A view of the continuous bioplate- making machine. and finished bioplates/saucers

Process for High Protein Nutritious Baked Snack Food (Singapore Patent No. 125665)

Major nutritional problems prevalent in the developing countries are protein-calorie malnutrition, vitamin A, iron and iodine deficiencies. Providing health foods fortified with critical vitamins and minerals reduces risk of malnutrition, especially in children. Snack food can be a source of high energy and high protein for children and adults supplementing their nutritional requirements.

CFTRI has formulated a high protein snack food targeted especially to children. It is made from a mixture of whole-wheat flour, soy flour, peanut grits, wheat germ, milk powder and sugar along with added micronutrients. The formulation has the following advantages: it provides a ready-to-eat and nutritious snack food and the product contains proteins from vegetable sources only and essential amino acids such as lysine and methionine. This snack food provides 18.0 g protein, 460 calories from 100 g snack food on dry weight basis with a well-balanced mixture of selected vitamins and minerals. Since the moisture content of the snack food is relatively low (3.5%), it has longer shelf-life. The product can be manufactured at a commercial scale and consumed either as a snack food or as a source of protein and other micronutrients, by people of all age groups. CFTRI has obtained a patent in India as well as in Singapore for the formulation.

Athermal Process for Concentration of *Garcinia* Extract (US Patent No. 7431951)

The fruit rinds of *Garcinia*, grown in North East part and Andaman Islands in India, have been a good source of (-)-Hydroxycitric acid (HCA) that is incorporated into a wide range of pharmaceutical preparations in combination with other ingredients for enhancing the weight loss, cardio protection, correcting conditions of lipid abnormalities and enhancing the endurance.

CFTRI has developed an athermal process for obtaining concentrated *Garcinia* extract by using osmotic membrane distillation (OMD).

The process involves extracting the cut and dried rinds of the fruit, *Garcinia pedunculata*, with de-ionized water filtration and osmotic membrane distillation to obtain concentrated extract. The main advantage is that it is a single step process for obtaining the concentrated free hydroxycitric acid (HCA).

Garcinia Species

This concentrated *Garcinia* extract is in its native form without being lactonized and derivatives of HCA like sodium, potassium and calcium salts facilitating better bioavailability and this product does not undergo any thermal damage since the process is athermal. The product is thus suitable for food and therapeutic applications. This process is simple and easy to scale-up.

Concentrated *Garcinia* Extract

Use of Fraction from *Cinnamomum zeylanicum* for Preserving Food (US Patent No. 7431958)

Synthetic antioxidants, such as butylated hydroxyanisole (BHA) and butylated hydroxytolune (BHT), have restricted use in foods as per food laws. Therefore, the importance of search and exploitation of natural antioxidants, especially of plant origin has greatly increased in recent years. The present invention relates to a use of brown color natural anti-oxidant fraction from fruits of the plant *Cinnamomum zeylanicum* for preserving the food articles, and a simple and efficient process for the preparation of an antioxidant fraction from fruits of the plant.

The advantages of the process are: the solvents used in this process can be regenerated for further use and antioxidant fraction is prepared from unconventional parts of the fruit.

Physical Oceanography of Indian Ocean
Prof. P.N. Vinayachandran's Shanti Swarup Bhatnagar Prize-winning Work

Prof. P. N. Vinayachandran of the Indian Institute of Science (IISc), Bangalore, has been awarded the Shanti Swarup Bhatnagar Prize in Earth, Atmosphere, Ocean and Planetary Sciences for the year 2008.

Prof. Vinayachandran has made significant contributions to the physical oceanography of the Indian Ocean. He was the first in India to implement and use an ocean general circulation model (OGCM). In all his studies, one can see a blend of observation and theory; a combination of data and quantitative earth-system-science. This blend of physics, state-of-the-art models and observations make his work unique in India. The following are amongst his most important contributions:

Ocean Circulation

Prof. Vinayachandran has used ocean models together with observations to unravel several features of the Indian Ocean circulation and to understand the processes that force them. He discovered that :

- There exists a North Bay Monsoon Current that prohibits the free southward movement of low-salinity water dumped into the northern bay by the *Ganga* and *Brahmaputra* rivers,
- The orographic effects of western Ghats leads to the formation of the Arabian Sea mini warm pool,
- The East India Coastal Current bifurcates east of Sri Lanka and only one part of it flows into the Arabian Sea,
- The wind-driven circulation is crucial in determining the path of freshwater in the Bay of Bengal,
- There exists a Sri Lanka Dome
- The Southwest Monsoon Current curves around Sri Lanka to intrude into the Bay of Bengal, and
- The monsoon circulation in the Bay of Bengal consists of several eddies and gyres.

Ocean Modeling

Prof. Vinayachandran implemented and carried out experiments using an OGCM for the first time in India in the early 1990s. Keeping pace with developments in model technology and high-speed computing in both India and abroad, he addressed more complex problems with each succeeding generation of models and computers. He recently developed a high resolution Indian Ocean model based on MOM. This model is able to reproduce the freshwater plume in the Bay of Bengal and the associated current and salinity fields realistically and its simulation of the Indian Ocean sea surface temperature (SST) is possibly the best in the world today.

Indian Ocean Dipole (IOD)

The IOD, which is characterized by cold SST anomalies in the eastern equatorial Indian Ocean and warm anomalies in the west, is an El-Nino-like event in the Indian Ocean. Its atmospheric counterpart (Equatorial Indian Ocean Oscillation) has a greater impact than does El Nino on the monsoon rainfall over India, with large deviations from the normal being influenced by the IOD and ENSO.

In a pioneering study, Prof. Vinayachandran had shown that the equatorial jets in the Indian Ocean, which have a major influence on the thermal structure of the equatorial Indian Ocean, weaken during certain years. This finding led to the discovery of the Indian Ocean Dipole. Since the discovery of IOD, which has become a hot topic of Indian-Ocean research, Prof. Vinayachandran has contributed significantly to elucidating its mechanism. He used MOM to show that planetary waves play a crucial role in generating the conditions favourable for the development of

Indian Ocean SST Anomolies (°C) during 2006 October

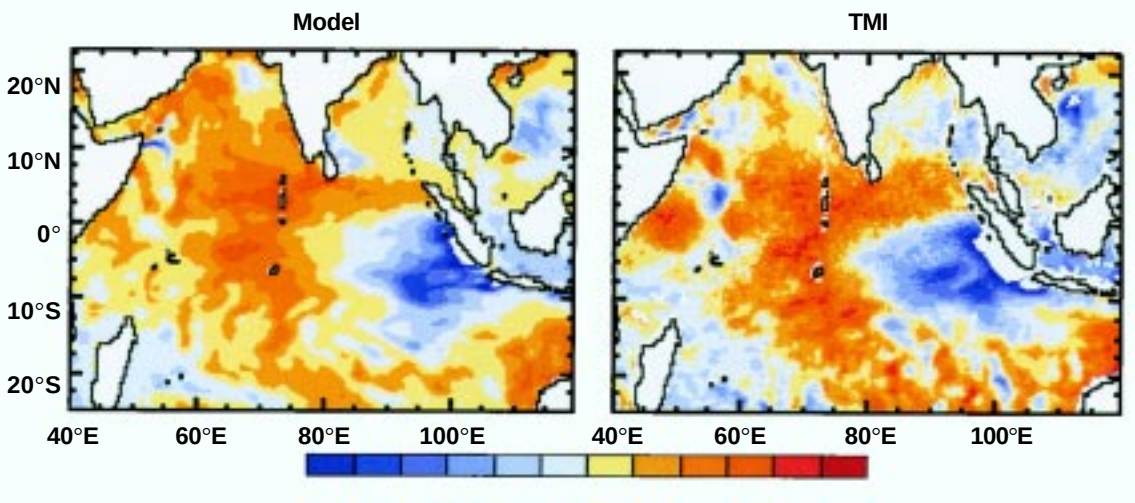


Figure: Deviation of sea surface temperature during October 2006 from its long term average. Left panels show simulation using an ocean general circulation model of the Indian Ocean and right panels show satellite observation by TRMM Microwave Imager

SST anomalies associated with the IOD and has proposed a mechanism for the triggering of IOD events. He is the first to simulate the strong IOD event of 2006 (see Figure), showing that in this event, unlike in the earlier ones, air-sea fluxes played a crucial role in generating the SST anomalies. He has also shown that IOD impedes phytoplankton blooms in the Bay of Bengal and prevents the bifurcation of the East India Coastal Current.

Physical–Biological Interactions

The Bay of Bengal was believed to be a region of low primary productivity compared to the Arabian Sea. Using satellite data, it was shown that the southwestern Bay becomes highly productive during the northeast monsoon, particularly under intense wind events such as cyclones. Prof. Vinayachandran showed that there are chlorophyll blooms around Sri Lanka during the summer monsoon. The Summer Monsoon Current is an efficient carrier of chlorophyll-rich water from the coast of Sri Lanka. Using an ecosystem model combined to a physical model, he found that in regions such as the Bay of Bengal with very shallow mixed layers, the sub-surface chlorophyll maximum is a significant contributor to the surface chlorophyll blooms.

Born on 19 April 1964 in Meladoor, Trissur District, Kerala, Prof. Vinayachandran did his B.Sc. in Physics from Christ College, Irinjalakuda, Calicut University, in 1984; M.Sc. in Oceanography, from Cochin University of Science & Technology in 1987; M.Sc. (Engg) in 1992 and Ph.D in 1996 in Oceanography from IISc.

He was a Research Fellow at National Institute of Oceanography (NIO), Goa, during 1987-1990; a Post-doctoral Fellow at University of Tokyo, Japan during 1996-97; and Senior Researcher at FRSGC, Tokyo, Japan (1997-99). He served as Assistant Professor (1999-2005) and became Associate Professor (2005 onwards) at CAOS, IISc, Bangalore.

His research interests are in Dynamics of the Indian Ocean; Ocean Modeling; and Physical-Biological Interactions in the Ocean.

Prof. Vinayachandran visited CSIRO Marine Research, Australia, from 22 to 30 March 2001; FRCGC, Tokyo, Japan, 16-23 December 2001; and IPRC, Hawaii, USA, 29 November to 12 December 2004. He was a Visiting Scientist at APEC Climate Centre, Busan, Korea, during December 2007-July 2008.

Other honours/awards received by Prof. Vinayachandran include: Frontier Research Award, 1998, of Frontier Research Centre for Global Change, Tokyo, Japan; and Editors Highlight and Press Release from American Geophysical Union, Aug. 2007.

HUGO Satellite Meeting at IICB

The Human Genome Organization arranged the Thirteenth Human Genome Meeting at Hyderabad, in September 2008. Several satellite symposia were organized in different parts of the country. Indian Institute of Chemical Biology along with other research institutes of Kolkata (i.e. Indian Statistical Institute, Chittaranjan National Cancer Institute and Saha Institute of Nuclear Physics) organized a symposium on "Complex Diseases: Approaches to Gene Identification and Therapeutic Management" on 25-26 September 2008.

The symposium was attended by a large number of scientists and scholars from various research institutes. Several eminent scientists from across globe were invited, including the President of HUGO, Dr Edison Liu, who delivered lectures on latest development in the focused areas of the symposium.

It may be mentioned in this context that considerable progress has been made in the identification of genes that underlie pathogenesis of complex diseases. However, the progress has been slow, especially because of limitations of large sample size requirements in case-control or family-based studies. Further, even for those complex disorders for which genetic underpinnings have been revealed, approaches to using this information for therapeutic management remain elusive.

The focus of this Satellite Symposium was to discuss novel approaches for gene identification and therapeutic management in comparison with the widely-used approaches.

IICB organises Alexander Hollaender Course

Seen on the dais during the inaugural session *(from left)*: Dr Siddhartha Roy, Director, IICB; Dr A. K. Giri, Organizing-Secretary, 14th AHC; Dr H. S. Maiti, Director, CGCRI; Dr David DeMarini, President, IAEMS and Dr A. B. Prasad, President, EMSI

The Alexander Hollaender Course (AHC) is organized every year in countries where environmental mutagenesis and health issues are of major concerns. The 14th Alexander Hollaender Course on "Genetic Toxicology: Genomic and Proteomic Approaches" along with a special workshop on "Arsenic Exposure Assessment" was held from 10 to 12 December 2008 under the auspices of Indian Institute of Chemical, Biology (IICB), Kolkata. This is the first time that this prestigious event has been hosted in India. The course and workshop were intended to review the advances in environmental mutagenesis and health.

The lecture course in Kolkata was well represented by scientists in the relevant fields and generated much interest in academic circles all over India. Invited speakers from different corners of the globe attended this conference, including Dr David DeMarini (USEPA, USA), Dr Stefano Bonassi (NCRI, Italy), Dr Christopher States (University of Louisville, USA), and Dr Brenda Eskenazi (UC-Berkeley, USA). There were 29 invited speakers in all, from India, Japan, Germany, UK, USA, Thailand, etc., and 38 participants took part in the course and were both from India as well as abroad.

The programme began with a colourful inauguration programme held in Meghnad Saha Auditorium in Central Glass and Ceramic Research Institute. It was chaired by Dr Siddhartha Roy (Director, IICB), Dr H. S. Maiti (Director, CGCRI), Dr David DeMarini (President, IAEMS), Dr Ashok K. Giri (Organizing-Secretary, 14th AHC), and Dr A. B. Prasad (President, EMSI).

There were nine sessions in all, including seven lecture

Dr David DeMarini delivering his talk

Recipients of the Best Poster Award: Dr Pritha Ghosh, Dr Sepideh Arbabi Bidgoli, Ms. Jayashree Roy (received prize on behalf of Dr Sarmistha Chanda and Mr Mayukh Banerjee with Dr A. K. Giri, Dr Takehiko Nohmi, Dr David DeMarini, Dr P. S. Chauhan

sessions, one poster session, and the concluding session. Eminent scientists addressed key issues in the field of genetic toxicology, such as "Population Monitoring for Health Hazards," "Mutagenic Hazards of Environmental Toxic Substances," "Current and Novel Mutagenic Assays," "Mechanisms of Mutagenesis and Carcinogenesis," "Genomic and Proteomic Approaches in Genetic Toxicology,' "Special Workshop on Arsenic Exposure Assessment," and "Environmental Mutagens and Health Research".

The poster session depicted the ongoing work in the field of genetic toxicology, and 27 out of the 38 participants presented their posters. The entire session was highly appreciated by the judges, invited speakers, and the participants. Several posters were of a very high quality and there was a keen contest for the best poster awards, which were financially supported by Dr Ben Adioo of NCTR, Jefferson, AR, USA. Four posters were given awards: Dr Prtiha Ghosh and Dr Sarmishtha Chanda were awarded $150 each, whereas Mr Mayukh Banerjee and Dr Sepideh Arbabi Bidgoli were awarded $100 each for their presentations along with certificates. Awards were presented to the winners by Dr David DeMarini during the concluding session.

Group photograph of the faculty and participants of 14th AHC

Following observations were made during the concluding session for future research:

- Development of a reliable field test kit for determining arsenic concentration in water and other samples is urgently required.
- It would be very important and interesting to see if arsenic has the potential to be a germ-cell mutagen.
- Nanomaterial toxicology presents unique problems and needs to be addressed immediately with new strategies and novel methodologies need to be developed towards that end.
- "Omics" technologies are very powerful tools for new-age toxicologists and provide the worker with the unique opportunities to seek out specific transcriptomic or proteomic signatures for any particular toxic material in real time.
- Methods for the assessment of genotoxic damage beyond the comet assay need to be developed.

NBRI celebrates Annual Day

The National Botanical Research Institute (NBRI), Lucknow, celebrated its 55th Annual Day on 25 October 2008. Prof. P.S. Ramakrishnan, INSA Honorary Senior Scientist, School of Environmental Sciences, JNU, New Delhi, was the Chief Guest at the function. Dr Shailesh Nayak, Secretary, Ministry of Earth Sciences, Government of India, New Delhi, delivered the presidential address.

Prof. P.S. Ramakrishnan, INSA Honorary Senior Scientist, School of Environmental Sciences, JNU, New Delhi, delivering the Annual Day Lecture

Delivering the Annual Day Lecture on "Knowledge Systems and Sustainability Concerns in the Context of Global Change and Globalization", Prof. Ramakrishnan said that conservation of biodiversity and its sustainable management was becoming an important issue for addressing sustainable management of natural resources and sustainable livelihood of human societies, both in the developing and the developed world. This concern was getting intensified to a great extent in the existing context of rapidly depleting natural resource base on the one hand, and the environmental uncertainties that are getting exacerbated owing to climate change in an ecological sense and economic globalization on the other, he elaborated. Prof. Ramakrishnan further said that adverse effect of this all would have more impact on the marginalized sections of the society particularly in the developing world. He gave an insight of the importance of using the amalgamation of traditional knowledge and modern technologies with community participatory approach for the sustainable development on the global level. In this context, he cited the initiative taken by a team of JNU under his leadership in 1970s while working in the northeastern region of India, a region where hundreds of very traditional tribal societies live. Through their research efforts, they have been able to trigger a massive land use plan in pace which was supported by Canada under the India-Canada Environmental Facility. This project which came to be known as the NEPED (Nagaland Environmental Protection & Economic Development) project, wherein for the first time in over 100 years a land use management and developmental plan got initiated involving participation of hundreds of

Dr Shailesh Nayak, Secretary, Ministry of Earth Sciences, Government of India, New Delhi and Prof. P.S. Ramakrishnan, INSA Honorary Senior Scientist, School of Environmental Sciences, JNU, New Delhi, inaugurating the NBRI Annual Day function

Dr Shailesh Nayak, Secretary, Ministry of Earth Sciences, Government of India, New Delhi, delivering his presidential address

Dr Rakesh Tuli, Director, NBRI, presenting the progress report of NBRI

NBRI Annual Report 2007-08 being released. Seen in the photo (*from left*) are: Dr Rakesh Tuli, Dr Shailesh Nayak, Prof. P.S. Ramakrishnan, and Dr S.P. Singh, Scientist-G, NBRI

Prof. P.S. Ramakrishnan handing over textbooks to the Principal of one of the schools

villages, directly or indirectly.

Specifying the benefits of the programme, Prof. Ramakrishnan said that by ensuring buffers within the soil system that was mediated through traditional knowledge-based technologies, the very fragile soil system's health has been restored, inputs of chemical fertilizers were brought down up to anywhere between 30-50%, productivity of the land under tea cultivation not only increased, but the quality of tea leaves too improved, fetching better price in the market. He reiterated that such an eco-philosophical message for sustainable management of natural resources linked with community-participatory efforts is rapidly gaining ground not only in developing countries such as the emerging economies of India and China, but also amongst the developed countries of Europe and USA.

Dr Shailesh Nayak in his presidential address said that annual day of an institute provides an opportunity of giving a thought to the year that has gone by and an enquiry for future activities to be done and thrust to perform better in the coming years. He said that NBRI has made extensive contributions in terms of scientific achievements and developed technologies of larger societal interest. He congratulated Dr Rakesh Tuli for his dynamic leadership in creating an enabling environment for achieving this growth.

Earlier at the outset, Dr Rakesh Tuli, Director, NBRI, welcomed the

august gathering and extended very warm and hearty greetings to Dr Shailesh Nayak, Prof. P.S. Ramakrishnan and other dignitaries from the industry, academia and media. Subsequently, he articulated the present research vision and performance of NBRI during the year 2007-08, highlighting the various activities undertaken and major achievements made by the institute in the past one year. 'This was a year of flourishing growth and expansion in terms of infrastructure development, modernization of the existing facilities and all round growth in basic and applied research," said Dr Tuli.

Highlighting the work carried out during 2007-08, Dr Tuli said that that year the institute published 115 research papers in SCI journals with a total impact factor of 161 which showed a significant increase over the last year. Twenty-one foreign patents were granted to the NBRI scientists. For implementing various programmes on conservation and sustainable utilization of biodiversity and in recognition of the R&D capabilities at NBRI, National Biodiversity Authority (NBA) has recommended NBRI as the 'National Repositories for Indian Flora'. NBRI received NABL accreditation for chemical testing in accordance with ISO/IEC 17025:2005 in the area of herbal drugs, essential oils, vegetable oils and soils, he informed.. He further reported that NBRI established some of the cutting edge technologies in the area of genomics and plant physiology at NBRI for doing the best of science. He congratulated the scientists for their hard work, creativity and team spirit and playing a significant role in the advancement of science and growth of the nation. He assured them his fullest support in their future endeavours. He also informed that DST bestowed the most prestigious 'JC Bose National Fellowship Award" to him.

Giving an overview of significant achievements of the year accomplished by the institute during 2007-08, Dr Tuli informed that in the project on bioprospecting, strategically selected 20 species of *Allium* were systematically screened to discover new proteins and peptides that could control agricultural pests, specially the sucking pests. Germplasm collection of energy plants was enhanced. Diverse lines of cotton (*Gossypium herbaceum* and *G. hirsutum*) were collected to examine molecular basis of drought tolerance and fibre quality. Challenging initiatives, comprising gene discovery and allele mining were taken up on cotton, *Jatropha* and rice to identify the molecular basis of economically important traits. Chloroplast DNA of *Jatropha curcas* was sequenced. A number of novel gene expression systems were developed. Transcriptome sequence data of cotton leaves and root was developed to discover genes for drought related traits. Transcriptome sequencing in multiple germplasm and computational analysis were done to identify SNPs. Molecular approaches were initiated to identify sequence polymorphism at species level. Taxonomical knowledge of *Berberis* at NBRI is being validated through sequencing of several genes reported as suitable for barcoding. A high yielding variety – NBRI-11 of opium poppy was developed. 'Vijay Kiran' – a new early blooming cultivar of chrysanthemum and 'Los Banos Variegata Jayanti', a new cultivar of Bougainvillea were released. The institute was invited by the Department of AYUSH to develop an "India Herbal Garden", at the Head Quarters of WHO in Geneva and a tactile (Smell and Touch) garden for visually impaired at Rashtrapati Bhawan, New Delhi. For conservation, research and educative purpose and to enhance the existing plant diversity at NBRI, an Orchidarium with about 50 Orchid species and a moss garden – first of its kind in India were developed in the botanic garden of the institute. Important progress was made towards the development of LAN enabled databases for medicinal plants used in ISM, databases of economically important plants, including taxonomic and biodiversity related data.

On this occasion, Annual Report 2007-08 of the institute was also released by the chief guest. Also, textbooks were distributed to various schools.

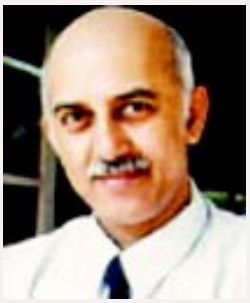
NASI Platinum Jubilee Award to Dr K.S.M.S. Raghavarao

Dr K.S.M.S. Raghavarao, Scientist, Central Food Technological Research Institute (CFTRI), Mysore, has been awarded the NASI - Reliance Industries Platinum Jubilee Award (2008) for application-oriented innovation in Physical Sciences by the National Academy of Sciences, India. The award was presented by Prof. M.G.K. Menon, Advisor, ISRO, in the 78th Annual Session of NASI held during 21-23 November 2008 at Chandigarh. The award carries a citation and a cash prize of Rs two lakh.

After an excellent academic career in chemical engineering with a direct Ph. D. from University Institute of Chemical Technology (UICT), Mumbai and post - doctoral research experience at NIST, USA, and a brief stint at National Institute of Technology (NIT), Warangal, Dr Raghavarao joined CFTRI in 1990 and established an active food and biochemical engineering group and facilities. He has been leading R&D projects in the area of food and bioprocesses. In 2002, he became Head of the Department of Food Engineering at CFTRI.

The achievements of Dr Raghavarao in the field of Biotechnology and Food/ Biochemical Engineering have been recognized at national as well as international level.

Dr V. Prakash nominated as Honorary President of IAFoST



Dr V. Prakash, Director, Central Food Technological Research Institute (CFTRI), Mysore, has taken over as the new honorary President of the International Academy of Food Science and Technology (IAFoST) of the IUFoST recently. He was decorated as the President in the 14th Congress of IUFoST held during 19 - 23 October 2008 at Shanghai, China, by Dr Ralph Blanchfield. Dr Prakash is the first Indian to have been nominated as the President and also is the first Fellow of IAFoST from India.

IAFoST is a group of elected distinguished food scientists and technologists who collectively pool scientific expertise in food science and technology. They are at the forefront of IUFoST helping to strengthen global food science and technology for humanity. IAFoST has a very large spread in various countries and it meets once in two years.

Dr Prakash has plans of taking IAFoST to higher levels of performance through networking of major institutions like CFTRI, around the world, to ensure not only the expertise in the world merges itself for a common focused agenda, but also knowledge network in the process.

Mr Dattatraya S. Kulkarni receives IEI Young Engineers Award 2008

Mr Dattatraya S. Kulkarni, Scientist, Computational and Theoretical Fluid Dynamics Division, National Aerospace Laboratories (NAL), Bangalore, has been awarded the First "IEI Young Engineers Award" for the year 2008 in aerospace engineering discipline by Institution of Engineers India (IEI) during the 22nd National Convention of Aerospace Engineers held at Birla Institute of Technology, (BIT), Mesra, Ranchi, during 27-29 November 2008. The award was presented by Dr Avinash Chander, Director, Advanced System Laboratory (DRDO), Hyderabad.

Dr Harsh K. Gupta awarded the Waldo E. Smith Medal of the American Geophysical Union

Dr Harsh K. Gupta, former Secretary of Department of Ocean Development, Government of India and former Director of National Geophysical Research Institute (NGRI), Hyderabad, has been awarded the 2008 AGU Waldo E. Smith Medal of the American Geophysical Union for his wide range of scientific contributions to the field of geophysics, his unique leadership in scientific policy, his numerous accomplishments to develop and promote geophysical research and its applications to societal needs in India, and his extraordinary services to geosciences communities in India and worldwide.

Dr Gupta has made significant and innovative contributions to several areas of geosciences (seismology, tectonics, marine geophysics, geothermal resources). He is internationally known for his pioneering work devoted to characterizing earthquakes triggered by filling of artificial water reservoirs, discriminating them from normal earthquakes, and developing innovative mitigation procedures. He also had several major contributions on seismic and geodynamic processes at work in the Tibetan Plateau and Himalayan regions, the Bay of Bengal, and the Arabian Sea, as well as on characterization of seismic rupture zones of the Koyna and Latur stable continental regions. Quite early in his career, it became clear that in addition to his impressive scientific credentials,

Dr Gupta also had a flair for scientific leadership. As the Director at the age of 40, he was responsible for building the Centre for Earth Science Studies at Trivandrum (India), before taking over as the Vice-chancellor of the Cochin University of Science and Technology. In 1983, he led the Indian scientific expedition to Antarctica and established the first permanent Indian base, "Dakshin Gangotri". In the early 1990s, he served as Advisor to the Department of Science and Technology, Government of India, and took several national research initiatives to enable the Indian science community to participate in international programmes. For about a decade, Dr Gupta served as the Director of the National Geophysical Research Institute (NGRI), Hyderabad. Under his stewardship, NGRI rose to be the top geosciences research institute in India. Dr Gupta's visionary leadership led NGRI to use the pool of basic research capabilities to address the country's needs in hydrocarbons, minerals, and groundwater resources, a crucial question for agriculture in India. Serving as Secretary to the Government of India in the Department of Ocean Development, Dr Gupta implemented several new programmes, in particular, gas hydrate exploration, detailed mapping of the entire exclusive economic zone of India – hence preparing India's legal claim for the continental shelf – and tapping the energy of the oceans for power generation as well as production of potable water for remote island communities. After the 2004 Sumatra earthquake, Dr Gupta was responsible for designing and implementing a unique tsunami warning system for the Indian Ocean within a record time. All of his leadership stints are marked by his extreme results-oriented approach that has helped him carry out diverse roles with great distinction and poise.

On the international scene, Dr Gupta has demonstrated effective leadership capabilities through his longstanding involvement with renowned international organizations such as the International Union of Geodesy and Geophysics, the International Association of Seismology and Physics of the Earth's Interior, and the International Council of Scientific Unions, in which he serves at the highest levels.

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