



# S&T Newsletter



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Centre for Science and Technology of the Non-Aligned  
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## From the Dg'S Desk

SEASON'S GREETINGS for a Happy, Prosperous and Productive New Year 2016!!



The NAM S&T Centre sponsored and participated in a mega event in Pretoria, South Africa - Science Forum South Africa (SFSA) - on 8-9 December 2015 on a theme on 'Igniting Conversations about Science'. The SFSA Conference was an initiative of the Honourable S&T Minister of South Africa, Mrs. GNM Pandor, in which ~1500 researchers, intellectuals and officials from 45 countries and several multilateral agencies took part. It was a first ever attempt to create a large-scale public platform for debating the science and society interface and South Africa intends to utilise it as a vehicle to strengthen its strategic international STI partnerships. In the Conference, besides being a Panel Member, I made a Statement on the vital role played by the Centre and possibilities of its future involvement through using STI for meeting recently adopted 2030 Sustainable Development Goals (SDGs) and Targets.

The Centre also sponsored a Regional Dialogue on 'S&T Policy in the Context of Biotechnology' organised by the UNESCO Regional Centre for Biotechnology (RCB) at Faridabad, India on 29-30 December 2015. In addition, the Centre deputed one of its Research Associates to make a presentation at the 5<sup>th</sup> Global Economic Summit at Mumbai, India during 19-21 November 2015 on a theme 'Enabling Food for All' organised by the World Trade Centre and All India Association of Industries (AIAI), Mumbai.

Implementation of the Research Training Fellowship for Developing Country Scientists (RTF-DCS) scheme for 2015-16 is moving ahead at full steam and 50 fellows from 33 countries selected by an Inter-Ministerial Committee are expected to join their respective Indian host institutions by March end.

Several scientific activities on a range of topics are lined up by the Centre in the coming period, including an International Workshop on 'Mitigation of Disasters due to Severe Climate Events: From Policy to Practice' in Colombo, Sri Lanka on 10-13 March 2016, the announcement of which has been circulated. We invite you and your colleagues to take part in our knowledge sharing and dissemination endeavours.

Happy Reading!

  
(Arun P. Kulshreshtha)

## Centre Sponsors

Science Forum South Africa:  
Igniting Conversations about Science  
Pretoria, 8-9 December 2015

At the initiative of Her Excellency Mrs. GNM Pandor, MP, Honourable Minister of Science & Technology of the Republic of South Africa, a 'Science Forum South Africa (SFSA)' was organised in Pretoria on 8-9 December 2015 on a theme on 'Igniting Conversations about Science'. The Forum assumes a great significance because in the recently held UN Sustainable Development Summit, the UNGA has formally adopted the



Panelists of the 1<sup>st</sup> Plenary Session of Science Forum, South Africa on 'STI Response to Climate Change (COP: 21 Comes to Pretoria)

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Regional Dialogue on  
Science & Technology Policy in the Context of Biotechnology,  
Delhi-Faridabad, India, 29 - 30 December 2015

The NAM S&T Centre was a partner with the UNESCO Regional Centre for Biotechnology (RCB) in holding a Regional Dialogue on 'Science & Technology Policy in the Context of Biotechnology' at Faridabad, Haryana, India on 29-30 December 2015. The key objectives of the dialogue were to create a knowledge platform for sharing the best experience in S&T policy with emphasis on biotechnology as a tool for sustainable development, identify the gaps and develop concrete strategies for integrated mechanism in S&T

(Contd. on page 4 col. 1)

(Contd. from Page 1 - Science Forum, South Africa)

2030 Agenda for Sustainable Development together with the new Global Goals that include the three dimensions of sustainable development: the economic, social and environmental. The Forum deliberations were particularly focussed on having pioneering ideas meeting the global, and more specifically Africa's, strategy for science, technology and innovation to meet different dimensions of the challenges faced in the developing world.



Prof. Arun Kulshrestha, DG NAM S&T Centre with H.E. Mrs. GNM Pandor, Minister of Science & Technology of South Africa (C)

The learned scholars and S&T managers sponsored by the NAM S&T Centre from its member countries for their participation in the SFSA Conference by providing their airfare for travel to South Africa were, namely, from Egypt (Prof. Dr. Said I. Shalaby, Vice President, Academy of Scientific Research and Technology - ASRT), Iran (Dr. Mohammad Esmaeilian, Head, Metallurgical Group, Advanced Materials Institute, Department of Advanced Material and Renewable Energy, Iranian Research Organization for Science and Technology - IROST), Mauritius (Mr. Aslam Sobratee, Administrator, Tertiary Education and Scientific Research Division, Ministry of Education and Human Resources, Phoenix), Myanmar (Dr. Tun Myint Aung, Deputy Director, Ministry of Science and Technology), Nigeria (Dr. Chima Cartney Igwe, Director, Chemical, Fibre and Environmental Technology Department, Federal Institute of Industrial Research, Oshodi (FIIRO), Lagos), Sri Lanka (Dr. Muditha Liyanagedara, Director/CEO, National Science & Technology Commission (NASTEC), Colombo), Zambia (Mr. John Lukonde Chongo, Acting Chief Science and Technology Officer, Department of Science and Technology, Ministry of Higher Education, Lusaka) and Zimbabwe (Ms. Rungano Karimanzira, Director, Projects and Technology Transfer, Ministry of Higher and Tertiary Education, Science and Technology Development (MoHTESTD), Harare). The NAM S&T Centre was represented in the Conference by Prof. Dr. Arun P. Kulshrestha, Director General and Mr. Madhusudan Bandyopadhyay, Senior Expert & Administrative Officer.

The SFSA Conference was the first attempt to create a large-scale public platform for debating the science and society interface and South Africa intends to utilise it as a vehicle to strengthen its strategic international science, technology and innovation partnerships. The event was highly successful in bringing together ~1500 scientists,

researchers and intellectuals from 45 countries and a number of multilateral organisations who exchanged ideas on the interface between science, technology and innovation in building a better society and showcasing the latest science innovations in the country, as well as for business enterprises to look out what the opportunities of the future might look like. Prominent among these were Dr. Nkosazana Dlamini-Zuma, Chairperson of the African Union Commission; Prof. Martial De-Paul Ikounga, African Union Commissioner for Human Resources, Science and Technology; Prof. Sir Peter Gluckman, Chief Science Advisor to the Prime Minister of New Zealand and founding Co-Chair of the International Network for Science Advice; Dr. Gordon McBean, Canadian Earth Scientist and President of the International Council for Science (ICSU); Mr. Koji Omi, Founder of Japan's Science, Technology and Society Forum; and Prof. Calestous Juma, Director of Harvard Kennedy School's Science, Technology and Globalisation Project, as well as a Champion for Science in Africa.

In her inaugural speech, the Hon'ble Minister Pandor emphasised on the following seven action points for all the stakeholders in order to achieve the lofty goals that have been set out in the Agenda 2063 for Africa:

- i. Investment by the Governments and institutions in Science and Innovation in Africa.
- ii. Increased attention to developing robust national systems of innovation to create an ecosystem that allows a smooth flow and take up of creative ideas from knowledge generating institutions through to enterprises and industry and promote joint industry research, public private partnerships, technology diffusion and movement of human capital.
- iii. Communities to be informed about science and encouraged to value the potential for development intrinsic to science, technology and innovation.
- iv. Seek out and secure flagship science initiatives [e.g. Square Kilometre Array (SKA)] that have the potential to support training and production of the next generation of scientists and technologists in Africa.
- v. Increased investment in the health sciences for improving the quality of life.
- vi. Increased effort to foster African science collaborations as well as global collaborations through greater funding.
- vii. Encouragement to the youth to prize knowledge and its potential for attaining the development trajectory of Africa.

The Science Forum's programme included two Plenary Sessions on the first day, and a Plenary Panel Discussion and a Closing Plenary Session on the second day. There were 24 Thematic Parallel Sessions, addressing a diverse range of science and society oriented themes. In addition, 18 Science Talk Sessions were organised in which speakers presented their papers on different topics. There was a special focus on the African science agenda, and how research and innovation can best be harnessed for the continent's growth and development. Some of the topics included Harnessing science,

(Contd. on page 3)

(Contd. from Page 2 - Science Forum, South Africa)

technology and innovation to advance sustainable development, especially in the context of fighting poverty; Role of science, technology and innovation in mitigating the effects of climate change; Role of science, technology and innovation in addressing societal challenges; and Challenges associated with developing human capital for the knowledge economy. Special attention was given to focus the role of women in science, technology and innovation. A few sessions were devoted to deliberate on how the gender imbalances in this sector can be eliminated, and how the contribution of women scientists and engineers can be maximised.

Prof. Arun Kulshreshtha, DG, NAM S&T Centre was included as a Panel member in the 1<sup>st</sup> Plenary Session on 'Science, Technology and Innovation Response to Climate Change (COP: 21 Comes to Pretoria)'. Mr. M. Bandyopadhyay, Senior Expert in the Centre presented a paper titled 'Science, Technology and Innovation (STI) Policy Making in Developing Countries: Initiatives in Emerging Economies' in one of the Science Talk Sessions.

Later, in another Session Prof. Kulshreshtha read a Statement titled 'Science, Technology & Innovation (STI) for Sustainable Development Goals (SDGs): Human Capital Development Programmes of the NAM S&T Centre', which provided a glimpse of the Centre's activities and also linked them in advancing the SDG Goals and meet the targets. The excerpts of his Statement are reproduced below:

*"..... There is no denying the fact that in the present day scenario, every country requires international partnerships for promoting indigenous science and technology and imparting an impulse to the domestic innovation practices. At the UN Sustainable Development Summit held on 25th September this year, the 193-member United Nations General Assembly formally adopted the 2030 Agenda for Sustainable Development, together with 17 global goals and 169 specific targets that balance the three dimensions of sustainable development: the economic, social and environmental. The agenda recognises that social and economic development depends on the sustainable management of our planet's natural resources and therefore it is necessary to conserve and sustainably use oceans and seas, freshwater resources, as well as forests, mountains and drylands and to protect biodiversity, ecosystems and wildlife. Achieving energy and food security; improving nutrition, health and education; promoting sustainable agriculture; making cities more sustainable; and combating climate change through sustainable development find important place among the targets of the 2030 Agenda for Sustainable Development.*

*Science, Technology & Innovation (STI) is an important driver for increased productivity and value addition that stimulates the growth and competitiveness of a nation. However, since the individual NAM and other developing countries are at different stages of development, the targets of achieving sustainable development in each country, and thereby the mechanisms, dimensions and STI interventions, need to be specific and unique for them taking into account different national realities, capacities and levels of development and keeping the national policies and priorities in focus.*

*In the context of the SDG framework the implementation of the Goals is replete with a number of challenges for which a close collaboration between the policy makers, S&T communities and other development professionals and stakeholders is*

*indispensable. In the implementation of several of the 17 Goals and achieving the set targets, STI has to directly or indirectly intervene and be applied with appropriate focus, especially in the developing countries and LDCs.*

*It is well established that for long-term development in the knowledge-based economy of a country, innovation and continuous generation of new technology play a significant role that ensure the success of a technical, manufacturing or industrial entity as well as the competitive advantage of the country vis-à-vis other nations. However these are largely influenced by the government policies which need to be strategically formulated with a view to facilitate the innovation ecosystem leading to research and development in priority areas of technologies, transfer and adaptation of new technologies to meet the indigenous requirements, and development of new technology-based industry backed up by corresponding support facilities and suitable institutional mechanisms. Even though STI policy at the national level is expected to be commensurate with the challenges of the globalising society, it is observed that the STI potential of the developing countries often remains unexplored or underutilised due to lack of appropriate framework of formulation of the STI policy as well as inadequacies in its implementation mechanisms. While formulating, the national policy should take into account the availability of natural resources and human resource within the country; a planned long term forecast of the growth of various factors to achieve progressive economic prosperity till the planned period and beyond; projected import and export of raw materials; import of technology with its adaption to meet the local requirements; etc., but it is observed that many developing countries neither have policy experts to design their own national STI policies nor have the capacity to absorb the outside experience in policy formulation and implementation. Therefore while North-South joint activities have their own merit with great drawbacks at most times, the developing nations must endeavour to cooperate amongst themselves through joint efforts on innovation, modification and adaptation of existing knowledge to ensure the generation of technologies relevant to their needs, available resources and modernisation imperatives...."*

Prof. Kulshreshtha took this opportunity to extend cordial invitation to all the developing countries to join the NAM S&T Centre and as a win-win proposition, take advantage of its wide ranging scientific activities to help in facilitation of achieving their sustainable development goals through Science, Technology & Innovation.

A special breakfast meeting was organised on the concluding day to discuss the new Science International Partnership involving various international organisations including International Council for Science (ICSU), The World Academy of Sciences (TWAS), the Inter-Academy Panel (IAP), International Social Sciences Council (ISSC), and the NAM S&T Centre to present its big data and open data initiatives, including capacity building for Africa.

Apart from the Forum deliberations, more than 50 South African and international organisations showcased their activities at an exhibition organised as a part of the Conference. Besides this, the first ever South African Science Diplomacy Awards were also announced during the Conference to celebrate partnerships that have made a noteworthy contribution in making the world a better place. Several international and local organisations, as well as individuals were honoured with these Awards as recognition of their excellence and achievements in international scientific cooperation.

## Participation of NAM S&T Centre in the 5<sup>th</sup> Global Economic Summit (GES) on 'Enabling Food for All', Mumbai, India, 19 -21 November 2015



**Ms. Vaneet Kaur**, Research Associate, represented the NAM S&T Centre at the 5<sup>th</sup> Global Economic Summit (GES) organised at Mumbai during 19-21 November 2015 by the World Trade Centre (WTC), Mumbai and All India Association of Industries (AIAI) on a theme 'Enabling Food for All'. The summit was held to discuss the new trends in agriculture and food distribution systems in the context of the challenges of the food security and also to serve as a platform for policy makers for strengthening the global value change in agro & food industries.

Around 500 leaders across the globe participated in the Summit which offered opportunities for networking through plenary sessions, panel discussions, exhibition, B2B meetings, industry visits and cultural events. Senior Officials from the Food and Agriculture Organisation (FAO), International Fund for Agricultural Development (IFAD), World Food Programme (WFP), United Nations Procurement Division (UNPD), World Farmers' Organisation (WFO) and World

Trade Centre's Association (WTCA), New York, Indian Council of Agriculture Research (ICAR) and foreign universities like Bocconi University (Milan, Italy), North Carolina State University (USA) and University of Manitoba (Canada) participated in the summit.

During the Summit Ms. Vaneet gave a presentation on 'Technological Innovations in Agriculture'. She focused on the need of sustainable agriculture and the judicious application of science and technology for achieving the 'zero hunger target'. She laid emphasis on various technological advancements in the field of biotechnology and other frontier sciences such as nanotechnology, which have created tremendous scope and opportunities for use of agricultural products and by-products in innovative and unconventional forms. She also focused on the role of integrated pest management, integrated nutrient management and precision agriculture and the growing need to move towards a trans-disciplinary research.

(Contd. from Page 1 - Science & Technology Policy in the Context of Biotechnology)

including biotechnology taking into account the economy, governance and stakeholder mechanism. The overall aim was to identify key areas for future development in S&T, applications of biotechnology relevant to the needs of the countries in the South Asian Region.

The Meeting was attended by several delegates including those from some member countries of the NAM S&T Centre - Bangladesh, India, Nepal, Sri Lanka and Vietnam. The delegate from Nepal, Dr.



Dr. Mukunda Ranjit  
(Nepal)

Mukunda Ranjit, Senior Academician (Biotechnologist), Nepal Academy of Science and Technology (NAST) presented a paper titled 'Use of Biotechnology for the Production of Disease-Free Horticultural Crops in Nepal', which emphasised on the development of tissue culture technology for the production of virus

free horticultural crops such as different species of citrus, seed potatoes, banana, large cardamom and orchids. He volunteered to clean viral infected horticultural crops from different viral diseases using meristem culture to the interested parties. The Vietnamese delegate, Dr. Phi Quyet Tien, Deputy

Director and Head, Fermentation Technology Lab., Institute of Biotechnology (IBT), Vietnam Academy of Sciences and Technology (VAST) presented a paper on 'Research & Applications of Biotechnology in Vietnam and contribution of IBT-VAST'. In his paper Dr. Tien presented the achievements in various areas of Biotechnology including the generation of national crop/forestry varieties, transgenic plants, animal embryo transfer, transgenic animals, monoclonal antibodies; application of microorganisms for agriculture, environment protection, industry and medicine, improvement of fermentation technology for producing biopharmaceutical proteins, biodiversity of microorganisms; recombinant proteins and enzymes for agriculture, industry and environment protection; diagnostic kits for diseases, recombinant vaccines for poultry and human, biomarkers; and Marine biotechnology (bioactive compounds from algae and seaweed; and utilisation of microalgae as feed for aquaculture, bioethanol from seaweed biomass). Other scientists, policy makers and professional institutions too shared their experiences in S&T policy, sustainable development approaches, biotechnology and related fields.

## Research Training Fellowship for Developing Country Scientists (RTF-DCS) 2015-16

### Inter-Ministerial Committee Meeting

The NAM S&T Centre is implementing a fellowship scheme titled 'Research Training Fellowship for Developing Country Scientists (RTF-DCS)' since the financial year 2012-13 for a five year period 2012–2017. The scheme aims at capacity building of young researchers of the developing countries in science and technology by giving them opportunity to affiliate themselves with premier academic and research institutions in India for a period of six months each with full financial support for their international travel, subsistence allowance, research contingency and domestic travel etc. In the last three years, this scheme was successfully implemented with 20 Fellows each having got affiliated with the Indian R&D and academic institutions in the years 2012-13 and 2013-2014, and 50 fellows in the year 2014-2015.

An Inter-Ministerial Committee was constituted comprising the representatives of various Ministries / Departments and scientific agencies of the Government of India and international agencies including Mrs. Sadhana Relia, Head, IMRCD, Department of Science and Technology (DST), Government of India; Mrs. Nilakshi Saha Sinha, Director, Ministry of External Affairs (MEA), Government of India; Dr. (Mrs.) Manju Singh, Joint Secretary, International Cooperation (IC), University Grants Commission (UGC); Dr. Amitava Bandopadhyay, Head (ISTAD), Council of Scientific & Industrial Research (CSIR); Dr. Harpreet Sandhu, Head, IHD, Indian Council of Medical Research (ICMR); Dr. (Mrs). Parvinder Maini, Ministry of Earth Sciences (MoES), Government of India; Dr. H.S. Gupta, Director General, Borlaug Institute for South Asia and International Maize and Wheat Improvement Center (CIMMYT); and Mr. M. Bandyopadhyay, Senior Expert & Administrative Officer, NAM S&T Centre (Member Secretary) to review the scheme and make final selection of the researchers under the RTF-DCS Scheme for the year 2015-16.

The Committee held its meeting in the premises of the NAM S&T Centre on 5<sup>th</sup> November 2015 under the chairmanship of Dr. H.S. Gupta. Prof. Dr. Arun P. Kulshreshtha, DG, NAM S&T Centre and the scientific staff of the Centre were also present during the meeting. Approval was given by the Committee for a priority list of 140 applicants from 36 countries out of total 481 applications received from 41 developing countries along with the prospective host institutions in India with which the selected Fellows could be affiliated.



Inter-Ministerial Committee Meeting for Selection of NAM S&T Centre RTF-DCS Fellows for 2015-16

### Visitors To The Centre

- |                                  |  |
|----------------------------------|--|
| <b>5<sup>th</sup> Nov. 2015</b>  | <b>Dr. H.S. Gupta</b> , Director General, Borlaug Institute for South Asia, International Maize and Wheat Improvement Center (CIMMYT), New Delhi, India                            |
| <b>11<sup>th</sup> Nov. 2015</b> | <b>Dr. H. Purushotham</b> , Chairman and Managing Director, National Research Development Corporation (NRDC), New Delhi, India   |
| <b>11<sup>th</sup> Nov. 2015</b> | <b>Dr. B. Chandrasekar</b> , Registrar, UNESCO Regional Centre for Biotechnology (RCB), Faridabad, Haryana, India  |
| <b>27<sup>th</sup> Nov. 2015</b> | <b>Prof. S. Mohammad Reza Khalili</b> , Research Counselor: Science, Research and Technology, India and Sub-continent, Embassy of the Islamic Republic of Iran in New Delhi, India |
| <b>1<sup>st</sup> Dec. 2015</b>  | <b>Dr. Laxman Prasad</b> , Group Director (R&D), Raj Kumar Group of Institutions, Ghaziabad (U.P.), India  |
| <b>18<sup>th</sup> Dec. 2015</b> | <b>Mr. Carlos Jimenez</b> , Minister Counsellor and Deputy Chief of Mission, Embassy of Peru in New Delhi, India   |

## Research Training Fellowship for Developing Country Scientists (RTF-DCS) 2014-15 Research Project Completion Reports

### Bangladesh – Project Completion Report of Mr. Kamol Dey



**Mr. Kamol Dey**, Assistant Professor, Department of Applied & Environmental Chemistry University of Chittagong, Chittagong, Bangladesh was sponsored by the NAM S&T Centre at the Institute of Nano Science and Technology, Mohali, Punjab, India under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) scheme for 2014- 2015 from 28<sup>th</sup> February to 23<sup>rd</sup> August 2015 to carry out research on a project titled '**Synthesis of TiO<sub>2</sub>-based Nanostructures towards Photo Catalysis and Super Capacitance**' under the supervision of **Prof. Dr. Ashok K. Ganguli**.

Today, global warming, green energy production and energy storage are all trendy topics of discussion in society. Ever increasing energy needs and depleting fossil-fuel resources demand the pursuit of sustainable large scale harnessing of novel and renewable sources of energy and eco-friendly energy storage technologies. Stimulated by the above concerns, Mr. Dey attempted to synthesise TiO<sub>2</sub>-based nanostructures towards visible-light-driven photo-catalysis and highly efficient energy storage system (supercapacitance). Titanium dioxide (TiO<sub>2</sub>) is an important material for photovoltaics, photocatalysis, sensors and lithium ion batteries. Various morphologies of TiO<sub>2</sub> nanomaterials have been synthesised, including zero dimensional (0D) nanoparticles, one-dimensional (1D) nanowires and nanotubes, as well as three-dimensional (3D) nanostructures. But the two-dimensional (2D) TiO<sub>2</sub> nanostructures, which are expected to have more promising properties and applications, are rarely reported. In his research work Mr. Dey has reported a surfactant-free hydrothermal method to synthesise 2D TiO<sub>2</sub> nanosheets. It revealed that controlled acid washing of layered-titanate plays an important role in retaining the 2D nanosheet structure. SEM and AFM study confirmed the successful fabrication of 2D TiO<sub>2</sub> nanosheets with 5 layers stacking. The as-resulted BET specific surface area of TiO<sub>2</sub> nanosheet was found 220.312 m<sup>2</sup> g<sup>-1</sup>. Compared with TiO<sub>2</sub> nanoparticles, the as-prepared TiO<sub>2</sub> nanosheet showed higher electrochemical performances due to the multilayer 2D nanosheets with many spaces each other having an increased portion of exposed surfaces which ensure a high utilisation of electrode materials. The proposed synthesis strategy would open up new opportunities in the development of high performance next-generation lithium-ion-batteries used for alternative energy and electric transportation.

### Benin – Project Completion Report of Mr. Kemonou Richard Senami Segun



**Mr. Kemonou Richard Senami Segun**, Researcher, Houdegbe North American University Benin, Cotonou, Benin was sponsored by the NAM S&T Centre for his affiliation with the Centre for Ecological Economics and Natural Resources, Institute for Social and Economic Change, Bangalore, India under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) 2014-2015 from 7<sup>th</sup> February to 11<sup>th</sup> October 2015 to carry out research on a project titled '**A Review of the Energy Approach to the Natural Value of Water Resources Valuation**' under the supervision of **Prof. Dr. Sunil Nautiyal**.

Water is a natural resource whose strategic importance can be acknowledged in environmental, social and economic fields. Its relevance is increasing for several reasons, especially its progressive scarcity in many parts of the world. There is a social pressure around the world for the implementation of public policies that would enhance water resources existence so as to support human activities and natural processes. That is why we observe in the last two decades a substantial increase in research studies aiming at developing a variety of indicators that attempt to encompass all variables related to sustainable science. However, there is disagreement amongst researchers on how to conduct water resources valuation. The literature is replete with struggles to establish a commonly accepted valuation method. The research project attempted to review the energy approach to water valuation and highlighted key issues and trends in the application of different approaches to water valuation. It was concluded that the energy analysis is a powerful instrument as it includes all natural and human made resources used in production and consumption systems in its analysis. However, it was argued that further research is urgently needed to conciliate both economic and ecological approaches to water valuation. In this endeavour, the energy analysis represents the platform which provides adequate ecological systems benchmarks against which economic indicators can be assessed; which ultimately will allow scientists to account for the full extent of water resources aspects in the valuation process. Furthermore, given that the people of developing countries have the greatest dependency on water and its services, and very few researches valuing water are done in those countries, it was recommended that while scientists should conduct more researches on water resources in developing countries, the application of energy analysis in these countries will give more insights into the adequate water conservation and sustainable utilization policies.

### Cameroon – Project Completion Report of Mr. Metsebo Jules



**Mr. Metsebo Jules**, PhD Student in the Laboratory of Modelling and Simulation in Engineering, Biomimetics and Prototypes of the Department of Physics, Faculty of Science, University of Yaoundé, Cameroon was deputed by the NAM S&T Centre to the Indian Institute of Information Technology, Design and Manufacturing, Jabalpur, India as a Fellow under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) scheme for 2014-2015 from 6<sup>th</sup> May to 28<sup>th</sup> October 2015 to carry out research on a project titled '**Damage Detection on A Mechanical Structure (Timoshenko Beam,**

(Contd. from Page 6 - RTF-DCS Fellowship Reports)

### Machine) using Vibration Signature Analysis' under the supervision of Dr. Pavan Kumar Kankar.

This study is focused on the influence of rotating shaft on the dynamics of rotor-ball bearings system, and of the transverse cracks on the shaft in the behaviour of this last one. In the first part, a mathematical modelling of the system has been carried out by considering rotating Timoshenko beam model. The radial force of rotor unbalance varied with rotating speed. The contact between balls and races is considered as nonlinear spring, whose stiffness is obtained by using Hertzian contact deformation theory. After shaft modelling, equations governing the dynamic behaviour of the system are derived. The bifurcation diagram and Lyapunov exponent are presented to define the state of system as a function of rotational speed. Fast Fourier Transformation (FFT) and phase trajectory are used to investigate the influence of the shaft under dynamics of system.

In the second part, the presence of transverse crack on rotating shaft of rotor-ball bearings system is analysed. Mathematical modelling of the system with crack has been carried out by considering rotating Timoshenko beam model. The radial force of rotor unbalance varied with rotating speed. The contact between balls and races is considered as nonlinear spring, whose stiffness is obtained by using Hertzian contact deformation theory. After shaft modelling, equations governing the dynamic behaviour of the system are derived. The bifurcation diagrams are used to investigate the effects of depth and size of the crack under dynamics of rotor ball-bearings system

### Egypt – Project Completion Report of Dr. Ahmad Kodous



**Dr. Ahmad Kodous**, Assistant Lecturer, Radiation Biology Department, National Center for Radiation Research & Technology, Egyptian Atomic Energy Authority, Egypt was sponsored by the NAM S&T Centre for his affiliation with the Adyar Cancer Institute, Chennai, India under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) scheme 2014-2015 from 16<sup>th</sup> May to 11<sup>th</sup> September 2015 to carry out research on a project titled '**Computational Analysis of Mutations in Ring finger domain and BRCT Domain of BRCA Gene**' under the supervision of **Dr. (Prof.) Thangarajan Rajkumar**.

BRCA1 and BRCA2 genes are involved in pathways important for DNA damage recognition, double-strand break repair, checkpoint control, transcription regulation and chromatin remodelling. These functions are essential and important for all cell types. Germ line mutations in these genes increase the risk of breast and ovarian cancer in women. Among the various types of mutations single nucleotide polymorphisms (SNPs) play a major role in defining individual's susceptibility to disease.

Hence in this study, a computational analysis of SNPs was done by using various silico tools to provide functional and structural impact of BRCA proteins. Out of 486 SNPs in BRCA retrieved from FSNP, a total of 10 SNPs were found to be deleterious by sorting Intolerant from Tolerant (SIFT), Polymorphism Phenotyping (PolyPhen). Additionally, stability of the protein was analysed by I-Mutant. The results indicate that C27F, A1708V could increase the stability of protein whereas other mutations decrease the stability. Predicted changes in stability and affinity of RING and BRCT domain of BRCA were computed using Residue Scanning Functionality in Bioluminate for all 10 SNPs. The mutation C61R could affect the stability of RING domain and all mutations in BRCT domain were affecting the inter subunit affinity and stability of the complex.

Combination of computational methods provides a way in understanding the impact of deleterious mutations in altering the BRCA protein stability and affinity. Based on these investigation, potential candidate SNPs for future studies of BRCA mutations is reported.

### Iraq – Project Completion Report of Ms. Duaa Saad Mohammed



**Ms. Duaa Saad Mohammed**, Engineer, Ministry of Science and Technology, Iraq was sponsored by the NAM S&T Centre for her affiliation with the Indian Institute of Technology (IIT), Delhi, India under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) scheme for 2014-2015 from 5<sup>th</sup> May to 23<sup>rd</sup> October 2015 to carry out research on a project titled '**Effect of using Directional Control Valves in Hydraulic Systems on Resulting Mechanical Stresses**' under the supervision of **Dr. Naresh Datla**.

This research problem comes from a real problem that happened in 1985 at one of the Iraq factories (al-Shaheed). They have a conveyer system to carry one ton cast named cake. This cake moved from conveyer to elevator, which raises it by four screw jacks. They noticed that while this system was working, one of the screw jack was broken. When they studied this screw jack, they found that it was fine to work and had no problem with it. Then they replaced the failed screw jack with a new one, but they later found that it failed again. The reason behind the jack broken is DCV. This research attempts to take away some of the confusion and apparent magic of fluid power schematic drawings, and thus help make designing and maintaining fluid power systems easier. Directional control valves can only perform three functions: Stop or block fluid flow, allow fluid flow, and change direction of fluid flow. They use normally close directional control valve (N.C DCV) in hydraulic system to lift the mechanical jack which have to carry 1000 ton load. In the present research project it was proved that the shock wave was caused by normally closed DCV and not by normally open DCV. A new hydraulic system test machine has been constructed. This test machine was equipped with both types of directional control valves named normally closed and normally open. In addition, a digital force sensor has also been attached to the test machine to facilitate resulting mechanical stresses. The behavior of the two types of valves has been experimentally investigated via implementing several experiments using varying ranges of applied input pressure. The experimental results obtained in this work show that using normally open directional control valve provides less resulting mechanical stresses as a result of reducing the mechanical shock induced from sudden closure of the system.

(Contd. from Page 7 - RTF-DCS Fellowship Reports)

### Nepal – Project Completion Report of Mr. Kanchan Sarga Nyaichyai



**Mr. Kanchan Sarga Nyaichyai**, Lecturer, Seabird International College, Nepal was sponsored by the NAM S&T Centre for his affiliation with the Bhabha Atomic Research Centre (BARC), Mumbai, India under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) 2014-2015 from 20<sup>th</sup> May to 14<sup>th</sup> November 2015 to carry out research on a project titled '**Application of TLD in Personnel Monitoring**' under the supervision of **Mrs. Ratna Pradeep, Dr. S.D. Sharma and Dr. D. Datta**.

Thermo luminescence (TL) is the emission of light from wide band gap material, called phosphor, during heating which has already been irradiated by energetic ionizing radiations ( $x$ , and  $\gamma$  rays) during irradiation. The energy stored in the phosphor is released during heating in the form of light and is detected using photo-multiplier tube. Heating plays the role of stimulant for initiating the emission of light. It is important to note that the TL material does not emit light by simply cooling and re-heating, it must be first exposed to ionizing radiation. The existence of band gap is essential for the material to exhibit TL, so conductors (metals) do not show TL. It is usually considered that thermo luminescence is caused by electron-hole recombination, one of which is released thermally from a trap. The wavelength of light emitted by the phosphor during heating lies in the visible region, in general, however there may also be emission in infrared region as well as ultra-violet region. Methods used for analysis were Initial Rise Methods, Methods of Various Heating Rates, and Peak Shape Method. The following can be concluded from the studies done on  $a\text{-Al}_2\text{O}_3\text{:C}$ .

The maximum glow peak temperature  $T_m$  is independent of variation of dose in the range 20 mGy – 1 Gy which indicates glow peak following first order kinetics; Change in peak position according to bleaching time suggests the glow curve following non-first-order kinetics. Results from  $T_m - T_{\text{stop}}$  study show that the dosimetry peak / trap of  $a\text{-Al}_2\text{O}_3\text{:C}$  does not have single trap depth/energy but may arise from traps having distribution of activation energies ranging from 0.86 to 1.56 eV; The dosimetry glow peak of  $a\text{-Al}_2\text{O}_3\text{:C}$  may be following non-first-order kinetics having  $b \sim 1.39$ , activation energy  $E \sim 1.5$  eV and frequency factor  $s \sim 10^{15} \text{ s}^{-1}$ .

### Nigeria – Project Completion Report of Mr. Bakare Emmanuel Afolabi



**Mr. Bakare Emmanuel Afolabi**, Lecturer II, Federal University Oye Ekiti, Nigeria was sponsored by the NAM S&T Centre to the Department of Mathematics, National Institute of Technology, Rourkela, India under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) scheme for 2014-2015 from 6<sup>th</sup> May to 28<sup>th</sup> October 2015 to carry out research on a project titled '**Application of Optimal Control Theory and Interval Analysis to Infectious Disease Models**' under the supervision of **Dr. Sneathish Chakraverty**.

This work presents the application of optimal control theory and interval analysis to infectious disease models. The SIR (Susceptible-Infected-Recovered) epidemic model is formulated and analysed. Existence and stability of the Disease Free Equilibrium (DFE) of the model is discussed in detail. The basic reproduction number  $R_0$  of the model is computed and it is established that the disease free equilibrium of the model is globally asymptotically stable for  $R_0 < 1$ . Existence and Uniqueness of the control were proved and necessary conditions for optimality were derived to characterize the optimal levels of the control. The resulting optimality system is solved numerically. The result shows that the optimal vaccination strategy required to achieve the set objective will depend on the relative cost of the associated control measure. The SIR Epidemic model is also proposed and solved under different uncertain intervals by HAM in order to obtain the numerical solution of the model. The results obtained are compared with the numerical solution and are found to be in good agreement. A five-compartmental deterministic mathematical model of Malaria disease transmission dynamics was also derived and analysed. Qualitative and quantitative analysis of the model have been performed. Existence and stability of the Disease Free Equilibrium (DFE) of the model is discussed in detail. The basic reproduction number  $R_0$  of the model is computed and it is established that the disease free equilibrium of the model is globally asymptotically stable for  $R_0 < 1$ . Homotopy Analysis Method (HAM) is used to solve the Malaria transmission dynamic model. Semi-analytical results obtained by HAM have been compared with the numerical solution and are found to be in good agreement. Finally, various simulations are done to discuss the solution.

### Nigeria – Project Completion Report of Mr. Bolarinwa Gabriel Oladeji



**Mr. Bolarinwa Gabriel Oladeji**, Principal Engineer, National Engineering Design Development Institute (NEDDI), Nnewi, Anambra State, Nigeria was sponsored by the NAM S&T Centre to carry out research at the School of Biomedical Engineering, Indian Institute of Technology - BHU, Varanasi, India under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) scheme for 2014-15 from 3<sup>rd</sup> May to 16<sup>th</sup> September 2015 on a project titled '**Biomechanical Analysis of Natural and Artificial Joints Using Some Finite Element Based Softwares**' under the guidance of **Prof. S.K Rai**.

The focus of this study was to carry out Biomechanical Analysis of natural and Artificial Joints Implant at different body weights using MIMICS and ANSYS Softwares for the analysis. It can contribute into the orthopaedic sector in the areas of pre-surgery, failure analysis, design of prosthesis and hips replacement with the use of finite element modelling. Stainless Steel SS316L was used for the implant because of its biocompatibility and strength as stated in literatures.

After the analysis, it was observed that the deformation increased with applied pressure. The Von-mises stress, the shear stress and the deformation began to increase drastically from load 80kg through 100kg force. The pressures obtained from the assumed forces were used in Finite element analysis using ANSYS 15.0 and the results obtained for the maximum values for Von-mises stress, shear stress and deformation were tabulated. The stainless steel responded linearly to the pressure load applied that is, increase in load yields increase in deformation in a linear manner. In the



(Contd. from Page 8 - RTF-DCS Fellowship Reports)

literature, the ultimate tensile stress for SS316L was 490MPa and 135-205 MPa for bone; the compressive strength of SS316L as 570MPa and 70-80 Mpa for bone. From the analysis results, the maximum von-mises stress values obtained was 3.0831MPa for Bone-implant. The max stress values were far less than the compressive strength of the SS316L; therefore we can say SS316L is a suitable material for the implant. The result obtained showed that the assembly has a good initial stability and also showed the behaviour of the joint after subjected to different body weight; the stresses absorbed and the deformation. It will also help in reducing pains in the patients and minimizes revision surgery.

This work was scoped on the conversion of the raw data from the CT scans and MRI obtained for natural and healthy femoral joints into three dimensional CAD modelling for the bone, modelling of an implant, virtual pre-clinical surgery on the modelled implants and the femur bone as an artificial joint. The type of analysis shall be limited to static structural analysis of both joints.

### Sri Lanka – Project Completion Report of Dr. Selladurai Arasaretnam



**Dr. Selladurai Arasaretnam** from the Department of Chemistry, Faculty of Science, Eastern University, Sri Lanka was sponsored by the NAM S&T Centre at the CSIR- Indian Institute of Chemical Technology (IICT), Hyderabad, India under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) 2014- 2015 from 15<sup>th</sup> July to 1<sup>st</sup> October 2015 to carry out research on a project titled '**Modification of Extracted Tannin from *Pinus radiata* Bark for Formaldehyde based Resin and Processable Thermoplastics**' under the supervision of **Dr. A. V. Sesa Sainath**.

Tannins are the most copious resource of natural aromatic biomolecules and an alternative feedstock for the elaboration of chemicals and building blocks to develop value-added polymeric materials. The study of Dr. Arasaretnam focussed on tannin extraction and modification to obtain green polymeric materials. In this challenge, tannin extracted from *Pinus radiata* bark (PBT) was modified by coupling with different aliphatic alkyl carboxylic acid and alkyl halides (C<sub>2</sub> to C<sub>18</sub>). Various weight percentages of alkyl chain lengths were introduced into the tannin by etherification or esterification. The resulted modified tannins were characterized by spectroscopic techniques, namely, Fourier transform infrared and proton/carbon nuclear magnetic resonance (<sup>1</sup>H- and <sup>13</sup>C-NMR), and thermal studies by thermogravimetric analysis and differential scanning calorimetry. Spectroscopic studies indicated that the degree of incorporation of alkyl chains depends on the feed of weight % of alkyl chains at modification process. Thermal analyses of the modified tannins revealed that thermal stability was increased for esterified and also etherified tannins compared to the neat tannins. The modified tannins were employed to prepare solution/thermo-processable materials.

### Tanzania – Project Completion Report of Mr. Nichrous Mlalila



**Mr. Nichrous Mlalila**, Research Fellow, NM-AIST, Arusha, Tanzania was sponsored by the NAM S&T Centre for his affiliation with the ICAR - Central Institute of Post-Harvest Engineering & Technology (CIPHET), Ludhiana, India under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) scheme for 2014-2015 from 21<sup>st</sup> April to 14<sup>th</sup> October 2015 to carry out research on a project titled '**Development of Polymeric Nanoparticles for Controlled Release Antimicrobial Packaging Materials**' under the supervision of **Dr. Dattatreya M. Kadam**.

The research project involved the synthesis of silver nanoparticles for developing the antimicrobial food packaging. The antimicrobial packaging is beneficial in food packaging in several ways. The beneficial features of active food packages include: (i) protect food products against contaminants and mass transfer of gases, light and moisture; (ii) global biosecurity and bioterrorism; (iii) centralized production and processing to improve distribution flow of both raw materials and finished products; (iv) consumer demands for convenient, safer and healthier food products and (v) eco-environmental safeguarding. This technology embraces as the clear strategy in reduction of post-processed food losses while curbing food insecurity, quality loss and safety issues.

The focus of the project was to develop the packaging materials that could be used to reduce the food and quality loss of food products after processing in developing countries. The target is to produce high quality packages, which are affordable to many tradition food processors and entrepreneurs for stimulating food processing while improving food security. Also, the packages could be used to control the amount of food preservatives in locally processed food as the developed packages have incorporated with preservatives, which are slowly released in the food matrix. Therefore in all period of the research work, synthesis, characterization and testing the synthesised silver nanoparticles was involved. The final nanoparticles were in good range of 30-100 nm and monodispersed. In antimicrobial efficacy studies, the nanoparticles were very effective against *Escherichia coli* suggesting being good for food packaging applications. These nanoparticles have been proved very stable at room temperature (25°C) and in the fridge (4°C) for more than 3 months.

The objective of this work was (i) to synthesise silver nanoparticles by chemical reduction method, (ii) to characterise the developed silver nanoparticles with regard to various process and formulation parameters and (iii) to test for antimicrobial efficacy of the developed silver nanoparticles in culture media.

### Tanzania – Project Completion Report of Mr. Shabani Kililwa Muller



**Mr. Shabani Kililwa Muller**, Laboratory Scientist, NIMRI (MOMS), Clinical Trial Unit - Morogoro Regional Hospital, Tanzania was sponsored by the NAM S&T Centre for his affiliation with the ICAR - National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI), Bengaluru, India under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) 2014- 2015 from 26<sup>th</sup> March to 19<sup>th</sup> September 2015 to carry out research on a project titled '**Molecular Characterization of *Leptospira* Species (Hands-on Training)**' under the supervision of **Dr. V. Balamurugan**.

(Contd. from Page 9 - RTF-DCS Fellowship Reports)

During the course of this period the following activities were conducted in a bio-containment laboratory level two - Preparation of EMJG; Field sample collection; Isolation of *Leptospira species*; DNA extraction; Microscopic Agglutination test for detection of Leptospira antibody in human and animals; Multiplex PCR; and Development and evaluation of recombinant Lsa25 protein based latex agglutination test (LAT) for serodiagnosis of leptospirosis.

The study found that rLsa25 LAT is specific, sensitive and easy to perform. It was revealed that use of rLsa25 protein in LAT for diagnosis of leptospirosis in human and animal can be applied as initial screening test for diagnosis of leptospirosis in endemic area.

### Tanzania – Project Completion Report of Ms. Kissa Tulibonywa Mwaisoba



**Ms. Kissa Tulibonywa Mwaisoba**, Agricultural Research Officer in the Agriculture Research Institute, Tanzania was sponsored by the NAM S&T Centre for her affiliation with the Institute for Social and Economic Change, Bangalore, India under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) scheme 2014-2015 from 24<sup>th</sup> May to 17<sup>th</sup> November 2015 to undertake research on a project titled "**Cocoa Value Chain Analysis and its Implication to Smallholder Farmers in India**" under the supervision of **Dr. S. Manasi**.

Urbanisation is one of the most key drivers of change in the world today as the world urban population will almost double from the current to more than 6 billion by 2050. Urban organic terrace gardening is one of the strategies currently being considered to combat all those recent trend changes, which also has the potential for environment benefits such as urban greening, improvement of urban climate and productive reuse of urban kitchen wastes.

The OTG in Bangalore was used as a case study to assess the status of urban organic terrace gardening. Specifically, the study aims to identify main characteristics of urban organic terrace gardening, determine the contribution on household level and local economy and find the major constrains and opportunities of urban organic terrace gardening. Questionnaire, personal interview with key informants, participation on Oota from thota event, gardeners meeting, attending training on Organic terrace gardening and field observation was used as a data collection techniques. The data collected were analysed using SPSS software and the descriptive statistical tools of frequency tables and percentages.

The study found that there are different vegetables and fruits grown in the study area, which are operated by individual-family households and they grow vegetables which are needed/used every day in their kitchen. Also eating health food - free from chemicals, own consumption, loss of green cover and air pollution was the major motives/goal for them to practice organic terrace gardening. The major constraints identifies were pests, shortage of space, low yield, right seeds, quality of organic manure from the private business stores and lack of support from the city government.

### Vietnam – Project Completion Report of Ms. Vu Thi Mo



**Ms. Vu Thi Mo**, Nhatrang Institute of Technology Research and Application, Vietnam Academy of Science and Technology, Vietnam was sponsored by the NAM S&T Centre for her affiliation with the Central Salt & Marine Chemicals Research Institute, Bhavnagar, Gujarat, India under the Research Training Fellowship for Developing Country Scientists (RTF-DCS) scheme 2014-2015 from 28<sup>th</sup> May to 21<sup>st</sup> November 2015 to carry out research on a project titled '**In Vitro Somatic Embryogenesis and Regeneration of Somatic Embryos from Pigmented Callus Kappaphycus Alvarezii (Doty) Doty (Rhodophyta)**' under the supervision of **Prof. C.R.K. Reddy**.

Objective of this study was to ascertain the optimum conditions for callus induction in economically important red alga *Kappaphycus alvarezii* from explants and to regenerate somatic embryos from induced callus. Three independent experiments were performed; with light intensities, agar concentrations as well as different plants growth regulatory hormones. The light intensities tested were 0, 5, 25, 50, 70  $\mu\text{mol photon.m}^{-2}.\text{s}^{-1}$ . The different agar concentrations used were 0.5%, 0.75%; 1.0%, 1.25%, 1.5%, 1.75%, 2.0%, 2.5%, 3.0% and plant growth regulators used were Naphthalene acetic acid and 6-bezyl amino purine either used separately or in combination at the concentrations of 0.1 and 1  $\text{mg l}^{-1}$ . The results showed that the optimal conditions for callus induction were PES solidified medium supplemented with 1–3% agar in 5-25  $\mu\text{mol photon.m}^{-2}.\text{s}^{-1}$  of light intensities. Plant growth regulators were not found to be significantly effective on callus induction rates but substantial differences were noted in survival rates between different hormone concentrations either individually or in combination. There were three different types of calluses observed namely white filamentous callus, brown filamentous callus and compact callus. The highest callus induction rate was (96  $\pm$  3.5 – 98  $\pm$  2.1%) at 5 - 25  $\mu\text{mol photon.m}^{-2}.\text{s}^{-1}$  with highest survival rate was 98% at the light intensity of 25  $\mu\text{mol photon.m}^{-2}.\text{s}^{-1}$  after 2 months of explants where Callus was not observed in dark condition (0  $\mu\text{mol photon.m}^{-2}.\text{s}^{-1}$ ). The highest callus induction rate was (87  $\pm$  5.8% – 90  $\pm$  5.0%) in 1% - 3% agar concentration with highest survival rate was (75  $\pm$  5.7 – 84  $\pm$  1.1%) in 0.75 – 1.5% agar concentration after 2 months of explants. These calluses, that were strong, big and had filamentous type, will be a good material for the next production stage of embryonic callus production and seedling regeneration from micropropagules.

## SCIENCE AND TECHNOLOGY NEWS IN THE DEVELOPING WORLD

### Abu Dhabi: Device to harvest Untapped Solar Power for Photovoltaic Cells

The Gulf States have huge potential to generate solar power - around 150 billion megawatt hours in a year or 400 times the regional demand. Traditional photovoltaic cells using silicon to transform light energy into electricity, can only absorb some of the sun's wavelengths from the visible light spectrum and therefore are poor at absorbing the shorter blue and green wavelengths, converting only 15 to 18 per cent of this light into electricity, and no light from the infrared spectrum is absorbed. Researchers in the Masdar Institute, a government-funded research organisation in Masdar City, have created a low-cost device that can make solar cells panels more efficient by splitting sunlight into its constituent colours. The new plastic device, which is a combination of a prism separating the different wavelengths of sunlight and a lens concentrating the light, can be used to help harness a greater amount of energy from the sun by both concentrating and separating sunlight into its key spectral components: all the visible colours of the rainbow and invisible infrared. This allows for the layering of solar cells so each coloured ray is directed onto a solar panel designed to convert this colour at maximum efficiency. By splitting the light and layering the solar cells, around 40 per cent of the energy from the shorter wavelength colours can be turned into electricity. Furthermore, making the device from plastic means it is cheap and can be mass produced. Layering solar cells improves the efficiency of the cells, and concentrating sunlight produces more electricity.

*Source: SciDev.Net, 29<sup>th</sup> December 2015*

### Africa: African Space Policy

The African science and education ministers adopted a continental space policy and strategy at the First Ordinary Session of the Specialised Technical Committee on Education, Science and Technology (STC-EST) of the African Union (AU) held on 27-30 October 2015 in Addis Ababa, Ethiopia. The STC-EST is an amalgamation of two continental ministerial gatherings - the African Ministerial Conference of Science and Technology (AMCOST) and the Conference of Ministers of Education of the African Union (COMEDA) - that previously met every two years. The 14-page policy will act as a 'guiding framework' for African activities in space, while the 20-page strategy provides a 'strategic framework' for operationalising continental projects. The two documents were prepared by the AU Space Working Group, made up of AU and national officials and experts. These are ambitious documents that aim to harness the power of technologies such as earth observation and satellite communications for the benefit of Africa's health and wealth. The space policy has two overarching goals: to use space science and technology to improve the quality of life and generate wealth in Africa, and to develop and maintain African infrastructure and capacity to service both African and foreign markets in a responsible way. It focuses on the creation of an African Space Programme, which will bring all African space activities under a common umbrella. Such activities will include the training of space-related experts, making use of continental and regional training networks and partnerships to ensure the optimal use of resources. The policy emphasises the importance of nurturing a strong space industry in Africa. This will include making sure that investments are directed at space technologies that make sense in the African market and can stimulate growth. One example is to develop better warning systems for events such as droughts, floods, tsunamis and cyclones that threaten lives and property on the continent. However, it adds that the continent also urgently needs to draw up regulatory frameworks for space technologies. African exploitation of space should be framed

around peaceful applications that respect international treaties and agreements. The African Space Strategy, meanwhile, takes the overarching policy goals of the space policy and suggests more concrete ways in which they can be achieved. It identifies the strengths of the continent (including pockets of expertise and strong political will) as well as weaknesses (such as disparities in space expertise across the continent) and threats (over-reliance on technology from abroad and 'brain drain'). Some of the opportunities can be used to address the weaknesses, it states. For instance, the extensive ongoing rollout across the continent of optical fibre broadband will help offset operational constraints on scientific equipment, data management and sharing. The strategy sets out projected outcomes. After one year, governance elements for the space programme should be in place, including regional centres of excellence. After five years, the continental space programme should be fully established. After ten years, Africa's space programme should be ranked among the top ten globally. The strategy also identifies indicators that can be used to measure whether continental ambitions in space are achieved. These include the number of space-related indigenous patents and academic articles, number of graduates in space-related fields, number of 'orbital slots' obtained for Africa-built or Africa-designed satellite and the level of long-term funding secured for space applications.

*Source: SciDev.Net Update, 20<sup>th</sup> November 2015*

### Bangladesh: Confined Field Trials of Vitamin-A Rich Golden Rice

Scientists from the Bangladesh Rice Research Institute (BRRI) have successfully completed the trials of Golden Rice in the screen house, and are now set for the next step - confined field trials. The National Technical Committee on Crop Biotechnology has approved the request of BRRI to conduct the confined field trials of the Golden Rice variety (GR-2 E BRRI dhan29) starting November 2015. World Health Organization (WHO) data say that one out of five pre-school children in Bangladesh lacks vitamin A, as well as 24 percent of pregnant women in the country. When Golden Rice becomes available, 150 grams of the vitamin-A enriched rice will be enough to supply half of the required daily intake of vitamin A for an adult.

*Source: Crop Biotech Update, 21<sup>st</sup> October 2015*

### Burkina Faso: Proven Parasite Drug as Malaria Weapon

A drug, ivermectin, used for decades against diseases caused by parasitic worms, including river blindness and elephantiasis, in Africa is being hailed as the newest weapon against malaria. A study shows that when given periodically to people in high-transmission areas, this drug can reduce malaria transmission by killing mosquitoes that carry the disease. The first results of the trial carried out in Burkina Faso were presented at the annual meeting of the American Society of Tropical Medicine & Hygiene and weeks earlier, William Campbell and Satoshi Ōmura received the Nobel Prize in Physiology or Medicine for their 1978 discovery of avermectin, the drug from which ivermectin is derived. For this study, researchers from the Research Institute for Health Sciences in Burkina Faso compared two groups of four villages, each with a high incidence of malaria. In the first four villages, ivermectin was given only once in a year as part of a regular mass drug administration against river blindness and elephantiasis. The population of the other four villages also received follow-up doses every three weeks, which were found to reduce malaria transmission by 16 per cent compared with the first group. It means that 94 cases of malaria in children were averted during the rainy season, and it is important to remember that these villages were

(Contd. from Page 11 - S&T News)

already using mosquito nets and insecticide spraying. Although ivermectin cannot be used to treat those who are already infected, it kills mosquitoes that feed on the blood of people treated with the drug. Repeated doses keep the drug at an effective level in the bloodstream. This is the first study to show an impact on clinical malaria when used in a formal trial situation and is definitely an approach worth pursuing to fight malaria.

*Source: SciDev.Net, 4<sup>th</sup> November 2015*

#### **Cambodia: Academy for Women aims to spark Growth**

Women's empowerment is a vital part of Cambodia's continuing journey towards a middle-income country by 2050, which drives economic growth and expands human welfare. Eighteen women became the first group selected for a US-funded academy set up to train women to become entrepreneurs on 21<sup>st</sup> November 2015 in Phnom Penh. The WECREATE Cambodia Startup Academy provides women entrepreneurs with skills, on-the-job training and mentoring. The WECREATE project is a key mechanism to achieving women's empowerment because it promotes entrepreneurial spirit, self-reliance and investment. Empowering women to pursue business ideas through the academy will assist Cambodian business and workers in moving up the value and manufacturing chain and in working collaboratively with other businesses in the ASEAN Economic Community. A woman with a voice is by definition a strong woman. But the search to find that voice can be remarkably difficult. This voice is your best tool in the boardroom, when talking to investors, when finding partners and when pitching to clients. Once you find your voice, hone it and practice. The academy, which provides women entrepreneurs with 15 weeks of tailored training, is important because more women are becoming entrepreneurs. Helping them start and run a business will strengthen small and medium sized enterprises (SMEs) in Cambodia. Cambodia's central location in the Mekong sub-region, as well as the number of special economic zones will provide more opportunities for foreign investment. The most important thing is that the SMEs association helps to draw more foreign investors and partners. Most important thing for women entrepreneurs is to strengthen their ability to take advantage of opportunities in the upcoming ASEAN Economic Community (AEC), which begins at the end of this year. Low productivity at a business reflects the lack of knowledge of its owner. To increase productivity, women entrepreneurs must be knowledgeable of international manufacturing standards, and for food or food-processing businesses they must adhere to hygiene standards. Ministry is working to strengthen the ability of women entrepreneurs to locate markets, determine prices and ensure food safety. The Startup Academy will help women entrepreneurs operate successful businesses. Those who attend it will learn how to implement a business model that has been tried and tested globally, and has been successfully implemented in 50 countries. After the 15 weeks of training, the women who attend the academy will be able to run their own businesses.

*Source: World SME Update, 15-30 November 2015*

#### **China: Nobel Prize for Traditional Medicine**

The Nobel Prize in Physiology or Medicine 2015 was divided, one half jointly to Satoshi Ōmura of Japan and William C. Campbell of the USA 'for their discoveries concerning a novel therapy against infections caused by roundworm parasites' and the other half to Youyou Tu of the China Academy of Traditional Chinese Medicine, Beijing, China 'for her discoveries concerning a novel therapy against Malaria'. This year's Nobel Prize is seen as an implicit recognition of traditional remedies. Youyou Tu found a reference to the use of sweet wormwood (*Artemisia annua*) for isolating the anti-malarial principle artemisinin in a Chinese text dating back to about 400AD. What is of particular significance is her working within the non-western tradition of Chinese medicine.

It has indeed taken a long time for the Nobel Committee to recognise the existence of significant traditions of scientific research that are available outside of the modern Western tradition. The biochemist and historian of science, Joseph Needham first discovered in the 1950s these home-spun scientific traditions in China. But West has stubbornly refused to accept any system other than its own. By choosing Youyou for the Nobel, the scientific establishment in the West seems to have opened its doors just a little, to allow other traditions of knowledge entry into their sphere of awards and fame. This can also be interpreted to mean that it is China's economic power that has forced the West to defer to what this ancient civilisation has to offer to the world. In the last quarter of century, historians of science in Europe and America have been prolific in their writings about the non-western knowledge traditions, part of which has been expropriated by the West without giving due acknowledgment to the original source. There is now need to apply the modern tools of research to the ancient systems of knowledge, to make them useful, and to revive diverse intellectual traditions of research. China has shown the way because its dependence on Western pharmacology remains limited. Managing to bring the older systems back into use, it has even created new frontiers in the field of medicine. Youyou Tu has shown that this can be done.

*Source: <https://www.nobelprize.org>, 5<sup>th</sup> October 2015*

#### **India: Biodegradable Bone-Regenerating Scaffold**

Researchers from the Centre for Nanosciences and Molecular Medicine in Kochi, India and others have synthesised a bone-regenerating composite scaffold by embedding microfibrinous sheets of an organic compound into a gelatin-nanohydroxyapatite matrix. This scaffold-aided differentiation and growth of bone cells could be used to replace bone tissues damaged by arthritis. Nanohydroxyapatite is porous and its properties resemble those of natural bone-forming scaffolds. But its brittleness makes it unsuitable for replacing worn-out load-bearing bone joints. The researchers synthesised biodegradable microfibrinous sheets from poly(L-lactic acid) and polyvinyl alcohol and incorporated these sheets into a gelatin-nanohydroxyapatite matrix. They then investigated the mechanical properties, cell infiltration, bone cell differentiation and bone regeneration of the scaffold by growing bone-forming human mesenchymal stem cells derived from adipose on it. Embedding the microfibrinous sheets into a gelatin-nanohydroxyapatite matrix reduced the scaffold's brittleness. The scaffold accelerated the proliferation and differentiation of bone-forming stem cells and performed better than scaffolds lacking microfibrinous sheets. The addition of the microfibrinous sheets improved cellular infiltration towards the centre of the scaffold. The scientists then surgically implanted the scaffold into defects in rabbit femur bone and found that the scaffold triggered cell infiltration and bone regeneration, so that bone defects healed within 4 weeks. The bone regeneration potential was significantly higher when compared to commercially available HA (Surgiwear™). Thus, this biomimetic, porous, 3D composite scaffold could be offered as a promising candidate for bone regeneration in orthopaedics.

*Source: Nanotechnology, Vol. 26, No. 4016, September 2015*

#### **India: Homeopathic Drugs modify Gene Expression in Cancer Cells**

Researchers at the University of Kalyani in West Bengal, India have discovered that very highly diluted homeopathic drugs can modify gene expression in cervical cancer cells. Thus, diluted homeopathic drugs could be used in combination with anticancer drugs to treat various cancers. Since the homeopathic drugs are very highly diluted, they are non-toxic and could be used as nanomedicines for personalised treatment that depends on the individual genome. To probe the effects of homeopathic drugs on

(Contd. from Page 12 - S&T News)

gene expressions, the researchers prepared two homeopathic drugs by highly diluting alcohol-based root extracts of two medicinal plants: *Hydrastis canadensis* and *Marsdenia condurango*. They then treated cultured cervical cancer cells with the drugs and a placebo drug for two days in a carbon dioxide incubator. The homeopathic drugs activated a host of genes, triggering apoptosis, a process that kills cancer cells in a controlled way. The drugs induced cell death by altering DNA methylation, an epigenetic process that is known to modify gene expression without changing DNA sequences. Of all the activated cancer-related genes, a marker gene known as SMAD4 was found to be activated by the homeopathic drugs. This gene triggers a cascade of cellular events that eventually suppress tumour growth.

*Source: Nature India Update, 25<sup>th</sup> November 2015*

### Malaysia: New Unmanned Aerial Vehicle Remote Sensing System (UAV-RS)

The Remote Sensing Malaysia Agency (ARSM), Multimedia University (MMU) and UST Sdn Bhd of Malaysia have developed a new Unmanned Aerial Vehicle - Remote Sensing (UAV-RS) system - to obtain information for monitoring natural disasters, resources management and land clearance, which is equipped with radar sensors, an optical sensor system and a ground control station. 185 kg drone can transfer data in real-time and has a service ceiling of 3 km within a 100 km radius for up to four hours. This ~US\$700,000 project was first researched in 2008, then developed in 2013 and made fully operational by 2014. The system has now clocked a total of 180 hour 4 minutes flight time. UAV-RS would improve the effectiveness of obtaining information of the Earth's surface and can be used for enhancing the efficiency of agricultural production, natural resources and environment, disasters, national security and land development. It is in line with the high-tech infrastructure that has been developed by the Malaysian government, and the benefits of remote sensing technology can be optimised to deliver high impact on the well being of the people.

*Source: New Straits Times Online, 23<sup>rd</sup> November 2015*

### Mongolia: Mongolians target Open Data to monitor Choking Air

According to the World Health Organization (WHO), Ulaanbaatar is among the five cities with the worst air pollution in the world, mainly due to heavy industry and the use of coal for household cooking and heating, yet data on pollution hotspots and trends is rare. But Mongolia's government is increasingly leaving the battle against air pollution to NGOs and individuals. At the start of next year, the government will shut down the country's Clean Air Fund, which supports projects to combat pollution, due to budget cuts. Therefore the Mongolians are increasingly turning to open data and Smartphone apps to monitor air quality. The public can grow more conscious by making air quality levels a daily part of their lives. This kind of information is especially important to flag up exposure to hazardous air pollution among people who may be unaware of it. The information will help the application's users understand the connection between real-time data and their actual experiences with air pollution. Open AQ, a not-for-profit organisation that collects global air quality data to create an online database for use by researchers and journalists, is working on a prototype Smartphone app that uses data from the Open AQ platform to create a global map of all the places about which air pollution information can be obtained.

*Source: SciDev.Net Update, 30<sup>th</sup> November 2015*

### South Africa: Preventing Shack Fires with Lumkani Fire Detectors

When fires break out, emergency services have difficulty locating and reaching houses because very few appear on official maps and roads are often blocked. It could be a shattering experience with

huge destruction of lives, livelihoods and shelters, particularly in shanty towns and informal settlements of most every big town of the world. Sometime an electricity pole may get sparks, or the easily flammable materials in densely packed houses may catch fire, or the use of open fires for cooking and kerosene for lighting may initiate fire, or people may throw away a burning cigarette on a pile to garbage or dry leaves etc. Now a new low-cost fire-detection device designed for shacks has become available at about US\$7, which activates devices in surrounding shacks within 20 seconds if a fire is not immediately brought under control. The Lumkani device uses heat detection technology instead of smoke detection (not suited for the shack environment given the heating, lighting and cooking methods that take place in homes) to sense for fires. As a heat detector it accurately measures the incidence of harmful fires, alerting the family inside the shack of the danger. Each device is networked to surrounding devices within a 100m radius. In the event of a fire, the detecting device will send a signal to surrounding devices within this range. A solid beep means that the device has detected a fire in your own home whereas a broken beep indicates that the fire is in the nearby surrounding. A wave of sound creates a community-wide alert and response to danger. This buys time for the community to become proactive in rapidly spreading fire risk situations. The networked functionality of the device is a way to confront the challenge of density and the rapid spread of fire. The devices are networked because it is not enough for one person to be alerted – everyone needs to be alerted. As a device Lumkani intends to stop the spread of fire through a community-wide response.

*Source: www.fireonline.co.za, 12<sup>th</sup> November 2015*

### UAE: IRENA and DTU launch World's Most Detailed Wind Resource Data

Wind energy potential across the globe is vast, but the upfront costs of measuring potential and determining the best locations for projects is an obstacle in many countries. The most detailed data and statistics on global wind energy potential became available online with launching on 21<sup>st</sup> October 2015 as a free resource by the International Renewable Energy Agency (IRENA) and the Technical University of Denmark (DTU). The Global Wind Atlas provides wind resource data at one-kilometre resolution directly and for free, making it a ground-breaking tool to help jumpstart wind energy development worldwide. Prior to this release, global wind data was only publically available at 10-kilometre resolution or poorer, which resulted in underestimations, increased risk and increased costs for wind energy planners. The Wind Atlas is the newest addition to the datasets available through IRENA's Global Atlas, a renewable energy mapping tool. The dataset uses microscale modeling to capture wind speed variability on small scales, allowing for better estimates. When locating wind farms, developers naturally pick areas with the highest wind speeds. In datasets that provide average wind speeds over large areas, the enhancement of wind speeds due to small scale features such as hills and ridges are not captured, making the resource appear weaker than it actually is. The Wind Atlas can prevent this underestimation, provide visual maps showing wind speeds at three different heights, and also provide tools to generate and export data and statistics such as wind roses and wind speed distributions over a chosen area. The Wind Atlas builds on decades of expertise in wind mapping at the Technical University of Denmark. It was funded by Denmark as part of its commitment to the Clean Energy Ministerial (CEM) process, and represents the achievement of the goal set forth by the CEM's Multilateral Solar and Wind Working Group to help increase the global share of renewable energy by providing the world with detailed and validated wind potentials through an online platform.

*Source: FuturENERGY Newsletter, 29<sup>th</sup> October 2015*

## Past Scientific Associates of NAM S&T Centre

### Dr. Mrunal Lakshane



**Dr. Mrunal Lakshane** joined the NAM S&T Centre in August 2006 as a Research Assistant and worked till February 2007. Her primary responsibilities included planning, implementation, evaluation and assessment of various scientific programmes of the Centre. She contributed to the organisation of the International Workshop – cum – Training Course on 'Natural Products – Drugs, Pharmaceuticals and Nutraceuticals – for the Benefit of Mankind' held jointly by the Centre with the International Centre for Chemical Sciences (ICCB), H.E.J. Research Institute of Chemistry at Karachi, Pakistan during 10-19 February 2006. Dr. Mrunal was also involved in the compilation and publication of the S&T Newsletter and the Centre's publication titled 'Plant Tissue Culture and Transformation Techniques'.

Moving from NAM S&T Centre, Dr. Mrunal acquired certifications in City & Guild 7302 Level 3 Certificate in Delivering Learning from Bridge Business & Training Centre, Hemel Hempstead, UK (2007), College Reading Learning Association (CRLA) Certification from Westchester Community College, Valhalla, New York (2011) and Clinical Research Associate Certification from Clinical Research Academy of America, New Jersey, USA (2012). She worked as Chemistry Tutor in Westchester Community College, Valhalla, New York (2009), and Bucks Community College, Newtown, Pennsylvania (2010), and then as Analytical Chemist at Micro Chem Laboratories, New Jersey (2012).

Presently, she is working as Quality Assurance and Quality Control Specialist with High Chemical Company, Levittown, PA, USA. Her current Responsibilities include establishing a system to release or reject raw materials, active pharmaceutical intermediates; packaging, and labelling materials for use outside the control of the manufacturing company; ensuring that internal audits (self-inspections) are performed; reviewing completed batch production and laboratory control records of critical process steps before release of the API for distribution; making sure that effective systems are used for maintaining and calibrating critical equipment; ascertaining the stability data to support retest or expiry dates and storage conditions on APIs and/or intermediates, where appropriate; performing annual product quality reviews; and performing the Quality Investigation, Deviation, CAPA, and Change Control programmes.

Dr. Mrunal's publications include Recovery of Oil from Desiccated Coconut Waste and Fate of Oil during Biodegradation (GDANSK, University of Technology, Chemistry Faculty, Oil and Environment, Auzo, 2005, Poland); Biotechnological Approach for Treatment of Textile Wastewater - A Case Study, Biomicroword, 2005 (International Conference on Microbiology and Biotechnology, Bedajoz, Spain, 2005), Treatment of Textile Wastewater using Aqueous Oxidative Agents and Their Effect on Biodegradation (Indo-Italian Workshop on Emerging Technologies for Industrial Wastewater Treatment and Environment, NEERI, Nagpur, 2002); Biotechnological Approach for Treatment of Textile Wastewater – A Case Study on Modern Applied Microbiology (WILEY-VCH Verlag, Germany 2006; Mendez-Vilas, Ed); An Approach for Treatment of Textile Wastewater - Wastewater Treatment Technology and Environment, Vol I, New Delhi; and Bio-treatment of Textile Wastewater in a Completely Mixed Activated Sludge System (National Symposium on Recent Trends in Biology and Biotechnology and 23rd Annual Session of the Academy of Environmental Biology, Kolhapur, India 2003).

Currently, Dr. Mrunal is a member of the Parenteral Drug Association (PDA), the leading global provider of science, technology and regulatory information and education for the pharmaceutical and biopharmaceutical community.

### Mr. Gaurav Gaur



**Mr. Gaurav Gaur** was one of the longest serving research scientists of the Centre. During his tenure of five years from March 2006 to May 2011, he played a key role in planning, coordination and management of various scientific programmes and activities carried out by the Centre. He handled programmes with a range of subjects of mainstream research, viz. Agriculture, Environment, Natural Disaster, Microelectronics, Natural Products, Nanotechnology, Traditional and Alternative Medicine etc., and also areas of thought leadership like S&T Policy Research, Technology Transfer, Science Popularisation etc.

The most remarkable contribution made by Mr. Gaur for which the Centre acknowledges his services is in the planning and execution of a 3-year multilateral collaborative project on 'Sustainable Rainwater Harvesting and Ground Water Recharge in Developing Countries – Human Resource Development and Technology Transfer' which was implemented by the Centre with partial support from Perez Guerrero Trust Fund (PGTF) of the Group of 77 (G-77).

Mr. Gaur corresponded with experts/scientists in different scientific fields in connection with their papers for the scientific volumes published by the Centre. He also contributed his inputs to the editorial tasks done by eminent editors of the Centre's publications. Besides this, he independently contributed to some segments of the Centre's Newsletter and assisted in finalising the presentation of the Newsletter.

He represented the Centre at various national and international conferences and seminars.

Mr. Gaurav Gaur is presently working in the capacity of an Assistant Director in the Federation of Indian Chambers of Commerce and Industry (FICCI) which is the oldest and one of the apex industry associations in India and looks after homeland security and geospatial technologies domains.

## *DISTINGUISHED VISITORS TO THE CENTRE*



**Mr. Carlos Jimenez (C)**, Minister Counsellor and Deputy Chief of Mission, Embassy of Peru in New Delhi, India



**Dr. H.S. Gupta (C)**, Director General, Borlaug Institute for South Asia, International Maize and Wheat Improvement Center (CIMMYT), New Delhi, India



**Prof. S Mohammad Reza Khalili (3<sup>rd</sup> from L)**, Counselor, Embassy of the Islamic Republic of Iran in New Delhi, India



**Dr. H. Purushotham (C)**, Chairman and Managing Director, National Research Development Corporation (NRDC), New Delhi



**Dr. B. Chandrasekar (C)**, Registrar, Regional Centre for Biotechnology (RCB), Faridabad, Haryana.



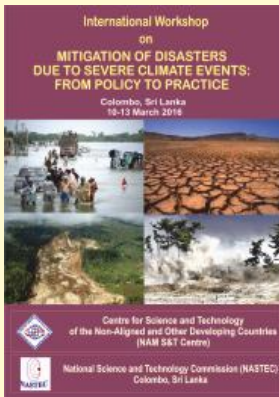
**Dr. Laxman Prasad (C)**, Director, Research & Development, RKG Group of Institutions, Ghaziabad (U.P.).

## *Participation of Centre's Scientists in Scientific Event*

- 19 - 21 Nov. 2015** **Ms. Vaneet Kaur**, Research Associate attended the 5<sup>th</sup> Global Economic Summit on 'Enabling Food for All' organised at the Expo Centre, Mumbai by the World Trade Centre (WTC), Mumbai and All India Association of Industries (AIAI) and made a presentation titled 'Technological Innovations in Agriculture'.
- 16 - 17 Dec. 2015** **Dr. Kavita Mehra**, Publication Advisor presented a paper titled 'Role of Science and Technology and Innovation Policies in the Innovation System of India' in the 5<sup>th</sup> IRAMOT International Conference on 'Learning and Technological Innovation in Large Enterprises and Networks' organised by the Iranian Association for Management of Technology (IRAMOT) in Tehran, Iran.
- 17 Dec. 2015** **Mr. M. Bandyopadhyay**, Senior Expert & Administrative Officer attended the Regional Seminar on 'Technology Facilitation for Sustainable Development Goals in the Asia Pacific' organised by the Asian and Pacific Centre for Transfer of Technology (APCTT), New Delhi, India.

## Centre Announces

### International Workshop on MITIGATION OF DISASTERS DUE TO SEVERE CLIMATE EVENTS: FROM POLICY TO PRACTICE Colombo, Sri Lanka, March 10-13, 2016



The NAM S&T Centre in partnership with the National Science & Technology Commission (NASTEC) and Industrial Technology Institute (ITI) of Sri Lanka announces the organisation of an International Workshop on 'Mitigation of Disasters due to Severe Climate Events: From Policy to Practice' in Colombo, Sri Lanka during 10-13 March 2016. The prime goal of the event is to develop a platform for the relevant professionals and policymakers in third world countries to act appropriately and share the knowledge and experience.

This International Workshop is primarily designed for scientists, meteorologists, engineers, policy makers, public health specialists, technologists and civil administration experts working in the field of disaster mitigation from different countries and industries across the world for deliberating on the challenge of severe natural disasters related to climate, formulating guidelines and strategic planning of mitigating severe climate events and debating on the development, enhancement or amendment of related national policies.

The Workshop programme will include presentations by experts in the field, country reports and technical presentations by the participants, brainstorming and networking sessions and a technical excursion.

**Last date for submitting the applications is 10<sup>th</sup> February 2016**

### International Training Workshop on COMMERCIALISATION OF TECHNOLOGY Tehran, Iran, May 22-25, 2016

The NAM S&T Centre will shortly announce the organisation of an international Training Workshop on a theme titled 'Commercialisation of Technology' jointly with Pardis Technology Park in Tehran, Iran during 22-25 May 2016. An exhibition, INOTEX2016, will also be held in the sidelines of this workshop.

Technology incubators and science parks are considered to be effective and influential mechanisms for converting the research results into useful products for industry and society. Proper management of incubators for achieving the desired goal is a serious matter and the concept needs to be spread across the academic and research communities in the developing countries in order to promote technological innovation.

The Tehran Training Workshop is primarily designed for the managers of technology incubators and science parks, students, academicians, entrepreneurs and artisans. The main objectives is to present the latest scientific and research achievements in the areas such as studying the problems and solutions and displaying the successful experiences of incubators' management; describing the prominent commercialisation models in the world and familiarising with the local commercialisation models; and intellectual property protection and protection of products' registration to survive in the market. Topics to be covered include: Commercialisation of technologies; Innovation by start-ups; Product patents and intellectual property; Study of the indigenous models as well as the prominent global models of commercialisation; and Scrutiny of the local models to maintain and protect the patents.

**Last date for submitting the applications will be in the first week of April 2016.**

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