IUSSTF

ANNUAL REPORT 2010 2011

INDO-US SCIENCE AND TECHNOLOGY FORUM

Catalyzing Indo-US Science & Technology Cooperation

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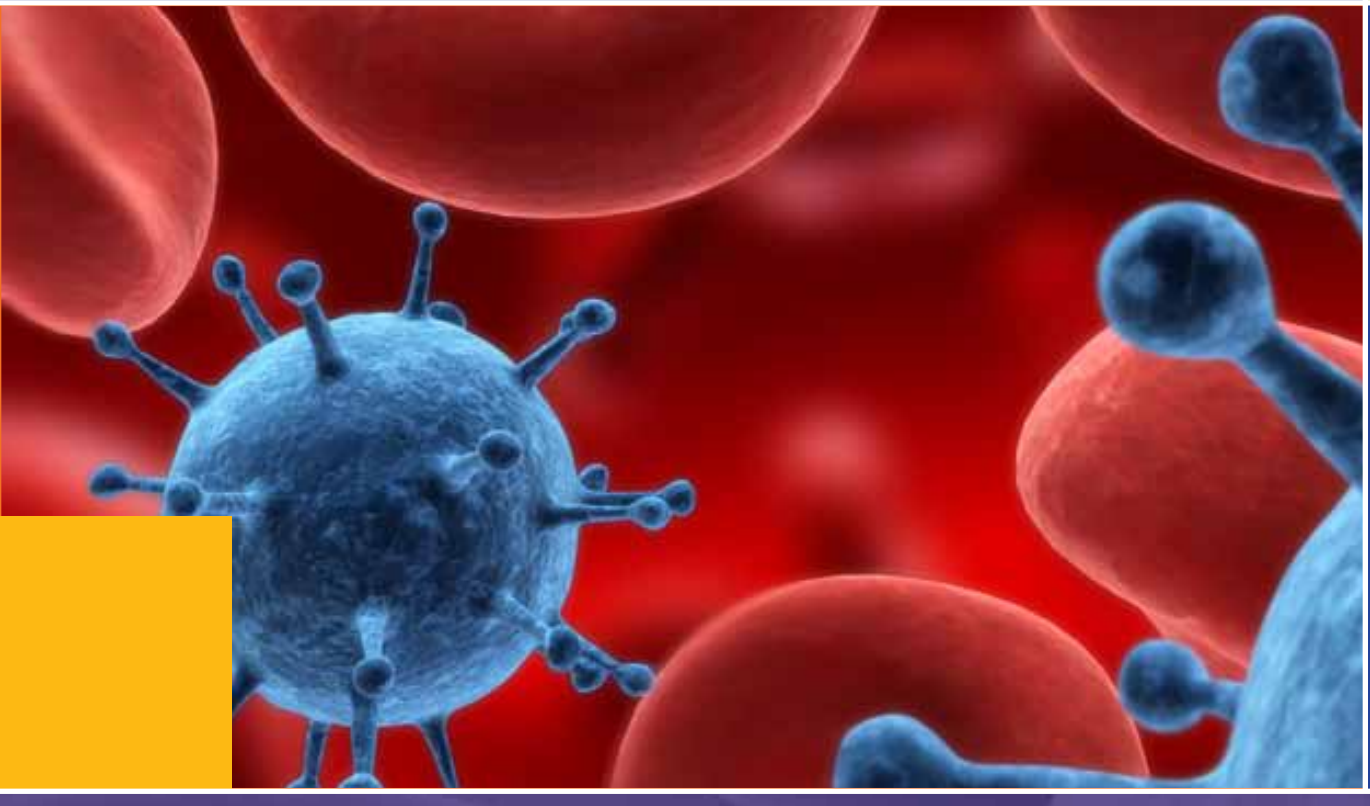
The Indo-US Science and Technology Forum (IUSSTF), established under an agreement between the Governments of India and the United States of America in March 2000, is an autonomous, not-for-profit society that promotes and catalyzes Indo-US bilateral collaborations in science, technology, engineering & biomedical research and innovation through substantive interaction among government, academia and industry.



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From the Executive Director's Desk

The Indo-US bilateral relationship has been steadily growing for past several years. Individual scientists and institutions in India and US have always been interacting and collaborating in various fields of science and technology. This relationship has been further strengthened by establishing the inter-Governmental Joint Commission on Science and Technology (JCST) which held its first meeting in June 2010 in Washington DC to review various ongoing collaboration programs. The JCST recommendations included promoting inter-agency collaboration for supporting basic and applied research through virtual joint research centers; initiation of Joint Clean Energy Research Centre; and accelerating formation of Science and Technology Endowment Board. It is heartening to report that recognizing its capacity to manage large extramural programs and efficient delivery mechanism, IUSSTF was subsequently involved in implementation of these activities.

IUSSTF has been chosen for implementing US-India Science and Technology Endowment Board (STEB), a strategic partnership with the objective of promoting science and technology led innovation and entrepreneurship. IUSSTF has also been entrusted by the Indian Ministry of Science and Technology to coordinate and administer multi-institutional, public-private networked R&D projects under the Joint Clean Energy Research and Development Centre (JCERDC) in three priority areas of solar energy, second generation bio-fuels and energy efficiency of buildings. This program, a strategic partnership between Indian Ministry of Science and Technology and the US Department of Energy has commitment of 5 million US$ by each side for five years with matching funds by the consortia partners.

Over the years, IUSSTF has catalyzed fruitful collaboration and partnerships spanning across

disciplines and institutions between our two countries. Working with government agencies, academia, professional societies, and industry partners from both the countries, IUSSTF has built over the years several novel programs in tune with public policy imperatives on all such aspects such as, nurturing and facilitating contacts between future generations of S&T leadership, mobility through faculty fellowships and student internships, capacity building in national priority areas, enabling an ecosystem of techno-entrepreneurship, build academia-industry linkages and networking through several Indo-US Joint Centers. It is very satisfying to share several such new and ongoing bilateral initiatives in this annual report. Some of these are highlighted below.

As part of the decadal celebrations of the Indo-US Science and Technology Forum, a high-level Indo-US Engineering Education conclave on "Meeting Common Challenges: Strengthening Engineering Educational Institutions in India and the US" was held in New Delhi in January 2011 in partnership with the Indian Ministry of Human Resource Development (MHRD). The meeting was aimed to initiate a dialogue between senior educators to improve mutual understanding of the challenges faced by engineering educational institutions in both countries and explore possible activities and programs to meet these challenges.

The IUSSTF has been playing an important role in promoting networking and information exchange between the Indian and US scientific groups through workshops in a broad spectrum of scientific topics. During the year, more than 500 Indian and US scientists, researchers and students were brought together through 27 workshops/ seminars.

It has been a continuous endeavor of IUSSTF to groom and connect the next generation and scientists and researchers which will shape the future of science and technology cooperation between India and US. IUSSTF has been able to successfully develop several student internship programs that would allow reciprocal visitation for science and engineering students to work in each other's country for periods up to six months. Under the Research Internship in Science and Engineering (RISE) program of IUSSTF, 12 US students were provided opportunities to undertake internships in leading academic /scientific institutions including private R&D laboratory in India. Fifteen Indian students attended 10 week internship at University of Wisconsin-Madison under the Khorana Program being implemented with partnership of UW-Madison and the Indian Department of Biotechnology. Ten Indian B.Tech/ M.Tech. students were awarded internships at the Viterbi School of Engineering, University of Southern California as part of the Viterbi-India Program.

With an aim to foster scientific cooperation, education, training and capacity building at individual and institutional levels, the IUSSTF has visiting professorships and student visitation programs with the American Society for Microbiology (ASM) and the American Society

It is heartening to record that through the canvas of activities supported by IUSSTF more than 10,000 scientists, technologists, medics and students have been brought together so far. During its existence of 11 years, IUSSTF has shown its capability to manage multiple modes of partnership towards promoting novel schemes of collaborations.

for Physics. Six Indian and US scientists and seven Indian and US students availed these visitation fellowships. The Indo-US Research Fellowships instituted in partnership with DST enabled 27 young Indian faculty members and researchers to work in premier US institutions for a period of 3 to 12 months, thus fostering new relationships.

IUSSTF has been effective in leveraging its unique position to bring together federal agencies, corporate houses, industry associations along with academia both from US and India on developing a program portfolio that identifies nurtures and promotes techno-preneurship. The DBT supported Stanford-India Biodesign Program (SIB) led to the development of several proto-types of biomedical devises that have potential for affordable commercialization. Four outstanding scientists/ engineers were selected for the 2011 SIB fellowships. The DST-Lockheed Martin India Innovation Growth Program (IIGP) is designed as an accelerated technology assessment and commercialization initiative. This program has enabled signing of several global business deals by awardees. During 2010-11, 15 innovators were selected for mentoring under this program.

The success of several multi-institutional bilateral Centers have been amply demonstrated by joint publications, patents, reciprocal student and faculty exchanges, and most significantly in the ability of some of the participating groups to garner national funding in their respective countries by showcasing the strength and value of such networked partnerships enabled through IUSSTF support.

It is heartening to record that through the canvas of activities supported by IUSSTF more than 10,000 scientists, technologists, medics and students have been brought together so far. During its existence of 11 years, IUSSTF has shown its capability to manage multiple modes of partnership towards promoting novel schemes of collaborations. All of this has been made possible through the guidance of a very eminent and highly professional Governing Body and the collective efforts of a small but highly dedicated and multi-skilled team at the IUSSTF secretariat. We at IUSSTF are confidently poised to shoulder and discharge a larger science and technology cooperation between India and USA with active engagement of our stakeholders.

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History of Indo-US S&T Cooperation

1950's

Green revolution facilitated with the U.S. PL 480 Rupee Funds

Establishment of Land Grant Colleges

1960's

Establishment of IIT, Kanpur

Establishment of NCERT, New Delhi

Nuclear Cooperation Agreement

Tarapur Power Plant

1970's

NASA-ISRO: Satellite Instructional Television Experiment (SITE)

Indo-US S&T Subcommission

1980's

Science & Technology Initiative (STI)

US-India Fund (USIF)

1990's

Indo-US Fellowships Program

ICAR MoU

Indo-US Vaccine Action Program

DST-NSF Program

NASA/NOAA-ISRO/DST MoU

DBT/ICMR-NIH/ CDC Health & Medical Sciences Program

2000's

Indo-US Science & Technology Forum (IUSSTF)

Indo-US Science & Technology Agreement

High Technology Cooperation Group (HTCG)

Indo-US Strategic Partnership
- ICT
- Agri Knowledge Initiative (AKI)
- Space Cooperation
- Clean Energy
- Safety & Security
- Health Sciences
- Education

Joint S&T Commission

NASA-ISRO Agreement / MOES-NOAA Agreement

Indo-US Nuclear Agreement

Indo-US S&T Endowment Fund for Innovation

Joint Clean Energy Research and Development Center (JCERDC)

Structure of IUSSTF

Management

The IUSSTF functions as

- Autonomous
- Bilateral
- Nongovernmental
- Not-for-profit society

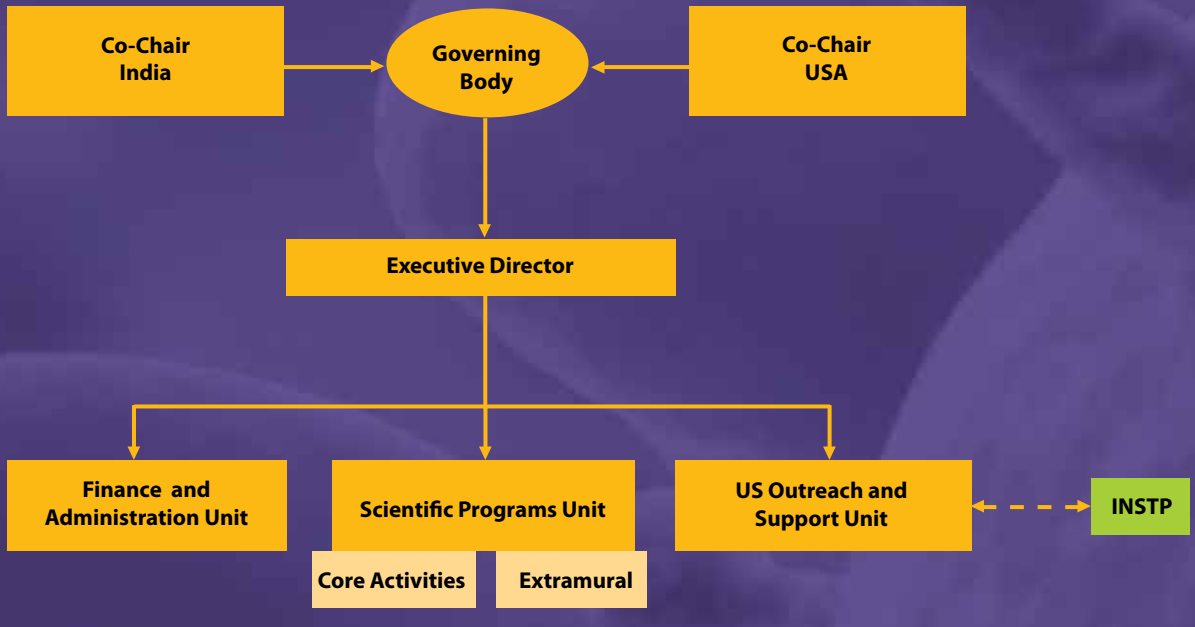
To ensure that the activities undertaken by the IUSSTF conform to the highest standards of excellence, a joint Governing Body consisting of seven Indian and seven American eminent scientists and technologists provide leadership to IUSSTF.

The Executive Director manages the IUSSTF affairs from its headquarters at the Fulbright House, New Delhi.

Funding

Annual interest earning from the endowment created by the US Government with matching contribution from Government of India through the Department of Science and Technology provides regular funds to administer the IUSSTF programs.

IUSSTF also has the freedom to receive grants, gifts, donations or other contributions from industries, foundations and private benefactors. Contributions to IUSSTF are tax-exempted under Section 80G of the Indian IT Act. Toward furtherance of its objectives, the IUSSTF welcomes fund contributions both in India and USA. As a 501(c)(3) entity, India Science & Technology Partnership (INSTP) serves to raise funds in USA to complement support for bilateral programmatic S&T activities.



Composition of the Governing Body

INDIAN CO-CHAIR

T. Ramasami
Secretary
Department of Science and Technology
Government of India

US CO-CHAIR

Norman P. Neureiter
Senior Advisor
American Association for the Advancement of Science

INDIAN MEMBERS

Maharaj K. Bhan
Secretary
Department of Biotechnology
Government of India

Samir K. Brahmachari
Director General
Council of Scientific & Industrial Research and Secretary, DSIR

Sanjay G. Dhande
Director
Indian Institute of Technology, Kanpur

R. Seshasayee
Executive Vice-chairman
Ashok Leyland India

Murali Sastry
Chief Scientific Officer
TATA Chemicals Ltd

Sheila Sangwan
Additional Secretary & Financial Adviser
Department of Science and Technology
Government of India

US MEMBERS

Michael Clegg
Foreign Secretary
National Academy of Sciences

Subra Suresh
Director
The National Science Foundation

Roderic Pettigrew
Director
National Institute of Biomedical Imaging and Engineering
National Institutes of Health

Phyllis G. Yoshida
Deputy Assistant Secretary,
US Department of Energy

Ray O. Johnson
Senior Vice President and Chief Technology Officer
Lockheed Martin Corporation

Venkatesh Narayanamurti
Director, Belfer Center for Science and International Affairs
Harvard University

Objectives of IUSSTF

Catalyst to facilitate seed and promote US-India bilateral collaboration in science, technology, engineering & biomedical research and innovation through substantive interaction among academia, R&D laboratories, industry and government.

- Support exciting and enabling science and technology program portfolio that paves way for sustainable interactions and potential collaborations through networking.
- Promote and strengthen strategic partnerships in science and technology under various intergovernmental initiatives and declarations.
- Create awareness through exchange and dissemination of information and opportunities toward promoting bilateral scientific and technological cooperation.
- Encourage public-private partnership and technopreneurship to foster elements of innovation and enterprise through knowledge networking between academia and industry.
- Capitalize on the scientific and technological synergy on issues of common concern leading to long-term partnership based on shared values.
- Explore new frontiers by nurturing contacts between young and mid-career scientists and technologists to develop mutual trust, leadership and fraternity in research and development.

Salient Outcome of IUSSTF Activities over the years...

"Success of IUSSTF in achieving its mandated activities should be considered as an exemplar and perhaps a benchmark for similar initiatives of S&T grant making bodies."
- NISTADS Report 2007

IUSSTF convened activities have led to the interaction of over 10,500 US and Indian scientists and technologists creating several new opportunities paving way to sustained collaborations in diverse areas of science, technology and innovation.

Inter-Institutional Agreements

IUSSTF convened events have led to collaborations through inter-institutional agreements in diverse areas like weather and climate studies (National Center for Medium Range Weather Forecast, National Center for Atmospheric Research, India Meteorological Department & National Center for Environmental Prediction); advanced computing (Center for Development of Advanced Computing & Louisiana State University); ayurvedic research (Department of Indian Systems of Medicine and Homeopathy & National Center for Complementary and Alternative Medicine); information sciences (Mysore University & University of Pittsburgh); ecoinformatics (Ashoka Trust for Research in Environment and Ecology & University of Massachusetts); technology management internship (Technology Information Forecasting Assessment Council & National Institute of Health); Sastra Ramanujan Awards (SASTRA University & American Mathematical Society); biomedical engineering (Shree Chitra Institute of Medical Science and Technology & Penn State University); water management (Jawaharlal Nehru Technical University and University of Colorado, Boulder); air traffic management (IIT-Bombay, National Aerospace Laboratories and NASA); conservation research (JNV University and University of Arizona); optoelectronic materials and devices (Society for Applied Microwave Electronics Engineering and Research, Tata Institute of Fundamental Research and University of New Mexico); post-harvest technology (Amity University and World Food Logistics Organization for a project funded by the Bill & Melinda Gates Foundation); mathematical proteomics (University of Hyderabad and University of Minnesota); the Unique Identification Number Project (IIIT Delhi & SUNY at Buffalo); protecting senior citizens from cyber security attacks in the e-health scenario (Amrita University, IIIT Delhi & SUNY at Buffalo); cloud computing and security (Amrita University, IIIT Delhi, IIT Bhubaneswar, IIIT Allahabad, SUNY at Buffalo, Arizona State University & Kennesaw State University); state-of the art research and knowledge center for cardiovascular diseases (Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram and Oklahoma Medical Research Foundation); ecological health of rivers (Indian Statistical Institute, Kolkata and University of Illinois at Urbana Champaign); self-assembled fibrillar gels (University of Nevada-Las Vegas and JNCASR, Bangalore; IACS, Kolkata and University of Maryland; Vidyasagar University, Medinipur and Georgetown University; IIT Kharagpur and Georgetown University; and James Madison University and Indian Institute of Science, Bangalore).

Indo-US Networking and Joint R&D Projects

IUSSTF has supported 181 bilateral workshops that have had a substantive impact in generating new joint R&D projects in areas of mutual interest like agricultural biotechnology (functional genomics);

traditional medicines; nanoparticle aerosol S&T; high performance computing; tissue engineering; advanced manufacturing; brain research; infectious diseases; epidemiology and environmental health; seismic studies; geological carbon dioxide sequestration; hydrogen storage materials; futuristic manufacturing; fuel cells; target detection from remotely sensed images; structures in nano-biosystems; coastal water resource management; ceramic-based biomaterials; molecular insights in digestive diseases (Christian Medical College and Tufts University School of Medicine received five NIH grants for the period 2007-2013); and public health in India (Christian Medical College and Yale University received two NIH and one Bill and Melinda Gates Foundation funded grant for the period 2009-2015).

To enable Indian and American scientists from academia and laboratories to carry out joint research activities by leveraging already existing infrastructure, **20 Indo-US Networked Joint Centers** have been initiated. The Joint Center (JC) on *Nanomaterials for energy* has received additional funding from Air Force Office of Scientific Research, Asian Office of Aerospace Research and Development and Defense Advanced Research Projects Agency; JC on *Climate Change and its impact on the ecosystem of the Arabian Sea* has received additional funding from NASA, NSF, and Space Application Centre; JC on *Biomaterials for Healthcare* has since been awarded 5 research projects by DRDO, DST and DBT in addition to the signing of an inter-institutional MoU between IIT-Kanpur and the University of Texas at San Antonio.

Considering the outcome and achievements of the Joint Centre on *Advanced Manufacturing* (under which one patent has been filed and the further research funding was received from agencies such as NSF and DST), IUSSTF awarded the partnering institutions the **Indo-US Centre for Research Excellence in Science and Engineering (CRESE)** on Fabrionics in order to consolidate and continue the collaboration by intensifying academic cooperation with the active involvement of industry and entrepreneurs required to translate the R&D outcome. This CRESE has received additional funding from DST and CSIR. Also, two patents have been filed and several joint publications have been generated. Other Centers for Research Excellence in Science and Engineering established include: *Advanced Materials Research* (Partners: Jawaharlal Nehru Centre for Advanced Scientific Research, Northwestern University, Indian Institute of Science and Argonne National Laboratory); *Nanobiotechnology* (Partners: National Center for Biological Sciences, Harvard Medical School, Jawaharlal Nehru Centre for Advanced Scientific Research and Centre for Cellular and Molecular Biology); and Nanomaterials for Energy (Partners: Jawaharlal Nehru Centre for Advanced Scientific Research, Purdue University and GE India Technology Centre Bangalore).

Educational Programs

By supporting over 35 Training Programs/Advanced Schools, IUSSTF has seeded the development of educational programs in information management sciences (Mysore University & University of Pittsburgh); green chemistry (Delhi University & Green Chemistry Institute); advanced manufacturing (IIT, Kanpur & Northwestern University); nanotechnology (SASTRA & University of Arkansas); microsurgery (All India Institute of Medical Sciences & US Association of Microsurgery); distance education in engineering (Amrita University/ISRO & 21 US partner university and institutions); number theory (Sastra University & University of Florida) and museum science communication (National Council for Science Museums, BITS, Pilani & Smithsonian Institution); ASEE led Indo-US collaboration for engineering education; and discrete mathematical chemistry (Osmania University and University of Minnesota). The IUSSTF supported University of California Berkeley-IIT Kharagpur collaboration on energy research has catalyzed the establishment of the *PK Sinha Center for Bioenergy* at IIT-Kharagpur with a gift of $2 million from an IIT-Kharagpur alum. The Center is now well positioned to strengthen and accelerate bioenergy research between IIT Kharagpur and US Berkeley.

Major Initiatives

Some of the major initiatives catalyzed by IUSSTF includes the Indo-US civilian space cooperation; University of California-India R&D Initiative; Indo-US distance education program in engineering; Aircraft borne tropical cyclone prediction system; Biogeochemical flux monitoring network - IndoFlux; Translational Health Science and Technology Institute, India – THSTI; India's joining the US led International Partnership in Hydrogen Economy (IPHE) and the US DOE Blue Sky Carbon Sequestration Program facilitated the inclusion of knowledge-based R&D (nano, info and biotechnology) as a part of the Indo-US High Technology Cooperation Group (HTCG) dialogue.

IUSSTF maintains a close working relationship with the federal agencies, laboratories, government institutions, and the academia in U.S. and India, cutting across all disciplines. In 2011, IUSSTF has been entrusted to administer the bi-national **US-India Science & Technology Endowment Fund and the Indo-US Joint Clean Energy Research and Development Center (JCERDC).** The aim of the endowment fund is to strengthen and expand S&T cooperation for public good through science and technology R&D entrepreneurial activities intended to lead to the commercialization of technology that will develop sustained partnerships between US and Indian scientists and entrepreneurs for the mutual benefit of both countries. The two priority areas identified are *'Healthy Individual'* and *'Empowering Citizens'*. The JCERDC is a joint initiative of the Government of India and the US Department of Energy with the overall aim being to facilitate joint research and development on clean energy by teams of scientists, technologists and engineers from India and the United States, and related joint activities, needed to deploy clean energy technologies rapidly with the greatest impact. To achieve this objective, the Indo-US JCERDC will support multi-institutional network projects using public-private partnership model of funding. The priority areas are *Solar Energy, Second Generation Biofuels and Energy Efficiency of Buildings.*

Road maps of cooperation

Road maps and contours of Indo-US cooperation were chartered through IUSSTF convened events on civilian space cooperation (ISRO & NASA); microlight air vehicle development (National Aeronautical Laboratory & University of Maryland); primate national action plan (Primate Research Council & US Wildlife and Fisheries Agency); Indo-flux program (DOES); linear collider for high energy physics (DST & DOE labs); technopreneurship in academia (National Entrepreneurship Board); GLP on medical devices. In 2008, IUSSTF had supported an Indo-US workshop on *low-cost diagnostic and therapeutic medical technologies.* As a result of this workshop, the National Institute of Biomedical Imaging and Bioengineering (NIBIB) and Department of Biotechnology (DBT), Govt. of India, are initiating jointly funded initiatives that capitalize on the expertise and resources of the two nations. On June 24th 2010, at the U.S.-India Science and Technology Joint Commission Meeting in Washington, D.C., NIBIB and DBT announced the availability of supplemental funding for eligible NIBIB-supported research grants to facilitate collaborative work among researchers in the US and India. The grants will be used to develop low-cost diagnostic and therapeutic medical technologies that can be used in underserved communities worldwide.

Indo-US Frontiers of Science (FOS) & Frontiers of Engineering (FOE)

IUSSTF has also initiated the *Indo-US Frontiers of Science (FOS) and Frontiers of Engineering (FOE)* symposium in partnership with the US National Academy of Sciences and National Academy of Engineering. This has provided a unique platform to the best and brightest young minds from India and US to interact and discuss cutting edge scientific pursuits. The series has helped to establish

trans-disciplinary research activities and build contacts between the next generation scientists through IUSSTF seed awards. As a spin-off, the annual national frontiers meeting in India has been initiated by the Indian Academies.

Industry supported activities

IUSSTF promoted techno-entrepreneurship through the *DST-Lockheed Martin Innovation Growth Program* in partnership with UT-Austin and FICCI has led to the signing of 69 business deals worth Rs 200 crores/$ 43m; *Stanford-India Biodesign program* in partnership with IUSSTF has generated eight prototypes of biomedical devices for commercialization; and the *DST-Intel India Innovation Pioneers Challenge* in partnership with IUSSTF have showcased several student led innovation which have won international awards and have commercialization potential. IUSSTF also partners with IBM to conduct the *IBM-IUSSTF Visiting Fellowships in Nanotechnology.* IUSSTF also supported the *Young Engineers Visitation Program* in partnership with Lockheed Martin Corporation. Several industry funded projects in academia were initiated following IUSSTF seeded activities in areas like cyber security; microwave technology; RFID and wireless sensors; design engineering; nano-coatings; rapid prototyping; nanofabrication for solar cells; lithium-ion based Nano batteries (joint Indo-US business venture); telecom switching; design of aerospace alloys, as examples of academia-industry partnerships.

S&T capacity building

Addressing the need for human S&T capacity building, IUSSTF has instituted the *Indo-US Research Fellowship* in partnership with DST. Reciprocal student exchange programs aimed to groom and connect the next generation of scientists have been launched, which includes the *Research Internships in Science and Engineering* for PhD students; *Khorana Scholars Program* (with DBT and the Univ. of Wisconsin-Madison); *UC Berkeley–IIT Kharagpur exchange program; MIT-IUSSTF internship program; Experimental Learning in International Agriculture exchange program* (Cornell Univ. and 4 Indian State Agriculture Universities); Visitation programs with the American Physical Society and the American Society for Microbiology. To address the need for human resource development and capacity building in the field of computer sciences and electrical engineering, IUSSTF and the Viterbi School of Engineering at the University of Southern California partnered to launch the *Viterbi-India Program* between Indian institutions and the Viterbi School of Engineering.

India Science and Technology Partnership

The India Science and Technology Partnership (INSTP) based out of the American Association for the Advancement of Science (AAAS) in Washington D.C. is the US partner of the Indo-US Science and Technology Forum.

INSTP complements the activities of IUSSTF by:

- Conducting outreach among US government technical and scientific agencies;
- Increasing and expanding contacts with the US academia, business community, professional and trade associations toward fostering new bilateral S&T programs;
- Developing a closer relationship with legislative and executive branch offices interested in and supportive of closer bilateral relations with India; and
- Representing IUSSTF at conferences, seminars, and other events in the United States.

INSTP also manages the US peer review process for the IUSSTF's grants program and maintains communications with US members of the IUSSTF Governing Body.

INSTP has been confirmed by the US Internal Revenue Service as a public charity, exempt from Federal income tax under Section 501(c)(3) of the Internal Revenue Code. Charitable contributions to INSTP are tax deductible under Section 170 of the code. In addition to corporate and individual contributions, INSTP has enjoyed financial support of the Richard F. Lounsbery Foundation, the US Department of State, the Office of Naval Research, the US Department of Agriculture, and the Director, Defense Research and Engineering. INSTP also enjoys significant in-kind contributions from the Smithsonian Institution, The National Academies, and AAAS.

Michael J. Cheetham serves as the Director of INSTP

12th Governing Body Meeting

The 12th annual meeting of the joint Governing Board of IUSSTF was held at Fulbright House, New Delhi on December 6, 2010 under the co-chairmanship of T. Ramasami Secretary, Department of Science and Technology, Govt. of India and Norman Neureiter Advisor, American Association for the Advancement of Science. Nobel Laureate Peter Agre, President, American Association of Advancement of Science and Director, Malaria Research Institute, Johns Hopkins Bloomberg School of Public Health, USA, attended the Board meeting as a special invitee.

As a prelude to the Board meeting, a series of invited presentations on the ongoing and future bilateral S&T activities were made. S.V. Raghavan, Scientific Secretary, Office of Principal Scientific Advisor, Govt. of India, gave an overview of the *GLORIAD-TAJ broadband system and the National Knowledge Network*. Renu Swarup, Advisor, Department of Biotechnology, Govt. of India gave an introduction to the *Indo-US Joint Clean Energy Research and Development Center (JCERDC)* being established under the Indo-US Clean Energy MoU. The Indian secretariat for implementing the JCERDC activities will be at the IUSSTF. Swati Basu, Advisor, Ministry of Earth Sciences, Govt. of India, spoke about the MOES-NOAA collaboration on *Dynamical Monsoon Forecasting* which will lead to the creation of an Indian Monsoon Desk by MOES at NOAA. The highlights of the *Indo-US Networked Center on Bio-materials for Healthcare* under IUSSTF program support was presented by Bikramjit Basu from IIT-Kanpur. Ritu Kamal, Stanford India Biodesign Fellow, presented the achievements of the Stanford

India Biodesign Program which has resulted into development of proto-types of several biomedical devices for commercialization. Nirankar Saxena from the Federation of Indian Chamber of Commerce and Industries, New Delhi, and Jim Vance from IC2 Institute, University of Texas, shared the successes of the *DST-Lockheed Martin India Innovation Growth Program* which aims at enhancing the accelerated growth and development of techno-entrepreneurial enterprises by adopting the prevalent best practices both in US and India.

In the GB business meeting, the Executive Director, IUSSTF highlighted the ongoing and several new programs implemented and launched during the year, most of which were in partnership with government agencies, professional societies, industry and academia. The Governing Body

expressed its unanimous appreciation of the role that has been played by IUSSTF to forge and catalyze a wide variety of bilateral S&T collaborations since its inception in 2000. As the binational body stepped into its ten years of existence, the Board deliberated upon the next decadal vision of IUSSTF aimed to discharge a larger and prolific role in promoting scientific and technological cooperation between India and USA, befitting the need and aspirations of all its stakeholders.

As part of the Decadal Celebrations of IUSSTF, Nobel Laureate Prof. Peter Agre delivered a captivating public lecture on "A life in Science" in New Delhi on December 8th, 2010. Prof. Agre is the director of the Johns Hopkins Malaria Research Institute and is currently the President of the American Association for the Advancement of Science (AAAS). He shared with the audience anecdotes from his childhood and early education in Minnesota. He spoke about his journey in science and the many remarkable associations he developed along the way. He impressed upon the audience the importance of team-work and camaraderie in science which is quite often the foundation of great discoveries. He then went on to elaborate his Nobel Prize winning work on the discovery of Aquaporins, a family of water channel proteins found throughout nature that is responsible for numerous physiological processes in humans and implicated in multiple clinical disorders. For this pioneering work, Prof. Agre shared the Nobel Prize in Chemistry in 2003.

Program Portfolio

IUSSTF promotes Indo-US Science and Technology partnerships by responding to the needs of its stakeholders in adopting a dynamic program portfolio largely conceived and driven by the scientific communities of both nations.

- Symposia, Workshops, Conferences on topical and thematic areas of interest
- Special initiatives on bilateral strategic partnerships
- Visitation program through fellowships and internships
- Industry – Academia connect programs
- Innovation programs to promote technoentrepreneurship
- Training programs and Advanced Schools towards human resource development
- Public-Private Networked Centers to foster pre-commercial R&D
- R&D Knowledge Networked Centers for promoting thematic research
- Centers of Research Excellence
- Travel Grants
- Flagship Initiatives for young scientists and technologists in partnership with US National Academies
  - Indo-US Frontiers of Science Symposium
  - Indo-American Frontiers of Engineering Symposium

Annual Report
Indo-US Science & Technology Forum

2010
Programmatic Activities
2011

FLAGSHIP PROGRAM

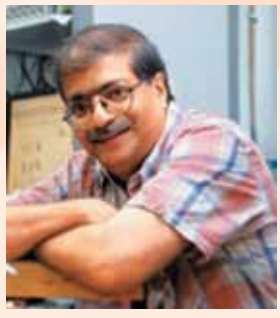
Fourth Indo-American Frontiers of Science Symposium

18-20 April 2011, Irvine, California, USA

Organizing Co-Chairs:
Sumantra Chattarji
National Centre for Biological Sciences, India
E-mail: shona@ncbs.res.in

Raissa D'Souza
University of California, Davis, USA
E-mail: raissa@cse.ucdavis.edu

The fourth **Indo-American Frontiers of Science Symposium** was convened by IUSSTF as its annual flagship event in partnership with the U.S. National Academy of Sciences (NAS) and was held at Irvine, California from 17-20 April 2011. The symposium brought together about 70 brilliant young scientists and technologists from Indian and US academia, laboratories and industry. At the symposium, attendees presented their talks as part of eight interdisciplinary sessions on contemporary research topics to colleagues outside their field with a view to both conveying and deriving cross-disciplinary



information and insights through a format, which allows informed one-to-one discussions amongst the participants.

The eight interdisciplinary sessions consisted of the following talks:

- ***Creative brain:*** Creativity, psychosis & human evolution: a panglossian perspective, and where ideas come from: the cognitive and brain bases of eureka! moments.
- ***Biological / biomimetic materials:*** Biological and biomimetic materials: nature's inspirations, and Synthetic mimics of biological materials.
- ***Future of freshwater supply – Himalayan glacier and river systems:*** Glacier changes and regional climate – past and present.
- ***Extinction causes and consequences: Population extinction:*** causes and consequences.
- ***Algorithms and big data sets: Networks challenge:*** where game theory meets network optimization; Sequencing the genome and what it tells us; and Algorithms for processing massive data streams.
- ***Genetic basis of variation in behavior, evolution and disease:*** Cracking the cancer code, and Ayurgenomics: old is the new new!.
- ***Topological order and quantum computation:*** Dirac physics in junctions of topological insulators.

- ***The role of organic synthesis in drug discovery:*** Small molecule transcriptional modulators, and Hybrid natural products: Nature's inspiration and opportunities for synthetic chemists.

FOS Awards have been instituted by IUSSTF with an objective to build long-term relationships between the young Indian and American scientific community and sustain linkages established during the symposium. The award consists of USD 25000 to be shared between the partnering Indian and American awardees, spread over a period of two years. This award enables the Indian and American collaborators and their research groups to visit and work in each others institutions. The following interdisciplinary proposals were selected for the 2011 FOS awards:

- ***Exploring natural products and hybrid natural products as probes of oncogenic transcription factors*** submitted by Krishna P. Kaliappan (IIT Bombay) and Angela N. Koehler (Broad Institute of Harvard and MIT)
- ***Development of a novel photo-activable cross-linking technique in the enteric pathogen, Entamoeba histolytica, to study protein-protein interaction*** submitted by Sunando Datta (Indian Institute of Science Education and Research, Bhopal) and Anna Mapp (University of Michigan, Ann Arbor)

Indo-US Engineering Education Conclave

10-11 January 2011, New Delhi, India

Organizing Co-Chairs:
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As part of the decadal celebrations of the Indo-US Science and Technology Forum, a high-level Indo-US Engineering Education Conclave on "Meeting Common Challenges: Strengthening Engineering Educational Institutions in India and the US" was held in New Delhi on 10-11 January 2011. This event was held in partnership with the Indian Ministry of Human Resource Development (HRD). The meeting was aimed to initiate a dialogue between senior educators to improve mutual understanding of the challenges faced by engineering educational institutions in both countries and explore possible activities and programs to meet these challenges.

The background for this meeting was based on four major interconnected challenges – changing students perception regarding engineering as a career; interdisciplinarity; societal and developmental needs; and globalization – issues that manifest themselves in both the US and India, although somewhat differently in each. On the US side, there is an increasing concern about recruiting and retaining science and engineering talent for the future, as highlighted in reports such as the US National Academies' "Rising above the Gathering Storm". Consequently, there has been a renewed focus on ensuring that there is a pipeline of talent

for engineering programs. Students must also be prepared for a future where the practice of engineering and development of new technologies increasingly draws on different disciplines (especially the natural sciences and social sciences), which requires managing the tension between disciplinary moorings and promoting interdisciplinary research and problem-solving. Also, a number of engineering schools have been directing research and education activities to develop a better understanding of, and engagement with, societal needs where engineering educational institutions could, and should, play an important role, especially through entrepreneurship and innovation.

In his inaugural address Mr. Kapil Sibal, Union Minister of HRD and Communications & Information Technology, Govt. of India, shared with the audience his vision for the Universities of the 21st century. He spoke about the necessity for the University system to "open up and embrace collaborative learning and collaborative knowledge production". The Minister also asked the delegates to deliberate over certain key issues that formed the basis for the ensuing discussions. Some of the questions and issues raised by him included the manner in which changes in the balance of power between higher education's different constituencies affect the social functions of higher education; how changes in the organization of higher education institutions relate to changes in intellectual programs and agendas; the role of national, regional and local contexts in determining the characteristics of modern higher education systems; and the role of public authorities and international connections, to name a few. Sam Pitroda (Chairman, National Innovation Council) and Charles Vest (President, National Academy of Engineering) delivered opening remarks on the "Role of engineering education institutions in the 21st century".

The various sessions consisted of focused discussions on Educational and Research challenges in US and Indian engineering education institutions; leading and managing engineering education institutions; and possible collaborative programs and activities. This conclave was both important and timely as a first step in a series of activities to initiate targeted inter-related collaborative programs that will help strengthen engineering education and research programs and institutions in both countries as well as allow them to work together to generate a positive societal impact.

PUBLIC-PRIVATE PARTNERSHIP PROGRAMS

DST-Lockheed Martin India Innovation Growth Program

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The DST-Lockheed Martin India Innovation Growth Program (IIGP) was launched in 2008 to enhance the growth and development of entrepreneurial economy in India by adopting the prevalent best practices both in the United States and India. IIGP is designed as an accelerated technology assessment and commercialization initiative through a business plan competition involving commercial assessment of technology; business development; and finally technology commercialization through structured mentoring. The program is jointly funded by the Department of Science and Technology, Government of India and the Lockheed Martin Corporation, a premier systems integrator and global security enterprise principally engaged in the research, design, development, manufacture, integration and sustainability of advanced technology systems, products and services. The IIGP is implemented by IC² Institute, University of Texas - Austin, the Federation of Indian Chambers of Commerce and Industries (FICCI) and IUSSTF.

The aim of this public-private initiative is to identify, award, mentor and hence accelerate innovative Indian technologies into new markets in India, United States and around the world. The unique feature of the IIGP is its focus on mentoring through professional business development engagement and applying world-class commercialization strategies to bright ideas that have potential towards market realization by a quick look commercialization analysis at IC² Institute and FICCI.

The program is open to technologies in areas such as aeronautics, agriculture, biotechnology, chemistry, communications, computing, defence, electronics, environment, IT, manufacturing, marine, materials, medical/life sciences, nanotechnology, etc.

The awardees of the DST-Lockheed Martin India Innovation Growth Program 2010 were:

Technology Name: **Biological neutralization of alkaline waste water**
Innovator: **Rita Kumar** (Institute of Genomics and Integrative Biology)
Technology Description: The technology is a biological process for the treatment of alkaline water from textile industrial waste water.

Technology Name: **Energy cakes**
Innovator: **Anil Kumar Singh** (Energy Research Applications)
Technology Description: It is a renewable energy technology that transforms industrial waste or biomass into cleaner fuel termed "Energy cake".

Technology Name: **Video communications for masses**
Innovator: **Hardik Sanghvi** (Vmukti Solutions Pvt. Ltd.)
Technology Description: This technology is a video communications cloud software platform that enables the convergence of voice, video and content over IP through a distributed peer-to-peer (P2P) platform.

Technology Name: **Clever texting**
Innovator: **Abhijit Bhattacharjee** (Luna Ergonomics)
Technology Description: Clever Texting is a limited keypad usability technology that allows the user to type in all languages of the world on the existing phone or existing keypad in a faster, simpler and ergonomic way.

Technology Name: **Natural formulation for chronic wound healing**
Innovator: **Manu Chaudhary** (Venus Medicine Research Center)
Technology Description: The technology is a synergistic poly herbal, topical formulation for healing chronic wounds and process of preparation.

Technology Name: **Man portable autonomous unmanned aerial vehicles**
Innovator: **Ashish Bhat** (IdeaForge Technology Pvt. Ltd.)
Technology Description: Man portable autonomous Unmanned Aerial Vehicles (UAVs) is a technology used for aerial surveillance and reconnaissance.

Technology Name: **Process for manufacture of sweetening catalyst Thoxcat ES**
Innovator: **M.O. Garg** (Indian Institute of Petroleum)
Technology Description: The technology is useful in extractive sweetening of LPG and liquid-liquid sweetening of lighter petroleum fractions, namely, light straight run naphtha (LSRN) and light thermally/ catalytically cracked gasoline.

Technology Name: **Shock wave treatment for bamboo**
Innovator: **Jagadeesh** (Indian Institute of Science)
Technology Description: This technology has been developed to impregnate preservatives into green/ dry bamboo.

Technology Name: **Oral sustained release nano-drug for treatment of tuberculosis**
Innovator: **Jitendra N. Verma** (Lifecare Innovations Pvt. Ltd.)
Technology Description: Oral-sustained release nano-drug is a long duration slow drug release technology for the treatment of tuberculosis including multiple drug resistant and extremely drug resistant tuberculosis.

Technology Name: **"MozziQuit" multi-purpose mosquito trap**
Innovator: **Ignatius Orwin Noronha** (Leowin Solutions Pvt. Ltd.)
Technology Description: The technology is a device that traps and instantly kills mosquitoes.

Technology Name: **Handheld digital retinal imaging system**
Innovator: **Anand Sivaraman** (Remidio Innovative Solutions Pvt. Ltd.)
Technology Description: This is a medical device for retinal imaging that consists of an illumination module, a camera module, a software module, a personal computer interface and an infant interface module.

Technology Name: **A new method for detecting diabetic neuropathy and predicting foot ulcer development**
Innovator: **C. Jairaj Kumar** (K.S. Hegde Medical Academy)
Technology Description: This medical device can be used for measuring the progression of neuropathy and predicting foot ulcer development.

Technology Name: **Active current conditioner**
Innovator: **Shwetank Jain** (P2 Power Solutions)
Technology Description: This technology involves an Insulated Gate Bipolar Transistor (IGBT)-based inverter as a building block for active current conditioner as a part of power quality enhancement and energy efficiency in facilities.

Technology Name: **Titanium based wonder gels for separation and degradation of organic dyes from aqueous solution**
Innovator: **Mohan K. Dongare and Shubhangi Umbarkar** (National Chemical Laboratory)
Technology Description: The technology is a novel titanium based gel adsorbent and photocatalyst for the separation of organic dyes from aqueous solution and its further photocatalytic degradation using solar light.

Technology Name: **Next generation holographic weapon sight**
Innovator: **P.T. Ajith Kumar** (Light Logics Holography and Optics)
Technology Description: This technology is used in the production of next generation holographic weapon sight elements that helps in improved aim sights for weapons.

VISITATION PROGRAMS

Indo-US Research Fellowships

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In an effort to augment scientific excellence in emerging areas of science and technology, IUSSTF announced the fourth batch of **Indo-US Research Fellowships** awarded to 27 outstanding young researchers from India below the age of 40, to carry out research in frontier areas of science and technology at a leading institution in the United States. This fellowship is aimed to introduce Indian scientists and engineers from leading academic institutions and laboratories, in the early stages of their careers, to research opportunities in the US thereby helping to forge long-term collaborative relationships and linkages between the scientific communities of the two nations.

This prestigious fellowship scheme was formally launched in August 2007 by T. Ramasami, Secretary-DST and Co-Chair, IUSSTF, and is implemented with funding support from the Science and Engineering Research Council (SERC) of the Department of Science and Technology (DST), Government of India. The fellowship will allow the awardees to spend between 3 to 12 months in any premier host institution in USA and will cover monthly stipend, return air-fare, preparatory allowances, conference allowances, etc.

The areas covered under the fellowship include atmospheric and earth sciences; chemical sciences; engineering sciences; life sciences; medical sciences; mathematical and computational sciences; and physical sciences. Researchers from academia and laboratories chosen for the 2011 awards are:

Aabgeena Naeem, Aligarh Muslim University, Aligarh
US Host: Douglas C. Goodwin, Auburn University
Subject area: Biophysics

Ajay Kumar Ghosh, Jadavpur University, Kolkata
US Host: Russell W. Giannetta, University of Illinois at Urbana Champaign
Subject area: Low temperature physics

Ashutosh Chamoli, National Geophysical Research Institute, Hyderabad
US Host: Anthony R. Lowry, Utah State University, Logan
Subject area: Understanding earthquake physics and the deformation cycle

Bhahwal Ali Shah, Indian Institute of Integrative Medicine, Jammu
US Host: Geert-Jan Boons, University of Georgia
Subject area: Glyco/carbohydrate chemistry

Debdas Roy, National Institute of Foundry and Forge, Ranchi
US Host: Carl C. Koch, North Carolina State University
Subject area: Nano-composite material

Gaurav Singhal, LASTEC, Defence Research and Development Organization, Delhi
US Host: Noel T. Clemens, University of Texas, Austin
Subject area: High speed gas dynamic flows

Sanjay Pandey, G.B. Pant Hospital, New Delhi
US Host: Abraham Lieberman, Muhammad Ali Parkinson Center of the Barrow Neurological Institute, Phoenix, Arizona
Subject area: Fall and Freezing of Gait (FOG) in Advanced Parkinson Disease

Kirti Gupta, Post Graduate Institute of Medical Education and Research, Chandigarh
US Host: Richard Gilbertson, St. Jude Children's Research Hospital Memphis, Tennessee
Subject area: Pediatric brain tumors

Kishore Kothapalli, International Institution of Information Technology, Hyderabad
US Host: Sriram Pemmaraju, University of Iowa
Subject area: Distributed algorithms

Madhavi Tripathi, Institute of Nuclear Medicine and Allied Sciences, Delhi
US Host: David Eidelberg, The Feinstein Institute for Medical Research, New York
Subject area: Positron emission tomography and network image analysis in Parkinson's disease and atypical parkinsonism

Md. Imtaiyaz Hassan, Jamia Millia Islamia, New Delhi
US Host: William S. Sly, Saint Louis University School of Medicine
Subject area: Structural genomics

N. Sudhakar, Sengunthar Arts and Science College, Tamil Nadu
US Host: Sheng Yang He, Michigan State University
Subject area: Molecular plant pathology/microbiology

Rajesh Singh, Indian Institute of Advanced Research, Gandhinagar
US Host: Javed Khan, Advanced Technology Center, Maryland
Subject area: Neuroblastoma, metastasis, apoptosis and miRNA

Raman Meenakshi Sundaram, Directorate of Rice Research, Hyderabad
US Host: Adam J. Bogdanove, Iowa State University
Subject area: Study of the molecular interaction between rice and the bacterial blight pathogen Xanthomonas oryzae p.v. oryzae (Xoo)

Ronojoy Adhikari, The Institute of Mathematical Sciences, Chennai
US Host: David Pine, Department of Physics, New York University
Subject area: Reversibility and irreversibility in non-equilibrium colloidal suspensions

Santosh Kumar Sahu, Indian Institute of Technology, Indore
US Host: Sripad T. Revankar, Purdue University
Subject area: Thermal hydraulics analysis

Saroj Panigrahi, University of Hyderabad, Andhra Pradesh
US Host: John R. Graef, University of Tennessee at Chattanooga
Subject area: Differential equations

Sharmistha Dutta Choudhury, Bhabha Atomic Research Centre, Mumbai
US Host: Joseph R. Lakowicz, University of Maryland, School of Medicine
Subject area: Photochemistry and fluorescence spectroscopy

Sudeb Dasgupta, Indian Institute of Technology, Roorkee
US Host: Kewal K. Saluja, University of Wisconsin-Madison
Subject area: Microelectronics

Susan Thomas, National Institute for Research in Reproductive Health, Mumbai
US Host: Stephan Schurer, University of Miami
Subject area: Computational drug discovery

Sushant Suresh Naik, National Institute of Oceanography, Goa
US Host: Jimin Yu, Columbia University, New York
Subject area: Paleo-oceanography

Surajit Borkotokey, Dibrugarh University, Assam
US Host: Sudipta Sarangi, Department of Economics, Louisiana State University
Subject area: Mathematical modeling of networks

Tamal Banerjee, Indian Institute of Technology Guwahati
US Host: Stanley I. Sandler, University of Delaware, Newark
Subject area: Molecular thermodynamics

Tapasya Srivastava, University of Delhi, New Delhi
US Host: Anindya Bagchi, Masonic Cancer Center, University of Minnesota
Subject area: Cancer Biology

Vijay Vasant Bokade, National Chemical Laboratory, Pune
US Host: Bruce E. Dale, Michigan State University
Subject area: Alternative fuels, energy and biomass conversion

Vinod Kumar, Defence R & D Establishment, Gwalior
US Host: Eric V. Anslyn, University of Texas at Austin
Subject area: Supramolecular chemical sensor and detection systems

Utpal Garain, Indian Statistical Institute, Kolkata
US Host: David Doermann, University of Maryland, College Park
Subject area: Information retrieval from optical character recognition of indic script documents

Stanford India Biodesign Fellowships

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The **Stanford-India Biodesign (SIB) Fellowship** is a leadership training program in biomedical technology innovation initiated by the Indian Department of Biotechnology (DBT), Govt. of India, and Stanford University in partnership with IUSSTF. The goal of this program is to train the next generation of biomedical technology innovators in India through a fellowship to be held jointly at Stanford University, the Indian Institute of Technology (IIT)-Delhi, and All India Institute of Medical Sciences (AIIMS), New Delhi. This program is directed to candidates with advanced degrees in engineering, medicine or business who could be potential innovators in early-stage development of new biomedical technologies for emerging healthcare needs.

Over the course of the one-year program, approximately half of the Fellows' time will be spent in India and the other half at Stanford University. The core objective of the program is a multidisciplinary team-based fellowship where SIB fellows will work with other young innovators with a combination of engineering, medical and industry backgrounds. The team will examine clinical needs within the Indian setting, identify opportunities for biomedical technology innovation with the goal to potentially invent, prototype, develop and patent one or more new technologies. Fellows will also be mentored by "real-world" experts from the biomedical technology, legal and venture capital industries both in the United States and India. The program would also include exchange of faculty between the academic institutions.

The 2008 SIB Fellows, Nish Chasmawala and Amit Sharma, have started a company ConSure Medical, which was recently recognized as one of the Top 75 startups in India to bet on by DARE magazine.

Four outstanding individuals were selected for the 2011 SIB Fellowship:

Avijit Bansal, with a background in Pulmonology

Ayesha Chaudhary, with a background in Biomedical Engineering

Chinmay V. Deodhar, with a background in Automotive Engineering

Mridusmita Choudhury, with a background in Biomedical Engineering

American Society for Microbiology (ASM) - IUSSTF Microbiology Visiting Professorships

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Under an arrangement between IUSSTF and the American Society for Microbiology (ASM), the **Indo-US Professorship Awards in Microbiology** were instituted in 2003 with the aim to foster scientific cooperation, education, training and capacity building at individual and institutional levels through exchange visitation. The ASM-IUSSTF Visiting Professorships award is administered parallel with the ASM International Professorship Program.

The program enables:

- Microbiologists in India and the United States to visit institutions in the two countries to teach an interactive short course on a topic in any of the microbiological disciplines (Teaching Professor)

- Microbiologists in India to participate in an interactive short course on a topic in any of the microbiological disciplines, or conduct a research project in partnership with colleague in a research facility in the US (Research Professor)

Open to ASM members and non-members alike, the program seeks to broaden collaboration between India and the US on issues of global concern. Up to eight Professorships are offered per program year.

The following visitations were awarded in 2010-11:

Atul Kumar Johri, Assistant Professor at Jawaharlal Nehru University, New Delhi visited Robert Stroud at the University of California, San Francisco for three months to undertake a research project on "Structural studies of a phsophate transporter gene (PiPT) from endophytic fungus *Piriformospora indica*".

Bijender Bajaj, Assistant Professor at the University of Jammu undertook a five-month research project on "Development of cost-effective technology for production of cellulase and xylanase enzymes with industrial process suitability" with Thaddeus Ezeji at the Ohio State University in Wooster, Ohio.

Vinayak Joshi, Associate Professor at Maratha Mandal's NGH Institute of Dental Sciences and Research, Belgaum, collaborated with Purnima Kumar at the Ohio State University, Columbus to work on a research project entitled "Relative contributions of diabetes and smoking to the subgingival microbiome".

IUSSTF-American Physical Society (APS) Fellowships

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IUSSTF and the American Physical Society (APS) have partnered to support a bilateral exchange program that includes the **Indo-US Professorship Awards in Physics** which will be awarded to faculties and scientists from India and USA every year to teach short courses or provide physics lecture series and the **Indo-US Physics Student Visitation Program** for student exchange every year. The program was launched in 2008.

'Professorships and Lectureships' consist of 1-2 week courses or a lecture series delivered at an Indian or US institution. Recipients are selected by a joint APS-IUSSTF review committee, with a call for proposals twice each year. Awards are typically used for travel, materials and expenses associated with course delivery. The objective of the Visiting Professorship is to enable physicists to build strong collaborative linkages in physics education and research between the scientific communities of US and India.

The Physics Student Visitation Program aims to mostly support graduate student travel to India by US citizens, while still enabling some students of Indian citizenship to travel to the United States. These studentship programs will help to build early career relationship between the next generation of physicists from US and India. The students can apply for this visitation program to attend a short-course, or summer training; to visit with a professor in his/her field of study; to work temporarily in a lab; or for any other opportunity that the student/professor feels is worthy of support.

The recipients of the **2010 Indo-US Professorship Awards** in Physics are:

Humphrey J. Maris, Brown University, Rhode Island
Host: Ambarish Ghosh, Indian Institute of Science, Bangalore
Subject area: Lecture course on "Supersolid helium, electrons in liquid helium, physics of nucleation and ultra-high frequency ultrasonics".

Irudayaraj Johnson, St. Joseph's College, Trichy
Host: Timothy Doyle, Utah State University, Logan
Subject area: Lecture series on "The effects and applications of ultrasound in nanomaterials, nano-thin films, and nondestructive evaluation".

Richard Packard, University of California, Berkeley
Host: Shobo Bhattacharya, Tata Institute for Fundamental Research (TIFR), Mumbai
Subject area: Lecture series on "Superfluid weak links".

The recipients of the **2010 Indo-US Physics Students Visitation** program are:

Aatish Bhatia, Rutgers University, New Jersey
Host: Ullas Kolthur and Himanshu Sinha, Tata Institute of Fundamental Research, Mumbai
Subject area: Theoretical physics and biological sciences

Amitai Bin-Nun, University of Pennsylvania, Philadelphia
Host: N. Dadhich, Inter-University Centre for Astronomy and Astrophysics, Pune
Subject area: Gravitational lensing and braneworlds

Benjamin Burch, Washington University, St. Louis, Missouri
Host: Pijushpani Bhattacharjee, Saha Institute of Nuclear Physics, Kolkata
Subject area: Dark matter detection

Chris Coleman-Smith, Duke University, North Carolina
Host: Dinesh K. Srivastava, Variable Energy Cyclotron Center, Kolkata
Subject area: Physics and astrophysics of the quark-gluon-plasma

James Matta, University of Notre Dame, Indiana
Host: Dinesh K. Srivastava, Variable Energy Cyclotron Center, Kolkata
Subject area: Physics and astrophysics of the quark-gluon-plasma

Joseph M. Grange, Fermi National Accelerator Laboratory, Illinois
Host: Mohammed Sajjad Athar, Aligarh Muslim University, Aligarh
Subject area: Experimental aspects of neutrino physics

Lovedeep Kaur Saini, Panjab University, Chandigarh
Host: Sridhara Dasu, University of Wisconsin, Madison
Subject area: Selection of events from Z+Jets processes in data from the Compact Muon Solenoid (CMS) detector and compaison to various Monte Carlo event generators.

Research Internships in Science and Engineering

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The Indo-US Science and Technology Forum supported **Research Internships in Science and Engineering (RISE) program** provides unique opportunities for science, technology, engineering and medical students from the United States to undertake internships in national laboratories, federal research centers, academic research institutes, and private R & D laboratories in India. Objectives of the internships are to provide students exposure to Indian S&T milieu, gain practical skills and develop collaborative networks. Internships are envisaged as a source of mutual cultural and professional enrichment for both the interns and their host institutions. The result will be the development of joint efforts that builds long-term collaboration and mutually beneficial professional relationships.

Indian and American citizens currently enrolled at a recognized institution of higher education pursuing Doctoral programs in science, engineering, technology and medical disciplines are eligible to apply for the internship. The internships will provide for monthly stipend, accommodation and airfare.

The RISE program was formally launched during the IUSSTF Governing Board meeting in December 2008 and was implemented from 2009.

The following 12 students interned in India under the RISE Program in 2010-11:

Aneesh Goly, Florida Atlantic University, Boca Raton, Florida
Mentor: P.P. Mujumdar, Indian Institute of Science, Bangalore
Subject area: Civil and ocean engineering

Ian Newborn, Carnegie Mellon University, Pittsburg, Pennsylvania
Mentor: Eswaran Subrahmanian, Centre for Study of Science, Technology and Policy, Bangalore
Subject area: Urban design and planning

Kraig Lee Popelka, Oklahoma State University, Stillwater, Oklahoma
Mentor: T. Ramprasad, National Institute of Oceanography, Goa
Subject area: Geology/seismology



Mathew S. Cherian, Massachusetts Institute of Technology, Cambridge, Massachusetts
Mentor: Kapali Viswanathan, HP Labs, Bangalore
Subject area: Computer Science

Ronald Dale Tyler Jr, Virginia Polytechnic Institute and State University, Blacksburg, Virginia
Mentor: B. Murali Manohar, Tamil Nadu Veterinary and Animal Science University, Chennai
Subject area: Veterinary pathology and comparative pathology

Ryan Francis Rundle, Florida Atlantic University, Boca Raton, Florida
Mentor: Bishwajit Chakraborty, National Institute of Oceanography, Goa
Subject area: Ocean acoustics

Sanjiv Kumar, Purdue University, West Lafayette, Indiana
Mentor: A.K Gosain, Indian Institute of Technology, Delhi
Subject area: Atmospheric sciences

Sayak Bhattacharya, Virginia Commonwealth University, Richmond, Virginia
Mentor: Rashna Bhandari, Centre for DNA Fingerprinting and Diagnostics, Hyderabad
Subject area: Physiology and biophysics

Simone Bianca Soso, Iowa State University, Ames, Iowa
Mentor: Mousumi Poddar-Sarkar, University of Calcutta, Kolkata
Subject area: Environmental sciences

Sivaram Ambikasaran, Stanford University, California
Mentor: Praveen Chandrashekar, Tata Institute of Fundamental Research, Bangalore
Subject area: Computational and applied mathematics

Sujit Kumar Mohanty, The University of Iowa, Iowa City, Iowa
Mentor: Ramaswamy Subramanian, National Centre for Biological Sciences, Bangalore
Subject area: Chemical and biochemical engineering

Vijay Sean Sajay Limaye, University of Wisconsin-Madison, Madison, Wisconsin
Mentor: Sreeja Nair, The Energy and Resources Institute, New Delhi
Subject area: Environmental sciences

Khorana Program for Scholars

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The **Khorana Program for Scholars** is a tripartite arrangement between the University of Wisconsin-Madison, the Department of Biotechnology, Govt. of India and the Indo-US Science and Technology Forum in order to enrich the scientific community of both nations. The program is named in honor of Dr. Har Gobind Khorana who won the Nobel Prize for his work at the interface of chemistry and biology in 1968 while a member of the UW faculty.

The Khorana Program is a summer internship program for Indian students (currently enrolled in B.Tech., M.Tech. and M.Sc. programs in Biotechnology) to undertake a research internship at UW for a period of 10-12 weeks. The program is in its third year of implementation. Out of a pool of more than 500 applicants each year, 12 students interned under the Khorana program in 2009 and 15 students were selected in 2010. This exchange program is aimed to foster and expand interaction between the Indian and U.S. scientific communities and prove to be transformative for both American and Indian students.

In 2010, the following 15 students attended a 10-week internship at UW-Madison:

Aayushi Uberoi, SRM University, Chennai
Advisor: Michael Hoffmann
Subject area: Analyzing the effects of mutations on the binding properties of SMAD3 in TGF-beta signaling pathway

Anantha Padmanabhan Raghuraman, BITS, Pilani
Advisors: Meyer Jackson and Michele Basso
Subject area: Voltage imaging studies on the superior colliculus in rats

Aparajitha Srinivasan, Cochin University of Science and Technology, Cochin
Advisor: Nihal Ahmad
Subject area: Role and functional significance of Sirt1 in melanoma

Apeksha Tare, Indian Institute of Science Education and Research, Pune
Advisor: Randal Tibbetts
Subject area: Emerging role of TDP-43 in regulation of notch signaling

Divyateja Adapala, Indian Institute of Technology, Madras
Advisor: Alessandro Senes
Subject area: Development of a method to measure transmembrane helix interaction in a cell-free expression system

Indroneil Ghosh, Indian Institute of Technology, Roorkee
Advisor: Timothy Donohue
Subject area: Lipid production from Rhodobacter sphaeroides

Kritika Kumar, Manipal Institute of Technology, Manipal
Advisor: Brian Pfleger
Subject area: Functional genomics-driven engineering of fatty acid overproduction in E. coli

Mohit Goel, Indian Institute of Technology, Guwahati
Advisor: David Beebe
Subject area: Design, fabrication, and optimization of microfluidic devices and in vitro microenvironments

Preethi Chegu, Indian Institute of Technology, Madras
Advisor: George Phillips
Subject area: Sequence analysis and modeling of cellulose synthase like (Csl) proteins

Sai Harisha Rajanala, National Institute of Technology, Warangal
Advisors: Paul Ahlquist & Johan den Boon
Subject area: Validation of gene expression data on HPV associated cervical cancer progression

Salman Hasan, Indian Institute of Science Education and Research, Kolkata
Advisor: Samuel Butcher
Subject area: Isothermal titration calorimetry of the RNA tetraloop-receptor motif

Samarjeet, Indian Institute of Technology, Kanpur
Advisor: Igor Slukvin
Subject area: Analysis of the differentially expressed genes during haematopoietic commitment

Shravan Sukumar, BITS, Pilani
Advisors: Sunduz Keles & Aseem Ansari
Subject area: Sequence specificity and fold structures of DNA binding molecules

Tapojyoti Das, Indian Institute of Technology, Kharagpur
Advisor: Alan Attie
Subject area: Determining the mechanism by which tomosyn-2 inhibits insulin secretion from pancreatic beta cells

Thiruvenkadam Shanmugam, University of Delhi, South Campus, Delhi
Advisor: Cameron Currie
Subject area: 16S survey of microbial communities associated with fungus-growing insects

The students visited UW-Madison from 30 May 2010 to 31 July 2010. The Khorana Scholars also got to present their work at the Student Symposium held at UW on 30 July 2010.

Viterbi – India Program

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An important aspect of engineering education in the 21st century is to provide the experience of international research to young scholars and a practical way to achieve this would be to foster their participation in international research programs. Such initiatives would offer them an array of experiences both academic and social that would help them gain a global perspective and prove invaluable in their professional careers through a cross-cultural exposure. To address this need for human resource development and capacity building in the field of computer sciences and electrical engineering, IUSSTF and the Viterbi School of Engineering at the University of Southern California partnered to launch the **Viterbi-India Program** between Indian institutions and the Viterbi School of Engineering.

The Viterbi-India Program is envisaged to provide an opportunity to the best and brightest Indian students to gain exposure and access to world class research facilities in the Viterbi School; promote research and capacity building in frontline areas of engineering and technology; encourage outstanding students to take up research as a career; and pave the way for the next generation engineers from India to interact with American peers, thus help building long-term R&D linkages and collaborations. The summer internship program is for Indian students currently enrolled in B.Tech. and M.Tech. programs in computer sciences and electrical engineering.

The following ten outstanding students have been selected for the program year 2011:

Amulya Yadav, Indian Institute of Technology, Patna
Advisor: Bhaskar Krishnamachari
Subject area: AI, robotics and mobile applications

Anurag Chaurasia,
Indian Institute of Technology, Rajasthan
Advisor: Craig Knoblock
Subject area: AI and networks

Apoorva Mahindra Athavale,
Indian Institute of Technology, Hyderabad
Advisor: Michelle Povinelli
Subject area: Quantum photonics and computing

Aravindh Mahendran,
International Institute of Information Technology, Hyderabad
Advisor: Gaurav Sukhatme
Subject area: Robotics, vision and cognitive science

Dibya Deepta Mishra, Indian Institute of Technology, Rajasthan
Advisor: Ellis Meng
Subject area: MEMS and Lab-on-chip

Kanika Narang, Indian Institute of Information Technology, Delhi
Advisor: Kristina Lerman
Subject area: Network security and biometrics

Karthik Narasimhan Rajagopal, Indian Institute of Technology, Madras
Advisor: Milind Tambe
Subject area: AI and algorithms

Prerit Terway, Indian Institute of Technology, Gandhinagar
Advisor: Shrikanth Narayanan
Subject area: Speech processing

Shiva Rudrani, Indian Institute of Technology, Madras
Advisor: Gerard Medioni
Subject area: MS research, face recognition and vision

Vishnu Vardhan Ratnam, Indian Institute of Technology, Kharagpur
Advisor: Urbashi Mitra
Subject area: Next generation mobile communication

Experiential Learning in International Agriculture

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To provide students with an exposure to the multi-dimensional issues affecting agriculture and agribusiness, Cornell University has collaborated with leading Indian State agricultural universities (Tamil Nadu Agricultural University, Coimbatore; Acharya N.G. Ranga Agricultural University, Hyderabad; University of Agricultural Sciences, Dharwad; and Govind Ballabh Pant University of Agricultural Technology, Pantnagar) and IUSSTF to jointly conduct a course on **Experiential Learning in International Agriculture.** Through the exchange program modules, students experience agriculture and rural development issues in upstate New York followed by field experience in India and finally present a group project paper. The course covers activities in the class room and library, field visits and hands-on laboratory work.

The program consisted of a Communication Module at Tamil Nadu Agricultural University, Coimbatore in the form of a workshop on communication skills designed to prepare the students for better communication during the course. The Indian students then visited Cornell University in the month of June 2010 to participate in the experiential field visits to farms and laboratories. The students then traveled to India in January 2011 and visited the states of Tamil Nadu, Kerala and Andhra Pradesh. Based on the interests of the scholars, they were divided into three thematic groups – Agricultural Systems, Rural Infrastructure and Value Addition.

The following 12 students (6 from India and 6 from the US) participated in the IARD program in 2011:

Amy Joy Nichols
Thematic Group: Rural Infrastructure
Project title: Rice is not enough: soil content, nutritional deficiencies and a developing community

Andrew Mark Mellinger Jr.
Thematic Group: Agricultural Systems
Project title: Issues and strategies related to agricultural water use in India

Brinda Rajendran
Thematic Group: Value Addition
Project title: Transgenic crops in India – an overview

Dhivya Rajasundaram
Thematic Group: Rural Infrastructure
Project title: Impact of gene revolution and public perception issues: an Indian perspective

Dhyaneswaran Palanichamy
Thematic Group: Rural Infrastructure
Project title: Hybrid vegetable seed production by self-help groups (SHGs) through seed villages in India

James Edward Keach
Thematic Group: Value Addition
Project title: Food on the edge: what is the place of underutilized crops?




Jennifer Elizabeth Spindel
Thematic Group: Agricultural Systems
Project title: Aflatoxin in developing countries: causes, effects, and strategies for intervention

Krishnadasan Ponnuswamy
Thematic Group: Value Addition
Project title: Milk by-products (whey proteins) and their utilization for nutrition and rural development

Marley Moore Lubin
Thematic Group: Rural Infrastructure
Project title: Mobile technology in rural India: telecommunications sector and agricultural productivity

Shashank Gaur
Thematic Group: Value Addition
Project title: Combating micronutrient deficiency through value addition of orphan crops in India

Shruti Anand
Thematic Group: Agricultural Systems
Project title: Problems and prospects of dryland agriculture in India

Veronica Rose Palladino
Thematic Group: Agricultural Systems
Project title: Biofortification in the context of India: Vitamin A deficiency and the potential of Golden Rice

BILATERAL WORKSHOPS

Early Detection and Early Treatment of Autism Spectrum Disorders

8-10 April 2010, New Delhi, India

Principal Investigators:
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Autism is a complex and pervasive disorder with often devastating effects on social, cognitive and language development. While formerly considered a low incidence disorder, autism spectrum disorder is now known to affect at least one in 150 persons, and this figure is consistent across all recent epidemiological studies regardless of nationality. Both behavioural and psycho-pharmacological interventions are being sought that will ameliorate some of the disability associated with autism, and there is evidence that intensive treatment early in life can improve the development of useful speech and decrease the severity of mental retardation.

In order to bring together American and Indian scientists to share information, identify common research interests, and provide the foundation for extended research collaborations, an Indo-US workshop on **Early detection and early treatment of autism spectrum disorders** was organized at New Delhi in April 2010. Seven American and eight Indian scientists participated in the event. Some of the talks presented at the workshop included New *directions in early detection-biological, behavioral and electrophysiological* (Geraldine Dawson, Autism Speaks, New York); *Early start Denver model* (Sally Rogers, UC Davis and Geraldine Dawson); *The Com Deall Program* (Pratibha Karanth, Com DEALL Trust, Bangalore); *Standards and guidelines for the assessment and diagnosis of young children with ASD* (Vikram Dua); *Alexa's playful learning academy for young children (PLAYC) program* (Aubyn Stahmer, Rady Children's Hospital, San Diego); *Early screening for autistic traits* (Jessica Greenson, UW Autism Center, Seattle); and *Motor skills assessment scales* (Jo Shear, University of California Davis).

Translating Molecular Cardiology into Clinical Practice

6-9 August 2010, Thiruvananthapuram, India

Principal Investigators:
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Globally, cardiovascular diseases are the number one cause of death and are projected to remain so. According to the World Health Organization, about 80% of these deaths occur in low and middle-income countries. If current trends continue, by 2015 an estimated 20 million people will die from cardiovascular diseases and it is estimated that 60% of the world's cardiac patients will be of Indian origin. Molecular cardiology is an area of cardiovascular medicine that aims to apply molecular biology techniques for the mechanistic investigation, diagnosis, prevention and treatment of cardiovascular disease. The remarkable advances that have taken place in this field during the past decade have raised hopes for innovative and dramatic improvements in the prevention, diagnosis and treatment of cardiovascular diseases. In order to bring together an outstanding panel of experts in molecular and clinical cardiology to discuss how advances in molecular cardiology could be exploited for addressing the challenges in prevention and treating cardiovascular problems in India, an Indo-US workshop on **Translating molecular cardiology into clinical practice** was organized at the Rajiv Gandhi Centre For Biotechnology (RGCB), Thiruvananthapuram.

Presentations during the workshop represented several important themes in advancing frontiers of molecular cardiology that included: vascular inflammation; vascular development; pathogenic mechanisms of cardiovascular diseases; newer diagnostic modalities such as genotyping, proteomic analysis and molecular imaging; regression of atherosclerosis; therapeutic use of stem cells; and novel therapeutic molecules. Several new developments were presented at the event such as the potential use of compstatin in the treatment of sepsis-related multi-organ failure; evidence in mice that H2S ameliorates oxidative and proteolytic stresses and protects endothelial-myocyte function in hyperhomocysteinemia; role of podoplanin and endothelial O-glycans in the separation of blood and lymphatic vessels during embryonic and postnatal development; mechanisms of phosphatidylinositol 4,5 bisphosphate (PIP2) signaling in vascular homeostasis and targeting PIP2 signaling for attenuation of Akt signaling and nitric oxide production; and novel stem cell-derived models for analysis of cardiovascular development.

The participants formulated new strategic approaches to translate the recent advances in molecular cardiology for clinical use and for the benefit of patients with cardiovascular diseases. **An MoU was signed between RGCB and Oklahoma Medical Research Foundation (OMRF) to set up a state-of-the-art research and knowledge center for cardiovascular diseases at RGCB. OMRF would render help to develop manpower for carrying out the research programs at RGCB through joint Ph.D. programs and faculty and fellow exchange programs.** Also as an outcome of the event, ten new joint projects were identified among the various participants.

Oral Immunization of Children in Low Income Countries and the Role of the Intestinal Microbiota in Regulating Immune Responsiveness

16-18 August 2010, Goa, India

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Over the past five decades since oral vaccines were first introduced, it has been observed that in developing countries immune responses are lower and less consistent than in more industrialized countries. Several reasons have been proposed for this difference, however, efforts to address these issues in real-world settings have been limited. In recent years, tremendous advances have been made in genetics, immunology, pathophysiology and disease, creating new tools and exciting opportunities for research. From the laboratory this research evolves into new applications for understanding the basis of disease and the host response to infection or vaccination and in this manner the research transitions from the laboratory into the community. In order to draw together basic and clinical scientists to create a platform for advancing translational research into oral vaccination, an Indo-US workshop on **Oral immunization of children in low income countries and the role of the intestinal microbiota in regulating immune responsiveness** was organized in Goa in August 2010.

The interactions between investigators in a diverse range of research areas linked by an interest in human immunology, intestinal microbiome and enteric infectious diseases acted as a catalyst for inter-disciplinary collaborative research between US and Indian scientists. New data with mono-, bi- and trivalent oral polio virus vaccines in use in northern India were presented by Hamid Jafari (National Polio Surveillance Project-WHO) and discussed by T. Jacob John (Christian Medical College, Vellore). The data from oral rotavirus vaccine trials in Africa and Asia were presented by Duncan Steele (PATH, Seattle). Earlier data on oral killed and live cholera vaccines, typhoid vaccines and Enterotoxigenic Escherichia coli (ETEC) vaccines were also discussed in light of what is now known about the immune response. New findings on the intestinal microbiome and on mixed infections were presented by David Relman (Stanford University, Palo Alto) and Colin Stine (University of Maryland Center for Vaccine Development, Baltimore).

The workshop helped to set a research agenda for India and encouraged scientists to enter into productive, innovative research collaborations that will seek to improve the health of the needy populations worldwide. Also as an outcome of the event, a list of potential studies was identified that would be submitted to the Department of Biotechnology, Govt. of India, for inclusion in the Vaccine Grand Challenges Program.

Women in Science

26 August 2010, New Delhi, India

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Inaccessibility of early science education in rural areas, restrictions on education of the girl child, inflexibility of the system to allow women to re-enter the workforce after a break, and gender-based inequities at work places are challenges that must continue to be addressed. Infrastructure development is in part the solution for rural inaccessibility issues, but there is much to be done in transforming societal mindsets so that every human being, irrespective of gender, has an equal opportunity to study science and to build a successful scientific career. Gender based inequities are common at workplaces and women are often underrepresented at senior levels in both the government and private sectors.

The Indo-US workshop on **Women in Science** was an attempt to assess the challenges for women in science in India, and recommend measures for addressing them. The workshop was inaugurated by Ambassador Timothy Roemer. Speakers at the inaugural session included Kiran Mazumdar Shaw (Chairman & Managing Director, Biocon), Kerri-Ann Jones (Assistant Secretary of State, Bureau of Oceans and International Environmental and Scientific Affairs) and T. Ramasami (Secretary, Department of Science & Technology, Government of India).

The various sessions dealt with themes such as Nurturing a science career, Women in science professions and Empowering women in science. The workshop recommendations emphasized on the need to have more government-run programs, to support technical training through e-education in rural areas, training for women attempting re-entry into the science workforce after family-related gaps in employment, and flexible job timings. The participants also suggested affirmative fiscal policies to encourage women in science – providing both incentives and recognition. Importance of mentors in education and career and using stories of gender equality in text books were points well received during the workshop. The participants emphasized on the need to have series of lectures or guest speakers at science colleges and institutions, as well as women's institutions, across the country.

Innovation Ecosystem Workshop

28-29 October 2010, Bengaluru, India

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The Indo-US Science and Technology Forum organized a two-day **Innovation Ecosystem Workshop** on 28-29 October 2010 in Bangalore, in association with the Federation of Indian Chambers of Commerce and Industry (FICCI) and the Defence Research and Development Organization (DRDO). The participants of this workshop included scientists and technologists from various DRDO labs and institutions. The resource persons were drawn from US industry (Lockheed Martin Corp.), academia, business associations, and government agencies.

The objective of the workshop was to create, nurture and support techno-entrepreneurial ecosystems. The workshop helped participants from DRDO to gain insights into the process of commercialization as technology moves from the lab to the marketplace. The workshop addressed elements of and models for successful innovation ecosystems through sessions on culture of innovation, diversity in perspective, encouragement of creativity and tolerance threshold for risk-taking. The practical implementation of these broad principles in industrial R&D scenarios for problem-solving was highlighted through case studies.

Issues in Computing Over Emerging Mobile Networks

31 October 2010, New Delhi, India

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Mobility is rapidly turning out to be a critical component of many next generation networking systems. Prominent among these include mobile vehicular networks, mobile social networks, mobile sensor networks, next generation cellular networks, mobile clouds etc. While computing in the presence of mobility has been a well studied topic, the emphasis has centered on only Mobile AdHoc Networks (MANETs). Unfortunately, many assumptions made in traditional MANETs like mobility models, purpose/scope of mobility, social aspects, network scale etc. do not hold true in many emerging mobile networks. Consequently, existing theories, architectures and protocols in traditional MANETs for issues like data delivery, data management, reliability, security, privacy etc. are not enough and need a ground-up redesign. Furthermore, a vast number of problems related to computing over wireless communications are emerging in mobile networks such as vehicular safety, fairness in content sharing, mobility centric threats and countermeasures, and performance of mobile cloud computing that are yet to be explored in detail. To address these issues, an Indo-US workshop on **Issues in computing over emerging mobile networks** was organized in New Delhi. The event was held in conjunction with the 29th International symposium on Reliable distributed systems.

Researchers made presentations on topics ranging from security in mobile networks to sensor applications for wildlife tracking. Also covered were networking layer protocols such as enhancement of TCP protocols, transmission capacity in wireless networks and end-to-end connection protocol in WSN. These presentations included not only practical and deployment issues, but also theoretical foundations.

Sedimentation, Erosion, Flooding, and Ecological Health of Rivers

1-3 November 2010, Kolkata, India

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Rivers are the integrators of all the natural and human activities that take place in its watershed. Over the last 100-150 years, the land use on almost all the river basins of the world have been altered significantly increasing watershed erosion, river sedimentation and flooding, both in magnitude and occurrence. All these factors have had an impact on the ecological health of rivers. This is quite true for river basins such as the Mississippi, Illinois, Missouri, and other rivers in the United States and the Ganges, Bhagirathi, Hooghly, Brahmaputra and other rivers in India. The Indo-US workshop on **Sedimentation, erosion, flooding, and ecological health of rivers** brought together scientists, engineers, and managers from India, and those working in the Upper Mississippi and Illinois River Basins in the United States.

The technical sessions covered river floods; erosion sedimentation, and geomorphology; ecology and ecological health; river management and restoration; river flows; soil erosion; water quality and aquatic zone hydrodynamics. In addition there was also a very well-received poster session.

The University of Illinois at Urbana-Champaign and the Indian Statistical Institute in Kolkata also signed a Memorandum of Understanding to enable collaborations between the two institutions.

Applications of Molecular Imaging in Health, Disease and Drug Discovery

8-10 November 2010, Hyderabad, India

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Molecular imaging is rapidly becoming the keystone for advanced biomedical research particularly in the preclinical field, where molecular imaging is being utilized for combined "theragnostics", a portmanteau derived from therapeutics and diagnostics. Molecular imaging modalities combined with nano- and meso-scale imaging probes, and targeting agents, are rapidly being developed for non-invasive imaging of various diseases, its progression and response to therapy.

The Indo-US workshop on **Applications of molecular imaging in health, disease and drug discovery** aimed to provide a platform where experts from the molecular imaging field and biomedicine interact, impart, and exchange ideas. Sixteen speakers from India and USA, who utilize optical, magnetic resonance, X-ray, or PET imaging presented their work as podium talks and plenary lectures. The technical presentations covered four imaging procedures for human and pre-clinical imaging systems and included optical, magnetic, nuclear and X-ray imaging systems. The latest advances in the development of new reagents that would enhance the contrast and resolution of molecular imaging at the cellular level and at the tissue level were described.

Recommendations that emerged as a result of the workshop included the following - usage of functional molecular probes for more sensitive approaches in optical imaging of normal and disease tissues; utilization of molecular imaging methodologies for early detection of cancer as well as delivery of drugs to targeted tissues; inclusion of multimodal or hybrid imaging approaches in both clinical and pre-clinical theragnostics; and the ***development of a specific collaborative project based upon the imaging of fibrotic tissues in the liver as a joint program between CCMB, Carestream R&D and Kit Lam's laboratory at the University of California, Davis.***

New Directions In Machine Learning, Game Theory, and Optimization

12-13 November 2010, Bengaluru, India

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With the virtual explosion in the magnitude of data being generated across the world – in fields as diverse as astronomy, biology, geology, and even defence – there is an urgent need for methods that can analyze such data and transform it into meaningful scientific conclusions. Machine learning, one of the fastest growing fields in computer science, holds the promise of providing such methods. These techniques are being used in computer vision to develop face recognition systems, in computational biology to discover new genes, and in drug discovery to prioritize chemical structures for screening.

The Indo-US workshop on **New directions in machine learning, game theory, and optimization** aimed to bring together leading researchers from India and the United States to share their perspectives on recent advances in the fields of machine learning, game theory, and optimization; and the challenges that lie ahead. The event included talks by eminent researchers from academia and industry, and a research poster session that included poster presentations by students and young researchers.

There were two primary recommendations coming out of the event. The first was to evolve a Center for Machine Learning at the Indian Institute of Science, which would build on the growing strengths in machine learning and related areas at the Indian Institute of Science, and more broadly, would help to create visibility for machine learning research in India as well as serve as a focal point for machine learning related activities in the future. The second recommendation was to enable sustained interactions and collaborations between Indian and US partners in order to develop talent in both countries at the emerging interface between machine learning, game theory and optimization, for example via an Indo-US Joint Center along this theme.

Biology of Fetal Growth Restriction

22-25 November 2010, New Delhi, India

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Intrauterine Growth Restriction (IUGR) is a highly significant problem affecting 25-30% of all pregnancies in India. Infants born Small for Gestational Age (SGA) have an increased risk of mortality and various morbidities in the neonatal period such as sepsis, birth asphyxia, hypoglycemia and hypothermia. While chromosomal anomalies, maternal under-nutrition or placental insufficiency can explain the growth restriction in some cases, a vast majority remain unexplained. The role of placental angiogenic and anti-angiogenic factors, hormones and growth factors and micronutrients such as folate, vitamin A, vitamin D and zinc in the pathophysiology of fetal growth restriction are areas of active research.

An Indo-US brainstorming meeting on **Biology of fetal growth restriction and catch-up growth in small for gestational age infants** was organized to discuss pertinent issues related to important fields of intrauterine growth restriction and catch-up growth in SGA infants and their long term health consequences. The aims of the meeting were to review the key issues in areas such as the epidemiology of fetal growth retardation, the biology of fetal growth in the context of IUGR, the clinical management of IUGR babies and the dynamics of catch-up growth in infants born small for gestational age.

Through the deliberations it was observed that India presents a unique opportunity to study the problems of fetal and infant growth because it has a dual burden of under-nutrition as well as diabetes at the same time, and therefore the entire spectrum of fuel-mediated-teratogenesis can be studied in the Indian population. Similarly, India presents a unique setting where the trade-off or cost-to-benefit analysis of short term morbidity (infections, under-nutrition) and long term metabolic risks (higher fat mass, insulin and leptin resistance) between slow and rapid weight gain in infancy can be studied. It was also felt that there is a critical need to develop infrastructure of centers of excellence, core data resources and training and fostering of future scientists.

Science Communication Awareness Creation

13-15 December 2010, Bengaluru, India

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Leading scientists and scientific organizations have identified public communication as a key element for the continuing development of science and technology. In India and the United States, where issues of ethnic, religious, or regional culture (including different languages) further complicate the process, and where different communities may have different understandings of what constitutes "reliable knowledge about the natural world", there needs to be an interdisciplinary dialogue between experts to evolve a common understanding of what constitutes the public and therefore, why science is understood the way it is.

In this context, an Indo-US workshop on **Science communication awareness creation** was organized to discuss the parameters that influence communication of science and the skills that are needed to be an effective communicator of science. The workshop aimed at strengthening ongoing

collaborations between academic institutions in India and the United States on issues of science communication – both training and research; developing science communication training workshops sensitive to cultural context for use in both countries; designing potential student exchange programs among institutions represented at the workshop; and creating substantial multi-disciplinary academic and practical contributions to the idea of "Science for all".

Emerging Issues in Energy and Environment Security: Challenges and Research Opportunities

13-15 December 2010, New Delhi, India

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An Indo-US workshop on **Emerging issues in energy and environment security: Challenges and research opportunities** was organized with the objective to continue efforts in mobilizing the academics of the two nations towards collaborative R&D for sustainable improvements in design and operation of processing systems especially energy and pollution abatement industries. The event was jointly funded by the National Science Foundation, USA. The workshop helped to identify the synergies in the research initiatives by the academics of the two countries, and served as a launching pad for further collaborative research with mutually beneficial objectives.

The main objective of this workshop was to have an exchange of scientific information and a dialogue between the American and Indian university faculty members on recent advances, mainly in the areas of conventional and alternative source of energy and their processes, which have a minimal pollution footprint on the globe and are sustainable in nature. Another goal was to inculcate a close long-term collaboration between the faculty members of these two countries for sustained interaction and mutually beneficial engagement. The effort of exploring fundamental new concepts that might lead to long-term solutions to the global energy and environmental challenges was to continue even after the workshop was over.

Essentially three sub-groups were formed - *Energy conversion and storage,* which covered work in the area of hydrogen energy and fuel cell, batteries, energy from biomass, photovoltaics; Cleaner coal technologies, which included novel and more efficient methods of exploiting the coal reserves in the two countries; and *Environmental challenges and sustainability,* which included clean air and water, CO_2 capture, multiple pollutant treatment with the use of photocatalysis, sonochemical methods, biological methods. The group also discussed life cycle analysis and sustainability in the context of energy processing and environmental stipulation. Faculty members were identified from both countries to work jointly on the above topics.

Nanotechnology in the Science of Concrete

14-15 December 2010, Roorkee, India

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Construction is one of the most strategic industries providing building and infrastructure to all sectors of the economy. It is a settled, cost-driven and traditional sector. Concrete is the most widely used man-made material in construction and cement is its main ingredient. Production of cement is a highly energy-intensive process and it accounts for approximately 7-8% of total CO_2 emissions. Recently nano-science has provided tremendous scope for technology development in the construction sector. Several applications have been developed to improve durability and enhance performance of construction components; to ensure energy efficiency and safety of buildings; to facilitate ease of maintenance and to provide increased living comfort. The use of nano-particles in developing new and innovative materials has gained widespread attention as it can lead to improvements in the nano-structure of building materials such as cement and concrete.

In order to provide a forum for interaction among researchers from both countries to explore broader strategies in this field, an Indo-US workshop on **Nanotechnology in the science of concrete** was organized at the Central Building Research Institute in Roorkee. The workshop highlighted the importance of recent advancements in the field of nanotechnology in cement science.

Several key issues were discussed during the two-day workshop and new developments in self consolidating concrete, nano-indentation, nano synthesis, modeling, durability of concrete etc. were presented. In addition, key problem areas and challenges were also deliberated and discussed. The deliberations helped identify the following areas for collaborative research efforts: characterization and modification of nanoparticles; understanding the basic molecular structure of Calcium-Silicate-Hydrate (C-S-H) gel; nanomaterials for infrastructure development; linking construction material from nanoscale to macroscale; detailed understanding of hydration process of cement/concrete based materials; and energy efficient and sustainable materials for buildings and infrastructure.

Physics and Applications of Quantum Phases in Condensed Matter

20-23 December 2010, New Delhi, India

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Condensed matter systems display a rich variety of quantum effects when subjected to low temperatures. The study of quantum phase transitions tuned by high magnetic fields, pressure and/or injected charge carriers is a field of contemporary interest. The discovery of new compounds; the ability to synthesize clean interfaces, heterostructures, tunnel junctions and field effect devices, which allow manipulation of carrier density in the material; clever ways of nano-structuring; and advanced imaging techniques have permitted visualization of quantum phenomena and simultaneously have opened up avenues for their technological usage. An Indo-US workshop on **Physics and applications of quantum phases in condensed matter** was organized to conduct a structured review of recent developments in quantum processes in low dimensional systems. The workshop was geared towards experimental low temperature physics research which is an area that needs to be strengthened.

The technical agenda of the workshop consisted of reviewing the recent developments in theoretical and experimental aspects of quantum processes such as: electron-electron correlations and correlations driven phase transitions; superconductivity and magnetism in correlated electronic systems; integral and fractional quantum Hall effect in new class of materials such as graphene, oxide interfaces and other novel 2D systems; and topological insulators in two and three dimensional systems. New developments presented at the event included composite fermion theory of fractional quantum Hall effect in Graphene; time reversal symmetry breaking in unconventional superconductors; new G-L like phenomenological theory of high Tc superconductors; Raman scattering and ultra-fast pump-probe study and Andreev reflection spectroscopy of pnictide superconductors; new collective modes in fractional quantum Hall effect in grapheme; and new generation modeling of highly resolved spectroscopies of solids.

Self-assembled Fibrillar Gels

5-8 January 2011, Thiruvananthapuram, India

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The field of gel research, especially molecular gels, has experienced an enormous growth in interest during the last two decades among scientists in very diverse fields, including organic chemists, theoreticians, molecular biologists, physicists and chemical engineers. Keeping in mind the enormous interest in fibrillar gels; the growing recognition that there are important, but not fully appreciated links between self-assembled and polymeric systems; coupled with limited interaction among gel scientists in India and the US; an Indo-US workshop on **Self-assembled fibrillar gels** was organized in January 2011 at Trivandrum.

A wide range of themes under the general area of 'fibrillar gels' was discussed – these included new organo- and hydro-gelators, enzyme-mediated gelation, nanocomposites based on gelators, functional gelators, rheological properties of gelators, structural studies of gels by neutron diffraction, theoretical understanding of the gelation process, etc. A few of the presentations, by design, addressed issues that are tangential to the current thrust of research in the area of fibrillar gels but which were potentially important to future advancements in the field. Most of the lectures included unpublished work of the investigators that included work being carried out on novel gelators, functional gels, application of gels, novel composite materials, application of new theoretical models for understanding the gelation process, etc. Thirteen of the student participants presented their work in the form of posters. They were on view and defended during three very well attended sessions, held on three separate days.

In fact, several new collaborations between Indo and US participants were established during the conference (Dong-Chan Lee, University of Nevada-Las Vegas and Subi George, JNCASR, Bangalore; Parthasarathi Dastidar, IACS, Kolkata and Srini Raghavan, University of Maryland; Braja Gopal Bag, Vidyasagar University, Medinipur and Richard Weiss, Georgetown University; Joykrishna Dey, IIT Kharagpur and Richard Weiss, Georgetown University; and Kevin Caran, James Madison University and Santanu Bhttacharya, Indian Institute of Science, Bangalore) and several others were being planned after email exchanges to define better goals and protocols.

Base Excision DNA Repair, Brain Function and Aging

6-10 January 2011, Hyderabad, India

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It is now clear that even the information-carrying master molecule, DNA, is not spared from attack by chemicals and free radicals in cells. This feature necessitated, over evolution, the development of defenses against such attacks. Hence various mechanisms to repair structural damage to DNA have evolved. As the complexity of organisms has grown, so have the many ways in which the DNA can be damaged. In responding to this, higher organisms have evolved both complex and specific DNA repair pathways to deal with such damages. Base Excision Repair (BER) is the pathway best equipped to handle oxidative and other common, small lesions in DNA, and therefore this pathway has a close link to free radical metabolism.

An Indo-US workshop on **Base excision DNA repair, brain function and aging** was organized to discuss the fundamental role of BER in health and disease, particularly in post-mitotic tissues such as brain, in a focused manner. The workshop shed light on interesting findings emerging from the labs in India and the US which would be central to organizing a collaborative effort in the field among the two countries. The workshop provided a platform for more focused collaborations, even at the clinical level that would help set an agenda to establish the precise role of BER in aging and other neurological disorders.

Several new developments were presented at the event and included new leads that point out the importance of BER DNA repair pathway in both health and diseases like cancer and Huntington, and general aging of post mitotic cells like neurons; studies revealing that mutator phenotypes of BER genes could responsible for cancer; that BER enzyme DNA Polymerase β may be involved in the causation of Down syndrome; and finally indications of improved genomic stability (in terms of cellular DNA single and double strand breaks) when experimental rats were fed with an Ayurvedic preparation - *Amalika Rasayana* for varying periods of time. A major and far reaching question that emerged out of this workshop was whether it would be possible to decelerate age-dependent general deterioration and appearance of neurodegenerative diseases if ways and means are found to maintain good level of BER repair pathway.

Science, Diplomacy and Policy

11-13 January 2011, Bengaluru, India

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An Indo-US workshop on **Science, diplomacy, and policy** was organized to strengthen the harnessing of the power of science diplomacy and to explore strategies for enhancing the capacity of both countries to conduct science diplomacy and cooperate on science components of global issues. The workshop was characterized by high-level participation by over 45 academics, current and former Ambassadors, Admirals, Government Secretaries and other officials from both nations. The workshop was inaugurated by Ambassador Ronen Sen. The keynote address was delivered by Alan Leshner (CEO of AAAS and Executive Publisher of the journal Science), who emphasized the role of S&T for building relationships between countries and exhorted the participants to come up with concrete suggestions for follow-up action. The various sessions covered a recounting of science and diplomacy in action; global issues in science and diplomacy; mechanisms in science and diplomacy; capacity building for science diplomacy; and the context for science diplomacy in both countries.

Five high-level conclusions emerged from the deliberations at the workshop; each underpinned by an increased level of scientific cooperation.

- With countries that have differences at the political level, science diplomacy through research cooperation and exchanges provides a good avenue for keeping channels of communication open and building trust.
- While it is neither generally desirable nor possible to convert diplomats into scientists, nor scientists into diplomats; it is useful for them to understand each other's language and compulsions. It was recommended that initially, the "Foreign Policy Institutes" in both countries build capacity in science diplomacy.
- India and the United States should explore the possibility of undertaking joint projects in third countries (such as in Afghanistan), focusing on projects that can synergize the relative strengths and knowledge base in both countries.
- The IUSSTF has successfully catalyzed collaborative S&T research projects in both countries and provided a mechanism for developing priorities for large-scale programs.
- Given the immense amount of goodwill and interaction that exists at the level of individual scientists, the scientific relationship would benefit again from commitments to major large-scale projects. For this to happen, barriers to mobility of scientists in both directions should be minimized, and increased levels of dedicated support should be explored. The success of 50:50 joint venture partnerships in the private sector provides one such model.

Nanosonics and Ultrasonics

12-14 January 2011, Trichy, India

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Dispersion and de-agglomeration by ultrasonication are a result of ultrasonic cavitation. Ultrasonication improves the mixing of the pre-cursors and increases the mass-transfer at the particle surface. This leads to smaller particle size and higher uniformity. The use of high-intensity ultrasound for food processing applications has been constantly explored. Extraction of gingerol from ginger, homogenisation of milk and generation of high quality emulsions from food ingredients are some examples where ultrasonication has been found to be efficient, at least in laboratory-scale trials. These ultrasonic processes primarily rely upon the physical effects of ultrasound. However, the potential restrictions and/or uses of the chemical effects generated by ultrasound-induced cavitation phenomena have often been overlooked. With this background, an Indo-US workshop on **Nanosonics and ultrasonics** was organized with the aims being to identify, focus, discuss and hence to solve the research problems associated with the application of high power ultrasound in food processing in order to make ultrasonic food processing a safe, viable and innovative processing technology in the food industry; and identify and discuss the applications of ultrasonics to nanomaterials (*Nanosonics*) which have manifold effects.

The new developments presented at the event included the possibility of breast cancer detection by ultrasound at an earlier stage; detection of tiny defects in welds by nano-technology and ultrasound; a novel online, non-destructive and non-invasive method for crystallization of food substances; and advanced blood characterization by nano-technology.

Transportation and Greenhouse Gas Emission

10-11 February 2011, New Delhi, India

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Greenhouse gas (GHG) emissions and their effects on global climate change are a major concern throughout the world. Transport is a key and crucial element in the infrastructure needed for the developmental process. Though transport makes a significant contribution to our national economy and to our quality of life, the negative impacts of transport on the environment include GHG emissions gases, air pollutants, noise, and damage to both natural and built environments. It is also a leading sector for energy consumption together with associated GHG emissions, and one of the most difficult sources to control. Addressing GHG emissions is a global issue requiring international action and cooperation. With this in mind, an Indo-US workshop on **Transportation and greenhouse gas emission** was organized. Significant issues with regard to transportation-related GHG emissions were explored through a series of technical sessions facilitated open discussions, and networking opportunities. Facilitated discussions explicitly explored lessons learned from each country and areas where India and the US can work beneficially together in follow-up activities.

The event brought together a range of participants representing the private and public sector, universities and research agencies from both India and the United States. The workshop included a series of five technical sessions spanning two days, in which topics ranging from broad policy overviews, inventory methods, sources and mitigation strategies, technological solutions, modeling approaches, policies and programs, and other transportation sector interventions were covered. The final plenary session of the workshop was a guided brainstorming session in which workshop participants discussed areas for future research and potential collaboration. It was noted that while policies, needs, and the local context may vary between India and the United States, the topic of greenhouse gas emissions from the transportation sector was one that provided many avenues for future research and collaboration – for example in mitigation strategies, inventory and modeling approaches and innovative data collection and use. The workshop also highlighted the opportunities for the research community and industry in India and the United States to learn from each other in tackling this global issue.

Effective Teaching in Engineering and Computer Science/Information Technology Programs

10-12 February 2011, New Delhi, India

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While initiatives to improve learning and teaching at the college/university level are in vogue in the United States with many universities establishing "Teaching and Learning Centers" to conduct research in this area as well as to disseminate best practices among teachers, this area is yet to pick up in India as the focus of education improvement is mostly on the subject areas themselves. Recognizing the need to begin a discussion on this important but overlooked topic in India, an Indo-US workshop on **Effective teaching in engineering and Computer Science/Information Technology programs** was organized to address wide spread concerns about the quality of education, and the desire and need in the country to rapidly expand the higher education sector.

Participants in this workshop included experts in teaching-learning from the United States, and respected academicians from India. Discussions were initiated on the important area of pedagogy at the University/College level. The workshop generated interest in various quarters about the importance of this area and the need to conduct research. The participants also initiated a discussion on establishing a center on teaching and learning in India in collaboration with such centers that already exist in various Universities in the US.

Highlights of scientific and technical presentations / deliberations along with the new developments and major recommendations of the event can be accessed at:
http://www.iiitd.ac.in/indo-us/index.html

Skeletal Dysplasia

12-13 February 2011, Lucknow, India

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A common medical condition as a group, skeletal dysplasia, is a major cause of morbidity all over the world. Significant advances in understanding of clinical manifestations, pathophysiology and genetic defects have had a tremendous impact on patient care, teaching and research in this field. In order to facilitate a meeting of scientists from India and United States to share clinical experiences, create awareness on recent advances, and explore the possibility of collaborative efforts in training manpower and research in this field, an Indo-US workshop on **Skeletal dysplasia** was organized at the Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow.

The workshop enabled a confluence of the technical expertise from the United States and the huge, diverse population (and patients) in India by enhancing knowledge and understanding in the areas of diagnosis, treatment and care for patients with skeletal dysplasia. The eminent US and Indian faculty deliberated on all the aspects of skeletal dysplasia which included anatomy, clinical evaluation, radiological analysis, genetic testing, pathophysiology, animal models, specific therapy, supportive/rehabilitative care, genetic counseling, prevention and prenatal diagnosis. **As a result of the event, Sanjay Gandhi Postgraduate Institute of Medical Sciences will now participate in the *Skeletal Dysplasia* Registry at Cedars-Sinai Medical Center, Los Angeles.**

Translational Cancer Biomarker Discovery and Prevention

13-17 February 2011, Bengaluru, India

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Global reduction in cancer mortality can be achieved by dissemination and implementation of cost effective early detection and preventive interventions for populations at risk. There is a significant disparity in these efforts between developing and developed nations. As cancer becomes the leading cause of mortality in developing countries such as India, it is important that population-specific preventive strategies are developed to reduce cancer related mortality. The Indo-US workshop on **Translational cancer biomarker discovery and prevention** brought together leading scientists, clinicians and policy makers from the United States and India to discuss and develop cancer preventive strategies which could be adopted to decrease the cancer burden around the globe.

The major aims of the workshop were to identify mutually beneficial translational cancer prevention research questions that address early detection of cancer and prevention priorities; compare population-based gene-environment interactions in India with those of other countries; and review preventive strategies in organ site specific high incidence and mortality cancers common to India and the United States.

As part of the developments presented at the event, discussions concentrated on cancer screening and epidemiology (mainly focused on the challenges faced by large scale screening programs and the significance of targeted chemoprevention in cancers of breast, cervix, and head and neck). The use of PPARγ activators such as Pioglitazone and EGFR inhibitors (Erlotinib) in chemoprevention were discussed. Early detection methods for the cancers of the oral cavity and cervix were debated upon; the established methods such as visual examination were compared with the others like optical property changes, spectroscopy, in vivo microscopy and salivary electrofluidics. One of the major developments in biomarker discovery that were discussed at the workshop included the utility of miRNA as diagnostic and prognostic markers in lung cancers and oral cancers. The use of next generation sequencing methods such as exome and transcriptome sequencing as a strategy for biomarker discovery were also discussed; identification of gene fusions, their functional relevance and utility as therapeutic targets being the main focus. At least nine different joint projects were identified as an outcome of this workshop.

Modern Trends in Macromolecular Crystallography

21-23 February 2011, Mumbai, India

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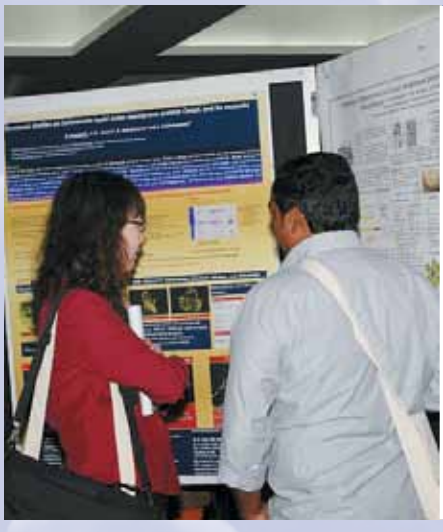
Macromolecular crystallography has undergone rapid transformation in the past few decades. X-ray Structure of biological macromolecules can illuminate vast amount of information about the functioning of the cell. Since the advent of macromolecular structure determination with the first protein structures of myoglobin and hemoglobin being determined, the field has seen a complete metamorphosis. From a structure determination effort, what used to take years earlier can now be completed, sometimes, in a few hours, because of the availability of synchrotron radiation and extensive effort on software development. There has been a dramatic rise in the total number of protein structures deposited in the protein databank. In addition, several structure determination consortia have also been formed in an effort to mine data for future use.

In an effort to bring together scientists from both India and the United States to discuss the basic concepts and the current developments in the field of macromolecular crystallography, an Indo-US workshop on **Modern trends in macromolecular crystallography** was organized at New Delhi. The topics covered in the various sessions included synchrotron data collection and processing strategies, macromolecular protein complexes, structure based drug design, structure determination and phasing techniques, crystallization techniques, emerging trends in macromolecular crystallography, data collection and processing, phasing techniques, crystallization and cryo-freezing techniques, and model building and visualization software.



Precision Agricultural Techniques and Technologies

28 February - 3 March 2011, Ludhiana, India

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In order to provide a platform to US and Indian experts to share their current knowledge, discuss, prioritize and identify areas where there is mutual interest for collaboration, a bilateral workshop on **Precision agricultural techniques and technologies** was organized at Punjab Agricultural University, Ludhiana. Precision agriculture is an art and science of utilizing advanced, innovative, cutting edge, site-specific techniques and technologies for management of spatial and temporal variability in farm fields for enhancing productivity, efficiency and profitability of agricultural production systems. With a major population increase in the world over the next 20 to 50 years, precision agricultural techniques have to be employed to overcome the lag in potential agricultural yield.

The event held at Ludhiana was attended by about 50 participants including twelve resource persons from the United States and fifteen from India. Besides the overview session, the workshop themes covered - constraints and opportunities for agricultural production in India; precision agricultural practices and opportunities to incorporate new techniques; precision water management techniques and new technologies for enhancing food production; precision nutrient management techniques and new technologies for enhancing food production. The final session discussed and enumerated opportunities to collaborate. There were also several farmland visits organized as a part of the workshop.

Aging and Age-related Diseases

3-4 March 2011, New Delhi, India

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Advancements in medical sciences and improved living conditions have led to a dramatic increase in the average human life span over the last century. This in turn has seen an increase in elderly population as well as age-related diseases in many countries, including the US and India. Thus, a lot of research focus is being diverted into the field of aging research as well as on diseases that occur primarily as we age. A large group of scientists in US are actively working in the field of aging/longevity. In order to introduce the field of molecular aging research to Indian scientists as well as host a close interaction between scientists of the two countries to discuss progress in research oriented towards understanding age-related diseases, an Indo-US workshop on **Aging and age-related diseases** was organized.

The symposium had four main sessions on metabolism and aging; *signalling, development, stress and aging; genomic instability and aging;* and *age-related diseases*. Many interesting new developments were presented at the meeting including: therapeutic interventions that delay or reverse osteoporosis in a mouse model; work on biphenyl ethers that can bring about fibril disruption which has great implications in treatment of amyloid diseases; data on identifying PGC-1 as a novel coactivator of p53, linking metabolism and cancer; reactive oxygen species-sensitive cellular mechanism of iron deposition in hepatic and neuronal cells that may contribute to age-related hepatic iron overload or neurodegenerative diseases; and studies indicating that structural and epigenetic integrity of telomeres may influence senescence by modifying core histones and their chaperones.

The Critical Global Challenge: Managing Water Resources for Food Security and Sustainability

5-6 March 2011, Chennai, India

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As leading global food producers, India and the United States also are leading irrigators and consumers of water, making it critically important that we work towards greater water productivity in agriculture in order to maintain – and increase – the food production that is critical to world food security. Our countries have differences in our histories, resources, needs, and approaches to water management in agriculture, but we share many of the same challenges, particularly in the areas of water quantity and quality, efficient use of water in irrigated and rain-fed agriculture, the effects of climate change, and the human dimensions of water use, involving policy, law, and human behaviour. Water-related challenges in the United States, India, and globally arise from multiple causes, and potential solutions will demand diverse approaches. India and the United States, with their common role as key food producers and their diverse expertise and resources, together can create the innovative solutions needed to increase agricultural productivity in a time of increasing demand for water and climate uncertainty.

The Indo-US workshop on **The critical global challenge: Managing water resources for food security and sustainability** brought together leading scientists and decision-makers from US and Indian institutions and the private sector to address the issues and challenges surrounding water and food productivity, an area of critical interest to both countries. The participants discussed potential paths to solutions and established priorities for innovative research, technologies, and policies related to the optimal use and management of water for agriculture.

Climate Change Health Adaptation

28-30 March 2011, Mumbai, India

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Current domestic and global climate science is largely focused on efforts to mitigate climate change. However, given experts' predictions of increased temperatures, rising sea levels, and changing disease patterns, there is a pressing need for enhanced scientific research on climate adaptation with a particular focus on the public health implications of global warming for the world's most vulnerable populations. Preparing for, and responding to, health emergencies caused by a changing climate will be critical to saving lives around the globe and protecting developing economies. However, in both the United States and India, efforts to model, understand, and research shifting climate patterns and exposed communities are still in early stages. The Indo-US workshop on Climate change health adaptation brought together leaders in this field to discuss strategies for the development and implementation of vulnerability assessments and related preparedness plans. Through the workshop, the aim was to increase the resilience and responsiveness of Indian urban centers to climate health emergencies. The conference also promoted enhanced scientific research on climate health adaptation both domestically and globally.

Over the course of three days, the workshop covered a vast range of topics. An introduction on heat stress was provided to familiarize all participants with the health effects of extreme temperatures and how heat stress affects other climate-health impacts including chronic diseases, infections and air pollution related conditions. Scientists from the US shared case studies, research methodology, study protocols and findings from heat stress studies in

America. Subsequently, Indian scientists shared information from occupational health studies and heat-related productivity studies. Participants from the Ahmedabad Municipal Corporation shared the city's climate profile, the municipality's experience with heat stress, and measures currently being undertaken to address heat vulnerability. There were discussions about the availability of datasets and the lack of surveillance of heat related mortality and morbidity in hospitals. Workshop participants also engaged in detailed discussions in two working groups: environmental and community determinants of vulnerability, and influences on adaptive capacity. Each working group identified the availability of data to address key questions, data gaps and methods to overcome them, institutional opportunities and institutional challenges. The groups further discussed policies and programs currently in place to address risks, gaps in current policies and programs, possible future approaches to identify vulnerability and create resilience against heat stress, and methods to remove existing barriers for effective, low cost adaptation measures against heat stress, including infrastructural, behavioral and institutional/legal.

TRAINING PROGRAMS

Comprehensive Stroke Center Training Program

9-11 December 2010, Chandigarh, India

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Stroke is the second most leading cause of death worldwide. In the United States, approximately 700,000 people have a new or recurrent stroke annually. In the developing world, stroke causes around 3 million deaths. In India, stroke incidence is around 146 per 100,000 people and it is predicted that in the next 30 years, the burden of stroke is going to increase in the developing world. An efficient stroke care system is central to the management of stroke.

The Indo-US **Comprehensive stroke center training program** was aimed to deliver training in the development of stroke systems and care to physicians in India by experts from the United States. The Indian physicians, chosen from various regions of the country for this training, would in turn be able to serve as leaders in stroke education in their respective regions of the country. The meeting covered all aspects involved in stroke management-basic science, acute management, stroke nursing and rehabilitation. The highlights of the event were presentations on development of criteria and importance of primary and comprehensive stroke centers in stroke care, various case scenarios on different aspects of stroke like acute treatment decision making, stroke complications, and critical-care issues in stroke. An expert panel session was also held on myriad stroke where debates were held on a myriad of stroke neuroimaging signs which aimed at improving the skills of the audience. There were also lectures on the use of various interventional devices / ultrasound in the treatment of acute ischemic stroke, as well as their indications and rationale for treatment beyond guidelines in certain situations.

Genes, Circuits and Behavior

7-18 February 2011, Bengaluru, India

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Genetic studies of diseases that affect human behavior such as schizophrenia and manic depression suggest that while the underlying cause maybe genetic, environmental factors are hugely influential in disease manifestation and progression. To understand genetic versus environmental contributions to behavior, it is necessary to study it in a context where both can be manipulated. The Indo-US advanced school on **Genes, Circuits and Behavior** organized at the National Centre for Biological Sciences, Bangalore began by establishing how genes and environment affect behavior in a relatively simple genetic model - *Drosophila melanogaster.* It then proceeded to discuss how genetic findings from *Drosophila* have helped understand more complex vertebrate neural circuits and behavior. The training brought together graduate students, post-docs and junior faculty and energized them to think about questions in human behavioral neuroscience and how these can be addressed using simpler genetic models like *Drosophila*.

The training program consisted of eighteen lectures; nine sessions for literature discussion and data analysis by students with the resource persons; and one session for a hands-on workshop on "Flycircuit".

SERC School in Neuroscience

21 February - 6 March 2011, Manesar, India

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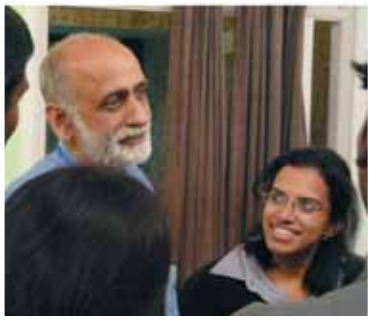


Systems neuroscience encompasses the functioning of neural circuits and information flow within the central nervous system. Research in this area focuses on how sensory information is processed and perceived, after which the brain makes decisions to respond appropriately, leading to different kinds of behavior, expressed through the motor system. The term 'Cognition' encompasses the different neural processes by which the brain represents and makes sense of the myriad forms of information it receives, resulting in a unified sense of the world. The Fourth **SERC School in Neurosciences** was specifically aimed at attracting young researchers to work in these areas by imparting intense training in both basic and advanced aspects of research in systems and cognitive neuroscience.

US and Indian experts in systems and cognitive neurosciences were invited to give lectures and demonstrations for the selected participants from different parts of India after a rigorous selection process. The first week of the school was mainly devoted to systems neuroscience, including introductory lectures and demonstrations to provide the basics of neuroscience. Lectures on speech and language; the olfactory, motor, somatosensory and auditory systems; and an introduction to magnetic resonance imaging (MRI) were included. The participants visited the MRI Centre in AIIMS, New Delhi over the weekend for a detailed demonstration of MRI-related techniques. The second week focused on cognitive neurosciences with experts in the field speaking about attention, language processing, EEG, memory, executive functions, cognitive disorders and cognitive retraining.

CENTERS FOR RESEARCH EXCELLENCE IN SCIENCE & ENGINEERING

Indo-US Centre for Research Excellence in Science and Engineering (CRESE) on Fabrionics

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With the emerging capabilities and rapid progress in the fields of molecular engineering, micro and nano-system technology, material science and computer engineering, the ability to manufacture micro- and nano- sized devices and autonomous machines will bring unprecedented changes in human society. The challenges are primarily a result of the current trend for miniaturization, development of new exotic nonmetallic materials and the lessons our scientists and engineers are learning from nature. Having identified and recognized this emerging new branch of technology through deliberations at the Indo-US Workshop on *Futuristic Shaping Technology at Meso, Micro and Nano Scales* held at IIT Kanpur in 2007, the participants coined the term "Fabrionics" to connote this multi-disciplinary facet of engineering sciences.

Based on the collaborative research and development work achieved under the umbrella of the earlier IUSSTF supported *Indo-US Joint Centre for Advanced and Futuristic Manufacturing,* a consortium was formed through the signing of an MoU by the five collaborating universities - IIT Kanpur; and IIT Kharagpur from India along with the University of Illinois-Urbana Champaign; University of California, Irvine; and Northwestern University, Evanston, Illinois. Considering the outcome and achievements of the Joint Centre on Advanced Manufacturing, IUSSTF in partnership with Department of Science and Technology awarded the *Indo-US CRESE on Fabrionics* in order to consolidate and continue the collaboration for by intensifying the academic cooperation through enlarging the participating group by inducting new institutions to bring in a multi-disciplinary expertise along with the active involvement of industry and entrepreneurs required to translate the R&D outcome. Each year, two workshops are organized – one in the US and one in India. Besides this, two lecture series for students have also been arranged that will result in books published by Springer. New smart materials for micro actuator, processes for micro forming and machining, different types of biosensors and some advanced nano- structured materials have already been developed.

The primary areas chosen for **R&D project** based work by the CRESE in Fabrionics include:

- New strategies/approaches for Fabrionics and shape generation through material manipulation at meso, micro and nanoscales;



- Fabrication at small scale using exotic materials-soft materials, bio materials, polymers, gels, composites etc;
- Fabrication and use of carbon Nanoelectromechanical systems (NEMS)/ Microelectromechanical systems (MEMS);
- Generative manufacturing processes-direct metal deposit techniques for micro sized parts;
- Shape generation by self assembly technique and self patterning;
- Micro fluidic-based micro devices;
- AFM based technology for mRNA isolation and protein sequencing;
- Smart material actuated micromechanism and micro devices;
- Protein motors for actuating autonomous nano robots and manipulators;
- Micro machine tools and micro factories;
- Hybrid multi-scale process development; and
- Developing the curriculum for joint teaching programs on "Fabrionics".

Research projects awarded

Consequent to the institution of the IUSSTF supported joint center has led to the following research projects getting funded to the respective partnering groups:

(i) *Characterization of μ-EDM* (PI: J. Ramkumar, IIT, Kanpur) funded by Department of Science and Technology, Govt. of India

(ii) *Development of multi-purpose micromachine tools for milling and EDM* (PI: Naga Hanumaiah, CMERI) funded by the Council of Scientific and Industrial Research, Govt. of India

(iii) *Magnetic field -assisted material removal in micro electric discharge machining process* (PI: S.G. Kapoor in collaboration with IIT, Kanpur and CMERI) funded by NSF for 3 years (2010-2013; $375,000.00)

(iv) *Laser-induced plasma micro-machining* (PI: K.F. Ehmann in collaboration with CMERI and IIT, Kanpur) funded by NSF for 3 years (2010 - 2013; $411,808.00)

Patents filed

(i) Ghubade A., Mandal S., Chaudhury R., Singh R.K., Singh D., Gurunath R. and Bhattacharya S. Title of the invention: *Integrated di-electrophoresis based concentration of pathogenic bacteria and quantization using ImageJ.*

(ii) Singh R.K., Basu B. and Bhattacharya S. Title of the invention: *A novel 2/3-Dimensional Soft-lithography technique to formulate micro-channels and evaluation of various associated mechanical and biological phenomena.*

As an outcome of the Centre activities the following **research publications** have been already generated:

(i) Sharma C.S., Sharma A. and Madou M. (2010) *Multiscale carbon structures fabricated by direct micro-patterning of electrospun mats of SU-8 photoresist nanofibers.* Langmuir 26: 2218–2222

(ii) Ghubade A., Mandal S., Chaudhury R., Singh R.K. and Bhattacharya S. (2010) *Dielectrophoresis assisted concentration of micro-particles and their rapid quantitation based on optical means.* Biomedical Microdevices DOI: 10.1007/s10544-009-9316-6

(iii) Bhattacharya S., Singh R.K., Mandal S., Ghosh A., Korampally V., Bok S., Gangopadhyay K. and Gangopadhyay S. (2010) *Plasma modification of polymer surfaces and their utility in building Biomedical Microdevices.* Journal of Adhesion Science and Technology 1-32

(iv) Ray M., Basu T. S., Jana A., Bandyopadhyay N. R., Hossain S. M., Pramanick A. K. and Klie R. F. (2010) Luminescent core-shell nanostructures of silicon and silicon oxide: nanodots and nanorods. Journal of Applied Physics, 107: 064311

Indo-US Centre for Research Excellence in Science and Engineering (CRESE) on Advanced Materials Research

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Indian Institute of Science, Bangalore
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With a continued push for miniaturization and the impending roadblock of fundamental physics constraints on the current silicon technology paradigm, there is an urgent need to diversify and enhance the back-bone technologies for the 21st century. This would require not only innovation in electronics but also in information storage, transfer and display to create science-enabled sustainable growth of a globally viable "eco-system" for developed and developing economies. Innovations in quantum materials/phenomena are critical to replace and/or complement existing architecture.

The Center for Advanced Materials Research (CAMR) set up in partnership with Department of Science and Technology has been anchored by the respective institutions leadership in materials research, leveraged by established grass-root collaborations and cross-institutional bridge-building. The areas of collaboration being carried out cover broad emerging materials critical for advancing next generation information technology and include nanomaterials, soft matter, molecular electronics, structure- property relationships and computational modeling. The areas being studied are timely and have considerable potential for both advances in fundamental research as well as technological applications.

The objectives of the CRESE on Advanced Materials Research include the establishment of grass-root collaborations and cross institutional bridge – building initiatives as well as out-of-the box cyber enabled global education, training and outreach Programs. The centre also promotes the exchange of graduate students, post doctoral fellows and faculty members between partnering institutions.

Some of the collaborative work which has been initiated under this CRESE includes:

- Evaluating polymer materials used in n-type field effect transistors (FETs) and comparing the field effect mobility to bulk mobility;

- Defining a research problem to identify features in the optical properties transparent FETs and determine time scales for switching responses;
- Exploratory work on properties leading to efficient solar cells. A paper which describes a bilayer FET is under preparation;
- Molecular dynamics force fields to simulate DNA in water and also SIESTA calculations; and
- Experiments on one-pot synthesis of gold nano-particles in poly (dimethylsiloxane) and how to pattern the metal layer that forms on the surface of the Au-PDMS gel with prolonged exposure to KAuCl4.

Research publications generated in 2010-11

(i) Rao M., Ortiz R.P., Facchetti A., Marks T.J. and Narayan K.S. (2010) Studies of photogenerated charge carriers from donor-acceptor interfaces in organic field effect transistors: Implications for organic solar cell. The Journal of Physical Chemistry C, 114: 20609

(ii) Gopalakrishnan K., Joshi H.M., Kumar P., Panchakarla L.S. and Rao C.N.R. (2011) Selectivity in the photocatalytic properties of the composites of TiO2 nanoparticles with B- and N-doped graphenes. Chemical Physics Letters, doi:10.1016/j.cplett.2011.06.033.

As part of the visitations under the CRESE, four scientists from India visited their collaborators in the US and four US scientists visited their Indian counterpart institutions. In addition, as a part of the CRESE activities, an US-India-Israel workshop on *Nanoscale phenomena in soft and hybrid matter* was organized in March 2011. The event focused on exploring scientific and technical areas of mutual interest in the field of soft and hybrid matter, encompassing nanoscale phenomena. The workshop deliberated on one- and two-dimensional materials, metal and semiconductor nanoparticles, energy solutions, biological systems, modeling complex systems, optical phenomena, and transport via molecular junctions.

Indo-US Centre for Research Excellence in Science and Engineering (CRESE) on Nanobiotechnology

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Other Partners:
Harvard-MIT Division of Health Science Technology, Cambridge, Massachusetts

Stem Cell Institute, Bangalore

Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore

Two emerging areas that will dramatically impact medical sciences in the future are stem cell biology and nanotechnology. Although, these two areas are already intersecting, the interface between these areas offers an untapped niche for scientific exploration and inventions that will revolutionize translational medicine. This Centre for Research Excellence in Science and Engineering set up by IUSSTF in partnership with Department of Science and Technology on nanobiotechnology brings together the strengths of groups at the National Centre for Biological Sciences (NCBS), Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) and InStem and the core expertise of Harvard-MIT Division of Health Sciences and Technology in material sciences and nanotechnology.

The Joint Centre has three major goals:

(i) Development of a strong research program elucidating the role of nanostructures in stem cell biology in the vascular context;
(ii) Development of a strong training component and exchange program; and
(iii) Aggressive pursuit of translation of technology developed by promoting an entrepreneurial culture and partnerships with the industry.

Specifically as the research component, the focus is on the mechanistics underlying the recruitment and differentiation of stems cells into vascular structures, and the development of novel nanostructures

that can perturb this process. This will enable the understanding of the process of vasculogenesis, which holds the key for regenerative medicine critical for the management of conditions such as ischaemic heart diseases, peripheral artery diseases and diabetic sores. Furthermore, nanostructures that promote the process can be engineered as scaffolds that can be harnessed as therapeutics in the above conditions. In contrast, nanostructures that are engineered to inhibit the process could evolve as potential therapy for pathological conditions characterized by overt neovascularization, including cancer, diabetic retinopathy and rheumatoid arthritis.

The collaboration between the partners brings together scientists from a multidisciplinary background, where chemical engineers, polymer chemists, material scientists, and nanotechnologists work closely with molecular and cell biologists. It is anticipated that this exchange of knowledge would enable the development of expertise on both continents. Furthermore, annual training

programs would be conducted at NCBS on tools and technologies in the area of bio-nanotechnology, which would be open to scientists across India.

Three active research projects have already been initiated by the binational team are:

(i) *Heparan Sulfate Glycosaminoglycans (HSGAGs) in human ES cell differentiation into cardiovascular lineages* (Shiladitya Sengupta, Harvard-MIT and Maneesha Inamdar, JNCASR); and
(ii) *Mechano-biology of the stem cell niche and the control of quiescence* (Jeff Karp, Harvard-MIT and Jyotsna Dhawan, InStem)
(iii) *Harnessing the human mesenchymal stem cell (hmsc) secretome for cardiovascular regeneration using bioengineering strategies* (Sudhir H. Ranganath, JNCASR, Maneesha Inamdar, JNCASR and Jeffrey M. Karp, Harvard-MIT).

As part of the CRESE activities, several exchange visits have been undertaken. Jeff Karp visited NCBS/InStem in November 2010 and in March 2011 and participated in scientific discussions. Shiladitya Sengupta visited NCBS/InStem in March 2011. R.A. Mashelkar visited Shiladitya Sengupta's laboratory in October 2010.

Abhijit Majumdar was recruited in the joint project between the Dhawan and Karp labs in 2010 and has made substantial progress on generating micro-patterned surfaces for growth and induction of quiescence of mesenchymal stem cells. Sudhir Ranganath was recruited in the joint projects between the Karp and Inamdar labs in August 2010 and has made substantial progress in establishing conditions for study of the hMSC secretome.

Also as part of the CRESE activities, the second meeting of the *Boston-Bangalore Bioengineering Initiative* was held from 07-08 November 2010 at Bangalore to spearhead a discussion between engineers, physicists, chemists, materials science experts and biologists.

Research publications generated:

(i) Sinha Roy R., Soni S., Harfouche R., Vasudevan P.R., Holmes O., de Jonge H., Rowe A., Paraskar A., Hentschel D.M., Chirgadze D., Blundell T.L., Gherardi E., Mashelkar R.A. and Sengupta S (August 2010) Coupling growth-factor engineering with nanotechnology for therapeutic angiogenesis. Proceedings of the National Academy of Sciences USA, 107(31):13608-13
(ii) Paraskar A.S., Soni S., Chin K.T., Chaudhuri P., Muto K.W., Berkowitz J., Handlogten M.W., Alves N.J., Bilgicer B., Dinulescu D.M., Mashelkar R.A. and Sengupta S. (July 2010) Harnessing structure-activity relationship to engineer a cisplatin nanoparticle for enhanced antitumor efficacy. Proceedings of the National Academy of Sciences USA, 107(28):12435-40.

Patents granted/filed:

(i) Paraskar A., Soni S., Basu S., Sengupta P. and Sengupta S. Platinum nanoparticles and methods of use thereof. PCT/US10/23217. Currently being licensed to Invictus Oncology, New Delhi by BWH.
(ii) Sinha-Roy R., Soni S., Harfouche R. and Sengupta S. 1K1 nanoparticles for angiogenesis. PCT filed by BWH. This patent has been licensed to Vyome Biosciences, New Delhi.

Indo-US Center for Research Excellence in Science and Engineering (CRESE) on Nanomaterials for Energy

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The India-US Center for Research Excellence in Science and Engineering (CRESE) on **Nanomaterials for energy** set up by IUSSTF in partnership with Department of Science and Technology is a collaborative effort between the Jawaharlal Nehru Center for Advanced Scientific Research (JNCASR, Bangalore, India) and Purdue's Birck Nanotechnology Center (West Lafayette, Indiana) with General Electric's John F. Welch India Technology Center (Bangalore, India). To begin with, a Joint Networked Center on Nanomaterials was developed through an IUSSTF-sponsored bi-lateral workshop in Bangalore during August 2008 (http://www.nanohub.org/resources/5514) and draws from the synergistic expertise in physics and chemistry of materials at JNCASR with that of nanofabrication and engineering at Purdue. The Center seeks to find new ways of exploiting the unique properties and characteristics of nanomaterials in a broad range of energy-related applications.

The establishment of this center enables new synergies among the partners, leading to many tangible outcomes, including:

(i) A new cohort of globally engaged researchers in nanotechnology and energy with appreciation for diverse professional and international cultures.
(ii) Creation of joint research programs of both academic-academic and industry-academic types leading to new discoveries at the interface between nanotechnology and energy.
(iii) Enhancement of collaborative use of cyber infrastructure research and educational resources such as nanoHUB.org and thermalHUB.org. These resources will support global collaborations through the use of web-based computational tools, online lectures/tutorials, collaborative user/project groups, and material databases.
(iv) Organization and hosting of summer schools and related tutorial materials offered annually to attract strong participation from industrial and academic participants.
(v) Strengthening of links between academics and global technology companies with R&D centers in the US and India.

Topics of collaborative research include:

(i) *Metal-semiconductor superlattice thermoelectrics*
Faculty Participants: Umesh Waghmare

(International Centre for Materials Science ICMS, JNCASR), T. Sands (Purdue)

(ii) *Exfoliated graphite/graphene materials for enhanced interfacial transport*
Faculty Participants: C. Narayana (ICMS, JNCASR), Timothy Fisher (Purdue)

(iii) *Liquid nanosolder for electrical contacts and thermal interfaces*
Faculty Participants: G.U. Kulkarni (ICMS, JNCASR), Timothy Fisher (Purdue)

(iv) *Integration of carbon nanotubes for solar, thermal and lighting applications*
Faculty Participants: C.N.R. Rao (ICMS, JNCASR), Timothy Fisher (Purdue)

(v) *Solid-state hydrogen storage*
Faculty Participants: M. Alam (JNCASR), U.V. Waghmare (ICMS, JNCASR), Timothy Fisher (Purdue)

(vi) *Behavior of attolitre water droplets*
Faculty Participants: G.U. Kulkarni (JNCASR), Scott (Purdue)

(vii) *Au nanoparticle-PDMS composites*
Faculty Participants: G.U. Kulkarni (JNCASR), Scott (Purdue)

(viii) *Electronic structure, vibrational spectrum, and thermal properties of yttrium nitride: A first-principles study*
Faculty participants: Timothy Sands (Purdue), Umesh Waghmare (JNCASR)

(ix) *First-principles analysis of ZrN/ScN metal/semiconductor superlattices for thermoelectric energy conversion*
Faculty participants: Timothy Sands (Purdue), Umesh Waghmare (JNCASR)

(x) *Interaction of butene with metal/metal oxide clusters*
Faculty participants: Timothy Fisher (Purdue), Pat Erwin (GE) and Umesh Waghmare (JNCASR)

(xi) *Quantum transport through nanostructures*
Faculty participants: N.S. Vidhyadhiraja (JNCASR), Timothy Fisher (Purdue)

(xii) *Thermal hysteresis and avalanches across the inhomogeneous Mott transition*
Faculty Participants: N.S. Vidhyadhiraja (JNCASR), Erica Carlson (Purdue), Karin Dahmen (University of Illinois at Urbana Champagne)

(xiii) *Properties of B-C-N nano structures*
Faculty participants: U.V. Waghmare (JNCASR), Timothy Fisher (Purdue), Ronald Reifenberger (Purdue)

(xiv) *Graphite petals: growth mechanism, structural and surface features*
Faculty participants: Timothy Fisher (Purdue), Ronald Reifenberger (Purdue)

(xv) *Atomic force microscope based electrical characterization of mesoscopic graphitic islands and graphene films*
Faculty participants: Timothy Fisher (Purdue), G.U. Kulkarni (JNCASR), Ronald G Reifenberger (Purdue)

(xvi) *Carbon nanotube Pd thiolate composites - thermal and electrically improved properties*
Faculty participants: G.U. Kulkarni (JNCASR), Timothy Fisher (Purdue)

As part of the visitations under the CRESE, two faculty and two students from India visited their collaborators in the US and seven faculty and two students from the US visited their Indian counterpart institutions. In addition, as a part of the CRESE activity a workshop was organized on *Basics of nanomaterials and applications in energy conversion, transport and storage* in August 2010. The Joint Centre has led to extended interactions with other institutions with

and outside of India such as University College London (UCL), Vellore Institute of Technology (VIT), Tribhuvan University - The University of Nepal, USAF, Res Lab, Thermal Sci & Mat Branch USA.

Research projects awarded

Consequent to the institution of the IUSSTF supported joint center has led to the following research projects getting funded to the respective partnering groups:

(i) *First-principles modeling and simulations of thermal properties of hexagonal nanomaterials* (PI: U.V. Waghmare ; Co PI: Timothy Fisher and A. Voevodin) funded by Air Force Office of Scientific Research (AFOSR)/ Asian Office of Aerospace Research and Development (AOARD)

(ii) *Nano thermal interface material development* (PI: Timothy Fisher) funded by Defense Advanced Research Projects Agency (DARPA)

Research publications generated in 2010-11

(i) Rout C.S., Kumar A., Kumar N., Sundaresan A. and Fisher T.S. (2011) Room-temperature ferromagnetism in graphitic petal arrays. Nanoscale 3(3): 900-903

(ii) Smith K.C., Alam M. and Fisher T.S. (2010) Athermal jamming of soft frictionless platonic solids. Physical Review E, 82(5) 051304 Part 1

(iii) Bhuvana T., Boley W., Radha B., Dolash B.D., Chiu G., Bergstrom D., Reifenberger R., Fisher T.S. and Kulkarni G.U. (2010) Inkjet printing of palladium alkanethiolates for facile fabrication of metal interconnects and surface-enhanced Raman scattering substrates. Micro & Nano Letters, 5(5): 296-299

(iv) Smith K.C., Fisher T.S., Waghmare U.V. and Grau-Crespo R. (2010) Dopant-vacancy binding effects in Li-doped magnesium hydride. Physical Review B, 82(13) Article Number: 134109.

(v) Scott A., Gupta R. and Kulkarni G.U. (2010) A Simple Water-Based Synthesis of Au Nanoparticle/PDMS Composites for Water Purification and Targeted Drug Release. Macromolecular Chemistry and Physics, 211(15): 1640-1647

(vi) Kurra N., Scott A. and Kulkarni G.U. (2010) Electrocondensation and Evaporation of Attoliter Water Droplets: Direct Visualization Using Atomic Force Microscopy. Nano Research, 3(5): 307-316.

JOINT CENTERS

Indo-US Networked Center on Theoretical Physics of Ultra-cold Atoms in Optical Lattices

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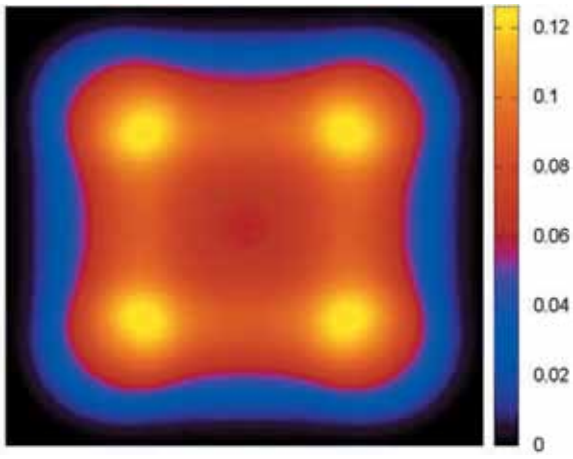
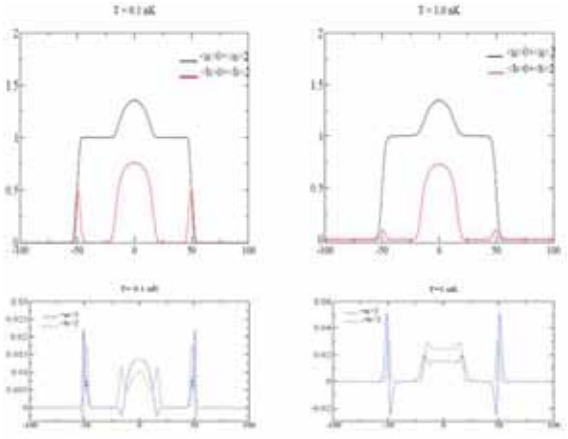
The **Indo-US Networked Center on Theoretical physics of ultra-cold atoms in optical lattices** is a collaborative effort between Georgetown University, Ohio State University, Indian Institute of Science and the Indian Association for Cultivation of Science.

The specific collaborative research goals of the Joint Center are two-fold:

(i) Determination of the stable phases in homogeneous and trapped systems of spinless and spinor bosons with on-site as well as longer-range interactions, and of mixtures (bose-fermi, or bose-bose). One of the main themes will be to determine precisely what information can be found from time-of-flight measurements, and how theory can calculate those results.

(ii) Determination of the response of these systems to different external perturbations (both linear response and non-equilibrium responses), which include moving the trap, either suddenly, or slowly, modulating the system by changing





the amplitude of the optical lattice (Bragg spectroscopy), and newer experimental techniques as they arise.

Two projects have already been completed and these include:

(i) Development of a strong coupling expansion for quantities that are directly experimentally measured in systems of ultra-cold bosonic atoms in a deep optical lattice as described by the Bose-Hubbard model with a trap potential, for parameter regimes when superfluid regions are present. The expansion works well in much of the experimentally relevant regimes.

(ii) Development of a generalized gradient approximation to go beyond the local density approximation in handling strongly correlated inhomogeneous systems such as ultra-cold atoms in a trap.

The current activities of the Joint Center are focused on:

(i) Developing a strong-coupling approach to non-equilibrium ultra-cold atomic problems in an optical lattice with a trap.

(ii) Calculating the efficiency for dipolar molecule formation in Rb-Cs mixtures on an optical lattice for use in an experiment from the Innsbruck team.

(iii) Further elaboration and implementation of the generalized gradient approximation as a way to go beyond the local density approximation in a variety of contexts.

(iv) Studying quantum quench dynamics around a quantum critical point.

As part of the visitations associated with the Joint Center, three scientists from Georgetown University visited the Indian Institute of Science, Bangalore and three Indian scientists visited Georgetown University.

Indo-US Networked Center on Accelerators and Detectors for future High Energy Physics Experiments

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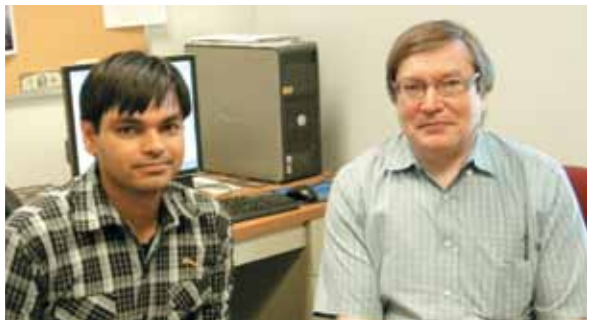
International Linear Collider (ILC) and Project-X R&D programs at Fermilab is extremely beneficial for Indian and US institutions, as these allows them to share resources, man-power and expertise in an interesting, topical and fast developing area of accelerator and detector technology. The strong motivation for establishing the **Indo-US networked center on accelerators and detectors for future high energy physics experiments** was due to the following reasons:

(i) Fermilab is host to the world's current highest energy accelerator along with its state-of-the-art detectors and is playing a major role in the ILC program.

(ii) Delhi University, through the Centre for Detector and Related Software Technology (CDRST), has been actively involved in ongoing and future high energy physics experiments through significant contributions in detectors and physics analysis.

The ILC provides a tool for scientists to address many of the most compelling questions of the 21st century including questions about dark matter, dark energy, extra dimensions and the fundamental nature of matter, energy, space and time.



The goals in the area of accelerator development are:

(i) To study and understand the preservation of small transverse beam emittances through the main linac of the proposed international linear collider using beam dynamics simulations.

(ii) To analyze and develop techniques of beam-based alignment to limit the transverse emittance growth because of static misalignments of the beamline elements.

(iii) To understand the effect of dynamic misalignments, like ground motion on the emittance growth and develop 5-Hz feedback system to perform dynamic tuning.

(iv) To perform integrated simulation in the emittance transport region to predict the luminosity of the ILC machine taking into account the ring-to-main linac system, and also the beam delivery system.

(v) To conduct cavity and coupler simulation for Project-X.

The objectives in the Silicon (Si) detector development are:

(i) To design, develop and fabricate the double-sided silicon strip sensors and perform characterization on these devices.

(ii) To perform simulation studies to understand and optimize the Si detector design.

(iii) To perform radiation hardness studies on these sensors and participation in detector testing using the Fermilab Test Beam Facility.

(iv) To design, construct and test prototype double-sided silicon detector modules.

(v) To characterize scintillator modules read out with SiPM's.

(vi) To develop pixilated photon detectors for the next generation of particle physics experiments and imaging applications.

Single sided detector fabrication is currently being done at Bharat Electronics Limited, Bangalore. Masks, needed for this purpose have been designed and fabricated. As part of the exchange visits undertaken, Kirti Ranjan and Arun Saini from Delhi University visited Fermilab; and Marcel Demarteau and Jerry Nolen from Argonne National Lab visited the Tata Institute for Fundamental Research.

Publications

(i) Saxena P., Ranjan K., Bhardwaj A., Shivpuri R.K. and Bhattacharya S. (2010) Development of multi-guard ring-equipped p+–n Si microstrip sensors for the SiD detector at the ILC. Semiconductor Science and Technology, 25, 105012.

(ii) Simulation Studies of the n+n- Si sensors having p-spray/p-stop implant for the SiD experiment. Accepted for publication in Nuclear Instruments and Methods in Physics Research A proceedings, 2011.

Conference proceedings

(i) Particle Accelerator Conference (2011) Inter-University Accelerator Centre, New Delhi:

- Ranjan K. Emittance preservation for the ILC main linac http://www.iuac.res.in/InPAC2011/proceedings/InPAC2011%20Proceedings/I-20/KRanjan.pdf

- Saini A., Mishra C.S., Ranjan K., Solyak N., Yakovlev V.P., et. al. Lattice design for superconducting CW linac for Project-X facility at Fermilab. http://www.iuac.res.in/InPAC2011/proceedings/InPAC2011%20Proceedings/Oral%20%20and%20posters%20contributory/98_arun.pdf

- Saini A., Mishra C.S., Ranjan K., Solyak N., Yakovlev V.P., et. al. RF cavities for superconducting CW linac for Project-X facility at Fermilab. http://www.iuac.res.in/InPAC2011/proceedings/InPAC2011%20Proceedings/Oral%20%20and%20posters%20contributory/100_arun.pdf

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(ii) Particle Accelerator Conference (2011), New York City

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Indo-US Networked Center on Cardiovascular Biology

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The prevalence of cardiovascular diseases in general and heart failure in particular is rising worldwide with the increasing aging population. Available heart failure therapy is directed towards neuro-hormonal intervention (beta blockers, angiotensin receptor blockers and angiotensin converting enzyme inhibitors). In spite of these therapies, heart failure remains a progressive disease with high rate of mortality and morbidity, demanding new therapeutic strategies.

The IUSSTF **Joint Centre on Cardiovascular Biology** is aimed towards bringing together US and Indian researchers in cardiovascular biology to create a niche in adrenergic receptor dynamics and therapeutic angiogenesis, two fast emerging areas of research.

The objectives of the Joint Center include:

(i) To determine how PI3K regulates βAR re-sensitization
(ii) To determine the molecular mechanism of regulation of PP2A by PI3K-ROS/RNS axis
(iii) To understand and develop nitrite based therapy for promoting blood vessels in the stroke affected tissues

Redox biology of cardiovascular diseases is an advance area of research being pursued by research teams led by S.K. Goswami at JNU and S. Prasad at the Cleveland Clinic. The groups are now working together in integrating two aspects of cardiovascular function - redox regulation of adrenergic signaling and adrenergic receptor sensitization-resensitization. The leads are now being pursued with regular e-communication and reagent sharing. Suvro Chatterjee's research group at Anna University works on nitric oxide signaling in endothelial bed and vascular remodeling to understand the role of nitric oxide signaling in cellular migration, permeability and angiogenesis; and Alan Schechter's (NIH) expertise is to detect, estimate and analyze the function of nitric oxide in human tissue contexts. The Joint Center has resulted in the integration of their respective research areas. Under the aegis of the Joint Center, two Indian scientists visited NIH and one American scientist visited collaborators at JNU and Anna University.

Cell-targeted Diagnostics and Therapy Using Nanomaterials

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Industry Partner:
Shireen Vali
Cellworks Research India Pvt. Ltd, Bangalore

Other Partners:
Brown Foundation Institute of Molecular Medicine, University of Texas at Houston

Stanford University

University of Connecticut

Growth of functional tissues includes regeneration of specific cells in tissues by facilitating the differentiation of stem cells, or the attachment and proliferation of particular cell types in judiciously designed nanomaterial-based assemblies (scaffolds, aggregates or gels). The use of bioactive molecules with nanoscale objects with extremely high epitope densities could facilitate receptor clustering for signaling and also maximize successful binding between ligands and receptors at the three-dimensional interfaces between matrices and cells. The objectives of the **Indo-US Joint Center on Cell-targeted diagnostics and therapy using nanomaterials** are as follows:

(i) Use of multipotent stem cells for differentiation into tissue using nanomaterial and nanomedicines.
(ii) Development of ECM simulating nanoscaffold constructs for tissue regeneration and vascularization.
(iii) *In vitro* and *in vivo* diagnostics of tumor cells and cancer stem cells using multifunctional contrast agents.

The following work has been carried out under the aegis of the Joint Center:

(i) Development of locally implantable nanoparticle-based gel system for interferon (IFN) delivery: Researchers have prepared a novel locally implantable gel based interferon delivery system, wherein IFN is better stabilized and released in a sustained manner over a period of ~ 21 days.
(ii) Microfluidic device assembly and gradient generation of vascular growth factors.
(iii) Preparation of scaffolds for osteochondral tissue engineering and diagnostics of embryonic stem cells using magnetic nHaP contrast agents: In this study two separate scaffolds were combined and adult stem cells were

differentiated into two cell types giving rise to a composite osteochondral tissue. The scaffolds were *Electrospun scaffold PCL with hydoxyapatite and Alginic acid/hyaluronic acid composite hydrogel.*

(iv) Electrospinning of 3D engineered protein nanomaterials.

(v) Micro-nano scaffolds for articular cartilage regeneration: As part of this study, 3D PCL microfiber scaffolds, 3D PCL micro and PCL nanofiber composite scaffolds and 3D PCL-fibrin nanofiber scaffolds were generated.

In its collaboration with Cellworks, ACNSMM provided the small molecules of interest and Cellworks conducted the computational analysis to understand the concentration and sequence of each of these molecules for efficient cancer therapy. The bioinformatics results will be compared with actual wet lab studies at ACNSMM to validate the results. In collaboration with Cellworks, the Heilshorn laboratory at Stanford University is investigating how cells respond to exposure of certain enzymes that may be used as therapeutic triggers. Rice University's collaboration with Cellworks explores the effects of a model inflammatory cytokine, tumor necrosis factor-alpha (TNF-α), as well as of known osteogenic growth factors, including bone morphogenetic protein (BMP)-2, BMP-4, BMP-7 and transforming growth factor-beta1 (TGF-β1), on bone regeneration.

As part of the activities of the Joint Center, four Indian scientists visited their US collaborators and two US scientists visited India. Additionally, two doctoral students (from Stanford and Rice University) visited ACNSMM; and three doctoral students from ACNSMM visited Rice University, Stanford and University of Connecticut respectively. Six seminars were also conducted at the partnering institutions as part of the Joint Center.

Research projects awarded

The IUSSTF supported joint center has led to the following research projects getting funded to the respective partnering groups:

In India:

(i) *Nanotoxicology and nanomedicine* funded by the Department of Biotechnology (DBT), Govt. of India.

(ii) *Tissue engineering and stem cell therapy using nanomaterials* funded by Department of Science and Technology (DST), Govt. of India.

In USA:

(i) *Preparation and delivery of clinically relevant numbers of stem cells using 3D hydrogels* funded by California Institute of Regenerative Medicine.

(ii) *Adaptable biomaterials that enable cell-induced remodeling and drug delivery* funded by the National Science Foundation (NSF).

(iii) *Flow perfusion bioreactor fabrication of bioactive polymer/ECM hybrid constructs* funded by the National Institutes of Health (NIH).

(iv) *Injectable cellular composites for cartilage engineering* funded by the National Institutes of Health (NIH).

Indo-US Networked Center on Physics Beyond Standard Model (BSM) Phenomenology

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Other Partners:
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Harish Chandra Research Institute
University of Wisconsin, Madison
University of Kansas, Lawrence

Our current understanding of nature can be summarized in terms of two Standard Models: one for extremely large cosmological scales - *standard model of cosmology;* and another for extremely tiny sub-nuclear particle physics scale - *standard model of particle physics*. Both these models have been extremely successful at their respective scales but are however unable to describe nature completely.

The beginning of Large Hadron Collider (LHC) at CERN, Geneva, ushered in a new era in particle physics. "New physics", whose presence is evident from observation of neutrino oscillations and existence of dark matter, might reveal itself in the experiments planned at the LHC. **The Indo-US Networked Center on Physics beyond standard model (BSM) phenomenology** investigates the properties of this "new physics" in three focused areas:

(i) **Neutrino physics:** Among phenomenological aspects, a detailed study of capabilities of a Long Base Line and Atmospheric neutrino detector with emphasis on DUSEL-based detectors will be undertaken. Studies of avor structure of very high energy astrophysical neutrinos will be carried out.

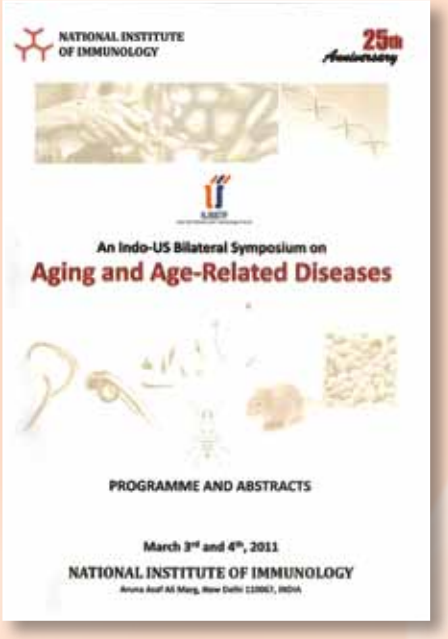
(ii) **Top physics:** Top physics will be looked at as a probe of BSM physics with the focus on use of the top polarization in isolating its nature at the LHC.

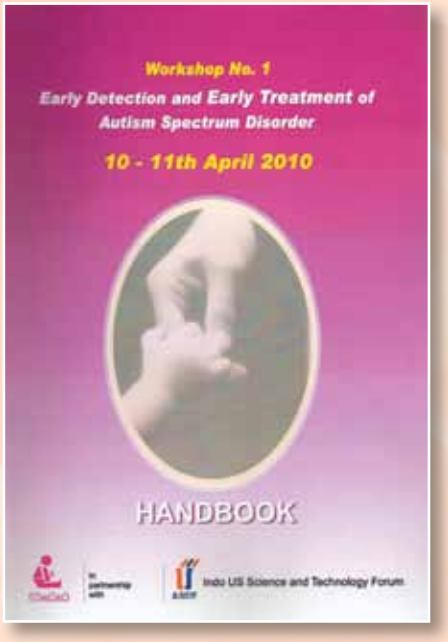
(iii) **Supersymmetry:** Here the Joint Center will address connections between dark matter studies and avor physics; and correlations between direct and indirect dark matter searches and LHC experiments.

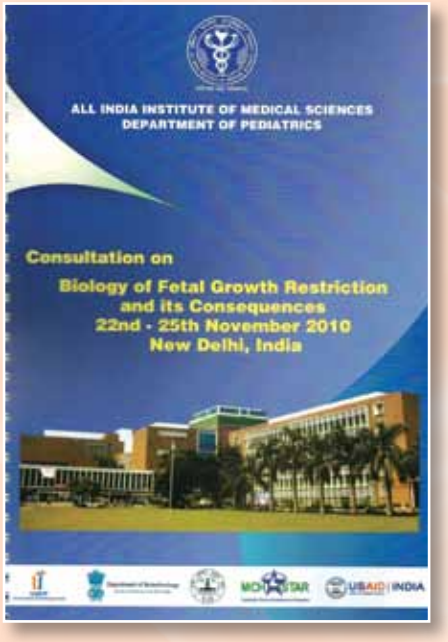
Raj Gandhi, one of the project members based at Harish Chandra Research Institute, visited the University of Wisconsin at Madison for a month to enable discussions with Vernon Barger and Danny Marfatia, two of the investigators on the US side of the project. These discussions enabled them to begin work on the first phase of calculations, which is to thoroughly investigate the physics capabilities of a large liquid argon detector for atmospheric neutrinos. Calculations underway at present focus on precise quantitative determination of the capabilities of such a detector when used to collect data on atmospheric neutrinos. The same detector when used as a target for a superbeam or neutrino factory can yield complementary and additional information on neutrino properties and parameters. The second phase of the project will focus on these calculations, and the final phase will work on how to combine these apparently disparate measurements to add to knowledge gleaned from the two separate sets of data.


CESE
IITK
International Conference on
Environmental Health and Technology
March 15 – 17, 2010
(Book of Abstracts)
Organized by
Centre for Environmental Science and Engineering
Indian Institute of Technology Kanpur

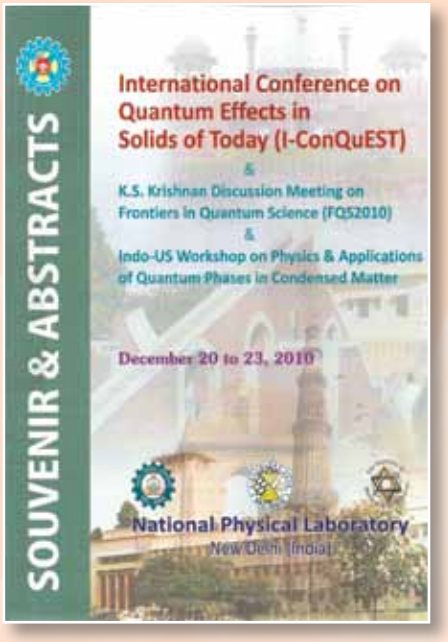

Indo-US Workshop on
HIGHWAY AND AIRPORT PAVEMENT ENGINEERING:
CHALLENGES AND OPPORTUNITIES
HiPAVE
30-31 July 2010

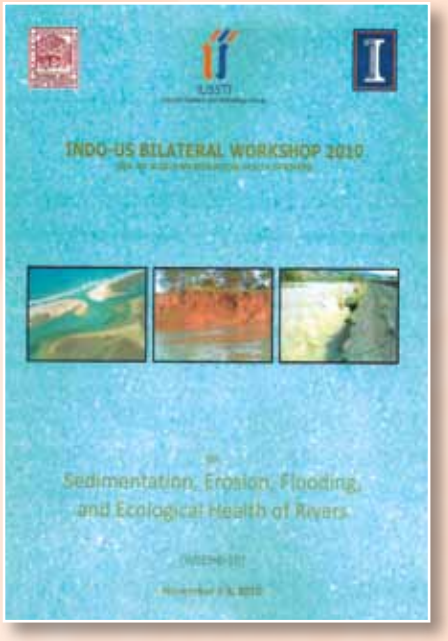

NATIONAL INSTITUTE
OF IMMUNOLOGY
25th
Anniversary
An Indo-US Bilateral Symposium on
Aging and Age-Related Diseases
PROGRAMME AND ABSTRACTS
March 3rd and 4th, 2011
NATIONAL INSTITUTE OF IMMUNOLOGY

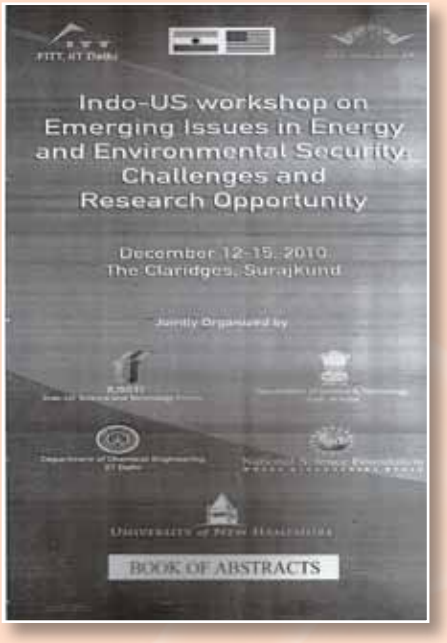

Workshop No. 1
Early Detection and Early Treatment of
Autism Spectrum Disorder
10 - 11th April 2010
HANDBOOK
Indo US Science and Technology Forum

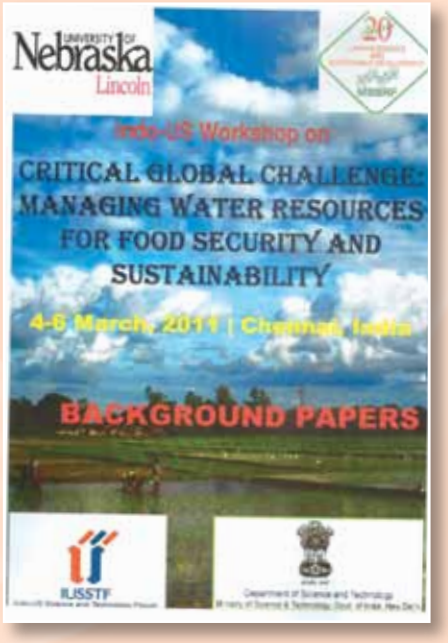

ALL INDIA INSTITUTE OF MEDICAL SCIENCES
DEPARTMENT OF PEDIATRICS
Consultation on
Biology of Fetal Growth Restriction
and its Consequences
22nd - 25th November 2010
New Delhi, India

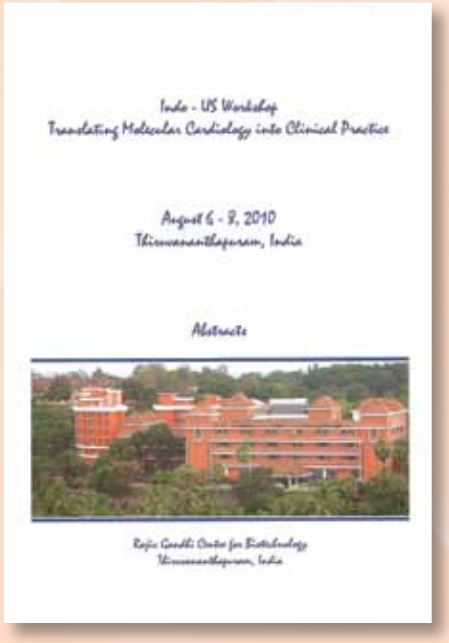

IUSSTF
NRDC
Climate Change:
Heat and Health
Addressing Vulnerability
Ahmedabad, Gujarat, India
March 28-30, 2011

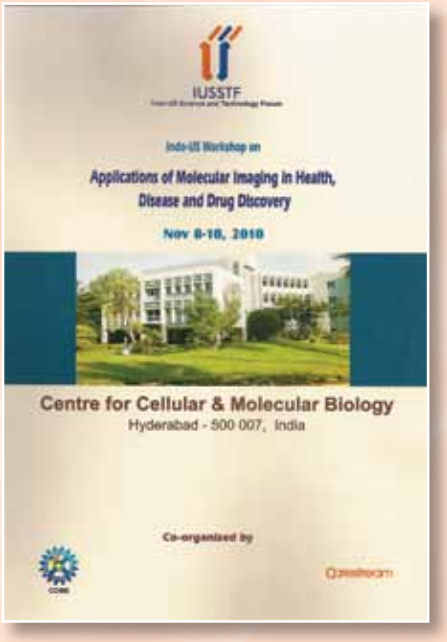

SOUVENIR & ABSTRACTS
International Conference on
Quantum Effects in
Solids of Today (I-ConQuEST)
&
K.S. Krishnan Discussion Meeting on
Frontiers in Quantum Science (FQS2010)
&
Indo-US Workshop on Physics & Applications
of Quantum Phases in Condensed Matter
December 20 to 23, 2010
National Physical Laboratory
New Delhi (India)

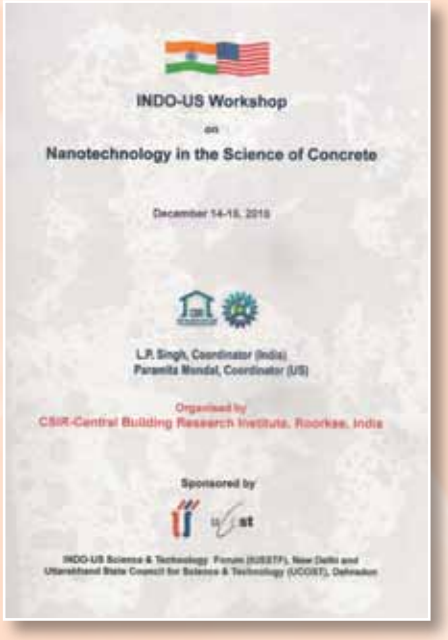

IUSSTF
INDO-US BILATERAL WORKSHOP 2010
Sedimentation, Erosion, Flooding,
and Ecological Health of Rivers


Indo-US workshop on
Emerging Issues in Energy and Environmental Security: Challenges and Research Opportunity
December 12-15, 2010
The Claridges, Surajkund
Jointly Organized by
BOOK OF ABSTRACTS

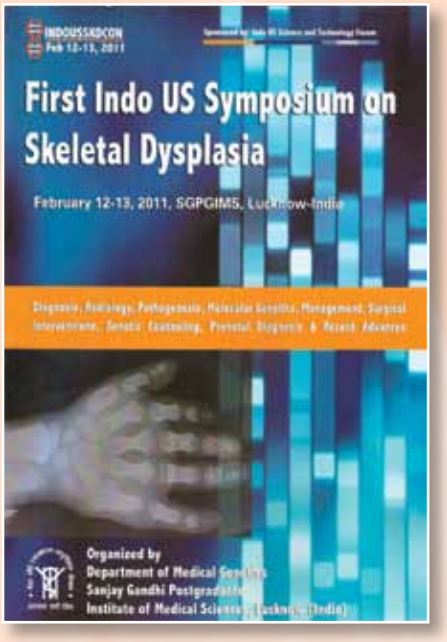

University of Nebraska Lincoln
Indo-US Workshop on
CRITICAL GLOBAL CHALLENGE: MANAGING WATER RESOURCES FOR FOOD SECURITY AND SUSTAINABILITY
4-6 March, 2011 | Chennai, India
BACKGROUND PAPERS
IUSSTF

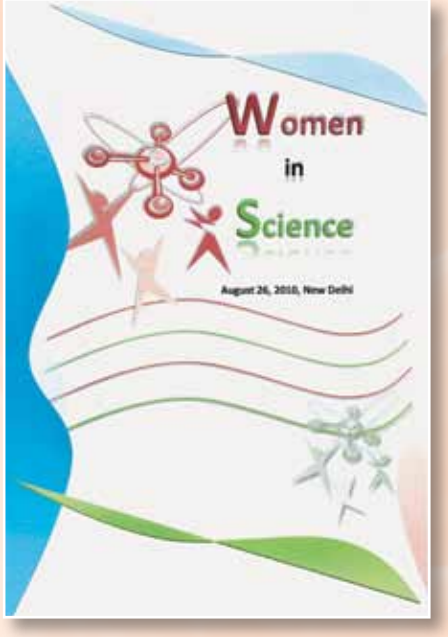

Indo - US Workshop
Translating Molecular Cardiology into Clinical Practice
August 6 - 7, 2010
Thiruvananthapuram, India
Abstracts
Rajiv Gandhi Centre for Biotechnology
Thiruvananthapuram, India


IUSSTF
Indo-US Workshop on
Applications of Molecular Imaging in Health, Disease and Drug Discovery
Nov 8-10, 2010
Centre for Cellular & Molecular Biology
Hyderabad - 500 007, India
Co-organized by


INDO-US Workshop
on
Nanotechnology in the Science of Concrete
December 14-15, 2010
L.P. Singh, Coordinator (India)
Paramita Mondal, Coordinator (US)
Organised by
CSIR-Central Building Research Institute, Roorkee, India
Sponsored by
INDO-US Science & Technology Forum (IUSSTF), New Delhi and Uttarakhand State Council for Science & Technology (UCOST), Dehradun


INDO - US WORKSHOP
on
Nanotechnology in the Science of Concrete
14-15 December, 2010
Central Building Research Institute, Roorkee [INDIA]
Workshop Notes
Organized
by
CSIR-Central Building Research Institute (CBRI)
Roorkee-247667, (INDIA)


INDOUSSKDCON
Feb 12-13, 2011
First Indo US Symposium on Skeletal Dysplasia
February 12-13, 2011, SGPGIMS, Lucknow-India
Organized by
Department of Medical
Sanjay Gandhi Postgraduate
Institute of Medical Sciences


Women
in
Science
August 26, 2010, New Delhi

SUPPORT TO INTERNATIONAL CONFERENCES/EVENTS

Functional Analysis and Operator Theory

8-11 August 2010, Bengaluru, India

T. S. S. R. K. Rao
Indian Statistical Institute, Bangalore
E-mail: tss@isibang.ac.in

Functional analysis and operator theory is an active area of research in mathematics. Given the interest and expertise among the Indian mathematical community, a conference titled **Functional analysis and operator theory** was held in association with the International Congress of Mathematics. IUSSTF sponsored the participation of two outstanding US experts for the conference – H.P. Rosenthal (University of Texas, Austin) and T. Schlumprecht (Texas A&M University). The talks given by the experts were mainly on *Isomorphic theory of banach spaces, Aspects of geometry of banach spaces and Operator theory including algebras and its applications.* Several Indian functional analysts and research scholars participated in the conference and benefited by the talks given by experts.

Digital Preservation of Archaeological Heritage

18-19 October 2010, Kanpur, India

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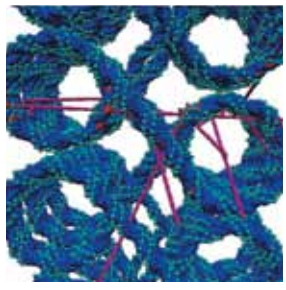
Our cultural inheritance is rooted in a deeper past, wherein lies the source of our identity. The past, therefore, matters for understanding the present and shaping the future. The facts and other forms of evidence of the past have to be identified, classified, examined and evaluated to understand the past and draw conclusions. The disciplines of history and archaeology which are central to this enterprise have, in the course of their development, increasingly taken the assistance of scientific concepts and methods in the pursuit and fulfillment of their concerns, and archaeology in particular relies crucially on them. The international workshop on **Digital preservation of archaeological heritage** was attended by eminent archaeologists and technologists. IUSSTF supported the participation of Holly Rushmeier (Yale University) who presented a talk on *Progress and open issues in 3D scanning for cultural heritage applications.* The workshop resolved to initiate closer interaction between Indian and American archaeologists and technologists to share their experience in learning about the past and for enhanced cooperation in digital archaeological applications. The objectives of the conference were to create awareness in the country about the upcoming digital technology for archaeological preservation; exchange state-of-the-art R&D efforts in this area between national and international experts; and to train the young scientists/archaeologists about this new digital technology in archaeological applications.

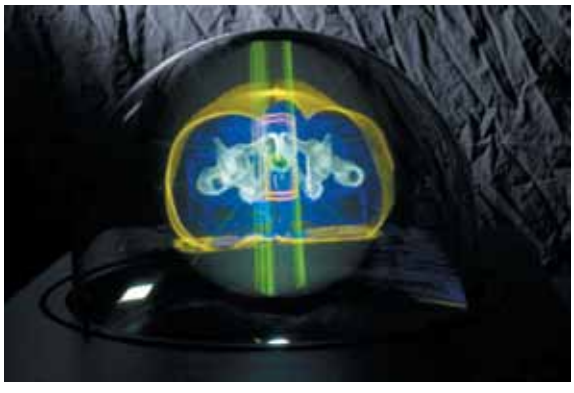
Radiation Biology: Nanotechnology, Imaging and Stem Cell Research in Radiation Oncology

15-17 November 2010, Chennai, India

S.P. Thyagarajan
Sri Ramachandra University, Chennai
E-mail: sptrajansrmc@gmail.com

The continual advancement of molecular biology coupled with the development of highly sensitive molecular techniques has facilitated the growth of new focus areas of research in radiation biology, particularly, aimed at understanding the mechanistic processes that regulate radiation damage and response in both normal and tumor tissues. The challenge to radiation biologists and oncologists is to use these cutting edge technologies to significantly improve the curative index in the management of human solid tumors by means of translating these new findings in the clinic. The international conference on Radiation biology: nanotechnology, imaging and stem cell research in radiation oncology was conducted in conjunction with the 10th biennial meeting of the Indian Society of Radiation Biology (ISRB). IUSSTF supported the participation of two US experts for this conference – Mansoor M. Ahmed (University of Miami, Miller) and Jacqueline P. Williams (University of Rochester Medical Center). The major focus areas of this meeting were preclinical research in radiation oncology; research initiatives and recent perspectives in low dose radiobiology; system biology; and heavy ion radiobiology in space. The





objectives were to expose Indian scientists to recent research and technological development on stem cells, molecular imaging and nanotherapeutics in radiation biology; and create awareness on medical management of radiation exposure.

TRAVEL SUPPORT TO AVAIL FELLOWSHIPS/SABBATICALS/EXPLORATORY VISITS

Travel support was extended to the following individual scientists to avail an already awarded fellowship or undertake their sabbatical research either in the US or India, or, for undertaking an exploratory visit aimed towards developing large-scale multi-institutional collaborations.

Asmit Bhowmik, student at the Indian Institute of Technology (IIT), Kharagpur, travelled to the Massachusetts Institute of Technology as an intern for a period of two months. His work at MIT was in the space of continuous manufacturing especially on modeling of powder flow using the discrete element method through the blender developed in Prof. Charles Cooney's laboratory. This is an area receiving a lot of research attention with many companies preferring to switch over from batch to continuous mode for pharmaceuticals manufacturing.

Kris Villez, Postdoctoral Research Associate at Purdue University visited Shankar Narasimhan's lab at the Indian Institute of Technology-Madras for two months to work on *Uncertainty in models for fault diagnosis - Bayesian Statistical Theory.* The project involved challenges in the context of latent variable methods from data mining, data reconciliation and gross error detection as well as methods developed for the particular tasks of on-line fault detection and identification. The grant also resulted in a joint publication in Computers & Chemical Engineering Journal.

Marcy Delcourt, Professor in Instructional Leadership at Western Connecticut State University, undertook a visit to India to deliver lectures on *Equity, excellence, and economy in a system for identifying students for gifted education programs* at Sanskriti School and Agastya International Foundation. She also attended the first *NIAS GEAR workshop on identification of gifted children in science and mathematics for school teachers* at the National Institute of Advanced Studies, Bangalore. As an outcome of the workshop, a joint wiki has been developed to improve communication. It includes instruments to identify high ability students in science and mathematics and workshop presentations, publications, and photographs from the NIAS GEAR workshop (http://indousproject.pbworks.com).

Terrence Deacon, Professor in Anthropology at University of California-Berkeley visited the Indian Institute of Science Education and Research (IISER) Pune where he delivered three talks: *Answering Wallace's riddle: How evolution achieves hierarchic complexity,* where he used examples from gene duplication, body segmentation, vitamin C dependency, effects of domestication on bird-song, and language evolution to demonstrate this effect; *How can a molecule come to be about anything? Origins of life and meaningful information,* where by exploring a simple thought experiment to show how reciprocally dependent self-organizing molecular processes can generate, preserve, and reproduce constraints, and how these properties are necessary prerequisites to biological information; and *Symbols aren't simple: How the code analogy misrepresents language and thought,* where he used a number of linguistic and nonlinguistic examples to demonstrate the dependency of symbolization on iconic and indexical phases of interpretation, and how this is relevant to universal constraints of sentence structure.

Vinay Gidwani, Associate Professor of Geography and Global Studies, University of Minnesota, visited the National Institute for Advanced Studies (NIAS), Bangalore as a Scholar-in-Residence for the Urban Research and Policy Program from 7-22 August 2010. At NIAS, he conducted three Master Classes for graduate students and NIAS faculty *(Origins of global modernity, The ideas of development, and Late capitalism)*; delivered a public talk entitled *Postcolonial urbanism*, and co-organized a two-day workshop on *The urban commons* from 18-19 August, involving a wide range of local and non-local scholars and civil society activists. He also participated on a panel on *Informal sector labour in India: issues and challenges* at the Madras Institute of Development Studies on 17 August 2010.

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