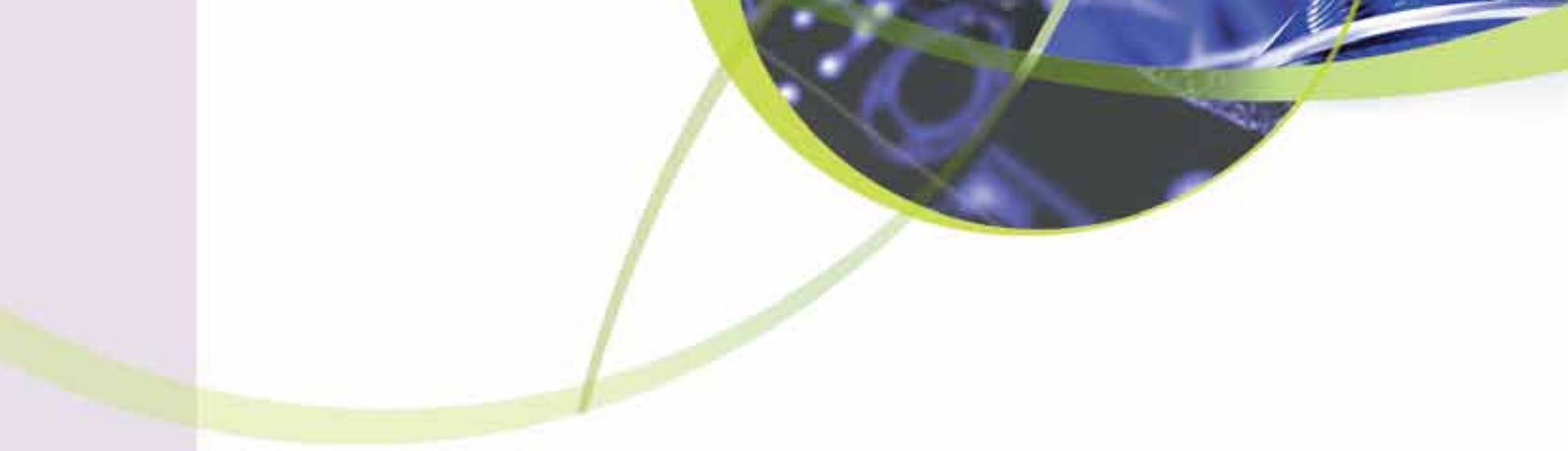
INDO-US SCIENCE AND TECHNOLOGY FORUM

A catalyst for Indo-US Science & Technology Cooperation

2009

ANNUAL REPORT

2010



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INDO-US SCIENCE & TECHNOLOGY FORUM

A catalyst for Indo-US Science & Technology Cooperation

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 and in particular the science and technology engagements between our two countries are propelled by the dynamic momentum which was set by the Indo-US Strategic Dialogue during the period under report. In addition to advancing global security & stability and deepening cooperation in trade & economics, both nations recognized the need to engage in collaborations on environmental stability, energy security, clean energy, climate change mitigation, agriculture, affordable health care, education and empowerment of people, all of which have strong elements of science, technology and innovation intrinsic to them.

This was truly demonstrated in July 2009 with the signing of the historic agreement to establish a new endowment fund for supporting joint research and development leading to innovation. Further, as a concrete outcome of the MoU on Energy Security and Clean Energy signed in November 2009, the two countries agreed to establish a jointly funded clean energy research and development centre for accelerating collaborative efforts to develop and deploy clean energy technologies. These partnerships are clearly aimed to further stimulate capacity building through innovation, entrepreneurial and commercialization activities, thus contributing directly to the economic growth process.

Through its evolving program template, IUSSTF has always recognized that new approaches need to be identified and integrated to support mutual gain outcomes - what can be referred to as 'collaborative advantage'. Since its inception, the R&D promotion activities of this organization have inherently flowed from the common scientific and technological perspectives of US and India and have been largely driven, guided and moulded by the aspirations of the two nations scientific enterprises. The IUSSTF has played an effective catalytic role in bringing this scientific potential upfront leading to fruitful collaboration and partnerships spanning

across disciplines and institutions between our two countries. It is satisfying to record in this annual report, several such new and ongoing bilateral initiatives, which IUSSTF has been able to conceive, plan and embark upon, by effortlessly working with government agencies, academia, professional societies, and industry partners from both the countries.

The culmination of diverse initiatives described in this annual report indicate that stakeholder expectations have been creatively met by IUSSTF, in both design and implementation of novel schemes in tune with public policy imperatives such as, nurturing and facilitating contacts between future generations of S&T leadership, enhancing scientific mobility through faculty fellowships and student internships, capacity building in national priority areas, enabling an ecosystem of techno-entrepreneurship, build academia-industry linkages and importantly, bridging R&D groups through seamless networking achieved by IUSSTF supported Joint Centers. The success of these multi-institutional bilateral Centers has 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 thus 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 9500 scientists, technologists, medics, and students have been brought together so far. 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 of up to six months. The Research Internship in Science and Engineering (RISE) has offered for the first time the opportunity for US graduate students to spend from 3 to 6 months in academic or scientific institution, including private R&D laboratory in India. In our constant endeavour to groom and connect the next generation which will shape the future of science and technology cooperation between our two nations, the Khorana Program with the University of Wisconsin-Madison was expanded with the joining of the Indian Department of Biotechnology as program partners. The University of California-Berkley and the IIT-Kharagpur exchange program has catalyzed the establishment of the P.K. Sinha Center for Bio-Energy at IIT-Kharagpur with a gift of US$ 2 million from an IIT- Kharagpur alum. The Centre is now well positioned to strengthen and accelerate bio-energy research between IIT, Kharagpur and UC, Berkley. The Indo-US Research Fellowships instituted in partnership with DST were expanded to provide a continued mechanism to enable twenty-five young Indian faculty members and researchers to work in premier US institutions, thus helping to build and forge new relationships.

IUSSTF has been effective in leveraging its unique position to bring together federal agencies,

The Research Internship in Science and Engineering (RISE) has offered for the first time the opportunity for US graduate students to spend from 3 to 6 months in any academic or scientific institution, including private R&D laboratory in India.

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 DST-Intel Techno Entrepreneurship Program (TEP) was continued for the third year in succession aimed to promote emerging student entrepreneurs through a business plan competition; 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; and the DST-Lockheed Martin India Innovation Growth Program (IIGP) which was designed as an accelerated technology assessment and commercialization initiative has enabled the signing of 20 Indian and 11 global business deals by several of the 2009 awardees. All of these programs have a strong component of mentoring and training rendered in partnership with US universities like UC-Berkley, Stanford and the University of Texas, Austin.

It is also heartening to report that during the course of the year, IUSSTF launched its quarterly newsletter 'CONNECT' as another vista of our active vision to connect the scientific, technical, academic, student, and industrial fraternity of India and USA by providing them a canvas, both to glimpse and share their thoughts and visions with IUSSTF. The inaugural issue of the newsletter also heralded the launch of the new logo of IUSSTF that symbolizes the synergy of collaboration along with the progressive and futuristic outlook of this bilateral organization. All of this has been made possible through a collective effort of a small but highly dedicated and multi-skilled team at the IUSSTF secretariat.

The vigour and variety in the IUSSTF programmatic activities is clearly reflected by the fact that for the third year in succession, IUSSTF could expend Rs 19.36 crores (US $ 4.20 m), which was nearly two and a half times its earnings received from the core funding. The additional programmatic expenditure was met from the extramural program based grants received from various agencies and industry partners. IUSSTF has not only shown its capability to manage multiple modes of partnership towards promoting novel schemes of collaborations, but as an organization it has also demonstrated its ability to absorb larger funds through proven business process efficiency. As the binational body steps into its ten years of existence, it is confidently poised to shoulder and discharge a larger and a more prolific role in promoting scientific and technological cooperation between India and USA, befitting the need and aspirations of all its 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 R&D Endowment Fund for Innovation

Structure of IUSSTF

Management

The IUSSTF functions as

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

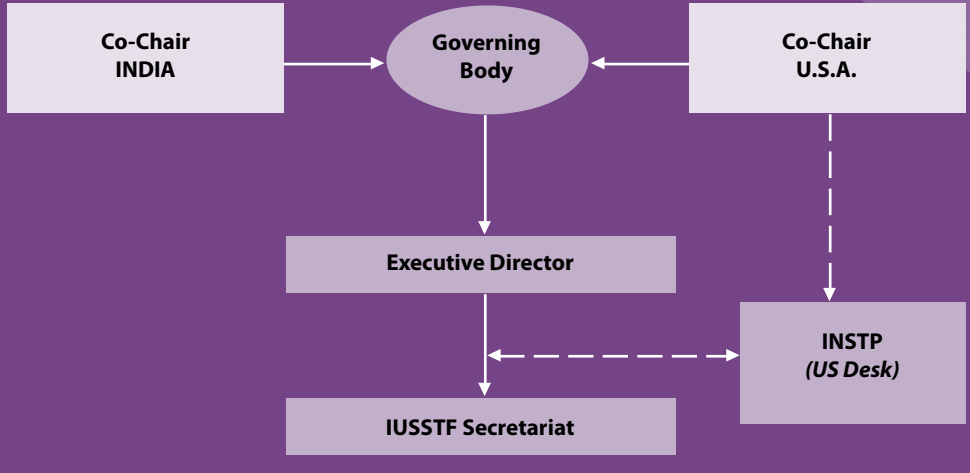
To ensure that the activities undertaken by the IUSSTF conform to the highest standards of excellence, a joint Governing Body consisting of seven Indian and seven American eminent scientists and technologists provide leadership to IUSSTF.

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
Advisor
Center for Science, Technology and Security Policy
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

Murali Sastry
Chief Scientist
Tata Chemicals Innovation Centre

R. Seshasayee
Managing Director
Ashok Leyland India

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

US MEMBERS

Michael Clegg
Foreign Secretary
National Academy of Sciences

Arden L. Bement Jr.
Director
The National Science Foundation

Roger I. Glass
Director
Fogarty International Center
National Institutes of Health

Patrick D. Gallagher
Director
National Institute of Standards and Technology

Ray O. Johnson
Sr. Vice President &
Chief Technology Officer
Lockheed Martin Corp.

Venkatesh Narayanamurti
Director, Belfer Center for Science and International Affairs
John F. Kennedy School of Government
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 9500 US and Indian scientists and technologists creating several new opportunities paving the 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 Buffalo); protecting senior citizens from cyber security attacks in the e-health scenario (Amrita University, IIIT Delhi & SUNY Buffalo); and cloud computing and security (Amrita University, IIIT Delhi, IIT Bhubaneswar, IIIT Allahabad, SUNY Buffalo, Arizona State University & Kennesaw State University).

Indo-US Joint R&D Projects

IUSSTF has supported more than 140 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 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. Two new Centers for Research Excellence in Science and Engineering have also been set up: one on *Advanced Materials Research* (Partners: Jawaharlal Nehru Centre for Advanced Scientific Research, Northwestern University, Indian Institute of Science and Argonne National Laboratory) and another on *Nanobiotechnology* (Partners: National Center for Biological Sciences, Harvard Medical School, Jawaharlal Nehru Centre for Advanced Scientific Research and Centre for Cellular and Molecular Biology).

Educational Programs

By supporting over 30 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 University of California-Berkley and the IIT-Kharagpur exchange program 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 Centre is now well positioned to strengthen and accelerate bioenergy research between IIT Kharagpur and UC, Berkley.

Major Initiatives

Some of the major initiatives catalyzed by IUSSTF includes 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.

Road maps of cooperation

Road maps and contours of Indo-US cooperation were chartered following 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 Fish and Wildlife Agency); Indo-flux program (DOES); linear collider for high energy physics (DST & DOE labs); technopreneurship in academia (National Entrepreneurship Board); Good Lab Practices 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 the Department of Biotechnology (DBT), Govt. of India, have jointly established a fund to develop low-cost diagnostic and therapeutic medical technologies.

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 for the best and brightest young minds from India and US to interact and discuss cutting edge scientific & technological pursuits. The series has helped to establish trans-disciplinary research activities and build contacts between the next generation scientists through IUSSTF frontier awards. As a spin-off, the annual frontiers meeting in India has been initiated by the Indian national Academies.

Industry supported activities

IUSSTF has promoted techno-entrepreneurship through the *DST-Lockheed Martin Innovation Growth Program* in partnership with UT-Austin & FICCI which has led to the signing of 69 business deals estimated worth Rs 200 crores/$43m; *Stanford-India Biodesign program* in partnership with DBT has generated prototypes of biomedical devises with potential towards commercialization; and the *DST-Intel India Innovation Pioneers Challenge* has showcased several student led innovation which have won international awards. Several industry funded projects in academia were initiated following IUSSTF supported 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 concrete examples of academia-industry partnerships fostered by IUSSTF.

India Science and Technology Partnership

The India Science and Technology Partnership (www.INSTP.org) based out of 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 US.

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 Office of Naval Research, the US Department of Agriculture, and the Director, Defense Research and Engineering and the US Department of State. INSTP also enjoys significant in-kind contributions from the Smithsonian Institution and The National Academies.

Michael J. Cheetham serves as the Director of INSTP based out of Smithsonian Institution in Washington D. C.

11th Governing Body Meeting

The 11th annual meeting of the joint Governing Board of IUSSTF was held at the National Institutes of Health (NIH), Bethesda, USA on December 8, 2009 under the co-chairmanship of Dr. Norman Neureiter and Dr. T. Ramasami. Dr. John Holdren, Advisor to the US President for Science and Technology and Director, US Office of Science and Technology Policy (OSTP) who was the invited guest speaker in the Board meeting provided an '*Overview on the science and technology priorities of the Obama administration*' including its global dimensions. He emphasized the need for cross-cutting S&T foundations to address big challenges like affordable health care, clean energy, climate change, homeland security, water and food security, human capacity building, etc. and the importance of international collaboration to foster innovation and build capacity. He felt that the United States and India could achieve much more now by adopting an "all hands on deck" approach to address these common issues facing humanity.

As a prelude to the Board meeting, a series of invited presentations on '*Forging science and technology partnerships between the United States and India*' was organized on 7 December 2009 at the Natcher auditorium, NIH. The day-long event which was attended by well over 250 participants showcased the varied and expanding S&T collaborative relationship and the potential of future areas of cooperation and engagement between the United States and India. In attendance were several key speakers whose presentations reflected the perspectives and opportunities of bilateral S&T engagements. Indian Ambassador Meera Shankar delivered the welcome address and highlighted the five pillars of Indo-US collaboration that emerged from the summit meeting between the Indian Prime Minister and the US President. She reiterated that the common strategy was clearly focused to meet the current global challenges through scientific and technological partnerships. Recalling that IUSSTF has

been an effective tool to promote extensive scientific exchanges and connectivity, the Ambassador emphasized the need to rationalize the operational methods of the new bilateral S&T arrangements in the offing to avoid any duplication of effort.

Mr. Aneesh Chopra, Chief Technology Officer to the US President, spoke on the *'President's initiative on innovation for America - expanding opportunities'*, thus highlighting the nation's innovation strategy and competitiveness. Mr. Michael Owen from the Bureau of South and Central Asian Affairs, U.S. Department of State, elaborated upon '*the Pillars of the US-India Relationship*'. Dr. Francis S. Collins, Director, NIH delivered a special address on the '*US Health priorities and the global health initiatives of NIH*'. He touched upon the extensive NIH linkages with India and the future opportunities to strengthen this collaboration. He complimented IUSSTF in playing the bridging role between institutions on both sides. Dr. Arden L. Bement Jr., Director, NSF, spoke on '*The progress of science in the United States*' particularly, on its renewal, revitalization and robustness. He felt that it was time that the S&T creativity of our two nations should be put to work together towards meeting societal challenges. Dr. T. Ramasami, Secretary, Dept. of Science and Technology shared his vision about '*Indian science and technology in the decade of innovations*' and touched upon the transformational changes in R&D investments, innovation and higher education envisaged in India.

Perspectives of various other US federal agencies were provided by Dr. Stephen Koonin, Under Secretary for Science, U.S. Department of Energy; Dr. Patrick Gallagher, Director, National Institute of Standards and Technology; and Dr. James Turner, Deputy Assistant Secretary for International Affairs, National Oceanic and Atmospheric Administration. In addition, three thematic sessions on '*Research & Development perspectives from industry'* were covered by Dr. Ray Johnson, Sr. V.P. & CTO, Lockheed Martin Corp and R. Seshasayee, M.D. Ashok Leyland, India; '*Building scientific capacity in the United States and India*' by Profs. Venky Narayanmurti, Director, Belfer Centre of Harvard University and Sanjay Dhande,

Director, IIT-Kanpur; and '*Translational health science & technology -building new institutions in partnership*' was illustrated by Profs. Martha Gray, MIT and Maharaj Bhan, Secretary, Department of Biotechnology, Government of India, showcasing the proactive role of IUSSTF in forging this unique institution-building relationship.

In the GB business meeting, the Executive Director, IUSSTF highlighted ongoing and several new programs successfully implemented and launched during the year under report, most of which were in partnership with government agencies, industry, professional societies and academia. Some of these included the Indo-US Centres for Research Excellence; Indo-US Research Fellowship; DST-Lockheed Martin Innovation Growth Program; Student and Faculty visitation programs, and the Translational Health Science and Technology Institute, etc. Presentations were also made by US P.I.s involved with the Joint Centres on *Nano-materials for Energy; Centre of Research Excellence on Nano-Biotechnology;* and *Centre of Research Excellence on Advanced Material Research.*

The Governing Board expressed its appreciation and unanimous support for the role being played by IUSSTF in effectively forging a variety of bilateral S&T relationships in a wide spectrum of areas with the involvement of multiple stakeholders from both countries. The ability of IUSSTF to anchor substantive value-based partnerships between performing groups in US and India through joint networked Centres was particularly commended by the GB. The GB also complimented the Secretariat on the launch of the quarterly IUSSTF newsletter '*Connect*' and authorised the Secretariat to plan a series of activities as a part of IUSSTF's decadal celebrations during 2010-2011.

The GB noted that the 'institution to institution' connectivity fostered through IUSSTF programs had yielded high returns. The GB felt that on the programmatic front, IUSSTF should therefore continue to work in close tandem with national efforts in building a larger canvass of S&T cooperation between the two nations. IUSSTF should further endeavor to develop programs that are aligned with national initiatives and can be ultimately sustained through federal funding from both sides and through multi-institutional participation. The GB also encouraged IUSSTF to embark on new initiatives by a judicious utilization of its resources and developing joint programs by leveraging extramural support and cost-sharing. By pursuing this pragmatic model, IUSSTF should now look at forging expansive relationships in interdisciplinary areas of grand challenges that can address emerging global issues like clean energy, agriculture, health, etc. In the above context, the GB recommended IUSSTF design future collaborative engagements in alignment with the outcome of the Indo-US Joint Commission.

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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

2009
Programmatic Activities
2010

FLAGSHIP PROGRAM

Third Indo-American Frontiers of Engineering Symposium

11-13 March 2010, Agra, India

Organizing Co-Chairs:
Partha Chakrabarti
IIT-Kharagpur, India
E-mail: ppchak@cse.iitkgp.ernet.in

Athanassios Panagiotopoulos
Princeton University, USA
E-mail: azp@perinceton.edu

IUSSTF convened the **third Indo-American Frontiers of Engineering (IAFOE) Symposium** in Agra from 11-13 March 2010. This annual flagship event was held in partnership with the U.S. National Academy of Engineering (NAE) and was organized in collaboration with the Indian Institute of Technology (IIT) - Kharagpur. The event brought together the future leaders in the fields of engineering and technology from both the countries. A total of 32 participants from India and 28 from USA drawn from academia, laboratories and industry attended the IAFOE.

At the IAFOE symposium speakers presented talks on cutting-edge research topics to colleagues outside their field. The format allowed informal one-to-one discussion on cross-disciplinary information and insights. The four interdisciplinary sessions in engineering and technology covered were:

(i) ***Health Diagnostics and Disease Monitoring technologies.*** Four talks covered: Telemedicine: key to uniform global healthcare service delivery; CommCare: Phone-base tools to strengthen community health programs; Challenges in








the application of molecular diagnostics for global health; and Advances in medical imaging.

(ii) ***High Performance Computing.*** Presentations addressed: Smart computers, smarter molecules; Mathematical models from molecules to life; Bridging the structured-unstructured gap: Searching the annotated web; and Computational challenges in flight control system design for high-performance aircraft.

(iii) ***Advanced Engineering Materials.*** Talks were on: Structural materials of the future; tailoring polymer properties from first principles; smart polymers: from shape memory to self-healing; and natural armor: encyclopedia of protective engineering designs.

(iv) ***Technologies for a Clean Environment and Environmental Clean-up.*** Presentations were made on: Future direction and challenges in fuel cell science and technology; Production of biofuels from lignocellulosic biomass using microbial systems; Ecomagination: advanced waste water treatment technologies; and Reinventing urban water systems.

In addition to the four technical sessions, there were three invited talks. Ray Johnson, Senior Vice President & Chief Technology Officer, Lockheed Martin Corp. USA spoke on *Innovation for secure future.* A.S. Kiran Kumar, Associate Director, Indian Space Research Organization spoke about the *Future Space missions of India* and Praveen Vishakantaiah, President, Intel-India gave an absorbing pre-dinner talk on *Technology trends and their impact.*

IAFOE Awards have been instituted by IUSSTF with an objective of building long-term relationships between the young Indian and American engineering and technological community and sustaining linkages established during the IAFOE Symposium. The award consists of US$ 25,000 over 2 years to be shared between the partnering Indian and American awardees. This award enables the Indian and American collaborators and their research groups to visit and work in each other's institutions. The 2010 IAFOE award was given to the interdisciplinary proposal on *'Nanoparticles for delivery of anticancer drugs in resistant tumors'* submitted by Sanjay Malhotra from National Cancer Institute, NIH and Rinti Banerjee from Centre for Research in Nanotechnology & Science, Indian Institute of Technology- Bombay.

PUBLIC-PRIVATE PARTNERSHIP PROGRAMS

India Innovation Pioneers Challenge

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As a part of its mandate to promote innovation and entrepreneurship, IUSSTF partnered with Intel Technology India Pvt. Ltd. and the Department of Science and Technology (DST), Govt. of India, to organize the 2009 India Innovation Pioneers Challenge. The IIPC is a business plan competition providing an unparalleled avenue of opportunities for emerging entrepreneurs to explore and share ideas and gain insight for commercializing their venture. Mentoring and networking support are a central element. The competition reached out to technology institutions, research labs, entrepreneurship-fostering networks and business schools all over India.

As a part of faculty mentoring, 14 selected Indian participants attended a week-long Global Entrepreneurship Leadership Symposium (GELS) in November 2009 at Hass School of Business, University of California, Berkeley.

The IIPC 2009 was held under two categories, ***Scholar Sparks*** and ***Champion of Champions.*** Under the Scholar Sparks category, 122 entries were received from students belonging to technology institutions, medical institutions and business schools with innovative technology business plans. Under the Champion of Champions category, winners of business plan competitions and incubatees attached

with prominent technology business incubators in India were able to compete; 15 proposals were received under this category. The proposals covered a wide range of topics including electronic systems and hardware, communication (mobile and wireless), digital devices, software and web services, manufacturing, biomedical devices, biotechnology, IT applications, etc.

Industry and academia experts mentored the short-listed teams, providing real-world insights on the strengths and weaknesses of their business plans. They received feedback from an eminent panel of judges, who evaluated the viability of the plan and advised and mentored on how best to strengthen the proposals towards actual realization. The top three teams under each category received cash awards. The team standing first in both categories received an all expenses-paid trip to the University of California at Berkeley for participating in the Intel-University of California Berkeley Technology Entrepreneurship Challenge 2009.

The winning teams in the Scholar Sparks category were:

First Prize

Team Name: **IntraOz**

Team Members and Institution: **Jayant Sitaram Karve** and **Srinivas Kiran Jaggu** (Stanford India Biodesign Centre, AIIMS, New Delhi)

Business Plan Description: IntraOz is a novel medical device start-up that aims to provide an alternative to difficult intravenous access in medical emergencies.

The technology is comprised of applying a progressive vacuum at the needle tip as it progresses inside the marrow. Fluids and medications infused via intraosseous lines reach the central circulation at a speed equivalent to intravenous infusion. The market potential for IntraOz will be an estimated 1.3 million patients annually.

Second Prize

Team Name: **µSpore**

Team Members and Institution: **Prabhakar Kulkarni** (Agharkar Research Institute, Pune)

Business Plan Description:
µSpore is a novel patented technology for long-term storage and transportation of DNA samples using sporopollenin microcapsules isolated from spores and pollen grains, which are in the form of micronic or sub-micronic capsules. The technology can be applied in several fields - forensic science, health care, pharmaceuticals, medicine, military and basic research. The technology is cheap, eco-friendly and easy-to-handle.

Third Prize

Team Name: **Indigenous Dental Implants**

Team Members and Institution: **Manjeet Mapara** and **S.M. Abdul Khader** (Manipal College of Dental Sciences, Manipal)

Business Plan Description: Indigenous Dental Implants involves a special laser treated bioactive surface for dental implants which is superior to and cheaper than all the contemporary implants available in the market.

Honorable Mentions

Team Name: **Innovation Challenger Kolkata**
Team Members and Institution: **Sudipta Saha** (Indian Institute of Chemical Biology, Kolkata)

Business Plan Description: This project deals with a unique computer-based spectrophotometric system to determine "vertical velocity" of the spermatozoa. It has been developed using the turbidimetric method of sperm motility analysis. The technology will be extremely helpful for treatment of human infertility and planning of animal breeding programs.

Team Name: **The Mavericks**
Team Members and Institution: **Nakul Khanna** and **Abhinav Bansal** (G.D. Goenka Public School, Delhi)

Business Plan Description: This team developed a massaging shoe. The idea was to provide a solution for people dealing with stress by incorporating massaging devices in their shoes. These devices are small enough to fit into an ordinary shoe and are powered by rechargeable batteries so that they can be used on the go.

The top teams in the Champion of Champions category were:

First Prize

The Jury recommended that no proposal was found worthy of the first prize under this category

Second Prize

Team Name: **Charismatic Chair**
Team Members and Institution: Mandeep Singh Sethi and Rahul Katyal (Max Super Specialty Hospital, New Delhi)

Business Plan Description: The team has developed a multipurpose wheelchair targeted for children with cerebral palsy in the age group of 4-7 years. The chair is equipped with various detachable devices used to exercise different body parts. The idea was to create a device based on play therapy so as to get the child involved in his/her rehabilitation without external assistance.

Third Prize

Team Name: **Spandan**
Team Members and Institution: **Varun Jain** and **Shikhar Gupta** (Indian Institute of Information Technology, Allahabad)

Business Plan Description: The project is aimed at manufacturing good quality and cheap acoustic material from carpet industry waste. The great dampening and sound absorbing quality of carpet wastes, mainly wool and jute, presents a golden opportunity to recycle this waste and to make a good quality and very cheap acoustic material. Since the demand for acoustics material is increasing in India, this product has a great market potential on account of its low cost.

DST-Lockheed Martin India Innovation Growth Program

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The **DST-Lockheed Martin India Innovation Growth Program (IIGP)** was launched in 2008 as a two-year project created to enhance the growth and development of entrepreneurial economy and adopting the prevalent best practices. IIGP is an accelerated technology assessment and commercialization initiative through a business plan competition involving commercial assessment of technology; business development; and finally technology commercialization. The program is jointly funded by the Department of Science and Technology, Government of India and the Lockheed Martin Corporation, USA, 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) in partnership with IUSSTF.

This public-private initiative is to identify, award, mentor and accelerate innovative Indian technologies into new markets in India, United States and around the world. IIGP focusses on mentoring professional business development and applying the 'Quick Look' process developed by IC². Targets are selected based on market potential. 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. 'QuickLook' process developed by IC² Institute is the fundamental methodology used for technology commercialization.

The program was open to technologies in the areas such as aeronautics, agriculture, biotechnology, chemistry, communications, computing, defence, electronics, energy, IT, engineering, medicine, life sciences and nanotechnology. More than 200 applications were received for the 2009 IIGP.

The other part of the program includes a specialized course on capacity building on Technology Commercialization conducted at the IC^2 Institute, Austin. Fifteen incubation managers were selected from various Indian institutions for participating in the tailor-made executive course held from 8-18 September 2009 at the University of Texas, Austin. The objective of the program was to provide in-depth understanding of process, key concepts, and tools to enable incubator managers to build successful technology business incubators. The program enabled the participants to gain insight into the process of commercialization as technology moves from lab to the marketplace through methods of assessing the commercial potential of early-stage technologies. Other skills covered included intellectual property protection, commercialization strategies and venture planning.

The fifteen final awardees of the DST-Lockheed Martin India Innovation Growth Program 2009 were:
Technology Name: **Complete Recycling of Beverage Cartons**
Innovator: **Tushar Shah**
Technology Description: The technology recycles 100% of the material used in aseptic beverage cartons: paper, polyethylene (plastic), and aluminum. The paper is converted to pulp and used as input for various paper products. The remaining polyethylene and aluminum is heated and pressed into durable roofing sheets. A part of the polyethylene and aluminum laminate is also used in a catalytic thermolysis process to reverse the polymers into liquid hydrocarbon fuels that can be further converted into bunker oil or diesel. The aluminum recovered from this process can be converted into poly-aluminum chloride for water treatment applications or for use in paints or fireworks.

Technology Name: **Latent Metonymical Analysis and Indexing (LMAI)**
Innovator: **Syed Yasin**
Technology Description: LMAI is a software tool that can be used to help large-scale text search engines produce dramatically better results on searches. The tool is an algorithm to supplement existing search engines. This technology, by providing contextually related words, will significantly improve the search result accuracy of search engines on less common words. The technology has been fully developed and tested in conjunction with web search engines like Google and enterprise solutions like IBM's OmniFind engine. A patent application has been filed for this invention.

Technology Name: **Cost Effective Technology for the Mass Production of Bacillus thuringiensis (Bt) Biopesticide**
Innovator: **M. Mohan**
Technology Description: The technology involves the cost-effective production of insecticidal spore-crystal proteins from Bacillus thuringiensis bacterium. These spore-crystal proteins are toxic to insects, which include caterpillars of the Lepidoptera order that infest a variety of plants - vegetable, cotton, rice, oil seeds and pulses.

Technology Name: **ECM Analog Technology**
Innovator: **Aroop Kumar Dutta**
Technology Description: ECM analog technology is a cell-interactive biomaterial for three dimensional cell cultures in a natural tissue-like condition to create artificial living tissues/organs of human and animal origin. ECM Analog biomaterial technology offers complete customization of biological (cell interactivity) and engineered properties simultaneously for the manufacturing process. It can be used for rapid prototyping and manufacturing of live tissues for research, diagnostic and therapeutic applications. The innovator holds various trademarks protected in India. Also, there are patent applications pending in India and the US.

Technology Name: **Interferential Non Invasive Pacer**
Innovator: **Narayanan Lakshmanan**
Technology Description: The Interferential non-invasive pacer was designed as an improvement to existing temporary pacers. This technology improves cardiac output and eliminates discomfort that is normally present when using temporary pacing. One of the most important aspects of the invention is that it stimulates the myocardium in isolation and hence is a novel technique for pacing the heart non-invasively. For IP protection, the inventor has filed a PCT application.

Technology Name: **Nano coatings on coronary Stent systems**
Innovator: **Sundar Manoharan**
Technology Description: The technology was developed at IIT-Kanpur and Sri Ramachandra Medical College in Chennai, and provides a nano coating of a preferred polymer on coronary stents. The coated stent provides an inert surface for arterial walls to heal and prevents the occurrence of thrombosis (clotting) and restenosis (renarrowing) of the artery. This technology is still in a prototype stage that is proceeding to validation. Sample stents have been processed using a pulse electron deposition method.

Technology Name: **LAMP based Diagnostics**
Innovator: **Shesheer Kumar**
Technology Description: The technology is a reagent and instrument for measuring molecular diagnostics. It provides cost effective confirmatory molecular tests for infections, cancers and genetic disease in animals, plants and humans. It is used in the confirmation of clinical, veterinary and plant diseases by testing presence of specific DNA or RNA pertaining to that specific causative agent. This technology uses low cost devices both for reaction and detection purposes. It is a stand alone product but can also be used with other immuno-diagnostics.

Technology Name: **Sensor Array Based Wide Frame Digital Diagnostic X-Ray Imager**
Innovator: **Karthikeyan Jawahar**
Technology Description: The Sensor array based digital X-ray imager is an electronic device with supporting software that converts x-rays directly into digital images. By going digital, costly film and processing chemicals are eliminated and the images can be stored cheaply and indefinitely, and zoomed-in for better diagnosis. The system is a plug-and-play device drastically reducing the time needed for installation and requires 25% lesser radiation. The skill required of the operator is also reduced. The inventor has successfully taken over 2000 images of animate and inanimate objects.

Technology Name: **E-waste to the Best**
Innovator: **B K Soni**
Technology Description: The basis for the e-waste solution is a shredder that was developed as a data destruction solution that can be delivered via a mobile platform. This data disposal shredder can process up to 100 disks in an hour with 100% assurance of data security post processing. The other application of this technology is in the processing of e-waste. The technology process is a combination of steps that include manual separation of electronics (like a computer) into sub-components, shredding of parts and then automated separation of materials such as metal through magnets and other processes.

Technology Name: **V-One Mobile, Peer-to-Peer Communication Session Initiation in Mobile Devices**
Innovator: **Gopi Kumar Bulusu**
Technology Description: The technology was developed to allow individuals to create an interface between two specific "smart phone" (internet capable) handsets allowing for real-time, interactive gaming to occur without the use of a third party hosting site. The software platform creates opportunity for peer-to- peer communication and provides developers the ability to build games specifically for the interfacing platform. Thus, these software platforms are essential for games to be published and downloaded.

Technology Name: **Heart Sound Analyzer**
Innovator: **Goutam Saha**
Technology Description: The Heart sound analyzer is a device and software package that gives a computer-assisted analysis of heart sounds for facilitating diagnosis of heart disorders. The device is attached to a stethoscope and a computer. The patient's signal is displayed on the computer screen in an audio-visual format. The device also has a library of audio files of common heart problems to which the physician can compare the patient's signal and help correctly diagnose the problem. The device can also "diagnose" the problem on its own for the physician and will show a "confidence factor" for that recommendation. A prototype has been produced and tested in the lab.

Technology Name: **World's First Water Pollution Free Starch/Sago Plant**
Innovator: **Natarajan Rayar**
Technology Description: The technology is a new industrial water-free process for starch processing operations which produces dried powder starch without utilizing water for running the operation. This new design requires 1/3rd of the input power used by the design of present operations. A demonstration plant has been built that can produce 4.5 tons of starch per day.

Technology Name: **WiLT**
Innovator: **Sondur Lakshmipathi**
Technology Description: The technology is a dual-core radio chip for use in 4G wireless devices, such as cell phones and femtocell products. The chip creates the ability to switch back and forth between LTE (Long Term Evolution) cellular and WiFi network signals, thereby allowing the consumer to offload cellular traffic to the lower-cost WiFi network. This can reduce cellular costs for both consumers and providers, and can reduce the amount of cellular bandwidth needed. It also provides the ability for carriers to migrate to 4G networks in a more controlled and cost-effective way. A provisional patent has been filed in India, and a patent search is planned for the US.

Technology Name: **Bio-Diesel Production by catalysis from Algae**
Innovator: **T. Raghavendra Rao**
Technology Description: The technology is a catalyst process for converting algae to bio-fuel. The innovation in this technology is the catalyst developed for the direct conversion of algae to bio-diesel. The catalyst is heterogeneous and is not mixed with the bio-oil. Two unique advancements are the direct conversion of algae to fuel without hydrogenation and the capability of this innovation to feed wet or dry algae directly into the process.

Technology Name: **Micro-Wind Turbine with Remote Online Monitoring**
Innovator: **Vinayak D. Manmadkar** and **Parag Kulkarni**
Technology Description: This technology seeks to resolve problem of acute shortage of power in rural/ semi-urban areas. The main features of this Windmill technology energy conversion, stand-alone system; designed for dual function (i.e. electrical power system and direct electrical water pumping system); creates a smart local power system (that minimizes load on grid and State Electricity Boards); and, is provided with novel safety and protection systems. This technology can also be scaled to meet the needs of end-users.

VISITATION PROGRAMS

IBM-IUSSTF Visiting Fellowship

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IUSSTF in partnership with IBM launched the ***IBM-IUSSTF Visiting Fellowships*** in 2008. The fellowships program is intended to provide an opportunity for Indian researchers working in the niche areas of nanotechnology to undertake research at IBM laboratories in USA for periods ranging between three to six months. The areas covered under the fellowship include spintronics; nanoelectronics; nanophotonics; materials and devices for energy conversion and materials for memory devices, amongst others. The fellowship is expected to foster cutting edge research and build long-term collaborative networks between academic institutions in India and the IBM labs.

The recipient of the 2009 IBM-IUSSTF Visiting Fellowship was:

Swaroop Ganguly, Indian Institute of Technology-Bombay, Mumbai

Host: Supratik Guha, Semiconductor Materials and Devices, Physical Sciences Department, IBM Thomas J Watson Research Centre, NY

Area of research: Swaroop Ganguly worked in the Solid State Materials and Devices division at the IBM T. J. Watson Research Center on two different areas. The first was solar analytics which involved building simple predictive models for solar cell/module output as a function of meteorological variables. The second topic was oxide electronics that explored transition metal oxides exhibiting strong electron-electron correlations as the building blocks for next generation logic/memory.

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 third batch of **Indo-US Research Fellowships** awarded to 26 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 introduces 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 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 allows the awardees to spend between 3 to 12 months in any premier host institution in USA and covers 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. The 26 researchers from academia and laboratories chosen for the 2010 award are:

Anugrah Singh, Indian Institute of Technology, Guwahati
US Host: John F. Brady, California Institute of Technology, Pasadena
Subject area: Fluid dynamics of suspensions

Anuja Krishnan, Institute of Molecular Medicine, New Delhi
US Host: Kartik Chandran, Albert Einstein College of Medicine, New York
Subject area: Virology

Arunasis Bhattacharyya, Bhabha Atomic Research Centre, Mumbai
US Host: Gordon D. Jarvinen, Los Alamos National Laboratory, New Mexico
Subject area: Fundamental bonding and electronic interactions in actinide and lanthanide complexes.

Ashudeb Dutta, Indian Institute of Technology, Hyderabad
US Host: John D. Cressler, Georgia Institute of Technology, Atlanta
Subject Area: Low-power integrated circuit design

B. Kadalmani, Bharathidasan University, Tiruchirappalli
US Host: Hugh S. Taylor, Yale University School of Medicine, Connecticut
Subject area: Stem cells and reproductive medicine

Bipin Kumar Gupta, National Physical Laboratory, New Delhi
US Host: Pulickel M. Ajayan, Rice University, Houston
Subject area: Study of optical (luminescent) properties of carbon nanotube and graphene devices

Debashish Goswami, Indian Statistical Institute, Kolkata
US Host: Marc Rieffel, University of California, Berkeley
Subject area: Non-commutative geometry and quantum group

Debasis Dash, Institute of Genomics and Integrative Biology, New Delhi
US Host: Akhilesh Pandey, Johns Hopkins School of Medicine, Baltimore
Subject area: Development of novel algorithms for MS based proteomics

Fayaz Ahmad Malik, Indian Institute of Integrative Medicine, Jammu
US Host: Max Wicha, Medical School and Comprehensive Cancer Center, University of Michigan, Ann Arbor
Subject area: Cancer biology and cancer drug discovery

Krishnendu Sengupta, Indian Association for the Cultivation of Sciences, Kolkata
US Host: Steven Girvin, Yale University, Connecticut
Subject area: Theoretical condensed matter physics

Manoj Kumar Barthwal, Central Drug Research Institute, Lucknow
US Host: Howard Kruth, National Institute of Health, Bethesda
Subject area: Atherosclerosis

Naveen K Sharma, Post-Graduate College, Ghazipur
US Host: Richard Malcolm Brown Jr., University of Texas, Austin
Subject area: Biofuel biotechnology

Nitin Umedlal Padhiyar, Indian Institute of Technology, Gandhinagar
US Host: Lorenz T. Biegler, Carnegie Mellon University, Pittsburgh
Subject area: Flow sheet simulation and optimization

P. Shanmugam, Indian Institute of Technology, Madras
US Host: Chuanmin Hu, University of South Florida, Tampa
Subject area: Comparative study of harmful algal blooms (HABs) in the Gulf of Mexico and Arabian Sea through improved HAB detection algorithms

R. Vijay, International Advanced Research Centre for Powder Metallurgy and New Materials, Hyderabad
US Host: G. Robert Odette, University of California, Santa Barbara
Subject area: Oxide dispersion strengthened steels

Rajesh, National Physical Laboratory, New Delhi
US Host: Ashok Mulchandani, University of California, Riverside
Subject area: Conducting polymers and biosensors

Rajesh Singh, Indian Institute of Geomagnetism, Navi Mumbai
US Host: Umran S. Inan, Stanford University, Palo Alto
Subject area: ELF, VLF remote sensing of ionosphere and magnetosphere

Ram Kumar Sharma, Institute of Himalayan Bioresource Technology, Palampur
US Host: Edward S. Buckler, Cornell University, Ithaca
Subject area: Plant genotyping and functional genomics

Rohit Y. Sharma, Jaypee University of Information Technology, Solan
US Host: Paul A. Kohl, Georgia Institute of Technology, Atlanta
Subject area: Modeling and optimization of high-speed interconnects for VLSI circuits and SoC applications

Samares Pal, University of Kalyani, West Bengal
US Host: Joseph P. Montoya, Georgia Institute of Technology, Atlanta
Subject area: Incorporation of stable isotopes in marine ecosystem models

Samudrala Gourinath, Jawaharlal Nehru University, New Delhi
US Host: Nikolaus Grigorieff, Brandeis University, Massachusetts
Subject area: High-resolution electron microscopy of macromolecular complexes

Santosh K. Tiwari, Banasthali University, Rajasthan
US Host: Michael L. Chikindas, Rutgers University, New Brunswick
Subject area: Design of antimicrobial peptides for therapeutic application: structure-function analysis

Shashi Bhushan, Indian Institute of Integrative Medicine, Jammu
US Host: Rajesh Agarwal, University of Colorado, Boulder
Subject area: Development of cyclin dependent kinases inhibitors as putative anticancer therapeutics

Suman Kundu, University of Delhi, South Campus, Delhi
US Host: Mark S. Hargrove, Iowa State University, Ames
Subject area: Novel hemoglobin biochemistry, stability and folding leading to engineering of stability in blood substitutes

V. Ganesan, Banaras Hindu University
US Host: Shelley D Minteer, Saint Louis University, St. Loius
Subject area: Bioenergy conversion devices

Y.V. Nancharaiah, Bhabha Atomic Research Centre Facilities, Kalpakkam
US Host: Bruce E. Rittmann, Arizona State University, Tempe, AZ
Subject area: Microbial bioenergy under environmental biotechnology

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 from 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 and a half 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.

Nish Chasmawala, 2008 SIB Fellow, has been chosen as an India TR35 recipient by Massachusetts Institute of Technology. TR35 lists the top 35 innovators under 35 in India. Srinivas Jaggu, 2008 SIB Fellow, has been selected as a 2009 TED India Fellow.

Four outstanding individuals selected for the 2010 SIB Fellowship are:

Gita Handa with a background in Rehabilitation Medicine

Nitin Sisodia with a background in Industrial Design

Pushkar V. Ingale with a background in Mechanical Engineering

Ritu Kamal with a background in Bioengineering

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), **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 in 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 U.S. (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 7 visitations were awarded in 2009-10:

Anita Chaudhary, Senior Scientist in the Division of Environmental Sciences at the Indian Agriculture Research Institute, New Delhi, performed a three month research project on *Optimization of parameters for biofuel production process by photosynthetic bacteria in photobioreactors* with Bruce Rittmann at the Arizona State University, Tempe.

B. Murali Manohar, Director of the Centre for Animal Health Studies at the Tamil Nadu Veterinary and Animal Sciences University in Chennai, visited Nammalwar Sriranganathan at the Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech, Blacksburg, to perform a research project on *Testing of nanoplexes containing gentamycin to treat chronic / persistent brucellosis.*

Laszlo Csonka, Professor of Biological Sciences at Purdue University visited Jayaraman Gowrishankar at the Center for DNA Fingerprinting and Diagnostics, Hyderabad to teach a course on *Genomic Annotation Computer Lab.*

Max Haggblom, Professor and Chair in the Department of Biochemistry and Microbiology at Rutgers University, New Brunswick traveled to India to teach an *International Short Course on Bioremediation* with Srikanth Mutnuri at the Birla Institute of Technology and Science in Goa.

Mrinal Bhattacharya, Associate Professor at the University of Hyderabad, collaborated with Nirbhay Kumar at the Johns Hopkins Bloomberg School of Public Health, Baltimore for a research project titled *Targeting the double strand break repair machinery of P. faciparum.*

Narayanan Rajendran, Associate Professor in the Department of Biology at Kentucky State University, Frankfort was awarded a professorship to teach a course on *Agricultural Microbes Bioinformatics* with Meenu Saraf at Gujarat University in Ahmedabad.

Ramesh Goel, Associate Professor in the Department of Civil and Environmental Engineering at the University of Utah, Salt Lake City, taught a course on *Microbes and Sustainability* with S. Krishnaswamy at the Madurai Kamraj University.

Shiv Pillai, Associate Professor of Medicine at Massachusetts General Hospital and Harvard Medical School, Boston visited Gagandeep Kang at the Christian Medical College, Vellore to teach a course on the *Cellular and molecular basis of protective immune responses.*

Venkata Nancharaiah, Scientific Officer at the Bhabha Atomic Research Centre, Kalpakkam collaborated with Arokiasamy J Francis at the Brookhaven National Laboratory, Upton on a research project entitled *Electron transfer mechanisms in microbial biotransformation of metal / radionuclides.*

IUSSTF-American Physical Society (APS) Fellowships

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IUSSTF implemented an MoU with the American Physical Society to conduct two bilateral exchange programs. The **Indo-US Professorship Awards in Physics** is awarded every year to faculty and researchers from India and USA to teach short courses or deliver a lecture of series. The **Indo-US Physics Student Visitation Program** supports an international research experience for US & Indian students. 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 two scientific communities.

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

The recipients of the **2009 Indo-US Professorship Awards** in Physics are:

Bhimsen K. Shivamoggi, University of Central Florida, Orlando
Host: Abhijit Sen, Institute for Plasma Research, Gandhinagar
Subject area: Lecture series on *Hall MHD reconnection*

Gary Williams, University of California, Los Angeles
Hosts: K.P.N. Murthy, University of Hyderabad, and Ramakrishna Ramaswamy, Jawaharlal Nehru University, New Delhi
Subject area: Seminar talks on *Vortex loops and the superfluid phase transition*, *Vortex-loop dynamics at the superfluid phase transition, and applications to superfluid turbulence*, and *Experimental aspects of superfluid and superconducting phase transitions*

G. Baskaran, Institute of Mathematical Sciences, Chennai
Host: John Quinn, University of Tennessee, Knoxville
Subject area: Lecture series on *Novel quantum phenomena in graphene* and *Topological quantum computation and quantum condensed matter*

K. D. Sen, University of Hyderabad
Host: Viraht Sahni, Brooklyn College, City University of New York
Subject area: Seminars on *Confined electronic systems* and *Scaling properties of net information measures for bound states of some model potentials*

Manoj K. Mishra, Indian Institute of Technology-Bombay, Mumbai
Host: John R. Sabin, University of Florida, Gainesville
Subject area: Lecture course on *Theoretical aspects of metastable electron attachment resonances*

Rajeev Krishnarao Pathak, University of Pune
Host: Sajan Saini, Queens College, City University of New York
Subject area: Lecture series on *Implications of mathematical inequalities in quantum theory*

Sajan Saini, Queens College, City University of New York
Host: Rajeev Krishnarao Pathak, University of Pune
Subject area: Short-course titled *Silicon photonics*

Zoltan Haiman, Columbia University, New York
Hosts: Biman B. Nath and Shiv K. Sethi, Raman Research Institute, Bangalore
Subject area: Lecture series on topics related to structure formation in the early universe

The recipients of the **2009 Indo-US Physics Student Visitation** program are:

Andrew Forrester, University of California, Los Angeles
Hosts: K.P.N. Murthy, University of Hyderabad, and Ramakrishna Ramaswamy, Jawaharlal Nehru University, New Delhi
Subject area: Dynamics of the superfluid transition under the conditions of a rapid quench from the critical temperature to low temperatures

Benjamin Heidenreich, Cornell University, Ithaca
Host: Gautam Mandal, Tata Institute of Fundamental Research, Mumbai
Subject area: *4th Asian Winter School on Strings, Particles and Cosmology*, Mahabaleshwar and research at TIFR

Byung Kyu Park, University of California, Berkeley
Host: Sadiqali A. Rangwala, Raman Research Institute, Bangalore
Subject area: All-optical switch

Haridas M., Indian Institute of Science, Bangalore
Host: Gary P. Wiederrecht, Argonne National Laboratory, Argonne
Subject area: Research with the nanophotonics group at ANL

Matthew Kerr, University of North Carolina, Charlotte
Host: Vasant Natarajan, Indian Institute of Science, Bangalore
Subject area: Application of optical trapping techniques to microsphere manipulation and alignment

Michael Giver, Brandeis University, Waltham
Host: Rajesh Ravindran, Institute of Mathematical Sciences, Chennai
Subject area: Constructing a theoretical framework for analyzing pattern formation in spatially heterogeneous chemically active media

Onkar Sharad Game, National Chemical Laboratory, Pune
Host: Oki Gunawan, IBM T.J. Watson Research Center, New York
Subject area: Semiconductor nanowires for energy conversion

Rahul Singhal, Inter-University Accelerator Centre, New Delhi
Host: Jagdish Narayan, North Carolina State University, Raleigh
Subject area: Fullerene thin films

Sandeep Pathak, Indian Institute of Science, Bangalore
Host: Nandini Trivedi, Ohio State University, Columbus
Subject area: Theoretical understanding of high temperature superconductivity

University of California, Berkeley-IIT, Kharagpur Visitation Program

Contact Persons:
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UC Berkeley and IIT Kharagpur, two premier academic institutions in the US and India launched a collaboration in May 2008 on Bioenergy and Emerging & Neglected Diseases. The program will be implemented in two phases. Phase 1 is planned to foster relationships amongst students, researchers and faculty and increase the pool of highly talented and capable participants through exchanges. Phase 2 would focus on conducting joint research and expediting the translation of scientific discoveries to market place.

The other participating institutions are Lawrence Berkeley National Laboratories (LBL) and the University of Illinois, Urbana Champaign (UIUC). While the joint project activities will be supported through extramural funding available to the respective institutions, IUSSTF will be supporting a part of the exchange and visitation activities under the collaboration.

In areas of both BioEnergy and Healthcare-BioTech, the UC-B and IIT-Kgp collaborative relationship is now strong and sustainable. This collaboration has catalyzed Prabha K. Sinha, IIT- Kharagpur alum, to establish the ***PK Sinha Center for BioEnergy at IIT Kharagpur*** with a gift of US $2 million. Additionally, as a result of the student and faculty visits and following the research symposium, several areas of interest for research have emerged.

In the summer of 2009 the following eighteen students from IIT Kharagpur attended an a 8-week summer research internship at UC Berkeley and LBL:

Abhishek Mandal
Project title: Finite source modeling of micro earthquakes in Parkfield, California
Advisor: Doug Dreger

Adya Anima
Project title: Healthcare biotechnology
Advisor: Kimmen Sjolander

Akhil Kumar Saraogi
Project title: Crystallization and data collection of thermophilic protein
Advisor: Paul Adams

Aniket
Project title: Experimental studies on the kinetics of cellulose-catalyzed hydrolysis of cellulose
Advisor: Doug Clark

Arush Dhawan
Project title: Chemical synthesis of transportation fuel from biomass in ionic liquid solvent medium
Advisor: Alex Bell

Bharath Bhat
Project title: Optimization of a digital microfluidic platform for quantification of bio-markers
Advisor: Rich Mathies

Dolonchampa Maji
Project title: To explore cryo electron microscopy sample preparation techniques that allow observation of plant tissue in unstained, frozen-hydrated state
Advisor: Manfred Auer

Gourab Chatterjee
Project title: Exploring fatty acid degradation pathways of *Mycobacterium tuberculosis* H37Rv
Advisor: Manfred Auer

Mrigesh Parashar
Project title: Hydroclimate processes
Advisor: Norm Miller

Naga Neehar Dingari
Project title: Study of enzymatic reactions in nano-channels
Advisor: Arun Majumdar

Prasant Kumar
Project title: Cloning and expression of terpene producing genes in *E. coli*
Advisor: Tom Alber

Satyakam Dash
Project title: Cloning and expression of terpene producing genes in *E. coli*
Advisor: Jay Keasling

Shailabh Kumar
Project title: Ultrastructural study of Arabidopsis mutants by Transmission Electron Microscopy
Advisor: Manfred Auer

Sheetal Sharma
Project title: To generate retroviral vectors expressing *Toxoplasma gondii* protein, ROP5
Advisor: Nilabh Shastri

Shouvik Chatterjee
Project title: Computerized control electronics for a novel self-contained dilution refrigerator
Advisor: Irfan Siddiqui

Subhamoy Das
Project title: Computational interpretation of total genetic variation in personalized genomes
Advisor: Jasper Rine

Sushant Gupta
Project title: SATCHMO: Simultaneous Alignment and Tree Construction using Hidden Markov Models – Visualization and extensions to the algorithm
Advisor: Kimmen Sjolander

Sushant Kumar
Project title: Development of a kinetic model of cellulose hydrolysis for evaluating optimal minimal cellulose mixture
Advisor: Harvey Blanch

Research Internships in Science and Engineering

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The **Research Internships in Science and Engineering (RISE)** program has been launched to create opportunities for science, technology, engineering and medical students from India and the United States to undertake internships in national laboratories, federal research centers, academic research institutes, and private R & D laboratories in each other's countries. The internships provide students with unique opportunities to live and work in an international context, to gain practical experience, and acquire professional skills. Internships are a source of mutual cultural and professional enrichment for both the interns and their host institutions.

Students currently enrolled at a recognized institutions of higher education pursuing doctoral programs in science, engineering, technology and medical disciplines are eligible to apply for the internship in India. More then 60 research institutions in India have signed in as hosts for US RISE interns. The internships will provide for monthly stipend, accommodation and airfare. RISE program was formally launched during the GB meeting of IUSSTF in December 2008 and was implemented from 2009. The following 6 students from USA interned in India under the RISE Program in 2009-10:

Guillermo Cabrera, University of Texas, Austin
Subject Area: Database system, information storage and retrieval
Mentor: Anbumani Subramanian, HP Labs Open Innovation Office, Bangalore

Kearns James, University of Massachusetts, Amherst
Subject Area: Physical Sciences
Mentor: Ashok Kumar Giri, Indian Institute of Chemical Biology, Kolkata

Marissa Rae Jablonski, University of Wisconsin, Milwaukee
Subject Area: Civil environmental engineering and water resources
Mentor: Hemant Purohit, National Environmental Engineering Research Institute, Nagpur

Paul Robert Scott, University of Missouri, Kansas City
Subject Area: Experimental spectroscopic condensed matter physics
Mentor: Victor Mutthu, Indian Institute of Science, Bangalore

Seron Kerouac Eaton, Arizona State University, Tempe
Subject Area: Cancer Research
Mentor: Gopal Pande, Centre for Cellular & Molecular Biology, Hyderabad

Susie Mihee Kang, University of California, Santa Barbara
Subject Area: Statistics
Mentor: Arnab Bhattacharya, Indian Institute of Technology, Kanpur

Khorana Program for Scholars

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In 2008 the University of Wisconsin-Madison (UW) launched the *Khorana Program for Scientific Exchange* in honour of Dr. Har Gobind Khorana, who won the Nobel Prize in 1968 for his work at the interface of chemistry and biology while a member of the UW faculty. Dr. Khorana has generously agreed to lend his name to this program. This exchange program fosters and expands interaction between the Indian and U.S. scientific communities by providing a transformative platform for both American and Indian students.

The Department of Biotechnology (DBT), Government of India, joined University of Wisconsin-Madison (UW) and IUSSTF as partners to support the **Khorana Scholars Program** allowing the exchange of students between Indian institutions and the University of Wisconsin-Madison in the field of biotechnology, including agricultural, health and biomedical sciences. The program provides an opportunity to Indian students pursuing B.Tech, M. Tech., or M.Sc. degrees to spend from 10-12 weeks in research laboratories at UW, mentored by UW faculty. The hands-on project based lab work undertaken as a part of the internship provided them the opportunity to become part of major research programs at UW-Madison as international teams of scholars. In 2009, the following 12 students were awarded a 10-week internship under this program.

Chileveru Haritha Reddy, Indian Institute of Technology, Kanpur
Subject area: Biochemistry – Bio-molecular recognition processes
Mentor: Laura Kiessling

Gayatri Rao Tadinada, Indian Institute of Technology, Guwahati
Subject area: Cellular and molecular biology: Stem cell research (focus on the human brain)
Mentor: Su-Chun Zhang

Hari Prasad, Indian Institute of Technology, Kharagpur
Subject area: Biochemistry – Regulation of gene expression
Mentor: Aseem Ansari

Jishnu Das, Indian Institute of Technology, Kanpur
Subject area: Physiology - Structural mechanisms underlying voltage-dependent gating in ion channels
Mentor: Baron Chandra

Madhuresh Sumit, Indian Institute of Science Education and Research, Pune
Subject area: Geoscience - Interfacial biogeochemistry
Mentor: Nita Sahai

Mathangi Srinivasan, Anna University, Chennai
Subject area: Biochemistry – Focusing on the function of molecular chaperones
Mentor: Elizabeth A. Craig

Mohammed Abdul Majeed, Indian Institute of Technology-Madras, Chennai
Subject area: Chemical and biological engineering – Focusing on the study of metabolism and regulation
Mentor: Jennifer Reed

Naina Kurup, Birla Institute of Technology and Science, Pilani
Subject area: Biochemistry – Molecular genetics of type 2 diabetes
Mentor: Alan D. Attie

Niranjana Natarajan, SASTRA University, Thanjavur
Subject area: Bacteriology – Focusing on the structure and assembly of Type IV pili
Mentor: Katrina Forest

Sarita Koride, Indian Institute of Technology, Guwahati
Subject area: Biochemistry – Structure, folding and design of integral membrane proteins
Mentor: Alessandro Senes

Shanmugapriya Sothiselvam, A.C. College of Technology, Chennai
Subject area: Biochemistry – Genetic recombination
Mentor: Michael Cox

Srivats Venkataramanan, Indian Institute of Technology-Madras, Chennai
Subject area: Biochemistry – Molecular genetics; RNA and RNA-protein interactions
Mentor: Marvin Wickens




On a reciprocal basis, the following 2 students from UW-Madison spent their internship as Khorana Scholars at various institutions in India:

Lauren Marinaro
Subject area: Function of nucleus plasticity and chromatin organizations
Mentor: Shiva Shankar
Host Institution: National Centre for Biological Sciences, Bangalore

Erica Barts
Subject area: Human immune response
Mentor: Apurva Sarin
Host Institution: National Centre for Biological Sciences, Bangalore

BILATERAL WORKSHOPS

New Approaches to Infant and Young Child Feeding and Development

6-10 April 2009, Hyderabad, India

Principal Investigators:
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Patrice Engle
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Under-nutrition remains a major problem in India, as in many parts of the world, and interventions to reduce it are of a high priority. Malnutrition restricts the ability of children to develop their full cognitive and socio-emotional potential. Based on the results of the Indo-US collaborative study on 'the efficacy of integrated feeding and care intervention among 3 to 15 months old rural children in Andhra Pradesh, India', an investigative workshop followed by a

conference on ***New approaches to infant and young child feeding and development*** was held at the National Institute of Nutrition, Hyderabad. The event was attended by eighty-five participants including five resource persons from US and nine from India.

The workshop was used as a base to analyze and draw conclusions from the efficacy trials under the Indo-US collaborative project. The academic highlights of the event included deliberations regarding the various models for interpreting data, use of more sophisticated statistical models for analysis e.g. multi-level modeling, appropriate indicators, etc. The workshop provided the opportunity to finalize the initial conclusions of the trial for dietary intake, growth, responsive feeding and child development. The recommendations of the workshop included highlighting the necessity for interpersonal communication methods that involve participatory discussions, behavioral experiences that could be used to improve children's nutrient intake, and interventions with young children that would incorporate improvements in responsive feeding and play/communication.

As an outcome, four abstracts were submitted to the International Congress of Nutrition (IUNS) that was held at Bangkok in October 2009.

Metrology, Standards, and Conformity Assessment and their use in Support of Technical Regulations

1- 4 June, Gaithersburg, Maryland, USA

Principal Investigators:
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Metrology, standards and conformity assessment procedures are used by societies to help develop technical regulations that address optimization of production, health, consumer protection, environment, security and quality, as well as to manage risk and intervene in cases of market failure. Sound development and effective implementation of these procedures and regulations enable sustainable development, build welfare and facilitate trade.

An Indo-US workshop on ***Metrology, standards, and conformity assessment and their use in support of technical regulations*** was organized at NIST from 1- 4 June 2009. The aim of the meeting was to provide detailed overviews of the measurement and standards system in the two countries. It dealt with the standards, documentary and measurement, conformity assessment and metrology systems and their applications to support technical regulations in the United States and India. It examined the role that these system components play in enhancing global trade and spurring innovation; and to explore opportunities for future collaboration. Laboratory tours to specific NIST laboratories e.g., nano, chemical, bio, manufacturing, engineering etc. were also organized. The workshop was attended by 42 representatives including 20 from India from government, academic institutions, regulatory bodies, industries and other allied organizations from both countries.

Delegates resolved to formulate a matrix where the major objective would be to create a network of scientists, technologists and entrepreneurs who can work together to promote joint research and enable development of projects on metrology that would help to foster mutually beneficial innovation in legal, physical, chemical, electronics and engineering, materials and building technologies.

Permian-Triassic Boundary Event in Spiti Valley, Himachal Pradesh

11-20 June 2009, Chandigarh, India

Principal Investigators:
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The Permian-Triassic (P/T) bio-stratigraphic break is coincident with the greatest mass extinction event in the history of life that took place ~251 million years ago. This extinction event is believed to be accompanied by the demise of 96% of all marine species and 70% of terrestrial vertebrates. Although the pattern of this mass extinction is still being debated, the proposed mechanisms for the extinction include wide-ranging catastrophic environmental change caused by for example, rapid flood basalt eruptions, bolide impacts, sudden release of methane gas hydrate from the sea-floor, sea-level changes, marine anoxia, and changes in the oceanic circulation caused by climate change.

In order to examine, investigate, and collect close-spaced geological samples from this P/T boundary section, an Indo-US bilateral workshop and field visit on the ***Permian-Triassic boundary event in Spiti Valley, Himachal Pradesh*** was jointly organized by the University of Rochester and Panjab University, Chandigarh. The workshop was held in Chandigarh and was followed by a field visit to collect samples from the Spiti Valley in Himachal Pradesh from 11-20 June 2009.

The event attracted nine US and eleven Indian participants. The lectures covered the general nature of the world-wide P/T boundary event, and, the geology of the P/T rocks of the Himalayas, in particular, the Spiti Valley. Field work was organized around Atargoo near Lalung, Guling, and Muth to examine and collect core samples from the upper Permian into the lower Triassic including the boundary layer formations. The successful collection of a well-documented geological sampling in close spacing across the P/T boundary in Spiti makes possible new geochemical, sedimentological and paleo-environmental collaborative research with potentially significant results.

Chemical Biology

2-7 July 2009, Bangalore, India

Principal Investigators:
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As an inter-disciplinary area, chemical biology has become a new frontline discipline in research which encompasses the application of diverse chemical concepts and tools to understand biological processes. Understanding protein structure-function dynamics using chemical tools has made enormous progress in the last few decades due to the coordinated efforts of experimentalists and theoreticians. On the experimental side, novel new developments in the areas of single molecule spectroscopy and protein dynamics coupled with tremendous growth in the reach of structural biology have fuelled unprecedented understanding of macromolecular function. On the theoretical side, energy landscape paradigms have been developed to understand protein folding, protein-DNA interaction and protein association. Computer simulations are playing an important role in bridging the gap between theory and experiments.

The remarkable efficiency of biological systems continues to fascinate scientists and worldwide efforts are being made to understand the physics and chemistry behind these structures with an aim of synthesizing artificial systems that mimic their biological counterpart. The emphasis of this workshop on ***Chemical Biology*** was on protein and enzymes including their function and kinetics. In order to achieve maximum impact and to maintain thematic focus, the workshop covered select areas of protein structure, function and dynamics involving protein folding, single molecule spectroscopy, enzyme kinetics, Protein-DNA interaction and CARS microscopy of tissue cells. The selected talks addressed the important aspect of biological chemistry that draw heavily from the fundamentals of pure chemistry and from many aspects of physics too.

Seven US and thirty-five Indian delegates participated in the event. New developments and results at the interface of chemistry and biology were presented at the event on photosysthesis, enzyme kinetics and single molecule spectroscopy.

Designing Sustainable Products, Services and Manufacturing Systems

18-20 August 2009, Bangalore, India

Principal Investigators:
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The primary objective of the bilateral workshop on ***Designing Sustainable Products, Services and Manufacturing Systems*** was to bring together domain experts from India and the US to discuss the social, economic, environmental, and technological aspects of designing sustainable systems, especially manufacturing systems. Sustainable systems are essential for ensuring a good quality of life for future generations by taking into account the environmental, societal and economic impacts of the activities or products that the systems control. The essential goal of such systems is to significantly reduce the consumption of resources and minimize the effects on the environment to an enduringly affordable level, while enhancing economic output and social structure.

The workshop consisted of technical sessions, breakout discussions, and industrial showcases that addressed important issues necessary for the production of such systems. The topics for the technical sessions included design of sustainable products, services, and manufacturing systems including integrating environmental aspects into product design and development; design for sustainability; product lifecycle management and lifecycle analysis; material science; advanced manufacturing technologies; nano-manufacturing; energy efficiency; conservation for production and use of products; reduction, reuse, and recycling; information infrastructure including advanced models and semantics for product and process.

Another important aspect covered was preparing engineering designers and managers for the 21st century, including designing of engineering curricula to include sustainability principles; national and international standards; multi-disciplinary approaches to engineering education; policies, standards and industry best practices for sustainable systems; and showcases of sustainable technology through Indian and US case studies and business models. About 120 participants including 50 students & 20 industry representatives & 11 resource persons from US attended the event. Eighteen students took part in mixed-institutional teams at a post-workshop competition on redesigning products to make them more sustainable.

Indo-US workshop on Cyber security, Cyber-crime and Cyber-forensics

19-21 August 2009, Kochi, India

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The IT and Business Process Outsourcing phenomena have resulted in strong relationships between business entities in the US and India in the recent past. The business relationships are in turn fostering increased collaboration between organizations across the two countries. Both nations are vulnerable to and face constant threats of cyber-crime that impede effective business continuity planning. Given the strong relationships in this area, it is imperative that academics, business professionals and governmental entities collaborate to effectively thwart increasing threats of global cyber-crime and initiate cyber security defenses. With this in mind, an Indo-US workshop on ***Cyber security, cyber-crime and cyber-forensics*** was organized at Amrita University.

The workshop which was attended by 30 participants including 8 resource persons from US and 12 from India focused on identifying the current state of application of IT in law enforcement; comparing important internet fraud detection techniques; identifying opportunities to integrate research, practice and educational efforts in the two countries to combat cyber-crime; and sharing expertise and knowledge on implementing cyber forensics. Position papers were presented on each of these topics followed by breakout groups on cryptography, malware detection, security in wired and wireless networks, digital media piracy, cyber-crime and law enforcement.

As an outcome of the event, three joint projects have been initiated on: Unique Identification Number; Cyber security attacks in the e-health scenario; and Cloud Computing and Security. Additionally, two publications are being generated including an edited volume titled, Cyber Security, Cyber Crime and Cyber Forensics: Applications and Perspectives to be published by IGI Global, USA.

Translational Neuroscience: New Trends in Mental and Neurodegenerative Disorders Research

15-16 October 2009, Chicago, USA

Principal Investigators:
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Mental disorders such as depression, bipolar illness, and schizophrenia as well as neurodegenerative disorders such as Alzheimer's disease, autism, and Parkinson's disease are major health problems both in the United States and India. According to the World Health Organization, about 450 million people suffer from mental and behavioural disorders. Four of the six leading causes for years lived with disability are due to neuro-psychiatric disorders. Achieving a better understanding of the neurobiology of these disorders using the recent advances in molecular biology, genomics and the role of environmental factors, will not only enhance knowledge of their patho-physiology but will also result in better management and treatment.

With this in mind, the symposium on ***Translational Neuroscience: New Trends in Mental and Neurodegenerative Disorders Research*** was held in Chicago. There were 24 speakers in the conference including 10 from India and 14 speakers from the United States and the symposium attracted over one hundred and eighty participants. The symposium sessions addressed a wide range of issues with regard to mental and neurodegenerative disorders with the objective of advancing neuroscience research.

The workshop included: a panel discussion on developing possible US-India programs in neurosciences exploring the interaction and networking amongst US and Indian neuroscientists, a session on submitting grant proposals for collaborative research at NIH and DST; a heightened awareness of new trends in research on mental and neurodegenerative disorders with potential for link-ups; and opportunities specially for conducting translational research.

Neurosurgery Collaboration Meet

24-28 October 2009, New Orleans, USA

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Neuroscience is one of the fastest growing disciplines today and significant laboratory, basic science and clinical research is taking place in both India and the United States. To further existing research, exchange of data and material would greatly help both nations. In order to further enhance the information exchange process, including ideas and expertise between the two countries, an ***Indo-US Neurosurgery Collaboration Meet*** was held in New Orleans. Dr. A.P.J. Abdul Kalam, former President of India, delivered the 2009 International Leadership lecture at the meeting.

The event consisted of multiple presentations in the form of didactic lectures, hands-on-workshops and symposia. Subjects covered included 3-D anatomy; surgical indications, techniques and alternatives for cranial vascular malformations; practical neurosurgical ICU management; cervical spine degenerative disease; applied spinal biomechanics; cerebral revascularization; inpatient and outpatient management dilemmas; neurosurgical practice development; nuances of minimally invasive spinal surgery; radiosurgery; and functional neurosurgery to name a few. New developments presented included updates on the management of CNS infection and CNS Trauma, and, how to achieve excellence in neuro healthcare.

Significant emphasis was placed on continuing ethical practice and providing excellent services. The workshop has lead to a real interest on both sides in further exploring the possibility of bilateral collaborations in neurosurgery like online didactic course work with contributions from India and US, webinars, self assessment, resident courses, neurosurgeon visiting fellowships, etc.

System of Systems Engineering in Large Scale Systems

26-28 October 2009, Kanpur, India

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With the advancement of technology, we are confronted with very large scale systems involving multiple disciplines such as sensor networks, collaborative robotics, power-grid, city traffic and airport operation. The field of ***'System of Systems'*** (SoS) is an interdisciplinary area that brings together these various themes. An Indo-US workshop on SoS engineering in large scale systems at IIT Kanpur provided a unique opportunity for experts from both countries to share and decipher research expertise to broaden the scope of SOS. The event was attended by thirty participants drawn from academia, research laboratories and industry.

Twenty-four technical presentations including 8 from USA and 16 from India were presented. Topics covered included: system of systems engineering in land, air and sea rovers; robotics; fuzzy systems; modeling and simulation; space applications; Boeing's approach to e-enabling commercial airlines; sensor networks; computational intelligence in control and optimization; reactor control; static and dynamic optimization; and aerospace systems. New developments were presented in the areas of networked control system with variable delay using Smith Predictor; macroscopic quantum mechanical approach to engineering design of system of systems; intelligent adaptive control of cooperative systems; innovative control of multi-agent systems and neural network approach to system of systems design.

Theoretical deliberations were done in terms of adaptive control and nonlinear control of multi-agent systems, variable structure control, networked control with variable delays, stability analysis of communication networks with variable delays and macroscopic quantum mechanics based SoSE design. Some of the participants presented their research work in the form of posters. As an outcome, a book edited by the two co-PI's titled 'Systems of systems engineering - towards bridging the gap between SoS and SoS' is under publication.

Climate and Energy Futures

26-27 October 2009, Chennai, India

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India and the US are already strategic partners in various areas of science and technology including energy and climate. Both countries are also part of the seven-nation Asia Pacific Partnership on Clean Development and Climate which is based on the principle that technology should play a key role in finding solutions for low-carbon growth. As part of this, several low-carbon energy projects have been initiated in various regions of India. More recently, India and the US signed a historic agreement for cooperation in civilian nuclear power, which is expected to give a boost to nuclear power production in India. It is now relevant for the two nations to further develop new collaborations in finding solutions to the energy-climate problem and also for framing of appropriate policies.

An Indo-US workshop on ***Climate and Energy Futures*** was organized against the backdrop of the Copenhagen summit on climate. This 2-day workshop included presentations on various topics such as coal, carbon capture, nuclear power prospects, transportation fuel options and solar energy. The workshop began with a keynote address on the "Power of the Sun" by Nobel Laureate Walter Kohn from the University of California, Santa Barbara. The workshop provided the initial interface necessary for core participants from these two countries towards establishing critical mass and interest for longer-term interaction to encourage basic research in developing new low-carbon technologies, and to initiate collaborations in technology-policy studies in various aspects of energy-climate policy.

The workshop was attended by seventy-five participants of whom fourteen were from the US. In addition, around twenty-five students also participated in the event. Joint projects between CSTEP and CMU on energy policy have been identified for implementation.

Recent Scientific Developments on Vitamin D & Health

12-13 November 2009, Manesar, India

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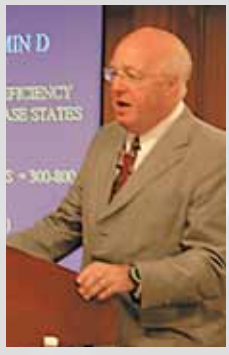

Recent research indicates that vitamin D deficiency is a potential risk factor for a variety of chronic diseases including diabetes, various cancers and cardiovascular events. Maternal vitamin D deficiency may be an important cause for the development of rickets in children. Early life vitamin D deficiency may be a risk factor for bone disease and autoimmune diseases later in life. In developing countries such as India, data on clinical and subclinical vitamin D deficiency status are scarce. There have been scattered epidemiologic studies, but few studies provide detailed clinical and biochemical information on the prevalence of hypovitaminosis D in the population. Vitamin D deficiency is common among both urban and rural Indians and its public health consequences are enormous.

Considering the new knowledge on vitamin D and its health implications, it was considered to be the ideal time to connect scientists from the United States and India, to discuss the recent scientific developments from both regions, identify research gaps and explore recommendations for public policy. A bilateral conference on ***Recent Scientific Developments on Vitamin D and Health*** was organized to: reinforce the importance of vitamin D across various stages of the life cycle; evaluate the need for maternal vitamin D supplementation during pregnancy and early life; explore challenges in adding this nutrient to Indian foods and products; and encourage further research to clarify beneficial and adverse effects of vitamin D in the Indian population. The event was attended by a total of one hundred and six US, Canadian and Indian participants.

The conference deliberations provided new insights on vitamin D requirements for various ethnic groups and identified critical research needed to understand the role of vitamin D in preventing chronic diseases including the evaluation of the dose-response between vitamin D and clinical outcomes in these chronic diseases. The conference summary will be published in Nutrition Reviews with the funding support of the Office of Dietary Supplements, National Institutes of Health.

High Performance Computing (HPC) in India: Indigenous Hardware, Software, & Infrastructure Research

15 November 2009, Portland, USA

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The Asian Technology Information Program (ATIP) held its first workshop on ***High Performance Computing in India: Indigenous Hardware, Software, & Infrastructure Research*** in conjunction with the IEEE (Institute of Electrical and Electronics Engineers, Inc.) conference "Supercomputing" (SC 2009) held in Portland, Oregon. The workshop included presentations, posters, and panels from an Indian delegation drawn from academia, research laboratories, industry, and graduate students addressing topics that included government plans, university research, infrastructure, and industrial applications. The workshop enabled 32 Indian and 64 US participants to get their perspectives on the status of computing research in India.

As the workshop was organized to explore collaboration possibilities among HPC researchers from India and US, most of the work/papers presented were inclined towards presenting the spectrum of HPC research work happening within individual research groups. The workshop was structured around the following topics: Indian government plans and programs; Indian HPC centers and related infrastructure; Indian university and Institute research on grid software, storage, checkpoint-restart, etc; science and engineering applications in India in automobile, weather, genomics, computational chemistry, nano, etc; and opportunities for Indo-US collaborations. An important component was a panel discussion wherein panelists identified topics that were suitable for collaborative research and also discussed the mechanisms for developing those collaborations. It is expected that there will be multiple focused engagements between Indian and US researchers based on research interests of individual members in areas spanning micro-architecture, compiling techniques, design methodologies, simulation engines/platforms, application synthesis and hardware reconfiguration.

As an outcome of the workshop, the Indian Institute of Science, Bangalore has begun collaboration with the TeraGrid project on weather modeling application.

Biology of Yeasts and Filamentous Fungi – 2009

12-14 December 2009, Hyderabad, India

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Amongst the model organisms, yeasts and filamentous fungi are in the forefront in contributing towards our current understanding of cell cycle regulation, chromatin remodeling, RNA metabolism and in many other very important areas in basic biology. The implications of discoveries made with these systems have directly contributed to our understanding of life in general and human diseases in particular. Additionally, research on pathogenic and commensal yeasts and fungi has also had fundamental impact on agriculture and medicine.

In this context, a 3-day Indo-US workshop on ***Biology of Yeasts and Filamentous Fungi*** was organized in Hyderabad to discuss the biology of yeasts and fungi as well as allied organisms such as Dictyostelium. The workshop presented the range of areas in classical and molecular genetics, cell biology and physiology, bioengineering, drug discovery, and genome studies and illustrated how they have been used to provide answers to new biological questions. The talks on yeast ranged from epigenomics, centromeres and spindle fibres, Holliday junctions, a new signaling network by pyrophosphorylations to quantitative trait analysis. Talks on filamentous fungus Neurospora crassa summarized work on mechanisms controlling DNA methylation and dissection of the Neurospora clock. A total of 23 presentations were made by 13 Indian and 10 US speakers. Participation was also offered to 30 doctoral and masters students from Indian universities.

As an outcome of the interactions held during the workshop, a perspectives article has been published in the Journal of Biosciences.

Innovative Materials and Structural Systems for Resilient and Sustainable Infrastructure

13-15 December 2009, Mumbai, India

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Proper design and maintenance of civil infrastructure systems in support of economic productivity and better living standards is a challenge faced by all nations. Natural disasters and terrorist threats have altered the performance demands placed on built infrastructure. Also, decades of neglect and poor maintenance has resulted in the need for repairing and strengthening older infrastructure that are rapidly losing their functionality. Furthermore, the recent focus on environmental concerns and depleting resources has resulted in an urgent need for developing innovative methodologies, technologies and processes for realizing sustainable infrastructure.

With this background the workshop on ***Innovative materials and structural systems for resilient and sustainable infrastructure*** was organized at IIT Bombay to discuss various aspects of built infrastructure. The primary objective of the workshop was to review the state-of-the-art and to identify collaborative opportunities aimed at research and development efforts for achieving resilient and sustainable built infrastructure. The workshop focused on four major themes: innovative materials, resilient structural systems, structural health monitoring, and sustainability issues for structural systems. The event was attended by fifteen US and twenty-one Indian participants, and a large number of students. The event was also partially supported by the National Science Foundation.

The two-day workshop was composed of several expert lectures besides a focus group meeting on research needs assessment. The Joint Working Group has been tasked to prepare a white paper by the end of this year, recommending initial high priority research areas and specific topics in the four theme areas of the workshop

Geospatial Information (GI) for Developing Countries: Science and Technology

16-18 December 2009, Mumbai, India

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Scientific efforts in the growing areas of earth observation and geospatial technologies have increased manifold in recent years. To address global challenges of climate change and other natural hazards, the use of geospatial technologies to mitigate their effects is becoming increasingly important. However, while attempting to do so, data-rich and information-poor environments are fast becoming common. Computer science and geo-informatics need to collaborate in order to address these scientific and computational challenges and provide innovative and effective solutions.

The Indo-US workshop on ***Geospatial Information for Developing Countries: Science and Technology*** held at IIT Bombay was an effort to bring together computer scientists, geo-informatics professionals and industry experts together with government agencies to understand the requirements of computational sciences in the domain of geo-informatics, especially in the current environment of "data-rich" systems. The talks and discussions were grouped into technology sessions and application sessions. Themes and topics covered included: modeling of geospatial data; interoperability; geosensor networks; uncertainty in GI; analytics of geospatial data; emergency related technologies; and standardization & open architectures. A variety of domains were covered in the workshop, including natural resource management, disaster management, climate change, agriculture, ocean observation and data infrastructures.

A total of about seventy participants including seven invited speakers from US and fifteen from India participated in the workshop which had break-out sessions followed by a panel discussion. Plenary talks covered: data modeling for spatio-temporal databases; Indian ocean observation services; uncertainty models in geospatial data; moving object databases to moving observation databases; geosensors and ubiquitous computing; value of geospatial information; and spatio-temporal data mining.

Epigenetic Regulation and Genome Control

16-19 December 2009, Hyderabad, India

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Epigenetic regulation of gene expression has occupied the center stage in modern biomedical research. The applications of this field of research span from devising more targeted therapeutics against diseases like cancer, to regeneration biology involving reprogramming stem cells. The epigenetics field is considered to be the new revolution in biology, and is going to shape the future of medical sciences.

The workshop on ***Epigenetic regulation and genome control*** organized in Hyderabad was intended to bring together leaders in the field of epigenetic research from the two countries in order to discuss their current work and create a platform to foster collaborative epigenome-related research. There were 32 participants from USA and 40 resource persons from India, in addition to a sizeable presence of student attendees.

The workshop helped both sides unravel the new factors responsible for epigenetics exploitation of different ethnic cultures and to determine the differences between racial populations. The conference elucidated the mechanisms involved for maintenance regions of silenced chromatin, the similarities and differences in the silencing phenomena among a variety of organisms. It also helped identify the different transcriptomes responsible for regulation of genes in different groups which underlies the racial diversity of two geographically well-defined countries. The event explored recent developments in epigenetics regulation and also analyzed the mechanical involvement of different regulatory RNAs on epigenetics regulation and genome-wide transcriptome analysis.

Redox Signalling In Degenerative Diseases

18-21 December 2009, New Delhi, India

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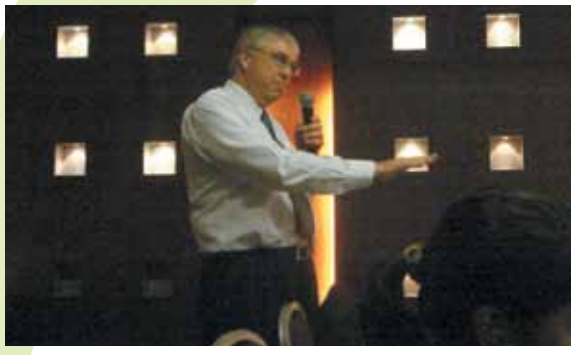

Redox signaling is implicated in various physiological and pathological processes including angiogenesis, embryonic development, cell death, differentiation and survival. Accumulating evidence suggests that redox-signaling plays a key role in the pathogenesis and progression of cancer, neurodegenerative and cardiovascular diseases. Intracellular reactive oxygen and nitrogen species (ROS/RNS) are the key constituents of redox signaling and disturbances in redox homeostasis leads to aberrant cellular responses causing cell death and disease development.

A bilateral workshop on ***Redox Signaling in Degenerative Diseases*** was organized in New Delhi which had a participation of 12 US and 16 Indian speakers and nearly 20 students.

The workshop focused on the redox responsive transcription factors, signal-transducers and cell-death regulators. The specific objective was to understand how disturbances in cellular redox may affect cell death and contribute to the development of diseases such as cancer and degenerative disorders. With the progress of the sessions, certain level of consensus evolved about the complex roles of transiently generated intracellular reactive oxygen/nitrogen species, antioxidant defense and target macromolecules in cellular patho-physiology. The bilateral workshop has helped in preparing a draft proposal for a joint Indo-US specialized center on redox signaling and its role in translational medicine.

Infectious Diseases: Novel Strategies for Design and Development of Vaccines and Drugs

5-8 January 2010, Mumbai, India

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Emerging drug resistance, lack of vaccines, and limited antimicrobials for several infectious diseases is posing substantial dangers to a very large fraction of the world population residing in under-developed and developing nations. There is an urgent need to devise novel strategies for vaccine development as well as target pathogen-specific pathways for the discovery and development of novel chemotherapeutics. Recent advances in structural and functional genomics and proteomics are providing unprecedented opportunities to vigorously pursue pathogen related research leading to prevention and cure. In this context, an Indo-US workshop on ***Infectious Diseases: Novel Strategies for Design and Development of Vaccines and Drugs*** was organized at TIFR.

The main goal of this workshop was to bring together the lead scientists and clinicians from India and USA working in the field of Infectious Diseases with a focus on design and development of vaccines and drugs. There were 16 US and 21 Indian lead speakers and a large number of students who presented posters at the event. In the presentations recent studies on several pathogens like Plasmodium, Leishmania, Entamoeba, Mycobacterium, Filarial worms, viruses that cause Dengue, Influenza and Measles, etc. were covered. As understanding the basics of biology of host-parasite interaction is a pre-requisite for identification of novel candidate vaccines as well as drug targets, investigators working on the biology of pathogens were included in large numbers. Importance of vector control and approaches for the development of vaccines and chemotherapeutics for the eradication of these diseases were covered in the eight technical sessions.

This collaborative conference served as a platform for outlining research networks between US and Indian labs. As an outcome of the workshop an MoU has been signed between TIFR, Mumbai and Bindley Bioscience Center, Purdue University for collaboration in the field of infectious diseases.

Parallelism and the Future of High-Performance Computing

9-10 January 2010, Bangalore, India

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In order to initiate interactions between Indian and US researchers in the area of parallel programming an Indo-US workshop on ***Parallelism and the Future of High-Performance Computing*** was organized at the Indian Institute of Science as a pre-conference event for two major international conferences, namely the International Symposium on High Performance Computer Architecture (HPCA-2010) and the Symposium on Principles and Practice of Parallel Programming (PPoPP- 2010). The bilateral event was attended by 16 speakers from India and 25 from USA. 15 US students and 7 Indian students presented posters as a part of this workshop.

The bulk of the workshop consisted of six panels: four were on research areas, one on industrial research and one on education. The technical sessions included: high performance embedded computing; parallel applications; programming languages and compiling techniques; and high performance architecture. Participants at the workshop covered areas related to parallel architecture, compiling techniques, parallel applications, and embedded systems. In addition, a range of interests including compiler, architecture, applications, and runtime systems were also covered.

The workshop emphasis on identifying collaboration among researchers including education and industry relevant research. It is expected that there will be multiple focused engagements between the Indian and US researchers based on research interests of individual members in areas spanning micro-architecture, compiling techniques, design methodologies, simulation engines/platforms, application synthesis and hardware reconfiguration. A binational committee has been constituted to coordinate the collaborative efforts in the field.

Marine Mammal Stranding

21-23 January 2010, Cochin, India

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Marine mammals are apex predators, but also serve as indicators of ecosystem conditions. Despite decades of research, much remains to be learned about these charismatic yet vulnerable marine animals that spend much of their lives below the surface. Marine mammals are defined as 'stranded' when they are out of their natural element, in deteriorating health and need of rescue. In most countries, including India, what we know about marine mammals is from stranding events on beaches or riverine areas.

Given the ecosystem importance of these species, their vulnerability to climate change, and the need to fill a void in the data gap that exists regarding marine mammals in India, an Indo-US workshop on ***Marine Mammal Stranding*** was organized in Cochin to increase awareness and interest in marine mammals among the scientific community and the local public, and to provide the impetus to create regional stranding networks in more parts of coastal India. A total of 37 participants including 6 resource persons from US and 6 from India participated in the workshop which was partially supported by NOAA. A more specific goal was to communicate the inherent scientific value of data collection from stranded animals, maintaining a stranding database, and engaging in environmental stewardship to conserve and protect marine habitats and their inhabitants.

New developments presented at the event included the mechanism of functioning of Marine Mammal Stranding Network in USA and the sampling of marine mammals for life history and pathology including reproductive physiology, anatomy, life history and impacts of human and environmental disturbance. It was suggested that NOAA can provide guidelines and share their experiences towards establishing and maintaining marine mammal stranding network for India including regulatory framework for authorizing stranding response, collecting scientific data from stranded specimens, data storage and analysis.

Identification of Giftedness with Special Focus on Science and Mathematics

27-29 January 2010, New Delhi, India

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Gifted children have innate capabilities that set them apart from other children. A great deal is happening across the world in the field of gifted education. Advancement in education and psychology has brought empirical and scientific credibility to the field of gifted education. The United States being the pioneer country in the development of Gifted and Talented Education (GATE) has created various federal and state laws and regulations to make policies on educating the gifted and talented in all the states of the U.S. While there are in India various agencies/ departments working in talent search programs in different subjects, there is a need for collaborative and sustained research based practices. With this in mind, an Indo-US round table discussion on ***Identification of Giftedness with Special Focus on Science and Mathematics*** was organized under the aegis of Indian National Science Academy (INSA) at New Delhi.

The discussions lead to empirical and descriptive understanding of issues concerning gifted education particularly in science and mathematics, and provided a platform for exchange of ideas and sustained collaboration in this area of research. The deliberations focused on early identification of highly gifted children and planning the appropriate mentoring program for them. Distinguished speakers from the US and India summarized the current status of practices as well as possibilities for collaborations. The meeting provided a highly interactive forum to the participants for in-depth discussions and to share common concerns. A comprehensive model for early identification and mentoring of gifted children was presented on the final day.

As an outcome of these discussions, a detailed action plan for India has been submitted. The action plan recommended the need to build up a community of highly committed professionals including scientists, mathematicians, educators and researchers from both the countries who can work on long term commitments of mutual exchange and joint projects to strengthen the field of gifted child education.

Emerging Trends in Intelligent Transportation Systems

11-13 February 2010, Chennai, India

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Indo-US workshop on ***Emerging Trends in Intelligent Transportation Systems*** was organized at Chennai for knowledge dissemination on current Intelligent Transportation Systems (ITS) technologies and challenges, as well as to identify research areas that would be useful for collaboration. Intelligent Transportation Systems simply defined, is the integration of a broad range of wireless and wire line communications - based information and electronics technologies to the transportation system. A total of 35 Indian and 10 US transportation professionals from universities, public and private sectors participated.

ITS are a popular and viable means of reducing and mitigating the effects of increased transportation demand on existing infrastructure – without resorting to building new roadways, widening existing roads, etc. These advanced communications technologies are applied both within the transportation infrastructure as well as in the vehicles that traverse the system. Consequently, these systems have the ability to gather, organize, analyze, and share information about the transportation network. It was evident that both US and India have considerable IT expertise to employ IT as a tool for ITS.

The workshop had five primary sessions each devoted to a specific aspect of ITS that is relevant to both the US and India namely, data collection and archiving of ITS data, system architecture for ITS, modeling of ITS systems, field implementation, and capacity building for ITS. The end goal was to develop collaborative research programs that would result in better ITS benefits to both countries. Of special interest to both sides was the possibility of leveraging on existing infrastructure such as cell phones for innovative traffic data collection.

Plant Genomics in Crop Improvement

25-27 February 2010, Hisar, India

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The availability of a variety of molecular markers facilitated the preparation of high-density maps, which proved useful in the identification of molecular markers linked with genes and/or quantitative trait loci for a variety of economic traits in cropping plants. Furthermore, genome and expressed sequence tag sequencing provides the sequence data to identify candidate genes for agronomic traits, either through in silico approaches, with the help of bioinformatics tools, or 'wet' laboratory experiments.

Integration of genomic approaches, together with transcriptomics, proteomics, metabolomics and tools of bioinformatics is essential for the effective use of genomics in crop improvement and holds great potential to provide solutions relevant to applications of agricultural biotechnology. A topical workshop on ***Plant Genomics in Crop Improvement*** covering the above aspects was organized at the Haryana Agricultural University under IUSSTF support. The event was attended by twelve US and fourteen Indian resource persons and nearly 50 other attendees, including students.

To facilitate information exchange in plant genomics, the participants recommended launching the India-U.S. Plant Genomics Resource Network that will serve as a platform for continued interactions and information sharing. Additionally, as an outcome of the workshop, seven US universities represented at the event namely Michigan State University, Washington State University, Tuskegee University, Texas Tech University, UC-Davis, Purdue University, Texas A&M University, and Ohio State University have agreed to form a consortium to facilitate faculty and students exchange between India and the US. As a follow-up to this workshop, it was also recommended to initiate student courses and develop Indo-US training programs in plant bioinformatics.

Silicon in Agriculture

25-27 February 2010, Bangalore, India

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Silicon is the second most abundant element after oxygen in soil. As a consequence, all plants rooting in soil contain significant amounts of silicon in their tissues. Although not considered essential for plant growth and development, silicon can benefit plant growth through greater yields in rice and cucumber or sugar content in sugarcane. Silicon also can be very useful when plants are challenged by abiotic or biotic stresses. In addition, silicon has been shown to enhance soil fertility, improve soil physical properties, increase photosynthesis, regulate evapo-transpiration, increase tolerance to toxic elements such as iron and manganese, and reduce frost damage.

To better understand this silicon physiology in plant growth, it is extremely important to review the role of silicon in plants and determine future research directions relating to when and how much of this element is needed for optimum plant function. In order to discuss these aspects of silicon with regard to its influence on agriculture, health, industry and environment, an Indo-US workshop on ***Silicon in Agriculture*** was organized in Bangalore. There were eight sessions in the workshop with seven speakers from USA and six speakers from India. The main aims of the workshop were: to identify research gaps in the use of silicon in agriculture and develop teams to formulate programs to address them; sensitize the fertilizer industry to recognize the importance of silicon in agriculture; and establish a centre of excellence on silicon in agriculture at UAS, Bangalore.

The workshop helped to identify potential collaborators in India and USA, and contributed to the efforts for capacity building in India for these studies. The workshop was also able to identify the target areas and crops, as well as propose strategies for the management of biotic and abiotic stress through silicon fertilization. Several fertilizer companies benefited from attending the event. Letter of intent for R&D cooperation between UAS Bangalore and LSU AgCenter, Louisiana, was signed. A book on Silicon in Indian Agriculture was released during the workshop.

Product Design – Impact from Research to Education to Practice

17-19 March 2010, Coimbatore, India

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The growth of new technologies, such as nanotechnology, biomedical technology, and increased computational abilities, has added both complexities and opportunities to the design of new products. As a result, there have been significant advances in the theories and tools used throughout engineering design which is dramatically changing its role from simply being a starting point of a business process to becoming a strategic business tool. Engineers who design products in today's competitive markets must rapidly deliver high performance products which offer outstanding value. This has led to significant research in predicting product performance and success both in the US as well as India.

The Indo-US workshop on ***Product Design – Impact from Research to Education to Practice*** held at Coimbatore brought together 8 US research faculty in the area of mechanical design theory with 15 from India along with graduate research assistants, and interested industry collaborators. The goals of the workshop were to present state-of-art research in the techniques and theory of mechanical design, the manner in which this research can improve the innovation and design activities in industry, and, the academic preparation of mechanical engineers.

The event initiated the interaction on the current relevant issues in product design like recycling; green concepts in design; opportunities and challenges in using new materials like nano composites; research issues in designing machines to produce components at meso and micro sizes; technologies for borderless design; and web-based design etc.

As an outcome of the workshop, the Indian PI has been invited to join as an international collaborator for the creation of a virtual organization known as VOICED (Virtual Organization for Innovation in Conceptual Engineering Design) involving four US Universities. An MoU was signed between the University of Texas, Austin and PSG Institute of Advanced Studies for research collaboration in emerging design areas.

TRAINING PROGRAMS

Concepts in Quaternary Climate Studies with Emphasis on Dendrochronology and Palynology

12-18 May 2009, Lucknow and Srinagar (Garhwal), India

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Issues such as global warming, land-use changes, pollution and other climate and human-related ecological changes are of great concern to policy makers and planners around the globe. Paleoecological data, such as those provided by palynological (pollen) and dendrochronological (tree-ring) studies, are crucial to provide long-term perspectives on climate and ecological processes. In this context a training program on ***Concepts in Quaternary Climate Studies with Emphasis on Dendrochronology and Palynology*** was organized from 12-18 May 2009. The training program was attended by twenty Indian participants and was provided by Peter M. Brown from Colorado State University. The two-day lecture series at the Birbal Sahini Institute of Palaeobotany, Lucknow was followed by a five-day field trip to the Garhwal Himalayas conducted by the Department of Forestry, HNB Garhwal Central University, for hands-on experience in field and laboratory methods.

The keynote lecture on Reconstructing Paleoclimates and Paleoecology with Tree-Ring Data was delivered by Peter M. Brown. The keynote was designed to set the basic theme of the training, both the importance and need for understanding longer-term ecological and climatological processes using paleo-proxy data, and how tree-ring data specifically are applied in environmental, cultural, and climatic studies.

The principle goal of the training was to provide participants with the knowledge-base needed to develop and apply multidisciplinary approaches to the study of longer-term ecological and climatological variability in the Indian subcontinent and elsewhere around the world. The new developments presented at the event included: analysis of isotopic ratio of C-14 and C-12 in the annual bands of trees from the Indian region for pollution assessment; carbon and oxygen isotopic analysis from tree-rings of trees growing in different geographical

regions in India for the analyses of various aspects of climatic change; analyses of multi-proxy data towards high resolution climate reconstruction through collection of subsurface sediments from centers of lakes; statistical applications in pollen analysis with development of revised formula and contemporary software techniques for quantification of reconstructed climatic information; and dating of fire scar in tree-ring sequences to build the forest fire history in a Chir pine forest of the Himalayas. The participants recommended the need to launch coordinated multidisciplinary research in key areas having the potential to provide high resolution long-term palaeoclimatic and palaeoecological records. As an outcome of the event, a project on "multidimensional aspect of dendroecology with emphasis on reconstruction of fire and insect outbreak history of some Himalayan Forests" has been launched. Partnering institutions include Birbal Sahni Institute of Paleobotany, Lucknow, Laboratory of Tree Ring Research Tucson & Rocky Mountain Tree-Ring Research, Fort Collins.

Advanced Summer School on Systems and Networks

18 June - 18 July 2009, San Diego, USA

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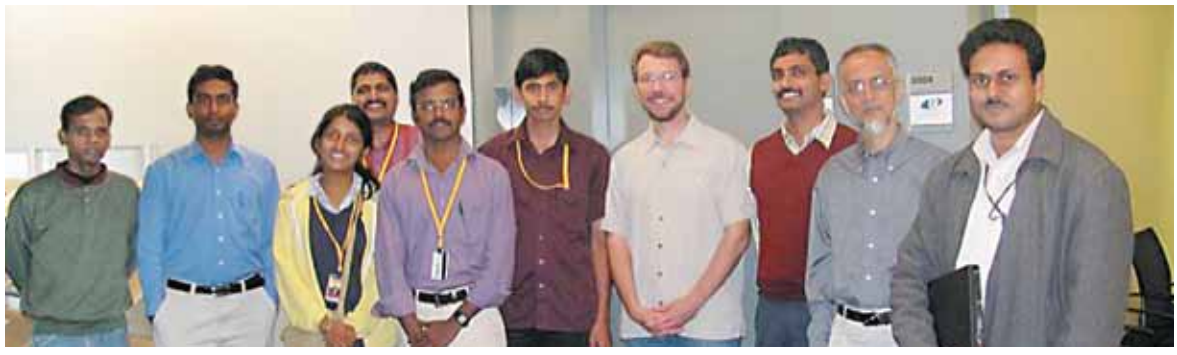

California Institute of Telecommunications and Information Technology (CalIT2), University of California San Diego (UCSD) conducted the Indo-US ***Advanced Summer School on Systems and Networks*** from 18 June-18 July 2009 at UCSD. The event successfully brought together researchers, students, and faculty members from both India and the US to work together on two important areas of communication research - systems and networking. New developments in systems and networks, interdisciplinary research on systems and networks, and developing ideas in many areas of wireless and Internet systems were presented and discussed at the advanced school.

Several eminent researchers from academia and industry in the area of communication systems and networks presented their work at the school. These included Geoff Voelker, UCSD; Rajesh Gupta, UCSD; Dilip Krishnaswamy, Qualcomm Research Center, San Diego; Navid Ehsan, Mushroom Networks, San Diego; Ping Zhou, Qualcomm R&D, San Diego; and Kalyan Vaidyanathan, Sun Micro Systems, San Diego.

This month long event, included a three track intense schedule where each track had a distinct technical activity - track 1 consisted of a series of lectures on design principles of distributed wireless systems in a class-rooms style with a total of 20 hours of lecture sessions; track 2 consisted of a series of lectures by academic and industrial experts conducted in a traditional workshop style with a total of 20 hours of lecture sessions; and track 3 comprised of an intense hands-on training of advanced network systems prototypes a total of more than 20 hours of training sessions with more than 40 hours of lab sessions.

This event paved the way for scientific co-operation between young Indian and American researchers and scientists who could work jointly towards the eradication of the digital divide. The participants included three Indian faculty members, five Indian students, twelve US faculty/ industry members and more than a dozen US students. The exposure that the doctoral students gained in the Indo-US advanced summer school helped them to develop new theories, solutions, and methods for advancing the science of systems and networks. New developments in systems and networks, interdisciplinary research on systems and networks, and developing ideas in many areas of wireless and Internet systems were presented and discussed at the event. The meeting between Indian and US faculty members also resulted in the drafting of a number of successful future collaboration plans.

Spatial Data Analysis in Ecology and Conservation

22-23 July 2009, Bangalore, India

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Support from IUSSTF helped bring together scientists from the National Centre for Biological Sciences (NCBS), Bangalore, and, the Nature Conservation Foundation (NCF), Mysore, with researchers from the GeoDa Center for Geospatial Analysis and Computation, Arizona State University (ASU) for a training workshop on ***Spatial Data Analysis in Ecology and Conservation*** from 22-23 July 2009. The purpose of the training workshop was to contribute to closing a gap in ecology and conservation research in India related to spatial analysis techniques for vector data. Such data, frequently encountered in ecology and conservation research, comprises points e.g. occurrences of individuals or events in space, lines e.g. routes of animal movement, seed dispersal, hydrologic flows, and areas or polygons e.g. fragments of habitat, resource patches, landscape element boundaries.

Mapping, measuring, and spatially exploring and analysing vector data is an essential component of research in the fields of landscape ecology, biodiversity conservation, forest ecology, and wildlife biology including the study of animal movement and human-wildlife conflicts in modern landscapes. Despite substantial recent theoretical and technical developments in spatial ecology and econometrics, including the availability of free and open source software for data analysis, few of these have been widely disseminated in India - unlike techniques such as remote-sensing imagery, which are more widely used. Keeping this in mind, the training program aimed to develop the ability to gather, use, and analyze spatial vector data among students and scientists in the field of ecology and conservation in India.

As a result of this training program, joint research projects have been initiated between NCBS, NCF and the GeoDa Center for Geospatial Analysis and Computation. The specific areas of research include area-level spatial regression analysis to address the research question if and to what extent conflicts are related to environmental variables in areas as large as the daily range of elephants; exploratory spatial point pattern analysis to help determine whether elephants target ration shops as stops on the way to target destinations such as forest patches or whether the ration shops represent destinations in themselves; and spatial optimization methods to assess where interventions such as new bamboo could be located to minimize the chance of future conflicts, supplemented by spatial evaluation methods to assess the effectiveness of existing interventions to reduce human-elephant conflicts.

Training Indian Leaders in Human Dimensions of Wildlife Conservation

20-31 July 2009, Bangalore, India

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Conservation of endangered species such as tigers and Asian elephants demands that we balance wildlife and human needs. To achieve this balance, each generation of wildlife conservation workers must understand ecological as well as socio-political and economic factors. Therefore, interdisciplinary training is required for the next generation of conservation leaders. In order to combine classroom instruction, small-team advising, field practicum, and collaborative research, an Indo-US training program on ***Training Indian leaders in Human Dimensions of Wildlife Conservation*** was organized from 20-31 July 2009 at Bangalore. The course was both interactive and participatory with tutorials followed by homework.

The Master of Science degree in Wildlife Biology and Conservation is collaboration between the National Centre for Biological Sciences (NCBS) and the Centre for Wildlife Studies (CWS). Originally the program was predominantly focused on the natural sciences and mathematics as they pertain to biological aspects of conservation. However, with a growing awareness of the demand for conservationists trained in human dimensions like human behavior, perceptions, attitudes, economics, and politics, the advisory board and instructional staff of the Masters program invited resource persons from UW-M and India to help teach a new module in the human dimensions of wildlife conservation including systematic conservation planning and relocation as a conservation strategy.

The event armed students with the translational and design skills needed to integrate human dimensions in wildlife conservation. It helped to deliver state-of-the-art training in the human dimensions of wildlife conservation; to collaborate in the design and conduct of social survey field research; to share curricular materials and pedagogical skills with Indian colleagues; and, to advance a long-term, multidisciplinary Indo-US collaboration.

Advanced Clinical Engineering

5-10 October 2009, Thiruvananthapuram, India

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Over the last five decades, healthcare delivery has increasingly become technology driven – including the development of medical devices, new drugs and vaccines or diagnosis, treatment and rehabilitation of patients in hospitals. In order to effectively utilize these healthcare technology developments, each country needs to have a two-fold strategy. It needs to set-up the infrastructure for development of indigenous technology and it should have trained human resource for development as well as effective and safe management of healthcare technology in all healthcare delivery settings.

Opportunities for improvement in healthcare technology broadly affect cost, patient safety, efficacy, utilization and quality assurance. In order to address this need, the American College of Clinical Engineering (ACCE) in collaboration with the World Health Organization (WHO), the Pan American Health Organization (PAHO) regional WHO offices and other non-governmental organizations, has instituted a series of Advanced Clinical Engineering Workshops (ACEW) in many countries since 1991. These workshops have contributed to the development and strengthening of the institutional capacity in host countries extended adequate technical support to the physical infrastructure and equipment used in healthcare delivery.

The Indo-US training program on ***Advanced Clinical Engineering*** was the first ACEW to be organized in India. The objective of the training was to inform stakeholders about modern clinical engineering professional practices and healthcare technology management strategies. The faculty for this training program included university professors, government agencies and heads of clinical engineering departments from leading hospitals in the US and India. The participants included post-graduate students, clinical engineers working in Indian hospitals, faculty from academia, and representatives of leading medical equipment manufacturers, hospital managers and medical doctors across the country. The joint faculty delivered lectures, and conducted hands-on demonstrations and group discussions in topics related to healthcare technology management policy; safety, risk and quality management; healthcare technical services operations; medical device regulation; and, medical device risk management. This 5-day training had 6 resource persons from US and 9 from India and attracted approximately forty-five participants.

School in Neurosciences

7-21 December 2009, Pune, India

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Neuroimaging methods have made tremendous progress in the recent past and have led to new opportunities for investigating the nervous system – from single neuron to the entire organism. Imaging has become an indispensable tool for the study of neuronal development, function, clinical diagnosis and understanding higher brain functions. The Science and Engineering Research Council (SERC) ***School in Neurosciences*** supported by DST was conducted from 7-21 December 2009 to provide intensive training to young investigators and students who have chosen neurosciences as their field of enquiry.

The teaching program at the School was divided into two stages. During the first stage, the focus was on the basics such as the organization of the vertebrate and invertebrate nervous systems, electrophysiology of the neuron, resting and action potentials, neuromuscular junction and synapses both electrical & chemical and brain as a processor of information. In the second stage, the focus was on understanding, the principles of imaging of the nervous system. Neural imaging approaches ranged from activity imaging using calcium and voltage sensors, optical imaging

of neurons in culture and in vivo, multiphoton confocal microscopy, Electroencephalography (EEG), Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET) to functional Magnetic Resonance Imaging (fMRI) and function mapping.

Twenty five students attended the course which was delivered by 5 US (supported by IUSSTF) and 13 Indian faculties. Hands on experience in high-end microscopy and data analysis were conducted to initiate the students in not only the applications but also in the logistics of developing an imaging platform. Demonstrations were organized for MRI, EEG and CT at a local hospital along with training in image analysis and segmentation.

Institute on Distributed Infrastructure for Security Monitoring and Intelligence Extraction

9-13 January 2010, Bangalore, India

Principal Investigators:
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Infrastructure security is an issue of high national priority for both the United States and India. An Indo-US training program on ***Distributed Security Monitoring and Intelligence Extraction*** was organized at the Indian Institute of Science, Bangalore from 9-13 January 2010. The program which was partially supported by NSF brought together 16 researchers from India and 15 researchers from US universities, companies and government organizations. The focus of the workshop was research and technology development for real-time security surveillance and intelligence for critical infrastructure and their associated computing and communication components.

The goal of the workshop was to establish new collaborations between the United States and India in cutting-edge research and technology development and knowledge transfer focused on areas of real-time security surveillance and extraction of actionable intelligence for both critical physical infrastructure and their associated computing and communication components. The major topics covered were monitoring, prevention, and recovery from natural and inflicted disasters by exploiting advanced technologies such as smart sensors, wireless networks, mobile agents, data and text mining, and profile-based learning in an integrated, collaborative and distributed manner. The framework discussed included real-time data gathering and fusion from a variety of sources to make online intelligent decisions thereby providing actionable intelligence in real-time to lessen the loss of property and lives.

The event brought together experts in wireless networks, sensor networks, network security, data mining and knowledge discovery, multimedia surveillance, data and applications security and privacy from academia, industry and government to brainstorm the various facets of the challenges involved and to put together a comprehensive plan of action to tackle these issues. As a concrete outcome, an edited book on the papers presented is under publication.

CENTERS FOR RESEARCH EXCELLENCE IN SCIENCE & ENGINEERING

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

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University of Illinois, Chicago
University of Missouri, Columbia
Indian Institute of Technology, Kharagpur
Central Mechanical Engineering Research Institute, Durgapur

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 the Northwestern University-Evanston from USA. Considering the outcome and achievements of the Joint Centre on Advanced Manufacturing, IUSSTF awarded the ***Indo-US CRESE on Fabrionics*** in order to consolidate and continue the collaboration 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. Two workshops were organized in addition to two lecture series for students. The course material has been published as a book 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.

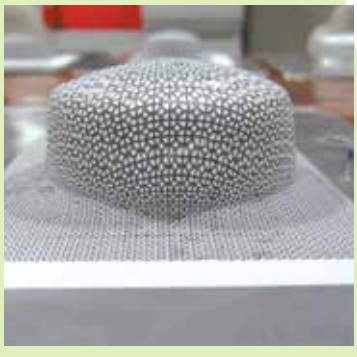
The primary areas chosen for **R&D project** based work by the CRESE in Fabrionics include:

- 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 Nano-electromechanical systems (NEMS)/ Microelectro-mechanical 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, Kapur) 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.

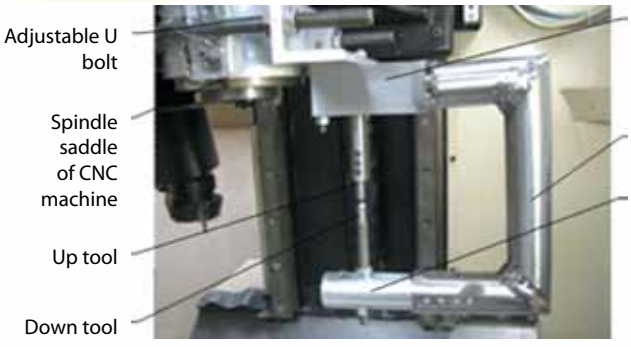
As an outcome of the Centre activities the following **research publications** have been already generated:

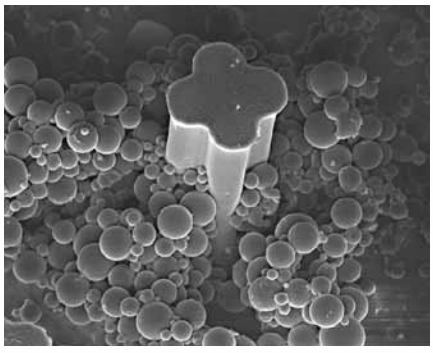
(i) Sharma C.S., Sharma A. and Madou M. (2010) Multiscale carbon structures fabricated by direct micro-patterning of electrospun mats of SU-8 photoresist nanofibers. Langmuir 26: 2218–2222

(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

(v) Sharma C.S., Kulkarni M.M., Sharma A. and Madou M. (2009) Synthesis of resorcinol-formaldehyde based carbon xerogel particles and fractal-like structures. Chemical Engineering Science 64: 1536-1543

(vi) Mandal S., Bhattacharya S., Singh D. and Gurunath R. (2009) Dielectrophoretic separation of nano-particle conjugated bacterial cells within micro-scale architecture. At: AIChE Annual Meeting 2009, Nashville, Tennessee, USA.

(vii) Reddy N.V. (2009) Incremental forming: Review and recent developments. At: Third Indo-Japan Joint Seminar, Pune, India.

(viii) Wang Y., Wu W., Huang Y., Reddy N.V. and Cao J. (2009) Experimental and numerical analysis of double sided incremental forming. At: International Manufacturing Science and Engineering Congress MSEC, October 4-7, 2009, Indiana, USA.

(ix) Chakraborty D., Gorkin R., Madou M., Kulinsky L. and Chakraborty S. (2009) Capillary filling in centrifugally actuated microfluidic devices with dynamically evolving contact line motion. Journal of Applied Physics, 105: 084904 (1-10)

(x) Chatterjee D. (2009) Use of [PtII(H2O)4]2+ complex towards development of ionic-polymer-metal composite actuators. Indian Journal of Chemistry (A), 48A: 1201-1203

(xi) Nagahanumaiah J.R., Glumac N., Kapoor S.G. and DeVor R. (2009) Characterization of Plasma in micro-EDM discharge using optical spectroscopy. Journal of Manufacturing Processes, 11: 82-87

In addition a **text book** titled "Microfluidics and Microfabrication" authored by Suman Chakraborty, IIT-Kharagpur has been published by Springer. As part of the visitations under the CRESE, fifteen faculty and eight students from India visited their collaborators in the US and seven faculty and four students from US visited their Indian counterpart institutions. In addition, two **workshops** were also organized: Indo-US workshop on Fabrionics at University of California, Irvine (28-29 June 2009) and, Fabrication at Small Scales (FASS) & IIT Kanpur (9-12 December 2009). A **short course** on "mechanics over micro and nano scales" was also organized by IIT-Kharagpur on 21-22 December 2009 as a part of the CRESE activity.

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

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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) 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:

(i) Evaluating polymer materials used in n-type field effect transistors (FETs) and comparing the field effect mobility to bulk mobility;
(ii) Defining a research problem to identify features in the optical properties transparent FETs and determine time scales for switching responses;
(iii) Exploratory work on properties leading to efficient solar cells. A paper which describes a bilayer FET is under preparation;
(iv) Molecular dynamics force fields to simulate DNA in water and also SIESTA calculations; and
(v) 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.

As part of the visitations under the CRESE, one faculty and one student from India visited their collaborators in the US and 10 students from the US visited their Indian counterpart institutions. In addition, as a part of the CRESE activity a workshop was organized on Advanced Materials Research at the JNCASR, Bangalore in September 2009. The workshop which covered areas like magneto-electronic materials; electro-optic materials; nano-patterning and characterizations; and materials for energy & environment helped towards identifying the potential areas of synergistic research activities of the Center.

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

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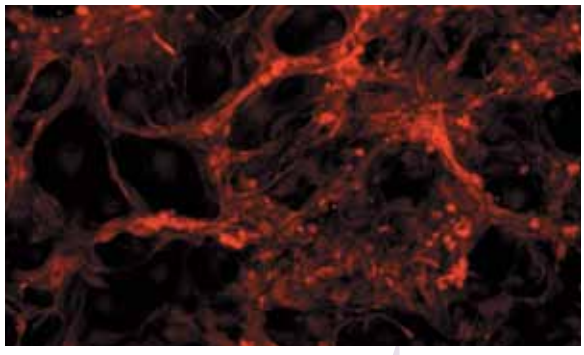
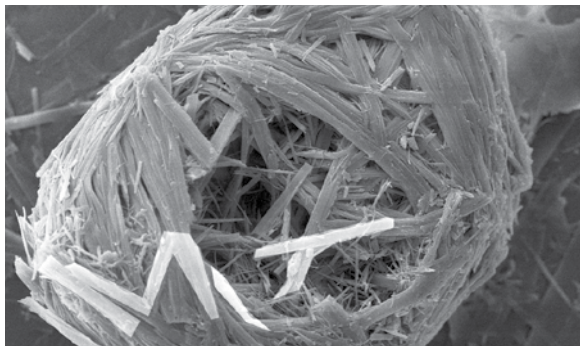
Other Partners:
Harvard-MIT Division of Health Science Technology, Cambridge
Stem Cell Institute, Bangalore
Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore





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 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 Stem Cell Institute (SCI) 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.

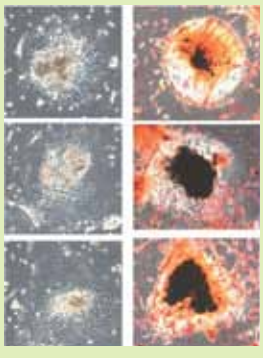
The collaboration between the partners brings together scientists from a multidisciplinary background, where chemical engineers, polymer chemists, material scientists, and nanotechnologists work closely with molecular and cell biologists. It is anticipated that this exchange of knowledge would enable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

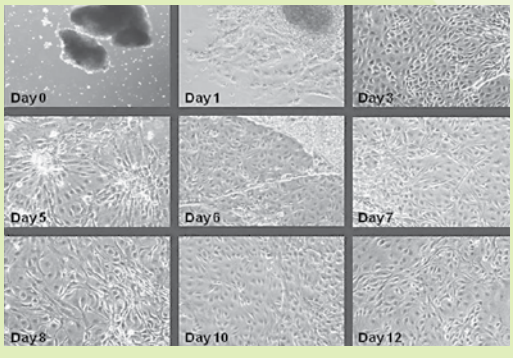
Two active research projects have already been initiated by the partnering team are:

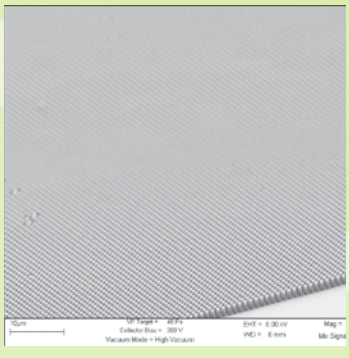
(i) Heparan Sulfate Glycosaminoglycans (HSGAGs) in human ES cell differentiation into cardiovascular lineages (Shiladitya Sengupta and Maneesha Inamdar); and

(ii) Mechano-biology of the stem cell niche and the control of quiescence (Jeff Karp and Jyotsna Dhawan)

As part of the CRESE activities, several exchange visits have been undertaken. Two students from Shiladitya Sengupta's lab visited Manisha Inamdar's lab in Jan 2010 for 6 weeks. A joint post-doc between the Sengupta and Inamdar labs has also been recruited. Jeff Karp visited NCBS & SCI in November 2009, participated in a Bioengineering program planning session and gave a talk on his recent results. A post-doctoral fellow has also been recruited in the joint project between the Dhawan and Karp labs in February 2010 and has begun work on generating micro-patterned surfaces for growth and induction of quiescence of mesenchymal stem cells.







JOINT CENTERS

Indo-US Public-Private Networked Center on Nanomaterials for Energy

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The ***Indo-US Networked Center on Nanomaterials for Energy*** is a collaborative effort between academic institutions represented by the Jawaharlal Nehru Center for Advanced Scientific Research (JNCASR) Bangalore and Purdue's Birck Nanotechnology Center with industry partner from General Electric's John F. Welch India Technology Center at Bangalore. The Joint Center seeks to find new ways of exploiting the unique properties and characteristics of nanomaterials in a broad range of energy-related applications and its establishment is drawn from the synergistic expertise in physics and chemistry of materials at JNCASR with that of nanofabrication and engineering expertise at Purdue and GE labs. This Joint Center was an outcome of an IUSSTF sponsored bilateral workshop on 'scalable nanomaterials for enhanced energy transport, conversion and efficiency' held in Bangalore in August 2008.

Topics for collaborative research identified to be taken up include metal-semiconductor super lattice thermo-electrics, exfoliated graphite/graphene materials for enhanced interfacial transport, liquid nanosolder for electrical contacts and thermal interfaces, integration of carbon nanotubes for solar, thermal and lighting applications, solid-state hydrogen storage, behavior of attolitre water droplets and gold Nanoparticle-PDMS composites. Application themes include nanoelectronics, thermal and electrical interfaces, biosensors and composite materials for energy conversion.

Through reciprocal mobility of scientists, engineers and students working in the identified projects under the center would enable:

(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 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 industrial and academic participants;

(v) Strengthening of links between academics and global technology companies with R&D centers in the US and India; and
(iv) Translating the R&D findings into market place products.

As part of the visitations associated with the Joint Center, four faculty members and one student from JNCASR visited Purdue University; and three faculty members and two students from Purdue visited JNCASR and GE Labs in India. Also, under the aegis of the Joint Center, a two-week short course on 'Nanoscale heat transfer' was conducted by Timothy Fisher from Purdue and K.R. Sreenivas from JNCASR at Bangalore in August 2009.

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

(i) Bhuvana T., Kumar A., Sood A., Gerzeski R.H., Hu J., Bhadram V.S., Narayana C. and Fisher T.S. (2010) Contiguous Petal-like Carbon Nanosheet Outgrowths from Graphite Fibers by Plasma CVD. ACS Applied Materials & Interfaces 2(3): 644-648
(ii) Saha B., Acharya J., Sands T.D. and Waghmare U.V. (2010) Electronic structure, phonons, and thermal properties of ScN, ZrN, and HfN: A first-principles study. Journal of Applied Physics 107(3): 033715
(iii) Kurra N., Scott A. and Kulkarni G.U. (2010) Electrocondensation and evaporation of attoliter water droplets: Direct visualization using AFM. Nano Research 3: 307 - 316
(iv) 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 & Physics, DOI: 10.1002/macp.201000079
(v) Bhuvana T., Smith K.C., Fisher T.S. and Kulkarni G.U. (2009) Self-assembled CNT circuits with ohmic contacts using Pd hexadecanethiolate as in situ solder. Nanoscale 1(2): 271-275
(vi) Grau-Crespo R., Smith K.C., Fisher T.S., de Leeuw N.H. and Waghmare U.V. (2009) Thermodynamics of hydrogen vacancies in MgH2 from first-principles calculations and grand-canonical statistical mechanics. Physical Review B, 80(17): 174117
(vii) Smith K. C., Fisher T. S. and Alam M. (2009) Quasi-static Compaction of Metal Hydride Powder. In: Powders and Grains 2009, American Institute of Physics, 1145: 90-93, Boulder, Colorado

Research projects awarded

The institution of the IUSSTF supported joint center has also 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 funded by the US Air Force Office of Scientific Research (AFOSR) and the Asian Office of Aerospace Research and Development (AOARD) at JNCASR.
(ii) Nano thermal interface material development funded by the US Defense Advanced Research Projects Agency (DARPA) at Purdue University.

Indo-US Joint Networked Center on Cerebro-vascular Diseases

Lead Partners:
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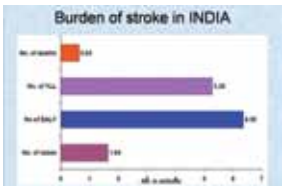
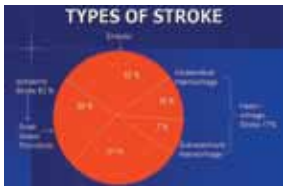
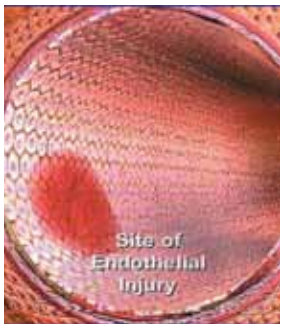
Massachusetts General Hospital (MGH) Stroke Research Center, Boston
E-mail: asinghal@partners.org

Other Partners:
Nizams Institute of Medical Sciences (NIMS), Hyderabad, and University of Massachusetts (UMASS), Worcster







Stroke in young, that includes children and young adults (<45 years) is an important cause of morbidity and mortality throughout the world, especially in developing countries. Despite few studies reported from India on stroke in young, most involved ischemic stroke conducted before the widespread use of modern neuro-imaging methods; and thus with a few exceptions, did not identify stroke subtypes, etiopathogenesis, and long term outcomes. Stroke prevention planning, reliable epidemiological information on pattern of disease and exposure to major risk factors and morbidity or mortality trends for cerebro-vascular disease in defined populations is imperative as nations have to face enormous socio-economic burden to meet the costs of stroke in the near future. There is a great need to monitor these trends in a simple and reproducible way.

With this in the background, the major objectives of the ***Indo-US Joint Networked Center on Cerebro-vascular Diseases*** are the following:

(i) Study the risk factors for stroke in young, including homocysteine, lipoprotein (a), triglycerides and other lipid fractions, procoagulant states, hemoglobin, and infections;

(ii) Assess stroke recurrence after first ever stroke in young and possible contributing factors; and

(iii) Assess pattern of distribution of atherosclerotic lesions intra-and extra- cranially in stroke in young.

The goal is to develop academic and scientific ties between the clinicians and health researchers in MGH and UMASS in the US and AIIMS and NIMS in India, targeting the development of programs to improve the understanding of stroke etiopathogenesis, risk factor profiles and recognition between the different ethnic communities, awareness, and acute stroke management with a focus towards the development of cutting-edge tertiary care centers and community programs targeting the population at risk for cerebrovascular disorders with special reference to stroke in young. The data obtained in a specifically designed registry will help better understand this unique cohort of patients.

Substantial progress has been made in developing the database through joint center work. In addition, a great deal of information has been exchanged about stroke care and ongoing research between the participating institutions. This would be the first prospective comparative study of stroke in young, their demographics, risk factors, stroke profiles and prognosis between two different ethnic and socio-demographic populations in the world. Four faculty members and one PhD student have already undertaken reciprocal visits in the first year of the Centers establishment.

Indo-US Joint Networked Center for Intelligent Structural Health Monitoring

Lead Partners:
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Other Partners:
Central Glass & Ceramic Research Institute, Kolkata
Michigan State University, East Lansing

Quantitative Nondestructive Evaluation (QNDE) of integrity and quality of materials and structures is a widely accepted and efficient tool for engineering critical assessment, structural health monitoring and process monitoring in automotive, civil, manufacturing and aerospace industries. From large structural members of bridges and buildings to medium-sized automotive components down to micrometric and nanosized advanced materials and structures, QNDE cover a wide range of applications across various industrial and laboratory scale operations. Lately QNDE has assumed a great deal of importance due to a paradigm shift towards Intelligent Structural Health Management (ISHM) – a methodology that aims to minimize the possibility of catastrophic failure of critical structures which is of great concern to the international community. ISHM comprises both off-line and on-line monitoring of materials, components and structures and provides diagnostic and prognostic tools for fail-safe management of structures. ISHM encompasses a broad horizon of emerging and well-established fields of science and engineering - namely smart materials, structural health monitoring, damage and failure mechanics, structural and reliability analysis and nondestructive evaluation.

India and the US face similar problems with regard to structural integrity of civil, mechanical and aerospace materials and therefore a cross-disciplinary, multi-institutional problem-solving approach would be most productive way of addressing some of these common plaguing issues.

Accordingly, the thrust of the **Joint Networked Center for Intelligent Structural Health Monitoring** is on developing QNDE tools and ISHM systems and methodologies with pragmatic adaptation. The Joint Center has adopted a multi-pronged approach towards developing and implementing state of the art QNDE tools such as laser-induced ultrasonics, fiber optics sensing, and piezeo-electric wafer active sensor-based guided wave ultrasonics.

The specific technical goals which the Centre aims at are:

(i) Development of fiber optic sensors and piezo wafer active sensors that can be attached/ embedded on a structure and used as sensors;

(ii) Generation and propagation of guided waves in composite structures using ultrasonics;

(iii) Understanding the behaviour of guided waves in structures such as ones used in aerospace and development of models that permit the simulation of the experiment and creation of optimal experimental protocols;

(iv) Development of high bandwidth demodulation apparatus that can convert the changes in the light traveling inside fiber optics into conditioned electrical signals that can be digitized and stored in a computer or a microprocessor based computing chip; and

(v) Development of data fusion and data processing algorithms to improve the quality of signals and provide an interpretable signal to the end user on the status of the structure/component.

There are presently seven Ph.D. students associated under the Joint Center - two from IIT-Madras, two from Northwestern University and three from Michigan State University. As part of the visitations associated with the Joint Center, Lalitha Udpa and Nizar Lajnef, both from Michigan State University visited IIT-Madras.

Indo-US Joint Networked Center for Magnetic Resonance Technologies in Brain Cancer Imaging

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Other Partners:
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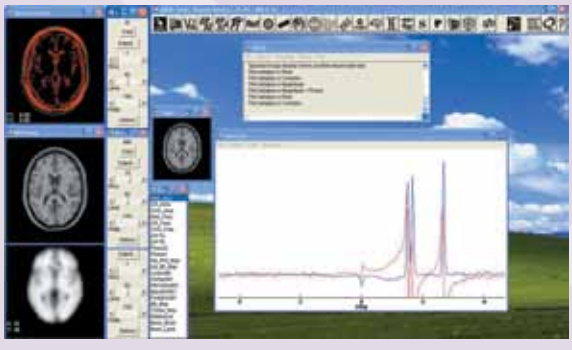
Stanford University, Palo Alto

By utilizing the magnetic properties of the nucleus, the technique of magnetic resonance provides a probe into the chemical and physical environment of an atom, making MR methods (also known as Nuclear Magnetic Resonance) a vitally important investigational technique used in many areas of physics and chemistry. When applied to studies in living tissue, MR methods can provide a wealth of information, ranging from high-spatial resolution images that can visualize detailed anatomy; chemical analysis of tissues; and information on tissue function such as rates of blood flow and oxygenation.



For studies of brain cancer, the anatomical images provided by Magnetic Resonance Imaging (MRI) are invaluable for localization of lesions within the brain; however, results are frequently ambiguous regarding the nature of a lesion and even if cancer is the primary diagnosis, the type of cancer may remain unknown. For tumors such as gliomas, it is known that conventional MRI underestimates the extent of the tumor, which can result in suboptimal treatment, and when used to monitor cancer treatment there can be considerable difficulty in distinguishing between edema, radiation damage, and cancerous tissues. Increased specificity from a diagnostic imaging study can have a significant impact on patient care, potentially ruling out unnecessary surgeries or treatments with substantial reduction of morbidity and health care costs. For this reason, additional MR acquisition methods have been investigated as a means of improving diagnostic specificity, of which the most widely used is MR Spectroscopy (MRS). MRS enables an analysis of tissue chemistry, and can identify cancerous tissues via differences in concentrations of several compounds, and notably by increased choline signal, which is an indicator of cellular proliferation.

The objectives of this inter-disciplinary ***Joint Center for Magnetic Resonance Technologies in Brain Cancer Imaging*** are to:

(i) Implement volumetric MRSI acquisition and reconstruction, MR-diffusion, and MRI-perfusion imaging on MRI instruments at the SGPGI;
(ii) Evaluate the combined advanced MRI methods for diagnostic studies of brain cancer, with emphasis on untreated glioma, and for treatment monitoring;
(iii) Develop a database of imaging markers for characterization of different brain lesions;
(iv) Develop computational methods for multi-parametric image-based tissue classification for characterization of multiple tissue types associated with brain cancer, including brain edema, infiltrative tissue, cancer, and abscess; and
(v) Develop new collaborative research and educational programs in brain imaging.

It is expected that this joint study will develop new data acquisition and processing approaches for combining metabolic information obtained by MRSI with information on the anatomy, blood flow, and tissue microstructure obtained by MRI. Evaluation of these approaches using studies in patients will indicate the clinical areas that would benefit most from these approaches and provide pilot data to support requests for continued research funding in the area of brain cancer diagnosis and treatment monitoring.

As part of the visitations associated with the Center, Andrew Maudsley from University of Miami School of Medicine visited SGPGIMS and IIT-Kanpur in 2010.

Research projects awarded

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

(i) Development of unified quantitative methods for MRI and MR Spectroscopy for the study of human brain funded by Indian Defence Research & Development Organisation.
(ii) Partnership for MR Spectroscopic Imaging Data Processing funded by US National Institutes of Health (National Institute of Biomedical Imaging and Bioengineering).
(iii) Brain Metabolic Imaging in Amyotrophic Lateral Sclerosis funded by US National Institutes of Health (National Institute of Neurological Disorders and Stroke).

Indo-US Joint Networked Center for Nanomedical and Cellular Engineering (NCE)

Lead Partners:
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Other Partners
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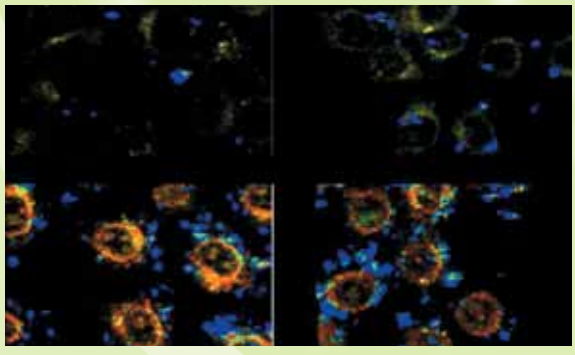
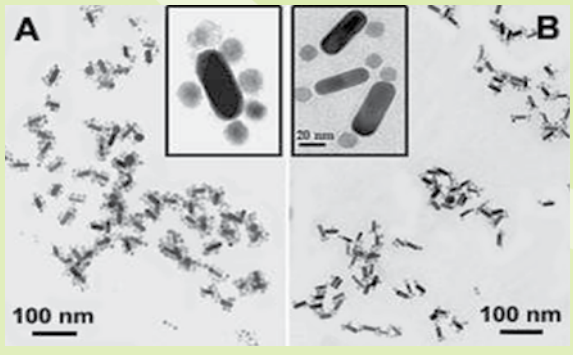
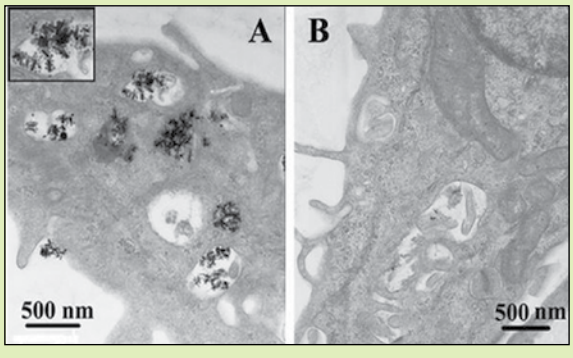
Indian Institute of Chemical Technology, Hyderabad
University of Illinois, Urbana-Champaign
University of Notre Dame, Notre Dame
Arizona State University, Tempe







Cancer nanotechnology is an evolving interdisciplinary area of research cutting across the fields of biology, chemistry, engineering, and medicine with significant implications in cancer detection, diagnosis and treatment at the molecular level. The need to expand and accelerate research in biomedical and nanosystems engineering is imperative to foster continued growth.

The foundation of the Indo-US Joint Networked ***Center for Nanomedical and Cellular Engineering*** is to advance the functional understanding of cell biology using nanoscience and nanotechnology. Through the partnership between Purdue University and the Center for Cellular and Molecular Biology collaborating with the University of Illinois at Urbana-Campaign (UIUC), University of Notre Dame (UND), the National Institute of Interdisciplinary Science and Technology (NIIST) and the Indian Institute of Chemical Technology (IICT), brings together a team of engineers, physicists, chemists, cell and molecular biologists with an unusual but complementary set of skills to address fundamental issues in the field of nanomedicine and cellular engineering. The team will create, design, and evaluate nanomaterials, biomaterials, imaging tools, nano and micro devices

for diagnosis and therapy of diseases with a specific focus on cancer, in conjunction with one of the seven National Cancer Institute designated basic research cancer centers in the United States - the Purdue Cancer Center.

The goals of NCE will be addressed through a coordinated set of experiments that build upon ongoing efforts at Purdue and CCMB and their collaborating partners to:

(i) Develop multifunctional nanoprobes and photonic structures for sensing;
(ii) Develop targeted and trackable nanomaterial based carriers of therapeutic nucleic acids;
(iii) Develop in vitro and in vivo cellular targeting and therapy administration methodologies for disease treatment and prevention;
(iv) Incorporate into these studies multimodal imaging tools comprising of Raman, fluorescence, hyperspectral, and magnetic resonance imaging with a long-term potential for in vivo imaging; and
(v) Fabricate nano-devices and biosensors to diagnose rare disease events that have a high potential for commercialization in the long-term.

The Joint Center will provide a platform for a core group of faculty and students with a common interest in nanotools, imaging tools, and nano-devices to develop long-term collaborations in high impact programs for early detection and treatment of cancer. There are presently two Ph.D. students associated under the Joint Center - one each from CCMB and Purdue University. The lead PI's from CCMB and Purdue have received internal grants from respective institutions as an aftermath to the establishment of the bilateral IUSSTF supported Center.

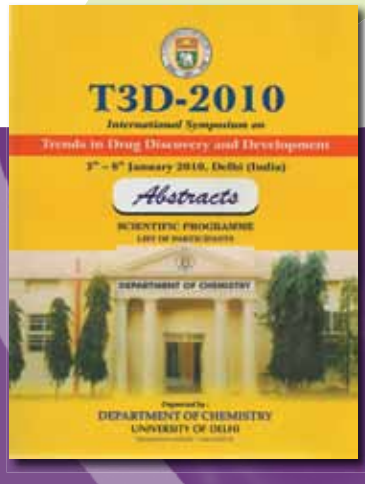
Using complementary highly sensitive probes, detection platforms, and devices enabled by nanotechnology with clinical translation potential will help track the evolutionary state of the disease relevant to protein expression, signaling pathway activity, and molecular profiles enabling early cancer detection. To improve therapeutic outcomes, especially with emerging therapies, it is essential to target multiple pathways and devise multi-diagnostic strategies for in vitro and in vivo characterization of tumors. Such nanoscale detailing combined with time-resolved characterization will help to better understand cancer progression/regression for more effective administration of therapy for individualized treatment. Besides cancer, the NCE's effort will also impact other angiogenesis-related diseases.

Some of the work accomplished by the Joint Center thus far are:

(i) Complete synthesis and characterization of iron oxide nanoparticles at CCMB;
(ii) Synthesis of gold nanoclusters and silver nanoparticles for drug delivery, and development of tools to quantify compartmentalization of drugs in different cellular compartments in single cells at Purdue University;
(iii) Examination of chemical structure on nanoparticles is under progress and will assist in revealing protein structures.


International Conference on
Recent Advances in Lobster Biology,
Aquaculture and Management
RALBAM 2010
Abstracts


US-India Workshop on Metrology, Standards,
and Conformity Assessment
&
Their Use in Support of Technical Regulations


T3D-2010
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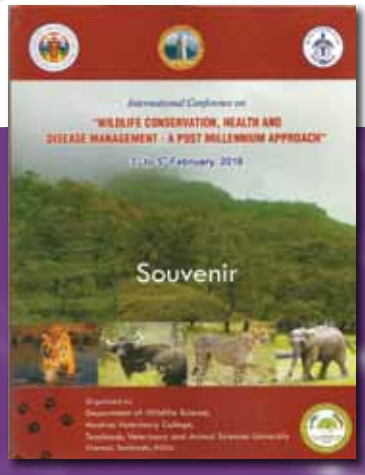
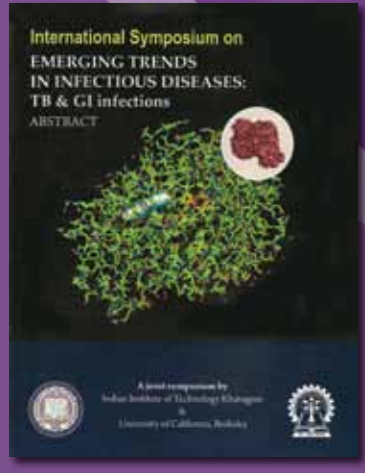
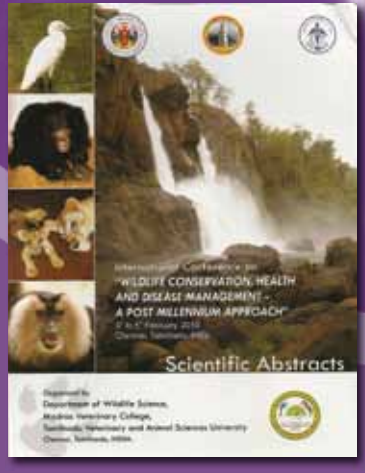
Trends in Drug Discovery and Development
Abstracts
SCIENTIFIC PROGRAMME
DEPARTMENT OF CHEMISTRY
DEPARTMENT OF CHEMISTRY
UNIVERSITY OF DELHI


"WILDLIFE CONSERVATION, HEALTH AND
DISEASE MANAGEMENT - A POST MILLENNIUM APPROACH"
Souvenir


GISE
WORKSHOP ON GIS TECHNOLOGY AND APPLICATIONS
GEOSPATIAL INFORMATION FOR DEVELOPING COUNTRIES
DECEMBER 2009


International Symposium on
EMERGING TRENDS
IN INFECTIOUS DISEASES:
TB & GI infections
ABSTRACT


"WILDLIFE CONSERVATION, HEALTH
AND DISEASE MANAGEMENT -
A POST MILLENNIUM APPROACH"
Scientific Abstracts


ATIP 1ST WORKSHOP ON HIGH-
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2009
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BIOGRAPHIES
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POSTER SESSION ABSTRACTS &
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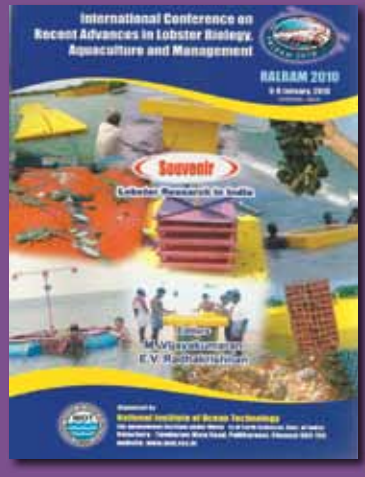
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RALBAM 2010
Souvenir
Lobster Research in India


SOUVENIR


ABSTRACT BOOK IUWMF'09
Organized by :
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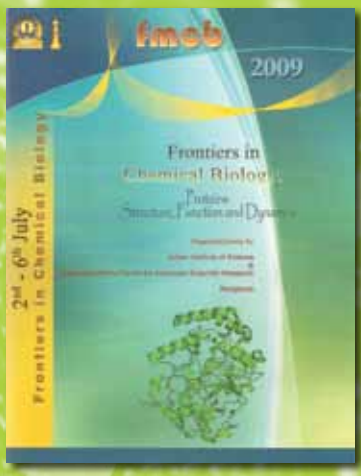
and
Department of Chemical Engineering
Indian Institute of Technology Kharagpur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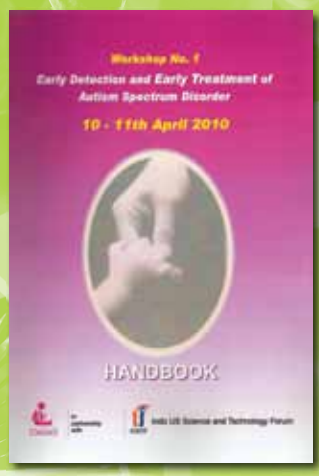
2009
Frontiers in Chemical Biology
2nd - 6th July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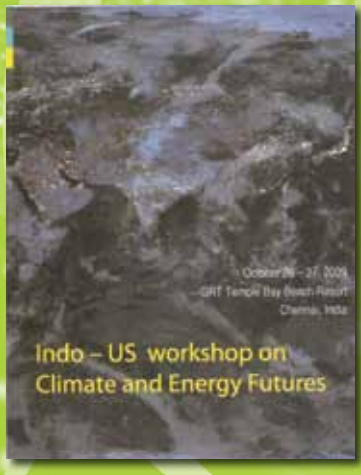
Early Detection and Early Treatment of
Autism Spectrum Disorder
10 - 11th April 2010
HANDBOOK


INTERNATIONAL SYMPOSIUM
ON SNOW AND AVALANCHES
Manali, India
Snow & Avalanche Study Establishment
Manali, India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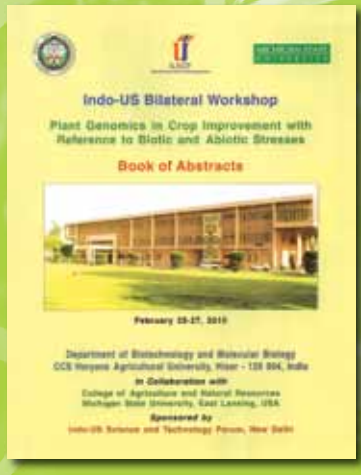
Climate and Energy Futures


Indo-US Bilateral Workshop
Plant Genomics in Crop Improvement with
Reference to Biotic and Abiotic Stresses
Book of Abstracts
February 15-17, 2010


Indo - US Conference on
Recent Scientific Developments
in Vitamin D and Health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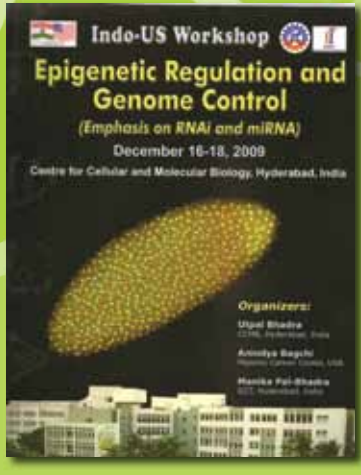
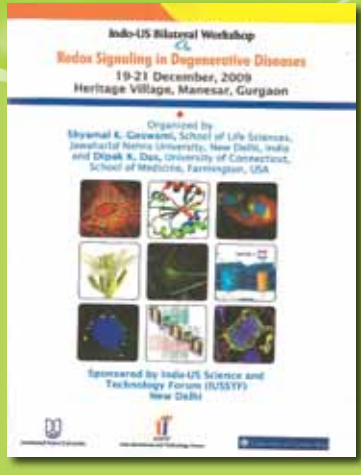
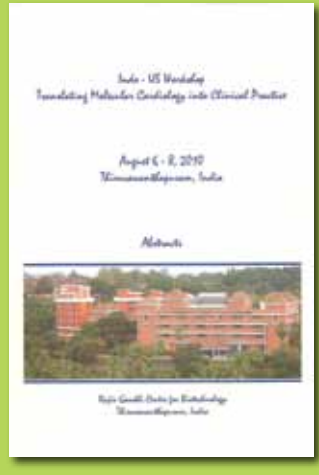
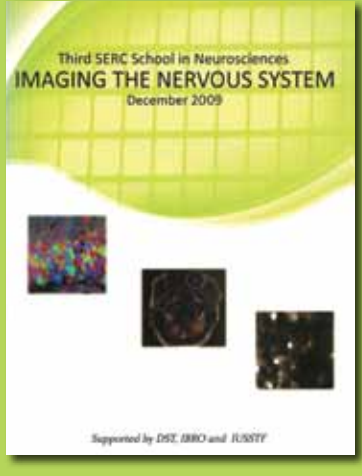
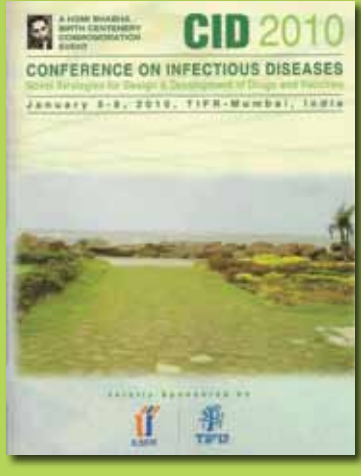

Indo-US Workshop
Epigenetic Regulation and
Genome Control
(Emphasis on RNAi and miRNA)
December 16-18, 2009
Centre for Cellular and Molecular Biology, Hyderabad, India
Organizers:


Indo-US Bilateral Workshop
Redox Signaling in Degenerative Diseases
19-21 December, 2009
Heritage Village, Manesar, Gurgaon


Indo - US Workshop
Translating Molecular Cardiology into Clinical Practice
August 6 - 8, 2010
Abstracts


Third SERC School in Neurosciences
IMAGING THE NERVOUS SYSTEM
December 2009
Supported by DST, IRRO and IUSSTF


CID 2010
CONFERENCE ON INFECTIOUS DISEASES
January 5-8, 2010, TIFR-Mumbai, India


Indo-US Workshop on
Silicon in Agriculture
ABSTRACT CUM SOUVENIR


Designing Sustainable
Products, Services and
Manufacturing Systems

SUPPORT TO INTERNATIONAL CONFERENCES/EVENTS
International Symposium on Snow and Avalanches (ISSA-2009)

6-10 April 2009, Manali, India

R. N. Sarwade
Snow & Avalanche Study Establishment,
Chandigarh
E-mail: rsarwade@gmail.com

The ***International Symposium on Snow and Avalanches*** was aimed at providing an opportunity for the international scientific community to exchange ideas about the research being conducted in the field of snow science, cold region engineering, climate change, mapping of snow and ice sheets and other related areas. The response to the symposium was overwhelming with more than 100 papers presented by the attending scientists and academicians. The symposium served as a platform for understanding how snow cover affects the hydrology, ecology and climate of the Himalayas and the other mountainous regions across the world. The whole event was divided into several technical sessions that covered mountain meteorology, snow properties, snow cover, avalanche dynamics, avalanche formation, snow stability, avalanche forecasting, snow hydrology and remote sensing. Among the delegates supported by IUSSTF, Hans Peter Marshall from Boise State University talked about the Non-stationery and process scale partitioning of snow depth fields using LiDAR surveys, Application of high resolution penetrometry for snow metamorphism and Spatial variability of snow stratigraphy using portable radars; and, Sivaprasad Gogineni, University of Kansas gave a comprehensive talk on the state-of-the-art instrumentation package for measurements of snow-ice thickness using microwave radar developed by his team in the Arctic region.

Ramanujan rediscovered - Elliptic functions, q-series, partitions and related number theory, with parallel sessions on Mathematics and IT

1-5 June 2009, Bangalore, India

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International Institute of Information
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The ***Ramanujan rediscovered*** conference brought together researchers from India and throughout the world for a stimulating interaction among pure and applied mathematicians. The conference had two dedicated streams, one catering to pure mathematics and the other to applied mathematics-Math IT. The mathematical intricacies of elliptic functions, q-series and partitions were the highlights of the event. Several proofs were presented in these topics. Among the US delegates, Bruce Berndt from University of Illinois gave a talk on Ramanujan's Contributions to Theta Functions, Krishnaswami Alladi, University of Florida spoke on Investigation of representations due to Andrews, Fine, and Ramanujan of a certain partial theta series, Frank Garvan, University of Florida gave a talk on the Rank and Crank of Partitions - In memory of A.O.L. Atkin, Tim Huber from Iowa State University gave a talk on Eisenstein series for subgroups of SL(2, Z), and, Ae Ja Yee Pennsylvania State University spoke about Parity in partitions.

All India Congress of Cytology and Genetics & Fogarty International Workshop on Molecular epidemiology, Environmental health and Arsenic exposure assessment

1-4 December 2009, Kolkata, India

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The ***14th AICCG*** conference was intended to review the advances in environmental mutagenesis, particularly relating to the topics of population monitoring, mutagenic hazards of environmental agents with special reference to arsenic, mechanisms of mutagenesis and carcinogenesis, environmental mutagenesis research in Asia, genomic and proteomic approaches to identify different toxic exposures, and, a special session on arsenic exposure assessment. Some of the highlights of the event included hands-on workshops on micronuclei assay from human peripheral blood lymphocytes and on techniques pertaining to arsenic exposure assessment in water and biological samples. IUSSTF supported the participation of 3 US delegates including, Nina Holland from School of Public Health, University of California - Berkeley, Jerome Nriagu, School of Public Health, University of Michigan-Ann Arbor and J. Christopher States, University of Louisville.

International Symposium on Translational Cancer Research: Cell signaling and Cancer

18-21 December 2009, Bhubaneswar, India

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Chemists, biologists, immunologists, and clinicians have been underscoring the importance of translational research to diagnose, prevent, treat, and perhaps cure cancer. While the concept of translating research from bench to bedside has become a norm in developed countries such as the United States, education and training are required to perpetuate this notion in developing countries such as India. Specifically for cancer, research-driven patient care is the only way forward. With this in mind, the 3rd ***International Symposium on Translational Cancer Research: Cell Signaling and Cancer*** was organized where leaders in translational cancer research gathered. Among the US participants supported by IUSSTF, Bharat Aggarwal, M. D. Anderson Cancer Center, Houston chaired the session on Inflammation and cancer. Sankar Ghosh from Columbia University, New York described the key role of NF kappa B in inflammatory and immune responses. Besides, there were other US speakers from University of Colorado and Anderson Cancer Center, Houston.

Recent Advances in Lobster Biology, Aquaculture and Management (RALBAM 2010)

5-8 January 2010, Chennai, India

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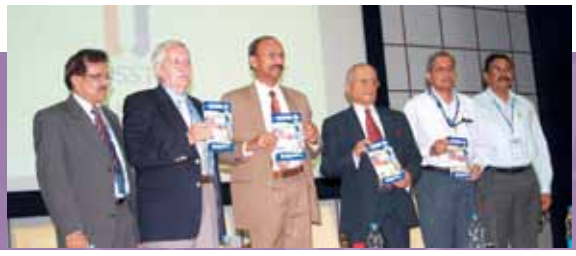

India is among the major lobster-producing countries in the world with annual landings of 2000 to 4000 metric tonnes. Several species of spiny lobsters and the sand or slipper lobsters constitute the entire catch of lobsters in India. The objective of the conference on ***Recent Advances in Lobster Biology, Aquaculture and Management*** was to conduct a mid-term review of lobster research across the world and focus on lobster research in India to generate international cooperation in formulating projects on lobster conservation and management, biology with special reference to habitat studies and aquaculture. IUSSTF supported the participation of Richard Wahle from Bigelow Laboratory for Ocean Sciences and two of his graduate students for the meeting. Richard Wahle and his students contributed information on the development of forecasting tools for the American lobster Homarus americanus based on a larval settlement index, and the application of satellite remote sensing data and growth modeling to refine such predictive tools. This information can be used to develop a model to predict lobster fisheries in India.

International Symposium on Trends in Drug Discovery and Development

5-8 January 2010, New Delhi, India

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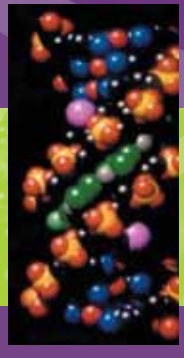

The pharmaceutical sciences have undergone several dramatic changes in the last few decades. Many new concepts, technologies and disciplines have been introduced and keep on emerging. The aim of this symposium on ***Trends in Drug Discovery and Development*** was to serve and advance excellence in the pharmaceutical sciences and innovative drug research, including in training and education, and to represent the interests of scientists engaged in drug research and development, drug regulation, drug utilization, and drug policy making. The symposium provided a forum to present and discuss scientific progress to support and strengthen cutting-edge research in both pre-clinical and clinical drug discovery, development and translational medicine. Among the US delegates sponsored by IUSSTF, Anthony L. DePass from Department of Biology, Long Island University – presented his work on Cell differentiation as a therapeutic target for cancer treatment, and Shivaani Kumar, Center for Cancer Research, National Cancer Institute gave a presentation on Development of molecularly targeted therapies for cancer.

Annual Global Conference on Entrepreneurship and Technology Innovation

16-18 January 2010, Kanpur, India

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Entrepreneurship and innovation being primary factors in a knowledge based economy are major determinants of economic growth in most countries. The Annual ***Global Conference on Entrepreneurship and Technology Innovation*** was organised by the Indian Institute of Technology, Kanpur in partnership with the Rensselaer Polytechnic Institute, New York. The objective of the conference was to bridge the gap between theory and practice in innovation led entrepreneurship and to highlight the strategic implications of recent research and experience. The topics featured in the panel discussions were commercializing emerging technology, entrepreneurship education, financing new ventures and corporate entrepreneurship. The major recommendations of the event included strategies to bring high-impact entrepreneurship innovation to the market place from laboratories; strategies for capitalizing on the products and services that result from breakthrough research; educating academicians & practitioners to recognize opportunities for innovation; and development of models that will foster institute-industry collaborations. IUSSTF supported the participation of Lois Peters, T. Ravichandran and Aparna Gupta from the Rensselaer Polytechnic Institute, New York.

Wildlife Conservation, Health and Disease Management – A Post Millennium Approach

3-5 February 2010, Chennai, India

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India is a vast country with abundant flora and fauna. However, there is constant destruction of wildlife as a result of human invasion and disease outbreaks. To enable wildlife veterinarians, biologists, conservationists to work towards the conservation of wildlife using a multi disciplinary approach, an international conference on ***Wildlife Conservation, Health and Disease Management – A post millennium approach*** was held at the Madras Veterinary College. International delegates were drawn from countries like Australia, Canada, France, Malaysia, Qatar, South Africa and USA. The conference offered an excellent opportunity for nearly 200 participants to share views and experiences on diverse issues of wildlife conservation, health and disease management and also to enhance effectiveness and efficiency of research through partnerships and collaborations. IUSSTF supported the participation of Murray E. Fowler from University of California-Davis, Susan Mikota, Elephant Care International, Hohenwald and Mark Irwin from Jefferson Community College, New York.

International Symposium on Biocomputing

15-17 February 2010, Calicut, India

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The last decade has witnessed a surge in life science research with the advent of high throughput instrumentation technologies. The staggering volume of data generated from different "omics" experiments has stymied integration of experimental procedures and computational activities. Efficient computational algorithms and tools are absolutely essential to manage and analyze the huge amount of biological data generated from various genome studies. In the present global scientific arena, bioinformatics has thus evolved as a complementary tool to biologists, assisting in interpretation of experimental data and also providing important leads for further experimental research. The ***International Symposium on Biocomputing*** attempted to embrace all of the areas that are pertinent to systems biology and personalized medicine to keep abreast of the latest developments in the fields of biotechnology, bioinformatics, and systems biology. IUSSTF supported the participation of Eric Jakobsson from University of Illinois at Urbana-Champaign who delivered the keynote address on 'What kind of graph is the Tree of Life? - Insights from a domain/motif-based view of molecular biology.

International Symposium on Phycological Research

25-27 February 2010, Varanasi, India

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Algae have been pivotal in understanding photosynthesis in higher plants and blue-green algae (cyanobacteria) are important model systems for deciphering stress responses in higher plants. The recent past has witnessed much progress in areas of food security (single cell protein), drug discovery (as source of new bioactive molecules), biofertilizers, pharmaceuticals (antioxidants), cosmetics as well as nutraceuticals. An ***International Symposium on Phycological Research*** was organized to discuss the developments in molecular biology, proteomics and genomics with gene sequences of certain model algae. The major recommendations of the event included the re-establishment of the Indian Phycological Society, and the establishment of a central facility for algal culture collection. IUSSTF supported the participation of R.W. Castenholz from University of Oregon who delivered the keynote address on Cyanobacteria and micro-algae under stress.

International Conference on Environmental Health and Technology

15-17 March 2010, Kanpur, India

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As a part of Golden Jubilee Celebrations of IIT Kanpur, a commemorative conference on ***Environmental Health and Technology*** was organized with national and international experts engaged in public health research in the areas of medicine, environment, engineering and biology. Although these fields of science are quite independent and have developed immensely, an interfacial integration of these fields can transform these areas into a single entity that can directly benefit society. As a result of the conference the newly-created Center for Environmental Science and Engineering at IIT Kanpur could benefit by the development of linkages and alliances with national and international experts. IUSSTF supported the participation of four US delegates for the conference - Leona D. Samson, Center for Environmental Health Sciences, MIT; Douglas Dockery Harvard School of Public Health Boston; Viney Aneja, N.C State University; and Michel T. Kleinman from University of California, Irvine.

TRAVEL SUPPORT TO AVAIL FELLOWSHIPS/SABBATICALS/EXPLORATORY VISITS

Travel support was extended to the following individual scientists to avail an 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.

Laurence Mueller, Professor at the University of California Irvine, and an expert in population dynamics, genetics, ecology and evolution, undertook a visit from 06-20 September 2009 to deliver public lectures at the Indian Institute of Science Education and Research - Pune (IISER-P), Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) and Indian Institute of Science (IISc), Bangalore. At IISER-P, he delivered a colloquium titled "Does aging stop," wherein he gave an overview of the recent advances in the field of gerontology, including the evolution of late-life mortality plateaus. At JNCASR, he participated in a two-day discussion meeting titled Evolutionary biology in India: looking ahead. He also attended the International Conference on Darwinism – A Sesquicentennial Celebration organized by Karnatak University, Dharwad and the Indian National Science Academy, New Delhi and delivered a valedictory talk titled "Evolution of behavior in response to crowding and stress."

P. Sundaresan, Senior Scientist at the Aravind Medical Research Foundation, Madurai, undertook a visit to John Crabb's laboratory at the Cole Eye Institute, Cleveland Clinic Foundation from 16 -30 April 2010 to work on proteomics and to learn the technology for proteomic biomarker discovery and validation. The title of the collaborative project was "Identification of biomarkers for primary open angle glaucoma (POAG)" and covered protein detection techniques, image analysis for proteomics experiments, amino acid sequence analysis, database search and characterization of protein post-translational modification. These techniques will be applied by the PI in the ongoing Indo-US project supported by NIH & DBT.

Paul S. Weiss, Distinguished Professor at the Pennsylvania State University visited India in July 2009, to explore research collaborations with leading research laboratories in India in the fields of Chemistry and Nanotechnology and also delivered an invited talk at the international workshop on Nanotechnology and Advanced Materials that was held at the National Chemical Laboratory, Pune.

Sourabh Ghosh, Assistant Professor at the Indian Institute of Technology, New Delhi, traveled to work with David Kaplan's group at Tufts University, to check modulation in gene expression between osteoarthritic tissue and tissue engineered arthritis in vitro disease model system. On this exploratory visit, it was decided that scientists at IIT-Delhi will try to isolate and purify silk fibroin proteins. This protein would then be used to fabricate three dimensional scaffolds.

Alok Thakar from the Department of Otolaryngology and Head-Neck Surgery at the All India Institute of Medical Sciences, New Delhi, undertook a visit to the University of Pennsylvania to observe, evaluate and adopt the practice of Trans Oral Robotic Surgery (TORS) in clinical practice for head-neck cancer and skull base surgery. The great maneuverability and precision of movements allows for complex surgical procedures to be undertaken through the mouth with no incisions. Special focus was laid on aspects of surgical technique, case selection, post-operative complications and swallowing rehabilitation. It is expected that AIIMS, Delhi will soon have the TORS facility.

Tapan Ganguly, Senior Professor at the Indian Association for the Cultivation of Science, Kolkata, traveled to Bruce S. Brunschwig's laboratory in Caltech, USA, to investigate photoinduced electron transfer processes within several systems of electron donors and acceptors. This area is not only important from a basic research point of view, but also has strong technological relevance especially in the construction of components of photovoltaic cells, light emitting diodes and organic solar cells.

Notes

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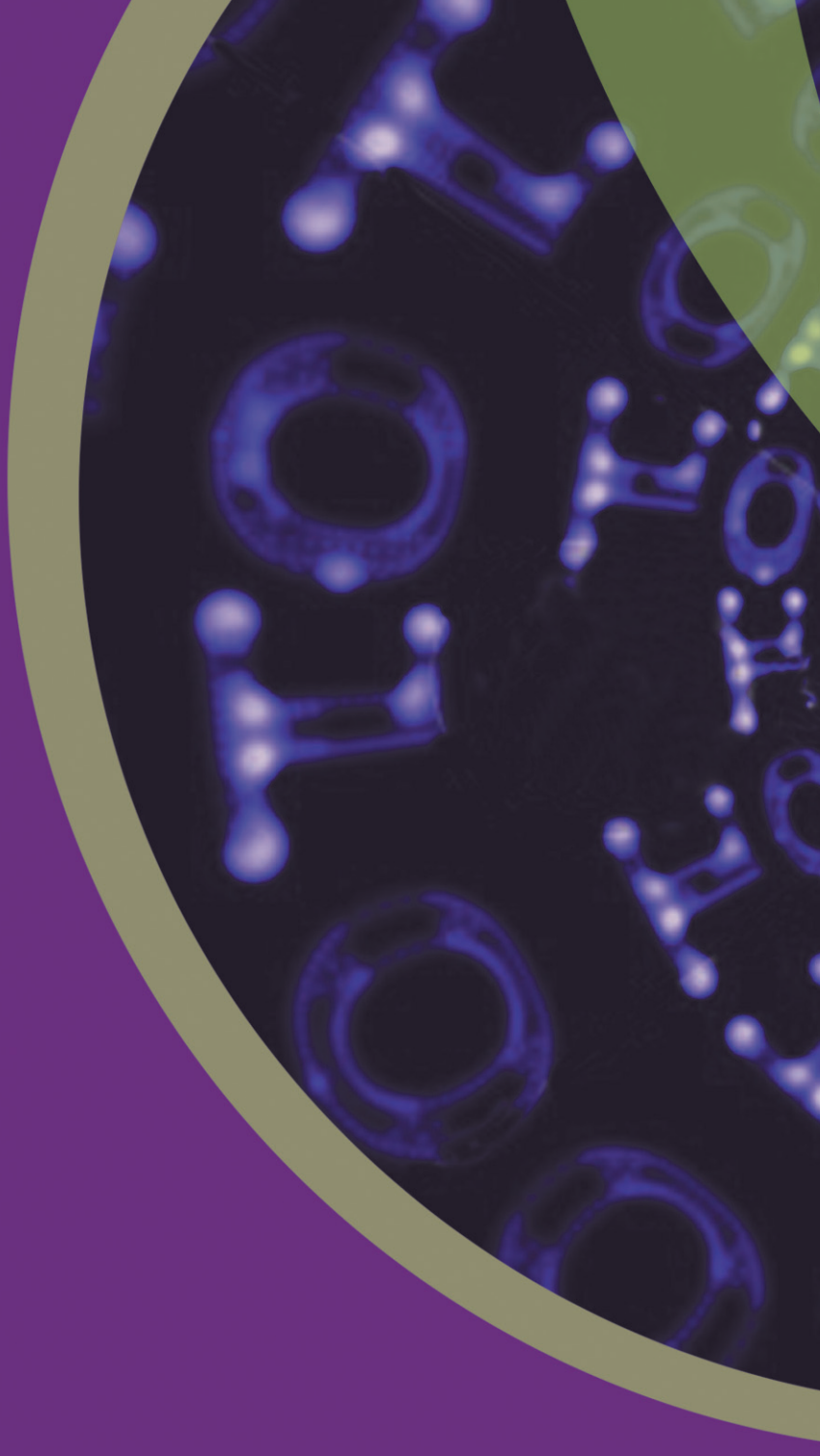

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