Indo-US Science & Technology Forum

Connect

Newsletter of IUSSTF

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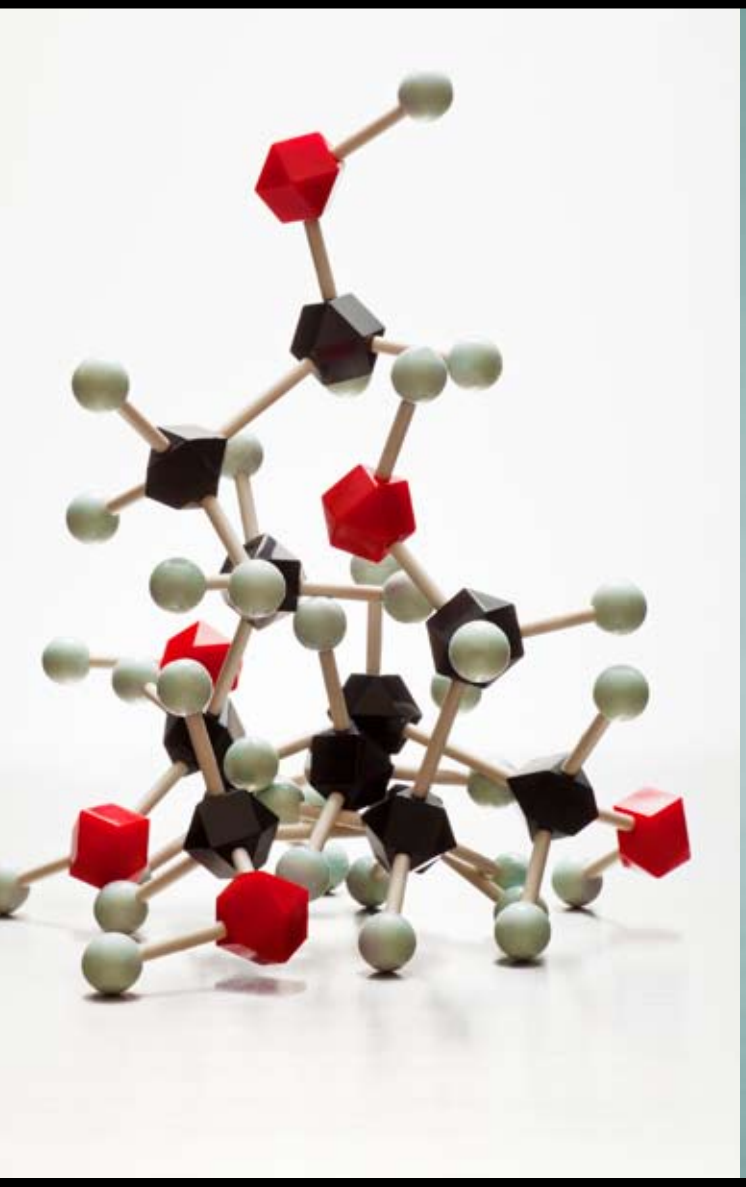

IUSSTF
Indo-US Science and Technology Forum

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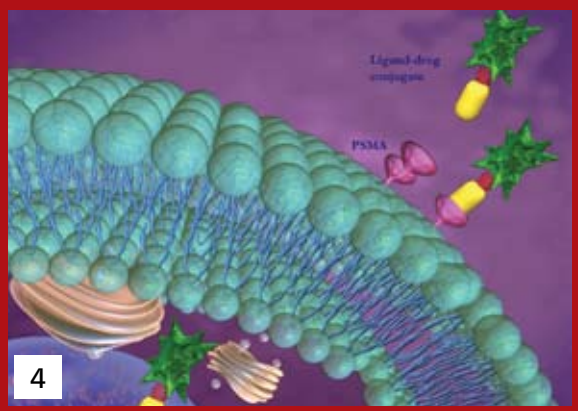

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From the Editor-in-Chief

The Indo-US relationship has been undergoing a transformation for the last few years. The engagement between the Governments of two great democracies has enhanced considerably over this period and this trend is continuing. Science, technology and innovation (STI) has always figured prominently in the deliberations of the *India-US High Technology Cooperation Group* (HTCG) and the *India-US Strategic Dialogue*.

The Indo-US Science & Technology Forum (IUSSTF) has become a central part of the Indo-US relationship in the arena of Science & Technology due to the dynamic leadership and untiring efforts of Dr. Arabinda Mitra, the founding Executive Director of IUSSTF. During the second annual meeting of the Indio-US Strategic Dialogue held on 19 July 2011 New Delhi, both sides lauded the activities of the IUSSTF.

I recall the address of the Ambassador Richard Celeste during the launch of IUSSTF wherein he expected that IUSSTF would bring the "wow" factor in the India-US S&T relationship. In its ten-year journey, the activities of IUSSTF has led to the interaction of nearly ten thousand Indian and American scientists, technologists, engineering and medical professionals and students. IUSSTF has been entrusted with implementing many new bilateral initiatives such as the *US-India Science and Technology Endowment Board* and *Joint Clean Energy R&D Centre*. As a bystander until recently, I watched this journey very curiously and I could say WOW, what an exciting journey this ten-year old child has made! I have now taken over the reins of IUSSTF after a career spanning over 26 years with an experience of nearly 15 years in developing and implementing several bilateral S&T cooperation programs with countries like Japan, Israel, Sweden, Finland, US, Canada, etc. and other bi-national centers in my previous assignment at the Department of Science & Technology, Government of India.

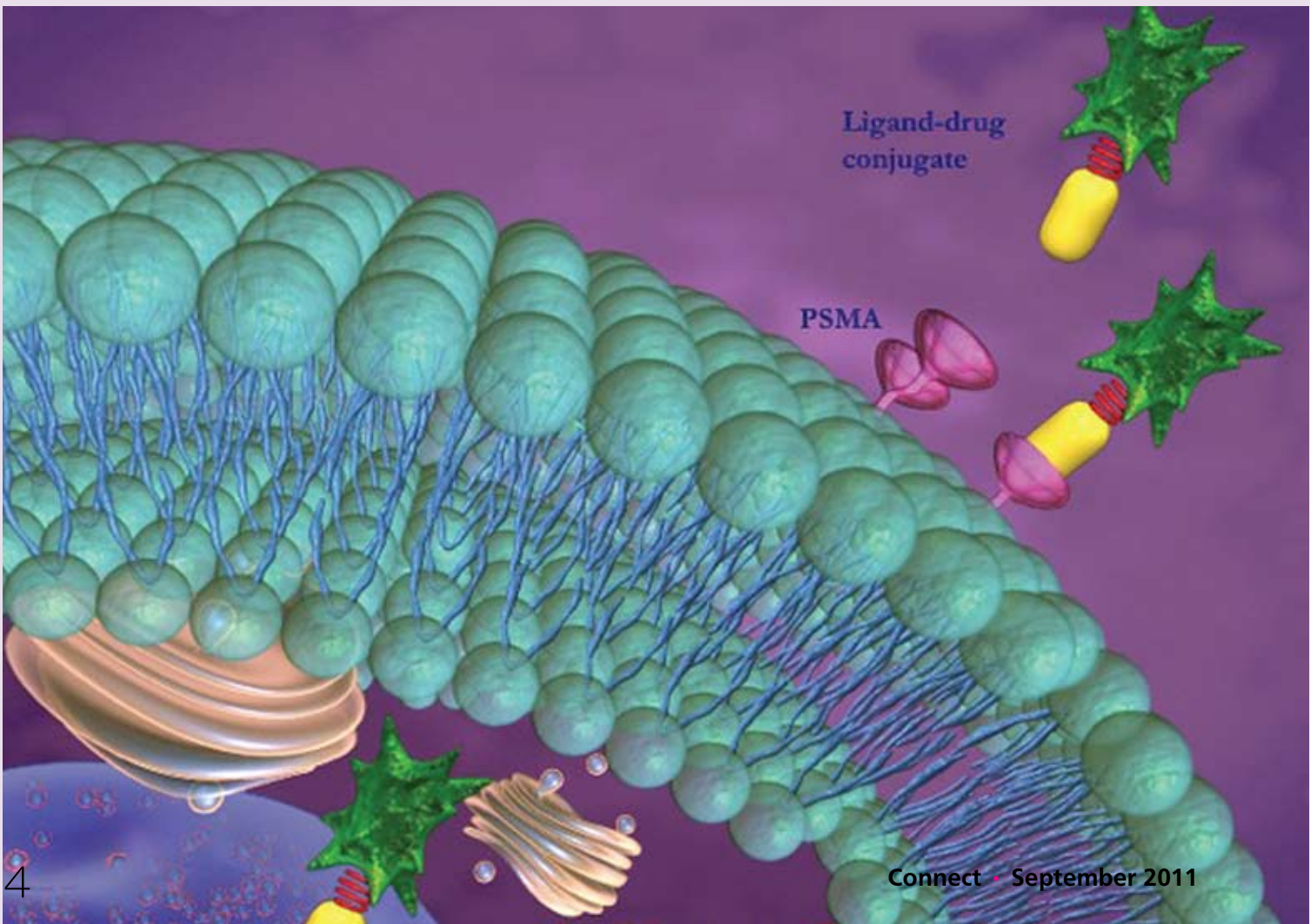
The year 2011 is being celebrated as the International Year of Chemistry to commemorate the achievements of chemistry, and its contributions to humankind. With this backdrop, the cover-story of this issue highlights *Drug-discovery and development in India*. IUSSTF has also been able to successfully develop several student visitation programs to groom the next generation who will shape the future of S&T cooperation between our two nations. The successes of two newly launched programs: the *Viterbi-India Program* and the *Lockheed Martin-IUSSTF Young Engineers Visitation Program* have also been highlighted in this edition of Connect. This edition of Connect also covers the *Indo-US S&T Innovation Exposition* organized by IUSSTF along with DST, Govt. of India and FICCI to showcase innovative technologies and foster a bidirectional Indo-US entrepreneurial ecosystem.

I hope that the attention and support of all the stakeholders of IUSSTF would continue in its journey towards the transformation from a child to an adult. I am looking forward to a fulfilling experience at the helm of IUSSTF!●

Rajiv Sharma
Executive Director, IUSSTF

Sanjay V. Malhotra
National Cancer Institute,
Frederick, Maryland, USA

For a Million Maladies More



The practice of medicine predates by thousands of years the current concepts of the science of medicines and the application of 'therapeutic' procedures by professionals similarly predates any scientific understanding of how the human body works, or what happens when it goes wrong. The ancients defined disease not only in very different terms, but also on quite a different basis from what would be recognized today. The origin of disease and the mechanism needed to counter it were generally seen as manifestations of divine will (natural powers) and retribution, rather than of physical malfunction. The scientific revolution in medicine which began in the 19th century and has steadily accelerated since, has changed our concept of disease quite drastically, and continues to challenge it, raising new ethical problems and thorny discussions of principle.

Nature is, as ever, an extremely rich source of potential drug agents with the anti-malarial drugs, quinine and artemisinin, being outstanding examples of therapeutic natural products. India has a rich heritage in natural products with putative health benefits. Several institutes such as Indian Institute of Integrative Medicine, Indian Institute of Chemical Technology and Central Drug Research Institute are engaged in research in this area. Natural products have formed the basis for a number of currently available active anticancer drugs. For instance, the first plant derived anticancer agents to be evaluated and eventually approved are the vinca alkaloids, vinblastine and vincristine. Since then multiple newer therapies, some now made synthetically, owe their origins to plant sources such as etoposide, paclitaxel, irinotecan. One of the experimental drugs, flavopiridol, being evaluated for the treatment of leukemia was synthesised based on the structure of a natural product, rohitukine, isolated by chemists at Hoechst India Ltd. in the early 1990s from *Dysoxylum binectariferum*. The evaluation of this plant is based on its reference in Ayurvedic text as a source of anti-inflammatory and immunomodulatory activity for treatment of rheumatoid arthritis.

Drug discovery research as carried out today represents the co-evolution of a number of disciplines, some scientific and some not. Although, chemistry and biology lie at the heart of the process they are certainly not the only important issues involved. The way in which modern research is done, the organizations that do it, and the rules that govern it are the result of dynamic changes in science, business, bioethics, and law that have been going on for well over a century. The goal has always been the same: finding new medicines to cure diseases and alleviate suffering.

In recent times we have witnessed the emergence of key trends that are set to redefine the pharmaceutical industry globally. While R&D budgets of big pharma are on the rise,

the number of new molecular entities (NMEs) approved are not keeping pace, thereby putting pressure on newer product flow. This has made India an increasingly dominant destination for global pharmaceutical companies looking to outsource early-stage drug discovery. India's competitive edge is the skilled work force, and the relatively low costs of setting up and running new plants with state of the art machinery, processes and systems, and lower human resource cost. India today has the highest number of FDA approved plants outside the US and accounts for one-third of all drug master file (DMF) filings with the Agency. Also, the distinct competitive advantages it offers in all aspects of the research and development cycle are increasingly respected. While previously India was scarcely at the forefront, today it is very much centre stage of the global pharmaceutical industry.

> "India boasts a vast pool of trained manpower, significant cost advantages and an increasingly favorable patent regime that supports innovation. While many of these growth supplements have put India's technology sector on the world map, the pharmaceutical industry seems to suffer one malaise – the ability to attract and retain the leadership that will help them capture all the opportunities before them."

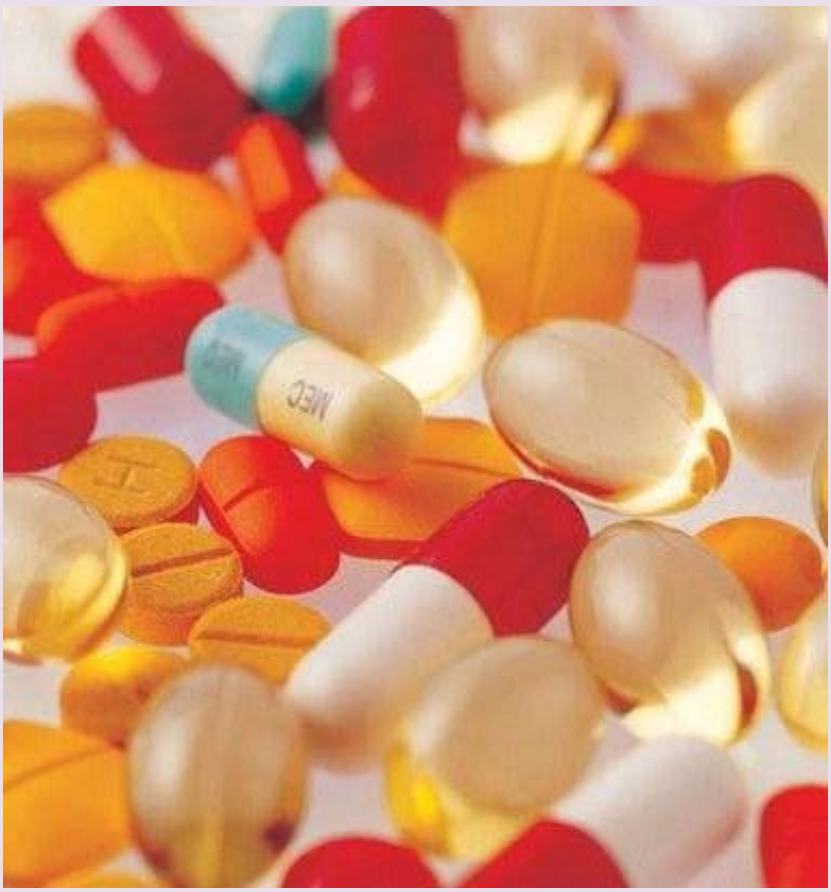
Today, India is luring the global drug industry to its shores partly because of business prospects and partly with an eye on improving its own healthcare infrastructure. This helps in job creation and national economy. However, with other developing economies rapidly building their infrastructure and providing similar competitive advantages, these gains could easily become short term only. This scenario certainly demands major changes and commitments from all sectors i.e. government, academia, and private industry.

Drug discovery research in pharma, biotech and academia has been a magnet that attracts keen scientific minds. India, undoubtedly, has a lot to offer. Although, drug discovery in India is a relatively new phenomenon and thus far very few compounds have really been discovered in India, the potential for success is high. Cost and speed have been the primary value proposition provided by Indian firms. However, talent and specialized knowledge in new technologies may become the source of competitive advantage. Considering the scientific challenges and complexities of processes in discovery of new drugs, the developed nations such as US are moving towards government-academia-industry partnership, a model that can also be implemented in India.

Capacity building is essential if we are to be perceived as a major player in the global drug discovery industry. There are several established institutes which can provide a leading role in the development of India's science and technology capability in drug research and development, to undertake frontline research, and to provide specialized scientific services, and human resource development which should be at par with other leading nations. State-of-the-art facilities and cutting-edge scientific programs in areas such as genomics and proteomics, target identification and validation, medicinal chemistry and pharmacology are essential in identifying new molecules as potential therapeutics. Similarly, infrastructure and skill set should be developed in technologies such as High-Throughput Screening (HTS), bioinformatics and animal modeling and testing i.e. rodent and non-human primate facility.

Currently, a state-of-the-art repository of natural products is being set up at the Indian Institute of Chemical Technology (IICT) which is planned to become a national resource to support drug discovery efforts. As in other nations leading in discovery of drugs, India should develop infrastructure from academia to national labs in all areas of preclinical research, and also implement reforms necessary to create a future workforce of skilled scientists ready to make India a leader in discovery of new drugs.

Industrialization and modernization for nation building could also cause significant health problems. As per a report by the World` Health Organization, there is a significant increase in the percentage of the population suffering



from cancer, HIV, respiratory, cardiovascular and metabolic diseases in India. This puts a huge burden on the health cost of the nation. However, it also opens opportunities for India to play a major role in discovery of new drugs and contribute to reducing the global burden of human disease. Clinical research accounts for the major portion of the cost in discovery and development of new drugs. While the infrastructure for preclinical research is being built, efforts to collaborate with agencies and leading pharmaceutical industries should be considered for the conduct of early phase/ Phase I clinical trials in India. The growing number of cases of advanced cancer in India makes it imperative that early phase clinical drug development efforts are undertaken. This would require building clinical research facilities dedicated to conducting such research, having academic institutions to train physicians to become clinical researchers, developing the regulatory infrastructure and oversight to ensure that high quality research is conducted and the highest standards of patient safety are implemented. Policy reforms and a global health care vision in this direction would make drugs affordable for everyone, help in lowering the burden of global health cost and certainly position India as a leading nation in discovery of new drugs

In conclusion, it is clear that India today has the potential of becoming an important player in the pharmaceutical R&D value chain. However the answer to the question 'Will India become the global centre for pharmaceutical research and development?' depends on how well its now globally recognized strong scientific community can leverage its innovation skills, backed by an environment that is increasingly facilitating entrepreneurship. If India has to become a global centre for R&D, it has to gradually understand the nuances of ascending the value chain from generics to drug delivery and finally to drug discovery with a long-term focus on building an innovation model that would give sustainable competitive advantage, one that will lead to enhancing shareholder wealth and benefit to patients. ●

Molecule to Medicine

Indo-US symposium on Frontiers in Medicinal Chemistry and Drug Discovery

"Indian pharmaceutical industry is set to gain as drugs worth $ 18 billion are going off patent by 2013 and the industry has to gear up to take advantage of the opportunities in drug discovery development. India is the third largest producer of pharmaceuticals in the world and is poised to become a leader in the sector."

Surinder Singh
Drug Controller
General of India

With the revolution in biomedical sciences in the past few decades, the field of medicinal chemistry has evolved from the chemistry of bioactive compounds to work at the interface of chemistry and biology. For most of the 20th century, the majority of drugs were discovered either by identifying the active ingredient in traditional natural remedies, by rational drug design, or by serendipity. However, with the advancement of medicinal chemistry during the past decades, chemists are not only synthesizing new compounds, but contributing to understanding the molecular basis of a disease and its control, identifying bio-molecular targets implicated as disease, and ultimately inventing specific compounds that control a disease or block the bio-molecules from progressing to an illness.

The **Indo-US Frontiers in medicinal chemistry and drug discovery** organized by J. S. Yadav (Indian Institute of Chemical Technology, Hyderabad), B. Suresh (JSS University, Mysore) and Sanjay Malhotra (National Cancer Institute, Frederick) brought together outstanding scientists and researchers from India and the US, not only to discuss exciting advances and opportunities in their own fields, but also to learn and deliberate about research at the cutting edge of other disciplines, while building new ties between future leaders of both the nations scientific enterprises.

The bilateral Indo-US symposium with the theme "Molecule to Medicine", was organized with the support of the Indo-US Science and Technology Forum from 21 - 23 April 2011 at JSS Medical College, JSS University, Mysore.

Surinder Singh, Drugs Controller General of India, was the Chief Guest and inaugurated the symposium. About 350 participants, including 11 from the US, attended the event. The participants from India included scientists, researchers, pharmaceutical industrialists, representatives of the professional associations, research scholars, students, etc. The participants exchanged their experience and discussed threadbare on various issues of drug discovery.

About 150 Poster papers on various topics were presented by research scholars, faculty and students and the same was published as the 'Symposium Chronicle' and distributed to all the members. The theme of papers presented included:

- Drug discovery and development
- Pharmacology and biotechnology
- Pharmaceutics and drug delivery
- Quality assurance and validation

In all, 9 technical sessions were held during the three-day deliberations wherein papers on 17 topics were presented by the invited speakers. In the Panel Discussion, chaired by B. Suresh (Vice-Chancellor, JSS University, Mysore), the participants from both India and US came up with a host of suggestions to initiate bilateral collaborative programs. A list of actionable suggestions was put together to be pursued by members representing various participating institutions. ●

Surinder Singh, Drug Controller General of India, lighting the ceremonial lamp to inaugurate the Symposium

Prominent speakers at the symposium :

United States

Michael A. Walters
University of Minnesota

Donna Huryn
University of Pittsburgh

Visakantha Murthy
Penn State College of Medicine

Barbara Laughon
US National Institutes of Health

Anil K. Patri
National Cancer Institute, Frederick

Barry R. O'Keefe
National Cancer Institute, NIH

Sylvie Garneau-Tsodikova
University of Michigan

Debabrata Mukhopadhyay
Mayo Clinic, Rochester

Sanjay V. Malhotra
National Cancer Institute, Frederick

Philip DeShong
University of Maryland

Krishna Kumar
Howard University

India

Prabhat Arya
University of Hyderabad

Erode N. Prabhakaran
Indian Institute of Science

Rajini Kaul
Indian Council for Medical Research

Rinti Banerjee
Indian Institute of Technology

S.P. Thyagarajan
Sri Ramachandra University Chennai

Asit K. Chakraborti
National Institute of Pharmaceutical Education and Research

Palpu Pushpangadan
Amity Institute for Herbal and Biotech Products Development

Yamini Bhusan Tripathi
Banaras Hindu University

Anamik Shah
Saurashtra University

J.S Yadav
Indian Institute of Chemical Technology

G. Mugesh
Indian Institute of Science

New Bridges

Raghu Raghavendra
Vice Dean
for Global Academic Initiatives
USC Viterbi School of Engineering
University of Southern California
Los Angeles

"I have had a great experience and a wonderful time here at the University of Southern California. I was always interested in doing my Masters from a university here in the US and now I am much more enthusiastic at the prospect of doing Masters here. The days have gone by very quickly and it has been a memorable and comfortable stay here. The atmosphere for studies is great and people have been very helpful in every way."

Anurag Chaurasia
Student at IIT Rajasthan

The Viterbi School of Engineering, University of Southern California (USC) and the Indo-US Science and Technology Forum (IUSSTF) have partnered to launch the **Viterbi-India Program**. The program provides opportunities to Indian students to undertake a research internship at the Viterbi School of Engineering for a period of 8 weeks.

The program envisages to provide an opportunity to the best and brightest Indian students to gain exposure and access to world class research facilities in the Viterbi School and promote research and capacity building in frontline areas of engineering and technology. It also seeks to encourage outstanding students to take up research as a career, and pave the way for the next generation engineers from India to interact with their US peers, to help build long-term R&D linkages.

Viterbi - India 2011 scholars at the Viterbi School of Engineering, University of Southern California

An important aspect of engineering education in the 21st century must include opportunities for research experience for young scholars and the building of global awareness. A practical and highly impactful way for engineering students from India to foster this awareness is to provide international research programs and encourage students to take part in them, for experiences that are meaningful both academically and socially, and that will prove to be invaluable to them as working professionals. Starting this summer, *Viterbi School of Engineering at the University of Southern California* established the **Viterbi-India Summer Research Program** for scholars from institutions in India, in partnership with the *Indo-US Science and Technology Forum*.

The Viterbi-India program provides summer research opportunity to 10 Indian students in the field of Electrical Engineering and Computer Science to work closely with a faculty member at the Viterbi School of Engineering. These students have completed 3 years of study at an Indian Institution to have enough engineering background for participating in a research project. These students are selected on a competitive basis from many applicants across India. In this program, students are assigned to work one-on-one with faculty members and conduct research on a project directed by faculty members. Such a summer research program provides significant exposure and useful academic and social benefits for participating students from India.

The objectives of the Viterbi summer research program is for young scholars to be exposed to research environment in a top tier research institution in the US, conduct research with a faculty member's group, interact with other researchers, and present their research results. This research program will be a valuable educational experience to the participants and also to encourage them to go on to a research career by getting into doctoral programs. In order for scholars to be able to conduct a research project, the program is designed to be of significant length and is for a duration of 8 weeks during summer. This is a great exposure for Indian students to get an understanding of how engineers from different countries are educated, perform their work and solve technical problems. Furthermore, students will maintain contact with their faculty advisors long after the internship and continue working with their advisors in finishing up research papers. This will allow for them to consider applying for PhD programs at USC or other top institutions in US or India.

The first batch of 10 students came to USC for this program on May 17, 2011 and completed the program on July 13, 2011. Each participating student in the summer research program will be paid a stipend for 2 months, and travel between India and USC. On their first day at USC, they went through an orientation, campus tour, learnt about services, safety, health center, and had a welcoming dinner and informal discussions with faculty advisors and other PhD students. During their stay at USC there were ample opportunities for them to meet with students from other countries, see interesting local sites, and attend seminars and other activities on campus. The final part of the program was a short presentation on their research work to faculty and other participating students. ●

The program director for this program is Prof. Cauligi Raghavendra, Vice Dean for Global Academic Initiatives. Prof. Raghavendra worked with IUSSTF and the partner institutions in selecting the final group of students interns. The coordinator for this program is Tracy Charles, who works in the Doctoral studies office under Associate Dean Margie Berti. For details please visit : http://indousstf.org/viterbi_india/viterbi_india.html

"The internship at Viterbi School of Engineering, USC provided exposure to the latest research going on in the world in my field of interest (Wireless Communications). It provided a great opportunity to work with and learn from research experts working here. I would like to make a special mention of the able guidance I have received from my guide Dr. Urbashi Mitra.

The institute also provides a great atmosphere and ambience to work in. Apart from the academic aspects, the food court, sports complex and other such facilities at the institute are top class. The people here were also very friendly and helpful."

Vishnu V. Ratnam
Student at IIT Kharagpur

Innovative Links

Lockheed Martin Corporation and the Indo-US Science and Technology Forum (IUSSTF) are committed to the common goal of developing and encouraging innovation and entrepreneurship. To achieve this aim, the Young Engineers Visitation Program was developed to create and nurture techno-entrepreneurial ecosystems.

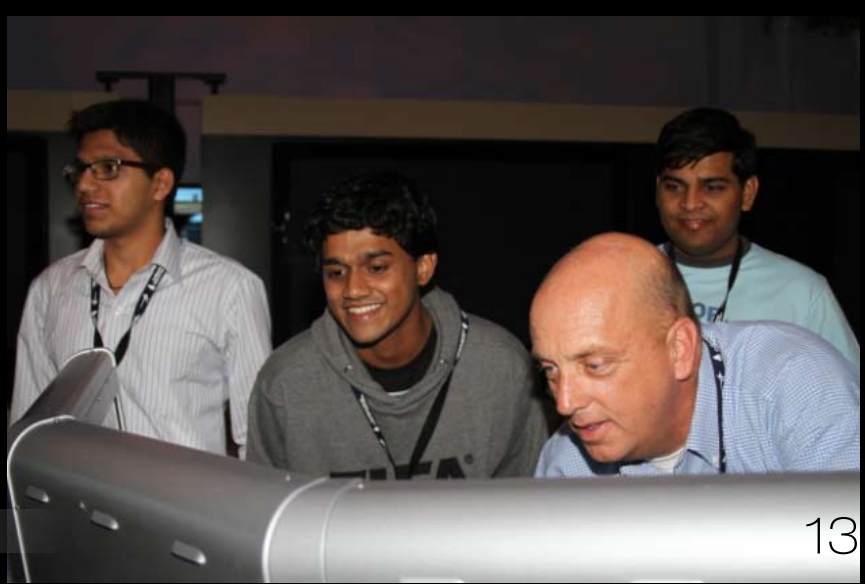
Lockheed Martin employs more than 66,000 engineers and scientists creating innovative solutions for the global security challenges of today and tomorrow. Technology development, engineering, and innovation are instrumental to the Corporation's Aerospace and Defense core markets, as well as to emerging markets such as cyber security, health care, energy and climate change. The Center for Innovation in

Suffolk, VA., has a world class collaborative environment that provides a unique proving ground to demonstrate and understand how new technology concepts will perform in the real world. The Corporation works to continually enhance capacity of scientific and technical community to drive innovation through communication and collaboration between its engineers and scientists. The Indo-US Science and Technology Forum is an autonomous, not-for-profit society that has been established under an agreement between the Governments of India and the United States of America with a mandate to promote and catalyze Indo-US bilateral collaborations in science, technology, engineering and biomedical research through substantive interactions between academia, industry and governmental agencies of the two countries. IUSSTF supports innovative programs aimed to foster scientific excellence by capitalizing on the scientific and technological synergy of the two nations.

The ***Young Engineers Visitation Program*** is envisaged to create sustainable, long-term networks for mutual good. The objective of the joint program was to create, nurture and support techno-entrepreneurial ecosystems.

"Thank you for giving me this wonderful opportunity. It was a great learning experience for me to spend time at such a great company. I got to meet so many brilliant people and got to learn so many things. The whole program was organized in a brilliant way. I'm very grateful for all your efforts in making our travel and stay there so comfortable. It enabled us to give our best to the program. This program has really inspired me to work hard and innovate at the cutting-edge of technology. I will strive to give my 100% to whatever task I take up and never be scared of experimenting. It has also taught me essential skills of team-work and working under constraints. Thank you so much for everything. Those few days will always be cherished by me throughout my life."

Brij Bhushan
Indian Institute of Technology, Madras



"The program was both challenging and rewarding. I enjoyed the JLTV challenge and working with the Lego Mind Storm Kits. That week at the Lighthouse will be cherished forever; I have already started missing Sector 4! All the Lockheed Martin employees were extremely welcoming and helpful. I would like to thank the Indo - US Science and Technology Forum for the same. This program has definitely increased my interest in pursuing a career in product design. Once again, thank you for the terrific week!"

Tanuj Jhunjhunwala
Indian Institute of Technology, Madras

The objective of this initiative was to allow young engineers to gain insight to the process of commercialization as technology moves from the lab to the marketplace through a visitation program at the *Lockheed Martin Center for Innovation*, Suffolk, VA. The Center for Innovation is a powerful net-centric experimentation and analysis laboratory and serves as a focal point for resourceful thinking and revolutionary technology.

For the year 2011, *34 young engineers* from six reputable institutions across India (Indian Institute of Technology, Bombay; Indian Institute of Technology, Madras; Indian School of Mines, Dhanbad; Madras Institute of Technology, Anna University, Chennai; Thapar Institute of Technology, Patiala; and, Malaviya National Institute of Technology, Jaipur) were selected to participate in the one-week program. The students were divided into small groups of 5 each and were given specific projects in two areas – *Lego robotics* and *Virtual world*. At the end of the week, the students made a presentation of their projects to a panel of judges that included Jennifer Byrne (Vice President, Technology Strategy, Lockheed Martin Corporation), Debapriya Dutta (Counselor S&T, Embassy of India, Washington DC), Michael Cheetham (IUSSTF), Jyotsna Iyer, Kate McNamara, Steve Falatko, Krish Narasimhan, and Prakash Sesha from Lockheed Martin. The students also got the opportunity to tour the world-class laboratories for collaborative experimentation and analysis at the Centre for Innovation.

USC VITERBI SCHOOL OF ENGINEERING

IUSSTF
Indo-US Science and Technology Forum

VITERBI-INDIA PROGRAM

The Viterbi School of Engineering, University of Southern California (USC) and the Indo-US Science and Technology Forum (IUSSTF) are partnering to support the **Viterbi-India Program. This program will provide opportunities to Indian students to undertake a research internship at the Viterbi School of Engineering in summer 2012 for a period of 8 weeks.**

The Viterbi-India Program is envisaged to:

- Provide an opportunity to the best and brightest Indian students to gain exposure and access to world class research facilities in the Viterbi School.
- Promote research and capacity building in frontline areas of engineering and technology.
- Encourage outstanding students to take up research as a career.
- Pave the way for the next generation engineers from India to interact with American peers, thus help building long-term R&D linkages and collaborations.

Eligibility:

- Indian students currently pursuing a Bachelors or Masters degree at select recognized institutions (refer application guidelines) of higher education in India.
- Open to students of Electrical Engineering and Computer Sciences only.

Scholarship includes:

- Stipend
- Airfare

For application format and guidelines please visit: **www.indousstf.org**

For program information contact:
Dr. Nishritha Bopana
Indo-US Science and Technology Forum (IUSSTF)
12, Hailey Road, Fulbright House, New Delhi-110001, E-mail: internship@indousstf.org

APPLICATION DEADLINE: 31 December 2011

On the sidelines of the Indo-US Strategic dialogue held on 19 July at New Delhi, an Indo-US S&T Innovation Exposition was organized by the Department of Science and Technology (DST) in partnership with the Federation of Indian Chamber of Commerce and Industries (FICCI) and the Indo-US Science & Technology Forum (IUSSTF). At the bilateral level, India and the United States have embarked upon a strategic partnership which specifically identifies science, technology and innovation as a major focus of this relationship in the 21st century. This was reinforced by the historic agreement signed in 2009 between the two governments to establish a new Endowment Fund for promotion of joint research and development leading to innovation, entrepreneurial and commercialization activities in science and technology.

Ashwani Kumar (Hon'ble Minister of State for Science & Technology and Earth Sciences & Planning, Govt. of India) addressing the gathering at the *Indo-US S&T Innovation Exposition*

For that Shared Vision

The expo was inaugurated by Ashwani Kumar, Hon'ble Minister of State for Ministry of Science & Technology, Ministry of Earth Sciences & Ministry of Planning, Govt. of India, and was attended by dignitaries who included and was attended by dignitaries who included John P. Holdren (Director, White House Office of S&T Policy and Science Advisor to President Obama), Aneesh Chopra (United States Chief Technology Officer), T. Ramasami (Secretary DST), Rajiv Kumar (Secretary General, FICCI), S. Natesh (Senior Advisor, DBT) and Arabinda Mitra (Former ED, IUSSTF). In his inaugural remarks Minister Kumar said that India needs a country-specific model for the promotion of innovation. While most global models of innovation are focused on the process of innovation, the Indian strength lies in developing affordable innovation addressing grass-root societal needs. The Minister mentioned that the creation of the innovation ecosystem would require both national consultation and international collaboration.

The aim of the expo was to showcase innovative technologies that have potential markets both in India and the US and have been identified through various Indo-US programs on innovation. IUSSTF has effectively brought together federal agencies, corporate houses, industry associations along with academia both from India and USA to nurture and foster a bi-directional Indo-US entrepreneurial ecosystem by developing a program portfolio that identifies, nurtures and promotes the 'power of ideas' to its realization in the market. *The DST-Lockheed Martin India Innovation Growth Program (IIGP)* with FICCI and the University of Texas, Austin; the *DST-Intel Techno Entrepreneurship Program (TEP)* with the University of California, Berkley; and, the DBT (Department of Biotechnology) supported *Stanford-India Biodesign Program (SIB)* were launched in tandem through active partnership from both sides. As an outcome, these programs have led to the identification of potential Indian entrepreneurs and the rapid commercialization of their technologies through value addition provided by US-India linkages. FICCI's Centre for Technology Commercialization (CTC) is dedicated to the cause of bridging the gap between the research labs and the market. It is overwhelming to note that since its inception in March 2007 the IIGP has led to more than 100 business deals getting signed in India and the US with an estimated economic value of over Rs. 350 crores (US$ 77 million). Similarly, the SIB program has resulted in 20 patents being filed and several proto-types of affordable bio-medical devices and technologies being developed which are at various stages of pre-commercialization. In addition to innovators from these programs, some grassroot innovative technologies nurtured by the National Innovation Foundation, Indian Angel Network and DRDO-FICCI Innovation program were also displayed at the Expo.

The expo also showcased new Indo-US bilateral initiatives in the space of R&D and Innovation. These included the **Joint Clean Energy Research and Development Center** established under a MoU on Partnership to Enhance Clean Energy (PACE-R) signed between the two Governments. The joint Funding Opportunity Announcement was made public in May 2011 seeking research projects in consortia mode in

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> "New opportunities for both the countries are fast emerging to nurture and foster a bi-directional entrepreneurial ecosystem by adopting some of the best practices and successful models based on the concepts of 'mind to market'."
>
> **Ashwani Kumar**
> Hon'ble Minister of State for Science & Technology, Earth Sciences & Planning

Ashwani Kumar (Hon'ble Minister of State for S&T, Earth Sciences & Planning, Govt. of India) in conversation with **John P. Holdren** (Director, White House Office of S&T Policy and Science Advisor to President Obama)

Excerpts from the Joint Statement

19 July 2011, New Delhi

"India's Minister of External Affairs Shri S.M. Krishna and the U.S. Secretary of State Hillary Rodham Clinton met in New Delhi on July 19, 2011, for the second annual meeting of the U.S.–India Strategic Dialogue. The leaders recognized the achievements made since the inaugural Strategic Dialogue in June 2010 and President Obama's historic visit to India in November 2010 in advancing our two countries' shared interests. They committed to continuing to broaden and deepen the U.S.-India global strategic partnership.

Since the inaugural Strategic Dialogue in 2010, the U.S.-India partnership has resulted in advances in nearly every area of human endeavor. The two sides have expanded their strategic consultations to cover all major issues and regions of the world. They have increased counterterrorism cooperation, intelligence sharing, and law enforcement exchanges. They have continued to expand their defense cooperation. They have expanded their growing partnership on export controls and non-proliferation. They have witnessed an expansion of the already robust people-to-people ties; scientific, space, and technology collaboration; clean energy cooperation; and connections among entrepreneurs and social innovators.

The two leaders welcomed the continued commitment of the two governments for full implementation of the U.S.-India civil nuclear energy cooperation agreement. They reiterated their commitment to build strong U.S.-India civil nuclear energy cooperation through the participation of U.S. nuclear energy firms in India on the basis of mutually acceptable technical and commercial terms and conditions that enable a viable tariff regime for electricity generated. They noted that the United States has ratified the Convention on Supplementary Compensation (CSC) and India intends to ratify the CSC within this year. They further noted that India is committed to ensuring a level playing field for U.S. companies seeking to enter the Indian nuclear energy sector, consistent with India's national and international legal obligations.

The United States and India plan to expand its higher education dialogue, to be co-chaired by the U.S. Secretary of State and Indian Minister of Human Resource Development, to convene annually, incorporating the private/non-governmental sectors and higher education communities to inform government-to-government discussions.

As part of the Obama-Singh 21st Century Knowledge Initiative (OSI), the two governments announced the publication of their requests for proposals from post-secondary educational institutions that support OSI's goals of strengthening teaching, research, and administration of both U.S. and Indian institutions through university linkages and junior faculty development.

The United States created the Passport to India initiative to encourage an increase in the number of American students studying and interning in India. The leaders recognized the great bridge of mutual understanding resulting from the more than 100,000 Indian students studying and interning in the United States.

The United States' Department of Energy and India's Department of Atomic Energy signed an Implementing Agreement on Discovery Science that provide provides the framework for cooperation in accelerator and particle detector research and development at Fermi National Accelerator Laboratory, Thomas Jefferson National Accelerator Facility, and Brookhaven National Laboratory.

The U.S.-India Science & Technology Endowment Board, established by Secretary Clinton and Minister Krishna in 2009, plans to award nearly $3 million annually to entrepreneurial projects that commercialize technologies to improve health and empower citizens. The two sides are strongly encouraged by the response

to this initiative, which attracted over 380 joint U.S.-India proposals. The Endowment plans to announce the first set of grantees by September 2011.

The Indo-US Science & Technology Forum, now in its tenth year, has convened activities that have led to the interaction of nearly 10,000 Indian and U.S. scientists and technologists.

The U.S. – India Joint Space Working Group on Civil Space Cooperation met in July 2011 in Bangalore. Building on the successful Chandrayan-1 lunar mission, NASA and ISRO reviewed potential areas for future cooperation in earth observation, space exploration, space sciences and satellite navigation. Both sides agreed for early finalization of three new implementing arrangements for sharing satellite data on oceans and global weather patterns. Recognising the research opportunities available on the International Space Station, both sides agreed to explore the possibilities of joint experiments. NASA reiterated its willingness to discuss potential cooperation with ISRO on human spaceflight activities. The two sides also agreed to expand upon previous work in the area of global navigation satellite systems with the goal of promoting compatibility and interoperability between the U.S. Global Positioning System, India's Navigation systems, and those of other countries." ●

Text Courtesy:
Ministry of External Affairs, Govt. of India and The U.S. Department of State. The complete text can be accessed at:
http://meaindia.nic.in/mystart.php?id=100017853&pid=2251 http://www.state.gov/r/pa/prs/ps/2011/07/168745.htm

Anil Kumar Singh explaining the "Energy Cakes" technology to the visiting dignitaries

Kranthi Kiran Vistakula from Dhama Apparel Innovations Pvt. Ltd. explaining "ClimaGear" technology to Minister Kumar and Dr. Holdren

Indo-US S&T Innovation Expo

For that Shared Vision

Contd. from pg. 17

the areas of solar energy; second generation biofuels; and energy efficiency of buildings. Another important initiative highlighted at the expo was the **US-India Science and Technology Endowment Fund** for R&D in two areas: "Healthy individual" and "Empowering citizens". The aim of the Endowment Fund is to promote and encourage entrepreneurial activities that have significant potential towards commercialization of joint technology thus contributing to economic growth through job creation and betterment of life.

The expo was followed by a roundtable session on "*Opportunities and obstacles in innovation*" co-chaired by John P. Holdren and Sam Pitroda (Adviser to the Indian Prime Minister on Public Information Infrastructure). The discussion was initiated with strategic inputs by T. Ramasami, Aneesh Chopra, Melanne Verveer (Ambassador-at-Large for Global Women's Issues) and Saurabh Srivastava (Chairman, CA India). ●

(L to R): Nirankar Saxena (Director FICCI), Shahnaz Hussain (Chairperson, Shahnaz Hussain Group), Balram Bhargava (Executive Director, Stanford-India Biodesign, All India Institute of Medical Sciences), Arabinda Mitra (Former ED, IUSSTF), Aneesh Chopra (United States Chief Technology Officer) and Sam Pitroda (Adviser to the Indian Prime Minister on Public Information Infrastructure) at the roundtable session on "Opportunities and obstacles in innovation"

IUSSTF
Indo-US Science and Technology Forum

Department of
Science and Technology
Govt. of India

Indo-US Research Fellowships for Indian Researchers

In an effort to augment scientific excellence in emerging areas of science and technology, the Indo-US Science and Technology Forum (IUSSTF) in association with Science and Engineering Research Council (SERC) of Department of Science and Technology (DST), announces the Indo-US Research Fellowships. The objective of the fellowship is to enable young researchers from India to carry out research in frontier areas of science and technology at a premier institution in USA. The fellowship will enable early and mid career Indian researchers to acquaint themselves with new scientific research methods and at the same time build strong collaborative linkages between the scientific communities of US and India.

Eligibility/Application Requirements

Academic Qualifications
Ph.D. in Science, Engineering, Technology or Medicine
Applicants must provide proof of independent research work in internationally recognized academic journals

Age
Upto 40 years as on 31 December 2011

Employment
A permanent position in a public funded R&D lab/S&T institution (non-private)/recognized universities/colleges in India

Areas covered under the Fellowship
- Atmospheric and Earth Sciences
- Chemical Sciences
- Engineering Sciences
- Life Sciences
- Medical Sciences
- Mathematical and Computational Sciences
- Physical Sciences

Promising applications in areas other than the above areas may also be considered

Place of work
The applicant should have letter of acceptance from reputed US scientific/technological institution where the applicant will be undertaking the research work under the Fellowship

Fellowship includes
- Monthly stipend
- Return airfare
- Preparatory allowances
- Conference allowances

Fellowship Duration
Minimum 3 months and upto 12 months

Proposal Guidelines and Format
Refer to www.indousstf.org

Application Deadline
31 December 2011

For immediate answers to your queries, please contact:
Dr. Smriti Trikha
Indo-US Science and Technology Forum
12 Hailey Road, Fulbright House, New Delhi-110 001
Phone: 011-42691700, Fax: 011-23321552
Email: fellowship@indousstf.org

Ganges Valley Aerosol Experiment

Looking at the Skies

V. Rao Kotamarthi
Argonne National Laboratory, USA

S. K. Satheesh
Indian Institute of Science, Bangalore, INDIA

The contribution of atmospheric aerosols to calculated radiative forcing in climate model remains uncertain. Atmospheric aerosols have a wide spectrum of impact on the radiative transfer through the atmosphere, ranging from direct influence by scattering or absorbing incoming radiation, to indirect effects that result from aerosol-cloud interactions.

The Intergovernmental Panel on Climate Change AR-4 report lists aerosol radiative forcing as one of the big uncertainties in climate model projections of future climate changes under increasing anthropogenic greenhouse gas emissions. This uncertainty arises from the uneven distribution of aerosols resulting from large differences in emissions and the short lifetime of the aerosols in the atmosphere (7-30 days); limited measurements of the optical and chemical properties of the aerosols in the atmosphere, and changes to these as a function of aging of the particles in the atmosphere.

Recent satellite based measurements and measurements from a network of observatories established by the Indian Space Research Organization (ISRO) have shown that the Indo-Gangetic plain has some of the highest observed aerosol optical depths over the earth. The aerosol optical depth (AOD) can be loosely

defined as the decrease in incoming solar radiation over a unit depth of the atmosphere, and higher the AOD the lesser the amount of radiation reaching the surface. The aerosol plume sometimes extends across the Indo-Gangetic Plain to the Bay of Bengal during the winter and early spring of each year. The aerosol layer is usually accompanied by a persistent fog and is of public health concern and a potential impediment to economic activity.The effects of this aerosol layer on solar input to the surface and on monsoon rainfall are not well understood.

The answer to many of these questions rests in collecting a rigorous data-set of relevant physical, optical, chemical, meteorological and cloud data-sets that can be used to understand the processes at work and improve climate models. Towards this end, the U.S. Department of Energy (DOE) has initiated collaboration with ISRO and the Indian Institute of Science (IISc),to conduct a field study named **Ganges Valley Aerosol Experiment (GVAX)** to collect a well-documented data-set and initiate data and model analysis. This is a first of its kind joint project between India and US that addresses one of the most pressing environmental concerns of the present time (http://blog.energy.gov/blog/2011/06/27/bluer-skies-and-brighter-days-us-and-india-collaborate-first-long-term-climate-exper).

A one-year operational period for the GVAX campaign is planned, starting from June 2011 to April of 2012 (http://www.arm.gov/sites/amf/pgh). The primary anchor facility for the project is the mobile climate monitoring facility AMF-1, operated by the DOE Atmospheric Radiative Measurement (ARM) Program (http://www.arm.gov/sites/amf). The AMF-1 has been installed at the Aryabhatta Research Institute for Observational Sciences (ARIES) observatory (http://www.aries.res.in/) at Nainital, India, in June, 2011. The June start coincides with the onset of the monsoon and high aerosol concentrations (primarily dust mixed with regional anthropogenic emissions). Deploying the AMF-1 over an annual cycle, in the context of other measurement activities in the region, will enable data gathering in different climate regimes: the wet monsoon; the dry, hot summer; and the cool, dry winter. ISRO is also placing its aerosol observational sites at Udaipur, Nagpur, Patiala and Dehradun in a cooperative mode for the period of the campaign.

An intensive operational period (IOP) is planned for the late winter-spring (February-April) of 2012 and around the time when the AOD over this region are expected to be the highest. The IOP period will bring two additional sites into play, one at Pantnagar and a second one at Lucknow. The Pantnagar site will be located within the campus of the G. B. Pant Agricultural University and the Lucknow site will operate from the ISRO Telementry, Tracking and Command Network (ISTRAC) facility. At the Pantnagar site a number of

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Epigenetic Regulation and Genome Control

Genome to Epigenome

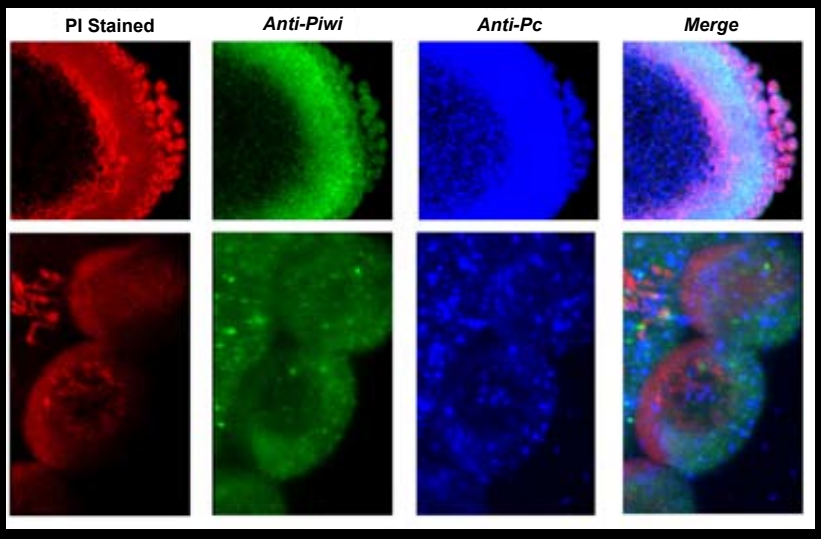
Epi (Greek above) genome has fascinated modern biologists for decades for its magical ability to affect the phenotype in a profound way in the absence of any underlying changes in genomic sequences. The field began with the interest in what accommodates the difference between the phenotype and genotype but later received great momentum which is now rapidly advancing the field of biological and medical research.

Utpal Bhadra
Centre for Cellular
and
Molecular Biology
Hyderabad, INDIA

Epigenetics has often been offered as a masterstroke in an orchestra, which can activate a certain part of genome while ensuring silence in others. It can also play the symphony of life in the surgical view of genome of well-known model organisms. In the last decade, the importance of silencing of a body of genes for functional evaluation is appreciated more than ever. We now know the reason for the loss of pigmentation in flower or that the delicate loss of part of the plant body is simply the result of failure to silence certain genes at an appropriate time of development rather than a cumulative effect of same set of genes.

The Indo-US Workshop on 'Epigenetics Regulation and Genome Control' supported by IUSSTF in 2009 at the Centre for Cellular & Molecular Biology (CCMB), Hyderabad, created the base for epigenetic research in India. This platform accommodated the scientific conglomeration from academia and industry along with students and scientific managers. The solutions to various heath challenges are now achievable because we know epigenetics dictates the activity of the genome template.

One of the wonders of modern biology is to recognize the protein-protein sequence from the genetic material of a live human cell, quite similar to searching for a needle in a haystack! Astonishingly, only 1-2% of the mammalian genetic materials carry protein-protein information. Genomics have often made scientists wonder about the relevance of information contained on the remaining 98% genetic material which, as a whole, bears little phylogenic conversation among closely related species. An astounding 70-90% of our nucleotides that are apparently transcribed in humans often contain 181,000 RNA instead of 25000-30000 protein coding sequences. The transcriptomes, a majority of which lack conserved open reading frame belongs to a rising stock of transcriptome thought to be Junk DNA.

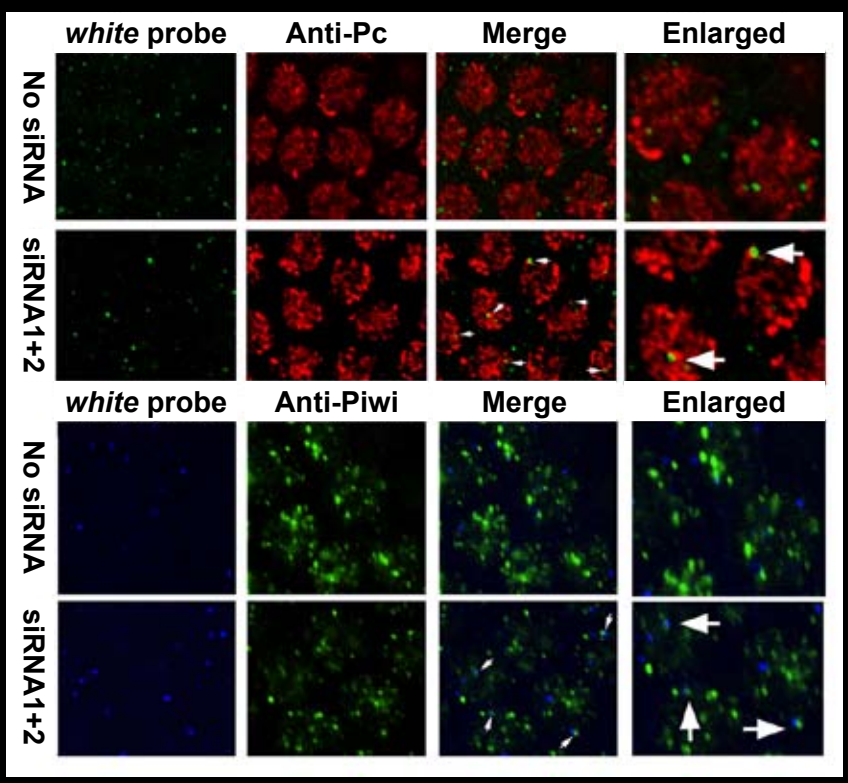


Immunostaining with Piwi (green) and Polycomb (blue) antibodies in Drosophila developing embryos displaying co-localization of two proteins in the pole cells. The embryos were counterstained with PI 9red) DNA dye.

The Indo-US workshop provided an extra emphasis on small regulatory RNA and its implication on epigenetics phenomena. Small regulatory RNA is turning out to play a major role in most vital activities in human cells by silencing the homologous gene based on sequence similarity. These RNA-RNA interactions referred to as RNAi, is a readymade knock down system applied in silencing of an innumerable number of genes. It protects the intriguity of DNA in tumor cells, cellular differentiation, development, chromatin organization, rapid cell proliferation, tumor formation etc. RNAi genome drugs are being developed. Moreover, the new role of RNA has emerged by the discovery of different regulatory RNAs including silencing RNA, repeat associated RNA, microRNAs, non-coding RNAs etc. The small RNAs can be used as a guide for destroying the machinery of infectious organisms once they enter our body. Yet doctors and clinical researchers are now talking about beginning human trials within the next two or three years. Part of the excitement also stems from the power of RNAi. It has a capacity to destroy any genetic material at any time point of our life in any specific type of cells that is thought to appear as gene knock out system.

When RNA viruses infect our body they make double-stranded copies of their genetic material. In response, our defense mechanism fights back and the viral RNA is chopped into small pieces of genetic code containing nearly 22 letters by a biological scissor i.e. RNAase III enzyme (Dicer). The small RNA duplex that floats in the live cells as isolated fragments, eventually binds to single stretches of viral RNA based on their similarity. Finally the same Dicer molecule and related proteins target the double stranded viral RNA and destroy them into degraded fractions. Therefore, the RNA killing process shuts off key viral genes.

The symposium brought together about 350 brilliant students, young scientists and technologists from India and US academic laboratories and industries. The attendees presented their talk as a part of eleven inter-disciplinary sessions related to epigenetic studies



Co-localization of white gene (mini-w array) and Piwi and Polycomb antibodies in Drosophila larval tissue was shown by RNA FISH following by immunocytochemistry. Silencing in white gene is associated with RNAi proteins and is Polycomb dependent.

and implications. The first session consisted of a popular talk that offered a glimpse of how the microRNA, a non-coding population of endogenous small RNA has a strong impact on medicine. Subsequent sessions explained microRNA regulated epigenetic gene regulation with emphasis on cancer. The most important contributions came from scientific talks presented by scientists explaining how RNAi phenomenon contributed in epigenetic regulation. Shiv Grewal (National Cancer Institute, National Institutes of Health, Bethesda) discussed the fascinating cross-inter-action between heterochromatin regulatory mechanism and how the RNAi contributed in heterochromatin formation. Another area was chromatin organization and DNA methylation in epigenetics, where Geeta Narilikar (University of California San Francisco) described the mechanism of ATP-dependent chromatin remodeling. John Widom (Northwestern University) spoke about the genomic regulation for nucleosome positioning. Sriharsa Pradhan (New England Biolabs, Ipswich) and Eric Selkar (University of Oregon) explained how RNAi controls the DNA methylation in mammalian system and Neurospora. William Kelly (Emory University) presented his work on the regulatory circuit of epigenetic information inherited from one generation to another in C. elegans. Additionally, a large number of very high quality posters were displayed that stimulated interaction between students and the visiting experts.

Samir Brahmachari (DG, CSIR) addressing workshop participants

The Indo-US workshop brought together world-renowned experts in the field of epigenetics and laid the foundation and provided a direction for collaborative research in this cutting-edge area.

Ganges Valley Aerosol Experiment

Looking at the Skies

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scientists from US will join together with Indian scientists from IISc, ISRO, DST and universities on a shared measurement platform and infrastructure facilities. To improve collaboration and coordination between the US-based and Indian science teams, regular science meetings and briefings are planned during this eight-week period and beyond. The ARM Mobile Aerosol Observing System (MAOS), an aerosol and gas-phase chemistry observatory, will be located at Lucknow. Six staff members, two each from IISc, ISRO and ARIES are currently visiting the DOE facility at Brookhaven National Laboratory (BNL), New York, to obtain training for operating the instruments in the MAOS facility. These scientists along with a personnel from BNL will operate the MAOS facility during its eight-week deployment at Lucknow. These two sites will bring instrumentation for single-particle characterization and measurement of aerosols precursor gas concentrations. During the IOP, a Beechcraft-20 aircraft platform operated by ISRO and IISc will collect profile data of absorbing and total aerosols over the Ganges valley. The instrumentation on the aircraft will consist of instruments available with Indian scientists with a few selected instruments from ARM to support *in situ* characterization of aerosol physical and optical properties.

This is a very exciting opportunity to develop a long-term collaboration between the climate science communities in India and the US and we are looking forward to interesting data, great science and fruitful collaborations.

REPORT

Indo-US Joint Networked Center

Biomaterials for Healthcare

The Indo-US Public-Private Networked R&D Center on Biomaterials for Healthcare was established in November 2008 with the overall objective to combine the cutting edge technologies of fabrication and testing of materials science with the knowledge of biological sciences. This would in turn help to form strategies to develop shaped implant materials in some of the emerging material systems to enhance public health. With more than twenty exchange visits, the center has covered significant ground in pursuit of its objectives. A few researchers, who were part of the Joint Center activities, recount their experiences.

C. Mauli Agrawal, University of Texas, San Antonio, USA

In the fall of 2009 I had the opportunity to visit two Indian universities that are partners in the IUSSTF supported Centre on Biomaterials for Healthcare – the Indian Institutes of Technology (IIT) at Kanpur and Mumbai. I am an alumus of IIT Kanpur but did not have the opportunity to visit the institution on a professional basis under a collaborative agreement such as the one provided by the Centre. I was truly amazed by the high level of faculty, students and facilities present on campus. This is perhaps a reflection of my own previous ignorance about the rapid development in India in the field of biomaterials. I found the biomaterials laboratories to be very well equipped – on par, if not better than the average such lab in the US. In addition the core facilities such as the one on nanotechnology were cutting edge.

I was really impressed by the quality of the graduate students at IIT Kanpur as well as IIT Mumbai and my visit to these campuses in India have been very productive. We have had a steady stream of visitors and students from India and we have now signed an MOU for collaboration with IIT-K. A unique outcome of these efforts has been the development of a joint monthly seminar series between UTSA and IIT-K, which is shared live using distance learning technology. I am looking forward to more joint projects and visits. The IUSSTF supported Centre on Biomaterials for Healthcare provides a model for the scientific community worldwide and exemplifies that science does not know the barriers of borders or time zones.

Justin Seil, Graduate student, Brown University

In the summer of 2009, Dhirendra Katti came to Providence and the Nanomedicine Laboratory of Thomas Webster at Brown University to learn more about the research that we were doing there. We discussed the possibility of a research collaboration over a car ride to Boston. At that point, I began making arrangements for a visit. A few months later I was on my way to India.

After attending the Asian Particle Technology Symposium at New Delhi where I gave an overview of the research being done in the Nanomedicine Laboratory at Brown, I traveled to Kanpur to start my research project at IIT-K in the laboratories of Dr. Katti and Dr. Basu. As I took meals in many different dining halls, I met many students and also got to know my lab mates quite well. The cultural differences that I observed were initially very striking, but everyone was so friendly that I felt comfortable asking questions and experiencing life in India.

Justin Seil with Dr. Basu and his students at IIT Kanpur

I was able to meet all the research goals that I had set. I learned a great deal about electro-spinning polymer nano-fibers and I was able to produce and characterize zinc oxide nanostructures. In spite of the time difference, I was able to easily communicate with my advisor back in the US while learning from my hosts. Since my visit to India corresponded with the holiday of Diwali, I was especially fortunate to be able to travel back to New Delhi to spend time with the family of a friend I had made in the lab I was visiting. That unique cultural experience was amazing and certainly one of the highlights of the trip.

My visit sponsored by IUSSTF provided a more personal experience than anything I would have had as a tourist in India. While I may have been able to learn some of the nanomaterials synthesis techniques from another US lab, the cultural experience of the visit was just as valuable as the research experience.

Siddhi Gupta, National Metallurgical Laboratory, Jamshedpur

Conducting research in an international atmosphere not only provides exposure to new techniques but the exchange of scientific ideas and culture, often results in marvelous outcomes which may not be possible without collaboration.

With my doctoral thesis project based on the development of polymer based scaffolds for soft tissue engineering, I could successfully complete the novel synthesis and structural characterization of the scaffolds at NML. The next step were the biocompatibility and cell-material interaction studies. It was in this backdrop that my mentor Arvind Sinha guided me to opportunities to visit Brown and carry out the cell culture studies on materials synthesized at NML. I grabbed the opportunity and come September 14, I was on the go.

I found out on arrival that in addition to its lush green beauty (and fall colors), Brown University was very well organized and offered excellent facilities for the visiting scholars. In my very

first meeting with Thomas Webster, he asked me to work with 'freedom' like his other students. In his research group, around 20 students carry out research on a variety of biomaterials as well as on a cellular level. My interactions with them gave me an understanding of the vivid and fascinating research on biomaterials which filled me with great enthusiasm to work.

Siddhi Gupta with the Nanomedicine group at Thomas Webster's Lab

Very soon I started learning new techniques with the help of another doctoral candidate, Nhiem Tran who helped me throughout my stay in the lab as well as other issues. I could complete the major objective of the study which was to learn the basic cell culture techniques and conducting cell adhesion and proliferation assays on polymeric scaffolds. Not only this, based upon my training experience gained at Brown, I along with my group members chalked out a plan for setting up our own cell–culture laboratory for carrying out complete research on Biomaterials which will be ready soon.

I express my sincere thanks to IUSSTF for providing me this excellent opportunity to work abroad that has helped me immensely in my doctoral study. Those two months at Brown University gave me everlasting fond memories and a strong desire to get another chance to further explore the enormous research prospects there.

Nikolas Wilson Hrabe, University of Washington, Seattle

There is no better way to get to know a group of people than to drive through the night in a cramped van together. This I found out on a trip to Banaras with my IIT Kanpur graduate student colleagues/friends. Sleep? Not so much. Fun? Definitely. Try to not have fun when drinking chai at 2 in the morning at a roadside, all-night food stand. Impossible. These weekend trips were fun, but I also worked with everyone in the lab every day, and we would get together outside of the lab as well. We shared meals (definite favorite: Saturday morning dosas at the Hall 4 cafeteria). We played badminton. We watched Bollywood movies. This short but intense immersion in a culture different than my own has given me a new, broader perspective on the world I live in, and I think this gained perspective is the best reason to conduct research in an international setting.

My host at IIT Kanpur, Prof. Basu, was extremely gracious and always made sure I was comfortable on campus and had everything I needed in the laboratory. Coming from a background in mechanical characterization of metals, the biological characterization expertise of his group was beneficial to me in broadening my areas of research experience and completing the research we had planned for my visit. In addition to learning about biological characterization, I worked on 3D printing of porous polyethylene. The facilities were impressive, and the graduate students continuously went out of their way to help me with my research.

At Triveni Sangam

I was also impressed with the caliber of the graduate students in the laboratory. This collaboration was mutually beneficial to both contributing institutions (IIT Kanpur and University of Washington), and I benefited professionally during the visit in my knowledge gained in the areas of biological characterization. However, I feel that the cultural exchange gained through living and working in a different country is the most significant aspect of this experience. As such, I am grateful to Prof. Basu for hosting me as well as my Ph.D. advisor at University of Washington, Prof. Bordia, for presenting me with the opportunity.

David A. Stout, Brown University, USA

In an ever changing, and more connected world, I realized that to be a world-class future researcher I needed to gain international research experience. To my luck, my mentor at Brown University, Thomas J. Webster, asked me if I wanted to participate in the Indo-US Joint Center on Biomaterials for Healthcare where I would spend a little over one month at IIT-Kanpur conducting research at Dr. Basu's Biomaterials Lab. Two weeks later on a cold snow day in Providence, Rhode Island. I was boarding a plane to Kanpur.

My experience in India was one of the hardest (working) and most rewarding times of my life. At IIT-Kanpur I characterized a new biomaterial that I created at Brown University for cardiovascular disease, designed a new electrospun polymer composite, and conducted numerous cell assay experiments to determine cyto-compatibility of a new composite. During my stay I was mentored on an almost daily basis making sure my research was on track and organized—something that I find very important while investigating the unknown.

With some of Dr. Basu's students at an IITK Hall "Birthday"

The climax of my exchange was a conference presentation and attendance to the *International Symposium on the Safe Use of Nanomaterials* and *Workshop on Nanomaterial Safety: Status, Procedures, Policy and Ethical Concerns* held in Lucknow during February 1-3, 2011. Not only was my research openly welcomed, but I was impressed with the overall organization, quality of technical talks, and international representation at the conference.

On my time off, I was able to participate in a traditional Indian wedding, learn how to ride on a broken bike and close my eyes when crossing traffic, understand the game of cricket, drink 4 cups of chai (tea) a day (minimum), and be poked at by many little Indian children to see if I was "real"—all in a beautiful, sunny climate.

As a snow flake falls from the Rhode Island sky, it attaches to another flake falling from the airy abyss—again, another attachment to another flake, and another. Soon, that one flake turns into a huge sheet of white frozen water—that if big enough—can shut down an entire US state. Such as one research trip to India; one experiment, one talk, one meeting, can turn an idea into a medical device that can save millions of live around the world. To this idea, I thank the support of the Indo-US Science and Technology Forum.

IUSSTF
Indo-US S&T Forum

Opportunities for
RESEARCH INTERNSHIPS IN SCIENCE AND ENGINEERING
In India

Indo-US Science and Technology Forum (IUSSTF) announces the **Research Internships in Science and Engineering (RISE)** to provide unique opportunities for science, technology, engineering and medical students from the United States to undertake internships in national laboratories, federal research centers, academic research institutes, and private R & D laboratories in India. Objective of the internships are to provide students exposure to Indian S&T milieu, gain practical skills and develop collaborative networks. Internships are envisaged as a source of mutual cultural and professional enrichment for both the interns and their host institutions.

Internship duration
- 3 to 5 months

Internship provides
- Monthly stipend • Accommodation • Airfare

Eligibility
- U.S. and Indian Citizen
- Open to science, engineering, technology and medical disciplines
- Ph.D and Master students currently enrolled at a regionally accredited institution of higher education in U.S.

Indian Institutions interested in hosting interns under the RISE program may contact us.

For program information contact:
Dr. Smriti Trikha
Indo-US Science and Technology Forum
12 Hailey Road, Fulbright House
New Delhi-110 001
internship@indousstf.org

For Application Guidelines & Format
www.indousstf.org

Application Deadline
30 November 2011

NEW FUNCTIONAL MATERIALS: SYNTHESIS, PROPERTIES AND METHODS

02-07 June 2011
Manali, India

Functional materials are of intense interest to leading experimental and theoretical researchers world-wide. These materials are important for understanding fundamentally important phenomena including metal-insulator transition, charge density wave, spin density wave, magnetoresitance, magnetic ordering, and superconductivity. Understanding the structure-properties affecting these important phenomena is required for the control and design of materials properties for technological applications.

An Indo-US workshop on ***New functional materials: synthesis, properties and methods*** was organized in order to bring together world leaders, active in the field both experimentally and theoretically in the area of functional materials, to exchange ideas, develop collaborations and advance this important multidisciplinary field. The principal investigators for the event were **Prof. C.N.R. Rao** (Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore), **Martha Greenblatt** (Rutgers University, New Jersey) and **Ashok K. Ganguli** (Indian Institute of Technology, Delhi). The technical program of the meeting consisted of 2 plenary lectures, 25 invited lectures, 10 oral presentations, 22 poster presentation and 4 presentations by poster awardees. The plenary and invited talks were focused on the fundamental and applied research including: properties and application of graphene, superconductors, electronic instabilities, magnetic and charge ordering and multiferroics.

BIOFUELS: RESEARCH CHALLENGES IN THE AREAS OF COMBUSTION AND FUEL INJECTION

22-23 June 2011
Bangalore, India

Aviation turbine fuel, or jet fuel, is produced exclusively from crude petroleum feedstock that is processed in a refinery to make many useful products including gasoline, diesel, petrochemicals, and asphalt components. Kerosene jet fuel is a hydrocarbon fuel composed almost entirely of hydrogen and carbon elements. The hydrocarbon composition consists mainly of paraffins, cycloparaffins and aromatics. Aviation fuels, such as Jet-A, developed over many years of application, have a relatively high energy density per unit weight and volume. The main issues with petroleum-based aviation fuels are availability and sustainability; environmental pollution; and energy security. Carbon neutral renewable liquid fuels are needed to replace the petroleum-derived transport fuels. Many critical technical and economic challenges need to be surmounted before economically viable and environmentally sound bio-jet fuels can be produced for partial or complete replacement of the petroleum-based jet fuels. The Indo-US workshop organized by **Saptarshi Basu** and **R.V. Ravikrishna** (Indian Institute of Science, Bangalore), and, **Ranganathan Kumar** and **J. Kapat** (University of Central Florida) on ***Biofuels: research challenges in the areas of combustion and fuel injection*** focused on two major aspects/challenges in biofuel research - combustion dynamics, and, atomization and vaporization of biofuel.

The workshop brought together eminent scholars from universities and industries in India and USA that are major players in alternative energy research. The workshop involved panel discussions, keynote speeches and posters, and covered the following topics: combustion stability, emission characteristics of biofuel, biofuel reaction kinetics, biofuel certification and portability to industries, fuel injection, mixing and vaporization of biofuel blends, droplet combustion, operational testing in gas turbines and engines, numerical work in droplet combustion, and, general state of biofuel research and possible research directions.

SYNERGY AND DIVERSITY OF MOLECULAR MEDICINE – SCOPE FOR COL

27-28 June 2011
Coimbatore, India

Molecular medicine strengthened particularly by the advances in molecular biology and –omics, has brought personalized medicine closer to reality than ever before. In addition, it has ramifications in public health, and drug development as well. Hence, molecular medicine has all the potentials for being the major driver of health-care and economics. A strong molecular medicine base in a country helps one to understand the dynamics of population, agent-host interactions and to initiate important scientifically informed decisions.

The primary objective of the Indo-US workshop on ***Synergy and diversity of molecular medicine – scope for collaborative research and better healthcare*** was to facilitate an international level collaborative approach for individual and inter-institutional R&D work in the area of molecular medicine. The major technological advances pertaining to this field were presented and discussed in the workshop. The workshop was organized by **Ramalingam Sankaran** (PSG Institute of Medical Sciences and Research, Coimbatore) and **Peter Bitterman** (University of Minnesota Medical School, Minneapolis). The major topics covered in the workshop included HIV and molecular mechanisms of T-lymphocyte activation; molecular mechanisms of lung cancer, cardiac repair and lung repair; experimental therapeutics of breast cancer, molecular oncology in resource-limited settings; differences in molecular medicine at population levels; clinical practice of molecular medicine in resource-limited settings; molecular advances in neurological diseases; role of genetic epidemiology in practice of molecular medicine; and, ethics of molecular medicine research and clinical practice.

COGNITIVE NEUROSCIENCE

05-14 July 2011
Bangalore, India

Cognitive neuroscience research and training in India is at a key point in its evolution, which presents an extremely important concern for Indian faculty and students: the establishment and maintainance of connections with the international community. Such connections provide access to the latest research findings, offer opportunities for international collaborative research, and lead to greater international awareness of discoveries made by Indian neuroscientists. In recognition of this need, the Indo-US workshop on ***Cognitive neuroscience*** paved the way for new collaborations and mutual exchange of students and ideas. The workshop was organized by **Aditya Murthy** (Indian Institute of Science, Bangalore) and **Thomas D. Albright** (The Salk Institute for Biological Sciences, La Jolla). The workshop accommodated 40 students recruited from the neuroscience community throughout India, with admission based upon merit and need. The workshop faculty consisted of 14 distinguished neuroscientists from the United States of America and a similarly distinguished group of 14 neuroscientists from India. The workshop itself had three basic educational components: lectures, lab practicum and discussion groups. These components were interwoven with other group activities that were largely social in nature and intended to promote discussion and informal interactions between students and faculty.

ASTRONOMY WITH ADAPTIVE OPTICS ON MODERATE-SIZED TELESCOPES

22-25 August 2011
Pune, India

Adaptive optics (AO) counteracts the severe blurring effect introduced by the earth's turbulent atmosphere, when celestial objects are observed using telescopes. AO techniques have been successfully employed in astronomy for more than three decades now. However, large overheads and low efficiency still limit the applicability of AO on large telescopes for which operational costs per unit time are high. On the other hand, small and medium sized telescopes are many more in number and their operational costs are substantially lower. A reasonably powerful AO system, which works with minimal overheads and provides good sky coverage, will greatly enhance the scientific capabilities of small and medium sized telescopes by opening up the possibility of hitherto unavailable observational approaches.

Caltech and IUCAA have entered into an equal partnership to develop an automated, affordable and efficient AO system suitable for use on 1-3m class telescopes. Work on this system (named Robo-AO) has progressed substantially and the scientific capabilities of Robo-AO were demonstrated on the Palomar 60 inch telescope during August 2011. The Indo-US workshop on ***Astronomy with adaptive optics on moderate-sized telescopes*** organized by **A. N. Ramaprakash** (Inter-University Centre for Astronomy & Astrophysics, Pune) and **Christoph Baranec** (Caltech, Pasadena) initiated the process of forging collaborations between astronomers in India and the USA, for taking up novel and unique scientific explorations exploiting Robo-AO.

Indo-US Joint Clean Energy Research and Development Center

The Indo-US Joint Clean Energy Research and Development Center (JCERDC) has been established under an MoU between the Governments of India and the United States of America. The JCERDC is funded by the Indian Ministry of Science & Technology and US Department of Energy (DOE) and will support multi-institutional networked R&D projects using public-private consortia model of funding. The objectives of the JCERDC are to enhance energy cooperation, energy security, clean energy and climate change research; facilitate joint R&D on clean energy; generate key technological advancements in clean energy sector through public-private collaboration; and, deploy clean energy technologies rapidly with the greatest impact for global good. The three priority areas for support are Solar Energy, Second Generation Biofuels and Energy Efficiency of Buildings.

(L to R): **Vagish Sharma** (IUSSTF), **R. Varadarajan** (IUSSTF), **Nishritha Bopana** (Science Officer, IUSSTF), **Renu Swarup** (Advisor, DBT, Govt. of India), **Daniel B. Poneman** (Deputy Secretary, DOE), **Phyllis Yoshida** (Deputy Assistant Secretary, DOE), **Arabinda Mitra** (Former ED, IUSSTF), **Ariadne Benaissa** (DOE) and **Angie Mizeur** (US Embassy, New Delhi)

To discuss the progress made thus far, a high-level delegation led by Deputy Secretary of Energy Daniel B. Poneman visited IUSSTF in July 2011 along with Phyllis Yoshida (Deputy Assistant Secretary of Energy for Asia, Europe and the Americas) and Ariadne Benaissa (International Relations Specialist in Office of International Policy and International Affairs, DOE).

More details about the JCERDC can be accessed at http://www.indousstf.org/JCERDC.html

Indo-U.S. Science & Technology Forum

Who we are

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

What we do

Foster excellence by capitalizing on the scientific and technological synergy
Disseminate information and create awareness through scientific exchanges
Build linkages through networking between academia and industry
Explore new frontiers by nurturing contact between young and mid-career scientists
Pave way to sustainable interactions and establish long term relationships
Encourage public-private partnership to inculcate elements of innovation and entrepreneurship

We support

Exciting and innovative collaborative programs cutting across disciplines and institutions

- Academia-Industry Connect Programs
- Advance Schools & Training Programs
- Bilateral Workshops & Symposia
- Flagship Events
- Industry Driven Programs
- Knowledge R&D Networked Joint Centers
- Programs on Innovation
- Public-Private Networked Joint Centers
- Special Initiatives for Strategic Partnerships
- Student Internships
- Travel Grants
- Visiting Professorships

We invite

Proposals which are peer reviewed both in India and USA for awards

Submission Deadlines	Award Announcements
February	May
June	September
October	January

How to contact us?

Further information available at **http://www.indousstf.org**

We value your interactions with us towards promoting Indo-U.S. Science and Technology collaborations

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Indo-U.S. Science and Technology Forum: A Catalyst for Indo-U.S. Science & Technology Cooperation