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The year 2013 began with the 14th meeting of the IUSSTF Governing Board held at IIT Bombay on 19th January 2013. The occasion also saw the release of two documents showcasing the efforts of IUSSTF over the past decade. First, a compendium of bilateral workshops and training programs supported by IUSSTF during 2007-2011, and second, an account of the accomplishments of virtual network centres supported by IUSSTF on cutting edge S&T challenges. A new initiative, the S.N. Bose Scholars Program for Indian and US students was launched in partnership with the Science and Engineering Research Board (SERB) during this meeting. Another highlight of the meeting was signing of an MoU between SERB and the National Institute of Biomedical Imaging and Bioengineering (NIBIB), National Institutes of Health, for collaboration on biomedical devices relating to hypertension.

It has been a constant endeavour of IUSSTF to create new connections between the future science and engineering leaders in India and the US. With this in mind, IUSSTF has been organizing biennial Indo-American Frontiers of Science (IAFOS) Symposia in partnership with the National Academy of Sciences since 2004 as a flagship event. In this series, the 5th IAFOS was held from 9th-12th April 2013 at Agra, India, where more than 70 young scientists from India and the US spent three days together discussing several interesting emerging areas. Befittingly, we have chosen the IAFOS as the cover-story for this edition of Connect. Dr. Bruce Alberts, Editor-in-Chief of Science, who had played a key role in the launch of the IAFOS, took time off to attend this year’s symposium.

As part of capacity building in science, IUSSTF and SERB have been providing Indo-US Research Fellowships to young, early-career scientists working in Indian academic and research institutions so as to enable them for further pursuing research at premier US institutions. The cumulative number of Research Fellows has crossed one hundred this year. On this occasion the First Conclave of past fellows supported under the initiative was organised at Pune, India in April 2013. More than 65 fellows shared their work with each other and with mentors during the conclave. A keynote lecture by Dr. R.A. Mashelkar on Science led innovation was a highlight of the event. It was heartening to note the impressive number of joint publications emerging from efforts pursued under these fellowships and the role these fellowships have played in advancing individual careers.

Type 2 Diabetes has become a major life style disease in India as well as US. Diet plays a major role in preventing/controlling this disease. This edition of Connect reports on an IUSSTF supported Indo-US workshop to facilitate an exchange of ideas on dietary aspects of management of Type 2 diabetes. We have also covered the progress of the Indo-US Joint Centre on ‘Cell targeted diagnostics and therapy using nanomaterials’ as described by its lead Indian principal investigator. For those interested in renewable energy, the report on the planning workshop on Sustainable Advanced Lignocellulosic Biofuel Systems will be of special interest. The workshop was held under the aegis of the Joint Clean Energy Research and Development Centre (JCERDC) at the University of Florida, Gainesville.

While we continue our efforts to make our programs more diverse and inclusive, your suggestions and feedback as to what we can do better, and how, will be most useful.

Rajiv Sharma
Executive Director, IUSSTF

From the Editor-in-Chief

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Communication & Outreach Division
AFE Consultants Private Limited
Aravali House, 431/D-22, Chhatarpur Hills
New Delhi-110074, India

Published and Printed by :
Nishritha Bopana on behalf of Indo-US S&T Forum from Fulbright House
12 Hailey Road, New Delhi - 110 001.

Printed at : Archana
C-78, Okhla Industrial Area
Phase-I, New Delhi - 110 020
The fifth Indo-American Frontiers of Science Symposium was convened by IUSSTF as its annual flagship event in partnership with the U.S. National Academy of Sciences (NAS) and was held at Agra, India from 7-10 April 2013. The symposium brought together about 70 brilliant young scientists and technologists from Indian and U.S. academia, laboratories and industry. At the symposium, attendees presented their talks as part of eight interdisciplinary sessions on contemporary research topics to colleagues outside their field with a view to both conveying and deriving cross-disciplinary information and insights through a format, which allows informed one-to-one discussions amongst the participants.
The challenges and prospects of energy storage in terms of technology as well as materials were deliberated upon in the first session that was on Materials for energy storage and conversion. The introductory speaker in the session was Don Seigel (University of Michigan) who spoke on Materials for energy conversion and storage and what can be done to secure a sustainable energy future. Jeff Sakamoto (Michigan State University) delivered a talk on keeping up with the increasing demands for electrical energy storage and conversion. Aninda Bhattacharyya (Indian Institute of Science) spoke about materials for modern rechargeable batteries using Lithium-based battery as a case-study.

The session on Planet/Star Formation gazed into the mysteries of the phenomenon that gives birth to new stars and planets as well as puzzles associated with physical, chemical and geological compositions of these celestial bodies. The lead speaker in this session was Sujan Kumar Sengupta (Indian Institute of Astrophysics) who spoke about more than 800 extra-solar planets that have revolutionized our understanding of planets and their formation. Maheswar Gopinathan (Aryabhatta Research Institute of Observational Sciences) delivered a talk on Bok Globules that are identified as the sites of low mass star formation in the solar neighborhood. The origin of the earth and solar system is one of the longest-standing questions in science and Andrew Youdin (University of Colorado-Boulder) spoke about the birth of planets in the solar system and beyond.

Understanding how a cell functions and conducts its interactions with the rest of the body of living organisms is key to pinning down reasons for the unusual behavior of cells that leads to disease. It is well known that understanding the cause of disease is the first step towards finding therapies that can cure the same. Systems Biology is the branch of science that looks into these issues and plays a central role in the discovery and development of therapeutic agents and diagnostic tools. The session on Systems biology and medicine began with a talk by K.V. Venkatesh (IITBombay) who gave an overview of the field with system science principles in conjunction with experimental methodologies required to achieve a system level understanding of cellular behavior.
Raul Rabadan (Columbia College of Physicians and Surgeons) delivered a talk on fast evolutionary processes by genome analysis of tumors and RNA viruses. Anurag Agrawal (CSIR-Institute of Genomics and Integrative Biology) spoke about how systems medicine is an exciting new frontier of science and translational applications of analytical concepts from systems biology to physiological or clinical data is rewarding.

The session on Battle of the sexes focused on our understanding of the interactions between males and females that are fundamental to the evolution of sexual mating systems. Alison Pischedda (University of California-Santa Barbara) delivered the introductory talk in the session and spoke about interactions between males and females being fundamental to the evolution of sexual mating systems. Ryan Calsbeek (Dartmouth University) spoke about the resolution of sexual conflict and N.G. Prasad (IISER-Mohali) talked about interlocus sexual conflict and the evolution of life-histories.

In the session on Quasiparticles and semiconducting devices, the lead speaker Andrea Young (MIT) spoke about massless electrons and fractionally charged particles in graphene. Mandar Deshmukh (Tata Institute of Fundamental Research) presented the efforts to develop a simple technique for lateral nanowire wrap around gate devices.
with high capacitive coupling. Jay Sau (Harvard University) talked about topological quantum computation and the search for non-abelian majorana modes in solid-state systems.

Subha Majumdar (Tata Institute of Fundamental Research) delivered the introductory talk in the session on Dark matter/dark energy. Sudhir Vempati (Indian Institute of Science) discussed particle physics models of dark matter. Marcelle Soares-Santos (Fermilab) presented an overview on dark energy and discussed prospects for shedding light on this problem with current and upcoming methods. The session discussed the question of “missing” energy density of the universe, as we know it that has fascinated physicists and philosopher’s alike.

Graphs are one of the most ubiquitous models of both natural and human made structures. Understanding properties of these graphs and developing algorithms to handle these structures is of particular interest to computer science. Prahladh Harsha (Tata Institute of Fundamental Research) delivered the introductory talk of the session on Graphs, randomness and computation and surveyed the area of graph theory and its applications. Nikhil Srivastava (Microsoft Research) spoke about a recent line of work with Batson, Spielman and Teng which showed that every graph can be approximated by...
one which is very sparse. David Liben-Nowell (Carleton College) talked about some recent computational research that studies information propagation through the digital traces of online activity.

Climate Change is perhaps the most powerful of all influences that man has caused on the earth’s operating systems and is something that is transforming planet earth in unprecedented ways. The complex inter-linkages between human actions and natural ecosystems formed the crux of the session on **Ecological Impact of Climate Change**. Mahesh Sankaran (Tata Institute of Fundamental Research) delivered the introductory talk in this session and spoke about how human activities are transforming our planet and its climate in unprecedented ways and the fact that understanding the consequences of these changes represents one of the most pressing problems faced by ecologists today. Sabin T.P. (Indian Institute of Tropical Meteorology) talked about high-resolution regional climate downscaling. Joshua Lawler (University of Washington) spoke about projected future changes in climate and how they will likely result in shifts in flora and fauna to track suitable conditions.

Poster sessions are a standard event at most conferences. At the FOS Symposium however, it is a little different. This is because unlike a limited-attention side-show in most
other conferences, poster presentations here are as integral a part of the deliberations as full scale presentations. This is achieved by giving each poster presenter a minute to speak about the work from the main podium. More than 50 poster presentations added to the academic diversity and scientific vibrancy of the symposium. Another unique dimension of the Indo-US FOS Symposium is the Frontiers of Science (FOS) Awards that have been instituted by IUSSTF and was announced by Rajiv Sharma (Executive Director, IUSSTF). The award consists of USD 10,000 to be shared between the partnering Indian and American awardees, spread over a period of two years.

Another added attraction of the event was the dinner-talk by Dr. Bruce Alberts, Editor-in-Chief of Science magazine. Dr. Alberts spoke about “Science and Future of the World” and laid significant emphasis on tweaking education systems at school and college levels to make the study of science an exciting prospect and, as a result, produce scientists who can help mankind find solutions to existing and future challenges. The presence of Dr. Alberts at the symposium at Agra was also significant as he was instrumental in kick-starting the Indo-US Frontiers of Science Symposium on the lines of similar symposiums that were then held between USA and Germany as well as between USA and Israel (see interview on pg. 10).
Connect: You played a key role in launching the Indo-American Frontiers of Science symposium in 2004. Here today, we are at the 5th iteration. What were your expectations when you started this program and how does it feel to be here in Agra in 2013. Can you reflect on your expectations?

Dr. Bruce Alberts (BA): I remember it was Dr. Prakash Tandon, Dr. Govardhan Mehta and I who got together around the thought that we will have this Indo-US FOS every year, as is now the case with the Indonesia-US FOS. We felt that a lot of Indian scientists were exposed to the United States as many of them had been there for school and/or had friends there but the Americans - most of them, had never been to India and knew very little about the country. We hoped that the FOS interactions will give American scientists an opportunity to visit various universities and institutions and form collaborations and friendships.

I have talked to many of the Americans here, and for most of them it is their first trip to India. They are forming, or are trying to form new collaborations. It is wonderful to be here to see that the promise of this meeting is being fulfilled. I just wished that it is held in India more often, instead of once in four years.

Connect: What are your ideas on how the FOS symposium format should be tweaked given the experience you have had so far or do you believe that this is serving the purpose and is ideal in its existing format?

BA: The format for the Indo-US FOS is the same as the one visualized by Frank Press, my predecessor at NAS for the United States Frontiers of Science
meeting, before I even came to the Academy. An important part of this format is that young scientists organize the meeting themselves. Even though we had one Vice President back at the Academy assigned to oversee the process; it was clear that the young people did not want any instructions. And so be it! The good thing about the format is that it allows young people with leadership ability to emerge. I remember meeting a young woman geo physicist named Marsha McNut as one of the speakers at one of the first such programs I attended in the U.S.. She was so energetic and dynamic that they made her one of the American leaders at the FOS next year. That started a career that took her to become the head of the U.S. Geological Service and she takes over as Editor-in-chief of the Science magazine from next month. So this kind of process, where you are empowering young people to do something is a great way to build the next generation of leaders.

I think it is very important to ensure that speakers address a broad audience and do not give their standard talks designed for their normal peer group. What we need here are “BIG PICTURE” talks that can be absorbed by non-specialist peers.

**Connect** : President Obama very recently announced the brain initiative in which they have put in a hundred million dollars. With your extensive knowledge of the Indian landscape, which according to you are the problems that can be better dealt with through a similar but bilateral initiative?

**BA** : India is doing wonderful experiments. The Aakash tablet, that brings advantages of modern communications technology for schooling and improving education is a wonderful opportunity to collaborate. I often talk in the Science magazine of making science out of education, which means understanding what happens with children when they are learning in different ways. It also means getting some of best researchers to work on this critical issue. After I finish my tenure with the Science magazine in a few months, I am personally going to focus on science education in the United States. I will be very interested in helping establish collaboration with Indian scientists and researchers to analyze what happens in some of these experiments.

**Connect** : What in your view can be done to make scientific opinion heard at the national level during policy formulation and decision making?

**BA** : Well, the voices of a small number of scientists is always heard at the national level. But what is not heard as effectively, in my view, is a consensus view of a group of scientists. A few people advising the government do not always know enough as it is just too complicated a world. I think India would benefit immensely from developing a study process where academies of science, medicine, engineering etc. could collaborate to actually learn from each other and develop a novel consensus view on how India might move ahead. Ten minds are better than one especially if these ten minds are from different areas and know different things and are willing to learn from each other. It is critical that the voice of these academy committees be honest and independent of government influence because the government needs to hear the truth. The government can later do whatever it wants. But if academies do not provide what they consider the scientific truth underlying policy issues then government is bound to make mistakes.

**Connect** : What do we need to do to make S&T development more inclusive and broad-based?

**BA** : First, Governments have to invest as heavily as possible in building up pre-applied research capabilities in institutions which are merit-based and bring in the best people and give them enough freedom so that they can be creative. Research in the corporate sector is mostly downstream research. All the tools have to be developed elsewhere. The U.S. has been successful in innovation and that, in a large part, has to do with some of our great universities that have attracted researchers from around the world, especially India.

**Connect** : Do you wish to share any thoughts with the young scientists of India?

**BA** : I have been trying to support the idea that was expressed by R.A. Mashelkar in an editorial in the Science magazine, a year ago, that India needs a “Young Scientists Academy”. Fifteen such academies already exist around the world. A Global Young Academy has been established in Berlin by the German government that incidentally was also the first country to establish a “young science academy”.

It will be wonderful to take under the umbrella of a “young academy” a group of your best young scientists and engineers and empower them to do something for their country, but not tell them what to do. I think that would be a great development for the future of India.
India and the U.S. are only surpassed by China in the number of individuals with type 2 Diabetes Mellitus. The prevalence of diabetes in both U.S. and Indian populations continues to rise at an alarming rate. Therefore, multi-pronged diabetes prevention efforts and evidence-based diabetes care methods are necessary to obviate the profound negative effects of diabetes, including neuropathy, retinopathy, nephropathy and cardiovascular disease. Non-invasive and inexpensive interventions that can help prevent and manage type 2 diabetes, such as lifestyle management, are vital to addressing the pandemic. The Indo-U.S. Interdisciplinary Conference on Nutrition Practice Guidelines for Type 2 Diabetes Mellitus: Sharing Evidence and Best Practices to Improve Health Outcomes was held to address the burden of this chronic disease, particularly for Indians and for Asian Indians residing in the U.S. The event took place from November 17-18, 2012 at the Raintree Hotel, Anna Salai, Chennai, India. This conference was made possible through an IUSSTF grant and organized by the American Overseas Dietetic Association (AODA), the international affiliate of the Academy of Nutrition and Dietetics (formerly American Dietetic Association), and Frontier Lifeline Hospital in Chennai, India. Dr. K.M. Venkat Narayan, Ruth and O.C. Hubert Professor of Global Health & Epidemiology and Professor of Medicine at Emory University, and Dr. Nirmala Jesudason, Consultant Dietitian at Frontier Lifeline Hospital and AODA Country Representative - India, served as the principal investigators from the U.S. and India, respectively. Camella Rising, AODA Country Representative - U.S.A., and Bramaramba Kowtha, AODA member and Program Analyst for the USDA Food and Nutrition Service, served as organizational and technical co-chairs for the event. Through illuminating presentations by diabetes experts, including Dr. D. Prabhakaran from the Indian Center for Chronic Disease Control (ICCD) and Dr. Judith Fradkin from the U.S. National Institute of Diabetes and Digestive and Kidney Diseases, the proceedings made clear the importance of addressing diabetes with a life course approach, using the sociological model, and through a more preventive model of care. The event also called attention to the fact that there are a number of parallel issues in diabetes presentation, prevention and care of Indian and U.S. populations, however there are striking differences as well. For example, type 2 diabetes presents in Indians at lower body mass indices (BMI), at younger ages, and with higher rates of insulin resistance and quicker progression from impaired glucose tolerance to diabetes when compared to the U.S. counterparts. Other important take-away messages from the conference include, but are not limited to, the following:

- A recent study (ICMR-INDIAB) on the prevalence of diabetes in India estimated that there are 62.4 million people with type 2 diabetes and 77.2 million people with prediabetes. Obesity prevalence and type 2 diabetes incidence are affected by diverse cultural, environmental and genetic factors.

- Evidence from several research trials (lifestyle modification alone or in combination with oral hypoglycemic drugs) confirm the message that type 2 diabetes can be prevented or delayed and that benefits from lifestyle interventions are cost effective and have the potential to counter genetic predisposition to diabetes.

- For those diagnosed with type 2 diabetes, medical nutrition therapy (MNT) remains the first-line treatment. MNT includes nutrition interventions such as reduced energy and fat intake, carbohydrate counting, simplified meal plans, individualized meal planning strategies, insulin to carbohydrate ratios, and use of exchange lists.
Nutrition Practice Guidelines for Type 2 Diabetes Mellitus

To address type 2 diabetes and common co-morbidities through research and clinical and community partnerships, several recommendations were posed during the conference for consideration and further investigation. These include:

- Implementing mass educational programs, such as public service announcements and community-specific nutrition education programs, that promote awareness of type 2 diabetes.
- Initiating clinical-community partnerships to efficiently screen people for type 2 diabetes across diverse strata of society.
- Identifying common themes in family, school and community approaches and partnerships to prevent obesity in youth.
- Establishing partnerships between governmental and non-governmental organizations for the development of policies that address type 2 diabetes prevention.
- Promoting overall health with effective food policy and education (e.g., focus on limiting the quantity of nutrient-poor foods while encouraging fruit, vegetable and whole grain intake and physical activity).
- Exploring, comparing and contrasting U.S.- and India-based research on the effects of different diabetes management regimens, including Western and non-Western therapies.
- Providing education and skills training that emphasizes the importance and effectiveness of interdisciplinary care that includes primary care physicians, specialty care physicians, dietitians and other ancillary health care providers.
- Advancing research that elucidates the factors that motivate individuals to take measures to prevent or optimally care for diabetes.

While glycemic index has been used in both Indian and U.S. scenarios, its use as a therapeutic modality is controversial; total amount of carbohydrates is a stronger predictor of glycemic response than glycemic index.

Of significance to evidence-based diabetes care, synthesis of available research and strength of the evidence for the impact of nutrition care on type 1 and type 2 diabetes outcomes is accessible online through The Academy of Nutrition and Dietetics’ Evidence Analysis Library (EAL). In this library, an Executive Summary of Recommendations and a Nutrition Practice Guideline Overview on the topic are available to the public; more detailed information is available to Academy members and EAL subscribers. The EAL and its products, including a companion toolkit, may serve as a foundation for collaboration among Indian and U.S. dietitians and researchers who aim to enhance the use of evidence-based nutrition to improve diabetes outcomes for Indians and Asian Indians living in the U.S.

Welcome!!
Captain Sunita Williams

The Indo-U.S. Science and Technology Forum in partnership with the Department of Science and Technology (Govt. of India) and the Embassy of the United States of America, organized a discussion on “Women in Science and Engineering” with Sunita Williams (NASA Astronaut) at Fulbright House, New Delhi on 1st April 2013. The Open Discussion on Issues of Leadership of Women in Science & Engineering was moderated by Dr. Vinita Sharma (Advisor, Department of Science & Technology, Govt. of India) and was attended by women leaders from Federal Agencies, Academia and Industry.

Captain Williams received her commission as an Ensign in the United States Navy in May 1987. She was designated a Naval Aviator in July 1988. Selected by NASA in June 1998, she reported for training in August 1998. Astronaut Candidate Training included orientation briefings and tours, numerous scientific and technical briefings, intensive instruction in shuttle and International Space Station systems, physiological training and ground school to prepare for T-38 flight training, as well as learning water and wilderness survival techniques. Following a period of training and evaluation, Williams worked in Moscow with the Russian Space Agency on the Russian contribution to the space station and with the first Expedition Crew. Following the return of Expedition 1, Williams worked within the Robotics branch on the station’s Robotic Arm and the follow-on Special Purpose Dexterous Manipulator. As a NEEMO2 crew member, she lived underwater in the Aquarius habitat for 9 days. After her first flight, she served as Deputy Chief of the Astronaut Office. She then supported a long duration mission as Flight Engineer for Expedition 32 and International Space Station Commander for Expedition 33. Williams has spent a total of 322 days in space on two missions; she ranks sixth on the all-time U.S. endurance list and second all-time for a female. With 50 hours 40 minutes, she also holds the record total cumulative spacewalk time by a female astronaut.
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In the 1970s and 1980s it was common to hear reports that the earth’s ozone layer, a shield of ozone molecules in the earth’s stratosphere, was being destroyed. Scientists began to detect a depletion of ozone over much of the earth with a huge gap appearing seasonally over Antarctica. Life on Earth could not exist as it is without the protective shield of the ozone layer, so the thinning of the ozone layer and the appearance of a huge and growing hole in the southern hemisphere were a cause of much consternation among scientists and the general public.

Our remarkable success in meeting this global threat posed to our ozone layer over the past 25 years is one of humankind’s proudest moments in mounting an effective defense of planet Earth. The global action leading to the recovery of our planet’s ozone layer can serve as a model as we come to grips with the
delicate balance of economic development and environmental sustainability. The formula for this happy outcome was the implementation of the Montreal Protocol, widely regarded as the world’s most successful environmental treaty. Today we are much more likely to hear lively discussions on the subject of climate change than about ozone depletion, and while we have further work to do together on ozone layer protection, scientists now report that the ozone layer appears to be stabilizing, and has even begun a slow recovery that may return it to pre 1980 levels after the middle of this century.

Signed in 1987 and entering into force in 1989, the Montreal Protocol on Substances that Deplete the Ozone Layer called for the control and dramatic reduction of emissions of ozone-depleting substances. Chief among these were the chlorofluorocarbons (CFCs) widely used in air conditioning, refrigeration systems, insulating foams, aerosols and other products. CFCs have largely been replaced by hydrochlorofluorocarbons (HCFCs), which have a lower ozone-depleting potential than CFCs. As a result of the Montreal Protocol the atmospheric concentrations of ozone-depleting compounds began to decline by the early 2000s, despite a rapid growth in the use of cooling systems worldwide. The Montreal Protocol, however, also calls for the phase-out of HCFCs starting with a freeze in 2013, and gradual reductions that lead to a virtual phase-out of consumption and production of HCFCs by 2030. Substitution of HCFCs is well underway, and the leading substitutes are hydrofluorocarbon (HFC) gases, which do not harm the ozone layer.

Unfortunately, many HFCs are extremely potent greenhouse gases (GHGs), some with

Ozone Hole of Antarctica in September 2006 (Source: NASA)
global warming potentials (GWPs) thousands of times higher than that of carbon dioxide. Unless alternative measures are taken, their production and use will likely grow rapidly in the near future, as they continue to replace CFCs and HCFCs being phased out by the Montreal Protocol, and as the demand for air conditioning and cooling systems increases. This growing use of HFCs will have a strong negative effect on global efforts to mitigate climate change resulting from GHG emissions. The United Nations Framework Convention on Climate Change (UNFCCC), is designed primarily to deal with waste gases, rather than deliberately produced gases such as HFCs, which require a different model of control.

In 2010 the United States, Canada and Mexico proposed an amendment to the Montreal Protocol to reduce the production and consumption of HFCs under the Protocol, without removing them from the list of GHGs under the UNFCCC. Unlike other GHGs, most HFCs are manufactured gases and their large-scale production is a direct result of the Montreal Protocol’s phase out of ozone-depleting substances. Recognizing that inexpensive alternatives are not yet available for all HFC applications, the proposed amendment does not call for a complete phase-out of HFCs, but a gradual phase-down over time, with separate phase-down schedules for developed and developing countries. The amendment would also allow funding for the phase-down through the Montreal Protocol’s Multilateral Fund.

The Montreal Protocol has been ratified by all UN member states as well as the European Union and is widely recognized as the most successful environmental treaty in history. Not only is it successfully phasing out most ozone-depleting substances, it has also done more to address climate change through direct reduction of GHGs than any other international climate initiative, because of the global warming potential of the CFCs and other compounds that it phased out. (Most ozone depleting substances are also potent GHGs). Under the proposed amendment, the Montreal Protocol’s successful formula would be applied to the very challenge it created, working in sectors where we already know the model works from experience in the CFC phaseout.

Regulators and manufacturers in many countries are already taking steps to replace HFCs with less potent alternatives. For example, the European Union requires low-GWP substances for motor vehicle cooling systems, the United States provides incentives for the use of climate-friendly refrigerants in motor vehicle air conditioning, Australia is using a carbon price that applies to HFCs, and China, Indonesia, and developing countries all over the world have used the Montreal Protocol’s Multilateral Fund to switch to non-HFC gases as HCFC replacements. In India, air conditioner companies recently introduced new models that use non-HFC alternatives, and Indian companies that export cars to Europe have built prototypes using next-generation low GWP refrigerants. Similar innovations by Indian companies away from HFCs would benefit domestic industry in the long run, as global markets make the shift, and could help avoid a transition into HFCs that would ultimately prove unsustainable and require a second transition later. Many of these markets are existing or potential export markets for Indian products. Furthermore, a home-grown industry of HFC alternatives would reduce India’s dependence on patent-protected foreign imports.

A phase-down of HFCs under the Montreal Protocol could allow Indian industry to make sustainable and cost-effective transitions to advanced technology along with other parts of the globe, particularly at a time of increased urgency for global action to address climate change, and the transition can be done in a way that allows India to meet the rapid growth in demand for cooling systems, while improving energy efficiency of equipment and appliances simultaneously.
To nurture future innovators and thought leaders, the Science & Engineering Board (SERB), Department of Science and Technology (DST), Govt. of India, the Indo-U.S. Science and Technology Forum (IUSSTF) and the University of Wisconsin-Madison (UW) have developed a dynamic student exchange program between Indian institutions and premier U.S. Universities led by the University of Wisconsin at Madison. The program has been named the S.N. Bose Scholars Program after the late Prof. Satyendra Nath Bose, a visionary Indian physicist best known for his work on quantum mechanics in the early 1920s, providing the foundation for Bose–Einstein statistics and the theory of the Bose–Einstein condensate. A Fellow of the Royal Society, he was awarded India’s second highest civilian award, the Padma Vibhushan in 1954 by the Government of India. He made important contributions to the field of quantum physics in the 1920s that changed how particle physics has been studied ever since. The class of particles that obey Bose–Einstein statistics, Bosons, was named after him. The inception of this program is particularly opportune as it would coincide with the discovery of the Higgs-Boson earlier this year at the Large Hadron Collider at CERN in Switzerland. It would honor an Indian scientist’s fundamental contribution to the completion of the Standard Model of the Universe.

Under the direction of UW-Madison, the program would also include a consortium of additional US universities including many of the universities represented by the Committee on Institutional Cooperation (CIC). It is envisaged that this partnership would continue to grow beyond these universities in the US. It has been unambiguously demonstrated that providing students with an exposure to cutting edge scientific research experience at a formative stage not only broadens their intellectual horizons but also leads to increased engagement in scientific and technological research careers. An added benefit is that an exchange program also enables the creation of sustainable and vibrant linkages between the two nations, as well as building deep-rooted long-term Indo-American science and technology relationships.

The dynamic exchange of information and knowledge between premier institutions in India and the US through this program will create sustainable, long-term networks in the mutual interest of both countries.

The broad objectives of the program are to:

- provide an opportunity to the best and brightest Indian students to gain exposure and access to world-class research facilities in U.S. academia and labs;
- promote research and capacity building in frontline areas of science and technology;
- encourage and motivate outstanding students to take up research as a career path;
- pave the way for the next generation scientists and technologists from India to interact with American peers, thus helping to build long-term R&D linkages and collaborations; and,
- bring talented American students to research laboratories in India to build a deeper appreciation of the culture of innovation and long-standing tradition of scientific enquiry in India.

For more information about the S.N. BOSE SCHOLARS PROGRAM please visit [http://www.indousstf.org/bose/scholars.htm](http://www.indousstf.org/bose/scholars.htm)
The Indo-U.S. Joint Centre on Cell Targeted Diagnostics and Therapy Using Nanomaterials had its genesis in 2009 when the Indo U.S. Science and Technology Forum (IUSSTF) supported “NANOBIO 2009”, the first International Nanobio conference to be held in India. IUSSTF funded the visit of half a dozen top U.S. scientists to attend the conference and join scientists from India, Korea, Europe and Japan to discuss cutting-edge research in the area of nanomaterials application in biology and medicine. The U.S. team was led by Prof. Tony Mikos, the most prominent name in regenerative materials technology in the United States, now elected to the National Academy of Engineering.
and also to the Institute of Medicine of the National Academies. Myself, from Amrita Centre for Nanosciences and Molecular Medicine, led the conference from the India side. This was one of the early attempts to integrate the tremendous developments in Nanotechnology into Regenerative Medicine; the latter representing biological advances in the understanding of how tissues regenerate themselves. With the understanding that tissues are very hierarchical, with both nano and micro components; the natural question was whether there was any potential to enhance regeneration using nanomaterials of controlled sizes and morphologies and also having the requisite chemistry that favor biological interactions.

There was intense discussion on the opportunities in this area which resulted in a joint proposal between Rice University, led by Tony Mikos; Stanford University, led by Sarah Heilshorn; University of Connecticut, led by Lakshmi Nair; and, on the India side, Amrita University Centre for Nanosciences and Molecular Medicine and also Cell works, a dynamic private R&D firm with interest in a systems biology approach to regeneration. This proposal was funded by IUSSTF in 2010 and thus was born this Joint Centre and the collaborative research activities therein.

The main objective of the Joint Centre was to develop cell targeted diagnostics and therapeutics. Nanomaterials, both in disease therapy and regenerative medicine, are particularly suited for cell targeting because of their size, and the fact that the size and surface functionalization allows one the ability to deliver molecules within cells of interest. Such a possibility did not exist in the era of molecule-based drug discovery. Secondly,

![Figure 2](image)

**Indian Partnering Institutions:**
- Amrita Centre for Nanosciences and Molecular Medicine, Kochi
- Cell Works Research India Pvt. Ltd., Bangalore

**U.S. Partnering Institutions:**
- Rice University, Houston
- University of Texas, Houston
- Stanford University of Connecticut

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**Figure 2**
Interferon (IFN) loaded nanoparticles loaded in a gel. (a) DLS showing formation of monodispersed IFN nanoparticles in aqueous medium, (b) SEM image showing spherical shaped IFN nanoparticles under dried conditions, (c) Spectrophotometric assay showing sustained release of IFN from PLGA nanoparticles, and, (d) SEM image showing IFN nanoparticles loaded gel medicine.
designing of nanomaterial structures that simulate the extracellular matrix (ECM) was a new avenue of research in regenerative medicine, that is, a “medicine” is provided that would encourage regeneration even of tissues that might not otherwise regenerate very easily. The word “medicine” therefore could be broadened to mean a foreign material inserted in the body that has either a disease curative effect or a tissue regenerative effect. Thus a “medicine” would include a scaffold that may be placed in the body that would help regenerate lost bone or nerve tissue or any other tissue.

Several novel outcomes were developed as a part of this collaboration, which needs to be taken forward with more work and joint research. Together with Rice University three new initiatives emerged. Binulal from Amrita Centre is spending time at Rice University developing spatially distributed scaffolds, which are capable of performing multiple functions. This example is shown in Figure 1, where one micron-sized layer is designed to serve an angiogenic function and another micron-sized layer is designed to serve an osteogenic function. This construct is being studied in an in vivo mouse model using a micro CT to follow angiogenesis in vivo. Further this work is exploring the use of co-culture systems using multiple cell types in the distributed scaffolds.

Another novel development is the use of a delivery system within a delivery system that we explored at Rice University. In this case a nanoparticulate drug carrier was contained within a gel-delivery system. This system delivers the nanoparticle, which in turn...
delivers the drug, giving the designer two levels of control. The application chosen was interferon treatment of oral giant cell tumor (Figure 2).

A third novel concept jointly studied at Amrita was the use of a multiscale and multicomponent scaffold to better simulate a hierarchical actual tissue structure. In this unique study, microfibers of Polycaprolactone (PCL) polymer were combined with nanofibers of fibrin (the material that natural blood clots are composed of). This unique structure (Figure 3) was proven to have more tissue formation than when only micron size fibers were used. The fibrin nanofiber technology was developed at Amrita and a Ph.D. student at Rice (Erica) worked at Amrita and used this technology to make the multiscale composite and demonstrate its novelty.

At Stanford University, a first of a kind joint study involved the electrospinning of recombinant proteins for tissue engineering. A family of recombinant elastin-like proteins was electrospun to give spaghetti-like nanostructures (Figure 4), which were highly functional towards mesenchymal stem cells.

While only some of the very unique highlights have been covered above, the overall experience was very positive for all the participating universities. Especially for the students, the experience was a transforming one – for the American students, a cultural feast and a unique experience research in India; and for Indian students, the experience of a research culture that is exceptionally focused and goal-oriented. Overall, seven high impact journal publications were published or accepted and an additional two are in preparation and three patents are planned to be submitted from this joint work in the development of tissue engineered bone, cartilage and drug releasing nanogels for oral cancer. There were 13 faculty exchanges and 6 student exchanges which have helped develop a very strong bond between the institutions in terms of future collaborative studies in this cutting-edge area of nanomaterials in diagnostic/therapeutic and regenerative technologies. Taking many of these new ideas forward is going to be the goal of the next few years of international collaborations.
A Joint Project Meeting of the U.S.-India JCERDC for Development of Sustainable Advanced Lignocellulosic Biofuel Systems was organized by the U.S. Principal Investigator Dr. Pratap Pullammanappallil at the University of Florida, Gainesville from 28th to 31st January 2013.

The meeting began with overview presentations by Dr. Sangita Kasture (Department of Biotechnology, Govt. of India), Dr. Rajiv Sharma (Indo-U.S. Science and Technology Forum) and Dr. Pullammanappallil (University of Florida). This was followed by presentations from the U.S. and Indian collaborating research institutions identifying the strengths, expected contributions to JCERDC and ongoing synergistic projects for all three work packages (Work Package I - University of Missouri, International Crops Research Institute for the Semi-Arid Tropics, Tamil Nadu Agricultural University, Directorate of Sorghum Research, Rajmata Vijaykraraje Scindia Krishi Vishwa Vidyalaya; Work Package II – University of Florida, Indian Institute of Chemical Technology, Indian Institute of Technology- Delhi, Indian Institute of Technology-Madras, Jawaharlal Nehru Technological University, Tamil Nadu Agricultural University; and, Work Package III - Virginia Tech, Montclair State University, Texas A&M University, Centre for Economic and Social Studies). Presentations were also made by the Industry partners (Abellon, Hindustan Petroleum Corporation Limited, Green LLC, Show Me Energy Co-op) on their expectations from the JCERDC project, expected contributions and ongoing synergistic activities.

The participants conducted intensive and rigorous sessions to discuss strategies to integrate the U.S. and India activities and methods to leverage this project for further activities, research proposals and projects. The
timelines for future workshops/conferences and special publications was also discussed.

A field trip to the Florida Center for Renewable Chemicals and Fuels (FCRC) was also organized. The FCRC was established in January 2002 with the primary goal of facilitating research and graduate education throughout the State University System in the multi-disciplinary areas of renewable chemicals and fuels. The Center provides a vehicle to solve new technological challenges, serves as a forum to foster productive interactions among faculty and students, assists faculty in the development of competitive research grants, and increases the visibility of this important activity at the state and national levels. The attendees had extensive discussions with the FCRC Director, Prof. Lonnie O. Ingram and the Associate Director Prof. K. T. Shanmugam.

To strengthen capacity on meeting the deliverables of Work Package-3 (Sustainability, Marketing and Policy); the Indian Institute of Chemical Technology (IICT), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Abellon Clean Energy Ltd and Virginia Tech conducted a 2-day training program for 24 participants from eight public sector organizations and two private companies on 3-4 January 2013 at IICT, Hyderabad. The workshop was inaugurated by Prof. Ahmed Kamal (Acting Director, IICT) and the training program was coordinated by Dr. Beena Patel (Abellon Clean Energy), Dr. Janaki Alvalapati (Virginia Tech), Dr. P. Srinivasa Rao (ICRISAT) and Dr. Ahmed Kamal (IICT).
Dr. K. VijayRaghavan has assumed charge as Secretary of the Department of Biotechnology (DBT), Govt. of India on January 28th, 2013. Prior to this, he was the Director of the National Center for Biological Sciences, Bangalore.

Conferred with the honor of a Padma Shri by the Govt. of India in 2013, Dr. VijayRaghavan is an outstanding geneticist. Elected as a Fellow of the Royal Society on April 19th, 2012, he is also a recipient of the Infosys Prize in the Life Sciences category in 2009.

Before he commenced his illustrious career as a scientist, Dr. VijayRaghavan graduated with a Bachelor of Technology degree in Chemical Engineering from IIT Kanpur in 1975. He completed his doctoral work in 1983 in the field of Molecular Biology and holds a Ph.D. from the Tata Institute of Fundamental Research following which he pursued post-doctoral research at the California Institute of Technology, USA.

Dr. VijayRaghavan is known for his research on understanding the cellular and molecular principles of adult muscle development in *Drosophila*. He has combined these studies with those on the development of the nervous system to study the control and development of movement.

IUSSTF wishes Dr. VijayRaghavan every success in his new assignment!

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The Graduate Aptitude Test in Engineering (GATE) is an all-India examination that tests the comprehensive understanding of various undergraduate subjects in Engineering and Technology. GATE is conducted jointly by the Indian Institute of Science and seven IITs (IIT Bombay, IIT Delhi, IIT Guwahati, IIT Kanpur, IIT Kharagpur, IIT Madras and IIT Roorkee) on behalf of the National Coordination Board – GATE, Department of Higher Education, Ministry of Human Resource Development (MHRD), Government of India (http://www.gate.iitb.ac.in/gate2013/).

**Ms. Deepa Rajagopalans** from SASTRA University has secured the All India First Rank in the GATE Examination. Deepa spent a semester at the University of Michigan-Ann Arbor, as a Khorana Fellow in 2012 where she worked on the Intracellular Trafficking of Vitamin B12.

**Ms. Diya Binoy Joseph** (Khorana Scholar Batch of 2012) from the National Institute of Technology, Calicut, has secured the All India Third Rank in the GATE examination. Diya interned at the University of Michigan-Ann Arbor, where she worked on Functional Characterization of ZNF700-MAST1 Fusion Protein.

IUSSTF congratulates Deepa and Diya and wishes them all the very best in their future endeavors!
The historic 100th Indian Science Congress (ISC) was inaugurated by the Hon’ble President of India Shri Pranab Mukherjee in the presence of the Hon’ble Prime Minister of India Dr. Manmohan Singh, Hon’ble Chief Minister, Govt. of West Bengal Smt. Mamta Banerjee, Hon’ble Governor, State of West Bengal Shri M. K. Narayanan, and a number of distinguished dignitaries at the Salt Lake Stadium, Kolkata on 3rd January 2013. The theme selected for the centenary session was “Science for shaping the future of India” and was aimed to engage the attention of the scientific community to discuss, debate and deliberate the best next ways of harnessing science for shaping the future of India.

The event witnessed participation from over 150 organizations from various sectors like R&D Institutes, Academic Institutes, Universities, Innovators, Defence Organizations, Ministries, Government Departments, State Governments, PSUs, Corporate, International agencies, etc.

The Indo-U.S. Science and Technology Forum also participated at the ISC to showcase its wide program manifesto that helps create linkages between India and the United States through the exchange and dissemination of information and opportunities in promoting bilateral scientific and technological cooperation IUSSTF booth at the 100th Indian Science Congress was well appreciated by both delegates and dignitaries. Prof. Yuan Tseh Lee, Nobel Laureate in Chemistry (Prof. at University of California, Berkeley) also visited the booth and greatly appreciated the programs of IUSSTF in promoting Indo-U.S. S & T collaborations.

Prof. Yuan Tseh Lee, Nobel Laureate in Chemistry (Prof. at University of California, Berkeley) visits the IUSSTF Booth

Dr. Ramasami (Secretary, Department of Science and Technology, Govt. of India) visits the IUSSTF Booth. Also in the picture are Dr. Hari Gopal (SERB, DST, Govt. of India), Dr. Smriti Trikha (IUSSTF), Ms. Monika Madan (IUSSTF) and Ms. Vandana Nath (IUSSTF)
The 14th meeting of the Governing Board of the Indo-U.S. Science and Technology Forum (IUSSTF) took place under the Co-Chairmanship of Dr. T. Ramasami, Secretary, Department of Science & Technology (DST) Govt. of India (Indian Co-Chair) and Dr. Norman P. Neureiter, Advisor, American Association for the Advancement of Science (U.S. Co-Chair), on 19 January 2013 at the Indian Institute of Technology-Powai Campus in Mumbai, India.

As it has always been the endeavor of IUSSTF to catalyze, promote and support networking activities in areas of importance to the U.S. and India; in order to showcase these activities and view their outcomes, Dr. Rajiv Sharma (Executive Director, IUSSTF) introduced to the Board a comprehensive compendium of all Workshops, Training Programs and Virtual Networked Centers supported by the Forum. This document...
aimed to showcase the strength and value of such networked partnerships enabled through IUSSTF support.

The Governing Board members deliberated and provided their views on the accomplishments and also the future vision and role for IUSSTF in promoting its mandate. Dr. Ramasami lauded IUSSTF’s role as a catalyst in deepening and broadening the scientific and technological collaborations between India and the United States. He was also appreciative of the manner in which IUSSTF is administering the Indo-U.S. Joint Clean Energy Research and Development program for the Govt. of India and the U.S. Department of Energy. He also lauded the visitation programs administered by IUSSTF and described them as “nation building exercises”. Dr. Neureiter expressed his happiness over the accomplishments of IUSSTF and felt that the time had come to think broadly and deeply about the future vision and path for the Forum. At the end of the meeting, Dr. Hari Gopal (Science and Engineering Research Board-SERB, DST, Govt. of India) announced the S.N. Bose Scholars Program supported by SERB in partnership with IUSSTF and the University of Wisconsin-Madison (UW). This dynamic and transformative student exchange program between premier institutions in India and the United States is named in honor of Satyendra Nath Bose (1894 – 1974), a visionary Indian physicist best known for his work on quantum mechanics in the early 1920s.

The Science and Engineering Research Council (SERC) (at present, Science and Engineering Research Board) of the Department of Science and Technology in partnership with the Indo-US Science and Technology Forum (IUSSTF) had launched the Indo-US Research Fellowship Program for Indian Researchers in August 2007 with the objective of introducing scientists and engineers in the early stages of their careers to international collaborative research opportunities at premier institutions in the United States, thereby furthering their research capacity and global perspective and forging long-term relationships with scientists, technologists and engineers in leading American R&D institutions and laboratories. Since then, 119 fellowships have been awarded to young and bright Indian researchers. In addition to several joint publications in peer reviewed journals, most of the IUSSTF Research Fellows have received project funding from National Funding agencies and have been the proud recipient of several prestigious awards.

The two-day event highlighted the research work carried out by the IUSSTF Research Fellows in the United States during their fellowship. The inaugural session began with a welcome note by Dr. Rajiv Sharma, Executive Director, IUSSTF. Dr. R. K Tayal from the Department of Science and Technology and Dr. L.S. Shashidhara, IISER Pune also shared their thoughts on the inception and subsequent evolution of the Indo-US Research Fellowship Program.

The keynote speaker, Dr. R.A. Mashelker, National Research Professor & President, Global Research Alliance, National Chemical Laboratory, Pune, motivated the audience with...
his talk on “Science led Innovation”. He spoke on the importance of bridging the gap between knowledge and its practical application.

The conclave consisted of various technical sessions on different areas of science and engineering. Each session was chaired by an area expert with two presentations by the Research Fellows. **Prof. Balasubramanian, IMSc-Chennai, Prof. Sanjay Dhande**, Former Director-IIT, Kanpur, **Prof. S. K. Acharya**, AIIMS, New Delhi, **Prof. Sanjay Puri**, JNU, New Delhi and **Prof. K. N Ganesh**, IISER-Pune steered the Technical Sessions. After each session, fellows from the respective areas were felicitated with medallions and certificates. An interactive poster session was also organized.

A special session on “**Funding opportunities and visa procedures**” was also scheduled keeping in mind the interest of the awardees. The session was chaired by **Dr. B. Harigopal**, OSD, SERB-DST, Govt. of India. Information on the various funding opportunities available with the Department of Science and Technology and Department of Biotechnology, Govt. of India, was given by **Dr. R. K. Tayal** and **Dr. T.S. Rao** respectively. **Ms. Anood M. Taqui**, from the US Consulate General, Mumbai, shared important information related to the U.S. Visa application process.

The conclave concluded with an interactive panel discussion to steer the direction and growth of the Indo-US Research Fellowship Program. Suggestions from the IUSSTF Research Fellows were also addressed by the panelists. **Dr. B. Harigopal** summarized the recommendations and suggested methods for their incorporation into the program.

The Conclave was an opportunity for the IUSSTF Research Fellows to share their thoughts and experiences not just with the funding agencies, program administrators, and policy makers, but also with fellow researchers.
Water use has increased ten-fold between 1900 and 2000. Eighty-eight developing countries, containing close to one-half of the world’s population, already experience water deficits, with resulting constraints on human ecosystem, health, as well as economic development. According to the World health Organization, 1.1 billion people around the world lacked access to improved water supply and more than 2.4 billion (40% of world’s population) lacked access to improved sanitation in 2000. It is reported that the greatest development failure of the twentieth century has been the failure to provide safe drinking water and adequate sanitation services to all people. The main objectives of the Indo-U.S. workshop on *Implementation of sustainable technologies for water/wastewater treatment and water reuse* organized by T. Pradeep (IIT-Madras, Chennai) and Sukalyan Sengupta (UMass, Dartmouth) included identification of methodologies for assessment of reliable source of water supply; emerging technologies for clean and affordable water; emerging contaminants and new analytical techniques; sustainable water supply for rural and under privileged communities; coastal zone water issues in addressing water supply as well as environmental protection; efficient distribution/collection systems to minimize transmission losses; centralized vs. decentralized systems for water supply and wastewater management; public private partnership in water supply and wastewater management; etc.

**POINT-OF-CARE HEALTHCARE TECHNOLOGIES**

Though the challenges of providing high-quality healthcare in developing countries are different than those in developed countries, there is a common goal to provide access to health monitoring and assessment technologies to people with limited or no healthcare facilities. While the developed countries may find Point-of-Care (POC) technologies as effective means for reducing healthcare costs and improving efficiency, POC technologies are critical in responding to essential healthcare needs in countries with large populations in rural areas. The developing countries in the eastern part of the globe accounting for more than 2/3rd of the world population face the basic challenge of providing minimal healthcare to all people living in adverse geographical or economic constraints, and also monitoring critical diseases and infections such as HIV/AIDS, TB, malaria, etc. The challenge becomes even more critical in the situation of potential outbreak of an epidemic. The Indo-U.S conference on *Point-of-care healthcare technologies* organized by Manjunatha Mahadevappa (IIT-Kharagpur) and Atam P. Dhawan (New Jersey Institute of Technology, Newark) focused on innovation, research, technology development and best practices in deployment of health monitoring technologies in developing and developed economies for better global healthcare. The conference featured research presentations and technology panel discussions and forums on recent technological advances and global issues on implementation of POC technologies. The conference provided a unique global networking opportunity with leading researchers, students, medical and industry professionals, and policy makers in innovative healthcare technologies.
Biodiversity Informatics is an emerging and evolving discipline. The area is motivated by efforts at documenting, detailing and databasing all living organisms of the world. The subject has assumed increased importance with a concern for biodiversity conservation in the wake of clear indications of climate change, habitat loss and consequently loss of biodiversity. Biodiversity Informatics is a coming together of taxonomists, biologists and computer scientists for using the Internet to provide open access to biodiversity information that will catalyze the science of taxonomy and advance conservation. In order to bring the current biodiversity informatics initiatives in India and exchange information with those involved in advanced biodiversity informatics in the United States, an Indo-U.S. workshop titled Biodiversity Informatics was organized by Gladwin Joseph Chakravarthy (Ashoka Trust for Research in Ecology and the Environment, ATREE, Bangalore) and Cynthia Sims Parr (Encyclopedia of Life, Smithsonian Institution, Washington D.C.). The event focused on bringing taxonomists and technologists together to exchange views on leveraging information technology for biodiversity informatics.

Blindness affects around 20 million people in India and occurs due to various ocular malfunctions caused by cataract, refractive errors, ocular infections, corneal diseases, glaucoma and retinal diseases. There is an increase in the prevalence of age-related and complex eye diseases both in India and the U.S. due to the changing demographics, senescence and life style factors. Studies on health economics have predicted alarmingly slow economic growths due to the loss of valuable productive years of an individual impoverished by visual impairment and blindness. A comprehensive management based on our current understanding of the disease pathophysiology and therapeutics is a major challenge worldwide. There have been some remarkable success stories due to the applications of stem cells and regenerative medicine in ophthalmology, use of nanotechnology and very recently the restoration of vision in some forms of retinal blindness by gene therapy. Thus, it is
imperative for both these countries to jointly undertake translational research in ophthalmology and vision care based on their respective resources and expertise. Adequate efforts are required to take advantage of the bench-side discoveries for bedside applications from innovative research in both these countries. The Indo-U.S. workshop titled *Novel tools and themes in vision sciences* organized by Subhabrata Chakrabarti (Hyderabad Eye Research Foundation, L.V. Prasad Eye Institute, Hyderabad) and Uday B. Kompella (University of Colorado, Denver) aimed towards creating long-lasting collaborations between the scientists, clinicians and young graduates and fellows across these nations for better eye-care management and applications to eradicate blindness and visual impairment. The event also helped foster interactions among the academia and industry for devising novel diagnostics and therapeutic options and also to propagate public awareness.

**INNOVATIVE APPROACHES AND TECHNOLOGIES FOR DIABETES PREVENTION AND MANAGEMENT**

Diabetes is a burgeoning global health problem that is straining the public health systems of developed and developing nations. In India and the United States alone, tens of millions of people are suffering every day from the scourge of this chronic disease and its serious health complications, which include kidney failure, heart disease, adult-onset blindness, and lower limb amputations. A significant number of affected individuals worldwide do not know they have the disease. In both nations, diabetes is increasingly striking in younger age groups, with potentially devastating implications for the health, well-being, and productivity of future generations. Affordable and practical approaches and technologies for preventing and managing the disease and its complications are urgently needed in both countries to reduce both the human toll and high cost of care. An Indo-U.S workshop on *Innovative approaches and technologies for diabetes prevention and management* was organized by Bela Shah (Indian Council of Medical Research, New Delhi) and Judith Fradkin (National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, Bethesda) to bring together researchers and funding officials from both countries to identify specific research needs and opportunities in high priority diabetes research areas of joint interest. The outcome of this workshop will be used to develop a joint Funding Opportunity Announcement (FOA) with funding from both the Indian Council of Medical Research and the National Institute of Diabetes and Digestive and Kidney Diseases.

**ELECTROCATALYTIC MATERIALS FOR FUEL AND BIOFUEL CELLS**

Electrocatalysis and bioelectrocatalysis are important process in fuel and biofuel cells respectively that are alternatives to conventional batteries. In order to discuss the latest developments in electrocatalysis and bioelectrocatalysis leading to fuel and biofuel cells, an Indo-U.S. workshop on *Electrocatalytic materials for fuel and biofuel cells* was organized by V. Ganesan (Banaras Hindu University, Varanasi) and Shelley D. Minteer (University of Utah, University of Colorado, Denver).
Salt Lake City). This conference helped benefit Chemists in general, young researchers, teachers, industrialists and students in particular and who would like to begin research in this field. The conference focused on the work of a galaxy of leading experts and researchers from the U.S. and India through their deliberations and presentations in frontier areas of fuel and biofuel cell research, to review current status, highlight future challenges and possible commercialization of fuel and biofuel cells through industries. The workshop bridged the traditional core areas of electrochemical science and technology and interfaced these with materials, technological, biological, and other bio-energy devices.

MOLECULAR IMAGING (68GA PET) AND TARGETED RADIO-Nuclide Therapy: Preclinical Evaluation and Clinical Applications

The use of Ga-68 for molecular imaging of cancer and other diseases has witnessed a dramatic increase over the last decade as production technologies have improved and become attractive to individual site purchase and operation for diagnostic imaging agent production. The Indo-U.S. symposium on Molecular imaging (68Ga PET) and targeted radionuclide therapy: Preclinical evaluation and clinical applications organized by Baljinder Singh (Postgraduate Institute of Medical Education & Research, PGIMER, Chandigarh) and Michael K. Schultz (Carver College of Medicine, University of Iowa, Iowa City) aimed to offer a unique forum for high-level scientific discussions on the recent developments in the exciting field of Theranostics, where Ga-68 is playing an increasingly larger role in drug development. The recognition of the potential for Ga-68 imaging of targeted drug therapies has led to a common belief that these new compounds are leading the way to personalized medicine using molecular Imaging (SPECT/PET/CT) and targeted radionuclide therapy (beta and alpha emitters).

NANO-STRUCTURED ELECTRONIC MATERIALS: CHALLENGES & RELEVANCE TO ELECTRONICS & ENERGY RESEARCH

With global energy use set to rise by 51% by 2035, renewable sources of energy and electronics are the only feasible way to create a secure energy future and future generation consumer electronics. Silicon is the cornerstone of most of the known technologies in the field of electronics and energy. The silicon semiconductor industry has charted an itinerary for itself for the next 5 years, which basically continues on the density and performance improvements of the past 50 years. Practical and/or fundamental limits are being approached and substantial changes to device technologies and structures are going to be required. A host of new materials are at the dawn of development and show promise for their exploitation in these critical fields of energy and electronics. The tailoring of the materials in the nano-scale regime for exploiting their exciting properties yet opens up major fundamental/application oriented opportunities and challenges that need to be devoured, addressed and cracked. Hence the aim of the Indo-U.S. workshop titled Nano-structured electronic materials: Challenges & relevance to electronics & energy research, organized by Dinesh P. Amalnerkar (Centre for Materials for Electronics Technology C-MET, Pune) and V. Renugopalakrishnan (Children’s Hospital/Harvard & Northeastern University, Boston) was to focus on Nano-scale Materials Challenges, with a special emphasize on electronics and energy technologies beyond silicon. The events provided a much needed platform for a wide spectrum of researchers, academics, scientists, engineers and industries to interact, exchange and disseminate knowledge; and, arrive at a roadmap to counter the future technological challenges associated with modern electronics and energy sector.
The Indo-US 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 in India, co-funded and co-governed by both the governments. IUSSTF promotes and catalyzes Indo-US collaborations in science, technology, engineering, biomedical research and innovation through substantive interaction among government, academia and industry.

**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

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**Exciting and innovative collaborative programs cutting across disciplines and institutions**

- Academia-Industry Connect Programs
- Advance Schools & Training Programs
- Bilateral Workshops & Symposia
- Flagship Events
- Knowledge R&D Networked Joint Centers
- Programs on Innovation and Entrepreneurship
- Public-Private Networked R&D Joint Centres
- Research Fellowships for Faculty
- Special Initiatives for Strategic Partnerships
- Student Internships & Visiting Professorships

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

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For program details visit: [http://www.indousstf.org](http://www.indousstf.org)