Indo-US Science & Technology Forum

Connect

Newsletter of IUSSTF

Volume 10 (2) | September 2018

IUSSTF
Indo-US Science and Technology Forum

Air Quality Monitoring

Time to Clear the Air

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COVER STORY

Editor-in-Chief
Rajiv Kumar Tayal
Executive Director, IUSSTF

Editor
Nishritha Bopana
Principal Science Officer, IUSSTF

Associate Editor
Pushpa Iyer
Program Officer, IUSSTF

Editorial Consultant
Manoj Dabas

Layout Design / DTP
Pramod Jha

Design, Production and Circulation
Creative Edge Media and Services Pvt. Ltd.
Aravali House, 431/D-22, Chhatarpur Hills
New Delhi-110074, India

Opinions
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Published and Printed by
Indo-US S&T Forum, Fulbright House, 12 Hailey Road
New Delhi - 110 001

From the **Editor-in-Chief**

As I look back on the past three years at the helm of the Indo-U.S. Science and Technology Forum, it has been a truly wonderful and engaging experience to have been a part of! Not only have we been able to establish new benchmarks of excellence, we have also been able to bring about a disruptive change in thinking and mind-set. We have added new dimensions to the IUSSTF portfolio to cater to all segments of the S&T and entrepreneurial ecosystem in both the countries. Our stakeholder base and operational efficiencies have multiplied several times over, and our outreach and brand value have gone up by several orders of magnitude through strategic partnerships with key constituents of the U.S.-India S&T ecosystem. While resources available to us through committed bilateral support have remained stagnant over the years, we have still managed to grow by roughly 20 orders of magnitude.

I am thankful to both the Governments for reposing their faith in assigning this responsibility to me, and I am grateful for their support while negotiating through the challenges of the assignment.

IUSSTF is a small yet beautiful organization and our real strength lies in our people. We are blessed with some the most wonderful people and I am immensely proud of each one of them. We are also very fortunate to have always received the unconditional support of all our patrons and stakeholders.

While there is always an unfinished agenda and even better ways of doing things in a dynamic world, I have tried my best to bring about a transformational change in the affairs of the Forum. Even as I move on with the new role in my professional life, the cause of Indo-US S&T Cooperation in general, and IUSSTF in particular, will continue to remain very dear to my heart.

IUSSTF has covered a lot of ground during the last 18 years and is now favorably poised to take a leap into the unlimited possibilities of the future! I invite all of you to be a partner in IUSSTF's journey, just as you have been a co-creator of this success story thus far!

Rajiv Kumar Tayal
Executive Director, IUSSTF

Streaming Analytics on Temporal Variables from Air Quality Monitoring (SATVAM)

ANALYSING AIR QUALITY

S.N. Tripathi*, Jishnu Bhattacharya*, Rajesh Zele#, Yogesh Simmham$, Malati Hegde$, Mike Bergin^, Ronak Sutaria~

*IIT Kanpur, INDIA, #IIT Bombay, INDIA, $IISc Bangalore, INDIA, ^Duke University, U.S.A., ~Urban Sciences, Mumbai, INDIA

Air pollution, both outdoors and in households, is ranked as the second-most serious risk factor for public health in India after malnutrition, according to a report (2017) by Indian Council of Medical Research, Public Health Foundation of India, and Institute for Health Metrics and Evaluation.

Figure 1
The Gas monitoring system with sensors (NO_2 & O_3) and 6Low PAN wireless data transmitter.

At this time, the influences of different sources of air pollution on human health are not well understood, given the lack of knowledge of air pollutant concentrations across India. To address this, a large, multi-institutional project on **Air Quality Monitoring Streaming Analytics on Temporal Variables from Air Quality Monitoring (SATVAM)** with IIT-Bombay and IISc as collaborating institutes from India and Duke University from the U.S. has been recently funded by the Indo-U.S. Science and Technology Forum. A system like SATVAM that we propose, can collect this information nation-wide sustainably and at a low-cost and will allow policy makers and citizens at large to deploy data-driven control and preventive mechanisms. The key objective

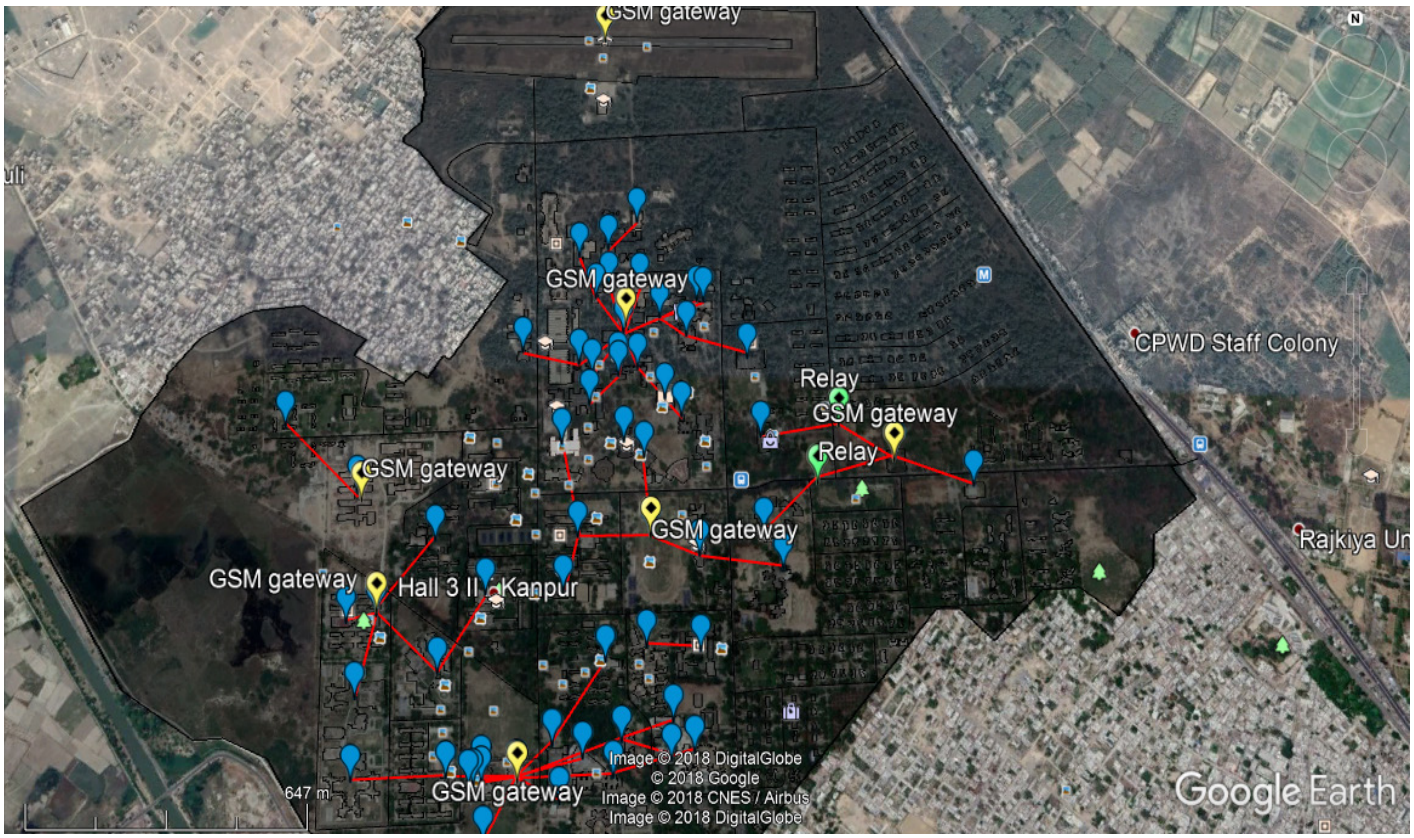
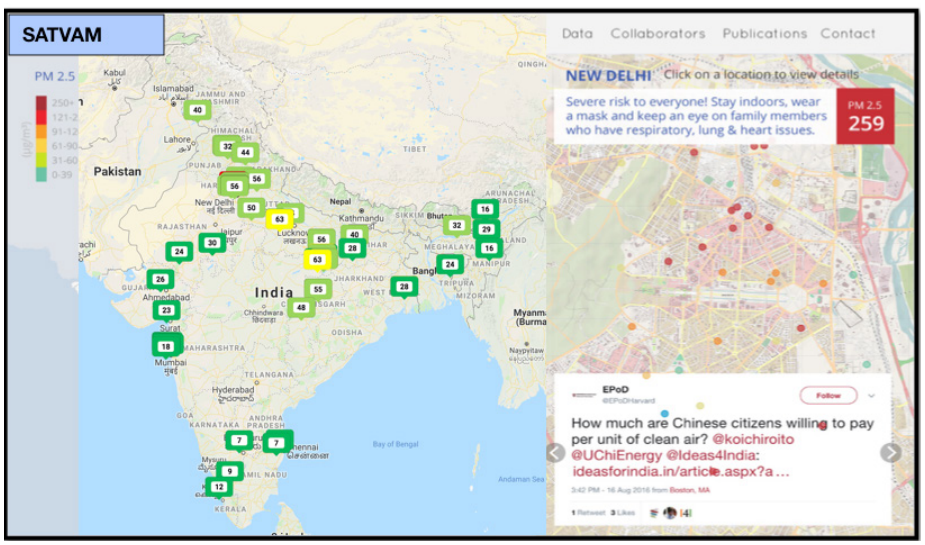


Figure 2: Geospatial view of draft deployment plan of motes and air quality sensors in IIT-K based Sub-GHz mote platform

of this project is to scale air quality monitoring by developing low-cost, energy self-sufficient air quality sensors that can be calibrated on the fly to transmit data seamlessly via cloud servers.

The SATVAM Gas monitoring system uses the Alphasense NO_2 & O_3 sensors which are connected to a System on Chip (SoC) module built using the TI CC2538 ARM Cortex-M3 running the ContikiOS. The module is configured to transmit over the 6LowPAN protocol stack.

The system we propose will provide long-range wireless data loggers which are energy self-sufficient using solar harvesting followed by energy storage such that uninterrupted monitoring of air pollutants is ensured in the remotest areas where either power lines have not reached, or scarce, or still face long power outages. Novel technique such as Thermoelectric Generation will be used to enhance the overall efficiency of the energy conversion. Initial results obtained thus far have been very encouraging.



SATVAM : Nationwide Real-time Air Quality Outlook

High-Resolution Air Quality Monitoring with Low-Cost Sensors

FOR A BREATH OF FRESH AIR

Bharadwaj Amrutur*, Navakanta Bhat*, Himanshu Tyagi*, Aditya Gopalan*, Chandra Shekhar P.*, Sridhar S.*, Rakshit Ramesh*, Vijay Mishra*, Mahesh Kashyap* Ajay Agrawal#, Suhas Bose# E S Kim$, Bhaskar Krishnamachari$ and George Ban-Weiss$

Indian Institute of Science, Bangalore, INDIA; #Central Electronics Engineering Research Institute, Pilani, INDIA; $University of Southern California, Los Angeles, U.S.A.

Air Pollution in Indian cities has emerged as a very serious public health problem. Low-cost sensor devices along with the calibration techniques will have the potential to revolutionize air quality monitoring.

A recent WHO study identified that India is home to 14 of the 15 most polluted cities in the world. Sources of air pollution in India range from vehicle emissions and traffic congestion to biomass and fuelwood burning. Poor air quality has serious health impact not just for vulnerable sections (children and the elderly), but also for otherwise healthy adults. Outdoor air pollution has been identified to be the fifth biggest killer in India and has been implicated in respiratory and cardiovascular diseases as well as asthma, bronchitis, lung-cancer, acidosis etc. Carbon Monoxide (CO) can cause harmful health effects by reducing oxygen delivery to the body's organs and can be fatal at high concentrations. Sulphur Dioxide (SO_2) can cause respiratory illnesses while short term Nitrogen Oxide (NO) exposures may cause airway inflammation and increase respiratory symptoms in

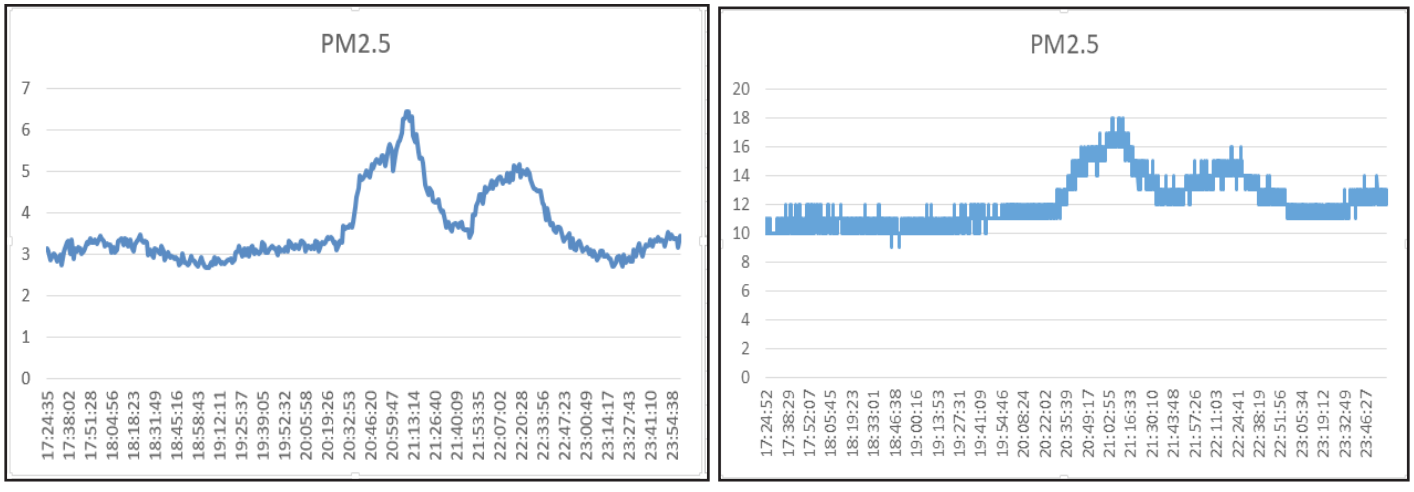


Fig. 1 : Left panel shows data from an expensive, higher quality sensor, while the right panel is data from a low cost sensor. Notice the disparity in the readings for PM2.5 concentration.

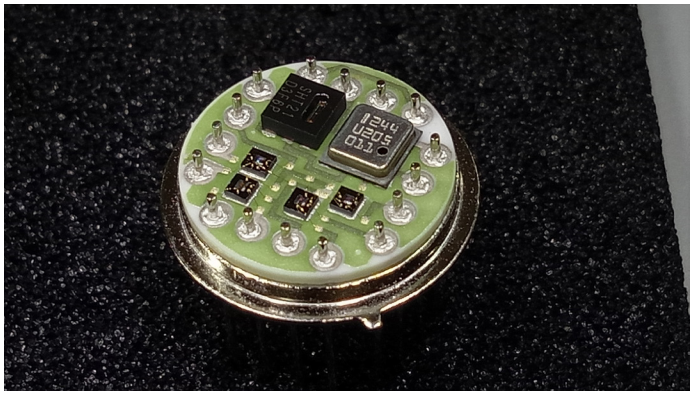


Fig 2 : Metal-Oxide gas sensors developed at IISc.

people with asthma. Children are at great risk from exposure to Ozone as they are more likely to be active outdoors when Ozone levels are high.

The first step towards mitigating air pollution is to reliably measure the amount of pollutants in air at a given location. Air quality index (AQI) is the measure of how good or bad the quality of air is over a region and is calculated based on measured concentrations of 8 different pollutants including CO, SO_2 and particulate matter (PM) of size upto 2.5µm and 10µm in diameter. In India, an AQI between 0-100 is considered to be safe while an AQI above 200 is considered harmful for humans. Concentration of pollutants are typically measured at a few monitoring stations using expensive reference grade equipment whose cost can run up to one Crore rupees. Many manufacturers have recently come out with lower cost equipment, with reasonable quality, but these too can cost up to seven lakh rupees. Thus it is impractical to deploy many such monitoring equipment and hence the pollution data we currently get is very sparse at kilometres level granularity. In this context, developing low-cost sensors that can reliably measure the concentration of the pollutants and can be deployed in large numbers at even 100s of meter spacing becomes important[1]. However low-cost sensors have a problem in terms of the quality of data they produce as can be seen in data from two sensors in Fig. 1, with the right panel from a low cost sensor. Thus if one wants to successfully use low cost sensors, it is critical to address this quality disparity issue.

Scientists from Indian Institute of Science, Bangalore (IISc), in collaboration with the Central Electronics Engineering Research Institute, Pilani (CEERI) and University of Southern California (USC), are currently working on a project funded by Indo-U.S. Science and Technology Forum (IUSSTF) to address this specific issue of quality of low-cost air quality sensors. The Center for Nano Science and Engineering at IISc Bangalore has developed low- cost, metal oxide based gas sensors[2].

The semiconductor-like, mass fabrication process to manufacture these, enable low production costs. A similar process is used by CEERI to develop Volatile Organic Compounds (VOC) sensors. The Robert Bosch Center for Cyber-Physical Systems at IISc will be deploying these sensors, along with a few commercially available sensors (such as Bosch's CLIMO) both at IISc and at the Smart-City testbed at the Electronics City, Bengaluru. The air quality data will be collected via the middleware framework developed by the Robert Bosch Center at IISc[3] and will be used for data analytics and modelling studies. Colleagues from the Electrical Communication Engineering department at IISc, will analyse this data and develop algorithms for both estimating the quality of the data, as well as techniques to correct the data (or calibrate the sensor readings). A combination of data-driven machine learning approach along with traditional dispersion based physical models for air quality will be used to explore possible solutions.

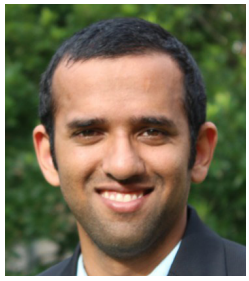
These low-cost sensor devices, along with the calibration techniques, will have the potential to revolutionize air quality monitoring and can be used to develop detailed spatiotemporal maps of pollutants. Such maps can be potentially used to determine the exposure to pollution for each individual. For example, given a route taken by a person to their work-place, the total exposure for the person during travel can be determined, thereby providing the person with a choice of taking an alternate less-polluted route[4]. Knowing air quality reliably has implications for not only public health, but also urban traffic.

1. Kumar, Prashant, et al. "The rise of low-cost sensing for managing air pollution in cities." Environment international 75 (2015): 199-205.
2. Prajapati, Chandra Shekhar, et al. "Single Chip Gas Sensor Array for Air Quality Monitoring." Journal of Microelectromechanical Systems 26.2 (2017): 433-439.
3. Amrutur, Bharadwaj, et al. "An open smart city IoT test bed: street light poles as smart city spines." Proceedings of the Second International Conference on Internet-of-Things Design and Implementation.
4. Skjetne, Erik, and Hai-Ying Liu. "Traffic Maps and Smartphone Trajectories to Model Air Pollution, Exposure and Health Impact." Journal of Environmental Protection 8.11 (2017): 1372. ACM, 2017.

Pulmoscan®

BREATHING EASY

Anurag Agarwal
CSIR-Institute of Genomics & Integrative Biology, INDIA



Gaurav Patel
Cognita Labs LLC, U.S.A.

Ashutosh Sabharwal
Cognita Labs LLC, U.S.A.

Chronic lung diseases are amongst the top three threats to global health. Of these, Chronic Obstructive Pulmonary Disease (COPD) and asthma are not just the most common, but also increasing in prevalence.

The clinical presentation of COPD may be as innocuous as a chronic cough that won't go away and as severe as acute respiratory failure. Clinical diagnosis can often be wrong in absence of objective tests of lung function. Spirometry, the commonest and most well accepted test, requires coordinated sharp forced expiratory effort by patients and takes time and training to be done properly. It requires comprehension on part of the test subject, making it unsuitable for a large number of young children with asthma, and is hard to do, making it poorly suited for elderly people with COPD. The class of tests known as Forced Oscillation Technique (FOT) has shown the most promise as an alternative to spirometry, requiring minimal instruction and training and therefore suitable for all ages. Such oscillometric devices are more sensitive than spirometry for early small airway disease and all such devices can additionally be used to perform spirometry. The currently poor penetration of oscillometric devices into the international market is almost entirely attributable to bulkiness, non-portability, cost

of currently available solutions (USD 25000 for an oscillometer versus USD 3000 for high-quality spirometers). The insurance coverage of oscillometric tests in the U.S. is also inconsistent, leading to financial disincentives in the U.S. market for physicians who choose to use oscillometry. However, a handheld, portable, battery operated oscillometer with automated analysis would be very suitable for high volume practices in India, where the time-efficiency and ease of use of oscillometers would make up for reasonable additional input costs.

Our group thus set out to build a new generation oscillometer with novel design and analysis elements to improve ease of use and reduce costs. We had a clear scientific and business plan, uniquely strengthened by the complementarity and synergy between the Indian and U.S. partners. Cognita Labs is a spinoff from Rice University with a strong background in engineering sciences. Its mission is to develop novel healthcare products with innovative deployment models. Cognita Labs had already built an advanced easy to use spirometer, ***UltraSpiro***, with an assistive coaching tablet application and a cloud support to allow minimally trained medical professionals to conduct accurate spirometry. The experience and partnerships created during building and testing ***UltraSpiro*** provided a strong technological head-start for building ***Pulmoscan***®. The experience in clinical applications of oscillometry at the CSIR-IGIB CoE for Translational Research in Asthma & Lung disease provided unique knowledge resources. The synergy led to a successful application to USISTEF for building a novel portable forced oscillation based device for simple yet more sensitive detection of airway disease. A lot was learnt in the process of applying and much useful feedback was gained, with the project taking full shape by 2016.

Over the last 2 years, we have seen ***Pulmoscan***® go to an actual two-hand bulky prototype running off a tablet, to a sleek one handed standalone version with visual cues for correct use and automated test completion. New engineering and design was required to come this far and IP protection has been applied for. The prototype was tested in over 1000 subjects, getting operational feedback from clinical partners. Many of these partners now anxiously await a market version that they can recommend to their friends for purchase. The results from the initial testing against in-market models have been promising with broad agreement with existing brands.

There have been challenges as well. It has become obvious to users that while all devices provide ability to distinguish normal and diseased subjects, there is fundamental variability in the absolute values and cutoffs between oscillometric devices, due to different approaches to a complex mathematical problem; unlike spirometers that are inherently simple in their design and principle. This can be confusing to clinicians. We have recently become part of an international group of oscillometer manufacturers and users that aims to best standardize the outputs across devices in a way that would make it uniform and more convenient for physicians.

We now expect to get ***Pulmoscan***® into the market in 2019, a bit later than originally envisioned, but very much past the steepest part of the climb. Many people, including those at USISTEF who saw its potential, deserve the credit for getting us as far as we have come, and we take the opportunity to thank them. We would strongly encourage device developers to take this opportunity and apply for the USISTEF Program. ●

ORTHOPAEDIC REGENERATION

Partnering Institutions

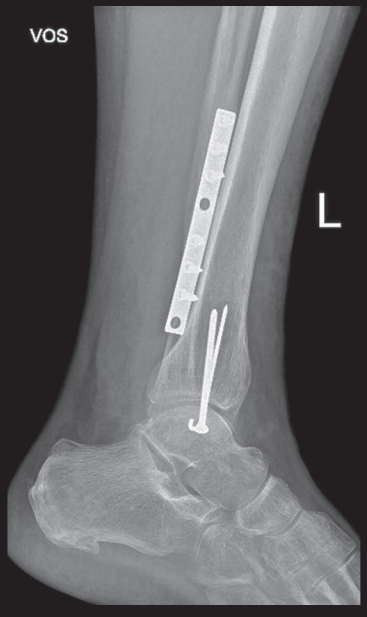
INDIA
- SASTRA University, Thanjavur
- Thanjavur Medical College, Thanjavur

U.S.A.
- University of Connecticut, Farmington
- Stevens Institute of Technology, Hoboken

Principal Investigators

S. Swaminathan
SASTRA University, India

Sangamesh Kumbar
University of Connecticut, U.S.A.



Traumatic tissue injuries to the ankle syndesmosis are treated surgically by fixing metallic screws of titanium or stainless steel between the tibio–fibular joints, which in turn transiently replace the normal articulation. The treatment strategy has evolved from rigid fixation to dynamic fixation of syndesmosis that permits early return of motion at the joint. Although metallic screws are considered to be the gold standard, screws interfere with the native fibula movement thereby altering the biomechanics of ankle joint.

In addition, mechanical mismatch between soft-tissue and metal leads to stress shielding at the tissue interface, hampering load transfer across the graft and promotes tissue damage and implant loosening. Buildup of particles around the materials due to wear would potentially incite inflammatory response and activate osteoclasts thereby triggering the osteolysis and other associated hypersensitivity reactions. These concerns demand revision surgery for the removal of conventional metallic screws. However, surgical removal of the conventional metallic screws after healing is associated with undesirable complications such as painful morbidity, removal of bone tissue if any, oseointegration and screw breakage.

Emergence of biodegradable screws promises the gradual dissolution and metabolization of implants by the body and thereby overcoming the limitations of metallic screws. Biodegradable screws are potential substitutes that replace metallic screws as it does not require any surgical excision. Synthetic polymers such as polylactide, polyglycolide and poly (lactide-co-glycolide) are widely used in the fabrication of syndesmotic screws.

These biodegradable screws have been found to reduce the stress shielding effect as it gradually transfers the load to the healing tissue while it resorbs. Though these polymeric screws show minimal interference of MR imaging, implantation of these screws has been associated with many clinical complications such as screw fracture, sterile abscess formation, and acute inflammation with the screw displacement due to the lack of host-tissue integration and accumulation of acidic degradation products. Poor integration with surrounding host tissue is mainly due to the lack of any bioactive signals in these synthetic biomaterials.

The pathological complications of biodegradable screws obviate the surgical removal of polymeric screw fragments. Hence, this Indo-U.S. Joint Center on **"Orthopedic Regeneration"** is currently working in the development of interconnected porous biodegradable orthopedic screws for syndesmotic injuries. We hypothesized that the open porosity of the screws helps to immigrate the healthy cells from the surround tissue. The tissue surrounding the screws become fragile leading to localized osteopenia due to the employment of physical force during implantation. Thus the open porous structures of these screws would facilitate the mechanical interlocking of the weak surrounding tissue with the screws that would directly avoid the screw loosening. Fabricating screws with open porous structures using traditional fabrication techniques like compression molding and machining are tricky. Hence, 3D printing technology has been employed for large scale manufacturing of biodegradable cortical screws for surgical implantation in syndesmotic injuries. For the first time, porous biodegradable screws have been fabricated with tunable porosity promising high reproducibility for complex porous architecture thus maintaining a balance between function and mass transport. This additive manufacturing based porous biodegradable screw designs would avoid the existing biological complications of polymeric screws by exhibiting excellent oseointegration along with neo-vascularization.

Indo-U.S. Joint Center for Orthopaedic Regeneration

The primary focus of this partnership is to develop personalized orthopedic implants with the ideal chemical and biological cues using 3D printing technology, which would essentially enhance the healing rate. This Joint Center helps the researchers in both countries to move towards the personalization of the implant by sharing newer technologies and process development on either side. Further, the Joint Center allows the partnering investigators to go beyond the primary focus of their individual research to address important areas of biomedical research, education, work force development, and cultural exchange. The center intends to build on long standing collaborations between the partnering investigators, and will leverage complimentary expertise and combined infrastructure to meet the proposed biomaterial challenge.

Our collective work in the area of personalized orthopedic implants has shown the benefits of 3D printing process; design precision, synthesis of semi-synthetic polymer, interconnected porous architecture enabled the biomimicry in maintaining the adequate mechanical properties and vascularization without eliciting inflammatory responses. Indian researchers are involved in the development of biodegradable orthopaedic screws using 3D printing technology.

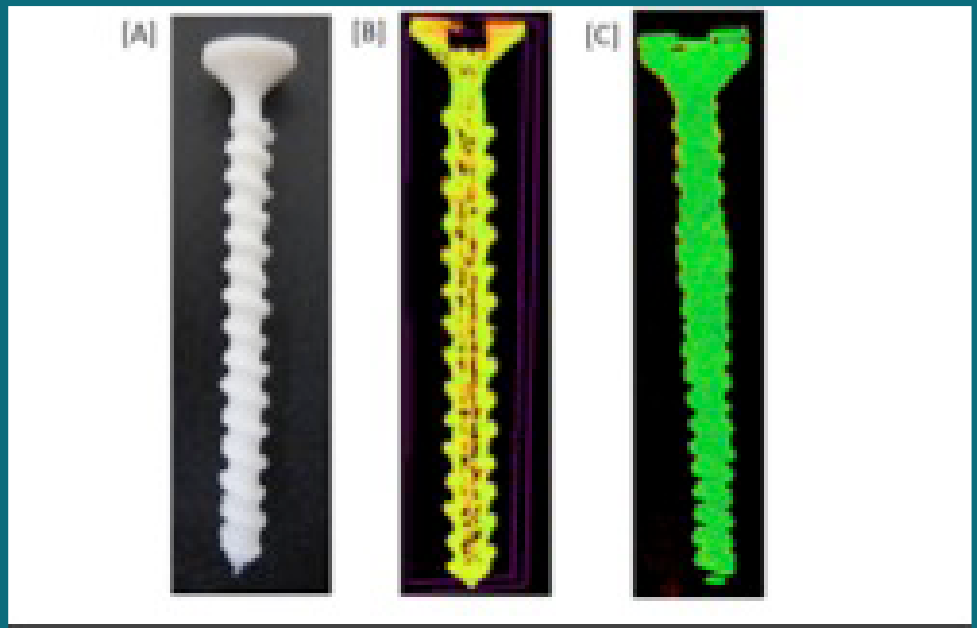


Figure 1 : [A] Optical image of 3D printed cortical screws: MicroCT image of [B] interconnected porous screws; [C] Non-porous screws

Figure 1 shows the optical image of 3D printed biodegradable screw and the microCT image confirms the interconnected porosity of the screws. Histopathological observations followed by subcutaneous implantation of screws showed no local irritation and observed the presence of minimal inflammatory cells. Interestingly, higher neo-vascularization was seen in tissues implanted with porous screws while there was no evidence of neo-vascularization in non-porous screws. The extent of neo-vascularisation is strongly related to osteogenesis, which is proved in literatures, where neo-vascularisation initiates bone remodeling and repair.

Use of 3D printing technology in the development of orthopaedic screws accomplishes the ease of fabrication, good reproducibility, use of versatile biomaterials and tunable porous architecture. Different head designs were evaluated for enhancing the structural and torsional stability of screws to avoid easy breakage and larger head region above implanted surface that causes microfractures in bones. A better head design was identified as a part of the project to achieve congruous fit while fixations at inclined positions. Furthermore, developing polymer-processing methodologies for semi-synthetic biomaterials may result in new polymeric materials with the ideal chemical and biological properties for 3-D printing.

Scientists from the U.S. are working on the synthesis of newer semi-synthetic polymers and the in vitro characterization of orthopaedic screws. U.S. counterparts recently filed a patent disclosure on the novel bio-erodible cellulose derivative proposed in this study includes 1-oxo-1H-pyrido[2,1-b][1,3]benzoxazole-3-carboxylic acid (AMP) a highly fluorescent molecule as an ionic group to facilitate ionic conductance in the biologic environment. The unusual fluorescent activity of AMP is attributed to additional pair of electrons on the heteroatoms such as oxygen and nitrogen and their circulation around π electrons. This bio-erodible polymer measured a stable ionic conductivity (IC) of 0.12 S/cm up to 6 weeks in vitro at pH 7.4 and 37°C which is significantly higher than many other reports using hydrogels. Additionally, scaffolds derived from this material can be imaged though skin by near infrared imaging (wavelength ~550nm) for the scaffold tracking purposes following its implantation. This AMP-biopolymer will degrade by the cleavage of AMP-ester linkage and cellulose acetate (CA) erodes from the site of implantation via hydrolytic and enzymatic means in in the physiologic environment.

In summary, this Virtual Networked Center is working towards the newer generation of biomaterials and the new knowledge generated via this collaborative program will be extremely useful to develop integrated approaches that harness physical, chemical and biological cues for the development of personalized implants.

सत्यमेव जयते

Department of Science & Technology
Govt. of India

IUSSTF
Indo-US Science and Technology Forum

Building Energy Efficiency

Higher & Advanced Network (BHAVAN) Fellowships

Recognizing that climate change, clean and efficient energy and environmental protection are among the biggest challenges facing India and the United States; cooperation between our countries is critical in tackling these issues. In order to address the need for human resource development and capacity building in these frontier areas, the Department of Science and Technology, Govt. of India and the Indo-US Science and Technology Forum (IUSSTF) have partnered to launch the **Building Energy Efficiency Higher & Advanced Network (BHAVAN)** Fellowships with an aim to nurture contact between students and scientists of science and technology from India and the US.

Eligibility

For Student Internships

- Indian citizens currently pursuing a Ph.D. or M.Tech. in the field of Building Energy Efficiency or in engineering / science / technology / architecture with a major area of research related to Building Energy Efficiency at a recognized institution of higher education and learning in India.
- Age: Up to 32 years as on 31 December 2018.

For Fellowships

- Indian citizens having Ph.D. / M.Tech. / M.Arch. in Science, Engineering, Technology or Architecture in the specific area of Building Energy Efficiency. Relaxation in qualifications could be made for individuals with proven and considerable research background and experience who are part of a recognized institution of higher education and learning in India.
- Applicants must be pursuing independent research on extra-mural / industry-supported research projects and should have published in high-impact academic journals.
- Age: Upto 40 years as on 31 December 2018.
- Employment: A regular position in a public-funded R&D Laboratory / S&T institution/ recognized academic institute (University / College) in India.

The Program is envisaged to:

- provide opportunity to best and brightest Indian students and scientists to gain exposure and access to world class research facilities in US academia and labs;
- promote research and capacity building in the frontline area of Building Energy Efficiency;
- encourage and motivate outstanding students to take up research as a career path; and
- pave 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.

Fellowship/Internship includes

- Monthly Stipend
- Return Airfare
- Contingency Allowance
- Health Insurance

Duration

- Internship: Minimum 3 months and upto 6 months
- Fellowships: Minimum 3 months and upto 12 months

Submission Deadline: 30 November 2018

For program information contact:

Indo-US Science and Technology Forum
Fulbright House, 12, Hailey Road, New Delhi - 110001, E-mail: energy.fellowship@indousstf.org

For Proposal Guidelines and Format please visit: **www.iusstf.org**

सत्यमेव जयते

DEPARTMENT OF BIOTECHNOLOGY
Ministry of Science & Technology

IUSSTF
Indo-US Science and Technology Forum

Indo-U.S. GENOME ENGINEERING / EDITING TECHNOLOGY INITIATIVE (*GETin*) PROGRAM

Acknowledging importance of strategies & techniques in genome modification, as modern day essential tools for research & development, the Department of Biotechnology (DBT), Govt. of India along with the Indo-U.S. Science & Technology Forum (IUSSTF) announces fellowship program between Indian Institutes and premier U.S. Universities, in significant areas of Genome Engineering / Editing Technology *(GETin)*.

The program is open to individuals whose research work has an interface with Genome Engineering / Editing Technology studies

PROGRAM MODULE & ELIGIBILITY:

STUDENT INTERNSHIP

- Indian citizens currently pursuing Ph.D. on a full-time basis in various forefront disciplines of biotechnology (agriculture, health sciences, bio-engineering, biomedical, fundamental biology or allied fields) at a public- funded R&D lab / S&T Institute / recognized academic institute / University / College in India.
- For a period of up to 6 months
- Age: Up to 32 years as on 31 December 2018

OVERSEAS FELLOWSHIP

- Indian citizens having Ph.D. in Life Science, Biotechnology, Engineering or Technology, holding a regular position in public funded R&D Lab / S&T Institution / recognized Universities / Colleges in India.
- For a period of up to 5 weeks to 12 months
- Age: Up to 45 years as on 31 December 2018

VISITING FELLOWSHIP

- U.S. Faculty or Foreign Post Docs presently working in U.S. (for at least two years) in a field having an interface with Genome Engineering / Editing Technologies.
- Applicant should possess Ph.D., M.D, M.S or equivalent degree with outstanding track record as evident though publications and other recognitions
- For a period of 2-3 months
- Age: Up to 60 years as on 31 December 2018

PROGRAM IS ENVISAGED TO:

- Provide opportunity to best and brightest Indian students and scientists to gain exposure and access to world class research facilities in leading U.S. institutions;
- Promote research and capacity building
- Encourage and motivate outstanding students to take up research as a career path;
- Create attractive avenues for skilled overseas researchers to pursue R&D in Indian or to mentor Indian scientist (s); and,
- Pave way for the next generation scientists and technologists from India to interact with American peers, in the frontline area of Genome Engineering / Editing Technology; thus helping to build long-term R&D linkages and collaborations.

FELLOWSHIP / INTERNSHIP INCLUDES:

- Monthly Stipend
- Contingency Allowance
- Return Airfair
- Health Insurance

SUBMISSION DEADLINE : 30th September 2018

For proposal Guidelines and format visit: Website: **www.iusstf.org** or write to **getin@indousstf.org,**

For program information contact:

Dr. Dhananjay Tiwary
Department of Biotechnology, Govt. of India
CGO Complex, Lodhi Road. New Delhi-110003

Dr. Chaitali Bhattacharya
Indo-U.S. Science and Technology Forum
Fulbright House,12 Hailey Road, New Delhi-110001

Giving WINGS TO TALENT

To address the need for human resource development and capacity building in science and technology, IUSSTF is committed to nurture contacts between scientists and students from India and the United States. It has been unambiguously demonstrated that providing students and young scientists with an exposure to cutting-edge scientific research experiences at a formative stage not only broadens their intellectual horizons but also leads to increased engagements in scientific and technological research careers. In this section of Connect, we share with you the experiences of some of our bright, young Interns and Fellows in their own words!

Water Advanced Research and Innovation Program

Ram Chavan
BITS Pilani, Goa Campus

I am working on development of algae based wastewater treatment systems and its integration to microalgal bio-refinery at Dept. of Biological Sciences, BITS Pilani, KK Birla Goa Campus. During summer 2017, I got an opportunity to work at Dept. of Biochemistry at the University of Nebraska-Lincoln (UNL) under the WARI Program.

Working at UNL has immensely helped me not only to understand my own self in a better way but also to change my perception about algal research. During my stay at UNL, I learned about the feasibility of novel drug like compounds with potential for production and storage of lipid in microalgae wherein we can reduce the wastewater treatment cost by using wastewater as a valuable resource and earn extra revenue out of value-added products produced from microalgal biomass.

During my internship tenure, I have visited large scale algae culture facilities at University of California and SCRIPPS Institute of Oceanography, San Diego to gain a better idea about the pros and cons of commercializing algal fuels. This Internship also helped me to attend the world's biggest microalgae event-ABO Summit-2017 that helped me intract with microalgae professionals from all over the world to explore mutual ideas, interests and possibly some fruitful collaborations in the near future. Of course all these events and my experiences will help me in strengthening my research in India.

I feel honored and privileged to have been a part of this competitive program which helped me to work with experts in this field and bestowed me with friends for lifetime. Summing up, this was an enriching program where my professional skills grew manifold and reinforced my desire for further research in this area.

Water Advanced Research and Innovation Program:
Webpage: http://www.iusstf.org/program/water-advanced-research--innovation-fellowship
E-mail: water.fellowship@indousstf.org

Bhaskara Advanced Solar Energy Program

Vamsi Krishna Narra
CSIR-Indian Institute of Chemical Technology, Hyderabad

The Bhaskara Advanced Solar Energy (BASE) Fellowship program is a great opportunity for Ph.D students who are working in the area of solar energy. Under this program, I worked at Georgia Institute of Technology under the supervision of Prof. Seth Marder who is the former Director and currently an Associate Director of the Center for Organic Photonics and Electronics (COPE) at Georgia Tech. I worked on a project titled "Non-fullerene acceptors for photovoltaic applications". Under this, I developed my skills on electron transport layers [ETLs] and hole transport layers [HTLs] in perovskite solar cells and organic semiconductors for energy-related applications. This research could be helpful to implement the state-of-the art materials for enhancing the stability and efficiency of the solar cells. Prof. Marder's research group provided an excellent platform for the development of materials for organic electronics and organic solar cells. Additionally, I was exposed to the world-class facilities and working environment with people from all over the world and also attended notable lectures by eminent scientists. I also visited Georgia Aquarium, World of Coca-Cola, CNN Center, National Aeronautics and Space Administration (NASA). I am thankful to IUSSTF for providing me with this great opportunity which has made me a more confident researcher.●

Bhaskara Advanced Solar Energy Program:
Webpage: http://www.iusstf.org/program/bhaskara-advanced-solar-energy-fellowship
E-mail: energy.fellowship@indousstf.org

IUSSTF-Viterbi Program

Arka Sadhu
Indian Institute of Technology – Bombay

I got the opportunity to work under Prof. Ram Nevatia in the Computer Vision Lab, University of Southern California and my work was based on Media Forensics which largely deals with the detection of tampered media (images in my case) and identifying the manipulations. It was extremely inspiring to work under the guidance of a professor who gives you so much time for discussing the project at length.

Los Angeles is a great city with good weather. Along with my fellow Viterbi-India Scholars, I visited a lot of places in and around Los Angeles like Universal Studios, Hollywood, Six Flags Magic Mountain, Santa Monica Beach, San Diego Zoo to name a few.

One thing I can definitely say is that the IUSSTF-Viterbi summer internship has far exceeded my expectations. If someone would have said that I would be working with a super-cool Professor on state-of-the-art research topics and working with extremely supportive colleagues, walking down the streets of Hollywood on the weekends, I would have not really believed it, but I am so glad that all of this came out to be true! Without a shred of doubt, I can say that this has been one of the most enlightening experiences which would play a pivotal role in my life. I thank the IUSSTF-Viterbi Program from the bottom of my heart for giving me this opportunity.

IUSSTF-Viterbi Program:
Webpage: http://www.iusstf.org/program/iusstf-viterbi-program
E-mail: viterbi-india@indousstf.org

S.N. Bose Scholars Program

Traveling to India has been a wonderful and unforgettable experience. India is a country diverse and rich in history, cultural traditions, languages, food... the list goes on. To be immersed in all of it feels thrilling, and is a beautiful adventure. But being away from home comes with challenges. You may feel culture shock, see things that disturb you, or feel isolated.

Traveling through a university program has been the perfect way to experience India for the first time. The US Bose Program is excellent in that it puts you on campus, connects you with a professor in your field, and pays for the trip. Having a safe home base to retire to amid the commotion of city life adds quite a bit of comfort to the experience. Having other students working in the same field nearby makes it easier to meet new people and learn. Plus, doing research gives you something to work toward, and helps you gain real experience. On top of that, the money from the stipend and accommodation go far in India, making it a very sweet deal. To be young and a college student, and to have access to all that this program has to offer is quite the opportunity; an opportunity I would advise anybody to take. ●

Sterling Just
University of Wisconsin-Madison

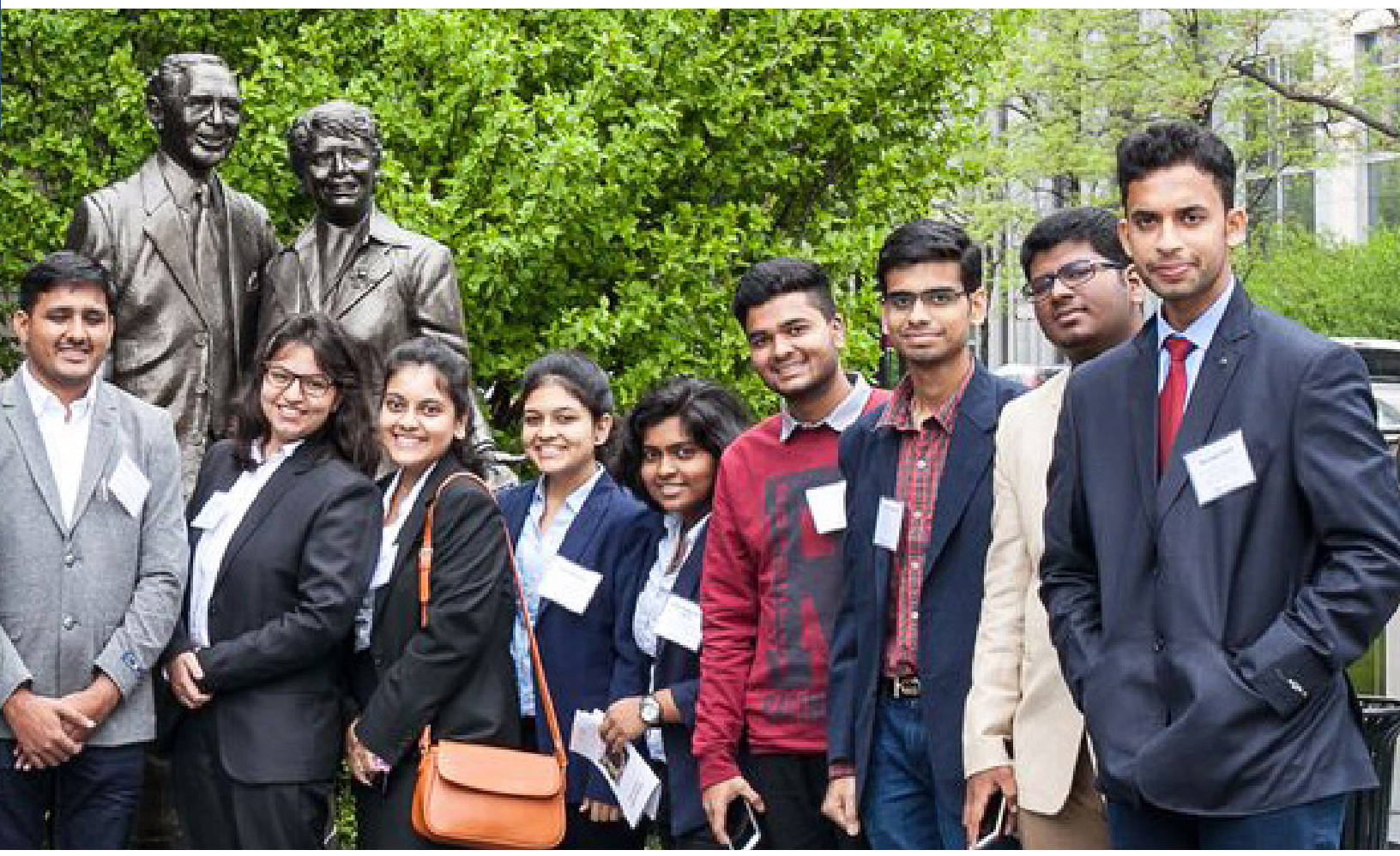
S.N. Bose Scholars Program:
Webpage: http://www.iusstf.org/program/sn-bose-scholars-program
E-mail: bose@indousstf.org

Khorana-Bose

Student Orientation 2018

An Orientation Program for students selected for the prestigious **Khorana Program for Scholars** and **S.N. Bose Scholars Program** was held at Knapp Center for Biomedical Discovery, University of Chicago on May 19, 2018.

From a total of 97 Khorana and SN Bose Scholars, 65 attended the Orientation which was hosted by WINStep Forward, and University of Chicago Vice Provost, Dr. Bala Srinivasan.



Joint Clean Energy Research & Development Center (JCERDC)

Indo-U.S. Smart Grids Meeting

Recognizing the success of the first phase of the JCERDC Program, the United States and India agreed to extend and expand the program and launched a new track on **Smart Grid and Energy Storage**. Both nations have long emphasized the critical importance of expanding clean energy research, development, manufacturing and deployment, which increases energy access and reduces greenhouse gas emissions.

After an intensive multi-level review, a consortium titled **"UI-ASSIST: U.S.-India collAborative for smart diStribution System wIth Storage"** was selected for award in September 2017. The team is led by Indian

Institute of Technology Kanpur and Washington State University, Pullman.

Within the UI-ASSIST team there are nine universities, three research institutes/labs, eight power utilities and ten power industry manufacturers/vendors. Together they address large global strategic needs in both India and the United States in mitigating climate change; ensuring mutual energy security; and building clean energy economies that drive investment, job creation, and economic growth. The team aims at developing and aligning these core priorities for relevant and impactful work that will fulfill deliverables set up by the funding agencies.

The first joint meeting of the project was held on 2nd and 3rd August 2018 at Portland. The Lead Indian and U.S. Partners of the consortium came together to celebrate the theme, *Creating Connections*, emphasizing the collaborative benefits that are generated from close cooperation among Indian and U.S. teams.

JUNE - 2018

Coastal Groundwater Dynamics: Combining Future Climate Change and Human Development (CLIMWAT-2018)

07-09 June 2018
Puducherry, INDIA

Coastal aquifers are susceptible to degradation due to its proximity to seawater, higher population, climatic influences and human intervenes. For coastal aquifers to continue being used as operational freshwater reservoirs, the development of better tools that facilitate the prediction of aquifer behaviour under climate change conditions and human interference is essential. This Indo-U.S. Workshop on ***Coastal Groundwater Dynamics: Combining Future Climate Change and Human Development (CLIMWAT-2018)*** organized by **K. Srinivasamoorthy** (Pondicherry University, Puducherry) and **Saugata Dutta** (Kansas State University, Manhattan) aimed to discuss and explore areas for advancing scientific understanding of groundwater and future climate change scenarios. It brought together researchers and practitioners from Indian and U.S. universities/organizations to provide a platform for the exchange of knowledge and experiences in combating coastal groundwater dynamics relating to future climate change and human influences using integrated techniques in specialized areas such as Technologies for vertical electrical tomography in assessing coastal vulnerability; Combined hydrochemistry, Isotopes and REEs in isolating coastal dynamics, past and present climatic influences; Application of flow, transport and geochemical modeling for coastal groundwater; Neural networks, multivariate statistical modeling for sea water intrusion and water quality parameters; Biogeochemistry of aquatic ecosystems, adaptability of biota to climate change, exposure to contaminants; and, Remote sensing and GIS techniques for coastal groundwater resource management, climate change resilience and protection scenarios.

JUNE - 2018

5th Bangalore Cognition Workshop

17-29 June 2018
Bengaluru, INDIA

Cognitive neuroscience research in India has roots in studies of head-injury and neurosurgical patients in the 1950s. This tradition of clinical research continues, but over time it has become augmented by basic cellular and systems level research in neuroscience, as well as by the development of non-clinical programs in neuroscience education. The ***5th Bangalore Cognition Workshop*** organized by **Balaji Jayaprakash** (Indian Institute of Science, Bangalore) and **Thomas D. Albright** (Salk Institute for Biological Studies, La Jolla) represented a continuation of efforts to build human resource development in the country in Cognitive Sciences. It was conducted through four modules which were aimed at providing a focused introduction to the problems and concepts in various aspects of neuroscience. These modules were: Vision, Attention – Multiple Scales, Motor Systems and, Memory and Spatial Navigation. The workshop introduced distinguished researchers with expertise in nearly every aspect of neuroscience to the participants. The goal of the workshop was to inspire Indian students to pursue a career in neuroscience while providing a mechanism to facilitate scientific exchanges between India and the United States.

AUGUST - 2018

3D Printing: A Solution for Medical Devices

17 August 2018
Thanjavur, INDIA

Developing biomedical implants and devices have a huge demand in the medical industry as it extends the essential function of human organs thereby improving the quality of patient lives. However, designing distinct types of medical implants or devices demands specific sets of requirements in terms of dimension, architecture and material selection since the application

of these biomedical implants may vary based on the implantation site. Emergence of 3D printing technology in the healthcare sector enables the rapid customization of implants with high precision and enables new product developments right from the anatomical models, mass production of patient-specific implants to personalized surgery. The main concept of this joint workshop on ***3D Printing: A Solution for Medical Devices*** organized by **S. Swaminathan** (SASTRA University, Thanjavur) and **Sangamesh G. Kumbar** (University of Connecticut, Farmington) was to inculcate 3D printing solutions to a broad group of people for replicating the complex prototypes identical to shape, texture and material properties of medical implants. The workshop provided awareness on the quick production of personalized implants and prostheses using 3D printing. It also provided a strong platform to healthcare sector people such as researchers and manufacturers for exploring the emerging technique to fabricate more standard and intricate customized orthopedic implants within few hours. The technical sessions led by eminent researchers from both India and U.S.A. brought forth problems associated with current methodologies; emergence of newer technologies that are aiming to promote the exchange of ideas and to create a platform for collaborative research in the biomedical field.

AUGUST - 2018

Live Operative Training Workshop and Recent Updates on Urology Malignancies

18-19 August 2018
New Delhi, INDIA

The ***Indo-U.S. Live Operative Training Workshop on Urology Malignancies*** was organized by **Niraj Kumar** (Safdarjang Hospital and Vardhman Mahaveer Medical College, New Delhi) and **Murugesan Manoharan** (Miami Cancer Institute at Baptist Health South Florida, Miami) to discuss the recent updates in urological malignancies like prostate, bladder, kidney, adrenal, testis and penile carcinoma. Young Urologists from India got an opportunity to learn both basic and advanced laparoscopic and robotic surgical skills along with management of patients having various uro-oncological cancers including prostate, renal and bladder cancers. This encouraged them to start performing various advanced robotic surgical procedures including robotic radical prostatectomy, robotic simple prostatectomy, robotic radical cystectomy, etc. helping to significantly reduce the morbidity & mortality of critically ill cancer and kidney failure patients. The workshop witnessed an active interaction, discussion and exchange of knowledge between the Indian and American participants.

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 months

Internship provides
- Monthly stipend • Accommodation • Airfare

Eligibility
- U.S. Citizens or permanent residents and Indian Citizens
- 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.

US institutions interested in sending students and Indian institutions interested in hosting under the RISE program may contact us.

For Application Guidelines & Format
www.iusstf.org

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

Submission deadlines
31 May
30 November

Award announcements
15 July
15 January

IUSSTF
Indo-US S&T Forum

Indo-US Science & Technology Forum

Who we are

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.

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
- 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

We invite

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

Bilateral Indo-US Workshop/Symposia & Indo-US Training/Advanced Schools

Submission Deadlines	Award Announcements
1 March	31 July
31 August	31 January

Indo-US Public-Private Networked Centres & Indo-US Knowledge R&D Networked Centres

Submission Deadline	Award Announcement
31 August	31 January

How to contact us?

Indo-US Science and Technology Forum
Fulbright House
12 Hailey Road,
New Delhi - 110 001

For program details visit:
www.iusstf.org

IUSSTF: Catalysing Indo-US Science, Technology and Innovation Collaborations for 18 Years!