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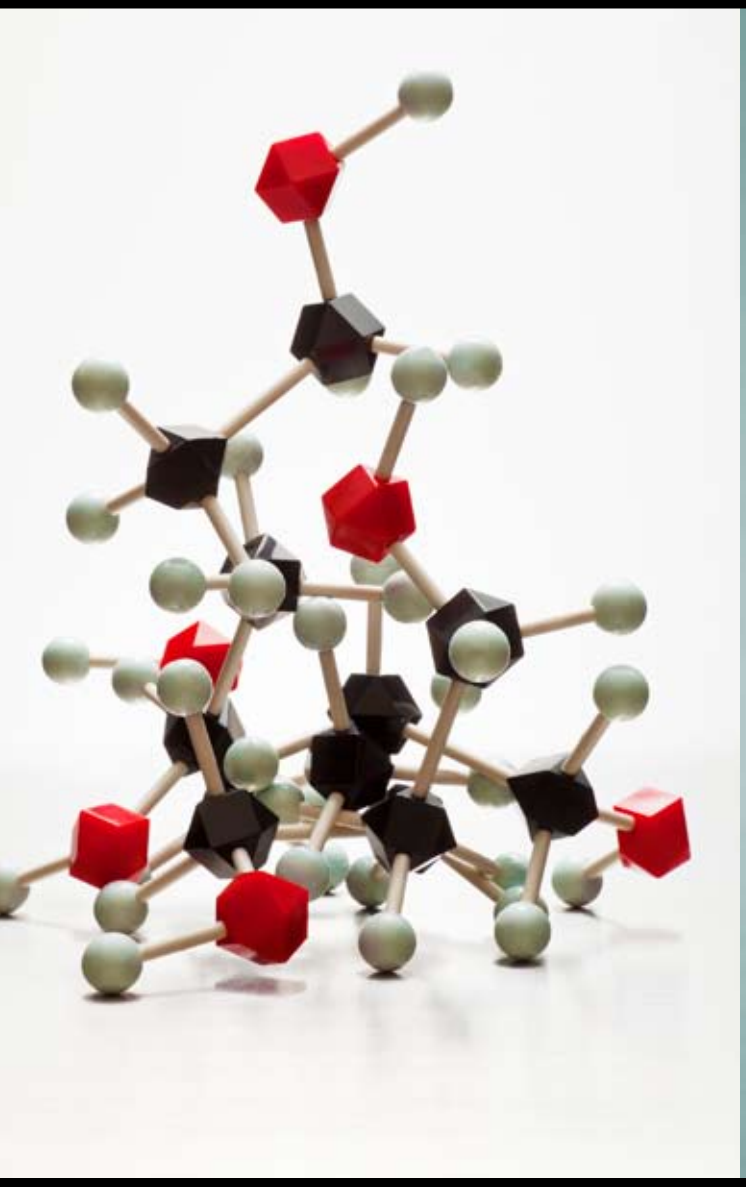

IUSSTF
Indo-US Science and Technology Forum

Drug Discovery and Development

Molecule to Medicine

REPORT

Indo-US Joint Networked Center

Biomaterials for Healthcare

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

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

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

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

Justin Seil, Graduate student, Brown University

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

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

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

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

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

Siddhi Gupta, National Metallurgical Laboratory, Jamshedpur

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

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

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

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

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

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

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

Nikolas Wilson Hrabe, University of Washington, Seattle

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

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

At Triveni Sangam

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

David A. Stout, Brown University, USA

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

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

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

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

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

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