

## **Meeting Global Challenges Metrics Purdue University's Discovery Park**

Purdue University's Discovery Park was created in 2001 to transform how knowledge is generated, integrated, and applied in local, regional, state, national, and global businesses and communities. Discovery Park is an integrated, interdisciplinary cluster of eleven centers that supports discovery and learning and drives the delivery of innovation.

Purdue University's Strategic Plan, approved in 2008 under President France Córdova, explicitly establishes three synergistic priorities for the University: Discovery With Delivery, Launching Tomorrow's Leaders, and Meeting Global Challenges. This document reflects metrics for the pivotal role that Discovery Park plays in Purdue's capabilities to meet global challenges.

Following is the list of global initiatives facilitated by Discovery Park in 2007. The following pages provide the entire list of initiatives.

1. **4** global research projects were funded. Some of these projects have long-term funding. For example, Purdue faculty and researchers from the Korean Institute of Science and Technology have held three international symposia. The first, in Seoul in September 2006, focused on molecular imaging and nanomedicine and led to a \$4.5 million, nine-year "Global Research Laboratory (GRL)" award from the Korean Ministry of Science. This award funded one global research project in 2007.
2. **9** global activities (joint workshops/symposia/conferences) included leadership or participation by faculty/staff/students affiliated with Discovery Park
3. **10** global partnerships were finalized through the leadership of faculty and staff affiliated with Discovery Park
4. **34** undergraduate students participated in programs to study internationally through the support and placement of Discovery Park programs and staff
5. **18** graduate students participated in global research or research conferences/workshops through the support and facilitation of Discovery Park staff/faculty
6. **35** faculty and staff participated in global research or research conferences/workshops through initiatives led by Discovery Park
7. **2** research articles were published with global collaborators (calendar year 2007 data)
8. **19** international speakers were invited to Discovery Park events to speak and interact with faculty, staff, and students

Examples of these metrics follow on the next pages.

## **GLOBAL RESEARCH PROJECTS**

The discoveries underway by faculty associated with Discovery Park reach many parts of the world. The list below reflects funded research in India, China, and Korea. The research partnership in Korea is part of a larger collaboration with the Korean Institute of Science and Technology.

Several of the funded projects are part of longer projects. For example, Professor Tim Fisher (ME), his family (wife Amy and three children ages 9-14), and one of his doctoral advisees (Kyle Smith, BSME '07) spent nearly five months in Bangalore, India from late December 2007 to mid May 2008. Professor Fisher served as a visiting faculty member at the Jawaharlal Nehru Centre for Advanced Scientific Research, whose founder is Purdue alumnus Dr. CNR Rao, FRS (PhD Chem '58, Hon Doc.'82). Many very fruitful research collaborations emerged, including studies of hydrogen storage materials, electrically enhanced carbon nanotube structures, and hybrid organic-inorganic solar cells. This experience was also very enriching for Professor Fisher's family. The children attended a private school whose student population was nearly 100% Indian, and Amy spent several days each week teaching elementary school children at a free school that served a slum area of Bangalore.

The list reflects the collaborative nature of the funding for global research projects.

- Studies of carbon nanotube, Timothy Fisher (Purdue) and C.N.R. Rao (India). Funded by National Science Foundation and Jawaharlal Nehru Center for Advanced Scientific Research, Bangalore.
- Strategic Deployment of Vehicle Detectors, Srinivas Peeta, Professor of Civil Engineering, Purdue University (PI), Shou-Ren Hu, Assistant Professor, National Cheng Kung University (Co-PI). Funded by NEXTRANS (U. S. Department of Transportation) and the National Cheng Kung University.
- Addressing Uncertainties in Travel Time Estimates using Artificial Intelligence Techniques for Intelligent Transportation Applications, Srinivas Peeta (Purdue), Partha Charkroborty, (IIT Kanpur, India). Funded by the Indo-US Science and Tech. Forum.
- Molecular Imaging and Nanomedicine for Therognosis Using Nano-Bio Materials, James Leary and Kinam Park (Purdue); Ick Chan Kwan and Kuiwon Choi, Korea Institute of Science and Technology. Korean Ministry of Science Global Research Laboratory. Funded through Global Research Award with the Korean Institute of Science and Technology.

## **GLOBAL ACTIVITIES**

The leadership of Discovery Park is dedicated to increasing the participation of Purdue faculty/staff/students in international activities. The representative programs listed below connect Discovery Park centers with differing parts of the world.

- Symposium on Bionanotechnology and Pharmaceuticals, 13-14 March 2008, Center for Cellular and Molecular Biology, Hyderabad India
- Joint India-US workshop on nanoscale nanomaterials for enhanced energy transport, conversion and efficiency, Jawaharlal Nehru Center for Advanced Scientific Research and J.F. Welch Technology Centre, GE Global Research, August 19-21, 2008, Bangalore, India
- 2007 China-US Joint Workshop Environmental Aspects of Bioenergy Production and Sustainability, September 11-13, 2007 in Knoxville, Tennessee, USA
- Third Annual Purdue-KIST (Korean Institute of Science and Technology) symposium for Nanomedicine and Theragnostics, June 1-4, 2008, Seoul
- Designing Cyberinfrastructure to Enable US-China Collaboration in Tobacco Research Workshop, Beijing, China, March 2008

## **FORMAL GLOBAL PARTNERSHIPS**

As an early step in the path to funded research projects and student programs, Discovery Park leaders are working with several global partners to formalize these collaborations. These formal agreements will facilitate quicker and easier response times for new ideas and opportunities. These agreements also solidify the work that has already been done to create collaborative partnerships.

The following agreements have been finalized.

- (Memorandum of Understanding) Beihang University (China)
- (Nondisclosure Agreement) Center for Cellular and Molecular Biology, Hyderabad (India)
- (Nondisclosure Agreement) Tata Innovation Center, Tata Chemicals Ltd., Pune (India)
- (Memorandum of Understanding/Product Lifecycle Management Advisory Board Membership) Satyam Computer Ltd., Hyderabad (India)
- (Memorandum of Understanding) Department of Science and Technology, New Delhi (India)
- (Memorandum of Understanding) National Taiwan University (Taiwan)
- (Memorandum of Understanding) Korean Institute for Science and Technology (South Korea)
- (Master Science Research Agreement) Themework Analytics
- (Contract) BP Azerbaijan
- Satyam Computer Services Ltd. – Full Product Lifecycle Management Center of Excellence industrial advisory board membership (2008)

## **UNDERGRADUATE LEARNING GLOBALLY**

Global learning opportunities for students were facilitated through Discovery Park in three ways: (1) A Study Abroad Program sponsored by the Burton D. Morgan Center for Entrepreneurship for students in the Certificate in Entrepreneurship and Innovation Program; (2) Internships at global companies; and (3) research internships.

- 2008 Summer International Discovery Undergraduate Research Intern at Tata Institute of Fundamental Research/Mumbai/National Center for Biological Sciences, India, Aditi Trehan, Biological Sciences;
- Research/Mumbai/National Center for Biological Sciences, India), Rachana Raghothama, Biomedical Engineering
- Summer 2008 interns at Infosys, India
  - Devanshu Singh – Software Engineer and Technologies Lab unit, Purdue Calumet—Engineering, Science and Math;
  - Gautam Agarwal – Product Lifecycle and Engineering Labs unit;
  - Manish Kumar - Software Engineer and Technologies Lab unit, Mathematics;
  - Smriti Bajaj - Software Engineer and Technologies Lab unit, Purdue Calumet—Engineering, Science and Math;
  - Tejas Kulkarni - Software Engineer and Technologies Lab unit, Electrical and Computer Engineering
- Summer 2007 interns at Infosys, India,
  - Benny Leong, College of Technology
  - Mohmmad Siddiqui, Computer Science
- In May 2008, twenty-five undergraduate students were part of a Purdue global entrepreneurship program designed to provide students with an understanding of business and innovation in China as well as to understand what it's like to live and work in China. Students participated in an April seminar and then a Maymester study abroad to Beijing, China for two weeks.

## **GRADUATE LEARNING GLOBALLY**

Discovery Park affiliated faculty avidly involve their graduate students in global learning opportunities. Often, this involves funding for these students to participate in international workshops and conferences. Here are representative examples of global graduate students' research projects.

- Advanced Modern Biology Program in 2007 and 2008, Mumbai, Enge Langhor (VM); Jacob Hale (Physics)
- 2008 Sustainable Development and Climate Change, Delhi, India, Dileep Birur (Agriculture); Kyle Smith (Mechanical Engineering); C.K. Castillo (Earth and Atmospheric Sciences)
- 2008 Bionanotechnology and Pharmaceuticals, Hyderabad, India, David Jaroch (Biomedical Engineering); Felice Butler (Pharmacy)
- 2008 Scalable Nanomaterials Research Symposium, Bangalore, India, Aaron Franklin; Scott; B. Cola; Jeremy Schroeder, D. Pandey; H. M. Aktulga; G. Prakash; K. Biswas; Kyle Smith
- 2008 Summer International Discovery Undergraduate Research Internship at Purdue, Rubul Mout and Sujaan Das, Tata Institute for Fundamental Research, India

**FACULTY WORKING GLOBALLY**

Discovery Park affiliated faculty are active participants in the global research community. This work informs their research initiatives and those of their global partners.

- Brian Rinner (Forestry & Natural Resources) and Caleb Phillips (Forestry & Natural Resources) conduct research in Azerbaijan and Russia, respectively
- Geoff Laban (Forestry & Natural Resources) participated in the NanoECO International Conference in Monte Verita, Switzerland March 2-7, 2008)
- T. Fisher (sabbatical), India
- J. Irudayaraj; J. Leary; P. Basu; P. Sharma; C. Buck; Y. Yeo; S. Byrn; C. Svensson (all participated in the Bionanotechnology symposium in Hyderabad, India)
- M. Abu-Omar; A. Alam; V. Balakrishnan; S. Datta; S. Garimella; D. Janes; R. Reifenberger; P. Sharma; T. Sands; L. Stanciu. Participated in a “Joint India-US Workshop on Scalable Nanomaterials for Enhanced Energy, Transport, Conversion, and Efficiency” in August 2008, Bangalore, India.
- Ned Howell (Satyam, Hyderabad visit)
- G. Cooks (Dec 2007 visit to India)
- Amy Childress, Barb Fossum, and Jim McGlothlin (International Programs Global Partners Grant to India, summer 2007 visit)
- Gabriela Weaver spent two months in Australia setting up a CASPiE partnership
- Jeong-Gyu Kim (visiting scientists from Korea, hosted by Linda Lee)
- John Bickham, Ryan Hubinger are part of the International Whaling Commission meetings
- (Spring 2008) Nan Kong, RCHE faculty and assistant professor in biomedical engineering, hosted visiting scholar Lei Zhao, Ph.D. from Tsinghua University, Beijing, China as part of a Visiting Indian and Chinese Scholars grant through Purdue’s Office of International Programs.
- Ahmed Elmagarmid, Qatar University
- Rudolf Eigenmann, Waseda University, Japan (2/08); Barcelona Super Computing Center, Barcelona, Spain (1/08); Kampur, India (12/07); Switzerland, Spain, Italy (5/08)
- Barb Fossum, Mumbai, Delhi, Bangalore, India (8/07); Beijing, China (3/08); Hong Kong, China (6/08)

## GLOBAL COLLABORATION ON PEER-REVIEWED PUBLICATION

As Discovery Park affiliated faculty become more integrated into the global research community through many of the initiatives listed in this report, their collaboration on scholarly publications will continue to increase. Here are two identified for the 2007 calendar year.

- Dirk Schweitzer, Junyi Zhu, Gotam K. Jarori, Junichi Tanaka, Tatsuo Higa, Vincent Jo Davisson & Paul Helquist, Synthesis of carbamate derivatives of iejjimalides. Retention of normal antiproliferative activity and localization of binding in cancer cells (2007) *Bioorganic & Medicinal Chemistry* 15, 3208-3216
- Santonu Sarkar, Girish Maskeri Rama, and Avinash C. Kak, API-Based and Information-Theoretic Metrics for Measuring the Quality of Software Modularization, *IEEE Transactions on Software Engineering*, Vol. 33, No. 1, January 2007

## GLOBAL SPEAKERS AT DISCOVERY PARK

Discovery Park welcomes the opportunity to bring distinguished scientists to speak about their research and their research agendas. These guests are encouraged to interact with faculty and students. These events are always opportunities for our worldwide guests to learn about the goals of Discovery Park and to ascertain if collaborations are possible.

The following individuals were hosted at Discovery Park during this time period.

- C.N.R. Rao, India
- A. Mitra, India
- S. Trikha India
- Murali Sastry, Tata Chemicals Ltd., India
- Gail Cassel, Lilly
- Maneesh Gangal, Satyam, India
- S. Goparaju, Infosys, India
- Rajiv Agarwal, India
- Paul Vaidya, India
- Jingwen Chen, Dalian University of Technology
- Ken Wai, Hinds International, LTD, Hong Kong
- Paolo Missier, Manchester, England
- Professor David Abramson, Monash University, Australia
- Ruy deOliveira, University of Bern
- Sandro Macchietto, Imperial College, London
- Charles Immanuel, Imperial College, London
- Paolo Missier, Manchester, England
- Ruy deOliveira, University of Bern
- Oh In-Hwan, Korean Institute of Science and Technology, South Korea