

## eDimensions, March/April 2015 Issue



### Dean's Welcome

The faculty and students in the School of Engineering and Technology at IUPUI have the knowledge and abilities to inspire, energize, and lead innovation on our campus, in the community, and beyond for the betterment of our society.

You will enjoy reading about some recent accomplishments in this issue of *eDimensions*. For example, mechanical and biomedical engineering students won the top prizes in the *Ideas Solving Social and Economic Challenges* competition.

The dedication of our faculty and students to improving the quality of the human condition through technological advancements is amazing. You will enjoy reading more about a recent National Science Foundation CAREER Award to a biomedical engineering faculty member whose work will help advance effective treatments for highly metastatic tumors, such as pancreatic cancer. An additional example is the work led by a mechanical engineering professor who is developing nanostructured materials to improve battery technology. This work will reduce the size and increase the charge life of battery-powered electronic devices, including medical devices, as well as dramatically increasing the range of electric vehicles.

Finally, our faculty members' influence on the continuous improvement of engineering and engineering technology education reaches far beyond Indiana. You will be proud to read the news about one of our engineering technology faculty being selected as a member of the Engineering Technology Accreditation Commission of ABET.

As always, thanks for your support of our School!

David J. Russomanno, Ph.D.

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### IUPUI mechanical and biomedical engineering students win top prizes in pitch competition



Motor sports and manufacturing have always played an integral role in the economic health of Indianapolis and the state. So it should come as no surprise that the winning idea at Indiana University-Purdue University Indianapolis' annual student pitch competition was all about keeping those investments safe.

SafeBay, a team of three School of Engineering and Technology students, took home the judges' top prize of \$2,500 as well as the Audience Choice award of \$1,000 in the Fourth Annual [Ideas Solving Social and Economic Challenges](#) competition organized by IUPUI's

Office of the Vice Chancellor for Research.

Vice Chancellor Kody Varahramyan called the winning idea -- a protective steel enclosure for motorcycles idealized for public use in parking garages, apartment complexes and even university campuses -- a perfect blend of creativity, intellectual acumen and market demand.

"Based on what both the judges and the standing-room-only audience saw, this team came up with a unique idea that solved a problem that most motorcycle users have experienced at one time or another," he said. "And we all know Indiana residents love their motorcycles."

The competition, which drew 15 multi-student teams from across IUPUI schools and departments, encourages IUPUI students to come up with innovative ideas to solve real-world problems through new approaches, products, services or venture. Students were given up to three minutes to present their idea without the benefit of slides or props. Prizes are awarded to encourage and support students who might be in a position to move forward with their ideas.

"This was the fourth year we've run this pitch competition under the IUPUI Innovation-to-Enterprise Initiative, and I was delighted to see so many talented students from across campus participating with passion and creativity to improve societal and economic well-being," Varahramyan added.

William Pearson, a member of the winning SafeBay team, called the pitch competition an exciting stepping stone for advancing their innovation in the public eye.

"Building a pitch for SafeBay provided an opportunity to hone the team's direction, and it will be valuable to have in our portfolio for future pitch opportunities," he said. "Our winnings will be used toward building a prototype and for participating in the patent process."

A panel of expert judges from business and industry selected winning pitches to receive the awards.

"For Indianapolis' entrepreneurial sector, it is encouraging to see many excellent, innovative ideas coming from IUPUI," said judge Ann Wilson, co-founder and CEO of the Impact Venture Center. "Investors, take note! Several of this year's entrants are nearly ready for implementation and will yield strong profits and global markets."

For more information, contact Karen White at [kfwhite@iupui.edu](mailto:kfwhite@iupui.edu) or 317-274-1083 .

The 2015 competition winners and their innovative solutions are:

**SafeBay:** First place, \$2,500; and Audience Choice, \$1,000

**Team members:** William Pearson, Edward Kello and Jamie Rutan, Purdue School of Engineering and Technology, mechanical engineering majors.

**Project description:** SafeBay is a secure and effective means of public and personal storage for motorcycles. A balance between security and convenience makes these substantial steel enclosures a unique and improved alternative to options in the market today. SafeBay provides a parking and storage solution for the motorcyclist and financial gains for owners by offering plenty of surface area for art/graphics/advertising.

**NeoWarm:** Second place, \$1,500

**Team members:** Demicca Rice, Camron Dawes and Emily Ragozzino, Purdue School of Engineering and Technology, biomedical engineering majors; and Harrison Holmes, IUPUI University College, biomedical engineering major.

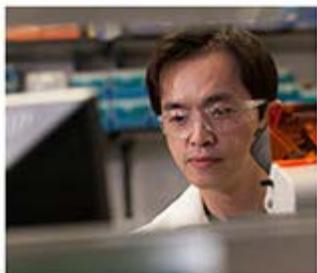
**Project description:** In the limited-resource regions of Africa and Southeast Asia, premature low-weight babies die

from hypothermia at a faster rate than elsewhere. The NeoWarm Pouch promotes skin-to-skin contact where the baby is warmed by lying against the mother's chest; when the mother is unavailable, the solar-powered pouch will heat the baby externally, monitor the baby's temperature and alert caregivers when the temperature is too low.

**LIRA Loans: a new lending model for 'Low Interest Rate Alternative' loans:** third place, \$500

**Team members:** Abigail Parham, IU School of Public and Environmental Affairs, civic leadership major; Phillip Mitchell, IU School of Social Work, social work major; Christopher Moeller, IU Robert H. McKinney School of Law, poverty law major.

**Project description:** The project is designed to address the public problem of payday loans in Central Indiana. The proposed model provides the same loans as the payday loans but at a much lower rate (36 percent vs. 390 percent) for a longer duration (30 days vs. 14 days).



### IUPUI biomedical engineering professor Chien-Chi Lin receives NSF Career Award

Chien-Chi Lin, an assistant professor in the Department of Biomedical Engineering at the School of Engineering and Technology at Indiana University-Purdue University Indianapolis, has been selected to receive a National Science Foundation Faculty Early Career Development Program Award. This award recognizes the highest level of excellence among early-stage researchers.

NSF awarded the \$490,000 grant for the project "CAREER: A reversible dynamic hydrogel system for studying stemness and drug responsiveness of cancer stem cells."

"A CAREER award from NSF is an exceptional achievement for a young faculty member," said Ed Berbari, chair of the Department of Biomedical Engineering. "It speaks to their accomplishments and promise in the future. Dr. Lin is an ideal candidate for this award, and his contributions to our department and our students will benefit our campus in many ways and well into the future."

According to the CAREER program, this is among NSF's most prestigious awards that support junior faculty "who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations. Such activities should build a firm foundation for a lifetime of leadership in integrating education and research.

This award will fund Lin's interdisciplinary research project integrating knowledge and technology from polymer science and engineering, and peptide and macromolecular chemistry, as well as cellular and molecular biology related to cancer stem cells. Cancer stem cells are highly metastatic and resistant to drug treatment, and many believe that understanding the behaviors of these cells may one day lead to the discovery of effective treatments against highly metastatic tumors, such as pancreatic cancer.

"I am honored to receive this CAREER award from the NSF Biomaterials Program," Lin said. "This award will allow my students and me to develop hydrogel matrices with highly controllable biophysical and biochemical properties for exploratory and mechanistic studies related to the phenotypes of cancer stem cells."

Lin's research has focused on the development of highly tunable hydrogels for tissue regeneration and drug delivery applications. Hydrogels, a type of crosslinked polymer that imbibes large amount of water without dissolving, have been extensively used in biomedical applications. In addition to hydrogels and cancer stem cell research, Lin plans to integrate the research results from this award into his teaching in both undergraduate and graduate levels.

He also plans to integrate his research into diverse educational outreach activities designed to promote the awareness of both biomaterials and cancer biology. These outreach activities will include participants from young and underrepresented groups at the campus level through the POWER and MEAP camps organized by the School of Engineering and Technology. Other outreach activities include free workshops with hands-on activities on hydrogel fabrication for high school educators as well as international students and researchers.



### Technology developed by IUPUI professor could redefine size, efficiency of batteries

Cell phones could be thinner and electric cars could go farther with technology and materials developed by Jian Xie, associate professor in the Department of Mechanical Engineering at Indiana University-Purdue University Indianapolis, in conjunction with Argonne National Laboratory.

Nature Communications, an open-access journal that publishes high-quality research from all areas of the natural sciences, is publishing Xie's paper, "Graphene-modified nanostructured vanadium pentoxide hybrids with extraordinary electrochemical performance for Li-ion batteries."

Xie — a faculty member in the Purdue School of Engineering and Technology at IUPUI and a member of the campus's Integrated Nanosystems Development Institute -- and his research team have developed graphene materials and technology that will have a significant impact on electronics and electric vehicles. According to the paper, this technology shows great promise in helping redefine the size and efficiency of a wide array of products, particularly batteries.

These nano-structured materials have applications in energy storage (batteries and super capacitors) and energy conversion (fuel cells), among others. Possible examples include cell phones one-third the thickness of current cell phones and electric vehicles with driving ranges three times farther than current models.

"Technology breakthroughs in today's world rely on our deep understanding of the fundamentals of materials, particularly on a nano-scale," Xie said. "This collaborative work is a great example of how we can benefit from understanding the properties and structure of graphenes and metal oxides as well as their fundamental issues — single sheet graphene, electronic/ionic conductivity, structural stability, etc. -- in order to solve engineering problems and develop applications. I am thrilled that this new approach will benefit the scientific community."

Xie's startup company, CE Helios, will commercialize this advanced technology. His approach will be used to develop next-generation battery technology that will have three times the current battery capacity — from 145 mAh/g of LiFePO<sub>4</sub> to 438 mAh/g of V<sub>2</sub>O<sub>5</sub>.

"In order to understand the extraordinary performance of the novel materials, the researchers carried out in situ high-energy X-ray diffraction and in operando X-ray absorption spectroscopy measurements at the X-ray Science Division's beamlines 11-ID-C and 20-BM-B, respectively," said Advanced Photon Source/Argonne National Laboratory physicist Yang Ren.

"Such a combined application of two powerful and complementary hard X-ray techniques at the U.S. Department of Energy's Advanced Photon Source not only elucidated the fundamental knowledge of the underlying mechanism at the atomic and electronic levels but also provided guidelines for future development of this new class of energy materials," he said.

Papers published by Nature Communications, a journal of the Nature Group, represent important advances of significance to specialists within each field. The journal has an Impact Factor of 10.742, according to the 2013 Journal Citation Reports Science Edition.

### **About Argonne National Laboratory**

Argonne National Laboratory seeks solutions to pressing national problems in science and technology. The nation's first national laboratory, Argonne conducts leading-edge basic and applied scientific research in virtually every scientific discipline. Argonne researchers work closely with researchers from hundreds of companies, universities and federal, state and municipal agencies to help them solve their specific problems, advance America's scientific leadership and prepare the nation for a better future. With employees from more than 60 nations, Argonne is supported by the Office of Science of the U.S. Department of Energy. The Office of Science is the single largest supporter of basic research in the physical sciences in the United States and is working to address some of the most pressing challenges of our time.

### **About the Integrated Nanosystems Development Institute at IUPUI**

The Integrated Nanosystems Development Institute is an interdisciplinary institute supported through the IUPUI Signature Centers Initiative in partnership with the Office of Vice Chancellor for Research, the School of Engineering and Technology, the School of Science and the School of Medicine. Over 30 faculty members from these schools are associated with INDI. These researchers have expertise in a wide range of interdisciplinary fields, including chemistry, physics, biology, electrical and computer engineering, mechanical engineering, orthopedics, cellular and integrative physiology, and pathology and laboratory medicine.

### **About the Purdue School of Engineering and Technology at IUPUI**

The mission of the Purdue School of Engineering and Technology at IUPUI is to be one of the best urban university leaders in the disciplines of engineering and technology recognized locally, nationally and internationally. The school's goal is to provide students an education that will give them the leverage to be leaders in their communities, industry and society.

### **About Indiana University-Purdue University Indianapolis:**

Known as Indiana's premier urban research and health sciences campus, IUPUI is dedicated to advancing the intellectual growth of the state of Indiana and its residents through research and creative activity, teaching, learning and civic engagement. Nationally ranked by U.S. News & World Report, Forbes and other notable publications, IUPUI has more than 30,000 students enrolled in 21 schools, which offer more than 250 degrees. IUPUI awards degrees from both Indiana and Purdue universities. eSearchers.



## IUPUI engineering technology faculty member named to accreditation commission

A Purdue School of Engineering and Technology faculty member has been named to a commission that accredits engineering technology programs at hundreds of colleges and universities in more than 20 countries.

Kenneth Rennels, P.E., Associate Professor of Mechanical Engineering Technology, Department of Engineering Technology, was appointed by the Board of Directors of ABET Inc. (formerly the Accreditation Board for Engineering and Technology) as a commission member of the 2015-2016 Engineering Technology Accreditation Commission.

ABET is a nonprofit, non-governmental organization that accredits college and university programs in the disciplines of applied science, computing, engineering, and engineering technology. Each of the discipline has its own accreditation commission.

ABET accredits over 3,400 programs at nearly 700 colleges and universities in 28 countries. The organization provides specialized, programmatic accreditation that evaluates an individual program of study, rather than evaluating an institution as a whole.

The voluntary accreditation, achieved through a peer review process, provides assurance that a college or university program meets the quality standards established by the profession for which the program prepares its students.