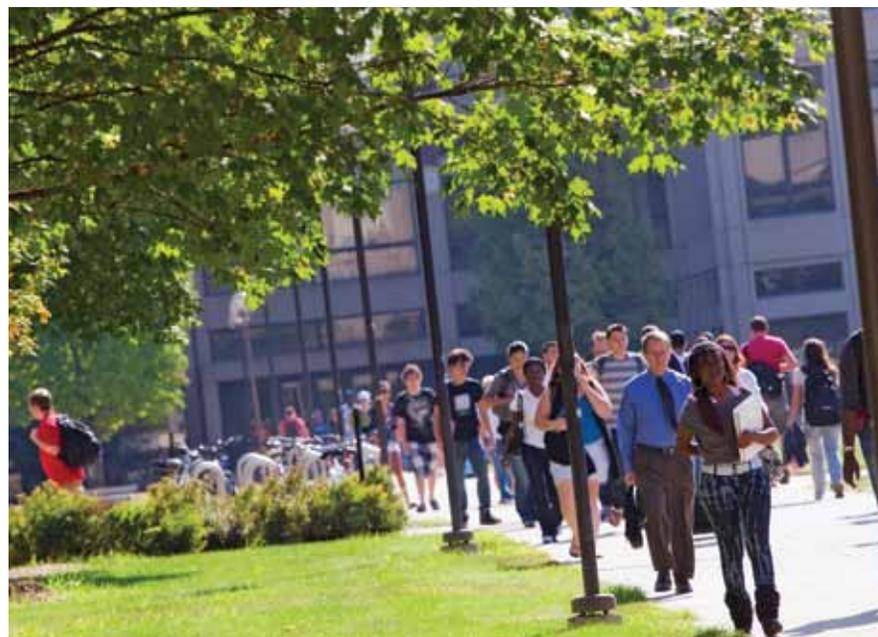




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VISION OF IMPACT  
THROUGH **DISCOVERY &**  
CREATIVE ACTIVITY

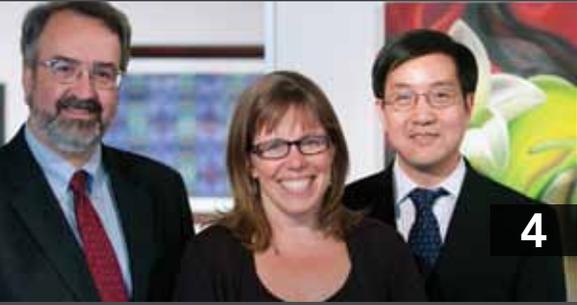
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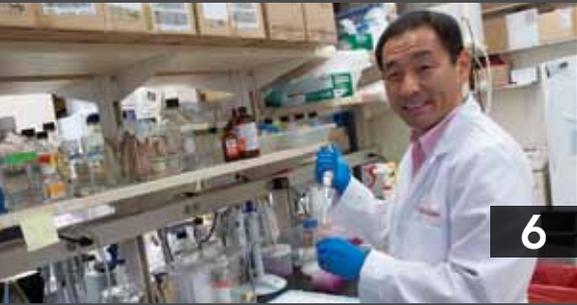
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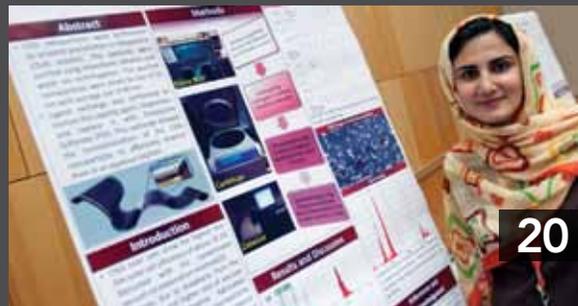
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# FROM INNOVATION TO IMPACT

*Message from the Vice Chancellor for Research*

Welcome to the IUPUI Annual Research Report for Fiscal Year 2011. This has been a remarkable year for research at IUPUI, as measured by research expenditures reaching an all-time high of \$287 million, and by the impact that the resulting research outcomes and creative activities are generating.

IUPUI researchers are expanding the frontiers of knowledge with an emphasis on addressing important national and global needs, and on taking knowledge generated from scientific inquiry and humanistic scholarship and transforming it into practices and solutions that improve people's lives, generate economic growth and contribute to social well being.

This report highlights the broad range of research and creative activity carried out by IUPUI investigators in Fiscal Year 2011. It is organized around campus-wide strategic initiatives, including the Translating Research into Practice (TRIP), the Signature Centers Initiative, the Indiana Clinical and Translational Sciences Institute (CTSI), the IUPUI Arts and Humanities Initiative, and the Imaging Research, and STEM initiatives. The report also provides a glimpse of the outstanding research infrastructure supporting IUPUI investigators, including world-class health and life sciences resources. Moreover, it highlights how, through technology transfer and commercialization, IUPUI research outcomes are making an impact on economic development and social well-being.

To learn more about the innovative research conducted at IUPUI, I invite you to visit our research webpage at [research.iupui.edu](http://research.iupui.edu), or contact us at [OVCR@iupui.edu](mailto:OVCR@iupui.edu).

Kody Varahramyan, Ph.D.  
Vice Chancellor for Research

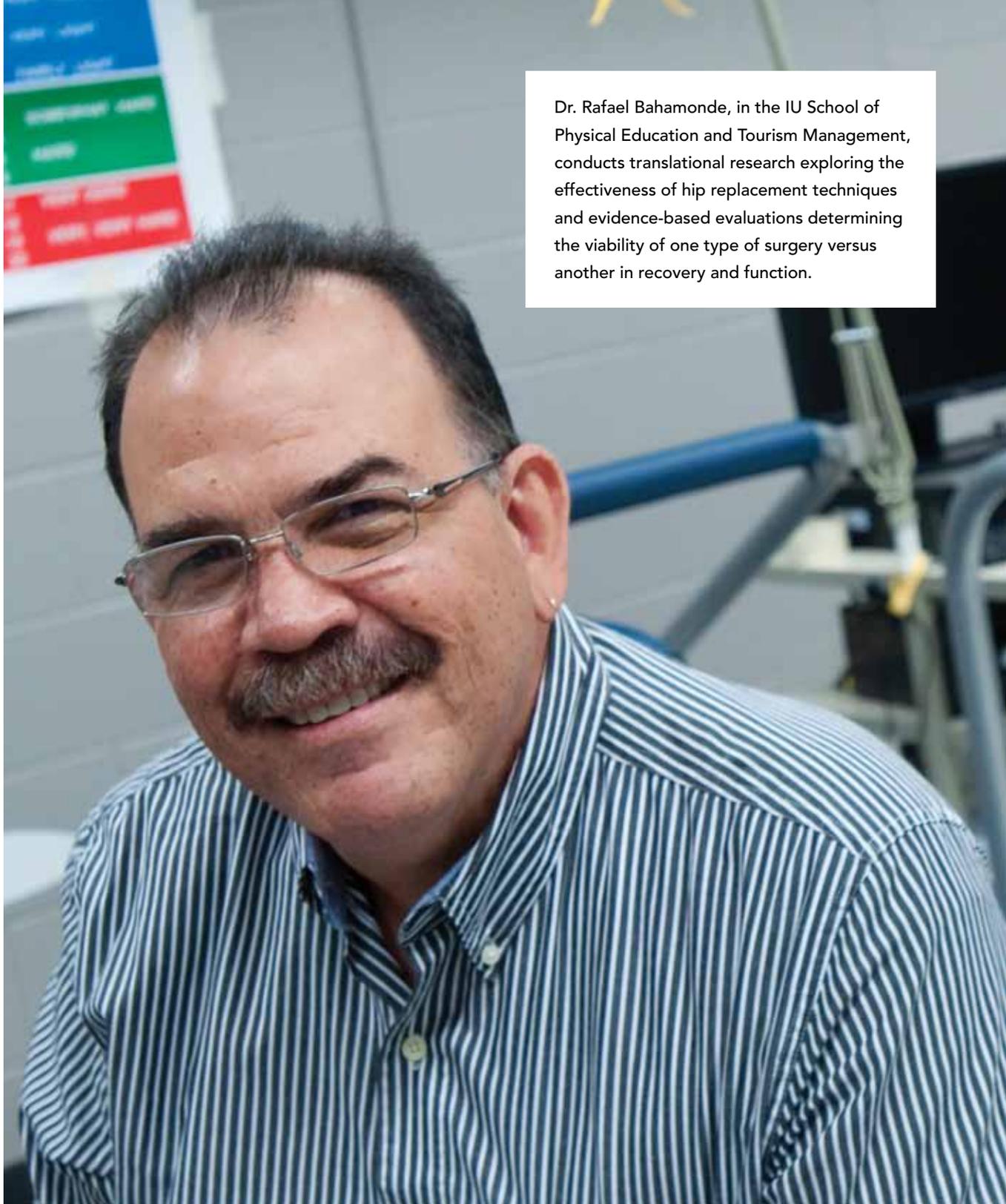


Chancellor Charles R. Bantz

# IUPUI TRANSLATIONAL RESEARCH INITIATIVE

Translating Research into Practice (TRIP)  
Mission 2011

Through the leadership and vision of Chancellor Charles R. Bantz, IUPUI continues to develop research that bridges the gap between the generation of new knowledge and using knowledge to impact lives every day. There are many campus successes to celebrate this year. In our recent TRIP Showcase, ten IUPUI scholars were recognized. Each is working to improve the lives of our citizens by translating their research, such that others can use their findings.



Dr. Rafael Bahamonde, in the IU School of Physical Education and Tourism Management, conducts translational research exploring the effectiveness of hip replacement techniques and evidence-based evaluations determining the viability of one type of surgery versus another in recovery and function.



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Dr. Joseph Defazio, in the IU School of Informatics, is working to decrease the risk of driving accidents associated with severe hypoglycemia among adolescents and young adults with Type 1 Diabetes.

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Dr. Alexia Torke, in the IU School of Medicine, investigates surrogate decision-making for hospitalized older adults and focuses on how communicative interaction affects understanding and choices by surrogates.

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Dr. Marquita Walker, in the IU School of Social Work, researches new ways to construct state and federal policies associated with the reintegration of displaced workers into the workforce.

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Dr. Dennis Fortenberry, in the IU School of Medicine, works on ways to reduce the re-infection rates of sexually transmitted diseases among adolescents and young adults.

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From left to right: Dr. Dennis Fortenberry, Teresa Bennett, Dr. Sandra Petronio, Stephan Viehweg

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The TRIP Initiative aims to create a campus-wide sustainable research culture that teaches, supports, and provides a platform to grow the production of translational research in every discipline represented on the campus. The current goals, under the direction of the IUPUI TRIP Team (Dr. Sandra Petronio, program director; Stephan Viehweg, program manager; Dr. Dennis Fortenberry, Chancellor's TRIP Faculty Fellow; Teresa Bennett, engagement liaison) include establishing programs that cultivate mentorship of researchers and students in learning best practices to accomplish translational research across the IUPUI campus; building infrastructure for the advancement of translating research into practice; engaging the larger community in targeting needs for translational research; developing paths for cross-fertilization of ideas among and between academic disciplines and community needs; supporting research training to grow new translational specialists; and finally providing outreach to the local community, state, nation, and world, bringing TRIP knowledge to others.

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# IUPUI SIGNATURE CENTERS INITIATIVE: CREATING A LEGACY OF DISTINCTION

The IUPUI Signature Centers Initiative is fostering the development of research centers that are bringing national and international distinction uniquely identifiable to IUPUI. In 2010, the first cohort of officially designated Signature Centers was announced. This year's cohort represents yet another stellar cadre of centers and institutes that are poised to tackle the most difficult challenges of their disciplines and fields. The three centers that received official IUPUI Signature Centers designation in 2011 are highlighted in this section.

## TRANSPORTATION ACTIVE SAFETY INSTITUTE

*Dr. Yaobin Chen, Director*

A trailblazing institute, the Transportation Active Safety Institute (TASI) strives to advance the use of active systems in automotive safety to reduce vehicle crashes and ultimately save the lives of drivers and passengers. In order to accomplish its goal, TASI draws from a broad range of university-wide expertise in vehicle control, sensor networks, wireless communications, and physiology to develop new and effective systems that bridge the gap between research and the development of consumer applications that enhance automobile safety.

## VASCULAR AND CARDIAC CENTER FOR ADULT STEM CELL THERAPY

*Dr. Keith March, Director*

The Vascular and Cardiac Center for Adult Stem Cell Therapy is establishing itself as a leader in the translation

of therapies involving transplantation of adult stem cells into patients with debilitating vascular and cardiac diseases. The center conducts multidisciplinary research aimed at repairing and enhancing the function of cardiovascular tissues, exploring novel approaches to repairing cardiac and vascular damage, and improving the function of the vascular system.

## ASSERTIVE COMMUNITY TREATMENT CENTER

*Dr. Michelle Salyers, Director*

The Assertive Community Treatment (ACT) Center is devoted to evaluating the effectiveness of mental health programs and training health specialists to implement evidence-based preventions that assist families in dealing with mental illness. The center also serves as an advocate for public policies that encourage implementation of effective and affordable support services for people with mental illness and their families.





From left to right: Dr. Yaobin Chen,  
Dr. Keith March, Dr. Michelle Salyers



# MEDICAL AND LIFE SCIENCES IMPACT

## NEW RESEARCH INSTITUTE PROMOTES DEVELOPMENT OF PERSONALIZED MEDICINE

One of the ways scientists and physicians plan to take full advantage of the discoveries made possible by advances in genomics and proteomics is the development of personalized medicine.

Selecting or adjusting treatments based on the individual characteristics of a patient and the particular variant of the disease promises to bring better, more cost-effective results.

The new Indiana Institute for Personalized Medicine will leverage the expertise of the IU School of Medicine (IUSM), Informatics, and Nursing with \$11.25 million in funding provided by the School of Medicine, the Department of Medicine, IUPUI, the Indiana Physician Scientist Initiative, and the Simon Cancer Center.

“Much of the future of health care is in personalized medicine, meaning more precise targeting of the right medication to the right patient at the right time,” said institute director David Flockhart, M.D., Ph.D.

An early example of personalized medicine is in breast cancer. Oncologists can now test breast tumors to determine whether they are the type stimulated by estrogen or whether they can be treated with hormone

Dr. David Flockhart

therapy or chemotherapy. Cardiology, pediatrics, and obstetrics also will be areas of focus for the institute, according to Dr. Flockhart.

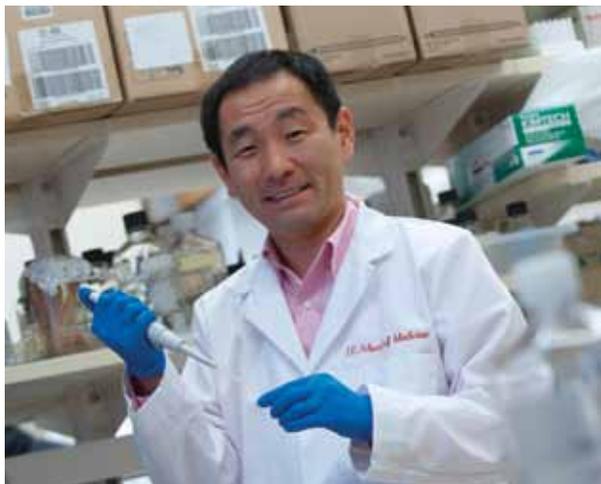
Janet Carpenter, Ph.D., R.N., professor in the School of Nursing and institute member, sees personalized medicine playing a key role in improving menopause treatment.

“About 6,000 American women enter menopause every day,” she said. “The institute will play a very important role in ensuring that women receive the most appropriate and effective menopausal management therapies.”

Mathew Palakal, Ph.D., associate dean for graduate studies and research at the School of Informatics, noted that “research in personalized medicine spans a broad spectrum from nanomedicine to gene therapy. Research in systems biology, biological network analysis, and proteomics, along with our graduate programs in health informatics and bioinformatics, will enable the School of Informatics to play a significant role in the institute’s success.”

The institute’s mission is to conduct research, train new specialists in personalized medicine, and promote the translation of scientific discoveries into new, more precise therapies.

Training new experts will be supported by the new Brater Scholarship in Personalized Medicine, which will provide funds for research to young physicians in medical fellowship training programs at the School of Medicine.



Dr. Yuichiro Takagi

### KEY COMPONENT OF DNA TRANSCRIPTION REVEALED

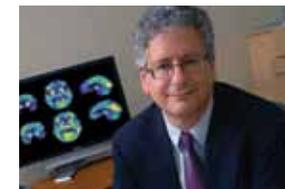
Advances in genomics and related research will make the advances in personalized medicine possible, but there is still much to learn about the processes by which the genetic instructions in the DNA are switched on or off, and modified.

A research team led by Yuichiro Takagi, Ph.D., IUSM assistant professor of biochemistry and molecular biology, provided a significant addition to that understanding by deciphering the structure of an essential part of Mediator, a complex molecular machine in the human body that plays a vital role in regulating the transcription of DNA.

Mediator is composed of 25 proteins organized into three modules known as the head, the middle, and the tail. Using X-ray crystallography, the Takagi team was able to describe in detail the structure of the head module, which is the most important for interactions with RNA polymerase II.



Dr. Fletcher A. White



Dr. Andrew J. Saykin

### OTHER SIGNIFICANT RESEARCH DEVELOPMENTS AT IUSM INCLUDED:

Fletcher A. White, Ph.D., Vergil K. Stoelting Professor of Anesthesia and director of anesthesia research, and Natalie Wilson, a National Science Foundation Fellow, reported their finding that an orphan drug originally used for HIV treatment short-circuits the process that results in additional sensitivity and pain from opioid use. The finding may ultimately make morphine a safer, more effective drug.

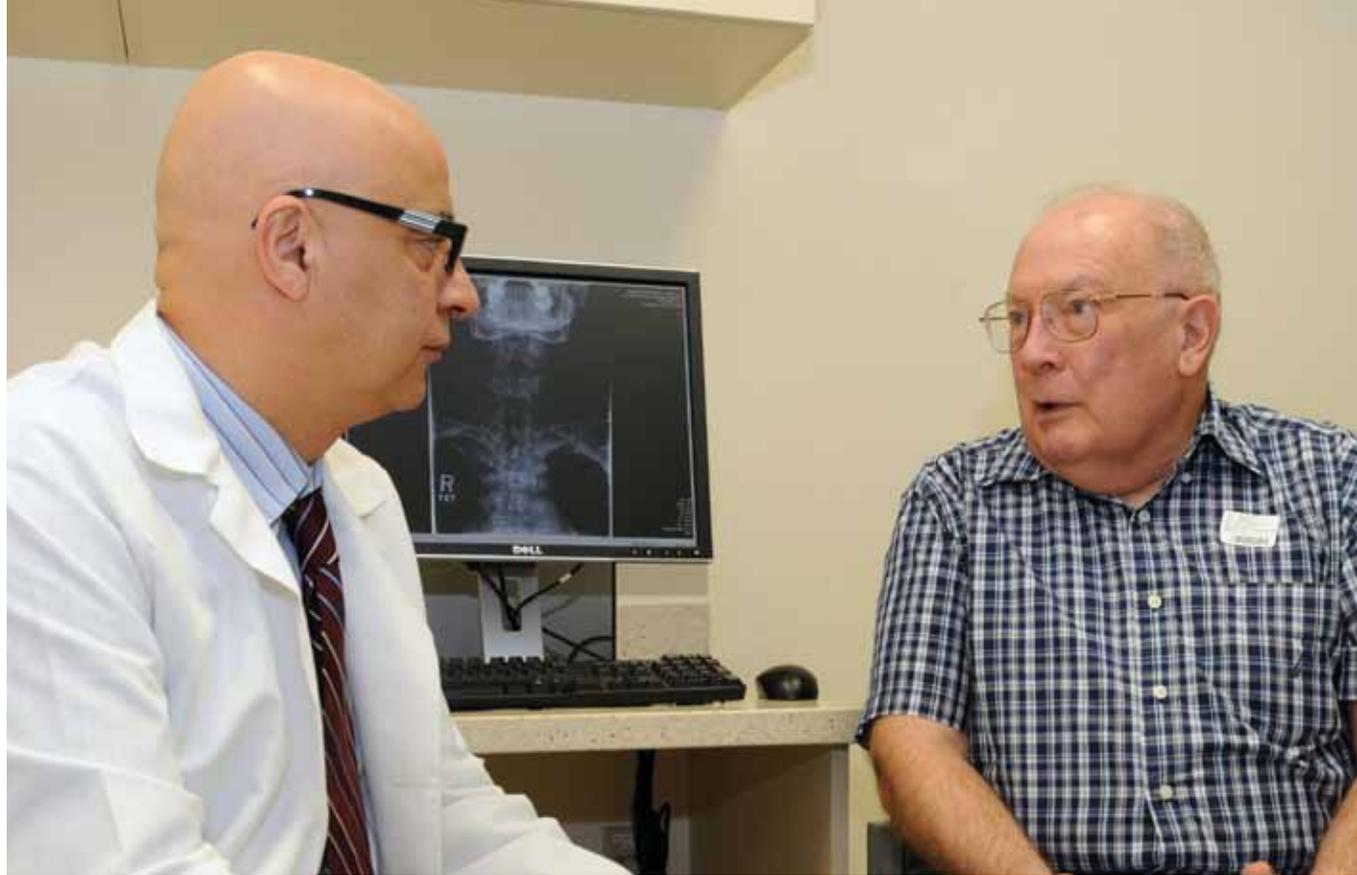
Malaz Boustani, M.D., Regenstrief Institute investigator and IUSM associate professor of medicine, co-authored a study that confirmed medications with anticholinergic activity cause cognitive impairment, which include many drugs frequently taken by older adults. The research was the first to identify a possible link between these drugs—which include sleep aids and incontinence treatments—and risk of death.

IUSM scientists led a national research team that added a new gene to the list of potential genetic contributors to Alzheimer’s. “This study was one of the first genome-wide analyses of biomarkers in cerebrospinal fluid, which has direct access to the brain and allows you to look at biochemical features that might be more directly tied to the disease,” said Andrew J. Saykin, Psy.D., Raymond C. Beeler Professor of Radiology and Imaging Sciences and director of the IU Center for Neuroimaging.



## INDIANA CTSI RESEARCH IN THE COMMUNITY

The Indiana Clinical and Translational Sciences Institute (CTSI) plays a central role in helping local and state-wide partners make an impact in the lives of many through such innovations as a program that connects volunteers to groundbreaking clinical trials research, a key factor among this year's accomplishments. The Indiana CTSI is led by Anantha Shekhar, M.D., Ph.D. It is an alliance that includes IU, Purdue, Notre Dame, and community partners, bridging the gap between basic and clinical research and improving health care across Indiana. The Indiana CTSI is funded by a five-year, \$25 million award from the National Institutes of Health, and nearly \$60 million collectively contributed by the state of Indiana, the three universities, and public and private donors.



### ENCOURAGING PARTICIPATION IN RESEARCH

Nearly 10 years ago, Fred Kocher entered his doctor's office expecting a routine checkup. He left diagnosed with multiple myeloma—a form of blood cancer—and a frightful prognosis.

“At that time, my expected lifespan was about two to four years,” said Kocher, who has overcome some daunting odds. “Now my condition is basically stable—little has changed since my diagnosis in 2001.”

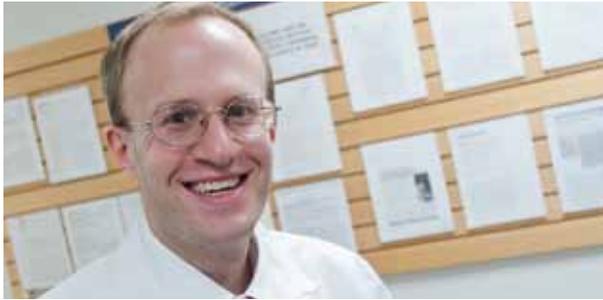
Kocher credits his longevity to his physician, Rafat Abonour, M.D., an IUSM faculty member and oncologist at the IU Simon Cancer Center, as well as participation

in clinical trials that provided early access to life-saving medications. In an effort to increase participation in such studies, Indiana CTSI has created INresearch.org, an online registry which connects people with clinical trials that most closely match their needs.

While few patients see results such as Kocher's, Abonour, who was integral to the development of INresearch.org, says pioneering patients as well as healthy volunteers who participate in research are vital to translating laboratory breakthroughs into therapies.

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From left to right: Dr. Anantha Shekhar; Fred Kocher consults with his physician, Dr. Rafat Abonour.



### UNLOCKING FRAGILE X AND AUTISM

Clinical research supported by the Indiana Clinical and Translational Sciences Institute is impacting patients such as Zachary Hammonds, 22, who was born with Fragile X syndrome, the most frequent single gene cause of autism and the most common form of inherited developmental disability.

A clinical trial in which Zachary recently participated revealed the potential therapeutic effect of acamprosate, a drug currently approved by the FDA to treat alcoholism in adults, for Fragile X syndrome and autism. During five months of treatment, he and two other participating patients showed marked improvement in communication and social behavior.

“We’ve observed improvements in eye contact, social interaction, and speech,” said Craig Erickson, M.D., IUSM assistant professor of psychiatry and clinical director of the Christian Sarkine Autism Treatment Center. “This is very early work, but it appears promising.”

A new, expanded clinical trial is now underway. Ultimately, Erickson says large-scale, multi-center clinical trials will be needed to determine the drug’s true potential. The results of the original study were recently published in the *Journal of Autism and Developmental Disorders*.

### HEALING BROKEN BONES, PREVENTING OSTEOPOROSIS

As the population ages, weak bones are growing increasingly common. With support from the Indiana CTSI, a biomechanical engineer who began studying bone loss in astronauts is focusing on a more earthly subject.

“As a mechanical engineer, I was exploring mechanical stimulation, or exercise, to strengthen bones,” says Hiroki Yokota, Ph.D., professor of biomedical engineering at IUPUI. “But by doing so, I came across the molecular pathway that began this discovery.”

In a project spawned from a \$20,000 Indiana CTSI award, Dr. Yokota has pinpointed a drug with strong potential to fight osteoporosis and accelerate healing in broken bones.

Early laboratory research suggests that bones treated with salubrinal—a chemical compound developed to boost insulin in diabetics—show statistically significant increases in strength and repair speed.

With \$2.6 million recently received from the U.S. Department of Defense, Dr. Yokota aims to move his work towards early clinical trials.

“Our ultimate goal is FDA approval to provide a safe, easy-to-use drug therapy that will heal hip fractures in the geriatric population,” he says.

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From left to right: Dr. Craig Erickson; Dr. Hiroki Yokota (forefront) and his team of biomedical engineering researchers



## ARTS AND HUMANITIES IMPACT

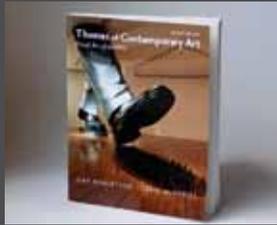
Established in 2011, the IUPUI Arts and Humanities Institute (IAHI) supports campus-wide attainment of excellence in research and creative activity in arts and humanities.

Karen Kovacik, professor of English at the School of Liberal Arts has been selected by the Indiana Arts Commission as the Indiana State Poet Laureate, serving a two-year-term. Professor Kovacik is director of the creative writing program and adjunct professor of women's studies at IUPUI. Her poem "Invisible Movements" is featured in the "Moving Forward" public art project. In addition to this recognition, her numerous awards include the 2011 and 2007 Trustees' Teaching Award; a 2011 NEA fellowship in literary translation; the 2007 Charity Randall Citation from the International Poetry Forum; and a Fulbright Research Grant to Poland. Professor Kovacik also serves as the current chair of the council overseeing the IUPUI Arts and Humanities Institute. This initiative was established in 2011 to reinforce the campus as a leader in arts and humanities research and creative activity as well as expanding its engagement with the broader community.





(Page 10): Dr. Karen Kovacik



(Page 11) From clockwise from top left: Dr. Jean Robertson and her editorial work on a scholarly online encyclopedia of world art; Dr. Rachel M. Wheeler; Former "tropical cowboys" interviewed by Dr. Ch. Didier Gondola in "Mofewana" (Far West) Township in Kinshasa, 2005; A group of "cowboys" and "cowgirls" in Kinshasa, Congo, ca 1960. Photo: Jean Depara; Dr. Ch. Didier Gondola; Susan Shepherd and a group of Kenyan children

Jean Robertson, professor of art history at the Herron School of Art and Design, received IAHI funding for her editorial work on a scholarly online encyclopedia of world art published by Oxford University Press. As part of this effort, she traveled overseas to research new trends in visual art, such as the influence of the life sciences on artists who create works that respond to scientific research in genetics and bioengineering. She also investigated the influence of global visual culture on visual art, including new communication technologies. Professor Robertson's research has provided new thematic content for a seminar she is teaching to fine arts graduate students at Herron, called "Art of the Last Two Decades."

Susan Shepherd, associate professor of English, has been a contributor to IUPUI's efforts in making an international impact in the medical humanities. Her research project is on "Improving Deaf Access to Reproductive Health Care

in Kenya: A Cultural Model." Professor Shepherd's qualitative study combines linguistic research on Kenyan Sign Language, deaf culture, and language rights with practical applications designed to improve access to health care. This year she and Nathan Ogechi, her Moi University colleague, have conducted interviews in three communities with deaf individuals, health care workers, and volunteer interpreters about their experiences. This information will be used to develop workshops and materials to improve communication in health care settings.

Rachel Wheeler, associate professor of religious studies, and two of her colleagues, Philip Goff and Arthur Farnsley II, received a grant from the National Endowment for the Humanities that resulted in a 2010 summer institute for twenty-five teachers. "The Many and the One: Religion, Pluralism, and American History" included topics such as the Scopes Trial and the intersection of slavery, race and

religion in the years leading up to the Civil War. The participants also visited the Frederick Douglass Papers project at IUPUI.

Ch. Didier Gondola, professor of history, received a prestigious international fellowship from the European Institutes for Advanced Study (Eurias) to continue his research on "Tropical Cowboys: Youth, Popular Culture and Masculinity in Colonial Kinshasa." The Eurias Fellowship affords professor Gondola a 10-month residency at the Institut d'Études Avancées in Nantes, France to be part of a multidisciplinary and international group of fellows stationed at the 14 institutes across Europe and Israel. He is completing a book manuscript on the "Tropical Cowboys," a project which looks at the ways in which young people in colonial Kinshasa (Congo) appropriated images from Hollywood cowboy movies to reshape existing patterns of masculinity.

# COMMERCIALIZATION AND ECONOMIC DEVELOPMENT

The research enterprise within the modern university setting extends beyond traditional scholarly activities such as publication in peer reviewed journals and presentations at professional seminars or conferences. University research has been the source for innovative medical devices, educational software, lifesaving medicines, and much more. This research stimulates economic development and impacts job growth locally and nationally. IUPUI is committed to providing support to faculty, staff, and students to ensure that important discoveries arising from their research reach the people who can benefit from them.

If there is an important societal need or market demand being met by faculty research, it is critical to connect IUPUI inventors with the expertise and resources to bring the technology to market. Indiana University Research & Technology Corporation (IURTC) assists faculty in navigating the legal, marketing, and licensing complexities of commercializing university research. The mission of the IURTC is to help companies bring new technology to the marketplace and support technology-based economic development throughout Indiana and the nation.

## MODULAR ANASTOMOTIC VALVE DEVICE FOR SELECTIVE SHUNTING DURING HEMODIALYSIS

Chronic kidney failure or chronic renal failure (CRF) affects more than 500,000 people each year and is growing at an alarming rate of 5-7% per year due to increases in diabetes, hypertension, and obesity. CRF patients' demand for kidney transplants far exceeds the supply of donor kidneys. Interim treatment measures for these patients most frequently involves chronic hemodialysis (HD). Each year, more than 350,000 patients rely on kidney dialysis, which comes at a tremendous cost. Medicare

spends \$25 billion annually on treatments for kidney failure, which translates to approximately \$75,000 per patient/year. To accomplish effective HD, a reliable vascular access is required. This vascular access is capable of withstanding multiple needle punctures and achieving adequate flow velocities required for effective dialysis. Vascular access construction is often accomplished through the use of a surgically created shunt between an artery and vein in the upper extremity. Failure of these surgically implanted shunts occurs regularly, resulting in significant risk to the health of the patient and costly procedures to



Dr. George Akingba

reestablish vascular access, which in the United States is close to \$1.8 billion annually.

Dr. George Akingba, a vascular surgeon and biomedical engineer at the Indiana University School of Medicine, has pursued extensive research on the causes of shunt failure. This work has resulted in the development of a modular anastomotic valve device (MAVD) capable of being seamlessly incorporated into the current surgical technique for shunt construction. The prototype could provide the opportunity to selectively shunt high-velocity blood flow only during HD periods (when it is required) rather than continuously as is currently performed. Dr. Akingba believes that selective shunting of blood will decrease exposure of the shunt to the altered hemodynamic risk factors responsible for shunt failure by approximately six-fold, which could in turn result in an approximately six-fold increase in the functional lifetime of the graft. The ultimate goal of this translational research is to use this novel technology to deliver enhanced and durable vascular access to the nephrology community to improve the delivery of HD to patients awaiting kidney transplant, thereby significantly increasing patient quality of life while reducing total associated healthcare costs.



Dr. Daniel Johnson  
and Dr. Vijay O Lulla

### IMPACT OF HEAT WAVES ON VULNERABLE POPULATIONS WITHIN URBANIZED AREAS

Experts predict that global climate change will result in more extreme weather phenomena in the coming decades. One critical example would be extensive heat waves that could impact human health and result in increased numbers of deaths. IUPUI climate researcher Dr. Daniel Johnson is leading efforts to develop tools that will allow public health and welfare services to address this critical issue.

Dr. Johnson, a geography professor in the School of Liberal Arts, and colleagues from the Indiana University Institute for Research and Social Issues, have conducted extensive studies on the impact of heat waves on vulnerable populations within urbanized areas. His research has developed vulnerability models designed to assist emergency personnel in their response to and mitigation of heat wave incidents. These

models of vulnerability, along with associated communication interactions developed by the Centers for Disease Control and Prevention, could have a significant impact by lowering heat-related mortality and the associated economic cost of the health effects on at-risk populations.

The models use complex statistical modeling tools and visualization, and space-borne satellite imagery to identify individual “hot spots” within the four subject cities and develop vulnerability maps based on the occurrence of past mortality during extreme heat events. The research has resulted in software tools that are capable of generating predictive reports for city officials, who would then be able to make better decisions with respect to allocating resources for emergency response. Dr. Johnson is currently working to establish a new venture to focus on product development and commercialization of the technology.

### SHOT COUNTER REDUCES MAINTENANCE COST

It’s all about shrinking the Pentagon’s budget, using a novel method of energy harvesting that has applications in manufacturing, remote sensing, and patient health care. Invented by IUPUI’s Peter J. Schubert, the recently-issued US Patent (to Packer Engineering, Naperville, IL) uses condition-based maintenance to reduce funds for support – which can be 70% of an asset’s lifecycle cost. The Shot Counter acts like the odometer on your car, so you can change the oil every 3,000 miles, not just every 3 months – whether it needs it or not. The Shot Counter helps us spend less on national defense without sacrificing capability. This patent is Professor Schubert’s 35th. His addition to the faculty of the School of Engineering and Technology represents an investment in entrepreneurship and innovation. His leadership will help bring cutting-edge technology from the Lugar Center for Renewable Energy to the marketplace, creating “green collar” jobs in central Indiana.



Dr. Peter J. Schubert

# IUPUI IMAGING RESEARCH INITIATIVE

The Vice Chancellor for Research has founded the Imaging Research Council to guide successful realization of the IUPUI imaging initiative. IUPUI has considerable strength in imaging research rooted in its investments in four strategic priority areas: Neuroscience Imaging; Cancer; Cardiology; Molecular Imaging and Probe Development.

The primary goals of the Council are to encourage and coordinate collaboration among IUPUI researchers from different disciplines, provide advice and guidance in the realization of highly competitive large grant proposals that will support and grow IUPUI imaging efforts into nationally and internationally recognized programs, and develop a strategic plan that will enable IUPUI to become nationally and internationally known as the place for imaging research and its applications.

(Page 14): Dr. Lauren Christopher in her laboratory  
(Page 15) From top to bottom: Dr. Li Shen, Dr. Flora Hammond, Dr. Karmen Yoder





## FACULTY MEMBERS WITH IMPACT IN IMAGING RESEARCH

Dr. Lauren Christopher is heading the 3D imaging and Very Large-Scale Integration (VLSI) research in the Department of Electrical and Computer Engineering. Her research includes 3D medical image registration and segmentation. For these tasks, she uses the Bayesian statistical and Markov Random Field mathematical image processing approach, with hardware FPGA/VLSI implementations for these algorithms. One current project uses signal processing with a single sensor to miniaturize the 3D camera for a medical bronchoscope or endoscope application. The 3D autostereoscopic (no glasses) display technology is used to view the 3D medical image data to develop potential image-guided applications. In 2011, she was inducted into the Consumer Electronics Hall of Fame for her leadership of the first DIRECTV set-top design at Thomson in the 1990s.



Dr. Li Shen, assistant professor of radiology and imaging sciences, is working to gain knowledge that will lead to earlier diagnosis, early assessment of treatment response, and targeted treatment strategies for individual patients. Dr. Shen and his collaborator Dr. Andrew Saykin have formed an interdisciplinary team at the IU Center for Neuroimaging to conduct research at the interface of neuroscience, genetics, computer science, informatics, and engineering.



They are currently leading the Genetics Core of the Alzheimer's Disease Neuroimaging Initiative (ADNI), an ongoing landmark imaging and biomarker study in AD.

Dr. Flora Hammond, chair of physical medicine and rehabilitation and Covalt Professor of Physical Medicine and Rehabilitation, has been awarded the prestigious 2011 William Fields Caveness Award for excellence in research in the field of brain injury. She is the director of the newly funded center, the Indiana Center for Brain Rehabilitation, Advanced Imaging, and Neuroscience (ICBRAIN). This center will develop and disseminate techniques and methodologies for advanced neuroimaging and precision behavioral measurement to evaluate novel rehabilitation interventions for people with acquired brain injuries (such as those sustained by soldiers returning from Iraq and Afghanistan with traumatic brain injuries.)

Dr. Karmen Yoder, assistant professor of radiology and imaging sciences, is using Positron Emission Tomography (PET) to study the neurochemistry of alcoholism, chronic pain, traumatic brain injury, normal aging, and cognitive decline. PET imaging allows Dr. Yoder to detect changes in brain dopamine during cognitive processes related to addiction and pain, and to determine relative levels of inflammation in various brain disorders.



## COMMUNITY PARTNERSHIP

IUPUI has a vested interest in building strong partnerships with the community. By strategically partnering with the community, IUPUI remains relevant and responsive to growing community challenges, needs, and opportunities. IUPUI offers the expertise and vibrant research enterprise needed to impact efforts that address community challenges and leverage unique potential, which meet real-world needs every day.

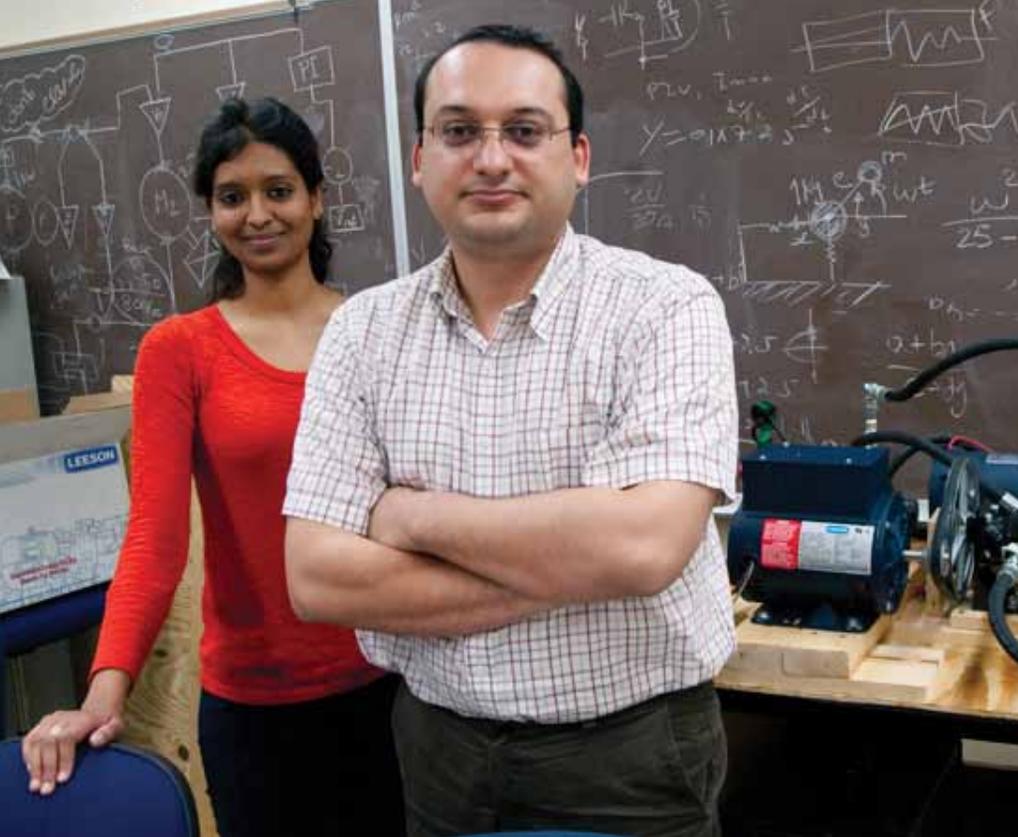
### STUDENT-COMMUNITY COLLABORATIVE RESEARCH

Students enrolled in Susan Hyatt's ethnographic methods class work collaboratively with neighborhood organizations to produce research that is both of scholarly merit and that serves community interests. An associate professor of anthropology in the School of Liberal Arts, Hyatt has most recently engaged her students with a range of communities and organizations to produce an oral history of the near Southside. Students are interviewing African Americans and Sephardic Jews in order to understand the complex ties that connected these communities to one another during the years when they lived side-by-side.

In so doing, they are challenging some commonplace understandings of race and religion in Indianapolis. An extensive image collection has resulted from this research, now part of IUPUI University Library's Digital Scholarship Program at <http://ulib.iupui.edu/digitalscholarship/collections/NoS>. Hyatt and her students plan to produce a book entitled "The Neighborhood of Saturdays: Memories of a Multi-Ethnic Community on Indianapolis' Southside."

### INNOVATIONS IN ALTERNATIVE ENERGY

Solar and wind-generated electricity are increasingly important alternative energy sources, and IUPUI researchers are working on innovative technologies to expand their



(Page 16): Dr. Susan Hyatt's ethnographic methods class interviewed African Americans and Sephardic Jews in order to understand the complex ties that connected these communities to one another during the years when they lived side-by-side. (Page 17) From left to right: Sree Likhita Gavini and Dr. Afshin Izadian; Dr. Thomas Iseley (top left) meets with community partners.

use and reduce costs of production through the leadership of Afshin Izadian, assistant professor of electrical engineering technology at IUPUI, and research faculty at Richard Lugar Center for Renewable Energy. Izadian has filed a patent for an approach that replaces bulky gearboxes in traditional wind turbine power trains with a hydraulic power transfer system and has potential to drive down the cost of electricity production dramatically. A company has been formed to develop an industrial-grade prototype using this innovation.

Izadian has also developed a passive, stationary solar concentrator for use on electricity generating photovoltaic (PV) modules. The device will increase the electricity

generated in low level, diffuse light situations by as much as 75%, and can dramatically increase the number of worldwide locations where PV technology can be cost effectively applied.

#### IUPUI WASTE-TO-ENERGY (WTE) RESEARCH TEAM

The IUPUI Waste-to-Energy (WTE) Research Team works to develop solutions for two of the world's most challenging problems: waste and energy. Led by Thomas Iseley, clinical professor of construction engineering management technology, the team focuses on municipal solid waste (MSW) – everyday trash or garbage that is

typically buried in landfills or burned. MSW is a global problem, and its disposal methods are increasingly unsustainable and harmful to the environment. Iseley's team is developing a rapid response to identifying, developing, evaluating, validating, and transferring into practice research about processes for transforming waste to energy. The team has performed assessments in Mali, Nigeria, and Mexico, to identify trends and opportunities for IUPUI to become a global leader in waste-to-energy. The team is also exploring opportunities with Indiana communities to create jobs and commercialize green technical solutions to dispose of MSW, provide renewable sources of energy, and address deteriorating infrastructure in municipalities.

# STUDENT RESEARCH IMPACT

From RISE to the Challenge (which enhances teaching and learning through research, international collaboration, service-learning, and experiential learning) to a myriad of undergraduate research programs, IUPUI continues to foster a culture of inquiry and discovery at all stages of a student's academic career. Working with faculty mentors, undergraduates engage in active learning and hands-on inquiries in the laboratory, library, studio, and field settings that result in intellectual and creative contributions. For the students, these experiences help to ignite a passion to pursue ongoing inquiry, discovery, and creativity far beyond the academy. The following stories demonstrate how research and scholarly endeavors have played an important role in the undergraduate experience in 2011.



Benjamin Sunderlin



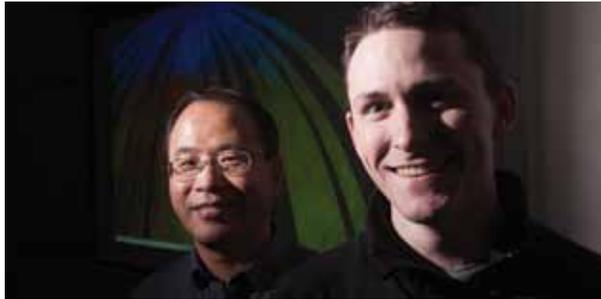


### A CREATIVE PASSION CAST IN BRONZ

Benjamin Sunderlin of Lafayette, Indiana originally transferred to the Herron School of Art and Design. Drawing upon history, science, philosophy, and foreign cultures, Benjamin adopted an unconventional goal: To produce art with a didactic approach of instilling the cultural value associated with timeless objects and icons.

Awarded an Undergraduate Research Opportunities Program Grant through the IUPUI Center for Research and Learning, Benjamin studied the traditional methods of bellfounding. At John Taylor and Co. (Loughborough, England), Benjamin was able to delve into the archives, make bell molds in the foundry, and discuss English bell history and craft with mentor and managing director Peter Hayward.

For the project component of his grant, Benjamin will cast in bronze a church bell with a balanced cast-iron headstock, counterbalanced clapper, and motorized drive chain. Smith's Bell and Clock Service Inc., of Mooresville, Indiana is assisting with supplementary research and the outfitting of Ben's bell. Benjamin will display his bell, photographs, and other related items in Herron's Basile Gallery in 2012.



Dr. Lin Li and Patrick Cavanagh

### ILLUMINATED FUTURE

Patrick Cavanagh is a senior computer engineering major in the School of Engineering and Technology. Current research with Dr. Lin Li, associate professor in the Department of the Earth Sciences at the School of Science Planetary and Environmental Remote Sensing Lab, involves analyzing hyperspectral imagery from the lunar surface gathered by the Moon Mineralogy Mapper. Information contained in the images of the moon is interpreted to determine optimal compression through a process of wavelength band selection. By establishing which portions of the electromagnetic spectrum reveal the most information about the lunar surface, future instruments could be finely tuned to focus on those features.

With support from the Center for Research and Learning, through the Multidisciplinary Undergraduate Research Institute and Undergraduate Research Opportunities Program, Patrick has been able to pursue research experience in planetary sciences in addition to an engineering degree. Patrick recently accepted a position as engineer in the Space Science and Engineering Division of Southwest Research Institute (SwRI). SwRI is one of the oldest and largest independent, nonprofit, applied research and development organizations in the United States.



Jordan Rhodes

### REVITALIZING THE FRINGE

During her summer research project, "Revitalizing the Fringe," Jordan Rhodes used the first three phases of the design process to develop a housing complex that is cost effective both to build and to maintain. The resulting structure, constructed primarily of recycled 20' and 40' shipping containers, incorporated several new urbanist planning principles including an emphasis on alternative forms of transportation, availability of mixed-income units, and employment of local architectural styles. Sustainable practices included passive solar design and on-site power generation. Further refinement of the design could allow for the structure to be an answer to certain low income, student, or post-natural disaster housing needs.

Supported by a Ronald E. McNair Postbaccalaureate Achievement Program grant and an Undergraduate Research Opportunities Program grant, this summer research project sparked Jordan's interest in urban planning and design. She plans to use her undergraduate degree in Interior Design, a Master's degree in Architecture and perhaps a Ph.D. in Urban Planning to design spaces that are contextually, ecologically, and socially conscious.

# IUPUI STEM INITIATIVES: MAKING LOCAL AND GLOBAL IMPACT

In 2011, IUPUI continued to blaze a path of success through its STEM (science, technology, engineering and mathematics) initiatives. Over the past six years, the campus has attracted nearly \$12 million in extramural funding in STEM education, including over \$2.4 million in 2011. Many of these initiatives are experiencing early and positive results in the effort to build a brighter STEM education future.

## IUPUI SURPASSES ITS STEMWORKS INDIANA GOALS

The campus portion of the U.S. Dept. of Labor's STEM Opportunities in the Workforce System Initiative closed 2011 with multiple successes. STEMworks Indiana focuses on disadvantaged youth and displaced workers, providing education and support for entrance into a high-tech job market. As stated in a Labor Department report, "There is a broad consensus that the long-term key to continued U.S. competitiveness and growth in an increasingly global

economy is the adequate supply of qualified STEM workers." IUPUI, through a million-dollar award in partnership with EmployIndy, is locally turning the tide. Its successes include the following:

1. created a STEMworks Indiana website that contains a Career Blueprint guide and Career Ladder Information: 1,182 registered users; 1,743 online training and skills assessments; 19,983 career blueprints pageviews.
2. served 100 at-risk youth ages 16–21 as STEM Scholars: 154 served.
3. assisted STEM Scholars to earn high school diplomas: 61 currently enrolled in high school, 88 graduated.
4. provided STEM Scholars with gateway job training: 52 certificates earned.
5. provided pathways to STEM Associate Science degrees: 3 (Computer Information Technology, Design Technology, and Biomedical Engineering Technology)

## UCASE EXPANDS ITS STEM TEACHER PREPARATION EFFORTS IN 2011 TO EXCEED STATED GOALS AND ATTAIN NEW FUNDING

UCASE, the Urban Center for the Advancement of STEM Education, has continued and expanded its mission to transform education for middle and high school STEM students through the preparation of outstanding STEM teachers. Through the combined support of the Woodrow Wilson Indiana Teaching Fellowship program (Lilly Endowment), the Robert Noyce Teacher Scholarship Program (NSF), and the Teacher Quality Partnership Program (US DOE), UCASE and the Schools of Education, Science, and Engineering & Technology supported the



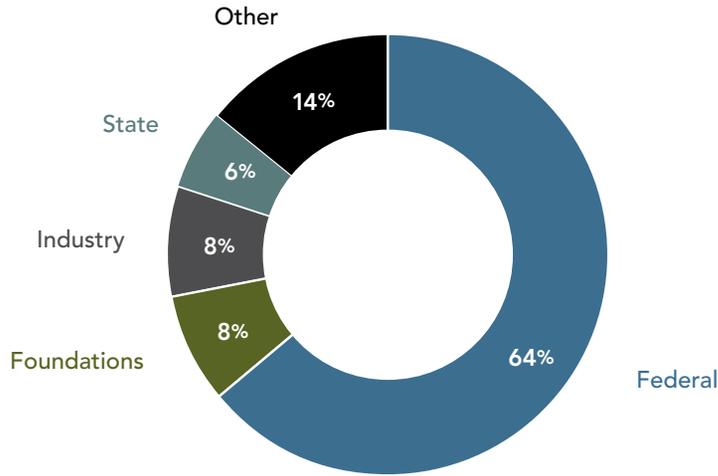
Dr. Charles Feldhaus, Principal Investigator on the STEMWorks Indiana contract with EmployIndy and associate professor of organizational leadership and supervision in the School of Engineering and Technology



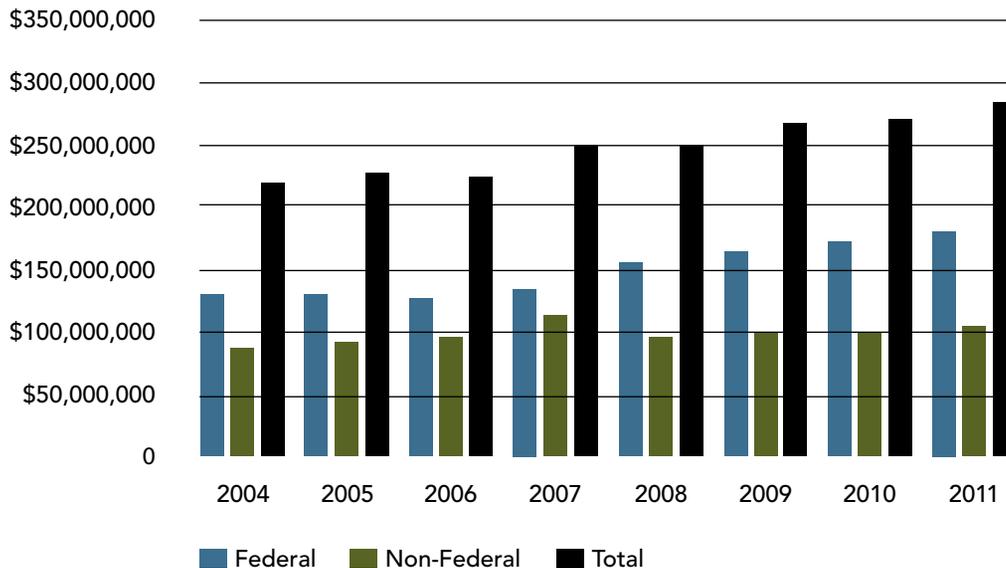
Dr. Kathleen A. Marrs, UCASE director and associate professor of biology in the School of Science

preparation of 33 new STEM teachers this past year. Ten of these new teachers also earned dual certification in Special Education, reflecting IUPUI's emphasis on high quality STEM education for all learners. The number of new STEM teachers this year exceeds the goals set by UCASE as part of IUPUI's leadership role in SMTI, the Science and Mathematics Teacher Imperative, and reinforces the UCASE commitment to build on the increasing calls for STEM leaders in Indiana and nationwide.

IUPUI RESEARCH EXPENDITURES FOR FISCAL YEAR 2011  
 TOTAL: \$286,733,144



IUPUI TOTAL RESEARCH EXPENDITURES 2004-2011 FEDERAL VS NON-FEDERAL



# IMPACT BY THE NUMBERS

## IUPUI RESEARCH COMMERCIALIZATION METRICS

	FY 2010	FY 2011
Disclosures Received	112	134
Patent Applications Filed	139	148
Provisional	66	81
Patent Cooperation Treaty (PCT)	26	22
Regular U.S.	20	28
Foreign	27	27
Patents Issued	11	13
Start-Up Companies Formed*	4	7
Licenses Executed	16	27
License Income	\$4.8M	\$4.2M

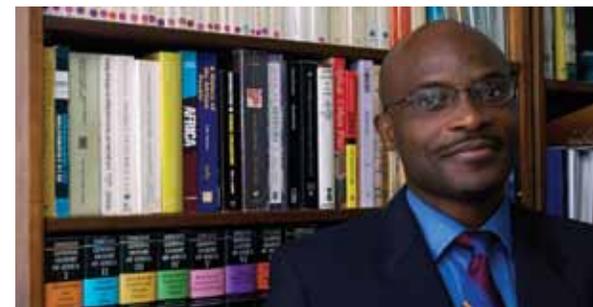
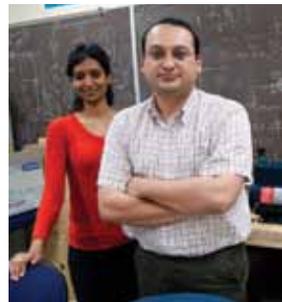
\* Company formation based on a license to an IUPUI technology.

# IUPUI

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As one of the outstanding urban research universities in the United States, IUPUI is Indiana's urban research university located in the heart of Indianapolis, just blocks from the Indiana Government Center and Fortune 500 companies. IUPUI is Indiana University's home campus for state-wide programs in medicine, law, dentistry, nursing, health and rehabilitation science, and social work, and it excels in providing programs in art and design, business, education, engineering and technology, informatics, journalism, liberal arts, library and information science, physical education and tourism management, public and environmental affairs, and science.



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