I am delighted to present the IUPUI Annual Research Report for Fiscal Year 2012. This has been yet another remarkable year for research at IUPUI. Research expenditure reached an all-time high of $288 million, significantly impacting such diverse areas as the arts and humanities, energy, and human health. This achievement has been supported by a strategic research roadmap, which was developed by campus stakeholders and launched in 2008, as the guidepost to aid IUPUI to reach its full potential in research and scholarly activity. The main goal of the roadmap has been for IUPUI to be a top urban research university, conducting research that has great socioeconomic impact. This goal is getting realized through the development and expansion of innovative research programs that align with the institutional mission and strategic plan, address important national and global needs, and through technology transfer and commercialization, noticeably support the economic development of Indiana and the nation.

In Fiscal Year 2012, the IUPUI research enterprise has continued its robust advancement, with significant achievements in many areas. This report highlights the broad range of research and creative activity carried out by IUPUI investigators during this period. It is organized around key campus-wide strategic initiatives, including the IUPUI Center for Translating Research into Practice, the Signature Centers Initiative, Medical and Life Sciences initiatives, the IUPUI Arts and Humanities Institute, the Integrated Nanosystems Development Institute, the STEM Education Research Institute, and the IUPUI Imaging Research Initiative. The report also has sections on innovative programs exposing undergraduate students to the research experience, and on effective community engagement projects. Moreover, it highlights how, through technology transfer and commercialization, IUPUI research outcomes are having 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, or contact us at OVCR@iupui.edu.

Kody Varahramyan, Ph.D.
Vice Chancellor for Research
IUPUI is increasingly known for success in translational research, research that bridges the gap between generating new knowledge and using that knowledge to solve everyday problems and improve people’s lives. The projects are as varied as the human story, yet all of them share an intricate connection to the community. Understanding the importance of that link led Chancellor Charles R. Bantz to establish the Center for Translating Research Into Practice. Dr. Petronio is a nationally recognized translational researcher in the field of communication and serves as the Center’s Founding Director. The Center is directed by Stephan Viehweg, who is assisted by the strategy team of Sandra Petronio (TRIP Project Leader), Dennis Fortenberry (TRIP Faculty Fellow), and Teresa Bennett (IUPUI Solution Center Director). “The faculty at IUPUI has a long history of partnership with the community as well as engaging students in research efforts that matter,” observes Bantz. The Center hosts the annual IUPUI TRIP Showcase as well as an annual TRIP Keynote Address to encourage faculty, students, and the community to engage in dialogues that result in additional translational research efforts.

In a personal effort to promote the growth of translational research on campus, Chancellor Bantz and Dr. Petronio have established the Bantz-Petronio Translating Research Scholarship Into Practice Award. The “TRIP Award” recognizes outstanding work in translational research by IUPUI faculty and includes a monetary award. The inaugural award will be announced in spring 2013 followed by the recipient presenting their research at the 2013 TRIP Showcase.

TRIP SCHOLARS SHOWCASE
Dr. Tamara Leech (Liberal Arts) discovered that Mapleton-Fall Creek community members were more likely to draw on informal, rather than formal, sources of support to fulfill the needs related to the well-being of teen mothers and fathers, and their children. Her findings support the efficacy of extending the Women’s Information and Support Exchange (WISE) program in specific, low-income neighborhoods. Dr. Patricia Scott (Health and Rehabilitation Sciences) used personal experience to explore strategies to support successful life experiences after liver transplants. Finding very little research in this area, Dr. Scott has engaged in a three-phase research project that explores the best interventions to support individuals struggling to resume meaningful, post-transplant lives.
Since its 2007 launch, this initiative has become a cornerstone of the IUPUI research enterprise, playing an important role in enhancing research and scholarly activity while fostering the development of research centers that are improving IUPUI’s national and international reputations. The following are examples of centers currently funded under the Signature Centers Initiative.

**CEN TER FOR PANCREATIC CANCER RESEARCH:**

The mission of the Center is five-fold: 1) to promote a better understanding of the critical pathways and molecular mechanisms involved in pancreatic tumor development, 2) to stimulate the consistent and productive exchange of ideas between clinicians and basic scientists, 3) to facilitate external funding for its members, 4) to disseminate information across the Indiana medical and research communities, and 5) to improve pancreatic cancer patient outcomes. The Center, comprised of basic, translational, and clinical researchers, represents the continuum of disease research from biological and molecular investigation to clinical trials. The Center is directed by Dr. Murray Korc.

**CEN TER FOR BRAIN REHABILITATION, ADVANCED IMAGING, AND NEUROSCIENCE:**

The research mission of the Center is to integrate and further develop neuroimaging and behavioral measurement technologies to provide integrated, and interdisciplinary methods for examining the natural evolution, individual differences, and responses to rehabilitative interventions in acquired brain injuries. The Center brings together an interdisciplinary team of clinical researchers in order to: 1) advance basic science and clinical knowledge to the next level of integration, 2) translate the knowledge gained directly into clinical care for improved patient outcomes, and 3) use the newly integrated knowledge to drive the leading edge of future research. The Center is directed by Dr. Flora Hammond.

**THREE-DIMENSIONAL IMAGING OF THE CRANIOFACIALDENTAL COMPLEX CENTER:**

The primary mission of the Center is to develop long-term intellectual and financial support for strong, interdisciplinary imaging studies related to a better understanding and quantification of 3-dimensional normal and abnormal growth, development, function, and treatment of the hard and soft tissues of the craniofacialdental complex. The secondary mission of the Center is to assess the airways of patients with sleep disorder breathing and the responses to therapies. The tertiary mission is to become the regional and national point of information and service for patients and health professionals involved with orthodontic orthopedic tooth movement, facial esthetics, functions, airways, and imaging. The Center is directed by Dr. Katherine Kula.

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In the highly competitive arena of medical research and extramural funding, the School of Medicine posted a new record $267 million in research grants and contracts in fiscal 2012, which according to Dean D. Craig Brater, M.D., “is a testament to the skill, persistence, and creativity of our scientists.”

Other exciting developments came from a variety of fields: aging, schizophrenia, and global health. 2012 also saw Indy’s Super Cure, a Super Bowl tie-in with the IU Simon Cancer Center to collect healthy tissue donations from more than 700 women for the Komen Tissue Bank, the world’s only bio-bank of healthy breast tissue samples. As Dr. Brater says, “Strong research programs enable us to develop therapies to help tomorrow’s patients, and enable us to teach young physicians to practice tomorrow’s medicine.”

New record for school of medicine

In August, just weeks after the new Ambulatory Care and Imaging building opened, ground was broken for the IU Neurosciences Research Building, which will provide School of Medicine scientists (including researchers from the Institute of Psychiatric Research and the Stark Neurosciences Research Institute) state-of-the-art facilities in which to conduct a broad range of research projects in fields such as neurotrauma, dementia, addiction, epilepsy, and pain.

A key element in research productivity is proximity. The connected buildings are “just down the hall from each other,” allowing investigators to easily consult with faculty physicians in neurological surgery, psychiatry, and neurology. According to Gary Oldﬁeld, Ph.D., director of the Stark Neurosciences Research Institute, the combined facility will give researchers and clinicians “unprecedented ability to collaborate in order to speed research findings to clinicians.” This will ensure that our patients and their physicians will have access to the latest diagnostic and top experts in a range of specialties.

The IU Health Neuroscience Center is located on 16th Street, across from Methodist Hospital.

Breaking ground on groundbreaking center — neuroscience gets new home

A simple discussion more than a year ago concluded when campus research and clinical leaders signed the Strategic Research Initiative. The School of Medicine and IU Health will invest $150 million in a 5-year collaboration to boost translational as well as basic research in cardiovascular disease, cancer, and the neurosciences.

“It is our goal to fund transformative proposals that will fundamentally change our understanding of these diseases and lead to important new therapies for patients,” said David S. Willers, M.D., Executive Associate Dean for Research Affairs at the School of Medicine. The School was evaluating new strategies of confronting the combined trend of increased difficulty landing large NIH grants (historically, about half of incoming research dollars) and more targeted research initiatives, such as team science. Meanwhile, IU Health’s intent on leveraging outcomes from the School Medicine in order to strengthen patient care.

2 Partners, 5 Years, $150 Million

SRI sparks new era of research

Medical and life sciences

IMPACT

Year of Firsts at School of Medicine

Dr. D. Craig Brater

Dr. Gary Oldfield

Dr. David S. Willers

I U Health Neuroscience Center

I U School of Medicine

2012 research report
Problem Solving on a Grand Scale

The Indiana CTSI

During its fourth year, the Indiana Clinical and Translational Sciences Institute saw strategic investments in innovative ideas and novel ways to bring new, more effective care to patients. The Indiana CTSI includes IU, Purdue, and Notre Dame, as well as public and private partners, and aims to accelerate health care market. Led by Anantha Shekhar, M.D., Ph.D., a research team whose results attracted an outside company to bring new, more effective care to patients, is unique in its ability to stimulate both osteoblasts, which create bone, and osteoclasts, which destroy bone, reducing unregulated bone growth. In early 2012, she received more than $1.5 million from the National Institute of Arthritis and Musculoskeletal and Skin Diseases to support this research.

“A new risk factor test for rare chest cancers”

Dr. Kacena is co-inventor on two patents filed by the IU Research and Technology Corp. related to the mouse model. In addition to a fellowship from the Indiana CTSI, Dr. Kacena has received more than $100,000 from the institute to create a genetically altered mouse model and conduct the initial studies needed to advance their research towards human clinical trials. Dr. Kacena has also received an additional $100,000 from the Indiana CTSI to advance other research efforts.

Dr. Kacena is co-inventor on two patents filed by the IU Research and Technology Corp. related to the mouse model and application of the drug in bone healing. The Indiana CTSI provided more than 200,000 to the project, which enabled the team to conduct polymerase chain reaction testing and other analyses that strengthened the research validity, attracting the interest of outside investors.

“Traditionally, telemedicine collects primarily objective measures,” said Jacob Kean, Ph.D., Assistant Research Professor of Pathology and Laboratory Medicine. Melvin and Bren Simon Cancer Center has resulted in a test that quantifies subjective illness in patients with TBI. The test is based on research conducted by Sunil Badve, M.D., M.B.B.S., M.D., Professor of Pathology and Laboratory Medicine, Patrick Leshoe Jr. M.D., Director of the IU Melvin and Bosom Simon Cancer Center, and Yosem Golman-Polar, Ph.D., Assistant Research Professor of Pathology and Laboratory Medicine.

Thymomas, while rare, are one of the most common cancers of the upper chest. Treatment involves surgical removal, often followed by radiation or chemotherapy. While physicians can generally diagnose a tumor's severity, they cannot easily predict whether the cancer will return. An accurate assessment of recurrence risk reduces the need for metastatic treatment resulting in a lifelong decline in quality of life by sparing patients with low risk for relapsing tumors.

“Thus, whole effort has been the perfect combination of research, clinicians, and pathologist working together,” Dr. Badve said. “Everyone played complementary roles to bring about a real change in cancer treatment for patients with thymoma.”

Dr. Kacena recently received more than $3.4 million from the National Institute of Arthritis and Musculoskeletal and Skin Diseases to support this research.

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The IUPUI Arts and Humanities Institute (IAHI) consists of a partnership between the Office of the Vice Chancellor for Research and participating campus units, including the Schools of Liberal Arts, Herron School of Art and Design, Informatics, Engineering and Technology, Medicine, and the University Library. Its mission is to support individual faculty, groups, and interdisciplinary teams in research and creative activities in arts and humanities, including interdisciplinary teams in support of the promotion of innovative inquiry-based arts and humanities educational experiences in academic curricula across campus, and act as a liaison between IUPUI and the community in the development of arts and humanities endeavors.

IUPUI hosts north american premiRe at the columbIA club
Tim Hardy, a faculty member of the Royal Academy of Dramatic Art in London, was the IAHI’s first Artist-in-Residence in September 2012. Hardy has decades of experience as both actor and director, having performed across Europe and North America. He has also performed with the Royal Shakespeare Academy and the Opera Theatre London. During his residency, Hardy guest-lectured in English and History where he discussed the nature of acting and how the performing arts can help integrate historical events. In his lectures, “From Shakespeare to Sundheim to Shaw,” he explored the profound impact that acting can have on worldviews.

The culmination of his visit was the American premiere of The Ancient Mariner, a dramatic music production inspired by Coleridge’s The Ancient Mariner. Written by London-based composer Geoff Paige, the piece is a sequence of songs and musical scenes sung as solos with piano accompaniment. Written by London-based composer Geoff Paige, the piece is a sequence of songs and musical scenes sung as solos with piano accompaniment.

Exploring Herron’s Roots — Classical Art in Modern America
Jennifer Lee, Associate Professor of Art History and Associate Dean of Student Services at the Herron School, has been coordinating a Herron-IAHI collaboration to study the history of Herron and its place in the evolution of American art schools. Specifically, she is looking at Herron’s museum, which formed the core of the Indianapolis Museum of Art. Like many art schools of its age (1902), Herron proudly owned a collection of plaster casts of ancient Greek works of art (also referred to as “the Parthenon sculptures”) that represented “the classical tradition.” Herron undergraduate Benjamin Sunderlin (BFA 2012) was commissioned to create new casts. The result was a set of pristine plaster casts of this famous relief sculpture and a greater understanding of the role of the Parthenon frieze in many copies in shaping public as well as training artists.

Global Access to an American Philosopher
In addition to being a philosopher, Charles S. Peirce (pronounced “pooz”) was a scientist, logician, and mathematician. Often referred to as “the father of pragmatism,” he was an extremely prolific writer whose papers reside in multiple locations (the bulk at Harvard) and are largely unorganized. The Peirce Project is a collaborative effort to catalogue, date, and organize his extensive writings. W/Peirce has published six of the estimated 50 volumes required to cover the body of Peirce’s work. The Peirce Edition Projects worked to retrieve what scholarly editions of great thinkers ought to be when posted online.

NEH and IAHI grant to spearhead an ambitious initiative
In collaboration with the Human-Computer Interaction Program at the School of Informatics, Pfeifer and De Tienne have been developing two revolutionary, open-source platforms. One is STEP (Scholarly Text Editing Platform), an online, web-based XML platform that provides all the tools needed to create scholarly editions from manuscript organization and transcription to editing and final layout. The second is CORePUS (Collaborative Online Research Platform for Users of Scholarly Editions), a powerful dissemination environment that will facilitate how the general public will browse the great texts in open access environments, and how scholars will contribute original work to the editions.

Symposium Draws International Scholars
Jack McGwire, Mary O’Brian Glasson Professor of History and Editor for the Frederick Douglass Papers, received IAHI funding to support the symposium, “Rediscovering the Life and Times of Frederick Douglass.” Douglass, a former slave turned abolitionist was one of the most influential writers during the Civil War and Reconstruction. The two-day event culminated the publication of the first scholarly edition of his third and final autobiography, Life and Times of Frederick Douglass, a revised and expanded 1881 edition.

In the Words of Frederick Douglass: Quotations from Liberty’s Champion
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The symposium and the upcoming journal issue are valuable new additions to the expanding scholarship on Frederick Douglass’s central role in the 19th century African American experience. Jack McGwire has also co-edited (with Heather L. Kaufman), The Words of Frederick Douglass: Documents from Early Champions and Select passages from Frederick Douglass, to be published by Yale University Press in 2014. Support came from the IAHI, Office of Diversity, Equity and Inclusion, Liberal Arts, and a special grant from Indiana Humanities.
SUCCESS BEGETS SUCCESS

The Indiana Center for Biological Microscopy recently received a second, 5-year renewal of its NIH P-30 grant, now entering its 11th year. The NIH renewal was also accompanied by funds from the Department of Medicine, the School of Medicine, and the IUPUI Imaging Research Initiative to help maintain the cutting-edge facility. The Center offers investigators unique opportunities to simultaneously view multiple dynamic biological processes in four dimensions (3D plus time) at the cellular and subcellular levels within living animals by using 2-photon microscopy. Developed within the Division of Nephrology and directed by Dr. Bruce Molitoris, the Center is utilized by 70 campus faculty as well as investigators from around the world. In the previous academic year alone, the facility contributed to 68 unique publications. In addition, Indiana CTSA Core funds are available to investigators to cover the costs associated with facility use. Educational courses are offered every other year, allowing researchers to have hands-on experience in obtaining and processing imaging data.

Perhaps the most important aspect of the 2-photon facility relates to translation of basic science discovery into clinical understanding and therapeutics. The ability to directly collect mechanistic data and observe therapeutic responses allows investigators to answer specific questions not possible with other techniques at organ, cellular, or subcellular levels. This approach has also resulted in FAST BioMedical, a spin-off company that has licensed an EU patent to develop a technology to quantify plants volume and kidney function at the bedside.

PICTURES WORTH MORE THAN 1,000 WORDS

Paul Salama, Associate Professor in Electrical and Computer Engineering and Director of the Visual Communications Laboratory, is one of the reason that imaging research is a strong suit at IUPUI. His recent efforts are many: 2D/3D Image analysis techniques (including registration and segmentation) for medical imaging, image fusion, image processing and medical security. He has collaborated with Biomedical Engineering colleagues to develop a plan to de-noise neural signals recorded from electrodes implanted in the peripheral nervous system.

IUPIU AT FOREFRONT OF CYBERSECURITY AND ACCESS CONTROL

Ellis Y. Dui, Associate Professor of Electrical and Computer Engineering and Founding Director of the Biometrics and Pattern Recognition Lab, leads her research team in designing secure and robust human identification approaches in the era of growing threats of security breaches and cyber attacks. Her and her team designed the first non-cooperative iris recognition system, which was funded by the Office of Naval Research and National Institutes of Justice. Dr. Dui collaborated with Dr. David Earls, Professor of Ophthalmology at the School of Medicine, to propose the iris recognition concept and design a iris recognition method. She and her team then designed the first fully automatic iris recognition system. They then combined the strengths of iris and sclera recognition and created multimodal eye recognition, which can perform more accurate, non-intrusive and non-cooperative human identification. These novel designs have resulted in several cooperative iris recognition methods, which are the hallmarks of disease. These advanced imaging methods, while ensuring identity security. Their goal is to make sure the user identifies themselves in the face of security breaches or even a series of system attacks.

MEDICAL IMAGING VISUALIZES BIOLOGICAL AND BIOCHEMICAL ALTERATIONS IN HUMAN DISEASE

Modern medical imaging provides windows into the human body, resulting biological and biochemical alterations that are the hallmarks of disease. There advanced imaging methods, commonly referred to as “functional and molecular imaging,” are used to establish the specific manifestation or translation of disease in individual patients. These imaging tools can also be applied to monitor the efficacy of experimental therapies. Dr. Gary D. Hutchins, John W. Duderstadt Professor of Radiology, Director of Imaging Research Council, with representatives from the Schools of Medicine, Science, Engineering and Technology, Library/Arts, and Informatics.

IUPIU IMAGING RESEARCH INITIATIVE

Stronger Research Collaboration

Dr. Gary D. Hutchins, John W. Duderstadt Professor of Radiology, Director of the Visual Communications Laboratory, is one of the reason that imaging research is a strong suit at IUPUI. His recent efforts are many: 2D/3D Image analysis techniques (including registration and segmentation) for medical imaging, image fusion, image processing and medical security. He has collaborated with Biomedical Engineering colleagues to develop a plan to de-noise neural signals recorded from electrodes implanted in the peripheral nervous system.
Building on the existing campus strength in STEM education and research, the STEM Education Research Institute (SERI) has been created to promote and coordinate STEM education research initiatives pursued through the institutes and in collaboration with its external partners. SERI consists of a partnership between the Office of the Vice Chancellor for Research and participating campus units, consisting of the School of Engineering and Technology, School of Science, and School of Education.

IUPIU responds to national need—STEM PIPELINE A CAMPUS PRIORITY

The U.S. Department of Labor projects 6 million openings for positions requiring technical degree by the end of this decade. A $52 million project funded by the NSF, the Central Indiana STEM Talent Expansion Program (STEP) has its mark in each of its first three years: increasing STEM graduates at IU by 10%. The goal is to add close to 300 STEM diplomas to the workforce by the end of 2014.

IUPIU RESEARCHERS ADAPT WINNING INSTRUCTIONAL MODEL TO CYBERSPACE

For more information, visit ctl.iupui.edu

Problem-based learning. It also improves performance and course retention, develops communication and team skills, raises motivation and course satisfaction, and increases interest in pursuing further studies in science. PBL has been successfully introduced in college STEM courses across the country.

Since 2009, Dr. Pratibha Varma-Nelson’s team has worked to adapt the PBL model to a cyber environment (PBLi). Their work represents a new direction for education research, expanding the knowledge on teaching STEM concepts as well as utilizing technology in education. With funding from the NSF and Next Generation Learning Challenges (NGLC), Varma-Nelson’s team has studied PBLi’s impact on student achievement, deep learning, and motivation. Their research shows PBLi’s positive impact on student performance and development. In efficacy is further highlighted by its designation as an Effective Practice in Online and Blended Education by the Share Center for Innovation, a technology group dedicated to quality in online education.

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The Integrated Nanosystems Development Institute (INDI) is a partnership between the Office of the Vice Chancellor for Research and campus units interested in advancing nanotechnology research and education. With the realization that progress within the field of nanotechnology results from multidisciplinary collaborations, INDI is comprised of 30+ faculty in Engineering & Technology, Science, Medicine, and Dentistry.

INDI facilitates collaborations in this diverse group of researchers in order to develop nanotechnology-based systems that address major societal needs. Building on campus strengths including the Lugar Center for Renewable Energy and the School of Medicine, the Institute focuses on nanoenergy and bionanotechnology. INDI is also actively engaged in educational and outreach activities such as nanotechnology summer camps for high school students and teachers.

Examples of Bionanotechnology and Nanoenergy Projects

Designing Biomembrane-Mimicking Substrates
Christoph Naumann, Chemistry and Chemical Biology

With the ability to feel and respond to their surroundings, cells plated on traditional glass or plastic substrates display features less predominant in native tissue environments. While previously developed elastic gel substrates better replicate tissue and have provided insight into the role of substrate elasticity on mechanotransduction, a lack of a suitable dynamic substrate has inhibited the assessment of substrate viscosity and its role. Novel biomembrane-mimicking substrates are being developed and characterized as tools for regulating substrate viscoelasticity and exploring its impact on cellular response. Preliminary results show profound changes in phenotype, cytoskeletal organization, and motility in response to changes in viscoelasticity.

Assessing Nanoparticle Toxicity
Frank Witzmann, Cellular & Integrative Physiology

Silver nanoparticles (AgNPs) are increasingly used in food packaging and dietary supplements due to their antibacterial qualities, yet their impact on health once ingested remains unclear. As a result, concerns regarding AgNP exposure are on the rise. Understanding biological interactions between engineered nanomaterials and the gastrointestinal tract is vital to assess potential risks and to develop safe, nano-material-based products. This research aims to develop an innovative analytics platform capable of accurately characterizing and assessing AgNP toxicity, dosage, exposure, and fate in the gastro-intestinal tract using a well-characterized in vitro platform that mimics the intestinal mucosa.

Fabrication and Characterization of Nanoparticle-Based Solar Cells
Mangilal Agarwal, Electrical and Computer Engineering

Copper Indium Gallium Selenium (CIGS) nanoparticle-based solar cells show promise in creating a viable and sustainable energy source. CIGS have been widely studied for high efficiency solar cell applications, yet in order to see widespread use, cost effective manufacturing must be developed. Utilizing a nanofabrication process known as Layer-by-Layer (LbL) nanoassembly, CIGS films can be fabricated in a cost effective manner. Preliminary data shows potential in CIGS-based solar cells as commercially viable renewable energy sources for the future.
Robinah Maasa then participated in the Bridges Aide, which piqued her interest in pharmaceutical studies. The bridge that Robinah Maasa crossed to realize her educational goals has literally spanned an ocean and two continents. Robinah received an education BS from Makerere University, Uganda's largest and second-oldest university. She then taught high school biology for five years, inspiring her students to love the essence of learning. Her thirst for knowledge and professional development led her, in 2006, to immigrate to Indiana.

Robinah plans to pursue a doctoral degree in medicine or pharmacology following her 2014 graduation. She is also an active member in the IUPUI Biology Club, serves as Student Ambassador for the Center for Research and Learning, and is a participant in the McNair Postbaccalaureate Achievement Program. She also delivered the student keynote speech at the 2013 IU Undergraduate Research Conference. Unwilling to rest on her laurels, Robinah plans to pursue a doctoral degree in medicine or pharmacology following her 2014 graduation.

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COMMERCIALIZATION AND ECONOMIC DEVELOPMENT
From Drawing Board to Market

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PEPTIDES ENHANCE CANCER IMMUNOTHERAPY
Hua-Chen Chang, Biology
Professor Chang founded Immune Peptide Therapeutics LLC as a result of her research discoveries at IUPUI. Despite the effectiveness of chemotherapy to kill cancer cells, many patients eventually relapse or have other disease progressions. Dr. Chang's goal is to develop an effective immunotherapy that would circumvent chemotherapy induced immune deficiency while also harnessing anti-tumor immunity. Chang's team has discovered a novel class of synthetic peptides that modulate immune functions, which could be an alternative regimen for immunotherapy to improve clinical outcomes and limit tumor progression. In short, it may prolong the lives of cancer patients. This peptide-based immunotherapy harnesses the anti-tumor immunity by enhancing tumoricidal activity of innate immune cells such as natural killer (NK) cells. The synthetic peptides developed in Chang's laboratory have additive effects on stimulating innate immune cells such as dendritic cells (DCs), which in turn will amplify the protective immune responses elicited by vaccination. These synthetic peptides could be used as adjuvants in therapeutic cancer vaccines for treatment as well as vaccines for prevention.

NEW BLOTTING DEVICE ADVANCES FIELD
Stanley Chien, Electrical and Computer Engineering
Hiroki Yokota, Biomedical Engineering
This duo formed an interdisciplinary research team for the development of bioelectric devices for protein analysis. One such product is a Multiblot Western Blotting Device. Western blotting is a common procedure for protein detection in many biomedical laboratories. The team has developed a novel device that significantly reduces time and costs for blotting. Specifically, it enables a uniform transfer of proteins of various sizes N-5 membranes from a single gel. An advantage of this device is the ability to generate multiple, high-quality membranes without being affected by variations among gels (US patent pending). A bioelectric company was established in 2012 for further development and commercialization of this device and others.

ANALGESIC THERAPEUTICS FOR AIDS-RELATED PAIN
Rajesh Khanna, Pharmacology & Toxicology
Chronic neuropathic pain is a huge problem in the U.S. to an increasingly aging population, one with estimates of 30-50% of this type of sufferer having become resistant to existing medications. Because of this, there is an imperative to increase knowledge of mechanisms of action of the key proteins in nociceptive pathways in vitro and to extend this knowledge to in vivo models of neuropathy to advance therapeutic development. N-type voltage-gated Ca2+ channels (CaV2.2) have emerged as potential novel targets for the treatment of chronic neuropathic pain. Funded in part by a FORCES grant, the team has identified two novel derivatives of the parent 15 amino acid CRP-3 peptide, derived from collapsin response mediator protein 2 (CRMP-2) that suppressed inflammatory and neuropathic hypersensitivity by inhibiting CRMP-2 binding to N-type voltage-gated calcium channels (CaV2.2). Pharmacokinetic studies revealed nanogram levels of peptide in plasma of rats systemic administration consistent with relief of hypersensitivity.

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The IUPUI Solution Center serves Indiana as the “front door” to the community by connecting the university’s intellectual capital to the pressing needs of business, government, and the nonprofit sector. Drawing on the talents of IUPUI’s faculty and students, the Solution Center facilitates partnerships with Indiana’s business, nonprofit and government sectors that will build human capital, aid in economic growth, and transfer information, technologies, and methods that enhance innovation and practice.

HEALTHY SMILES FOR EMPLOYABILITY

Dentistry faculty and students aim to give Indianapolis residents in need more than one reason to smile. Under the direction of Dr. Karen Yoder, Director of Civic Engagement and Health Policy at IUPUI, and Dr. Timothy Carlson, Professor of Operative Dentistry, students working at Dentistry’s Student Outreach Clinic in the Near Eastside neighborhood are researching the link between dental health and economic development.

The project, “Healthy Smiles for Employability,” is supported through two funds at the IUPUI Solution Center: the Community Venture Fund and the JPMorgan Chase Near Eastside Legacy Initiative. The grant will cover the cost of student intern salaries at the clinic as well as oral surgery fees and dentures for up to 20 Near Eastside unemployed or underemployed residents.

As part of the project, IUPUI students are interviewing Near Eastside employers to determine what role, if any, dental health plays in employer hiring decisions. Students are also connecting their dental patients to neighborhood job assistance programs. Their goal: discover how the combination of healthy teeth and a strong neighborhood support system affect a person’s employment prospects.

A RISING TIDE LIFTS ALL BOATS

In an effort to overcome communication challenges in Indianapolis’s Near Eastside neighborhood, IUPUI faculty and students collaborated on a foundational research project to understand methods of communication and information sharing in the underserved neighborhood. Beginning in fall 2011 and concluding one year later, students in class projects funded by the IUPUI Community Ventures Fund and the Solution Center’s JPMorgan Chase - IUPUI Near Eastside Legacy Initiative program completed field work interviewing Near Eastside residents about how they communicate in their daily lives.

Although the project originally called for communication quick-fixes, such as websites, IUPUI faculty members found that the neighborhood’s communication needs ran deeper than that and would need to be more closely examined if the university-community partnership was to have a real and lasting impact.

The project involved 13 Herron School of Art and Design, 15 from Medicine’s Department of Public Health, and 15 from Liberal Arts. Each group was faculty-led by Youngbok Hong, Associate Professor of Visual Communications; Kathryn Coe, Professor of Social and Behavioral Sciences; and Elizabeth Goering, Associate Professor of Communication Studies. After completing research separately in their respective fields, the interdisciplinary teams came together to share their findings and create an overall communication strategy for the Near Eastside. Solutions included opening up more varied channels of communication to reflect the neighborhood’s diverse population, providing more affordable transportation options to make it easier for community members to get together, and implementing incentives for business owners to help make the community a safer place to live and work.

The student/faculty research teams laid the foundation for future university-community partnerships by presenting their research to community partners. The Solution Center is currently using the research findings to develop future projects through the center’s JPMorgan Chase grant that will further benefit the Near Eastside.

For more information, visit iupui.edu/solctr
An institution’s research capacity depends not only upon technology but also upon the human capital available to drive the enterprise. To build that human capital, IUPUI has launched two new schools and six new Ph.D. programs.

In alignment with the Life Sciences mission of IUPUI, three of the six new Ph.D. programs are in the newly chartered and newly named Richard M. Fairbanks School of Public Health.

**New Ph.D. Programs on Campus**

**Capacity + Expertise = Innovation**

**Programs**

- **Biostatistics** — This degree engages faculty from Mathematics, Public Health, and Medicine to produce tools and data to improve medical decision making.
- **Epidemiology** — This degree trains researchers who discover how diseases spread and how to best protect the public.
- **Health Policy & Management** — This degree will train researchers to use data to drive a more efficient and effective health care system.
- **Economics** — This degree focuses on medical economics, a vital component for a Life Sciences campus.
- **Health and Rehabilitation Sciences** — This interdisciplinary degree focuses on research on how the body moves, contributing to improved health for Indiana citizens.
- **Urban Education Studies** — This degree focuses on developing best practices to meet urban educational needs.
- **School of Philanthropic Studies** — This school will be the new home of the Ph.D. in Philanthropic Studies, which was originally developed in the School of Liberal Arts. This Ph.D. program is developing researchers who are creating the new academic field focused on philanthropy.

**IUPUI Research Commercialization Metrics**

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<th>Disclosures Received</th>
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<th>Start-Up Companies Formed*</th>
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<th>Licenses Executed</th>
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<table>
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<th>License Income</th>
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<tr>
<td></td>
<td>$4.2M</td>
<td>$4.55M</td>
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*Company formation based on a license to an IUPUI technology.

**IUPUI Research Expenditures for Fiscal Year 2012**

**TOTAL: $287,892,801**


**Impact by the Numbers**