Research Enterprise

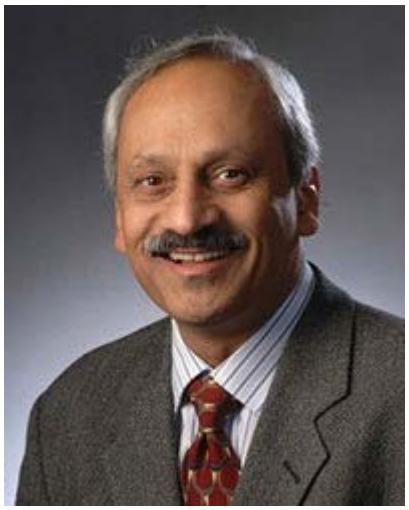
July 22, 2016

INSIDE THIS ISSUE:

FEATURE STORY

IUSM's Precision Health Initiative is first recipient of Grand Challenges fund

IU announced that the Precision Health Initiative, a research endeavor focused on patient-centered precision medicine therapies and led by IU School of Medicine faculty, will receive the first funding under the university's new $300 million Grand Challenges Program.



The Precision Health Initiative, led by Anantha Shekhar, M.D., Ph.D., will transform biomedical research, health care innovations and the delivery of health interventions in Indiana. | Photo By James Brosher

The Precision Health Initiative will develop IU's expertise in individualized precision medicine with team members working closely with several prominent business and community partners, including Eli Lilly and Company, Roche Diagnostics, Cook Regentec, Deloitte, Regenstrief Institute, and Indiana University Health.

IU President Michael A. McRobbie said the Precision Health Initiative is a visionary proposal that fully realizes the vision of IU's Bicentennial Strategic Plan to improve the education, health, economy, and quality of life of the people of Indiana. Led by IU Associate Vice President for Clinical Affairs and IU School of Medicine Executive Associate Dean for Research Affairs Anantha Shekhar, the Precision Health Initiative will seek to cure at least one cancer and one childhood disease, as well as find ways to prevent one chronic illness and one neurodegenerative disease.

"Precision health and person-centered approaches to patient care will be the next paradigm shift for health care delivery, and likely the dominant new forces in training the next generation of graduates from health sciences schools," Shekhar said. "The goal of precision medicine is to get the right prevention or treatment to the right patient at the right time, and this initiative will enable us to do that for Hoosiers across the state."

To read more about the Grand Challenges and the Precision Health Initiative, visit MedNet. To view a video about the Precision Health Initiative and its goals, click here. You can also visit the IU School of Medicine website for ongoing information and developments about this project.

ANNOUNCEMENTS

Mechanical engineering team awarded $200K by NSF to study increasing capacity of lithium batteries


Likun Zhu, Ph.D.


Yongzhu Fu, Ph.D.

The National Science Foundation has awarded $200,022 to a research team led by Likun Zhu, an associate professor of mechanical engineering with the School of Engineering and Technology, to overcome problems with one approach to increasing the capacity of lithium ion batteries.

Increasing the capacity of rechargeable lithium ion batteries is important because they help enable sustainable energy systems by storing electricity generated by intermittent renewable resources such as wind and solar energy, Zhu said. They also power zero-emission electric vehicles charged by electricity from renewable resources.

Yongzhu Fu, an assistant professor of mechanical engineering with the School of Engineering and Technology, is co-principal investigator.

According to Zhu, one approach to significantly improving capacity is to replace conventional graphite anodes with alloy-type anode materials that include the elements silicon, germanium and tin.

But the problem has been that these alloy materials swell up after charging and shrink down after discharging, which leads to fracturing of micrometer-sized particles and promotes mechanical failure.

This research will address this issue by adding the element selenium to alloy-type anodes, such as germanium and tin, made from micrometer-sized particles.

The resulting selenium-doped microparticles may be able to withstand the massive swelling/shrinking of the anode, Zhu said. But the fundamental mechanisms are still unclear.

"Advanced imaging and computational studies will gain a fundamental scientific understanding of these selenium-doped alloy materials, with the long-term goal of developing commercially affordable, high-performance anode materials for better batteries," Zhu said.

The research will be a collaborative effort between researchers at three universities: IUPUI, Mississippi State University and the University of Texas at Austin.

Shekhar receives inaugural IURTC Outstanding Innovator Award

Indiana University Research and Technology Corp., which helps IU faculty and researchers realize the commercial potential of their discoveries, has awarded the first IURTC Outstanding Innovator Award to Anantha Shekhar, M.D., Ph.D.

Dr. Shekhar is the August M. Watanabe Professor of Medical Research and a professor of psychiatry, neurobiology and pharmacology at IU School of Medicine. He is also co-founder of Anagin LLC. Indiana University President and IURTC Chairman Michael A. McRobbie presented the award to Shekhar at the June 22 meeting of the IURTC board of trustees.

For more, visit the IUSM Newsroom.

Mitra awarded Schreiber Research Prize

Anirban Mitra, Ph.D., assistant professor of medical and molecular genetics, IU School of Medicine Medical Sciences Program, was awarded the Schreiber Research Prize for Outstanding Mentored Investigators from the Ovarian Cancer Research Fund Alliance.

Mohammed receives global cancer research award

Sulma Mohammed, Ph.D., associate professor of cancer biology in the Department of Comparative Pathobiology, Purdue Veterinary Medicine, recently received the African Diaspora Ambassador Award at the 2016 Global Health Catalyst (GHC) Summit at the Dana Farber Harvard Cancer Center. Dr. Mohammed has been the course director of medical microbiology for IU School of Medicine-West Lafayette since 2002.

CENTER SPOTLIGHT

IU study finds testicular cancer survivors may have hearing loss after cisplatin therapy

Many testicular cancer survivors experience hearing loss after cisplatin-based chemotherapy, according to researchers at Indiana University.

The researchers, led by Lois B. Travis, M.D., Sc.D., the Lawrence D. Einhorn Professor of Cancer Research at the IU School of Medicine and a researcher at the Indiana University Melvin and Bren Simon Cancer Center, studied for the first time the cumulative effects of cisplatin-based chemotherapy on hearing levels in testicular cancer survivors through comprehensive audiometry measurements. They found that increasing doses of cisplatin were associated with increased hearing loss at most of the tested frequencies, involving 4, 6, 8, 10, and 12 kHz.

The research was published online June 27 in the Journal of Clinical Oncology.

Lois B. Travis, M.D., Sc.D.

"In addition to hearing loss, about 40 percent of patients also experienced tinnitus (ringing-in-the-ears), which was significantly correlated with reduced hearing," Dr. Travis, also director of the cancer center's Survivorship Research Program, said.

Although this study was conducted in patients with testicular cancer, the authors point out that the general conclusions are likely applicable to patients with other types of adult-onset cancers that are commonly treated with cisplatin. They indicate that it will be important to follow patients given cisplatin-based chemotherapy long-term to better understand the extent to which the natural aging process may further add to hearing deficits, as it does in the general population.

"The results show the importance of comprehensive hearing assessments, preferably, both before and after treatments," Dr. Travis said. "Our findings suggest that health care providers should, at a minimum, annually query patients who have received cisplatin-based chemotherapy about their hearing status, consulting with audiologists as indicated. Patients should also be urged to avoid noise exposure, drugs having adverse effects on hearing, and other factors that may further damage hearing."

Co-first author Robert Frisina, Ph.D., added: "We are the first to show definitively that in a significant number of the cancer survivors, they have hearing loss above and beyond age-related hearing loss. They were of different ages --20s to 60s -- so this was a new analysis." Dr. Frisina is a professor in the Department of Chemical and Biomedical Engineering, director of the Biomedical Engineering Program, and director of the Global Center for Hearing and Speech Research at the University of South Florida. He designed the auditory portion of the study.

Platinum-based cisplatin is one of the most commonly used drugs in medical oncology that also has toxic effects on the inner ear. Despite its use for more than 40 years, knowledge about the effects of cumulative cisplatin dose on hearing loss in survivors of adult-onset cancer has remained limited.

The researchers found that every 100 mg/m2 increase in cumulative dose of cisplatin resulted in a 3.2 dB impairment in hearing. The researchers also found high blood pressure was significantly related to hearing loss in these patients, even when cisplatin dose was taken into account. Thus, they emphasized the importance of high blood pressure control.

The researchers pointed out that because alterations in the highly successful testicular cancer regimens are unlikely for patients with advanced disease, their results underscore the importance of ongoing research aimed at the identification of genetic variants associated with cisplatin-related ototoxicity. An ultimate goal is to use the genetic results to develop effective agents that will protect the ear during the administration of cisplatin. For patients treated with cisplatin-based regimens for other types of cancer, it might also influence a physician to offer an alternative to those patients found to be genetically susceptible to the ototoxic effects of cisplatin after carefully weighing the risks and benefits of alternative treatments.

Lawrence Einhorn, M.D., Indiana University Distinguished Professor, Livestrong Foundation Professor of Oncology at the IU School of Medicine, and a physician scientist at the IU Simon Cancer Center, also was an author of the study.

In 1974, Dr. Einhorn tested cisplatin with two additional drugs that were effective in killing testis cancer cells. The combination became the cure for this once deadly disease. The results of this three-drug regimen were stunning. Tumors dissolved within days. Subsequent clinical research directed by Dr. Einhorn minimized the extremely toxic side effects of treatment;

shortened the duration of two years of therapy to nine to 12 weeks; and established a model for a curable tumor, which has served as a research roadmap for generations of oncologists.

The researchers studied 488 men enrolled in the Platinum Study, which is open at the IU Simon Cancer Center and seven other cancer centers in the United States and Canada. The aim of the study is to gain new information that can benefit future testicular cancer patients and other patients treated with cisplatin-based chemotherapy.

The study was funded by a grant from the National Cancer Institute.

Other authors included M. Eileen Dolan of the University of Chicago; Steven E. Lipshultz of Wayne State University School of Medicine; Shirin Ardeshir-Rouhani-Fard and Patrick Monahan of the IU Simon Cancer Center; Eileen M. Johnson and Sophie D. Fossa of Oslo University Hospital, Oslo, Norway; Amy Budnick and Darren R. Feldman of Memorial Sloan-Kettering Cancer Center; Clair J. Beard of Dana-Farber Cancer Institute; David J. Vaughn of the University of Pennsylvania; Robert Hamilton of Princess Margaret Cancer Centre; Howard D. Sesso of Brigham and Women's Hospital; Chunkit Fung and Sarah L. Kerns of J.P. Wilmot Cancer Institute; and Heather Wheeler of Loyola University.

INSTITUTE SPOTLIGHT

Young African-American adults are less susceptible to delirium in ICU than Caucasians

The first study to evaluate the relationship between race and intensive care unit delirium has found that African-American ICU patients age 18 to 50 are less susceptible to delirium than similarly aged Caucasians or than either African-American or Caucasian ICU patients age 50 or older.


Babar A. Khan, M.D.

Delirium is a state of confusion that comes on suddenly and is associated with longer ICU and hospital stays, increased costs of care and higher death rate. Known risk factors for developing delirium in the ICU include age, pre-existing cognitive impairment, and sedation (often used in conjunction with mechanical ventilation). Prior to the new study by researchers from the Regenstrief Institute and the Indiana University Center for Aging Research, the relationship between race and delirium had not been systematically evaluated.

"Relationship between African-American Race and Delirium in the Intensive Care Unit" was published online ahead of print in the journal Critical Care Medicine.

"Since African-Americans tend to have higher disease severity in the ICU, we were surprised to find that race could be a protective factor for younger African-American adults," said Regenstrief Institute investigator and IU Center for Aging Research scientist Babar A. Khan, M.D., the first author of the study.

"We now know that race should be considered among the risk factors for developing delirium for Caucasians of all ages but only for African-Americans if they are 50 or older. Clearly, different groups have different risk profiles for delirium."

A total of 2,087 adults, admitted to a medical or surgical ICU, 48 percent of whom were African-Americans, participated in the study. The majority participated in an indigent care program or state Medicaid program and were thus considered to be of similar economic status. All had ready access to healthcare services and delivery at Eskenazi Health, a health care system that puts special emphasis on vulnerable populations in the metropolitan Indianapolis area. Dr. Khan is the medical director of the Eskenazi Health Critical Care Recovery Center.

Based on patient data from the Regenstrief Medical Record System, the African-Americans and Caucasians had comparable death rates, illness severity and similar rates of mechanical ventilation and dementia diagnoses, however smoking and depression diagnosis were greater among Caucasians. More drugs associated with delirium were prescribed for Caucasians than African-Americans.

The reasons why African-Americans have lower rates of delirium are unclear according to Dr. Khan and will need exploration in future studies.

"If you look at various studies, there are certain medications to which African-Americans respond better and from which they have better outcomes compared to Caucasians," Dr. Khan said. "If in the near future we are able to learn more about delirium at a basic or molecular level utilizing genetics and biomarkers, we may be able to come up with better preventive and treatment strategies based on personalization of therapy. Our findings provide the kind of information we need to conduct precision medicine."

Dr. Khan notes that even in the short run the clinical implications of the study findings should raise awareness among physicians and other health care providers who can provide targeted interventions to decrease delirium burden.

Delirium presents in several ways. Individuals with delirium may be agitated and aggressive (hyperactive) or lethargic and withdrawn (hypoactive) or be both hyperactive and hypoactive. While many patients could have delirium upon admission to the ICU, some are able to communicate or follow commands when admitted. They are still at risk for developing delirium during their ICU stay, which once developed render them unable to pay attention or communicate.

According to the American Geriatrics Society approximately 7 million hospitalized Americans experience delirium every year.

The study was supported by the National Institute on Aging (R01AG034205 and K23-AG043476).

Authors, in addition to Dr. Khan are Anthony Perkins M.S., Sujuan Gao, Ph.D., and Mark O. Farber, M.D., of the IU School of Medicine; Siu L. Hui, PhD, of the Regenstrief Institute and IU Center for Aging Research; Noll L. Campbell, PharmD, of the Regenstrief Institute, IU Center for Aging Research and the Purdue University College of Pharmacy; and Malaz A. Boustani, M.D., MPH, of the Regenstrief Institute, IU Center for Aging Research, IU School of Medicine and the Center for Health Innovation and Implementation Science.

FACULTY SPOTLIGHT

Study: Violations of privacy rights by fusion centers are the exception, not the rule


Jeremy Carter, Ph.D.

Concerns that law enforcement fusion centers are violating individuals' privacy rights as they gather intelligence on terrorism, criminals and other threats to public safety are the exception and certainly not the rule, according to a study published in the Journal of Police and Criminal Psychology.

The paper "Law Enforcement Fusion Centers: Cultivating an Information Sharing Environment while Safeguarding Privacy" authored by Jeremy Carter, an assistant professor in the School of Public and Environmental Affairs at Indiana University-Purdue University Indianapolis, addresses the privacy-rights issue, among others.

The national network of fusion centers in the U.S., currently numbering 78, was created in response to the terrorist attacks of Sept. 11, 2001. In the wake of the attacks, the need for greater information-sharing and increased intelligence capabilities across various law enforcement levels and locales became widely apparent.

The idea was to try to have the necessary pieces of information funneled to a fusion center so analysts could stay abreast of potential threats and then relay that information back to law enforcement to mitigate the threat, Carter said.

The fusion centers were designed to enhance information-sharing among law enforcement agencies, public agencies and private organizations by acting as hubs for information and intelligence on terrorist, criminal and other public safety threats.

Given the large quantities of information being collected, coupled with an emphasis on terrorism and multijurisdictional partnerships, concerns about privacy and civil rights have surfaced to question the legitimacy of fusion center operations, Carter said.

Some people are concerned that fusion centers are "Big Brother watching us" and that information is being gathered about people regardless of whether they've done anything wrong, he said.

Another concern stems from non-law enforcement organizations that participate in fusion centers, including private businesses, Carter said: "That raises questions about what those organizations can do with an individual's information versus what law enforcement can do."

"There are concerns about who has access to what, and what they are using it for," he said.

Based on a survey of fusion center personnel and three in-depth case studies, however, the study found that fusion centers are taking steps to safeguard the privacy rights of individuals.

To begin with, according to Carter, fusion centers are not gathering reams of data about people and holding onto it.

"Fusion centers are following the federal regulatory code, 28 CFR Part 23, that is the legal standard for collecting information," he said. "That code says you have to establish a criminal predicate, basically probable cause, to keep information on identifiable individuals."

Further, the centers have instituted a series of checks and balances to safeguard the privacy of individuals and have review boards or advisory councils watching them to ensure they are adhering to legal guidelines. "This is not a case of police policing themselves," Carter said.

The oversight boards also assist fusion centers to develop policies and best practices to safeguard individuals' privacy rights when fusion centers engage non-law enforcement agencies, Carter said.

The paper is Carter's latest study focusing on the role and operation of fusion centers.

STUDENT SPOTLIGHT

Nuclear medicine technology students receive accolades

Sarah Pigmon, a 2016 nuclear medicine technology program graduate, presented her research at the Society of Nuclear Medicine and Molecular Imaging annual meeting in San Diego earlier this month. Competing against 45 other students, she placed second for her research, “The Necessity of Using Heparin in an UltraTagTM Kit when Tagging Blood for a Nuclear Medicine Study.” Pigmon also submitted her research for publication in the Journal of Nuclear Medicine Technology.

Shelby Bryant, a senior in the program, was elected to the National Council of Representatives for the Society of Nuclear Medicine and Molecular Imaging. She will serve as the national student representative. Only one student is chosen every two years to serve in this position. Bryant will attend the mid-winter meeting in Phoenix and the annual meeting in Denver next year.

TRANSLATIONAL RESEARCH IMPACT

IU researchers begin PET scans of certain older patients in new Alzheimer's related study

In a new Alzheimer's disease-related initiative, Indiana University School of Medicine researchers have begun using PET brain scans to look for signs of abnormal protein deposits known as amyloid plaques in older patients who have been diagnosed with mild cognitive problems.

The new project, part of a national research study that will enroll more than 18,000 participants, was made possible by Medicare's decision to reimburse for the amyloid PET brain scans in the study.

The Imaging Dementia - Evidence for Amyloid Scanning Study, known as the IDEAS Study, will use amyloid PET brain scans to determine whether participants have abnormal deposits of amyloid proteins in the brain, which are closely associated with Alzheimer's disease. The IDEAS

Study is led by the Alzheimer's Association and managed by the American College of Radiology and American College of Radiology Imaging Network.

Although imaging technologies to identify amyloid deposits in the brain have been available for several years, Medicare -- the federal government's health insurance program for Americans age 65 and older -- has decided only to cover the scans in the context of this study in order to learn more about the impact of amyloid PET brain scans before making a final decision on coverage for Medicare beneficiaries who may benefit from the scan.

The research goal of the IDEAS Study is to determine whether knowing that patients have the amyloid deposits will change physicians' treatment plans for those patients. Researchers will also gauge after 12 months whether this knowledge had an effect on hospitalizations and emergency room visits.

At least 200 participants will be enrolled at the IU School of Medicine and IU Health, said Liana Apostolova, M.D., Barbara and Peer Baekgaard Professor of Alzheimer's Disease Research and principal investigator for the research study at IU.

Participants must be age 65 or older and have been diagnosed as having mild cognitive impairment or other objective measures of cognitive decline. The participants may be referred to the trial by any physician, but IU dementia specialists will make the final determination of who qualifies for the trial. As with any medical service covered by Medicare, participants will be responsible for any deductible or co-payment required for the service. The actual amount that the individual will pay will depend on their Medicare plan.

Dr. Apostolova said that adding brain amyloid PET scans to the physician's standard toolset would have numerous benefits, starting with more accurate diagnoses -- some patients with mild cognitive impairment or other forms of dementia are now misdiagnosed as having Alzheimer's disease. Information from amyloid PET brain scans could help exclude underlying Alzheimer's disease, and may help guide patient management.

In turn, accurate diagnoses may reduce unnecessary diagnostic tests and inappropriate treatments, may encourage better planning and financial decisions by patients and their families, and may also reduce costs. With an accurate diagnosis, patients can receive more precise and suitable education in order to better prepare for the future.

Because of growing evidence that the initial stages of Alzheimer's begin years, even decades before symptoms of the disease appear, many researchers are focusing their efforts on identifying people with biomarkers -- such as increased amyloid protein deposits -- that put them at increased risk of developing the disease. Such people could be placed on regimens meant to delay or prevent the disease – once they are developed and proven – much like statins, dietary changes and exercise are prescribed to reduce the risk of heart attacks.

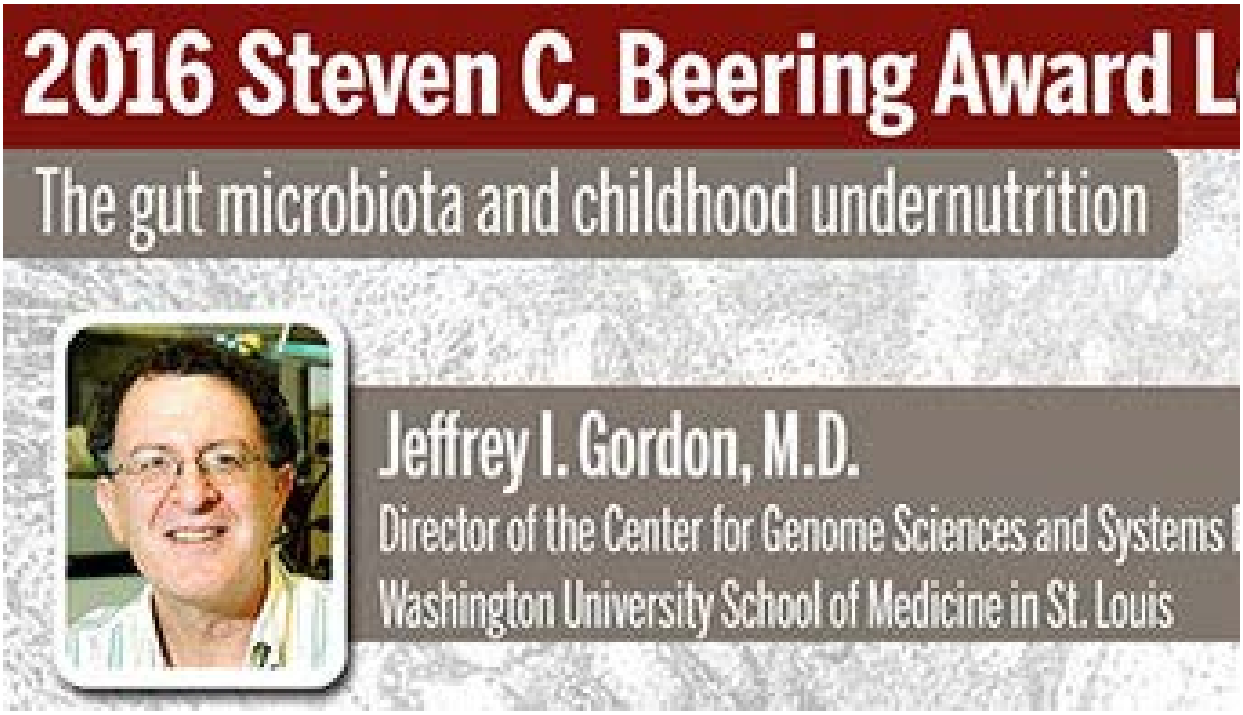
EVENTS AND WORKSHOPS

Although widely used in research to analyze and communicate data, graphs and charts are often poorly mastered by researchers. Based on Dr. Jean-luc Doumont's popular book, Trees, Maps, and Theorems, this workshop will provide attendees the skills needed to:

- Select the appropriate type of image for a given data set and research question
- Optimize a graph's layout to reveal a study's outcomes
- Write a caption that is useful for the researcher and reader

Thursday, August 18
5:15 p.m. - 7:00 p.m.
Glick Eye Institute (GK) 103

Register »



Please join us for the 2016 Steven C. Beering Award Lecture given by the 2016 winner, Jeffrey I. Gordon, M.D., Dr. Robert J. Glaser Distinguished University Professor, and Director of the Center for Genome Sciences and Systems Biology at Washington University School of Medicine, St. Louis, MO. Reception to follow in the Walther Hall atrium.
Dr. Gordon will also be giving the 2016 Beering Student Lecture, "A microbial view of human nutrition: Opportunities and challenges" on Monday, September 19 from 4:00 p.m. - 5:00 p.m. in Walther Hall (R3), Room 203.

Tuesday, September 20
3:00 p.m. - 4:15 p.m.
Walther Hall (R3), 203

Register »

CURRENT EXTERNAL FUNDING OPPORTUNITIES

Funding opportunities in this section include selected current grant announcements from federal agencies for new initiatives and changes to existing programs. Announcements with limited scope are not listed here but instead are sent directly to IUPUI School Deans. For comprehensive coverage of funding opportunities, please use the links below to search online tools.

NATIONAL INSTITUTES OF HEALTH

Advanced Laboratories for Accelerating the Reach and Impact of Treatments for Youth and Adults with Mental Illness (ALACRITY) Research Centers (P50): This opportunity invites applications for centers to support transdisciplinary teams of clinical and mental health services researchers, behavioral scientists, social scientists, health information

and communications technologists, health systems engineers, decision scientists, and mental health stakeholders (e.g., service users, family members, clinicians) to engage in high-impact studies that will significantly advance clinical practice and generate knowledge that will fuel transformation of mental health care in the United States. ALACRITY Research Centers will support the rapid development, testing, and refinement of novel and integrative approaches for: 1) optimizing the effectiveness of therapeutic or preventive interventions for mental disorders within well-defined target populations; 2) organizing and delivering optimized mental health services within real world treatment settings; and 3) continuously improving the quality, impact, and durability of optimized interventions and service delivery within diverse care systems. ALACRITY is also expected to provide opportunities for graduate students, postdoctoral researchers, and new investigators to participate in transdisciplinary, T2 translational mental health research. *Deadline: October 18, 2016.* http://grants.nih.gov/grants/guide/pa-files/PAR-16-354.html

Social Epigenomics Research Focused on Minority Health & Health Disparities (RO1): The purpose of this opportunity is to support and accelerate human epigenomic investigations focused on identifying and characterizing the mechanisms by which social experiences at various stages in life, both positive and negative, affect gene function and thereby influence health trajectories or modify disease risk in racial/ethnic minority and health disparity populations. *Deadline: November 15, 2016.* http://grants.nih.gov/grants/guide/pa-files/PAR-16-355.html/p>

NATIONAL SCIENCE FOUNDATION

Energy-Efficient Computing: from Devices to Architectures: There is a consensus across the many industries touched by our ubiquitous computing infrastructure that future performance improvements across the board are now severely limited by the amount of energy it takes to manipulate, store, and transport data. While the limits and tradeoffs for this performance-energy crisis vary across the range of application platforms, they have all reached a point at which evolutionary approaches to addressing this challenge are no longer adequate.

Truly disruptive breakthroughs are now required, and not just from any one segment of the technology stack. Rather, due to the complexity of the challenges, revolutionary new approaches are needed at each level in the hierarchy. Furthermore, simultaneous co-optimization across all levels is essential for the creation of new, sustainable computing platforms. These simultaneous technical and organizational challenges have never been as complex or as critically important as they are now. The urgency of solving the multi-disciplinary technical challenges will require new methods of collaboration and organization among researchers. Therefore, a comprehensive and collaborative approach must be undertaken to maximize the potential for successfully identifying and implementing revolutionary solutions to break through the bottleneck of energy-constrained computational performance. Programmers, system architects, circuit designers, chip processing engineers, material scientists, and computational chemists must all explore these new paths together to co-design an optimal solution path.

The NSF and the Semiconductor Research Corporation embark on a new collaboration to support compelling research that is of paramount importance to industry, academia, and society. This partnership will specifically support new research to minimize the energy impacts of processing, storing, and moving data within future computing systems, and will be synergistic with other research activities that address other aspects of this overarching energy-constrained computing performance challenge. *Deadline: Application: March 28, 2017* http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf16526

Critical Resilient Interdependent Infrastructure Systems and Processes (CRISP): The goals of this solicitation are to: 1) foster an interdisciplinary research community of engineers, computer and computational scientists and social and behavioral scientists, that creates new approaches and engineering solutions for the design and operation of infrastructures as processes and services; 2) enhance the understanding and design of interdependent critical infrastructure systems (ICIs) and processes that provide essential goods and services despite disruptions and failures from any cause, natural, technological, or malicious; 3) create the knowledge for innovation in ICIs so that they safely, securely, and effectively expand the range of goods and services they enable; and 4) improve the effectiveness and efficiency with which they deliver existing goods and services.

These goals lead to the following specific objectives:1) To create new knowledge, approaches, and engineering solutions to increase resilience, performance, and readiness in ICIs; 2) To create theoretical frameworks and multidisciplinary models of ICIs, processes and services, capable of analytical prediction of complex behaviors, in response to system and policy changes; 3) To develop frameworks to understand interdependencies created by the interactions between the physical, the cyber (computing, information, computational, sensing and communication), and social, behavioral and economic elements of ICIs. These could include, but are not limited to, software frameworks for modeling and simulation using advanced cyber infrastructures, management, monitoring and real-time control of interdependent ICIs and novel software engineering methodologies; and 4) to study socioeconomic, political, legal and psychological obstacles to improving ICIs and identifying strategies for overcoming those obstacles.

Projects supported under this solicitation may undertake the collection of new data or use existing curated data depending on the category of award, and must recognize that a primary objective is integrative, predictive modeling that can use the data to validate the models and that can be integrated into decision making. *Deadline: March 7, 2017.*
http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf16519

Innovations at the Nexus of Food, Energy, and Water Systems (INFEWS): Factors contributing to stresses in food, energy, and water (FEW) systems include increasing regional/social pressures and governance issues as result of land use change, climate variability, and resource distribution. These interdependencies associated with the food, energy and water nexus create research grand challenges in understanding how the complex, coupled processes of society and the environment function now, and in the future.

FEW systems must be defined broadly, incorporating physical processes (built infrastructure and new technologies), natural processes (biogeochemical and hydrologic cycles), biological processes (agroecosystem structure and productivity), social/behavioral processes (decision making and governance), and cyber elements. Investigations of these complex systems may produce discoveries that cannot emerge from research on food or energy or water systems alone. It is the synergy among these components in the context of sustainability that will open innovative science and engineering pathways to produce new knowledge and novel technologies to solve the challenges of scarcity and variability.

The NSF INFEWS initiative is designed specifically to attain the following goals: 1) Significantly advance the understanding of the food-energy-water system through quantitative and computational modeling, including support for relevant cyberinfrastructure; 2) Develop real-time, cyber-enabled interfaces that improve understanding of the behavior of FEW systems and increase decision support capability; 3) Enable research that will lead to innovative system and technological solutions to critical FEW problems; and 4) Grow the scientific workforce capable of studying and managing FEW systems.

This solicitation outlines four tracks of research: 1) FEW System Modeling, 2) Visualization and

Decision support for Cyber-Human-Physical Systems at the FEW Nexus, 3) Research to Enable Innovative Solutions; and 4) Education and Workforce Development. *Deadline: March 22, 2017.* http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf16533

SIMONS FOUNDATION

Simons Fellows in Theoretical Physics Program: This program enables research leaves providing time away from classroom teaching and academic administration. Research leaves from classroom teaching and administrative obligations can provide strong intellectual stimulation and lead to increased creativity and productivity in research. This program is intended to make leaves more productive by enabling the extension of sabbatical leaves from one academic term to a full academic year. *Deadline: September 26, 2016*.
Simons Fellows in Theoretical Physics

U.S. DEPT. OF DEFENSE

Minerva Research Initiative: The Minerva Research Initiative emphasizes questions of strategic importance to U.S. national security policy. It seeks to increase the Department's intellectual capital in the social sciences and improve its ability to address future challenges and build bridges between the Department and the social science community. Minerva brings together universities and other research institutions around the world and supports multidisciplinary and cross-institutional projects addressing specific topic areas determined by the Department of Defense. The Minerva program aims to promote research in specific areas of social science and to promote a candid and constructive relationship between DOD and the social science academic community.

The Minerva Research Initiative competition is for research related to the following 5 topics and associated subtopic: 1) Identity, Influence, and Mobilization; 2) Contributors to Societal Resilience and Change; 3) Power and Deterrence; 4) Analytical methods and metrics for security research; and 5) Innovations in National Security, Conflict, and Cooperation. *Deadlines: White Paper: Feb. 27, 2017; Application: June 17, 2017.*
http://www.grants.gov/web/grants/view-opportunity.html?oppId=280923

NOTE: *All faculty, researchers, and scientists on continuing contracts at IU interested in applying for Department of Defense funding are eligible for assistance by the consulting firm--Cornerstone Government Affairs-arranged by the Vice President for Research. Those interested in securing assistance from Cornerstone must submit a 2 page summary of their research project.*

IDENTIFYING FUNDING OPPORTUNITIES

On-line search tools are available to IUPUI investigators who are interested in identifying funding opportunities in their areas of interest.

Pivot (formerly COS): Pivot is a primary on-line search tool for identifying funding opportunities. To take advantage of this tool, register at https://pivot.cos.com/register. Once you have completed the short registration process, you can personalize your search by selecting the option entitled “launch your workbench”. You can access federal, local, corporate,

foundation, nonprofit and other funding opportunities using key terms and save the results of up to 20 searches and have them delivered to you weekly via email.

National Institutes of Health (NIH) "NIH Guide": To take advantage of this search tool, register at http://grants.nih.gov/grants/guide/listserv.htm. It allows you to receive discipline specific funding opportunities that are delivered to you weekly via email.

National Science Foundation (NSF) "MyNSF": To take advantage of this search tool, register at http://service.govdelivery.com/service/multi_subscribe.html?code=USNSF&custom_id=823. It allows you to receive discipline specific funding opportunities that are delivered to you weekly via email.

Federal Business Opportunities "FedBizOpps": FedBizOpps is the single government point-of-entry for Federal government procurement opportunities over $25,000. To take advantage of this search tool, visit https://www.fbo.gov. Opportunities found at this site include, but are not limited to, presolicitations and special notices for research and service contracts for specific projects and some national centers and surveys that would not be found in Grants.gov and may not be found in the Community of Science.

Limited Submission Funding Opportunities:

Many federal agencies and foundations offer grants, awards and fellowships that limit the number of applications that can come from one institution or require special handling. In order to comply with agency and foundation guidelines and increase the chances of Indiana University (IU) succeeding in such limited submissions and special handling opportunities, IU policies and procedures are in place and are utilized by the Office of the Vice Chancellor for Research and other IU research offices to facilitate internal coordination and competitions.

Individuals interested in responding to limited submission opportunities must inform the Office of the Vice Chancellor for Research about their intent to apply to a given limited submission opportunity, such that they can be included in the internal review and selection process. Failure to do so may disqualify individuals from consideration for submission to the funding opportunity.

Individuals interested in a limited submission opportunity or have any questions about the internal coordination process, contact Etta Ward at emward@iupui.edu or 317-278-8427. For a description of upcoming limited submission funding opportunities, as well as guidelines and application forms, go to: http://research.iu.edu/limited_sub.shtml. Please note that this is not a comprehensive list, and that any external funding opportunity that imposes any type of submission limitation is subject to the IU limited submission policy and procedures.

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