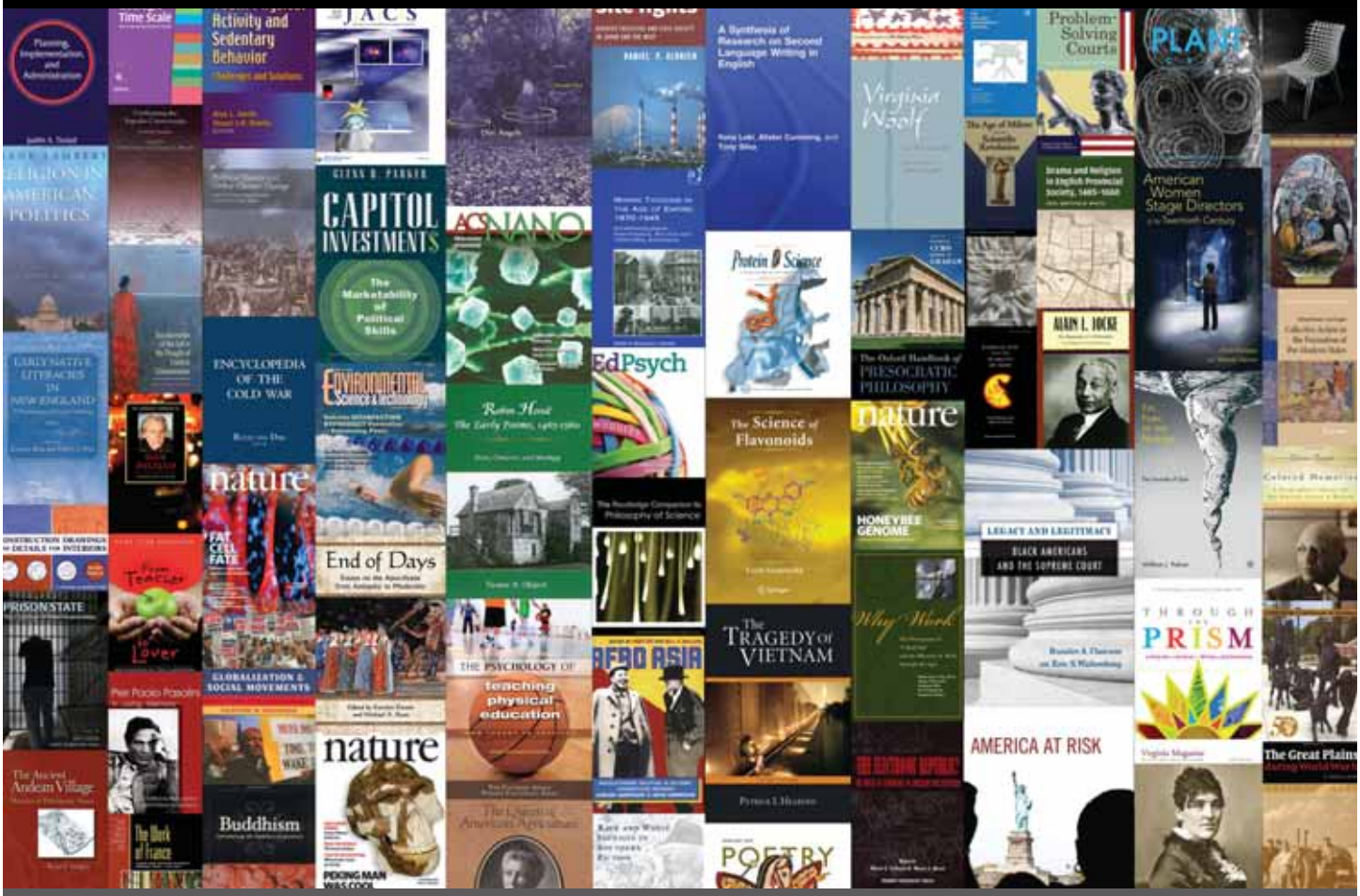
DIMENSIONS of DISCOVERY



Purdue Scholars Push Dimensions of Discovery

Welcome

Welcome to the first issue of *Dimensions of Discovery,* published by the Office of the Vice President for Research. *Dimensions of Discovery* replaces the *Research Review* newsletter which had been in circulation for nearly 23 years.

Each issue will include articles on a variety of topics highlighting the many dimensions of the discovery process and important announcements regarding changes in federal regulations, upcoming lectures, conferences and workshops, and updates on research procedures and protocols. See page 23 for more information.

Scholarly activities at Purdue University progress in countless dimensions. In this inaugural issue of *Dimensions of Discovery*, a snapshot highlighting just a small number of the many journals and books authored by Purdue investigators captures a fascinating world of research and scholarship unique to this university.

A distinctive collection of individual investigators has selected Purdue University as a place to push the boundaries of discovery beyond that which is known.

Scholarship is articulated in many forms. It may be through a concise recording of geologic time, dating early Peking Man, restoring missing gaps in history, writing biographies and novels, understanding human and political conflicts, improving health, healthcare and education, exploring religion, studying and discovering the intricacies of the tiniest of particles—plant cells, proteins, biomarkers, nanoparticles—or designing a high-tech chair.

The multiple dimensions of discovery are probed by inquiring investigators willing to push the boundaries of knowledge. View the work of colleagues and see the new dimensions that emerge.

PURDUE UNIVERSITY

Inside »

Visit the Office of the Vice President for Research Web site for more information about the scholarly activities represented in the collage of journal and book covers at **www.purdue.edu/research/vpr.**

1 *Confronting the Yugoslav Controversies: A Scholar's Initiative,* West Lafayette, IN: Purdue University Press, 2009, **Ingrao, C. W.** & Emmert, V. (Eds.).

2 PRDM16 controls a brown fat/skeletal muscle switch, *Nature* 454, 961-967, August 21, 2008, P. Seale, B. Bjork, W. Yang, S. Kajimura, S. Chin, **S. Kuang,** A. Scimè, S. Devarakonda, H.M. Conroe, H. Erdjument-Bromage, P.Tempst, M. A. Rudnicki, D. R. Beier and B. M. Spiegelman.

3 Electrochemical Biosensor of Nanocube-Augmented Carbon Nanotube Networks; *ACS Nano* 3: 37–44, 2009, **J. Claussen,** A. Franklin, A. ul Haque, **D.M. Porterfield, T. Fisher.**

4 Age of Zhoukoudian Homo erectus determined with 26Al/10Be burial dating, *Nature 458,* 198-200, March 12, 2009, G. Shen, X. Gao, B. Gao and **D.E. Granger.**

5 *Pierced Drain Chair;* Bridge for Emerging Contemporary Art, New Orleans, LA, Exhibition, Feb. 2009, **L. Drake.**

6 *Religion in American Politics: A Short History,* Princeton, NJ: Princeton University Press. 2008, **F. Lambert.**

7 One of the Best Loved, North and South: The Appropriation of National Reconciliation by Lasalle Corbell Pickett; *Virginia Magazine of History and Biography;* Volume 116 / Number 4; pp. 370–406; 2008, **C. E. Janney.**

8 Gyromagnetic Imaging: Dynamic Optical Contrast Using Gold Nano-stars with Magnetic Cores. *Journal of the American Chemical Society* 131 (28), 9728-9734, 2009, **Q. Wei, H-M Song, A.P. Leonov, J.A. Hale, D. Oh, Q.K. Ong, K. Ritchie, A. Wei.**

9 Mutation of the Membrane-Associated M1 Protease APM1 Results in Distinct Embryonic and Seedling Developmental Defects in *Arabidopsis, Plant Cell* 21: 1693-1721, 2009, **W.A. Peer, F.N. Hosein, A. Bandyopadhyay, S.N. Makam,** M.S. Otegui, **G-J Lee, J.J. Blakeslee, Y. Cheng, B. Titapiwatanakun, B. Yakubov, B. Bangari,** and **A.S. Murphy.**

10 *The Concise Geologic Time Scale,* Cambridge University Press, 2008, **J.G. Ogg,** G.Ogg and F.M. Gradstein.

11 *The Routledge Companion to Philosophy of Science,* Routledge, 2008, S. Psillos and **M. Curd** (Eds.)

12 *Colored Memories: A Biographer's Quest for the Elusive Lester A. Walton,* Columbia, MO: University of Missouri Press, 2008, **S. Curtis.**

Bolded names indicate Purdue faculty, graduate students and post-doctorates.

Online Resources Ease Proposal Preparation

Access Resources Online

To review and print proposal preparation resources:

Timeline: Go to **www.purdue.edu/research/vpr/rschdev/docs/projtimeline.doc**

Sample Outline: Go to **www.purdue.edu/research/vpr/rschdev/docs/outline.doc**

Sample Proposals: Browsing sample proposals may help you understand what you'll need to do. Go to **www.purdue.edu/research/vpr/** □

Four Keys to Funding Success

Proposal coordinator Sally Bond offers these keys to preparing proposals:

1. **A compelling storyline that provides context**
2. **Good writing mechanics**
3. **An answer to "Why Purdue?"**
4. **Independent feedback** □

Gain Advantage with Planning, Timeline, Review: Sharpen your proposal's focus and better your odds for funding success with online tools from the Office of the Vice President for Research.

Start with Timeline

A valuable first resource is a one-page project timeline that takes you step-by-step from planning to final edits. Surprising to some, the timeline calls for the writing to begin in week 5 of a 10-week process.

"Many seeking funding get a proposal and want to immediately start writing, but there are some things you will be wise to do before writing," says Sally Bond, proposal coordinator.

The timeline lists the "do first" items in red. They include: create a problem overview or storyline; identify your vision, goals, winning themes and differentiators, such as expertise, equipment, experience, uniqueness and prior work; prepare your outline; and identify your basic management and personnel structure.

Use Sample Outline

A sample online outline, which can be adapted to your proposal, will keep you focused, Bond says.

Then you're ready to write. "If you've followed the timeline and prepared an outline, the proposal will flow a lot faster and the writing will happen more efficiently with you or your team," she says.

Get Mock Review

Before sending your proposal off, Bond suggests one more step: get feedback from individuals or, even have a mock panel review.

"Getting feedback from other Purdue faculty members who have experience reviewing proposals is invaluable, so allow yourself time to get a review of your proposal and revise with their input."

Tap More Resources

Also available at the Office of the Vice President for Research Web site are proposal writing guides; education, outreach and diversity resources; and links to other tools. ■

Sally Bond, proposal coordinator

→‖ RESEARCH DEVELOPMENT

Upcoming Grantsmanship Workshops

For the 2009-10 academic year, the Office of the Vice President for Research (OVPR), together with Sponsored Program Services (SPS), has developed a series of grantsmanship workshops, with the intended audience being new faculty or others new to the research process at Purdue. ***Each of these events is scheduled for Tuesdays, from 11:30 a.m.-1 p.m.,*** with box lunches provided by the OVPR. Below is the listing of dates and topics. Further information about each workshop will be available closer to the time of the event.

» **September 29**	OVPR Research Development Services and SPS Pre-Award Services
» **November 3**	OVPR Office of Research Administration
» **December 8**	Industry Research and Collaboration
» **January 19**	Post-Award Services for Researchers: Departmental, College, SPS, and OVPR
» **February 23**	Discovery Park, Policy Institute, and working with the OVPR on large proposal development
» **March 23**	Management of Intellectual Property

In addition to these workshops, on Thursday, April 15 the OVPR will bring back Robert Lucas of the Institute of Scholarly Productivity, for a daylong workshop on scholarly writing and its application to grant proposals.

Each of these events will be posted on the OVPR events Web site at **www.purdue.edu/research/vpr/**. Registration will be required, along with choices for box lunches.

OVPR Can Assist with ARRA Reporting

Faculty who receive research awards funded through the American Reinvestment and Recovery Act (ARRA) should be aware that SPS and the OVPR are working together to assist researchers with the mandatory quarterly reporting requirements for these awards.

OVPR will work with PIs to ensure that the technical (narrative) component of these reports is completed. In early September, OVPR proposal coordinators will communicate with PIs of all ARRA awards to ascertain their needs for completing this portion of the report, and will assist in writing the narrative component, as needed. ■

Assistance for Interdisciplinary, Multimillion-dollar Proposals

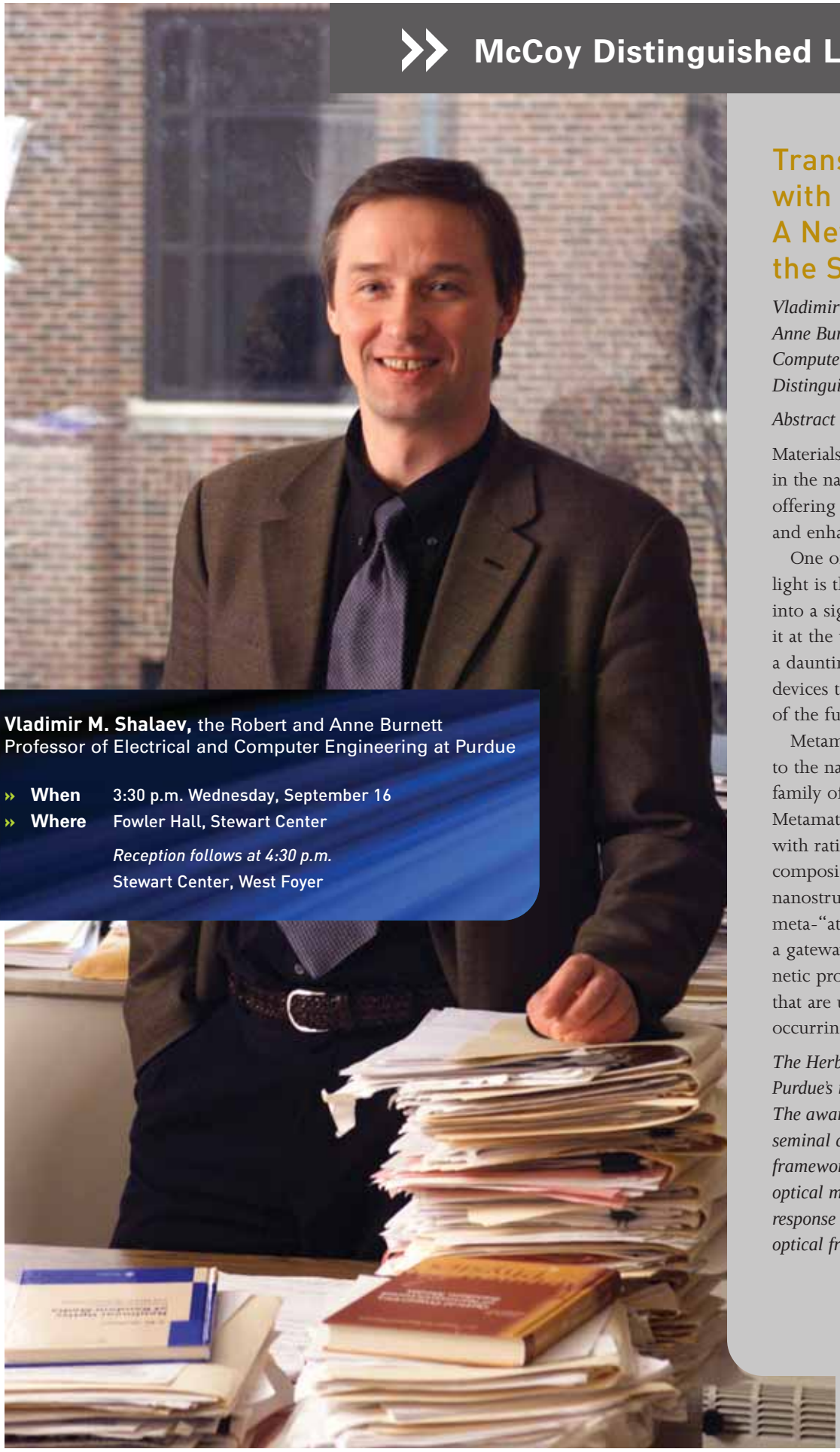
Staff in The Office of the Vice President for Research are available to coordinate multi-million-dollar, interdisciplinary proposals.

Services may include help with establishing timelines; conceptualizing the project storyline, vision and goals; and writing text, as appropriate.

Other assistance could include compiling draft proposals; editing for grammar and solicitation requirements; overseeing document control; and collecting proposal components, such as bio sketches. □

For assistance, contact Cris King, director of research development, ***hcking@purdue.edu.***

McCoy Distinguished Lecture



Vladimir M. Shalaev, the Robert and Anne Burnett Professor of Electrical and Computer Engineering at Purdue

» **When** 3:30 p.m. Wednesday, September 16

» **Where** Fowler Hall, Stewart Center

Reception follows at 4:30 p.m.
Stewart Center, West Foyer

Transforming Light with Metamaterials: A New Paradigm for the Science of Light

Vladimir M. Shalaev, the Robert and Anne Burnett Professor of Electrical and Computer Engineering, will give the McCoy Distinguished Lecture September 16.

Abstract of Lecture

Materials with optical properties not found in the natural world can now be designed, offering unprecedented control over light and enhanced device functionality.

One of the most unique properties of light is that it can package information into a signal of zero mass and propagate it at the ultimate speed. It is, however, a daunting challenge to bring photonic devices to the nanometer scale because of the fundamental diffraction limit.

Metamaterials can focus light down to the nanoscale and thus enable a family of new nanophotonic devices. Metamaterials, i.e. artificial materials with rationally designed geometry, composition and arrangement of nanostructured building blocks called meta-"atoms," are expected to open a gateway to unprecedented electromagnetic properties and functionalities that are unattainable with naturally occurring materials.■

The Herbert Newby McCoy Award is Purdue's most prestigious research award. The award is in recognition of Shalaev's seminal contributions to both the theoretical framework and experimental realization of optical metamaterials with strong magnetic response and negative refractive index at optical frequencies.

Things to Consider as Fall Semester Begins

→‖ RESEARCH ADMINISTRATION

In the academic year cycle, the season of re-initiation and rejuvenation clearly comes with the beginning of the fall semester. New and returning faculty and students arrive to renew their education and research programs. To get us off on the right foot in our new and continuing programs, now is a good time to consider the activities critical to starting and sustaining productive research.

» **Protocols for research requiring regulatory approval.** Regardless of the source of support (federal, foundation or private sector sponsors or Purdue institutional funds), if your research involves human or non-human vertebrate animal subjects, use of recombinant DNA or other potentially biohazardous materials, or radioactive materials or radiation producing devices (including Class 3b or 4 lasers), you will need to submit a protocol for prior review and approval by a Purdue regulatory oversight committee before initiating the project. If you have submitted a proposal to an external sponsor during the past spring or summer and anticipate receiving an award, please recall that Purdue's Sponsored Program Services will not be able to provide access to project funds until all regulatory requirements have been satisfied. Depending on the risks associated with your project and the specific regulatory requirement, this review and approval may take days or weeks. Each of the above categories of research involving potential risks requires completion of education and training for investigators appropriate to their specific projects prior to approval of protocols. Information on these various requirements and Purdue procedures for review and approval of protocols is available on Web sites maintained by the Office of Research Administration (**www.purdue.edu/research/vpr/rschadmin/**) and Radiological and Environmental Management (REM) (**www.purdue.edu/rem/home/files/researchers.htm**).

» **Establishing a new research laboratory/facility.** New faculty setting up new laboratory facilities should be aware of federal requirements and Purdue procedures for assuring general laboratory and chemical safety. These involve assessments of specific potential hazards associated with the planned research activity and documentation of training for lab personnel. New investigators will find information on these requirements and procedures on REM's Web site (**www.purdue.edu/rem/home/files/researchers.htm**).

» **Use of controlled substances in research.** If your research program requires use of certain controlled substances, you may need to obtain licenses from both the Indiana Board of Pharmacy and the federal Drug Enforcement Administration. Information on these requirements and sources of assistance can be found at **www.purdue.edu/rem/eh/DEA.htm**.

» **Permission to engage in outside activities and potential conflicts of interest.** Over the summer, a reminder was sent from the Office of the President of the requirement that all University employees wishing to engage in outside activities must obtain prior approval through completion and approval of Form 32A. Returning faculty and staff should note that approval granted for ongoing activities

(continued on page 8)

→‖ RESEARCH OVERSIGHT

Laboratory Animal Program

Rat and Mouse Workshops

Held in Animal Holding Facility

These hands-on workshops are designed to introduce participants to the basic techniques of handling and restraint in the laboratory rat and mouse. Each workshop will have a maximum of five participants. *Workshop dates are filled on a first-come, first-served basis.*

Workshops are available during September in the following categories:

1) Basics of rodent handling, restraint, oral gavage and normal behavior;
2) Injections in the rat and mouse;
3) Blood collection in the rat and mouse;
4) Tail vein catheter placement in the lab rat;
5) Rodent identification–toe tattooing, ear punch, etc.; and
6) Suturing basics.

If you are interested in participating in any of these workshops, please complete the enrollment form online at **www.purdue.edu/research/vpr/animals/seminars** and indicate which date and session you would like to attend, or contact Carol Dowell at **dowellc@purdue.edu** or 765-494-2521. If the listed times do not fit your schedule or training needs, contact Dowell for individual training.□

during the previous fiscal year expired in July 2009, and approval for the current fiscal year requires submission of a new Form 32A. More information on this requirement and process are available at **www.purdue.edu/research/vpr/rschadmin/coi/**.

» **Disclosure of financial interests.** Indiana statute requires that all University employees having a financial interest in any University contract, procurement, investment or loan must disclose this financial interest to the University. This requirement applies to any form of financial interest and also applies to financial interests held by an employee's spouse or dependent children. The University's procedure for disclosure of employee financial interests requires submission of a Form C-1 and is described at **www.purdue.edu/research/vpr/rschadmin/coi/**. Investigators submitting proposals to Public Health Service agencies (NIH, CDC, FDA, etc.) or to the National Science Foundation must complete a Financial Interest Statement for each proposal at the time of submission. The Financial Interest Statement is a one-page form that requires the signature of the individual investigator; it cannot be completed by someone on behalf of the investigator. Form C-1 and information on this disclosure process can be found at **www.purdue.edu/research/vpr/rschadmin/coi/**.

» **H1N1 influenza.** In recent weeks, the Center for Disease Control (CDC) and Purdue's administration have reminded us that although our experience with H1N1 influenza thus far has demonstrated predominantly mild virulence comparable to seasonal influenza, this virus has been categorized as pandemic by the World Health Organization and we cannot know for sure what will happen during the upcoming fall influenza season. Faculty and staff supervisors are reminded to read and implement the recommendations for action described in recent correspondence from Provost Randy Woodson. A link to Woodson's August 11, 2009, letter to faculty can be found at **www.itap.purdue.edu/tlt/faculty/**. Critical to Purdue's plan to protect the University community is encouraging individuals presenting symptoms of influenza to remain at home. Even assuming continued low virulence, it is likely that many individuals will become ill during the fall influenza season. To prepare for this, all departments/laboratories/centers should update their communication plans and ensure the availability of multiple cross-trained individuals capable of maintaining sensitive critical research resources (cell lines, genetic lines, microbial cultures, etc.).■

Writer: Pete Dunn is associate vice president for research and director of university research administration and compliance.

SPONSOR
» National Science Foundation
» Dept. of Health and Human Services
» Dept. of Defense
» Dept. of Energy
» Dept. of Agriculture
» National Aeronautics and Space Administration
» Other Federal
» Dept. of Education
» Environmental Protection Agency
» Dept. of Transportation
» Agency for International Development
Total Federal
» Industrials and Foundations
» State/Local Governments
» Purdue Research Foundation/Purdue University
» Foreign Governments
Total Non-Federal
Total Purdue System-wide

Program Year-to-Date Activity

Awards by Sponsor

July 1, 2008 to June 30, 2009

	FY2009 (YTD 06/30/2009)		FY2008 (YTD 06/30/2008)		% Change	
	NO.	$ AMOUNT	NO.	$ AMOUNT	NO.	$ AMOUNT
	315	66,131,020	328	53,102,086	-4%	25%
	275	52,161,902	276	50,388,032	0%	4%
	204	30,889,044	198	27,059,874	3%	14%
	121	26,781,702	88	16,773,195	38%	60%
	159	14,063,141	144	14,993,536	10%	-6%
	73	6,303,114	75	7,559,517	-3%	-17%
	85	10,758,701	67	9,311,024	27%	16%
	31	6,347,220	18	4,225,931	72%	50%
	16	1,883,962	12	1,819,664	33%	4%
	23	5,668,650	23	3,904,874	0%	45%
	19	2,789,116	15	895,590	27%	211%
	1,321	**$223,777,572**	**1,244**	**$190,033,323**	**6%**	**18%**
	1,789	83,164,289	1,443	81,374,896	24%	2%
	200	24,678,983	272	44,318,143	-26%	-44%
	566	9,043,201	712	16,218,890	-21%	-44%
	28	1,506,465	18	1,478,897	56%	2%
	2,583	**$118,392,939**	**2,445**	**$143,390,825**	**6%**	**-17%**
	3,904	**$342,170,511**	**3,689**	**$333,424,148**	**6%**	**3%**

Data provided by Sponsored Program Services.

New Coates Supercomputer Serves Diverse Research Needs

Purdue researchers who were away from campus July 21 missed the chance to help build Purdue's newest supercomputer. More than 200 ITaP staff members and volunteers assembled the Coates cluster that morning and the machine was running research jobs before noon.

Purdue faculty and campus units still have an opportunity to be part of Coates. The cluster has a capacity of 1,280 nodes. "Not all of the slots were filled in the initial build and ITaP will continue to add nodes until Coates is full," says John Campbell, associate vice president in charge of ITaP research computing.

Coates is made up of HP nodes with eight AMD processors each and a half dozen memory and storage configurations designed to meet varying needs of researchers. The lower price ITaP negotiated for the equipment in Coates also is good for departmental purchases made for use outside the cluster. For information visit **www.rcac.purdue.edu/userinfo/resources/coates**.

At full capacity, Coates, combined with the Steele cluster brought on line in 2008, should increase the high-performance computing capacity ITaP makes available to Purdue researchers from just 14 teraflops in 2006 to more than 160 in 2009. That ranks Purdue near the top nationwide and first in the Big Ten among academic institutions not dependent on a national laboratory or a national supercomputing center.

"Purdue has more supercomputing resources on campus than any other university in the United States, according to the rankings in the Top 500 list," says Gerry McCartney, vice president for information technology and chief information officer. "When it comes to total computing resources for faculty, it's hard to identify anyone who can surpass Purdue."

Researchers across Purdue have bought into Coates initially, including Aeronautics and Astronautics, Agronomy, Biology, Chemical Engineering, Chemistry, Civil Engineering, Communications, Computer Science, Earth and Atmospheric Sciences, Electrical and Computer Engineering, Electrical and Computer Engineering Technology, Industrial Engineering, Mechanical Engineering, Medicinal Chemistry and Molecular Pharmacology, Physics, the Purdue Terrestrial Observatory and Statistics.

Likewise, Coates will be applied to a diverse collection of research topics. That includes science and engineering typically done on ITaP high-performance computing resources, such as modeling the weather and climate change, designing new drugs at a molecular level, developing new rocket engine technology, and simulating properties of microscale and nanoscale devices at an atomic level.

(continued page 12)

(above) Purdue University Project Manager Donna Cumberland reviews the installation of the Big Ten's newest and largest campus supercomputer.

(opposite page top) Joshua Riaubia, an IT computer operator at Purdue University, races to deliver a cart of nodes to the campus data center.

(opposite page bottom) Douglas Couch, an information technology security engineer at Purdue University, installs a 10-gigabit network card into a computer node.

(photos courtesy of Purdue University/photos by Andrew Hancock)

Consortium Offers Purdue Researchers Access to Massive Computational Power

Purdue researchers will have a chance on September 23 to learn about opportunities for research computing and computing education projects related to the Blue Waters petascale computer being built at the National Center for Supercomputing Applications (NCSA). Purdue is one of 28 Blue Waters consortium members.

» What
A Purdue seminar on Blue Waters

» When
10 a.m. Wednesday, September 23

» Where
Burton D. Morgan Center for Entrepreneurship in Discovery Park

The seminar begins at 10 a.m., with a question-and-answer session at 10:45 a.m.

Funded by the National Science Foundation, Blue Waters is expected to be the most powerful supercomputer available for open scientific research when it comes online in 2011.

A key element of the Blue Waters project, the consortium of universities, colleges, national research laboratories and other institutions, is designed to foster use of petascale computing. The group's educational and workforce development program makes sure advances are passed to the next generation of researchers and applied to frontier questions in science, technology, engineering and the social sciences. □

Registration is not required. The event is sponsored by ITaP and ITaP's research and discovery arm, the Rosen Center for Advanced Computing.

Coates *(cont'd)*

Coates also has attracted some new types of users. That's indicative of the growth in demand from Purdue researchers employing computational techniques, which has prompted ITaP to continue to expand the resources and services it offers faculty, Campbell says. The number of users almost tripled from 2007 to 2008 alone.

Agronomy Professor Scott Jackson will use Coates in analyses of multiple plant genomes involving hundreds of billions of DNA base pairs, a task Jackson characterizes as "daunting and impossible on desktop computers." His lab has built its own, smaller clusters previously. But Jackson says it needs a lot more computing power for the research it is doing now, which includes understanding the function and evolution of the plant genomes, including the soybean's genome, and looking for DNA sequences predictive of certain plant traits.

"We're hoping we can reduce the amount of time that it takes," Jackson says.

Communications Professor Sorin Adam Matei is using Coates to analyze the DNA of Wikipedia in a sense. He's analyzing Wikipedia's entire content, plus revisions, which the open source encyclopedia makes freely available. With assistance from ITaP's David Braun, who's working on visualizing the data, Matei is trying to understand the structure behind Wikipedia. Among other things, he plans to test whether it is really a new kind of egalitarian, communal collaboration at heart, or is more organized and hierarchical than expected, in the manner humans have traditionally tackled complex projects.

Coates is a "community" cluster, and not just in the sense of the high-tech barn-raising held to build it. Through its community clustering program, ITaP pools funds from grants, faculty startup packages and institutional sources to make more computing power available than faculty and campus units could afford individually for major engineering, science and social science research projects. The Rosen Center for Advanced Computing, ITaP's research computing arm, installs, administers and maintains the community clusters, including security.

"We've allowed the researchers to focus on research and not dealing with the technology," Campbell says "We manage the systems for them."

One goal of community clustering is maximizing the use of resources by sharing computing power researchers use only part of the time with their peers, who can make use of it during what might otherwise be idle time. Researchers always have access to the computing power they purchase, and potentially more if they need it.

The new cluster is named for the late Clarence L. "Ben" Coates, a pioneer in computer education at Purdue and the chief advocate of the high-performance computing and networking plan that led to the creation of the Engineering Computer Network. The Coates cluster continues ITaP's practice of naming new supercomputers for notable figures in Purdue computing history.■

Event will Highlight Research Computing Services Available to Purdue Researchers

Research computing services and cyberinfrastructure available to Purdue researchers in all fields will be the focus of Cyberinfrastructure Day, a series of informational sessions scheduled for Wednesday, September 30.

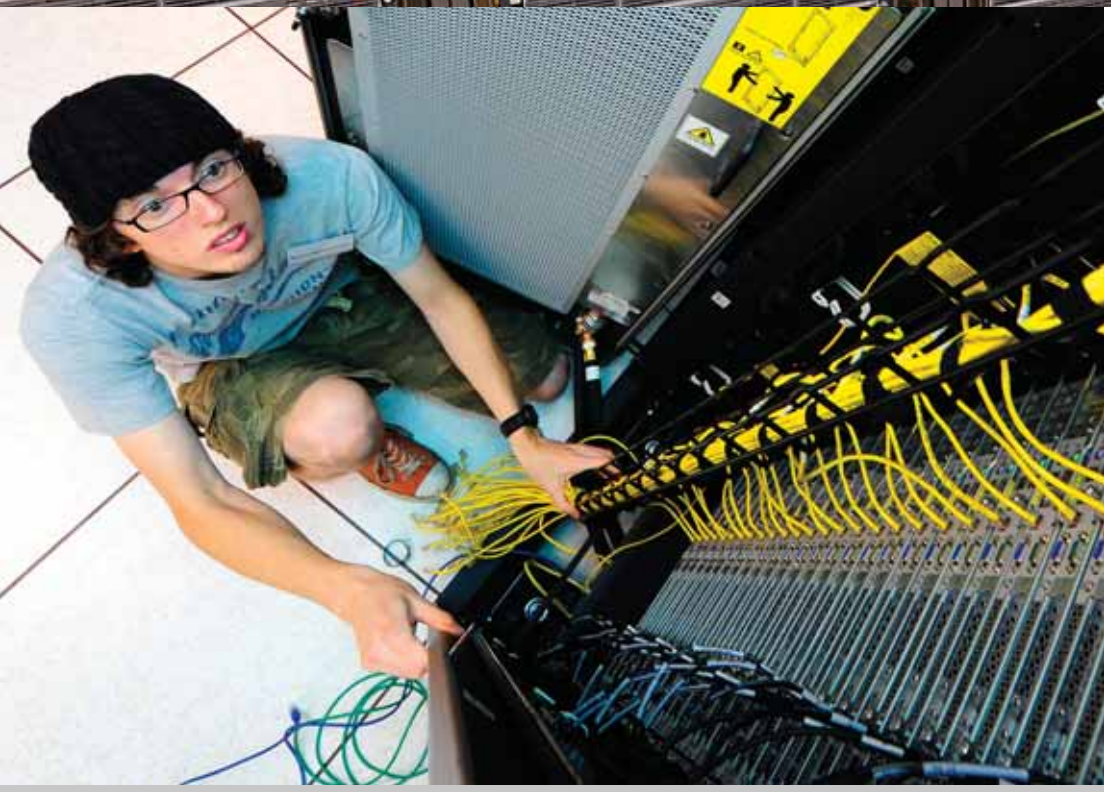
- **What**
  A Purdue seminar on campus services for faculty, research scientists and graduate students
- **When**
  8 a.m. – 5 p.m. Wednesday, September 30
- **Where**
  Stewart Center

To register, visit **www.rcac.purdue.edu/events/cidays.cfm**. There is no fee; lunch will be provided.

Topics scheduled to be covered include ITaP's community cluster and storage programs, the Condor distributed computing pool and Purdue's partnership through ITaP in the National Science Foundation's extensive TeraGrid cyberinfrastructure for research and education.

The program also will cover ITaP services for providing data visualization assistance, high-resolution satellite and remote sensing data, collaboration on grant applications, and more. In addition, the event will highlight Purdue-developed HUBzero, a Web-based platform that makes it easy for researchers to connect with colleagues throughout the world and share ideas, tools, computational resources and data storage while satisfying funding agency grant requirements. □

Registration is required. The event is sponsored by ITaP and ITaP's research and discovery arm the Rosen Center for Advanced Computing.



Jake Collins, an information technology student employee at Purdue University, turns on a supercomputer node after installing the cabling that connected the computer's processors. The supercomputer, named Coates, is expected to be the Big Ten's largest, with more than 10,000 processors. Students and staff built the computer in less than four hours.

(bottom) Purdue University student Ryan Rosenogle installs cabling for Coates.

(photos courtesy of Purdue University/ photos by Andrew Hancock)

Writer: Greg Kline, science and technology writer, Information Technology at Purdue (ITaP), 765-494-8167, gkline@purdue.edu.

(above and at right)
Over five years, the School of Engineering Education has grown to include 22 faculty members and more than 40 graduate students.

Engineering Education: Laying the Researc

Purdue's School of Engineering Education offers new insights into teaching and learning through rigorous research and collaborations in the College of Engineering and beyond.

One year into their National Science Foundation grant on cyber-enabled professional development for teachers, Heidi Diefes-Dux and her research colleagues are keeping their focus on the big picture. "We're trying to ensure that young learners have exposure to engineering," says the associate professor of engineering education. "We want them to learn to think like engineers, to understand how engineering impacts their everyday lives, and to take advantage of pathways for continuing in engineering."

Educating those students' teachers—in this case, cohorts of 2nd- through 4th-grade teachers in the Arlington, Texas, Independent School District—about engineering concepts and design is essential to increasing interest and performance in future engineers. Determining what constitutes effective teacher professional development with engineering is the goal of the research.

h Foundation

"We're developing video and online mentoring resources to extend face-to-face teacher training workshops so that teachers can continue to improve in using engineering learning materials in their classrooms," says Diefes-Dux. "And we're developing valid, reliable tools and methods for assessing how effective those resources are."

Research Across the Preschool-through-practitioner Continuum

The grant is just one example from the rapidly expanding research portfolio of the School of Engineering Education (ENE). Established in 2004, with Kamyar Haghighi as founding head, ENE is shaping the emerging discipline of engineering education as one grounded in research—and is pursuing research that addresses American students' declining interest in engineering, their low retention rates in the discipline, the need to diversify the engineering workforce, and the effects of rapid change and globalization on our country's technological competitiveness.

The world's first such academic program, ENE incorporates the First-Year Engineering Program; the first doctoral program in engineering education; Interdisciplinary Engineering, an undergraduate program; and INSPIRE, the Institute for P-12 Engineering Research and Learning (through which Diefes-Dux's research is conducted).

Through its research institute INSPIRE, the School of Engineering Education explores how young students learn engineering concepts.

→‖ FACULTY EXPERTISE

Community of Science A Great Resource

The Community of Science (COS) is the largest single repository of research funding information on the Web. Three of its databases of particular value to researchers are COS Expertise, COS Funding Alert and COS Funding Opportunities. All can be accessed at **www.cos.com** or through the OVPR Web site.

COS Expertise provides individual researchers the opportunity to create research expertise profiles which then are accessible to potential research collaborators within Purdue University as well as among the greater academic community. The profiles also are available to potential industry sponsors as well as to OVPR staff seeking researchers for specific projects.

COS Funding Alert Service provides researchers with weekly e-mail updates of funding opportunities in areas specified by the researchers.

COS Funding Opportunities is a searchable database of funding opportunities in all disciplines. □

For questions about or assistance setting up profiles and/or funding alerts, contact Christine King at 765-494-6706 or hcking@purdue.edu.

Engineering Education *(cont'd)*

"Through this set of programs, the School of Engineering Education works across the entire educational continuum," says David Radcliffe, interim head of the School and Epistemology Professor of Engineering Education. "We take a rigorous, research-based approach to exploring engineering education from preschool through college, and even in the workplace."

Bridging Research to Practice

This new paradigm combines deep knowledge of engineering with deep knowledge of pedagogy, how people learn engineering, and other factors critical to understanding the issues and opportunities for advancing engineering education.

Research will enable engineering educators to understand how engineering is best learned, taught and practiced, and that understanding will provide the basis for innovative curricula that meet 21st-century needs, specifically the need for engineers who have the leadership, creative and problem-solving skills to help society address pressing challenges like energy, climate change and sustainable food production.

"Engineering education isn't solely about improving an instructor's teaching methods," says Sean Brophy, chair of ENE's research committee. "The discipline also looks at root causes of why, for example, certain concepts are difficult to understand. There are a lot of centers of learning and teaching that help instructors implement best practices. Engineering education is about bridging research to practice—defining effective practices, identifying the reasons why they work and designing new ways to enhance learning."

ENE researchers are pivotal in shaping the intellectual framework of the discipline. In 2005 and 2006, faculty from Engineering Education at Purdue played a catalytic role in the initiation and leadership of the NSF-sponsored National Engineering Education Research Colloquies, engaging 70-plus thought leaders from around the country (including additional Purdue participants) in defining and synthesizing a research agenda (see next page).

Cross-disciplinary Collaboration

On campus, the School of Engineering Education collaborates with colleagues across the College of Engineering and in education, the sciences, the social sciences, technology and other disciplines to pursue strategic research.

ENE also draws upon considerable multidisciplinarity within its own 22-person faculty: faculty members come from a range of engineering backgrounds and include experts in education, psychology, women's studies, philosophy, and leadership and policy studies as well.

Funding Steadily Increasing

Research grants have risen steadily since 2004 and now exceed $5 million per annum. Grants include multi-institutional projects and Purdue-wide collaborative efforts. They cover a range of topics, among them student-teamwork management systems, collaborative research methods, graphical user interface systems for student problem-solving, new pedagogical approaches to student modeling activities, and the retention of minority women in STEM faculty positions at Purdue.

ENE researchers are also providing leadership in exploring the educational potential of nanoHUB (Purdue's online resource for the nanoscience and technology community), and of other communities building on its basic cyberinfrastructure now called

HUBzero. They also continue to partner with colleagues across campus on NSF technical grants to develop educational emphases in response to NSF's Review Criterion #2 ("broader impacts").

"We can work with our colleagues to provide a clearer vision and a sounder theoretical foundation for effective educational plans involving learning technologies, diversity and human learning relative to a particular domain space, to name a few possibilities," says Brophy.

For ENE, the big picture is nothing short of transforming how engineering education happens—based on proven ideas. ■

Writer: Lisa Tally is communications director for the School of Engineering Education.

Research Areas in Engineering Education

At the National Engineering Education Research Colloquies in 2005-06, the School of Engineering Education (ENE) led a team of researchers, educators, and practitioners in identifying the discipline's five priority research areas. Within those areas, ENE researchers explore such questions as these:

1 Engineering epistemologies

- Engineering thinking: What constitutes engineering thinking, knowing, and knowledge?
- Engineering practice: How can engineers' practice in the workplace inform pedagogical methods?
- Design thinking and behavior: How do students learn and practice engineering design?
- Curricular reform: What changes in the curriculum will best prepare engineering students to meet 21st-century challenges?

2 Engineering learning mechanisms

- Cognitive science foundations: How do students comprehend and reason about engineering concepts?
- Learning technologies: How can information technology improve engineering teaching and learning?
- Cyberinfrastructure for engineering discovery and learning: How do virtual networks, communities, and distributed data and simulations change the way engineering is practiced and engineering education operates?

3 Engineering learning systems

- Learning environments: How can we design effective environments that develop students' adaptive expertise, problem-solving abilities, and capacity for learning difficult concepts?
- Pedagogical/instructional methods: How can we develop, test, and implement effective, research-based approaches to teaching and learning?
- PreK-12 learning and teaching: How are engineering concepts best learned and taught at the pre-college level?

4 Engineering diversity and inclusiveness

- Multidisciplinary engineering: How do diverse human talents and ideas contribute solutions to engineering challenges?
- Student access, retention, and success: What factors, approaches, and environments help students enter, remain in, and excel in engineering?
- Policy: How can engineering educators understand, influence, and participate in institutional policy-making?

5 Engineering assessments

- Assessment and evaluation: What kinds of assessment methods, instruments, and metrics best inform engineering education practice and learning, as well as program evaluation?
- Methodological approaches: What methods, instruments, and metrics are appropriate to measure learning processes, domain knowledge, sociocultural factors, and teaching pedagogies in an engineering educational environment? ■

→‖ FACULTY EXPERTISE

About INDURE

Project INDURE began at Purdue in fall 2006 to develop, deploy and maintain an easy-to-access database of research expertise, intellectual property and ongoing sponsored research projects at academic institutions across the state of Indiana.

Currently, the database contains information on over 12,000 faculty and staff from four Indiana universities: Ball State, Indiana University, Notre Dame and Purdue.

Researchers may use INDURE by logging onto **www.indure.org**, selecting their university and logging onto the system using their university login credentials.

A basic search may also be carried out without logging into the system. □

The next Discovery Lecture Series, a two-day event, coincides with the international symposium, Bionanotechnology on a Global Scale, sponsored by Purdue researchers at Discovery Park's Bindley Bioscience and Birck Nanotechnology centers and the Korea Institute of Science and Technology.

Research teams from Discovery Park and the Korea Institute of Science and Technology are collaborating on a five-year, $4.5 million project to develop molecular imaging and nanotechnology tools to simultaneously diagnose and treat cancer and chronic and infectious diseases.

Purdue's Discovery Park and Indianapolis-based Lilly Endowment are co-sponsoring the free lectures. Lilly Endowment provided a $1 million gift to Purdue in 2005 to sponsor the Discovery Lecture Series. □

Discovery Lecture Series Highlights Global Bionanotechnology Advancements

- **What** Transformation of Science into Products; Ken Bradley, Ph.D.
- **When** 4 p.m. Monday, September 21
- **Where** Fowler Hall, Stewart Center

- **What** Bionanotechnology in 21st Century Healthcare; Roderic Pettigrew, Ph.D., MD.
- **When** 10 a.m. Tuesday, September 22
- **Where** Fowler Hall, Stewart Center

Two experts in global advancements in bionanotechnology will speak at Purdue in conjunction with this fall's Discovery Lecture Series.

Venture capitalist Ken Bradley, Ph.D., of ARCH Partners in Chicago, will deliver his keynote talk, "Transformation of Science into Products," at 4 p.m., September 21.

Roderic Pettigrew, Ph.D., MD., director of the National Institute of Biomedical Imaging and Bioengineering, will present "Bionanotechnology in 21st Century Healthcare," at 10 a.m., September 22.

Both talks are free and open to the public.

Ken Bradley, Ph.D.

Ken Bradley joined ARCH in January 2008 as venture partner, bringing a rich background in discovering and developing nascent technologies for supporting the firm's life and physical sciences teams with a special focus on micro- and nanotechnologies.

Before that, he served as chief executive officer of Arryx, a startup company commercializing Holographic Optical Trapping technology for laser-based micro- and nanoscopic instrumentation in the life sciences sector.

Haemonetics, a $2 billion firm based in Massachusetts, purchased Arryx in 2007. Bradley remains vice president of development at Haemonetics, which is developing blood management technologies that are key components of collection, surgery and transfusion services.

Roderic Pettigrew, Ph.D., MD.

Before becoming the first director of the National Institute of Biomedical Imaging and Bioengineering, Roderic Pettigrew was a professor of radiology medicine at Emory University and professor of bioengineering at the Georgia Institute of Technology. He also served as director of the Emory Center for Magnetic Resonance Research at Emory University School of Medicine.

Pettigrew is known for his pioneering research involving four-dimensional imaging of the heart using magnetic resonance. ■

Pioneers in Energy Lecture Series

Over the past five years, Purdue has hosted world-class speakers to discuss energy challenges. They have scheduled Nobel Laureate Richard E. Smalley, who won the 1996 Nobel Prize in chemistry in 2005; Salomon Levy, National Academy of Engineering member and president of S. Levy and Associates Inc.; and Lawrence L. Kazmerski, NAE member and director of the National Center for Photovoltaics at the Department of Energy's National Renewable Energy Laboratory.

The goals of the Pioneers in Energy series are to increase understanding of specific energy challenges and to promote interactions with prominent scientists in order to build a stronger Purdue energy research community across colleges and departments.

This year, the series features Michael Ladisch and Rakesh Agrawal of Purdue.

Michael Ladisch, Ph.D.

- **What** Liquid Transportation Fuels from Coal and Biomass: Technological Status, Costs, and Environmental Impacts. *(Report on Findings of Panel on Alternative Liquid Fuels National Academy Study on America's Energy Future)*
- **When** 7 p.m. Thursday, September 17
- **Where** Fowler Hall, Stewart Center

Rakesh Agrawal, Ph.D.

- **What** Sustainable Energy Solutions for a Limited Fossil Fuels Future
- **When** 7 p.m. Tuesday, September 22
- **Where** Fowler Hall, Stewart Center

For more information contact Wendy Madore at wmadore@purdue.edu, or call 765-494-6792, or visit the Web site www.purdue.edu/discoverypark/energy/events/pioneers_in_energy_lecture_series_2009.■

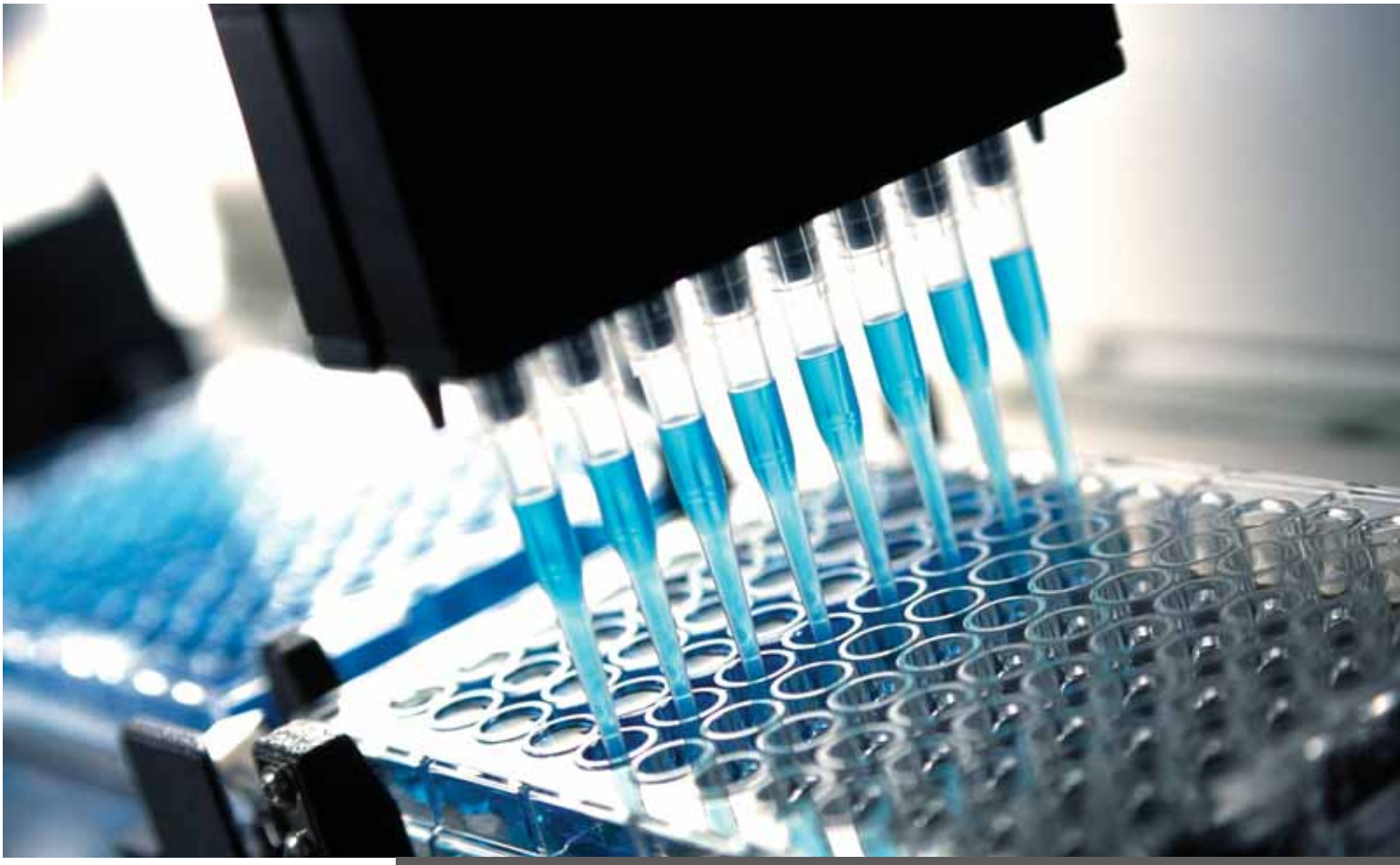
Michael Ladisch, Ph.D., Distinguished Professor and Director of the Laboratory for Renewable Resources Engineering

Mike Ladisch is a member of the National Academy of Engineering (NAE). His lecture draws from the NAE study and report on 'Liquid Transportation Fuels from Coal and Biomass,' to which Ladisch contributed.

Rakesh Agrawal, Ph.D., the Winthrop E. Stone Distinguished Professor of Chemical Engineering, Purdue University

Rakesh Agrawal is a member and participated in the National Academy of Engineering study on 'Electricity from Renewable Resources.' His lecture will be based on his independent work in the area of sustainable solutions.

Both lectures are free and open to the public.



National Grant Writing Seminar Coming to Purdue

» **When**
8 a.m.-4:30 p.m.
Tuesday, October 27

» **Where**
Stewart Center, Room 206

The training will address both practical and conceptual issues that are important to the proposal-writing process. It is designed for faculty members who have had some exposure to writing grant applications, either through training/mentoring or personal experience. Emphasis is given to idea development, identification of the most appropriate granting agency, how to
(continued on page 21)

Clinical Translational Sciences Institute (CTSI)

Building a Greater Research Agenda on Indiana Strengths

Conversations to stimulate statewide collaborations for building research teams, preparing for high end grant applications, and leveraging facilities and resources.

» **What** 2nd Annual Retreat at Purdue University
» **When** 8:30 a.m.-4 p.m. Thursday, September 24
» **Where** Burton D. Morgan Center for Entrepreneurship in Discovery Park

The program includes panel discussions on a range of topics

- Personalized Medicine and Nutrition
- New Tools and Technology Development
- Imaging Technology
- Modeling/Simulation
- Infectious Diseases and Animal Models
- Poster Session

For more information contact Luanne Ludwig at 765-494-2276.

Online registration is available at www.indianactsi.org/workshops/ictsiretreat09/apply.

Regenstrief Center for Healthcare Engineering

Fall Conference on Transforming Healthcare Delivery

» **What** Care Coordination and Population Health
» **When** Tuesday, September 29 (see below for time/transportation details)
» **Where** The Trails Conference and Banquet Facility
West Lafayette, Indiana

With all eyes on the healthcare system and an increasing emphasis on healthcare delivery, the time to explore healthcare engineering research and possibilities has never been better. The Regenstrief Center for Healthcare Engineering (RCHE) is hosting a fall conference focusing on care coordination and population health; it is now open for registration.

Building on interest generated during the spring conference, this one-day event will delve into greater detail on these two priority research areas, covering key areas of ongoing research and providing discussion opportunities for developing future research projects. Speakers represent Georgia Tech's Health Systems Institute, University of Arkansas, Mayo Clinic, Blue Cross Blue Shield, and more.

Transportation will be provided from the Purdue Memorial Union (PMU) to The Trails, with pick-up at 8 a.m. and 11:30 a.m. Return trips from The Trails to PMU will be at 1 p.m. and 4 p.m. Parking and wi-fi are available at The Trails.

Breakfast and lunch will be provided. ■

The conference is free and open to the public; however, registration is required. Register at www.purdue.edu/rche/events/conferenceregistration.php.

More information about this event is available at www.purdue.edu/rche.

(continued from page 20)
write for reviewers, and tips and strategies that are of proven value in presenting an applicant's case to reviewers.

Participants are taught to organize their presentations using a linear progression of logic, which leads reviewers through their applications. The training will stress that applicants are writing for two different audiences—the assigned reviewers, who have read the application in its entirety, and those who have read little, if anything, before the review meeting.

The training will take place on Tuesday, October 27 from 8 a.m. to 4:30 p.m. Box lunches will be provided, and each participant will receive a workbook and handouts.

Faculty who are not sponsored by their academic units will be invoiced for $80 to cover the costs of materials, lunch and refreshments. Faculty who wish to participate in this one-day training should contact Janet Perkins at **perkinje@purdue.edu** for more information. □

With support from the Office of the Vice President for Research, the College of Consumer and Family Sciences is pleased to once again bring a nationally acclaimed trainer in grant writing to Purdue.

→‖ BUSINESS COMPETITION

Sixth Annual Life Sciences Business Plan Competition Set

The Purdue Life Sciences Business Plan Competition to foster translational research and accelerate the commercialization of intellectual property in the life sciences arena is Tuesday, November 10.

The Competition exemplifies Purdue's spirit of Discovery-to-Delivery by generating entrepreneurship opportunities and driving economic development of life sciences research.

Participating teams must represent an actual life sciences company that is no more than three years old; recent startup life sciences companies are of particular interest.

» **When**
Tuesday, November 10, 2009

» **Where**
Burton D. Morgan Center for Entrepreneurship in Discovery Park

The competition offers total prize money and in-kind services in excess of $100,000 that teams will apply towards furthering and commercializing the research. Ample opportunities for networking among team members, judges, experts and attendees will be provided during the competition, including an intimate feedback session between the finalist teams and judges. □

For more information please email ***BDMCenter@purdue.edu*** *or call 765-494-6400.*

» Purdue Libraries Host Events for Open Access Week

Purdue will be participating in the first annual international Open Access Week from October 19-23, 2009.

An expansion of Open Access Day, which Purdue hosted along with 120 other campuses in October 2008, Open Access Week will feature speakers, displays, and programs on a variety of open access issues relevant to the Purdue research community.

Topics planned for discussion include the basics of open access, compliance with the NIH open access mandate for funded research, use of the author rights addendum with publishing agreements, and perspectives from various faculty members at Purdue on key open access issues.

Watch for programs and events at **www.lib.purdue.edu/info/oaday** in the coming month.

International Open Access Week is presented by the Scholarly Publishing & Academic Resources Coalition (SPARC), the Public Library of Science (PLoS), Students for FreeCulture, eIFL.net, OASIS (the Open Access Scholarly Information Sourcebook), and the Open Access Directory (OAD).■

For more information on the international effort, visit www.openaccessweek.org.

Dimensions of Discovery Introduced

Welcome to *Dimensions of Discovery,* published by the Office of the Vice President for Research. *Dimensions of Discovery* replaces the *Research Review* newsletter.

Each issue will include articles on a variety of topics highlighting the many dimensions of the discovery process and important announcements regarding changes in federal regulations, upcoming lectures, conferences and workshops, and updates on research procedures and protocols.

Summaries and trends in sponsored program awards received will be reported in *Dimensions of Discovery* with information and links to the OVPR Web site to access a comprehensive list of sponsored program awards. Please note that sponsored program awards are documented and posted two months behind the current month. Visit the OVPR Web site each month for access to sponsored program awards.

A list of sponsored program awards received is available online and includes additional awards, known as B-awards, which were not previously published in print.

A search and sort Excel file version of the awards is also available online. Please visit the OVPR Web site at **www.purdue.edu/research/vpr/** for access to the awards.

Past recipients of the *Research Review* newsletter will receive *Dimensions of Discovery*. The mailing list includes faculty, research scientists and postdoctoral associates, as well as administrators and staff with responsibilities related to sponsored programs. If you would like to be on the mailing list, please email Linda Howell at **lahowell@purdue.edu** or Pam Burroff-Murr at **burroff@purdue.edu**.

Dimensions of Discovery will be published four times throughout the academic year —November, February, May and September. ■

New Office of the Vice President for Research Web Site Unveiled

The Office of the Vice President for Research (OVPR) Web site has a new look. Access to OVPR areas of assistance and information are navigable from the top horizontal menu. Also available are research news and links to research videos.

A new feature linking to sponsored program awards has been added. It is on the left navigation bar under "About Research at Purdue." You may download a pdf version for easy reading or an Excel version for searching and sorting award data. □

*Please visit our Web site at **www.purdue.edu/research/vpr/.***

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Read *Dimensions of Discovery* online at » www.purdue.edu/research/vpr/publications/

Dimensions of Discovery is published four times a year by the Office of the Vice President for Research. We welcome comments. Send e-mail to **burroff@purdue.edu.**

Distribution » *Dimensions of Discovery*'s mailing list includes faculty, research scientists and postdoctoral associates, as well as administrators and staff with responsibilities related to sponsored programs. If you would like to be on the mailing list, please email Linda Howell at **lahowell@purdue.edu** or Pam Burroff-Murr at **burroff@purdue.edu.**

The monthly listing of sponsored program awards received is available online and includes additional awards, known as B-awards or industrials and fellowships.

A downloadable pdf file of the July 2009 awards and a search and sort Excel file of the awards are accessible at **www.purdue.edu/research/vpr/.**

PURDUE UNIVERSITY