Leading life science discovery...

For our **HEALTH,** *our* **ENVIRONMENT,** *for* **LIFE** *and* **LEARNING**

PURDUE
UNIVERSITY

Inside »

Purdue's renowned Markey Center for Structural Biology research group will have a new home in the Wayne T. and Mary T. Hockmeyer Hall in Discovery Park, which is scheduled for completion in fall 2009. The work of structural biologists is key to the prevention and treatment of widespread disease. Purdue's structural biology group has had many breakthroughs during the past 40 years, including fundamental insights into how important groups of human viruses infect cells, build themselves, and are recognized by the human body.

Purdue News Service photo/David Umberger

From the **PRESIDENT** »

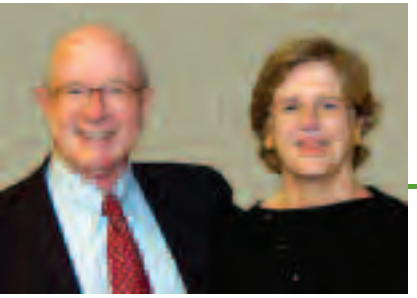
A great university ultimately fulfills its destiny by improving the quality of human life. One of the ways we do this at Purdue is by creating new knowledge through research and then finding ways to apply these findings to useful purposes. This "discovery through delivery" process produces many benefits, not only for our students, our state, and our nation, but for the entire global community. Discovery Park, our hub for interdisciplinary learning and research, takes innovative thinking into the marketplace in the form of new businesses that provide job opportunities and support economic development. Research in the life sciences is finding new ways to treat and prevent diseases, protect human health, and improve the delivery of health care. We can all be proud of the year covered in this report. With more than $301 million in sponsored program awards, Purdue had the best research year in its history. Our new discoveries in the life sciences were especially exciting, and this is the focus of the report. We also must strengthen our interdisciplinary initiatives. We are committed to advancing on these fronts and to continuing our efforts to improve our world through discovery.

—France A. Córdova, *President*

From the **PROVOST** »

It's an extremely exciting time for discovery in the life sciences at Purdue. Life-saving innovations from Purdue are moving from the research bench to the public at a vigorous pace. Growth in the life sciences is both a strategic initiative of the university and a critical component to the economic development of the state. In addition to the groundbreaking research discoveries taking place at Purdue, we are committed to the education and engagement of all the stakeholders affected by the advancements in life sciences. Purdue is preparing the next generation of scientists and scholars through our extensive STEM education outreach—science, technology, engineering and mathematics disciplines. Undergraduates are exposed to Purdue's extensive research programs through programs like the Discovery Park Undergraduate Research Internship program. We are creating a culture of entrepreneurship through innovative programs like our Certificate in Entrepreneurship and Innovation and our multiple business plan competitions. It's an exciting time to be at Purdue as we promote the vision of discovery, learning and engagement of this great land-grant university.

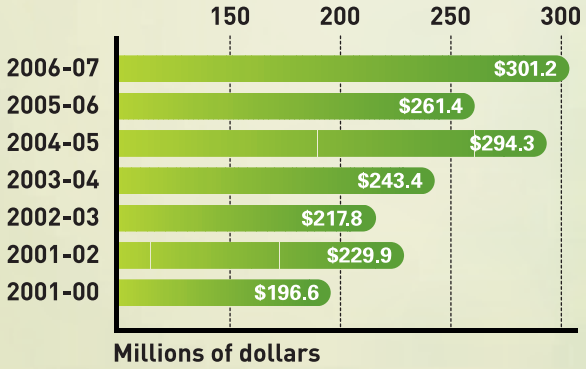
—Victor L. Lechtenberg, *Interim Provost*



Wayne T. Hockmeyer, a Purdue alumnus and founder of biotechnology company MedImmune, and his wife, Mary T. Hockmeyer, gave $5.3 million toward the building construction.

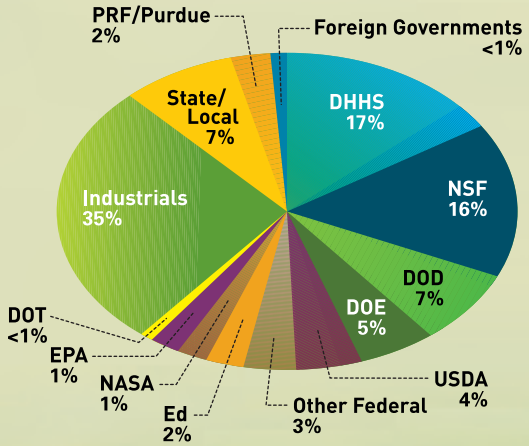
(from left) At the ceremony are: Richard Kuhn, head of the Department of Biological Sciences and director of the Bindley Bioscience Center; Jeffrey S. Vitter, the Frederick L. Hovde Dean of the College of Science; Wayne and Mary Hockmeyer; and Purdue President France A. Córdova.

Systemwide Sponsored Program Awards*



*Support in collaboration with Development is included.

Summary of Awards by Sponsor FY 2006-2007



From the **VICE PRESIDENT** *for* **RESEARCH** »

Purdue University's record of success in the life sciences is broad and impressive. From Michael G. Rossmann's mapping of the common cold virus more than 20 years ago to the nanomedicine discoveries of today that may help end cancer, the University's researchers are working to create a new and better world.

The 2006-07 annual report focuses on Purdue's variety of life sciences research programs—some are multidisciplinary efforts; some are individual; all are inspiring.

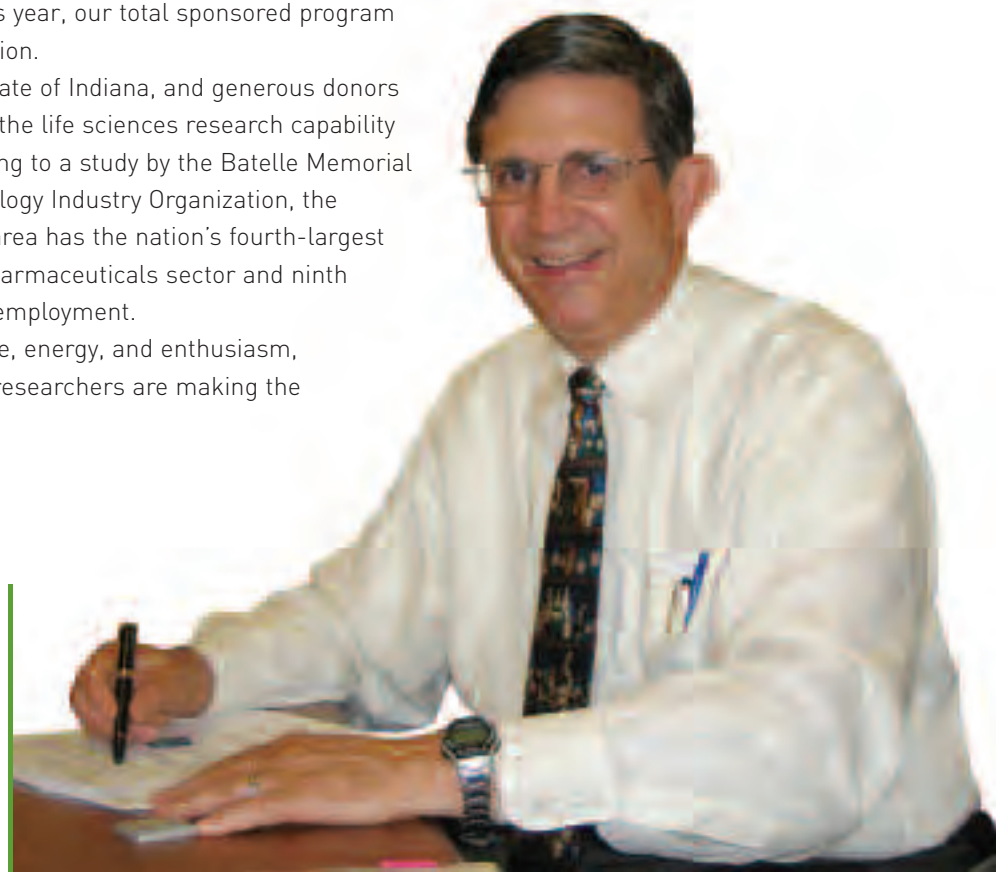
Purdue's research programs in the life sciences emphasize three critical areas that affect the well being of individuals, communities, and the planet. Investigators are targeting medicine and health, food production and bioenergy, and environment and ecology. Many of our faculty members have received worldwide recognition for their extraordinary contributions in these specialty areas.

Over the past several years, research expenditures in the life sciences at Purdue have consistently been in the range of 40 to 45 percent of the University's total research expenditures. This year, our total sponsored program awards exceeded $301 million.

Purdue University, the State of Indiana, and generous donors to Purdue have invested in the life sciences research capability and it is paying off. According to a study by the Batelle Memorial Institute and the Biotechnology Industry Organization, the Indianapolis metropolitan area has the nation's fourth-largest employment base in the pharmaceuticals sector and ninth largest for all biosciences employment.

With a wealth of expertise, energy, and enthusiasm, Purdue University and its researchers are making the world a better place to live.

—Charles O. Rutledge



Charles Rutledge

This year's annual report focuses on a few of the many life science research projects taking place at Purdue University.

Life science research at Purdue is focused in three topical areas: medicine and health; environment and ecology; and food production and biofuels. Campus-wide, significant cross-disciplinary research in Purdue's colleges and schools is resulting in landmark discoveries.

Through stories and briefs, this report spotlights Purdue's scholarly activities in the life sciences and highlights some of the new technologies that are translating into hope for treating paralysis patients or for improved imaging technology resulting in earlier detection of cancer. Work also includes cowpea weevil control so Africans can protect their main food staple from insect pests, technologies to more easily identify foodborne pathogens, more viable alternative energy sources, and efforts to restore damaged ecosystems.

A year of advancements and collaborations

Multi-disciplinary projects abound at Purdue—from sustainable agriculture research and portable HIV/AIDS testing devices for Swaziland, involving agriculture, veterinary science and liberal arts; to the development of sub-microscopic biological machines, or nanomotors, that may have potential use in the diagnosis and treatment of diseases. The nanomotor project illustrates the power of university-wide and external collaboration by merging the expertise of researchers in engineering, biology, chemistry, mathematics, computation, and physics, with that of colleagues at the University of Cincinnati.

Although this report emphasizes life science, recent achievements have a much larger scope.

Researchers at the Center for Laser-Based Manufacturing (pictured, center right) pioneered a production technique that allows powdered materials to be applied, laser-melted and machined, all at the same time. This is a boon in the production of ceramics with complex internal features. A team of experts in computer science and civil engineering developed a scientifically based animation (pictured, bottom right) of the September 2001 fall of New York's World Trade Center towers that will help in future design.

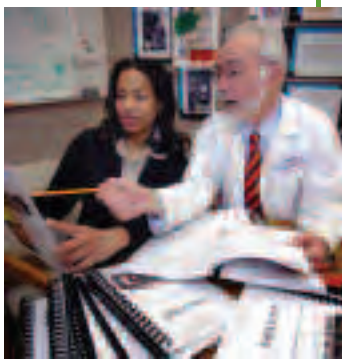
These are but a sampling of the thousands of Purdue discoveries making headlines and a difference.

Hotbed of activity

Some 835 of the University's 1,970 faculty are involved in life science discovery, learning, and engagement. With more than $300 million in total research funding this year alone, and work underway at 116 different research centers, each week brings key findings, new milestones and opportunities for Purdue's translational research.

This report showcases the rich and varied world of life sciences research at Purdue as it affects our health, preserves our environment, and nourishes life and learning in Indiana and around the world.✽

Hildred Sarah Rochon *(at left)* research coordinator, and project leader J. Paul Robinson, professor in Purdue's schools of biomedical engineering and veterinary medicine discuss travel plans to Africa to introduce a low-cost portable HIV/AIDS testing device, the focus of Purdue's Cytometry for Life program.



Purdue research successfully tackles spinal cord injuries

At 27, Brandon Ingram is like many young men. He's recently married, enjoys lifting weights, plays aggressively as a guard on his basketball team, operates his own business, and eagerly shares enthusiasm about life with others.

Quite the accomplishments for a guy who five years ago flew through the front windshield of his car in a nighttime auto accident. The carefree 22-year-old was zipping down an I-74 off-ramp in Indianapolis, heading home, when the car in front of him suddenly braked. Ingram landed in the hospital with four fractured ribs, a punctured lung, stitched eyelids and paralysis—potentially permanent.

"The doctor said I may never be able to walk again," Ingram recalls.

New device offers help, hope

In a fortunate twist of fate—possible because of Purdue University research findings—his doctor was able to offer some hope.

Would Ingram want to try a newly developed device, now in the research stage, to see if his nerve fibers could be regenerated? A small, pacemaker-sized box containing the device, today called the Andara™ Oscillating Field Stimulator™ (OFS), would have to be implanted within days of his injury.

"Well, sure," responded Ingram, then a forklift driver and paper feeder at a local printing plant who was eager to be back on his feet.

At that time, he was immobile, with no feeling below his waist. "Now, I can feel two-and-a-half-inches below that. I have the nerves back in my legs. I can feel when

Richard Borgens

Purdue News Service photo/David Umberger

Richard Borgens, professor of basic medical sciences and founder of Purdue University Center for Paralysis Research, discusses new research that identifies a drug commonly used for hypertension that may also reverse damage from spinal cord injuries, cancer and other diseases.

Brandon Ingram and Representative Langevin

Brandon Ingram *(left)* traveled to Capitol Hill in June 2007 to tell legislators about the critical importance of innovative treatments such as the Andara™ OFS™ Therapy developed at Purdue. He's pictured with Cyberkinetics neurosurgeon and consultant Beverly Walters and Representative James Langevin of Rhode Island, who was paralyzed after a spinal cord injury while training at a police academy.

I do a weight shift and I can wiggle my toes," he says. "And I'm up on braces and walking."

His positive attitude, determination and faith go along with the new device in his continuing recovery, he says. "I was supposed to be in the hospital three months. I gave it 110 percent as far as rehab, and knocked it down to two-and-a-half months."

Two years ago, he rekindled a former friendship and married Aisha. And he's launched a motivational speaking business, telling audiences at schools, juvenile centers and recreational facilities, "Think about what you're doing before you do it. Think about the consequences."

He's also continuing physical therapy and competes on the Indianapolis Pacers wheelchair basketball team. "I know I'll be able to walk one day," he says.

Results exceed research expectations

The success Ingram and others have realized exceeds what Purdue University professor and researcher Richard Borgens ever anticipated.

"The patient responses could be half as significant as they were, especially for sensory recovery, and I would have felt 'even this' would have been more than we could have expected," says the Mari Hulman George Professor of Applied Neurology, who holds joint veterinary medicine and biomedical engineering appointments and heads Purdue's Center for Paralysis Research.

Ingram is one of 16 people who have been treated with the Andara™ OFS™ device Borgens pioneered—14 in Indiana during clinical trials and two in Europe.

FDA marketing approval pending

In September 2006, the device was designated a Humanitarian Use Device by the U.S. Food and Drug Administration. The company with licensing rights, Massachusetts-based Cyberkinetics Neurotechnology Systems Inc., expects to receive authorization to market it to people with acute spinal injuries any day now. It would be the first commercially available device for partially restoring sensation and function in acute spinal cord injuries.

"We've made great progress evolving the product and navigating the regulatory pathway," says Mark Carney, whose startup company, Andara Life Science, co-founded by Borgens, first licensed the technology from Purdue.

"The patient responses could be half as significant as they were, and I would have felt 'even this' would have been more than we could have expected."

—Purdue University professor and researcher Richard Borgens

Carney is now executive vice president and director at Cyberkinetics, which purchased Andara in 2006. "Two landmark studies by Dr. Borgens with naturally injured dogs went a long way toward helping us show efficacy."

Borgens widely recognized

Of Borgens, Carney says, "He is a luminary." And of the research, "It has the potential of doing more for people with spinal cord and potential brain injury than virtually anything out there."

Borgens, who earned his doctorate at Purdue in 1977, discovered in the mid-1970s that low voltage could be used to re-grow damaged nerves. Twenty years ago, he established the paralysis center, and in the 1990s, he developed a machine to re-grow nerves in humans.

It's helped quadriplegics regain use of their hands and paralyzed patients feel their feet again. In 2004, *Business Week* named him a "genius," and in 2006 the Indiana Health Industry Forum gave him the Outstanding Contributor to Scientific Commercialization Award for work on the device.

For Ingram, the value of Purdue's research is immeasurable. "It opens the doors for a lot of things and gives hope, especially to people like me."✽

Geddes Receives Nation's Highest Honor for Innovation

Leslie A. Geddes, Purdue's Showalter Distinguished Professor Emeritus of Biomedical Engineering, was awarded the National Medal of Technology Laureate in July. The award is the nation's highest honor for technological innovation.

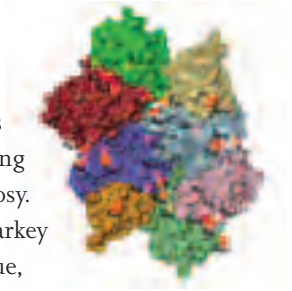
Geddes, who came to Purdue in 1974 to help the University develop an organized biomedical engineering research center and create new technologies in the field, was recognized "for contributions to electrode design and tissue restoration that have led to the widespread use of numerous clinical devices. His discoveries and inventions have saved and enriched thousands of lives and have formed the cornerstone of much of the

Leslie Geddes and President George Bush

modern implantable medical device field."

In more than 50 years of research, Geddes has developed innovations from burn treatments to miniature defibrillators, ligament repair to tiny blood pressure monitors for premature infants. He officially retired in 1991, but continues to teach and has ongoing research projects.

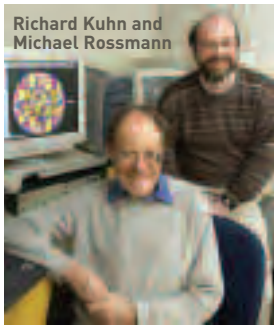
Leading life science discovery for our HEALTH



Building Better Antibiotics

Research by biologist David Sanders may lead to more effective antibiotics and a defense against diseases including stomach cancer, meningitis, and leprosy. Sanders, who is affiliated with the Markey Center for Structural Biology at Purdue, has determined the structure of a protein that controls the starvation response of *E. coli*. The protein, which acts as an enzyme and catalyzes chemical reactions within the bacteria, provides the signal for bacteria to enter starvation mode and limit reproduction.

The research is relevant to the treatment of many diseases, because the same protein is found in numerous harmful bacteria. Sanders' findings offer a valuable, new approach to combating bacterial infections that have become resistant to antibiotic treatments.



Richard Kuhn and Michael Rossmann

Mapping the Viral Structure

Purdue University biologists have unlocked the key to West Nile Virus, which has sickened thousands of Americans in the last five years and can be fatal. They have also mapped the structure of the immature dengue virus, which kills more than 24,000 people annually.

Michael G. Rossmann, the Hanley Distinguished Professor of Biological Sciences, and Richard J. Kuhn, head of Biological Sciences and director of the Bindley Bioscience Center in Discovery Park, used cryoelectron microscopy and advanced imaging techniques to determine where an antibody binds to the West Nile virus and have suggested a mechanism for how the antibody neutralizes the virus to prevent infection. Joined by biologist Timothy Baker, the researchers have also studied the dengue virus. Their research could be a step toward development of antiviral drugs and vaccines to combat the deadly mosquito-borne diseases.

Center Improves Drug Development

Purdue researchers are looking at ways to improve the way pharmaceuticals, foods, and agricultural products are developed and manufactured. The work is funded by a $17.5 million five-year grant from the National Science Foundation that was awarded in July 2006 to support an Engineering Research Center (ERC) to enhance the quality and consistency of solid dosage form drug pharmaceuticals and other products that consist of structured combinations of solid organic materials. Gintaras "Rex" Reklaitis, the Purdue Edward W. Comings Professor of Chemical Engineering, is Purdue principal investigator and deputy director of the center.

Gintaras Reklaitis

Research at the center could result in more efficient, predictable and innovative manufacturing processes, which could, in turn, lead to a reduction in the cost of the products. Such improvements could also make medicines more accessible to developing nations. The center draws on Purdue's strengths in pharmaceutical sciences and process and particulate systems engineering and fosters an interdisciplinary educational and research environment for future engineers. Purdue is collaborating on the ERC with the New Jersey Institute of Technology; University of Puerto Rico; and Rutgers, the State University of New Jersey.✽

Miracle makers: Cancer researchers bring new hope

Cancer is under attack on all fronts at Purdue. Researchers across the University—from engineering to behavioral science—are engaged in an aggressive battle against the disease that the National Cancer Institute (NCI) at the National Institutes of Health would like to see eradicated.

Faculty from nine colleges and schools and 28 departments are among those engaged in the fight. Their work could lead to miracles—a blood test that identifies early stage cancer, a drug that targets and kills cancer cells, and the use of a laser to detect individual cancer cells that are present in extremely low quantities in the blood. The University is especially focused on developing new technologies for early detection, according to Marietta Harrison, professor of medicinal chemistry and molecular pharmacology and director of the Oncological Sciences Center in Discovery Park.

Many of the researchers are affiliated with the Purdue Cancer Center (PCC), which was founded in 1978 and is one of the oldest basic-research facilities in the nation. It is one of seven National Cancer Institute-designated basic-research facilities in the country.

"The Purdue Cancer Center is one of the best basic-research centers in the world. It fosters a remarkable collaboration across departments and across the nation that is key to success in the fight against cancer," says Timothy Ratliff, who assumed leadership of the Purdue Cancer Center in July.


Timothy Ratliff

The Purdue Cancer Center works in tandem with the University's Oncological Sciences Center (OSC) in Discovery Park, which was formed in 2005 with a grant from the Lilly Endowment and is directed by Harrison.


Jiri Adamec and Fred Regnier

Purdue News Service photo/David Umberger

Jiri Adamec *(left)* a research assistant professor, discusses the results of an experiment with Fred Regnier, Purdue's John H. Law Distinguished Professor of Chemistry, in the Bindley Bioscience Center's Proteomics Lab. The Purdue-IU Analytical Proteomics Team, led by Regnier, has been approved as a national center in the National Cancer Institute's Consortium for Proteomics Technology Assessment for Cancer. The team studies the detection and prediction of cancer through analysis of blood samples.

The Oncological Sciences Center integrates broad areas of the research community in life sciences and functions as the Discovery Park arm of the Purdue Cancer Center.

The Purdue Cancer Center does not treat patients; rather, it is entirely focused on research. But strategic research partnerships established by the PCC and the OSC allow for a clinical setting for some of the work. The PCC and OSC have partnerships with the Walther Cancer Institute, the Indiana University Simon Cancer Center in Indianapolis, and with local clinicians in the greater Lafayette area. The relationship with the Indiana University Simon Cancer Center currently provides the clinical setting necessary to advance and refine early-stage detection and treatment of cancers.

Advancing Technology

Purdue is a national leader in proteomic technology, which includes the study of proteins that can be used to diagnose cancer. Purdue analytical chemists and cancer researchers in this area have teamed with colleagues from Indiana University to form the Purdue-IU Analytical Proteomics Team, which will utilize advanced analytical technologies to diagnose breast and prostate cancer from biomarkers in blood samples.

The project, funded by a $7 million grant from the NCI, combines Purdue's expertise in mass spectrometry and proteomics technology and the expert clinical team of cancer researchers from the IU School of Medicine (IUSM).

"This is the future of cancer detection in America," says PCC member Fred Regnier, Purdue's John H. Law Distinguished Professor of Chemistry and the principal investigator for the team. "Proteomics holds great promise for more precise diagnosis and tailored cancer therapies through the identification of proteins specific to cancer and other diseases, called 'biomarkers.'"

Miniscule Weapon, Big Impact

Purdue can also look to its preeminence in nanotechnology as a weapon against cancer. Researchers are using nanotechnology to study ways to improve drug design, enhance early imaging technology, and advance early detection.

Purdue and IUSM researchers are together studying the use of nanotechnology in breast cancer research. Joseph Irudayaraj, PCC member and associate professor of agricultural and biological engineering, and Harikrishna Nakshatri of the IU School of Medicine have found that gold nanoparticles can identify marker proteins on breast cancer cells. The method not only holds promise for early detection, but it is cheaper than the most common method.

From the smallest proteins to the largest imaging equipment, Purdue researchers are finding innovative ways to end cancer.✽

"The University is especially focused on developing new technologies for early detection."

—Marietta Harrison, Purdue University professor of medicinal chemistry and molecular pharmacology and director of the Oncological Sciences Center

Marietta Harrison

A visualization of biochemist Philip Low's groundbreaking research which led to the formation of a company in the Purdue Research Park called Endocyte, Inc. The company develops targeted therapy products to treat cancer and other diseases.

Research Leads to Drug for HIV

A molecule developed by Purdue researcher Arun Ghosh, professor of chemistry and medicinal chemistry and molecular pharmacology, has led to the first FDA-approved drug to treat drug-resistant HIV.

Purdue News Service photo/David Umberger

The FDA approved the pill-based therapy of Ghosh's molecule, TMC-114, for medicinal use in June. The molecule, now known as Darunavir, is a forerunner in a series of molecules under development by Ghosh that may have broader applications in antiretroviral therapy.

The human immunodeficiency virus (HIV) is known for its ability to outsmart therapies by rapid mutation. As it changes form, it becomes resistant to treatment. Ghosh designed Darunavir to target an unchanged "backbone" region of the HIV protease, thus decreasing the probability of resistance developing. This is a concept he advanced to combat drug resistance. The molecule has selected features of the naturally occurring molecules that improved its drug-like properties and its ability to fight HIV effectively.

The molecule has fewer side effects than existing protease inhibitors because the dose required is smaller. Its size also makes it more easily absorbed and tolerated by the body. Because the molecules are synthetic, lab-created materials, they lend themselves to cost-effective mass production, which, in turn, makes them more accessible to developing nations where the HIV epidemic is worst.

Pigs May Provide Key to Human Health

Purdue biochemist Weiguo Tao and colleague Mike Sturek of the Indiana University School of Medicine have turned to Ossabaw pigs for information about human infertility, diabetes, and cardiovascular diseases. The rare breed of pig—rescued from a Georgia coastal island—could help in a cure for infertility and related diseases. Tao's group is using the pigs for an exploration of metabolic syndrome and cardiovascular studies.

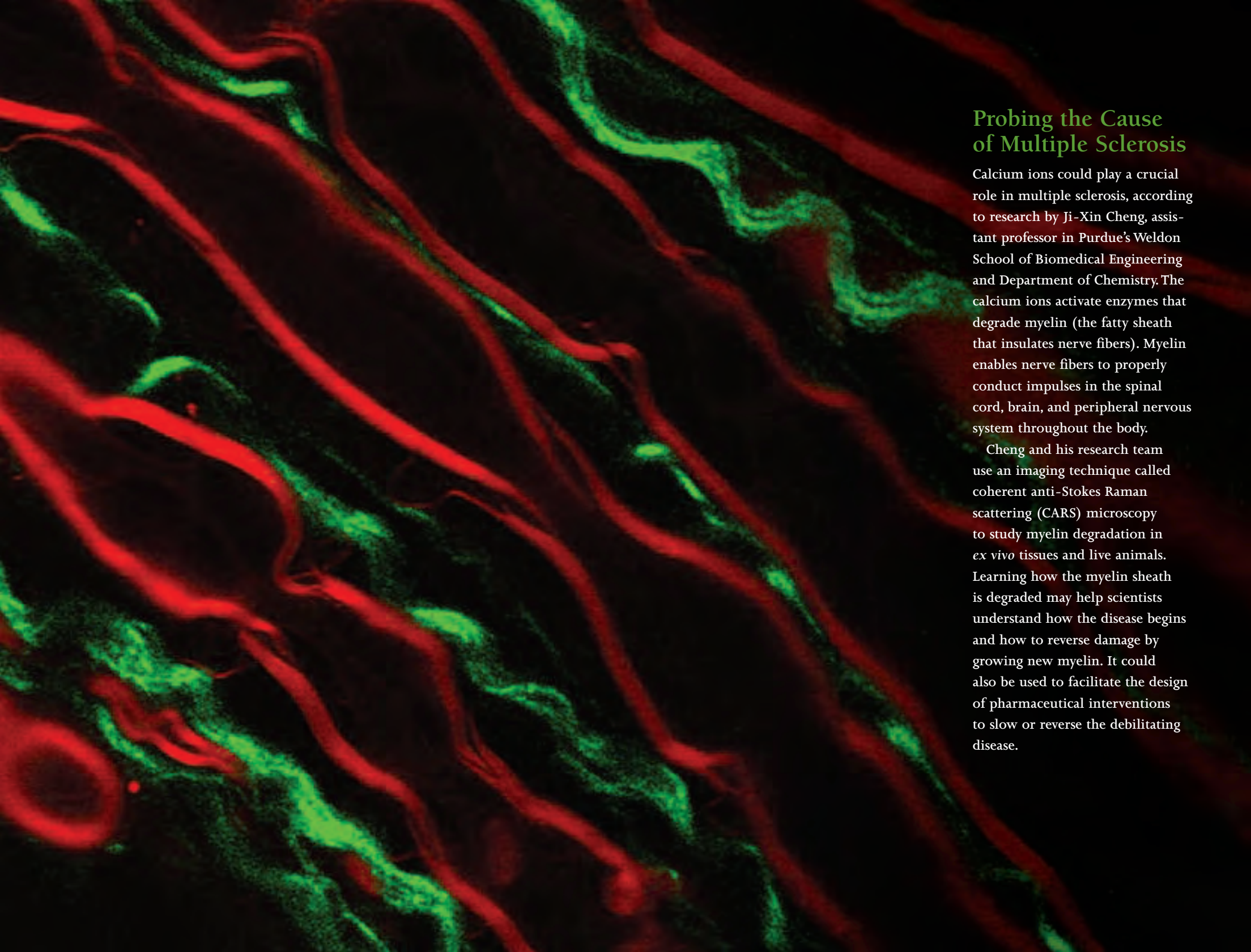
Like some humans, the pigs are predisposed to metabolic syndrome, a disease that includes a host of health problems—obesity, insulin resistance leading to Type 2 diabetes, hypertension, artery-clogging bad cholesterol and triglycerides, and abnormally high blood clotting. Many of these features are also characteristic of polycystic ovary syndrome, an illness that leads to infertility in 5 to 10 percent of reproductive-age women.

The research is part of the Center for Comparative Medicine, a collaborative effort among the Indiana University School of Medicine, Purdue's Department of Animal Sciences, and Purdue's School of Veterinary Medicine.

(at left) Arun Ghosh *(right)* a Purdue professor of chemistry and medicinal chemistry, and graduate student Xiaoming Xu discuss the structure of an enzyme inhibitor designed to treat Alzheimer's disease.

(below) These Ossabaw pigs, are helping Rebecca Krisher and other Purdue researchers understand diabetes, cardiovascular disease and infertility.

Purdue University photo/Tom Campbell



Probing the Cause of Multiple Sclerosis

Calcium ions could play a crucial role in multiple sclerosis, according to research by Ji-Xin Cheng, assistant professor in Purdue's Weldon School of Biomedical Engineering and Department of Chemistry. The calcium ions activate enzymes that degrade myelin (the fatty sheath that insulates nerve fibers). Myelin enables nerve fibers to properly conduct impulses in the spinal cord, brain, and peripheral nervous system throughout the body.

Cheng and his research team use an imaging technique called coherent anti-Stokes Raman scattering (CARS) microscopy to study myelin degradation in *ex vivo* tissues and live animals. Learning how the myelin sheath is degraded may help scientists understand how the disease begins and how to reverse damage by growing new myelin. It could also be used to facilitate the design of pharmaceutical interventions to slow or reverse the debilitating disease.

Biochip Speeds Drug Development

A new biochip that can detect individual levels of different ions may speed the development of drugs to treat diseases including epilepsy and muscle and nerve disorders.

The chip measures the electrical activities of cells and can obtain 60 more times data in one reading than is possible with current technology. Instead of limiting researchers to one experiment per day, the technology could be automated and could support hundreds of experiments in the same time period.

The new chip could speed the collection of data and the development process of drugs for human disorders involving ion channel malfunction, such as epilepsy and chronic pain, according to research team leader Marshall Porterfield, professor of agricultural and biological engineering.

Test Detects Genetic Disorders Early in Life

Genetic disorders found in infants and young children may be more easily detected using a technique developed by Purdue chemist Daniel Raftery and colleagues in collaboration with the Indiana University School of Medicine. The new testing method, which involves quick analysis of fluid such as blood or urine, makes the markers for some genetically caused metabolic disorders up to 100 times more visible. It will enable treatment early in a child's life so that effects such as brain damage can be prevented. It may also catch borderline cases that would otherwise go undiagnosed until serious symptoms arise.✽

Purdue News Service photo/David Umberger

(from left) Purdue University assistant research scientist Nagana Gowda and chemistry professor Daniel Raftery discuss their work with Murthy Shanaiah, a post-doctoral research assistant, and graduate student Aruni DeSilva *(seated in front of tank).* The researchers are performing an analysis, using nuclear magnetic resonance spectroscopy equipment. Raftery's team established a new technique for detecting a number of genetic disorders found in infants and young children.

Purdue Professor on Nobel-winning Team

Purdue Professor Kevin Gurney is among the 2,500 scientists awarded the 2007 Nobel Peace Prize alongside Vice President Al Gore. Gurney, associate director of Purdue's Climate Change Research Center, is a contributing author and reviewer to the Intergovernmental Panel on Climate Change (IPCC), which shared the prize with Gore. The Nobel committee praised the recipients "for their efforts to build up and disseminate greater knowledge about manmade climate change and to lay the foundations for the measures that are needed to counteract such change."

Gurney is a member of IPCC, which commissions assessments of global climate

change from hundreds of experts in the field. The fourth assessment report, published this year, was based on computer modeling of global climate. Gurney, who also is an assistant professor of earth and atmospheric sciences and agronomy, contributed research results on linkages between climate change and carbon cycling to the most recent IPCC assessment.

Leading life science discovery for our

ENVIRONMENT

Water Research Looks at Impact of Biofuels

The ways in which biofuel production, manure, fertilizer, and agricultural chemicals affect water quality is the topic of study at Purdue's Water Quality Field Station (WQFS) located near the West Lafayette campus. As biofuels become part of the country's energy portfolio, the impact of their production on water and soil resources is of special concern to Professors of Agronomy Sylvie Brouder, Ron Turco, and Jeff Volenec.

Biofuel can be derived from corn, switchgrass, timber, and other agricultural sources that rely on soil and water resources for production. Brouder and her colleagues are studying whether biofuel production affects the water that is leaving soil, how the removal of corn stover for use as a fuel supply impacts both soil and water quality, and if the intensive and expanding use of nitrogen needed for the corn to make ethanol, alters water and soil quality. Early results, Turco says, indicate that the nation needs to pay more attention to the ancillary impacts of biofuel production.

From Waste to Wattage

Industrial and farm waste may soon become a source of electricity for residents of central Indiana's Clinton County, courtesy of a partnership between Purdue planners and scientists, and industry and government.

Methane produced by waste will be converted to electricity in two separate facilities—one for industrial waste and one for hog waste—that are scheduled to begin operation in Frankfort in spring 2008. The project involves Clinton County, the city of Frankfort, Archer Daniels Midland Co., and Indiana Clean Energy LLC.

"We're bringing together agriculture and industry to optimize the energy potential in waste," says Ron Turco, Purdue environmental microbiologist and project leader.✽

Monitoring growth: Scientists advise as Azerbaijan moves into modern era

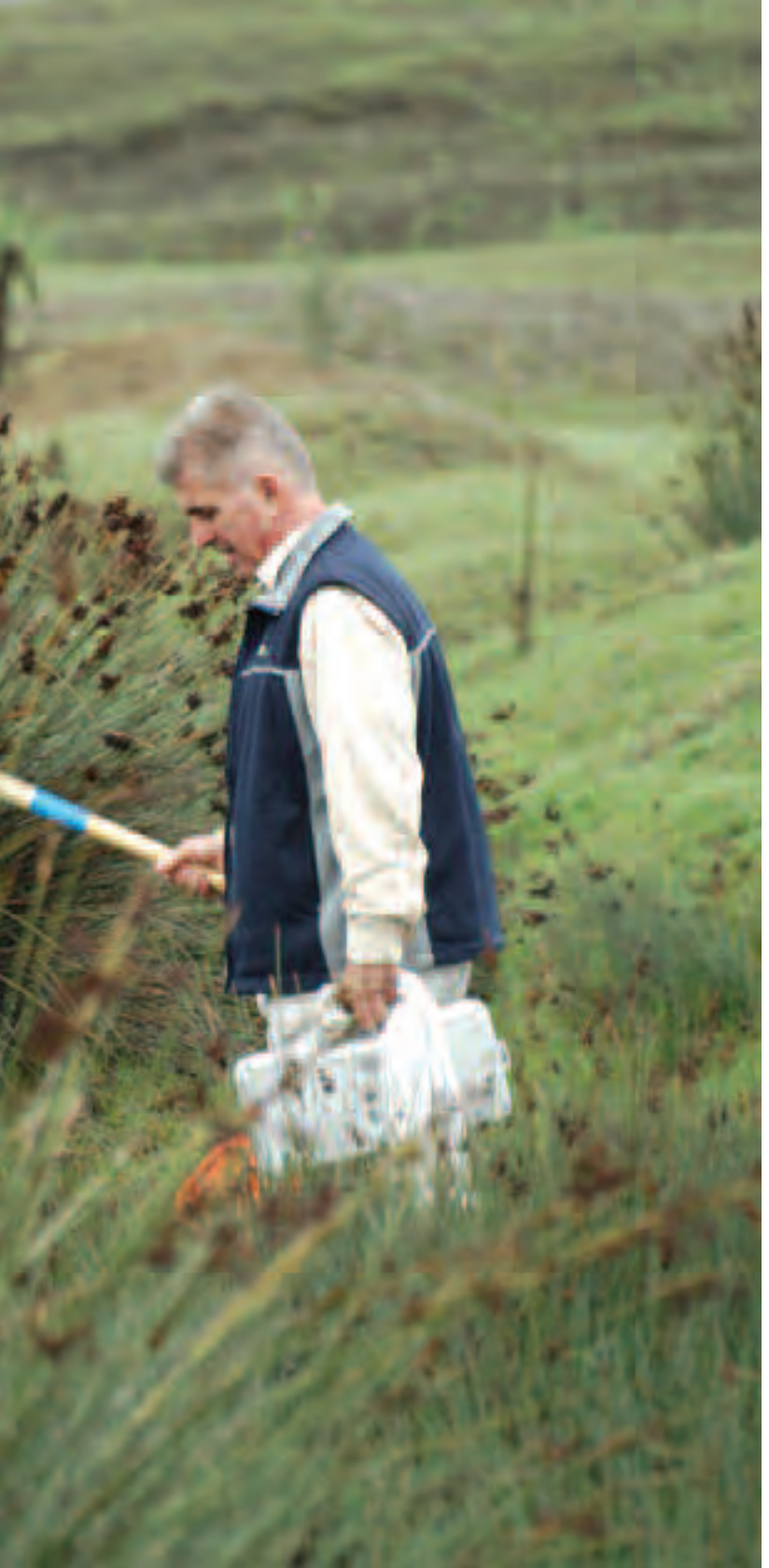
The Republic of Azerbaijan is on the brink of a new age. With some of the richest oil reserves in the world, the former Soviet state stands to gain economically. But the gains could come at a cost to the environment. Many areas of the nation are already heavily polluted by the former Soviet Union's chemical and oil industries. A Purdue research team, however, is working to improve and protect the environment of the Caspian Sea and surrounding areas.

John Bickham, director of Purdue's Center for the Environment, is drawing together an interdisciplinary team to help Azerbaijan as it moves into the modern era of oil extraction. He has spent the last 10 years studying the genetic effects of chemical contaminants on sturgeon, frogs, turtles and other wildlife in Azerbaijan. His initial contact with the country came through work as part of a team of consulting environmental scientists working with Amoco, which was then developing oil fields in the Caspian Sea. The scope of the research has expanded—and, since coming to Purdue in 2006 from Texas A&M University, Bickham is quickly drawing colleagues into the studies.

Researchers can play a role in helping Azerbaijan move responsibly into the modern age of oil extraction as its political and social climate undergoes change, Bickham says. "Azerbaijan is an oil-rich country, the pipelines are

John Bickham

Biologist John Bickham studies the genetic effects of chemical contaminants on wildlife populations in Azerbaijan. Bickham, director of Purdue's Center for the Environment, has worked in Azerbaijan for the last decade. *(center photo)* Arif Islamazdey collects frogs in Azerbaijan.



completed and oil is flowing to the West. It stands to make a lot of money. The government may now be able to address problems they didn't have the resources to deal with in the past," he says.

Purdue and the oil company BP recently signed a contract for offshore drilling activities in Azerbaijan. Researchers will perform risk assessments and other studies to help the company evaluate environmental impacts. The team will also interact with government agencies and industry to help the government move toward a risk-based system of monitoring and away from its current focus on regulating contaminant levels. Plans are underway to hold a risk assessment workshop in Azerbaijan with local and international experts. Bickham hopes to involve engineering, agriculture, science, veterinary medicine, pharmacy and pharmaceutical sciences, forestry and natural resources, pathobiology, and biological sciences.

Impact on Human Lives

As the scope of the research in Azerbaijan has grown over the years, the projects have evolved. Scientists from Texas A&M have expanded their environmental studies to human subjects, looking at exposure to contaminants and health effects in the refugee population that has migrated from the Karabakh region of western Azerbaijan. The focus on human health assessment

"Azerbaijan is an oil-rich country, the pipelines are completed and oil is flowing to the West. It stands to make a lot of money. The government may now be able to address problems they didn't have the resources to deal with in the past."

—John Bickham, director of Purdue's Center for the Environment

will include studies of biomarkers and other indicators of risk that could involve Purdue experts in biomedicine, environment, and the emerging field of epigenetics. Other planned studies that involve Purdue scientists include monitoring a multimillion-dollar oil field clean-up and biodiversity studies of medicinally important plants.

"Our group has been involved in many studies in the country and we have seen how things have changed over the years. I'm optimistic that the environment in Azerbaijan will improve. The clean up of the oil field near the capital city of Baku is a huge step forward, but it is only a step and they have many more to take," Bickham says. ❋

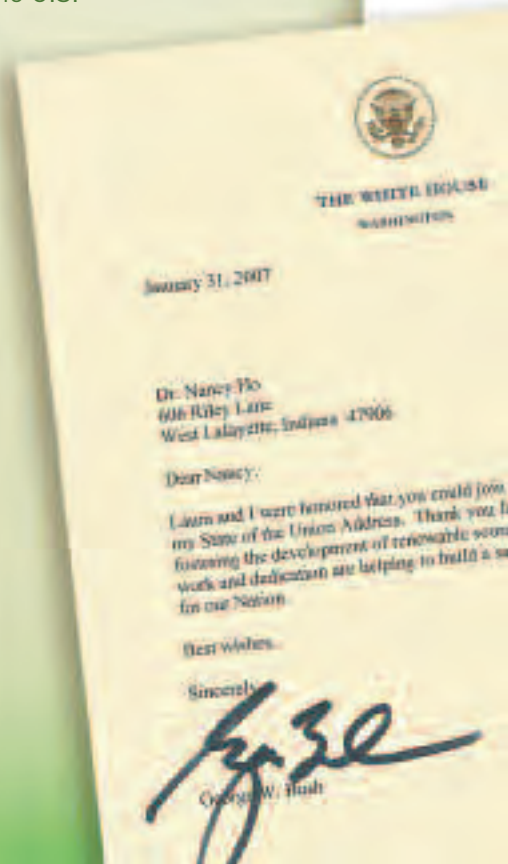
Ho's Biofuel Work Honored at White House

Nancy Ho

Researcher Nancy Ho was recognized by President George W. Bush during his State of the Union address in January. Ho is a research professor in the School of Chemical Engineering and heads the Molecular Genetics Group at Purdue's Laboratory of Renewable Resources Engineering (LORRE). She is recognized globally for her work with a strain of yeast that will convert biomass—such as corn stalks and wood chips—into ethanol, a process that could fuel American vehicles long after some natural resources are exhausted.

The yeast, named "Ho-Purdue Yeast," was patented in 1993 and since 2004 has been used by the Canadian biotechnology company logen in Ottowa, Canada. The facility now produces about 700 gallons of fuel a day from straw residue, according to Ho. Additional companies are now working with Ho to use the Ho-Purdue yeast for cellulosic ethanol production.

During his annual address to the nation, President Bush mentioned the need to create alternative fuels. He encouraged investment in cellulosic-ethanol technology. This recognition was followed in April by a $5 million grant from the Department of Energy that will help Ho's research team further improve the yeast to be more efficient for cellulosic ethanol production. Ho believes that in a few years, many companies will use the Ho-Purdue yeast actively to produce cellulosic ethanol in the U.S.



THE WHITE HOUSE
WASHINGTON

January 31, 2007

Dr. Nancy Ho
606 Riley Lane
West Lafayette, Indiana 47906

Dear Nancy:

Laura and I were honored that you could join
my State of the Union Address. Thank you f
fostering the development of renewable ener
work and dedication are helping to build a s
for our Nation.

Best wishes.

Sincerely,

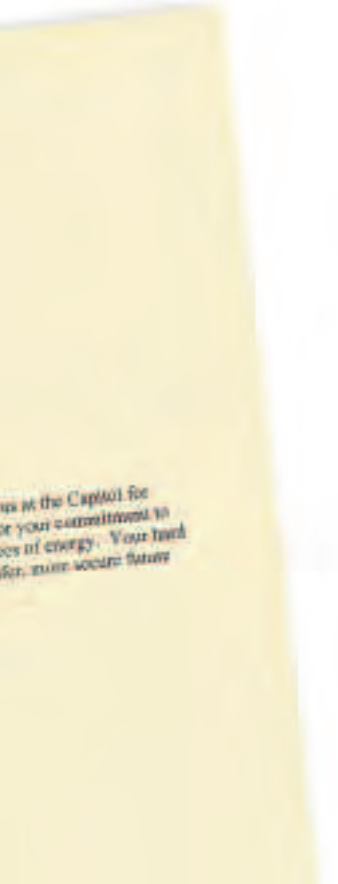
George W. Bush

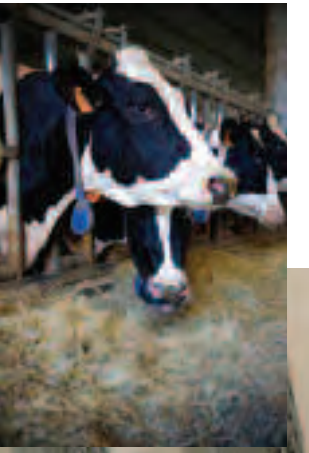
Animal Feeding Operations and Air Quality

Air emissions at animal feeding operations are being measured and analyzed in a study conducted by Al Heber, professor of agricultural and biological engineering. The study is the largest ever to measure levels of gases and pollutants emitted from barns and manure storage units at poultry, dairy, and swine facilities across the nation.

Using advanced measurement tools—such as lasers and reflectors—the study will measure levels of hydrogen sulfide, particulate matter and ammonia, among other chemicals released from livestock facilities. The data will allow the researchers to estimate the quantity of emissions given a farm's activities and number of animals, according to principal investigator Richard Grant, a professor of agronomy. Researchers will be able to use this data to validate advanced farm emission models that will be developed after the study is completed.

The National Air Emission Monitoring Study is funded by $14.6 million from the Agricultural Air Research Council and undertaken in collaboration with 11 researchers from seven universities.*





Al Heber

Al Heber, a Purdue professor of agricultural and biological engineering, inspects a ventilation fan during a training event at a swine-rearing facility in central Indiana.

Purdue Agricultural Communication photo/Tom Campbell

Reviving the American Chestnut Tree

The grand and glorious American chestnut, an important wildlife tree and timber resource, could be restored with help from Douglass Jacobs, associate professor of forestry in Purdue's Hardwood Tree Improvement and Regeneration Center and member of the science cabinet of the American Chestnut Foundation.

The tree, which once dominated the landscape from Maine to Mississippi, was driven to near-extinction by a fungal disease introduced about 100 years ago. Jacobs is studying how well American chestnut trees grow in plantations, research essential to future reintroduction plans. He also is developing a blight-resistant hybrid to be used in future planting projects.

In a paper published in July's issue of the journal *Biological Conservation,* Jacobs details the challenges to restoring the tree. To reintroduce the American chestnut, researchers must get past several policy limitations, gather new data, educate the public about the species, and address new threats posed by exotic pests. The tree, which was known for its annual largesse of nuts, rot-resistant wood and sheer size, could be available to the public in 10 years. ❃

Purdue University photo/Bruce Wakeland

Purdue University researcher Doug Jacobs stands next to an American chestnut.

Nelson Awarded 'Nobel' of Agriculture

Philip E. Nelson, the Scholle Chair Professor in Food Processing at Purdue, was awarded the World Food Prize in June for his contributions to food processing and preservation. The award is considered the Nobel of agriculture.

Nelson is credited with developing technology to transport processed fruits and vegetables without product spoilage. The technology, known as aseptic bulk storage and distribution, revolutionized global food trade. Without his work, much of the world could not enjoy orange juice, tomato products, and other perishable foods.


Philip Nelson

Nelson, who helped establish the Department of Food Science, served as its head until 2003. He now teaches half time.

In honor of Dr. Philip E. Nelson, Indiana Governor Mitch Daniels announced the creation of a new state prize. The prize is named the Dr. Philip E. Nelson Innovation Prize and recognizes outstanding Hoosier scientists for their unique discoveries, research and inventions.

Leading life science discovery for our

LIFE *and* LEARNING

Storage Method Preserves African Food Staple

Farmers in 10 West and Central African nations are learning how to better protect cowpeas, an important food and cash crop, with the help of a storage method developed at Purdue. Cowpeas—known in the U.S. as black-eyed peas—are marketed in those African nations by an estimated 3.4 million households. They are vulnerable, however, to the cowpea weevil, which can consume nearly all of the cowpeas stored on a farm. That leads farmers to sell at harvest, when prices are lowest.

Purdue entomologist Larry Murdock has studied cowpea weevils for the last 20 years and developed a hermetic storage method that involves triple bagging the cowpeas in plastic. It is low cost and does not involve the expense or health and environmental risks of chemical treatment. In a project led by agricultural economist Joan Fulton, researchers are on a quest to educate farmers and get 50 percent of the cowpeas stored at the farm level in triple-layer bags within five years. The use of triple-bag storage for cowpeas could result in an average increased income per household of $150 per year. Across the 10 countries, this would be worth about $255 million annually to some of the poorest nations in the world.

The project, which covers Benin, Burkina Faso, Cameroon, Ghana, Mali, Niger, Nigeria, Senegal, Chad and Togo, is funded by an $11.4 million grant from the Bill and Melinda Gates Foundation.


Larry Murdock

Purdue Agricultural Communications photo/Tom Campbell

Military Families and Change

When soldiers come home, they go through a period of adjustment; so do their families. How they all cope with the change is the subject of studies by Shelley MacDermid, director of the Military Family Research Institute and associate dean for Discovery and Learning in the College of Consumer and Family Sciences.

To better understand how military families react to repeated deployments and the stresses of raising children during wartime, MacDermid has interviewed members of an Army reserve unit and 256 active-duty members in all branches of the military. She found that one of the most common homecoming experiences is a long period of adjustment for the service members and their

continued on page 21

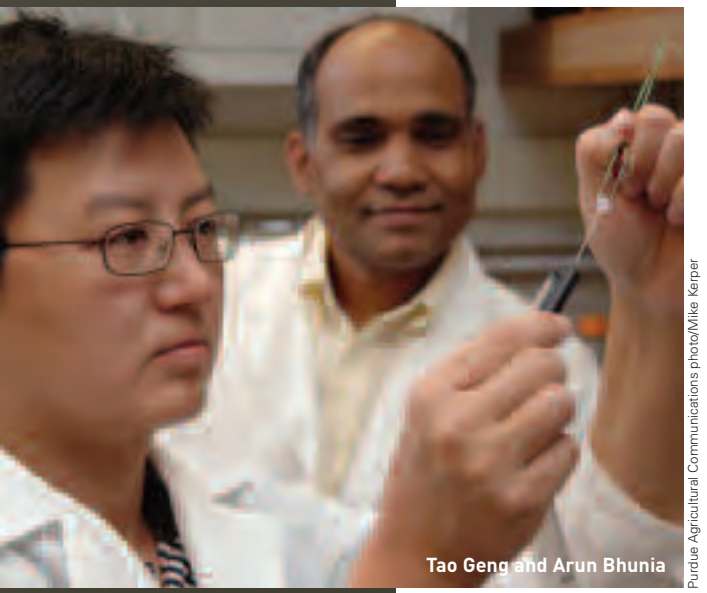
Food fight: Researcher faces off with *E. Coli* and other pathogens

Nothing gets the public's attention faster these days than the mention of contaminated spinach, lettuce, ground beef, or processed foods. It is a problem that results in illness, death, economic loss to the food industry, and it is one that is getting bigger. Arun Bhunia, Purdue professor of molecular food microbiology in the Department of Food Science, is determined to find a solution.

Listeria, *Salmonella*, and *E. coli* are the major foodborne pathogens of concern in the United States. In order to decrease bacterial contamination, the food processing industry needs a rapid and affordable way to identify the pathogens. The problem lies in the timetable for this process. The food industry includes many small food processors and producers that do not have in-house microbiological laboratories for testing for food pathogens. The companies send out samples for analysis, which takes time; results sometimes come back after foods have been consumed.

Bhunia and colleagues at the Center for Food Safety Engineering have pooled their expertise in microbiology, light scattering and image analysis to tackle the problem. The result is an "optical biosensor" that uses laser light to detect the presence of a target organism. Their BARDOT (Bacterial Rapid Detection using Optical Scattering Technology) design employs a light scattering sensory method. Unlike other methods, this system does not destroy the bacterial sample and keeps it intact; therefore, the sample can be used as an evidence to link the association of the organism with a specific food during an outbreak investigation.

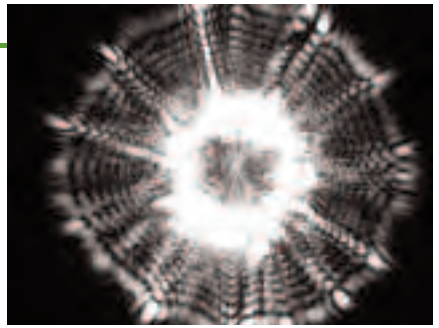
Each pathogen species has its own unique scattering pattern. BARDOT acquires images of the bacterial colonies growing on an agar plate that can then be used for analysis. For example, the bacteria classified as *Listeria*—one of the

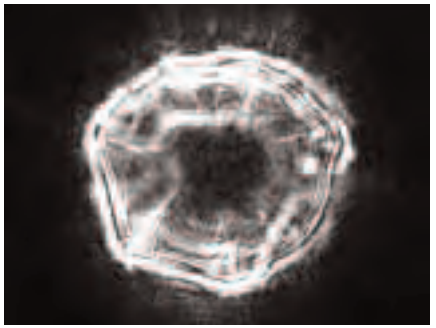


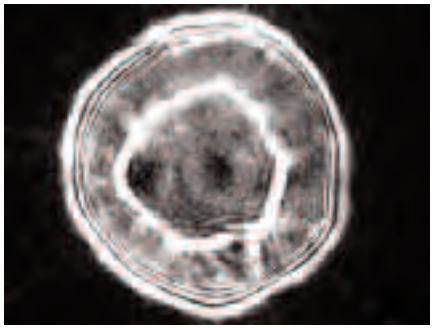
Tao Geng and Arun Bhunia

Purdue Agricultural Communications photo/Mike Kerper

Purdue researchers have developed a new biosensor that can detect minute quantities of the deadly foodborne bacteria *Listeria monocytogenes*. Here, research associate Tao Geng places an optical fiber, which is part of the biosensor, into a sample to test for the bacteria's presence as Arun Bhunia, professor of food science, watches.







Laser optical scatter images of colonies of *Listeria, E. coli* and *Salmonella*.

(from left) Listeria monocytogenes, E. coli O157:H7 and *Salmonella Enteritidis*

most fatal pathogens—includes six different species, but only *L. monocytogenes* can infect humans. The team's sensor can differentiate between pathogens and identify the *Listeria* strain in a matter of seconds. The team is currently investigating the application BARDOT to detect *E. coli O157:H7, Salmonella,* and *Vibrio* from ready-to-eat meat, vegetables, and seafoods.

The BARDOT system is good news for wary consumers. The Centers for Disease Control currently estimates that 76 million people get sick, more than 300,000 are hospitalized, and 5,000 Americans die each year from foodborne pathogen illnesses.

The technique may also have future applications in medicine, food defense, and homeland security, by identifying dangerous organisms far more quickly and at much lower costs than conventional methods, according to E. Daniel Hirleman, professor and William E. and Florence E. Perry head of the School of Mechanical Engineering. ✽

continued from page 19

spouses as the couple relearns how to depend upon and accommodate one another. An $8.9 million gift from a Lilly Endowment announced in October will help the institute, which is the only one of its kind in the nation, reach out to military families across the nation and serve as a model for others.

A Peaceful Revolution

Purdue faculty members are reaching across the globe to help develop agriculture and veterinary programs in Afghanistan. The work is supported by a $7 million grant from the U.S. Agency for International Development awarded in April in an effort to develop agricultural education and support rebuilding of the country's economy.

The Advancing Afghan Agricultural Alliance program—a consortium of U.S. universities and development agencies—will work with Afghan universities and create partnerships among the country's Ministry of Agriculture, local economic development organizations, and universities. It will also provide educational opportunities for students and promote faculty education and recruitment.

"It is essential for Afghanistan's development that people from there are trained to participate. The program will

continued on page 22

Purdue University photo/Kevin McNamara

In this September 2006 photo, students take an outdoor exam at Kabul University because of a lack of classroom space. Purdue professor of agricultural economics Kevin McNamara said he hopes his team's efforts—like helping to renovate the now-completed school of agriculture in the picture's background—will provide students with better educational opportunities.

prepare students for meaningful job opportunities while empowering them to contribute to the country's development," said Kevin McNamara, project leader and professor of agricultural economics. McNamara has been working with the Afghan Ministry of Higher Education the last three years.

In addition to nurturing the academic environment, the project will also help rebuild its infrastructure; many of the country's academic institutions were destroyed by years of civil war. McNamara and others have helped renovate the agriculture and veterinary schools buildings at Kabul University and will build demonstration farms and a greenhouse.

A Better Understanding of Diet and Nutrition

Several centers at Purdue are focused on helping Americans and populations around the world live healthy lives through good diet and nutrition.

Purdue's **Ingestive Behavior Research Center (IBRC)** addresses the need for integrative, cross-disciplinary approaches to the study of ingestion and its disorders. The center is directed by Terry Davidson, professor of psychological sciences.

Among the IBRC affiliates is the Laboratory for Sensory and Ingestive Studies, where researchers are working to better understand how diet and behavior influence health. Their studies consider the influences of neural, genetic, metabolic, hormonal, cognitive, cultural and sensory factors on human ingestive behavior, nutrient utilization, and energy balance in healthy and clinical populations. The lab is headed by Richard Mattes, professor of foods and nutrition at Purdue University and adjunct associate professor of medicine at the Indiana University School of Medicine. He is the associate director of IBRC.

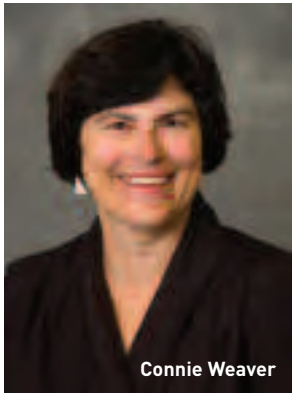

Richard Mattes

Current studies at Mattes' lab are focused in three areas:

- The role of caloric beverages in the overweight/obesity epidemic and the mechanisms by which beverages may be especially problematic
- Exploring whether "fatty" is a basic taste and the effect that mere sensory exposure to dietary fat has on blood fat concentrations
- The effects of nut consumption on cardiovascular disease risk and body weight. Studies are underway in the U.S., Ghana, and Brazil.

At the **Botanical Center for Age-Related Diseases,** Connie Weaver screens botanical dietary supplements for their ability to prevent age-related bone loss.

Weaver, Distinguished Professor and Head of the Department of Foods and Nutrition, is leading studies on calcium and Vitamin D requirements in children and on soy isoflavones and bone health in post-menopausal women. Her research on calcium metabolism in teens, conducted as a summer program called Camp Calcium, has influenced recommendations for calcium intake for populations around the world. Her work has also provided insight into factors affecting development of peak bone mass during growth, which determines risk of osteoporosis in women. Weaver is also affiliated with the IBRC and the Center on Aging and the Life Course.✽


Connie Weaver

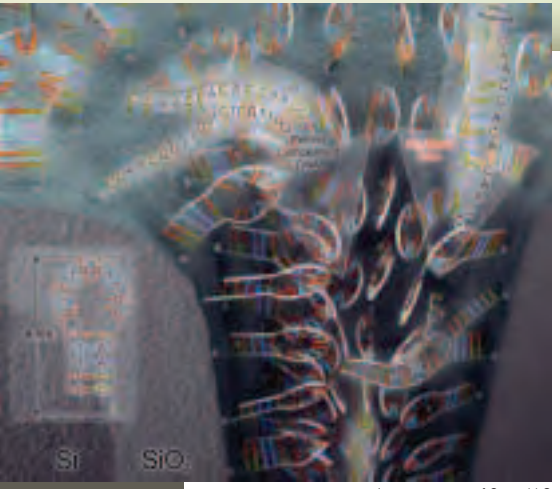


Image courtesy of Seyet LLC

This artist's rendition depicts how "nanopore channels" can be used to rapidly and precisely detect specific sequences of DNA, a potential tool for future sensors with possible genomic applications in medicine and biology. The tiny channels, which are 10 to 20 nanometers in diameter and a few hundred nanometers long, were created by researchers from Purdue's Birck Nanotechnology Center. The Purdue researchers "functionalized" the channels so that single strands of DNA were attached inside each one.

PURDUE UNIVERSITY Discovery Park

An Interdisciplinary Research Hub

"Discovery Park is home to Purdue's interdisciplinary research programs. It is a place where scientists and students dare to take on society's 'grand challenges;' where the vision of today is transformed into the reality of tomorrow."

—Al Rebar, senior associate vice president for research, executive director for Discovery Park

Regenstrief Center Pioneers Healthcare Engineering

The Regenstrief Center for Healthcare Engineering, founded at Purdue in 2005, is an interdisciplinary center that draws on the university's strength in engineering, science, management, and social sciences. Its mission is to transform the healthcare delivery system by optimizing quality, cost-effectiveness, and access for all. The center is the only integrated university-wide effort in healthcare engineering in the nation.

Research efforts focus on primary care access, acute care efficiency, chronic care management, population health, and patient safety. Current research projects include physician adoption of information technology, clinical scheduling and patient flow, utilization patterns and costs among Medicaid patients with dementia, at-home monitoring for chronic care patients, and statewide pandemic planning.

The center has a number of partnerships with Indiana hospitals and with the State Department of Health. It is also involved in the Healthcare Technical Assistance Program, launched in May 2005 with the Indiana Hospital&Health Association. Through it, interdisciplinary teams from Purdue's College of Engineering and School of Nursing work with Indiana hospitals to improve patient care, safety and productivity. The program is run by Purdue's Technical Assistance Program, which collaborates on projects with Indiana businesses and state and local governments.

The center is funded by The Regenstrief Foundation, which was created by Sam and Myrtle Regenstrief in 1967 to promote the application of engineering and production concepts to healthcare delivery.

Doctorate of Nursing Program Expands

Purdue's School of Nursing has developed a doctor of nursing practice degree program with help from a $2.49 million grant from the Helene Fuld Health Trust. The grant supports an endowment for scholarships; leadership development; and implementation, evaluation, and the delivery of new programs. The doctoral program, which graduated its first students in May, "helps equip a new generation of nursing leaders who will create genuine change in health policy, delivery systems and patient care," according to Julie Novak, head of the School of Nursing.


Julie Novak

Purdue's program, the tenth formed in the country, emphasizes interdisciplinary education by partnering nursing students with Purdue's Regenstrief Center for Healthcare Engineering and other academic disciplines. It includes coursework that integrates epidemiology, evidence-based practice, innovative clinical projects, collaborative partnerships, health policy initiatives, and the application of engineering principles to health care to improve hospital design, improve use of information technology, apply motion studies for efficiency of operation, and explore the use of alternative service delivery methods in underserved areas.

Discovery Learning Center: Learning by Working

The Discovery Learning Center in Discovery Park administers two student internship programs: the Discovery Park Undergraduate Research Internship program (DURI) and the Interns for Indiana Program (IfI).

DURI engages undergraduates in the interdisciplinary research environment of Discovery Park. The program pairs highly motivated students with faculty and researchers on cutting-edge research projects affiliated with one or more Discovery Park centers. DURI offers 50 student internships per academic semester (fall and spring).

IfI matches Purdue undergraduate and graduate students with local high-tech start-up firms. The program supports 20-25 students per academic year and up to 25 students during the summer. It seeks to enhance the quality of Indiana's workforce by stemming the "brain drain" and keeping Indiana college graduates in the state and by supporting start-up companies.

Burton D. Morgan Center promotes Entrepreneurial Learning

With activity in both commercialization and education, the Burton D. Morgan Center for Entrepreneurship promotes a culture of entrepreneurship. Its activities are multi-fold. Yearly competitions range from the Life Sciences Business Plan Competition to the Competition for EPICS & Social Entrepreneurship. Programs include the Technology Commercialization Laboratory (TCL), which uses MBA students and technical doctoral students to analyze the commercial viability of emerging Purdue technologies. The center's BIOMEDSHIP is a focused educational program that provides formal training in innovation and entrepreneurship in the context of biomedical technology. The Certificate in Entrepreneurship and Innovation (CIEI) gives students from a wide variety of disciplines the opportunity to prepare for careers in start-up ventures or large organizations. Through a series of five three-credit courses and related experiential programs, they learn the theory and practice related to starting and running new business ventures. Approximately 850 students from a wide variety of disciplines have been enrolled so far and the goal is to have 1,000 students by 2008.

(top) Artist's rendition of Discovery Learning Center positioned within Discovery Park and the Burton D. Morgan Center for Entrepreneurship.

(below) Professor Karen Chang, PhD, RN, has partnered with Purdue computer technology faculty and developed custom applications which synchronize with hospital information systems to help nurses view up-to-date patient information in the Pocket PC and Tablet PC and take notes about their patients. Notes can be synchronized with a desktop computer and transferred to another Pocket PC and Tablet PC.


Philip Low

Purdue Research Park Announces Record Number of Startups

It has been a record-breaking year for startup companies formed from Purdue licensed technologies.

Fifteen companies were launched in the fiscal year running from July 2006 to June 2007, according to the Purdue Research Foundation's Office of Technology Commercialization. The office leads the effort to bring Purdue researchers' discoveries into viable commercial enterprises in the fields of medical devices, life sciences, information technology, agriculture, advanced manufacturing, telecommunication and engineering design.

"The dramatic increase in new companies developed through our Office of Technology Commercialization can be attributed to several factors, including our concerted effort to increase the Purdue Research Park's collaborations with Discovery Park and other areas of research taking place on the Purdue campus," said Joseph B. Hornett, Purdue Research Foundation's senior vice president, treasurer and COO.

The Office of Technology Commercialization executed 102 licenses, filed 208 patent applications for this latest fiscal year, and reported more than $5 million in royalty revenue.

Purdue Research Park is ranked among the nation's best university research parks. Within the park, 140 businesses, of which more than 90 are high-tech, employ more than 2,900 people.

Purdue's Discovery Park has grown into a $375 million interdisciplinary research complex where researchers are tackling society's challenges in areas ranging from advanced manufacturing, cancer treatment and energy to nanotechnology, life sciences and the environment.

"Our goal of moving discoveries from the laboratory to the market is advancing even faster than we anticipated," said Alan Rebar, executive director of Discovery Park. "We are very pleased with the collaborations we have developed, particularly with the partnerships formed through the Burton D. Morgan Center for Entrepreneurship within Discovery Park and the Purdue Research Foundation's Office of Technology Commercialization."

Philip Low, Joseph F. Foster Distinguished Professor of Chemistry, was recognized with the University's Outstanding Commercialization Award. The award recognizes recipients for translating ideas into commercial products that make a difference in everyday life and create jobs for Indiana. He has secured some 28 worldwide patents with 32 more pending.

Low developed a therapy that has helped fight cancer, Crohn's disease, diabetes and other illnesses. His "Trojan horse" therapy sneaks large molecules into disease-causing cells and can be used to directly treat or detect diseases. The technologies in his lab led to the formation of Endocyte Inc., a Purdue Research Park company which is pioneering a new generation of receptor-targeted therapeutics or "smart drugs" for the treatment of cancer and autoimmune diseases.

2006-07 STARTUPS

Of the 15 companies formed during fiscal year 2006-07, all have locations in Indiana.

›› *Purdue Research Park:*

MatrixBio LLC
M4 Sciences Inc.
MagSense Life Sciences
Kylin Therapeutics Inc.
2K Corp.
Moerae Matrix LLC
(also in New Jersey)
Nanovis Inc.

›› *Elsewhere in Indiana:*

BioProcessing Technologies Inc.
Cascade Metrix Inc.
Sift Data Systems LLC
VEM Systems LLC
(also in Columbus, Ohio)
Zb2 Inc.
Celsys Biofuels, Inc.
AlGalCo LLC
Data Rangers LLC

Here's a look at two new start-ups:

Kylin

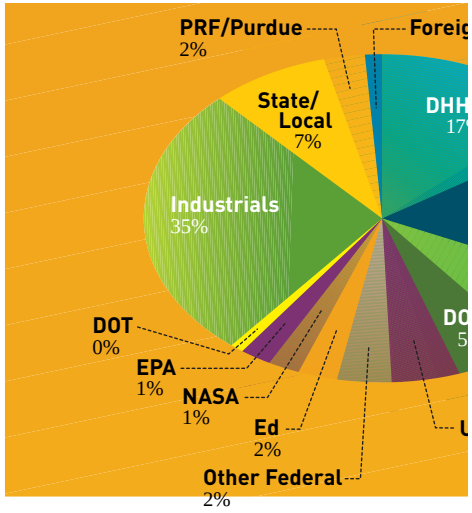
A partnership between Kylin Therapeutics Inc. and Fort Dodge Animal Health, a division of Wyeth, will lead to the development of new therapeutics for the treatment of cancer in companion animals.

Kylin Therapeutics is building technology that can target any gene whose expression causes or contributes to a disease—from cancer-causing oncogenes to viral genes to genes responsible for cardiovascular disease, diabetes, and Alzheimer's disease. Its RNA nanotechnology platform, called pRNA, was developed by Peixuan Guo, Purdue professor of molecular virology. Fort Dodge Animal Health is a manufacturer and distributor of prescription and over-the-counter animal health care products.

MatrixBio, LLC

A Purdue chemist's research has led to a noninvasive, accurate and reliable technology for breast cancer detection. Professor Daniel Raftery, a member of the Bindley Bioscience, Oncological Sciences, and Energy Centers uses Nuclear Magnetic Resonance (NMR) to identify the biomarkers for breast cancer. The technology is being marketed through MatrixBio, launched in 2007 with the guidance and support of Purdue's Discovery Park and the Purdue Research Park. ✽

Office of Technology Commercialization Summary



Clinical Trial Partnership

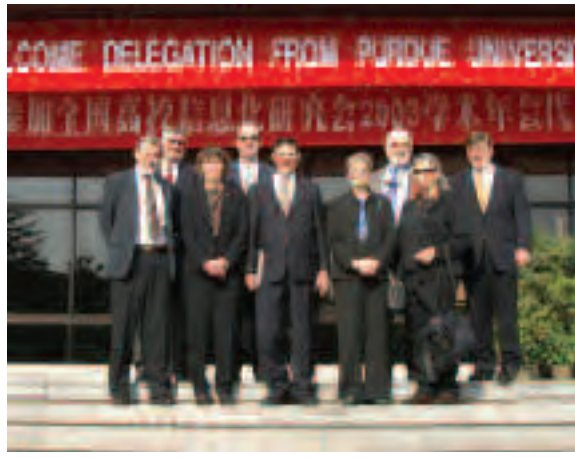
A collaborative effort between Purdue researchers and local physicians has resulted in the first local clinical trial on humans for Lafayette, Indiana. The drug therapy, developed by Philip Low, Purdue researcher and founder of Endocyte, Inc., targets lung and ovarian cancer in patients with advanced stages of the disease. The drug attaches potent cancer medicine to folic acid. Lung and ovarian cancer cells consume the folic acid resulting in triggering the death of the cancer cells—commonly referred to as the "Trojan horse" technique. Dr. Wael Harb of Horizon Oncology Center in Lafayette was instrumental in the formation of the Cancer Research Clinical Partnership and will run the local trial. The potential for additional local clinical trials could be on the horizon based on this initiative between local physicians and Purdue scientists.

Purdue News Service photo/David Umberger

James Leary *(from left)* a School of Veterinary Medicine professor of nanomedicine and professor of biomedical engineering at Purdue, and Michael Zordan, a graduate student in biomedical engineering, prepare samples for a special high-speed cell sorter at Discovery Park's Bindley Bioscience Center. The 10-by-4 foot machine, located in Bindley's Molecular Cytometry Laboratory, is a key part of a $4.5 million project that combines molecular imaging, cytometry and nanomedicine to diagnose and treat illnesses and diseases at the molecular level.

A Future Rich in Partnering, Progress

Whether partnering with local oncologists through the Purdue Cancer Center or nearby Indiana University School of Medicine, teaming with industry, or working with countries around the world, Purdue continues to build on its solid reputation in collaborative research.



Purdue and South Korea: Nanomedicine

Research teams from Purdue University and the Korean Institute of Science and Technology (KIST) are collaborating on a $4.5 million project to develop molecular imaging and nanotechnology tools to simultaneously diagnose and treat cancer and chronic and infectious diseases. The Purdue group is led by James Leary, School of Veterinary Medicine professor of nanomedicine, and professor of basic medical sciences and biomedical engineering.

The South Korean Ministry of Science and Technology selected the KIST and Purdue team project, with Purdue designated as a "Global Research Lab" from among 20 international research proposals on the molecular makeup of diseases. The research initiative, which spans nine years, will initially involve dozens of KIST and Purdue researchers.

Chao Center, Eli Lilly fight MDR-TB

The Chao Center for Industrial Pharmacy & Contract Manufacturing, located in Purdue Research Park, will become the sole U.S. provider of a drug to fight multi-drug resistant tuberculosis (MDR-TB), which strikes some 450,000 annually. Most victims are in China, India, South Africa, and countries of the former Soviet Union.

A centerpiece of the Eli Lilly/Chao Center agreement is the transfer of technologies to countries fighting MDR-TB. Purdue will teach them how to manufacture the drugs along with general manufacturing principles, such as, quality standards through good manufacturing processes, and business management education.

The Purdue College of Pharmacy, Nursing and Health Sciences is a center partner with the Chao Center.

The world of the future is now. Purdue researchers in the Life Sciences are helping solve some its most challenging problems. The impact of their efforts reaches from small-town America to outlying Azerbiajan and from Tanzania to Costa Rica. They are working …

For Our Health

In September, research teams from Purdue University and the University of Notre Dame led a global health forum during the United Nations General Assembly outlining how the two universities are working to address health concerns in Africa and other countries. Information shared during the presentation focused on how to harness the energy and expertise of their combined faculties, researchers and students to address international health challenges.

For our Environment

Purdue scientists are working to protect the environment by developing alternate energy sources, conducting biofuel seminars in China, monitoring water quality, and improving air quality and enhancements in climate modeling.

For Life and Learning

Purdue scientists are tackling world hunger and spreading their knowledge. They are protecting cowpeas, a primary African food source. They are working with fish farmers in Tanzania. They are leading swine production training in Vietnam. They are rebuilding engineering and veterinary medicine schools in Afghanistan.*

"Purdue University is a global player in discovery and innovation. We invest in our people and our ideas, and we impact society."

—*Charles O. Rutledge*

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