



2010 ANNUAL REPORT

FUELING THE ECONOMIC ENGINES OF INNOVATION



PURDUE
OFFICE OF TECHNOLOGY
COMMERCIALIZATION

Contents

- 2 Our Mission
- 3 Letters
- 4 Purdue Research Foundation History
- 6 Office of Technology Commercialization
- 8 Purdue Research Park Economic Impact Statement
- 10 Successful Startups
- 16 Entrepreneurial Resources
- 18 Outreach Activities
- 20 Available Technologies
- 26 Awards and Recognition
- 28 Project Managers



Our Mission:

To serve Purdue University through the commercialization of its intellectual property.

The Purdue Research Foundation's Office of Technology Commercialization (OTC) operates one of the most comprehensive technology transfer programs among leading research universities in the United States. Services provided by this office support the economic development initiatives of Purdue University and benefit the University's academic activities.



Purdue's intellectual property is an asset we strive to protect, market, and license. We work hand-in-hand with Purdue faculty, staff, and students to provide the resources to protect and actively support transforming intellectual property (patents, copyright, trademarks, and tangible research property) into an actual product or service to benefit the world. To ensure the long-term success of the innovations, we can take the process one step further and enable our creative teams to form startups complete with investor support and qualified management teams.

Office of Technology Commercialization activities:

- Help transform scientific discoveries into products and services available for the public.
- Create jobs by bringing new products into the commercialization stream.
- Provide additional revenue to Purdue and innovators.
- Catalyze public-private partnerships.



France A. Córdova,
President,
Purdue University
and Purdue
Research
Foundation

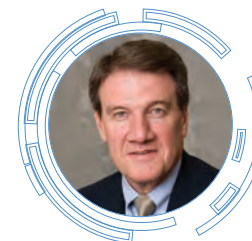
Discovery with Delivery

A critical mission of Purdue University is to move discoveries out of the laboratory to benefit the world and drive economic development. The Purdue Research Foundation's Office of Technology Commercialization helps us achieve this strategic goal of "Discovery with Delivery."

In 2009, the Office of Technology Commercialization filed 377 new global patent applications, announced 247 new discoveries, and finalized 85 licensing opportunities through startups and established companies.

This data demonstrates the important research our faculty conducts and exemplifies the collaborative environment we have created at Purdue.

As we celebrate these accomplishments, we recognize the continued commitment of Purdue faculty to focus on future discoveries to address global challenges.



Richard O. Buckius,
Vice President
for Research,
Purdue University

Supporting Research

Purdue University experienced the largest annual increase in research funding in its history when it rose from \$342 million in the 2009 fiscal year to \$438 million in the 2010 fiscal year.

We credit this increase to our Purdue faculty and staff. Their research and work epitomize how an academic institution can improve lives and strengthen economies at local, state, and national levels.

Our research strengths align with global priorities and the commitment of faculty and staff to commercialize their discoveries through the Office of Technology Commercialization and move new technologies to the public.



Joseph B. Hornett,
Senior Vice
President,
Treasurer and
COO, Purdue
Research
Foundation

Economic Engine of Innovation

The Office of Technology Commercialization helps drive Purdue Research Foundation's economic engine of innovation.

By leading the technology transfer activities, the Office supports Purdue's state, national, and global impact. The Office helps discoveries in life sciences, engineering, biomedical sciences, manufacturing, technology, and other disciplines move to the public.

The economic impact is impressive. Half of the 200 companies in the Purdue Research Park network are directly linked to a Purdue discovery patented through the office. The growth of the Purdue Research Park equates to a \$1.3 billion annual economic impact for Indiana.

It's a powerful economic engine, as you will see in this 2010 annual report.



Elizabeth Hart-Wells,
Assistant Vice
President and
Director, Office
of Technology
Commercialization,
Purdue Research
Foundation

Technology Transfer

2010 marked the 30th anniversary of the Bayh-Dole Act, which transformed the technology commercialization process for universities. Indiana Sen. Birch Bayh co-authored the act following a conversation with Ralph Davis, then-director of Purdue's first technology commercialization office. As a result, Purdue is a national leader in technology transfer.

Sixty-seven Purdue faculty are linked to a startup in the Purdue Research Park network, another 25 Purdue discoveries are the primary technology for a park-based company, and countless other Purdue discoveries are used by new and expanding companies around the world. Purdue continues to realize the Congressional intent of the Bayh-Dole Act and to make a positive and meaningful impact on the world.

Purdue Research Foundation History

Our History

The history of the Purdue Research Foundation dates back to 1930, a time when the country faced its most devastating economic decline – the Great Depression. It was founded on the belief of David E. Ross, a prolific Indiana inventor, and Josiah K. Lilly Jr., of Eli Lilly and Company, that industry could benefit by partnering with academic institutions and licensing academic discoveries.

Ross, a former President of the Purdue University Board of Trustees, and Lilly, a Purdue University Board of Trustees member, provided \$25,000 each to create the Purdue Research Foundation.

Today, the Purdue Research Foundation is valued at nearly \$1 billion. The Foundation manages and licenses Purdue University's intellectual property, accepts gifts, administers trusts, acquires property, and performs other services helpful to the University.

Those early endeavors are fully realized through the Purdue Research Foundation's Office of Technology Commercialization. The Office operates one of the most comprehensive technology transfer programs among leading research universities in the United States. Project managers work with Purdue faculty, staff, and students to provide the resources needed to better understand Purdue policies related to intellectual property and the processes to protect Purdue's intellectual property including patents, copyright, trademarks, and tangible research property.



Josiah K. Lilly Jr.

David E. Ross



Part of the Foundation's growth is in the Purdue Research Park. The Park, with more than 200 companies in four locations around the state, is a recognized national model for the technology transfer of University discoveries, commercialization, and economic development.

Nearly 70 Purdue faculty are directly involved with the creation of a Park-based company, another 25 faculty have developed technology used as a primary product of Park-based companies, and countless other Purdue discoveries are licensed by startups and established companies around the globe. Since 1999, Park-based companies have provided about \$22 million for sponsored research at Purdue.

Purdue Research Foundation Board of Directors

- David Adams, *Carmel, IN*
- Elizabeth Bechdol, *Auburn, IN*
- Michael Birck, *Naperville, IL*
- France Córdoba, *West Lafayette, IN*
- Barbara Edmondson, *Clayton, IN*
- John Hardin, Jr., *Danville, IN*
- Bob Jesse, *Fort Wayne, IN*
- David Johnson, *Indianapolis, IN*
- Keith Krach, *Los Gatos, CA*
- Randall Lewis, *Carmel, IN*
- J. Timothy McGinley, *Indianapolis, IN*
- Kelvin Pennington, *Chicago, IL*
- Charles Schalliol, *Indianapolis, IN*
- Steven Schmidt, *Boca Raton, FL*
- Jerry Semler, *Indianapolis, IN*

Officers

- France Córdoba, *President*
- Joseph Hornett, *Senior Vice President and Treasurer/COO*
- Gregory Deason, *Vice President-Real Estate/Research Park Development*
- Judith Hall, *Corporate Secretary*
- David Hodde, *Assistant Corporate Secretary*
- Belinda Rachwal, *Assistant Treasurer*
- Richard Buckius, *Vice President for Research*

Advisors

- Al Diaz, *Executive Vice President for Business and Finance, Treasurer*
- Scott Seidle, *Senior Director of Investments*
- Anthony Benton, *Legal Counsel*

Purdue University Board of Trustees

- Michael Berghoff, *Indianapolis, IN*
- Michael Birck, *Naperville, IL*
- JoAnn Brouillette, *Fowler, IN*
- John Hardin, Jr., *Danville, IN*
- Keith Krach, *Los Gatos, CA*
- Gary Lehman, *Lafayette, IN*
- Miranda McCormack, *Plainfield, IN*
- Thomas Spurgeon, *Washington, IL*
- Don Thompson, *Oak Brook, IL*
- Bruce White, *Merrillville, IN*



Office of Technology Commercialization

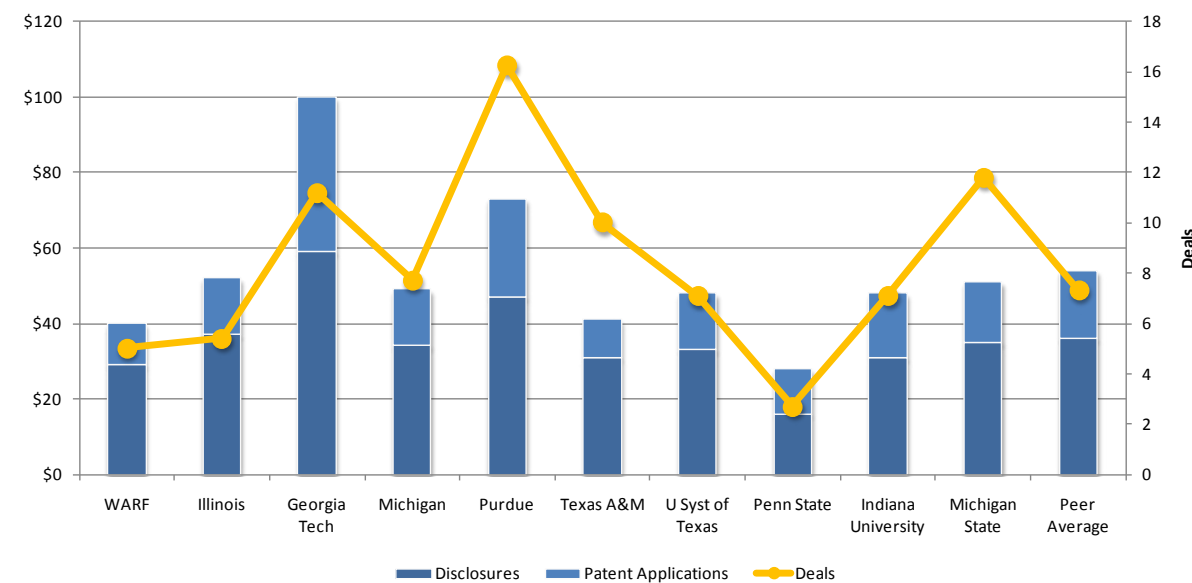
The Office of Technology Commercialization protects, markets, and licenses Purdue's intellectual property.

Currently, there are more than 450 technologies available for licensing. Among them: a software system to monitor students' progress in learning a foreign language, an Internet-based system to expedite shipping and receiving cargo, and a system to detect seizures in real time.

Peer Comparison

In the past few years, the Office of Technology Commercialization has met or exceeded peer and aspirational peer institutions' averages in technology commercialization. This data, the most current available through the AUTM 2009 Licensing Survey, includes New Discoveries Announced, Total U.S. Patent Applications, and Commercialization Deals.

2009 Peer Institution Data per \$100 million in research



2009 Calendar Year

85

Commercialization Deals

\$524 Million

Research Expenditures

247

New Discoveries
Announced

\$4.2
Million

Licensing Royalties

377

New Global Patent
Applications

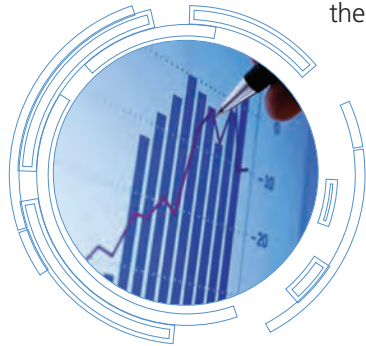
10

Startups

Purdue Research Park Economic Impact Statement

Thomas P. Miller and Associates was tasked with analyzing the economic impact of the Purdue Research Park network and its associated Purdue Technology Centers on the four communities in which they reside and on the State of Indiana as a whole.

This analysis includes both “traditional” and “new economy” impacts as well as the growing value of the Park network to Purdue University. Since the 1990s, the Purdue Research Park network has evolved into a statewide economic and entrepreneurial powerhouse and has become a major Indiana economic player with a statewide footprint. Among the highlights:



the Indiana average. High wages resulted in an estimated 2010 wage bill paid to Park company employees of about \$238 million. The largest concentrations were in West Lafayette (\$188 million) and Northwest Indiana (\$43 million).

\$1.3 billion job creating economic engine

The Purdue Research Park network has a large impact on output and jobs across the State of Indiana.

- Cumulative facility and infrastructure investment since 1999 generated total output in excess of \$585 million and construction wages of nearly \$183 million paid to 4,724 workers (in terms of full-time equivalents for one year). This is a one-time impact.
- The Park network is driving about 10,000 jobs and more than \$1.3 billion annually in total economic activity across Indiana.
- This economic activity is accompanied by an annual contribution of nearly \$48 million to State and local tax coffers across Indiana.

Top 20 employer

The Park network ranks among the largest employers in the State, and Park company employees live in 39 Indiana counties. Network companies employed 4,101 workers in 2010 (3,856 FTE). If the Purdue Research Park network were a single company, it would have ranked as the 20th largest employer in the State on the Indianapolis Business Journal's 2010 list of “Largest Indiana Employers,” falling between Toyota Motor Manufacturing Indiana Inc. (Princeton, IN) and Wishard Health Services (Indianapolis, IN).

Above average wages

Employees of Purdue Research Park-based companies receive very high average annual wages of more than \$63,000. This is 45 percent above the national average and a full 65 percent higher than

Strong community investment

Between 1999 and 2010, more than \$585 million (2010 prices) was invested in facilities and infrastructure for the Purdue Research Park network as a whole. For a sense of scale, Park network investment is more than one-third as large as Lucas Oil Stadium (\$720 million) and nearly one-quarter of the cost of the Indianapolis Midfield Airport project (\$1.06 billion).



Highly educated employees

The 2010 survey of Park companies conducted as part of the economic impact study revealed that 46 percent of the employees of Purdue Research Park network companies held associate degrees or above and 42 percent held baccalaureate degrees or above. This level of educational attainment not only exceeds the Indiana average but also substantially exceeds the national average.

Federal R&D grant leader for small businesses

Park companies have received a large share of federal awards to all Indiana companies under the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs. Cumulative SBIR/STTR awards to companies based at the Purdue Research Park of West Lafayette have totaled about \$49 million since 1987. More than 95 percent of these awards have occurred since 2002.



Successful Startups

Endocyte

Imagine a “drug guidance” system designed to deliver drugs directly to diseased cells. In the early 1990s, a Purdue University professor and researcher did just that when they discovered that attaching drugs to folate creates a unique system that promises to make treatments of cancer and other diseases more successful.

Philip Low, Purdue’s Ralph C. Corley Distinguished Professor of Chemistry, and his then-graduate assistant, Chris Leamon, took this idea and created a company that is working to develop new cancer treatments.

“We’re using cancer’s nutritional needs against itself,” Low said. “We are essentially slipping medicine in with cancer’s favorite food — folate.”

The treatment that Endocyte is developing can deliver potent drugs known to kill cancer cells without causing traditional toxicities or side effects for cancer patients.

“Because our treatment is targeted so specifically to the cancer cells, we can decrease traditional toxicities or side effects for cancer patients,” Leamon said. “We also have developed companion imaging diagnostic agents that are useful in identifying patients whose cancer over-expresses the targeted receptor.”



In 1996, Low partnered with Ron Ellis, now President and CEO of Endocyte, to establish Endocyte Inc., a biopharmaceutical company developing a new generation of receptor-targeted therapeutics, or “smart drugs,” for the treatment of cancer and autoimmune diseases. Low is the chief science officer and Leamon is the vice president of research. Endocyte, which employs 61 people and is located in the Purdue Research Park of West Lafayette, has completed early-to-mid-stage clinical trials for several diseases. Endocyte began trading on NASDAQ in February 2011 and raised \$78.8 million in its initial public offering.

Cook Biotech

Cook Biotech Inc. works with surgeons around the world to relieve pain and discomfort for people coping with surgical wounds and in need of other types of tissue repair. Cook Biotech, which is part of the internationally recognized medical device company Cook Group Inc., develops and manufactures tissue-repair products that have been used in more than 1 million patient applications worldwide. The company, which is based in the Purdue Research Park of West Lafayette, uses a technology discovered in the 1990s by a Purdue



biomedical engineering team led by the late, famed innovator and educator Dr. Leslie Geddes.

The company manufactures Biodesign® Advanced Tissue Repair Products, which are used in hernia repair, fistula repair, plastic surgery, ophthalmology, oral surgery, and dural repair. OASIS® Wound Matrix, another product developed from the same discovery, is used to treat wounds, burns, skin ulcers, and pressure ulcers. The products provide a specialized “biological scaffold” to guide and assist the body’s healing process.

“Knowledge about biological processes and wound healing in particular is exploding,” said Mark Bleyer, president of Cook Biotech.

“What was discovered at Purdue is a way to jump-start a patient’s own biology to repair damaged tissue. Our goal – and the goal of all Cook Medical companies – is to work with physicians and build upon new discoveries to improve life. That is what has driven Cook Biotech since it began with the Cook family almost 50 years ago.”

“ Our goal is to work
with physicians and build upon
new discoveries to improve life.”

– Mark Bleyer, President, Cook Biotech

Successful Startups Continued

BATS

What if in the aftermath of Hurricane Katrina, the rural Louisiana residents had a near foolproof way to call for help? What if in coordinating ships to surround an oil spill, those ships never lost communication with their fleet? What if a surveillance helicopter was able to provide live video feeds to ground personnel of a disaster stricken area?

BATS (Broadband Antenna Tracking Systems) offers an alternative to satellite and wired communications in those events and allows for a rapid wireless communication system to be established.

Founded by three Purdue faculty innovators — Lonnie Bentley, Anthony Smith, and Michael Kane from the Department of Computer and Information Technology — BATS is based on a self-aiming and -tracking antenna system.

“We’ve taken wireless broadband to a whole new level because we can establish a connection even if one or both of the systems are mobile,” Bentley said.

The technology is being used by:

- First responders of natural disasters to act as a back-up 911 call center.
- The Department of Defense and the Department of Homeland Security to maintain quality communication while soldiers are moving in the field.
- The Toronto police department for its high priority communications during the 2010 G-20 Toronto Summit where world leaders met.

The BATS technology was developed by Bentley at Purdue University and licensed through the Office of Technology Commercialization.



SonarMed

Neonatal patients and others suffering from respiratory problems will soon be able to get improved health care through a Purdue discovery being commercialized by SonarMed Inc. in Indianapolis.

The technology was developed at Purdue University in the laboratory of George R. Wodicka, professor and head of the Weldon School of Biomedical Engineering. It was licensed to SonarMed Inc. through the Office of Technology Commercialization.

The SonarMed AMS uses acoustic technology to continuously monitor breathing tubes.

“While we are launching first into the adult market, we plan to expand the technology to help all patients,” said Andrew Cothrel, SonarMed president and CEO.

SSCI

SSCI began in the early 1990s in the sewing room of Sally Byrn’s home. In 1993, the company had two employees, the Byrns’ oldest daughter, Beth, and one of her friends. By 2003, the company had 70 employees and its own building in the Purdue Research Park of West Lafayette.

“We had this idea to provide short courses to pharmaceutical scientists, and I started it in the only extra room we had – my sewing room,” Byrn said. “It’s easy to say our niche worked, but we worked very hard as a team to make it a success. I take great pride in the culture of the company we created and in the fact that so many of the SSCI employees are Purdue alumni.”

Purdue graduates represent about one-third of the company’s staff.

In 2006, Greenwich, Conn.-based Aptuit Inc. acquired the firm, and it now employs more than 90 people in its West Lafayette facility.

M4 Sciences

Purdue is impacting the \$65 billion world market for machine tools with the TurboMAM drilling system. The product is designed to increase precise drilling productivity by 500 percent, and it is compatible with computer controlled machine tools used to manufacture precision parts for automobile systems, medical devices, aerospace, and industrial systems.

The Office of Technology Commercialization licensed the technology to James Mann (BS AAE ‘90, MS AAE ‘94, PhD. IE ‘10), who founded M4 Sciences, located in the Purdue Research Park, and successfully commercialized it.

In 2010, M4 Sciences completed product distribution agreements with Fukuda Corporation (Tokyo, Japan) and Neida Products Ltd. (Staffordshire, United Kingdom). The agreements enable M4 Sciences to pursue product sales and distribution for Japan, the United Kingdom, and Ireland.

“There is a high demand for MAM drilling technology, and with these international relationships combined with U.S.-based distribution,



Successful Startups *Continued*

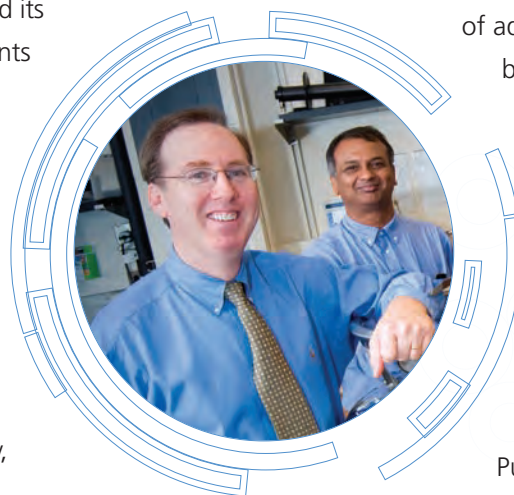
M4 Sciences can access more than 80 percent of the world market for the TurboMAM,” Mann said.

In 2010, M4 Sciences was awarded the R&D 100 Award, naming the TurboMAM drilling system as one of the 100 most innovative products introduced to the marketplace. Purdue’s School of Industrial Engineering was recognized as a co-developer. In 2011, M4 Sciences received a Tibbetts Award from the U.S. Small Business Administration for demonstrating advanced technological innovation, economic growth, and exceptional performance in the National Science Foundation Small Business Innovation Research (SBIR/STTR) program.

BioRegeneration Technologies

BioRegeneration Technologies’ proprietary Regen-C product may help prevent arthritis by repairing injured joints faster and more completely than conventional methods. The product is placed on a damaged joint surface and its porous material absorbs nutrients from surrounding areas to augment the body’s natural healing processes and repair the injured joint.

“With current treatments, patients get temporary pain relief and scar tissue forms, but eventually it breaks down. There is no long-term durability, which leads a patient either to partial or total joint replacement,” said Darryl Dickerson, co-founder of BioRegeneration Technologies. “We have found in our pre-clinical trials that Regen-C creates a durable joint surface.”



The technology is based on Dickerson’s graduate research, which was performed under the direction of Eric Nauman, associate professor in the School of Mechanical Engineering at Purdue. Dickerson and Nauman founded BioRegeneration Technologies.

Matrix-Bio

Breast cancer is the second most common cancer in American women, claiming more than 41,000 lives each year. Providing more accurate, reliable tests for detecting and monitoring breast cancer drives Matrix-Bio to excel in the emerging field of metabolite profiling.

With early detection, breast cancer is highly treatable and survivable.

Founded in 2006 and based in the Purdue Research Park of West Lafayette, Matrix-Bio is an Indiana-based life science company focused on the development and commercialization of advanced metabolite profiling-based blood tests for early cancer detection, recurrence detection, and therapy monitoring that offer greater accuracy than current testing methodologies.

Led by company founder and chief scientific officer and Purdue professor Daniel Raftery, Matrix-Bio has enabled simple yet highly accurate tests for early-stage cancer diagnosis, recurrence monitoring, and tracking the effects of chemotherapy.

Griffin Analytical

Griffin Analytical, a business unit of FLIR Systems Inc. that is based in the Purdue Research Park of West Lafayette, provides customers with the unique ability to perform chemical analysis on-site and in real time through its fieldable mass spectrometer systems.

The technology used by Griffin Analytical was discovered by R. Graham Cooks, Purdue’s Henry B. Hass Distinguished Professor of Analytical Chemistry.

Successful completion of multiple government contracts and a strong relationship with Purdue University’s analytical chemistry department has generated technological breakthroughs. Using proprietary Cylindrical Ion Trap technology from Purdue, Griffin has developed a family of chemical analysis products that includes the only fieldable gas chromatograph/mass spectrometer (GC/MS) systems capable of multidimensional analysis (MS/MS).

“ We provide customers with the unique ability to perform chemical analysis onsite and in real time.”

– R. Graham Cooks, Griffin Analytical Scientific Officer



Entrepreneurial Resources

Trask Innovation Fund

The Trask Innovation Fund (TIF) offers proof-of-concept funding to competitively selected Purdue technologies under the management of the Office of Technology Commercialization. Funds are awarded under the advisement of the TIF Advisory Council, which consists of representatives from the Purdue University Office of the Vice President for Research, Purdue faculty, Purdue Research Foundation, and executives from the local business community.

The fund's objective is to support short-term development to enhance commercial value of Purdue University intellectual property assets. Financial support is designed to provide an individual technology portfolio up to \$50,000 for a period of six months.

Visit: http://www.prf.org/otc/trask_fund.asp

Emerging Innovations Fund

With the Emerging Innovations Fund (EIF), Purdue Research Foundation and Purdue University have created a paradigm for enabling new technology to move from the lab to the marketplace. EIF is designed to provide new ventures with the targeted funding, support, and structure necessary to translate great ideas into commercial products and services.

The EIF investment is made following the recommendation of its Economic Advisory Board, which consists of active investors and venture capitalists.

The Emerging Innovations Fund is designed to accelerate product development by investing in Purdue discovery with delivery efforts. Visit <http://emerginginnovationsfund.org/Purdue> or contact Jon Gortat, Project Manager, (765) 588-3485, jdgortat@prf.org

Planet Eureka

In 2010, the Office of Technology Commercialization joined the Planet Eureka! International Innovation Network.

The NIST-supported program offers business assessment and analysis to help identify potential licensees and investors to move innovative ideas to the market faster.

Visit: <http://planeteureka.com/marketplace/>

Indiana Innovation Showcase

Indiana Innovation Showcase connects entrepreneurs with fast-growing companies in the Midwest – allowing them to present their business ideas to venture capitalists, angel investors, and business leaders. The annual event hosts more than 50 startups and more than 700 participants.

The event is presented by Venture Club of Indiana and Verge and sponsored by DeveloperTown; Barnes & Thornburg LLP; Purdue Research Foundation; Fortify.vc; Cantaloupe.tv; IU Kelley School of Business; Katz, Sapper & Miller, LLP; Indy Audio Labs; Major Hospital/Intelliplex; Allos Ventures; TechPoint; Carmen Commercial Real Estate; and PinPoint Resources, LLC.

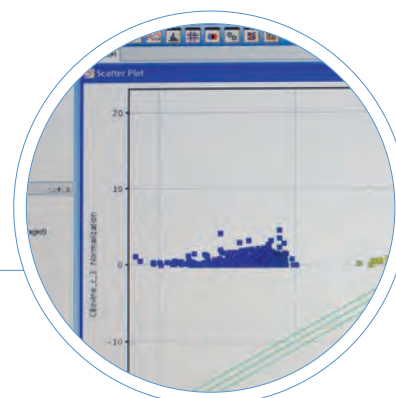
"Innovation Showcase provides an important forum for entrepreneurs to present their ideas and for investors to hear about the latest technologies and discoveries that are being commercialized," said Joseph B. Hornett, senior vice president, treasurer and COO of the Purdue Research Foundation.

P3 Alliance

The P3 Alliance enables accredited investors who have an interest in furthering the mission of Purdue University and Purdue Research Foundation to obtain a first-look advantage for investing in select high-tech companies.

Companies seeking equity investment are featured through online subscription as well as live presentations.

Utilizing an online presence, Purdue-associated new ventures seeking angel investments pitch their investment opportunity to pre-qualified participants in the P3 Alliance. Due diligence and term sheet negotiations are the responsibility of each prospective investor. Visit: <http://www.purdueresearchpark.com/investors.asp>



Outreach Activities

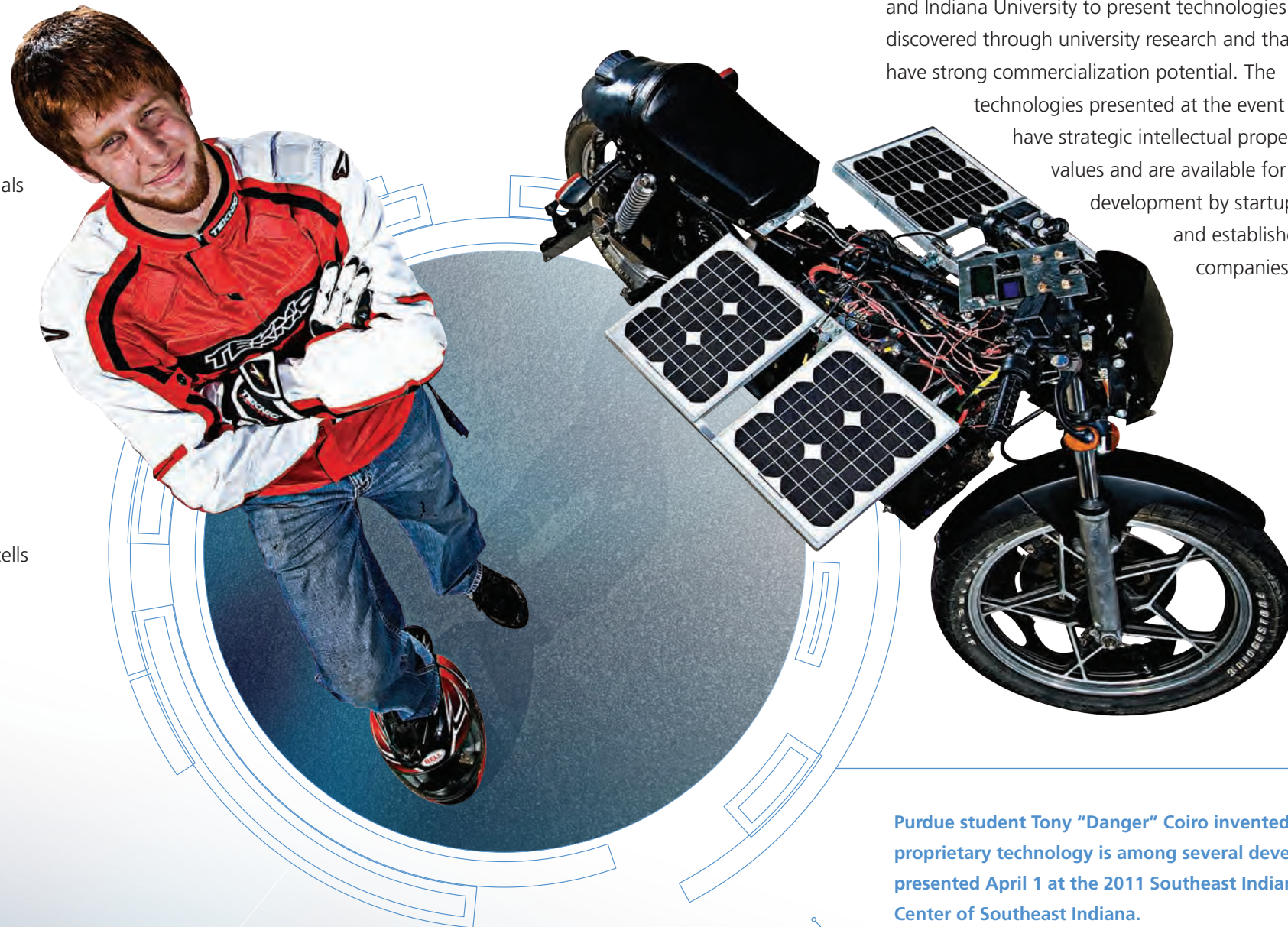
2011 Southeast Indiana Technology Showcase highlights Purdue, IU discoveries

Proprietary technologies developed at Purdue University and Indiana University were presented April 1 at the 2011 Southeast Indiana Technology Showcase in the Purdue Technology Center of Southeast Indiana.

Officials from both universities presented different technologies that offer value to existing businesses or provide the foundation for a new business.

Technologies that took to the road:

- Solar-powered, high-speed motorcycle
- Self-aligned wafer level integration system
- Self-cleaning anti-fogging materials
- Method and system for ensuring integrity, authenticity, and indemnity in outsourced cloud databases
- Integration of ICU data in interactive visual format for enhanced critical care evaluation treatment
- Solution-based, layer-by-layer nanoassembly of thin film solar cells



Purdue, IU present new technologies in Evansville

A technology that gives robotic machines the ability to “see” like humans and a social media program that allows people to use Facebook, Twitter, and text messaging simultaneously were two of several new technologies presented in February at the 2011 Southwest Indiana Technology Showcase in Evansville.

The program is held annually by Purdue University and Indiana University to present technologies discovered through university research and that have strong commercialization potential. The technologies presented at the event have strategic intellectual property values and are available for development by startups and established companies.

Attendees included entrepreneurs, investors and financiers, business community leaders, technology specialists, and a large student group from Southern Indiana University.

Event sponsors include the Purdue University Office of Engagement, Indiana University Office of Engagement, the Purdue Research Foundation’s Office of Technology Commercialization, and Indiana University Research and Technology Corp.

Purdue volunteers pick apples to help needy, honor entrepreneurs

Purdue University has developed 25 varieties of apples that have been used in pies, ciders, cobblers, cakes, jams, salads, breads, and candies and often eaten fresh off the tree.



In 2010, Purdue apples served another purpose — to fill the pantries of Lafayette Urban Ministry and honor Global Entrepreneurship Week. Volunteers from the Office of Technology Commercialization picked thousands of apples and donated them to the Lafayette Urban Ministry.

Purdue’s apples can be found growing in France, Italy, Chile, South Africa, Turkey, Australia, New Zealand, and other countries.

Purdue student Tony “Danger” Coiro invented a street-legal solar-powered motorcycle. His proprietary technology is among several developed by Purdue University researchers that was presented April 1 at the 2011 Southeast Indiana Technology Showcase at the Purdue Technology Center of Southeast Indiana.

Available Technologies

Therapy to delay onset, reduce severity of MS symptoms

People suffering from multiple sclerosis may benefit if patent-pending research conducted at the Center for Paralysis Research at Purdue University shows that a decades-old, FDA-approved drug to treat hypertension can also delay the onset and reduce the severity of MS symptoms.

Purdue professor Riya Shi is examining the effects of hydralazine on acrolein, a compound that can affect the central nervous system and damage nerve cells. Acrolein causes harm by reacting

with the proteins and lipids that make up cells, including neurons. Hydralazine sequesters acrolein and acrolein-protein compounds, leading to their expulsion from the body.

Heat mapping key to new humanlike computer vision

Heat mapping and heat distribution — two new techniques for computer-vision technology — mimic how humans perceive three-dimensional shapes.

Both techniques build on basic physics and mathematical equations related to heat's diffusion over surfaces, said Karthik Ramani, Purdue University's Donald W. Feddersen Professor of Mechanical Engineering.

As heat diffuses over a surface, it follows and captures a shape's precise contours. The system takes advantage of this "heat intelligence," simulating heat's flow from one point to another and characterizing an object's shape, Ramani said. This advance could help machines see more like people.

"Albert Einstein made contributions to diffusion, and 18th-century physicist Jean Baptiste Joseph Fourier developed Fourier's law, used to derive the heat equation," Ramani



said. "We are standing on the shoulders of giants in creating the algorithms for these new approaches using the heat equation."

Technology "listens" to cancer cells, shows effect of drug therapies

A Purdue physicist has created technology to detect motion inside three-dimensional tumor spheroids, which may enhance the pharmaceutical industry's early drug discovery capabilities.

Physics professor David D. Nolte has developed Holographic Tissue Dynamics Spectroscopy (TDS), a technology allowing researchers to look inside cells using holography and lasers. The technology was highlighted in a letter of the peer-reviewed Journal of Biomedical Optics. The work is done in collaboration with John Turek, professor of basic medical sciences at Purdue.

In 2010, Nolte received a National Science Foundation CBET Award (Chemical, Bioengineering, Environmental and Transport Systems) for his cancer research.

"The technique measures the living motion that is going on inside a cell."

— David D. Nolte



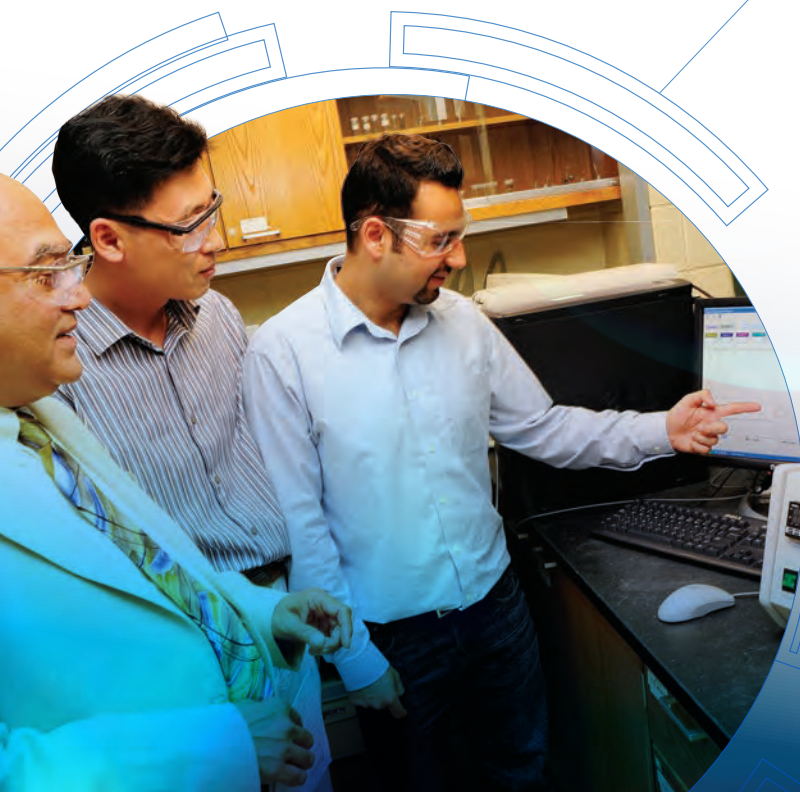
Available Technologies *Continued*

New lab-on-a-chip advance uses low-cost, disposable paper strips

Purdue researchers have invented a technique that uses inexpensive paper to make “microfluidic” devices for rapid diagnostics and chemical analysis.

The innovation represents a way to increase the sophistication and lower the cost of commercially available paper-strip assays like those used for diabetes and pregnancy.

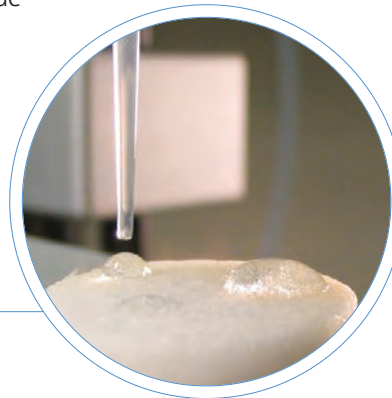
“With current systems that use paper test strips you can measure things like pH or blood sugar, but you can’t perform more complex chemical assays,” said Babak Ziaie, a Purdue University professor of electrical and computer engineering and biomedical engineering. “This new approach offers the potential to extend the inexpensive paper-based systems so that they are able to do more complicated multiple analyses on the same piece of paper. It’s a generic platform that can be used for a variety of applications.”



Technology could help clean up oil spills

A new type of membrane that separates oil from water developed by Purdue University material engineers may be used to clean up oil spills such as BP’s massive spill in the Gulf of Mexico.

Jeffrey Youngblood, a Purdue assistant professor of materials engineering, has created technology that could eventually be used to help with environmental cleanups.



The new technology, which is being licensed through the Office of Technology Commercialization, would last longer than conventional filters for separating oil from water and can attract water while simultaneously beading oil, characteristics that are usually mutually exclusive.

Brain changes found in football players thought to be concussion-free

A Purdue University study suggests some high school football players suffer undiagnosed changes in brain function and continue playing even though they are impaired.

“Our key finding is a previously undiscovered category of cognitive impairment,” said Thomas Talavage, an expert in functional neuroimaging who is an associate professor of biomedical

engineering and electrical and computer engineering and co-director of the Purdue MRI Facility.

The finding represents a dilemma because it suggests athletes may suffer a form of injury that is difficult to diagnose.

Partnering with the Alfred Mann Institute of Biomedical Engineering at Purdue, the Office of Technology Commercialization hopes to accelerate the commercialization of a protective head gear that could be used in blunt trauma scenarios such as combat.

“We are helping commercialize this even in the early stage of discovery because of its potential to help all generations of athletes, soldiers, and the public in general,” said Elizabeth Hart-Wells, director of OTC. “Using typical commercialization processes, it could take years before it is offered to the public.”

Precise new sensor employs hydrogels

Purdue researchers are developing a new type of biological and chemical sensor that has few moving parts, is low-cost, and is highly sensitive, sturdy, and long-lasting.

The “diffraction-based” sensors are made of thin strips of gelatinous material called hydrogel, which expands and contracts depending on the acidity of its environment.



Recent research findings showed the sensor can precisely determine pH – a measure of how acidic a liquid is – and reveal information about substances in liquid environments, said Cagri Savran, a Purdue associate professor of mechanical engineering.

The sensors’ simple design could make them more practical than other sensors, he said.

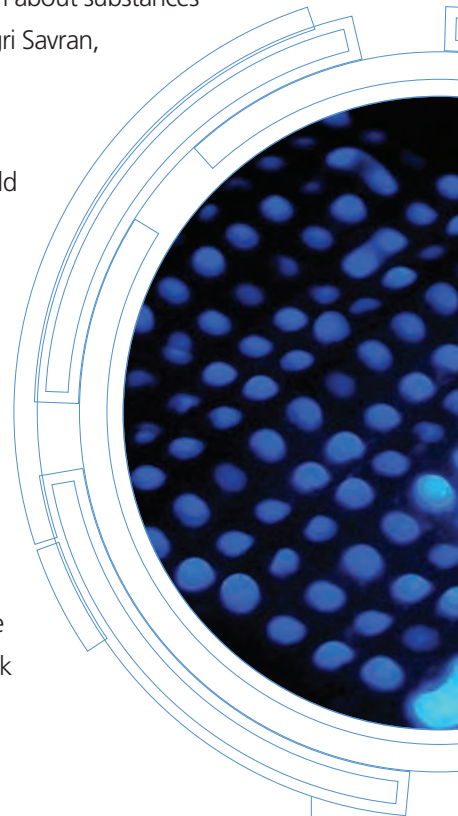
“Many sensors being developed today are brilliantly designed but are too expensive to produce, require highly skilled operators and are not robust enough to be practical,” said Savran, whose work is based at Purdue’s Birck Nanotechnology Center.

Hydrogen-generating technology might power boats, store energy from wind, solar sources

Researchers have developed a method using aluminum and a liquid alloy to extract hydrogen from seawater. The method can be used in boat or ship engines, representing a potential replacement for gasoline and diesel fuel in marine applications.

The technique had previously worked only for freshwater, but a new formulation also generates hydrogen from seawater, said Jerry Woodall, a Purdue University distinguished professor of electrical and computer engineering.

Hydrogen generated by the new method could be fed directly to an internal combustion engine.



Available Technologies *Continued*

Technology helps Parkinson's patients speak louder

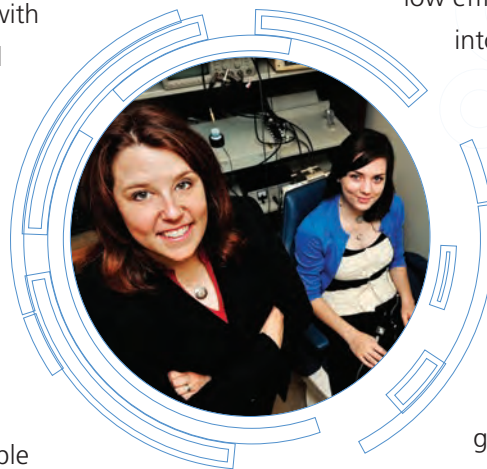
Purdue researchers have developed a new technology that helps Parkinson's patients relearn to communicate, a vital part of a good quality of life.

"People with Parkinson's disease commonly have voice and speech problems," said Jessica Huber, an associate professor in Purdue's Department of Speech, Language and Hearing Sciences.

About 89 percent of people with Parkinson's have voice-related change, which is related to how loudly they speak, and about 45 percent have speech-related change, or how clearly they speak.

Huber asks Parkinson's patients to speak louder while a recording of background "multitalker babble noise" is played. The background sound elicits a well-known phenomenon called the Lombard effect, a reflex in which people automatically speak louder in the presence of background sound.

The Office of Technology Commercialization partnered with the Alfred Mann Institute of Biomedical Engineering at Purdue and, working with Huber's team, have advanced development of the new device to clinical trials and commercial prototype development.



Ultrafast laser 'scribing' technique to cut cost, hike efficiency of solar cells

Researchers are developing a technology that aims to make solar cells more affordable and efficient by using a new manufacturing method that employs an ultrafast pulsing laser.

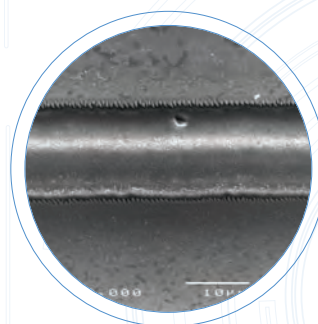
The innovation may help to overcome two major obstacles that hinder widespread adoption of solar cells: the high manufacturing costs and

low efficiency of converting sunlight into an electric current, said Yung Shin, a professor of mechanical engineering and director of

Purdue University's Center for Laser-Based Manufacturing.

Critical to the solution are tiny "microchannels" that interconnect a series of solar panels into an array capable of generating useable amounts of power, he said. Conventional "scribing" methods, which create the channels mechanically with a stylus, are slow and expensive and produce imperfect channels, impeding solar cells' performance.

The researchers hope to increase efficiency while cutting cost significantly using an "ultrashort pulse laser" to create the microchannels in thin-film solar cells.



Chemical engineers at Purdue University have developed a new method to process agricultural waste and other biomass into biofuels.

Purdue, NIST working on breathalyzers for medical diagnostics

Researchers have overcome a fundamental obstacle in developing breath-analysis technology to rapidly diagnose patients by detecting chemical compounds during a person's real-time respiration.

The researchers demonstrated their approach is capable of rapidly detecting biomarkers in the parts per billion to parts per million range, at least 100 times better than previous breath-analysis technologies, said Carlos Martinez, an assistant professor of materials engineering at Purdue who is working with researchers at the National Institute of Standards and Technology.

"People have been working in this area for about 30 years but have not been able to detect low enough concentrations in real time," he said. "We solved that problem with the materials we developed, and we are now focusing on how to be very specific, how to distinguish particular biomarkers."

New biofuels processing method for mobile facilities

Chemical engineers at Purdue University have developed a new method to process agricultural waste and other biomass into biofuels and they are proposing the creation of mobile processing plants that would rove the Midwest to produce the fuels.

"What's important is that you can process all kinds of available biomass — wood chips, switch grass, corn stover, rice husks, and wheat straw," said Rakesh Agrawal, the Winthrop E. Stone Distinguished Professor of Chemical Engineering.

The approach sidesteps a fundamental economic hurdle in biofuels: Transporting biomass is expensive because of its bulk volume.

The new method, called fast-hydropyrolysis-hydrodeoxygenation, works by adding hydrogen into the biomass-processing reactor. The hydrogen for the mobile plants would be derived from natural gas or the biomass itself. However, Agrawal envisions the future use of solar power to produce the hydrogen by splitting water, making the new technology entirely renewable.

Awards and Recognition

Purdue researcher receives NSF award recognizing innovation

Purdue University professor Suresh V. Garimella has received the 2011 Alexander Schwarzkopf Prize for Technological Innovation from the National Science Foundation's Industry/University Cooperative Research Centers (I/UCRC) Program.

The award recognizes the professor's research to develop advanced cooling technologies for electronics and cars.

Fund provided \$3.8 million to help commercialize the advanced cooling system for hybrid and electric cars.

Garimella founded the Purdue-based I/UCRC Cooling Technologies Research Center, a consortium of corporations and government laboratories working to overcome heat-generation problems in electronic systems by developing new compact cooling technologies.

"Suresh's center is one of the strongest in the Industry/University Cooperative Research Centers Program," said program director Rathindra DasGupta. "It has consistently grown and produced industrially relevant research results that have been utilized by its members to make them more competitive. I am proud of the I/UCRC Program's accomplishments."

Garimella, Purdue's R. Eugene and Susie E. Goodson Distinguished Professor of Mechanical Engineering, received the award during an I/UCRC meeting. One award is issued annually.

The prize specifically recognizes his team's work to develop "two-phase microchannel heat sinks" to cool high-power electronics in electric and hybrid cars, computers, and telecommunications systems. Indiana's 21st Century Research and Technology

Purdue faculty inventors recognized during annual event

The Purdue Research Foundation recognized 51 Purdue University researchers at its annual Inventors Recognition Reception in the Herman and Heddy Kurz Purdue Technology Center.



The top honor, the 2010 Faculty Commercialization Award, sponsored by the Central Indiana Corporate Partnership, was presented to George Wodicka, head of the Weldon School of Biomedical Engineering and professor of biomedical engineering and computer engineering.

The 51 Purdue researchers who were issued patents during the 2009-10 fiscal year were recognized at the dinner:

- Mahdi Abu-Omar, *College of Science*
- Mikhail Atallah, *College of Science and College of Engineering*
- Anil Bajaj, *College of Engineering*
- James BeMiller, *College of Agriculture*
- Richard Borgens, *School of Veterinary Medicine and College of Engineering*
- Charles Bouman, *College of Engineering*
- James Braun, *College of Engineering*
- Nicholas Carpita, *College of Agriculture and Bindley Bioscience Center*
- Srinivasan Chandrasekar, *College of Engineering*
- Yan Chen, professor, *College of Engineering*
- Jason Clark, *College of Engineering*
- W. Dale Compton, *College of Engineering*
- Supriyo Datta, *College of Engineering*
- David Ebert, *College of Engineering*
- Kirk Foster, *College of Engineering*
- James L. Garrison, *College of Engineering*
- Stanton Gelvin, *College of Science*
- Eckhard Groll, *College of Engineering*
- William Hutzler, *College of Technology*
- Jules Janick, *College of Agriculture*
- Hilkka Kenttamaa, *College of Science*
- Michael Kinch, *School of Veterinary Medicine*
- David Koltick, *College of Science*
- Gary Krutz, *College of Agriculture and College of Engineering*
- Michael Ladisch, *Laboratory of Renewable Resources Engineering; College of Agriculture and College of Engineering*
- Richard Linton, *College of Agriculture*
- David Love, *College of Engineering*
- Philip Low, *College of Science*
- John Lumkes Jr., *College of Agriculture and College of Engineering*
- James Mann, *College of Engineering*
- Wilfredo Moscoso, *College of Engineering*
- Nathan Mosier, *College of Agriculture and College of Engineering*
- Philip Nelson, *College of Agriculture*
- Shimon Y. Nof, *College of Engineering*
- David Nolte, *College of Science*
- Dimitrios Peroulis, *College of Engineering*
- Voicu Popescu, *College of Science*
- P. Veeraragha Ramachandran, *College of Science*
- Karthik Ramani, *College of Engineering*
- Fred Regnier, *College of Science*
- Randall Replogle, *College of Science*
- John Rice, *College of Science*
- Kaushik Roy, *College of Engineering*
- Elisha Sacks, *College of Science*
- Robert Santini, *College of Science*
- Riya Shi, *College of Engineering and School of Veterinary Medicine*
- Thomas Talavage, *College of Engineering*
- Weldon Vaughn, *College of Science*
- Alexander Wei, *College of Science*
- Andrew Weiner, *College of Engineering*
- Peide Ye, *College of Engineering*



Project Managers



Jon Gortat, Project Manager
765-588-3485
jdgortat@prf.org



Michael Halbrook, Senior Project Manager
765-588-3483
mlhalbrook@prf.org



Eric Lynch, Project Manager
765-588-3477
eslynch@prf.org



Matt McFarland, Associate Director, Commercialization
765-588-3487
mjmcFarland@prf.org



Vicky Montenegro, Project Manager
765-588-3491
mvmontenegro@prf.org



Sally Ross, Assistant Director, Operations
765-588-3490
saross@prf.org



Hilton Turner, Project Manager
765-588-3479
haturner@prf.org

For More Information

Send correspondence to:

Assistant Vice President and Director of OTC
Purdue Research Foundation
Herman and Heddy Kurz Purdue Technology Center
1281 Win Hentschel Blvd.
West Lafayette, IN 47906

Visit these websites for more information about
the Purdue Research Foundation, the Office of
Technology Commercialization, and the Purdue
Research Park network:

<http://www.prf.org/>
<http://www.prf.org/otc>
<http://www.purdueresearchpark.com/>
<http://www.purdueresearchpark.com/indianapolis>
<http://www.purdueresearchpark.com/merrillville>
<http://www.purdueresearchpark.com/newalbany>

Writers/Editors:

Cynthia Sequin, Steve Martin, Margaret Rytlewski,
Purdue Research Foundation Marketing and
Communications

Designer:

Kate Smith, Dearing Group



