

Innovation Metrics Purdue University's Discovery Park

Purdue University's Discovery Park was created in 2001 to transform how knowledge is generated, integrated, and applied in local, regional, state, national, and global businesses and communities. Discovery Park is an integrated, interdisciplinary hub of eleven centers that supports discovery and learning and drives the delivery of innovation.

The structure of Discovery Park is uniquely supportive of innovation—new technologies, new companies, new courses, and new research initiatives. Discovery Park and the Purdue Research Park are strongly connected; staff roles are geared toward support of new technologies; funding is dedicated to new research cores and initiatives, new courses, and support for new faculty hires. Discovery Park's facilitation of innovation at Purdue is a key measure for success.

For the fiscal year 2007-2008, Discovery Park facilitated the following:

1. **4** start-up companies
2. **31** disclosures were completed with **4** licenses/options
3. **80** industrial proposals for **\$8,004,069** were awarded to faculty projects associated with Discovery Park with **56** industrial sponsors
4. **\$3,717,876.77** total patent costs **with 63.5% reimbursed** by licenses
5. **2** new graduate programs were launched
 - a. Graduate Certificate Program in Veterinary Homeland Security
 - b. Ecological Sciences and Engineering Interdisciplinary Graduate Program
6. **20** new courses affiliated with Discovery Park that apply to degrees were taught; **4** new professional education courses were developed
7. **9** teams affiliated with Discovery Park competed in one of the Discovery Park Business Plan competitions
8. **\$1,383,927** was spent to improve facilities and equipment for the Purdue University campus
9. **\$695,000** was awarded for seed funding through Discovery Park Centers
10. **6** new faculty hires were facilitated by Discovery Park through start-up funding and office and lab space
11. **5** new research centers/capabilities were developed

START-UP COMPANIES

Discovery Park connects faculty researchers with the Office of Technology Commercialization. Discovery Park also facilitates the creation of start-up companies based upon the work of the Office of Technology Commercialization staff. One of the “big” mission areas of Discovery Park is the creation of a campus culture that is entrepreneurial. Discovery Park, through the Burton D. Morgan Center for Entrepreneurship and the Discovery Learning Center, supports several programs targeted at students, staff, and faculty for a better appreciation of the commercializable aspects of their work. These programs provide the educational tools essential to be a successful entrepreneur. Opportunities to learn about the world of venture capital and to network in these circles are offered. Students participate in the Interns for Indiana program which places them in start-up companies. Over 1000 undergraduate students have enrolled in the Certificate in Entrepreneurship and Innovation Program. Graduate students participate in the Technology Realization Program. Faculty and staff participate in the Academic Bootcamp and the Entrepreneurial Leadership Academy. All of these programs are Discovery Park investments in transforming Purdue’s culture.

The tangible outcomes of these investments are start-up companies. Since 2001, Discovery Park has facilitated the development of 29 start-up companies. Most of these companies are located at the Purdue Research Park, but not all. These companies span many business sectors. In 2007 (calendar year), Discovery Park facilitated the development of four start-up companies.

Four Start-up Companies Facilitated in 2007 by Discovery Park

- AlGalCo
- Moerae Matrix, Inc.
- National Institute of Pharmaceutical Technology
- Intelimmune LLC

Profiles for these four companies are provided following.

AlGalCo has the exclusive license from Purdue University to commercialize a new technology in which hydrogen gas can be generated simply by adding water to a solid alloy comprised of 95% common aluminum. Hydrogen is considered by many to be the ideal solution to our energy needs. It burns cleanly in a standard gasoline or diesel engine as well as in a fuel cell. The problem with hydrogen is that storage and transportation must be under very high pressure; until now. AlGalCo’s solid alloy is completely safe, inert, and can be stored indefinitely at regular atmospheric pressure. The aluminum used for the alloy can be standard industrial grade or scrap aluminum from old cars and recycled beverage cans. After reacting with water, the aluminum becomes alumina which can be sold into a very active market. The other 5% of the alloy is gallium which serves only as a catalyst and is not consumed in the reaction. The process has been established to easily and inexpensively recover the gallium and incorporate it an unlimited number of times into fresh alloy. The first application is a one kilowatt in-home, emergency portable generator for medically fragile customers living in rural areas. Since hydrogen burns cleanly, gensets can be placed directly where they are needed and all necessary medical devices operated for as long as the grid is down. The successful Phase II preproduction genset demonstration may be viewed: www.youtube.com, AlGalCo I, Phase II demo. A five kilowatt genset to power an entire home as well as a water purification application is also ready for commercialization.

Moerae Matrix is a development-stage biotechnology company focused on creating novel, locally-active peptide therapeutics -- drugs that mimic or block active portions of proteins naturally produced by the body to mediate key biologic functions. Four compounds, currently in the preclinical stage, have been generated to date from Moerae's discovery platform. These drugs will be developed for high-value market applications in general surgery, oncology, rheumatoid arthritis and wound healing. Current corporate resources (SBIR, matching state and angel funds) have been utilized to establish proof of concept in animal models (lead drug) or animal tissues.

National Institute for Pharmaceutical and Technology Education (NIPTE) is an independent, nonprofit organization representing 11 U.S. universities that are leaders in pharmaceutical science and engineering. In addition to Purdue, the other member universities are Duquesne University, Illinois Institute of Technology, Rutgers University, the University of Puerto Rico, the University of Connecticut, the University of Iowa, the University of Kansas, the University of Kentucky, the University of Maryland-Baltimore, and the University of Minnesota. The consortium was created specifically to work with the FDA and industry to enhance the way pharmaceutical products are being developed and manufactured by increasing the quality and education of best practices used.

Intelimmune LLC is a joint effort between a northern Indiana biotechnology firm and two Purdue University researchers. Intelimmune recognizes the importance of simple reliable tools with which to detect, characterize and quantify specific biomarkers significant to research and clinical diagnostics. Their mission is to apply a doctrine of innovation and simplification as a means to develop sophisticated analytical techniques and products that afford the researcher or clinician a high degree of confidence in their analytical results and facilitate solution of the larger problem. Their mission is achieved in an economically and socially responsible manner that allows customers, employees and community to consider Intelimmune as a trusted partner.

Also in 2008, TrustBearer Labs began a new product, Identity Alliance, which had its roots in the Purdue Research Foundation's Office of Technology Commercialization and was facilitated by Discovery Park.

TrustBearer Labs is an authentication solutions provider with over 10 years experience developing products and custom software for trusted devices such as smart cards, biometrics, and USB tokens. Staff members include software engineers, project managers, and graphic/web designers with experience in all aspects of trusted device and security software development. TrustBearer Live, the company's flagship product, simplifies integration of trusted devices with web-based applications enabling instant deployment of online applications for trusted devices on a variety of platforms. TrustBearer Labs is located in downtown Fort Wayne, IN.

DISCLOSURES AND LICENSES

Title	Date
CCD E-Lab Notebook, Including User Database, IP Digital Signature and Notarization	7/24/2007
Method for generating Hydrogen from Ammonia Borane	8/7/2007
Improved Endothelial Cell Responses on Patterned Titanium Surfaces with Rationally-Designed, Micrometer to Nanometer Features	8/17/2007
Atomic-Layer-Deposited Nanostructures for Graphene-based Nano-electronics	9/5/2007
Targeting Resequencing Using Massively Parallel (TRUMP) Methods for Mutation Detection	9/10/2007
Visual Analytic Tool for Liquid-Chromatography/Mass Spectrometry (LC/MS) Data Analysis and Interpretation	9/12/2007
Label Free DNA Detection Using Electrical Measurements	9/17/2007
Self-supporting Nanowire Array for High Performance Thermoelectric Power Generators	9/18/2007
Integration of Bulk Thermoelectric Materials with Carbon Nanotube Arrays by a Cost Effective Process to Obtain Thermomechanically Compliant and High Electrical Contact Conductance Contacts	10/18/2007
Holography Enabled Multi-Scale Optoelectronic Platform for Particle Manipulation	10/22/2007
Electrical Noise Thermometer Using Nanowires or Nanotubes	10/22/2007
RF Graphene Field Effect Transistor	11/7/2007
Graphene/Semiconductor Heterostructures and Heterojunction Devices	11/8/2007
Titanium Microneedle Devices for Intraocular Drug Delivery	11/20/2007
PHSI Software and Materials	12/5/2007
Group Specific Internal Standard Technology (GSIST) and Global Isotope-Labeled Internal Standard Addition (GILISA) Labeling Strategy	12/6/2007
Biomarkers for Cancer Metastasis 12/19/2007	
Stippling by Example	2/12/2008
Synthesis of Graphene on Silicon	2/25/2008
Fabrication of Graphene Field Effect Transistors on Silicon Carbide Wafers using Chemical Vapor Deposition	2/25/2008
Apparatus and Method of Forming Metal Oxide Semiconductor Field-Effect Transistor with Atomic Layer Deposited Gate Dielectric	2/27/2008
Formation of Epitaxial Graphene in a Controlled Ambient	3/5/2008
Graphene on Atomically-Smooth Silicon Carbide	3/5/2008
Software for Building Mathematical Models from Experimental Data with a Bayesian Approach	3/6/2008
Electrokinetic Particle Capture and Patterning with Opto-Electrothermal Fluid Flow	3/7/2008
Method Silicon Substrate for Indium Gallium Nitride Light Emitting Diodes	3/25/2008
Flexible Neural Probe for Magnetic Insertion	3/31/2008
Scoops: An Edible Soy Based Ice Cream Waffle Bowl	5/5/2008
A Novel and Simple Cell-Based Detection System with a Collagen-Encapsulated B-Lymphocyte Cell Line as a Biosensor for Rapid Detection of Pathogens and Toxins	5/2/2008
Encapsulation of Living Cells Within an Aerosolized Sol-Gel Matrix	5/15/2008
Open Configuration Optoelectrowetting Droplet Acutation	5/28/2008

INDUSTRIAL SPONSORED PROJECTS

80 industrial proposals for **\$8,004,069** were awarded to faculty projects associated with Discovery Park with **56** industrial sponsors. A few examples follow.

Mapping the condition of *Diporeia*: Insights to mechanisms of declines.

Funded by Great Lakes Fishery Trust, \$596,513

Center for the Environment

PIs: Maria Sepúlveda and Tomas Höök (Purdue University); Co-PIs: Thomas Nalepa (NOAA-GLERL), David Fanslow (NOAA-GLERL), Jiri Adamec (Purdue U.), Jacques Rinchar (USGS-GLSC and U. Michigan), Krista Nichols (Purdue U.), Wendylee Stott (USGS-GLSC and U. Michigan), Steven Pothoven (NOAA-GLERL), Tom Johengen (U. Michigan), David Jude (U. Michigan), and Michael Wiley (U. Michigan).

Diporeia, a group of small invertebrate species, have historically been an important member of benthic communities throughout the Great Lakes. These shrimplike creatures have served as sources of food for many economically important fish and their disappearance is negatively impacting the multi-billion dollar sport fishing industry. Since the early 1990's, *Diporeia* have experienced a precipitous decline in abundance in lakes Michigan, Huron, Erie and Ontario. While many believe that the declines in *Diporeia* are linked to increases in invasive mussel species, this does not appear to be the sole factor determining their decline. Interestingly, *Diporeia* declines have not progressed in a spatially uniform manner, and there are areas within the aforementioned lakes and Lake Superior where populations persist. Further, *Diporeia* remains abundant in other lake systems despite the presence of invasive mussels. This suggests that there may be a combination of *Diporeia* population characteristics and/or environmental factors that determine survival and that these vary across and within the Great Lakes. A research team lead by Marisol Sepulveda is using new methods for measuring metabolic responses of these organisms to a number of environmental factors. At the same time, they are investigating whether genetic differences in the declining and thriving populations may make some groups more susceptible to declines in health and numbers. Results of the team's first study published in *Aquatic Toxicology* showed that when exposed to even very small quantities of the common water pollutant atrazine (an herbicide), *Diporeia* collected from declining populations had very different metabolic profiles than those from thriving populations (only 5% similarity in metabolites). This is only the first step in elucidating the underlying causes for rapid declines in this important member of the Great Lakes ecosystem. Other studies are being conducted to look at a number of environmental and biological factors with a team of scientists from Purdue, the University of Michigan, and the State University of New York.

Proposal for Characterizing Fuel Contaminant Size and Type

Cummins Engine Foundation, \$223,666

Birck Nanotechnology Center

PI: Steven T. Wereley, Mechanical Engineering

Cummins Filtration provides fuel filtration systems that are engineered to optimize fuel system protection and reduced costs. This level of expertise is obtained through several processes which include characterization of the fuel contaminants to be filtered and obtaining the necessary knowledge based on this characterization to develop a particle sensor unique to its regional contaminants.

NEW PROGRAMS

Graduate Certificate Program in Veterinary Homeland Security

A web-based, graduate level, distance learning certificate program was developed for individuals involved in animal emergency response. Participants enhance their understanding of natural and intentional threats to animal health and strengthen their skills in management of animal-related emergencies. This activity is a cooperative effort among the Purdue University School of Veterinary Medicine, the Purdue Homeland Security Institute, the Indiana State Board of Animal Health, the Indiana State Police, the Purdue Graduate School, and Purdue University Continuing Education and Conferences.

More than 80 professionals from 27 states, Washington D.C., Singapore and Bermuda have enrolled in the veterinary homeland security program. Participants represent the veterinary profession, government, military, academia, law enforcement and industry. Completed projects included plans for addressing animal emergencies in various communities and the identification of community resources to be used in the event of emergencies involving animals.

The Ecological Sciences & Engineering Interdisciplinary Graduate Program (ESE-IGP)

The ESE-IGP, developed by a group of faculty from across campus and facilitated by the Center for the Environment, was approved in 2003 and launched in fall of 2005. The Ecological Sciences & Engineering Interdisciplinary Graduate Program (ESE-IGP) provides students with educational and research experiences that integrate engineering, science, policy, and life cycle thinking concepts to addressing sustainable solutions that cut across multiple disciplines. The ESE-IGP partners with a variety of academic units that provide the discipline foundation under a set of complementary integrating themes. The ESE-IGP also serves as a catalyst to promote collaborative inter-disciplinary environmental and ecological research among Purdue University faculty members.

- The ESE-IGP is enhancing recruitment of top graduate students to Purdue in all environment-related areas at Purdue, which is benefiting multiple academic units. Faculty from 6 units within the Colleges of Agriculture, Engineering, and Science stated that the ESE-IGP applicants had higher GPAs, GRE scores, and level of maturity than applicants through their traditional department portal in their area of interest.
- Applicants increased from 7 in 2007 to 38 for 2008 (70% accepted), to over 40 prospects as of October 1, 2008 for the 2009 academic year.
- The ESE-IGP provides professional development through coursework and activities such as the ESE campus-wide symposium that attracted 175 students, faculty, and citizens last year to Purdue on the topic of sustainability.
- The overwhelmingly positive impact of the ESE-IGP on graduate recruitment and education has resulted in financial support from the Deans of the Colleges of Agriculture, Engineering, Liberal Arts, Science, and Technology and the Provost Office for the 2008-2009 academic year.

NEW COURSES

Courses that Apply for Degrees

Intensively Managed Landscapes Theme (CE 597G and GRAD 590I): This Ecological Sciences & Engineering (ESE) seminar course provides a forum for presenting current research on agricultural lands and sustainability issues by Purdue ESE faculty from across campus, while fostering dialog within the ESE community and campus wide. The course will bring additional expert speakers to Purdue, and engage students in discussion regarding grand challenges in the environment. (7 guest speakers presented to the class).

Urban & Industrial Landscapes Theme (CE 597M and GRAD 590I): This course examines sustainability issues of the urban and industrial landscape in terms of impacts on soil, water, climate, and quality of life. Students examine “mega-cities” of the world and present comparative finding of patterns of growth and impacts, with potential solutions discussed. (7 guest speakers presented to the class).

Wind Energy (ME-597W). This Mechanical Engineering class was offered Spring 07 and in Fall 08. Topics addressed include: Wind Farm Economics, Wind Energy Fundamentals, Wind Data Analysis, Wind Energy System Performance, Environmental Issues, and Wind Turbine Blade Design.

Biosecurity for Veterinary Responders (VCS 651): A didactic course outlining biosecurity procedures for professionals responding to animal health emergencies. Topics include quarantine establishment, notification, personal protective equipment, general biosecurity, decontamination techniques, trace-out, collecting and mailing samples, and prevention of pathogen transmission by people and animals.

High Consequence Disease Review- Avian (VCS 646): A didactic course presenting etiology, transmission, clinical signs, lesions, diagnostic methods and differential diagnoses for high consequence diseases that affect birds.

High Consequence Disease Review: Bovine (VCS 642): A didactic course presenting etiology, transmission, clinical signs, lesions, diagnostic methods and differential diagnoses for high consequence diseases that affect cattle. Actual cases will be included when available.

Business Continuity Management (VCS 659): A didactic course outlining considerations for managing business continuity during an emergency.

Global Entrepreneurship and Innovation (ENTR 390G): The Certificate in Entrepreneurship and Innovation’s study abroad program provides students with the opportunity to learn about global entrepreneurship, innovation, product development, and opportunities for new products and services in specific global markets. In 2007, twenty students traveled to Seoul, South Korea to meet students and faculty from prestigious educational institutions, and visit small and large companies, and relevant economic development and government organizations. The trip was preceded by a weekly seminar on global entrepreneurship and innovation.

Risk Management in the Development of New Products and Processes (CHE 597): *Chemical Engineering, College of Engineering.* CHE 597A covers material balance concepts coupled with quantitative decision making tools which address issues related to deciding which products/processes to develop and, once selected, how to bring them to market as quickly as possible.

Fossil Fuels and Society (EAS 391): Department of Earth and Atmospheric Sciences, College of Science. EAS 391S provides students in all majors with an in-depth understanding of the oil industry from exploration, production, and refining, to distribution and retailing.

Business Writing for Entrepreneurs (ENGL 420E): Department of English, College of Liberal Arts. English 420E teaches students the rhetorical principles and writing practices necessary for producing effective business letters, business plans, memos, reports, and collaborative projects for entrepreneurial contexts. The curriculum also includes readings that cover the important roles of writing, communication, and ethics in entrepreneurship and innovation throughout a wide array of business, industry, and social contexts.

Food Processing III (FS 430): Department of Food Science, College of Agriculture
 Students work in teams to develop new food products that may be linked to existing food companies or may be proposed as the basis for a new start-up companies.

History, Ethics and Innovations of Healthcare Delivery Systems (NUR 625): This course examines the historic and philosophic foundations to the development of the current health care delivery system. It broadens and refines the student's view of the current health care delivery system by providing an analysis, from an historical perspective, of the forces that have shaped the system, including scientific discoveries, technological advances, social justice issues, and the development of health professions and institutions. Nursing knowledge is influenced by these multiple factors; thus, the course provides students with tools to lead others in meeting the many challenges the health care system brings. The course uses a chronological and topical format that investigates policy and societal trends affecting health care, the nursing and medical professions, and professional practice. Changes in the roles of health care providers and consumers are assessed from economic, social, organizational, political, ethical, legal, and technological perspectives.

Health Policy: Local to Global (NUR 632): This course provides an overview of policy decisions related to the organization, financing, and delivery of healthcare in the global community. Social, ethical, cultural, economic, and political issues that affect the delivery of healthcare and nursing services are critically analyzed. International models for development of health policies will be examined. Roles of healthcare providers and consumers of healthcare services, as well as government and entrepreneurial interests are examined.

Health Policy Residency (NUR 673): Theories of leadership, motivation, power, and influence are used to evaluate interpersonal relationships within healthcare organizations. Theories of communication and justice, coaching, and oversight in healthcare organizations are also utilized. Students do program evaluation for improvements in clinical outcomes, efficiency, resource allocation, and cost reduction.

Role Transition and Synthesis (NUR 675): This course provides an integration of core, cognate, and specialty knowledge with an emphasis on role transition and synthesis. It focuses on internal and external health care organizational factors at the local, state, national, and international levels. Seminars will explore role issues, licensure, credentialing, finances, legislation, health care policy, legal issues, ethics, cultural diversity, evidence based practice, emerging trends in the management of acute and chronic conditions of adults, and independent and collaborative practice.

Medication Utilization and Patient Management (PHAD 46): The management of a pharmacy practice is governed by regulations, healthcare organization structures and decision-making by key stakeholders. This course provides the knowledge as well as a decision-making framework and tools to permit students to effectively manage individual practices and their patients' medication utilization. Specific focus is on organizations and reimbursement systems involved in healthcare delivery (e.g., Medicare, Medicaid,

managed care), as well as techniques used in health policy decisions (e.g., health outcomes research). The course combines reading assignments, lectures and recitations to provide students an opportunity to learn these management principles and apply them, using practical examples of practice decisions.

Comparative Healthcare Systems (Soc 572) using cost, quality, and access to care as core concepts, this course explores healthcare in comparative context. Special topics are health and gender, the environment, epidemics, long-term care, technology, and rationing, among others.

The Human Side of Medicine (Soc 573) focuses on sociological theory and research related to social conflicts over the delivery of healthcare in the U.S. Considers social issues pertaining to abortion, AIDS, human experimentation, reproductive technologies, euthanasia, and others.

The Social Organization of Healthcare (Soc 574): Analysis of the determinants and consequences of the social organization of medical care. Considers morbidity and mortality, costs and utilization of medical services, healthcare occupations and institutions, and change in programs and policies.

Professional Education Courses

Boeing PLM (Product Life Cycle Manufacturing) Certificate Program, consisting of four courses: 1) Introduction to Digital Manufacturing, 2) Application of Digital Manufacturing, 3) Product Data Management, and 4) Virtual Team Development and Management

Department of Labor ETA Grant courses developed and offered through TAP: 1) Continuous Improvement in Product Development, 2) Design of Quality Processes for Advanced Manufacturing, and 3) Minimizing the Environmental Impacts of Advanced Manufacturing

Department of Labor ETA Grant courses developed and offered through EPE: 1) Factory Basics, 2) Program Management, and 3) Bridging Generational Gaps: Maximizing Workplace Potential

Pharmaceutical Technology & Education Center courses: 1) Active Pharmaceutical Ingredient (API) Process Development, 2) Manufacturing and Design of Solid Dosage Formulations, 3) Pharmaceutical Quality by Design, and 4) Pharmaceutical Supply Chain Management

DISCOVERY PARK AFFILIATED TEAMS IN BUSINESS PLAN COMPETITIONS

Life Sciences Competition, Spring 2007

Aerial Image Corporation	Aerial Image is a service based company for aerial mapping and photography for the Agriculture and telecommunications industries
Jinsitec, LLC	Jinsitec offers innovative technology to improve the quality of life for persons taking medication, effectively addressing the serious problem of global compliance.
Seyet LLC	Seyet delivers visual communication solutions that provide the most concise, clear, and accurate means for life sciences companies and researchers to communicate complex information which will engage audiences and enable them to make critical decisions. This includes investors, scientists, doctors, sales representatives, patients, and juries.
SnapFire	SnapFire will realize the promise of personalized medicine with a revolutionary approach to visualization and analyses of the huge volumes of data that characterize current biomedical research and health care delivery. A first product that will bring positive cash flow in year 2 will capture the market for proteomics and metabolomics research data analysis. Continued development at SnapFire will expand to diverse and heterogeneous data types with progressively larger markets and profit prospects.
QHeart Inc	QHeart, Inc. is a medical devices company currently commercializing the BioQ Cardiac Assist System (CAS), a unique self powered device that is designed to offer preventative and cost effective treatments to the global heart failure community.
MatrixBio	MatrixBio has developed advanced “Metabolite Profiling” technology that provides highly accurate tests for early cancer diagnosis and for following the effects of drug therapy. MatrixBio analyzes multiple small molecule biomarkers that are used to diagnose cancer at its earliest stages, providing more therapy options and better outcomes.

Burton D. Morgan Business Plan Competition, Spring 2007

Cytometry for Life

Cytometry for life (C4L™) was established as a not-for-profit entity to address the need for Cluster of Differentiation 4 (CD4) capabilities to deal with the impact of the HIV/AIDS epidemic in remote or rural regions that lack high-infrastructure laboratory environments. Using innovative approaches and mature technology, C4L's CD4 T-lymphocyte counter measures CD4 absolute count and percent lymphocytes in a manner that is simple to operate, portable, reliable, and battery powered.

Iprivacy Manager

The services provided by this organization will be IT Training and business/project implementation simulation.

GameSense

To create an Indiana web portal databasing all Indiana small businesses and startup companies. Portal will be in a wiki format editable by registered companies in database with the option to upgrade to websites created by Start Indiana. The ability to use tagged and filtered searches will allow a registered user to easily navigate a complete listing of all Indiana small businesses. There would also be targeted internal paid advertising options. Through advertising and sales of site upgrades an ROI could be returned and the site format would be repeatable in all 52 States allowing for increased revenue due to economies of scale bringing costs down.

FACILITIES/TOOLS/EQUIPMENT

The facilities afforded through Discovery Park to support research and new discoveries make a critical difference for faculty, staff, and students. In addition to the over \$100 million in buildings at Discovery Park, the tools and equipment added contribute significantly to Purdue's research agenda. Since all of the equipment in Discovery Park is shared, the resources here are leveraged far more broadly than is typical when discussing laboratory space and equipment. Additionally, Discovery Park provides technical staff to support complicated and sensitive instruments and manage data.

In 2007, Discovery Park added \$1.4 million worth of equipment to the Purdue University campus, much of it in Discovery Park. Since the inception of Discovery Park in 2001, Discovery Park has added \$27 million worth of tools and equipment to our campus. Some of the most notable equipment includes:

High throughput genetic analysis

Discovery Park has contributed to next generation sequence analysis platforms now on campus. The SOLiD and 454 next gen sequencers provide capabilities for describing the genome sequence of new species and of genetic modifications created in the laboratory and in nature. As a compliment to these systems for determination of DNA sequencing, specific variations can be interrogated quickly, cheaply and in parallel with the GeXP analysis system in the Bindley Center. This system is an integrated platform for simultaneous detection of multiple genes or gene variants from many different samples. In the same experiment, the system can analyze DNA sequence, DNA modifications such as mutations and single nucleotide polymorphisms as well as mRNA expression.

Applications include: (a) Detect and describe distinct species in populations of soil and water bacterial populations, (b) Characterize genetic differences in cancer cell lines exposed to anti-cancer drugs, and (c) Characterize expression of neurotransmitter receptor gene sequences in cells that model nervous system communication. The users for these two pieces of equipment are interdisciplinary. The SOLiD system is especially important to researchers across the campus. Discovery Park, often, is a contributing investor to enhance the purchase of equipment by Purdue. For example, the GeXP system was purchased through a vendor award to Bindley Bioscience of \$65K plus cost shares with Bindley Bioscience Center, the Oncological Sciences Center, and the Purdue Cancer Center to reach the total of \$130K.

Complimentary tools for metabolomics

Characterization of the presence and quantity of small molecule metabolites in complex biological samples is the specialty of the Bindley Metabolite Profiling Facility (MPF). A suite of mass spectrometers specialized for different aspects of small molecule detection have been obtained in cooperation with investigators across campus. Lilly Endowment award funds augmented an NSF major research instrumentation award to enable the MPF to obtain multiple high sensitivity metabolomics instruments and a data handling and storage system to ensure data archiving. Two triple quadrupole mass spectrometers for ultra-high sensitivity analysis of specific metabolites in the sample were obtained in 2008 via consortium funding from 4 Purdue Colleges and the Provost's office. The new triple quads provide direct connection of data between existing metabolomics platforms (time of flight and ion trap mass spectrometers) via the integrated nanochromatography 'chip cube' system that was first available for complex biological sample analysis in the Bindley center.

Applications include: (a) Detect trace concentrations of vitamin D and its analogs in human samples, (b) Define metabolites associated with muscle wasting (cachexia) in cancer patients, (c) Identify active therapeutic molecules in medicinal herbs, tea and fungi, and (d) Precisely define

concentration of specific cancer biomarker proteins. MPF users are campus wide, especially Science, Engineering, Pharmacy, Agriculture, Consumer and Family Sciences, Liberal Arts. The purchase of the triple quadrupole mass spectrometers reflects the collaborative leveraging of Discovery Park. The equipment was purchased via the Provost equipment matching funds in 2008 with contributions from Bindley Bioscience Center, and the Colleges of Pharmacy, Science, Agriculture and Consumer and Family Sciences (Lead unit for Provost equipment RFA) to reach the total cost of \$400K.

SEED FUNDING

Discovery Park awarded 20 seed grants totaling \$695,000 to faculty in the Colleges of Science, Engineering, Liberal Arts, Technology, Agriculture, Nursing, Veterinary Medicine, Pharmacy, Management, and Libraries, as well as other units on campus such as the Envision Center and the Center for Wireless Systems. Here are three examples:

Portable Immersive Virtual Learning Environment for Biotechnology Education, Kari Clase, Jenna Rickus, Nicoletta Adamo-Villani, and Aman Yadav. The proposed project will develop a tool that will be used to examine the efficacy of Virtual Reality as a mechanism for infusing the knowledge and excitement of cutting-edge research into the high school and undergraduate classroom. The tool will be used to validate an interactive module using portable immersive virtual technology to teach abstract concepts in biology and engineering. The interactive module will allow students (and teachers) to enter and manipulate the parts of a cell, discovering first hand the effects that permutations have on the system. Users will confront misconceptions as they interact within the Virtual Learning Environment. The general goal of the project is to develop professional resources and tools for the instruction of K-12 and undergraduate students and teachers in the interdisciplinary field of industrial biotechnology (integration of biology, engineering and technology) with specific applications to emerging industrial needs, such as bioenergy. The specific objective of this work is to develop an immersive, interactive, 3D-animation based Virtual Learning Environment for biotechnology education that can be delivered on low-cost portable immersive virtual reality systems. (Discovery Learning Center)

Life Long Analysis of Bladder Cancer Development and Patient Care: Dog as Proxy/Surrogate to Human, Deborah W. Knapp, Department of Veterinary Clinical Sciences; Marietta Harrison, Dept. of Medicinal Chemistry and Molecular Pharmacology, and Seza Orcun, e-Enterprise Center. The goal of this project is to develop a methodology to study complete cancer care trajectories using the care of pet dogs with naturally occurring cancer as a proxy to the delivery of human healthcare. The long term goal is to be able to predict cancer behavior and response to therapy in the individual patient, and thus to individualize cancer care. (Discovery Park Administration)

Self-care and Health Literacy in Telehealth and Traditional Home Health Patients with Heart Failure; PI-Karen Yehle, Nursing; Collaborating Faculty – Kimberly Plake, Pharmacy; Healthcare Partner – St Vincent Health. Heart failure is a chronic illness that requires daily monitoring. The current system is not designed to provide education and support. Without education and support, patients do not develop self-care behaviors. Management behaviors include adjusting fluid and sodium intake, and increasing the diuretic dose based on symptoms. Another dimension of self-care is the patient's confidence in evaluation of symptom importance, noticing health changes, taking action, and evaluation of the action taken. This study looks at self-care abilities of participants in St. Vincent's Home Health Program, relationships between these behaviors and outcomes, and to compare telehealth to traditional home health for developing these self-care behaviors. (Regenstrief Center for Healthcare Engineering)

Additionally, \$83,980 *recharge grants* given in Birck Center to 14 different faculty from Colleges of Engineering, Technology, Science, and Pharmacy.

Entrepreneurial Leadership Academy

Nine Purdue University professors participated in the 2008 *Entrepreneurial Leadership Academy*. The program brings faculty together with business innovators and introduces entrepreneurship ideas in the classroom. The academy is part of the Kauffman Campuses Initiative at Discovery Park's Burton D. Morgan Center for Entrepreneurship and also is supported by the Susan Bulkeley Butler Center for Leadership Excellence. Each faculty participant received a \$5,000 award to be used for entrepreneurship projects or research. Results from these projects included publications, funded grants, new course development, and start-up companies. A few examples are highlighted below.

Grants

A USDA-NRI grant on family business transition, "Transfers for Strong and Sustainable Small and Medium Sized Farm Family Businesses," was funded at \$485,000 starting January 2009-December 2011.

Publications

"Open Access Book Publishing in Writing Studies: A Case Study." (David Blakesly with Charles Bazerman, Mike Palmquist, and David Russell). *First Monday*. 13.1 (7 January 2008).
<http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2088/1920> [10,300 words]

Start-up Initiatives

Under the guidance of a participant, a group of students recently started a new firm called ReLaunch (Responsive Launch) and are presently seeking SBIR and venture capital funds.

Course

ENTR 490, "Global Entrepreneurship and Innovation," The course of 20 and 25 students for 2007 Korea visited and 2008 China visited, respectively. The course comprised four in-class sessions on the local cultural and economic environment, political and financial systems, and the infrastructure for promoting start-ups in a university context. A strong emphasis was multiple company visits. Through in-depth panel discussions, students were able to learn first-hand from the entrepreneurs of the local enterprises regarding the challenges for doing business in Korea or China.

NEW RESEARCH CENTERS/CAPABILITIES

Center for Analytical Instrumentation Development (CAID)

Analytical chemistry and its instrumentation provide the measurements and quantitative information underlying much of the research and commercial activity in chemistry, biology, and medicine. CAID has been created in Discovery Park that brings together chemists, physicists, engineers, biologists, and physicians from multiple Schools at Purdue University, University of Notre Dame, Indiana University, and the University of Illinois at Urbana-Champaign. The mission of the Center is to develop innovative “machine-tools of science” that enable discoveries across a broad spectrum of life science. These activities will lead to routine, point-of-need devices for use in drug discovery, clinical diagnostics, environmental monitoring, and the fight against chemical and biological terrorism. America leads the world in the development of analytical instrumentation and CAID proposes to lead America. CAID is led by Dr. R. Graham Cooks and Dr. Fred E. Regnier of the Department of Chemistry.

The Purdue Center for Metal Casting Research (PCMC)

The PCMC was launched in July, 2008. The center is led by Director Kevin Trumble (Professor, Materials Engineering (MSE)) in collaboration with Prof. Qingyou Han (Mechanical Engineering Technology), Prof. Christine Corum (MET), Prof. Matthew Krane (MSE), and Prof. David Johnson (MSE). The center will conduct interdisciplinary, industry-driven research and education programs to advance commercial metal casting practices and develop new commercial solidification processes. The PCMC will organize consortia of specific casting industries (e.g., die-casting, re-melting) that have a strong economic presence in Indiana. The center will operate under the umbrella of the Purdue Center for Advanced Manufacturing through which it will seek to maximize collaboration with the manufacturing research community at Purdue and across the state. Proposals totaling over \$10M in funding for the Center have been submitted to federal agencies in addition to several industry proposals. A major proposal to the Indiana Economic Development Corporation is also under preparation.

The **Discovery Learning Center (DLC)**, a research center in its own right, also provides assessment and evaluation services in support of other Centers and Units on campus, as well as external to Purdue. DLC Assessment activities are led by Dr. Deborah Bennett and supported by the staff and graduate students in the DLC. Dr. Bennett is an Associate Professor of Educational Studies in the College of Education at Purdue University and a Faculty Fellow with the Discovery Learning Center. Through her funded research, Dr. Bennett has established the **Assessment Research Center (ARC)** to support research and development in the areas of assessment and evaluation. She currently holds a joint appointment between the Discovery Learning Center and the Purdue College of Education and ARC is co-located between College of Education and DLC. The Assessment Research Center, working through the DLC, leads evaluation efforts for a number of large grants and has supported grant submission of many others by designing and implementing assessment plans, developing and validating instruments, mentoring graduate students, and managing evaluation efforts.

Funded Grants supported by DLC-ARC: HHMI Electronic Field Trips in Comparative Biology; Lilly Endowment Opportunities for Indiana; Lilly Endowment Supporting and Enhancing IfI; NASA Indiana Space Grant Consortium; NIH Interdisciplinary Cancer Prev. Research Internship Program; NSF CPATH; NSF Advance; NSF CCLI; NSF CI-TEAM; NSF NCLT; NSF Mentoring Native Americans for Success in the Geosciences; NSF GK-12; NSF S-STEM FEELS; BDM Foundation Interns for Entrepreneurship

Health Literacy Informatics Technology

Health Informatics and Learning Technologies (HILT) is an applied research and development cluster focused on improving healthcare outcomes. Their multidisciplinary team is dedicated to supporting the patient-provider care continuum through the innovative use of information technologies, communication, and learning technologies. Their areas of focus include telehealth, e-learning, and team collaboration.

Center for Assistive Technology

The Regenstrief Center for Healthcare Engineering (RCHE) at Purdue University was privileged to make a proposal to the Indiana Family and Social Services Administration (FSSA) regarding the building of innovation capacity in the adaptive technology (AT) market and ultimately establishing a global epicenter of AT innovation in Indiana. RCHE strongly supports the vision of the FSSA and its partners. The Center for Assistive Technologies (CAT), is initially supported by FSSA and Purdue University, but ultimately sustained through the mobilization of the AT market. The goal is to create market forces that sustain AT innovation for the benefit of those with disabilities and FSSA.