INVENTING THE FUTURE TOGETHER
A Report on Research at IIT

Highlighting advances in basic and applied research, technology transfer and commercialization.

ILLINOIS INSTITUTE OF TECHNOLOGY
Message from the Dean

As a research university, IIT’s mission is to create and disseminate knowledge and technologies that address national and global needs and priorities. In the past five years, the dedicated faculty, staff and research students of IIT have made tremendous progress in research and sponsored programs. Our researchers have contributed an amazing array of investigations, analyses, designs, prototypes, services, and tools. The charts and graphs on this page and the next two pages demonstrate our commitment to our research accomplishments. The trends reported in this document are encouraging:

• Over the past five years, sponsored project revenues have doubled.
• The internal Education and Research Initiative Funds awarded to faculty on a competitive basis have achieved a 17-to-1 return in external program funding in the past five years.
• IIT Research Scholarships offered to domestic students in sciences and engineering have attracted many highly qualified U.S. nationals and members of underrepresented groups in engineering and sciences to various graduate programs.
• Seven research centers are established in critical technical areas.
• Marketing and licensing of IIT inventions and technology commercialization activities have increased significantly.

To enhance participation in research, the Graduate College continues to implement new faculty initiatives. In 2003, we offered tuition cost share for all graduate students budgeted on projects that carried full, on-campus, indirect cost. Also beginning in 2003, faculty were given spending jurisdiction on 10 percent of the indirect cost recovery associated with their research projects to enhance their research infrastructure.

These incentives will ensure that IIT continues to develop and support a broad base of faculty research. As examples of our leadership in research, you will find a collection of research stories in this report. Better image diagnosis to improve early detection of breast cancer, novel sensor technologies for public health-care and homeland security, clean energy alternatives and power electronics are some of these contributions that respond to the needs of the society. The stories introduce a small selection of our research programs; yet remind us that our researchers are making a difference. Additional research achievements and detailed information about our researchers are available at our Website. Please join us as we focus on “inventing the future together.”
Fiscal Year 2003

Financial Highlights

Research and Sponsored Program
Awards and Expenditures
Awards and expenditures for research have shown a steady increase over the past five years. Awards exceeded $14 million between 2000 and 2003. Expenditures have also increased steadily, going from $25 million in 2000 to $28 million in 2003.

Facilities and Administrative Costs
Awarded and Recovered
The amount of facilities and administrative costs have increased steadily over the past five years. Costs awarded increased nearly $2 million between 2000 and 2003. Costs recovered increased more than $1 million between 2000 and 2003.

Proposals Submitted and Awards Received
The number of proposals submitted have increased from 209 in 1999 to 346 in 2003. Awards received have nearly doubled from $16 million in 1999 to more than $31 million in 2003.
In FY 2003, Research and Sponsored program awards exceeded $31 million. Awards from Federal Government Agencies accounted for 53% of all awards, and State and Local Government Agencies accounted for 30%. The remaining awards from Industry, Foundation, and other, accounted for 17%.

**Awards by College**

In FY 2003, more than $31 million in research awards were received. The College of Science and Letters brought in 34%, while Armour College of Engineering accounted for 21%. Other Academic Units brought in 26%, with the remaining 19% brought in by Administrative Offices.

**Awards in College of Science and Letters**

Total awards in the College of Science and Letters was $10.9 million.
- Biological, Chemical & Physical Sciences Department - 88%
- Computer Science Department - 7%
- Applied Mathematics Department, Lewis Department of Humanities, and Center for the Study of Ethics in Professions - 5%

**Awards in Armour College of Engineering**

Total awards in the Armour College of Engineering was $6.5 million.
- Mechanical, Materials & Aerospace Engineering Department - 29%
- Biomedical Engineering - 26%
- Chemical & Environmental Engineering Department - 25%
- Electrical Computer Engineering Department - 20%

**Awards from Other Academic Units**

The awards received by other Academic Units was over $8 million.
- National Center for Food Safety & Technology - 74%
- Institute of Psychology - 15%
- Chicago-Kent College of Law - 6%
- College of Architecture - 4%
- Stuart Graduate School of Business - 1%

**Awards from Administrative Offices**

The Administrative Offices received $5.8 million in awards.
- Academic Administration - 95%
- Graduate College, Undergraduate College, Library-Griffin, Rice, and External Affairs - 5%

**Awards from Other Academic Units**

The awards received by other Academic Units was over $8 million.
- National Center for Food Safety & Technology - 74%
- Institute of Psychology - 15%
- Chicago-Kent College of Law - 6%
- College of Architecture - 4%
- Stuart Graduate School of Business - 1%
Multivariate Meshfree Approximation Methods: Theory and Applications

Greg Fasshauer, Professor, has teamed with graduate students and collaborators from numerous universities to study multivariate meshfree approximation methods, through funding from the National Science Foundation.

Traditional numerical methods were motivated mostly by early one- and two-dimensional simulations of engineering problems through partial differential equations. These methods were based on finite element, finite difference, or finite volume discretizations. All of these methods require some sort of underlying mesh for the computation. Creation of these meshes becomes a difficult task in three dimensions, and virtually impossible for higher-dimensional problems. This is where meshfree methods enter the picture. Meshfree methods are often radially symmetric in nature, achieved by composing some univariate basic function with a (Euclidean) norm, and turning a problem involving many space dimensions into one that is virtually one-dimensional. These radial basis functions are at the heart of this research.

Computation with high-dimensional data is an important issue in science and engineering. Many traditional numerical methods can either not handle such problems at all, or are limited to special (regular) situations. Meshfree methods are often better suited to cope with changes in the geometry of the domain of interest than classical discretization techniques such as finite differences, finite elements or finite volumes.

Recently, Fasshauer was guest editor for a special issue of the journal *Computers and Mathematics with Applications* on meshfree approximation methods. He was asked to join the editorial board of the journal *Engineering Analysis with Boundary Elements* when they decided to add an emphasis on mesh reduction and meshfree methods and has recently contributed a 90 page chapter on meshfree methods for a *Handbook of Theoretical and Computational Nanotechnology*.

Fasshauer expects to find applications for his research in an ever increasing array of problem areas. “I want to get more people involved in this research,” he says, “and invite them to try meshfree methods for their applications.”
Understanding and Modeling Ocean Currents

The daily activities and quality of life for humans is dependent upon the environment and the climate. To better understand changes in the environment and in climate, Professor Jinqiao Duan is conducting research on complex geophysical flows, particularly the impact of small-scale to large-scale flows in various oceans.

Duan and his research group at IIT are collaborating with Paul Fischer from the Argonne National Laboratory, Tamay Ozgokmen of the University of Miami, and Traian Iliescu of Virginia Tech.

This research began with seed money from IIT, in the form of an Educational and Research Initiative Fund (ERIF) grant. Research results were instrumental in receiving a collaborative grant, between mathematical sciences and geosciences, from the National Science Foundation.

To date, the team has been able to achieve a basic understanding of gravity currents, in an idealized situation, with high-resolution non-hydrostatic three-dimensional numerical simulations. They developed visualizations of basic dynamics of 3D overflows, considering entrainment and mixing, and the impact of topology. They have also achieved a basic understanding of the impact of noise at boundary on geophysical flows inside the domain.

The next step for Duan's team will be to investigate the impact of various uncertainties (random forcing, uncertain data, uncertain parameters) on geophysical flows. Numerical simulations will also be examined under uncertainty and new mathematical modeling methodologies for complex systems will be studied under random influences. The team also plans to investigate stochastic dynamical systems approaches for geophysical flows.

For a list of other ERIF winners, see page 43.
A team of scientists at IIT has successfully tested a new sensing device that can identify dangerous bacteria, with the potential to confirm the presence of dozens of other toxic agents in air, water and food. The prototype could become a powerful new tool for U.S. homeland security, military counter-terrorism efforts and everyday medical diagnosis.

This new detection device, called IIT ChemArray, includes an electronic microchip sensor, a little larger than a penny, which can easily be incorporated into a handheld scanner. The device may one day better protect the public against toxic pathogenic organisms and viruses, including ricin, the poisonous protein recently found in U.S. mail delivered to Congress. In laboratory testing, the device, a version of a commercially available electronic sensor, was able to instantly read the presence of E coli (Escherichia coli), a bacteria commonly associated with food poisoning and infant diarrhea. IIT researchers believe ChemArray will have the same capability with a host of other toxic viruses and bacteria, including SARS, anthrax, salmonella, listeria and staphylococcus.

Development of the new sensor, funded by a federal biodefense research grant from the U.S. Office of Naval Research, is viewed as a key component in U.S. counterterrorism efforts, offering the military and civilians a faster, more portable way to detect a variety of dangerous biological agents in the field. “Current testing methods are often time-consuming and require analysis in a specialized laboratory,” said Joseph Stetter, Professor of Chemistry and research team leader. “This portable device can instantly detect a variety of dangerous agents in the field, through a device no larger than a typical handheld computer.”

In addition to helping U.S. counterterrorism efforts, the ChemArray device will help health organizations around the world better fight fast-spreading diseases. “Many more people around the world die of undiagnosed and untreated diseases than die of terrorist attacks,” said William Penrose, a Research Professor in chemistry and one of the scientists on the project. “Tuberculosis, for example, is the leading cause of death around the world, next to malaria. An inexpensive, handheld scanner that could be used to seek out tuberculosis patients in remote locations could be used to identify infected people early, in time to start drug treatment or, at the very least, to prevent the disease from spreading.”
Along with Stetter and Penrose, other members of the IIT team include Victor Perez-Luna, Professor of Chemical and Environmental Engineering, and students Jenna Zhang, Kiera Lonergan, Chandra Hanumanthaiah and Gregory Allan Hudalla.

The IIT ChemArray scans more than 93,000 tiny sensors in an area the size of a postage stamp in less than 50 milliseconds. A specific antibody is anchored on the sensor's glass surface and serves as a microscopic “magnet,” attracting a particular bacteria or protein. The ChemArray then accurately confirms the bacteria's presence on the antibody-coated portion of the surface. By making spots of different antibodies on the glass surface, a single sensor can be treated to search for hundreds or even thousands of different bacteria at the same time.

With confirmation of the sensor's ability to detect E coli bacteria, work is now underway to incorporate the sensor into a portable device for testing of many different agents. Their work will take less than a year, depending on continued financial support. IIT’s long-term goal is to enable field testing by military and civilian researchers in applications from counter-terrorism to infectious disease prevention.

Along with funding from the U.S. Office of Naval Research, additional support has come from the microchip's manufacturer, STMicroelectronics, Geneva, Switzerland, and Transducer Technology, a Chicago startup company. U.S. Representative Bobby Rush (D-III.) and U.S. Senator Dick Durbin (D-III.) have also been key supporters of the research project.

[Image of William Penrose, Research Professor in Chemistry]

Research Highlights in Chemistry

I. Khan
“Novel Nanostructured Solids: Potential DeNox Catalysts”
Funding from NSF

B. Mandal
“Synthesis of Photoactive Phthalocyanine Derivatives”
Funding from ANL

J. Stetter
“Development of Prototype BioDetectors”
Funding from ONR
Linda Spentzouris was selected by the National Science Foundation for a Career award during 2003 for her proposal, “Particle Beams of the Future.” Career awardees are selected on the basis of creative, career-development plans that effectively integrate research and education within the context of the mission of their institution.

The first objective of her proposal was to strengthen the nation’s basic research in particle beam physics. Second, Spentzouris proposed to establish a sustainable infrastructure for this research at IIT’s newly established Center for Accelerator and Particle Physics. Finally, she proposed to integrate all aspects of this cutting-edge research into teaching activities, offered to diverse populations of graduate and undergraduate students in the coming decades.

“Particle accelerators and storage rings are not just for atomic physics anymore,” Spentzouris writes in her Career proposal. “They are now ubiquitous tools of the modern age, used for basic research in many fields, as well as for industrial, medical, and security-related applications.” She explains that today high-energy accelerators are being used by scientists across many fields, which is why the demand for higher quality beams, more sophisticated machines, and more beam physicists is increasing.

Spentzouris says that her research will address issues related to the generation of high-intensity beams, “. . . in particular, the propensity for the charges comprising a beam to destabilize the beam through mutual electromagnetic interaction, also known as the space charge force.” She also addresses improving the technology to enhance the capability and accessibility of particle accelerators, and possible future machine technologies.

Spentzouris plans to bring IIT students and new tools into the Center for Accelerator and Particle Physics. She recognizes the need for beam physics education within academic institutions, as it is traditionally not a formal program. Through national and international organizations, Spentzouris is forging a path to bring particle beam education into the graduate and undergraduate classrooms.
Understanding the Structure and Function of Biological Membranes

In recent years, evidence has increasingly pointed to an important role for nanometer-sized domains within lipid membranes as locales for the binding of anchored proteins, signal transduction, protein transport, and the binding and transport into the cell of several pathogens and toxins, including the HIV-1 virus.

Because the domains appear to exist in a sea of other membrane molecules, they are often referred to as “lipid rafts,” and they tend to be rich in a certain class of lipids called sphingolipids and in cholesterol. At this time, details of the sub-nanometer structures and of the interactions that drive raft formation are not known. Simulation is being used as a tool to begin to probe the driving forces that underlie lateral organization in membranes.

Larry Scott, two IIT students, and researchers from University of Illinois at Urbana-Champaign and the National Institutes of Health (NIH) are in their seventh year of NIH funding for conducting this work.

Using molecular dynamics and Monte Carlo simulation, they are able to obtain atomic level models for biomembranes. This is done to better understand several important problems in membrane biology: the role of cholesterol in membranes, the lateral organization and compartmentalization within membranes, and the interactions between membrane lipids and membrane proteins.

The group has been able to explain the formation of lipid-cholesterol “condensed complexes” in membranes, and show how cholesterol drives a membrane into a peculiar “liquid-ordered” phase, a necessity for membranes to function properly. They are the first research group to use simulation as a tool to probe the structures of lipid rafts, requiring simulations of exceptional size and length. An innovative discovery is that cholesterol appears to play an essential role in expediting the formation of rafts, acting as an interface between the raft and the rest of the membrane.

The researchers are also beginning to employ a new method called Langevin Dynamics to extend the power of simulations to vastly greater time and length scales than previously accessible.
Department Of
Biomedical Engineering

The Department of Biomedical Engineering conducts research in the areas of cell and tissue engineering, medical imaging, neural engineering, and biomaterials. Through its interdisciplinary scientific approaches and its collaborative endeavors with a number of the country’s leading educational, medical and research institutions, the Pritzker Institute is pursuing biomedical science and engineering education, research, and commercialization of biomedical technologies at a new level of complexity and creativity. During 2003, more than $1 million was received in research funding from agencies, including the National Institutes of Health, the Whitaker Foundation, and the American Chemical Society Petroleum Research Fund.

Early in 1996, IIT was awarded a National Institutes of Health contract to design and fabricate an implantable visual prosthetic device for the blind, based on electronic stimulation of the visual cortex. However, several months into the project, NIH officials announced plans to abandon the human research, citing as one of the reasons its inability to guarantee human volunteers lifelong maintenance of visual-prosthesis implants. Initially, the decision was a devastating blow for those whose careers had been devoted to advancing the research and who now felt the once unimaginable was within reach. In addition, IIT researchers had already made major progress under its NIH contract. Although NIH would honor the IIT contract, there were no plans to use the implantable device.

Soon, some NIH researchers began pitching the visual prosthesis project elsewhere, hoping that the NIH might continue funding under the auspices of a different organization. Phillip Troyk, IIT Professor of Biomedical Engineering, was dedicated to reviving the work, and quickly assembled a 20-member team of distinguished biological, behavioral and visual scientists from the University of Chicago, an international leader in psychophysical research and neurosurgery; Huntington Medical Research Institute, Pasadena, Calif., which pioneered the development and safety testing of electrode arrays used in intra-cortical visual prosthesis research; and EIC Laboratories, a Newton, Massachusetts-based leader in advanced electrode technology. In addition, Troyk enlisted two retired NIH scientists, including the neurosurgeon who performed the landmark brain implant of a visual prosthesis at NIH, as well as an NIH expert in electrode design.

Under Troyk’s leadership, the newly formed team began putting together an NIH proposal for restarting the project. Meanwhile, IIT tapped into private funding to support its development and testing of a visual prosthesis.

Presently, using a combination of NIH and private funding, IIT researchers are developing a prototype intra-cortical visual prosthesis. The system will use fully-implanted electronic stimulators that would produce the tiny currents needed to drive more than 1,000 miniature electrodes implanted in the visual cortex. The implants will be powered and communicated with remotely, by a magnetic coil placed on the surface of the skin. No wires will cross the skin. Design of the implantable system, which includes the electrodes and associated electronic circuitry, is an engineering challenge due to the need for extremely high packaging.

“Given the brain’s ability to modify neural pathways and form new connections, patients might—after months of training—be able to integrate these points of light into nebulous forms, or even sharper images.”

Visual Prosthesis

Earlcy in 1996, IIT was awarded a National Institutes of Health contract to design and fabricate an implantable visual prosthetic device for the blind, based on electronic stimulation of the visual cortex. However, several months into the project, NIH officials announced plans to abandon the human research, citing as one of the reasons its inability to guarantee human volunteers lifelong maintenance of visual-prosthesis implants. Initially, the decision was a devastating blow for those whose careers had been devoted to advancing the research and who now felt the once unimaginable was within reach. In addition, IIT researchers had already made major progress under its NIH contract. Although NIH would honor the IIT contract, there were no plans to use the implantable device.

Soon, some NIH researchers began pitching the visual prosthesis project elsewhere, hoping that the NIH might continue funding under the auspices of a different organization. Phillip Troyk, IIT Professor of Biomedical Engineering, was dedicated to reviving the work, and quickly assembled a 20-member team of distinguished biological, behavioral and visual scientists from the University of Chicago, an international leader in psychophysical research and neurosurgery; Huntington Medical Research Institute, Pasadena, Calif., which pioneered the development and safety testing of electrode arrays used in intra-cortical visual prosthesis research; and EIC Laboratories, a Newton, Massachusetts-based leader in advanced electrode technology. In addition, Troyk enlisted two retired NIH scientists, including the neurosurgeon who performed the landmark brain implant of a visual prosthesis at NIH, as well as an NIH expert in electrode design.

Under Troyk’s leadership, the newly formed team began putting together an NIH proposal for restarting the project. Meanwhile, IIT tapped into private funding to support its development and testing of a visual prosthesis.

Presently, using a combination of NIH and private funding, IIT researchers are developing a prototype intra-cortical visual prosthesis. The system will use fully-implanted electronic stimulators that would produce the tiny currents needed to drive more than 1,000 miniature electrodes implanted in the visual cortex. The implants will be powered and communicated with remotely, by a magnetic coil placed on the surface of the skin. No wires will cross the skin. Design of the implantable system, which includes the electrodes and associated electronic circuitry, is an engineering challenge due to the need for extremely high packaging.

“Given the brain’s ability to modify neural pathways and form new connections, patients might—after months of training—be able to integrate these points of light into nebulous forms, or even sharper images.”
density. Implants for other applications, such as pacemakers and cochlear implants typically provide only a fraction of the electrodes and stimulation channels that will be needed for the visual prosthesis.

The ultimate goal is to link the electronic stimulators to a video camera mounted on a pair of glasses to communicate the artificial image information to the cortex. Signals passing through the lens to the implanted devices would selectively stimulate electrodes in the visual cortex to produce visual percepts, often experienced as spots of light, called phosphenes. Researches hope that the resulting image “seen” in the mind will actually correspond to an object in the environment. But they’re really not sure what patients will perceive. “At first, they might only sense pinpoints of light, or crude ‘Light-Bright’ facsimiles of images in which there are only outlines of images,” explains Troyk. “But given the brain's ability to modify neural pathways and form new connections, patients might-after months of training-be able to integrate these points of light into nebulous forms, or even sharper images.”

One of the most exciting aspects of this project is to study how researchers can use a multichannel stimulation system, connected to the human cortex, to communicate information via a non-biological interface. Understanding how a multichannel cybernetic stimulation interface might exploit the eloquent neural machinery of cortex could significantly advance our fundamental knowledge of brain function. The multi-institutional team faces an ambitious agenda that is expected, one day, to culminate in brain implants of the IIT-developed visual prosthesis in human volunteers.
In the past decade, radiation therapy has undergone a revolution. Advances in treatment delivery equipment, imaging systems, and treatment planning capabilities have resulted in treatment fields becoming smaller and more tightly conformed to the tumor. These new treatments have become much more susceptible to errors in patient positioning, caused either by set-up errors or organ motion. There is an increasing need for imaging methods to identify the tumor volume within the patient before the treatment delivery.

Mark Anastasio, IIT Professor in the Biomedical Engineering Department, has teamed up with Daxin Shi (IIT), and Charles Pelizzari and Xiaochuan Pan (both of the University of Chicago) to research new technologies for radiation therapy. This research stems from an Educational and Research Initiative (ERIF) grant that Anastasio was awarded from IIT in 2001. This seed support led to advancements in the project, resulting in a one-year American Cancer Society-Illinois Division grant and subsequently a three-year Whitaker Foundation Biomedical Engineering research award and a two-year National Institutes of Health (NIH) award.

Radiation therapy conformally delivers a high radiation dose to the target volume that contains the cancerous tissue, while also minimizing the exposure of healthy tissues to damaging radiation. It is critically important that the exact position and orientation of the patient, or more specifically, the position of the tumor volume and radiation sensitive structures that surround it is known. If there are errors in the positioning of the patient, the effectiveness of the treatment may be degraded and an excessive radiation dose may be delivered to healthy tissues.

The team plans to develop and investigate dose-efficient tomographic imaging methods that will facilitate patient positioning verification in conformal radiation therapy treatments. They are developing and evaluating local tomography algorithms for reconstructing 2D and 3D images of a tumor volumes. Additionally, they are investigating the feasibility of reconstructing 2D and 3D images of a tumor volume using truncated projections that correspond to treatment beam orientations, and quantitatively and objectively evaluating the ability of the algorithms to reconstruct accurate and clinically useful tumor volume images.

For a list of other ERIF winners, see page 43.
Medical Imaging: A Productive Collaboration Between Three IIT Departments

Medical imaging is one of IIT’s most successful interdisciplinary research activities, bringing together researchers from the Biomedical Engineering Department, Electrical and Computer Engineering Department, and Biological, Chemical and Physical Sciences Department. Miles Wernick, IIT Professor, is fostering these efforts as Director of Medical Imaging. Other core faculty members include Professors Mark Anastasio, Konstantinos Arfanakis, and Yongyi Yang. The team collaborates with researchers throughout the United States, Canada, and Europe. Within the medical imaging group, Wernick and Yang work together as a team, along with Jovan Brankov and Ana Lukic. Their research encompasses a broad spectrum of medical-imaging fields, supported by six of the National Institutes of Health.

X-ray imaging. The group has developed a new imaging method called multiple-image radiography (MIR), which promises to replace conventional mammography. MIR produces amazingly detailed images, and may eliminate the need for painful breast compression during imaging. IIT is currently forming a company to commercialize MIR and related techniques.

Computer-aided diagnosis. The group is developing new computer aids to improve accuracy in diagnosing breast cancer, including a mammogram search engine that assists radiologists in their diagnoses by recalling relevant past cases from a database. The group is also developing computerized diagnostic methods that provide physicians with a “second opinion.”

Cardiac imaging. The cardiac stress test, a procedure for diagnosing heart disease, is based on an imaging method called SPECT, which produces low-quality images that are very difficult to interpret. The imaging group is developing new techniques, called 4D and 5D imaging, which greatly improve image quality and yield new information from these important tests.

Functional brain mapping. Medical imaging can now display changes in brain activity caused by normal thought processes, disease, or therapeutic drugs. Wernick and Yang are working on the sophisticated image-processing and data-mining methods needed to identify these patterns of brain activity. Wernick is currently involved in a commercial venture that uses imaging to help large pharmaceutical companies determine which new drugs are the most promising candidates for further investment.
The Department of Chemical and Environmental Engineering has received more than $9 million in research funding over the past five years, most recently from funding agencies, including the Particle Technology and Crystallization Center, Gas Technology Institute, and the Water Environment Research Foundation. The faculty members and researchers conduct numerous projects in the department’s core areas of research competency: air pollution and gas separation, biomedical and biochemical engineering, chemical process modeling, statistical monitoring and control; computational fluid dynamics and fluidization; electrochemical science and engineering; energy; food processing and safety; particle technology and crystallization; polymer science and engineering; waste remediation, wastewater treatment and water resources. Research Centers include the Energy + Power Center, Center for Electrochemical Science and Engineering, and the Center of Excellence in Polymer Science and Engineering.

Increasing environmental problems caused by fuel-emissions led Chemical and Environmental Engineering Professor Jai Prakash to pursue cleaner alternatives for fuel in the automobile industry. In 2003, he received funding from Argonne National Laboratory and the U.S. Department of Energy under FreedomCar, a government initiative to free automobiles from petroleum dependence and pollutant emissions, while giving Americans the freedom of choice among vehicles types and obtaining convenient and affordable fuel. Prakash’s work focuses on the use of Li-ion and Li-polymer batteries.

Lithium ion batteries possess high-energy density compared to other secondary batteries. Currently, the Li-ion batteries are being developed as power sources for electric vehicles to provide longer driving range, higher acceleration, and extensive lifetime. However, the primary challenge in designing an EV lithium ion battery is its safety under abusive as well as normal operating conditions. Under abusive conditions, or occasionally even under normal conditions (if internal shorts exist), Li-ion cells undergo thermal runaway producing exceedingly high temperatures, smoke, explosion and fire. Also, under certain conditions, the flash point of the electrolyte can be exceeded and Li-ion cell can be overheated, resulting in major safety problems. Thermal runaway and hence safety of the Li-ion cells is a direct consequence of the reversible (thermodynamic) and irreversible (polarization) processes occurring in the cell during cycling.

Research in Prakash's laboratories focuses on these issues by developing nonflammable electrolytes to ensure safety, and by carrying out thermal diagnostic studies of the baseline (Li-ion and Li-ion/gel-electrolyte) chemistry to understand the degradation, failure, and safety mechanisms.

Jai Prakash is currently working with a team that includes one post-doctoral fellow and six graduate students. The ultimate goal of their research is to achieve zero emissions from vehicles. Prakash explains, “Development of these batteries will help in cleaning the environmental pollution caused by automobile exhaust.” So far, their research has resulted in one patent in Nonflammable Electrolytes for Li-ion Batteries, over 15 research publications, three M.S. and four Ph.D. degrees.
Collaborating for Sustainable Energy

Three years ago, Professor Said Al-Hallaj put together IIT’s first renewable energy conference featuring speakers from around the world sharing developments in the areas of solar energy, wind turbines, hydrogen production, and fuel cells. In subsequent conferences, the level of awareness and interest in sustainable energy has grown among government officials, industrial attendees, and academics. As a result, Said has been asked to help the state of Illinois create strategies for an eventual hydrogen economy. Numerous companies have visited IIT to discuss opportunities for collaboration in everything from battery-powered dragsters to urban wind turbines and photovoltaic technology.

Said’s personal research interests include solution of thermal management problems in electrochemical systems, hydrogen generation and storage, fuel cell improvements, novel photovoltaic systems, wind energy, and energy-efficient transportation systems. IIT Interprofessional Projects (IPRO) and Entrepreneurial IPRO’s (or EnPRO) teams have helped solve real energy-related problems while increasing their understanding of the need to design for environmental responsibility. His graduate students are working on all phases of these technologies from basic research to the most practical aspects of connecting components into efficient integrated systems. In the area of photovoltaic technology, his group received a donation of intellectual property involving holographic concentration of the sun’s rays. They have developed improved techniques for manufacturing the solar modules, analyzed the architectural market for solar energy, and created an attractive business plan for commercializing their technology. A different group built an integrated system for collecting solar energy, generating and storing hydrogen, and finally powering an electric sign using a fuel cell.

A current project that combines technical challenge, fun, and public relations involves use of a lithium battery with IIT’s patented thermal management system in a four-wheel scooter of the type people with disabilities use for mobility. A local real estate developer who was working with Said on energy-efficient buildings donated the scooter after learning of the battery technology. An industrial executive whose teenage son wanted to build a solar vehicle began a discussion of potential collaboration, which eventually evolved to fuel cells. A fuel cell company whose senior executives visited Said’s laboratory volunteered a fuel cell for use in the project. Collaboration continues to be an essential part of sustainability.

“Said has been asked to help the state of Illinois create strategies for an eventual hydrogen economy.”

Research Highlights in Chemical and Environmental Engineering

H. Arastoopour
Fluidization of Nanoparticles
Funding from NJIT & NSF

A. Myerson
Particle Technology and Crystallization Research
Funding from PTCC

K. Pagilla
Sustainable Technology for Achieving Very Low Nitrogen and Phosphorus Effluents
Funding from WERF
Chicago-Kent
College of Law

Chicago-Kent College of Law has enjoyed a steady increase in research funding over the past five years, totaling more than $2 million. In the past year, funding agencies included the U.S. Department of Energy, National Science Foundation, Internal Revenue Service, U.S. Department of State, and the Law School Administration Council. Research and clinical training areas include the most extensive and comprehensive legal writing and research program and one of the largest in-house clinical programs in the United States. Research Centers include: Institute for Science, Law and Technology; Institute for Law and the Workplace; Institute for Law and the Humanities; the Justice Web Collaboratory; and the Illinois Technology Center.

ori Andrews, Professor of Law at Chicago-Kent College of Law, studies the impact of new medical technologies on individuals, families, communities, social institutions and society at large and then suggests social policies to deal with the benefits and risks of those technologies. “I view my work as similar to writing science fiction,” she says. “I try to figure out what sort of society we would have if one set of technologies, or one set of laws, were adopted versus another.”

Andrews is helping to set policy at the highest levels. She chaired the federal Working Group on the Ethical, Legal and Social Implications of the Human Genome Project. Federal agencies, such as the Centers for Disease Control, the Social Security Administration, the U.S. Department of Health and Human Services, and various presidential bioethics committees, have called upon her for aid. On the international level, she has advised the World Health Organization, the Science Ministers of 10 countries, the French Parliament, and the government of Dubai.

With funding from the National Institutes of Health, Andrews analyzed the impact of genetic testing on an individual’s self-concept, personal relationships, and relationships with social institutions. She identified gaps in legal protections for people who undergo genetic testing and suggested solutions, reported in her book, Future Perfect: Confronting Decisions About Genetics.

In collaboration with the Chicago Historical Society (CHS), Andrews and her team at the Institute for Science, Law, and Technology (ISLAT) at IIT tackled a challenging new application of genetics: the use of genetic testing and other biological analyses on the tissue of historical figures. Bioanalysis has been used to investigate historical figures’ behavior, disease, cause of death, and lineage. Albert Einstein’s brain tissue was analyzed to attempt to determine the source of his genius and Beethoven’s hair was analyzed to see if lead poisoning caused certain behaviors. Attempts were made to test Einstein’s brain to determine if he had a genetic predisposition to aneurysm and a proposal was made to test Abraham Lincoln’s blood or skeletal remains to determine if he had Marfan’s syndrome. Genetic analysis indicated that Thomas Jefferson may have fathered a child with his slave Sally Hemings. In some instances, though, such testing was done in violation of the express wishes of the individual before death or in a manner that did not follow proper scientific procedures.
With funding from the National Science Foundation, the ISLAT and CHS group analyzed the problems and promises of previous instances of biohistory, the scientific technologies involved, the social impact of the analyses, and the existing legal and professional guidelines covering such testing. They suggested guidelines for such testing in “Constructing Ethical Guidelines for Biohistory,” 304 Science 215 (April 9, 2004).

Chicago-Kent Professor Tim Holbrook and ISLAT research fellows Jordan Paradise and Laurie Rosenow have teamed with Andrews in an extensive multi-year research project on gene patents. Funded by the U.S. Department of Energy and the Robert Wood Johnson Foundation, the group is assessing the impact of gene patents on health care and on medical research. Unlike a patent on an invention, a patent on a gene provides the holder with a monopoly over basic scientific information – the sequence of the gene. The patent holder can then preclude anyone else from using that gene in any way, including diagnosing genetic diseases in patients and undertaking research for a gene therapy to cure the disease. The ISLAT team has found considerable evidence that gene patent claims have been granted by the U.S. Patent and Trademark Office in ways that violate existing patent law. They have also found evidence that gene patents hamper health care and research. The team is now developing policy alternatives to remedy the problems.

Andrews has seen evidence of a biological revolution that makes the industrial revolution look mild. “Ours is going to be the generation that decides: Will we live among cloned human beings? Watch sports played by genetically enhanced athletes? Use prenatal screening as admission standards for birth?” she says. With bioethicist Nigel Cameron, she brought together leaders of the pro-life and pro-choice movement with the idea of putting the abortion issue aside and discussing human cloning, genetic discrimination, gene patents, assisted reproductive technologies, germline genetic interventions, and nanotechnology. That effort led to the formation of the Institute for Biotechnology and the Human Future at IIT. The U.S. Congress voted an appropriation to the new institute to serve as a clearinghouse and policy think tank on these pressing social issues.
The main research areas in the Department of Civil and Architectural Engineering are structural, architectural, geotechnical and geoenvironmental engineering, construction engineering and management, transportation engineering and public works and architectural engineering, including acoustics and building energy concepts. Faculty members conduct a vigorous program of research in cooperation with the Illinois Transportation Research Center. Research facilities include laboratories devoted to concrete structures, structural models, metal structures, materials, architectural engineering, geotechnical engineering, transportation engineering, and construction engineering and management. In addition, researchers have access to the extensive on-campus facilities of the IIT Research Institute and the Argonne National Laboratory nearby. The department has a computer-aided engineering and design lab equipped with state-of-the-art hardware and software. The department has received more than $300,000 in research awards during the past five years.

Many state agencies, including the Illinois Department of Transportation (IDOT), are shifting toward nighttime construction because it lessens the impact of construction operations on the traveling public, shortens the duration of construction operations, and reduces interruptions to construction activities. But nighttime construction operations may be more hazardous for both drivers and construction personnel because of visibility problems at nighttime.

Professors David Arditi and Jonathan Shi, and Research Assistants Mehmet Ayrancioglu and Dong-Eun Lee received funding from the Illinois Transportation Research Center (ITRC) to study the effects of nighttime construction conditions on worker safety. Through the study of statistics provided by the National Highway Traffic Safety Administration’s Fatality Analysis Reporting System (FARS) and by seeking the experiences of IDOT personnel across the nation, the types of high-visibility garments used by construction workers and IDOT personnel on Illinois highway projects as well as those used in other states were surveyed.

“The performance of six high-visibility vests was investigated, not in a laboratory setting but on actual construction/maintenance sites involving different lighting, traffic, and weather conditions,” explains Arditi. “Potential users’ perceptions concerning the performance of these six safety vests were also collected through a questionnaire survey.”

“The study shows that safety does not seem to be any more of a problem in nighttime than in daytime works. Most nighttime accidents involve workers struck by through traffic inside the work area as well as workers struck by construction equipment inside the work area. The
The main reason for nighttime accidents is perceived to be the condition of vehicle operators, with poor lighting condition being the second most common reason. For these reasons, investigating visibility issues associated with safety garments at nighttime is crucial.

Through their research, Arditi and Shi took measurements of mean luminance values of the front faces and sides of six commonly used safety vests and the users perceptions of which vests were superior. Their findings supported IDOT’s recent decision to make one of the highest-testing vests mandatory in highway construction/maintenance works performed in Illinois.

Sound Energy Research

Professor Ralph Muehleisen is researching a variety of topics in architectural and physical acoustics, including Acoustic Radiosity, Thermoacoustic Heat Engines and Refrigerators, Measurement of the Acoustic Properties of Porous Media and Photoacoustic Gas Detectors.

Acoustic Radiosity is a new method of computing sound fields in diffuse enclosures (rooms) based on overall acoustic energy transfer between surfaces. It is an acoustic analog of the radiosity (also known as luminous flux transfer method) that is used in rendering of computer graphics and illumination engineering. Thermoacoustic heat engines convert heat energy to sound and thermoooustic refrigerators use sound energy to move heat. Thermoacoustic devices have no moving parts for high reliability and use environmentally friendly noble gases to replace the hazardous chemicals used in conventional refrigerators. Photoacoustic gas detectors measure the optical absorption of gas from the sound waves generated during optical absorption. These devices will allow for high-sensitivity (ppb to ppm) gas analyzers that are inexpensive, rugged, and portable.

David Arditi and Jonathon Shi, Professors of Civil and Architectural Engineering
Information Retrieval Research

Information overload is a problem of the 21st century and search technology is being used everywhere in an attempt to organize it. People search for information on the Internet and organizations rely on search technology to support their processing. The efforts of Ophir Frieder, IIT Professor of Computer Science, and his research team of colleagues and students are supporting these and other applications through their information retrieval research. Ophir states, “I have always believed that search technology is crucial to the well-being of individuals and organizations. Current search technology does not adequately address their needs.”

Just five years ago, Frieder’s team was empty-handed, and since then, because of combined funding from the National Science Foundation, National Institutes of Health, AOL, BitSystems, Lockheed Martin, U. S. Army, and IITRI (now AlionScience), have built an internationally renowned lab at IIT, one of the few dedicated next generation search labs. It is called the Information Retrieval Laboratory (IR Lab), and the majority of the research focuses on scalable, next-generation search technology. The development of such technology involves the design of efficient methods to ingest data from multiple sources, and to search and retrieve results from both English and foreign language document collections and from collections comprised of multiple data types. These methods must also harness high-performance computer technology, and accurately answer user questions. The IR Lab has developed several scalable systems and has transferred or licensed the technology to both the commercial and governmental sectors where the technology is regularly used.

Over the years, the IR Lab has also developed a search engine called AIRE that is now in daily use by companies and universities alike. AIRE is annually evaluated using the National Institute of Standards and Technology benchmarks in an international evaluation forum called TREC. The AIRE system is consistently ranked among the top search systems worldwide.

Recently, IR Lab members expanded the AIRE search capability to support the searching of document collections authored in Arabic by an English-speaking user who is interested in searching a collection of documents written in Arabic. The user provides AIRE with a query written in English, the AIRE system translates the requests into Arabic, searches the collection and indicates which Arabic documents are relevant. Such a
system is called an English-Arabic Cross Lingual Information Retrieval system. The advantage of using such a system over simply translating the entire collection is that the translation of large volumes of documents is time prohibitive. By translating only relevant documents after a search, users are provided with accurate responses within acceptable periods of time.

Among their achievements is the successful transfer of their technology to world renowned organizations, such as the National Institutes of Health, AOL, NCR, MCI, Northrop Grumman, Harris Corporation, BitSystems, and many others. They have also collaborated with or directly influenced the work of many leading researchers from top institutions worldwide such as ETH Zurich, University of Tokyo, The Technion, University of California Santa Barbara, George Washington University, and the University of Illinois Chicago.

Frieder expects that the IR Lab will improve state-of-the-art search. “Currently, people think Google has solved the world’s search problems when in fact people in most organizations still spend countless hours searching for information. They search their e-mail, their local databases, their large systems, etc.,” he explains. “We develop technology that allows users to pose questions to and receive answers from any data repository independent of the data type, data volume, or data location.”

---

Research Highlights in Computer Science

**O. Frieder**
“Using a Relational Database to Implement XML-QL: Phase IV”
Funding from Bit Systems Inc.

**C. Hood**
“CAREER: An Infrastructure for Multi-Technology Network Fault Management”
Funding from NSF

**J. Lan**
“IxUPP: Network Performance Predicting and Scheduling for Grid Computing”
Funding from IXIA

**R. Orlandic**
“Design of a Scalable Database Architecture for Scientific Simulations”
Funding from ANL

**X. Sun**
“Collaborative Research: DOT - Distributed Optical Testbed to Facilitate the Development of Techniques for Efficient Execution of Distributed Applications”
Funding from ANL, Northwestern University, and NSF
Development of a Data Engine for Grid-Enabled Analytical Computing

Professor of Computer Science Ratko Orlandic has received funding from the National Science Foundation to research the problems of scale in the management of persistent data, as well as the basic framework for this research, under the auspices of a U. S. Department of Energy grant on which he was a co-principal investigator.

His research is directly related to the problem often referred to as “massive data,” which deals with issues such as the ever-increasing volumes and dimensionalities of data, as well as the currently limited ability to understand and make use of these data. The objective of Orlandic’s research is to support the infrastructure for scientific/analytical computing by developing new and original techniques for efficient storage, retrieval, and analysis of multi-dimensional data. Orlandic and his Ph.D. students are also developing a prototype of a scalable data engine for these environments.

Keys to the realization of the project are the advances in the areas of searching and clustering data in multi-dimensional spaces. The teams’ solutions will be able to operate in high-dimensional spaces (e.g., with tens or hundreds of dimensions) without implicit or explicit dimensionality reduction approaches of current techniques. The solutions will be appropriate in low-dimensional spaces and in conjunction with dimensionality reduction, but their advantages will be more pronounced in spaces with many dimensions.

When asked what inspired this research, Orlandic responded, “My belief that science should be responsive to the time when it is conducted. This research certainly is.” So far, the team has developed and studied several new multi-dimensional indexing techniques, developed and partially studied an original clustering technique, and designed and partially developed a new method for similarity searching. They have designed the engine as well. Based on the results for the techniques studied so far, Orlandic believes they already have or will have something unique and practical in each of these areas.
Pervasive Computing Research: Cross Network Service

With the advance of mobile computing and wireless communication technologies, pervasive computing has emerged as a feasible technology for “human-centered” computing. New challenges of pervasive computing include mobility (computing mobility, network mobility, and user mobility), context awareness (smartness), and cross-platform service. Through funding from that National Science Foundation and the U. S. Department of Energy, and in collaboration and sponsorship with Lucent technologies and Motorola, IIT Professor Xian-He Sun is working to overcome these challenges with the Scalable Computing Laboratory.

Sun and his students have developed the “cross network (phone network and internet) service” mechanism, allowing the Internet to share the reliability of the phone system, while the phone system shares the functionality of the Internet. Applications of the crossing-network service include surveillance (monitor landline phone on computer in addition to monitor cell phone), disaster relief (blocked wireless phone calls can be sent through instant message or a landline call— as the New York blackout indicates, this function is very useful), and increased user experience. The Chicago Sun-Times calls his work in cross-network service as turning “POTS (plain Old Telephone service) into PANS (Pretty Amazing New Stuff), moving (landline) phone into the Internet loop.”

A prototype context-aware supporting system, Scarlet, has successfully been developed by Sun’s research group. Scarlet collects and supplies context information. It can run on different hardware and software systems, add in new services and new applications easily, and work well on large or small devices. Applications of Scarlet include identifying location inside buildings, and providing services anywhere, anytime.

Beyond the laboratory, Sun has introduced the concept of Pervasive Computing to both graduate and undergraduate students at IIT through a research course “Pervasive Computing and Web Services” and an Interprofessional Project (IPRO) called “Application of Pervasive Computing.”
Hybrid Electric Vehicles: Building Better Transportation

With soaring gas prices and concerns about pollution, many automobile owners are seeking alternative transportation. Through financial support by the industrial affiliates program of the Grainger Power Electronics and Motor Drives Laboratory, research is being conducted by the IIT Consortium on Advanced Automotive Systems (ICAAS), led by Ali Emadi, professor in the Electrical and Computer Engineering Department at IIT, and a team of graduate students, Srdjan M. Lukic, Sheldon S. Williamson, and Fernando Rodriguez.

“The main goal of our research is to improve fuel economy and performance as well as to reduce emissions of automobiles by hybridizing them,” explains Emadi. “If the fuel economy of a conventional car is 30 miles per gallon (mpg), the fuel economy of a hybrid electric car can reach up to and beyond 80 mpg.”

“We expect to be the leader in integrated education and research in the areas of automotive power electronics and motor drives.”

Hybrid electric vehicles (HEVs) have proved to be the most practical solution in reaching high fuel economy as well as low emissions. However, there is no standard solution for the optimal size or ratio of the internal combustion engine and the electrical traction system. The optimum choice includes complex trade-offs between the heat engine and electric propulsion system against cost, fuel economy, and performance. Each component, as well as the overall system, has to be optimized to give optimal performance and durability at a low price.

The team was inspired to conduct this research after noticing the huge trend in the automotive industry to use more and more electrical systems instead of conventional mechanical and hydraulic systems. This has become more popular to improve fuel economy and performance and also for luxury loads which are mostly electric. Emadi explains,
“By 2010, even if 20 percent of this huge market goes to electric/electronic components in cars, that is just huge. This is like an ocean of opportunity.”

There are not many electrical engineers understanding these increasingly complicated automotive systems. There are also not many researchers working in the areas of automotive electrical/electronic systems. Emadi’s team is positioning themselves to lead and address these needs.

“We have obtained the optimized hybridization level through our comprehensive modeling tool, which has uniquely been developed at IIT for precise and complete simultaneous simulation of mechanical, hydraulic, magnetic, electrical, and chemical subsystems of a hybrid electric vehicle,” Emadi explains. “This was done while considering full vehicle dynamics, fuel consumption, system level issues, and driving conditions.”

IIT’s multi-disciplinary project team believes this is the first time a comprehensive approach for modeling, simulation, design, optimization, and model validation of hybrid electric vehicles is presented with applicability to military and civilian vehicles. This, in turn, will assist the automotive industry and government agencies in making reliable procurement and acquisition decisions for hybridized vehicles.

The team has already published several books, conference papers, and journal papers as well as conducted seminars. They have even offered short courses in Vehicular Power Systems and Industrial Applications of Power Electronics and Motor Drives. Confident of their progress, Emadi states, “We expect to be the leader in integrated education and research in the areas of automotive power electronics and motor drives.”
Ion Channels as Natural Nanodevices

Ion channels control a wide range of biological functions, including neuronal communication, muscle contraction, hormone secretion, and food intake. Furthermore, recent developments in solid-state microelectronics will soon allow for the design of a class of hybrid monolithic bio-electronic devices, such as bio-sensors and bio-processors, based on the selective nature of ion channels, and on the processing capabilities of solid-state electron devices. The main benefit of bio-sensors and bio-processors to society is better insight into human and animal diseases caused by defective ion channel function. A short list could include generalized epilepsy with febrile seizures, myotonic muscular dystrophy, and cystic fibrosis. Ion channels also play a key role in viral replication, for example in the type A influenza virus.

The understanding of the mechanisms of permeation (electro-diffusion of ions through channels) and gating (regulation of permeation through conformational changes of the channel) will help to explain the selective nature of ion channels, and the detail of their biological action. Given the large fraction of drugs acting on channels, the pharmacological implication of this research will be powerful. If successful, this work will also be an important contribution to genomics, for a large fraction of the human genome provides codes for channel and membrane transport proteins.

“The main benefit of bio-sensors and bio-processors to society is better insight into human and animal diseases caused by defective ion channel function.”

The objective of the current research project, funded by DARPA, is the design and realization of a new family of bio-devices based on biologic ion channels and silicon technology. The proposed devices will be the building block of an innovative process that integrates the biological functions of ion channels with the high sensitivity, low noise and in-situ signal processing capabilities of solid-state nanoelectronics. A novel layout is being realized, in which a lipid membrane is deposited on a
silicon microfluidic cell. The cell design will allow low-noise measurements of the ionic currents flowing through one or more ion channels inserted in the membrane.

The interdisciplinary nature of the project required a scientifically diverse group of researchers, including both experimentalists and theoreticians. The following four researchers compose the research team: Robert Eisenberg, chairman of the Molecular Biophysics Department of Rush University; Stephen Goodnick, chairman of the Electrical Engineering Department of Arizona State University; Marco Saraniti, the investigator at IIT; and Trevor Thornton, a device physicist with more than 15 years experience in fabricating and characterizing semiconductor nanostructures.

The research will allow the practical realization of the potential of detectors based on biological structures. Devices fabricated with this new technological process can, and will, integrate ligand-gated channels made of specifically designed mutants of natural proteins. In this way, an unprecedented sensitivity and selectivity will be achieved by interfacing the man-made integrated electronics circuitry with the extremely sophisticated functionality offered by natural ion channels. In other words, this research program aims to implement complex biological functions within an innovative and highly controllable hybrid device.

The feasibility phase of the research was successful. Several components of the biosensor have been designed and implemented. Lipid bilayers have been deposited on the solid-state substrate of the sensor, and ion channels have been inserted in the lipid membrane. Single-channel recording of ionic current flowing down the channels have been performed as well. An accurate electrical characterization of the whole assembly is currently being performed.

Electric Power Systems

IIT has long maintained high quality education and research programs in Electric Power and Energy Systems. In 2001, the Electric Power and Power Electronic Center (EPPEC) was created under the leadership of Professor Mohammad Shahidehpour. The mission of the EPPEC is to make a leading contribution to the cause of ensuring that the nation continues to enjoy a reliable and economic supply of electricity, while meeting the new challenges of pollution prevention and reduction, restructuring and competition, and infrastructural inadequacies.

The electric power industry remains in the midst of a major restructuring process in which electricity is traded as a commodity. Electricity is a $200 billion per year market, which makes it the largest commodity market in the United States. In addition, the blackout on August 14, 2003, in which 50 million US and Canadian customers lost power, reminded us that the interconnected electric power grid is critical infrastructure and difficult to control.

In response to the electric industry restructuring, new phenomena, new circumstances, and new risks, the EPPEC has contributed to the state-of-the-art in the following areas:

- Integrating Distributed Resources in Restructured Power Systems
- Distributed and Hierarchical Control of Electric Power Systems
- Parallel Agents Theory for Transmission Congestion Management
- Advanced Forecasting Techniques for Electricity, Load Demand and Gas
- Reliability Centered Maintenance in Electric Power Systems
- Arbitrage in Electricity Markets
- Asset Valuation and Risk Analysis
- Power Markets and Game Theory
- Hydroelectric Optimization in Developing Countries
- Agent Based Optimization in Electric Power systems
- Dynamic Generation Scheduling in Autonomous Power Systems
- Transfer Capability Studies of 100,000 Bus Power Systems
- Fast And Accurate Contingency Screening with respect to Voltage Collapse
- Parallel Simulation of Power System Behavior via Message-Passing Techniques on Distributed-Memory Compute Clusters
The Institute of Psychology has received more than $1 million in research funding in 2003, and over $6 million during the past five years. Research areas include clinical, rehabilitation, and industrial/organizational psychology, as well as human resource development. Psychology faculty and students collaborate on applied research projects through the Center for Research and Service. Facilities include laboratories for human behavioral assessment studies, psychophysiological research, infant and maternal attachment research, and testing and interviewing laboratories with one-way mirror viewing. The University Center for Disability Resources is housed within the Institute of Psychology. Many journals and databases are available online.

The federal government has issued several warnings as well as sponsored many public service announcements on the dangers of overeating and maintaining a sedentary lifestyle (e.g. the “cheeseburger bill”). Recent studies by the government have revealed that overeating could soon replace smoking as the No. 1 preventable cause of death and that an alarming two out of three adults and 9 million children are overweight or obese.

In response to these urgent issues, Tamara Sher, Professor of Health Psychology at the Institute of Psychology, is conducting a study that takes a “couples” approach to the issue of reducing cardiac risk. She received an initial $2.4 million grant from the National Heart, Lung and Blood Institute of the National Institutes of Health, and has received several follow-up grants. Her goal is to determine if improved interpersonal relations can result in sustained health behavior change, improved quality of life and tangible health benefits for cardiac patients. The research encompasses psychology, medicine, nutrition and exercise physiology and is being conducted by Sher and several researchers from Rush-Presbyterian-St. Luke’s Medical Center.

“Like the governmental focus, the goal of this project is to help people lose weight, become more active, and take lipid-lowering medications when necessary to promote longer life and better health.”

Although her research focuses on behavior change within a medical population, and thus takes a secondary prevention approach, it highlights the difficulties inherent with behavior change generally, and takes an environmental approach to encouraging these changes. Sher explains, “Like the governmental focus, the goal of this project is to help people lose weight, become more active, and take lipid-lowering medications when necessary to promote longer life and better health.”
Long-term maintenance of behavioral change to reduce health risk factors is essential to producing a positive effect on medical outcomes. This study examines whether an ongoing, long-term relationship can be used to help patients diagnosed with coronary artery disease adhere to a risk-reducing behavioral intervention and maintain healthy behavioral changes. “I have had an ongoing interest in couples, behavior change, and illness,” Sher states. “All three interests came together nicely in this research opportunity.”

The intervention takes the form of group meetings for 18 sessions over a six-month period. Study participants are assigned to either an individuals (patients focused) group, or a couples group for education and skills training. Both groups receive diet counseling, cardiac rehabilitation and exercise guidelines, and education about their medication and medication adherence strategies, as well as information to enhance their adherence to recommended behavioral changes. The intervention is focused on making and maintaining behavior change, as well as relationship issues for the couples group, and is followed up by comparing the changes in diet/nutrition, exercise/activity levels and adherence to lipid-lowering medication, between the two groups.

Although data analysis is in process, and participants are still continuing through the intervention, preliminary analyses have revealed that patients are able to increase their activity levels and take their medication according to their prescriptions following our intervention. Partners are also able to increase their activity levels following the intervention, regardless of whether or not the patients were assigned to the couples group or the individuals group. Patients are making important nutritional changes, and maintaining these changes for six months after the end of the intervention. Furthermore, for people who begin the study depressed, the intervention reduces their levels of depression and for people who begin the study with relationship-distress, the intervention increases their levels of satisfaction into the non-distressed range.
The Department of Mathematics and Science Education at IIT is recruiting science teachers for participation in year five of Project ICAN, a five-year teacher enhancement grant funded by the National Science Foundation.

Scientific inquiry and nature of science provide a meaningful foundation for the learning of science subject matter, not to mention their inclusion in the Illinois Learning Standards. Current national and state reforms stress student understanding of scientific inquiry and nature of science, yet these skills and concepts are difficult for teachers to incorporate into the classroom without an understanding of the development of scientific knowledge and support for translating this knowledge into effective instruction and assessment. As participants from the first four years of the project can attest, Project ICAN empowers teachers to do just that. One participant states, “This experience will impact my teaching because I’ll be able to bring a more realistic view of science into my classroom.”

Beginning in July 2002, teachers participated in a two-week summer workshop at IIT. In the fall, ICAN hosted monthly workshops throughout the academic year. Workshops focused on disciplinary knowledge, scientific inquiry, the nature of science, pedagogical knowledge, skills related to scientific inquiry, leadership skills, and the development of performance-based assessments for scientific inquiry and nature of science.

Project ICAN activities have included: engagement in authentic scientific investigations under the guidance of practicing research scientists; working with scientist mentors and ICAN project staff to design and implement inquiry-based projects and activities appropriate for your own classrooms; “Field test” creation of instructional materials with local area students; and ICAN project staff visits to classrooms to support teachers in their implementation of ICAN generated instructional materials.

Project ICAN has also provided stipends and course credit. Summer Institute Stipends: $100 daily; Academic Year Workshop Stipends: $100 daily. Graduate credits and continuing education credits are available.
First Annual Workshop on NSF’s Research Experience for Teachers Program

In September of 2003, IIT hosted a workshop to familiarize both principal investigators and high school and community college teachers with NSF’s Research Experience for Teachers Program. The program supports the active involvement of K-12 teachers and community college faculty in engineering research in order to bring knowledge of engineering and technological innovation into their classrooms. This one-on-one interaction allowed participants to match common teaching and research interests, and to initiate a partnership that could lead to the funding of the teacher or community college faculty to participate in a research experience in that researcher’s laboratory.

The workshop was attended by nearly 200 enthusiastic teachers. Approximately 50 principal investigators from Chicago area and midwest universities also attended. The teachers represented several public and private schools from the City of Chicago and the surrounding suburbs. The principal investigators represented: IIT, Northwestern University, University of Illinois Chicago, University of Illinois Urbana-Champaign, University of Wisconsin Madison, Illinois State University, Southern Illinois University, and Northern Illinois University.

Program managers from NSF, faculty members from IIT, Northwestern University, John Hopkins University, Vanderbilt University and Loyola Marymount University made presentations and organized breakout sessions at the workshop.

The workshop ended with a poster session, where the teachers visited booths set up by the principal investigators who highlighted their current research. Before leaving, teachers filled out forms indicating the name of the principal investigator with whom they were interested in working.

Upcoming RET Workshops

IIT plans to continue strengthening this bond between principal investigators and teachers. During the summer of 2004, IIT is hosting an RET site funded by NSF to establish partnerships among IIT researchers and Chicago area (K-12 or community college) teachers with the following objectives:

- Engage ten K-14 teachers for eight weeks in ongoing IIT research projects.
- Create educational modules for use in K-14 teaching environments.
- Train an additional 30 teachers during a weeklong workshop to use the educational modules.
- Develop a deeper understanding of engineering and technological innovation in K-14 students.
The accurate assessment and prediction of the dispersion of contaminants with a limited amount of resources is crucial to environmental management and policy, as well as the national defense against potential biological or chemical threats. After the terrorist attacks on the World Trade Center in September 2001, the national awareness of potential terrorist threats has undergone a significant change.

Researchers from IIT’s Department of Mechanical, Materials and Aerospace Engineering at IIT, have teamed up to develop technologies that will detect biological contaminants quickly and locate the source of attack at a faster rate, while using a smaller amount of resources. The research team includes Dietmar Rempfer, Candace Wark, Kevin Cassel, Herek Clack, and Jamal Yagoobi. They have received funding through the Office of Naval Research grant from the U.S. Department of Defense, based on preliminary results from an IIT EIRF grant.

The general goal of this project (which is an integrated element of an IIT initiative on Rapid Detection and Response Systems for Bio-Defense) is to develop methods for designing sensor networks and identifying the location of each sensor in order to both predict the dispersive spread of contaminants in the atmosphere, and to determine the source of contaminants once they are detected. The research work includes computational studies, wind-tunnel experiments and eventually field studies.

As a first step, the team's approach has been validated using a computational data set that was provided by Dr. Sang-Mi Lee of the Department of Civil and Environmental Engineering at Arizona State University. In future work, the turbulent flow over some modestly complex terrain, modeling a typical subset of an urban landscape, will be studied in wind-tunnel experiments.

There are two critical issues that the group must address. It must be possible to solve the dispersion problem with adequate accuracy, even in the presence of complex boundary conditions (such as a metropolitan area, or landscapes with trees and buildings). Also, the number and complexity of the sensors that are needed to provide the data for prediction and source location has to be kept as small as possible.
The Fluid Dynamics Research Center (FDRC), located in IIT’s Mechanical, Materials and Aerospace Engineering Department, was established in 1985 to continue the tradition of research in fluid dynamics begun by the pioneering work of Professors Mark Morkovin and Andrew Fejer carried out at IIT in the 1960s. The center’s researchers have established a tradition of excellence in research, particularly through the use of advanced experimental techniques, in areas such as flow control, unsteady aerodynamics, fluid-structure interaction, turbulence, hydrodynamic stability and aeroacoustics.

In 1986, the FDRC was chosen as one of three National Centers of Excellence by the Air Force Office of Scientific Research. The center maintains several wind tunnels, jet facilities, water channels, and a new research quality axial flow compressor. In recent years, the Center has established expertise in computational fluid dynamics (CFD) to complement its strengths in experimental research, and it has partnered increasingly with industry to augment its traditional base of funding through U.S. Department of Defense agencies.

Notable accomplishments in the last year include:
- The first full-scale demonstration of micro-active flow control on a tilt-rotor aircraft.
- Patents awarded for novel actuator devices in the aerospace field and a revolutionary new spirometer for diagnosing pulmonary disease.
- Innovative numerical and experimental approaches to modeling contaminant dispersion through urban areas, impacting homeland security.
- Demonstration of new flow control techniques to improve aircraft engine efficiency.
- Computational fluid dynamics simulations of flow in a muon beam ionization cooler, which is part of a multi-disciplinary collaboration with Argonne and Fermi Lab.

The center is directed by David Williams, Professor of Mechanical and Aerospace Engineering. Faculty members include: Kevin Cassel, Hassan Nagib, Ganesh Raman, Dietmar Rempfer, and Candace Wark. The FDRC team also includes 35 graduate and undergraduate students. All work together in eight laboratories on IIT’s main campus.
The Stuart Graduate School of Business is one of only 36 AACSB-accredited business schools worldwide that is focused exclusively on graduate-level education. In addition to its scholarly and teaching activities, faculty members are consultants to major national and international corporations. Their expertise has been called upon by local and federal government agencies, including the Environmental Protection Agency, National Institute of Standards and Technology, NASA, Metropolitan Sanitary District, U.S. Department of Housing and Urban Development, U.S. Department of Defense, U.S. Department of Agriculture, and U.S. Department of Energy. The Quantitative Research Lab, at the Stuart Graduate School of Business, provides an interactive learning environment, featuring simulated trading, investment analysis and financial industry databases. During 2003, more than $100,000 in research funds was received from agencies such as the U.S. Environmental Protection Agency, NASA, the City of Chicago, and Gas Technology Institute.

Metrics of Technology Transfer at the National Aeronautics and Space Administration

Stimulating the economy, increasing competition within the private sector, promoting innovation and creativity are all among the many benefits of NASA’s technology transfer program. In the past two years, the Office of Management and Budget (OMB), Executive Office of the President, has enforced a rigorous review of contributions being made by government agencies to the national well being (GPRA), particularly in the area of technology. A requirement by the OMB calls for a well-designed and effective mode of measuring the ways and means by which agencies, such as NASA, actually contribute to the national economic and social agenda.

As budgets become more restricted, there is now an urgent need to develop measures of utilization that allow for a better model of allocation of government resources. Therefore, the need for metrics is crucial. Eliezer Geisler, Professor at the IIT Stuart Graduate School of Business, is working with a team of researchers to develop a model of metrics to improve technology transfer at NASA. The research is based on Geisler’s work in various technology organizations, spanning over two decades, and including major government laboratories, such as the U.S. Department of Defense and U.S. Department of Energy.

Geisler’s team is developing a model of metrics of technology transfer that will allow NASA to better direct its effort at transfer and commercialization. The team includes Geisler, as Principal Investigator, and research assistants, Chris Turitto and Darcy Lewis. The funding received was a research grant from NASA, channeled through the Logistics Management Institute. This was a first-step grant to examine the feasibility of the larger study and analyze the report produced by NASA’s internal technology transfer team. Currently, the team also has a larger proposal under review by the agency, which should extend the research even further.

The research was aimed at a review of current practices at NASA of measuring the impacts of the Research & Development conducted by the agency, and the degree to which it transferred the outcomes to itself, other government agencies, academia, and industry. Once the review was completed, the researchers were asked to propose more effective ways to monitor and measure such technology transfer. Geisler’s team proposed a novel model of creating and using metrics of technology transfer.
Management of Medical Technology

Healthcare delivery is an important and challenging social-economic issues of national magnitude. The runaway costs of health care and the major transformation it has undergone in the past decade have contributed to its critical position in policy making and industrial significance. Health care consumes more than 15 percent of the country’s domestic national product.

An integral component of healthcare delivery is medical technology. The role that medical technology plays in the efficiency and economics of healthcare delivery is currently widely considered to be crucial. Recent statistics suggest that some 18-20 percent of the cost of healthcare delivery can be attributed to medical technology. But it is the management of such technology that has recently become a most important area that needs to be explored.

In recent years, Elie Geisler, Professor at the Stuart Graduate School of Business, and his colleagues pioneered the field of management, medicine, and technology. Geisler spearheaded the creation of this area of study. He co-authored the major textbook in this new and exciting academic field, and published several special issues in scientific journals. He also completed a comprehensive study of the management of medical technology in U.S. hospitals and medical centers. He chaired several symposia on the topic and has been instrumental in the creation of at least one dedicated scientific journal.

Geisler established the Center for Management of Medical Technology (CMMT) in 2003 at IIT. The center is dedicated to research, education and dissemination knowledge in the management of medical technology. Among its research activities, the center sponsored the Second International Conference on Management of Healthcare and Medical Technology. Through the CMMT, graduate students have had the opportunity to work with hospitals in the area, particularly Mount Sinai Hospital, in examining problems of efficient utilization of resources. For example, they worked on a system for allocation of nursing personnel.

The CMMT is also studying the adoption of medical and healthcare technology, including information technology, on a nationwide sample of hospitals. The study is investigating the impacts of adoption and implementation of such technologies.
Technology Commercialization

Resources

As IIT’s emphasis on the quality and quantity of sponsored research has increased over the past five years, so has its focus on commercializing the resulting technologies. The basic research at IIT has generated new knowledge that is being converted to products that serve the public. Through the efforts of undergraduate students on IIT Interprofessional Projects (IPRO) and Entrepreneurial IPROs (EnPRO), teams, faculty members are finding a source of expertise in converting lab curiosities into prototypes, early-stage ideas into defensible value propositions, and non-specific future applications into focused business plans. A network of alumni and interested friends is growing as a source of business acumen, industry contacts, and practical wisdom so valuable to an early-stage business. Staff members such as Dennis Roberson, Jay Fisher, Tom Jacobius, Myron Gottlieb, and Bob Anderson bring more than a century of cumulative high-tech business experience, which is available to any in the IIT family who feel the urge to start their own businesses.

Undergraduate programs, courses, and activities in entrepreneurship, creativity, invention, and leadership are identifying future leaders in the business startup arena and providing them with a taste of the thrills and disappointments of being personally responsible for a business success or failure. Increasingly, Stuart School of Business faculty such as George Kalidonis and David Pistrui are integrating their activities with those of IIT’s main campus.

Existing Companies with Management Teams, Business Plans, and Strategic Vision

All Cell Technologies LLC
Basic research in IIT’s Center for Electrochemical Science and Engineering led to an understanding of the potential and the limitations of lithium ion batteries to deliver portable energy with lower weight and space requirements. Many people are familiar with applications in our cell phones and portable computers, and are also familiar with the heat released by the battery. Extending the performance benefits to transportation vehicles such as scooters, wheelchairs, motorbikes, city electric vehicles, fleet electric vehicles, and eventually hybrid electric vehicles required solution of the heat problem. Professors Rob Selman and Said Al-Hallaj received a patent for their solution. IIT licensed this patent to a startup company, All Cell Technologies LLC, which is currently involved in commercializing the technology. IIT will benefit from the success of this venture from royalties and from equity participation in the company. IPRO and EnPRO teams have gained valuable experience in solving the problems of taking new ideas to market.

Intranet Mediator, Inc.
Computer Science professors Ophir Frieder and David Grossman have also gained valuable assistance from IPRO and EnPRO teams in converting a patent for a new data-warehousing tool into a product that is “ready for prime time.” The proliferation of information managed by large organizations is becoming even more complex as they store not only structured information such as customer contact information, but unstructured information such as pictures, movies, recordings, and text. An experienced entrepreneur and business executive, IIT alumnus Larry Kane, has agreed to start up a business to commercialize this technology under license from IIT. Preliminary demonstration of the capability of the mediator in retrieving information from a number of IIT databases confirmed performance capability. The company is currently looking for a demonstration site to confirm the value of improved information retrieval capability in a corporate environment.

DEI Technologies LLC
IIT, colleagues from other universities, and national laboratories demonstrated a new way to extract information from x-rays used to diagnose cancer and diseases or damage in soft tissue such as cartilage and tendons. Currently the technology is applicable only to synchrotrons, which are available only in national labs. Experienced entrepreneur, Leonard Stark, is working to turn this into a commercial reality.
Almost Ready for an Entrepreneur to Take Hold and Build a Business

**Spirometer**
Professors David Williams and Kevin Meade and graduate student Nicole Wilson have received a patent for an improved device to measure lung capacity in patients with asthma and related lung diseases. Benefits include portability, cost reduction, and more precise measurement.

**Solid state shear extrusion**
Professor Hamid Arastoopour and colleagues have developed patented technology for recycling tires, scrap rubber, and plastics such as polyethylene. While competitive technologies exist for size reduction, the IIT technology has the benefit of devulcanizing the rubber thus making it chemically more reactive in a reuse application. Preliminary work in using the treated rubber as a coating component shows promise.

**Photovoltaic building panels**
IIT received a donation of intellectual property last year from Apogee, Inc. The patented technology is based on using holography to concentrate the sun's rays onto a solar panel in such a way as to make the panel suitable for incorporation into various building components such as skylights and windows. Engineering students have been working with an architect to develop a product design, manufacturing procedures, a business plan and a demonstration designed to attract investors, and a business team to carry their designs into commercial use.

**Electrohydrodynamics**
Professor Jamal Yagoobi, chair of the Mechanical, Materials and Aerospace Engineering Department, came to IIT from Texas A&M with a portfolio of patents covering use of electrohydrodynamics to enhance the efficiency of heat transfer in large-scale refrigeration system applications such as office buildings, hospitals, schools, and apartment complexes. IIT has responsibility for commercializing this technology. Engineering executives with experience in licensing, business development, and technology commercialization have started early-stage business development efforts to identify applications where the capital cost savings, space savings, and energy conservation opportunity will justify trying new technology.

**Financing**
IIT participates in government-sponsored programs such as Illinois Technology Enterprise Centers (ITEC), which provides expertise, counseling, introductions, and often badly needed cash to entrepreneurs. Faculty and graduate students are encouraged to take advantage of federal programs such as SBIR and STTR, which provide early stage seed money for technically oriented businesses.

**Licensing**
Licenses or options on licenses have also been signed with Compact Power to commercialize fuel cell-related intellectual property donated to IIT by Telcordia and with a group to commercialize a blood-drawing system developed by a student at the Institute of Design.

**IPRO Program**
The IIT Interprofessional Projects (IPRO) Program engages multidisciplinary teams of students in semester-long undergraduate projects based on real-world topics from sponsors that reflect the diversity of the workplace: corporations, entrepreneurial ventures, non-profit organizations and government agencies.

**EnPRO Program**
Entrepreneurial IPROs, or EnPROs, are a core and distinctive feature of the Ed Kaplan Entrepreneurial Studies Program. EnPROs are a special kind of IPRO, IIT’s signature undergraduate experience where teams of students from various disciplines and academic levels work together on real-world problems. Teams can receive support in marketing, venture funding, accounting, law and prototype building.
Research Centers

IIT has more than 20 research centers, with three new centers opening in 2003, that provide faculty and students the opportunity to engage in research across a range of disciplines. These research centers have provided funding and resources that help make IIT’s commitment to innovative research a reality.

Counter-Terrorism Research at IIT’s National Center for Food Safety and Technology

As a result of their Counter-Terrorism (CT) research, IIT’s National Center for Food Safety and Technology (NCFST) will be one of the few facilities readily available to industry in the case of an attack. CT research investigates such aspects of food technology as rapid detection methods, tamper-evident packaging, behavior of organisms in food matrices and the thermal destruction of toxins, bacteria, and viruses. These are all of continuing interest to the food industry from a food safety perspective. Counter-terrorism research at NCFST is two-pronged: investigating the persistence in foods of agents used in potential terrorist activities and ways to prevent or mitigate contamination.

As Center for Food Safety and Applied Nutrition’s (CFSAN) only laboratory that deals with food processing and packaging, the Division of Food Processing at NCFST is a unique resource for the Food and Drug Administration (FDA). The center is also unique in that it can rapidly change its research programs to address pressing research needs. Due to these factors, FDA is supplementing NCFST’s budgets with funds directed to CT research activities as well as redirecting some of CFSAN’s internal research.

The increased emphasis on CT research over the next few years will undoubtedly generate information on how to increase the safe processing of foods. While it may be perceived that the CT research program is being emphasized at the expense of the collaborative food safety program, food safety research will continue to be the major focus of NCFST. Many of the facility upgrades required to perform CT research strengthen food safety research as well.

CT supplemental funding serves as a bridge to retain experienced staff and proven programs and to build infrastructure at a time when food safety research and development expenditures are contracting at both industry and government levels. However, the need for continuing research on food safety will remain not only to ensure the continuing production of safe foods but also to deal with emerging pathogens, new technologies, and new products.

The center is currently strengthening its pilot plant programs in all research areas and anticipates improved services to its industry clients.
Center for Synchrotron Radiation Research and Instrumentation

The Center for Synchrotron Radiation Research and Instrumentation (CSRRI) at IIT is an umbrella organization founded to coordinate and facilitate activities among the Collaborative Access Teams (CATs) affiliated with IIT, and any other scientists at the University with an interest in synchrotron radiation research. The goal is to construct and operate synchrotron radiation beamlines at the Advanced Photon Source at Argonne National Laboratory.

Members of the center are part of three different CATs at the APS. These include:

**BIOCAT**: An NIH-funded CAT dedicated to studies of the structure and dynamics of partially disordered biological systems.

**IMCA-CAT**: A consortium of 12 pharmaceutical companies primarily focused on the use of synchrotron radiation to aid in drug design and protein engineering.

**MRCAT**: Use of X-ray scattering, reflectivity and XAFS to study in-situ materials. A consortium consisting of the University Notre Dame, the University of Florida, Northwestern University, Amoco Corporation, Argonne National Laboratory (Chemical Technology Division), and IIT.

CSRRI has been a co-sponsor of several significant scientific meetings in recent years, including: First International Conference on Synchrotron Radiation in Materials Science; The Sixth International Conference on Biophysics and Synchrotron Radiation; The Tenth International Conference on X-ray Absorption Fine Structure (XAFS X).

Staff members include Grant Bunker, Dean Chapman, Andrew Howard, Thomas Irving, Ishaque Khan, Timothy Morrison and Carlo Segre.

New Research Centers in 2003

The Center for Complex Systems and Dynamics (CCSD) provides an interdisciplinary collaborative environment for fundamental and applied research for understanding and mathematically describing complex systems; developing mathematical and computational techniques for simulating, analyzing, and modifying their behavior; and applying these methods to various complex systems of national interest. Current research areas include nonlinear and stochastic phenomena in complex systems, multi-agent systems, complex networks and adaptive systems, natural and industrial ecologies, dynamics of multiphase systems, fluid turbulence, molecular level modeling of physical systems, brain electrophysiology and computational neuroscience, and transportation systems. Ali Cinar, director, can be reached at cinar@iit.edu or 312.567.3637. Web: www.grad.iit.edu/researchcenters/ccsd.

The Center for the Management of Medical Technology (CMMT) is dedicated to research, education and dissemination of knowledge in the management of medical technology. The CMMT has five major research thrusts: 1) generation, adoption and utilization of medical technologies; 2) the nature of medical technology and innovation and the role it plays in health care delivery; 3) evaluation of medical technologies; 4) ethics, social implications and patient value of medical technologies, and 5) management of medical information and emerging technologies. Eliezer Geisler, director, can be reached at 312.906.6532.

The Center for the Study of Ethics in the Professions (CSEP) promotes research and teaching on practical ethical issues in the professions. It was the first multi-disciplinary ethics center to focus on the professions. CSEP continues to be one of the nation’s leading ethics centers, and is internationally recognized for its work on ethics in science and engineering. CSEP has been committed to carrying out multi-disciplinary, multi-institutional projects that introduce and propagate innovations in teaching and that produce research combining empirical investigation with conceptual analysis. This focus equips CSEP very well for the ESI component of the NNIN. Vivian Weil, director, can be reached at 312.567.3472 or weil@iit.edu. Web: www.iit.edu/departments/csep.
Research Centers

Centers Offer a Wide Range of Research at IIT

The Advanced Building Materials and Systems Center conducts studies and analyses of new, experimental or unusual building materials or building systems, either in the field or in the Advanced Building Materials Laboratory on the IIT Main Campus. Sidney A. Guralnick, director, can be reached at 312.567.3549.

The Center for Accelerator and Particle Physics provides a focus for interdisciplinary activities at IIT aimed at the continued development of research in elementary particle physics, at developing new particle-accelerator technologies, and at education and outreach to educational institutions and to the wider business, philanthropic and general public sectors. It serves as a base to coordinate the activities of a group of IIT faculty, graduate students, and staff from various departments currently involved in a number of research programs, and will promote substantial increases in such involvement through a close working relationship with other universities in the region and with Fermilab. Daniel Kaplan, CAPP director, can be reached at 312.567.3389 or at kaplan@iit.edu. Homer Harwood, administrative associate, can be reached at 312.567.3579. Web: www.capp.iit.edu.

The Center for Electrochemical Science and Engineering conducts basic and applied research primarily in fuel cells and batteries, while preparing students for careers in advanced energy technology. Jai Prakash, director, can be reached at 312.567.3639. Web: www.chee.iit.edu/research/cese/cese.shtml

The Center for Excellence in Polymer Science and Engineering, an interdisciplinary research and education center established in 1990 through a grant from the Amoco Foundation, is devoted to the advancement of polymer science and engineering. Research is conducted on synthesis, rheology, characterization and processing of polymers. Education programs include concentrations for B.S., MAS (non-thesis), M.S. and Ph.D. degrees. Jay Schieber, director, can be reached at 312.567.3046 or schieber@iit.edu. Web: www.chee.iit.edu/research/cpepe

The Center for Financial Markets provides a unique focus on four interrelated spheres of knowledge needed by any professional who works for a financial intermediary or other capital market institution: financial markets, trading, financial engineering, and information technology. The center supports Stuart School’s M.S. in Financial Markets program and offers related certificate programs online and onsite; promotes scholarship and linkages to Chicago’s financial industry; assists faculty and students to contribute actively to projects in electronic trading, risk management, and new derivatives product development. Michael Ong, director, can be reached at 312.906.6568 or ong@stuart.iit.edu. Web: www.stuart.iit.edu/cfm.

The Center for Research and Service offers professional consulting services through the Institute of Psychology at IIT. The center supports its clients through research-based solutions that improve individual, team and organizational performance. Bruce Fisher, director, can be reached at 312.567.6471. Web: www.iit.edu/~phycrsc

The Center for Synchrotron Radiation Research and Instrumentation promotes application of the tools and techniques of synchrotron radiation to science and engineering research, with a particular focus on developing experimental beam line facilities to serve the needs of various collaborative access teams at the Advanced Photon Source at Argonne National Laboratory. Tim Morrison, director, can be reached at 312.567.3381. Web: www.csrs.iit.edu

The Chicago Center for Sustainable Enterprise has as its mission “to identify, develop, communicate, and help implement practical and equitable business strategies that advance the ecological sustainability of the Chicago area while fostering current and future economic viability.” The center brings together many disciplines at IIT in a collaborative relationship with business corporations, other academic institutions, government agencies, and members of the NGO community. George Nassos, director, can be reached at 312.906.6543 or gnassos@stuart.iit.edu.

The mission of the Electric Power and Power Electronics Center is to make a leading contribution to the research and development in electric power and power electronics technologies. The mission includes the integration of research and education in power engineering for maintaining a strong industry/university cooperative effort. The center sponsors technical studies for industrial partners, visits by technical scientists on related subjects, scholarships for potential candidates, and degree programs and accelerated courses on electric power and power electronics. Mohammad Shahidehpour, director, can be reached at 312.567.5737, and Ali Emadi, assistant director, can be reached at 312.567.8940. Web: www.motor.ece.iit.edu/power/.

Energy + Power Center offers research and education programs that respond to the needs of the energy and power industries. The center’s activities include the Energy/Environment/Economics (E3) program. Henry R. Linden, center director, can be reached at 312.567.3095. Energy/Environment/Economics (E3) is an academic program of research and coursework for students in chemical, mechanical, environmental and electrical engineering. The research program encompasses areas of specialization that relate to energy, sustainable development, industrial ecology and environmental design. Hamid Arastoozpour, E3 program director, can be reached at 312.567.3038. Web: www.chee.iit.edu/research/engpow.htm.

The Fluid Dynamics Research Center conducts experiments and theoretical studies on fluid flow management and control, particularly in the area of boundary layer turbulence, applying the principles of computational fluid dynamics. The center is the site of the National Diagnostic Facility, the world’s largest university wind tunnel, fully dedicated to basic research, and supported by the Air Force Office of Scientific Research and the Office of Naval Research. David R. Williams, director, can be reached at 312.567.3192. Web: http://fdrce.iit.edu.

IIT Research Institute (IITRI) is IIT’s not-for-profit contract research affiliate. With a focus on biomedical research, IITRI’s staff of approximately 150 scientists and technicians conducts programs for both government and commercial sponsors. Specific areas of expertise include preclinical toxicology; carcinogenesis and cancer prevention; inhalation technology; molecular biology; analytical chemistry; and biodetection. David McCormick, IITRI vice-president and director of its Life Sciences Group, can be reached at 312.567.4972. Web: www.iitri.org.

The Institute for Science, Law & Technology provides a forum to produce and disseminate knowledge on the implications and applications of science within societal and legal contexts. As part of its mission, the institute sponsors long-term, multi-disciplinary research, public conferences, judicial training, symposia for journalists, and other programs. Public programming, scholarship and research, and student educational opportunities in the institute focuses on biotechnology, information technology, environmental science, and cross-cutting issues such as products liability, intellectual property, design of legal and
market institutions, and use of technology in the courtroom. In addition, institute staff and faculty draft laws and regulations and develop other programs that guide public policy decisions. Lori Andrews, director, can be reached at 312.906.5359.

The Manufacturing Productivity Center is the hub of all activities relating to manufacturing technology and management. Keith E. McKee, director, can be reached at 312.567.3650. Web: www.mtm.iit.edu/mpc.html.

Grainger Power Engineering Laboratory (GPEL) focuses on studies related to electric power generation transmission, distribution, operation and controls. GPEL houses several graduate and undergraduate laboratories. Annual research support of more than $400,000 is provided by federal and private agencies. S. M. Shahidehpour, director, can be reached at 312.567.5737. Web: http://power.iit.edu/power/home.htm.

The National Center for Food Safety and Technology at IIT’s Moffett Campus is a consortium comprised of IIT, IITRI, the U.S. Food and Drug Administration, the University of Illinois and industrial sponsors to advance the safety and quality of our food supply, through research and education programs and extensive pilot plant facilities in food biotechnology, food packaging and food processing. Darsh Wasan, interim director, can be reached at 708.563.1576. Web: www.ncfst.iit.edu.

The Particle Technology and Crystallization Center is devoted to the development of fundamental knowledge, methods and strategies in the areas of nucleation, crystallization, particle technology, and characterization that will result in faster development of new pharmaceutical compounds, development of new forms, and a reduced time to bring a new compound to market. This center is a collaboration of IIT, Purdue University, and Massachusetts Institute of Technology. A unique mechanism for addressing these important problems in particle technology and crystallization in the pharmaceutical industry arises from the combination of the particle technology and crystallization group at IIT, which includes characterization facilities at the Advanced Photon Source at Argonne National Laboratory; the expertise provided by the Department of Industrial and Physical Pharmacy at Purdue University in polymorphism, materials science, spectroscopic analysis, and manufacturing; and MIT in benchmarking and process analysis. The center has developed relationships to firms within the pharmaceutical industry to ascertain and address important issues that are essential to new manufacturing knowledge and development. Allan Myerson, director, can be reached at 312.567.3163. Web: www.grad.iit.edu/researchcenters/ptcc.

The Pritzker Institute of Biomedical Science and Engineering explores the application of engineering principles to the solution of healthcare problems. The main areas of focus are cell and tissue engineering, medical imaging and neural engineering. Areas of interest are cardiovascular disease, biomaterials, vision, brain electrophysiology, signal processing and analysis. Vincent Turitto, director, can be reached at 312.567.5324. Web: www.pime.iit.edu.

Through the Thermal Processing Technology Center faculty and students undertake research to support the needs of the materials processing and manufacturing industries. The center performs high quality basic and applied research in thermal processing technology of interest to the primary metals and manufacturing industry. In addition, the center provides training and education to enhance the human resources available to industry. Multi-disciplinary research teams are used to provide innovative crosscutting technological solutions to the materials processing problems. Philip Nash, director, can be reached at 312.567.3056. Web: http://tptc.iit.edu.

Awards

Strong History of Career Award Recipients at IIT

The Faculty Early Career Development (Career) Program is a Foundation-wide activity that offers the National Science Foundation’s most prestigious awards for new faculty members. The Career program recognizes and supports the early career-development activities of those teacher-scholars who are most likely to become the academic leaders of the 21st century. Career awardees are selected on the basis of creative, career-development plans that effectively integrate research and education within the context of the mission of their institution.

Career Award recipients from IIT:

Herek Clack 2003
(Mechanical, Materials and Aerospace Engineering)
“Droplet Vaporization Under Asymmetric Conditions: Implications for Combustion at Conventional and Reduced Scales”

Linda Spentzouris 2003
(Biological, Chemical and Physical Sciences Department)
“Particle Beams of the Future”

Albert Wang 2002
(Electrical and Computer Engineering Department)
“Investigating Electrostatic Discharge Protection in ULSI ICs Down to Nano-scale”

Cindy Hood 2000
(Computer Science Department)
“A Framework for Multi-Technology Network Fault Management”

Alex Flueck 1999
(Electrical and Computer Engineering Department)

NIH Career Development Award (NIH K01)

Jialing Xiang
(Biological, Chemical and Physical Sciences Department)
“Prostate Cancer: Mechanisms of Bax-induced Cell Death”
Project Goals: To define the molecular function of proapoptotic molecule, Bax, in androgen-dependent and androgen-independent prostate cancer.
Awards

IIT’s Sigma Xi Research Awards Promote Innovative Research

The 2003 IIT/Sigma Xi Research Awards recognize the exemplary accomplishments in research, scholarship, and creative activity by faculty members and graduate students at IIT.

2003 recipients of the Sigma Xi Awards:

Senior Faculty Division:

Mohammad Shahidehpour
(Electrical and Computer Engineering Department)
Shahidehpour, Professor of Electrical and Computer Engineering and Director of the Electric Power and Electronics Center, received numerous letters of support citing his extraordinary leadership in research initiatives, publication of four books and over 200 technical articles, recent election as an IEEE Fellow, as well as the exceptional guidance and care that he provides to his graduate students.

Junior Faculty Division:

Albert Wang
(Electrical and Computer Engineering Department)
Wang, Professor of Electrical and Computer Engineering, was selected for his excellent work in electrostatic discharge protection research, the publication of a textbook on integrated circuits, and his active participation at numerous conferences and professional society meetings.

Graduate Student Division:

Haigang Feng
(Electrical and Computer Engineering Department)
Feng, graduate student in Electrical and Computer Engineering, was noted for the significant contributions that he has made to the establishment of the Integrated Electronics Laboratory and his leadership role as a lab manager.

ERIF Awards Plant Seeds to Build Strong Research at IIT

Each year, IIT holds an internal competition for the Educational and Research Initiative Fund (ERIF). The objective of the ERIF program is to provide seed funding to initiate innovative research and education programs that will use the results obtained during the project period for developing proposals seeking external funding.

ERIF Award recipients:

2003

Jennifer Kang Denwent (Biomedical Engineering)
“Investigation of Cultured Photoreceptor Cell Rescue/Replacement Therapy: A Possible Treatment for Photoreceptor Degeneration Disease”

Zhiling Lan (Computer Science)
“Exploring Dynamic Load Balancing Techniques on Distributed Systems”

Dietmar Rempfer (Mechanical Materials and Aerospace Engineering)
“Optimal Solution of the Direct and Inverse Problems of Contaminant Dispersion”

Yu-Zhu Zhang (Biological, Chemical and Physical Sciences)
“Solution Structure Determination of the WW, Polar and C2 Domains of PQBP-1 by NMR”

2002

Mark Anastasio (Biomedical Engineering)
“Development and Application of Tomographic Imaging Algorithms for Radiation Therapy”

Gruia Calinescu (Computer Science)
“Connectivity with Minimum Energy Consumption in Wireless Ad-Hoc Networks”

Ali Emadi (Electrical and Computer Engineering)

Kura (Computer Science)
“Determination of the Sound Radiation Efficiency of Finite Size Multilayered Elements”

James Stine (Electrical and Computer Engineering)
“Accurate Function Approximation Using Compressed Synthetic Bipartite Tables”
Scholarships

Scholarships Boost Student Research

Cyrus Tang Scholarships

Full-time students of Chinese origin are eligible to apply for this scholarship, made possible by the Cyrus Tang Foundation. This $4,500 scholarship provides one year tuition support and stipend. Students are admitted or currently enrolled in an M.S. or Ph.D. program.

2003 Cyrus Tang Scholarship recipients:

Zhendong Song (Biomedical Engineering Department)
“Conducting workshops in China for students”

Liang Deng (Civil and Architectural Engineering Department)
“Building alumni network to foster community service”

IIT Research Scholarships

The Dean of Graduate College and the Dean of Armour College of Engineering recently renewed the IIT Research Scholarship program to further enhance the quality and number of graduate students in science and engineering research programs. U.S. citizenship or permanent resident status is required. This nonrenewable scholarship includes nine credits of tuition for each of two semesters (in one academic year) and a $16,000 annual stipend.

Recipients of the IIT Research Scholarship:

2003-2004
Andrew Bowen (Biological, Chemical and Physical Sciences)
Kevin C. Lauzze (Chemical and Environmental Engineering)
Abigail Parsons (Mechanical, Materials and Aerospace Engineering)
Peter Simko (Electrical and Computer Engineering)
Susan Zawaski (Biomedical Engineering)

2002-2003
Danny Bockenfeld (Mechanical, Materials and Aerospace Engineering)
Thomas Duk (Biological, Chemical and Physical Sciences)
John Erickson (Applied Mathematics)
William E. Mustain (Chemical and Environmental Engineering)
Joseph Owens-Ream (Biomedical Engineering)
Academic Programs

Ph.D. Programs at IIT

- Applied Mathematics
- Architecture
- Biology
- Biomedical Engineering
- Chemical Engineering
- Chemistry
- Civil Engineering
- Computer Engineering
- Computer Science
- Design
- Electrical Engineering
- Environmental Engineering
- Management Science
- Materials Science and Engineering
- Mathematics Education
- Mechanical and Aerospace Engineering
- Molecular Biochemistry and Biophysics
- Physics
- Psychology
- Science Education
- Technical Communication and Information Design

M.S. Programs at IIT

- Applied Mathematics
- Biology
- Chemical Engineering
- Computer Science and Master of Chemical Engineering (dual degree)
- Chemistry
- Civil Engineering
- Computer Science
- Computer Science for Teachers
- Computer Engineering
- Computer Engineering and Electrical Engineering (dual degree)
- Electrical Engineering
- Environmental Engineering
- Environmental Management
- Finance
- Financial Markets
- Food Process Engineering
- Food Safety and Technology
- Information Architecture
- Manufacturing Engineering
- Marketing Communication
- Materials Science and Engineering
- Mathematics Education
- Mechanical and Aerospace Engineering
- Metallurgical and Materials Engineering
- Molecular Biochemistry and Biophysics
- Rehabilitation Counseling
- Rehabilitation Counseling (dual-degree w/ B.S. in Psychology)
- Personnel and Human Resources Development
- Personnel and Human Resources Development (dual-degree w/ B.S. in Psychology)
- Physics
- Psychology
- Science Education
- Technical Communication and Information Design

IIT Grants 339 Doctoral Degrees During Past Five Years

![Bar chart showing the number of doctorates awarded from 1999 to 2003.}]
Research Sponsors

Funding Agencies Provided over $31 million in 2003

$1,000,000 +
- U.S. Food and Drug Administration
- Illinois Board of Higher Education
- Illinois Department of Commerce and Economic Opportunity
- Industrial Macromolecular Crystallography Association
- National Institutes of Health
- National Science Foundation
- U.S. Department of Energy

$100,000 - $999,999
- Air Force Office of Scientific Research
- AKM, Inc.
- Al-Ghurair Investment
- ALION Science and Technology
- Argonne National Laboratory
- Atlas Material Testing Technology LLC
- Bit Systems, Inc.
- Defense Advanced Research Projects Agency
- Federal Aviation Administration
- Fermi National Accelerator Laboratory
- Flow International
- Gas Technology Institute
- Honeywell
- Ixia
- National Aeronautics and Space Administration
- Office of Naval Research
- Particle Technology & Crystallization Center
- Sloan Foundation
- Sun Microsystems
- U.S. Department of Agriculture
- U.S. Department of Education
- Water Environment Research Foundation
- Whitaker Foundation

$50,000 - $99,999
- Agilent Technologies
- American Cancer Society
- Corporation for National and Community Service
- U.S. Environmental Protection Agency
- Educational and Research Initiative Fund
- Illinois Council on Food and Drug Administration
- In-Q-Tel, Inc.
- Internal Revenue Service
- Law School Administration Council
- Lockheed Martin
- Motorola, Inc.
- National Sea Grant
- National Institute of Standards & Technology
- Rush University
- Tobechi Automotive

$1,000 - $49,999
- Army Research Office
- Bridgestone Co., Japan
- Cadence
- Chamberlain Group
- Chicago Housing Authority
- Chicago Library System
- Chicago State University
- City of Chicago
- Dimension Bond Corporation
- Engineering Research Center
- Federal Reserve Bank of Chicago
- Five Star Tech
- Hines VA Hospital
- Illinois Cooperative Collection Management Program
- IIT Research Institute
- Illinois Secretary of State
- Illinois State Library
- Los Alamos National Laboratory
- Mitsubishi
- National Collegiate Inventors and Innovators Alliance
- National Research Council
- North Central Regional Educational Laboratory
- Society of Architectural Historians
- Schering-Plough
- University of Chicago
- University of Georgia
- UOP, Inc.
- Wieland-Werke AG
Safety Committees

Safety Committees Bring Standards to Research

IIT Institutional Animal Care and Use Committee

IIT has established an Institutional Animal Care and Use Committee in response to the need of faculty members to conduct studies on animal subjects. The committee will ensure that federal rules and regulations regarding animal housing and care are followed.

Committee Members Include:

Robert Arzbaecher, Ph.D. (chair)
Mr. Royce Cunningham (community member)
Connie Hall, Ph.D.
Brooks Harder, DVM
Thomas Irving, Ph.D.
Victor Perez-Luna, Ph.D.
Allan Wolach, Ph.D.
Jose Padilla, J.D. (ex-officio)
Domenica G. Pappas, CRA (ex-officio and Executive Officer)

Institutional Review Board (IRB)

At IIT, regulations apply to all research and programs (sponsored and unsponsored) involving human subjects. The review process is carried out before the study begins. The IRB is charged with the responsibility to review all research and teaching activities involving the use of human subjects in accordance with IIT’s policies and external regulations.

Committee Members Include:

Scott B. Morris, Ph.D. (chair)
Christine Bard, Ph.D.
Susan Catania (community member)
Peter Greene, Ph.D.
Joyce Hopkins, Ph.D.
Norman Lederman, Ph.D.
Kenneth Schug, Ph.D
Jose Padilla, J.D. (ex-officio member)
Domenica G. Pappas, CRA (ex-officio member and Executive Officer)

Institutional Biosafety Committee

IIT’s Institutional Biosafety Committee performs the following functions (contact person is the Director of Telecommunications and Environment):

- Reviews and approves all university research and teaching activities involving the use of biohazardous agents and recombinant DNA molecules, blood, bloodborne pathogens, or other potentially infectious materials.
- Advises the university and recommends policies to guide investigators in carrying out the IIT’s Biosafety Program in the acquisition, use, training, transfer, storage, disposal, and emergency response procedures for all biosafety activities.
- Reviews all biosafety protocols regardless of the source of funding for the project. The committee may approve research protocols with or without modifications, or withhold approval for all or any portion of a protocol.

Protocol Approvals and Renewals: University policy requires protocol review and approval by the Biosafety Committee before the proposed project begins.

Committee Members Include:

Benjamin C. Stark, Ph.D. (chair)
Domenica G. Pappas, CRA (ex-officio and Executive Officer)
Administration

Board of Trustees Officers
Robert A. Pritzker, Chair of the Board
Robert W. Galvin,
Chair of the Policy Committee
Lew Collens, President
Craig J. Duchossois, Vice Chair
David J. Vitale, Vice Chair

Board Members
Austin A. Adams
Bahman Atefi, Ph.D.
William C. Bartholomay
Thomas H. Beeby
Ronald Lee Bliwas
S. R. Cho
Martin Cooper
Robert A. Cornog
James E. Cowie
Bryan R. Dunn
Andrew J. “Flip” Filipowski
Marshall B. Front
Michael P. Galvin
Alvin L. Gorman
Robert L. Growney
Randall C. Hampton
Robert L. Heidrick
James Hill, Jr.
Donald R. Hollis
Richard M. Jaffee
Norbert O. Kaiser
Edward L. Kaplan
Patrick J. Kelly
James W. Kiley
Jules F. Knapp
Kaarina Koskenalusta
Thomas E. Lanctot
Bruce C. Limatainen
Dirk Lohan, FAIA
James A. McClung
Victor A. Morgenstern
Anita M. Nagler
Walter Nathan
Satyan “Sam” Pitroda
Jay Robert “J. B.” Pritzker
Ellen Jordan Reidy
Victor H. Reyes
John R. Schmidt
Carole Browe Segal

Paula A. Sneed
Tanya Solov (ex officio)
Federico Vidargas, AIA (ex officio)
Priscilla Anne “Pam” Walter
Ralph Wang
Craig M. Watson
John A. Wing

Life Trustees
Vernon Armour
Harold A. Bergen
Heather M. Bilandic
Kenneth L. Block
Robert D. Cadieux
Calvin A. Campbell Jr.
Donald E. Goss
Theodore E. Hanson
Albert K. Hawkes
Robert M. Janowiak
John H. Krehbiel, Jr.
Richard A. Lenon
Homer J. Livingston, Jr.
Gordon R. Lohman
John W. Madigan
William P. Mahoney
Dr. Thomas L. Martin, Jr.
William B. McCain
Robert B. McDermott
Werner E. Neuman
William W. Parks
Robert J. Potter, Ph.D.
Robert L. Raclin
The Honorable Ilana D. Rovner
Dr. Lajos Schmidt
M.A. Self
Bernard F. Sergesketter
Charles H. Shaw
Raymond C. Tower
William A. VanSanten, Jr.

Honorary Trustee
Mrs. Lester Armour

President’s Staff
Lew Collens
President
David E. Baker
Vice President for External Affairs
Judith Carr
Executive Assistant to the President
John Collins
Vice President for Business & Finance
David L. McCormick
Vice President and Director,
Life Sciences IIT Research Institute

Betsy Hughes
Vice President for Institutional Advancement
Mary Anne Smith
Vice President, General Counsel,
and Secretary to the Board of Trustees

Provost & Senior Vice President’s Office
Allan S. Myerson
Provost & Senior Vice President
Hamid Arastoopour
Dean of Armour College of Engineering
John M. Baworowsky
Vice President for Enrollment and Student Affairs
C. Robert Carlson
Center for Professional Development
Ali Cinar
Dean of Graduate College, Vice Provost for Research
Patricia Grow
Director of Finance
M. Zia Hassan
Interim Dean of Stuart Graduate School of Business
Noreen M. Kozak
Executive Assistant to the Provost
Harold J. Krein
Dean of Chicago-Kent College of Law
Fred R. McMorris
Dean of College of Science and Letters
M. Ellen Mitchell
Director of Institute of Psychology
Elizabeth T. Nguyen
Manager of Institutional Information
Pamela Reardon
Vice Provost for Academic Program Development
Dennis Roberson
Vice Provost for New Initiatives and Director of the
Institute of Business & Interprofessional Studies
Donna V. Robertson
Dean of College of Architecture
Mary Ann Rowan
Vice President for Graduate Enrollment
Susan S. Sitton
Assistant Provost for Retention
Ophir Trigalo
Chief Information Officer
Vincent Turitto
Director of Pritzker Institute of Biomedical Science & Engineering
Donald R. Ucci
Associate Provost and Interim Dean of
the Undergraduate College
Darsh Wasan
Vice President for International Affairs
Sohair F. Wastawy
Dean of Libraries
Patrick F. Whitney
Director of the Institute of Design

Report on Research
Administration

Department Chairs & Program Directors
Edwin F. Stueben
- Applied Mathematics
H. Larry Scott
- Biological, Chemical & Physical Sciences
Vincent Turitto
- Biomedical Engineering
Fouad Teymour
- Chemical & Environmental Engineering
Jamshid Mohammadi
- Civil & Architectural Engineering
Edward M. Reingold
- Computer Science
Thomas Wong
- Electrical and Computer Engineering
C. Robert Carlson
- Information Technology & Management
Keith McKee
- Manufacturing/Industrial Programs
N. G. Lederman
- Mathematics & Science Education
Jamal Yagoobi
- Mechanical, Materials & Aerospace Engineering
Ullica Segerstrale
- Social Sciences
Robert Ladenson
- Humanities

Research Support Services:
Ali Cinar
- Vice Provost for Research, Dean of Graduate College
Alexander J. Flueck
- Associate Dean for Research
Mary T. Spina
- Assistant Dean for Research, Executive Director, Research Support Services
Toni R. Allen
- Assistant Director
Pamela Andrews
- Research Coordinator
Janice D. Haney
- Administrative Assistant
Glenn Krell
- Director, Office of Research Proposal Development
Robert Lapointe
- Research Projects Coordinator
Domenica G. Pappas
- Associate Director, Office of Sponsored Research & Programs

Office of Technology Transfer & Intellectual Property
Robert Anderson
- Director
Myron Gottlieb
- Manager

Production

Ali Cinar, Alex Flueck
- Project Direction
Melissa Zabel
- Writer, Editor, Design & Production Coordinator
Robert Anderson, Ali Cinar, Alex Flueck,
Mary Spina
- Contributing Writers
Mary Spina
- Data Management & Coordination
Blue H2O, Ltd.
- Cover Design & Design Assistance
Philip Spina III
- Photography

A special thanks for contributions from:

Published by the Graduate College at Illinois Institute of Technology.

Address correspondence to:
Graduate College
3300 S. Federal St.
Main Building, Rm. 301B
Chicago, IL 60616

Telephone: 312.567.3035
Fax: 312.567.6980
Email: orsp@iit.edu

© 2004 Illinois Institute of Technology. All rights reserved. Production in whole or part without written permission is prohibited.

IIT’s intention is to act in accordance with all regulations of the federal, state and local governments with respect to providing equality of opportunity in employment and in education, insofar as those regulations may pertain to IIT. IIT prohibits and will act to eliminate discrimination on the basis of race, color, religion, national origin, sex, age, handicap or veteran status. Any student, applicant or employee of IIT who believes that he or she has received inequitable treatment because of discrimination violating IIT’s stated policy of equal opportunity in employment and education should communicate, either in writing or in person, with the director of equal opportunity programs in Room 223 of Perlstein Hall on IIT’s Main Campus.