Notre Dame Science

The magazine of the College of Science at the University of Notre Dame

Winter 2013

IMPACT

Training the next generation of scientists to impact the world

GREGORY P. CRAWFORD
William K. Warren Foundation Dean
of the College of Science

UNIVERSITY OF NOTRE DAME FOUNDER, FATHER EDWARD SORIN, C.S.C., had a vision of the University becoming a powerful means for doing good in the country. Today, Notre Dame is fulfilling this bold vision, as well as expanding upon it by becoming a powerful means for doing good not only here at home, but around the world as well.

This edition of *Notre Dame Science* highlights a unity of purpose in the research being conducted by faculty and students in the College of Science and in the community as a whole, as well as in cross-collaboration with both our campus counterparts in other colleges and with our off-campus colleagues at the Harper Cancer Research Institute. This unity of purpose broadens the scope of the University's research initiatives while, at the same time, focuses each of our individual efforts on serving the common good through purposeful research that, ultimately, leads to solving real-world problems.

In 2010, Notre Dame created the Department of Applied and Computational Mathematics and Statistics (ACMS). Part of the College of Science, ACMS enables the cross-fertilization of ideas by taking a multidisciplinary team approach to uncovering common patterns in diverse and complex subjects.

Last year, Notre Dame became just the fourth college or university in the country to offer a Master of Science in Global Health. The interdisciplinary program will provide a mixture of both classroom and on-site learning where science is comprehended in the context of its promise to improve the health of those who are disproportionately affected by preventable diseases due to living in resource-poor settings.

Finally, scientists from both the University of Notre Dame and the Indiana University School of Medicine are collaborating at the Mike and Josie Harper Cancer Research Institute on research in cancer biology, placing special emphasis on genomics and proteomics, as well as breast, prostate, and colon cancers.

It is my sincere hope that this issue of *Notre Dame Science* enlightens you to the truly groundbreaking work that's going on at the University. It's also my hope that it inspires you. Most of all, I hope the work, on and off campus and around the world, makes you as proud as it makes me, to be a part of Father Sorin's vision and of the Notre Dame family.

Sincerely,

GREGORY P. CRAWFORD, PH.D.
William K. Warren Foundation Dean of the College of Science
Professor of Physics

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MORE THAN 1,000 CELEBRATE TRANSIT OF VENUS AT NOTRE DAME
The Notre Dame and South Bend communities came together on June 5 at the Jordan Hall of Science to witness the Transit of Venus, a rare astronomical event in which the Earth, Venus, and the Sun align. More than 1,000 visitors gathered to watch Venus transit the Sun for the last time this century.

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UNIVERSITY OF NOTRE DAME
College of Science

Fulfilling Father Sorin's Vision

To Be One of the Most Powerful Means for Doing Good in the Country and Around the World

The University of Notre Dame is building upon its growing strength in global health research and training, while also continuing its Catholic tradition of creating a sense of human solidarity and contributing to the common good, by offering a Master of Science in Global Health. Notre Dame is just the fourth college or university in the country to offer such a degree.

The M.S. in global health provides a mixture of classroom and experiential learning where science is understood in the context of its promise to improve the health of those people in resource-poor settings who are disproportionately affected by preventable diseases. The program requires course work to be completed over two semesters, followed by one to two months of field experience in a location where access to health care is limited. Finally, students are required to present a scholarly report based on either original or literature-based research. A few core courses and electives include: Research Methods in Global Health Science, Population and Disease Ecology, and Medical Microbiology. Additionally, the program emphasizes project management, study design, and cultural sensitivity.

Joseph Bock, director of global health training at the Eck Institute for Global Health, oversees the Master of Science in Global Health. Bock has been the University's liaison to Catholic Relief Services and has supported the University's work in Haiti. Bock says the goal of the program is to "help people widen their perspectives, to look closely at the reasons behind extreme poverty and vulnerability, and to develop the practical skills to make a real and lasting difference in world health. This is not just about intellectual curiosity. This is about having a passion to reach out to the poor and vulnerable."

The inaugural class of 14 members graduated in May 2012 after completing field experiences fighting Dengue fever in Puerto Rico, cholera in Haiti, and Hepatitis C in Malaysia. Nineteen students in this year's class are headed to places such as Tanzania and India to fight infectious diseases that are becoming more threatening because of increases in non-communicable diseases.

In his inaugural address in 2005, University of Notre Dame President Rev. John I. Jenkins, C.S.C. , said, "The world needs a university that graduates men and women who are not only capable and knowledgeable, but who accept their responsibility to serve others—especially those in greatest need." Notre Dame is that university. ■

JOSEPH BOCK, director of global health training

MARTA MICHALSKA worked at a hospital in Tanzania through the Eck Institute for Global Health.

Notre Dame Strengthens International Collaborations

Although Notre Dame is located in the state of Indiana, known colloquially as the "crossroads of America," the University has long been enriched by distinctly international perspectives.

To extend Notre Dame's global impact, Nicholas Entrikin, vice president and associate provost for internationalization, was recruited to Notre Dame in 2010 to enhance and expand the international components of Notre Dame. Through his leadership, Notre Dame champions international study, research, and collaboration. In particular, it strengthens the University's international collaborations with institutes and researchers, other universities, study abroad opportunities, international student recruitment and support, government partnerships, global corporate and foundation partnerships, international delegations, and University advancement.

In the fall of 2012, Notre Dame International hosted the inaugural Symposium on Study Abroad Assessment that brought together scholars and administrators of study abroad programs from a new consortium of private research universities that include Princeton, Georgetown, Yale, Duke, Rice, and Columbia to explore ways to strengthen the academic quality of study abroad programs. Notre Dame ranks ninth in percentage of students studying abroad among American doctoral/research institutions.

New Dual Degree Prepares Physicians for Global Health Careers

Integrated program allows IUSM students to pursue M.S. in Global Health

Beginning in August, the Eck Institute for Global Health at the University of Notre Dame and the Indiana University School of Medicine (IUSM) will offer a new opportunity for IUSM medical students to receive global health training through a joint Medical Doctor/Master of Science of Global Health (M.D./M.S.) Integrated Dual Degree program.

"This effort capitalized on the shared relationship the South Bend campus and Eck Institute for Global Health has built around several shared research projects," said Rudy Navari, M.D., associate dean and director of IUSM-South Bend.

This new academic collaboration is offered to medical students from any of the IUSM campuses who plan to practice medicine in underserved settings. Students will take a leave of absence during their third year of medical studies to join the master's students in global health at Notre Dame for a 12-month program. Upon completion of the M.S. in Global Health degree, students will resume their medical degree studies following with the option of finishing at the IUSM-South Bend campus for their third and fourth years. "We are excited about this joint effort that will prepare students to make a big impact on the health of some of the world's most underserved populations," says Gregory Crawford, dean of the College of Science at the University of Notre Dame.

"The new joint effort will better prepare our graduates for highly competitive global health careers at places like the World Health Organization, the U.S. Centers for Disease Control, and the National Institutes of Health," says Eck Institute for Global Health director, David Severson. "This program will strengthen Notre Dame's tradition of placement in these international organizations as well as the thousands of non-governmental organizations such as Catholic Relief Services with whom we have existing relationships."

The one-year supplemental science-centric training program consists of 30 credit hours over two semesters and a summer involving a 6-8 week field experience in an international resource-poor location. All students complete a required master's research project, a scholarly report based on original research or literature-based research. "We are only in the second year of the existing one year master's program," says director of Global Health Training, Joseph Bock, "and the demand has been more than we expected."

Although there are similar five-year programs at other leading universities, this degree program will be the first dual degree of its type from two collaborating universities. ■

RALPH PENNINO '75 performs emergency surgery in Haiti after the devastating earthquake in 2010.

A Class of Its Own

Notre Dame's Master of Science in Patent Law

SMARTPHONES, SEARCH ENGINES, AND SOCIAL networking, fuel-cell technologies, texting, and email, satellite radio, HDTV, and GPS have revolutionized how we work and play. But, without the legal protection to exclusively manufacture and market their products, what's the incentive for an inventor or entrepreneur to invest their time and money in research and development?

The reality is that innovative new products do much more than simply improve how we live; they create new jobs and drive our modern economy. So, protecting products, typically through patents, is absolutely essential. Yet, despite an exponential increase in new patent filings, the growth in the number of new patent practitioners has remained steady. Notre Dame's Master of Science in Patent Law is one of the first programs of its kind to address the growing need for the professionals necessary to legally protect the products that grow our economy and positively impact our lives.

"Currently, most patent agents learn and practice patent law through the same apprenticeship-based model as that in which junior associates are trained; a model that can prove costly to a law firm, because much of the time spent in training is non-billable," says Karen Deak, a Ph.D. geneticist and patent agent, with experience evaluating the viability of intellectual property and prosecuting patent applications before the United States Patent and Trademark Office (USPTO).

Developed in collaboration with the Law School, the College of Science, and the College of Engineering, the master's in patent law prepares students with a bachelor's degree in either science or engineering to pass the patent bar. The program not only provides traditional classroom instruction in legal concepts, writing, and research, but also teaches students how to search, prepare, and file a patent application, as well as how to analyze and respond to USPTO communications.

There are several benefits of a career as a patent agent versus that of a patent attorney. "Given a patent agent's greater technical expertise, lower salary requirements, and equivalent ability to practice at the USPTO," says Deak, "law firms often prefer them to patent attorneys." Another benefit is that patent agents are registered with a federal bar, so they have more career mobility than an attorney who is only licensed in one state jurisdiction.

The program enrolled nine students in fall 2012, and the University anticipates a class size of 50–60 students in the coming years. ■

KAREN DEAK, director of the Master of Science in Patent Law

Patent Law Students Apply Intellectual Property Knowledge

Three students in the Master of Science in Patent Law program are working with Notre Dame alumnus Shane Fimbel, chief operating officer at Union Station Technology Center in South Bend, on a project to help Nationwide Children's Hospital of Columbus, Ohio, accelerate the commercialization of the hospital's innovations.

Kerisha Bowen, Ashley Ferraro, and Ke Min are involved in the pilot study by Intellectual Analytics, whose innovative methodology, TechnoFlow, uses large data sets to identify and predict the innovative output of research laboratories. They expect to publish a peer-reviewed article on Nationwide's technologies and create a series of dashboards for key metrics for Nationwide's technology transfer office as well as measure the hospital's innovative output.

Fimbel, who earned a Ph.D. in biological sciences at Notre Dame in 2007, worked for three years at the Purdue Research Foundation's Office of Technology Commercialization before returning to South Bend.

New Multidisciplinary Graduate Program Consolidates Life Science Opportunities

BRIAN BAKER ,
co-director of the Integrated Biomedical Sciences Program

HOLLY GOODSON,
co-director of the Integrated Biomedical Sciences Program

"Science is becoming so interdisciplinary. We need to respond with new interdisciplinary graduate programs."— Holly Goodson

Modern research in biochemistry, molecular and cellular biology, and the related biomedical sciences is highly interdisciplinary. Modern biomedical scientists are not limited to the confines of only one discipline, nor are they isolated within the confines single departments.

Notre Dame responded to this shift by creating the Notre Dame Integrated Biomedical Sciences Program (ND IBMS). The program offers graduate students the opportunity to do research across disciplines such as bioinformatics, biophysics, genomics, and proteomics. The innovative program aims to attract graduate students by showcasing the range of biomedical research scattered across departments on campus while simultaneously increasing interdisciplinary opportunities and collaborations.

The newly launched program expects to enroll up to 13 students in the fall of 2013 with support from the College of Science, the Graduate School, the Departments of Chemistry and Biochemistry, Biological Sciences, Physics, and Applied and Computational Mathematics and Statics, and the Indiana University School of Medicine–South Bend.

Holly Goodson, associate professor of chemistry and biochemistry, who initiated the idea with Brian M. Baker, co-director of the program, said the degree will provide an agile response to research in developing fields. "Science is becoming so interdisciplinary," she said. "We need to respond with new opportunities. Under this umbrella, we could focus on a number of fields and respond much more quickly to new research."

The program will consolidate research expertise that was previously found across campus in different departments. Uniting those efforts in the new umbrella program will also place the University high on students' online searches. Goodson said, "We think this is going to improve both the number of students that are applying and also promote research."

For example, a biophysicist might need a cell biologist in the lab, but no one seeking a cell biology Ph.D. would normally apply to a physics department. "Now that physicist can have a cell biologist in their lab, and the cell biologist can be learning both cell biology and physics," Goodson said.

Many other universities have developed umbrella programs, but the Notre Dame IBMS program, by including the Departments of Physics and Applied and Computational Mathematics and Statistics, is broader than most. Students will spend their first year rotating through three different laboratories independent of departments and taking courses from a curriculum specifically designed for their field. At the end of the year, they will choose an advisor, whose department becomes responsible for their administration, but they remain in the program and earn an Integrated Biomedical Sciences Ph.D. ■

(L) LIZ LOUGHRAN AND (R) PETER FEIST,
began pursuing Ph.D.'s in the IBMS program this year.

One Department, Two Disciplines, Endless Possibilities

You have been told you have breast cancer. So, what can you expect? At some point, there's a strong likelihood you will have to undergo chemotherapy. But, is there a scenario in which you might safely forego chemo treatments? Someday soon, statistics might provide the answer.

Steve Buechler is researching the application of statistics to medicine, specifically, to personalized medicine that assesses the genetic state of breast cancer. Recently, he developed an algorithm for determining the likelihood for relapse based on a measurement of the expression levels of four genes in the initial biopsied tumor. Patients identified by his algorithm as unlikely to suffer recurrence could safely avoid chemotherapy treatment. That's the power of applying mathematics and statistics to solving real-world problems. And it's why, in July 2010, Notre Dame created the Department of Applied and Computational Mathematics and Statistics (ACMS), chaired by Buechler.

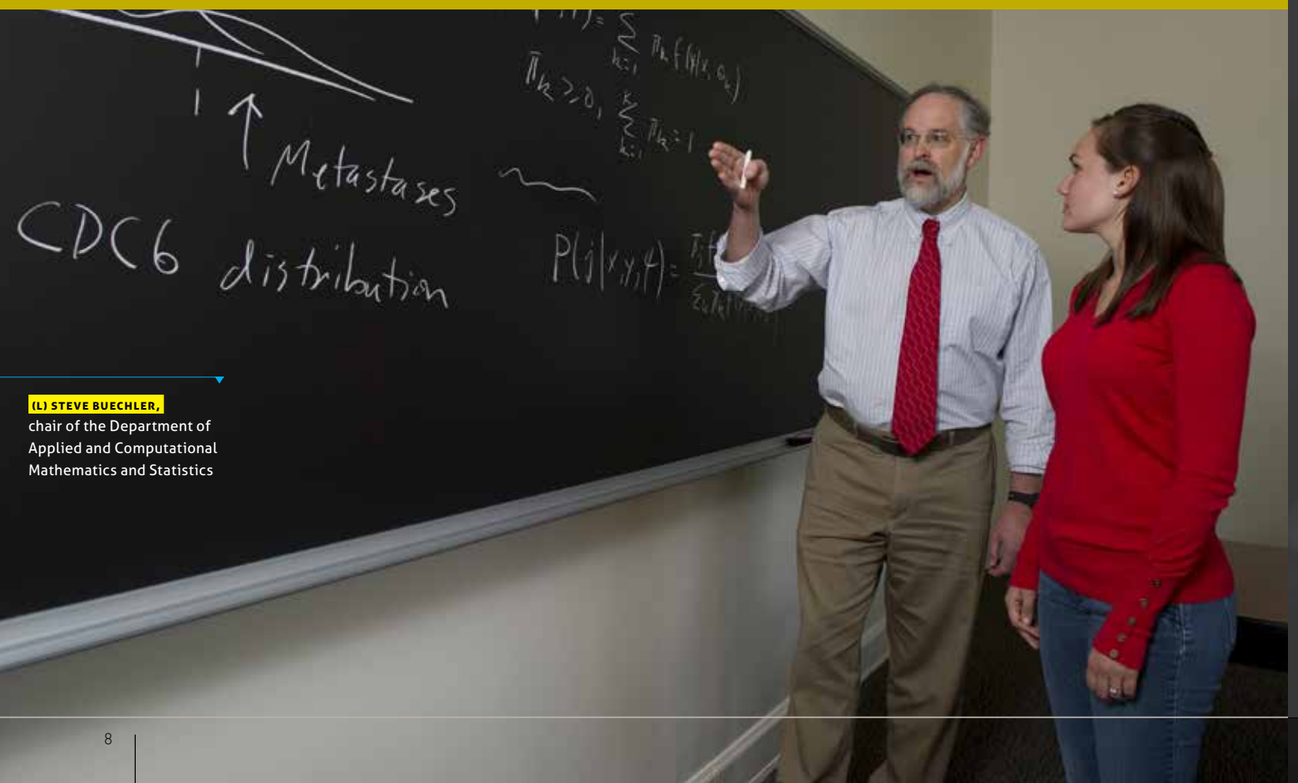
The ACMS department—part of the College of Science—supports a collaborative, interdisciplinary approach to research by preparing and empowering students and faculty with deep domain knowledge in mathematics and statistics to apply their expertise, alongside researchers, in a variety of fields. Specific areas of research in ACMS include: mathematical and computational biology, numerical differential equations, numerical algebraic geometry, bioinformatics and biostatistics, applied partial differential equations, and scientific computing.

ACMS began offering bachelor's and doctoral degrees in fall 2010. Graduates earning doctorates will likely go on to work at research centers and institutes, medical schools, and national laboratories like Argonne and Los Alamos, applying what they learned while at Notre Dame to researching a wide variety of topics, including blood clotting, tumor growth, spread of infection, cancer prognosis models, gas and fluid flow in jets, movement of chemicals in developing cells, combustion modeling, high-performance fuel pumps, hurricane storm surge prediction, and flow patterns in coastal seas. ACMS also offers innovative professional master's degrees designed around private sector needs.

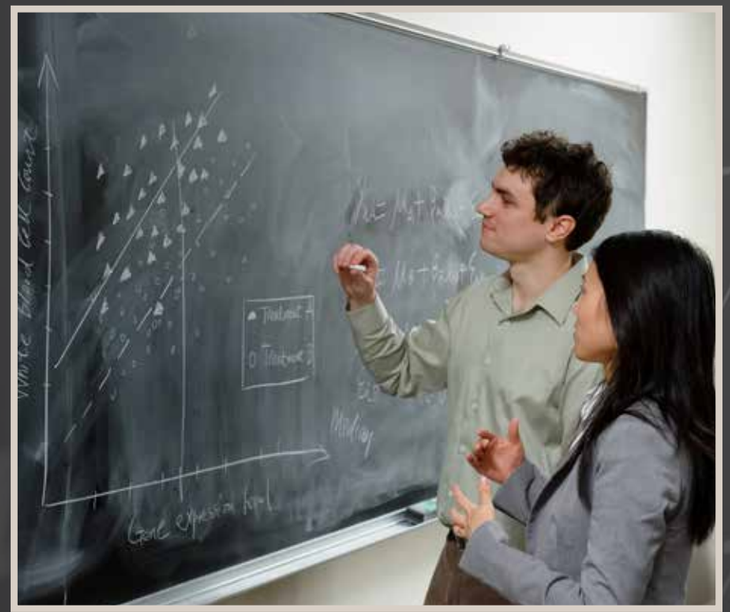
Research projects in numerous areas are currently inhibited by the lack of a sophisticated collaborator in statistics. Just as serious is the lack of research in fields in which statisticians often find breakthroughs. The Department of Applied and Computational Mathematics and Statistics takes a multidisciplinary team approach to finding common patterns in diverse and complex subjects, so as to enable the fruitful cross-fertilization of ideas. As Zhiliang Xu, assistant professor of mathematics, whose research in the application of multiscale modeling and computational approaches to studying biological problems says, "It's a great opportunity to combine the strength of applied mathematicians and people from other fields on campus to tackle big problems." It also contributes to the University's goal of enhancing interdisciplinary research. The deepest needs for statistical consultations and support are in the Departments of Biological Sciences, Economics, Political Science, Psychology, and Sociology.

Until the 2010–11 academic year, the University did not have a department of either applied mathematics or statistics. Today, Notre Dame has one department that combines both, something that is surprisingly uncommon among research universities. And, with state-of-the-art computational facilities and research centers like the University's Center for Research Computing, Notre Dame is quickly moving toward achieving its goal of being among the world's top research universities, one that is committed to improving the quality of life for all people.

"We're all very excited," Buechler says. "We're working very hard, yet we're not trying to reproduce what other universities have done or are doing; we're creating something unique, and something that someday might not only save billions of dollars currently spent on health care, but also save countless lives." ■



(L) STEVE BUECHLER, chair of the Department of Applied and Computational Mathematics and Statistics



New Statistics Major Fills Growing Need for Graduates with Quantitative Skills

The Department of Applied and Computational Mathematics and Statistics has launched a new degree, the Bachelor of Science in Statistics, as well as a supplementary major in statistics. The major addresses a large and growing need for experts in the field as big data becomes an important aspect of doing business. Professionals in statistics are sought-after in industries from health care and pharmaceuticals to academia and high-volume retail.

The degree includes courses that develop a foundation in the methods of applied mathematics and data analysis, in addition to courses in a wide variety of application areas. The supplementary major is particularly beneficial for students in business and the social sciences as well as the natural sciences and engineering.

Graduates are qualified for jobs such as identifying transaction data patterns in online sales, estimating actual risk in the insurance industry, analyzing investment data in the banking industry, and analyzing performance data in the manufacturing sector. Graduates are also prepared to enter master or doctoral programs in statistics, biostatistics, computational biology, finance, or the social sciences.

Feature

Innovative Master's Program Prepares Graduates to Succeed in World of Big Data

Master of Science in Applied and Computational Mathematics and Statistics

The need for talented scientists and engineers who can immediately apply their knowledge and skills in the modern workplace—and in service to the common good—has never been greater. The College of Science's Department of Applied and Computational Mathematics and Statistics (ACMS) is filling this growing need through a highly innovative and intensive, ten-month degree program.

The new Master of Science in Applied and Computational Mathematics and Statistics is directed by James Delaney, assistant professional specialist, who says the aim of the program is to develop professionals who can solve real-world problems in business, science and industry with the tools of statistics, mathematics and computation.

There are four specialties offered in the program: applied statistics, computational finance, predictive analytics and applied and computational mathematics. "The professional specialties in the Master of Science in Applied and Computational Mathematics and Statistics train students to solve complex real-world problems with statistical, mathematical and computational modeling," Delaney says. "This intensive, ten-month program combines education in the discipline with training in business fundamentals and project work on practical problems."

By 2018 "demand for deep analytical positions in a big data world could exceed the supply being produced."

–THE MCKINSEY GLOBAL INSTITUTE

The degree is completed in two semesters followed by a month-long capstone project that could involve faculty projects or collaborations with business and industry. "When it's appropriate, the student will work with a faculty member on campus," Delaney says. "That works best for people in the applied statistics degree program because there are a lot of opportunities for them to serve on campus as statistical consultants. All the students are going to get a lot of attention from faculty, and we're hoping at some point to establish relationships with firms that can provide us some projects."

Computational finance and applied statistics are the two most popular specialties. "For computational finance, the core sequence has a lot to do with derivatives pricing," Delaney says. "We are teaching a course that relaxes some of the most unrealistic assumptions of the classical option pricing theory and presents a more modern approach to derivative pricing and risk management. Students are going to be well suited for industries that trade derivatives," such as proprietary trading firms, investment banking firms and insurance companies.

The degree program expects to enroll about 20 to 25 students each year who will graduate ready to make immediate and meaningful contributions in their chosen professions, and to our world at large. ■

(L) JAMES DELANEY, director of the master's program in applied and computational mathematics and statistics, instructs graduate student Amy Buchmann.

Feature

Notre Dame's New Sustainability Minor

Answering the Vatican's call to action, the College of Science began offering students in all majors and colleges the opportunity to minor in sustainability beginning in the fall of 2011.

Developed under the leadership of Biological Sciences Associate Professor Jessica J. Hellmann and Chemistry and Biochemistry Professor Anthony S. Serianni, the sustainability minor takes a multidisciplinary approach to examining the theories, principles, and practices of sustainability; how human activities affect sustainability; the technical and social approaches, and how to integrate each across disciplines; and, quantitative problem-solving through independent research and interdisciplinary teamwork. Through a variety of coursework

One of the gravest challenges humankind will face in the 21st century is that of forging a new relationship with their natural world. Notre Dame's sustainability minor will prepare students to meet the challenge of satisfying current human needs, while preserving natural capital for future generations. ■

"… if these [soil, water, and climate], the world's life support systems, are spoiled or destroyed irreparably, there will be no viable economy for any of us … environmental concerns have to be understood … as the basis upon which all economic—and even human—activity rests."

—H.E. ARCHBISHOP CELESTINO MIGLIORE, APOSTOLIC NUNCIO, PERMANENT OBSERVER OF THE HOLY SEE (STATEMENT TO THE 61ST SESSION OF THE U.N. GENERAL ASSEMBLY, 2006)

MARIA PIA MIGLIETTA, director of the sustainability minor

Department of Mathematics Offers New Minor in Actuarial Science

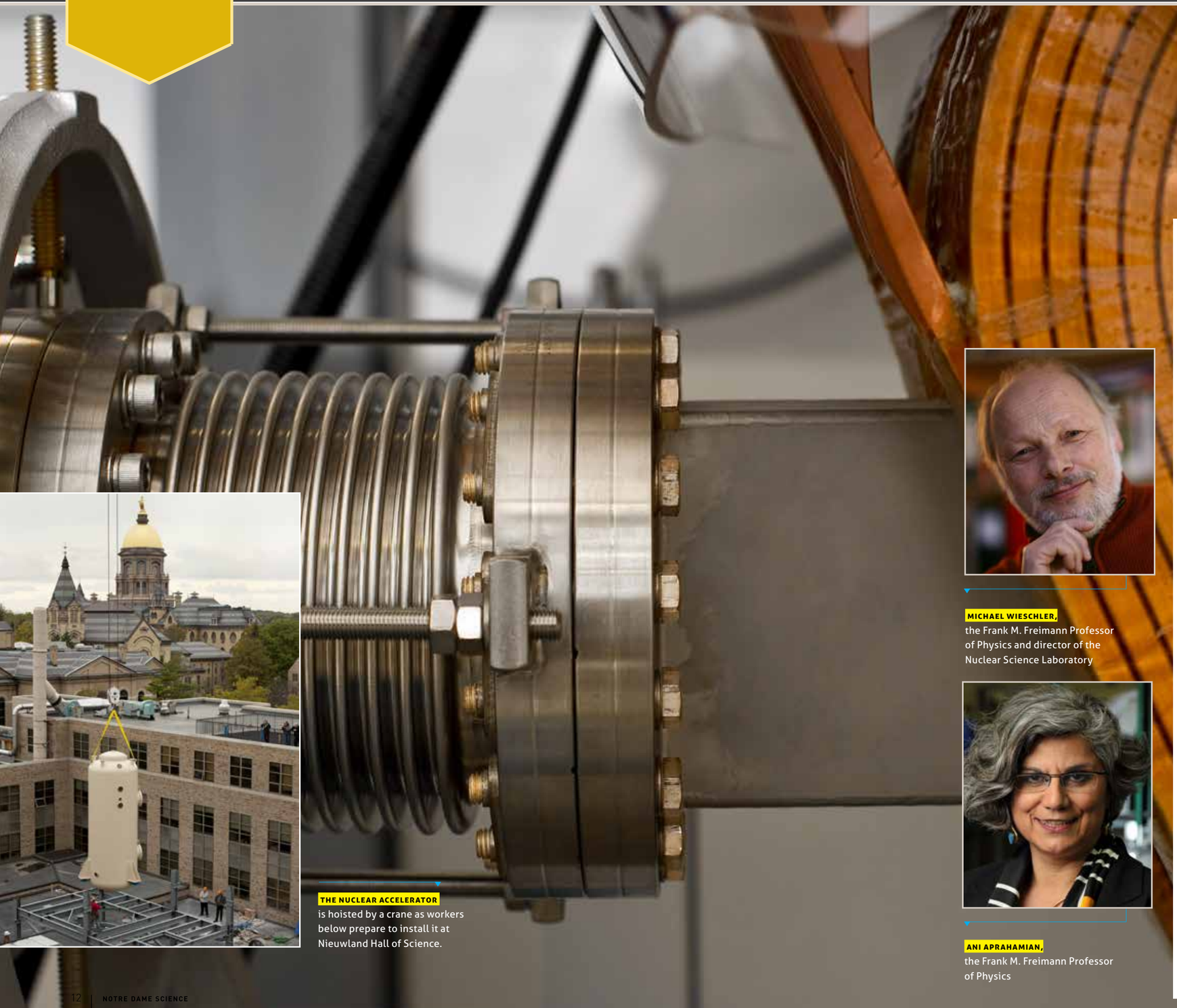
After years of student requests, the Department of Mathematics began offering a new minor in actuarial science in the fall 2012 semester.

Actuaries work in business and government, using data sets and computer models to calculate cost and probability. Many former Notre Dame students have excelled in this career field, but with the addition of the actuarial science minor, preparation is no longer an independent endeavor.

In the past, demand for classes in the Mendoza College of Business has made it difficult for non-majors to take courses in disciplines like accounting or finance. Students pursuing the actuarial science minor will now have easy access to four courses within the college.

The minor also includes course work in probability, statistics, and economics. Though this course work was selected to prepare students for the actuarial exams required to enter this career field, the minor also requires students take two exam review courses.

According to the Bureau of Labor Statistics, demand for actuaries is expected to grow by 27 percent between 2010 and 2020. Though many recent college graduates face a tough job outlook, students pursuing actuarial science have an edge in this competitive market, and the new minor seeks to prepare them for these pursuits. ■



THE NUCLEAR ACCELERATOR is hoisted by a crane as workers below prepare to install it at Nieuwland Hall of Science.

NSF Places the First Nuclear Accelerator Since the '80s at Notre Dame

The first new accelerator for low-energy nuclear physics in the United States since the 1980s was installed at Notre Dame, sponsored by the National Science Foundation.

MICHAEL WIESCHLER, the Frank M. Freimann Professor of Physics and director of the Nuclear Science Laboratory

ANI APRAHAMIAN, the Frank M. Freimann Professor of Physics

THE FIRST NEW ACCELERATOR FOR LOW-energy nuclear physics in the United States since the 1980s was installed at Notre Dame this past year. The $3.5 million project includes a 10-ton tank installed vertically in the center of Nieuwland Science Hall and provides beams to the newly designed St. George Recoil Separator at Notre Dame.

"It's mainly for nuclear astrophysics, for simulating nuclear reactions that take place in stars and other stellar environments," said Michael Wiescher, the Frank M. Freiman Professor of Physics and director of the Physics Frontier Center JINA (Joint Institute for Nuclear Astrophysics). Wiescher came to Notre Dame in 1985 to start the University's nuclear astrophysics program, now one of the leading global centers.

Ani Aprahamian, the Frank M. Freimann Professor of Physics, said the research would focus especially on the origin of carbon and oxygen, essential elements for life on earth, in the first star generations.

"Besides these fundamental research questions, a number of more applied applications for the accelerator are being envisioned," she said. "These are mostly associated with providing new tools and signatures for medical diagnostics and treatment. Further developments are in the field of nuclear forensics and isotope analysis with numerous applications in geology, climatology, and biology. A new program was recently highlighted that opens new opportunities in the analysis of art and archaeological samples.

Already, more than 100 user groups from nearly 30 countries visit Notre Dame regularly to conduct experiments, and the new accelerator will increase interest. "It's great visibility for Notre Dame," Wiescher said. "All these people are coming, and they bring their students with them." The Nuclear Science Laboratory has a grant of $1.5 million a year, and JINA, a collaboration that includes Michigan State University, the University of Chicago, and Argonne National Laboratory, has a grant of $2 million a year.

Notre Dame's nuclear physics program includes about 25 graduate students as well as research faculty and postdoctoral fellows, making it one of the largest nuclear physics groups in the world. Researchers from other departments, from anthropology to archaeology and architecture, also use the facility in their work.

In addition to the new accelerator, which will produce heavy ion beams, two other accelerators will continue to operate in Nieuwland, providing mostly proton and alpha beams to several experimental setups.

The new accelerator is the main source of beams for the St. George separator that was installed in early 2011. This $3 million project can find a single particle created by an alpha capture reaction from the 10 beam particles. The equipment, developed at Notre Dame, is a model for other separators now being built. ■

Notre Dame Taking the Lead in Adult Stem Cell Research

STRATEGIC RESEARCH INVESTMENTS

THE UNIVERSITY OF NOTRE DAME'S STRATEGIC RESEARCH INVESTMENTS, or SRIs, are interdisciplinary research projects selected for their outstanding thought, social value, and reflection upon the University as a preeminent research center. They are funded by a combination of internal resources, grants, and gifts. The project began with the 2007 creation of the Strategic Academic Planning Committee, which was tasked with investing in the most promising projects proposed by faculty and given a budget of $40 million for this purpose. Response was enthusiastic, and in 2008 the process was repeated, bringing the total investment to $80 million and continuing the valuable and innovative dialogue between diverse groups of experts.

In addition to the three profiled here, existing SRIs include the Eck Institute for Global Health, Notre Dame Nanoelectronics research initiative, the Notre Dame Integrated Imaging Facility, Advanced Diagnostics and Therapeutics, and the Notre Dame Institute for Advanced Study.

MAJOR INITIATIVES FOR INTERDISCIPLINARY investigations involving non-embryonic stem cells are positioning Notre Dame as a leader in the field, adding the University's unique Catholic voice and rigorous research to the area that holds promise for a wide range of medical applications. Stem cell therapy could regenerate damaged organs such as the heart, kidneys, liver, and parts of the central nervous system as well as cure such diseases as heart disease, Parkinson's disease, and cancer.

As a Catholic institution and in accordance with Catholic doctrine, Notre Dame does not conduct research involving the destruction of human embryos, a practice antithetical to its respect for the dignity of the human person, but it affirms the search for human healing by ethical stem cell means. David Hyde, the Rev. Howard J. Kenna, C.S.C. Memorial Director of the Center for Zebrafish Research, was invited to participate in the First International Vatican Adult Stem Cell Conference in November 2011.

In the past five years faculty members have received more than $13 million in federal and private funding with direct costs of about $10 million. Internal support has come from the Zebrafish Research Facility, the Adult Stem Cell Initiative, the Strategic Research Initiative, and a recent endowment from Elizabeth and Michael Gallagher to hire three junior faculty in the College of Science. In July 2011, the University hosted a workshop on adult and non-embryonic stem cell research with prominent academics and church leaders, including two member of the Pontifical Council for Culture at the Vatican.

A joint initiative between the College of Science and the Office of the Vice President for Research provided $50,000 each for six projects for work related to stem cell research by the college and others on campus. Overall, research efforts involving the College of Science include:

■ David Hyde's research on neural regeneration in zebrafish that shows promise for treating such retinal diseases as retinitis pigmentosa, glaucoma, and diabetic retinopathy. Hyde also conducts research involving cultured human adult stem cells derived from placentas and umbilical cord blood, isolated after childbirth, to regenerate cells that are lost during macular degeneration.

(R) DAVID HYDE, the Rev. Howard J. Kenna, C.S.C. Memorial Director of the Center for Zebrafish Research

"The work that Prof. David Hyde does is just one example of our innovative approach to research. We believe that Notre Dame's groundbreaking discoveries will be the future of stem cell research."

— DEAN GREGORY CRAWFORD

■ Malcolm Fraser, Jr.'s development of the piggyBac transposon, a University-patented transgene tool that is licensed and sublicensed to companies and research institutions around the world to generate induced pluripotent stem (iPS) cells, which are stem cells that are reprogrammed from ordinary adult cells such as skin or muscle.

■ Kevin Vaughan's studies in zebrafish to examine if perturbations in the brain neural stem cells affects different types of neurons and possibly the progression of Niemann-Pick Type C disease.

■ Rebecca Wingert's research on kidney regeneration and development, using zebrafish to study what happens to cells after kidney injury and how small molecules can enhance kidney regeneration from the resident adult stem cells.

■ Bob Schultz's studies on regulating blood formation that revealed key events necessary to maintain adult stem cells and their differentiation into different types of blood and immune cells. The work could lead to treatments for leukemia.

■ Greg Timp's research to create a synthetic adult stem cell niche that can exert functional control over blood-forming stem cells. Timp also conducts research to improve the efficiency and quality of iPS cells using solid-state nanopores and optical tweezers to control cell reprogramming. ■

Mini SRIs

Nanowire Solar Cells: a new way to convert sunlight into electricity

GREG HARTLAND, Ken Kuno, Libai Huang, and Prashant Kamat received a Strategic Research Investment grant to investigate the properties of semiconductor nanowires, and to determine whether these materials can be used to create improved solar cells.

Semiconductor solar cells work by absorbing photons (light) to create electrons and holes, which can be harvested to generate current. Present technology is based on silicon, which has reached a fundamental limit in efficiency. In order to improve the performance of semiconductor solar cells, the Notre Dame group proposed to use a process called charge carrier multiplication, where absorption of high-energy photons results in the formation of multiple electron-hole pairs. This can potentially double solar cell efficiencies; however, there are scientific and engineering challenges that have to be overcome to achieve this goal.

To date, the group has synthesized a variety of different types of semiconductor nanowires, and has used ultrafast laser spectroscopy to examine the fate of optically excited charge carriers. A spin-off company, "US-Nano," has also been created to exploit the advances in synthesis generated from SRI funding. US-Nano has recently been awarded both a Phase 1 and a Phase 1B SBIR grant from the NSF, and its first products have just come to market. Current work is centered on improving the efficiency of charge carrier extraction in nanowire solar cells.

Huber's Lab Studies Nanoparticle Dangers

The laboratory of **PAUL HUBER** has been granted Strategic Research Investment funding for research into the toxicity of nanoparticles. Nanoparticle research is a rapidly growing field; the particles' special properties suggest a wide variety of applications, from targeted drug delivery systems to medical nanomachines to the treatment of bacteria-resistant clothing. The potential hazards of these new materials, however, are poorly understood, and they remain unregulated by the FDA even as millions of tons of them are released into the environment yearly.

Huber's work aims to improve on previous studies which have drawn optimistic conclusions without adequately ensuring that the cells in question have assimilated the nanoparticles. His program has developed increasingly precise methods for introducing the particles into cells, using the embryonic cells of frogs and zebrafish; these cells' sensitivity to change make them ideal for study, and researchers have already observed potential DNA damage during their development.

Ultimately, Huber's goal is to understand how nanoparticles express their toxicity at the molecular level. The project is also an effort to develop an improved screening system, one which will facilitate quick, cheap, large-group cellular injections that will help toxicity research keep pace with the rest of the nanotechnology field.

Fraser's Genetic Research Combats Viral Diseases

The laboratory of **MALCOLM J. FRASER, JR.** has been the site of dramatic advances in the field of genetics, many of them stemming from the discovery of piggyBAC, a transposon vector which allows genes to be safely and stably transferred to existing cells, facilitating previously impossible advances in genetic engineering. Recently, Fraser's lab has been pioneering new strategies to combat mosquito-spread diseases such as Dengue fever. In the process, Fraser and his team are taking steps beyond piggyBAC to develop a variety of tools for effecting transgenesis, or the introduction of genes into living organisms.

The mosquito research involves the use of Group I introns as antiviral agents. When introduced into susceptible mosquito cells and tissues, these introns can suppress the mosquito's ability to carry the virus and transmit it to humans. The success of this approach has led to theorization on its potential for use in curing chronic virus diseases in humans, specifically AIDS and Hepatitis C. The realization of this potential is an important research goal going forward; Fraser intends to seek funding in future for a grant directed at multidisciplinary research into viral vaccines, viral transgene vectors, antiviral drug agents, and human viral diseases. His recent work is made possible by Strategic Research Investment funding.

STRATEGIC RESEARCH INVESTMENTS

Sustainable Energy Initiative

Advancing Sustainable Fossil, Nuclear, Solar Energy

The Sustainable Energy Initiative (SEI) has been one of the University's most notable success stories, transforming its $10 million funding into a rich interdisciplinary program. The Center for Sustainable Energy at Notre Dame (cSEND), which was founded in 2011, manages SEI. The SEI program currently funds 27 seed projects and 40 project-years of research to enhance the research capabilities in sustainable energy.

In addition to funding new seed projects, the SEI is funding four new research facilities and has attracted six new faculty members to the University to pursue energy-related research: Franklin Tao, Haifeng Gao, and Vlad Iluc in the Department of Chemistry and Biochemistry, Ruilan Guo and William Phillip in the Department of Chemical and Biomolecular Engineering, and Tengfei Luo in the Department of Aerospace and Mechanical Engineering. Among them, the six faculty have benefited from the availability of SEI research funding and have received awards for 8 of the 27 SEI seed projects.

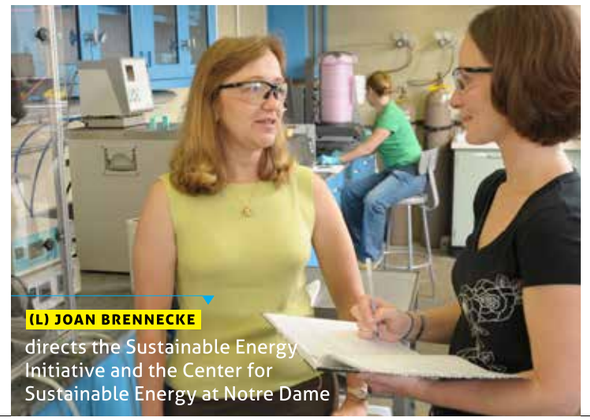
Although cSEND itself acts as an epicenter for all energy-related research, the SEI focuses on improvements in three particular areas of sustainable energy: fossil, nuclear, and solar energy. The fossil fuels portion of the SEI, which is led by William Schneider in the Department of Chemical and Biomolecular Engineering focuses on improving the sustainability of fossil energy. One key area of inquiry concerns new ionic materials whose solid-to-liquid phase change on exposure to CO_2 could dramatically reduce the energy required for capture, which under the current technology remains impractically high.

The nuclear research effort, led by Peter Burns in the Department of Civil and Environmental Engineering and Earth Sciences, aims to develop novel actinide materials; actinides are the radioactive elements that fuel nuclear energy, and Notre Dame scientists' refinements in synthesis and characterization of novel actinides position them for a substantial step forward in the safe disposal and even recyclability of nuclear fuels.

The solar research effort is led by Prashant Kamat, the Rev. John A. Zahm Professor of Science, whose work, as Kenneth Henderson, associate director of cSEND and chair of the Department of Chemistry and Biochemistry, explains, "focuses on assembling semiconductor nanostructures for light energy conversion and obtaining fundamental information on electron transfer processes at semiconductor interface. In particular, his research group makes use of unique optical and electronic properties of semiconductor nanostructures for developing new strategies to capture and convert solar energy."

The SEI has also funded a series of new laboratory facilities, which are managed by cSEND. The Actinide Facility is a lab equipped for the study of complex actinide materials containing transuranic elements and is entirely unique in the nation. The Materials Characterization Facility has an array of instruments for solid and liquid material characterization by analytical methods involving spectroscopy, heat transfer, X-rays, and BET. The Materials Characterization Facility also combines the capabilities for material synthesis and modification. The Transformative Solar Facility is currently being assembled and will be equipped to evaluate the photo-electro-chemistry of new materials. The SEI has also funded the Computational Molecular Science and Engineering Laboratory. All four laboratory facilities are available for use by the entire academic research community and by external users too.

cSEND is administered and operated by faculty and staff who strive to enable the center to reach its full potential in fulfilling its mission. Joan Brennecke, the Keating-Crawford Professor of Chemical and Biomolecular Engineering, serves as the director of cSEND. This past July, Stephen Takach joined the University and became the managing director of cSEND. He is a 1986 graduate of the University with a B.S. in physics. He holds a master's and Ph.D. in physics from Yale University, and is responsible for the business management of cSEND, its staff, and the laboratory facilities. ■



(L) JOAN BRENNECKE directs the Sustainable Energy Initiative and the Center for Sustainable Energy at Notre Dame

Research News

(L) PRASHANT KAMAT, senior scientist, leads the University's research efforts on solar energy.

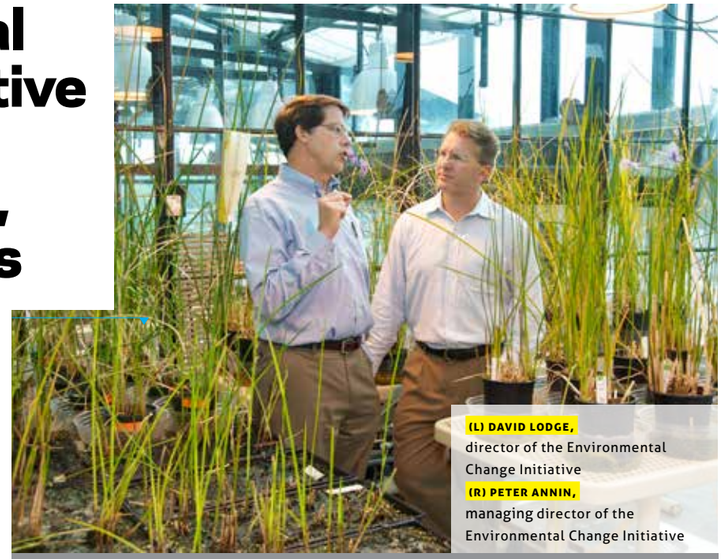
Energy Studies Minor Attracts Students from All Disciplines

The minor in energy studies, which started in the fall of 2011, is part of the Sustainable Energy Initiative.

The minor equips students for a future in which energy efficiency and sustainable energy will be increasingly vital. The program offers separate technical and non-technical tracks for students in different fields. The first track surveys the fundamental aspects of the energy infrastructure; the second examines the political, societal, and business ramifications of that infrastructure and its place in a world of depleting fossil resources and changing climates.

All students take a pair of overview courses which covers the basics of both tracks. These are taught respectively by faculty in the Department of Physics and in the Mendoza College of Business. After the overviews, students specialize by completing three electives offered by the College of Engineering, the College of Science, the College of Arts and Letters, and the School of Architecture. On the technical track, electives range from courses on alternative vehicles, to climate science, to nuclear physics; non-technical courses from energy policy, to environmental history, to the psychology of changing behaviors toward the environment. The minor is completed with a capstone project under the guidance of the minor advisor.

Environmental Change Initiative Developing New Methods, Collaborations



(L) DAVID LODGE, director of the Environmental Change Initiative
(R) PETER ANNIN, managing director of the Environmental Change Initiative

NOTRE DAME'S ENVIRONMENTAL CHANGE Initiative (ND-ECI) examines the problems of invasive species, agricultural land use, and climate change and their complex, interrelated impact on water resources. It is also an important testing ground for new research techniques and novel collaborations, combining biological and ecological science with technology and engineering to develop practical solutions that maintain the delicate balance of environmental and social welfare. David Lodge, professor of biological sciences, and the ND-ECI's director, emphasizes that this blend of expertise places his team "not only in a position, like so many others, to diagnose the many problems that we have in the environment, but to actually help solve them."

The project's scale is ambitious. Its researchers will partner with the National Ecological Observatory Network (NEON), a new, continental-scale research platform which will gather detailed data on the ecological effects of climate change, land-use change, and invasive species across the 48 continental United States. NEON will also make this data fully available to researchers and the public on a near real-time basis. These resources will allow ND-ECI not only to observe environmental processes, but to examine the effectiveness and the results of its testing across the breadth of North America's ecological variety. The ND-ECI project considers the exploration of these new real-time research techniques to be an independent goal, closely intertwined with its immediate objects of study. Another goal is to incorporate the work of humanists, social scientists, and risk analysts in its research, in order to be mindful of the dangers of implementing new techniques with inappropriate timing and placement and without regard for local needs.

Among the techniques in development to counter invasive species will be analysis of organism spread under various climate change scenarios, bioeconomic modeling of the mutual impact of environment and trade, and experiments on the impact of species together with new genetic technologies for their detection. The ND-ECI will also develop methods of modifying agricultural land use to minimize the runoff of excess nutrients into local aquatic ecosystems, an ecologically destabilizing side effect of farming. It will create new and unique embedded sensor networks to measure runoff in field scale experiments, which will be the key to the effective design and testing of potential adaptive policies.

This past summer, the initiative launched the Notre Dame Linked Experimental Ecosystem Facility (ND–LEEF) in collaboration with St. Patrick's County Park. The facility will not only provide an unrivaled opportunity for scientific and environmental outreach, but will also allow collaborating scientists and educators to follow the research in real-time through the Internet from anywhere in the world. ■

Innovation Fellows Advance Discovery from Bench Toward Bedside

(R) RICHARD TAYLOR AND (L) COLE STEVENS are investigating new cancer therapeutics based on protein translation inhibitors.

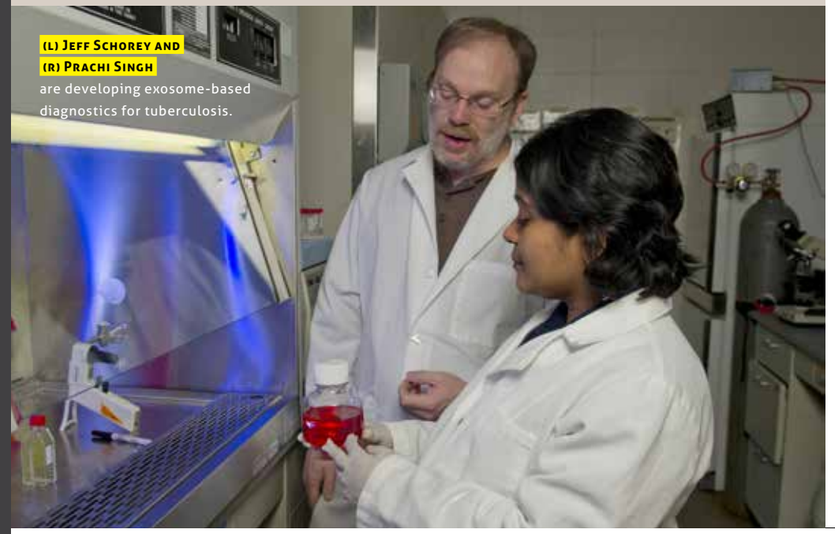
INNOVATION FELLOWS HAVE MOVED discoveries in Notre Dame laboratories closer to commercialization. The fellows have advanced research that has already become the basis of startup companies as well as journal publications and large grant applications. In 2012, the third year of the program, the College of Science Entrepreneurial Innovation Fund identified eight projects after funding three in the first year and five in the second.

Prachi Singh is working with principal investigator Jeff Schorey, associate professor of biological sciences, to develop exosome-based diagnostic tools for identifying tuberculosis in patients, using protein signatures from people infected with the disease. The group aims to create a high-throughput screen for the diagnosis. It's going to be a pretty diverse and challenging project for us. They have samples, and plan to target proteins and RNA signatures.

Cole Stevens is working with principal investigator Richard Taylor, professor of chemistry and biochemistry and associate dean for research, on new cancer therapeutics based on protein translation inhibitors. Stevens helped set up a biological chemistry laboratory to produce gephyronic acid molecules, an anticancer therapeutic, in a scalable way. The bacterium that naturally produces the molecule is difficult to grow, and the synthetic method for producing it is also not scalable. The laboratory inserts genetic material from the bacterium into easily-grown E. coli to produce the molecule. "Our role in the process is to develop a scalable easy route to the molecule for industry," Stevens said, adding that the work has also generated analogs and slightly different versions of the molecule and provided insight into how it is produced.

Oleg Kim is working with principal investigator Greg Crawford, dean of the college, on ways to identify the age and causes of bruises, an important tool in fields such as child protection. Kim focused on data analysis and building a model, based on the Monte Carlo method for simulating highly complex systems to calculate the amount and concentration of blood and other chemicals in a bruise. The research used data from a small sample of patients at a children's hospital as well tests on skin that had not suffered bruising. The group is also modeling the distribution of blood in the bruise and expects to conduct research with a larger sample to refine the model calibration.

Other innovation postdocs are Maksym Zhukovskyi, working with Masaru K. Kuno on semiconductor nanowire yarns; Ziheng Wu, working with Mark Alber on multi-scale blood clot modeling for thromboembolic disease; and Nan Sun, working with Carol Tanner and Steven Ruggiero on high precision detection of nanoparticles. Five other projects are planned including researching microvessicles as novel cancer biomarkers with Crislyn D'Souza-Schorey and novel vaccine adjuvants with Mark Suckow. ■



(L) JEFF SCHOREY AND (R) PRACHI SINGH are developing exosome-based diagnostics for tuberculosis.

(R) MITCHELL WAYNE, principal investigator of QuarkNet, explains a radiation study to Michael Tripepi, a local high school student involved in QuarkNet.

QuarkNet Receives $6.1 Million NSF Award to Advance Program

THE UNIVERSITY OF NOTRE DAME HAS RECEIVED A FIVE-YEAR, $6.1 million award from the National Science Foundation (NSF) to support the continuation of the nationwide QuarkNet program, which uses particle physics experiments to inspire students, and provide valuable research, training, and mentorship opportunities for high school teachers.

Through the QuarkNet program, physicists at Notre Dame, Fermilab, and 50 other research institutions will continue to mentor teachers in research experiences, enabling them to teach the basic concepts of introductory physics in a context that high school students find exciting. Faculty, students, and teachers work together as a community of researchers, which not only develops scientific literacy in students, but also attracts young students to careers in science and technology.

Mitchell Wayne, professor of physics and principal investigator of the NSF grant, said, "The Notre Dame QuarkNet Center is a great example of the mentoring and training provided by particle physicists at universities and national laboratories across the country. It has become a focal point for educational outreach into our community. Hundreds of local high school students and many of their teachers have done research in particle physics at the center." In addition, other education and outreach programs have been initiated by QuarkNet teachers, most significantly the Notre Dame extended Research Community (NDeRC), a significant GK-12 effort that brought interactive projects in physics, chemistry, biology and engineering to thousands of local school children.

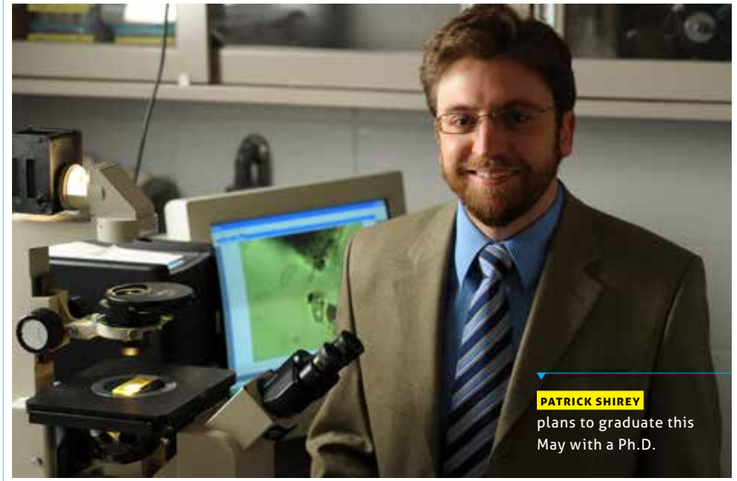
One key feature of QuarkNet is the summer research experiences that participating centers offer for teachers and students. Recently, 15 teachers, 14 students, 9 mentors, and a graduate student worked on nine different projects with Notre Dame faculty, including investigations into new scintillators, a presentation of particle physics in the Notre Dame Digital Visual Theater, investigations using the Compact Muon Solenoid e-Lab, and cosmic ray studies.

In the past few years, the reach of QuarkNet has become international, with QuarkNet-sponsored activities such as cosmic ray studies and masterclasses now being offered to students and teachers around the world. Since 2006, more than 2,100 students have participated in masterclasses in 25 countries.

Notre Dame was one of the initial QuarkNet Centers. When Randy Ruchti, professor of physics, started the Notre Dame center 15 years ago, he worked with three other physicists to start the national QuarkNet program as well. The Large Hadron Collider (LHC) was still a decade away from operation. His vision was to inspire and educate high school students who would be interested and engaged in particle physics, and who would be prepared to work on the large LHC project. To reach these students meant reaching out to their teachers and engaging these skilled professionals in the research effort. He says, "the program has worked amazingly well, and is a two-way process: for teachers and students—professional development and forefront research experiences; for physicists—critical educational input from master teachers and expansion of the research effort to nontraditional, enthusiastic participants."

Students and teachers in the QuarkNet program helped to build elements of the major Fermilab and LHC experiments over the last decade and are working on new detector upgrades. They are able to look at the latest scientific data from the LHC experiments, including events from the search for a Higgs-like Boson, whose discovery was announced at CERN, the Center for European Particle Physics, on July 4, 2012. Ruchti says, "It just doesn't get more scientifically exciting than this!" ■

GLOBES Fellow Combines Ecology and Law to Guide Ecological Restoration



PATRICK SHIREY plans to graduate this May with a Ph.D.

PATRICK SHIREY, A FELLOW OF NOTRE Dame's Global Linkages of Biology, the Environment and Society (GLOBES) program, holds a master's degree in wildlife science and a law degree. As a graduate student in biological sciences, Shirey will complete an NSF Integrative Graduate Education and Research Traineeship (IGERT) as part of GLOBES. He has applied his research to a wide field and won national honors and broad exposure for his work. He expects to complete his Ph.D. in spring 2013.

In an article for the journal *Conservation Letters*, Shirey and his advisor, chair of the Department of Biological Sciences Gary Lamberti, warned of potential legal problems that could hamper efforts to help species adapt to climate change. Shirey studied how the Endangered Species Act might apply to moving species out of their historical ranges, sometimes called assisted migration or assisted colonization. He discovered that bureaucratic regulations attached to the law in the 1980s could arm opponents of such moves. Shirey, who focuses on ecology in the context of history, says the research grew out of his class project in a GLOBES course taught by Jessica Hellmann and Jason McLachlan, international experts in climate change adaptation.

An invited comment by Shirey and Lamberti in the journal *Nature* in 2011 called for enforcing existing regulations of trade in rare plants. Their research showed that over 10 percent of the 753 plants listed as threatened and endangered under the U.S. Endangered Species Act are being offered or at least advertised for sale online. Of the sellers offering plants for sale between states, very few are obtaining the required permits. Some shoppers are individuals or groups conducting "assisted colonization" projects aimed at moving the plants to new environments to mitigate for climate change. Shirey and Lamberti emphasize that there are consequences to such haphazard moves that could harm efforts to protect species, such as spreading pests or plant pathogens, or creating undesirable hybrids. Along with Notre Dame coauthors, including an undergraduate student, they have a forthcoming in-depth article on the conservation implications of commercial trade in endangered plants.

"Environmental agencies and governing bodies must better enforce existing species protection laws and re-evaluate legal frameworks to monitor and manage this rise of species redistribution," Shirey said. He suggests that if assisted colonization is to be used for species conservation, it should be a coordinated effort between government agencies, concerned citizens, commercial entities, and non-government organizations including botanical gardens.

This research is part of Shirey's interdisciplinary dissertation, where he uses ecology, history, and law to inform environmental policy and ecological restoration efforts. Additional projects include monitoring the response of the Juday Creek fish community to stream restoration on the Notre Dame campus, leading field efforts to survey brook trout streams in Michigan and Wisconsin, and contributing to a historical evaluation of the Namekagon River in Wisconsin to plan for river restoration.

Building on his Namekagon River work, he was awarded a 2012 George Melendez Wright Climate Change Fellowship from the National Park Service to support research on water temperature, fish habitat, and native brook trout. As part of the field component led by Shirey, two additional graduate students and three undergraduate students participated in habitat surveys, sampled fish populations, worked alongside state and federal agency personnel, and engaged with the public. After graduating from Notre Dame, he plans to continue to use his education in science and law to address research questions and solve problems that are relevant to environmental management. ■

Harper Cancer Research Institute Welcomes New Faculty

THE MIKE AND JOSIE HARPER CANCER Research Institute, a collaboration between Notre Dame and Indiana University School of Medicine, focuses on innovative and integrative cancer research, with an emphasis on establishing multidisciplinary teams to address cancer-specific problems. The institute is located in Harper Hall, which opened in spring 2011 after a $10 million contribution to Notre Dame from Charles M. "Mike" Harper which was matched with a $10 million appropriation from the state of Indiana to Indiana University for the project.

M. Sharon Stack, the institute's director, says the initiative has recruited new faculty, established the Tumor Biorepository, and developed the interdisciplinary Science Program Working Group structure that includes faculty from colleges of science, engineering, and arts and letters.

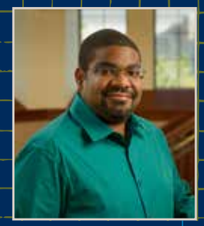
Four new researchers were hired this year: Reginald Hill, an assistant professor of biological sciences at Notre Dame whose research focuses on genetic models of pancreatic cancer; Laurie Littlepage, an assistant professor of chemistry and biochemistry at Notre Dame whose research focuses on the contributions of the epithelium and surrounding stroma/microenvironment to both cancer progression and normal mammary gland development; Jenifer Prosperi, an assistant professor of biochemistry and molecular biology at Indiana University School of Medicine–South Bend whose research focuses on breast tumor biology, including mutation of a tumor suppressor; and Siyuan Zhang, an assistant professor of biological sciences at Notre Dame whose research focuses on cancer metastasis and resistance to anticancer treatments.

The Biosample Repository, directed by Zonggao Shi, research assistant professor of chemistry and biochemistry at Notre Dame, collects tissue and biofluid samples from cancer patients and control groups to help the institute's researchers investigate the mechanistic basis of human cancers, identify new therapeutic targets and assess novel biomarkers of disease incidence or progression. The repository is a collaboration with pathologists at the South Bend Medical Foundation and physicians at St. Joseph Regional Medical Center and Memorial Hospital of South Bend. ■

M. SHARON STACK
Ann F. Dunne and Elizabeth M. Riley Director of the Harper Cancer Research Institute

LAURIE LITTLEPAGE
Campbell Family Assistant Professor of Cancer Research

SIYUAN ZHANG
Nancy Dee Assistant Professor of Cancer Research



REGINALD HILL
Archibald Assistant Professor of Cancer Biology

College News

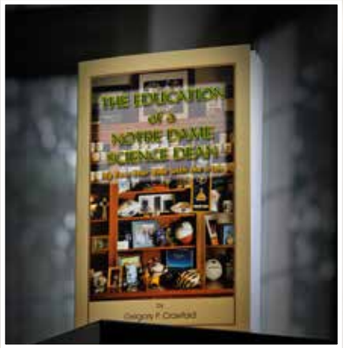
Partnering with the Ara Parseghian Medical Research Foundation

The partnership between the College of Science at University of Notre Dame and the Ara Parseghian Medical Research Foundation supports research initiatives to find a cure or treatments for Niemann-Pick Type C (NPC), a rare and deadly neurodegenerative disease that primarily strikes children before or during adolescence, including three of Coach Parseghian's grandchildren. ■

PARSEGHIAN CLASSIC, JUNE 21-24,2013 AT PEBBLE BEACH

Dean Greg Crawford's third cross-country bike ride last summer raised awareness and funds for research to find a cure or treatments for NPC disease. The Road to Discovery ride took him 3,250 miles from Boston to Pebble Beach, Calif., in time for the ParseghianClassic at Pebble Beach Resorts® which raised funds for research to fight the disease. The 2013 Parseghian Classic will be held June 21-24 at Pebble Beach Resorts® to benefit NPC research.

parseghianclassic.nd.edu



THE EDUCATION OF A SCIENCE DEAN SUPPORTS NPC RESEARCH

The Parseghians and the cross-country bike rides fill four chapters of Crawford's recent book, *The Education of a Notre Dame Science Dean: My Four-Year Ride with the Irish.* The 200-page book, published by Corby Books, is the dean's personal account of his experiences. Working with Coach Parseghian in the fight against NPC, he says, fulfills his childhood dream of playing for a Notre Dame coach as his Great-Uncle Pomp played for Knute Rockne. Allproceeds from the book go to the Ara Parseghian Medical Research Foundation.

ND LIGHTS Brightens Under-equipped High School Laboratories

MICHELLE JOYCE, associate director of the Mass Spectrometry and Proteomics Facility, administers the ND LIGHTS program.

ND LIGHTS—NOTRE DAME LABORATORY Instrumentation Giving Hope To Students—has expanded its laboratory equipment donation program to include training for teachers using student-designed experiments. The program has also given equipment to colleges as well as high schools in need of laboratory equipment.

Michelle Joyce, associate professional specialist in the Department of Chemistry and Biochemistry, administers the program. She teaches a spring semester undergraduate laboratory course, Instrumentation and Science Education, where students develop pre-packed experiments for high school students to perform using the donated instruments. In spring 2012, a science-business major, a premed major, and a chemistry major prepared a total of six equipment packets.

The chemistry major, who joined Notre Dame's Alliance for Catholic Education (ACE) program, took a set of donated materials to her school in Baton Rouge, La. Other high schools who received equipment were Washington, Clay, and Riley in South Bend, and West Catholic and Grand Rapids Catholic Central in Grand Rapids, Mich. High school teachers came to campus for training in how to use the instruments and perform the experiments. Scientific supplier VWR donated the materials used in the experiments.

College-level equipment was donated to Saint Mary's College, a Jesuit university in West Virginia, and Catholic University of Eastern Africa, a connection through the Ford Family Program.

Instruments included optical microscopes, rotary evaporators, pH meters, a voltmeter and glassware, among other things. The rotary evaporator, for example, came with reagents and accessories to extract and separate pigmentation from leaves that students collect, allowing them to compare leaves from different species and leaves from the same species in different seasons. The Office of Sustainability assisted in preparing instructions for classroom experiments.

The donations are especially important at a time when budget cuts strain schools' ability to buy laboratory supplies and equipment. "I feel like this is part of our mission—to transfer the tools of scientific discovery," Joyce said. "If we have instrumentation, and we're not using it, we should definitely pass it on." ■

Irish Students Bring their Passion and Innovative Spirit to ESTEEM

THE MASTER OF SCIENCE IN ENGINEERING, Science, Technology and Entrepreneurship Excellence (ESTEEM) is an interdisciplinary degree that integrates technology innovation with entrepreneurship. The course work provides students with the core understanding of business principles needed to complement their scientific, mathematic, or engineering backgrounds. Students are challenged to become technologically innovative leaders who can deliver solutions to the problems of today's changing world.

This year, Tomas Collins, Shane McCarthy, Shane McQuillan, and Conor O'Donoghue came from Ireland to study in the ESTEEM program through the Naughton Fellowship Program. Naughton fellowships provide Notre Dame and Irish students with the opportunity for an international education in science, technology, engineering, or mathematics. The goal of the program is to encourage research and build connections with host institutions and countries.

"Meeting and exchanging ideas with people from a broad range of backgrounds has been very exciting," explains Collins. "To do this at the University of Notre Dame was a major plus given its golden history, tradition, and strong relations with my country of birth."

"Notre Dame's reputation, particularly with regards to its business faculty, meant I was fully confident that someone like me, who came from a purely technical background in engineering, could develop business acumen," says McCarthy. "There is a lot of emphasis at Notre Dame for engineering to provide social good, which also resonated with me."

The one-year program focuses on a capstone thesis, which takes an idea from its initial formation to commercialization. "My capstone, which utilizes my new knowledge of commercialization of high-tech products, consists of developing a comprehensive business plan for a nanotechnology start-up company," explains O'Donoghue. "Although it was challenging to come up to speed with a field of study relatively unfamiliar to me, I am thoroughly enjoying the whole process. With the continued help of the great faculty mentors and advisors I have, it will be a great success."

Post-graduation plans for the Irish students vary, but all four hope to stay in the United States for a while. Collins will launch his own start-up and believes the United States is the ideal place to bring his ideas to life. McQuillan wants to work for a large company where he can develop products that impact millions of people daily. O'Donoghue would like to work for a start-up because he enjoys the early development phases of a project. McCarthy says he will gain valuable experience from working in the United States and would like work with some of his ESTEEM colleagues in the future. "They say if you find talent, you should stand next to it. The students in the ESTEEM program this year are truly talented."

Their enthusiasm for the ESTEEM program and Notre Dame is clear. McQuillan sums up his experience quite well. "I'm having the year of my life so far. It's just a pity it's going so fast!" ■

(L-R) SHANE MCCARTHY, SHANE MCQUILLAN, TOMAS COLLINS, AND CONOR O'DONOGHUE collaborate with other ESTEEM students at Innovation Park.

Research Experience Impacts Career Decisions

REVATHI KOLLIPARA uses paper analytical devices to test for counterfeit drugs.

The College of Science Summer Undergraduate Research Fellowship program, which began six years ago, integrates students into research teams across the college where they gain valuable experience in research that can help them prepare for graduate school and make career decisions.

More than 75 students were supported during the summer by the college in 2012, with mentors from across the College of Science and beyond. Students said they gained skills beyond the laboratory experience in the academic curriculum.

"I truly feel that I, in a sense, lost my 'training wheels' in the lab, and I have become more confident in my experiments and the conclusions that I draw from them," said Danica Lapid, who worked with Richard Dahl at the Indiana University School of Medicine on leukemia, specifically how MiR-24 regulates hematopoiesis through targeting tribbles protein, Trb3. "This summer was simply incomparable to course labs, in which the experiment almost always works out, and there is always someone to troubleshoot the problems for you. Problem solving is essential to research, so I honestly believe that this summer encouraged me to grow as an analytical thinker," said Lapid who expects to pursue a Ph.D./M.D.

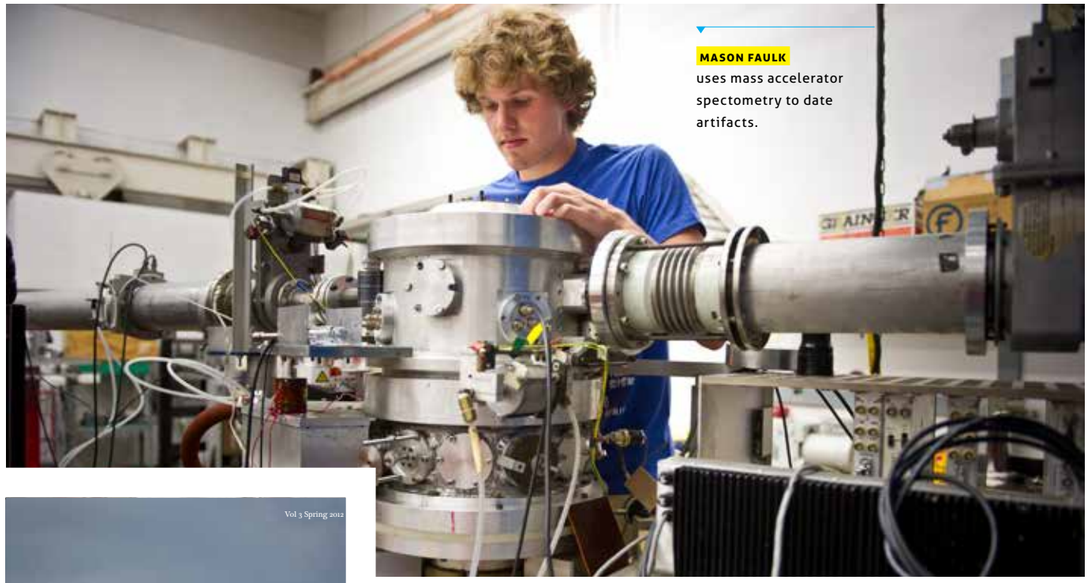
Mason Faulk worked with Philippe Collon, associate professor of physics, on an accelerator application to art and archeology, using accelerator mass spectrometry to detect very small concentrations of Carbon 14 for dating artifacts. The procedure was able to detect Carbon 14 in a sample with as little as one part per trillion.

Revathi Kollipara worked with Marya Lieberman, associate professor of chemistry and biochemistry, on the paper analytical device project, focusing on detection of counterfeit antimalarial drugs. "Research has not only taught me the importance of teamwork but also to be responsible for my own project," she said.

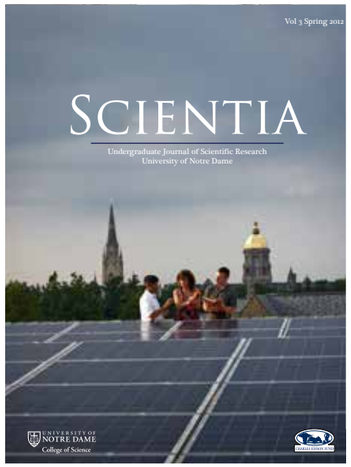
"This experience proved extremely helpful in discerning my career goals and reaffirming my decision to pursue further education" —Matthew Sarna

Janet Mostrom, who worked on vaccine development with alumnus Michael Munks of National Jewish Health in Denver, researched the development of contraceptive vaccines for cats and dogs. She said the summer provided a window into the life of a scientific research as well as specific scientific knowledge. Michael Kraft said his study of vector biology with Zainulabeuddin Syed, assistant professor of biological sciences helped develop his lateral and critical thinking skills that will advance his goal of becoming a doctor. He studied the attraction of *Culex pipiens* toward plant produced odorants.

"This experience proved extremely helpful in discerning my career goals and reaffirming my decision to pursue further education," said Matthew Sarna, who aims for a Ph.D./M.D. He studied infectious diseases with Joshua Shrout who holds a joint appointment in the College of Science and the College of Engineering. He studied the regulation of quorum sensing and swarm motility suppression for *Pseudomonas aeruginosa* grown on hard surfaces. "What's more, I feel that my summer experience assisted in my development of stronger critical thinking, time management, and communication skills, " he said. ■



MASON FAULK uses mass accelerator spectometry to date artifacts.



Undergraduates Publish Research in *Scientia*

UNDERGRADUATE STUDENTS PRODUCE THEIR own scientific journal, *Scientia,* that launched in 2010 and is supported by the Charles Edison Fund. Teams of students review submitted articles and manage the layout and design of the annual publication. Submissions are published online even if they are not included in the print edition.

Coeditors-in-chief Rebecca Marton and Rachel Cotton both joined *Scientia* as freshmen, when they took responsibility for its layout. Both of them are involved in research, both on campus and beyond, as well as publication.

Marton participated in a developmental biology project at Cold Spring Harbor in summer 2012, where she worked with Caenorhabditis elegans, a roundworm that is a valuable model organism for the study of genetic manipulation. Cotton, a member of Mary Ann McDowell's lab, studies the disease-causing parasite Leishmania. She has completed internships at La Jolla Institute for Allergy and Immunology, Washington University in St. Louis, and the Laboratory of Parasitic Diseases at the National Institute of Allergy and Infectious Diseases (NIAID).

Physics section editor Kevin McDermott, a senior, spent nine weeks conducting research at CERN, home of the Large Hadron Collider (LHC) in Switzerland in the summer of 2012. He rewrote the software package to monitor the quality of data from the ALICE (A Large Ion Collider Experiment) detector, a dedicated heavy ion experiment that uses the LHC to collide lead ions to study conditions theoretically present in the early universe. The software has been added to the ALICE repository. As a section editor, McDermott gathers submissions from physics researchers, reviews and edits them and selects two or three for each journal issue. He joined the staff in his junior year.

"Notre Dame takes pride in educating the next generation of scientists, and learning in the classrooms and laboratories is only part of the educational experience," Greg Crawford, dean of the College of Science, wrote in the 2012 edition of *Scientia.* "Our undergraduates also need to learn the methods of scientific writing, peer review, and editing. Through this publication undergraduates are sharing their own new knowledge while honing their scientific communication skills." ■

DOMINIC VACHON, director of the Ruth M. Hillebrand Center for Compassionate Care in Medicine, teaches the courses Medical Counseling Skills and Compassionate Care in Medicine.

Undergraduate Students Learn Compassionate Care in Medicine

> *"Compassionate care in medicine is essential to the best practice of medicine. To think otherwise now is scientifically outdated."* —Dominic Vachon

THE RUTH M. HILLEBRAND CENTER FOR Compassionate Care in Medicine trains aspiring and practicing physicians in the interpersonal dimension of patient care, fulfilling its mission to advance the scientific theory and practice of compassionate care in medicine and to promote effective communication skills in physicians, nurses, and allied health professionals at every level of training and practice.

Dominic Vachon, '80,'85, an expert in the emerging field of caring science, is the director of the center and teaches a basic course, Compassionate Care and the Medical Professions, that applies caring science theory to the practice of medicine and allied health professions. The course covers both research methods in the emerging field and the practice of compassionate care, including the balance between being emotionally detached and emotionally overinvolved with patients.

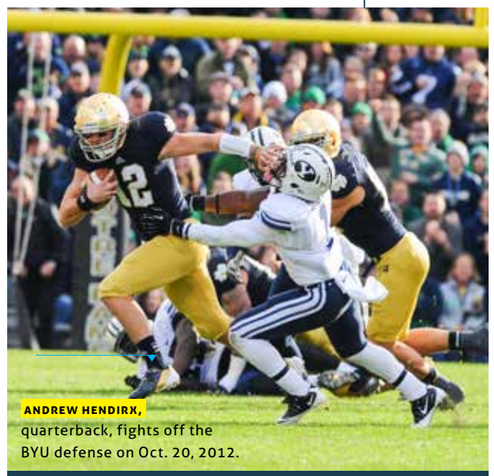
"Many people in medicine have come to think that bedside manner is not critical to the practice of medicine," Vachon says. "Now, we can prove the opposite is true: compassionate care in medicine is essential to the best practice of medicine. To think otherwise now is scientifically outdated."

The center takes a rigorous scientific approach to such topics as compassion and burnout, with attention to biology, evolutionary biology, neuroscience, and psychology, as well as medicine, spirituality, and business organizational dynamics aimed at fostering supportive caring environments for medical professionals to practice. The center is named after the late Ruth M. Hillebrand, a clinical psychologist in Manhattan. She became acutely aware of the need for compassionate care in medicine when she received her terminal cancer diagnosis in a brusque late-night phone call from a doctor who then hung up. After her death in 1994, her brother Joseph Hillebrand granted her wishes in endowing the center and a similar training facility in Toledo in 2004. ■

Student-Athlete Spotlight

Andrew Hendrix

Science Preprofessional Major



ANDREW HENDIRX, quarterback, fights off the BYU defense on Oct. 20, 2012.

IF YOU NAMED TWO THINGS FOOTBALL and science have in common, hard work and resilience would likely come to mind. Notre Dame quarterback Andrew Hendrix knows all about both.

The junior from Cincinnati is majoring in science preprofessional studies. "Both of my parents are in the medical field, and since I was little I dreamt of becoming a doctor. I have always loved helping people, and the human body and science have always fascinated me."

During the football season, Hendrix balanced challenging football practices with a rigorous academic schedule that included Physical Chemistry and Statistics for Life Sciences. "It has been one of the more difficult things I have done and sacrifices had to be made," explains the quarterback. "Summer classes allowed me to get ahead on requirements, and proper time management allowed me to balance athletics and academics."

Like all Notre Dame fans, Hendrix is proud of the football team's success, on and off the field. "To see a whole team of your good friends succeed like we did was unbelievable. To know how hard everyone works outside of football on class work, resulting in carrying the nation's highest graduation rate makes our accomplishments all the sweeter! We couldn't be more proud of our accomplishments in 2012."

The Fight for Sight: Biology Club Raises Over $7,500 to Fight Blindness

THREE YEARS AGO, MARIA SELLERS, '11, a student in the Mendoza College of Business, visited Rev. Theodore M. Hesburgh, C.S.C., and was inspired to find a way to help fight retinal degeneration.

"As an avid reader, I was drawn to the many books that lined his office walls," said Sellers. "He spoke of his love of reading, but how he'd been losing his sight to macular degeneration and had resorted to listening to books on tape."

Sellers began researching retinal diseases and learned about the Foundation Fighting Blindness and the Vision Walk. "After attending a Vision Walk in Fort Wayne, I worked with the Biology Club to coordinate the walk at Notre Dame," Sellers explained. "It seemed like a great fit, as Prof. Hyde was in charge of groundbreaking retinal degeneration research with zebrafish on campus."

ND VISION WALK 2012 (L-R): Nestor Agbayani, Vision Walk co-chair; Prof. David Veselik, biology club advisor; Antoinette Pusateri, Vision Walk co-chair; Maria Sellers, ND Vision Walk founder; and Prof. David Hyde

Over 75 students, faculty, and South Bend community members raised more than $7,500 at the third annual walk on Oct. 28, 2012. Families from Chicago, Cleveland, and Columbus also came to Notre Dame to walk in the event.

"To see the turnout of people that I didn't even know who had just heard about it from their friends, from their church, or from their families; that was inspiring," said Antoinette Pusateri, '14, co-chair of this year's event.

More than 10 million Americans of all ages and ethnic groups suffer from retinitis pigmentosa, macular degeneration, and other retinal degenerative diseases. Vision Walk events are held nationwide and proceeds from the events provide funding for research in areas such as genetics, gene therapy, transplantation, artificial retinal implants, and pharmaceutical and nutritional therapies. ■

College Expands Faculty

In August 2012, eight new tenure-track faculty joined the College of Science, including three just in the Harper Cancer Research Institute.

Justin Crepp
Frank M. Freimann Assistant Professor, Physics
Research: Search for planets orbiting stars other than the sun

Laurie Littlepage
Campbell Family Assistant Professor of Cancer Research, Chemistry and Biochemistry, Harper Cancer Research Institute
Research: Cancer biology and therapies

Kenjiro Kimura Gomes
Frank M. Freimann Assistant Professor, Physics
Research: Experimental condensed matter

Adrian Rocha
Assistant Professor, Biological Sciences, Environmental Change Initiative
Research: Land and atmosphere interactions and ecosystem carbon cycling

Reginald Hill
Archibald Assistant Professor of Cancer Biology, Biological Sciences, Harper Cancer Research Institute
Research: Pancreatic cancer; tumor microenvironment; chemoresistance

Roxana Smarandache
Associate Professor Mathematics, Engineering
Research: coding theory; discrete mathematics

Jun Li
Assistant Professor, ACMS
Research: Applied statistics, biostatistics

Siyuan Zhang
Assistant Professor, Biological Sciences , Harper Cancer Research Institute
Research: Tumor microenvironment, cancer metastasis and resistance to anti-cancer therapies

Additional faculty hires in 2012-2013

Travis Bailey
Research Asst. Professor, Biological Sciences
RESEARCH: developmental biology; organ regeneration

Mary Beard
Research Asst. Professor, Physics
RESEARCH: understanding nuclear reactions in stellar and exotic environments

Carlos Gartner
Research Asst. Professor, Chemistry and Biochemistry
RESEARCH: chemical biology and proteomics analysis

Lacey Haussamen
Asst. Professional Specialist, Biological Sciences, Eck Institute

Huy Huynh
Asst. Professional Specialist, Applied and Computational Mathematics and Statistics
RESEARCH: biological diversity; multinomial maximum and its application; probability and statistics for risk management

Ankita Jain
Asst. Professional Specialist, Applied and Computational Mathematics and Statistics
RESEARCH: stochastic modelling; probability and statistics

Sonja Mapes
Research Asst. Professor, Mathematics
RESEARCH: commutative algebra and combinatorics

Shahir Rizk
Research Asst. Professor, Biological Sciences, Center for Rare and Neglected Diseases
RESEARCH: protein engineering, rare and neglected infectious diseases

Daniel Robertson
Research Asst. Professor, Physics
RESEARCH: experimental low-energy nuclear astrophysics

Liangliang Sun
Research Asst. Professor in Chemistry and Biochemistry
RESEARCH: capillary electrophoresis, mass spectrometry, immobilized trypsin, proteomics

Tetsuya Tanaka
Research Assoc. Professor, Biological Sciences, Chemical & Biomolecular Engineering, Advanced Diagnostics and Therapeutics
RESEARCH: stem cell biology

Faculty Spotlight

* * * *

Rebecca Wingert

Since 2007, the National Institutes of Health (NIH) has bestowed its director's New Innovator Award upon exceptionally creative, early-stage researchers whose groundbreaking work in the fields of biological and behavioral sciences has the potential to significantly impact research and, ultimately, improve public health. In 2011, the extremely competitive $1.5 million award was granted to 49 promising new investigators, two of whom are in Notre Dame's Department of Biological Sciences, including Rebecca Wingert, the Gallagher Family Assistant Professor of Biological Sciences.

"The New Innovator Award provides tremendous funding support over the next five years," says Wingert, as well as an "amazing opportunity to forge ahead with our work on kidney regeneration."

A growing global healthcare burden, chronic kidney disease affects the quality of life for millions of children and adults worldwide—23 million adults in the United States alone, according to the NIH—and the loss of life for thousands of others. And while kidney diseases are diverse in origin, many share a common trait: damage to the basic unit of the kidney called the nephron. Wingert is researching nephron cell regeneration in zebrafish, whose kidneys are similar to ours, and her findings not only are leading to a better understanding of how the human kidney regenerates, but also could lead to more effective treatments for those with kidney disease.

"I am delighted to be pursing this line of research at the University of Notre Dame," she says. "I am inspired every day by the excitement and passion of the undergraduate and graduate students who have made my lab a special place for the pursuit of knowledge."

Wingert earned her Ph.D. at Harvard University, and performed her postdoctoral training as a research fellow in medicine at Harvard Medical School. In addition to receiving NIH's New Innovator Award, her research program is funded by a Mentored Career Award from the NIH (2009–2016) and a March of Dimes Basil O'Connor Starter Scholar Award (2012–2014). She was previously a recipient of a Harvard Stem Cell Institute Seed Grant Award (2008–10) and a Polycystic Kidney Foundation Fellowship (2007–09). A four-time recipient of the Harvard University Certificate of Distinction in Teaching (2005–08), Wingert's teaching philosophy is to provide students with a skill-set for conceptualizing, managing, and analyzing the overwhelming and ever-increasing amounts of information pertinent to the study of biology, while also cultivating in them a lifelong fascination with the science.

*****

The Gallagher Family Professorships in Adult Stem Cell Research was established in 2012 thanks to a $5 million gift from alumnus Michael Gallagher and his wife, Elizabeth. Professorships such as Wingert's strengthen the University's leadership in the field of stem cell research, while enhancing dialogue between the biomedical research community and the Catholic Church on matters related to the use and application of stem cells and regenerative medicine. ■

Graduate Student Spotlight

DOUG BERRY, a graduate student in the Department of Physics who worked for nearly four years at CERN, was a recent co-discoverer of the Higgs Boson. He worked intensely over a two year period as a member of the core analysis team searching for the Higgs decaying to two photons detected by the CMS detector.

On July 4, 2012 the discovery was announced and received worldwide attention. Berry made two of the critical plots shown at the announcement. He analyzed large data sets collected by the CMS experiment. "The real work is working on the analysis and getting the analysis right," he said.

Berry grew up in Midland, Mich., where his father worked at Dow Chemical and his mother at Dow Corning. He graduated from the University of Michigan in 2007, and came to Notre Dame, where he is advised by Colin Jessop, professor of physics and Nancy Marinelli, research assistant professor. Berry completed course work in advanced physics, from theoretical mechanics to quantum field theory, for two years.

He went to CERN in May 2009 and started work on the Higgs search in November 2010. The study focused on the decay of a Higgs boson into two gamma rays. Berry made many significant contributions to the analysis. One of these was in the vertexing group, tracking how photons convert to electrons in flight in order to find the primary vertex of the Higgs boson.

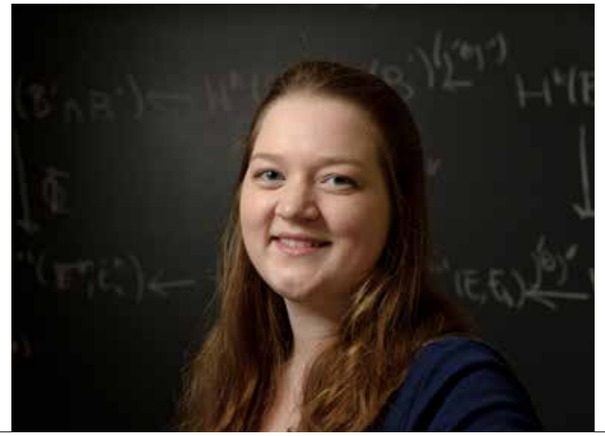
Berry, who expects to complete his Ph.D. in May 2013, continues to work with the team that expects to produce a full analysis on the 2011–2012 data set and significant improvements in the cross section measurement in the spring. He expects to continue working in the high– energy particle physics field. ■

Undergraduate Student Spotlight

MURPHYKATE MONTEE '13, a senior honors mathematics and music double major, has been named 2013–2014 Churchill Scholar, and has also received the 2013 Alice T. Schafer Mathematics Prize, a prize awarded by the Association for Women in Mathematics to only one undergraduate woman in the United States each year.

Montee is a member of the Seminar for Undergraduate Mathematical Research (SUMR), a program designed for the most talented mathematics students at Notre Dame. Montee is completing a senior honors thesis titled "On the Construction of the Chern Classes of Complex Vector Bundles." She has already coauthored three research articles, two of which have been submitted for publication and have appeared on the Mathematics ArXiv. She is advised by Frank Connolly, professor of mathematics and director of the SUMR program.

In addition to excelling in mathematics, Montee also has a passion for music and is pursuing a concentration in vocal performance as part of her second major in music. She sang the lead mezzo-soprano role in Sondheim's *Sweeney Todd* (2012) at the University of Notre Dame and will be the lead soprano in Notre Dame's 2013 production of Poulenc's *Dialogues des Carmelites*. ■



Alumnus Spotlight

THOMAS QUINN '69, '70 has spent more than 30 years studying the transmission and spread of HIV/AIDS. Now a leader in his field, director of the Johns Hopkins Center for Global Health, and associate director for international research at the National Institute of Allergy and Infectious Diseases, Quinn traces his success back to his time at Notre Dame.

"From high school onward, I was fascinated by biology," he says. Though he completed a variety of course work as an undergraduate in the life sciences, a parasitology course taught by Prof. George Craig proved to be his career-defining moment.

"I fell in love with his enthusiasm for the science. It was something that really opened up my excitement for the … pursuit of tropical medicine," says Quinn. "I realized right then I wanted to pursue both biomedical research and the practice of medicine to take care of patients with these types of tropical diseases."

Earning a bachelor's degree in biological sciences, Quinn decided to continue his tropical disease research at Notre Dame, subsequently completing a master's degree in 1970 under his mentor Craig. With years of laboratory research under his belt, Quinn left Notre Dame to study the clinical aspects of disease in medical school at Northwestern University.

"After medical school I did my internship and residency, and there you just take care of patients; you don't have time for research at all. I realized then how much I missed the research, and I decided I had to get back into that," he says.

Quinn accepted a fellowship at the National Institutes of Health, where he worked with fellow Notre Dame alumnus Bob Gwadz in the research of malaria. Seeking to complete his training as an infectious disease expert, Quinn moved on to a fellowship at the University of Washington, where studied human infections and sexually transmitted diseases.

He didn't know it yet, but those years of training were about to pay off in very a big way. "I had just finished my training in infectious diseases and came back to the NIH [and Johns Hopkins]. It was July 1981, and in June 1981, there was this report of homosexual men coming down with this deadly disease, and they didn't know what was causing it," says Quinn.

Quinn and his colleagues were witnessing the beginning of the AIDS epidemic in America. Realizing that migrant farm workers in Maryland were presenting with the same symptoms, Quinn tracked the virus to Haiti and eventually to Africa, being one of the first to investigate the geographical source of HIV/AIDS.

"That was an eye-opener, because [when we arrived] the epidemic had already been there for 10 years, but nobody had recognized it," says Quinn. "It was explosive—it was spreading like wildfire. This was a worldwide epidemic … and it was hitting everyone that came in contact with the virus that we now call HIV."

Quinn and his colleagues published their findings in top journals, also collaborating with virologist Luc Montagnier, who would go on to win the 2008 Nobel Prize in Medicine for his work in the identification of HIV.

In the past three decades, Quinn's work and expertise have taken him around the world. "All the training I picked up at Notre Dame came in handy, as I flew from one country to another, figuring out why this disease was being spread and what it was doing."

Though he's already made a number of significant contributions in the field of HIV/AIDS, Quinn is now using his understanding of the virus to develop techniques for effective control and prevention. He has impacted thousands of lives, but he said he'll always have a special place for the professional and social connections he made while at Notre Dame. He says, "I truly did enjoy every day that I was there." ■

Standing Ovations

Faculty Accolades

Ten University faculty members were named fellows of the American Association for the Advancement of Science (AAAS) in honor of their efforts towards advancing science applications that are deemed scientifically or socially distinguished. Nine of the new Notre Dame AAAS fellows are faculty members from the College of Science including, **NORMAN DOVICHI, GRACE-RUPLEY** Professor of Chemistry; **CRISLYN D'SOUZA-SCHOREY,** Notre Dame Professor of Biological Sciences; **JEFFREY FEDER,** professor of biological sciences and director of the GLOBES-IGERT Program (Global Linkages of Biology, the Environment, and Society); **STEFAN FRAUENDORF,** professor of physics; **PETER GARNAVICH,** professor of physics; **RANDAL RUCHTI,** professor of physics; **JEFFREY SCHOREY,** professor of biological sciences; **M. SHARON STACK, ANN F. DUNNE** and **ELIZABETH RILEY,** Science Director of the Harper Cancer Research Institute and professor of chemistry and biochemistry; and **OLAF WIEST,** professor of chemistry and biochemistry.

Five faculty have been named fellows of the American Mathematical Society for 2013, including **WILLIAM G. DWYER,** professor emeritus of mathematics and the William J. Hank Family Professor of Mathematics, **JULIA F. KNIGHT,** Charles L. Huisking Professor of Mathematics and the director of Graduate Studies for the Department of Mathematics, **MEI-CHI SHAW,** professor of mathematics, **ANDREW SOMMESE,** the Vincent J. and Annamarie Micus Duncan Professor in Mathematics and **NANCY K. STANTON,** professor of mathematics. The fellows designation recognizes members who have made outstanding contributions to the creation, exposition, advancement, communication and utilization of mathematics.

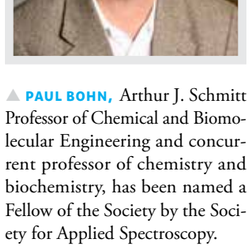
ANI APRAHAMIAN, the Frank M. Freimann Professor of Physics, has been appointed to a three-year term on the Physics Policy Committee of the American Physics Society. The Physics Policy Committee addresses science policy issues that affect the development of physics, the health of the institutions in which physics is practiced, the resources available to physics, and the balanced use of these resources for the nation's scientific and technological needs.

BRIAN BAKER, associate professor of chemistry and biochemistry, received the 2012 Director of Graduate Studies Award. Baker has been an integral part in placing the University's graduate program above the mean for the top-quartile chemistry programs nationwide. Baker encourages faculty to support more students on external grants, and has changed the department's teaching assistant support model.

BRUCE BUNKER, professor of physics, was elected as Chair of the International X-Ray Absorption Society for a three-year term. IXAS oversees activities and education to promote the growth of the field of fine structure associate with inner shell excitation by various probes.

Bunker was also named a 2012 American Physical Society Fellow for his contribution to the development of X-ray absorption spectroscopy and applications to complex nanoscale materials.

PAUL BOHN, Arthur J. Schmitt Professor of Chemical and Biomolecular Engineering and concurrent professor of chemistry and biochemistry, has been named a Fellow of the Society by the Society for Applied Spectroscopy.



PATRICIA CLARK, the Rev. John Cardinal O'Hara, C.S.C., associate professor of chemistry and biochemistry, was the recipient of the Michael and Kate Bárány Award for Young Investigators. This award is given to someone who has made outstanding contributions to biophysics, but has not reached the rank as a full professor. Clark was selected for her contributions and research on the biophysics of protein folding in the cell. She is the first Notre Dame faculty member to win an award from the Biophysical Society.

PHILIPPE COLLON, associate professor of physics, was named a 2012-2013 Kaneb Faculty Fellow. The Kaneb Center names faculty fellows each year to recognize their teaching excellence. Fellows share teaching experiences and techniques in workshops, research, and discussion groups.

JEFFERY DILLER, professor of mathematics, received the 2012 Father James L. Schilts, C.S.C./ Doris and Eugene Leonard Teaching Award, presented for excellence in teaching at the undergraduate or graduate level. He earned the award for his salutary influence on students in and out of the classroom. His exemplary teaching ability is evidenced through the other recognitions he has received in his career, including the Kaneb Teaching Award (2003), and the Joyce Award for Undergraduate Teaching (2008).

NORMAN DOVICHI, the Grace-Rupley Professor of Chemistry, received the 2012 Robert Boyle Prize for Analytical Science by the Royal Chemistry Society. Dovichi's group was partially responsible analytical instrument used by the Human Genome Project when it successfully determined the primary structure of the human genome. The prize is award to the candidate whose work is of broadest relevance to the science community.

Dovichi was also named a 2012 Fellow of the Royal Chemistry Society.

HOLLY GOODSON, an associate professor of chemistry and biochemistry, received the 2012 Thomas P. Madden Award, recognizing exceptional teaching of first-year students. In her 12 years at Notre Dame, she has developed a reputation as an educator who inspires students to think creatively beyond traditional disciplinary boundaries. This is exemplified by her leadership in providing first-year engineering students with an understanding of the biological aspects of chemistry.

MICHAEL HILDRETH, professor of physics, has been named a 2013 Compact Muon Solenoid (CMS) LPC Senior Fellow. The LHC Physics Center (LPC) at Fermilab is a regional center of the CMS collaboration.

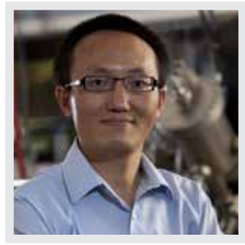
BOLDIZSÁR JANKÓ, research professor in the Department of Chemistry and Biochemistry, accepted the invitation to join the editorial advisory board of the *Journal of Combinatorial Chemistry.* The American Chemical Society has published this peer-reviewed scientific journal since 1999.

SHAHRIAR MOBASHERY, the Navari Family Professor of Life Sciences, received the 2012 Research Achievement Award for his contributions to biomedical research. He is best known for his work on drug-resistant bacteria and diseases of the extracellular matrix, which are being applied to diabetes, stroke, and cancer metastasis. He has recently developed therapeutics for stroke and brain injury that can potentially reduce damage caused by these events.

ANTHONY SERIANNI, professor of chemistry and biochemistry, was named a 2012 Fellow of the American Chemical Society. He is one of only 96 researchers selected nationwide. Serianni was selected for his outstanding contributions in the development and commercialization of synthetic methods. Serianni was also named a 2012 Fellow of the Royal Chemistry Society.

M. SHARON STACK, science director of the Harper Cancer Research Institute, has become a member of the editorial board of the journal *Cancer Research.*

JENNIFER TANK, the Galla Professor of Biological Sciences, has been selected as a 2013 Leopold Leadership Fellow. She is one of only 20 academic environmental scientists selected from across the nation to be named a Fellow this year.



FRANKLIN TAO, assistant professor of chemistry and biochemistry, was selected as the 2012 recipient of the Paul H. Holloway Young Investigator Award by the American Vacuum Society (AVS), Thin Film Division. Tao received the award for his contributions to the understanding of surface and interfacial processes in thin film and nano-materials systems, based on the development of instrumentation for structural and electronic property characterization of surfaces under catalytically relevant conditions.

ZOLTÁN TOROCZKAI, professor of physics and concurrent associate professor of computer science and engineering, accepted an invitation to serve on the advisory board of *Chaos: An Interdisciplinary Journal of Nonlinear Science.* As a member of the advisory board, he will submit articles to the journal, solicit articles from other researchers, and provide ides for the direction of future issues, including ideas for potential focus areas.

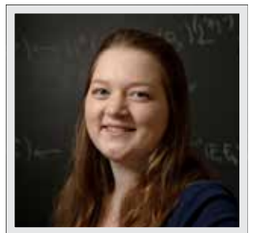
Toroczkai was also named a 2012 American Physical Society Fellow for his contributions to the understanding of the statistical physics of complex systems, in particular for his discoveries pertaining to the structure and dynamics of complex networks.

Undergraduate Accolades

☆ ☆ ☆ ☆

LEXIE BELOW, TAYLOR BOLAND, MATTHEW COLLINS, PATRICK FAGAN, AND RACHEL ROGERS are recipients of the Braco Award for Excellence in cell biology research, funded by Dr. Robert Braco. It is awarded each year to sophomore Cell 27241 research teams that have generated exemplary results in their research.

PAUL LAMBERT, was the recipient of the 2012 Dean's Award, which recognizes a graduating senior for exemplary personal character, service, and scholarship. He began working in Amanda Hummon's lab in 2009 researching colorectal cancer and published a paper in the journal *Proteomics*. He is now attending the University of Chicago Pritzker School of Medicine.



MURPHYKATE MONTEE, a senior honors mathematics and music double major, has received the 2013 Alice T. Schafer Mathematics Prize, an honor awarded to only one undergraduate woman in the United States each year. Montee has also received a Churchill Scholarship to attend graduate school at University of Cambridge next fall.

NANCY PAUL was the recipient of the Dean's Research Award. A physics major in the Glynn Family Honors Program, she was the first undergraduate physics student to receive the National Science Foundation Graduate Research Fellowship. She is now pursuing graduate studies at the University of Notre Dame.

MATTHEW SARNA, has received the American Society for Microbiology Undergraduate Research Fellowship.

JENNIFER SCHULTE, was the recipient of the 2012 Dean's Award, which recognizes a graduating senior for exemplary personal character, service, and scholarship. She was an active volunteer throughout her college career, primarily working in hospitals and health care-related organizations. She is now attending the University of Chicago Pritzker School of Medicine.

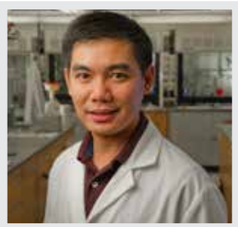
Graduate Accolades

☆ ☆ ☆ ☆

KAREN ANTONIO, a chemistry and biochemistry graduate student, has been awarded a National Science Foundation Graduate Research Program Fellowship. This fellowship helps to enhance the scientific and engineering workforce in the United States, and provides three years of support.

KAREN BAUER, a biochemistry graduate student, was the recipient of the Indiana Clinical Translational Science Institute Predoctoral Trainee Award. She performs molecular expression profiling in primary colon cancer tissue to identify patients that can avoid chemotherapy.

MATTHEW COOPER, a graduate student in the Global Linkages of Biology, Environment and Society (GLOBES) program, was recently nominated for a one-year term on the Integrative Graduate Education and Research Traineeship (IGERT) program's trainee advisory board.



MAJOR GOOYIT, won the Baxter Young Investigator Award for his work on the elucidation of molecular mechanisms of gelatinase-dependant diseases, such as diabetic wounds.

BRIAN HAYDEN, a physics graduate, has been awarded the Rodger Doxsey Prize from the American Astronomical Society (AAS).

PAUL KROGER, a biology graduate student, received second-place honors from the Society for Developmental Biology for his oral presentation on transmembrane proteins expressed in fly immune cells.

SHAILAJA KUNDA a graduate student in chemistry and biochemistry, received the Faculty for the Future Award. Sixty-three fellowships were awarded to 28 women around the world.

CHAD MEYER, a physics graduate student, received the 2012 Center for Research Computing Award for Computational Sciences and Visualization.

MATTHEW POLINSKI, a Ph.D. student, has been awarded second place in the U.S. Department of Energy's Innovations in Fuel Cycle Research Awards. His award-winning paper was published in *Angewandte Chemie*.

JORDAN SCOTT was awarded the American Heart Association's Predoctoral Fellowship, which is given to students who research cardiovascular function and disease and stroke.

JESSICA STOLLER-CONRAD has been awarded the Mass Media and Science and Engineering Fellowship by the American Association for the Advancement of Science.

SABRINA STRAUSS, a physics graduate student, received the Stewardship Science Graduate Fellowship from the Department of Energy National Nuclear Security Administration.

ANNA WOODARD, a physics graduate student, was awarded a three-year Graduate Research Fellowship from the National Science Foundation. Woodard collaborates with other scientists at CERN's Large Hadron Collider in Switzerland.

Alumni

☆ ☆ ☆ ☆

CHRISTOPHER PORTER, who recently completed his Ph.D. in mathematics and philosophy, has received an International Research Fellowship from the National Science Foundation to conduct mathematics research for two years at the Université Paris Diderot.

MARIANA SAFRONOVA, who earned a Ph.D. in physics in 2001, received the honor of being named the American Physical Society's Woman Physicist of the Month for August 2012. Safronova is an associate professor at the University of Delaware where she has become a leader in the theory of atomic structure. She has published a paper every five weeks since 2010.

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Senior Kevin McDermott spends the summer at CERN

Kevin McDermott, a senior physics major at the University of Notre Dame, was one of only 10 students selected from the United States to conduct summer research at the European Organization for Nuclear Research (CERN) in Geneva, Switzerland. CERN is home to the Large Hadron Collider, the most powerful particle accelerator in the world.

"For the last seven years, I had dreamed of working at CERN," says McDermott. "My experience at CERN was once in a lifetime, and this was undoubtedly the best summer of my life."