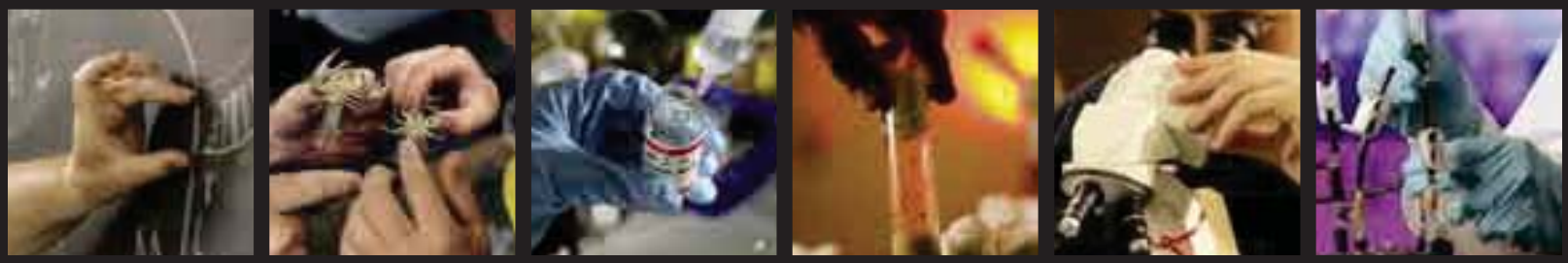
The Journal of the University of Notre Dame College of Science
Spring 2008, Volume 5, Number 1

# Renaissance



## UNDERGRADUATE AND GRADUATE RESEARCH

## LETTER FROM THE DEAN

Welcome to the spring 2008 issue of *Renaissance*, the seventh since the College of Science launched this publication in spring 2004. *Renaissance* was created to inform those outside of the University, as well as those in the campus community, about the significant developments that are occurring in science research and teaching here at Notre Dame.

My term as dean is coming to a close at the end of June. I feel privileged to have served the students, faculty, and staff of the College of Science in my role as dean over the past six years. The college has made significant strides in undergraduate education, infrastructure and research. During this period, the research funding of the college has almost doubled. With the opening of Jordan Hall of Science, the college and University are poised to lead the nation in science education.

In this issue, we devote a large section to highlighting undergraduate research. We recently appointed a new coordinator of undergraduate research, Dominic Chaloner, and the University also continues to show strong support for undergraduate research. Currently, student interest in research opportunities outpaces funded positions, but we're making significant progress to satisfy this demand. I am pleased to say that now over a third of our students are involved in research, in both laboratories and in the field. These students will be enriched by their experiences and will be able to apply their enhanced problem-solving skills no matter where their studies or careers take them.

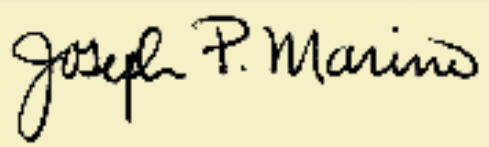
Our faculty continue to make excellent progress in growing our research programs. Frank Collins, director of the Center for Global Health and Infectious Diseases, recently received a $20 million grant, the largest ever for the college, from the Bill and Melinda Gates Foundation. Collins will lead the Malaria Monitoring and Control Consortium that will, for the first time, provide a pin-point assessment of various malaria control strategies and where they are most effective. Most recently, the University of Notre Dame Environmental Research Center (UNDERC), directed by Gary Belovsky, was designated by the NSF as a National Ecological Organization Network (NEON) site for environmental research and awarded a grant of approximately $20 million over 10 years.

On the horizon is another significant development affecting science. Notre Dame has partnered with the City of South Bend to create Innovation Park, a research park on 12 acres of land south of campus. It will enable our science and engineering faculty to identify potential market applications for our research and will bring together academia, industry, and venture capitalism to stimulate economic development.

One of the hallmarks of the University of Notre Dame is that it is a place that cares about suffering in the world. Our students and alumni who participate in medical missions in Third World countries are exemplary. This issue of *Renaissance* focuses on two programs that support those students and alumni: the Dooley Society, which provides funding assistance, and the Haiti Program under the direction of Rev. Thomas Streit, C.S.C., that is ridding this impoverished nation of lymphatic filariasis.

The future of the college looks very bright, and we should expect great advances over the next decade.

Best regards,



Joseph P. Marino
*William K. Warren Foundation Dean*
*College of Science*

UNIVERSITY OF NOTRE DAME
College of Science

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Renaissance

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## MISSION



## STUDENT RESEARCH AT NOTRE DAME



***About the cover:***
*Chemistry graduate student Leslie Patterson, who is pictured on the cover and above, with undergraduate Jonathan Stefely (center), and her advisor, Prof. Marvin Miller (right,) synthesized a compound that has applications for treatment of iron overload diseases. Patterson's results were published in the* Journal of Biological Chemistry *as well as the journal* Science. *Stefely, a chemistry major who has also conducted research in the Miller laboratory, has utilized triazole-based anti-cancer compounds to develop potential treatments for breast cancer. Read more about Stefely on page 17 and Patterson on page 22.*

## COLLEGE OF SCIENCE NEWS

# Center for Global Health and Infectious Diseases to Aid in Eradicating Malaria

At the Gates Malaria Forum in Seattle in October 2007, Bill and Melinda Gates declared that they would apply considerable financial resources to the war against malaria.

In her address to researchers and policy makers from around the world, Melinda proclaimed, "Bill and I believe that these advances in science and medicine, your promising research, and the rising concern of people around the world represent a historic opportunity not just to treat malaria or to control it—but to chart a long-term course to eradicate it."

Her use of the word *eradicate* left no doubt among those in attendance that they intend to see malaria wiped out like smallpox, the only infectious disease that man has successfully eradicated in nature.

The couple's bold statement caused a stir, especially among the world health authorities, who have witnessed more failures than successes since the early 1960s when the World Health Organization famously predicted that the insecticide DDT and the malaria medication chloroquine would soon lead to the demise of malaria.

The Gates' declaration received considerable press, unlike the announcement two months earlier that the Gates Foundation had awarded a $20 million grant to the University of Notre Dame's Center for Global Health and Infectious Diseases and its director, Prof. Frank Collins, to prepare the way for their visionary venture.

The five-year project, centered on the Notre Dame campus, will evaluate the effectiveness of control methods and will involve field sites in diverse locales such as

PHOTO COURTESY OF BILL & MELINDA GATES FOUNDATION / KARIE HAMILTON

Indonesia, Tanzania, Kenya, Uganda, and Zambia. The study will direct thousands of people in multiple institutions who are part of a Malaria Transmission Consortium (MTC) and who will carry out studies in these targeted zones. Among the key institutions joining the Notre Dame center are the Swiss Tropical Institute, the U.S. Centers for Disease Control, the London School of Tropical Medicine and Hygiene, and Durham University. It will be left to the computer science and engineering program at Notre Dame to take the vast amount of data collected and assemble it for later analysis and model simulation.

**"Bill and I believe that these advances in science and medicine, your promising research, and the rising concern of people around the world represent a historic opportunity not just to treat malaria or to control it—but to chart a long-term course to eradicate it."**

*—MELINDA GATES*

"This is not a project in which we are trying to develop new methods of controlling malaria-carrying mosquitoes," said Collins, the George and Winifred Clark chair in the Department of Biological Sciences. "The world has plenty of resources at hand to control *Anopheles gambia*, the primary vector of malaria. The question is, 'How can we use these methods more efficiently?'"

The answer is not intuitively obvious, and it underscores the size of the $20 million grant, the largest ever received within the College of Science.

The *Anopheles* mosquito is a nocturnal creature that seeks out humans and their blood while they sleep. When an infected mosquito finds a vulnerable human, it takes his or her blood as a meal and in doing so injects a microscopic malaria parasite called *Plasmodium falciparum* into the bloodstream. Once the parasite is inside, it multiplies by the billions.

Malaria has roared back from the 1960s when DDT and chloroquine reduced deaths worldwide. In Africa alone, malaria kills 3,000 people a day, and most of its victims are young children.

The creation of new tools to fight malaria has kept the disease from inflicting an even greater toll. Deaths have been dramatically reduced in areas where people are given insecticide-impregnated bed nets, which not only keep mosquitoes at bay, but kill those that land on the bed net.

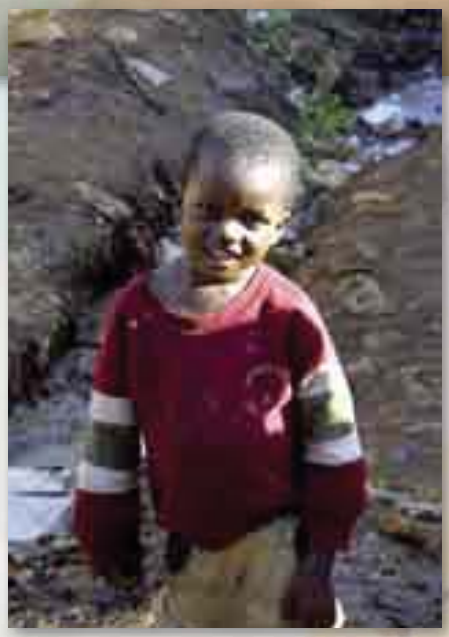
Malaria has been so difficult to wipe out because the *Anopheles* mosquito employs numerous strategies, including re-inventing itself to become resistant to insecticides like DDT and to medicines like chloroquine. Some strains of *Anopheles* even prefer biting humans during the day. And still others will only bite outside and not inside. Malaria transmission rates also vary significantly from the highlands of Kenya, where transmission rates are low, to the areas around Lake Victoria, where transmission rates are many times greater.

In order to cover the full spectrum of the effectiveness of malaria control techniques, specialists will map five different malaria endemic areas in Africa and three different areas in Indonesia, including the high transmission area of Papua Indonesia and lower transmission areas on the islands of Java and Sumatra.

PHOTO COURTESY OF THE BILL & MELINDA GATES FOUNDATION / LIZ GILBERT

*A group of local women receive free bed nets during a UNICEF bed net distribution campaign funded by The Global Fund. 3 million nets will be distributed in Ethiopia alone, Harar. Ethiopia, September 2005.*

MATT CASHORE



"The problem is that it is really difficult to compare control methods across zones where transmission rates vary so greatly. In one place a person may be bitten by hundreds of malaria-infected mosquitoes each year, while in others the average exposure is one or two infected bites a year. This means that a strategy used in one place may not be effective at another place," Collins said. The lessons learned from this program will be applicable to most of Southeast Asia as well as sub-Saharan Africa, which carries an estimated 70 percent of the world's malaria burden.

Once the first milestone is passed, mapping transmission rates, the scientists will then turn their attention to evaluating the control methods in these different settings. Take bed nets, for example. "Do we give bed nets out to everybody in a village, or do we give bed nets only to high-risk people like infants, pregnant women, and people whose immune systems are compromised by HIV or TB?" Collins posed.

Only when those issues are cleared up can researchers address the vexing issues of insecticide resistance and other biological nuances such as nighttime or daytime feeding. This last element of the grant is the third of the three phases that must be addressed before the Gates' vision of a world without malaria can even begin to be realized. Yet, the new techniques being thrown into battle against malaria create a sense of optimism that the disease can be defeated.

Bill Gates, himself, alluded to the development of promising techniques. During the Malaria Forum, he said, "So why would anyone want to follow a long line of failures by becoming the umpteenth person to declare the goal of eradicating malaria? There's one reason. We should declare the goal of eradicating malaria because we *can* eradicate malaria."

UNLESS NOTED, PHOTOS BY ED COHEN, *NOTRE DAME MAGAZINE*

# Notre Dame Students Bolster Effort to End LF in Haiti

**Begun 10 years ago under the dynamic leadership of Notre Dame priest and biologist, Rev. Thomas G. Streit, C.S.C., the Haiti Program seeks to eliminate lymphatic filariasis from Haiti by 2013. Its principal tool for stopping the transmission of the disease has been tablet-based mass drug administration. Two proven, safe drugs are used in tandem—diethylcarbamazine (DEC) and albendazole.**

Haiti is a developing country that faces many challenges—not the least of which is the plague of lymphatic filariasis (LF). A mosquito-borne illness, LF is caused by parasitic worms, *Wuchereria bancrofti*—about four-inches long and nearly as thin as human hairs—that invade a human's lymph vessels and cause them to malfunction. For many, this condition leads to the grotesque swelling of legs, arms, genitals, or breasts (thus leading to the condition's common name, elephantiasis). Although not usually fatal, the social stigma that accompanies the physical disfigurement caused by the disease can be devastating for its sufferers.

Above: *Students Gregory Podolej, Brennan Bollman, and Megan Rybarczyk present information on the fortified salt,* Bon Sel.

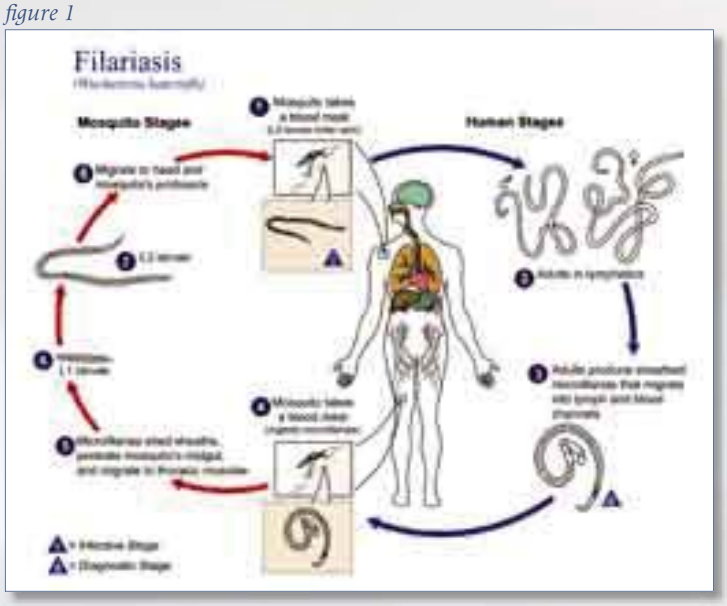
**"We hear all about AIDS and malaria and their death tolls, but we don't speak about the living dead like those having elephantiasis."**

*—REV. TOM STREIT, C.S.C.*

LF was eliminated in many countries in the early 20th century by modern hygiene and sanitation practices, but persists in the 21st century in many developing countries. World-wide, more than 40 million people are incapacitated by the effects of LF and over 1.3 billion are at risk, and in coastal Haiti, nearly half the population carries the parasite.

In January, junior biology majors Brennan Bollman, Gregory Podolej, and Megan Rybarczyk joined Rev. Tom Streit, C.S.C., director of Notre Dame's Haiti Program, to continue efforts begun in 2005 to market and distribute a co-fortified salt aimed at eradicating the disease that has decimated this country's population. The salt distribution effort is to complement the existing national Mass Drug Administration started in 1999 in coordination with Haiti's Ministry of Public Health and

*figure 1*




the Population. At the same time, a team of three American doctors and a nurse assembled by a 1978 Notre Dame graduate, Dr. W. Kevin Olehnik, chairman of the Department of Surgery at the Penobscot Bay Medical Center in Rockport, Maine, were in Haiti to perform surgeries on 15 men as part of a humanitarian effort under the auspices of the Notre Dame Haiti Program.

While the students focused mainly on their task of determining better ways to raise awareness of the salt effort, they were also able to assist with some of the surgeries performed by the American team. Says Rybarczyk of the opportunity, "It was an incredible experience—one that I never thought I would have as an undergraduate!"


## Why Salt?

The *Wuchereria bancrofti* parasites are transmitted by the *Culex* mosquito at night as they locate and feed on human hosts. It takes multiple bites from a mosquito that carries worms to infect a human. The disease's complicated lifecycle has made it hard to eradicate in countries like Haiti where illiteracy, poverty, and limited access to healthcare go hand in hand to keep the cycle going. Nevertheless, Fr. Streit is adamant that there is hope in Haiti.

The drug diethylcarbamazine citrate (DEC) is the synthetic organic compound that treats lymphatic disease by working with the body's defenses to kill the microfilariae that swim in the bloodstream. The mosquitoes normally would suck up the microfilariae when they feed at night and later transmit them to other humans after a developmental stage in the mosquito's body, keeping the cycle of infection going (see figure 1, above). But if the worms are killed in the blood stream because of the DEC, they cannot be transmitted from human to human by mosquitoes. Because everybody in Haiti uses salt, it was chosen as a good vehicle to distribute the medication. "If everybody in Haiti took the salt, then I believe that we could rid the island of LF in two years," Fr. Streit said.

## Marketing the Medicated Salt

An interdisciplinary program was begun in the 2004–05 school year to develop a plan to distribute DEC-fortified salt to the population of Haiti. During that time, three graphic design seniors under the direction of Prof. Robert Sedlack worked with M.B.A. students to develop an identity program and marketing campaign designed to get the word out about the benefits of using the treated salt. They named the product *Bon Sel* (good salt) and created the slogan *clairemont bon* (clearly good).

Unfortunately, the social unrest that followed President Jean Bertrand Aristide's departure from the country after an uprising in February 2004 disrupted this part of the program for nearly three years. With the country more recently returning to a sense of political and social stability, the program has resumed with gusto.

Indeed, when Bollman, Podolej, and Rybarczyk visited Haiti in January, their principle goal was to investigate ways to increase the use of DEC-fortified salt among the Haitian people. The first thing they did was to organize a focus group in a Catholic church. "We had 13 very eager participants," Bollman said. "We asked them how we could best educate people on the purpose of the salt." The participants' responses were very helpful for the students in understanding the unique challenges involved in successfully marketing the salt to Haitians.

They stressed that the salt cannot be washed, which Haitians routinely do, as they do rice. "Haitians living in New York City will open their box of Uncle Ben's rice and wash it out of habit," said Fr. Streit, who has witnessed Haitians washing away the medication from the salt in their kitchens.

The students were received warmly everywhere they went and felt they were successful in getting the message out about the benefits of the medicated salt. Says Podolej, "Everybody who we told about the salt and about its benefits wanted to buy it immediately."

## The Haitian Connection

Bollman points out that none of their work would have been possible without Haitian program administrators forging the connections and helping to form the plan for distribution of the salt, first in Port-au-Prince, and then throughout the country. She mentions Rev. Michelet Dorescar, C.S.C., who oversees the day-to-day salt project operations. He made the connections that enabled the students to conduct research in the various locations in Port-au-Prince. Bollman also points out the work of Dr. Madsen BeaudeRochars, who is the LF program director in Haiti and also the president of the Haitian company (Group DEC) that is fortifying the salt for this project.

Jean Marc Brissau, a Haitian attorney currently earning his LL.M. with the Center for Human Rights program at Notre Dame's Law School, has also been instrumental over the past four years in getting the salt program started in Haiti and maintaining its structure during turbulent times.

Top: *Dr.W. Kevin Olehnik, ND '78, and chairman of the Department of Surgery, Penobscot Bay Medical Center, Rockport, Maine; Kendall Robinson, RN; Dr. Douglas S. Cole, general surgeon; Dr. David Maddox, anesthesiologist; Dr. Lars Ellison, urologist*

Bottom: *Wilner Bozor, 64, lies ready for his operation at Hopital Sainte Croix in Leogane, Haiti.*

## Dealing with the Devastation

Although the DEC-medicated salt and Mass Drug Administration of DEC and albendazole tablets have begun to produce positive results, these medicine distribution strategies deal only with eliminating the impetus of the disease, not with its devastating results. That's where medical humanitarian efforts come into play.

Beginning Jan. 7, 2008, the medical team assembled by Dr. Olehnik performed 15 pro-bono surgeries on Haitian men who had various ailments caused by LF. One of the worst cases was 64-year-old Wilner Bozor, who had been living with a grotesquely swollen scrotum for years. The condition so stigmatized him that he was virtually an outcast in his town. Bozor came to the Hopital Sainte Croix for an operation that would help him recover his dignity. As he sat on the edge of his hospital bed awaiting surgery, the drained, expressionless look on his face revealed him to be a man of constant sorrow.

The doctors from Maine knew they had a problem the minute they conducted a preliminary health check on Bozor. "It was obvious that he had a prior hernia and that the hernia had re-occurred," said Kendall Robinson, the recovery nurse with the group. Bozor's surgery at Hopital Sainte Croix lasted three hours. "The hernia repair was the most difficult part of the operation," said Dr. Olehnik.

Once they had the hernia portion of the surgery under control, they were able to focus on correcting Bozor's LF-induced condition. Slowly, under the guidance of Haitian urologist Dr. Mitelot Clervil, the team of American doctors cut away a huge mass of excess tissue. Dr. Clervil's experience in this type of surgery was a vast help for the Americans who had never seen a condition like Bozor's. "He is an excellent surgeon. I learned a lot from him," said urologist, Lars Ellison.

Two days after the surgery, Bozor was sitting up in his room convalescing. He smiled. "God is good to me," he said grinning widely.

"It's not until visitors meet these people do they realize that their lives have been destroyed by this disease," Fr. Streit said afterward. "We hear all about AIDS and malaria and their death tolls, but we don't speak about the living dead like those having elephantiasis. I often tell people that this disease does not kill people physically, but it kills their spirit and it kills their chance to lead a normal life."

**Find out more about the Haiti Program by visiting haiti.nd.edu.**

# Students Serve in Medical Missions Supported by Dr. Tom Dooley Society

Notre Dame's most famous physician/humanitarian, Dr. Thomas A. Dooley III had lived for only 34 years when he succumbed to malignant melanoma in 1961. What this Irish Catholic from St. Louis, Mo., accomplished as a U.S. Navy physician treating Vietnamese and Laotian refugees for smallpox, leprosy, malaria, and malnutrition would earn him worldwide fame in the 1950s.

President Dwight D. Eisenhower said of him, "Few, if any, men have equaled his exhibition of courage, self-sacrifice, faith in his God, and his readiness to serve his fellow man."

His legacy has lived on at Notre Dame by the efforts of undergraduate students who are willing to embark on summer service missions through programs such as the Center for Social Concern's International Summer Service Learning Program (ISSLP). And now, nearly 45 years after his death, Dr. Dooley's efforts live on through the auspices of a new organization—one that bears his name, the Dr. Tom Dooley Society.

The creation of the Dooley Society can be traced back to the day when Matt Hubbard, M.D., (ND '02), then a third-year medical student at the University of Rochester, drove toward campus on Interstate 80 for a football weekend. During the time he spent driving, Hubbard

Above: *Supported by the Dr. Tom Dooley Society and the Center for Social Concerns, senior Andrea Dreyfuss served at a clinic in Ecuador where she became very involved with the community.*

Left: *The statue of Thomas A. Dooley III, M.D., stands near the Grotto on campus.*

*Dr. Martínez and Dr. Espiñoza mentored Andrea Dreyfuss.*

began envisioning an organization of Notre Dame alumni in the medical profession who would engage in professional development, community service, and mentorship of current preprofessional undergraduates.

In just three years, the Dooley Society has grown dramatically. Starting in 2005 with just three Notre Dame alumni members, the organization has grown to over 1,000 members across the country. Its bylaws dictate that 25 percent of its dues be used to fund stipends for students who serve the medical needs of individuals in impoverished areas of the world. About half of the students who received stipends from the Dooley Society served through the Center for Social Concern's ISSLP, while the other students arranged their own service through various international agencies, including Intervol and the Foundation for Peace.

To date, the Dooley Society has provided 20 stipends to Notre Dame pre-med students serving abroad. Dooley Society President Don Condit, M.D., (ND '80) is quick to point out that the stipends are just one aspect of the organization's initiatives. "I think the most important thing that we have done to date is give our students the opportunity to network with other Notre Dame medical alumni. Last year, we helped connect the dots between our undergraduates and our alums by placing over 200 students in offices around the country during the Christmas holidays," he said.

Condit, an orthopedic surgeon in Grand Rapids, Mich., is no stranger to conditions in Third World countries. He volunteers with the Helping Hands Medical Missions in El Salvador every year.

"It's a great thing that our students learn about these opportunities and participate in these missions and learn first-hand about the world," he said.

Seniors Andrea Paola Dreyfuss, a preprofessional studies and anthropology double major, and Lindsay Martin, a biology major, were among the 15 students who received Dooley stipends last summer. The two students, who are both planning to be physicians, traveled to Pedro Vicente Maldonado, a place in Ecuador that Dreyfuss described as "a small town between the jungle and the Andes Mountains."

The clinic in Pedro Vicente Maldonado was created by Andean Health & Development (AHD), which was founded in 1995 by Notre Dame alumnus David Gaus, M.D., and Notre Dame President Emeritus Rev. Theodore Hesburgh, C.S.C.

Dreyfuss, who was born in Lima, Peru, had grown up amid the comforts of a middleclass family. "But I always wanted to be a doctor in a rural area of Central America," she said. Dreyfuss and Martin taught first-aid classes and took patients' pulse, blood pressure, weight, and temperature. They assisted in the ER and completed medical histories where none had existed. Dreyfuss also had a chance to see a baby delivered.

Dreyfuss expected the grinding poverty, the prevalence of

*Matt Hubbard, M.D. '02*
*Founder of the Dooley Society*

Matt Hubbard, M.D., a surgical resident at Case Western Reserve in Cleveland, started the Dooley Society to link preprofessional students with medical alumni to form mentoring relationships. He started the organization because, as he says, "I wish I would have had this when I was a student."

The organization offers memberships to alumni physicians, dentists, and other licensed medical practitioners, as well as students who are planning to enter the medical profession. Over this past winter break, approximately 200 students were matched geographically to shadow alumni doctors and dentists.

Last summer, 15 students and alumni who received partial funding from the Dooley Society for medical missions traveled to sites such as the Maryknoll Missions in Cambodia, Common Hope in Guatemala, the Timmy Foundation in Ecuador, the Foundation for Peace in the Dominican Republic, and the Institute for Internal Medicine in Africa.

Brennan Bollman, a junior biology major who received partial funding from the Dooley Society, served at a Maryknoll Mission in Cambodia through the Center for Social Concern's ISSLP. In her paper, titled "An Open Hand: Critical Awareness of Suffering," Bollman recounted her experience of spending time with Nary, a patient at Seedling of Hope HIV/AIDS hospice.

*Nary lay, as usual, on her side in a contorted half-fetal position, her far arm thrown across her tiny body to grasp the iron rail of the hospice bed. Her head had half fallen off her pillow; so her open eyes fixed on the tile floor. In medical jargon, one could call her a 35-year-old AIDS patient, recovering from tuberculosis of the lymph nodes and partial paralysis from a TIA. She is also a wife, and a mother. Yet her husband has left her for another woman; she no longer sees her children.*

*She's sick. She's depressed. She's abandoned.*

*I walked into Nary's room, sat cross-legged on the tile floor, and looked into her big, sad yet beautiful eyes. I inched my hand closer to hers, as it now only loosely draped over the guardrail. I didn't hold her hand, for that action should be her dignified choice. I did start singing. Though I knew I shouldn't choose a Christian hymn in a Buddhist culture, she wouldn't understand English, so I let myself sing the first thing that came to mind—**On Eagle's Wings.** "And He will raise you up on eagle's wings, bear you on the breath of dawn, make you to shine like the sun, and hold you in the palm of his hand."*

*By the end, Nary slid her dainty fingers into my open palm.*

diseases like diabetes, the shortages of electricity, and unclean water. But what shocked her was the high rate of suicide among teenagers. "Every week we would encounter an average of two attempted suicides," she said. "Youths as young as 14 would try to kill themselves out of the despair 'that they are doomed for the rest of their lives.'"

So desperate are Ecuadorian parents that they would attach American-sounding names, like "Michael Jordan," to the family surname of their newborns just on a faint notion that doing so might give their child an edge or an opportunity some day in the future.

Hundreds of people make the long and arduous journey to the hospital. "They would travel four hours, getting up at 1:00 a.m. and get to the hospital by 5:00 a.m.," she recounted. "The hospital was not entirely organized, so we would take a lot of our own initiative to get things done like…creating staff IDs and doing medical histories."

They shadowed doctors and later were allowed to assist in surgeries. But they wanted to do more. "The doctors and staff told us that teaching English would be something very helpful. So for the last five weeks of our stay we would help teach English to the doctors, nurses, and the people at the front desk," Dreyfuss said.

*Sean Duffy (left) and Katie Zedler (right) assisted in setting up health fairs in Antigua, Guatemala.*

Other Dooley stipend recipients, like seniors Sean Duffy and Katie Zedler, teamed up last summer with an organization called Common Hope, founded in 1990 in Antigua, Guatemala. They, too, experienced the widening economic disparity between the rich and the poor, their lack of basic resources, and the

tenuous access to health and education.

The two seniors assisted Guatemalan families by helping to build Common Hope residences for the poorest families living in temporary shelters with dirt floors, lack of sanitation, and no system of removing garbage. Zedler and Duffy used their Spanish to help coordinate the work of volunteers and construction workers who could not speak English.

Top: *Lisa Zickuhr assisted these disabled patients in Antigua, Guatemala.*

Middle: *Megan O'Hara volunteered in an orphanage for children with HIV in Cambodia.*

Bottom: *While volunteering in a Guatemalan hospital, Lisa Zickuhr lived with a local family.*

At the nearby clinic, they helped by organizing patient charts for over 1,000 families being served by the clinic. They shadowed a U.S. medical student who had taken the time to volunteer for Common Hope. "We also helped out with public health fairs to educate some of the people in the village surrounding Antigua," Duffy said. The purpose of the fair was to educate the people about nutrition and hygiene as well as lifestyle changes to prevent the onset of diseases like Type II diabetes, which is very prevalent in Guatemala as well as throughout Latin America in general."

"There are a lot of myths about diabetes in the popular culture. One particularly damaging one is that insulin causes blindness. So we participated in the effort to try to debunk those damaging myths," Duffy said.

While there are few people in Guatemala on the verge of starvation, Zedler and Duffy saw plenty of evidence of malnutrition in the form of iron deficiency anemia and effects of Vitamin A deficiency. "At one of the health fairs, we did blood tests on children for anemia, and we found that over half the children who came to the health fair were anemic," Duffy said.

PHOTOS THROUGHOUT PROVIDED BY STUDENTS

Geographical access was also an issue there. Because all of the specialized health care services were located in Guatemala City, the people who needed this care would have to travel nine to 15 hours to get there. And, during their stay, Zedler and Duffy witnessed the lingering effects of the four-decade-old civil war that devastated the indigenous, Mayan population before the war ended in 1996.

Biology major Lisa Zickuhr gained a similar experience in Antigua, Guatemala, through an organization called *Las Obras Sociales de Hermano Pedro*. She supported the nursing staff, fed elderly patients who no longer had use of their hands, and provided desperately needed companionship to the disabled residents. Her experience gave her insights into the Guatemalan medical system. Zickuhr, a senior, has already been accepted by several medical schools.

Throughout the students' experiences were several common elements. Each of the students experienced firsthand the combined effects of poverty, language barriers, and a lack of accessible transportation that served to exacerbate the existing medical deficiencies.

For more information on the Dooley Society, visit **dooleysociety.com.**

# Undergraduate Rese

In his address to the faculty this past September, Rev. John I. Jenkins, C.S.C., President of the University, proclaimed, "At Notre Dame, we must enhance undergraduate education by making research an important and expanding aspect of the undergraduate experience."

The benefits of undergraduate research are numerous. Research gives students the opportunity to apply the knowledge they have gained in the classroom and teaching laboratory and challenges them to think critically about real-world problems. With the support of faculty mentors, students develop their own research projects and confront the daily challenges facing scientific researchers. They gain transferable skills as they operate state-of-the-art equipment and use a variety of laboratory techniques to analyze their results. The experience of conducting their own research project prepares students for graduate studies and ultimately a strong career in science, as well as other professional degrees in medicine or business.

The doubling of the number of College of Science undergraduates who have participated in research since spring 2000 is due in large part to the growing recognition that work on an actual scientific investigation is as much of a learning experience—if not more—than time spent in the classroom.

According to Associate Provost and Professor of Chemistry and Biochemistry Dennis Jacobs, "Research is the most authentic way for our students to learn about science, because science is not simply a collection of facts. It's a process of knowing about the natural world through inquiry and exploration. In research, our students work at the forefront where scientific knowledge is advanced. They are creating and testing new knowledge that answers some of their own questions about how the world behaves."

In September, Dominic Chaloner, research assistant professor in the Department of Biological Sciences, was appointed as the undergraduate research coordinator for the College of Science. Chaloner took over the position from the college's first coordinator, Michelle Whaley, who continues to advise students and chair the undergraduate research committee in the Department of Biological Sciences. In October, Chaloner organized the

# arch at Notre Dame

Undergraduate Research Symposium, in which 18 students presented their research in the Jordan Hall of Science.

Over 220 students in the College of Science are actively involved in a research project each year, either in a laboratory or in the field. "Our objective is to double that number in the next few years," Chaloner said. However, "the number is undoubtedly higher." Many students are not counted because they are engaged in research elsewhere, but not for academic credit. During the summer, many students participate in REU (Research Experience for Undergraduates) programs on campus and at other universities, research internships at R&D laboratories, and other off-campus programs.

The opportunities for undergraduate research at Notre Dame are quite diverse as they encompass a huge subject range, can involve directed research as part of a course, or involve independent research in a faculty lab, but Chaloner sees some commonality. "The best undergraduate experiences likely share certain characteristics such as involvement in original research that is mentally demanding and scientifically rigorous, with a critical element of faculty mentorship, all of which is possible at Notre Dame," he said.

"Science is as much as a hands-on endeavor as sculpture," Chaloner explained. "I see myself as helping our undergraduates become aware of the research possibilities and how the problem-solving skills they learn under the guidance of a professor is an important step toward their development as a scientist."

"For many students, however, it's a matter of pointing them in the right direction," Chaloner said, adding that, "for example, it may be simply making students aware of the range of services offered by the Career Center to find research internships off-campus." Employers and alumni are encouraged to send information on research opportunities to Prof. Chaloner at dchalone@nd.edu.

All of the departments within the College of Science offer opportunities for students to conduct research under the guidance of faculty and graduate students. The following are just a few interesting examples of undergraduate students who have recently conducted research. The experience of these students demonstrates the diversity and depth of research being undertaken by undergraduates within the College of Science.

Visit **science.nd.edu/research** to read expanded profiles of each of these students.

## Gary Nijak '09

**CHEMISTRY AND CHEMICAL ENGINEERING DOUBLE MAJOR**

**PPG SUMMER FELLOW, SUMMER '07**

During his summer fellowship at PPG (Pittsburgh Plate and Glass), Gary Nijak Jr. worked on developing a new polymer that would be the breakthrough to the development of an automated pathogen detection device to reveal bacteria like *E. coli* in water samples. His attempt failed, so Nijak threw out the concept of inventing a new polymer. However, he then discovered a fluorescent compound developed by a small company in Oregon for intercellular pH detection.

Nijak began to tinker with the company's reagent, which is composed of a sugar bound to a fluorescent marker via a glycosidic bond. This time, his efforts were successful, and he was able to develop a way to detect *E. coli* in water samples. The device works by detecting *E. coli* enzymes that bind to the active site on the reagent. A fluorescent compound is released, which can then be detected by a photometer or CD array.

The beauty of Nijak's apparatus is that it is fully automated. A state or county health department no longer would need to train an individual to go to a site—be it a river or a lake—and carefully take water samples to be brought back to the lab for analysis. Cities typically only measure bacteria outbreaks after citizens have been complaining of sickness, so "instead of waiting two days for lab results to come back telling you whether water is polluted, this device gives the answer in just six or eight hours," Nijak said. "Not only did I find something entirely new, but this process works better."

## Kaitlyn Moran '09

**MATHEMATICS MAJOR**

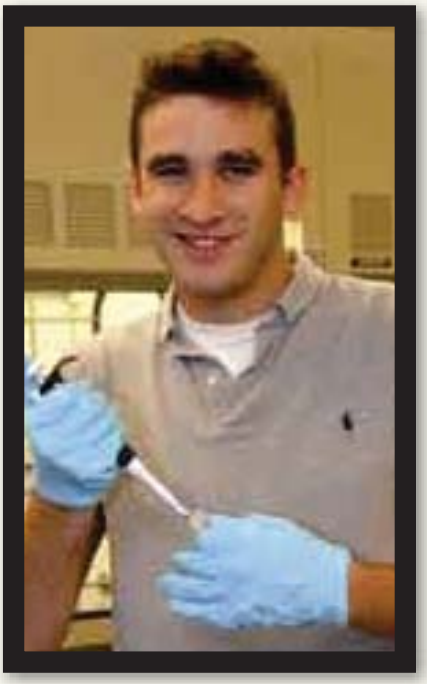
**NOTRE DAME REU, SUMMER '07**

A year ago, Kaitlyn Moran knew little about research in mathematics. That changed last summer when she entered the mathematics REU program at Notre Dame, along with eight other students, to research algebraic topology.

Moran and two other students (one from Harvard and one from UCLA) were mentored by Kate Ponto, an REU program director. Ponto, who specializes in the field of algebraic topology, had a problem in mind for the REU students to solve. Since the students were at different levels of understanding abstract algebra, Ponto gave each of them several books to read, based on what they had not yet studied in the classroom.

Initially, the students went separate directions to digest the new material. Eventually, each had something unique to bring to the table. About halfway through the seven-week program, Ponto started writing claims on the blackboard and challenged Moran and the others to work on a proof. "Eventually, we did manage to prove most of them." Moran said.

That is when Moran realized what Ponto had in mind all along. "All of a sudden, we realized that all of our claims that we had proven added up to an ultimate proof to the theorem that she had in mind for us to prove at the start of the summer," Moran said. "It was very cool to know that the four of us had come up with a new proof that no one else ever had done." Ponto says, "It's the experience of being self-motivated that is most important. Students learn what it's like to work on a problem by themselves, without being able to find the solution in a textbook."



## Sean Cullen '09

**BIOLOGY AND ANTHROPOLOGY DOUBLE MAJOR**
**INDIANA UNIVERSITY SCHOOL OF MEDICINE, SOUTH BEND, SUMMER '07**
**UNDERC-EAST, SUMMER '06**

Senior Sean Cullen had a moment in his molecular cell biology lab when he realized what his life's work would be—research in the field of infectious disease. "I was working under the hood, and I realized that—here I was—a sophomore in college, and I was culturing the parasite that causes malaria," he recalled. "I saw how exciting the field was to work in, and thought it was something I could do for the rest of my life."

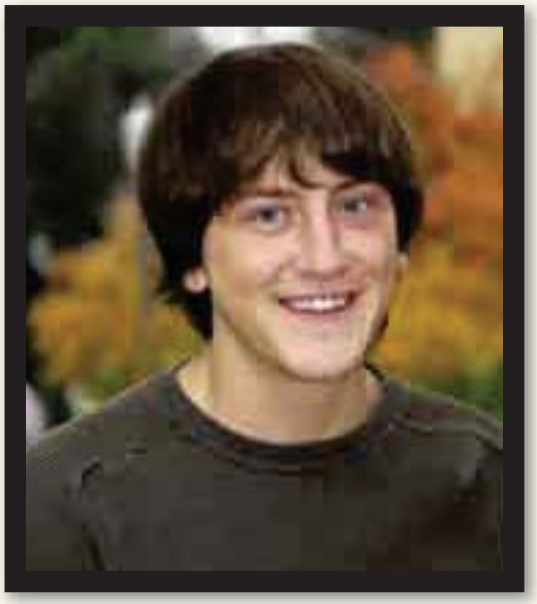
In the summer of 2006, Cullen was able to participate in research conducted at UNDERC-East, the University of Notre Dame's Environmental Research Center in Land O' Lakes, Wisc. His independent research project that summer dealt with using different habitat variables to predict Eastern Chipmunk (*Tamias striatus*) presence or absence.

Later, Cullen was able to join Prof. Robert Stahelin's research team, which conducts research into proteins and their effects on cancer. Cullen's project on the lipid-binding properties of the E3 ubiquitin ligase, hNedd4-1, could one day lead to a fuller understanding of its various cellular roles in the development of cancer.

He plans to pursue an M.D./Ph.D. degree at a school with a strong infectious disease or microbiology/immunology department. Cullen explained, "I see great value in doing a dual-degree program. The skills one learns while training to be a physician enables one to help people directly on a very intimate level, while the skills one gains from doing academic research hold the possibility for aiding others on a more global scale. I look forward to employing both skill sets in the future.

## Adam Boocher '08

**HONORS MATHEMATICS MAJOR**
**WILLIAMS COLLEGE REU, SUMMER '07**
**CLAREMONT COLLEGES REU, SUMMER '06**
**UNIVERSITY OF NOTRE DAME REU, SUMMER '05**



Very few undergraduates can say that their research is being published, but senior honors math major Adam Boocher has two papers in the process of being published. His most recent paper, "Unique Factorization Domains and Geometrically Regular Fibers," resulted from his work at an REU program at Williams College.

"There were five of us in our group, and at the beginning of the summer, our advisor gave us a problem she had been trying to solve for the last several years...each day we would meet in the classroom and go to the board to try to crack the problem," Boocher said.

Three students eventually decided to try another tack, while Boocher and another student remained with their original strategy. He noted that at the end of the summer, "when we mixed our two solutions together, we found that we understood the problem a lot better."

Back at Notre Dame, Boocher coordinated a symposium in September 2007 titled "Undergraduate Work in Mathematics: (What I Did for my Summer Vacation)." The event included a panel discussion on mathematics research and featured eight students who shared their undergraduate research experiences. "Prof. Frank Connolly eloquently likened the process of studying mathematics to building a cathedral—each mathematician adding his or her contribution to the project," Boocher said.

As a freshman, Boocher was the only first-year student ever invited into the SUMR (Seminar for Undergraduate Mathematical Research) program at Notre Dame, a program for the most gifted junior and senior mathematics students. His other collaborative research paper, which was the result of his work in the Notre Dame REU, will be published in *Linear Algebra and Its Applications*.

Boocher turned down an invitation to Harvard University as a high school senior and chose to attend Notre Dame, based on the reputation of Notre Dame's math faculty. He is now applying to top graduate schools in the country.

## Jenny Enright '08

**BIOLOGY MAJOR**
**ZEBRAFISH RESEARCH CENTER AT NOTRE DAME,**
**ACADEMIC YEAR 2006–07, SUMMER '07, ACADEMIC YEAR 2007–08**
**MARYANN MCDOWELL CELL BIOLOGY RESEARCH LAB AT NOTRE DAME,**
**SPRING '06**

As a sophomore, Jenny Enright decided that undergraduate research was essential—both as a learning experience and as a path toward medical school. She was interested in the work of David Hyde, the Rev. Howard J. Kenna, C.S.C., Director of the Zebrafish Research Center, renowned for his work on understanding how zebrafish can regenerate the rods and cones of their retinal neurons destroyed by "blinding light."

Zebrafish possess certain stem cells that can multiply and repair damaged rods and cones, the first critical element of a long chain of mechanisms and chemical events that produce vision. Understanding these mechanisms could provide clues as to how humans might restore lost eyesight.

One way of figuring out the process by which these stem cells operate is to tinker with the candidate genes that are thought to be the key to the zebrafish's unusual ability to restore eyesight. One of Enright's projects was to develop an *in vivo* technique to reduce the expression from these genes and test their role during retinal regeneration, thus giving a better clue as to how these stem cells are produced and remain active. Inhibiting the proteins Pax6 and PCNA (proliferating cell nuclear antigen) could give them a better clue as to how these stem cells are produced and remain active.

She and members of the lab achieved what is known as "knockdown" of these proteins. The group found that Pax6 knockdown prevented the newly formed stem cells from continuing to proliferate, suggesting a potential role for Pax6 in cell cycle regulation.

Enright received a Braco Award, as well as a summer research grant from the Glynn Family Honors Program, to support her research. She plans to pursue a combined M.D./Ph.D. degree after graduation.

## Mary Alldred '08

**BIOLOGY MAJOR**
**UNDERC-WEST, SUMMER '07**
**UNDERC-EAST, SUMMER '06**

Those who are fortunate to visit either of these two University of Notre Dame Environmental Research Centers—UNDERC-East and UNDERC-West—know long before their journey begins that they will be venturing into some of the most unique habitats in America to carry out their ecological research projects. Mary Alldred is one of only a handful of Notre Dame students who have experienced life at both UNDERC sites.

Under the guidance of Gary Belovsky, director of UNDERC, and Gretchen Gerrish, assistant director of UNDERC-West, Alldred tested the diversity of macroinvertebrates in irrigation ditches and the natural streams into which they flow within an agricultural irrigation system of western Montana. Her research on measuring the levels of macroinvertebrates has a direct correlation to stream health and agricultural run-off on natural stream systems of the Flathead Indian Reservation.

Alldred said she did not come to a definitive conclusion concerning the cause of the difference in diversity between irrigation ditches and natural streams. "However, I hypothesized that the cause could be structural (less heterogeneity), chemical (nutrient concentrations), or due to colonization effects," she said. "The take-home message is that changes in water quality are having an observable effect on the biota, and that these changes can be detected early on by monitoring macroinvertebrate community assemblages."

Because she collected so much data, Alldred is writing her senior thesis based on the results of her summer project in Montana. She is more determined than ever to pursue a career in aquatic and marine ecology as a result of her experiences.

## Sarah Sullivan '09

**BIOLOGY AND ANTHROPOLOGY DOUBLE MAJOR**
**UNIVERSITY OF CONNECTICUT HEALTH CENTER, SUMMER '07**
**INDIANA UNIV. SCHOOL OF MEDICINE, SOUTH BEND, SPRING AND FALL '07**

Sarah Sullivan spent her summer conducting research at the University of Connecticut in the lab of Prof. Timothy Hla. A primary investigator in the vascular biology department, Hla studies the mechanisms in which Cox-2 and EDG-1 genes function during angiogenesis. His laboratory focuses on the molecular mechanisms of angiogenesis, the process that regulates the formation of new blood vessels during normal conditions, as well as during tumor formation. Angiogenesis is essential to the process of wound healing, but it also is implicated in the growth of tumors. One key player is a lipid mediator called sphingosine 1-phosphate (S1P), which plays an important role in cell survival, cell death, and even cell differentiation.

Sullivan extracted lipids from 400 serum samples from cancer patients to see if S1P could be a biomarker for early cancer detection, testing each sample via high-performance liquid chromatography (HPLC) to determine S1P concentrations in these patients.

By the end of the summer, Sullivan was able to report that her results showed a variety of S1P responses in the patients undergoing cancer treatment, and thus rule out S1P as a biomarker for early cancer detection. Her results opened up a variety of new hypotheses to be tested.

"My summer internship was a wonderful experience. I would recommend an experience like mine to any student considering graduate school," she said.

## Jonathan Stefely '09

**CHEMISTRY MAJOR**
**MARVIN MILLER LAB AT THE UNIV. OF NOTRE DAME, SPRING AND SUMMER '07, ACADEMIC YEAR 2007–08 (ELI LILLY & CO. GRANT, SUMMER '07)**

Jonathan Stefely's steps to achieve his goal of developing his God-given gifts to benefit humanity began in his first-year organic chemistry class.

In that class, chemistry professor Marvin J. Miller explained how his lab synthesized Mycobactin S, a siderophore promoting growth of *Mycobacterium tuberculosis,* by helping deliver critical supplies of iron. Miller's research group was linking antibiotics to siderophores, thus creating a "Trojan Horse" antibiotic to deliver a disguised antibiotic along with iron.

In the fall of 2006, the Notre Dame Forum on global health ignited Stefely's passion. "I became fired-up to fight the global health crisis and decided it was time to get into the laboratory and do my small part," he said. Stefely joined the Miller lab and conducted a multi-step experiment aimed at synthesizing a particular compound, a sugar β-lactam, which would allow scientists to exploit a vulnerability in the cell's outer wall.

"The basic idea is to take advantage of the fact that bacteria ingest sugar. If we can make a drug that looks like lactose to the bacteria, they will ingest it. Then, once inside, it will spring into action and kill the bacteria from within its own cell wall, just like a Trojan horse," he said. Utilizing sugar transport pores for drug transport would be especially important for attacking bacteria such as thick-walled *Mycobacterium tuberculosis*.

Stefely plans to continue working in the Miller lab until he graduates and hopes to use his experience to lead a multidisciplinary team in drug development in the future. Eli Lilly & Co. offered him a grant to continue his work in the Miller laboratory next summer.

## Patrick Holvey '10

**CHEMISTRY AND PHYSICS DOUBLE MAJOR**

**NANO-BIO REU PROGRAM, UNIV. OF NOTRE DAME, SUMMER '07**

Sophomore Patrick Holvey investigated the use of supercritical water as a coolant in power plants as part of his research initiative this past summer with his advisor, Daniel Gezelter, associate professor of chemistry and biochemistry. "Raising the temperature of water to increase power generation efficiencies is great. But the problem is that supercritical water is extremely corrosive on pipes, such that you have to switch out the pipes every two weeks to a month," Holvey explained. The Department of Energy has explored ways that supercritical water might be used in nuclear power plants, but the obvious problem of radioactive water and pipes has made this option unattractive.

In his research, Holvey used a new model of a water molecule, called a "Soft Sticky Dipole," which enabled him to calculate and measure the energy of each model atom. His investigation gave him insight into another potential for research on metallic nanoparticles: cancer. "We could take nanoparticles and attach them to a cancer-seeking virus that would attach itself to a cancer cell and stick on it," he explained. "If you release a bunch of them into the bloodstream, then scan the body with infrared light, you can see if any tumors are present," he said.

Holvey has already decided the type of research he will pursue. "Computational chemistry is very physics-based. I am looking forward to spending two more summers here, and possibly a third. The teachers are great here. They really opened my eyes to computational chemistry," he said.

## Stephanie Nienaber '09

**PREPROFESSIONAL STUDIES MAJOR**

**CINCINNATI CHILDREN'S HOSPITAL MEDICAL CENTER AND RESEARCH INSTITUTE, SUMMER '07**

Last summer, Stephanie Nienaber conducted laboratory experiments involving two main proteins: perforin and granzyme B, which are utilized by natural killer cells triggered by the immune system to attack cells infected by viruses.

The project concluded that the neutralization of the cytoplasmic granule containing these two proteins leads to rapid degradation of perforin, but not granzyme B. The lab is currently conducting further research on preventing the degradation of perforin.

Nienaber was inspired by the career of her mentor, Kimberly Risma, M.D., Ph.D., of the Division of Allergy and Immunology at Cincinnati Children's Hospital and an assistant professor at the University of Cincinnati College of Medicine. Under Risma, Nienaber plunged into her work with an intensity that made others at the hospital take notice.

What drove Nienaber to spend long hours in the lab with such unusual energy? She explained: "I began at the age of 13 as a volunteer at a local hospice. Much of my philosophy on life has been affected by three very special patients I met during my time there."

After her intense summer of immunological research, Nienaber is interested in pursuing an M.D./Ph.D. degree, having been inspired by her mentor and the many people she's encountered who have faced death. "I think about all of the families that I have met and helped, and I am driven to use science and research to help future patients. It seems like an appropriate way to honor their memory," says Nienaber.

# Where are they now?

## Four College of Science alumni who conducted undergraduate research

**The success of our alumni who have performed research demonstrates the value of the undergraduate research programs at Notre Dame. Our students have performed hands-on biology research at UNDERC (University of Notre Dame Environmental Research Center), mathematics research through the SUMR (Seminar for Undergraduate Mathematics Research) program, research in all four disciplines through REU (Research Experience for Undergraduates) programs, and various research investigations in faculty laboratories.**

**Former biology REU students Perciliz Tan '04 and Scott Breunig '06 have graduated with Ph.D.'s from Johns Hopkins and Princeton University, while Matthew Mendlick '97 is pursing an M.D./Ph.D. at the Ohio State University, a top-ranked research and medical institution. Former UNDERC student (Lisa Cellio '94) became a doctor of veterinary medicine. Physics alumnus Tonio Buonassisi '01 completed his Ph.D. at UC Berkley and is now an assistant professor at MIT. SUMR participant Kevin Thomas '03 earned an M.D. at Loyola University, Chicago. Recent alumnus Leonard Edokpolo '07, who performed research in the Hyde lab, is now pursuing an M.D. at Harvard.**

**Following are the profiles of four recent alumni whose careers were influenced by their early research experiences.**

**"Oftentimes in looking back, our graduates say that it was in the research lab that they understood most about what it would mean to pursue a vocation in science."**

*—Dennis Jacobs, associate provost and professor of chemistry and biochemistry who has mentored many undergraduate student researchers*

## Susan McGovern

**B.S. IN BIOCHEMISTRY AND MATHEMATICS, UNIVERSITY OF NOTRE DAME, 1997**
**M.D., PH.D. NORTHWESTERN UNIVERSITY, 2005**

In the late 1990s, a radically new approach to biochemistry was taking hold. The development of massively parallel, special-purpose supercomputers and innovative mathematical and computational techniques made it possible to direct unprecedented computational power toward solving difficult scientific and technical problems in molecular simulation and design. That was also when Notre Dame undergraduate Susan McGovern found her research niche.

As a senior biochemistry and mathematics double major, she joined the computational chemistry laboratory of Sharon Hammes-Schiffer, professor of chemistry and biochemistry, where she modeled electronic transport.

"That was a particularly great experience," she recalled. "Having that kind of exposure got me interested in biophysics and in using computational methods in chemistry and biology."

It opened her eyes to what it means to do research every day, and the commitment that was required. "That was the most important thing that I learned. It's only when you're in an independent research project, where the burden is definitely upon you, that you really appreciate what it means to do research," she said.

After graduation, McGovern joined the Shoichet Laboratory at Northwestern University to be involved in research using computational methods in drug design. After receiving her M.D. and Ph.D. degrees at Northwestern in 2005, she began her residency training at the University of Texas M.D. Anderson Cancer Center in the department of radiation oncology.

"By taking care of patients, I see new opportunities for research to make a difference in the lives of people with cancer. My long-term plans are to continue in the field of radiation oncology and develop drugs that make cancer treatments less toxic and more effective," she said.

Where are they now? *continued*

## Jon Camden

**B.S. IN CHEMISTRY AND MUSIC, UNIVERSITY OF NOTRE DAME, 2000**
**PH.D. IN PHYSICAL CHEMISTRY, STANFORD UNIVERSITY, 2005**

At Notre Dame, Jon Camden maintained a balance between his two loves: music and chemistry. Although he majored in both, he spent summers in the laboratory of chemistry professor Dennis Jacobs, conducting beam scattering experiments on silicon surfaces.

Interacting with graduate students and post-docs and dealing with issues on a high scientific level was a new experience for Camden. "I certainly got a flavor of what research was all about during my years at Notre Dame," he said.

Camden wrote computer code for molecular dynamics simulations of hyperthermal ion collisions involving the scattering of high-energy neon atoms off silicon surfaces. His experiments, supported by the U.S. Air Force and the National Science Foundation, related to the understanding of the effect of atoms in a rarified atmosphere on a satellite in lower Earth orbit.

Camden received the College of Science Dean's Award and the Outstanding Chemist Award. After graduating *summa cum laude* in music and chemistry, he went to graduate school at Stanford, studying under the preeminent physical chemistry scientist Richard N. Zare, Jacobs' advisor in the mid-1980s. "Dennis got his Ph.D. with Dick in1988, and I got my Ph.D. with Dick in 2005," Camden said.

Now a post-doctorate at Northwestern University, Camden conducts Air Force-supported research. "All this would not have happened, obviously, if I had not done undergraduate research," he said. "To this day, Dennis and I keep in touch. I really think undergraduates can have a lifetime relationship with their college professors if they are willing to foster it."

## Helga Schaffrin Huntley

**B.S. IN MATHEMATICS, UNIVERSITY OF NOTRE DAME, 1999**
**M.S. IN MATHEMATICS, NEW YORK UNIVERSITY, 2003**
**PH.D. IN MATHEMATICS, NEW YORK UNIVERSITY, 2005**

In my senior year at Notre Dame, I nearly quit my research. I had been in Prof. Frank Connolly's Seminar for Undergraduate Mathematical Research (SUMR), and was working on my own project within differential geometry. It was an interesting subject, and I loved pushing the limits of my understanding. However, I was also taking an overload of regular classes and with time for research scarce, had not made much progress in weeks.

One weekend, I picked up the book I was working through, found the part I was stuck on, and half-heartedly started once again on the derivation. This time, however, it worked! Any thought of quitting was gone.

It is very rewarding to solve a problem—more so than completing an assignment or acing an exam. In graduate school, a professor told us, "It is interesting that there is anyone who wants to do research in math. After all, you spend most of your time being unhappily stuck." I had learned that lesson

during my undergraduate years, but I had also learned how to see beyond the immediate obstacles and to forge ahead.

It was not a straight path from my undergraduate thesis on "Hyperelliptic Riemann Surfaces" to my current position researching ocean currents and their mathematical models at the University of Delaware. After graduating from Notre Dame, I spent a year volunteering with a development organization in Zambia, assisting with anti-AIDS and orphan support programs. When I returned to the U.S., I started graduate school at New York University. The first year was tough, but very rewarding.

The focus of my research has changed from theoretical to applied mathematics, but my undergraduate research experience remains valuable—many of the skills I learned then have been as relevant in my volunteer activities as in my research position. I cannot credit undergraduate research alone, though: my Notre Dame education consisted of much more—its breadth, including research and classes, sciences and humanities, the academic and the extracurricular—serves as a solid foundation for the multifaceted interests I pursue today.

## Andrew Serazin

**B.S. IN BIOLOGICAL SCIENCES WITH A CONCENTRATION IN SCIENCE, TECHNOLOGY, AND VALUES, UNIVERSITY OF NOTRE DAME, 2003**
**PH.D. IN MEDICAL SCIENCES, OXFORD UNIVERSITY, 2006**

Andrew Serazin, a research officer in Global Health Discovery at the Bill & Melinda Gates Foundation, received his doctorate as a Rhodes Scholar at the University of Oxford for work on genomic aspects of antigenic variation in *P. falciparum*. He tells us how his Notre Dame undergraduate research experience affected his career.

*The path from Galvin Hall to the Gates Foundation was a rather quick one for me—a little under four years from graduation day to "day one" at the world's largest charity. Unsurprisingly, there is a direct link between the skills I acquired as an undergraduate research student with Nora Besansky and Frank Collins and the focus of my current work. Their impact, along with many faculty members of biological sciences, including Michelle Whaley, has been profound, but I will concentrate here on two interrelated themes, which were first taught at Notre Dame and are daily sources of inspiration to me.*

*My role in the Global Health Discovery team at the Gates Foundation broadly covers infectious disease, nutrition, and reproductive health. In such a capacity I have great access to some of the most exciting discoveries in the life sciences.*

*Fortunately, it isn't enough to make independent observations as a lone investigator—no matter how exciting they are. New results must be filtered by the experience of a community of scientists through mechanisms large and small—peer review of papers, scientific conferences, and journal clubs the world over. In this way, faulty logic will be exposed; non-repeatable results will be discounted. Therefore, an attitude of healthy criticism makes the whole system work. My experience at Notre Dame helped me develop this frame of mind while putting science in the context of larger social aims.*

*At the Gates Foundation, we attempt to maintain this restless skepticism of new results and new data, much like any member of the scientific community. More than this, we aim to challenge the way science is done. In linking activities in the laboratory to real-world solutions, we highlight the important contributions of scientists, many of whom are at Notre Dame, in improving the lives of the poorest people in today's world.*

# Graduate Research at

**Under the direction of their faculty mentors, College of Science graduate students conduct a wide range of investigations, but all of them learn new ways of approaching problems, acquire new skills, and eventually develop their own, original research projects. Throughout the process, they form collaborations with faculty at Notre Dame as well as researchers across the nation and around the world. They share the results of their research through poster and oral presentations at scientific meetings and earn prestigious NSF and NIH fellowships. Along side faculty, they become some of the best mentors for undergraduate student researchers.**

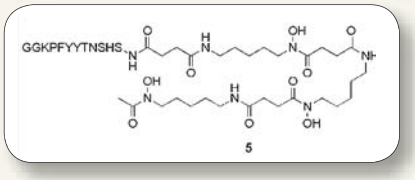
**We have chosen four current graduate students and four graduate alumni to demonstrate the variety of graduate student experiences at Notre Dame.**

## Leslie Patterson

**PURSUING A PH.D. IN CHEMISTRY**
**B.S. IN BIOLOGY-CHEMISTRY, MANCHESTER COLLEGE, 2004**

The research of third-year graduate student Leslie Patterson could make a big difference in the lives of people affected by iron overload diseases. Patterson synthesized a compound that consists of a known iron chelator, Desferal®, conjugated to a novel peptide. The peptide was discovered by the Theil group and was found to facilitate release of iron from ferritin. Patterson's compound was shown to increase the release of iron by eight times over that of the peptide alone.

Patterson recently published the results of her collaborative research with her advisor, Prof. Miller, and Prof. Elizabeth Theil from the Children's Hospital Oakland Research Institute (CHORI) and a biologist at UC Berkley. Her research, which originally appeared in the Nov. 2, 2007 edition of *Journal of Biological Chemistry,* was also featured as an editor's choice in the journal *Science*.




*This is the molecular structure of the compound Patterson synthesized.*

## Stacy Hoehn

**PURSUING A PH.D. IN MATHEMATICS**
**B.S. IN MATHEMATICS AND COMPUTER SCIENCE, XAVIER UNIVERSITY, 2004**
**M.S. IN MATHEMATICS, UNIVERSITY OF NOTRE DAME, 2006**

Fourth-year graduate student Stacy Hoehn specializes in the study of geometric topology. Her research interests have led her to study Siebenmann's end theorem, surgery theory, algebraic K-theory and automorphisms of manifolds. This year, she is organizing the Topology Seminar at Notre Dame, and last spring, she gave a talk at the Graduate Student Topology Conference at the University of Chicago.

Because of her promising work, she received a prestigious three-year Graduate Research Fellowship from the National Science Foundation in 2005 that included a $30,000 stipend and international travel allowance. In 2006, she flew to Germany to give a presentation on microbundles at a workshop on high-dimensional manifolds and attended a conference on surgery theory in Scotland.

Hoehn has a participatory teaching style and encourages students to explore mathematic topics in which they are interested. She has taught Principles of Finite Mathematics, and says, "Instead of merely lecturing to the students, each day I give the students sample problems that they can work on in small groups." That way, the students are more actively engaged in their learning.

# Notre Dame

## Charles "Chuck" Vardeman II

**PURSUING A PH.D. IN CHEMISTRY**

**B.S. IN CHEMISTRY, UNIVERSITY OF NOTRE DAME, 2000**

All graduate students in the Department of Chemistry are required to create an original research proposal, and the proposal that Charles Vardeman II wrote was "in a word, phenomenal," according to Chemistry Associate Professor J. Daniel Gezelter.

Vardeman, a specialist in computational chemistry, proposed a project to create (both experimentally and on a computer) glassy bimetallic nanoparticles to figure out if laser-induced heating followed by an extremely rapid cooling due to their small size would lead to glass formation. Glassy materials have some interesting and unique physical properties, and no one has yet been able to create glassy nanoparticles. Vardeman's research confirms that silver-copper alloys would be a good target for researchers to tackle.

Vardeman is one of the principal authors of the research group's simulation code, OOPSE (Object Oriented Parallel Simulation Engine). He set about to form glassy particles using copper and silver alloys. "I have used experimental data to create a realistic model for how nanoparticles cool after laser-induced heating in water and then looked at the resulting structure of those nanoparticles."

"Chuck's research projects have posed computational challenges that are beyond many of the graduate students that I have known over the years," Gezelter said. "He has a deep understanding of computational algorithms and physical chemistry, and has applied this knowledge to systems of wide interest."

"Probably the most important aspect of my experience here has been the leeway that I have had to pursue research," Vardeman said. "It has given me a broad base of knowledge that will open up a lot of possibilities after graduation."

## James Whitcomb

**PURSUING A PH.D. IN BIOLOGICAL SCIENCES**

**B.S. IN BIOLOGICAL SCIENCES,**

**UNIVERSITY OF ILLINOIS AT CHICAGO, 1995**

After graduating with a bachelor's degree in Biological Sciences, James Whitcomb worked for awhile in private industry before becoming a technician in the laboratory of biologist Mary Ann McDowell. "Eventually, I made the logical transition to graduate school," he explained. His research involves the study of the infectious disease, leishmaniasis, and specifically, the role of the Vitamin D receptor and how it modulates our immune response.

Until he became a Notre Dame graduate student, Whitcomb had never considered himself to be a teacher. "I have always enjoyed training people on the job. If I knew how to perform a technique, I was more than happy to help someone learn how to do it themselves. But I never made the connection that training is the same as teaching," he said with a laugh.

Now Whitcomb regularly visits a local high school where he brings hands-on science to the classroom. His work is part of a new program in the physics department funded by the National Science Foundation called NDeRC (Notre Dame extended Research Community), which links graduate students with K–12 teachers. "During the week, the students perform an experiment that uses zebrafish with and without pigments to study the genetics of pigmentation. The students pick out a male and female zebrafish for mating. The next day, the zebrafish have laid eggs, and for the rest of the week the students use a microscope to make observations as the embryo develops… The students get really excited when they start to see organs like the eyes and heart form."

Now that he has discovered his talent for teaching, he envisions himself in a classroom after graduation.

# Where are they now?

## Four College of Science alumni who conducted graduate research

### Dori Woods

**B.S. IN BIOLOGICAL SCIENCES, UNIVERSITY OF ARIZONA, 2001**
**PH.D. IN BIOLOGICAL SCIENCES, UNIVERSITY OF NOTRE DAME, 2007**

Dori Woods's academic career at Notre Dame has been marked by one success after another. Woods chose Notre Dame for her graduate degree in biology following her graduation from the University of Arizona. Under the direction of Alan Johnson, professor of biological sciences, she wrote her dissertation, "Follicle Selection and Differentiation of the Granulosa Cell Layer in the Domestic Laying Hen." Shortly afterward, she initiated her own research project investigating the underlying mechanisms of human granulosa cell tumors. This study, published in *Cancer Letters*, has important implications for the study of ovarian cancers.

"Being able to establish independent research at Notre Dame was really important to me. When I presented my research at scientific meetings, I was able to do so with confidence. I had a sense of ownership of my project, and this really opened a lot of doors for me," she said.

Woods gives Johnson a lot of credit for guiding her early on. "He made it very clear in the beginning that I would be conducting independent research. It involved a lot of hard work. But once I got going, it became really fun," she said.

After completing a postdoctoral fellowship in the Department of Biological Sciences, she will be leaving in August for the Harvard Sciences' Vincent Center for Reproductive Biology.

### Sean Seymore

**B.S. IN CHEMISTRY, UNIVERSITY OF TENNESSEE, 1993**
**M.S. IN CHEMISTRY, GEORGIA INSTITUTE OF TECHNOLOGY, 1996**
**PH.D. IN CHEMISTRY, UNIVERSITY OF NOTRE DAME, 2001**
**J.D., UNIVERSITY OF NOTRE DAME, 2006**

This fall, Sean Seymore will join the faculty of Washington and Lee University School of Law in Lexington, Va., where he will teach courses in patent law as well as law and science. His Ph.D. in chemistry combined with his law degree from Notre Dame have prepared him well.

He will bring to his students the overriding message that he learned during his years at Notre Dame: to do high-quality, meticulous work. "Graham Lappin [chairman of the chemistry department] once told me that you want people to be able to trust what you publish," he said. "This is true with the professors throughout the chemistry department," Seymore added after ticking off a list of people who had a big impact on his professional development.

The professor he mentioned above all was Seth Brown, his thesis advisor. "In addition to being a brilliant chemist, Brown was an outstanding mentor and a fine teacher. He is very warm person who truly cares about his students. I really enjoyed working with Seth," said Seymore, who is currently a visiting assistant professor at Northwestern University School of Law.

Seymore's experience with Brown certainly rubbed off. Seymore won the Emil T. Hofman Outstanding Graduate Teaching Award during graduate school. His dissertation was titled "Polar Effects of Metal-Mediated Nitrogen and Oxygen Atom Transfer."

When he returns to his home state of Virginia this fall, Seymore will carry with him many of the lessons he learned at Notre Dame. His own students will be the beneficiaries.

## Bhoopesh Mishra

**M.S. IN PHYSICS, INDIAN INSTITUTE OF TECHNOLOGY, 2000**

**PH.D. IN PHYSICS, UNIVERSITY OF NOTRE DAME, 2006**

Mishra is a postdoctoral research associate in the Department of Geosciences at Princeton University. As a graduate student at Notre Dame, he received the Outstanding Graduate Dissertation Award for his thesis work specializing in the application of synchrotron based X-ray microspectroscopy techniques on a variety of environmental science problems. He recently wrote the following about his Notre Dame experience:

I was shy, inhibited, and unprepared when I came to Notre Dame. It took me months to overcome the cultural shock of coming to the United States from my small, Brahmin town in Northern India. Yet, Notre Dame soon became my home.

I started working on dilute magnetic semiconductors (DMS) with Prof. Bruce Bunker. Nevertheless, destiny had something else in store. My adviser was a key scientist in the new Environmental Molecular Science Institute (EMSI) on campus. Environmental issues always intrigued me, and I saw this as an opportunity to learn and contribute. I soon learned I preferred environmental science.

My thesis dealt with identifying a new reactive group (sulfhydryl) on bacterial surfaces that play a key role in binding metals at realistic geologic settings, and proving that despite significant morphological differences, a broad range of bacterial surfaces behave the same from a metal adsorption chemistry point of view. I complemented synchrotron-based X-ray experiments with equilibrium thermodynamic modeling for these studies. These results can be directly applied to developing bioremediation strategies to clean up the metal and radionuclide contaminated sites in the United States, a legacy of the Cold War era.

As graduate school passed by, my conscience urged me to stay close to academia and share my knowledge and experience with others. I am now a confident and passionate researcher, a postdoctoral research associate at Princeton University, embarking on a journey as an assistant professor. I am a dreamer. I have been a dreamer since childhood. Notre Dame taught me how to make my dreams come true.

## J. Patrick Loria

**B.S. IN CHEMISTRY, GEORGE WASHINGTON UNIVERSITY, 1990**

**PH.D. IN CHEMISTRY, UNIVERSITY OF NOTRE DAME, 1997**

Now an associate professor of chemistry and biophysics at Yale University, J. Patrick Loria sees his time at Notre Dame as a time of transformation.

It began with his first trip to campus. "Notre Dame was not my first choice for graduate school. When I came to the campus on a visit, I met Tom Nowak and Tony Serianni. I talked with Tom about science and the projects in his lab. I saw the type of environment there. That changed my mind on the spot to come to Notre Dame," he said.

He began working on his doctoral thesis in conformational changes in yeast pyruvate kinase, which involved a considerable amount of protein chemistry and late-night NMR experiments.

But in the process of starting his work, Loria learned something else that was to have a profound effect on him: a sense of independence. "I was in my early 20s, and I admit I was pretty naïve," he explained. "Tom was very insightful and guided me and the other graduate students without us knowing it at the time. He fostered independence, so when I joined another lab that operated at a faster pace, it paid a lot of dividends. I felt I did not need a lot of supervision. I was not uncomfortable trying to tackle projects on my own. Tom should get a lot of credit for that."

Loria felt he matured greatly during the years he spent at Notre Dame, as a student and as a teacher. "Serianni, Nowak, and (Paul) Huber were excellent and their teaching styles got me excited in areas of science distinct from my thesis," he said. The campus still holds a lot of fond memories for Loria in one other aspect: "I met my wife at Notre Dame."

# Notre Dame Launches Innovation

NOTRE DAME'S EMERGENCE AS A WORLD-CLASS RESEARCH UNIVERSITY HAS NOT BEEN WIDELY NOTICED IN EVERY CORNER OF WORLD—BUT THAT'S ABOUT TO CHANGE.

David Brenner, a 1973 College of Business alumnus, is a seasoned entrepreneur who has helped guide start-up businesses in Grand Rapids, Mich. Now he's prepared to do the same for fledgling enterprises spawned by Notre Dame research.

There was a time when Notre Dame scientists and engineers would go to a place that would take their successes in the laboratory and transform their innovative work into a marketable product. That place was called "elsewhere."

In just 18 short months, that place will be called "here"—a 50,000 square foot building that will launch the creation of an incubator facility, known as Innovation Park at Notre Dame. The facility will be built starting next spring on 12 acres of undeveloped land immediately south of campus. Eager to get started, Brenner is not waiting until the new facility opens. He is actively exploring temporary facilities in the area to use beginning in early 2008.


David Brenner

As its new director, Brenner intends to develop a research park that is consistent with the historic mission of Notre Dame, one that encourages active exploration and pursuit of innovative ideas that serve society's needs. "As a long-time member of the Notre Dame family, I understand the mission and tradition of the University and that it is important that we do this the right way," he said. To that end, Innovation Park will be patterned after the most successful business, technology, and research parks in the country. "No one park does it completely right. But we will take the best ideas from each and mold them specifically to what will work best for Notre Dame," he said.

In 2000, Brenner founded IdeaWorks, LLC in Grand Rapids, to accelerate the development of fledgling companies such as Product Animations, a 3D simulation technology company headquartered in Chicago, and LumenFlow, which dealt with advanced optics.

Innovation Park expects to draw a $1 million commitment from the City of South Bend with additional support coming from St. Joseph County's Project Future, the Medical Education Foundation of South Bend, and the Indiana Economic Development Corporation through its certified technology park program. But it will clearly have a Notre Dame emphasis.

# Park

Brenner said the first building planned for Innovation Park will consist of three floors, with the first floor containing a "greenhouse" where entrepreneurs will bring their freshly germinated ideas to the park to be nurtured in an ideal environment for accelerated growth.

**Brenner intends to develop a park that encourages active exploration and pursuit of innovative ideas...**

"The greenhouse will be a place where our faculty, students, and graduate students can bring their ideas and engage in a free-wheeling discussion with industry experts. We intend to work closely with all of the colleges, especially the colleges of science and engineering, and help them move their theories quickly to the proof of concept stage where potential market applications might lie," he said.

Once those discussions lead to a sound business proposal, the next step in the sequence could involve the participation of "angel" investors or venture capitalists in the talks. In his career of fostering entrepreneurial talent, Brenner has learned that attracting capital is not always an issue facing prospective start-up companies. "Capital will always chase a good start-up idea," he noted. "The park's job is to increase the odds that this happens with our tenants, by working closely with them to understand what the market demands from their venture."

Once the business proposal is determined to be viable in the marketplace, then the ventures will move up—literally—to the second and third floors of the Innovation Park complex.

It is on these two floors where the newly formed companies become tenants. Depending on their needs, a wet or dry lab may be built or simply brought in on wheels. "It will be a very flexible facility that will be nothing like you have seen on this campus," Brenner said.

Brenner said the Innovation Park will have many similarities to other Midwest facilities, such as those at Purdue University, the University of Indiana Fort Wayne, and the Southwest Michigan Innovation Center in Kalamazoo. As these communities have learned, the benefit of successful new companies extends well beyond the park itself, bringing new life and exciting jobs to the immediate area.

"There will be many opportunities for faculty and students to get involved with the park. We have a lot of smart students here and a lot of basic work that needs to go on in the park, such as market research and data-mining. The park will benefit from their talents and energy, and the students will leave here much richer for the experience," he said.

Brenner insists that his core staff, while small in number, will include former entrepreneurs who have experienced the tough times most start-up companies face. Some members of that core group could come from the Irish Angels, a newly formed network of Notre Dame alumni and friends who have first-hand experience with the challenges and the exhilaration of new venture development.

Brenner confidently predicts that the park will make a positive contribution to the University and its mission, by opening new pathways for Notre Dame's research to flourish and make a difference in the market.

# New Titles and New Faces

## Chaloner Begins New Role as Undergraduate Research Coordinator

The College of Science is pleased to welcome Dominic Chaloner, Ph.D., as the new undergraduate research coordinator. In this role, Chaloner hopes to enhance the college's existing infrastructure to support undergraduate research, to promote the many successes resulting from the mentorship of undergraduates by science faculty, and to provide advice to students about pursuing the most appropriate and fulfilling avenues of research.


Dominic Chaloner

Chaloner strongly believes in the value of undergraduates pursuing original research with mentorship from faculty. According to Chaloner, "Undergraduates should conduct research because it is simply the best way to learn how to 'do science.'" He recommends that students talk to their professors about research and continually keep their eyes and ears open for opportunities, on and off campus. Since competition can be intense, Chaloner advises students to apply to as many different programs as possible to maximize their chance of success.

Chaloner has been a research assistant professor in the Department of Biological Sciences since 2005. He originally came to the University of Notre Dame in 2000 to work as a post-doctoral researcher in the Stream Ecology Laboratory. He completed his Ph.D. in zoology at University College London in the United Kingdom.

Chaloner has taught several undergraduate courses, including "General Ecology" and "Earth in Crisis—Current Environmental Issues." His research interests include the ecological influence of Pacific salmon on streams in Alaska and the Great Lakes, funded by grants from the U.S. Department of Agriculture and the Great Lakes Fishery Trust, as well as the ecotoxicology of ionic liquids, a novel replacement for organic solvents used in industry, funded by grants from the National Oceanic and Atmospheric Administration.

## Astrophysicist Directs Digital Visualization Theater

In January, the College of Science welcomed astrophysicist Keith Davis as the director of the Digital Visualization Theater (DVT) in the Jordan Hall of Science. Davis plans to expand the use of the DVT and enhance our faculty's ability to interact with students during presentations. "The immersive qualities of the DVT can then be combined with the flexibility of traditional teaching aids to make the DVT a truly amazing teaching tool," Davis explained.

In addition to developing content for courses in the College of Science, Davis will also be forming collaborations with departments across the University. He plans to work with faculty in disciplines such as engineering, architecture, film, and economics in much the same way he works with science faculty to find the areas of the curriculum where an immersive experience is vital to understanding, and then to create content for the DVT that provides that experience. He also hopes to collaborate with other directors of full-dome theaters around the country to share and create new content. Eventually, he would like to host a digital content library to make noncommercial content more readily available.


Keith Davis

Davis' well-rounded scientific knowledge and interest will be a tremendous asset to the college. He received his doctorate in physics from Clemson University in South Carolina, where he was the planetarium manager and an astronomy instructor. He earned a master's degree in physics, also from Clemson University, and a bachelor's degree in applied mathematics with an emphasis in environmental science from the University of Tulsa.

# Veteran Cardiologist Guides Students in Careers in Medicine

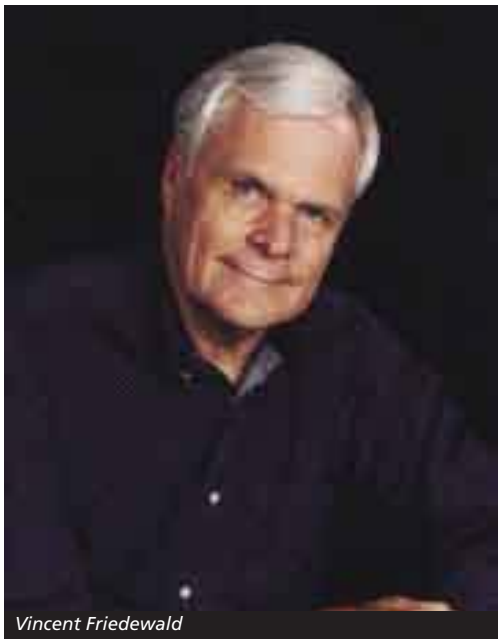
Beginning this semester, preprofessional students are being guided by a veteran cardiologist, Vincent Friedewald, M.D. Because of his experience as a cardiologist, clinical professor of medicine, and clinical researcher, Friedewald is a perfect fit to advise students and coordinate clinical research opportunities for preprofessional students. He joins three other faculty advisors in the Center for Health Sciences Advising: James Foster, C.S.C., M.D., the director of the center; Kathleen Kolberg; and Jennifer Nemecek, who collectively advise over 200 students in each class year applying to medical, dental, veterinary, and other professional schools.

Friedewald's philosophy on undergraduate research for premedical students is that, "The more research is personally relevant, the more impact it will have." For instance, he might guide a student toward conducting periodic blood pressure and cholesterol tests on fellow students and tracking these results over four years to see the effect a collegiate diet might have on health prospects years later.

"We know that the critical time for developing the risk for heart disease is around age 20," he said. "Students could run an experiment in a controlled environment in which they make all sorts of measurements related to future health. So I think there are many opportunities like this in undergraduate research that we could tap into," he said.

**In addition to his career as a cardiologist for over 25 years, Friedewald has been a clinical professor, author of medical textbooks, editor of a medical journal, and an executive producer of medical television and video series.**

This same approach underscores his philosophy about educating students. He plans to work with Keith Davis, director of the Digital Visualization Theater, to develop 3D medical animations. One example would be the development of a program that shows the inside of a human cell in a way that no illustration can. "I want to focus on educational programs in which 3D really makes sense and not to just develop a show that 'wows' people," he said.


Vincent Friedewald

He is a 1963 preprofessional studies alumnus who, after earning his M.D. at Southwestern Medical School in Dallas and completing a medical internship at the University of Indiana Hospitals, began his residency at the Baylor College of Medicine in Houston. It was at Baylor that Friedewald began to find that his real strength as a doctor lay in his abilities to empathize with his patient and to talk with the patient until he had enough information to make a diagnosis.

Friedewald is also the author of several books, including two medical textbooks, *The Clinical Guide to Bioweapons and Chemical Agents* and *The Clinical Guide to Cardiovascular Diseases,* which will be released early this year. He has also cowritten four books in the *Ask the Doctor* series titled *Depression*, *Hypertension*, *Asthma,* and *Breast Cancer*.

Friedewald has gained national recognition as an executive producer for health-related video and television productions. For physicians and other healthcare professionals, he has produced *Milestones in Medicine, Journal Watch*, and *Pharmacy Rounds*. He also produced and hosted *Cardiology Today* and *Morning Rounds* for MDTV, a syndicated network of 300 television stations in the United States and Canada. His most recent, Internet-based CME series on cardiovascular medicine, *The Personal Professor*, is produced in conjunction with *The American Journal of Cardiology,* for which he is the assistant editor.

The achievements of his prolific career have given Friedewald the experience, the insight, and the wisdom to prepare him to guide preprofessional students in the Center for Health Sciences Advising.

# New T&R Faculty

This fall, the College of Science welcomed six talented new faculty members. As leaders in their fields, these individuals will join an already impressive group of teachers and researchers to enhance the academic excellence of the college.

**Brandon Ashfeld**
**Assistant Professor of Chemistry and Biochemistry**

Ashfeld came from the Department of Chemistry at Stanford University where he was a Ruth L. Kirschstein National Institute of Health Postdoctoral Fellow. His research interests include organic synthesis and the design of novel synthetic processes. He earned a Ph.D. at the University of Texas at Austin in 2004 and a bachelor of science from the University of Minnesota-Twin Cities in 1998. He taught "Advanced Organic Chemistry II" this semester. Ashfeld explained his reasons for joining the faculty here, "I chose to come to Notre Dame because of the University's commitment to maintaining a reputation of excellence as a world-renowned research institution, as well as the level of quality in the undergraduate and graduate students who matriculate."

**Nero Budur**
**The Rev. Howard J. Kenna, C.S.C., Assistant Professor of Mathematics**

Before coming to Notre Dame, Budur was a member the Institute of Advanced Study at Princeton University, preceded by three years as the J.J. Sylvester Assistant Professor at Johns Hopkins University. He was a visiting research assistant at Harvard University before completing his Ph.D. He earned a Bachelor of Science in Mathematics in 1998 and a Ph.D. in Mathematics in 2003, both from the

University of Illinois at Chicago. His research interests include algebraic geometry and the study of higher-dimensional geometric objects. He taught "Topics in Algebraic Geometry: Singularities" in the fall and is continuing the class this spring. Budur said he was "attracted to Notre Dame by the quality of the research."

**Mark Caprio**
**Assistant Professor of Physics**

Most recently, Caprio was a post-doctoral associate at the Center for Theoretical Physics at Yale University and was a visiting fellow at the European Centre for Theoretical Studies in Nuclear Physics in Trento, Italy. His research interests focus on the structure of the atomic nucleus and on phenomena that occur in quantum systems consisting of small numbers of particles. He taught "Electricity and Magnetism" this semester. Caprio earned a Ph.D. in Physics from Yale University in 2003 and both a Master of Philosophy in Physics and a Master of Science in Physics from Yale University in 1998 and 1999, as well as a Bachelor of Science in Physics and Mathematics from Oglethorpe University in 1994. He explained his reasons for choosing Notre Dame, "Notre Dame was especially appealing as a place to come to, since it has a vibrant physics research community, with a long history in nuclear physics, and yet it also places a strong emphasis on undergraduate teaching. It therefore combines some of the best aspects of the research and liberal arts worlds."

**Antonio Delgado**
**Assistant Professor of Physics**

Delgado came from CERN in Geneva, Switzerland, where he was a postdoctoral fellow. Prior to that, he held positions at Johns Hopkins University in the Department of Physics and Astronomy and at the Instituto de Estructuro de la Materia at C.S.I.C. in Madrid, Spain. He is a theoretical high energy physicist with research interests related to the last building

block left to be discovered within the standard model of particle physics, the Higgs boson. He is teaching "Quantum Field Theory" this semester. He earned a Ph.D. at the Universidad Autónoma de Madrid in 2001 and a bachelor of science at Universidad Autónoma de Madrid in 1997. He said, "I chose Notre Dame because of the good atmosphere I found when I visited, and also the quality of the high energy group."

**David Galvin**
**Assistant Professor of Mathematics**

Galvin came from the Department of Mathematics at the University of Pennsylvania, preceded by membership at the School of Mathematics at the Institute for Advanced Study at Princeton University, which followed a postdoctoral research position at Microsoft Research in the theory group. His research focuses on discrete probability, combinatorics, and graph theory. He earned a bachelor's in mathematics from the Univ. of Cambridge in 1995, completed Part III of Mathematical Tripos at the Univ. of Cambridge in 1996, and earned a Ph.D. in Mathematics at Rutgers University in 2002. In the fall, he taught "Introduction to Operations Research." Galvin said, "I am excited to join the Notre Dame family. I am looking forward to the opportunities and challenges associated with working alongside a world-class research faculty, and an intellectually curious and socially aware student body."

**Karsten Grove**
**The Rev. Howard J. Kenna, C.S.C., Memorial Chair**
**Professor of Mathematics**

Grove was previously a professor of mathematics at the University of Maryland. He has profoundly influenced the development of modern Riemannian geometry. The "Grove Program" to classify positively curved manifolds by their symmetry groups has become a flourishing research area. Grove has also made fundamental contributions to a variety of other subjects, including geodesics, rational homotopy theory in geometry, singular metric foliations, and manifolds with curvature bounded from below. His research interests include metric and differential geometry, topology, and geometric analysis. He earned a Cand. Scient. in 1971 and a Lic. Scient. in 1974 from the University of Aarhus in Denmark. Grove reflected on why he joined the Department of Mathematics, "I thought it was an exciting opportunity. In my area of research, it's already a very strong department, and I think I can help make it even stronger."

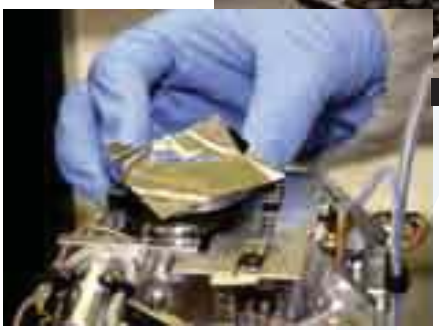
# JINA Reaches Out

Elizabeth High has firm plans about where she wants to go in life. Outer space is one of those places.

By the time she graduated in 2007 with a 4.0 GPA from Penn High School in Mishawaka, Ind., she had decided that a career in physics could put her on the right trajectory to take her there.

This past summer, she landed a job working at the Institute for Structure and Nuclear Astrophysics (ISNAP), under the guidance of physicist Ed Stech, an assistant professional specialist. High was already familiar with the institute and its FN Tandem Van de Graaff accelerator, having participated in JINA's new summertime outreach program for high school teachers and students, PIXE-PAN (Proton Induced X-ray Emissions—Physics of Atomic Nuclei) in its inaugural year in 2006. This two-week summer course is designed to give high school physics teachers and their students a look into cutting-edge nuclear research.

Elizabeth High



High has become the shining star of several outreach programs that were begun in 2003 by the Joint Institute for Nuclear Astrophysics (JINA), a collaboration of physicists from the University of Notre Dame, Michigan State University, and the University of Chicago. Michael Wiescher, the Freimann Professor of Nuclear Physics at Notre Dame, currently serves as JINA's first director.

JINA is a National Science Foundation Physics Frontier Center, one of only 10 in the country. JINA fosters communication within the different fields of nuclear astrophysics to help solve questions concerning the origin of the elements in the universe.

Shortly after beginning her first semester as a freshman at Notre Dame, High was chosen to work on a project looking at the effects of radiation on ultra-thin aluminized kapton foils. This material is being developed as an advanced propulsion system for spacecraft sent on extended missions. The foils were sent to Germany for further testing.

Although she is only 18, High can lay claim to having rubbed shoulders with some of the leading nuclear physicists in the world. Notre Dame hosted the JINA Frontiers 2007 Workshop that brought together JINA participants to discuss recent and planned research in nuclear astrophysics. "I was lucky enough to be able to sit in on these presentations, which, although I may not have completely understood the information, were very informative and interesting," she said.

There is no better place than Notre Dame to run a summer program like PIXE-PAN. The Nuclear Structure Laboratory at Notre Dame is one of only three medium-scale accelerator

Left: *2007 PIXE-PAN participants*

Below: *A 2007 PIXE-PAN team performs an experiment in a Jordan Hall of Science physics laboratory.*

laboratories in the United States funded by the National Science Foundation to perform basic research in a wide spectrum of areas that overlap with most of the highest priority scientific objectives in modern nuclear physics.

PIXE-PAN is by no means the only outreach activity conducted by JINA. A week-long summertime program for grades six through eight called "Sensing our World" introduces young, aspiring scientists to the principles behind lasers and electronics.

One of the first outreach initiatives created by JINA was its "Art-to-Science" program, which contributes instructors, textbooks, and art supplies to at-risk students in the local area. JINA scientists also facilitate field trips for local students to see the Notre Dame research facilities in Nieuwland Science Hall and the National Superconducting Cyclotron Laboratory at Michigan State University.

JINA's creation of these outreach initiatives has inspired both students and their parents. On the final day of the 2007 PIXE-PAN program, the students assembled in Nieuwland with their parents and gave PowerPoint presentations describing their experiments. The parents sat in the student's chairs while the teams of students presented their experiments. One team set out to prove the theory behind the Compton Effect that light has a dual nature as both a wave and a particle. Another team measured the speed of light, while another determined the elemental make up of various samples using X-ray fluorescence. A fourth team showed how proton-induced X-ray emission is useful for determining the elemental composition of various artifacts and historical documents, while a fifth team used three different formulas to determine the charge-to-mass ratio of the electron and compared their findings with the accepted value.

"You could see the look of astonishment on the faces of these parents as their teenagers gave their PowerPoint presentations," said Mary Dewitt, JINA outreach specialist. What the parents wrote afterward reflected their pride in seeing their sons and daughters distinguish themselves before a crowd. Two comments conveyed the general sentiment of all the parents:

"I wanted to let you know that my son is still talking about his experience at Notre Dame… It definitely had an impact on him!"

"I was very impressed by what the students were able to accomplish and grateful for the opportunity for my daughter to be involved in this program."

# QuarkNet Students Travel to CERN

For two local high school students, Tony Coiro and Caleb Phillips, their summer experience with QuarkNet took them far—4,300 miles—on trip of the lifetime to CERN in Geneva, Switzerland, the site of the Large Hadron Collider.

Coiro, a senior at Marian High School in Mishawaka, and Phillips, a senior at La Lumiere School, in La Porte, Ind., had teamed up this summer at the QuarkNet headquarters on Eddy Street to produce cosmic ray detectors for use in museums and planetariums.

Called CRiL—for Cosmic Ray interactive Laboratory—the detector is made of four tiles of scintillating plastic with embedded wave-shifting fibers. Every time a high-energy cosmic ray, or proton, hits the air in our atmosphere, the collision produces a shower of subatomic particles, one of which is a muon. Countless muons pass through us every second. The scintillators in the detectors will record a weak light signal indicating that a muon just passed through.

These are the same kind of muons that will be detected at the Large Hadron Collider by a gigantic detector, the Compact Muon Solenoid (CMS), which is related like a distant cousin to the demo version Coiro and Phillips constructed. Some of those collisions are expected to produce a very specific signal indicating the presence of the Higgs boson, the mysterious and long-sought entity thought to endow everything in the universe with the essential property called mass.


Caleb Phillips

Notre Dame's involvement with the Large Hadron Collider is not inconsiderable, for deep within the CMS are critical components called optical decoder units (ODUs) that were built by QuarkNet students along with high school teachers involved in the Notre Dame RET (Research Experiences for Teachers) program under the direction of physics faculty Randal Ruchti and Dan Karmgard. One of these ODUs may pick up the much-anticipated and unmistakable signal of the Higgs. When (and if) that happens, the news will spread across the globe that the Higgs, at last, has been found.

So, this past summer, Coiro and Phillips were put to work fabricating the detectors. Coiro was given the job of soldering a Crockcroft-Walton generator, a network of capacitors and diodes to generate high voltages that comprise the heart of the detector. It was a perfect fit for the eccentric teen who could be counted on for raising the energy

Left: *Tony Coiro, Mike McKenna and Caleb Phillips assemble the CRiL frame.*

Middle: *During a day off the group explores Chamonix, France.*

Right: *Jeff Chorny stands in front of a muon detector.*

# QuarkNet

**QuarkNet is an educational program sponsored by the National Science Foundation (NSF) and the Department of Energy (DOE) whose aim is to support science education in schools by establishing a nation-wide science teacher network. It provides opportunities for school science teachers to learn firsthand about frontline physics research in universities and establish mentor relationships between science teachers and physicists at universities and national laboratories.**

*Tony Coiro*

level inside the QuarkNet headquarters with his antics. "QuarkNet allowed me to be me for an entire summer," Coiro said. Meanwhile, Phillips built the cylindrical casing for the muon detectors under the direction of Mike McKenna.

"QuarkNet was an amazing experience because we found ourselves doing live science," Phillips said. "Some of the students worked with fiber-optic cables that are going into the International Linear Collider (the next generation collider is still on the drawing boards). It was absolutely fantastic and intellectually stimulating working with a scientific purpose."

Coiro and Phillips built a dozen cosmic ray detectors, one of which is already in use at the Adler Planetarium in Chicago. Others will be on display at the Jordan Hall of Science, Fermilab in Chicago, and the Smithsonian Institute in Washington, D.C.

The pair left Detroit Metro Airport in September with Randy Ruchti, Barry Baumbaugh, Mike McKenna, Cindy McKenna, Dan Karmgard, and Danielle McDermott, a high school teacher from the Arkansas Delta who developed the touchscreen software display for the CRiL, and Jeff Chorny, a high school teacher from Michigan who has been working on similar cosmic ray detectors in the QuarkNet program for several years.

They delivered their detector to a visitors' gallery called SX5, where it now sits quietly counting passing muons and waiting for that epic day—perhaps in 2009—when a spray of muons signals the moment of mankind's greatest scientific achievement, the detection of the Higgs boson.


Left: *Caleb Phillips holds the detection hardware for the CRiL.*

Right: *Tony Coiro stands on a city street in Chamonix, France.*

# Young Science Elite Show Their Talents at 2007 Siemens Competition

Team: Christopoher Ding and James Jiang

Nandini Sarma

PHOTO COURTESY OF THE SIEMENS FOUNDATION

Fifteen extraordinary young scientists from the Midwest brought their innovative, independent research projects to Notre Dame Nov. 16–17 for the Region 3 Finals of the 2007–08 Siemens Competition in Math, Science & Technology, the nation's premiere competition for high school students.

These science superstars presented the results of their ambitious investigations into such topics as breast cancer cryotherapy, Vitamin D deficiency in women, the delivery of drugs across the blood brain barrier, and methods to combat muscle atrophy.

But only one individual and one team would be chosen to move on to the national finals at New York University, New York City, to vie for scholarships ranging from $10,000 to the top prize of $100,000.

The winning individual in the judging at Notre Dame was Nandini Sarma of Overland Park, Kans., whose research focused on the herpes simplex virus. The top team prize went to the collaborative effort of Christopher Ding, a senior at Adams High School in Rochester Hills, Mich., and James Jiang, a freshman at Troy High School in Troy, Mich., for their project on brain tumors.

Ms. Sarma, a senior at Shawnee Mission East High School in Prairie Village, Kans., won a $3,000 college scholarship for her research on the herpes simplex virus (HSV), a highly infectious pathogen affecting a significant percentage of the human population. Her project was titled "Cellular translation factors are required for the Virion Host Shutoff (Vhs) function of Herpes Simplex Virus: Use of siRNAinduced depletion of cellular factors to test involvement in Vhs activity."

Crislyn D'Souza Schorey, associate professor in the Notre Dame Department of Biological Sciences who served as a judge, said, "The herpes simplex virus produces a protein that ultimately causes destruction of the host cell. Ms. Sarma's work enhances our understanding of how this protein does that, providing novel insight into the mechanism by which the herpes virus elicits disease. Her work could provide strategy for therapeutic intervention."

The team of Ding and Jiang shared a $6,000 scholarship for their research on brain tumors, titled "Inhibition of VEGF decreases photodynamic therapy-induced angiogenesis, and reduces tumor regrowth of nude mice bearing U87 human glioma."

The primary judge of their entry, Alan Johnson, a professor in the Department of Biological Sciences, said, "This team evaluated the effectiveness of a photodynamic therapy in treating brain tumors using a mouse model system. They found that this treatment actually results in greater tumor growth. Their experiments showed that by blocking a protein that promotes growth of new blood vessels that allow tumors to grow, they could reduce tumor size. Their results suggest the possibility of a more effective, potentially noninvasive treatment for brain tumors."

Ms. Sarma, her class valedictorian and a tennis varsity letter winner, is a three-time Intel International Science and Engineering Fair first place Grand Award winner (microbiology, 2005–07). She has presented research at the London International Science Youth Forum and the Portugal Youth Science Forum. Ms. Sarma is fluent in Spanish, is a proficient pianist, and earned fourth place at the International Baldwin Piano Competition.

Ding is a member of National Honor Society, German Club, and Science Olympiad. He plays the piano and clarinet and has performed with the Metropolitan Youth Symphony. He became interested in different cancer therapies after volunteering at the neurology department at Henry Ford Health Systems. Fluent in Chinese, he hopes to study international relations, environmental science, or pre-law. His dream job is to become a diplomat.

Jiang is a member of Club Med, Chinese Club, and Biology Competition. He is also a pianist, having attained a superior rating in solo piano at a 2007 National Federation Festivals event. He enjoys track, basketball, running, and reading, and aspires to become a surgeon. Kobe Bryant is his personal hero.

At the Siemens National Finals in New York City on Dec. 3, Sarma received a $20,000 scholarship. In the team category, Ding and Jiang shared a $30,000 scholarship. The $100,000 scholarship winner was Isha Jain of Bethlehem, Pa., for her research on bone growth. The $100,000 prize in the team category went to Janelle Scholossberger and Amanda Marinoff, of Plainview, N.Y.

The Siemens Competition was launched in 1998 to recognize America's best and brightest math and science students. This year, 1,641 students registered to enter the competition, with a record number of projects submitted. Based in Iselin, N.J., Siemens provides more than $2 million in scholarships and awards annually.

Also hosting regional competitions were the California Institute of Technology, Carnegie Mellon University, Georgia Institute of Technology, Massachusetts Institute of Technology, and the University of Texas at Austin.

# Solving Mankind's Energy Crisis

When you have some of the brightest minds from midwestern high schools as your audience, what do you say to them?

Joan Brennecke had no trouble coming up with a topic that would hold the attention of 15 contestants who had gathered at Notre Dame in mid-November for the Regional Finals of the 2007 Siemens Competition in Math, Science & Technology.

The professor of chemical engineering exhorted the students to use their talents to address one of the single-most important issues facing mankind: the energy crisis. "Where will our energy come from?" she asked, while noting that the use of new sources of energy must not worsen the concentrations of carbon dioxide in the atmosphere that are creating global warming.


*Joan Brennecke*

Even from a practical point of view for the United States, a huge infusion of dollars for research and technology into clean sources of power is needed because our oil and gas reserves are projected to last only another 50 years.

While the United States has much larger reserves of coal— enough for 150 years— the global warming threat makes it essential that the coal undergo gasification through a process that removes nitrogen, so the pollutants known as nitrous oxides are not emitted. To develop this gas, known as "syngas" (for synthesized gas), we must solve some key issues similar to those that are preventing the necessary leaps in efficiency for other promising technologies such as photovoltaics, wind power, geothermal power, and hydrogen power.

"A lot of miracles need to happen," she said, adding that it will take the brain power of our most talented students to solve the power problem.

# STANDING OVATIONS

## FACULTY ACCOLADES

**Ani Aprahamian**, professor of physics, was elected chair of the scientific council of Laboratory GANIL (Grand Acceleratoeur National D'ions Lourdes) in Caen, France (2007–09).

**William Dwyer,** the Hank Professor of Mathematics, was awarded the degree of *honoris causa,* by the Univ. of Warsaw at a ceremony held in Warsaw, Poland, on July 31.

**Peter Garnavich,** associate professor of physics, has been elected a Fellow of the American Physics Society "for pioneering work on the discovery of dark energy and the cosmic equation of state, along with important observational discoveries regarding the nature of gamma ray bursts and the physics of supernova light curves."

For his work with a team of collaborators from other universities, Garnavich was awarded a share of the 2007 Gruber Prize in Cosmology along with a share of the $500,000 cash prize. The team identified a supernova, called "2006gz," caused by the collision of two stars.

**Malcolm Fraser Jr.** professor of biological sciences, presented "Progress in Group I Intron Inhibition of Dengue Virus Infection of Mosquito Cells" at the Third Annual Grand Challenges in Global Health meeting in Cape Town, South Africa, Oct. 7–9.

**Jeremiah Freeman**, professor emeritus of chemistry and biochemistry, received the 2007 Founder's Award from the Dr. Tom Dooley Society. The award, which is the highest given by the society, is in recognition of his numerous years of service that Freeman gave to preprofessional students.

**Don Howard**, professor of philosophy, has been elected a Fellow of the American Physical Society through the APS Forum on the History of Physics. Howard was recognized "for his ground-breaking studies of the interplay between physics and philosophy of science in the 20th century, especially in connection with the work of Einstein and Bohr, and for organizing conference series and editing book series fostering the dialogue between physicists and philosophers and historians of science."

**Dennis Jacobs,** vice president and associate provost, led a panel of three Notre Dame faculty at a special event highlighting global health initiatives at Notre Dame at the opening of the 62nd session of the United Nations General Assembly in New York City on Sept. 25. **Rev. Thomas Streit, C.S.C.,** research assistant professor of biological sciences, presented "Eliminating Elephantiasis in Haiti" while a description was given of the work on malaria control by **Frank Collins,** the George and Winifred Clark Professor of Biological Sciences and director of the Center for Global Health and Infectious Diseases.

**Shahriar Mobashery**, the Navari Family Professor of Life Sciences, was named a Fellow of the American Association for the Advancement of Sciences (AAAS). Mobashery was cited for "creative work on antibiotics and the mechanism of antibiotic resistance in bacteria, especially for contributions on methicillin-resistant *Staphylococcus aureus* (MRSA). Mobashery is a world-renowned expert in antibiotic resistance and enzyme inhibitors. He serves on the editorial boards of eight scientific journals and numerous governmental and industrial panels. He has published more than 200 scientific papers and holds eight patents. He received the AAAS honor in Boston on Feb. 16.

Mobashery is the 2008 recipient of an Astellas USA Foundation Award by the American Chemical Society for his work on antibiotic resistance and his contributions to the understanding of the bacterial cell wall. The award, which carries a $30,000 prize, will be presented to him at the 236th ACS national meeting in Philadelphia in Aug. 2008.

**Richard Taylor**, professor of chemistry and biochemistry, was named the "Silveira Distinguished Lecturer" by Oswego State Univ., Oswego, N.Y.

# STANDING OVATIONS

## STUDENTS

### GRADUATE STUDENT

**Katie Hull** was awarded the Eloise Gerry Fellowship by Sigma Delta Epsilon/Graduate Women in Science in August. This research award is given annually to outstanding female graduate students and postdoctoral researchers in the sciences. Criteria for the award include overall scientific merit, quality of proposed research, and collaborative/mentoring capacity. Hull is a graduate student in the Henderson group, and her project is directed towards the synthesis, structure, and application of novel geminal diorganometallic complexes.

### UNDERGRADUATE STUDENTS

**Adam Boocher** and **Julie Lederer** were selected as the 2007–08 Robert P. Balles University of Notre Dame Mathematics Scholars. Both Boocher and Lederer hold 4.0 GPAs in mathematics. The Balles awards are given to two seniors with the highest GPAs in mathematics. One award is given to honors majors while the second is given to non-honors majors, with ties broken by considering the quality and quantity of math courses completed. While several honors mathematics majors held 4.0 GPAs, Boocher had taken the greatest number of graduate courses. Lederer is a math and French double major who is enrolled in the dual degree program leading to a bachelor of science and a master's of business administration degree.

**Patrick Brown**, junior chemistry and biochemistry, received a 2007 Vincent P. Slatt Fellowship award for undergraduate research in the field of energy systems and processes. The fellowship was created by Christopher and Jeanine Slatt. Christopher Slatt is a 1980 Notre Dame alumnus.

Four undergraduate research students in the Department of Biological Sciences were selected to receive the Braco Award for their work in cell research. The award, which was presented in November, includes a $500 mini-grant to cover research expenses. The recipients included **Caitlin Lazar**, a junior in the laboratory of Kevin Vaughan; **Sara Putnam,** a senior, also in the Vaughan laboratory; **Blake Jones**, a senior in the McDowell lab; and **Jenny Enright**, a senior in the laboratory of David Hyde. The Braco Award was established by Robert Braco, M.D., who is a 1976 biology alumnus who practices occupational medicine at the Occupational Health Center, a division of Beloit Memorial Hospital. Braco has supported biology student research projects since 1988. He also sponsors the Braco Award for Research Excellence, which is given to sophomores in the cell research course who faithfully attend their final poster presentations each spring.

## ALUMNI

**David DeMartini,** who earned a bachelor's degree in physics from Notre Dame followed by a Ph.D. in physics from the Ohio State University, was designated on Nov. 12 by Lexaria Corp. to conduct a thorough reevaluation of existing seismic and other technical information. Since September, DeMartini has been writing customized software to apply to existing seismic data to assist the company in prioritizing oil and gas targets in the region. He was inducted to the Offshore Energy Center Hall of Fame as a Technology Pioneer in 2006 and is a thorough investigator and prolific author, having contributed to 19 public-domain publications and many more proprietary to Shell.

**Paul Drzaic**, who earned a bachelor's degree in chemistry from Notre Dame and a Ph.D. in chemistry from Stanford, presented at the Fraunhofer IZM Munich Forum 2007 'be-flexible' Thin Semiconductor Devices on Dec. 5. He is Unidym's chief technology officer, holds 51 U.S. patents, has authored 19 journal publications, and received the 2002 National Team Innovation Award from the American Chemical Society.

**Nancy Lynch,** who holds a bachelor's degree in preprofessional studies (A&L) and psychology from Notre Dame, an M.D. from the Washington University School of Medicine in St. Louis, and an M.B.A. from Duke, was promoted to principal of Scale Venture Partners on Sept. 12. Lynch "has made significant contributions to the team, identifying innovative companies in the areas of orthopedics, diabetes, and obesity." A Board-certified orthopedic surgeon, AAOS Fellow, and fellowship-trained hand surgeon, Lynch completed her residency, serving as chief resident, at the Mayo Graduate School of Medicine, and her fellowship at the Indiana Hand Center.

**James Merz**, who received his bachelor's degree in physics from Notre Dame and who is the Frank Freimann Professor of Electrical Engineering at Notre Dame, was named a 2008 Fellow of the American Association for the Advancement of Sciences (AAAS). Merz was cited for "distinguished contributions to the field of photonic devices and particularly to optical spectroscopy of semiconductor nanostructures." He attended the University of Göttingham in Germany as a Fulbright Fellow, and earned his master's degree and doctorate at Harvard University, where he was a Woodrow Wilson and Danforth Fellow.

# STANDING OVATIONS

**Frederick Morin III** was named dean of the College of Medicine at the University of Vermont on Aug. 25. Morin came from the University of Buffalo, a member of the State University of New York, where he was the A. Conger Goodyear Professor and Chair of Pediatrics in the School of Medicine and Biomedical Sciences and chief of pediatric service for Women and Children's Hospital of Buffalo and Kaleida Health. Morin earned a bachelor's degree in biological sciences from Notre Dame and an M.D. from Yale University School of Medicine. He completed a residency in pediatrics at Stanford University and a research fellowship in neonatology at the University of California San Francisco. He also served as interim vice president for health affairs at the University of Buffalo and interim dean of the School of Medicine and Biomedical Sciences from 2005 to 2006.

**Thomas Nasca,** a College of Science alumnus with a bachelor's degree in preprofessional studies and an M.D. from Jefferson Medical College, was named chief executive officer of the Accreditation Council for Graduate Medical Education on Sept. 12. Nasca was dean of Jefferson Medical College, senior vice president for academic affairs for the university, and president of Jefferson University Physicians. Nasca has held numerous positions in medical education, including chair of the ACGME's Residency Review Committee for Internal Medicine, president of the Association of Program Directors in Internal Medicine, and a member of both the Health and Human Services' Council on Graduate Medical Education and the National Board of Medical Examiners.

**Cindy Parseghian,** a member of the College of Science Advisory Council who holds a bachelor's degree in accountancy from Notre Dame and an M.B.A. from Northwestern, was named to the NIH National Neurology Advisory Council on Oct. 16. The council serves as the primary principal advisory board to the NINDS (National Institute of Neurological Disorders and Stroke), the nation's primary supporter of basic, translational, and clinical research on the brain and nervous system. She is founder and president of the Ara Parseghian Medical Research Foundation in Tucson, Ariz.—a volunteer, nonprofit organization that funds research on the fatal genetic disorder known as Niemann-Pick.

**William Richtsmeier** was chosen to be listed in the "Best Doctors in America" 2007–08 database on Sept. 23. Richtsmeier earned a bachelor's degree in biological sciences from Notre Dame, a doctorate in microbiology from the Medical College of Wisconsin, and a medical degree from Case Western Reserve University. Before becoming a Bassett Healthcare physician, he was chief of head and neck oncology in the Department of Otolaryngology–Head and Neck Surgery at Johns Hopkins University School of Medicine before joining Duke University Medical Center in 1992, where he was professor and chief of otolaryngology–head and neck surgery.

**Paul Vogt** was named vice president of process development services for SiGNa Chemistry, Inc., on Nov. 15. Vogt received his bachelor's degree in chemistry from Seton Hall University and his Ph.D. in chemistry from Notre Dame. SiGNa, an advanced materials company, has developed a green nanotechnology-based solution that makes reactive metals far more efficient, safer, and more cost effective. As a member of the company's senior leadership team, he will help drive the company's strategic growth and rapid product development.

**Richard Zakour** became executive director of both the Tech Council of Maryland's MdBio division and the charitable MdBio Foundation on Sept. 4. Zakour, who is also a board member of the MdBio Foundation and the Tech Council, was previously general manager for Fisher BioSciences and held positions with Cambridge Biotech Corp., Allied Signal, Inc., and the National Institute of Environmental Health Sciences at Research Triangle Park, N.C. He holds a doctorate and master's in biology from Rice University and a master's and bachelor's in biology from Notre Dame.

**Faculty, students, and alumni may submit information on awards and achievements to science@nd.edu for inclusion in Standing Ovations.**

## Reunion '08

**College of Science alumni, if you will be attending Reunion '08, please plan to attend the College of Science Open House where you can reconnect with your professors, chat with your fellow classmates, and take a tour of the new, 202,000 square foot Jordan Hall of Science that opened in 2006. We will meet on Saturday, May 31 in the Jordan Hall of Science. Please consult the Reunion Weekend website, alumni.nd.edu/reunion for the specific time, or send us an e-mail at science@nd.edu.**

# College of Science NSF-Sponsored Research Programs Summer 2008

**BIOLOGY REU • May 27–August 1**
Devoting their time to full-time research, undergraduate students conduct investigations on several topics in integrative cellular and molecular biology. They develop their own research proposals, hone their scientific writing skills, and publicly present their findings.
**nd.edu/~biology/reu/indexpage.html**

**GLOBES REU • May 27–August 1**
The GLOBES (Global Linkages of Biology, the Environment, and Society) undergraduate research program provides an exciting opportunity for students to be involved in cutting-edge research with the intent of providing real-world solutions to global environmental and human health issues.
**globes.nd.edu/**

**MATHEMATICS REU • June 23–August 2**
Going beyond what is usually available in the undergraduate curriculum, the Mathematics REU introduces students to the challenges and rewards of mathematics research and prepares them for graduate work.
**nd.edu/~ndreu/**

**NANO-BIOENGINEERING REU • May 28–August 2**
Undergraduates participate in projects at the interface of biology and engineering. They use a variety of advanced research instrumentation under the guidance of faculty from the departments of chemistry and biochemistry, biology, mathematics, and others in the College of Engineering.
**nd.edu/~nanoreu/**

**PHYSICS REU • May 27–August 2**
Undergraduates work closely with faculty and graduate students on a range of research projects including atomic physics, elementary particle physics, astrophysics and astronomy, nuclear physics, complex systems/biological physics, and solid state/low temperature physics.
**nd.edu/~sciwww/reu/index.html**

**RET (Research Experience for Teachers) • June 11–August 3**
High school teachers conduct research projects directed by faculty members from several departments in the colleges of science and engineering. The projects cover a wide choice of mathematical, scientific, and technological topics.
**nd.edu/~ndrets/**

**QUARKNET • June 12–August 2**
High school students and teachers join others from around the globe in education and research. QuarkNet centers are connected to high-energy physics experiments operating at CERN in Switzerland, at Fermilab in Illinois, and other locations.
**nd.edu/~quarknet/**

*QuarkNet Director Beth Marchant (left) explains an Optical Decoder Unit to two area school teachers at the NDeRC (Notre Dame extended Research Community) Forum. The units were built by students at QuarkNet and taken to CERN for an experiment for the Large Hadron Collider at CERN. Over one hundred K-12 teachers attended the NDeRC Forum on Dec. 1 in the Jordan Hall of Science.*

UNIVERSITY OF NOTRE DAME
College of Science

*Junior biology majors Brennan Bollman, Megan Rybarczyk and Greg Podolej traveled to Haiti in January 2008 to assist the Notre Dame Haiti Program with educational and medical initiatives. Clockwise from top: Brennan with a local family, Greg with children at an orphanage, local children playing, the three students with local program administrators and medical personnel at Hopital Sainte Croix.*

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