

UNIVERSITY OF DELAWARE
Research

On the path to a new energy future

UNIVERSITY OF DELAWARE Research

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www.udel.edu/researchmagazine

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Knowledge is the light of the mind.

Scientia sol mentis est — “Knowledge is the light of the mind” — is the University of Delaware’s motto. UD has a long history of excellence, extending to 1743.

The University of Delaware's Research



The University of Delaware is classified by the Carnegie Foundation for the Advancement of Teaching as a research university with very high research activity, a designation accorded to fewer than three percent of the more than 4,200 degree-granting institutions in the United States.

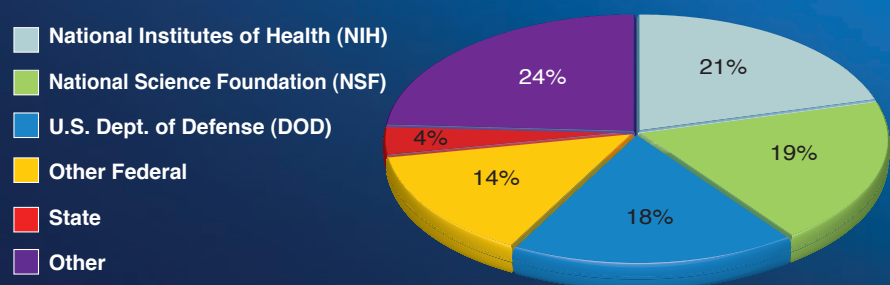
Rich in heritage and innovation, UD traces its origins to a small school in New London, Pennsylvania, opened by the Rev. Dr. Francis Alison in 1743. Among its first class were three young men who would later go on to sign the Declaration of Independence and one who would sign the U.S. Constitution.

Today, UD is a Land Grant, Sea Grant, and Space Grant institution. In addition to the main campus in Newark, Delaware, UD operates campuses throughout the state, including Wilmington, Dover, Georgetown, and Lewes, and teaching facilities in London and Paris. A thriving study-abroad program and expanding international partnerships further enhance our students' transformation as global citizens.

Nearly 3,500 graduate students are in UD's graduate research program across the University's seven colleges, with research in fields such as natural resources; arts and sciences; business and economics; environment; education and public policy.

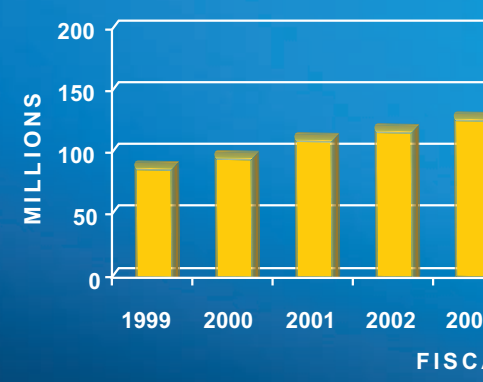
Numerous undergrads also engage in research through the graduate Research Program, Honors Program, and other opportunities. They have the opportunity to work with a faculty of world-class authors, and artists including Guggenheim and National Academy of Sciences, and Nobel Prize-winning Intergovernmental Panel on Climate Change to name only a few.

FY 2008 Research Expenditures by Sponsor



Annual Expenditures

In 2008, UD Sponsored Programs reached over \$130 million.



Enterprise

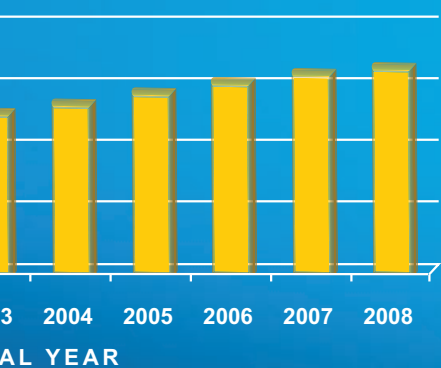


involved in research and scholarship which focus on agriculture and natural resources; the earth, ocean, and atmosphere; and the health sciences.

discovery at UD through the Undergraduate Research Program, and Service Learning Program. UD has a distinguished faculty of scientists, engineers, and Fulbright Fellows, members of the National Academy of Engineering, and a Presidential Panel on Climate Change,

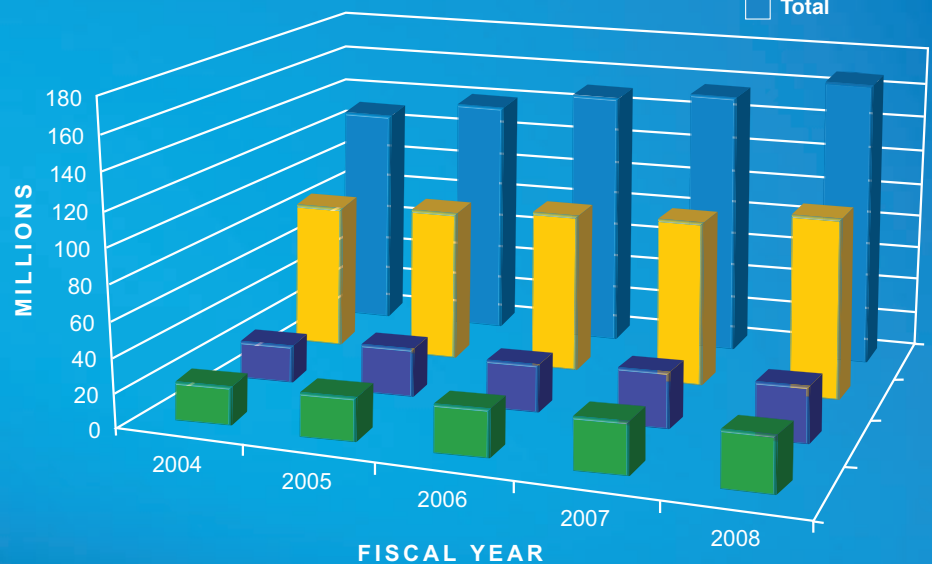
Our faculty and students are embracing the great challenges and opportunities of our time, working across the arts, business, engineering, humanities, social sciences, and natural sciences, in well-equipped labs and more than 60 research centers on campus, as part of regional health alliances, at U.S. national laboratories, with international research partners, and in field research locations on every continent. Over the past decade, external funding for UD research and sponsored programs has more than doubled and now exceeds \$162 million a year.

reached \$162 Million (doubled in 10 years).



Sponsored Programs Expenditures

- Public Service
- Instruction
- Research
- Total





FROM THE PRESIDENT

Welcome to the first issue of *University of Delaware Research*, a semiannual magazine showcasing the University's major research initiatives; the discoveries, inventions, and innovations of our faculty and students; and the local and global impact of UD's growing research enterprise.

This inaugural issue — an annual report of the past fiscal year — leads off with the University of Delaware Energy Institute (UDEI), a new research center marshaling UD's considerable expertise in alternative energy science, engineering, and policy. With more than 250 researchers working on America's renewable energy challenges, UDEI is leading the way to a new energy future.

UD is also leading the way in health sciences. This spring, the University helped found the Delaware Health Sciences Alliance, an important regional partnership dedicated to transforming the latest bioscience research into clinical practice and developing cutting-edge biotechnologies. Bolstering its work are significant biomedical grants fueling Delaware's cancer, cardiovascular, and neurosciences research.

Advanced environmental research takes UD around the world — to the Delaware River Basin, where we've undertaken the most comprehensive evaluation of its health to date; to China, where we founded — with Xiamen University — the Joint Institute for Coastal Research and Management; and to the South Pole, where we're helping to build the world's largest neutrino telescope.

Research is a mainstay in every college and every department. Helping these researchers tap the potential of their discoveries and inventions and bring them to the marketplace is the Office of Economic Innovation & Partnerships. The office fosters entrepreneurship campus-wide and connects faculty and students with the private sector, so that their research can be applied in new ways — in new technologies, processes, and materials. This is how UD creates new wellsprings of innovation and stimulates state and regional economic growth.

High-quality, high-profile research is one of the University of Delaware's core strengths: UD has earned the Carnegie Foundation's highest designation for research activity, and external funding for research has fully doubled over the last decade. But the University is eager to take on new challenges, for one of the key goals in our Path to Prominence™ is to rank among the world's very best research institutions.

As UD's scholars and researchers set about addressing the greatest challenges of our age, we look forward to the future — a future made brighter by engaging the tremendous power of the curious mind.

Patrick T. Harker
President, University of Delaware





Q & A

UD RESEARCH OFFICE

Mark Barteau is UD's Senior Vice Provost for Research and Strategic Initiatives and the Robert L. Pigford Chair of Chemical Engineering. He is a member of the National Academy of Engineering and recently was named to the American Institute of Chemical Engineers' list of "100 Chemical Engineers of the Modern Era."



Patrick Harker
President

Tom Apple
Provost

Mark Barteau
*Senior Vice Provost for
Research & Strategic Initiatives*

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Q: What is the UD Research Office's mission?

A: The core mission is to "advance the University's research enterprise." Five words, but it is a multifaceted challenge that is integrated into much of what we do as a university, from undergraduate and graduate education, to creative scholarship, infrastructure creation, economic development, and partnership building.

Q: What major goals have you set since you took the research helm in July 2008?

A: We have set five priority initiatives for the Research Office, each with action items aimed at making us a top-flight research university:

- (1) Build research capability and capacity;
- (2) Improve the growth rate of funded research;
- (3) Advance the impact and visibility of UD research and researchers;
- (4) Effectively advocate for the UD research enterprise; and
- (5) Cultivate operational excellence.

Q: What are UD's research strengths, and what areas are targeted for growth?

A: That's always a difficult question to answer without leaving something out! In the University's Path to Prominence,™ we tried to identify strengths on which we could build for significant impact. For example, the UD Energy Institute, launched in 2008, is built on internationally recognized strengths in solar photovoltaics, catalysis, and lightweight composites, as well as more recent successes in fuel cells and wind energy. Our upcoming environmental institute will span an even broader range of research and outreach. Both institutes will also have a strong public policy component.

Additionally, the new Delaware Health Sciences Alliance includes thrusts in cancer, cardiovascular health, and rehabilitation, connecting our strengths to those of our partner institutions and providing important translational connections for the fundamental biomolecular research activities of the Delaware Biotechnology Institute.

But it would be a mistake to focus only on these headline grabbers. One of the best parts of my position is the chance to see the wealth of UD research and creative activity being pursued across the social sciences, humanities, public policy, and other fields. And our real strength is our culture of collaboration! Framing multidisciplinary initiatives in the strategic plan or declaring grand challenges to be solved isn't much good if they do not resonate with a community eager to tackle them. I believe we have such a community here, and my most important task is to connect, nurture, promote, push, cajole, inspire — in short, to enable our faculty to make bigger things happen by working together!

Q: UD researchers have doubled the funding from competitive research grants in the past decade. Do you expect this trend to continue?

A: I am very bullish for two reasons. First, there has been a sea change in Washington in both the attitude toward research and the federal investment in research. As a nation, we have been seriously underinvesting in many fields for at least two decades. That is changing, not only with short-term "stimulus" funds, but in core budgets.

Second, UD has an enormously talented faculty. They are the "yeast" that will make the institution rise. I'm confident that with the right mix of resources and infrastructure, our rise will be even more dramatic. I see one of my critical missions as making the case statements and connections that will help attract both internal and external investments in UD research.

Q: What inspires you in your new job?

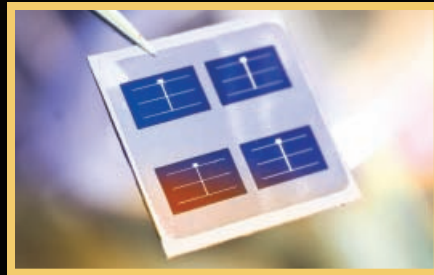
A: It is a privilege to be part of President Harker's team to help shape the University's future and to help realize the vision of the UD to come. As I interact with students and faculty colleagues in my new role, I am reminded that *they* are the University, and advancing their opportunities is what my job, and that of every other member of the administration, is all about.

On the path to a new energy future

From the hydrogen bus that shuttles students across campus, to a model energy savings program that's gaining international momentum, the University of Delaware is putting numerous clean, green initiatives in motion on the path to a new energy future.

And now UD has a brand-new powerhouse to help coalesce, integrate, communicate, and advance these efforts on an even larger scale — the University of Delaware Energy Institute (UDEI).

Officially launched last September, UDEI is now the driving force for interdisciplinary research and education on alternative energy at the University, a critical step in UD's Path to Prominence™ strategic plan, which includes among its six milestones the "Initiative for the Planet."



Photovoltaic solar cells convert sunlight directly into electricity. They are made of semiconductor materials similar to those in computer chips.

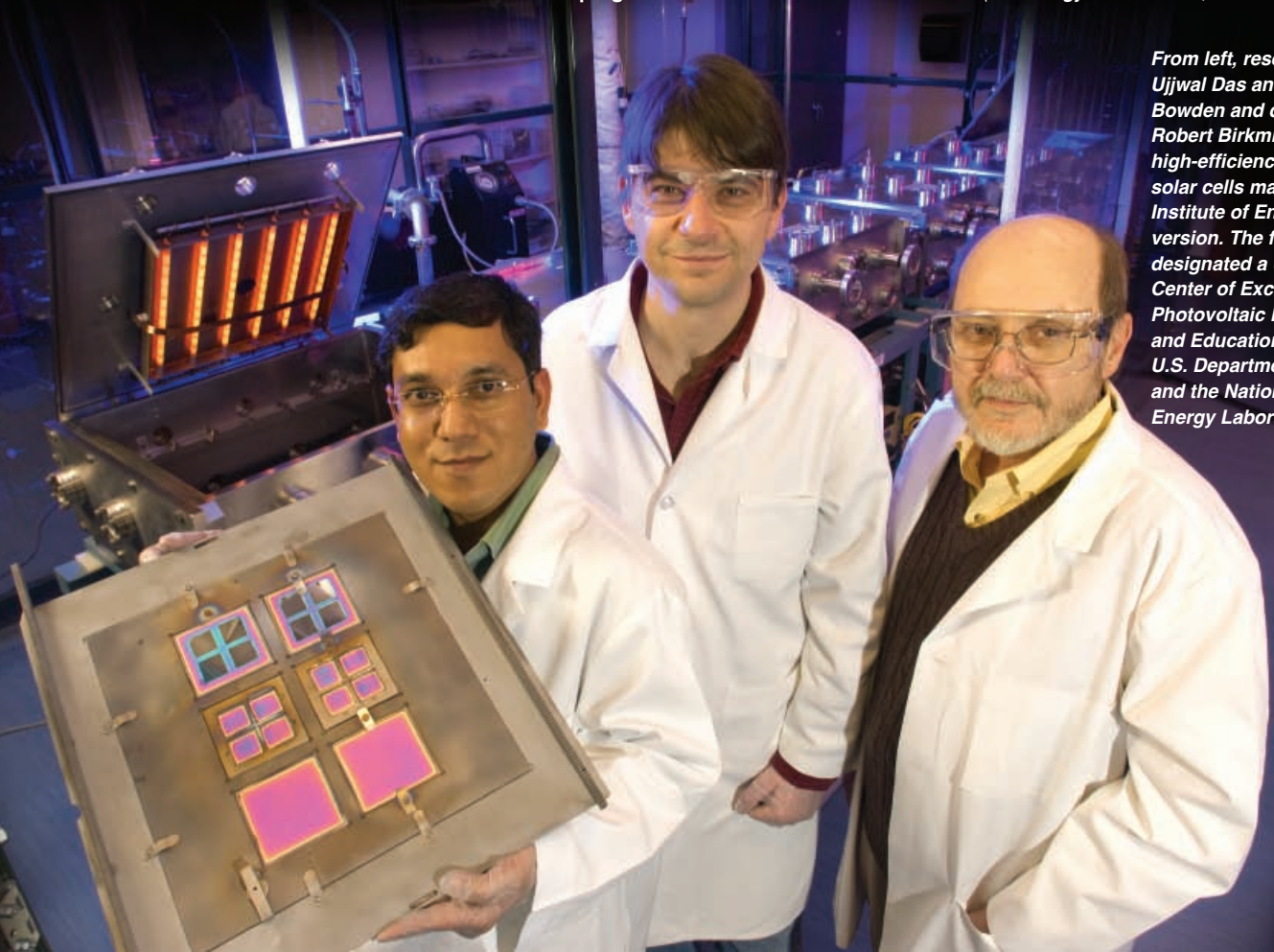
As part of that initiative, UD is committed to leading path-breaking environmental research, becoming 'The Green University,' developing and demonstrating alternative energy technologies, and integrating environmental programs into the curriculum.

UDEI's mission is to marshal and expand the University's science, engineering, and public policy expertise in emerging energy technologies and, with industry and government partners, use this research to address the challenges posed by future energy needs, according to Mark Barteau, senior vice provost for research and strategic initiatives. Barteau is UD's Robert L. Pigford Chair of Chemical Engineering and the institute's founding director.

"Energy is, as the National Academy of Engineering declared, one of the grand challenges of our time," says Barteau, who was inducted into the distinguished group in 2006. "You can't look at the problem through any single prism to solve it. It's much more complex than that," he notes.

(See Energy for the Future, continued on p. 4)

From left, researchers Ujjwal Das and Stuart Bowden and director Robert Birkmire display high-efficiency silicon solar cells made at UD's Institute of Energy Conversion. The facility was designated a University Center of Excellence for Photovoltaic Research and Education by the U.S. Department of Energy and the National Renewable Energy Laboratory in 1992.



On the path to a new energy future

The United States uses about 25% of the world's energy supply.

CURRENT U.S. ENERGY PORTFOLIO:

Oil — 40%

Coal — 23%

Natural gas — 22%

Nuclear power — 8%

Renewables — 7%

(The renewables are represented primarily by hydropower and biomass sources such as wood, crops, and municipal waste.)

Source: *What You Need to Know about Energy*, National Research Council, 2008

A diverse portfolio of energy resources, including solar power and other renewables, will be critical to our energy future.



(Energy for the Future, continued from p. 3)

Barteau, who participated in the National Academies' Summit on America's Energy Future last year, quotes sobering statistics about energy usage and what lies ahead.

World energy consumption has reached 400 quads per year, or 13.5 terawatts. U.S. energy consumption represents about one-quarter of that total. Seventy percent of the petroleum we use (more than 60% is imported) is for transportation, while coal-fired plants supply most of our electricity.

As world population grows, a tripling of energy use is predicted by the end of this century, with the additional challenge to decrease carbon dioxide emissions from current levels.

"There is no silver bullet. No single resource can meet our energy needs," Barteau says. "Conservation, natural gas, 'clean coal,' nuclear, solar, wind, geothermal, bioenergy, and others can contribute significantly. There are economic, environmental, and societal trade-offs among these, but regardless of how we consider them, we will need a diverse portfolio," he notes.

While the challenges may seem daunting, Barteau sees increasing opportunities for UD, which now has more than 250 faculty, postdoctoral researchers, and graduate students engaged in energy research, not to mention dozens of undergraduate students.

"An increasing share of our future energy needs will be met by technologies that are now in the research or development stages," Barteau notes.



Built at UD with support from Delmarva Power and Light Co., and dedicated in 1973, SOLAR ONE was the first experimental house to directly convert sunlight into both heat and electricity for domestic use.

For nearly four decades, UD has been leading research on solar cells, catalysts for fuel production, lightweight composites for fuel-efficient vehicles, and energy and environmental policy. Today, UD is expanding on these strengths and building new research programs and collaborations across the energy spectrum, including wind power, vehicle-to-grid technology, biofuels, hydrogen storage, magnetics, and other areas, according to Jingguang Chen, Claire D. LeClaire Professor of Chemical Engineering. Chen is serving as interim director of UDEI while the search for an endowed chair is under way.

"The University also is developing the curricula and hands-on training essential to educating a new generation of energy science and policy leaders," Chen says, noting that faculty created the world's first graduate course on offshore wind power, as well as an Industrial Assessment Center to improve the energy efficiency of Mid-Atlantic businesses. Additionally, with support from the National Science Foundation, UD conducts an Integrative Graduate Education and Research Traineeship (IGERT) in Sustainable Energy from Solar Hydrogen and a Research Experiences for Undergraduates (REU) program on alternative energy that attracts students from across the United States.

Recently, the U.S. Department of Energy selected UD to be the home of a new Energy Frontier Research Center. UD's center is one of 16 to receive funding from the American Recovery and Reinvestment Act, where a primary criterion is job creation.

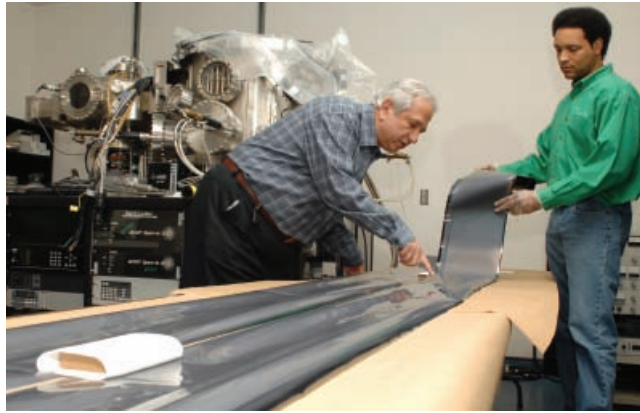
"This award is an outstanding recognition of the ability and vision of our faculty," Barteau says. "Beyond establishing world-class programs on campus and partnerships with top researchers in other universities and national labs, our faculty have been actively involved in building the foundation for energy research in the United States. We started UDEI because we have the commitment," he notes. "Failure is not an option. Our researchers know the future is now."

UD a leader in solar research

Founded in 1972, the brainchild of Karl Böer, UD Distinguished Professor Emeritus of Physics and Solar Energy, years before the first oil embargo and the formation of the U.S. Department of Energy, UD's Institute of Energy Conversion (IEC) shines in solar-cell research. Its scientists conduct fundamental studies of thin-film photovoltaic solar cells, as well as manufacturing-scale projects, in collaboration with universities and companies around the globe.

Photovoltaic-based solar cells convert sunlight directly into electricity and are made of semiconductor materials similar to those used in computer chips, explains Robert Birkmire, director of IEC. When these materials absorb sunlight, the solar energy knocks electrons loose from the atoms, allowing the electrons to flow through the materials to produce electricity.

IEC is the only laboratory in the world to have fabricated thin-film solar cells with efficiencies between 10 to 20 percent using four different absorbing semiconductors: amorphous silicon (a-Si), cadmium telluride (CdTe), copper-indium-diselenide (CuInSe₂), and copper sulfide (Cu₂S).



Researchers Erten Eser (left) and Shannon Fields check a flexible solar panel manufactured at UD's Institute of Energy Conversion.

An efficiency of 10 percent means that a solar module can convert 10 percent of incoming sunlight into electricity. A typical solar module of about 10 square feet would generate 100 watts of electricity.

IEC also first demonstrated the viability of roll-to-roll technology for manufacturing flexible solar cells in long sheets, like newsprint from a printing press, opening the door to the manufacture of lightweight solar panels for roofs, spacecraft, and other applications.

Currently, IEC leads the nation in competitive university research funding awarded from the U.S. Department of Energy's Solar America

Initiative, which seeks to make solar energy cost-competitive with conventional forms of electricity by 2015.

As part of that initiative, awarded in 2008, IEC is expanding its pioneering research on flexible copper-indium-gallium-diselenide (CISG) solar cells in a joint project with Dow Corning. The team also is working with Silicon Valley-based SunPower to couple thin-film and crystalline silicon technologies to increase the conversion efficiencies of solar cells beyond 26 percent.

In recent years, IEC researchers have developed 10 new technologies, eight of which are now patented. So far, 60% of these solar innovations have been licensed, all to U.S. companies.

The broad scope of IEC's research offers students, postdoctoral fellows, and visiting scholars unique educational opportunities in physics, chemistry, materials science, chemical engineering, mechanical engineering, and electrical engineering, as well as collaboration with industry groups.

"We've developed a great group of people here — an integrated team of scientists and students from different disciplines, which is critical to this research," Birkmire notes.

(See *Energy for the Future*, continued on p. 6)



Sun and engineers bring clean water to African village

With help from the sun, UD's chapter of Engineers Without Borders (UD-EWB) is bringing clean water to Bakang, a village of 3,000 people in western Cameroon.

The remote village has no electricity and previously has had to rely on muddy creeks and open wells for drinking water.

UD-EWB recently won a prestigious Outstanding Commitment Award from the Clinton Global Initiative of the William J. Clinton Foundation, which included a \$10,000 grant from the Wal-Mart Foundation to support the chapter's solar water pumping project in Bakang.

The grant funded the UD-EWB chapter's fifth expedition to Cameroon, a three-week trip in June, led by adviser Steve Dentel, professor of civil and environmental engineering, and former chapter president Sarah O'Neill, the primary author of the grant application. Students Ramsey Hazbun, Alyssa Serra, Taylor King, and Matt Lindemer completed the UD contingent. The team installed solar-powered water pumps in two new wells with 6,000 liters of tank storage for the village.

To show their appreciation, the chief of Bakang promoted Dentel to the rank of prince in front of a gathering of villagers.

"Thing is, I don't deserve this," Dentel blogged from Bakang. "Firstly, it's the students who make this possible, and there are lots of them who have been to Bamendjou and Bakang to help, and others who provide the behind the scenes support, including tireless fundraising work. And of course there are LOTS of folks who provide the finances that underwrite our efforts. You *all* deserve this recognition. . . . But I did call my wife to tell her that her husband is now a prince and a village Notable," he wrote. "She said these titles will not apply in Delaware. But they do send a *message* to Delaware," he noted. "They really love what we do!"



Posing near water storage tanks are, from left, student Andrew Paulus, a farmer from the village of Bakang, Sarah O'Neill, and Doug DeVoto.

UD professor Steve Dentel is made a prince in Bakang, Cameroon, in honor of UD-EWB's efforts to bring clean drinking water to the village.

Sun powers poultry house in novel project

Delmarva's economy is linked to a thriving poultry industry, which encompassed over 1,700 growers, 5,000 chicken houses, 570 million chickens, and a wholesale value estimated at more than \$2.1 billion in 2008.

One of the biggest challenges facing poultry growers is the cost of energy to maintain the carefully controlled temperatures and ventilation needed to raise day-old chicks to maturity. To assess the economic feasibility of powering poultry houses with solar energy, UD, in conjunction with numerous project partners, installed a 42-kilowatt photovoltaic system on an Allen Family Foods poultry farm near Laurel, Del., in 2007.

The ground-mounted system is divided into a 12-kilowatt net metering system and a 30-kilowatt demand management system connected to the farm's diesel generator and to Delmarva Power, the farm's commercial supplier of electricity. In a net metering program, the electric company allows a customer's meter to actually run backwards if the electricity generated by the customer is more than the energy used.



Robin Morgan, dean of UD's College of Agriculture and Natural Resources, and Charles C. "Chick" Allen III, chief executive officer of Allen Family Foods and a UD alumnus, stand before a photovoltaic collector that is providing energy for a poultry house near Laurel, Del.

During daylight hours on sunny and even cloudy days, the photovoltaic system converts light into electricity. When the system's output does not meet the power needs of the poultry house, the balance of power is supplied by Delmarva Power. When the system produces more power than needed, the excess power is directed to a back-up battery bank and to the utility via net metering. Battery-stored power can be used on demand, including times when peak electric rates apply.

Delmarva Power provides retail credit at the current market rate for energy sent to its grid.

Inverters automatically decide whether to

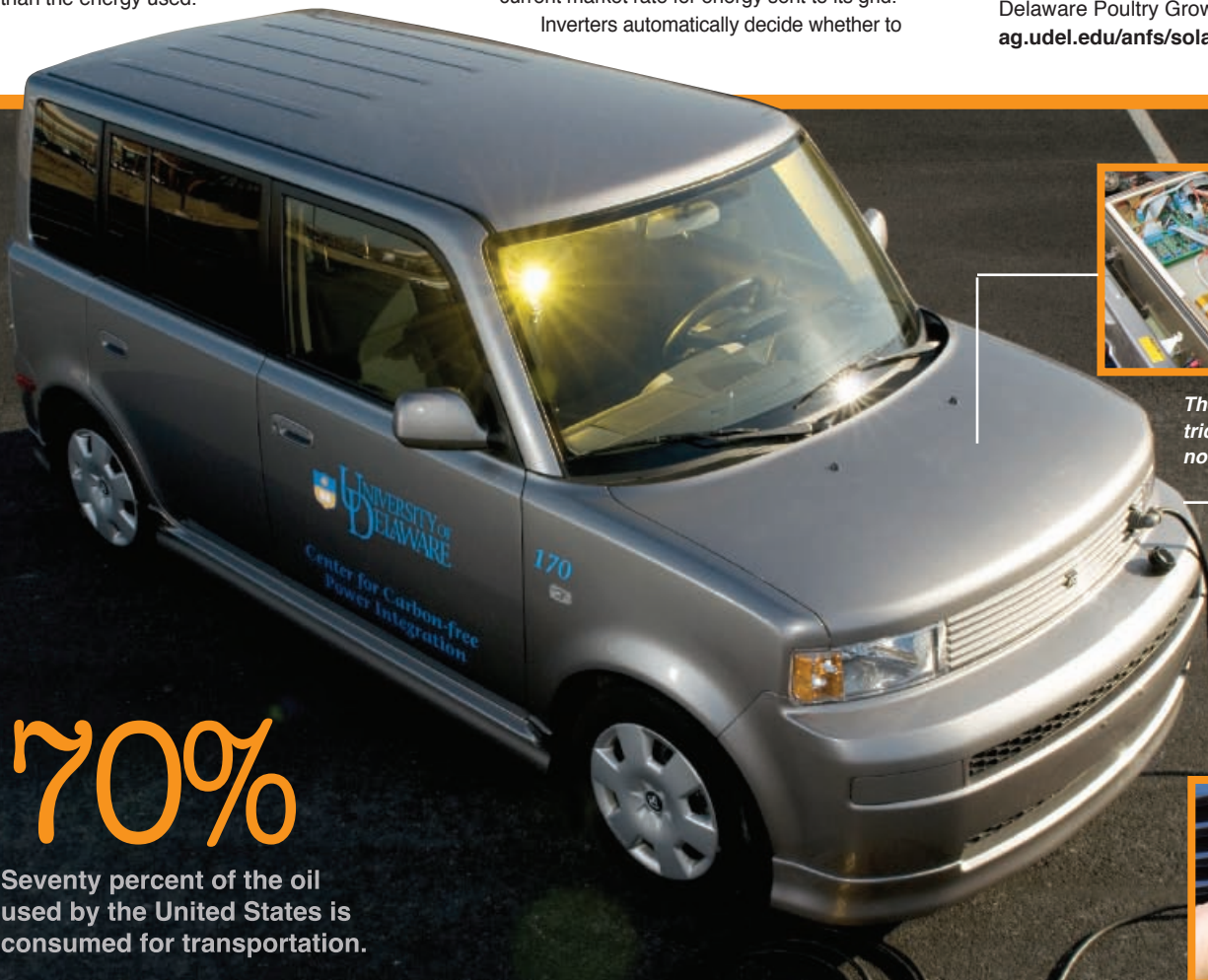
buy from or sell to the utility depending on the amount of solar energy being captured and the power needs of the poultry house.

The pilot photovoltaic system cost approximately \$500,000 to install, half of which is eligible for rebates through a combination of state and federal tax credits, including the Delaware Green Energy Fund, the Federal Tax Credit for Energy Efficiency (30 percent), and renewable energy credits (RECs). Poultry growers are eligible for the same incentives and may be eligible for special loans.

In the first year of operation, the system showed a savings of 56,000 kilowatt hours, or \$7,500, and has demonstrated the technical feasibility required for growers applying for U.S. Rural Development Grants, according to Robin Morgan, dean of the College of Agriculture and Natural Resources.

"The University of Delaware is well known for its poultry research programs and is a leader in solar technology," says Morgan. "Putting these two strengths together has the potential to help the state's economy by strengthening one of our largest and most important industries as well as stimulating a newly emerging one."

Detailed information about the project, including "An Investment and Cost Guide for Delaware Poultry Growers," is available at ag.udel.edu/anfs/solar/index.html.



The car runs on electricity alone. It has no exhaust system.

A large plug allows electricity to move from the car to the power lines and back.



70%

Seventy percent of the oil used by the United States is consumed for transportation.



Mechanical engineering professor Ajay Prasad is directing UD's new Center for Fuel Cell Research.

New fuel cell center driving novel research

"Delaware is a great place to start a fuel cell center," says Ajay Prasad, UD professor of mechanical engineering, and the director of UD's new Center for Fuel Cell Research, which launched last fall.

"We have a large number of people here at UD doing work related to this subject, and many of the major players in the fuel cell market are within a 50-mile radius of the University," Prasad notes.

A fuel cell is like a battery that doesn't "go dead" — so long as hydrogen and oxygen constantly flow into the cell, it will produce electricity. Its one byproduct is water.

The center's goal is to improve the understanding of fuel cells and address critical

issues and barriers to commercialization of this potential source of clean energy that uses hydrogen as its fuel. The center also will provide students with opportunities for research.

Housed in the Department of Mechanical Engineering in the College of Engineering, the center includes some 25 faculty members from that college, as well as the colleges of Arts and Sciences, and Earth, Ocean, and Environment.

Traditionally, fuel cell research was the domain of electrochemists, but Prasad says there are tremendous opportunities for engineers and materials scientists as well.

"It is also necessary to involve diverse fields like biotechnology," he says. "For example, photobiological water splitting using certain types of bacteria and sunlight might offer an exciting, renewable way to produce hydrogen in the future."

Important components of the center's mission are technology transfer to industry and public engagement. And for the latter, what could be more cool than a hydrogen fuel cell bus that operates on campus?

Prasad is the principal investigator on the project, which is sponsored by the U.S. Department of Transportation and the Delaware Department of Natural Resources and Environmental Control.

(See *Energy for the Future*, continued on p. 8)

On the path to a new energy future

The University of Delaware Energy Institute (UDEI) — a portal to UD's energy research and education programs — seeks to create and integrate new solutions to challenges in energy sufficiency and sustainability. Over 250 researchers at UD are working on energy issues.

Car generates electricity — and cash!



UD's interdisciplinary V2G team includes (from left) Meryl Gardner, associate professor of business administration, Ajay Prasad, professor of mechanical engineering, Willett Kempton, associate professor of marine policy, and Suresh Advani, George W. Laird Professor of Mechanical Engineering.

for the environment. And it offers a way to sustain the supply of non-polluting "green" energy available to power our needs when the sun is not shining or the wind is not blowing, as solar and wind energy begin playing a larger role in our energy supply.

Most new cars begin depreciating as soon as you drive them off the lot, but not this one.

The University of Delaware and industry partners have developed a novel system known as "Vehicle-to-Grid" (V2G) that transforms an electric car into a mini-power plant, capable of sending the electricity stored in its batteries back to utility companies, putting cash back in its owner's pocket.

The vehicle doesn't take any gas to run. It doesn't generate any exhaust, which is good

The research, led by marine policy scientist Willett Kempton in the College of Earth, Ocean, and Environment, with colleagues in mechanical engineering and business administration, made an exciting surge forward on Jan. 9, 2009, when the City of Newark, Del., home to UD's main campus, became the first electric utility in the United States to approve the use of an electric vehicle to store and provide power for the local electric grid.

Newark's approval paves the way for larger-scale adoption of V2G electric vehicles nationwide, helping to advance the electric grid infrastructure and reduce consumption of oil.

The Delaware Department of Natural Resources and Environmental Control provided the initial funding for the project. Additional funding has since been provided through a Google RechargeIT grant and from Delmarva Power's parent company, Pepco Holdings, Inc., which also is an industrial partner along with PJM, the regional grid operator, California-based electric vehicle manufacturer AC Propulsion, and others. The project is a continuing focus of UD's new Center for Carbon-free Power Integration, which Kempton directs.

Kempton and his team of researchers plan on having a fleet of six vehicles by the end of 2009, two at the University of Delaware and four operated by the state of Delaware. For more information, visit www.udel.edu/V2G.

Model program saves energy, cuts CO2



John Byrne

Delaware became the first state to establish a nonprofit utility with the sole mission of promoting efficiency and renewable energy when the Delaware Sustainable Energy Utility (SEU) was signed into law in June 2007.

It has been cited by the Institute for Electrical and Electronics Engineers as the “most comprehensive energy savings and distributed renewables program in the United States.”

“What makes Delaware’s SEU unique is that it serves as an independent organization with the sole purposes of saving energy and reducing greenhouse gas emissions,” says the measure’s chief architect, John Byrne, Distinguished Professor of Energy and Climate Policy and director of UD’s Center for Energy and Environmental Policy. Byrne also is a member of the Intergovernmental Panel on Climate Change (IPCC), which shared the Nobel Peace Prize in 2007.

The SEU aims to reduce Delaware’s energy use by 30% by 2015 and cut the state’s CO2 emissions by 5.5 million metric tons by 2020, which is 33 percent of the state’s current carbon footprint.

How does it work? Delaware’s SEU is funded by a \$30-million tax-exempt bond issue. Unlike a traditional government bond, however, this one is paid through the “shared savings” received by Delawareans from SEU investments.

The utility provides families and businesses with upfront capital to purchase high-efficiency appliances. In turn, the participant shares an estimated 35 percent of the total energy costs saved for three to five years, after which all savings accrue to the participant. A similar initiative will support energy-efficient remodeling or purchase of a hybrid car.

For residents and businesses interested in renewable energy, the SEU will support up to 50 percent of the capital cost through bond financing and recover the investment from 25 percent of the renewable energy credit (REC) revenues that local utilities are required to pay in Delaware. After the bond investment is paid off, the participant receives 100 percent of the REC revenue.

(Energy for the Future, continued from p. 7)

UD’s first fuel cell bus, which rolled into service in 2007, transports 100 students per day, on average. It emits no greenhouse gases, is much quieter than a typical diesel transit bus, and gets better gas mileage.

“By 2011, we should be up to four buses,” Prasad says, “and we also have plans to build two more hydrogen refueling stations, one in Wilmington and one in Dover.” Newark already has a station.

Prasad says the new center will work to tackle three barriers to widespread adoption of fuel cell technology: cost, durability, and lack of a hydrogen infrastructure.

“Public acceptance is also an important issue,” Prasad notes, “and the bus project has helped by increasing

awareness. The presence of three filling stations in the state also has the potential to contribute to future efforts to attract fuel cell related research and demonstration projects to Delaware.”

Winds of change

While Europe has offshore wind farms, there are none in the United States.

Sweeping changes are under way, however, with the approval of an offshore wind farm for Delaware and the U.S. government’s recent issuing of offshore exploration leases for wind energy production off Delaware and New Jersey.



Vice President Joe Biden, a UD alumnus, visited the campus in May to recognize the University’s leading research in offshore wind power. At the podium is Willett Kempton, director of UD’s new Center for Carbon-free Power Integration.

No one had done a definitive study of the size of the Mid-Atlantic offshore wind resource until professors Willett Kempton and Richard Garvine and



This hydrogen-powered shuttle bus operates on the UD campus as a demonstration project by the Center for Fuel Cell Research. It produces no harmful emissions — only water.

Zero Pollution

The SEU's goal is to enable households and companies to reduce their annual energy use by 30 percent, which translates into energy bill savings of \$1,000 to \$3,000 per year for households alone.

The SEU will double the number of weatherized homes in Delaware, while promoting 300 megawatts of customer-sited renewable energy applications, such as solar and geothermal installations.

Washington, D.C., has passed legislation to create the nation's second SEU, and Byrne is now assisting Maryland, Philadelphia, Seoul and Daegu in South Korea, and Bermuda in designing programs. The April 2009 special issue of the *Bulletin of Science, Technology and Society* is devoted to implementation of the SEU in Asia, Africa, and Europe.

Legislative Hall in Dover, Del., at night. ►



graduate student Amardeep Dhanju in UD's College of Earth, Ocean, and Environment published their findings in the scientific journal *Geophysical Research Letters* with colleagues at Stanford University in 2007.

They concluded that offshore winds are capable of producing 330 gigawatts of electricity, which could supply the energy needs of nine states from Massachusetts to North Carolina, plus the District of Columbia — with enough left over to support a 50 percent increase in future energy demand.

"For the whole Northeast, the resource is large enough to displace all electricity, all heating fuels, and all gasoline," says Kempton, "and it's clean energy."

UD's new Center for Carbon-free Power Integration, which Kempton directs, also is exploring vehicle-to-grid (V2G) technology, a way to transform an electric car into a "mini-power plant" by sending the energy stored in its batteries to utility companies. Besides netting cash for the owner, the technology could contribute power to "fill in" when renewable sources such as wind are intermittent.

Kempton and Jeremy Firestone, associate professor of marine policy and legal studies, also have conducted public opinion surveys, provided objective information to decisionmakers, and developed the nation's first course on offshore wind power to train students for the potential U.S. industry.

Last fall in Delaware, UD President Patrick Harker opened the nation's first industry conference on offshore wind, which was organized with UD support.

During a visit to campus this spring, Vice President and UD alumnus Joe Biden and Secretary of the Interior Ken Salazar underscored the importance of alternative energy development, especially offshore wind resources, and recognized UD's leadership.

"Because of the history that the University of Delaware and [the state of] Delaware have with respect to wind power," Salazar said, "I expect that Delaware will be at the point of the spear in terms of making this new energy source a reality."



University of Delaware faculty and graduate students were the first to estimate the size of the Mid-Atlantic offshore wind resource.

UD exploring wind energy on Lewes campus



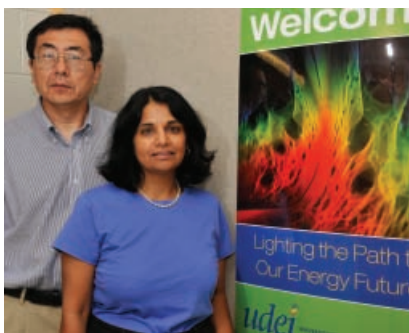
UD is exploring wind power for the Hugh R. Sharp Campus in Lewes, which is home to several academic programs and research labs of the College of Earth, Ocean, and Environment, as well as the home port for the University's 146-foot research vessel *Hugh R. Sharp*.

Last year, a temporary tower was installed and outfitted with electronic gear to provide information about local wind speed and duration to help determine whether one or more wind turbines on the property could someday supply the campus with cheap, clean energy. The study, the results of which were shared in a public forum, was inspired by the work of professors Jeremy Firestone and Willett Kempton who have researched the amount of power supplied by Delaware's offshore winds as well as public reaction to and policies for wind-energy use.

In July 2009, the University and Gamesa Corporación Tecnológica signed a memorandum of understanding that could facilitate the installation of a utility-scale 2.0 MW Gamesa wind turbine at the Lewes campus next year.

Delaware Gov. Jack Markell, who attended the signing event, said, "This agreement is a significant step forward in Delaware's efforts to seize the economic development opportunities presented by our nation's commitment to energy independence and the concern over climate change."

Energy Institute



ADMINISTRATION: Jingguang C. Chen, Interim Director and Claire D. LeClaire Professor of Chemical Engineering; and Neeloo Bhatti-McAndrew, Assistant Director (*shown above*)

INAUGURATED: September 19, 2008p

MISSION: To marshal and expand the University of Delaware's science, engineering, and public policy expertise in new and emerging energy technologies and, with its industry and government partners, to use this research to address the entire spectrum of challenges posed by our future energy needs.

AFFILIATED RESEARCH CENTERS & PROGRAMS:

- ◆ Center for Carbon-free Power Integration
- ◆ Center for Catalytic Science and Technology
- ◆ Center for Composite Materials
- ◆ Center for Energy and Environmental Policy
- ◆ Center for Fuel Cell Research
- ◆ Center for Spintronics Research
- ◆ Chemical Engineering in Energy Research and Sustainability — Research Experience for Undergraduates (REU)
- ◆ High-Efficiency Solar Power Program
- ◆ Institute of Energy Conversion
- ◆ Magnet Research, Physics and Astronomy Department
- ◆ Solar Power Program
- ◆ Sustainable Energy from Solar Hydrogen Integrative Graduate Education and Research Traineeship (IGERT)

FOR MORE INFORMATION:

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UD selected for Energy Frontier Research Center

The University of Delaware is the home of a new Energy Frontier Research Center (EFRC) that will develop innovative catalytic technologies to efficiently convert biomass such as trees and grasses into chemicals, electricity, and fuels.

The U.S. Department of Energy Office of Science plans to invest \$777 million in EFRCs over the next five years. Forty-six were selected for funding from some 260 applications. UD's center is one of 16 chosen to receive funding from the American Recovery and Reinvestment Act, where a primary criterion is job creation.

The grants were announced by the White House in conjunction with a speech by President Obama at the 2009 annual meeting of the National Academy of Sciences in April.

"This represents the largest commitment to scientific research and innovation in American history," Obama said. "In no area will innovation be more important than in the development of new technologies to produce, use, and save energy."

The UD EFRC, to be funded initially by a five-year, \$17.5-million federal grant, will be led by Dion Vlachos, Elisabeth Inez Kelley Professor of Chemical Engineering and director of the Center for Catalytic Science & Technology.

Jingguang Chen, Claire D. LeClaire Professor of Chemical Engineering and interim director of the University of Delaware Energy Institute, and Raul Lobo, professor of chemical engineering, will serve as co-directors.

According to Vlachos, the center's mission is to develop the science base that will enable the operation of future biorefineries and prepare the workforce for such jobs.

"We are very excited about the opportunity to tackle some grand challenges in the utilization of renewables that can impact the state of Delaware and U.S. energy independence," Vlachos said.

The team plans collaborations with scientists at Lehigh University, California Institute of Technology, and the universities of Massachusetts, Minnesota, Pennsylvania, and Southern California. It also will utilize the National Synchrotron Light Source at Brookhaven National Laboratory and several U.S. Department of Energy Office of Science computational facilities.

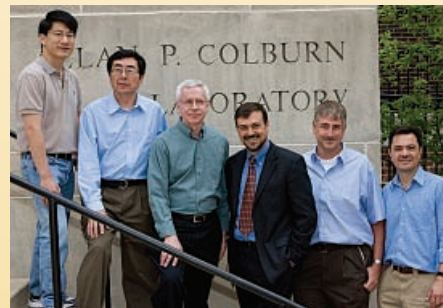
Outreach and education also will be cornerstones of the center, which will foster students' ability to work in multidisciplinary teams and will offer short courses, webinars, and seminars to graduate and undergraduate students, as well as to industry and government employees. High school teachers and other education professionals also will be involved in the center's activities to raise awareness about the importance of biomass as a source of sustainable energy for the future.

"These centers will mobilize the enormous talents and skills of our nation's scientific workforce in pursuit of the breakthroughs that are essential to make alternative and renewable energy truly viable as large-scale replacements for fossil fuels," said Secretary of Energy Steven Chu. "Meeting this challenge will require significant scientific advances."

"In no area will innovation be more important than in the development of new technologies to produce, use, and save energy."

— President Barack Obama

Annual meeting of the
National Academy of Sciences,
April 27, 2009



A team of chemical engineers, chemists, and biochemists are involved with UD's Energy Frontier Research Center including, from left, Kelvin Lee, Jingguang Chen, Douglas Buttrey, Dion Vlachos, Jochen Lauterbach, and Raul Lobo. Not pictured are Mark Barteau, Stanley Sandler, and Douglas Doren.

ADVANCING economic development



University of Delaware President Patrick Harker believes the goal of economic advancement is “to make people’s lives better, to unleash human potential, and to create opportunity for all.”

Since UD’s Office of Economic Innovation & Partnerships (OEIP) opened its doors in July 2008, it has risen to President Harker’s challenge to strengthen the University’s participation as a partner in economic development that enhances economic prosperity and quality of life.

Led by David Weir, founding director of the Delaware Biotechnology Institute, the office is facilitating exciting new partnerships in areas as diverse as agriculture, energy, biomedicine, and the environment.

Of special importance is a research and education partnership with the U.S. Army’s Research, Development and Engineering Command (RDECOM), as the nearby Aberdeen Proving Ground in Maryland expands to house high-technology programs.

OEIP’s chief roles include the following:

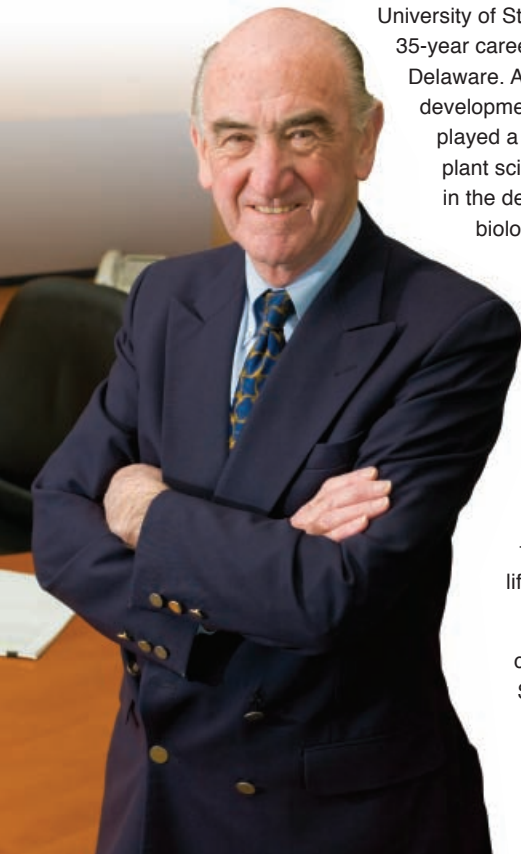
- ◆ To function as a communication gateway, providing external entities access to UD’s knowledge-based assets, and UD personnel access to research and development opportunities outside the University;
- ◆ To foster invention, innovation, and entrepreneurial activities campuswide, from the arts to the physical sciences;
- ◆ To develop, leverage, and market UD’s invention portfolio through the Intellectual Property Center;
- ◆ To provide UD entrepreneurs with business, marketing, financial, and legal expertise to enable commercialization of University inventions;
- ◆ To provide guidance (business, marketing, financial, legal) to small businesses, start-up companies, and entrepreneurs through the Small Business Development Center;
- ◆ To develop state, regional, national, and international partnerships encompassing research, business, and education; and
- ◆ To provide leadership to the state of Delaware for science and technology-based economic development.



Business Week named Newark the best city for business start-ups in Delaware in part because of proximity to the knowledge-based resources of the University of Delaware.

An 'aye' for innovation

With a keen eye for innovation and years of experience forging collaborations and advancing new products to the marketplace, David Weir is a natural to lead the University of Delaware's Office of Economic Innovation & Partnerships.



David Weir, Director, University of Delaware Office of Economic Innovation & Partnerships

Weir holds a Ph.D. in chemical physics and taught at the University of St. Andrews, Scotland, before embarking on a 35-year career at the DuPont Company in Wilmington, Delaware. As vice president for global research and development in DuPont's agricultural business, he played a lead role in building DuPont's capability in plant science, meeting with industry and political leaders in the developing world to explore the role of modern biology in agriculture and sustainable development.

After retiring from DuPont, Weir was lured to UD by the opportunity to direct a new center for life sciences research: the Delaware Biotechnology Institute, a partnership involving state government, academic and medical institutions, and the private sector that launched in 2001.

The institute, with its interdisciplinary research teams, has led to the creation of an estimated 12,000 new primary and secondary jobs in the life sciences.

Today, in addition to leading OEIP, Weir chairs the executive committee of the Delaware Science & Technology Council, a statewide organization that is working to improve Delaware's competitive position so that the state is recognized broadly as a center of excellence in science and technology. In 2009, he received the Delaware Bio Award for outstanding service to the bioscience industry.

Q: What goals have you set since you took the helm in July 2008?

A: We've set four goals to establish the University of Delaware as a recognized center for innovation and entrepreneurship, benefiting the community, the state, and region:

- (1) Create an environment that nourishes invention, innovation, and entrepreneurship and has the capability to convert it into valuable businesses, creating high-quality jobs;
- (2) Develop a strong portfolio of intellectual property;
- (3) Establish OEIP as the communications gateway to enable those outside the University to access UD's knowledge-based assets and vice versa; and
- (4) Develop a network of partnerships for UD, the state, and the region.

Q: How does the current economic downturn affect your plans?

A: There are, of course, serious issues, but there is a bright side. It actually provides increased opportunities for us. The way back to a healthy economy is small businesses, and that ties right in with what we're trying to do here.

Q: What advantages and disadvantages does UD have compared to other universities in this arena?

A: One disadvantage — I think the capabilities and competencies of this University have been underappreciated and

Entrepreneur in Residence program gets down to business

Soon, UD students may leave campus not only with a freshly minted degree, but also a small business in tow.

That's one of the goals of the Office of Economic Innovation & Partnerships (OEIP), which has established the Entrepreneur in Residence program to connect students and faculty with business leaders.

William G. Mavity, UD's first Entrepreneur in Residence, offered his insights on topics ranging from international business assignments to raising venture capital during his inaugural lecture in December.

A 1972 UD graduate in mechanical engineering administration, Mavity is president, chief executive officer, and director of Paracor

Medical, Inc. The Sunnydale, Calif., company develops innovative ways to treat heart failure using mechanical devices that don't require patients to undergo open-chest surgery.

Among Mavity's advice for UD students:

- ◆ If you ever have the opportunity to work overseas, take it.
- ◆ Raising money is not for the faint of heart. Venture capitalists look for three things in identifying projects to support: a good balance between opportunity and risk, the right kind of management team, and a protectable idea.
- ◆ Pay attention in your classes — even the ones that don't interest you.

◆ And follow your passions.

"Try to find a company and pursue your idea," Mavity said. "You have tremendous resources today to do your research using the Internet. What took me weeks in the library 20 years ago, you can do in just a few hours now."

During his presentation this past April, UD alumnus Michael Bass, executive vice president and chief operating officer of La Dove, Inc., told students that no amount of academic education beats being prepared for the unexpected.

Miami-based La Dove is a leading full-service research facility, formulator, and manufacturer of personal care products for

underutilized. A major advantage is that we have an integrated team that is flexible and nimble. When you put this together with our ability to interact with the private sector and the governor and legislature — a hallmark of a small state like Delaware — we have very real opportunities to differentiate ourselves and to promote economic development.

Q: How can UD better leverage its intellectual property and transfer it to beneficial use?

A: First off, we're working to streamline the process. When researchers call this office and say they have an invention, we immediately file a new invention disclosure, and we put a business team (legal, business, marketing expertise) together with the inventor. Then we begin to answer the question of whether it is a new business opportunity, or one for licensing for equity or royalties, etc.

Q: What opportunities lie ahead for UD?

A: One of my beliefs is that as the world shrinks and economies become more knowledge-based, universities are going to

become a very critical component of innovation and entrepreneurship, especially as the private sector outsources more of their basic research. That's a big shift. Additionally, UD researchers have developed proposals competing for several hundred million dollars in federal stimulus funding. We also are working closely with the U.S. Army through the Department of Defense Base Closure and Realignment Commission (BRAC) to develop graduate courses and programs and to foster research collaborations and student internships at the expanding Army base at nearby Aberdeen Proving Ground in Maryland.

Q: What is your biggest challenge?

A: Being able to get the financial wherewithal to support all the good ideas we've got. It's how to manage them and remain financially sound and fund all of these opportunities.

Q: What is your guiding philosophy?

A: My career has always been involved in the creation of new opportunities — at DuPont, I was involved in Lycra, Nomex, Tyvek, Kevlar. I like starting with a blank sheet of paper and creating something new that has value. I get a lot of satisfaction from that, I really do. And I like to see the people that I work with grow themselves. So if I can create new value and grow an organization where people thrive in their careers, that's very satisfying for me.



◀ *William G. Mavity (center), UD's first Entrepreneur in Residence, meets with students in the Venture Development Center in Purnell Hall. Mavity, the president of Paracor Medical, Inc., earned his bachelor's degree in mechanical engineering administration from UD in 1972.*

Bass recounted his experiences early in his career at another company when he worked with difficult accounts and bad clients. He encouraged the students to take on challenges and learn from them.

"The way you learn is to go to the clients that don't work, go into the bowels of companies that don't work. That's how you learn," Bass said.

both the professional and retail markets, including hair care, skin care, and body care products for some of the world's leading cosmetic brands.

OEIP Contacts



David Weir

David Weir, Director. He is former vice president for global research and development at DuPont and the Delaware Biotechnology Institute's founding director.



Denise Bierlein

Denise Bierlein, Administrative Coordinator. She assists with the filing of patent applications and related activities associated with the Intellectual Property Center.



Shelley Cook

Shelley Cook, Business Development Analyst. She is coordinating research and education activities relating to the Army Base Realignment and Closure (BRAC).



Amalea Maidanos

Amalea Maidanos, Administrative Assistant. She assists with external relations and is often the first point of contact for callers and visitors to OEIP.



Cyndi McLaughlin

Cyndi McLaughlin, Manager. She coordinates the office's communications and external relations activities, with an emphasis on programs enabling innovation.



Bruce Morrissey

Bruce Morrissey, Director of Technology Development, Intellectual Property Center. He oversees legal issues relating to inventions, patents, copyright, and trademarks.



Clinton Tymes

Clinton Tymes, State Director, Delaware Small Business Development Center Network. He is responsible for the network's long-range planning and development.



Bradley Yops

Bradley Yops, Assistant Director, Intellectual Property Center. Yops assists UD researchers with legal issues relating to inventions, patents, copyrights, and trademarks.

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“Mouth mouse” aids people with spinal injuries



The “mouth mouse” designed by Kurt Manal, research assistant professor of mechanical engineering, is a novel assistive technology that can give people with disabilities, particularly individuals with severe spinal cord injuries, the ability to operate a computer and other electronic systems.

The device, consisting of a dental retainer embedded with sensors, detects the magnitude and location of the force applied by the user’s tongue, moving the cursor on a computer screen accordingly.

The mouth mouse can be used to drive motorized wheelchairs, control environmental conditions in a home or office by switching lights on or off and regulating thermostats, as a call-switch to sound a bell when personal care or assistance is needed, and as a possible “third hand” for surgeons or for military use by pilots, among other applications.

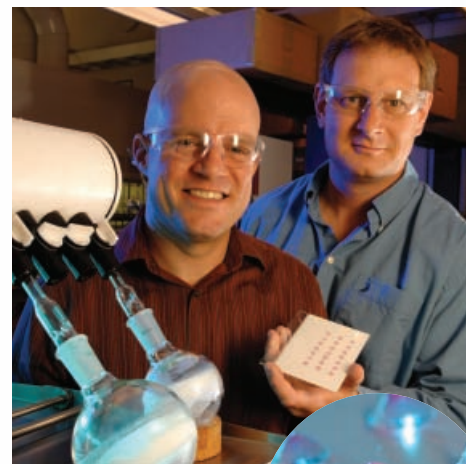
UD inventions designed to

High hopes for healing hydrogels

What’s a hydrogel? Think of a soft contact lens. However, UD researchers Darrin Pochan, professor of materials science and engineering, and Joel Schneider, professor of chemistry and biochemistry, are now moving hydrogels into exciting new applications once deemed the domain of science fiction.

They’ve invented a new kind of hydrogel based on “smart peptides” that transform from a solution into a gel once injected in the human body, capable of delivering a targeted, timed-release payload of cells and antibiotics for repairing wounds or diseased organs.

Providing wounded soldiers in battle with pain-killing, infection-fighting treatment, regenerating healthy tissue in a cancer-ridden organ, healing a biopsy site, providing a dermal filler for cosmetic reconstruction, and aiding with numerous dental applications, from periodontal therapy to dental implants, are among the myriad uses the scientists foresee for the new technology.



Darrin Pochan (left) and Joel Schneider with their hydrogels.



‘Superman’ technology to protect troops, police officers

Scientists from UD and the U.S. Army recently invented a leading-edge technology that sounds a lot like Superman — It’s able to stop a speeding bullet. It’s called “shear thickening fluid.” It flows like a liquid until something hits it. Then it hardens on impact.

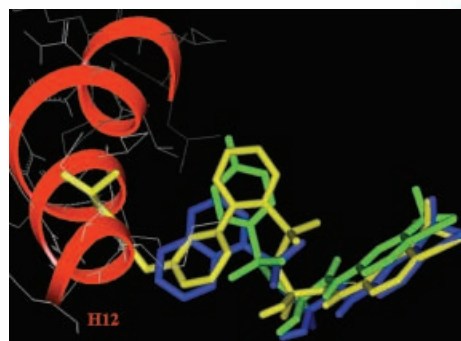
Norman Wagner, the Alvin B. and Julia O. Stiles Professor and chair of the UD Department of Chemical Engineering, and his students and Eric Weitzel, a scientist at the U.S. Army Research Laboratory, have been working to develop “liquid body armor” — a bulletproof, lightweight, and flexible material to help protect soldiers in battle.

Besides safeguarding soldiers and law enforcement officers, the novel material is being examined at UD’s Center for Composite Materials for use as a “hip guard” to protect elderly patients from fractures. Wagner and his students are working with UD health and exercise scientist Charles Buz Swanik on this aspect of the research.

Breakthrough technology for treating prostate cancer

Prostate cancer is the second leading cause of cancer death in men in the United States, after lung cancer. The National Cancer Institute predicts 192,280 new U.S. cases of prostate cancer in 2009 and 27,360 deaths from the disease.

John Koh, professor of bioorganic chemistry, and Paula McGinley, recent UD doctoral graduate, have developed a breakthrough technology for enhancing prostate cancer treatment based on the unique therapeutic agent PLM1. The scientists have designed PLM1 to target androgen receptor mutations, which are known to impart resistance to anti-androgens, the chemotherapy agents that block the production of male hormones to stop the prostate cancer cells from growing. PLM1 and its analogs could serve as a critical second line of defense in anti-androgen therapy when mutations to the androgen receptor give rise to anti-androgen withdrawal.



A new class of anti-androgen molecules have been designed to disrupt critical portions of the androgen receptor associated with prostate cancer progression.

improve lives

A simple way to clean water

One-sixth of the world's population — over a billion people — lack access to clean drinking water. While potable water is readily available in the United States, there is increasing concern about the high levels of chlorine used in water disinfection and treatment.

Yan Jin, professor of plant and soil sciences, and Pei Chiu, associate professor of civil and environmental engineering, have developed an inexpensive technology that uses iron to remove microorganisms from water — not only bacteria such as *E. coli*, but also viruses.

The technology is less expensive than existing disinfection methods. It doesn't require power, use toxic chemicals, or generate harmful byproducts. In fact, it can remove chlorine, arsenic, chromium, lead, and other contaminants. And it can be incorporated into existing water treatment systems.

NASA Tech Briefs, the top-circulation engineering magazine in the United States, named the technology one of the top seven innovations of 2007.



Yan Jin (right) and Pei Chiu developed an inexpensive technology for removing bacteria and viruses from drinking water.



Find out what else is perking at UD's gateway to innovation

From powered leg aids to help stroke patients regain the ability to walk, to telecommunications devices based on new-age spintronics, UD has dozens of technologies available for licensing.

To learn more, contact the Office of Economic Innovation & Partnerships at oeip-info@udel.edu or (302) 831-7140.

Way to go, baby!

Using joysticks, infants with special needs can gain precious mobility in a controlled, safe environment with the aid of this robot designed by Sunil Agrawal, professor of mechanical engineering, and Cole Galloway, associate professor of physical therapy.

The device may be manually driven by the infant or remotely by a caregiver. In addition, using in-house developed intelligent software, it can be autonomously or semi-autonomously driven safely, avoiding obstacles.

Further developments include a force-field joystick to train an infant to navigate within a cluttered environment, and a "virtual leash" to allow the robot to autonomously follow a parent within a selected leash radius while navigating in an indoor or outdoor environment.

The technology is ready for widespread clinical testing with children.

From left, researchers Sunil Agrawal and James (Cole) Galloway and doctoral candidate Ji-Chul Ryu with their happy young driver.



UD and DuPont partnership yields disease-resistant corn

Through a successful collaboration of the University of Delaware and DuPont, the DuPont seed business Pioneer Hi-Bred is now marketing Pioneer® brand hybrid 34F26 — the first corn hybrid in North America to carry the trait that provides enhanced resistance to anthracnose stalk rot (ASR). This corn disease annually causes an estimated \$1 billion in yield losses in North America alone.

The commercial agreement between UD and DuPont regarding their multi-year, corn disease research collaboration was announced February 11, 2009.

“We’re thrilled to see the discoveries of University of Delaware scientists being put to work for farmers through our collaboration with DuPont,” said UD President Patrick Harker.

James A. Hawk, professor of plant and soil sciences in UD’s College of Agriculture and Natural Resources, became familiar in the 1980s with a gene in corn known to provide resistance to *Colletotrichum graminicola*, the fungus that causes ASR. At the time, the gene was found only in a “tropical” corn line from Mississippi, which could not be used commercially.

Hawk worked for more than 20 years to demonstrate that the gene could be bred into commercial germplasm and developed “near-isogenic lines” that facilitated the genetic characterization of ASR resistance. He and his associates then teamed up with DuPont scientists, and cutting-edge technology was used to “fine map” the gene and develop molecular markers under a collaborative research agreement.



Corn without resistance to the fungus Colletotrichum graminicola can be attacked by anthracnose stalk rot, a devastating disease.



DuPont scientists are using the markers in high-throughput genetic technology to move the gene into a wide variety of elite commercial germplasm.

“Bringing additional disease resistance to our customers is part of our overall strategy to increase their productivity,” said Paul E. Schickler, president of Pioneer and vice president and general manager at DuPont.

Anthracnose stalk rot typically rots corn stalks from the bottom, causing the stalks to break over or ears to fall off completely, making harvest much more difficult. The disease also can kill the plant from the top down, a trait called top dieback, which results in premature plant death and reduced yields.

The increased incidence of anthracnose stalk rot is thought to be associated with increased use of no-till agricultural practices to reduce soil erosion and fuel costs. Higher risk of the disease also is associated with corn planted in fields that had corn the previous year because the pathogen over-winters in corn residue.

The technology developed by UD and DuPont adds to the arsenal of tools farmers can use to combat ASR and protect corn yields. A portion of the royalties to the University from sales of the ASR-resistant hybrid will be reinvested in support of continuing research at UD.



Jim Hawk, UD professor of plant and soil sciences (right), and scientist Teclerariam Weldekidan examine a diseased corn stalk.

Proteins could detect cancer’s spread

The University of Delaware signed a partnership agreement with Strategic Diagnostics, Inc. (SDI), in November to develop biomarkers that detect the spread, or metastasis, of prostate cancer.

SDI is a major developer and producer of antibodies and immunoreagents for a broad range of applications. The biotechnology company is based in Newark, Del.

The Helen F. Graham Cancer Center also is a collaborator in the effort under an existing agreement between UD and Christiana Care Health System, based in Wilmington, Del.

Scientific findings suggest that when cancer cells implant in normal body tissue, they cause damage to surrounding proteins upon breaking away from the primary tumor, leaving behind fragments of protein molecules. These fragments are indicators that the cancer has metastasized.

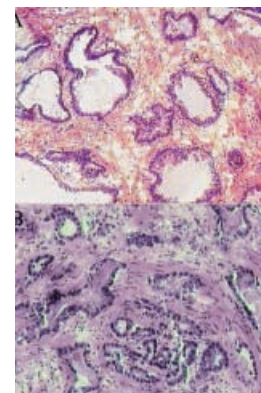
SDI will work to develop antibodies to detect these protein fragments left by the invading cancer cells. The results of tests that

employ such antibodies would help determine the stage

and severity of the cancer and allow medical professionals to develop effective treatment options for patients with metastatic disease.

“We are extremely excited about this collaboration with the University of Delaware and the Helen F. Graham Cancer Center,” said Francis M. DiNuzzo, president and chief executive officer of SDI. “The applications of SDI’s Genomic Antibody Technology™ in fields such as cancer biomarker discovery represent an important opportunity for us to further demonstrate the efficacy of our technology platform. We look forward to contributing to this critical scientific research with the University and the center.”

“It is a perfect triple play,” noted David Weir, director of UD’s Office of Economic Innovation & Partnerships, which facilitated the agreement. “It benefits SDI and is another important step in building a biomedical research and business capability in the state. This partnership is clear evidence of the importance of deploying the University’s knowledge-based assets for



Healthy prostate (top) vs. prostate cancer (bottom). Note the irregular glands and clumps of cells in the bottom histograph.

economic and community benefit, with SDI’s technology being a strong value driver.”

Dr. Nicholas Petrelli, medical director of the Helen F. Graham Cancer Center, called the collaboration “an example of the successful establishment of the Center for Translational Cancer Research, which will not only succeed in helping in the care of patients, but also in establishing new jobs in the state.”

The Center for Translational Cancer Research is a collaborative initiative of the state of Delaware, the University, the Delaware Biotechnology Institute, and the Helen F. Graham Cancer Center.

New alliance advancing health research, services

Discussing the Delaware Health Sciences Alliance are, from left, Tom Ferry of Nemours, UD President Patrick Harker, Robert Laskowski of Christiana Care, and Robert Barchi of Thomas Jefferson University at the "Stronger Health-Based Partnerships" conference held in March at UD.



Delaware Health Sciences Alliance

A coalition of leading education, healthcare, and medical research institutions has formed to nurture research and the development of advanced technology in the First State.

The new Delaware Health Sciences Alliance, announced during the "Stronger Health-Based Partnerships" conference held at UD in March, will combine the strengths and assets of its members — Christiana Care Health System, Nemours, Thomas Jefferson University, and UD — to provide leadership in the improvement of health and health services to all Delawareans and to serve as a key element in the state's economic future.

In addition, said UD President Patrick Harker, the Delaware Health Sciences Alliance will further the University's goals of becoming a premier research and graduate institution and achieving excellence in professional education.

"This alliance, critical on its own merits, is also a critical vehicle for advancing UD's strategic priorities and fulfilling the mission to which we obligated ourselves one year ago," Harker said at the announcement. "Neither goal will be advanced without close and dynamic partnership with the researchers and clinicians who deal in pressing healthcare challenges daily."

Harker noted that the four alliance partners have a long, shared history of cooperation. For example, the Partnership in

Health Education, announced last fall, formalized the collaboration between UD and Thomas Jefferson University, enabling articulated degree pathways and joint research proposals.

"Before the partnership, we hadn't really pursued collaboration with a defined framework," Harker said. "That partnership and this alliance give us that framework."

He said the alliance also represents a way for the partners to articulate common priorities, including world-class healthcare education, interdisciplinary research, and better healthcare quality and delivery, and a structure for combining expertise and resources to meet those priorities.

A key component of healthcare education represented by the alliance will be the development of a Campus for Healthcare Education in Delaware. The campus will include classrooms, study halls, and a new residential facility for up to 150 medical, pharmacy, nursing, and occupational and physical therapy students.

The alliance also has these initiatives under way:

- ◆ The Delaware Valley Institute for Clinical and Translational Science (DVICTS), which seeks to acquire new grants that could collectively fund greater research discoveries and ensure the rapid movement of these findings from the lab to clinical settings to the patient, referred to as "bench to bedside" research;
- ◆ The Delaware Center for Cancer Biology, which will build on the unique research capabilities of the Kimmel Cancer Center at Jefferson, the Helen F. Graham Cancer Center at Christiana Care, the

Nemours Center for Childhood Cancer Research, and the Delaware Center for Translational Cancer Research, which includes researchers at UD, Christiana Care, Nemours, and the Delaware Biotechnology Institute; and

- ◆ The Delaware Rehabilitation Institute, which will leverage partner strengths to become the premier research and training center in physical rehabilitation in the nation.

Other major centers are being considered in the areas of cardiovascular disease, women's and children's health, the neurosciences, and health policy.

In addition to announcing the alliance's formation, the conference included keynote addresses by Delaware Gov. Jack Markell and Newt Gingrich, former speaker of the U.S. House of Representatives and founder of the Center for Health Transformation.

For more about the Delaware Health Sciences Alliance, visit www.delawarehsa.org.



As part of her doctoral research in psychology, Amber Belcher works as a psychotherapy extern at Christiana Care's Helen F. Graham Cancer Center, helping patients and their spouses cope with breast cancer. Such collaborations are expected to expand through the new Delaware Health Sciences Alliance.



Center to build 'smart'



Thomas Beebe, Jr., is directing UD's new center for biomaterials research.

From contact lenses to hip implants, biomaterials are not new. But a research center focusing on them is at UD. And its aim is to develop "smart" new biomaterials, from vocal cords to pharmaceutical drug carriers, that operate by mimicking natural processes in the human body.

The National Institutes of Health's National Center for Research Resources (NIH-NCRR) awarded UD a five-year, \$10.5 million grant for a multidisciplinary research program on molecular design of advanced biomaterials in October.

◀ *UD's advanced biomaterials research team includes (from left) Xinqiao Jia, Darrin Pochan, Thomas Epps, Kristi Kiick, Sandeep Patel, Zhihao Zhuang, and Millicent Sullivan.*

\$17.4-million NIH grant boosts biomedical research

Delaware took another major step toward expanding human health research when, in April, a partnership of six of the state's academic and clinical institutions, led by UD's Delaware Biotechnology Institute, won a five-year, \$17.4-million grant from the National Center for Research Resources at the National Institutes of Health to develop the state's biomedical capacity in the target areas of cancer, cardiovascular, and neurosciences research.

The program — the Delaware IDeA Networks of Biomedical Research Excellence (INBRE) — involves Christiana Care Health System, Delaware State University, Delaware

Technical & Community College, Nemours/A. I. duPont Hospital for Children, the University of Delaware, and Wesley College.

"The University of Delaware's INBRE program has been, and continues to be, at the forefront in developing a cyberinfrastructure network to address bioinformatics needs and applications to advance biomedical sciences," said Barbara M. Alving, M.D., director, National Center for Research Resources. "This award will help advance research to combat diseases including cancer, heart, and neurological disease — research that may lead to improved health within the state and far beyond its borders."

DBI, a major research center for the life sciences at UD, drove the development of the successful proposal. The institute also managed the first INBRE program grant, awarded by NIH in 2002, which, among its accomplishments, catalyzed formation of the Delaware Center for Translational Cancer Research, a collaboration of UD, Christiana Care's Helen F. Graham Cancer Center, and the Nemours Center for Childhood Cancer Research, and the hiring of 50 new life sciences faculty across the state's academic and medical institutions.

"Our new INBRE grant will help build a new generation of health researchers for the 21st-century workforce, to improve the health of the citizens of Delaware and expand health-based economic development in the state," said David Weir, founding director of DBI and leader of the INBRE effort. Weir was appointed director of UD's Office of Economic Innovation & Partnerships last year.

The new effort will encompass cancer, cardiovascular, and neurosciences research programs; four new research centers — in bioinformatics, clinical outcomes research, cardiovascular research, and neurosciences; and four new Ph.D. programs — in neurosciences, biomolecular science and engineering, bioinformatics and computational systems biology, and cardiovascular research. The program also will provide funding for 80 graduate students and 150 undergraduate researchers throughout the state.



Ulhas Naik, professor of biological sciences, is directing a new cardiovascular research program, and will lead a cardiovascular research center to be developed at UD, through a new NIH INBRE grant.

biomaterials

The program, involving researchers in chemistry and biochemistry, biological sciences, chemical engineering, and materials science and engineering, is directed by Thomas P. Beebe Jr., professor in the Department of Chemistry and Biochemistry and director of the Surface Analysis Facility.

Beebe has pioneered new classes of nanomaterials and biomaterials, including materials designed to stimulate and guide nerve cells, and hopes to eventually invent a cure for paralysis caused by spinal cord injuries.

The grant is part of NIH's Centers of Biomedical Research Excellence (COBRE) program, which funds projects

to strengthen the research infrastructure and further the research careers of junior faculty in this field.

"For many years, the biomedical industry has focused on making anything that goes into the body as strong, unreactive, and inert as possible," Beebe says. Commonly used materials have included titanium, ceramics, and stainless steel.

"Rather than trying to fool the body into thinking that there is no object present," Beebe explains, "our researchers will use their understanding of chemistry, biology, and physics to design and make new biomaterials by determining what the component molecules would need to be and how they would need to be connected to each other in order to give the final

material its desired properties. This can be done by taking advantage of the body's natural processes, by mimicking the body's properties in that location, by releasing additional drugs when and where they are needed, or by contracting, expanding, flexing, solidifying, flowing, adhering, or vibrating as needed," he says.

"It may not be tomorrow, it may not even be by the end of the five-year grant," Beebe says, "but we fully expect the results of this program to be translated into clinical applications that will have an impact on patients."

UD has two other COBRE programs, one on the prevention and treatment of osteoarthritis and the other on membrane protein production and characterization.

Cancer Research

The cancer research program will focus on cancer cell mobility and the role of specific proteins in metastasis, DNA repair, computer-based tools for simulation and early diagnosis of cancer, and biomaterials for use in cancer treatments.

Dr. Nicholas Petrelli, Bank of America Endowed Medical Director of Christiana Care's Helen F. Graham Cancer Center, will serve as program director. A key partner will be the Delaware Center for Translational Cancer Research, directed by Robert Sikes, UD professor of biological sciences.

Cardiovascular Research

Ulhas Naik, UD professor of biological sciences, is leading the cardiovascular research program, which will focus on the effect of kidney function on cardiovascular events, extracellular matrix remodeling in heart failure, and biomaterials for cardiac tissue engineering. He also will direct a new cardiovascular research center to be developed at UD.

Neurosciences Research

The neurosciences research program will address molecular mechanisms of learning and memory, spinal muscular atrophy, and cardiovascular autonomic nerve function in diabetes. A key goal will be to establish a new center for brain disease and translational neurosciences. It is directed by Melissa Harrington, associate professor of biology and director of biomedical research at Delaware State University.

Bioinformatics critical to future of medicine, research pioneer says

Cathy Wu sees the integration of genetics and the environment as key to the practice of medicine in the future, with a focus on personalized medicine, where care is tailored to the individual based on his or her genetic profile.

"The driving force of 21st-century biology is integration," says Wu, UD's recently appointed Edward G. Jefferson Chair of Bioinformatics and Computational Biology.

The new faculty chair honors the late former chairman and chief executive officer of the DuPont Co. who was a University trustee and benefactor.

Wu is a pioneer in the emerging field of bioinformatics, which uses computer science, mathematics, and information theory to model and analyze biological systems.

She says she is looking forward to collaborating with researchers in engineering, computer science, math, and biological sciences across campus. A major aim is to create the Center for Bioinformatics and Computational Biology at UD.

"The new center will become a focal point for a lot of synergistic activities," she says.

New graduate programs will be established through the center, and Wu plans to have a master's course of study in place for the 2010–2011 academic year, with a Ph.D. program to follow.

Before joining UD, Wu was a professor at Georgetown University Medical Center, where she will retain adjunct status.

Since 2001, Wu has led the Protein Information Resource (PIR), a major bioinformatics tool supporting genomics, proteomics, and systems biology research. The PIR Web sites, accessible by researchers worldwide, receive more than 4 million hits per month. PIR will now have two branches: one at Georgetown and one at UD.



Cathy Wu, UD's Edward G. Jefferson Chair of Bioinformatics and Computational Biology



Under the watchful eye of Lynn Snyder-Mackler, Alumni Distinguished Professor of Physical Therapy, at UD's Physical Therapy Clinic, T. Fraser Russell does a quadriceps strengthening exercise as part of his recovery from total knee placement surgery.

Getting a new knee?

It may be uncomfortable at first, but doing exercises to strengthen your quadriceps after you've had knee replacement surgery due to osteoarthritis is critical to recovery. In fact, it can boost the function of your new knee to nearly that of a healthy adult your age.

That's the finding of a University of Delaware study published in the February issue of *Arthritis Care & Research*. It was written by Lynn Snyder-Mackler, Alumni Distinguished Professor of Physical Therapy at UD, Stephanie Petterson, clinical faculty at Columbia University, Ryan Mizner, assistant professor at Eastern Washington University, Jennifer Stevens, assistant professor at the University of Colorado at Denver, and Drs. Leo Rasis, Alex Bodenstab, and William Newcomb of First State Orthopaedics in Newark, Del.

Petterson, Mizner, and Stevens all received their doctorates in UD's nationally ranked Biomechanics and Movement Science (BIOMS) program.

"It sounds logical that exercises to strengthen your knee should be a component of your post-operative physical therapy after a total knee replacement, but it's not the convention at all," Snyder-Mackler says.

"There are all of these old wives' tales that strength training is a detriment to the patient and that the new knee should be treated delicately," she notes. "Our study demonstrates that intensive strength exercise as outpatient therapy is critical to begin three to four weeks after surgery."

Nearly a half-million knee replacements, also known as total knee arthroplasties (TKAs), are performed every year in the United States to treat severe knee osteoarthritis, the loss of the cushiony cartilage padding the knee. The joint disease leaves its sufferers with persistent pain and limited function, resulting in an overall diminished quality of life.

A step forward for stroke patients

Sometimes called a "brain attack," a stroke occurs when the blood supply to the brain is blocked or when a blood vessel in or around the brain bursts, damaging a part of the brain. It's the third leading cause of death in the United States and a leading cause of adult disability.

A team of UD engineers and physical therapists is developing new technology — in the form of a robotic exoskeleton worn over the leg — in the quest to help stroke patients fully regain the ability to walk.

"About 700,000 people suffer strokes each year in the United States, and as many as 3 million survivors are living with

the after-effects," says Sunil Agrawal, professor of mechanical engineering and director of UD's Mechanical Systems Laboratory, who is the project's leader.

The team includes Stuart Binder-MacLeod, Edward L. Ratledge Professor and chair of the Department of Physical Therapy; John Scholtz, professor of physical therapy; and Jill Higginson, assistant professor of mechanical engineering and director of UD's Center for Biomedical Engineering Research.

The research is funded by a new five-year, \$3-million grant from the National Institutes of Health's Bioengineering

Research Partnerships (BRP) program. An initial BRP grant, awarded in 2002 and led by mechanical engineering professor Thomas Buchanan, enabled the researchers to develop robotic prototypes and demonstrate the feasibility of the treatment approach through limited testing with human subjects. Significant progress also was made in developing biomechanical models to predict muscle deficiencies during normal and abnormal gait.

The competitively renewed grant focuses on embedding two robotic exoskeletons developed during the initial research with a variety of position and force sensors. The first of these is a U.S. patented, non-motorized device, known as a gravity-balancing orthosis, which increases

Exercise after surgery is critical

While knee replacement alleviates the pain of osteoarthritis and improves function, patients exhibit impaired quadriceps strength and function for such activities as walking and climbing stairs, and the levels remain below those of healthy people the same age.

In a randomized controlled trial at UD's Physical Therapy Clinic conducted between 2000 and 2005, 200 patients who had undergone knee replacements were given six weeks of progressive strength training two or three times a week starting four weeks after surgery. Half of the group also received neuromuscular electrical stimulation.

Their function was compared to that of 41 patients who received conventional rehabilitation and home physical therapy. Quadriceps strength, knee range of motion, and gait were measured in such tests as timed up-and-go, stair climbing, and a six-minute walk.

The group in the progressive strength-training program showed significant improvement in quadriceps strength and functional performance. They also demonstrated substantially greater quadriceps strength and functional performance after 12 months than the group having conventional rehabilitation.

"This study clearly demonstrates the importance of surgeons encouraging their patients to be compliant with progressive quadriceps strengthening during their rehabilitation to enhance their clinical improvement and function post-total knee replacement," notes Dr. Leo Raisis, a total joint surgeon at First State Orthopaedics and adjunct associate professor at UD.

Raisis, one of the lead total joint surgeons on the study, has been in practice for over 20 years and currently serves as chairman of the

Center for Advanced Joint Replacement of the Christiana Care Health System.

"Why undergo a \$25,000 elective surgery and then not do as much as you can to get the most out of it and improve your quality of life?" Snyder-Mackler says. "Older people are incredibly motivated — they hurt after the

surgery and they want to be better. They need to do this."

A variety of media reported the study, including *The New York Times*. The research is one component of a multi-investigator \$11 million program on osteoarthritis, funded by the National Institutes of Health in 2007.



UD AROUND THE
World

Research on aging goes international

Individuals 60 and older are projected to comprise 30 percent of Delaware's population by 2030, and 41.5 percent over age 65 likely will have a disability, according to Veronica Rempusheski, UD's Jeanne K. Buxbaum Chair of Nursing Science.

The University of Delaware and the Azienda Unità Sanitaria Locale 11 di Empoli (AUSL11), a local health authority in the Tuscan region of Italy, signed an agreement in January fostering mutual cooperation in research, teaching, and faculty/student exchanges focusing on aging. AUSL11 is one of 12 local health authorities in Tuscany — which has a population of nearly 3.7 million, 22 percent of whom are 65 or older — in an area of 383 square miles.

The agreement was facilitated by Steven Stanhope, professor in the College of Health Sciences; Francesco Benvenuti, director of the Department of Rehabilitation and Frailties, AUSL11, and Velio Macellari, direttore Dipartimento Tecnologie e Salute, Istituto Superiore di Sanità (the Italian equivalent to the National Institutes of Health).

"The Rehabilitation and Frailties Department of AUSL11 has a unique, innovative model care system for persons with chronic motor disabilities. They have implemented a community-based Adaptive Physical Activity (APA) program for addressing the disabling functional decline in persons with chronic health conditions — the only program of its kind in the world," Rempusheski said.

The APA program has evaluated 10,000 citizens in the past four years and currently includes 4,500 regular attendees. The program provides a rich resource and ideal clinical environment for answering research questions of interest to clinicians. UD and Italian researchers already are setting in motion studies to build on the Italian experience and replicate the APA program in the United States.



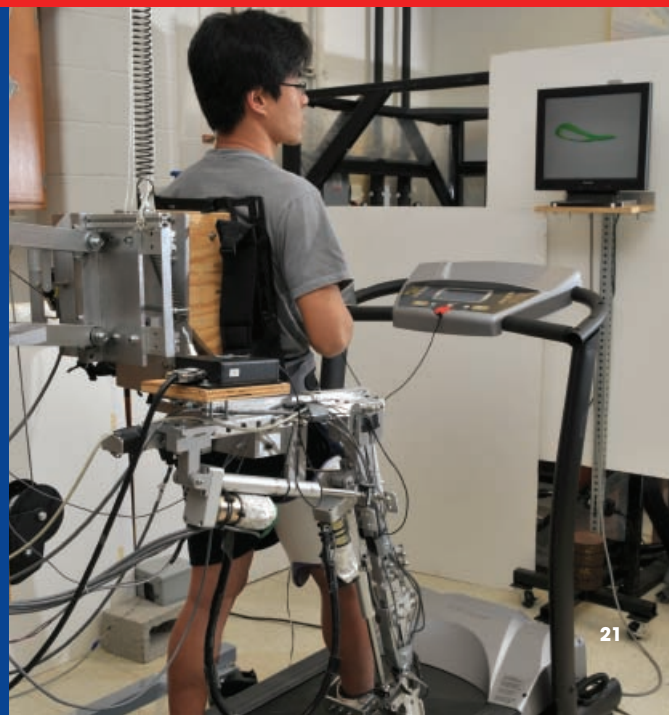
range of motion in impaired individuals by removing gravity from their joints.

The second is an Active Leg Exoskeleton, or ALEX, which fits over the leg and contains sensors as well as motors. While walking on a treadmill, ALEX users receive visual feedback from a video monitor on how well their gait matches a desired pattern. In addition, motors on the device help users maintain their leg motion within a designated range by guiding the foot back when it moves outside that range.

ALEX not only improves motion but also maximizes learning, or retraining of the brain, Agrawal says, adding that research has found that survivors can benefit from using the device even years after their stroke.

Stroke is a leading cause of adult disability. About 700,000 people suffer strokes each year in the U.S.

Postdoctoral researcher Seok Hun Kim demonstrates the robotic exoskeleton that helps correct a patient's gait while walking on a treadmill.



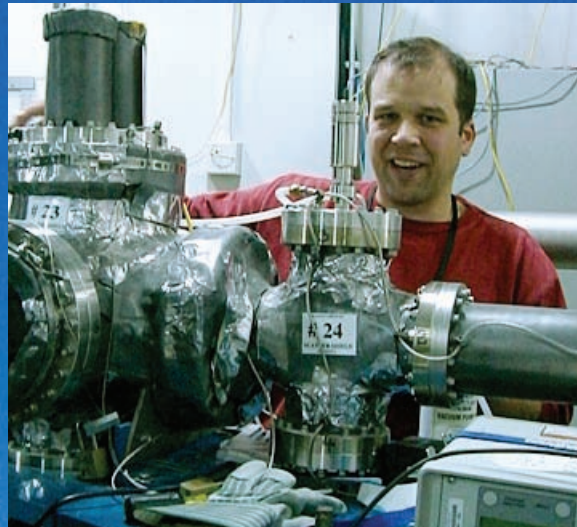
Exploring the Natural World

Research targets Delaware ecosystem health issues

Improving the environmental health of the First State is the focus of the Delaware Experimental Program to Stimulate Competitive Research (EPSCoR), a National Science Foundation (NSF) initiative involving UD, Delaware State University, Delaware Technical & Community College, and Wesley College.

The Delaware partnership's five-year, \$15 million award, announced by NSF in November, is the second Research Infrastructure Improvement grant the four institutions have shared since 2005. The grant is coordinated by the Delaware EPSCoR Office located at UD.

"This new funding will do three things," says Steve Borleske, Delaware EPSCoR director. "It will allow the state's institutions to expand environmental research capacity and broaden educational opportunities. It will also allow us to collaborate with government agencies, industry, and nonprofit organizations to solve key state and regional environmental problems and to promote economic development."



Postdoctoral researcher Matthew Ginder-Vogel examines arsenic-contaminated soils at Brookhaven National Laboratory's National Synchrotron Light Source. Photo courtesy of Marta Avila Perez

According to Donald Sparks, principal investigator and director of UD's Center for Critical Zone Research, the research catalyzed by the new grant focuses on the state's major goals of improving air and water quality, preserving its delicate coastal ecosystem, and promoting brownfield redevelopment.

UD researchers take to the land, sea, air, and ice in the search for answers to environmental mysteries....

The five projects seeded by the program in March all “aim to improve Delaware’s environment through discovery research,” according to Sparks:

Developing a “Lab on a Chip”

Karl Booksh, professor of chemistry and biochemistry, and Raul Lobo, professor of chemical engineering, are developing a “lab on a chip” sensor platform to monitor air quality for volatile organic hydrocarbons (VOC) and ammonia vapor. The tool will enable continuous monitoring outside animal feed lots, power plants, and other settings where emissions may impact quality of life for workers or local residents.

Examining Air Particulates

Matthew Ginder-Vogel, postdoctoral researcher in plant and soil sciences, Don Sparks, and Murray Johnston, professor of chemistry and biochemistry, are working with William Ritter, chairperson of the Department of Bioresources Engineering, and Eric Benson, associate professor of bioresources engineering, to study a major environmental issue facing the animal industry and regulatory agencies in Delaware — airborne emissions of particulates from confined animal feeding operations, such as poultry houses.

(Continued on page 24)

Changing climate may make ‘super weed’ even more powerful

UD researchers have discovered a new reason why the tall, tasseled reed *Phragmites australis* is one of the most invasive plants in the United States.

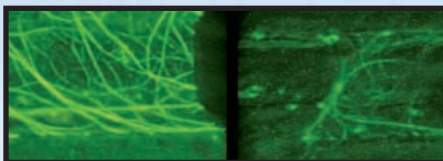
They found that *Phragmites* delivers a one-two chemical knock-out punch to snuff out its victims, and the poison becomes even more toxic in the presence of the sun’s ultraviolet rays.

The study, published in the June issue of the journal *Plant Signaling & Behavior*, is believed to be the first to report the effects of UV-B radiation on plant allelopathy — the production of toxins by a plant to ward off encroachment by its neighbors.

The authors include Thimmaraju Rudrappa, a former UD postdoctoral researcher who is now a research scientist at DuPont; Harsh Bais, assistant professor of plant and soil sciences; Yong Seok Choi, postdoctoral researcher in chemical engineering; Delphis Levia and David R. Legates, both associate professors of geography; and Kelvin Lee, Gore Professor of Chemical Engineering and director of the Delaware Biotechnology Institute. The research was conducted in Bais’s lab at the institute and in Delaware wetlands.

“The toxin secreted by *Phragmites* is degraded by sunlight — ultraviolet rays — and causes severe deleterious effects on other native plants,” Bais says.

“Our research also addresses the growing questions of increased UV-B incidences because of global warming and its ultimate effect on plants. In this case, an invasive plant is accidentally utilizing the changed global conditions for its survival and invasion,” Bais notes.



Micrographs of untreated *Arabidopsis* roots (left) and roots treated with mesoxalic acid (right), one of *Phragmites*’ weapons. Note the degradation of the plant’s structural protein, actin, at right.

degraded by ultraviolet light to produce another toxin, mesoxalic acid, effectively hitting susceptible plants and seedlings with a double-whammy.

The mesoxalic acid triggers a similar “cellular death cascade” in victim plants as gallic acid does, Bais says, destroying the structural protein in the roots within minutes of exposure.

The team detected the biological concentrations of mesoxalic acid in Delaware wetlands, in stands of both exotic and native *Phragmites*. The study highlights the persistence of the photo-degraded phytotoxin, particularly potent in the exotic species of the plant, and its enhanced effects against the native species of *Phragmites*, which is becoming increasingly endangered in the U.S.

Walnut trees, pine trees, ferns, and sunflowers are among the plants that release harmful chemicals to prevent other plants from growing too close to them. However, *Phragmites* uses this strategy not so much to keep other plants away, but to aggressively conquer them and invade new territory, Bais says.

Funding for the project was provided by the University of Delaware Research Foundation.



Harsh Bais (left), UD assistant professor of plant and soil sciences, and Thimmaraju Rudrappa, a research scientist at DuPont, examine specimens of *Phragmites*.

Two years ago, Bais led a study funded by the NSF-Delaware EPSCoR program which revealed that *Phragmites* actively secretes gallic acid to kill off plants and take over new turf. Gallic acid, also known as 3,4,5-trihydroxybenzoic acid, is used to tan leather, make dyes, and formulate astringents, among other applications.

In this research, the scientists found that the gallic acid released by *Phragmites* is

Novel Imaging System for Intertidal Areas

Thomas McKenna, associate scientist-hydrogeologist at the Delaware Geological Survey, is working with Jack Puleo and Christopher Meehan, assistant professors in the Department of Civil and Environmental Engineering, to develop a ground-based imaging system for the coastal zone that extends beyond the visible light range, to thermal and infrared imagery.



Tom McKenna measures subsurface temperature along Delaware's Indian River.

Such a system could aid research on a number of Delaware environmental issues, including water quality, wetland loss, point and nonpoint source pollution, contaminated sites, habitat degradation, coastal erosion, oil spills, and deteriorating sewer and water infrastructure.

Assessing Beachface Flow

Through a combination of field experiments at Cape Henlopen, Delaware, and lab studies, Holly Michael, assistant professor of geological sciences, and William Ullman, professor of oceanography, are working to demonstrate the applicability of new and improved methodologies for studying fluid and particle flow through beachfaces on the time scale of tides and waves.

The research is expected to increase scientific understanding of the ecological benefits of sandy beaches, ultimately aiding beach managers in improving the health of coastal marine ecosystems.

Nanotechnology

John Rabolt, professor of materials science and engineering, is collaborating with John Xiao, professor of physics and astronomy, and Shouheng Sun of Brown University to develop a new class of environmental sensors.

The team is using new and established processing protocols to fabricate nanoparticles and nanofibers, displaying functional groups that interact with such environmental contaminants as arsenic, zinc, chromium, and nickel. These high surface area nanostructures concentrate the toxic atoms/molecules, allowing small concentrations to be analyzed using spectroscopic techniques.

Report puts Delaware River Basin's health in focus

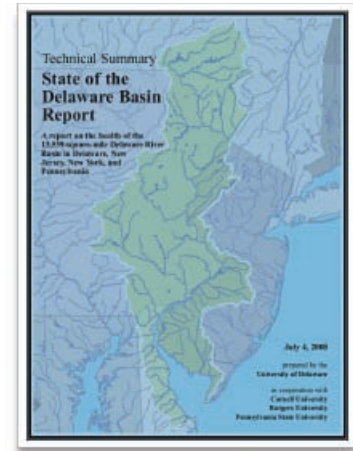
A recent report published by the University of Delaware provides the most comprehensive scientific evaluation of the health of the 13,539-square-mile Delaware River Basin to date, thanks to a collaboration of land-grant institutions in the four states that share the watershed.

The *State of the Delaware River Basin Report*, the culmination of a three-year, \$145,000 project funded by the Delaware River Basin Commission and the Partnership for the Delaware Estuary, was the product of a research consortium that included Cornell University in New York, Rutgers in New Jersey, the Pennsylvania State University, and UD.

The effort was coordinated by the Water Resources Agency in the Institute for Public Administration, College of Education and Public Policy.

"We have a tremendous resource that we need to keep healthy," says Gerald Kauffman, Water Resources Agency director, who was one of the project's principal investigators.

The longest undammed river east of the Mississippi, the Delaware River extends 300 miles from Cape Henlopen, Delaware, to the Catskills. The river is the world's largest freshwater port yet also sustains reviving shad and striped bass fisheries. The basin also provides drinking water to 15 million people, including Philadelphia and New York, Kauffman notes.



In the 1950s, the Delaware River at Philadelphia was called "one of the most grossly polluted areas in the United States." Since then, Kauffman says, environmental policies have sparked the resource's comeback.

Among the Delaware River basin's improvements:

- ◆ Water quality as measured by dissolved oxygen, phosphorus, lead, and zinc levels has improved in most tributaries since 1990.
- ◆ Watershed groups are removing dams that impede fish migration.
- ◆ Over 1,600 federal Superfund sites are being cleaned up.
- ◆ Blue crab landings are up, resulting in a \$7-million economy.
- ◆ Bald eagles are back, with more than 50 nesting pairs.
- ◆ Forests cover more of the basin now than during the 1930s.
- ◆ More than 400 miles of rivers in the basin are included in the National Wild and Scenic Rivers Program.

However, a number of troublesome trends remain:

- ◆ The pesticides atrazine and metolachlor have been detected in 8 out of 10 basin streams.
- ◆ Fish-consumption advisories remain on 4,000 miles of streams.
- ◆ The red knot, a shorebird that gorges on Delaware Bay horseshoe crab eggs during its spring migration from the tip of South America to Canada, is closer to extinction.
- ◆ About 15% of habitat for brook trout, the state fish of New Jersey, New York, and Pennsylvania, has been extirpated.
- ◆ The Atlantic sturgeon is teetering on the brink of extinction. Only two fish per haul were caught in the Delaware in 2004 and none in 2005.
- ◆ Between 1996 and 2001, the Delaware Basin lost 18 square miles of agricultural land, 4 square miles of wetlands, and 48 square miles of forests, while gaining 70 square miles of urban/suburban land.

UD a 'hotbed' for polar studies



William S. Carlson

With multiple research projects under way in both the Arctic and Antarctic, and world-class Inuit art collections at home, the University of Delaware is a veritable 'hotbed' for polar studies, as geography professor Frederick E. "Fritz" Nelson will tell you. And that's thanks in large measure to William S. Carlson, an accomplished arctic explorer and Earth scientist who was UD's president from 1946 to 1950.

Carlson established the University's geography program, which included "Problems in Polar Research" as one of its first seminars. Ever since that seminar, which was taught by Carlson himself, UD has been active in cold-regions research, says Nelson, who directs



Frederick "Fritz" Nelson (left), director of UD's Permafrost Group, with research associates Dmitry Streletskiy (center) and Nikolay Shiklomanov, oversees the Circumpolar Active Layer Monitoring (CALM) program, a network of 168 permafrost observatories involving researchers from 15 countries. CALM recently received \$1.7 million from the National Science Foundation for its third five-year program of research.



Lawson Brigham signs the American Geographical Society's Fliers' and Explorers' Globe, assisted by Mary Lynne Bird, the society's executive director.

UD's Permafrost Group and is a member of the Intergovernmental Panel on Climate Change, which shared the 2007 Nobel Peace Prize.

In 2008, the University launched the William S. Carlson International Polar Year Events in recognition of the late Carlson, the world's fourth International Polar Year, and UD's significant polar research. The 15-month series covered polar science, social science, material culture studies, and photography through public lectures, seminars, films, and art exhibits at the University Museums. A polar course also was offered at UD's Academy of Lifelong Learning.

Organized by a University committee led by Nelson and Lesa Griffiths, associate provost for international programs, and co-sponsored by the American Geographical Society (AGS), the series collectively attracted thousands at events and via Webcasts, simulcasts into UD Second Life, and an interactive Web site at www.udel.edu/research/polar/, which includes an overview of UD polar research activities.

The series kicked off with the signing of the AGS Fliers' and Explorers' Globe, containing the signatures of over 75 famed explorers, from Robert Peary to Neil Armstrong. On an appro-

priately icy evening, U.S. Coast Guard Capt. Lawson Brigham added his name, as the first to navigate the ocean's polar extremes, from Antarctica's Ross Ice Shelf to the North Pole.

As Brigham spoke at the Roselle Center for the Arts, pictures of the icebreaker *Polar Sea* barreling its way through five-foot-thick ice at the North Pole were projected, along with polar bears that he had been told wouldn't venture that far north, and a whale that pushed its head through the ice to take a look at the crew.

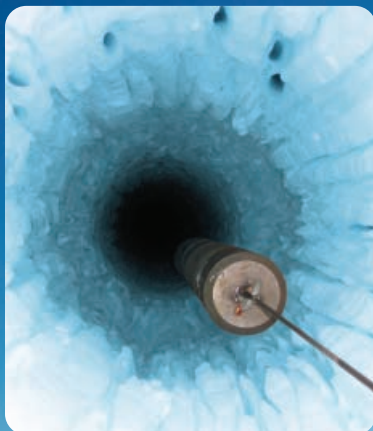
The series culminated with an AGS awards ceremony honoring the past and looking to the future of polar research. Gold medals were awarded to the late Matthew Henson, the African-American explorer who assisted Robert Peary on the 1909 expedition to the North Pole, and Peter Smith, leader of the Phoenix Mars Mission, which in 2008 confirmed the existence of water-ice in the soil of the Martian Arctic.

UD's polar explorers work in the Dry Valleys of Antarctica to drifting ice packs in the Arctic Ocean. The Arctic Research Consortium of the United States (ARCUS) recently published a special insert on UD's polar studies in "Witness the Arctic" available online at www.arcus.org/.



The Mabel and Harley McKeague Collection of Alaskan Inuit Artifacts at UD includes baskets, toys, slides, and

letters amassed by the couple as they collected vital statistics about Yup'ik communities for the state of Alaska from 1958 to 1964. Mabel McKeague (right) is shown with Sophie Nevak, Nelson Island, July 1962.



Hole in the ice — watch your step!

Scientists from UD's Bartol Research Institute are helping to build the world's largest neutrino telescope, aptly named "IceCube," deep in the ice near the South Pole. Neutrinos are elusive, high-energy particles that can travel millions of miles through space, passing right through planets.

The telescope's optical detectors are suspended like beads on a necklace in mile-and-a-half deep holes like this one in the

Antarctic ice. It takes a special 5-million-watt hot-water drill two days and 4,800 gallons of jet fuel to melt one hole.

Once frozen in the ice, each detector is sensitive enough to detect a single photon of light, which may be generated if a neutrino slams into an ice molecule as it passes through the ice.

The detectors are designed to capture the flash of light, stamp it with a precise time code, and relay the information to the IceCube Lab, where the particle's path can be reconstructed and scientists can trace its origins, perhaps to an exploding star or black hole. Learn more at www.expeditions.udel.edu/antarctica/.



Novel airship joins UD's research fleet

The University of Delaware has one of the most advanced coastal research vessels in the world — the 146-foot *Hugh R. Sharp*.

Now, thanks to a generous donation from UD alumna Rachel Jewett Ledbetter, who graduated in 1944 with a degree in chemistry, the University has added another remarkable “floating classroom” to its research fleet: an airship.

Believed to be the first of its kind in a university setting, the Low-altitude Environmental Analysis Dirigible (L.E.A.D.) is a novel environmental research and monitoring platform for a myriad of studies.

The airship, dedicated in May, is expected to impact thousands of students across four colleges and more than 50 courses at UD, facilitating undergraduate inquiry in disciplines ranging from geography to civil and environmental engineering, urban planning, and agricultural and natural resources, among others.

The brainchild of Michael A. O’Neal, assistant professor of geography, the 60-foot long airship operates via remote control at altitudes of up to 500 meters with instrument payloads of up to 100 pounds. It has an interchangeable payload design, enabling it to be equipped with a

variety of imaging instrumentation, including a laser scanner and visible, ultra-violet, and infrared cameras.

“Much of what we do in classroom settings attempts to utilize data made publicly available by other institutions or agencies,” O’Neal says. “LEAD transforms learning in the classroom by not restricting students to such data, but instead allowing them to choose the type, extent, and resolution of data collected for their particular need — an unprecedented goal for any university.”

Depending on the instrumentation used, researchers have the capability to capture data and analyze land-use and land-cover change,



Transmitting answers to black duck decline

Once the most abundant ducks in eastern North America, black ducks have declined to as few as 188,000 on traditional wintering grounds.

Kurt Anderson, a master’s degree student in the College of Agriculture and Natural Resources who is a biologist at Ducks Unlimited in Delaware and New Jersey, is working with wildlife biologists there and at several federal and state fish and wildlife agencies to find out why.

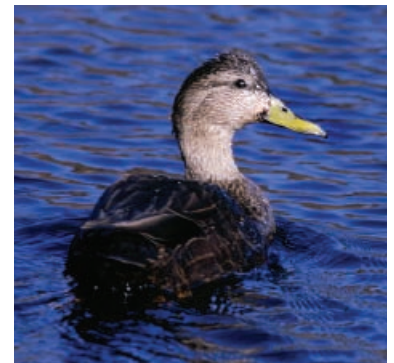
“We know a little bit about the fall migration of black ducks thanks to banding efforts and harvest data, but we know even less about the timing of spring migration, their migration routes, and habitat use patterns on stopovers,” says Anderson.

Anderson is outfitting female black ducks with satellite transmitters to learn more about the conditions they encounter during spring migration, which is critical to their reproductive success. The ducks are trapped, measured, weighed, given federal leg bands for traditional tracking purposes, and then outfitted with a harness and solar-powered satellite transmitter, almost like a little backpack.

Mature hens with a body weight of over 1,000 grams are selected, with the harness and transmitter adding only 38 grams. After second year (ASY) females are selected, Anderson says, because of their importance in population dynamics and familiarity with migration routes. Waterfowl will often return to the same location they were born to reproduce, sometimes even to their same nests.

During the past two winters, 68 black ducks have been outfitted with satellite transmitters through the collaboration of UD, Ducks Unlimited, the U.S. Fish and Wildlife Service, and state fish and wildlife agencies in Delaware, New Jersey, New York, Ohio, and Virginia. You can follow the ducks on the Ducks Unlimited Web site at www.ducks.org/Conservation/BlackDuckStudy/3415/FollowtheDucks.html.

“This project has been a unique collaboration of state, federal, and private partners,” Anderson says. “We hope to offer further insight into the reasons behind the decline and provide habitat recommendations for wildlife managers throughout the black duck’s entire range.”



American Black Duck



UD graduate student Kurt Anderson holds a female black duck that he has outfitted with a satellite transmitter.



geomorphology, climate variability, coastal processes, landfill chemistry, and a variety of other environmental phenomena.

“The blimp will offer us a wonderful opportunity to fly over large sections of the coast every six months or so and note changes, at a much lower cost than renting a small plane each time,” says Jack Puleo, assistant professor of civil and environmental engineering.

One of Puleo’s interests lies in using LIDAR (Light Detection and Ranging) equipment to generate topographic maps of Delaware’s coastline so that he can assess dune height variability and beach erosion.

Research using the airship is already under way with funding from Kent County and the University of Delaware Research Foundation. In addition to the purchase of the airship itself, enabled by Mrs. Ledbetter’s donation, the colleges of Arts and Sciences; Earth, Ocean, and Environment; and Engineering provided funds for accessories, including the 20-foot trailer used to transport the airship when deflated.



Rachel Jewett Ledbetter christens UD’s airship. Note the wording on the gondola, with the airship dedicated to the memory of her grandfather, Thomas Tustin Cloward, a proud Delawarean who once worked for the Pennsylvania Railroad. Looking on are UD President Patrick Harker, left, and professors Jack Puleo and Michael O’Neal who led efforts to develop the novel research facility.



UD and Xiamen University establish joint coastal institute

The logo of the new Joint Institute for Coastal Research and Management (Joint-CRM) symbolizes a key objective of the world-class collaboration established by the University of Delaware and China’s Xiamen University (XMU) last summer.



The converging water drops signify the institute’s goal to attract scientists from around the globe to work together to meet common goals in ocean and environmental science.

In its first year of operation, the institute, believed to be the first alliance of its kind established in the field of marine science between China and the United States, has fostered numerous faculty exchanges between its lead partners — UD’s College of Earth, Ocean, and Environment and Xiamen University’s College of Oceanography and Environmental Science. An international workshop on ocean climate change was held in December, a collaborative Web site (joint-crm.org) has been launched, and peer-reviewed jour-



Nancy Targett,
Dean, UD College of Earth, Ocean, and Environment



Minhan Dai,
Dean, College of Oceanography & Environmental Science, Xiamen University

nal articles have been written, co-authored by scientists from each institution.

Known as China’s “cradle of marine sciences,” Xiamen University was the first Chinese university to initiate a program in marine science studies. The institution has a reputation for excellence in oceanography and the environment, chemistry, and chemical engineering, as well as the life sciences and the social sciences. The university has 34,000 students and 4,600 faculty and staff.

Similarly, UD’s College of Earth, Ocean, and Environment is a pre-eminent institution for marine and environmental research and policy in the United States. It is home to the Delaware Geological Sur-

vey, the Delaware Sea Grant College Program, and the Scientific Committee on Oceanographic Research (SCOR), among other major programs, and operates the 146-foot *Hugh R. Sharp*, one of the world’s most advanced coastal research vessels, as part of the University-National Oceanographic Laboratory System fleet.

“The past year is only the beginning,” say Deans Targett and Dai in their joint message in the institute’s first anniversary newsletter. “Joint-CRM will continue our efforts to build the best global platforms for scientists, staff, and students from both UD, XMU, and beyond to explore the coastal oceans. We will make our expertise sharable, our collaborations efficient, and our friendships lasting.”



UD President Patrick Harker (left) and Xiamen University President Chongshi Zhu sign a Memorandum of Understanding between the two universities on June 27, 2008.



The latest tools of the trade New facilities foster research, entrepreneurship

The 2,200-square-foot Exelon Trading Center at UD is modeled on the trading floors in investment banks, brokerage houses, and hedge funds on Wall Street.

Exelon Trading Center gives students, faculty a leading edge in the marketplace

It's business as usual at the University of Delaware's Exelon Trading Center. Located in Purnell Hall in the Alfred Lerner College of Business and Economics, the 2,200-square-foot facility replicates the trading floors in investment banks, brokerage houses, and hedge funds on Wall Street.

Funded in part by a generous donation from Exelon Corp. — one of the nation's largest utilities with nearly \$19 billion in annual revenues — the state-of-the-art facility features information needed to trade commodities, specifically the purchase and sale of electricity in addition to securities.

The novel center is "right on the money" in terms of providing business students and faculty with opportunities for discovery-based learning and research. It is equipped with 16 classroom workstations, four research room workstations, real-time feeds to two tickers, and four LCD displays, in addition to financial markets applications.

Specialized software from Bloomberg and Reuters provide real-time quotes and historical data on a variety of financial instruments. Additionally, the center is equipped with statistical software such as SAS, EViews, and @Risk, which are used to analyze historical data from the FTSE Group, CRSP, Compustat, Eventus, and other data providers.

A crowd of 100 well-wishers attended the facility's inauguration on Oct. 16. Afterward, representatives from UD and Exelon traveled to the Big Apple to ring The Closing Bell® at the New York Stock Exchange to celebrate the center's official opening.

At the New York ceremony, Ian McLean, executive vice president for finance and markets at Exelon, said the corporation is proud to partner with UD to provide students with access to real-world learning tools that will help them address emerging issues.

"Such educational experiences will better prepare students to tackle tomorrow's exciting business challenges — challenges like using competitive energy markets to identify the most cost-effective solutions to global climate change," McLean said.

"The University of Delaware's partnership with Exelon is truly a winner for everyone," noted UD President Patrick Harker. "It provides our Lerner College of Business and Economics students with hands-on experience in the trading of commodities, gives them internship opportunities, and allows our faculty members to work with professionals at Exelon."

McLean earlier cited the efforts of Exelon Power Team trader and UD alumnus Frank Henshaw in bringing academia and industry together.

"Frank Henshaw came to

me and said, 'I think there is a real opportunity here,'" McLean said. "I asked him to bring me a business plan, and he did. He actually had an idea and did the work to back it up. This is really about the people I have met here at UD. These people are going to help take us to a new level."

According to Conrado "Bobby" Gempesaw, dean of the Lerner College, less than 5 percent of business schools in the United States have such a facility.

"We would like to claim that our students and our faculty now have the edge in the marketplace because of the Exelon Trading Center," Gempesaw said.

The Blue Hen Investment Club, a student-run Lerner College organization that invests UD funds in the stock market, meets each Tuesday in the Exelon Trading Center.

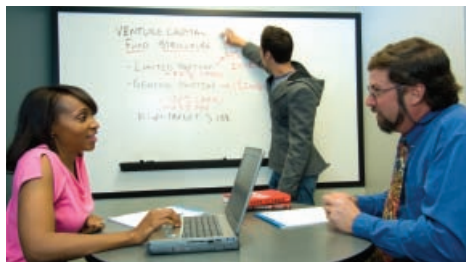


UD and Exelon rang the closing bell on the New York Stock Exchange on Oct. 16 to celebrate the new Exelon Trading Center at UD. Ian McLean, Exelon's executive vice president for finance and markets (center), and UD President Patrick Harker (with gavel) led the delegation. Photo courtesy of the News Journal/Robert Craig

Venture Development Center opens

Kavi Chokshi, an Honors Program marketing and management student in the Alfred Lerner College of Business and Economics, has spent the last two years developing a business plan for a student-oriented commercial Web site he hopes to launch soon. Now, he says, he has a new resource to help him move his entrepreneurial ideas forward.

The Venture Development Center, which opened in November on the first floor of Purnell Hall, offers students like Chokshi an applied learning laboratory where they can find office space, intensive mentoring, and other support as they work to create new businesses. The center was designed to help students develop ideas into successful businesses, while also providing educational and networking opportunities.



Scott Jones, professor of accounting and entrepreneurial studies (right) and director of the Venture Development Center, meets with graduate student Rhonda Crowder and Matt Racz, an Honors Program student in business and economics.

“We want to promote the spirit of entrepreneurship and encourage our students in their plans,” said Conrado “Bobby” Gempesaw, dean of the Lerner College, at an event introducing the new center to the UD community in November. “We will be looking for big

things from this center . . . to nurture and sustain those entrepreneurial ideas our students may have.”

With the recent creation of the Office of Economic Innovation and Partnerships (OEIP), Gempesaw said, such support for entrepreneurial ventures has become “a University-wide priority.”

Scott Jones, professor of accounting and entrepreneurial studies in the Lerner College, is the center’s director. Jones was “the prime mover” of UD’s annual business plan competition and also suggested creating the interdisciplinary minor in entrepreneurial studies that is open to students in all majors across the University, Gempesaw said.

Additionally, Gempesaw noted, Clinton Tymes, director of the Delaware Small Business Development Center, and James O’Neill, professor of economics who has led Lerner College’s Center for Economic Education and Entrepreneurship since it was created in the 1970s, have been instrumental in supporting entrepreneurship.

Another Honors Program student who is making use of the new Venture Development Center is Nikhil Paul, a senior electrical engineering major who is preparing to

launch a social networking and knowledge-sharing Web site for college students. Paul says he expects the center to be especially helpful as his business plan progresses.

“I absolutely plan to spend a lot of time here,” Paul said in the center’s conference area. “I’m passionate about my idea and about entrepreneurship.”

Also at the introductory event for the center, students had the opportunity to ask questions of Charles Cawley, founder and former president of MBNA Corp.

Important qualities for an entrepreneur, Cawley said, are “being able to see the whole picture of possibilities at one time” and the ability to focus on what needs to be done on a daily basis, regardless of difficulties and setbacks. “The most serious problem for small businesses is not a lack of money,” he said. “It’s procrastination.”

Cawley visited the Venture Development Center and met with the students before delivering UD’s inaugural President’s Lecture on Entrepreneurship later that day. In the lecture, he urged the audience of students, faculty, and community members to think of “the entrepreneurial spirit” as not limited to those who start their own businesses, but as also found in some employees of large organizations.

“Entrepreneurial, creative, risk-taking — they all mean the same thing,” Cawley said.



The Venture Development Center offers students an applied learning laboratory where they can find intensive mentoring and other support as they work to create new businesses.



Bobby Gempesaw (far left), dean of the Alfred Lerner College of Business and Economics, students, and guests listen as Charles Cawley, founder and former president of MBNA Corp., talks about his career.

New insights, advances for communities

Getting a Head Start to success



Head Start preschoolers in the Delaware Early Reading First project are exposed to quality storybook reading, instruction, and play-based literacy activities.

The first Head Start preschoolers to experience the Delaware Early Reading First (DERF) project have “graduated,” and researchers say their astonishing success in kindergarten clearly demonstrates the value of early language arts intervention in improving the academic outlook of children from impoverished circumstances.

“The results of the follow-up study indicate that the DERF project graduates performed as well as or better than the general population of children their age,” says Myae Han, assistant professor of human development and family studies. “The children’s performance is particularly impressive on these measures when one remembers that the majority of the children were not only from low-income families but also came from homes where English was not the primary language spoken.”

The project began in 2005 with a competitive \$3.3 million grant awarded by the U.S. Department of Education to faculty in the College of Education and Public Policy, in cooperation with New Castle County (Del.) Head Start.

Children in Head Start preschool programs are considered at risk for academic challenges and failure due to economic circumstances, home language, or disability. Without interven-

tion, these youngsters often start formal schooling lagging behind their peers.

“Head Start provides each family with a case manager who helps ensure that basic needs for food, shelter and clothing are being met,” says Martha Buell, professor of human development and family studies. “Our project provides additional enrichment and resources to support their language and literacy development — something that their home environment often lacks.”

For the last four years, DERF has assisted three Head Start preschools in New Castle County with services and materials based on recent research that has clarified exactly how children learn to read. The project provides literacy materials, ongoing professional development, and on-site coaching to support teachers’ use of research-based reading strategies and developmentally appropriate literacy instruction.

Each day in the classroom, the children are exposed to quality storybook reading, instruction, and play-based literacy activities. Master’s-level teachers trained in reading and literacy provide coaching, while UD graduate students tutor the students one-on-one and assist with data collection.



UD AROUND THE
World

EXTREME 2008

Students dive in to deep-sea adventure



Craig Cary, professor of marine biosciences, was chief scientist for the Extreme expedition.

Excited middle and high school classrooms around the world “took the plunge” last November as participants in UD’s “Extreme 2008: A Deep-Sea Adventure,” a multimedia educational program to explore hydrothermal vent sites in the Pacific Ocean. The program was sponsored by the National Science Foundation.

Over 21,000 students from 350 schools in 7 countries participated, including Aruba, Australia, Canada, Costa Rica, Great Britain, New Zealand, and the United States.

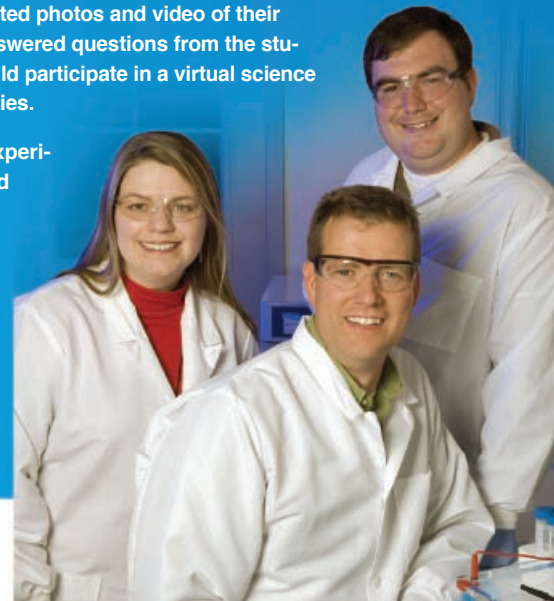
The students followed an actual 21-day expedition at sea, led by UD scientists and involving researchers from the University of Colorado, University of North Carolina, University of Southern California, the J. Craig Venter Institute, Universidad Nacional Autónoma de México, and the University of Waikato, New Zealand. The international team lived aboard the 274-foot Navy research vessel *Atlantis* and dived to the depths in the famous submersible *Alvin*.

The centerpiece for the classrooms’ virtual field trip, developed by the UD Office of Communications & Marketing, was an interac-

tive Web site that immersed students in the geology and biology of the vents and the high-tech tools used to explore these structures where super-heated water rockets from the Earth’s crust. Curricula, study guides, and videos also were available on the site.

Every day during the mission, the scientists blogged from the ocean, posted photos and video of their discoveries, and answered questions from the students, who also could participate in a virtual science fair and other activities.

The capstone experience for 50 selected classrooms was a “Phone Call to the Deep,” with scientists working live in the sub at hydrothermal vent sites more than a mile beneath the ocean’s surface.



The researchers followed 97 of their project's 2007 Head Start graduates into kindergarten in Delaware's Colonial School District in the spring of 2008 and found that, in general, the children who had participated in DERF produced higher scores on various parts of standardized literacy assessments than would be expected of the average population beginning first grade, including letter-word identification, story recall, understanding directions, decoding words, and receptive vocabulary. Their teachers judged all but 14 of the 97 children to be in the intermediate to proficient stage of development on each rated skill.

"We were delighted with the children's performance on these measures," says Carol Vukelich, director of UD's Delaware Center for Teacher Education and Hammonds Professor in Teacher Education. "Our Early Reading First project, including New Castle County Head Start and Colonial School District kindergarten teachers, can take great pride in how well prepared these children are for success today and in the future."

Vukelich added, "Research clearly shows that building young children's oral language skills; their knowledge of the alphabet letter names and sounds; print awareness such as reading from left to right; what authors and illustrators do; the differences between a picture, a word, and a letter; and phonological awareness or knowledge of the sound structure of our oral language are all key to children's later success as readers."

Weaving sustainability into apparel industry

UD's *FIBER* journal (www.udel.edu/fiber) is connecting the global fashion and apparel industry to timely research, insights from business leaders, and educational resources on issues ranging from finding and engaging suppliers, known as "sourcing," to environmental sustainability.



The journal is the centerpiece of the Fashion International Business Education and Response (FIBER) project, funded by the U.S. Department of Education and led by Hye-Shin Kim, associate professor of fashion and apparel studies. A series of audio programs broadcast live over the Internet from UD, called "FIBERcasts," also has been launched, linking academic and industry experts with listeners worldwide.

"A major goal of these efforts is to assist the fashion and apparel industry, including U.S. small businesses, in learning more about emerging world markets and to share best practices for working internationally," Kim says.

The guide *Creating a More Environmentally Sustainable Apparel Business: Policies for Apparel Brands and Retailers* also recently was released. It is part of the UD Sustainable Apparel Initiative (UDSAI), established by the Department of Fashion and Apparel Studies, with the American Apparel and Footwear Association, Bureau Veritas, Nike, and Under Armour. It is co-directed by Huantian Cao, associate professor, and Marsha Dickson, chair of fashion and apparel studies.

Here is a sampling of the recommendations in the guide:

- ◆ Eliminate waste in all points of the supply chain.
- ◆ Eliminate excess product manufacturing by balancing supply to demand.
- ◆ Develop and implement advertising and marketing strategies that avoid greenwashing — that is, unspecific and unsupported claims about a product's environmental impact.
- ◆ Consider and implement end-of-life strategies (recycle, renew, or reuse) when choosing materials, designing, and producing apparel.

For more information about UDSAI, visit the Web site at www.sai.udel.edu.



Teacher Gioya DeSouza-Fennelly and her students at I.S./143M Eleanor Roosevelt Junior High School in New York City stand by for the "Phone Call to the Deep," a conference call with scientists working in the submersible *Alvin* at vent sites on the ocean floor.

Extreme Impacts

Extreme 2008 involved 21,224 students at 358 schools in 7 countries.

99% of students surveyed said the study of science has become more "real life" to them thanks to UD's Extreme program.

97% of teachers surveyed said they would recommend the program to other teachers for their science curriculum.

Viruses and bacteria in a water sample from Chesapeake Bay.

Associate professor K. Eric Wommack (seated) led the Extreme 2008 study of marine viruses with postdoctoral researchers Bekki Helton and Shawn Polson. "As a group, viruses are the most abundant biological entities on Earth and contain its largest reservoir of unknown genes," Wommack says.

Learn more at www.expeditions.udel.edu

"I have never seen my students so engaged and excited. This was the greatest real-world experience my students have ever had."

— Teacher, Johannesburg-Lewiston High School, Johannesburg, Mich.

"This makes me realize that science isn't just a subject I have to learn in school, it could be a job for me someday."

— Student, Granville High School, Granville, N.D.

"The phone call to the scientists was really cool. I can't believe that we were actually having a conversation with someone who was underneath the sea in a submarine. I will probably remember that forever."

— Student, Scarborough Middle School, Scarborough, Maine

Joining forces to improve hurricane evacuations



Satellite image of Hurricane Katrina taken at 1:15 p.m. EDT, Aug. 29, 2005, as the Category Five storm churned in the Gulf of Mexico with sustained winds near 175 miles per hour. The storm made landfall on the U.S. Gulf Coast the next day. Courtesy of National Oceanic and Atmospheric Administration

When Hurricane Katrina struck New Orleans on Aug. 29, 2005, many residents ignored the mayor's mandatory evacuation order. Some had no access to cars, while others believed they would be safe in their homes or needed to stay behind to protect their property. Even the date was a factor in some people's reluctance to leave: it was the end of the month, and many were waiting for much-needed paychecks.

In the case of Hurricane Rita, which hit Louisiana and Texas less than a month later, the evacuation process proved to be more deadly than the hurricane: seven people died as a direct result of the storm, but many more perished in hot cars stalled on gridlocked highways.

Civil engineer Rachel Davidson and sociologist Tricia Wachtendorf are leading a multidisciplinary team that is developing mathematical models to optimize the full range of sheltering and evacuation decisions. The three-year, \$750,000 project was awarded last fall by the National Science Foundation and is being coordinated by UD's Disaster Research Center, the world's first social science research institute devoted to the study of disasters. Wachtendorf is the center's associate director.

Davidson points out that evacuation is a battle between the time required to get everyone to safety and the lead time provided by hurricane forecasting. "This is an area where there's a lot of uncertainty," she says. "If a decision to evacuate is delayed for too long, lives can be lost. On the other hand, making that decision too soon, when the hurricane track

and intensity are still unknown, can result in the expense and danger of unnecessary evacuations."

In addition, recent demographic, cultural, and technological shifts suggest that evacuation behavior may be changing, with implications for the way it is managed. For example, there are now more single-person, single-parent, and elderly households. Cell phones, the Internet, in-vehicle GPS and other technologies have changed the way people receive and disseminate information.

"Overcoming these daunting challenges requires a fundamentally new, holistic approach to decision support for hurricane evacuation and sheltering," Davidson says.

"We plan to adopt a broad decision frame and use mathematical programming to optimize the full range of sheltering and evacuation decisions."

Wachtendorf emphasizes the importance of respect for the realities of individual and organizational behavior in developing effective hurricane evacuation and sheltering plans.

"For example," she says, "only about 15 percent of people typically use public shelters. It's important for us to know that, if we want to develop a model that will really be useful to planners and stakeholders."

The project will include the input of focus groups of evacuation and sheltering decision-makers, as well as case studies from North Carolina to ground the theory in real examples, calibrate and validate the models, and illustrate how the final models can be used. Emergency planning and management officials in the state are acting as consultants.

"By providing a substantive example of truly interdisciplinary disaster research, this project will help facilitate the transformation of UD's well-known Disaster Research Center, historically based in sociology, into an interdisciplinary center," notes Sue McNeil, professor of civil and environmental engineering and urban planning and public affairs, who is the director of the center. The project also will launch the center's new interdisciplinary graduate program in disaster science and management, McNeil says.

Online gamers play against stereotypes

who's the compulsive gamer?"



The stereotype of online gamers may be wrong. They are by and large not obese teenage boys. Instead, they're older and fitter than the U.S. general population and a surprising number are female, says Scott Caplan, UD associate professor of communication.

Along with colleagues from the University of Southern California and the Palo Alto Research Center, Caplan studied 7,000 players of the online game EverQuest 2. EverQuest2 is a massively multiplayer online game (MMO), with a virtual world where players create characters and interact with other players. The researchers found the average player is 31 years old.

"I would have expected it to be college age," Caplan says, noting that counter to even his own stereotype, most players are 30-somethings. And, almost 20 percent are female.

"Although there's not as many women playing," he says, "they play more than the men, which goes against the stereotype of the adolescent male

Researchers gathered the data through a survey that appeared inside the game. Sony Online Entertainment gave researchers access to proprietary information about its customers. Caplan and his colleagues believe Sony is the first major game company to share public data for outside research.

Armed with those numbers, the social scientists calculated gamers' body mass index, a measure of fitness. The average BMI for the U.S. general population is 28. The gamers' average BMI is 25.1.

That surprised researchers. The gamers' mental health, however, did not startle Caplan. They reported higher-than-average rates of substance abuse and depression. Caplan says the question now is "Why?"

"Why are people going to the games, and what are they getting out of the games," Caplan wonders.

The stereotypical response might be that gaming is responsible for their poor mental health. But what if you consider the flip side of that argument?

"If gaming actually helps people who have mental health problems, and they are turning to it because of the benefits," Caplan says, "then knowing that gives us a way to look at games as having therapeutic value."

Graduate student Kate Wight treats a Moorish Islamic ceiling at the Metropolitan Museum of Art during her third-year internship in the Winterthur/University of Delaware Program in Art Conservation. It is one of only five art conservation programs in the United States.



UD AROUND THE
World

Preserving the Treasures of Our Heritage

At museums across the United States and around the world, University of Delaware graduate students are helping to preserve the treasures of our heritage — irreplaceable artifacts for future generations, from ancient Egyptian mummies to Neil Armstrong's spacesuit.

The students are on advanced internships in the Winterthur/University of Delaware Program in Art Conservation (WUDPAC). A cooperative effort of UD and Winterthur Museum & Country Estate, the program is one of only five in the United States to offer the master's degree in art conservation, an interdisciplinary field that combines art and science.

"The Winterthur/University of Delaware Program in Art Conservation has played a critical role in the development of conservation education and preservation practice in the United States," says Debra Hess Norris, UD's vice provost for graduate and professional education, chairperson of the Department of Art Conservation, and Henry Francis du Pont Chair in Fine Arts.

"During their careers, our graduates have been responsible for the examination, technical analysis, conservation, and preservation of such irreplaceable objects as the Declaration of Independence, multiple drafts of the Constitution, the Emancipation Proclamation, the Star-Spangled Banner, the Treaty of Paris, the Dead Sea Scrolls, and works of art by Old Masters to contemporary artists — from Rembrandt to Van Gogh and Wyeth," Norris says.

Other notable treasures conserved by the program's graduates include Babe Ruth's baseball contract, the original R2D2 from the movie *Star Wars*, the world's first photograph, Elvis Presley's 81 gold records, the 1905 Wright Flyer III, the ruby slippers from *The Wizard of Oz*, and the architectural interiors of Mount Vernon and the Forbidden City.

As a capstone experience in their third and final year of the program, students complete an 11-month internship at a museum or private conservation laboratory in the United States or abroad.

(See *Treasures of Our Heritage*, continued on p. 34)



Graduate student Bret Headley conserves a 15th-century German memorial shield at the Philadelphia Museum of Art.



At the Walters Art Museum in Baltimore, graduate student Louise Orsini treats the "Portrait of Pope Pius the V" by Passerotti, from the museum's permanent collection.



As part of her graduate internship at Heugh-Edmondson Conservation Services, LLC, in Kansas City, graduate student Lisa Duncan works on the 1930 senior class photoboard from Park College in Parkville, Missouri, that was in a flood and badly water damaged.

“Since its inception in 1974, WUDPAC has developed a curriculum that addresses basic conservation issues and responds to current trends and changing practices in our field,” says Jae Gutierrez, assistant professor of art conservation and interim director of the program. “We aim to ensure that our learning and teaching goals meet national and international preservation needs. Our internship year is an essential component of this education and training.”

The past year’s interns worked at Alexandria Conservation Services in Annandale, Va., the Arizona State Museum in Tucson, Heugh-Edmondson Conservation Services in St. Louis, the Metropolitan Museum of Art in New York City, the Philadelphia Museum of Art, Smithsonian Institution Museum Conservation Institute in Suitland, Md., Walters Art Museum in Baltimore, Yale University Gallery of Art in New Haven, Ct., and the National Gallery of Canada, in Ottawa, Ontario.

During her internship at the Walters Art Museum in Baltimore, Lauren McMullen had the opportunity to work on a variety of projects. One of her favorites, she says, was documenting, treating, analyzing, and helping to install approximately 20 ancient Egyptian works for a small exhibit titled “Mummified,” which explores the ancient Egyptians’ fascination with mummification and discusses resurrection symbols and their meaning.

McMullen was able to handle and treat all of the objects in the exhibit — some of which are over 2,500 years old, including two animal mummies, a cat and an ibis, on loan from the Johns Hopkins Archaeology Museum, a painted limestone ushabti, stone sculptures, faience amulets, and numerous bronze statuettes.

She analyzed pieces using X-radiography and X-ray fluorescence spectroscopy (XRF) and obtained X-radiographs of the ibis mummy, so the images could be used in the exhibit.

“Overall, I gained a greater understanding of ancient Egyptian objects and materials through this wonderful hands-on experience,” McMullen says.

National Endowment for the Humanities grant supports fellowships

Last fall, the Winterthur/University of Delaware Program in Art Conservation won a \$256,800 grant from the National Endowment for the Humanities (NEH), which is being used to bolster fellowship and learning opportunities for master’s-level students in 2008–2010.

The funding, which will go toward programming and merit-based fellowships over the next two years, will pay for students’ travel and research costs; honoraria for special guest lecturers in preventive, objects, painted surfaces, and textile conservation; and other training expenses.

“Our program is very competitive,” Norris notes. “We accept only 10 graduate students each year, and they all receive full tuition scholarships, as well as fellowships. What this NEH fellowship will fund, primarily, are additional fellowship opportunities — conference and seminar fees and national and international research and travel expenses. Funds from the grant also will support the costs of bringing experts from across the nation to speak to our students about issues relating to preservation of historic sites or emergency response and recovery — an area for which UD is well-known.”

Norris says the funding also allows for new directions in the field and advances ongoing ventures such as public outreach and collaboration with other institutions.

Graduate student Sharon Norquest (right) assists Lisa Young, president of Alexandria Conservation Services, in caring for Neil Armstrong’s spacesuit.



“Nothing . . . excepting always sound scholarship and adequate equipment for instruction, redounds more to the credit of an educational institution or adds more to its prestige than a Press bearing its name, wisely administered, and issuing only books and journals of acknowledged and permanent value which carry to other institutions of learning and to educated men in all parts of the world the name of the institution. . . .”

This statement, which appears in the July 1922 President’s Report of UD President Walter Hullihen, conveys the importance the University placed on scholarly publishing — a sentiment that continues today.

University Press publishes landmark books in art history

The University of Delaware Press recently published two landmark books in art history: *Lockwood de Forest: Furnishing the Gilded Age with a Passion for India and Zinc Sculpture in America 1850–1950*.

The book on de Forest presents the first major study of this artist, collector, and businessman (1850–1932). De Forest was trained as a painter by the American landscape artist Frederic E. Church. His interest in travel, the Middle East, and decorative art led him to become an early business partner of Louis Comfort Tiffany, and from there to become a “professional artistic decorator” (a profession that first emerged in the 1880s) who specialized in East Indian arts and crafts during what is now called the Gilded Age.

Written by Roberta Mayer, who received her Ph.D. in art history with a specialty in American art history and a minor in the decorative arts from UD, the book has been named the year’s best decorative



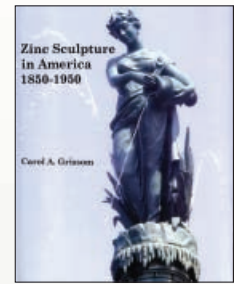
arts monograph by the Metropolitan Chapter of the Victorian Society in America.

Carol Grissom, senior objects conservator at the Smithsonian Museum Conservation Institute, has written the first comprehensive overview of statuary produced from zinc, which was introduced to the United States as a new sculptural material in the mid-nineteenth century.

Because zinc was less expensive than marble or bronze, even the smallest towns could afford life-size statues to give prominence to the town square, courthouse, and cemetery.

Grissom provides an interdisciplinary overview that engages aspects of art history, popular culture, local history, technology, and art conservation. Included is an illustrated catalog presenting more than 800 statues organized by type: trade figures and Indians, gods and goddesses, fountain figures, animals, famous men, military figures, firemen, cemetery memorials,

and religious subjects. The author’s experience as a conservator makes this an essential resource for preservationists seeking to repair statues damaged by years of outdoor exposure.



A member of Associated University Presses (AUP), the University of Delaware Press publishes about 40 books each year. Its major strengths are in literary studies, especially Shakespeare, renaissance, and early modern literature; eighteenth-century studies, art, and culture; French literature of the eighteenth and nineteenth centuries; art history and history; and historical and cultural studies of Delaware and the Eastern Shore.

The University of Delaware Press is managed by a board of editors composed of faculty from multiple departments and chaired by Donald C. Mell, Jr., professor of English. Karen Druliner is the managing editor. For more information, visit www2.lib.udel.edu/udpress/.

Students experience the power of service

Each year, more than 700 UD undergraduates gain hands-on research experience in the lab, in the field — and in their communities.

Lynnette Overby, faculty director of the Undergraduate Research, Service Learning, and McNair Scholars programs, describes service-learning projects as great opportunities to apply disciplinary knowledge in the community setting.

“It’s not just about volunteerism, though that is very important,” Overby says. “When we do service-learning, we really look at combining our disciplinary knowledge with problem solving that comes with experience.”

Such experiences, Overby says, benefit both the students and the communities they serve. “Students gain civic awareness, and they can witness firsthand the power of service, along with another key element, knowledge,” she notes.

At the Service-Learning Scholars Symposium in August 2008, program coordinator Sue Serra introduced 15 undergrads and their advisers who talked about how they used their academic training to help communities at home

UD was named to the 2008 President’s Higher Education Community Service Honor Roll by the Corporation for National and Community Service.

and abroad. The projects ranged from “Youth Cultural Integration Through Basketball” by health science majors Matthew Keefe and Jennifer Simpkins, who at the time were in Dublin, Ireland, working on the effort, to “Behind the Beat: Bringing Hip-Hop to the Classroom,” by Shanyah Wright, a junior in psychology.

Senior exercise physiology majors Kristen Beddingfield and Dannielle Miccinello described their project, which compared the energy expenditure of young adults with autism and those without autism. Their adviser was Nancy Getchell, associate professor in the College of Health Sciences.

“We know that there are a lot of people who are overweight, and that this is even more so among people with autism,” Miccinello said. “We also know that there has been a significant increase in the number of people diag-



Hardikkumar Patel, a junior health sciences major, outlines his service-learning project, “Increasing Physical Activity in Pre-Schoolers.”

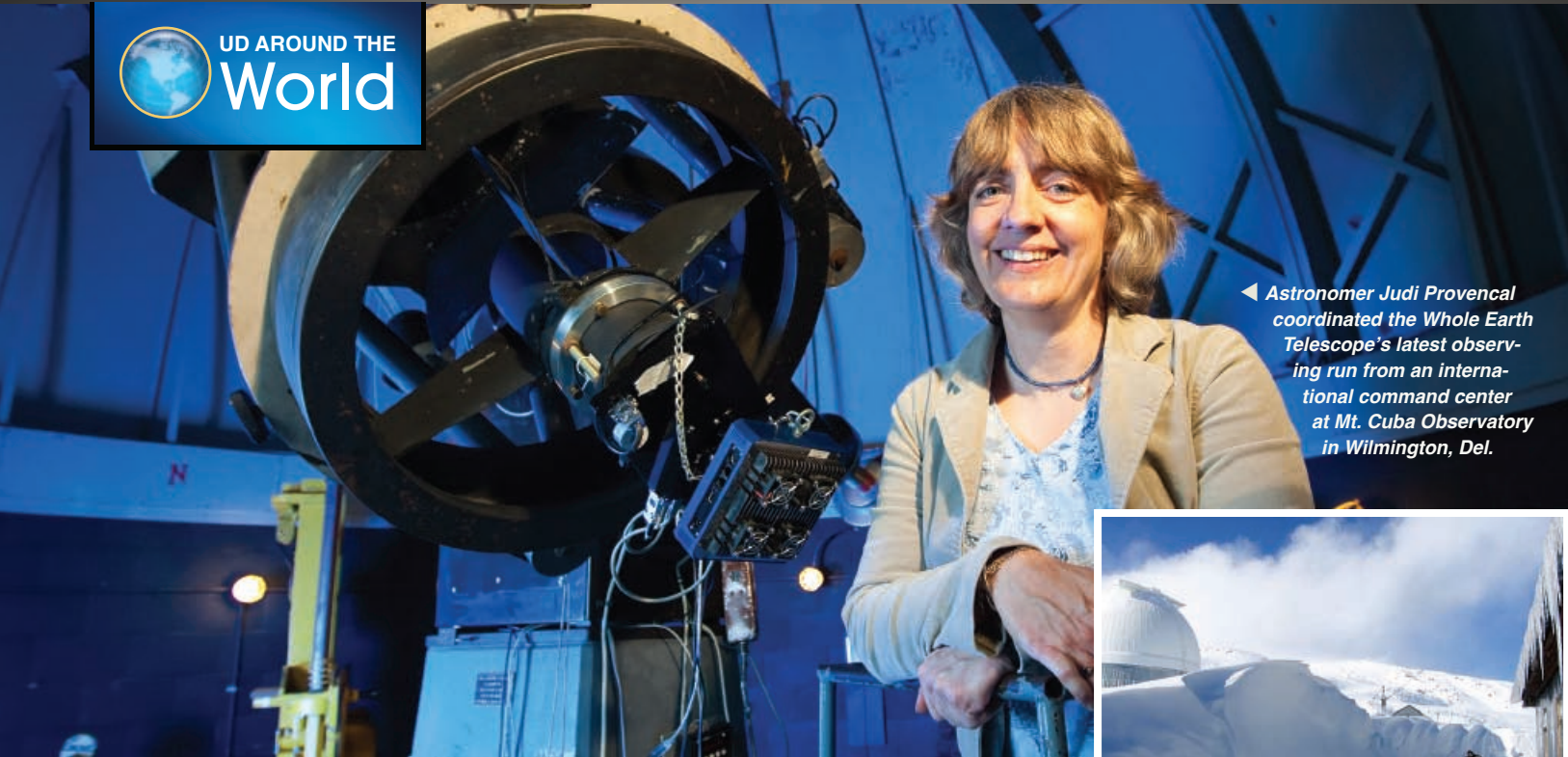
nosed with autism. We wanted to know if the increase in obesity in people with autism is due to their condition or a social problem.”

Both researchers participated in physical education classes alongside students and measured energy expenditure during 16-minute periods of walking and jogging.

“Energy expenditure in people with autism is something that needs to be looked at. We set up our goals for what we wanted to accomplish each week and reported weekly to Dr. Getchell,” Beddingfield said. “Part of our success in this project was due to our interactions with the students we were working with. We are hoping to get our findings published.”

Making out-of-this-world discoveries

Scientists illuminate the microscopic to the astronomic



◀ Astronomer Judi Provençal coordinated the Whole Earth Telescope's latest observing run from an international command center at Mt. Cuba Observatory in Wilmington, Del.



Putting a 'cool star' in focus

The Whole Earth Telescope (WET), a global network of observatories coordinated by the University of Delaware, finished an international relay in June. Instead of a foot race around the world, however, the observatories synchronized their lenses for four weeks of round-the-clock coverage of a cooling star.

The dying star, a white dwarf identified as WDJ1524-0030 in the constellation Ophiuchus in the southern sky, is losing its brightness as it cools, its nuclear fuel spent. As the star dims, scientists hope it will shed light on the workings of our own planet and other mysteries of the galaxy.

Like an international relay team, observers at Mt. Cuba Observatory in Greenville, Del., would focus on and photograph WDJ1524-0030 until sunrise, and then observers at McDonald Observatory in Fort Davis, Texas, and at Kitt Peak National Observatory in Tucson, Ariz., would stand watch while the star was in their sky, followed by observers in New Zealand, Australia, China, and so on, around the globe.

The thousands of photos taken by the WET team were e-mailed to the command center staffed by UD researchers at Mt. Cuba Observatory, who are now analyzing them using the fledgling science of "star quakes" known as asteroseismology, which can determine the age, temperature, and composition of a star from its oscillations and brightness.

"A white dwarf is the size of the Earth and as dense as the sun. This star pulsates or quakes as waves of energy travel through it — its outer surface sashes from side to side like waves on the ocean," says Judi Provençal, assistant professor of physics and astronomy and director of the Delaware Asteroseismic Research Center (DARC).

"What is of interest to scientists is the shape of the pulses," Provençal notes. "From them, we can measure how the atmosphere is moving around in these pulsating stars and figure out what's going on inside them. This one is really sloshing around."

Although there are thousands of white dwarfs in our galaxy, only about 30 percent are bright enough for scientists to study using asteroseismics, according to Provençal. She notes that WDJ1524-0030 is one of only about 20 percent of the stars in the universe whose atmosphere is composed of helium versus hydrogen. The WET team hopes to find out the composition of the star's core, whether hydrogen or oxygen.

The process of discovery will take on the order of two years to stitch together all of the images, analyze the data, interpret the data with the input of the WET community, and report the results. Eventually, the findings will be applied to other stars, including the sun, and to our own planet, Provençal says.

"We don't understand the weather on Earth, the transport of energy," she says. "We don't understand convection at all. Hopefully, this field of research, which is still very new, will help every aspect of astronomy."

While the administration of the Whole Earth Telescope is supported by the Crystal Trust Foundation, the observers are not paid to observe.

"Without them, it wouldn't happen," she notes. "It's a community effort."

The latest WET run included telescopes in Austria, Chile, China, France, Germany, India, Italy, Lithuania, New Zealand, Poland, Russian Federation, South Africa, South Korea, Spain, Taiwan, and the United States, including Arizona, California, Delaware, Florida, and Texas.

Robots take flying lessons from animals

Xinyan Deng is on a quest to build a better flying robot. Mechanical dragonflies to robotic boxfish inhabit her lab in the Department of Mechanical Engineering.

A study in the April 10 issue of *Science*, co-authored by Deng and graduate student Bo Cheng in collaboration with biology professor Tyson Hedrick at the University of North Carolina, sheds new light on how animals fly.

For Deng, assistant professor and director of UD's Bio-Robots Laboratory, the research provides the foundation for the next generation of flying robots — tiny flapping devices with a variety of potential military and civilian applications ranging from surveillance and security to search-and-rescue operations.

Previously, in research supported by her 2006 National Science Foundation Faculty Early Career Development Award, Deng

developed a mathematical model of saccade flight in fruit flies. Saccade flight comprises a series of straight flight paths punctuated by rapid 90-degree turns. From that study, she found that flapping fliers benefit from a passive "braking system" now known as flapping counter-torque, or FCT.

Basically, Deng explains, when a fruit fly turns, the outside wing moves faster during the down-stroke while the inside wing moves faster during the up-stroke. This asymmetry produces the torque that slows body rotation and straightens out the ensuing flight path.

Hedrick had learned of Deng's work with fruit flies and proposed a collaborative study when they met at the Fourth International Symposium on Adaptive Motion of Animals and Machines last year.

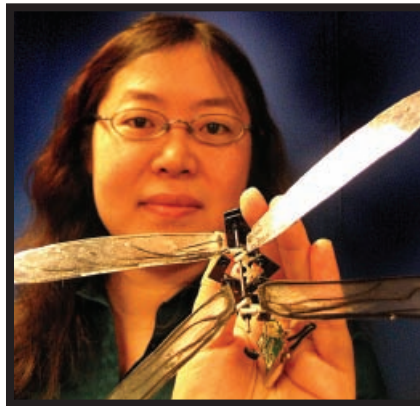
Using high-speed video cameras, the team observed that flying animals of all sizes, from fruit flies to large birds, seem to benefit from FCT and demonstrate a similar ability to turn in flight and then straighten out to fly on a new course.

The researchers discovered that animals with similar morphology exhibit similar turning dynamics in terms of wingbeats regardless of body size. They also found that the faster the wings beat, the better the animal's maneuverability and stability. These two properties are usually antagonistic in engineering systems.

As one news story about the research announced: "Birds do it, and now we know how."



▲ The bright star inside this nebula (gas cloud) is a young white dwarf. Courtesy of Space Telescope Institute/NASA and the Hubble Heritage Team.



Xinyan Deng with robotic insect.

◀ Peak Terskol Observatory in the Russian Federation was among the participants from 16 countries in the Whole Earth Telescope's latest observing run.

Mysterious nature of glass explained in a 'twinkle'

Archaeological evidence suggests that glass was first made in the Middle East sometime around 3000 B.C. Today, some 5,000 years later, scientists are still perplexed about how glassy materials make the transition from molten to solid state. Richard Wool, professor of chemical engineering, thinks he has the answer.

In a paper published in November in the *Journal of Polymer Science Part B: Polymer Physics*, Wool documents a new conceptual approach — the Twinkling Fractal Theory — to understanding the nature and structure of the glass transition. The theory provides a quantitative way of describing a phenomenon that previously had been explained strictly from an empirical perspective.

As water freezes, the molecules settle into a neat and orderly crystal pattern. As glass turns from a molten liquid to a solid, its molecules slow down, but they never completely

stop. Even after hardening, glass mysteriously retains the molecular disorder of a liquid.

Another difference between glass and more conventional materials is that its transition from liquid to solid does not occur at a standard temperature, like that of water to ice, but instead is rate-dependent: the more rapid the cooling, the higher the glass transition temperature.

Wool discovered that as molten glass cools and transitions to a solid, the atoms form clusters of crystals in fractal shapes. As the molecules jump from liquid to solid and back, the energy at which they vibrate changes, and they "twinkle," according to Wool.

"At the glass transition temperature, these fractals appear to twinkle in a specific frequency spectrum," he says. "The twinkling frequencies determine the kinetics of the glass



Even after molten glass cools and hardens, its molecules never completely stop moving.

transition temperature and the dynamics of the glassy state."

Wool says the Twinkling Fractal Theory has the potential to shed light on the behavior of all kinds of glassy materials, including polymers, metals, and ceramics, and may contribute to a better understanding of such phenomena as fracture and physical aging of materials, as well as new insights into nanomaterials.

Internet2 deploying UD technology

Phoebus is the name of the Greek god of light. It's also the name of a bright, new technology developed by Martin Swany, assistant professor of computer and information sciences, that has been selected for deployment by Internet2, the research and development consortium that is inventing and testing the technologies that will create tomorrow's Internet.

Led by over 200 U.S. universities, working in partnership with industry, government, and international partners, Internet2 operates an advanced network that connects more than 50,000 research and education institutions in the United States and more than 80 international research networks. UD has been a charter member of the consortium for nearly a decade.

The Phoebus platform is being deployed by Internet2 as an experimental prototype with the goal of significantly improving network performance for long-distance, high-capacity data transfer that today is very difficult to achieve using traditional Internet Protocol (IP) technology. Such a tool could play

a critical role in supporting major scientific projects that require high-performance networks to connect researchers around the globe.

Phoebus works by enabling Internet2 to automatically switch large data flows from its IP network, which is shared among all the Internet2 users, onto dedicated circuits or paths. By transparently moving high-demand applications onto these dedicated paths, Phoebus improves network performance because the application can benefit from the more precise service qualities of circuit networking, while placing much less strain on the shared IP infrastructure.

"The Internet2 network provides our members with a proving ground for new technology and services like Phoebus," says Rick Summerhill, chief technology officer for Internet2. "We are excited about the potential of Phoebus to enable our members to experiment with and better

leverage the high performance capabilities of the Internet2 hybrid optical and IP network environment."

Swany says UD students have been critical in the development of Phoebus, and that research on the technology is continuing.



Martin Swany, assistant professor of computer and information sciences, and his students are helping to develop the next generation of the Internet.



Associate professor Joseph Fox and doctoral student Melissa L. Blackman have devised a fast chemical reaction for tagging biomolecules.

Fast chemical reaction may speed drug discovery

Chemist Joseph Fox and his research group have developed a super-fast chemical reaction process for labeling biomolecules. The patent-pending technique ultimately may speed the discovery of new drugs and biomaterials.

The research, which also involved doctoral student Melissa L. Blackman and former post-doctoral researcher Maksim Royzen, was published in the *Journal of the American Chemical Society* in September and highlighted in *Chemical and Engineering News* in October.

The latter publication quoted chemical biologist Carolyn R. Bertozzi of the University of California Berkeley, who said the kinetics of the UD reaction are "perhaps the fastest reported for any bioorthogonal ligation to date."

Bioorthogonal reactions are tools that allow for the tagging and visualization of biomolecules, a field that is growing as researchers seek to develop new drugs and novel biomaterials such as artificial organs and tissues.

The 2008 Nobel Prize for chemistry was awarded to scientists who discovered the green fluorescent protein, which allows scientists to tag and monitor individual living cells and their proteins. The tagged particles appear bright green under blue and ultraviolet light.

In technical terms, the labeling method developed by Fox and his group is defined as an inverse-electron-demand Diels-Alder reaction. In it, an electron-rich cyclooctene dienophile reacts with an electron-poor diene, tetrazine.

In addition to working rapidly, the chemical reaction process works in water and can withstand interference from the many complex reactions that occur within biological systems.

Currently, Fox and his team are collaborating with other groups to use the UD technique to put radioactive labels on proteins. Such a "tagged" protein could be designed to bind to a cancer cell versus a normal cell, for example, he says, providing high-resolution diagnostic imaging.

Fox says his group came upon the discovery while working in a completely different area.

"Sometimes you have to leave yourself open to let the science tell you where to go," he notes.

He and his research team are working to perfect the chemistry of the reaction to make it as useful as possible. Since the original paper was published, the second generation of the chemical reaction already has been developed.

Avian flu research a national partnership

The University of Delaware's expert staff and state-of-the-art avian influenza facilities play a critical role in the health of the poultry industry, a major food resource and economic driver on the Delmarva Peninsula.

Yet UD's avian influenza diagnostics and emergency response programs have impacts far beyond the region.

UD is a member of a national partnership of 18 leading research institutions called the Avian Influenza Coordinated Agricultural Project (AICAP), which is working to prevent and control avian influenza.

Originally established in 2005, the project received a \$5-million renewal grant from the U.S. Department of Agriculture's (USDA) Cooperative State Research, Education and Extension Service last year.

In addition to UD, and the University of Maryland College Park, where the grant is administered, participating institutions include Virginia Tech, Auburn University, University of California-Davis, University of Georgia, USDA-ARS-Southeast Poultry Research Laboratory, Ohio State University, Oregon State University, Texas A&M University, and Western University Health Sciences.

"The AICAP is unique and successful because it brings together top scientists to broadly address avian influenza challenges facing animal agriculture," says Jack Gelb, chairperson of the Department of Animal and Food Sciences, professor of avian virology, and director of UD's Avian Biosciences Center. "It basically applies the land-grant agricultural philosophy to an important disease with clear poultry health consequences and potential human health implications."

Among its accomplishments since it was founded in 2005, AICAP has:

- ◆ Assembled the first continent-wide network to study the ecological and biological characteristics of avian flu viruses isolated from wild birds;
- ◆ Shown that quail can change and expand the host range of avian flu viruses, and found that quail respiratory and intestinal tracts have human-like sialic acid receptors that could partially explain the emergence of avian flu strains with the capacity to infect humans;
- ◆ Developed a comprehensive training program for producers and veterinarians in 33 states and in Canada and Brazil;
- ◆ Developed a test for rapid diagnosis of avian flu in birds; and
- ◆ Developed promising vaccines for mass immunization of birds.

Avian influenza research and outreach activities at UD are supported by AICAP, as well as state and other federal funds. Projects include surveillance programs in commercial poultry, backyard flocks, and wild birds; development of rapid diagnostic tests; emergency poultry depopulation research; in-house composting for responding to catastrophic poultry losses; efficacy of disinfectants and common chemical compounds on avian influenza virus; viral



Doctoral student Michele Maughan is investigating the immune response of different poultry species to avian influenza.

pathogenesis and vaccine evaluations; and regional, national, and international technical assistance programs. Internationally, UD researchers have assisted scientists from Turkey, India, Bulgaria, and Romania.

UD's avian influenza diagnostic team received special recognition at the 2008 Delmarva Poultry Industry (DPI) awards ceremony. The team routinely performs surveillance for avian influenza among commercial broiler chickens and backyard flocks and tests diseased flocks.

"One of this group's watershed moments was when the workloads peaked at an all-time high in 2004, the year Delmarva's chicken industry encountered and successfully controlled low-pathogen avian influenza," said Bill Satterfield, DPI executive director at the event. "These individuals were the backbone of poultry diagnostic services on Delmarva, with the help of other colleagues in the University of Delaware and in the region. Our industry owes a great deal to this team for its talents, willingness to pitch in when necessary, and hard work over the years."

For more information about UD's poultry health system and the Avian Biosciences Center, visit ag.udel.edu/abc/.

Newsmakers

Compelling, intriguing, relevant ... University of Delaware experts are in the news on local airwaves to international media nearly every day. Here are selected highlights from print, broadcast, and online media during the past year.



Elson comments on Wall Street crisis

Charles Elson, Edgar S. Woolard Jr. Chair and director of the John L. Weinberg Center for Corporate Governance, is UD's most-quoted expert. In 2008 alone, he was quoted more than 150 times in local to international media, from Delaware's *News Journal* to the *Wall Street Journal* and CNN's "Finance News."

Featured on NBC's "Today Show," Sept. 17, 2008, in a segment about the financial crisis on Wall Street, Elson said: "The amount of money these folks were making was really absolutely incredible. And the problem was because they argue that they knew such — so much more about this than the rest of us, that there was no accountability, there was no counterweight to what they were doing. And that's where the greed became unbridled greed."

UD offshore wind research in national news

UD's offshore wind power research has been sweeping across the nation and around the world. Willett Kempton, associate professor of marine policy, established the first graduate course in offshore wind power in the United States at UD in 2005.

On Sept. 28, 2008, *The New York Times Magazine* described the political process that took offshore wind power from concept to possibility in Delaware, starting with the landmark study led by Kempton's graduate student Amardeep Dhanju, which quantified the Mid-Atlantic offshore wind resource.

In *Nature* on April 16, 2009, Kempton said he "expects that, by 2018, the United States will be installing offshore wind capacity at a rate of 500 megawatts per year and will employ hundreds of scientists in design development, impact assessments, manufacturing and installation."



Stroke research highlighted

Darcy Reisman, assistant professor of physical therapy, was featured on *Ivanhoe News'* "Discoveries and



Darcy Reisman

Breakthroughs Inside Science" for her research on retraining the brain after a stroke.

She's determining if a specially designed split-belt treadmill may speed a stroke patient's recovery. The belts can run together or be programmed to run separately. When a patient's legs move at two different speeds, the brain sends an error signal to the cerebellum, which controls coordination. Her research shows that for a period after usage, stroke patients have an easier time walking on solid ground.



Use native plants in the garden, expert advises

Douglas Tallamy, chair of UD's Department of Entomology and Wildlife Ecology and author of the acclaimed book *Bringing Nature Home: How Native Plants Sustain Wildlife in Our Gardens* (Timber Press, 2007), recently has been interviewed by *The New York Times*, *USA Weekend*, and other media.

"Most native insects cannot, or will not, eat alien plants," said Tallamy in an interview for "Native Delaware," UD Cooperative Extension's weekly column in the *Wilmington News Journal*.

"When native plants disappear, so, too, do native insects. A land without insects sounds like a gardener's dream; doesn't it?" Tallamy said. "But a land without insects is a land without most higher forms of life," he noted.



Prof shares campaign insights from "epicenter of politics"

Numerous media sought out Joseph Pika, James R. Soles Professor of Political Science and International Relations, for expert comment on the presidential election, months before and after.

From August 23–26, 2008, alone, Pika was featured in a *Washington Post* online discussion of the selection of UD alumnus Joe Biden as the vice presidential candidate on the Democratic ticket, quoted in *USA Today* about the selection, and cited in a *Bloomberg News* story that hailed UD as the "epicenter of politics" for its many connections to the presidential campaign. In addition to Vice President Biden and Second Lady Jill Biden, who are both UD alumni, presidential campaign strategists David Plouffe for the Democrats, and Steve Schmidt for the Republicans, also attended UD.

Prof lauded as a “modern Caravaggio”

The work of Stephen Tanis, who retired from the UD art faculty in 2000, was recently shown at the University Gallery and highlighted in a review in the *Philadelphia Inquirer*.

“Tanis is a remarkably robust realist with demonstrable roots in Old Master technique and attitude,” wrote art critic Ed Sozanski. “In particular, he often resembles a modern incarnation of the Italian master Caravaggio. His realization of figures and still lifes is exceptionally vibrant, and imbued with such spatial and psychological tension, as to make most of what his contemporaries are producing look insipid by comparison.”



“Phone Call” by Stephen Tanis



Peter Feng (left) and Turner Classic Movies host Robert Osborne

Feng cohosts TCM series

Peter X Feng, UD associate professor of English and women's studies, co-hosted the film series “Race and Hollywood: Asian Images in Film” on Turner Classic Movies (TCM) with Robert Osborne last June.

Feng authored *Identities in Motion: Asian American Film and Video* (2002), is editor of *Screening Asian Americans*, and serves on the *Journal of Asian American Studies*' editorial board.

UD composites on Sundance, Discovery Channel

What do you get when you combine soy oil and chicken feathers? Richard Wool, professor of chemical engineering, is turning the unlikely combo into cool stuff like computer circuit boards and hurricane-resistant roofs.

Wool directs UD's Affordable Composites from Renewable Sources (ACRES) program at the Center for Composite Materials. The program's innovative research was featured during the past year on the Discovery Channel's “How Stuff Works” and on the Sundance Channel's “Big Ideas for a Small Planet.”

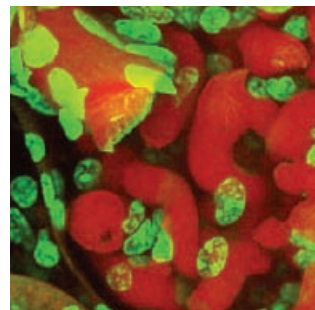


Richard Wool

UD gives new view into kidney on Apple Web site

Professor Emeritus Roger Wagner's three-dimensional modeled images of a glomerulus — one of about two million renal corpuscles found in the human kidney — debuted on the Apple Web site in “Inside the Image: How Scientists See the World.”

Modeled images allow anatomic structures to be observed from any angle. They also provide precise quantitative information because data are rendered in volume elements called voxels. Thanks to these images, we now know there are about 19 miles of capillaries in a single kidney, Wagner said.



Begleiter interviewed about Pentagon policy on photos of the fallen

In February, the Associated Press, *Washington Post*, National Public Radio, and other media interviewed Ralph Begleiter, Edward F. and Elizabeth Goodman Rosenberg Professor of Communication and Distinguished Journalist in Residence, about plans by the Obama administration to review the ban on photography of coffins of men and women killed in military service, and the administration's decision to lift the ban on Feb. 26. Begleiter filed a Freedom of Information Act lawsuit in response to the ban in 2005.

In his commentary on the policy reversal published on CNN.com, Begleiter concluded: “This dramatic change in government policy should once again allow all Americans to see the full human cost of war, while paying respect to those who served their nation as well as to their families.”



Policy leader urges changes in energy habits

John Byrne, Distinguished Professor of Energy and Climate Policy, director of the Center for Energy and Environmental Policy, and a member of the Nobel Prize-winning Intergovernmental Panel on Climate Change, said that people hold the key to solving the climate problem, not technology, in an April 18, 2009, article in the *News Journal*. Over the past year, Byrne has been interviewed for several articles in Delaware's top-circulation newspaper, which recently initiated an “All Green to Me” Web site with “go green” news, blogs, and tips.

“There are things we can do today,” Byrne stressed. “Our buildings and our driving — Delaware has a long way to go.”

Expanding passenger rail service and getting people to use it is a step the region's leaders need to take, Byrne said. Turning off lights, limiting power usage at peak times, and making sure buildings aren't leaking heat in winter and air conditioners aren't working too hard in summer are steps we all can take.



John Byrne



Physics of teardrops on *LiveScience*

Doctoral student Kara Maki and Richard Braun, professor of mathematical sciences, are using mathematical computer models to find out how fluid travels through the eye and leaves as teardrops. The research was reported on *LiveScience*.

“The reason why we're interested in studying this is because it's a highly dynamical system,” Maki said. “If we can try to understand and gain insight into tear film dynamics, we can aim at trying to find better treatments for dry eye.”



STUDENT HONORS

Nearly 3,500 graduate students are engaged in research and scholarship activities across 115 master's and 43 doctoral programs at the University of Delaware. Each year, more than 700 UD undergraduates also actively participate in research. The honors highlighted here, selected from dozens across UD, demonstrate the excellence and promise of our student scholars.

Names in bold — University Honors Program students

Rivers named 2009 Truman Scholar



William Rivers, a UD student working on an Honors Degree with Distinction in international relations with a concentration in U.S. foreign policy, has been named a 2009 Truman Scholar. He is the seventh UD student to win the prestigious award in the last eight years.

The award provides \$30,000 for graduate study, along with priority admission and supplemental financial aid at several premier graduate institutions, leadership training, career and graduate school counseling, and special

internship opportunities with the federal government.

Recipients must be U.S. citizens, have an outstanding record of achievement and leadership ability, and be committed to careers in government or the not-for-profit sector.

For Rivers, the scholarship will help to pay for law school, which he said he hopes will eventually lead to a career as a U.S. attorney or a federal prosecutor.

"The positions are the point of contact between humans and the Department of Justice," Rivers said. "Going to law school would give me the opportunity to be the best advocate I could be. I will pray about it and talk about it. It's a fantastic opportunity, and I want to see how I can benefit the most people by doing this."

Longwood grad student selected to attend national forum



Jackie Bergquist, whose research focuses on disaster management in public horticulture institutions, was invited to participate based on professional and community leadership.

Graduates of UD's Longwood Program, a partnership with Longwood Gardens in Kennett Square, Pa., manage some of the nation's finest public gardens and horticultural institutions.

Jackie Bergquist, a Fellow of UD's Longwood Graduate Program in Public Horticulture, was selected by the Institute of Museum and Library Services to attend the national conservation forum "It's Alive! Petals to Primates: Preservation Challenges of Living Collections" in February in San Diego.



Grad student wins prestigious fellowship from American Heart Association

Megan Wenner, a doctoral student in the Biomechanics and Movement Sciences Program, won a \$21,000 pre-doctoral fellowship from the American Heart Association last year to support her dissertation research on the effect of salt intake on persons who take Celebrex, a prescription drug for arthritis, to see if the drug increases sensitivity to salt.

"The fellowship is very competitive, and her application scored in the excellent rating," says her adviser, William Farquhar, associate professor in the Department of Health, Nutrition and Exercise Sciences.

Wenner, who completed her Ph.D. earlier this year, is now pursuing postdoctoral research at Yale University on reproductive hormones and body fluid regulation.

Marco Bedolla (left) and Aleksey Dvorzhinskiy are UD's 2009-10 Goldwater Scholars.



Goldwater Scholars aim for careers in science and engineering

Aleksey Dvorzhinskiy, a junior biological sciences major, and **Marco Bedolla**, a junior chemical engineering major — have won Barry M. Goldwater Scholarships, one of the top awards in the United States for undergraduates studying mathematics, science, and engineering. The award covers the cost of tuition, fees, books, and room and board up to \$7,500 per year.

Since freshman year, Dvorzhinskiy has been working in the laboratory of Diane Herson, associate professor of biological sciences, on the resistance of a strain of *Salmonella* to antimicrobial compounds. He plans a career in medicine and wants to earn both his M.D. and Ph.D. so that he can conduct biomedical research and integrate his findings in patient care.

"The opportunity to do undergraduate research has been one of the best things about the University of Delaware," Dvorzhinskiy said. "While I have gained a great deal from my traditional coursework here, I believe the true strength of my academic training comes from the hands-on research experiences that I have had."

Bedolla, of Newark, Del., also has been involved in research at UD since his freshman year. Working in the lab of Mark Barteau, Robert L. Pigford Chair of Chemical Engineering, Bedolla is exploring the gas-phase epoxidation of propylene. He plans to pursue a Ph.D. in chemical engineering. His career goal is to lead a research group in surface chemistry and catalyst design and possibly teach at the university level.

Art history student awarded Thaw Curatorial Fellowship



Janet Dees, a doctoral student in art history, received the Eugene Thaw Curatorial Fellowship for two years at SITE Santa Fe, a

contemporary arts organization in New Mexico.

Dees will be doing research for exhibitions, working with artists, and developing her dissertation on Sherman Fleming, Adrian Piper, and Linda Montano, well-known artists who combine visual and performance arts.

At UD, Dees served as an instructor and curated the exhibition "In Remembrance: Artists from the Paul R. Jones Collection." Other honors include the Alisa Mellon Bruce Predoctoral Fellowship from the National Gallery of Art and awards for outstanding achievement and excellence in teaching from the UD Department of Art History.

Economics student wins research, teaching honors



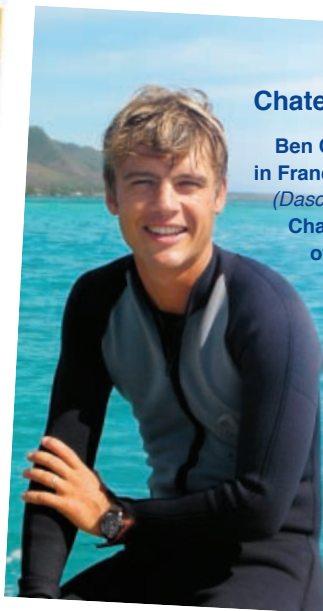
Stela Stefanova has forged a path of accomplishment on her way to a doctorate in economics.

During the past year, Stefanova won the 2009 Lerner College of Business and Economics' Graduate Student Excellence in Teaching Award and the University's 2008 Excellence in Teaching Award for Graduate Students.

She also was selected for two summer internships at the U.S. Department of Agriculture. Based on her work there, she and her co-authors won a best paper award at the American Agricultural Economics Association conference, and she also took first place in the association's annual poster competition.

Last August, Stefanova and fellow economics doctoral students

Chateaubriand Fellowship winner studying reef fish



Ben Ciotti, a doctoral student in marine biosciences, is doing research in France and French Polynesia on the ecology of juvenile damselfish (*Dascyllus aruanus*) living in coral reefs with support from a Chateaubriand Fellowship from the Office of Science and Technology of the Embassy of France in the U.S. Ciotti is one of 20 graduate students from American universities to be selected for the honor.

Every year, the Chateaubriand Fellowship provides pre- and post-doctoral researchers in science, humanities, and social science positions with the opportunity to conduct their studies in some of the best research institutions in France. Recipients receive a monthly stipend, roundtrip airfare to France, and health insurance.

Ciotti is examining the genetic and physiological properties of the young damselfish that survive on various experimental reefs around the island of Moorea near Tahiti and testing whether these properties vary according to the environmental conditions at each site.

Laura Cojocar and Leo-Rey Gordon were chosen by the National Science Foundation to attend the third Lindau Nobel Laureate Meeting in Economic Sciences in Germany, where they had the opportunity to interact with 14 Nobel Laureates.

Sussman Prize honors stellar doctoral graduates

Michelle V. Knights, graduate of the Department of Human Development and Family Studies, and Bethany Welch, graduate of the School of Urban Affairs and Public Policy, won the College of Education and Public Policy's Sussman Dissertation Prize.

The award was established in 1997 by Marvin B. Sussman, the former Unidel Professor of Human Behavior who was widely regarded as a truly interdisciplinary scholar. Sussman died in 2007.

Knights' dissertation, "Environment and Process: Exploring Developmental Pathways of Self-Regulatory Capabilities in Young Children at Risk," looked at how preschoolers develop the ability to control their own behavior in social settings. She is now an assistant professor of human development and family science at Messiah College in Grantham, Pa.

Welch's dissertation, "The Catholic Church and Revitalization: A Case Study of the Office for Community Development of

the Archdiocese of Philadelphia," investigated how religious institutions in America have expanded their role into areas such as community development, housing, public affairs, social services, and education. She is now a senior research associate at the Center for Governmental Research in Rochester, N.Y.



Bethany Welch, left, and Michelle Knights, won the Sussman Prize.



Three receive Fulbright awards

Three University of Delaware students received 2009 Fulbright Scholarships for research in Europe and Southeast Asia.

The Fulbright Program is the flagship international educational exchange program sponsored by the U.S. government through the U.S. Department of State's Bureau

of Educational and Cultural Affairs. It is designed to "increase mutual understanding between the people of the United States and the people of other countries."

◆ **Megan Fisher**, a recent graduate in biological sciences, will take classes at the Ludwig-Maximilians-Universitaet Muenchen in Germany and conduct research with Jochen Graw at the Helmholtz Zentrum Muenchen (German Research Center for Environmental Health), investigating the role of BetaB2-crystallin in intracellular signaling.

◆ **Jared Larson**, doctoral student in political science and international relations, will travel to Lisbon, Portugal, to study the effects of Muslim immigration to Spain and Portugal.

◆ In affiliation with Atma Jaya University in Jakarta, **Timothy McKinnon**, doctoral student in linguistics, will continue his work to save an endangered language — the Malay dialect known as Kerinci — on Sumatra, Indonesia's largest island.



FACULTY HONORS

University of Delaware researchers are high achievers! Among our distinguished faculty are internationally known authors, scientists, and artists, including Guggenheim Fellows, Fulbright Fellows, and members of the National Academy of Sciences, National Academy of Engineering, and Nobel Prize-winning Intergovernmental Panel on Climate Change, to name only a few. Here is a selection of honors from the past year.

FRANCIS ALISON AWARD



Lynn Snyder-Mackler

Lynn Snyder-Mackler, Alumni Distinguished Professor of Physical Therapy, is the 2009 recipient of the University of Delaware's highest faculty honor: the Francis Alison Award.

The award, consisting of a \$10,000 prize and membership in the Alison Society, recognizes the professor who best characterizes "the scholar-schoolmaster" exemplified

by Francis Alison, who founded in 1743 the institution that is now the University of Delaware. His first class of students included three future signers of the Declaration of Independence and one signer of the U.S. Constitution.

Snyder-Mackler is an international leader in orthopedic rehabilitation research, with expertise in knee, shoulder, and spine rehabilitation and neuromuscular electrical stimulation.

A certified sports physical therapist and athletic trainer, she has written over 100 research articles, given 165 presentations in the U.S. and 12 foreign countries, and is an investigator on \$6 million in research projects. She also is the academic director of UD's nationally ranked graduate program in Biomechanics and Movement Science and directs the Physical Therapy Clinic and the Sports Physical Therapy Residency.

FRANCIS ALISON SOCIETY'S YOUNG SCHOLARS AWARD



Michael Shay

Michael Shay, assistant professor of physics and astronomy, won the Francis Alison Society's Young Scholars Award. Shay studies plasma physics, including the explosive release of magnetic energy referred to as "magnetic reconnection" and other multi-scale processes using massively parallel computer simulations. His work has application to diverse phenomena from solar flares, to Earth's magnetosphere and space weather, to controlled fusion devices.



Norris honored for achievement in art conservation

Debra Hess Norris (above right), vice provost for graduate and professional education, Henry Francis du Pont Chair in Fine Arts, and chairperson of the Department of Art Conservation, received the 2008 University Products Award for Distinguished Achievement in Conservation from the American Institute for Conservation of Historic and Artistic Works. The award recognizes the accomplishments of leading conservation professionals who have advanced the field and furthered the cause of conservation.

The University of Delaware is one of only five institutions in the United States to offer the graduate degree in art conservation including an emphasis in photographic conservation. Norris's former students comprise approximately 70 percent of professional photograph conservators in America.

Norris also recently was appointed to the U.S. National Commission for UNESCO as a representative for heritage preservation.



Ten win national awards

Ten UD assistant professors have won prestigious awards in the past year from federal and industry grant programs designed to support the work of academia's "rising stars."

Five received the National Science Foundation's Faculty Early Career Development Award: E. Fidelma Boyd, from biological sciences; Matthew Doty, materials science and engineering; Jingyi Yu, computer and information sciences; and Christopher Meehan and Jack Puleo, civil and environmental engineering.

Matt Oliver, oceanography, was selected for NASA's New Investigator Award in Earth Sciences, and Thomas Epps, chemical engineering, and Erik Thostenson, mechanical engineering, won the U.S. Air Force Young Investigator Award. Joshua Zide, materials science and engineering, received the U.S. Office of Naval Research Young Investigator Award; and Maciek Antoniewicz, chemical engineering, won DuPont's Young Professor Grant.



Biologist E. Fidelma Boyd is working to determine what role global environmental change may play in the emergence of pathogenic microbes.



Internet pioneer inducted into National Academy



David Mills

David Mills, professor of electrical and computer engineering, was elected in 2008 to the National Academy of Engineering,

one of the highest distinctions accorded to an engineer.

Mills is among a group of researchers who helped build the Internet. He developed the Network Time Protocol, which synchronizes the clocks of computer networks. Without it, among only a few examples, stock market buy and sell orders could not be timed, and Web streaming of video would be chaotic. The protocol also makes possible such online activities as air traffic control, radio and TV program control, and real-time teleconferencing.

Having mastered time on Earth, Mills says his new interest is keeping time in space, noting that time-keeping and celestial navigation are intertwined. He'd like to make the Network Time Protocol work on Mars.

Profs win Ford Foundation Diversity Fellowships



Rosalie Rolon-Dow



Stacey Simon

Rosalie Rolon-Dow, assistant professor of education, and Stacey Simon, postdoctoral researcher at the Delaware Biotechnology Institute, won Ford Foundation Diversity Fellowships last year. Only 20 of the awards are made annually by the National Research Council.

Physicist wins Humboldt Award

Thomas K. Gaisser, UD's Martin A. Pomerantz Chair of Physics and Astronomy, has received a prestigious 2009 Humboldt Research Award from the Alexander von Humboldt Foundation in Germany.

Conferred in recognition of lifetime achievements in research, it is one of the top awards bestowed by the German government to renowned scientists worldwide. The award, valued at 60,000 euros, enables the recipient to spend six months to a year at a German institution working with colleagues on a research project.

Gaisser, shown here at the South Pole, leads the UD research team that is building the "IceTop" surface array of detectors for "IceCube," the world's largest neutrino telescope, which is being constructed deep in the Antarctic ice. Neutrinos are high-energy particles that can tell us more about phenomena ranging from the sun's activity and Earth's structure, to the origins of cosmic-ray particles in the early universe.



Rolon-Dow is studying the educational experiences of Latino students and how they are shaped by linguistic and cultural factors in U.S. schools.

As part of UD's rice epigenome project, funded by the National Science Foundation, Simon is exploring the regulatory roles of small RNAs in rice in response to infection by the fungal pathogen *Magnaporthe oryzae* (rice blast).

American Society of Agronomy, and the American Association for the Advancement of Science. In 2002, he was designated a "highly cited researcher" by the Institute of Scientific Information.

Economics prof named "Saving Star"

James O'Neill, professor of economics, was named Delaware's 2008 First State Saves Saving Star for "his extraordinary commitment to financial education and independence."



James O'Neill

First State Saves is the local campaign of America Saves, a nationwide coalition of nonprofit, business, and government organizations that encourages and assists Americans in lowering their debt and saving for the future.

Since 1972, O'Neill has directed UD's Center for Economic Education and Entrepreneurship, which is nationally known for its hands-on economics teaching programs for teachers of all grade levels. Besides educational programs for teachers, the center sponsors a master of arts in economics and entrepreneurship educator program and the Stock Market Game for grades 4–12. O'Neill also leads the Delaware Council on Economic Education.

- ◆ Antoniewicz's research focuses on manipulating biological systems for the production of sustainable energy sources for biofuels.
- ◆ Boyd is examining the seaborne pathogen *Vibrio vulnificus* as a model organism for understanding the emergence of pathogenic microbes and the role of global environmental change in this process.
- ◆ Doty is researching quantum dot molecules, "artificial molecules" that can be controlled at the electron level, with potential applications in lasers and other optoelectronics and in developing novel materials.

Oceanographer Matt Oliver is developing satellite techniques to look beneath the ocean's surface.



sided" surfaces formed in stiff clays or shales and devising a service-learning program on engineering reconnaissance after disasters.

- ◆ Oliver's aim is to take the use of satellites to a new level, to estimate the three-dimensional structure of environments under the ocean's surface.
- ◆ Puleo's research focuses on coastal processes in the swash zone, where waves and beach meet. He's developing a new model for predicting shoreline changes.
- ◆ Thostenson is studying novel micro- and nano-structured composites for sensing and actuation.
- ◆ Yu is creating a framework to characterize and design new multi-perspective cameras and displays for computer vision and graphics applications.
- ◆ Zide is developing new semiconductors and nanocomposites for thermoelectric power generation.



Chemical engineer Thomas Epps is researching new technologies for energy storage and generation.

- ◆ Epps is working to create conducting membranes for energy generation and storage devices, from batteries to solar cells.
- ◆ Meehan is studying the seismic behavior of weakened "sicken-

Sparks elected Distinguished Geochemistry Fellow

The Geochemical Society and the European Association for Geochemistry elected Donald Sparks, S. Hallock du Pont Chair of Plant and Soil Sciences and director of UD's Center for Critical Zone Research, a geochemistry fellow, an honor awarded to less than one percent of the membership of the combined societies each year.



Donald Sparks

Sparks is a leading expert on the kinetics of geochemical processes and the application of synchrotron radiation techniques to study the fate and transport of metals and nutrients in soils and other natural systems.

Sparks also is a fellow of the Soil Science Society of America, the

UNIVERSITY Books

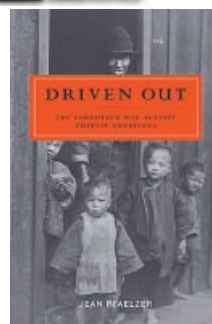
A selection of books by UD authors and their publishing honors



Pfaelzer wins national literature award



Jean Pfaelzer, professor of English, won the 2008 Asian/Pacific American Award for Literature in the nonfiction category for *Driven Out: The Forgotten War Against Chinese Americans*. The book, published by Random House, was named one of the 100 Notable Books of the Year by the *The New York Times*, one of *Choice* magazine's top academic books, and one of *The Bloomsbury Review's* favorite books in 2007.



The Asian/Pacific American Librarians Association, which presented the award, noted that "drawing upon a number of sources," Pfaelzer "details the racial tensions that forced many Chinese immigrants from California and the Pacific Northwest. The Chinese were targeted by white laborers, who burned down their homes, banished residents, and drove them from their shops. However, the Chinese fought back and resisted. They asked for reparations, organized strikes and demanded civil rights. Pfaelzer's research is an important contribution, and she sheds light on a history that has been perhaps too little-known."

Dying Inside details prison's 'lethal abandonment'



Dying Inside: The HIV/AIDS Ward at Limestone Prison details the deadly circumstances — the mass imprisonment that came with mandatory sentences, decreased prisoner rights, limited privatized medical care, and the HIV epidemic — that have made a horror of segregated HIV/AIDS wards at many American penitentiaries.

The book was written by Benjamin D. Fleury-Steiner, UD associate professor of sociology and criminal justice, with Carla Crowder, former investigative reporter for the *Birmingham News*, and published by the University of Michigan Press. It focuses on the problems associated with Dorm 16, the ward for prisoners suffering from HIV/AIDS at Limestone Correctional Facility in Harvest, Ala.

Fleury-Steiner says the solution to the problem is a dramatic decrease in prison populations to enable administrators to cope with the public health crisis within their walls. He also believes there must be a national debate on how America deals with marginalized populations, particularly prisoners.

Authors spotlight social responsibility in apparel biz



Marsha Dickson, professor and chairperson of UD's Department of Fashion and Apparel Studies, Suzanne Loker of Cornell University, and Molly Eckman of Colorado State University in the preface of *Social Responsibility in the Global Apparel Industry*, published by Fairchild Books.

"This is a book we wish was unnecessary to write. But this book is necessary to write," say Marsha Dickson, professor and chairperson of UD's Department

"Unsafe factory conditions, long hours, inadequate pay, and use of toxic chemicals are not isolated incidents but widespread, systemic problems throughout the global apparel industry," the authors say.

Dickson and her coauthors address the complexity of identifying and finding solutions for such problems as child labor, harassment and abuse, discrimination, excessive work hours, low wages, factory health and safety, and limits on freedom of association. They also highlight innovative measures and best practices of leaders in responsibility.

Anthology celebrates Delaware authors

As Delaware is sometimes referred to as the Diamond State, it should be no surprise that the stories and poems included in



On The Mason-Dixon Line: An Anthology of Contemporary Delaware Writers might be compared to jewels that sparkle with their own special luminosity.

Published by the University of Delaware Press, the book is co-edited by Billie Travalini, founding director of the New Castle Writers' Conference and fiction editor of the *Journal of Caribbean Literatures*, and Fleda Brown, UD professor emerita of English and former poet laureate of Delaware. It includes over 50 poems, short stories, essays, and excerpts from novels and memoirs that help define what it means to be a Delawarean.

Prof named a top author of chemical engineering books



Stanley Sandler

Stanley Sandler, UD's Henry Belin du Pont Chair of Chemical Engineering, has been named one of "Thirty Authors of Groundbreaking Chemical Engineering Books" by the American Institute of Chemical Engineers for "creat[ing] a major part of the heritage and shared experience of all chemical engineers."

Sandler said his book, *Chemical, Biochemical, and Engineering Thermodynamics* (Wiley), grew out of his own confusion about the subject as an undergraduate.

"Most of the previous books presented thermodynamics in a way that required students to memorize a specific way to do every problem. I thought it would be more effective to have a small set of very general equations and then be able to treat every new problem as a special case of those equations. That's how I taught myself, so I decided to write a textbook to teach others in this way," he said.

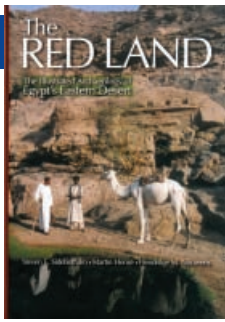
Since the first edition's publication in 1977, he has revised the book three times, incorporating changes based on new technology and student feedback.

The Red Land explores Egypt's Eastern Desert

Ancient dwellers of the Nile Valley feared the desert, which they referred to as "the Red Land." Although reluctant to venture there, they exploited the region's mineral wealth and profited from valuable goods originating from Arabia, Africa, India, and elsewhere in the east that were conveyed across the desert between the Nile and Red Sea ports.

The Red Land: The Illustrated Archaeology of Egypt's Eastern Desert, by Steven Sidebotham, professor of classical archaeology and ancient history at UD, with freelance artist/archaeologist Martin Hense and archaeologist Hendrikje Nouwens, reveals the cultural and historical richness of this little-known region.

Archaeological sites from pre-historic to Byzantine times are featured, with treasures ranging from petroglyphs to emerald mines. Through the latest research, artistic reconstructions, and 250 photos, the authors lead the reader into "the hauntingly beautiful Eastern Desert to discover its human history." The book is published by the American University in Cairo Press.



tivists, students, and others, with a foreword by U.S. Vice President Joseph R. Biden Jr., a UD alumnus, the book is an outcome of

Delaware's 2004 Redding Symposium, marking the 50th anniversary of the landmark Supreme Court decision that brought about desegregation in U.S. schools.

Wrote reviewer Mark Tushnet, William Nelson Cromwell Professor of Law at Harvard Law School: "This splendid collection" provides a "well-rounded understanding of the experience of desegregation in Delaware and, as important, around the nation." The Pennsylvania State University Press published the book.

Prof teaches how to innovate in new book

David Pensak wonders what the world would be like if we didn't need sleep. For starters, he says, the real estate industry would collapse. Who would need a six-bedroom house?

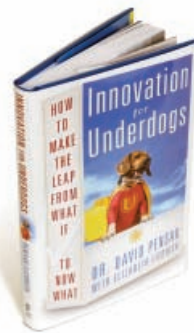
Pensak, adjunct professor of business administration at UD, has spent his whole life wondering about "what if's?" Now, he's encouraging all of us to do the same in his book, *Innovation for Underdogs: How to Make the Leap From What If to Now What*.

Anyone can innovate, Pensak says. Adults should look to kids as role models.

"Kids are the most creative and innovative creatures on the planet," he says. "Gradually it fades away as people try to accommodate what teachers want, and later what bosses want."

An accomplished innovator with a doctorate in chemistry, retired from a 30-year career at DuPont, Pensak created the Internet firewall

and has 38 patents, with more applications being prepared in agricultural chemistry to solid-state physics to business-process modeling. Career Press published the book.



Book explores women's role in politics worldwide



Marian Palley

Although women represent more than half the world's population, they account for only 15 percent of its elected officials.

Women and Politics around the World, by Marian Lief Palley, UD professor of political science and international relations, and Joyce Gelb, professor of political science at the City College of New York, examines the progress women have made in achieving political equality. The two-volume set is published by ABC-CLIO.

Volume one examines general issues such as reproductive rights, education, and political development, as well as trafficking and violence against women.

Volume two profiles 22 different countries, examining the history and current state of women's political and economic participation in each nation. Contributors included International and U.S. authors.

Desegregation focus of Choosing Equality

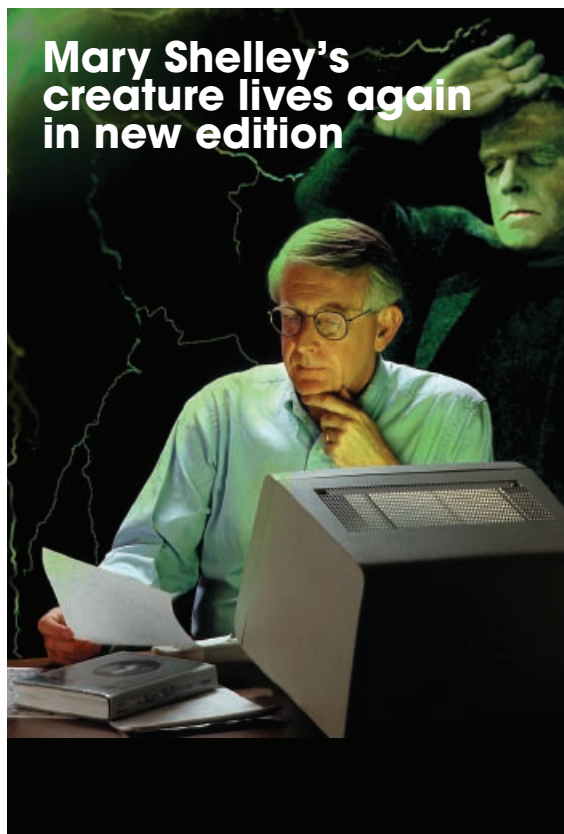


Leland Ware

Choosing Equality: Essays and Narratives on the Desegregation Experience, edited by Leland Ware, UD's Louis L. Redding Profes-

sor of Law and Public Policy, and Robert Hayman, Jr., professor of law at Widener University, provides an overview of desegregation since *Brown v. Board of Education*, focusing on Delaware as a microcosm reflecting the national scene and also looking at events across the country.

A compilation of essays on desegregation by scholars, judges, lawyers, community ac-



Mary Shelley's creature lives again in new edition

Did Mary Shelley really write the most famous monster story of all time, or does the credit belong to her husband, poet Percy Shelley?

The Original Frankenstein (2008) published by the Bodleian Library at the University of Oxford may put an end to the literary debate. Edited by UD English professor Charles Robinson, the book contains the version edited and amended by Percy Shelley, and a second version in which most of Percy's changes are removed.

Although Percy deleted many words and contributed at least 4,000 words to the 72,000-word novel, Robinson says the manuscript evidence attests to the fact that the novel was conceived and mainly written by Mary Shelley.

Examining the manuscripts leaf by leaf at Oxford, Robinson says he was aptly inspired: "The library became a laboratory, and the 'hideous progeny' of Mary Shelley's *Frankenstein* once again came to life," he notes.



A DISCOVERY-ORIENTED CAMPUS

The University of Delaware has a long tradition of excellence, from our founding as a small private academy in 1743, to the research-intensive, technologically advanced institution of today.

Seven colleges and more than 60 research centers reflect the diversity and rigor of UD's research activity and our commitment to improving the world we live in. A thriving study-abroad program and expanding international partnerships provide additional opportunities for discovery.



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