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ENGINEERING

Summer 2010

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ENGINEERING *Summer 2010*

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Dr. Metin Duran, Associate Professor of Civil and Environmental Engineering, and Lauren Glose CE '11 in the Environmental Microbiology and Biotechnology Laboratory

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Message from the Dean

Not long ago, Villanova's College of Engineering articulated its goal to become a premier engineering program in the country, while maintaining the University's Catholic values.

In pursuing this goal, the College committed to a five-year strategic plan for achieving our chief aspirations to build a reputation for innovative curricula, teaching, and research, and to lead in the development of intellectual and humanitarian engineers. Concurrently, we resolved to measure our success against these goals by the success of our alumni and the view of our peers.

After just three years of progress, we have made great strides toward fulfilling many of our goals:

- **At the College level, we've increased the diversity of our student body and faculty,** with a goal to exceed national averages for underrepresented groups in engineering. We have added new opportunities for students and faculty to develop unique STEM education experiences for middle and high school students in our community. We have also strengthened ties to alumni and industry partners, whose ongoing committment continues to open doors for our students. This fall, we'll introduce yet another way to connect our students with the professional engineering community – a state-of-the-art Multidisciplinary Design Laboratory.

- **In Undergraduate Studies, we successfully completed the inaugural year of our new First-Year Curriculum,** among the most innovative freshman engineering experiences in the country. Our departments now offer revised curricula to allow for more electives and minors – including the new bioengineering minor (developed with the College of Liberal Arts and Sciences) and the entrepreneurship minor (through collaboration with the Villanova School of Business). We've also increased participation in summer research experiences and internships.

- **In Graduate Studies and Research, we've reinvigorated our master's of science degree programs and launched one of the nation's first M.S. degree programs in sustainable engineering.** We've solidified the foundation for Ph.D. studies, which is growing quickly, with nearly 30 candidates currently enrolled. And finally, we've launched a new multidisciplinary research center – the Villanova Center for the Advancement of Sustainability in Engineering.

Read on to see how these strategic initiatives came to life in the 2009-2010 academic year.

We're pleased with the progress we've made but look forward to addressing the challenges that remain and to aligning our goals with the University's new strategic plan. To read more about the College's achievements or University's strategic plan, visit **www.Villanova.edu.**

Sincerely,

Gary A. Gabriele, PhD
Drosdick Endowed Dean of the College of Engineering

HANDS-ON LEARNING

New First-Year Curriculum Promotes Experiential Education

by Debbie Clayton

Freshman students worked in teams on multidisciplinary projects, including one focused on the aerodynamics of vehicles, reducing drag, and saving energy.

Before Ian Dardani arrived at Villanova as a freshman engineering student last fall, he was pretty sure he'd decided which engineering discipline was right for him. But halfway through second semester, he changed his mind. Now, he's confident that mechanical engineering holds a future for him.

Dardani credits his decision largely to the new hands-on First-Year Curriculum program at the College of Engineering. The program requires freshmen to participate in two seven-week mini projects by mid second semester. By exposing students to multiple disciplines within each project, the new program strives to solidify career paths earlier in the college experience.

"I think this is definitely a good direction," says Dardani, who participated in engineering fairs and learned technical drawing and AutoCAD software during high school in Syracuse, N.Y. "I elected to do the SMARTBEAM project second semester and found the math and science behind it very satisfying. It incorporated civil, mechanical, and electrical engineering. Just being around so many different kinds of professors really gave me a good feel for what each discipline does."

The brainchild of Dr. Gerard (Jerry) Jones, Associate Dean for Undergraduate Studies, and a multidisciplinary faculty committee, the new First-Year Curriculum evolved from a similar program Dr. Jones championed as a mechanical engineering professor in the early 1990s. Designed for mechanical engineering sophomores, the earlier hands-on program emphasized reverse engineering. For various reasons, the first program ended, but Dr. Jones never stopped dreaming of a workable experiential learning model.

"I knew that hands-on – or what we call experiential – learning worked well with

Student teams built dialysis filter units for "The Artificial Kidney" project.

educating engineers," explains Dr. Jones, who has been at Villanova for 23 years, six of them as Chair of the Department of Mechanical Engineering and the last three as Associate Dean. "We wanted to build hands-on, multidisciplinary projects into the freshman curriculum wherever we could. At the same time, students need some basic fundamentals before they start working on projects. Otherwise, all they'd be doing is tinkering – not that tinkering is bad, but it's not an effective learning tool."

Villanova's College of Engineering retention figures – defined as those remaining in engineering after freshman year – average an impressive 90 percent, compared to roughly 70 percent at other engineering programs. However, in addition to maintaining high retention numbers, the new curriculum program endeavors to maintain underrepresented groups, such as women, minorities, international students, and those challenged due to lack of high school experience. Surveys indicate that these students tend to transition out of engineering in greater numbers than their fellow students.

"Many students come to us with high school experience in robotics and various software packages," explains Stephen Konyk, Assistant Professor of Electrical and Computer Engineering. "Previously, we were taking them right into the classroom and grinding them with mathematics and engineering fundamentals. But the newer students don't work that way. They need a reason and a motivation to buy into education. We really needed to find a better way of challenging them early on. Rather than telling them to have faith and sit in the corner until sophomore year, the new program engages them in their first semester."

Core Course and Mini Projects

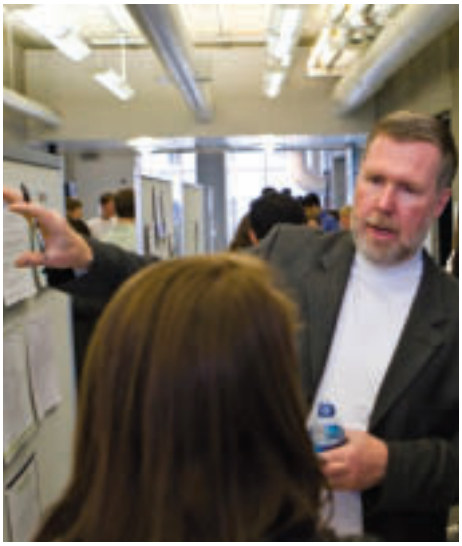
Breaking the two-semester sequence into four parts, the new program begins with a core course the first quarter. "It starts with lecture but then every week students do a micro project on a number of multidisciplinary topics," adds Dr. Jones, who continues to do research and teach mechanical engineering. "Students usually worked on micro projects outside the classroom. For example, they studied momentum and vectors utilizing pool balls at the Connelly Center pool table. They had a lot of fun with that one!"

Mini projects took place the second half of the fall and first half of the spring semesters. Students selected one of six multidisciplinary projects, switching to a different project second semester. Projects included:

- *Application of Acoustic Technologies for Predicting Structural Failure*
- *Experimental Evaluation of a SMARTBEAM*
- *Robotics and MATLAB Programming*
- *Electric Car Design*
- *The Artificial Kidney – Improving Dialysis*
- *Aerodynamics of Vehicles – Reducing Drag, Saving Energy*

Dr. David Dinehart, Professor of Civil and Environmental Engineering and Director of the Structural Engineering Teaching and Research Lab, taught the acoustics and SMARTBEAM projects. "Students were most excited about getting into the lab," he says. "They really relished that they got to build things. They actually made concrete and cut beams for the acoustics project. Getting them that excited about engineering was very rewarding to me."

Roughly 12 faculty members were involved in the program. At the end of each project, the students presented technical



Dr. Gerard Jones, Associate Dean for Undergraduate Studies

The Engineering Gene

Engineering blood runs deep in Maureen McManus's family in Harrison, N.Y. Her father is an engineer and both of her older sisters are engineering students. "My mom's an English teacher, but I didn't get those genes," she jokes.

Knowing that she, too, wanted to be an engineer, McManus chose Villanova University for its small class sizes and its wide variety of labs. But she didn't expect the new First-Year Curriculum program when she started as a freshman in 2009.

"It's much better working in the labs and talking one-on-one with the professors than just sitting in the classroom," she says. "I know students who really weren't sure what type of engineering they wanted to do. This way, they got to test out what they liked before making the decision."

McManus, on the other hand, knew she wanted to go into mechanical engineering before arriving at Villanova. Her two mini projects – aerodynamics and acoustics – simply confirmed that choice. "The new program is amazing!" she adds.

Students applied lessons learned from the core course to their multidisciplinary projects.

papers, participated in competitions, or gave a poster presentation. "By the end of those three quarters, students had done one core course and two mini projects," says Dr. Jones. "Then, in the middle of spring semester, they selected their majors." The last seven-week session was spent studying in the chosen disciplinary field.

Sharpening Communication Skills

One of the things Dr. Dinehart and his colleagues set out to accomplish with their projects was to improve their students' communications skills. They devoted one lecture to making a formal presentation, including PowerPoint development and transferring technical information to a poster. Another lecture focused on putting together a technical report, covering figures, text, and tables. At the end of the semester, the freshmen participated in a poster presentation attended by administrators, faculty, graduate students, and upperclassmen.

"I was amazed at the quality of their presentations – the results were far above what your typical freshmen could do," notes Dr. Dinehart. "My seniors and graduate students who came to the poster session said 'oh wow, we wish we'd gotten a chance to do that as freshmen!'"

But the students weren't the only ones who benefited from the new program. Dr. Dinehart felt he learned a lot from working with other faculty members he'd previously not encountered day-to-day. Konyk enjoyed engendering excitement in the students. "They'd stay up all night – even over the weekend – to work on some of the projects," he says.

With a successful pilot year complete, the faculty plans to regroup for future planning for the program. "One of the tasks we're currently addressing is how to evolve the new program over the next two years," explains Dr. Jones. "However, we don't want to make many changes yet. It would be rash on our part to reach conclusions based on one year of data."

Still, Dr. Jones and his colleagues plan to make a few tweaks for next year. Though the mini projects will remain the same, they may introduce an alternate one on micro hydroelectric power. In addition, they are considering adding an honors section to the initial core course. But based on feedback so far, the program is a resounding success with both students and faculty.

"The new curriculum is light years ahead of what we were doing before," Konyk notes. "We still have to refine what we're doing and assess the process in terms of impact on the students and faculty. But my gut feeling tells me this curriculum is a good thing."

Planning by Committee

Planning for the new First-Year Curriculum began in January 2008. Dr. Jerry Jones helmed the committee of five faculty members:

- James O'Brien, Assistant Professor of Mechanical Engineering
- Dr. Joseph Yost, Associate Professor of Civil and Environmental Engineering
- Dr. Frank Mercede, Assistant Professor of Electrical and Computer Engineering
- Edward Char, Instructor, Electrical and Computer Engineering
- Dr. Randy Weinstein, Professor and Chair of the Department of Chemical Engineering

After writing a request for proposals to the College, the committee encouraged faculty members and members of the College's research centers to submit ideas for mini projects. The Center for Advanced Communications proposed the acoustics project and the Center for Nonlinear Dynamics and Control suggested the robotics project. Groups of faculty members submitted the other four projects. Each was evaluated and funded the summer before first semester 2009.

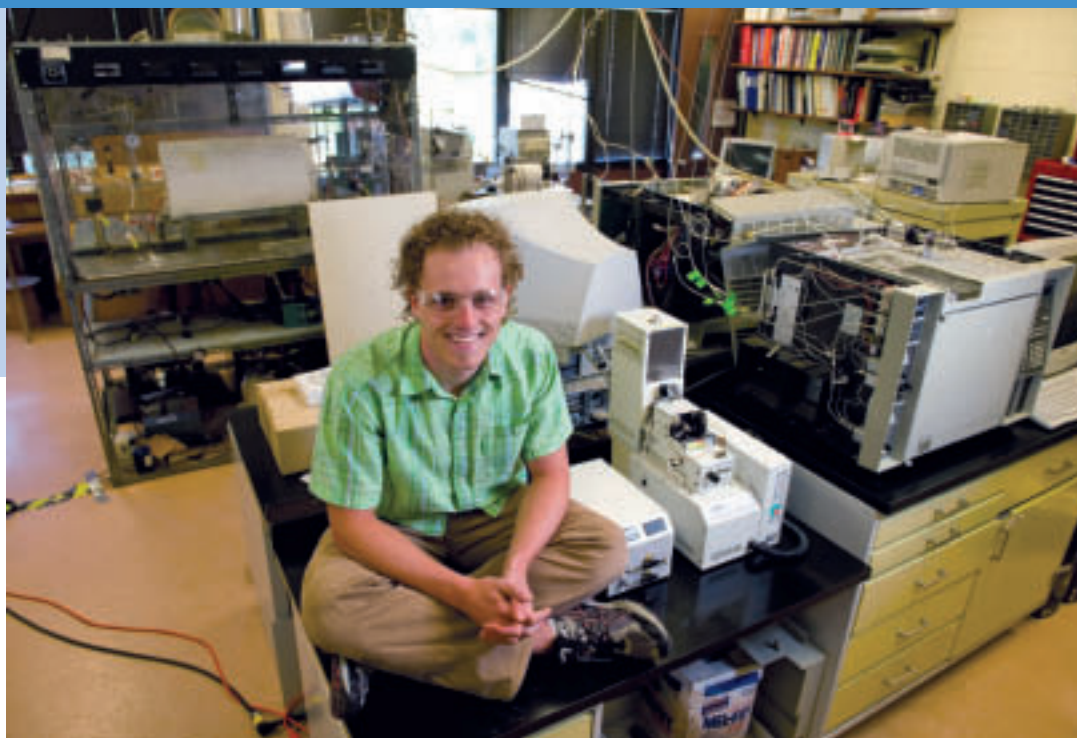
SUSTAINABILITY: POLICY AND PRACTICE

"You discover the Earth's springing energy, its amazing beauty, its most excellent potency... to praise your Creator you make the Earth's cry your own."

—St. Augustine, Enarratio in Psalmum 144.13

by Christopher Murray

Villanova's commitment to sustainability is rooted in Augustinian values and can be seen as far back as 1970 when students and faculty embraced the inaugural Earth Day. Four decades later, environmental sustainability continues to be part of the fabric of the University community, evidenced by the implementation of a Campus Environmental Sustainability Policy, pledging the University to sustainable practices.



Justin Yeash ChE '09 is among the first students to pursue the new master's of science degree in sustainable engineering.

In addition, Father Peter M. Donohue reaffirmed this campus-wide mission in 2007 by signing the American College and University Presidents' Climate Commitment, which strives to make Villanova a climate-neutral campus.

Most importantly, these beliefs are manifesting themselves in tangible practices, including the University's designation as an arboretum with 1,500 trees of 250 different species, green buildings and roofs, and recently hosted environmental conferences. More and more, sustainability is an integral component of campus infrastructure, curricula, events, and the University's growing research strengths. Perhaps nowhere is that more apparent than within the College of Engineering.

Master's of Science in Sustainable Engineering

The College of Engineering recently launched a master's degree program in sustainable engineering to better position students for success in the ever-changing professional landscape.

"We are not just keeping up with the times; we are setting the times," explains Dr. Randy Weinstein, Chair of the Department of Chemical Engineering and director of the new degree program. "That is the key to a successful future in a global society that is rapidly evolving."

While acknowledging the critical need for renewable resources is important, understanding the engineering implications and taking action to help address technical problems and improve the planet is paramount. The launch of this program epitomizes the College's leadership in this growing field, which is woven through all engineering disciplines.

"There are social, political, and economic sides to sustainability, along with the ever-important engineering issues," says Dr. Weinstein. "We are taking a multidisciplinary approach through all our engineering departments. Our solutions are not discipline-specific, as we are looking at ways to improve renewable energy, decrease resource usage, and provide access to clean water all at the same time."

Faculty members in each engineering discipline are bringing their research into the classroom, using campus as the primary laboratory and demonstration model.

"In White Hall, we are monitoring energy, water usage and temperature, and analyzing why costs are what they are; at the end of our analysis, we may implement changes based on the findings," adds Dr. Weinstein.

The program is flexible, offering classes on campus and online, allowing full- and part-time students to pursue a full degree or graduate certificate, with or without a thesis option. It is designed for a broad range of

Dr. Robert Traver, Director of VCASE, connects research into sustainability with the features of Villanova's campus, such as the wetlands located alongside the Structural Education Teaching and Research Lab.

students and professionals, including those just completing their undergraduate work, as well as accomplished engineers.

"This degree is for people striving to be their best and those who want to make changes for the better," adds Dr. Weinstein. "People with MBAs and other master's of science degrees are coming back because of the relevance of the subject matter."

The courses aren't focused solely on engineering topics.

"One of the courses we teach is a social economics course, co-taught by professors of business, philosophy, and engineering," says Dr. Weinstein. "We recognize this is not just about engineering solutions, but rather, engineering as part of the bigger picture of sustainability."

Attracted to Integration

It was this holistic approach that attracted Villanova alumnus and current College of Engineering graduate student Justin Yeash ChE '09 to the degree program.

"I feel a need to care for the Earth," says Yeash, "and I came to Villanova because of the unique opportunity to attend a Catholic school, where there is an integration of faith and studies, part of which is responsibility for the environment."

Yeash further explains his interest in sustainable engineering because it encompasses many disciplines: economics, politics, ethics, and environmental studies.

"In sustainable engineering, you are trained to examine all externalities and recognize the downstream implications of a company's operations," says Yeash. "It's not about ways to make new energy, but rather, ways to use the energy we already have more efficiently."

According to Yeash, the engineer who is focused on sustainability looks at whole systems and the interconnectedness of decisions. "For example, how can a company make its supply chain more efficient and use less energy to transport the same amount of goods?"

Right now, major corporations are committing themselves to sustainability, and not just to save the planet. "The bottom line of sustainability is efficiency," adds Yeash, "and efficiency saves money. It is a win-win situation."

Faith and Work

"It is very unique that I, as an engineering student, can dialogue so easily with the head of mission and ministry at Villanova and incorporate those values into my work," says Yeash. "Theology and sustainability are deeply connected, and I love the opportunity to bring these two disciplines together in my work, while having a profound impact on people and the environment."

This field and Villanova's degree program will continue to grow and evolve. "The courses in 10 years could be different than today," says Dr. Weinstein. "Problems and complexities change, and so will we; we can't teach about problems of the past with solutions of the past."

The degree is also a great way for alumni to get involved in the program.

"Our hope is to set up fellowships and undergraduate scholarships," concludes Dr. Weinstein, "and alumni working in various fields can help give students the opportunities to advance themselves."

These opportunities can help students take their passion to the next level.

"Villanova offers me 'ultimate life integration,' where I can focus my loves into a career at an institution that is committed to maintaining its Catholic identity, while expanding its research capabilities."

VCASE

This evolution of the engineering profession has also led to the creation of the Villanova Center for the Advancement of Sustainability in Engineering (VCASE), which houses multidisciplinary research and teaching on campus in areas including alternative and renewable energy, environmental sustainability, and watershed and infrastructure management.

VCASE research focuses on alternative/renewable energy, environmental sustainability, and watershed and infrastructure management.

Justin Yeash ChE '09 and Amanda DelCore are pursuing the M.S. in sustainable engineering.

"We are looking at ways to reduce man's impact on the planet," says Dr. Pritpal Singh, Chair of the Department of Electrical and Computer Engineering and the solar energy expert of the group. "We want to use resources more efficiently to minimize fossil fuels and move toward renewable alternatives such as higher-efficiency, low-cost solar cells."

"We created VCASE because it no longer makes sense for engineers to work as individuals," adds Dr. Robert Traver, Professor of Civil and Environmental Engineering and Director of VCASE. "Sustainability needs to be inclusive, not exclusive, and engineers need to look at multiple components of situations they are asked to address; everything is multidisciplinary."

Sustainable engineering practices can already be seen in many projects to which the College of Engineering lends its expertise and support:

- Stormwater sustainability has long been a focus at Villanova. The campus master plan offers more opportunity to advance and analyze the impact of a green infrastructure approach to stormwater management across the entire campus.
- In addition, the Center for Engineering Education and Research (CEER) has a green roof, which not only supports vegetation, but also has thermal properties, naturally insulating the building. CEER also boasts a 4 kilowatt solar electrical system that provides energy.
- Fedigan Hall's geothermal energy and LED lighting systems are saving energy and lowering costs.
- Porous paving and rain gardens around campus allow water to infiltrate the soil, reducing damaging runoff to the Darby and Mill Creek Watersheds.

"Research is the experimental process of looking at new ideas," adds Dr. Traver, "and our campus is the best laboratory to conduct these experiments and examine these ideas."

According to Dr. Traver, in today's academic environment, the university infrastructure should be a place to do research and apply what is learned. "Overall, there is more green research and coordination happening on campus, which is introducing students to new technologies," adds Dr. Traver. "Our Facilities Department is part of the educational process, and everyone benefits from that."

Because of the active research on campus, there is equipment in place that can be used to teach. "It gives us an opportunity to really bring students in and give them practical experience," says Dr. Traver. "VCASE research supports the curricula, allowing students to apply theory and principles learned in the classroom," adds Dr. Singh.

Complementing the tangible work on campus, VCASE frequently hosts industry and community outreach activities.

Last fall, the Center hosted a smart grid symposium, which covered a diverse range of topics for approximately 150 faculty, students, and professionals who engaged in quality dialogue on the changing dynamics of the electric grid system and the evolution of intelligent appliances. A two-day seminar on stormwater held every two years attracted nearly 300 attendees in 2009.

VCASE also reaches out to other disciplines by holding seminars on campus for students and faculty, demonstrating sustainability expertise and opportunities.

"I am very proud of the willingness of faculty to come together and create this tremendous opportunity for our students and the University," says Dr. Traver. "There are natural partnerships with nursing, business, and law to fully round out the educational impact of VCASE."

"Moving forward, our hope is to expand our reach to include other universities and build partnerships with engineering firms and manufacturing organizations," Dr. Traver continues. "Potentially, we could develop new technologies and commercialize them," adds Dr. Singh.

"Industry knows what industry needs and is very interested in the next generation of employees," concludes Dr. Traver. "Therefore, they have a vested interest in supporting education in sustainable engineering."

As St. Augustine said, "to seek the highest good is to live well." At the College of Engineering, living this Augustinian ideal means a tradition of service to, and care for, one's community every day.

ENGINEERING FOR LIFE

Villanova's Cellular and Molecular Bioengineering Research Group Discovers New Ways to Improve Quality of Life

by Carly Keeny

According to the National Academy of Engineering (NAE), if the 20th century's greatest engineering achievements revolutionized the way we live, work, travel, and communicate, then the 21st century demands a dual engineering commitment to advancing society and improving the overall quality of life.

Dr. William Kelly (left) in the Biotechnology Lab

Sherrie-Ann Martin ChE '09 (left) worked with Dr. Noelle Comolli

Together with the National Science Foundation, the NAE established a global committee of engineering experts to identify the top engineering priorities of the 21st century. When the group unveiled its final list of "Grand Challenges for Engineering" in 2008, nearly half were initiatives that require the incorporation of bioengineering techniques.

As bioengineering continues to evolve as a central component for societal advancement, Villanova students and faculty are well-poised to contribute meaningfully to the way new medicines are developed and delivered, chronic health issues are diagnosed and treated, water supplies are purified, and new research breakthroughs are discovered thanks in part to the College of Engineering's Cellular and Molecular Bioengineering Research Group.

This multidisciplinary research group includes faculty experts in mechanical, civil and environmental, electrical, and chemical engineering who share resources and information, learn from one another, and maintain the College's new state-of-the-art Core Genomics Laboratory (funded by a National Science Foundation Major Research Instrumentation grant, which opened in 2009 and allows for scientific exploration at the gene level). Along with their undergraduate and graduate students, the group conducts research projects that, although varied, hold the promise of a positive impact on living systems.

Improving Biopharmaceutical Processes

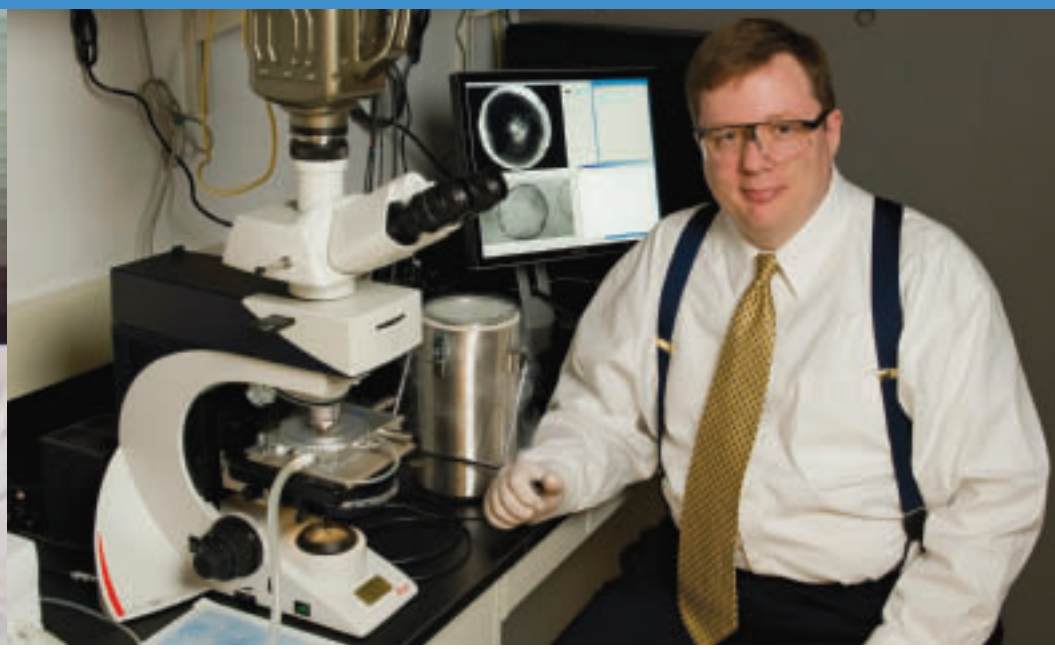
With more than 20 years of experience in bioprocessing, Dr. William Kelly, Associate Professor of Chemical Engineering, has spent his career at the intersection of biology and engineering. Dr. Kelly came to Villanova via pharmaceutical giant Merck and Company, where he developed vaccines and improved the systems used to create materials for Merck products.

> **"The research I have done in bioengineering at Villanova has allowed me to gain the experience I needed in order to land a full-time position in the pharmaceutical industry."**
>
> *— Stefanie McDermott ChE '10*

Today, Dr. Kelly focuses on research that can help pharmaceutical companies grow cells that improve drug performance and refine the systems required to purify products. "My experience at Merck has absolutely informed my work here at Villanova," says Dr. Kelly. This experience has also made him an ideal partner for a number of sponsored research projects conducted in his Biotechnology Laboratory on behalf of Eli Lilly; Centocor, Inc.; and GlaxoSmithKline, in addition to his former employer, Merck.

This year, Dr. Kelly secured a two-year, $50,000 grant from GlaxoSmithKline to help the company optimize chromatography, the process by which molecules used to make a drug are extracted from cells. "This work is tied to a real drug in their pipeline, and the outcome could affect what protein purification strategy is chosen for large-scale manufacturing," says Dr. Kelly. Stefanie McDermott ChE '10 helped kick off the project, which will include computer modeling and experimentation.

In addition, Dr. Kelly has also helped



(right) as an undergraduate student to research drug delivery improvements. *Dr. Jens Karlsson in the Biothermal Sciences Laboratory*

pharmaceutical companies grow CHO cells, which secrete antibodies beneficial to humans, and then separate the protein desired for medicines. He is also working with plasmids extracted from E. coli bacteria, which can be loaded with genetic material for gene therapy drugs.

Improving Drug Delivery

Having grown up with asthma, Dr. Noelle Comolli, Assistant Professor of Chemical Engineering, knows the importance of having an effective drug treatment to manage an attack. Unfortunately, about 25 percent of asthmatics don't respond to traditional treatments of steroids or albuterol. This non-response can be life-threatening.

In her Biomaterials and Drug Delivery Laboratory, Dr. Comolli improves drug performance and delivery by engineering existing medicines to work efficiently in a different dosage, release differently over time, reduce side effects, or target specific problems. Currently in collaboration with a medical doctor from Penn Medicine, Dr. Comolli and graduate student Matt Scionti ChE '09 are developing a new asthma treatment that will deliver a high dose of Vitamin D directly to inflamed lung cells.

"Through the Department of Chemical Engineering, I have been exposed to aspects of bioengineering that I didn't know existed, and I have been able to discover my real passion."

— Olivia Donaldson ChE '10

"When inflamed, lung cells present receptors for albuterol, which normally attaches to cells and signals the stop of inflammation," says Dr. Comolli. "For those who don't respond traditionally, we're trying to target that same cell receptor with albuterol on the outside of a particle so it will still attach, but inside, the particle will contain enough Vitamin D to stop the inflammation." Her goal is to deliver these particles in a traditional liquid inhaler or nebulizer.

In addition, Dr. Comolli is also working on designing nanoparticles to add to drugs that can speed axon growth after spinal cord injury, developing biodegradable thin film deliveries that can be loaded with anti-inflammatory drugs and applied directly inside the body after surgery, and developing microparticles that can be added to cancer drug therapies to target tumors directly.

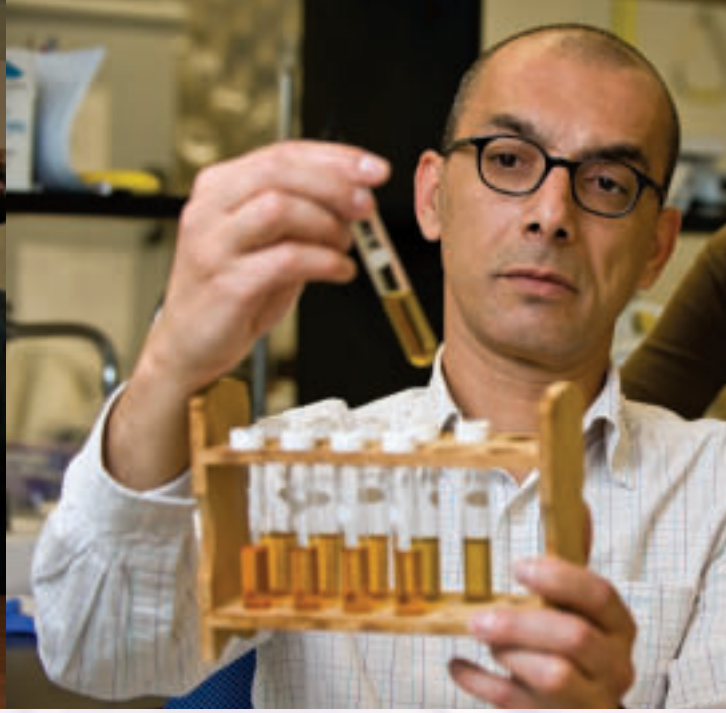
Preserving Cells and Tissue

In the Biothermal Sciences Laboratory, Dr. Jens Karlsson, Associate Professor of Mechanical Engineering, and his team investigate the effect of extreme temperatures on living systems. A current focus of the laboratory is to develop novel strategies for cryopreservation of cells and tissue. If perfected, cryopreservation technology will open the door for mass production of tissue-engineered medical products used in organ and tissue transplantation.

"Outside the body, living tissues can only last for a few hours before the cells begin to die," says Dr. Karlsson. "Because cryogenic temperatures can provide a shelf life of many years, the development of successful cryopreservation techniques for cells and tissue would make possible manufacturing of tissue-engineered organs on a commercially viable scale."

Dr. Karlsson received a three-year, $280,000 grant from the National Science

Susan Mischinski ME '10 (left) works with Dr. Ani Ural (right) on microlevel bone research.



Dr. Metin Duran (left) and graduate student Yasemin Dilsad Yilmazel research waste conversion in the Environmental Microbiology and Biotechnology Lab.

"Villanova has some of the most advanced technology in the bioengineering field and offers all students an opportunity to work with it."

— Kathleen Bommer ME '11

Foundation to study how ice crystals damage cells during the freezing process. He is using a unique high-speed imaging cryomicroscope to detect ice formation in tissue-engineered endothelial constructs, made using cells from the lining of blood vessels.

Dr. Karlsson is also collaborating with Dr. Angela DiBenedetto, Associate Professor of Biology, to develop cryopreservation methods for zebrafish embryos – an important animal model for research in genetics and development. Because they are so popular for biological research, scientists have produced so many genetic variations that it is becoming impossible to maintain the fish stock required to preserve each genetic strain. "If you can cryopreserve the embryos, you can easily store zebrafish strains until they are needed, at which time the embryos can be thawed and allowed to develop into live fish," says Dr. Karlsson, who is assisted by Kathleen Bommer ME '11 on this project.

Identifying Fracture Risk

Dr. Ani Ural, Assistant Professor of Mechanical Engineering, applies new ways of identifying fracture risk to different hierarchical structures of bone to see how they impact osteoporosis.

Wrist and hip bones are different sizes and shapes, but they share the same make-up and structure at the macro level. Studies show that if a person suffers a low-energy hip or spine fracture, he/she likely suffered a Colles' fracture, or a break in the wrist at the radius, about 10 years prior.

"We want to predict the Colles' fracture to prevent eventual fracture in the hip and spine," says Dr. Ural, who uses a computational model to predict the level of load that will cause fracture. Next, she hopes to incorporate CT scan images from real patients to determine which load might cause fracture, based on the patient's age, bone geometry and material, as well as the fall type and wrist position.

"Under the guidance of Dr. Wu, my fellow lab members and I have turned our lab into one of the premier consolidating porous medium labs in the country."

— Robert Crawford, graduate research assistant

At the micro level, Dr. Ural explores bone microstructures (osteons, cement lines, and pores) to determine the impact of microcracks. "We want to understand how microstructures change over time, at different ages, and how those changes – and their ability to withstand microcracks – affect the overall bone," says Dr. Ural. Susan Mischinski ME '10, who worked on micro level bone research as an undergraduate, will conduct the next phase of research under Dr. Ural's direction when she returns to Villanova this summer as a graduate student.

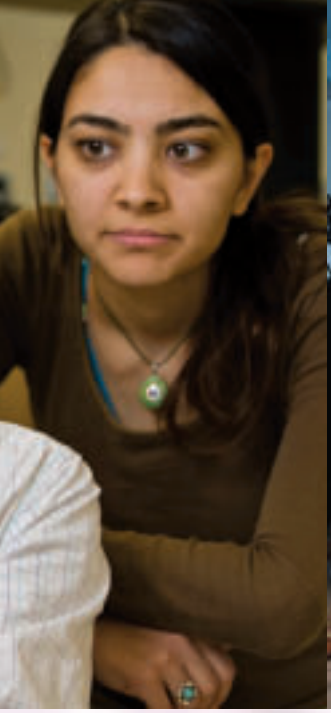
Incorporating Biomimicry

For Dr. Qianhong Wu, Assistant Professor of Mechanical Engineering, discoveries made from the human body have the potential to impact the human experience.

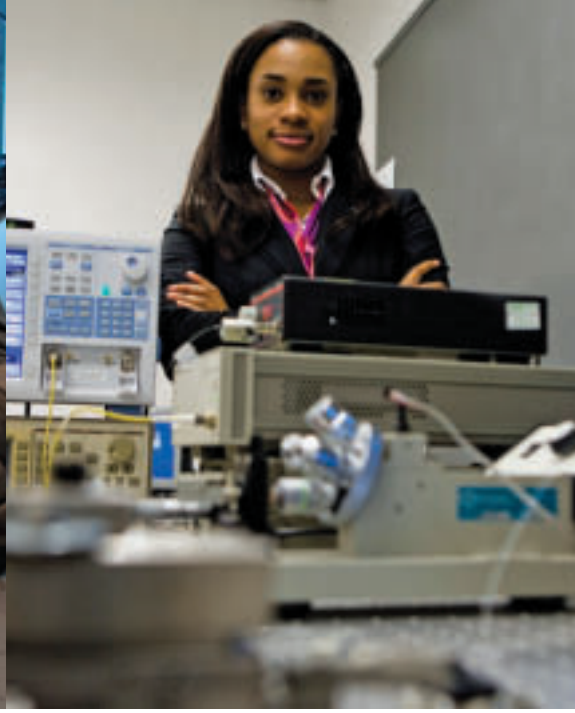
Dr. Wu works to understand the role of the endothelial glycocalyx layer (EGL), which coats the surface of all microvessels. This layer is critical because damage to it contributes to conditions like type 2 diabetes, atherosclerosis, and other cardiovascular diseases.

"We've discovered the EGL's role as a lubricator for the motion of blood cells in a capillary. Now, we want to understand the mechanotransduction mechanism via the layer – its role as a sensor for communicating what's going on outside the endothelial cells," says Dr. Wu. In the Cellular Biomechanics and Sport Science Laboratory, Dr. Wu is working with a team of graduate and undergraduate students to expose human umbilical vein endothelial cells to fluid flow with different conditions to determine response.

Dr. Wu also employs biomimicry to apply biology-based lessons from microcirculation to a new concept called "super lubrication." "What we learn from the human body can be developed into something used in everyday life," says Dr. Wu. "We're working on a 'super lubricator' for machinery that completely eliminates friction, which by extension, also reduces heat genera-



Dr. Qianhong Wu and his students have developed a renowned porous medium lab.



Dr. Rosalind Wynne, Associate Professor of Electrical Engineering

"It is a wonderful feeling going into some of the undergraduate courses already having a knowledge of different experimental processes and machinery because of my work in the lab."

—Lauren Glose CE '11

tion, energy consumption, and greenhouse gas emissions."

For this work, a team of graduate and undergraduate students have built several unique experimental setups designed to characterize the permeability of various soft porous materials, measure lift generation during rapid compression, and monitor the friction as a planing surface glides over them. Dr. Wu and his team hope to apply the fundamentals learned to the development of functionalized nano-porous materials that can be used as a soft porous bearing with greatly reduced friction and infinite life.

Developing Alternative Energy

"Waste not, want not" is a way of life in the Environmental Microbiology and Biotechnology Laboratory, where Dr. Metin Duran, Associate Professor of Civil and Environmental Engineering, and members of his research group convert wastewater byproducts into alternative energy.

"The Core Genomics Laboratory gives us the ability to understand the genetic mechanisms that allow microorganisms to convert waste into methane or ethanol and use that information to optimize those processes," says Dr. Duran.

During the wastewater treatment process, about 50 percent of what's treated becomes a byproduct, which goes directly to the landfill. "If you can tie the production of energy to waste material, it's an ideal solution," says Dr. Duran. This year, Dr. Duran secured a one-year, $26,000 grant from a local company hoping to enter the renewable energy area. "We're trying to find ways to increase the natural microbial activity that converts byproduct into ethanol," he says.

Dr. Duran has secured more than $250,000 in funding from the Philadelphia Water Department over the last two years. Two recent projects are related to "energy from waste concept" with a total budget of nearly $90,000. "Naturally-occurring methanogens digest biosolids, the organic matter present in wastewater," says Dr. Duran. "We put these microbes into an engineered system designed to optimize the digestion process, which results in methane gas, a resource the water department hopes to harness." The team is also looking into converting "scum," the fats and oils collected during the wastewater treatment process, into methane as well.

Detecting Chemicals with Fiber Optics

Dr. Rosalind Wynne, Associate Professor of Electrical Engineering, is applying her expertise in fiber optics to improve technology used to identify the presence of chemicals in water systems, airflow, and the human body.

"I want to use fibers to develop spectroscopy techniques that enhance the 'state-of-the-art' for devices that environmentalists and the health-care community use to detect pathogens, proteins, or chemicals in the samples they measure," says Dr. Wynne.

For example, an environmentalist seeking the presence of E. coli bacteria in water will apply tags to the sample that glow in the presence of the bacteria. Fibers improve the collection of light fluorescence used to monitor the tags and allow the same sensitivity of detection with smaller sample sizes of materials.

To determine water quality, Dr. Wynne hopes to build a fiber-based portable, handheld device that can be used by the government, water treatment facilities, or the military for field work. She also sees the potential to develop similar devices that the medical community can use to detect chemicals that are markers for diseases.

Meeting the Challenge

One hundred years from now, a future generation of engineers will outline the top engineering challenges for the 22nd century. Almost certainly, their decisions will involve a thorough analysis of how well the 21st century's engineers met their chief challenges. The work of the Cellular and Molecular Bioengineering Research Group and the students they work with will be woven into that fabric of accomplishment. For more information on undergraduate, graduate, and faculty research at the College of Engineering, visit **www.Engineering.Villanova.edu.**

SERVANT LEADERS

Engineering Students Lead by Putting Others First

by Carly Keeny

When former AT&T executive Robert Greenleaf published his 1970 essay "The Servant as Leader," he introduced a new concept in leadership that "begins with the natural feeling that one wants to serve…first. Then conscious choice brings one to aspire to lead…[it] manifests itself in the care taken…to make sure that other people's highest priority needs are being served."

Forty years later, a similar leadership style permeates the College of Engineering, where students play key roles in groups that put the needs of their global neighbors first.

In Waslala, Nicaragua, engineering students provided design services to establish reliable, clean drinking water for the local community.

Far and Away

Each year, dozens of engineering students forgo a Spring Break spent on the beach in favor of time spent on service-learning trips to remote villages in Latin America, where basic resources are scarce. What may start with a slight case of culture shock eventually becomes a transformational experience for many students, who not only hone their technical skills, but also make connections to local communities, broaden their worldviews, and sharpen their leadership skills.

"During the week you can see a gradual change in the students' feelings about being in a third world country. When they first arrive, you can see a wide range of emotions, from shock, to wonderment, and sometimes to pity," says Dr. Gary Gabriele, Drosdick Endowed Dean of the College of Engineering, who has for the past three years joined the trip to Waslala, Nicaragua. "But as they work through the week, you can see their attitudes change to respect for how hard the people work, gratitude and amazement at how friendly and generous they are, and a real sense of respect for how they make a life for themselves in such difficult situations."

This year, students fanned out to Nicaragua, Honduras, and Panama to improve local water resources.

- **In Waslala, Nicaragua,** 10 students from a variety of disciplines provided engineering design services to connect water from springs in the surrounding mountains to the villages below for reliable, clean drinking water. Annual service trips to Waslala began in 2004, and to date, more than 60 students have participated. This year's group also included Dr. Gabriele; Dr. Alfonso Ortega, Associate Dean for Graduate Studies and Research; and James O'Brien, Assistant Professor of Mechanical Engineering.

- On the 11th annual trip to the **Amigos de Jesus orphanage in Poses Verdes, Honduras,** 16 civil and environmental engineering students tackled the first water resource project in trip history – as well as a basketball court. For 10 years, students have designed and built much-needed facilities for the orphanage, which serves more than 50 children. Approximately 100 students have worked at the site, where projects have included a 30'x60' chapel and volunteer center, a school complex, and a 25-foot cross that symbolizes hope. This year's group also included Dr. Bridget Wadzuk, Assistant Professor of Civil and Environmental Engineering, and Dr. Andrea Welker, Associate Professor of Civil and Environmental Engineering.

- **In Torti, Panama,** 10 mechanical engineering students worked on a water supply intake dam and reservoir expansion project and provided design services for a water distribution system. In Panama, the College collaborates with Father Wally Kasuboski, who runs the local Capuchan Mission dedicated to improving conditions for local communities. This year's trip also included Dr. Gerard Jones, Associate Dean for Undergraduate Studies;

Engineering students and Dean Gary Gabriele in Waslala

Engineering students have provided services to Amigos de Jesus orphanage in Poses Verdes, Honduras for 11 years.

Civil and environmental engineering students developed a water filtration system and built a basketball court at Amigos de Jesus orphanage in Honduras.

Dr. Edward Glynn, Assistant Professor of Civil and Environmental Engineering; and alumnus Dan Lutz PE, owner of Capstone Development Group.

Before each trip, students learn to approach projects as "partnerships" with local communities. "We're not about imposing external ideas on local organizations. It's important that students learn the value of supporting local solutions and to see how engineering expertise can play a part in that," says Jordan Ermilio, Engineering Service Coordinator and Adjunct Professor of Mechanical Engineering.

Once the initial shock of being in unfamiliar territory subsides, there's real work to be done, and it's up to the students to choose the best course of action. "The faculty takes great pains to allow the students to identify possible projects. As instructors, our role is to ensure that there is significant engineering content to the project. As advisors, we help to facilitate the design process, but if we manage the projects like a classroom, we might miss out on the next best idea for these communities," says Ermilio.

"Being able to make the decisions as students has a big impact. You're able to say 'I designed this' for people who don't have the technical background that we have," says Maggie Carragher CE '11, who spent her second consecutive Spring Break in Honduras.

Leading by Example

On each trip, student leaders help oversee projects, manage the group dynamic, serve as liaisons to faculty advisors and local communities, and organize evening reflections. "The student leaders really set an example of engagement with the tasks at hand and enthusiasm for the goals of the trip that seems to infect the rest of the group. Leading by example is how I would characterize it," says Dr. Gabriele.

Rory Kotter ME '11, a veteran of the Villanova chapter of Engineers Without Borders (an international, non-profit organization that partners with communities worldwide to improve their quality of life), used his previous experience with water system development in Thailand and Kenya to help lead the trip in Waslala. "Through EWB, I've learned to be comfortable when I'm out of my element or trying to connect with local communities in other countries," says Kotter. "That experience helped me be a better resource to the team. I could offer advice about design work based on what I had already learned in the field or help answer questions about the sensitivities and considerations of working in a different culture."

Meanwhile, a changing work scope in Honduras meant a new mix of faculty and students this year. The only participants with any previous experience at Amigos de Jesus were four students, including Lauren Havener CE '11. With no playbook for the group to refer to as they set out to design and install a water filtration system and build a basketball court, Havener drew on previous experience to help the group navigate the basics of the orphanage, share lessons learned from the previous year, and help get the input they needed from staff . "I was able to help because I was already comfortable there; I understood the community better and knew how to get help when we needed it," says Havener.

In Panama, student leader Eric Nolan ME '11 focused on what he calls "the human aspect" of leading. "I realized there are small things you can do to make a difference – even something as simple as smiling," says Nolan. "Or, if you're trying to communicate, you should try your hardest. Even though my Spanish was poor as we surveyed local families about water needs, I kept trying, and the people really appreciated it. I just tried to demonstrate the need for patience, understanding, and having a good attitude."

Students often make personal connections with local children.

Closer Connections

The students and faculty who participate in service-learning trips together develop relationships based on opportunities for unique collaborations. "It was so impressive that they went with us, especially the deans, who at other universities might seem invisible to the student body," says Kotter. "We were all able to operate on the same level because we all had the same goals."

Havener agrees. "Allowing the students to lead the projects gives the faculty a chance to see us in a different light," she says. "The work is more collaborative than in class."

"Having the faculty and deans along gives us a chance to make more personal connections and breaks down the walls between 'student/teacher' relationships," says Nolan, who also appreciated the exposure to faculty he hasn't studied with before. "I got to know Dr. Jones very well on my trip. He's an incredible source of information, and I learned a classroom's worth of information just by talking to him. I hope to have him as a teacher!"

To learn more about these and other student service-learning trips, visit www.Villanova.edu/Engineering/Service

Going Pro

Engineering students also put their leadership skills to work for each other, from running project competition groups and student government organizations, to discipline-specific honor societies and peer mentoring groups.

The students who lead the Villanova chapters of professional engineering organizations try to give their fellow students tools they can use for life after college, including mentoring opportunities, professional networks, internship and career resources, and more.

American Institute of Chemical Engineering (AIChE)

This year, Villanova's AIChE hosted a student workshop on interviewing skills, sponsored by the local AIChE Delaware Valley section. Student members of the AIChE also have access to exclusive conferences for students, which provide access to high-profile speakers, chemical engineering trade shows, online career fairs, alumni networking receptions, and graduate school fairs.

"We want to help chemical engineers start good relationships early on in their careers," says Erik Sheets ChE '10, president. "The AIChE opens up opportunities for students to find summer research and internships."

"At Villanova, the IEEE offers members a network," says Co-Chair Sonia Guleria EE '10. That network can open doors to new professional connections, career opportunities, and different avenues to consider.

Institute for Electrical and Electronics Engineers (IEEE)

The IEEE organizes tours of companies like Boeing in Ridley Park, Pa., and the Exelon nuclear reactor in Limerick, Pa. It also hosts information sessions, where companies like Schlumberger, which provides project management and information solutions to members of the oil and gas industry, discuss opportunities in the field. The group also welcomes speakers from other types of organizations, such as financial services firms, which helps electrical engineers consider other career avenues.

American Society for Civil Engineers (ASCE)

"The ASCE looks for ways to connect students with professionals," says Maggie Carragher CE '11, president. The organization hosts several guest speakers per semester, giving members access to civil engineers from a variety of settings, including private companies, consulting firms, and government bodies.

"The speakers give us face time with working professionals who can tell us about their experience in 'the real world.' These speakers can also help open doors to internships or other networking opportunities," says Maggie Carragher CE '11.

"We're all about connecting the underclassmen in mechanical engineering with the upperclassmen," says Emily Wakelin ME '10, co-president.

American Society of Mechanical Engineering (ASME)

Cross-year relationship-building holds many benefits. "Upperclassmen, who know the lay of the land better, can serve as mentors to younger students, even for things outside of engineering," says Emily Wakelin ME '10. ASME facilitates the process at monthly meetings, special events, and field trips to inspiring places like the American Helicopter Museum in West Chester, Pa., or the Comcast Center in Philadelphia.

To learn more about the College's student organizations, visit www.Villanova.edu/Engineering/Organizations

LIFE-SAVING SOLAR SOLUTIONS

Engineering Faculty and Students Help Expand the Impact of the Solar Suitcase

by Christopher Murray

Observation sparks innovation. This simple philosophy is saving lives around the world and, thanks to a chance meeting, Villanova University engineering students are collaborators in the process.

Engineering graduate students are collaborating with the founders of WE CARE Solar to optimize the design of the Solar Suitcase, which provides reliable electricity to health clinics in developing countries.

2008

During a trip to Nigeria, Dr. Laura Stachel witnessed the devastating impact unreliable electricity has on maternal mortality rates. An obstetrician/gynecologist, Dr. Stachel saw firsthand the dangerous conditions women often face while going through childbirth in developing countries.

Doctors were working by candlelight or kerosene lamp. Expectant mothers were turned away from hospitals with no electricity. Power outages made it nearly impossible to address complications during labor such as massive bleeding, obstructive labor, seizures, and infection. Lives were lost when appropriate emergency care could not be provided.

Dr. Stachel returned to the United States committed to solving this infrastructure problem. She didn't have to look far, partnering with Dr. Hal Aronson, her husband and an expert in solar electricity.

Soon thereafter, the two founded the nonprofit organization Women's Emergency Communication and Reliable Electricity, also known as WE CARE Solar.

The Solar Suitcase

Before Drs. Stachel and Aronson could address challenges overseas, they needed to consider one oft-ignored reality. Much of the electrical equipment sent to developing countries goes unused, due to inability to operate and fix complicated machinery.

"We discussed matching solar energy with efficient appliances," Dr. Aronson says. "We knew there had to be a less complicated way to bring electricity to these countries – to minimize the wiring, while still providing sufficient power in a lightweight system."

The result was the Solar Suitcase, a portable photovoltaic system that powers lighting for treatments and surgeries, mobile communications, and essential medical devices.

Manufactured to fit inside a standard piece of luggage, the solar suitcase provides 12 volts of electricity for up to 50 hours after spending one full day in the sun. "It offers both directional and ambient light, to help perform surgery; it also charges tools such as walkie talkies, which enable real-time communication and response in healthcare facilities," says Dr. Aronson. "And getting the Solar Suitcase to these countries is simple; it's a carryon bag."

2009

Dr. Pritpal Singh, Chair of the Department of Electrical and Computer Engineering, attended the Institute of Electrical and Electronics Engineers "Humanitarian Technology Challenge Conference," where Dr. Stachel presented the Solar Suitcase and its impact on maternal health in northern Nigeria.

"I was drawn to the project when I heard the horrifying maternal mortality statistics," says Dr. Singh. "When I realized the dramatic impact low-power energy and communication technology could have, I realized our students could help save lives by harnessing the potential of solar energy."

At a follow-up IEEE Humanitarian Technology Challenge Solutions Workshop in October, Dr. Singh approached Dr. Stachel about a partnership with Villanova.

"I saw an opportunity to do further engineering of their design," says Dr. Singh. "I was confident we could come up with the next generation of the Solar Suitcase and help improve its performance."

Ask and the Door Shall Be Opened

Graduate students in the College of Engineering are currently working on designing more advanced components for the Solar Suitcase. "The Solar Suitcase is doing great things, and there is more room for improvement," says Dr. Singh. "The design is not yet optimized."

It didn't take long to get started.

"We met with Villanova's graduate stu-

In one small hospital in northern Nigeria, women were dying during childbirth at the rate of 1x per month; **the Solar Suitcase contributed to a reduced rate of one death every three to six months.** "The Solar Suitcase is doing great things, and there is more room for improvement," says Dr. Singh.

dents of engineering to discuss what improvements we could make to the functionality and efficiency of the Solar Suitcase," Dr. Aronson adds. "We are encouraging them to look at the product, understand the needs of the communities they are serving, and allow that to guide their ingenuity."

Dr. Singh is currently overseeing three students who are working to improve how the solar panel, battery, and control module interface. The students are thrilled to have the opportunity to work on a real-world application, where they are truly making a difference.

"They are excited to develop an engineering product that can be used to improve maternal healthcare and reduce mortality rates," says Dr. Singh. "This work is very impactful, tangible, and practical for the students; it inspires and motivates them."

In addition to improving the Solar Suitcase, Villanova students will be designing high-efficiency and low-power devices that can run on the same voltage as the Solar Suitcase, including ultrasound equipment, fetal heart monitors, oxygen delivery systems, and sterilization and suctioning equipment.

Why Villanova?

So what attracted two doctors from San Francisco to a University rooted in Augustinian values just outside of Philadelphia?

"We love the University," says Dr. Stachel. "There is a top engineering school, a top nursing school, an appreciation for entrepreneurship, a mission for public service, and a commitment to peace and justice. Everything that touches our mission, Villanova brings to the table."

All of this made Villanova a great home for WE CARE Solar.

"With Pritpal's vision, we see a lot of potential here to develop more products," says Dr. Stachel. "Pritpal has an amazing capacity to make things happen, and we look forward to partnering with Villanova to perform important public service in developing countries. This is a real platform for improving maternal healthcare."

Dr. Hal Aronson and Dr. Laura Stachel, founders of WE CARE Solar, developed a photovoltaic system that powers lighting, mobile communications, and essential medical devices – that fits in a carryon suitcase.

The Future

WE CARE Solar hopes to continue improving speed of communication, machinery and technology, and even medical care protocols with training material such as DVDs, in developing countries. "We are very excited to have such highly qualified engineering students and faculty focusing on this important social issue," Dr. Stachel says.

"One of our hopes is to organize formal funding to support and further this initiative," adds Dr. Singh. "We want to continue bringing hope to economically depressed areas by providing access to renewable energy and improved healthcare."

"Our goal is to develop equipment that marries well with the skill sets of the locals," concludes Dr. Aronson. "Ultimately, we want to bring our knowledge to people in other countries. The ability to assemble and maintain this equipment should contribute to economic development and will ensure that the equipment will be maintained."

UNDER THE SEA

Underwater Robotics Competition Held at Villanova Steers Kids Toward Engineering

by Debbie Clayton

Student teams from high school robotics clubs put their remote operated vehicles (ROVs) to the test in Villanova's Olympic-sized swimming pool.

When the School District of Philadelphia approached Dr. "Nat" Nataraj, Chair of the Department of Mechanical Engineering, last fall to ask if Villanova could host an underwater robotics competition in the spring, his response was, "How soon can we begin?" The program, called Marine Advanced Technology Education (MATE), seemed like a logical progression of the College of Engineering's extensive participation in community outreach programs.

Dr. Nataraj and James O'Brien, Assistant Professor of Mechanical Engineering, have provided curriculum development for the SeaPerch competition, a national underwater robotics competition geared toward middle and high school students throughout the region. But the MATE program represented a more sophisticated version of SeaPerch, focusing mostly on high school and college students and taking the contest to the next level. Plus, it dovetailed nicely with research Dr. Nataraj and other faculty within the College's Center for Nonlinear Dynamics and Control had been doing with the U.S. Navy on unmanned vehicles.

"We need to level the playing field for many kids who don't have access to some of the better schools – and programs like MATE go a long way toward doing this," says Dr. Nataraj, who regularly visits area schools to talk about engineering. "So many kids are not aware of what science and engineering are

MATE teams guided their ROVs into underwater targets.

all about. These types of programs alert them to the potential opportunities that exist. Granted, there's only so much science you can teach them through a competition. The real value, however, is that they get exposure – and it's a glimpse at the excitement of the world of engineering."

One of many Villanova initiatives that seek to enhance STEM (science, technology, engineering, and math) education, MATE strives to help prepare America's future workforce for ocean-related occupations. The program is part of Villanova's commitment to a national endeavor geared to increasing America's global competitiveness through improving interest and education in the sciences.

For the competition, teams of students developed remotely operated vehicles (ROVs) and put them through their paces in an underwater setting – in this case, Villanova's Olympic-sized pool. They also presented a technical report, underwent an engineering evaluation, and displayed a poster of their project.

International Competition

New to Pennsylvania, MATE is an international competition with 19 regions participating. Spearheaded regionally by Velda Morris, a robotics education specialist with the School District of Philadelphia's Secondary Robotics Initiative, the MATE competition took place on May 22. Some 34 teams descended on Villanova from Delaware, Maryland, New Jersey, Pennsylvania, and South Carolina for the regional event. The top two teams went on the international MATE competition in Hilo, Hawaii, in June.

"This program was layered beautifully among the high school students, the teachers, the Villanova students, the Mechanical Engineering Department, and the industry folks who came out to judge," explains Morris. "My promotional flyer said, 'Come make history with us,' and people really responded to that."

With a grant from the Office of Naval Research (ONR), Dr. Nataraj and O'Brien plunged headfirst into the MATE program, coordinating student mentors to help teams, developing curricular materials for the teachers, and organizing two professional days at Villanova to help teachers learn how they could better coach their teams.

"The ultimate goal of the MATE program is to increase awareness of marine technical fields," says Dr. Nataraj. "But it also helps students develop the skills necessary to work as a team, solve problems, enhance critical thinking, and improve 'soft' – but important – skills such as effective communication and project management."

Regionally, the MATE competition fielded two types of teams – Scout and Ranger. Scout teams were similar to SeaPerch teams, where the students actually get into the pool with their ROVs. Ranger teams had higher criteria and were subjected to more complex tasks and missions. They guided the ROVs using cameras and hydrophones.

Hosting such a huge competition required a massive organizational effort from Morris and the Villanova team. "Safety first was our motto," Dr. Nataraj says. "We had some 50 volunteers managing logistics, props, food, technical aspects, judging, and you name it! Our chief engineer and right-hand man was Eric Baker, a mechanical engineering student who graduated in May."

Villanova will host the regional competition again next year – a reward for a job well done. "As educators, it's our mission to widen the community to whom we teach," adds Dr. Nataraj. "Education is not limited to the few people who come into our classroom – we have a societal responsibility, too."

For more information about the College's community outreach, visit www.Villanova.edu/Engineering/Service

Guiding the Next Generation

Joe Cunningham spent a week at the MATE Center in Monterey, Calif., last summer, learning how to build a MATE ROV in preparation for the MATE competition at Villanova. A biology teacher at Murrell Dobbins Career and Technical Education High School in Philadelphia, Cunningham started the school's robotics club 10 years ago and has run it ever since.

"I've organized teams for the SeaPerch competition, so it was natural for me to move on to the MATE competition," says Cunningham, who just finished his 11th year of teaching. "Velda Morris gave us supplies to get started, but we were free to build the ROV using any materials we chose."

Cunningham's Ranger team of 10 students included 10th, 11th, and 12th graders. His school teaches business, cosmetology, fashion design, culinary arts, and computer sciences. Surprisingly, a few of the most involved students on his MATE team were girls in the fashion design sequence.

"Programs like MATE accomplish the objectives of STEM since we are using scientific principles like thrust, buoyancy, and propulsion and doing a lot of electronic things that most kids aren't exposed to in high school," says Cunningham. "My students got experiences through MATE that they wouldn't have gotten anywhere else. In fact, most of my students in the robotics program go on to college – frequently in technical areas."

If you're an alumnus, you can help us shape the next generation of Villanova Engineers. Consider these 10 easy ways to strengthen your ties to the College and your fellow Wildcats:

- **Join the Villanova Engineering Alumni Society,** which supports academic programs and offers networking opportunities for members.
- **Connect with the University's Career Services Center** to make them aware of internship and career opportunities within your organization for new engineers – and to secure the best new engineering talent for your company.
- **Mentor an undergraduate** to share your insights as a seasoned professional and help a new engineer prepare for life after graduation.
- **Contribute financially to the College of Engineering,** which will support the College's goal of becoming a premier engineering program in the country.
- **Sponsor a project for the upcoming Multidisciplinary Design Lab,** designed to give students real-world research experience for industry.
- **Establish a Villanova Corporate Alumni Partnership** within your organization to bring together fellow alumni for timely updates from the College, professional development and networking opportunities, and the chance to build a Villanova identity within your company.
- **Visit the College of Engineering's website** for news and information about student programs and achievements; faculty research, recognition, and accomplishments; and special events.
- **Host an information session for students** at your company, or serve as a guest speaker for one of the student branches of professional engineering societies.
- **Share information about opportunities for sponsored research or faculty fellowships** available within your company.
- **Follow the College's news and updates** via Facebook and LinkedIn (coming this fall!).

Next steps…

- For more information about the College of Engineering, visit www.Engineering.Villanova.edu.
- For inquiries about alumni events or involvement, visit www.Villanova.edu.
- To make a financial contribution, contact Cynthia Rutenbar, Director of Major Giving (Cynthia.Rutenbar@Villanova.edu) or Lisa Kailian, Major Gifts Officer (Lisa.Kailian@Villanova.edu).
- For inquiries about the Villanova Corporate Alumni Partnership or questions regarding corporate partnerships or research, contact Burton Lane, Director of External Relations (Burton.Lane@Villanova.edu).
- To serve as a student mentor or to connect with student organizations, contact Gayle Doyle, Administrator of Student Support Programs (Gayle.Doyle@Villanova.edu).

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