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### Make a Life of Your Passion

Over the course of her nearly 30-year career, Christine Maglione (Beniers) '86 OR has proven herself to be nothing if not versatile. And she always follows her heart.

*By Mark Rader*

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Tammy Freeman chose the co-op program as a way to get off campus and experience the real world. "It was one of the best decisions I ever made."

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Students in the new Information Science, Systems and Technology curriculum call it the "major for the future," pointing to the need for people who can apply technology to business processes and issues that affect society at large.

*By Jay Wrolstad*

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An engineering degree can be the key to the future—sometimes in unexpected ways. Catherine Marie Charlton took hers to the top of the worldwide instrumental music charts.



## ASK AN ENGINEER

Chat sessions give prospective students the real scoop on life at Cornell.

**S**asha asks if engineering students spend all their time studying. Wolf wants to know how common it is for students at Cornell to do team projects. Tennisman88 inquires about the quality and availability of apartments in Ithaca.

Such queries are typical of those received during Internet chat sessions held by the College of Engineering in an effort to draw prospective students to Cornell. And the Engineering undergrads who respond via computer in a second floor lab at Carpenter Hall have all the answers.

Given the popularity of instant messaging, blogs, and interactive web sites among teens and young adults, chat rooms can be an effective recruiting tool, says Mark Spencer, director of Engineering Admissions.

"It's fun, because conversations get started among the Cornell students and those sitting at home," he says. "High school students like this because it gives them anonymity, and they feel free to ask about anything that comes to mind." Participants at both ends are identified by screen name only, although the Cornell students may ask where a person lives and get other personal information after the ice is broken.

A company called Chat University, which has hundreds of higher education clients, helps set up the informal sessions that let the schools connect with recruits and respond in real time to their inquiries.

Typically there are about dozen engineering students tapping out responses to the questions, and the give-and-take can get a bit frenetic at times as the chat room gets crowded during the three-hour sessions. Questions are taken on academics, student life, Ithaca, and the college campus.

The chats are held twice a year, once in December when the deadline for college applications approaches and again in April when acceptance notices are delivered and the objective is to encourage students to commit to Cornell.

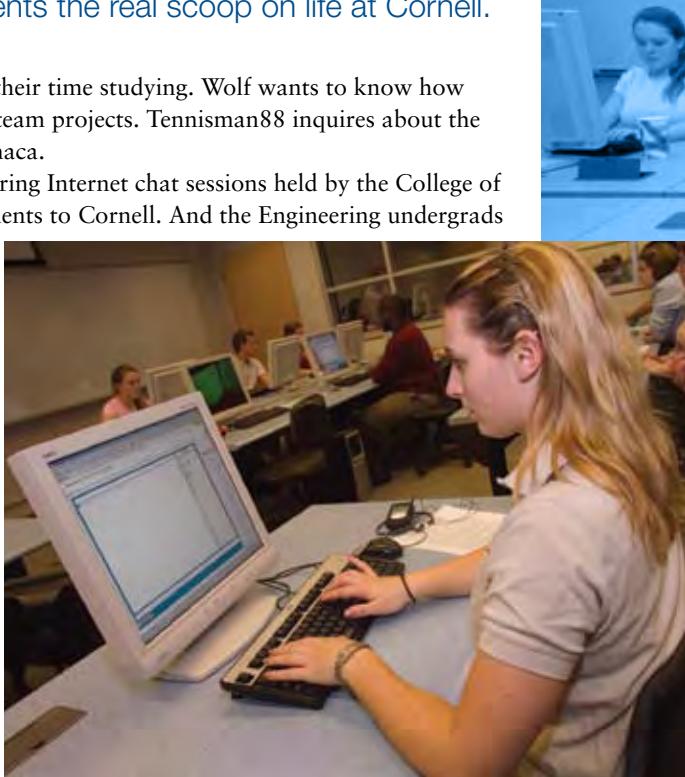
Different from the phone-a-thon approach, online conversations enable everyone in the computer lab to communicate with the students at the other end of the line—and those recruits can communicate with each other as well, Spencer says.

"It can get pretty hectic at times, with the high school students peppering us with questions that we have to answer as quickly as possible to keep the conversation going," says senior engineering student Sara Maly, who has participated in three online chats.

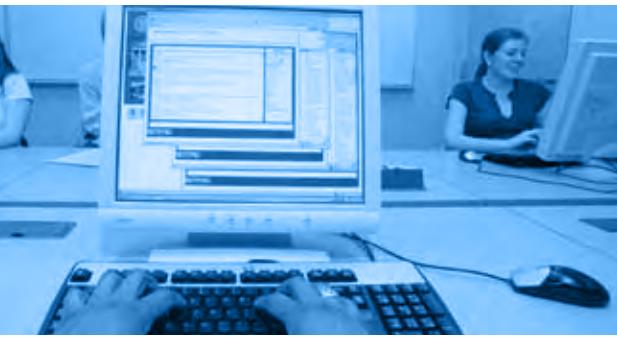
She notes that most of the queries she has dealt with concern the amount of work required of engineering students or the requirements for a specific major. "This is much less intimidating than getting a phone call from the university," Maly says, "and unlike a school visit, their parents are not hovering over them and monitoring what they say."

Senior Anna Domask, another chat session veteran, points out that instant messaging is a great way for a prospective student who can't make a campus visit to receive information about Cornell. "I have communicated with people who live in India, Korea, and Singapore who are not able to see the campus but who want to know where to live, or what there is to do in Ithaca," she says.

Among the more unusual questions she received was an inquiry about the popularity of LAN



What's good about the chat sessions is that there is someone in the room who can answer just about any question.



parties—which involve using wireless technology to communicate or play interactive games. “I was able to answer that because I am familiar with the activity,” Domask says. “What’s good about the chat sessions is that there is someone in the room, either a student or staff member, who can answer just about any question. And we know what they will face on campus.”

“This is not as much about giving them a sales pitch as it is about presenting a positive attitude about Cornell and eliminating any fears and preconceived notions,” Domask says of the online conversations.

It’s hard to quantify the yield rate from chats, given the anonymity of the recruits who participate, but Spencer believes the sessions may make a difference to those sitting on the fence. That view is shared by Shawn Felton, a communications strategies specialist in the Cornell Undergraduate Admissions Office who helps facilitate the chat rooms.

Felton contends that technology is changing the way colleges and universities sell themselves in a highly competitive market. “There are so many ways to communicate today, using the computer or cell phones, and with real-time communications like online chats, we can provide a lot of information in a short time,” he says.

—Jay Wrolstad

## NEVER GIVE UP

Cornell student engineers did not win the FSAE world championship race-car competition this year—as they did last year and in eight previous years—possibly due to an error by the competition organizers. But with pit work worthy of Indianapolis pros, the team pulled out a satisfying consolation, winning the 2006 *Road and Track* trophy over seemingly impossible odds. The team will be featured in *Road and Track* magazine later this year.

As related by Brad Anton, associate professor of chemical and biological engineering, the story is one of initial frustration, small triumphs, a devastating setback, and a final redemption—or at least a moral victory.

Al George, the J.F. Carr Professor of Mechanical Engineering, is the faculty adviser to Cornell’s student team, assisted by Anton. The annual competition, organized by the Society of Automotive Engineers (SAE), challenges student teams to build a Formula SAE race car and drive it in a series of tests. The competition was held May 17–20 at the Ford Proving Grounds in Romeo, Mich. Cornell has won four out of the last five years, and nine times since it first entered the competition two decades ago.

The Cornell team designed its car to run on an alternative fuel, E85 ethanol, a mix of 85 percent ethanol and 15 percent gasoline. In order to promote the development of alternative fuels, the U.S. Department of Energy has offered additional prizes to teams that win with cars using the alternative fuel DOE designates. “We’ve won thousands of dollars extra over the years by using DOE-sponsored fuel,” Anton said. Only about 10 other teams designed their cars for E85.

But when those teams filled up with fuel provided by the organizers, Cornell’s car refused to start, as did several other E85 vehicles. After an all-nighter of troubleshooting, the Cornell students drained the fuel from their car and refueled with commercial E85. And the car started.

The jury is still out, but according to a

Working to repair the engine are FSAE team members, from left, Erik Shewan, Isaac Zaworski, Andrew Maduskuie, and David Porter.



Provided

student team from Iowa—which might be expected to know something about ethanol—the organizers’ fuel was not E85 but almost pure ethanol. Without the gasoline additive, Anton explained, straight ethanol doesn’t provide enough flammable vapor to start the car.

The team had lost so much time that they missed one of the performance driving events, but they scored well in two others. Although they had fallen behind, they were still within striking distance if they could win the endurance event, worth 400 of the 1,000 points at stake for the entire competition. In this race, two drivers each drive 10 laps. After outstanding performance in the first 10 laps, Cornell’s car started smoking and was disqualified, losing any chance for a comeback.

The engine had overheated and was seriously damaged. “We suspect we damaged the engine by turning it over again and again for 20 hours, trying to start it on pure ethanol,” Anton said.

Ordinarily it would have been time to pack up and go home. But, based on its excellent performance in the first few events, Cornell was one of five teams selected by *Road and Track* magazine for a special afternoon run-off competition on a slalom course.

To the amazement of everyone, the Cornell team completely rebuilt its engine in two-and-a-half hours, in time to enter and win the *Road and Track* magazine trophy. In a dynamometer measurement, the resurrected car rated 86 horsepower, second only to a car from Finland, barely ahead at 87 horsepower.

“We went out to the *Road and Track* event and killed everybody,” Anton said. “We were very, very proud of the team.”

—Bill Steele, Cornell News Service



## MOUNTED PYTHON

The year was 1915. During a hunting expedition in the mountains of the Philippine island of Luzon, U.S. Army administrator Norman McJunkin and a group of officers and locals were sitting around a campfire when they were startled by a commotion in a nearby tree. McJunkin fired his shotgun into the darkness in the direction of the sound. Moments later something large crashed to the ground.

By the morning light, the group discovered a dead 26-foot-long reticulated python beneath the tree. It was too big to carry, so they laid the carcass over some anthills and returned a few days later to find nothing left but bones.

Those bones are now assembled and elegantly framed in the Cornell University Museum of Vertebrates research collection in the Imogene Powers Johnson Center for Birds and Biodiversity, home to Cornell's Lab of Ornithology. The skeleton, a recent gift from still-active Reed McJunkin, a Class of '32 civil engineer who kept the relic from his father's Army days, is not on public view but is available to students and researchers.

"I think this is quite likely the largest specimen of a snake in any museum in the world," said Harry Greene, a Cornell herpetologist and professor in the Department of Ecology and Evolutionary Biology. "At least I haven't been able to locate, as yet, anything larger."

Greene worked painstakingly with snake anatomy experts from Lehigh University to reassemble the skeleton from almost 1,000 vertebrae, ribs, and head bones.

Alive, the giant female python weighed close to 165 pounds, large enough to prey on deer, wild pigs, monkeys, and even people.

—Krishna Ramanujan, Cornell News Service



Charles Dardia/Museum of Vertebrates

The skeleton was assembled from bones that had been stored with the vertebral column strung on a cord and the ribs and skull elements in separate boxes.

## INAUGURATION PLANS

Dr. David J. Skorton will be inaugurated as Cornell University's 12th president during an open-air ceremony Sept. 7, 2006, on the Cornell campus in Ithaca.

The installation ceremony for the new president will take place on the university's Arts Quad at 3:30 p.m. It will be followed by a reception for the campus community and guests, also on the Arts Quad. In case of rain, the ceremony and reception will be held in the university's Barton Hall.

More information about Skorton, his wife Robin Davison, the inauguration schedule, and related events is available at <http://inauguration.cornell.edu/>.

## CRACKING THE CODE

Members of Cornell's Global Positioning System (GPS) Laboratory have cracked the so-called pseudo random number (PRN) codes of Europe's first global navigation satellite, despite efforts to keep the codes secret.

The navigational satellite, GIOVE-A (Galileo In-Orbit Validation Element-A), is a prototype for 30 satellites that by 2010 will compose Galileo, a \$4 billion joint venture of the European Union, European Space Agency, and private investors. Galileo is Europe's answer to GPS in the United States.

Because GPS satellites, which were put into orbit by the Department of Defense, are funded by U.S. taxpayers, the signal is free. Galileo, on the other hand, must make money to reimburse its investors—presumably by charging for PRN codes. Because Galileo and GPS will share frequency bandwidths, Europe and the United States signed an agreement whereby some of Galileo's PRN codes must be "open source." But when GIOVE-A broadcast its first signals on Jan. 12, 2006, none of the codes had been made public.

In mid-January, Mark Psiaki, professor of mechanical and aerospace engineering and co-leader of Cornell's GPS Laboratory, requested the codes from Surrey Satellite Technology Ltd. His request was declined. "Then it dawned on me," said Psiaki. "Maybe we can pull these things off the air, just with an antenna and lots of signal processing."

That's just what Psiaki's team did. By mid-March they derived their first estimates of the code and published final versions on their web site (<http://gps.ece.cornell.edu/galileo>) on April 1. The codes and the methods used to extract them were published in the June issue of *GPS World*.

Other authors of the *GPS World* article are Paul Kintner, professor of electrical and computer engineering; graduate students Todd Humphreys, Shan Mohiuddin, and Alessandro Cerruti; and engineer Steven Powell.

—Thomas Oberst, Cornell News Service



Mark Psiaki, left, hooks up an experimental GPS/Galileo digital storage receiver and patch antenna with the assistance of graduate students Todd Humphreys, center, and Shan Mohiuddin in Rhodes Hall.



President Skorton talks with Chris Schaffer, assistant professor of biomedical engineering, during a break in the joint meeting of biomedical engineering and neurological surgery.



## BUILDING BRIDGES

could detect the origin of an epileptic seizure.

These were just a few of the ideas on the table when Weill Cornell Medical College neurosurgeons traveled from New York City to Ithaca to meet with their colleagues in Cornell's Department of Biomedical Engineering in July.

Closer collaboration between the two campuses was on the mind of Cornell President David Skorton when he spoke to the group. Some of the logistical hurdles involved in this collaboration, said Skorton, who has a joint appointment at the medical school and biomedical engineering department, can only be solved with dollars. His role, he said, will largely be in securing funding and in supporting specific plans worked out by faculty who know the issues best.

It's a well-timed event, said Michael Shuler, the Samuel B. Eckert Professor of Engineering and the James and Marsha McCormick Chair of the BME department. "Biomedical engineering is in a period of rapid growth. For us to be as competitive and successful as we can be, the interaction with the medical school has to be good."

"This has gone amazingly well. It's good to see the dialogue going," said Phil Stieg, chair of Weill Cornell's Department of Neurological Surgery. "You can feel the energy. I'd like to see this be the first strong relationship between the university and the medical school. This was a great first effort."

—Lauren Gold, Cornell News Service

One of several rows of visitors who lined up to play student-created computer games at the 2006 Game Expo in Upson Hall.



Bill Steele/Cornell News Service

## GAME DAY

**C**huck kumquats!" "Defeat baboons!" "Repopulate the world and eat anything that stands in your way!"

These were typical of the slogans, from whimsical to gross, displayed in abundance at the 2006 Game Expo presented May 10 in Upson Hall by the Cornell Game Design Initiative. The event exhibited games created by students in CIS 300, Introduction to Game Design, and a follow-up advanced course. The games were created by student teams of programmers, artists, and musicians.

"We are looking for ways to reach out to more art students," said lecturer David Schwartz, who teaches the game courses. "They are an extremely important part of the team."

Many of the games on display belied their student origins—perhaps a bit shorter and simpler than games seen at an arcade but often just as impressive in their art and storylines. A hundred or so students, accompanied by quite a few grade-schoolers, lined up to play.

The games included "Restless Moon II," a 10-level shooting game along the lines of the best-selling "Doom" in a 3D environment simulating lunar gravity, and "The Last Lemi," the aforementioned kumquat-collecting game. "Green, Eggs, and Pan," Cornell's winning entry in the national Games for Girls competition (see p. 29), attracted many players, including grade-school girls.

CIS 300 is more than just fun and games, Schwartz pointed out. It trains students to work in interdisciplinary groups that include nontechnical students, he said, adding that there are rapidly expanding employment opportunities in the game industry.

—Bill Steele, Cornell News Service

## PHYSICIAN'S ASSISTANT

Physicians may someday monitor a patient's blood flow, blood pressure, and temperature with tiny, implantable devices—some small enough to be injected into a person's vascular system—thanks to research by a Cornell University professor and an Ithaca-area high-tech firm.

Such tiny, implanted sensors could provide separate readings for particular organs in a patient or be unobtrusively implanted in patients whose systems need constant monitoring, said Edwin Kan, associate professor of electrical and computer engineering.

His research recently received a boost of \$255,000 from the New York State Office of Science, Technology and Academic Research. The agency's grants are designed to assist academic research institutions and businesses in their efforts to bring high-tech innovations from the laboratory to the marketplace.

"The product is aimed to enhance the surgical tools used today," said Kan, who is working with Transonic Systems, which already produces miniature devices for measuring blood flow in animals and human patients and is contributing significant staff time and funds to this research effort. "So one day, surgical monitoring equipment will be in the form of microscopic implants or integrated with present tools."

—Susan S. Lang,  
Cornell News Service



## THE GATES

The Bill & Melinda Gates Foundation has awarded \$25 million to Cornell University to support the construction of the signature building for a planned information campus that will bring together the several units of the university's Faculty of Computing and Information Science (CIS).



The new building, to house the Department of Computer Science and elements of the Information Science Program, will be named William H. Gates Hall. Further additions to the information campus will provide space for computational biology, the Program of Computer Graphics, and portions of the Cornell Theory Center. The School of Operations Research and Industrial Engineering of the College of Engineering also could be located there, along with elements of the Department of Statistical Science.

"The Gates Foundation's grant will have a transformative effect on our academic and research programs by bringing together faculty members who are now scattered across the campus, enhancing opportunities for creative interaction, and serving as a focus for computing education and research within the university," said Hunter Rawlings, interim president of Cornell when the gift was announced last spring. "It will make Cornell a model for education in the age of digital information by allowing every student, studying any subject, to understand the impact of computers on the development of that subject, and it will distinguish our graduates in every field."

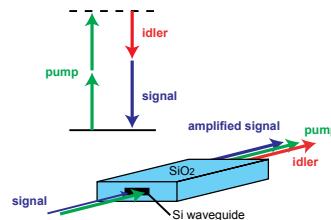
"By investing in Cornell and its planned information campus, the Bill & Melinda Gates Foundation will foster the sweeping integration of computing and information science into every field of study at the university and further facilitate cross-disciplinary collaboration," said Robert Constable, dean of CIS.

About a dozen possible locations for the building are being evaluated. The proposal for the project calls for the information campus to be strategically located in proximity to the Colleges of Engineering and Arts and Sciences, the Life Sciences Technology Building, and other key academic partners.

—Bill Steele, Cornell News Service

## LIGHT TOUCH

Cornell researchers have created a broadband light amplifier on a silicon chip, a major breakthrough in the quest to create photonic microchips. In such microchips, beams of light traveling through microscopic waveguides will replace electric currents traveling through microscopic wires.



A team of researchers working with Alexander Gaeta, professor of applied and engineering physics, and Michal Lipson, assistant professor of electrical and computer engineering, used the Cornell NanoScale Facility (CNF) to make the devices. They reported their results in the June 22 issue of the journal *Nature*.

The amplifier uses a phenomenon known as four-wave mixing, in which a signal to be amplified is "pumped" by another light source inside a very narrow waveguide. The waveguide is a channel only 300 x 550 nanometers wide. The photons of light in the pump and signal beams are tightly confined, allowing for transfer of energy between the two beams.

The advantage this scheme offers over previous methods of light amplification is that it works over a fairly broad range of wavelengths. Photonic circuits are expected to find their first applications as repeaters and routers for fiber-optic communications, where several different wavelengths are sent over a single fiber at the same time. The new broadband device makes it possible to amplify the multiplexed traffic all at once.

"A number of groups are trying to develop optical amplifiers that are silicon compatible," Gaeta said. "One of the reasons we were successful is that Michal Lipson's group has a lot of experience in making photonic devices on silicon." The work was supported by the Cornell Center for Nanoscale Systems (CNS). CNS and CNF are funded by the National Science Foundation and the New York State Office for Science, Technology and Academic Research.

—Bill Steele, Cornell News Service

## CU NANO SCORES BIG

In a series of rankings of university nanotechnology programs by *Small Times*, a trade magazine devoted to nanotechnology, Cornell ranked in the top 10 in eight out of nine categories, and in the top five in six categories, leading all universities overall.

*Small Times* sent questionnaires to 100 universities, and 50 responded. They asked universities to rate their peers and to report data about their own programs. In peer rankings, Cornell was rated second in nanotechnology research, fifth in micro research (a little bit larger scale), fifth in micro commercialization, and sixth in nano commercialization.

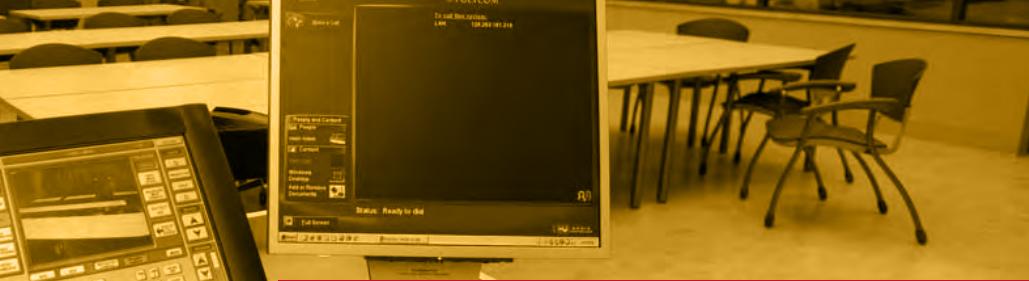
In rankings based on self-reporting, Cornell was rated first for nanotechnology commercialization, second for facilities, fourth for nanotechnology research, and 10th for industrial outreach.

"It's a very satisfying validation of our faculty, staff, and facilities," said Joseph Burns, the Irving Porter Church Professor of Engineering and vice provost for physical sciences and engineering. "I'm delighted that Cornell leads the nation's universities in a research area that policy-makers have identified as crucial for America's competitiveness. We've invested heavily in facilities and faculty support, and these rankings show that our investments have been wisely spent."

—Bill Steele,  
Cornell News Service

During his February 2004 visit to campus, Bill Gates met with a panel of Cornell faculty and staff members (including Engineering Dean Kent Fuchs, lower right), who briefed him on Cornell's interdisciplinary program in computing and information science.

Manufacturing tools available at the Cornell NanoScale Facility made it possible to create waveguides with the precise dimensions needed. Read more at <http://nanophotonics.ece.cornell.edu>. Image provided by Gaeta Group/Cornell.



## HIGHWAY ROBBERY

Extension associate David Orr, left, and Lynne Irwin, director of the Cornell Local Roads Program, work with their falling weight deflectometer, which can evaluate pavement and predict when cracks, potholes, and ruts will develop.



Rough roads impose a hidden tax on motorists in wear and tear, depreciation, and higher fuel use that can add 20 cents a mile over the cost of driving on smooth surfaces, says Lynne Irwin, associate professor in the Department of Biological and Environmental Engineering.

"We pay about 50 cents a gallon in taxes at the pump, and another 50 cents a gallon or more when the roads are rough," says Irwin. When roads are smooth, motorist costs to operate their vehicles are, on average, about 30 cents per mile, not counting the taxes, he says. That cost goes up to 40 cents, or even 50 cents per mile, depending on road roughness.

The extra costs to motorists due to rough roads can be saved if roads were repaved before they begin to break up. To that end, Irwin works with devices called falling weight deflectometers (FWDs), specialized computers in a truck, which evaluate the structural integrity of pavement and predict when cracks, potholes, and ruts will develop.

"Bad roads are like a sore foot. You only think about a sore foot when it hurts. You are not aware that it is not sore. The same is true of rough roads," says Irwin. He is director of the Cornell Local Roads Program, which does research on roads and provides technical assistance and training for local government highway officials and employees in 1,608 municipalities in New York state.

An FWD works by dropping a weight onto the pavement at a given force, and sensors around the weight record the subsequent deflections. By measuring the deflections on the surface of the pavement at various points over a distance of 6 feet from point of contact, experts can predict when the road will deteriorate into cracks and potholes.

"The work will allow highway agencies to repair roads before drivers see physical evidence of the deterioration," says Irwin. For both agencies and motorists, he says, that would result in significant savings, especially in this age of soaring fuel costs.

—Susan S. Lang, Cornell News Service



## GOING, GOING ... GONE!

The student-designed and -built solar house—the second-place winner in the U.S. Department of Energy's 2005 international Solar Decathlon competition—will not be leaving the local area.

The 640-square-foot home was sold at a campus auction in April for \$121,000 to an anonymous Cornell alumnus who bid over the Internet and will place the house on his property outside Ithaca, in Lansing, as a second residence.

The new owner described himself as "an alum who cares a lot for Cornell" and who "wanted to do the best for the project."

The bidding started at \$50,000, and with 24 bidders, including two bidding via an Internet auction service, within minutes escalated to more than \$100,000. It was all over in less than 25 minutes, said Thomas P. LiVigne, manager of Cornell's Real Estate Department.

"There were a good amount of bidders, the bidding was lively, and a lot of spectators were there even though it was raining—pouring, in fact," he said. "While the auction was going on, students were going by who could hear the auctioneer say, 'Incredible minds put this house together, what's another thousand?'"

In the meantime, the Cornell University Solar Decathlon Team (CUSD) is gearing up for the 2007 competition in Washington, D.C. Its proposal was accepted in January with an award of \$100,000 over two years. According to its web site, <http://cusp.cornell.edu/>, the team already has more than 90 student members.

—Susan S. Lang, Cornell News Service

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A woman with dark skin and short hair is shown from the chest up. She is wearing a dark, sequined dress with a scalloped edge and a matching beaded headpiece. Her right arm is raised, with her hand open and fingers spread. She is looking upwards and slightly to the right. The background is a soft, out-of-focus white.

MAKE A LIFE

Christine Maglione

follows her

heart to find

OF YOUR

fulfilling career

opportunities and

family priorities.

by Mark Rader

Over the course of her nearly 30-year career in show business, Christine Maglione (Beniers) '86 OR has proven herself to be nothing if not versatile. She's played spunky girls (Rizzo in *Grease*, Eliza Doolittle in *My Fair Lady*); dreamers (Bebe in *A Chorus Line*); a prostitute (Aldonza from *Man of La Mancha*); and most recently, in a Boston-area production of *Kiss of the Spider Woman*, the fictional movie star Aurora, a character by turns seductive, exuberant, and menacing. Impressive as her resume is, what's perhaps more impressive are the roles Maglione has played off stage—wife, mother of three young children, civil litigator for a prominent Boston law firm, and, for four years at Cornell University, a student in the School of Operations Research and Industrial Engineering in the College of Engineering.

So how did an ORIE student who once spent her nights grinding through statistical analysis problems end up kicking up her heels on Broadway? One night in May, after sending their three kids off to bed, Maglione and her husband, Bob Beniers '85 EE, sat down in the kitchen of their home in Hingham, Massachusetts, to tell the story.

Her love of music, Maglione says, came early. As a girl, growing

up in Cedar Knolls, New Jersey, she was addicted to show tunes. *Singing in the Rain*, *Oklahoma*, *Cabaret*, you name it. At talent shows she performed alongside her sister wearing costumes her mother sewed herself. (“Fishnet stockings and a bowler hat,” she says, laughing. “Oh yes, totally appropriate for fourth grade.”) In fifth grade, her class performed a musical she wrote herself, called *The Lost Key*, in which the Easter Bunny loses the key to the Easter egg storage bin. At the age of twelve, she got her first paying role, in a dinner theater production of *The King and I*, for five dollars a show. “Everyone else was at the pool while I was doing twelve shows a week. I loved it!”

Her father, a firechief, and mother, an office administrator, were supportive of her interest in the performing arts and proud of her work ethic. But they were also pragmatic about the chances of making a career out of singing and dancing. “My parents encouraged my interest in theater,” she says, “but they did not want me to struggle. My sister and I were the first in the family to have the opportunity to go to college. So it was ‘get the best education you can, and make sure you can get a job.’” Since Maglione had always excelled in math and had been encouraged by her AP calculus teacher to pursue a career in the sciences, she focused her college search on a school that would let her both perform and prepare for a career in engineering. Cornell fit the bill.

It didn’t take long, however, for Maglione to wonder if she had made the right decision. Her ORIE classes were “very challenging.” She could work on a problem for hours, for days even, and still feel like she was getting nowhere. “I had a feeling early on that it probably wasn’t going to be a match,” she says. Still, she decided to stick it out, and get her degree. She also received support from her adviser, Professor Jack Muckstadt, who helped her choose electives in courses that satisfied her other interests, like acting and history. “He was wonderful,” Maglione says. “I finished the program, but was able to tailor it suit my personality.”

Throughout her time in Ithaca, Maglione kept involved in musical theater productions, on and off campus. Of all the performances she was part of, she says, *Sweet Charity* holds a special place in her mind, as it was the first show her future husband, Bob Beniers, an electrical engineering student a year ahead of her, saw her perform in.

“Bobby was a trooper,” she says, laughing. “He was very supportive. He sat through all of my shows and often dragged along his friends and fraternity brothers.”

Like Christine, who felt torn between her major and her love of the theater, Bob was going through his own educational identity crisis—should he stick with engineering or move into a less time-consuming major such as those many of his fellow football players had chosen? Juggling practices and games and an engineer’s course load was proving to be nearly impossible. Like Christine, Bob decided to stick to his guns and finish what he’d started. “I thought

it was more important to have your education,” he says. “I knew I needed to get a job, so I focused on school.” And after graduation, Bob did get a job as a representative for an industrial manufacturing company. In 1992, he and three colleagues at the company quit and started their own company, dBm Technical Sales, which is thriving.

Christine’s career trajectory has been—to say the least—a bit more unconventional. After graduating in 1986, she was offered a job in information consulting with Arthur Andersen; as she was considering the offer, she was auditioning for various summer stock theater jobs in New York. “I’d have my suit on and my leotard in my bag and I’d change and go tap,” she says. When, at the last second, a theater job came through, Christine felt she couldn’t pass it up. Like Professor Muckstadt, she says, the man who had wanted to hire her at Arthur Andersen couldn’t have been more supportive. “He said, ‘Good for you. And, by the way, send me two tickets to your first Broadway show.’ And I did, when I started with *A Chorus Line*.”

For the year following that summer, Christine did perform in *A Chorus Line*, though not on Broadway. As part of a “bus and truck” production, she toured the country, performing the show in small town venues. It was, she says, “perfect fun, the kind of thing you should do when you’re twenty-two.” Throughout the tour, she and Bob, who had moved to Boston, continued to date long-distance. Occasionally, he would fly out to meet her on the road; once, he flew in just long enough to ride the bus with her and the rest of the cast to her next venue. “It certainly wasn’t the most glamorous way to date each other,” she says, laughing.

After a brief gig performing the musical with an international company in Paris, Maglione got her break on Broadway, as a vacation replacement—a position that soon turned into a full-time position playing Bebe—a starry-eyed dancer. Eighteen months later, the long-running musical closed (“We took to calling the play ‘The Finish Line,’” she says), which led her and Bob to another crossroads. When she was offered a chance at playing the understudy to Maria and Anita in an international production of *West Side Story*, Maglione declined. “We needed to make decisions to get closer together,” she says. “And this would bring us further apart.” They decided it was time, after more than seven years of dating, to get married, and live together full-time, in Boston, where Bob was working. Before moving, however, Maglione applied to the law school at Boston College. If she wouldn’t be able to perform full-time, it was time, she thought, for a new challenge.

In the months before entering law school, Maglione performed in *Grease* and *Man of La Mancha* at the now-defunct Nickerson Theatre located just outside of Boston; in fact, the day after she closed out *Man of La Mancha* she began her classes at Boston College. Compared with the intensive engineering curriculum at Cornell, Maglione says, law school was “quite manageable.” She also found that the

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ability to patiently work through a complex problem—a skill she'd honed as an ORIE student—was invaluable to her in her law classes. While at BC law, she interned at the Norfolk County district attorney's office, clerked at the Massachusetts Supreme Judicial Court, and, after graduation, joined the law firm Hale and Dorr (now Wilmer Cutler Pickering Hale and Dorr). Not surprisingly, it was the performance aspect of being a lawyer that Maglione enjoyed the most. The same techniques she'd used onstage she found she could use to her advantage in a courtroom—projecting her voice, being focused on the moment, taking care not to mumble her words. There was also the similar challenge of connecting on an emotional level with your audience. "You're like the script writer and the actor at the same time," she says. "You're telling someone's story, just like an actor. And you have to find the truth in it and make it make sense to people. It was very exciting."

The demands of her job—all-nighters were not uncommon—made it nearly impossible for Maglione to also be involved in theater; for nearly seven years she didn't perform. "I did miss it," she says, "but I wasn't crying about it." But after the birth of her second child, Bobby, while she was on maternity leave, a friend from her early days in Boston theater called to ask her to audition for a local professional production of *The World Goes Round*. It was an offer she couldn't refuse. After the show closed, she decided that she would not return to her job. "I wanted to spend as much time as I could with my family and the law firm wanted me to spend as much time as I could on their work, which I totally understood."

While taking care of her kids full-time—her and Bob's third child, Matthew, was born in 2002—Maglione satisfied her appetite for singing and dancing by managing the choir at her church, singing at benefits and weddings, and taking ballet classes. When, last winter, her daughter, Gianna, got involved in a local community theater production of *Annie*, she even considered giving up her hard-won Equity card so she would be able to perform with her daughter in non-professional productions.

But then, in May, the theater came knocking again. A fellow actor and friend, Sarah DeLima, called to tell Maglione that Speakeasy Stage Company—a professional company in Boston—was looking for someone to play the part of Aurora/Spider Woman, in *Kiss of the Spider Woman*, and that she might be a good fit. After talking it over with Bob, she auditioned and got the part. "We needed someone who was a triple threat, who could sing, dance, and act," says Paul Daigneault, the theater's artistic director. "And after meeting her, we realized she was the right person. The play didn't come easy to any of us, but she made it look easy."

"It was so much fun to do," Maglione says. "I had wonderful dance numbers, exquisite costumes, and a

great score to sing. And Speakeasy was one of the most professional theaters for which I'd ever worked." Maglione so impressed critics that last winter she was nominated for best actress in a musical by the Independent Reviewers of New England.

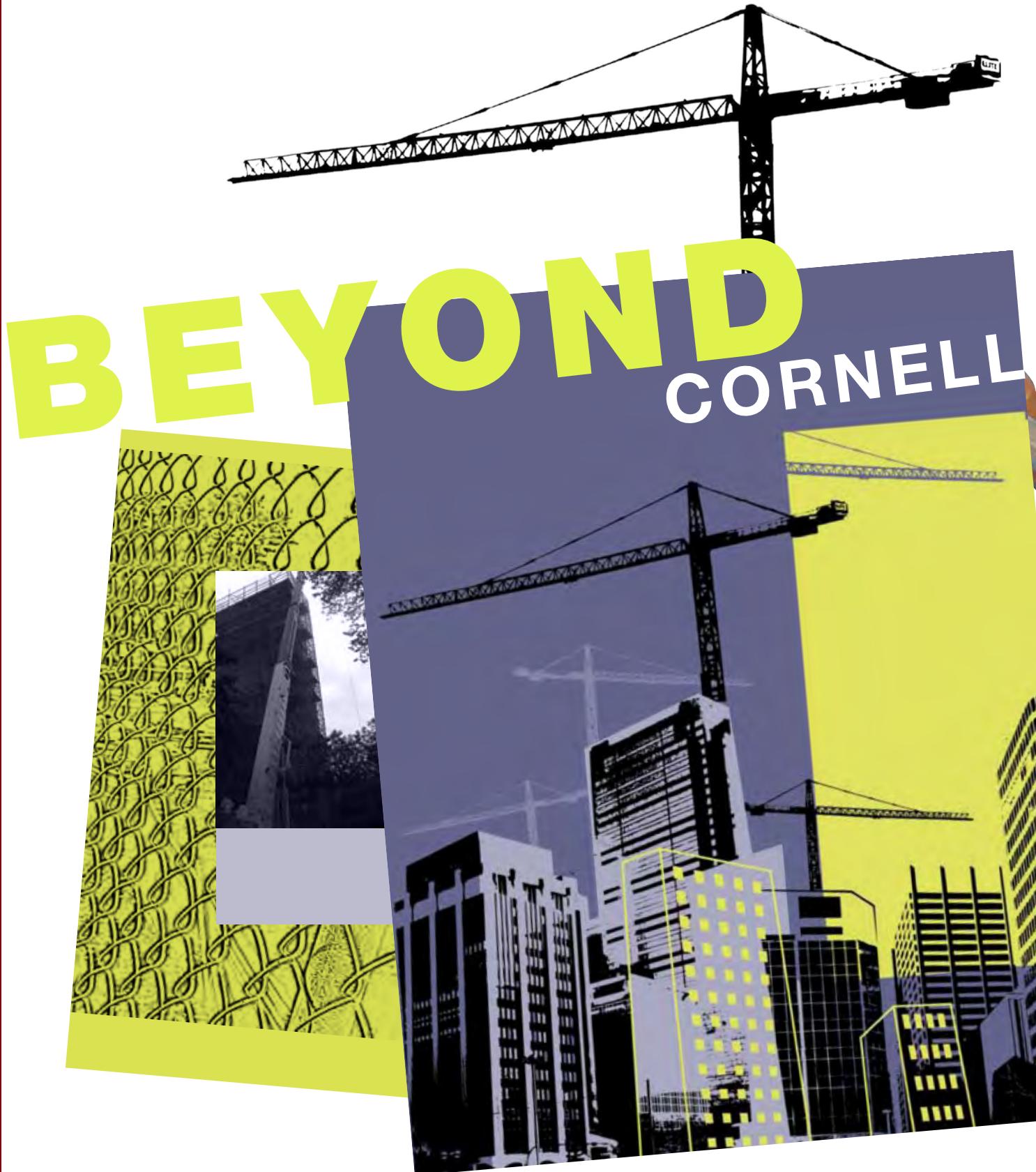
As was the case when she performed in *The World Goes Round*, Maglione says she couldn't have done it without the help of her husband, Bob, and her family. "It wouldn't have been possible," she says. Rehearsals were six days a week for four weeks, and the musical ran for one month, six or seven shows a week. When she left for rehearsal at 5:30, Bob would take over, shuttling the kids to their after-school activities, and getting them into bed. During tech week, which required Christine to be at the theater twelve hours a day, her mother even flew up from New Jersey to help out. Now that she's gotten back into the musical theater scene in Boston, Maglione says she will try to limit her involvement to one show a year and try to find other creative outlets she can immerse herself in year-round. "I'd like to do things involving theater. Teaching voice, directing or choreographing musicals—that really makes me happy."

That's her advice to students as well. "Follow your heart and make a life out of your passion. Maybe you won't make a million dollars, but you'll be doing something that you care about. It has to start from that."

Regardless of what she ends up deciding to do next, Maglione says her top priority these days are her husband and her children—Gianna, 9, Bobby, 7, and Matthew, 3. Matthew, the ham of the family, keeps everyone on their toes, and, Christine says, has been known to sing to himself at his desk at Montessori school. Following in her mother's footsteps, Gianna is taking figure skating, ballet, and piano lessons and, since playing an orphan in *Annie*, has "been through three karaoke machines." Bobby, Christine says, has great pitch, is also learning the piano, and has recently shown an interest in helping out Bob on projects around the house; just recently he helped repair a faucet and construct a landing area for the jungle gym in the family's backyard.

Maglione says that having kids has forced her to be more organized than she used to be. "I've always been the type of person who manages better the more I have to do." Asked if any of what she learned in her ORIE courses about creating efficient systems has helped her run her household and her career as a performer, Maglione laughs. "I need Jack Muckstadt to give me a simulated model!" ■ ■ ■





By Melanie Bush



Co-op jobs give students the opportunity to take the real world for a test drive before graduation.

I first signed up because people said co-op was a great thing to get on your résumé. Also, I wanted to take a breather from school and see the real world. You can get really sucked into what my friends and I call ‘Cornell World,’ and it’s important to get away for a little while, to use your knowledge and to see if you really want to *do* what you’re studying to do. It was only after starting my co-op that I realized just how great it is. It was one of the best decisions I ever made.”

Tammy Freeman, a senior majoring in civil engineering, is talking about Cornell’s Engineering Cooperative Education Program, or “co-op” program, which offers students the opportunity to get as much as eight months of work experience in a corporate environment during their undergraduate degree program—and still graduate in four years. Freeman is currently completing the second of two co-op work terms at Turner Construction Management in Milford, Connecticut.

Cornell’s co-op program, established in 1946, is the only one of its kind among Ivy League schools and one of just a few nationwide in which student participation is strictly voluntary. In the early years, the number of students choosing to participate was fairly small, but annual participation gradually increased to record highs in the 1980s, with over 200 students taking co-op jobs. In all, more than 3,000 Cornell engineering students have participated in co-op.

The co-op program is grounded in the College of Engineering’s aim to prepare students for the lifelong creation of knowledge and solutions to complex

real-world problems. It provides an opportunity for students to integrate their academic interests with paid work experience—to put theory into practice—as well as to gain knowledge and skills that will enhance future coursework.

As the program has grown, the number of companies and organizations hiring Cornell co-ops has risen from an initial handful to a solid base of over 80 organizations ranging in size from small entrepreneurial start-ups to large manufacturing firms employing 100,000-plus full-time employees. Although the majority of companies are located in the United States, employers overseas, such as Sanyo Electric in Osaka, Japan, have also hired Cornell co-ops.

The co-op experience begins in the sophomore year with the interview and offer process. “You basically apply to everything that looks interesting,” says Freeman, “then the companies pick out people to interview. It’s very intimidating—these are real firms! But the interviewers were great; they made you feel welcome. Cornell has found companies really geared toward helping students, not just getting cheap labor.”

Co-op interviews take place in February, and employment offers are made in March. Companies typically identify more than one student who could fill their needs, and if their primary offer is declined, then a student listed as an alternate is given an opportunity. All offers of co-op employment are coordinated through Engineering Cooperative Education and Career Services to keep the process on schedule and flowing smoothly for both companies and students as offers are made and accepted or declined. Freeman interviewed with six companies and received three offers, but she had determined early on that Turner Construction was her employer of choice.

Co-op is typically a two-part assignment, in which students work full-time off-campus for one semester and one summer. Most students take a semester’s worth of courses during the summer after sophomore year, work during the fall of their junior year, return to campus for spring semester, and rejoin their co-op employer the following summer, which completes the co-op commitment. Students are back on campus for their entire senior year and graduate on time with nearly eight months of paid work experience.

Going into the co-op process as a sophomore, Freeman was impressed by the strong foundation the co-op office provided for every student. “They really prepared us for what was coming. Even if I hadn’t gotten a job, I learned so many life skills. The co-op office put us through a series of trainings: In the fall we did mock networking and mock interviews and had résumé workshops. We met the real employers in February.”

The program is administered by Engineering Cooperative Education and Career Services; the co-op component has been headed for the past two years by Christa Downey, who came to Cornell with degrees in both education and business. “I love this job,” says Downey. “It’s a lot of fun working with co-op students, training them to get jobs, seeing how these jobs relate to their

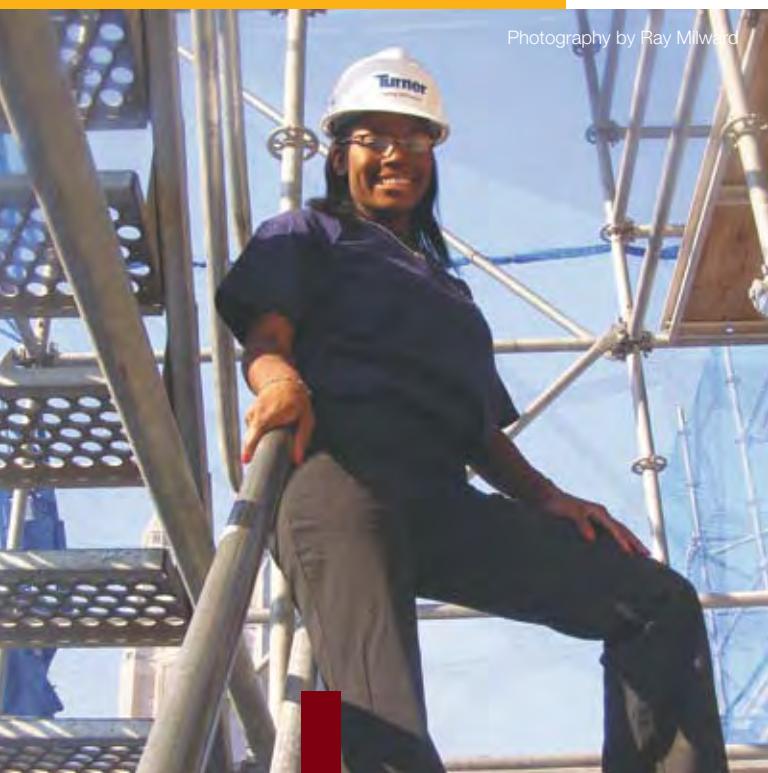


Scaffolding set up for Yale's Silliman College 2006 renovations



# 60 to 80 percent of co-op students receive an offer of full-time work from their co-op employer.

Photography by Ray Milward



careers. Our office is one-stop shopping: We help students with both internships and full-time jobs, so we get to know the students very well. Going out to visit them at their job sites also helps us to understand what they're doing, which makes us better able to help them with their future career planning."

Participating in co-op "absolutely helps students get jobs after graduation," says Downey. "To begin with, 60 to 80 percent of co-op students receive an offer of full-time work from their co-op employer. Most Cornell seniors have offers by winter break, but co-op students typically have offers by mid-October of senior year."

Despite the obvious incentives, only about 20 percent of engineering undergraduates participate in the co-op program. "I think it's because there's just so much to choose from," says Downey, listing the many opportunities for Cornell engineering students to enrich their academic experience beyond the classroom. "There are regular summer internships and the project teams, such as Formula SAE racing, and most of our students do research."

One direction that Downey would like to grow the program is in global opportunities. "We are trying to set up more international internships," says Downey, "but this can be a complicated process." Where does she have in mind? "Anywhere the students want to go!"

Engineering students who participate in co-op assignments typically come back from their work experience as keen advocates of the program. "Current students are strong mentors," continues Downey. "They make presentations and conduct mock job interviews. This year, Mu Sigma Tau, the co-op student organization, started a program to mentor new co-op students."

According to Downey, co-op students generally make an easy transition from school to work. "Certainly some areas shock them," she allows. "They already have the technical skills to work in a professional setting, but what they learn during co-op is *how* to work with other people. I think one thing a lot of them are amazed by is how much free time they have when they're not in school. They say, 'Wow—I have all these free evenings and weekends!'"

Freeman agrees. "Engineering at Cornell is very competitive. The co-op was really a break." In fact, the hardest thing about co-op, says Freeman, was coming back to school. So school is actually harder than life? "Oh yes! In school, you focus on the worst-case scenario. When you finish a project, the professor may say, 'By the way, I think your building is about to fall down,' or 'Don't forget about that Category 5 hurricane coming.'"

With that kind of rigor in the classroom, students often find the pace more relaxed in the real world. Another welcome change is having cash flow in the opposite direction: during work periods, students typically earn more than \$3,000 a month as starting salaries.

Originally from Chicago, Freeman began her education as an architect, choosing Cornell because of its number one ranking in architecture and because "I hate hot weather." She later realized that her real interest lay in structural engineering. "I'm interested in both building and design,"

Freeman says. Structural engineering, she explains, means infrastructure—what holds things together, what makes things stand up. Because of their responsibility for public safety, civil engineers require a license that takes several years of work under a professional engineer to obtain. Freeman plans to complete a master's program in architecture first.

During semesters on campus, Freeman finds time to take advantage of the wealth of extracurricular activities available at Cornell. She's a dancer and performs at Cornell with Uhura Kuumba, an African modern ballet troupe. She's a member of the National Society for Black Engineers and works with Habitat for Humanity, with whom she helped build trusses this year for low-income houses in Rochester.

Her dream job? "Ideally I would like to work for an architecture/engineering design firm that builds in urban areas; specifically, taller nonresidential buildings, such as those on college campuses." Freeman hopes to do high-quality construction, which she illustrates with examples from around the Cornell campus. "Take Balch Hall—what a gorgeous building, all the stone quarried from Ithaca, the incredible craftsmanship and woodworking."

in construction management, Garner explains. "We do not physically do the construction; we manage the process. We are brought on by an owner, for example, to hire and supervise the concrete and steel tradesmen. We also do budgeting, estimating, all the preconstruction work."

She has the highest praise for Freeman. "People were very impressed with what she was able to do as a co-op. She knew when to ask questions and when to forge ahead. She was able to manage quite a few tasks at the same time, which is what we do here. Most co-op students and interns come here book-smart, but a lot of it is performance. And Tammy wanted to be busy—she was always asking for work."

"A student who will excel in co-op is a student who takes initiative," Downey says, "someone who shows up with an open mind, who thinks, 'I'm here to do everything I can for this organization,' a student who is motivated to come up with ideas and implement them." But, she points out, the right employer is also essential to a successful co-op experience. "We seek out employers who think of this as an educational experience, who really want to work with students, not just to meet the project needs of the company."



At Turner, Freeman worked on school renovations in Connecticut, part of a 10-year project to improve the state's elementary and middle schools. "I was mainly out in the field, working with engineers and handling scheduling," she says. She also worked on a condominium project in Westchester; during that project she was in the office, working with the purchasing department before construction began. This summer, Freeman will again be out in the field, at Yale, working on a renovation to a dorm with the project superintendent.

Freeman was pleasantly surprised by how easily she fit into the Turner environment. "It's a big office, really big, but the people were so nice. When I got there, they said, 'C'mon, let's meet everybody,' and they meant *everybody*—including the vice-president," she reports. "I was never working just with other interns; I was never stuck in the copy room. People thought I was a new hire. People invited me to dinner at their homes and out to events. Even though I was by myself in a new place, I never felt alone." Freeman met a lot of Cornellians there: Turner employed 57 Cornell alumni as of 2005 and hired four more in the past year.

Sarah Garner, senior cost engineer, was one of Freeman's supervisors at Turner. The company specializes

We like them to advise the students on learning objectives, to be real mentors."

"Tammy's employers at Turner were blown away, not only by her technical knowledge but also by her professionalism," says Sara Xayarath Hernández, assistant director of the college's office of Diversity Programs in Engineering. Representatives from the college typically make a field visit to each co-op student to document how the assignment is working for both student and employer; Hernández visited Freeman at Turner last fall. "She's clearly a role model to younger engineers and is very passionate about encouraging younger members to take advantage of the co-op program. I think Turner's had great experiences overall with Cornell co-ops, but they just raved about Tammy."

And Tammy raves about co-op. "I recommend it to all of the underclass students I know. You get a chance to work in a company in your field and gain life skills, while getting paid and graduating on time. The question they should ask themselves is, why not? No reason! It has been a wonderful experience." ■ ■ ■

## PARTNERS IN THE PROGRAM

Employers who partner with Cornell's Engineering Cooperative Education Program range from small start-ups to established conglomerates; many government agencies participate as well. The following is a list of recent co-op employers.

3M Corporation  
 Abiomed Inc.  
 Advanced Financial Strategies  
 Advanced Micro Devices Inc.  
 Air Force Research Laboratory  
 Air Products & Chemicals Inc.  
 Amazon.com  
 American Consulting Inc.  
 Annapolis Micro Systems Inc.  
 Apple Computer Inc.  
 Applied Materials Inc.  
 Autodesk Inc.  
 Axiohm Transaction Solutions Inc.  
 Blackrock  
 Bloomberg Financial Markets  
 Boehringer Laboratories  
 Boeing  
 Borg-Warner Automotive Inc.  
 Brontes Technologies  
 Cascade Engineering  
 Cascade Microtech  
 Central Intelligence Agency  
 Clough, Harbour & Associates LLP  
 Cornell University  
 Corning Inc.  
 Cummins Engine Company Inc.  
 Cuno Inc.  
 Deitel & Associates Inc.  
 DiDonato Associates  
 Dominion Semiconductor  
 The Dow Chemical Company  
 DuPont  
 Eastman Kodak Company  
 Empower Solutions  
 Estee Lauder  
 F.M. Global

First USA Bank  
 Florida Power & Light Company  
 Gemfire Corporation  
 General Electric Company  
 General Motors  
 Goldman Sachs  
 Goodrich Corporation  
 Hillcrest Communication  
 Honeywell Inc.  
 Hospital for Special Surgery  
 IBM Corporation  
 Infineum USA LP  
 Intel Corporation  
 Jet Propulsion Laboratory  
 Johnson & Johnson  
 Keithley Instruments  
 Keyspan Engineering and Survey Inc.  
 Kimberly-Clark Corporation  
 Kraft Foods  
 L'Oréal  
 Logistics Management Institute  
 Lutron Electronics Inc.  
 Maxim Integrated Products Inc.  
 Mercedes Benz  
 Merck & Co. Inc.  
 Merrill Lynch  
 Microsoft Corporation  
 MicroSystems Integration Inc.  
 MIT Lincoln Laboratory  
 MITRE  
 National Aeronautics and Space Administration (NASA)  
 National Institute of Standards & Technology  
 National Instruments  
 National Radio Astronomy Observatory  
 National Security Agency  
 Naval Research Laboratory  
 Naval Surface Warfare Center  
 Nestle  
 Nuclear Fuel Services  
 Parsons Brinckerhoff Quade & Douglas Inc.  
 Pitney Bowes  
 Premier Rides  
 Procter & Gamble  
 Qualcomm  
 The Raymond Corporation  
 Raytheon Corporation  
 RDA Inc.  
 RiskMetrics Group  
 Robert Bosch Corporation

Rohm & Haas  
 Sandia National Laboratories  
 Sanyo Electric Co. Ltd.  
 Schlumberger  
 Schneider Electric  
 Scholastic Inc.  
 Sensis Corporation  
 Shipley Co.  
 Siemens Moore Products  
 Simpson Gumpertz & Heger Inc.  
 Sun Microsystems Inc.  
 Symyx Technologies Inc.  
 Syracuse Research Corporation  
 Tangibl LLC  
 Teradyne  
 Texas Department of Transportation  
 Texas Instruments  
 The MONY Group  
 TriQuint Semiconductor Inc.  
 Turner Construction Company  
 United Parcel Service  
 United Technologies Corporation  
 U.S. Department of Defense  
 Verizon Wireless  
 Vicor Corporation  
 Visteon Systems LLC  
 Vollmer Associates LLP  
 Westinghouse Savannah River Company  
 Wetland Studies and Solutions Inc.  
 Willis Re Inc.  
 Winbond Electronics Corporation of America  
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search  
Inst



# ching for ability

By Kenny Berkowitz '81

**Harnessing instabilities in physical and chemical systems, Paul Steen has created an electrical switch made of water and filled with enormous potential.**

Paul Steen's teenage daughters think it's funny their father earns his living playing with soap bubbles. But after studying the reconfiguration of thin films by surface tension for the last dozen years, Steen has many questions still unanswered, and that unpredictability is at the mathematical heart of his two latest projects: an electrical switch made of water and a method for spin-casting metal in thin, continuous sheets.

"Soap bubbles are simple but very effective," says Steen, a professor in the School of Chemical and Biomolecular Engineering, sitting in his office at Olin Hall. "The individual soap bubble is relatively well understood, but when you combine a group of them with different geometrical constraints, and when you let them work together or fight one another, you see them elucidating this wonderful set of instabilities. It's very dramatic, because there's a balance of forces, and then some disturbance comes to throw everything out of whack, and all of a sudden you've got ... a catastrophe."

What kind of man spends his life searching for instability? "It's a field that draws people who are analytically minded, who want to do quantitative, predictive science," says Professor Tim Healey, chair of the Department of Theoretical and Applied Mechanics, where Steen is a member of the graduate field faculty. "First and foremost, Paul is a scholar. He's the quintessential mathematically driven scientist. He's not using an Edison approach, where you try 185,000 different things until you get something to work. With Paul, the science always comes first. That's what drives him."

Playing with a palm-sized prototype of the switch, Steen leans forward, speaking softly, enthusiastically about his work: the thrill in trying to understand these catastrophes, the beauty in the nexus of math and physics, the creativity in designing tools to harness this instability. He talks about the power of surface tension, using a bead of spit between thumb and index finger as an example, and multiplying that effect hundreds of thousands of times.

In the electro-osmotic droplet switch (EODS), Steen uses electricity to create and release an adhesive bond between a droplet of water and a flat plate. With the current flowing in one direction, low voltage moves the water's positively charged ions through capillaries in a porous glass

disk, forming a micrometer-sized droplet that quickly attaches itself to a flat surface; flowing in the other, the droplet detaches itself just as easily, breaking the bond as it returns through the glass pores.

It's a project that was originally inspired by the palm beetle, which can cling to a leaf with a strength equal to a hundred times its body weight — imagine Steen supporting six or seven cars with that bead of spit — and by Cornell entomologist Tom Eisner, who first brought him the idea, based on Eisner's work with Professor Dan Aneshansley in the Department of Biological and Environmental Engineering. "This after-dinner talk at the Statler and the image of the beetle clinging and releasing itself stuck in my mind for the next few years," says Steen. "And the more I rolled it around, while I was riding my bike or jogging or walking, the more I thought I should take a closer look at how we could put it to practical use."

By fall 2003, when he sat down with long-term collaborator Peter Ehrhard at the Institute for Nuclear and Energy Technologies (IKET) in Karlsruhe, Germany, it was still on his mind, and soon became the focus of Steen's sabbatical at IKET. "We were discussing what we might do together," says Steen. "I had this idea of designing a landscape for capillary systems, but I had no way of triggering the system from one state to another. Peter suggested electro-osmosis, which is another idea that's been around for a while, but never used this way. So it wasn't a matter of technical prowess; it was a product of bringing together two things that had never been combined before. I spent the next two months running all these calculations with pencil and paper. And instead of being off by orders of magnitude, everything worked out — which doesn't usually happen."

Built by Mike Vogel, a post-doctoral associate in chemical and biomolecular engineering, that first device cost under \$100 with basic equipment that can be found in any chemistry stockroom. It's surprisingly simple: a robust, easily fabricated switch that has no solid moving parts, turns on and off in under a second, runs on less than five volts, and can be used either by itself or in larger arrays. Engineered down to the hundred-nanometer scale, which seems a stretch but within reach, an array of switches could enable Steen to walk across the ceiling of his office, focus the lens of a cell phone camera, or act as a microscopic, energy-efficient lab-on-a-chip. The implications are enormous — it's no surprise that the Defense Advanced Research Projects Agency (DARPA) is underwriting the fabrication of the first complex array of droplet switches — and though Steen grows uncomfortable with its comparison to the transistor, the full range of applications is still unimaginable.

"It's one of the most ingenious ideas that I've seen in a long time," says Professor Paulette Clancy, the William C. Hooey Director of the School of Chemical

and Biomolecular Engineering. "It is so clever and so thoroughly backed up with theory. That's what Paul brings to his projects: a deep understanding of the mathematics that underlie a principle and the experimental tour de force of actually showing what can be done."

It will be the third patent for Steen; in the first, applied for in 2002 and awarded in spring 2006, he designed a system for casting molten metal into thin, solid ribbons in a single step, manipulating the surface tension of the cooling, hardening metal on a rapidly spinning wheel. It's a dream that dates back over 150 years: feeding molten metal into one end of a machine and retrieving solid, continuous sheets from the other; and though the patents seem dramatically different, to Steen, they're two sides of the same coin. With the droplet switch, his goal is to harness instability driven by surface tension; in casting metal, he's trying to suppress instability.

"Paul is using surface treatments of the casting wheel to modify the behavior of the melt puddle. This has the possibility of modifying the instabilities and, equally important, of modifying the microstructure, and thus the final properties, of the finished product," says Associate Professor Shefford Baker, a faculty member in the Department of Materials Science and Engineering and one of Steen's collaborators on the spin casting project. "Paul has been looking at the fluid dynamics of this process for a long time. He's very meticulous, very good at thinking through problems from different angles, and very careful to ensure that the path he's on is the right one."

Clancy calls it "an incredibly exciting project," and at a time when the world is once again focused on conserving energy, casting by design could become a huge boon to producers of flat products of aluminum and steel. For aluminum foil alone, the savings would amount to 300 gigawatt hours of power per year with a reduction of carbon dioxide emissions by 250,000 tons a year in the United States alone. But for Steen, who's still hard at work refining the process, talking about the applications is far less interesting than thinking about the science behind it, and as both projects move to the next stage, he finds himself spending more time in the search for funds, acting as a reluctant salesman.

"It reminds me of when I was a young boy in rural Pennsylvania, selling strawberries door-to-door," says Steen. "It's almost the same thing. You grit your teeth, and even though you really don't want to do it, you walk up to the door, knock, and start your pitch: 'I've got this great thing I want to sell you....' I was the last of five children, climbing trees and picking wild berries, and it's hard to imagine how I ended up here."

Growing up in Meadville, a small city located between Erie and Pittsburgh, Steen didn't think much about his career. His father taught math at Allegheny College and his mother taught business at the local high school. As his siblings grew older, they all found work in science, but Paul wavered

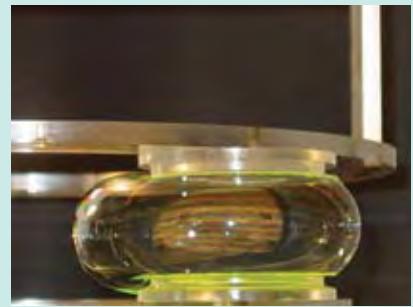
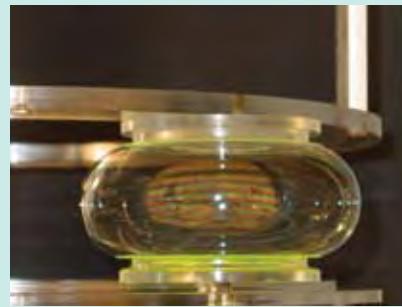
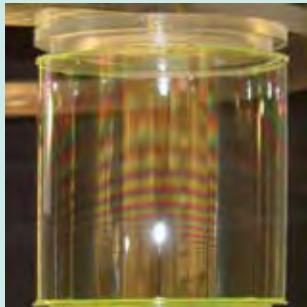
It is so clever  
and so  
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between English, history, math, and engineering. ("With what I now understand about genetics," he says, "when I look back at my family, I can guess that I would have gone into science.") Attending Brown University, Steen graduated in 1975 with two bachelor's degrees, one in English literature and the other in biomedical engineering, though he suspected he'd have a brighter future as an engineer than as a novelist. Five years later, he completed his Ph.D. in fluid mechanics at Johns Hopkins University, and after a two-year post-doctoral appointment at Stanford University, he joined the faculty at Cornell.

In the years since, he's risen to full professor in the School of Chemical and Biomolecular Engineering, becoming a member of the graduate field faculty in applied mathematics in 1984 and in theoretical and applied mechanics in 2002. He's a fellow of the American Physical Society, serves or has served on its executive, program, publications, and prize committees, and as a member of the

with undergrads," he says, "because their diplomas don't depend on the idea working out and they're some of the best brainstormers you'll ever find.") Faria, who begins medical school this fall, tells the story of successfully reverse engineering a bubble toy that Steen's younger daughter brought home from a birthday party. When he showed the results to Steen, "he was ten times more excited than me. He just jumped out of his chair, landed on the floor, and kept staring at this bubble. And that's the attitude he carried throughout the whole lab."

"Paul gives his students a lot of freedom," says Vogel, who has spent the last three years working with Steen as a post-doc, collaborating closely on both the droplet switch and casting by design. "He's very easygoing, with a very laid-back approach. He's very good at boiling down complicated problems into a relatively simple theoretical framework. And it's nice to work with someone who has faith that you'll produce great things."



Images by Carolyn Cummings '05 ChE

The "beer-belly" instability occurs for a short enough soap-film bridge. Initially, (1) a soap film is stretched between circular plexiglass grips to form a cylindrical-shaped bridge. As the grips are slowly moved closer and closer together, the bridge becomes fatter (2) and fatter (3) until it suddenly snaps through to a shape that is no longer a surface of revolution (4).

Science Advisory Council of the Universities Space Research Association, which acts as liaison between NASA and the academic community.

He is associate editor of the *Journal of Fluid Mechanics*, co-author of more than 60 published articles, and mentor to countless Cornell students, both undergraduate and graduate. "Basically, Professor Steen taught me how to be a scientist," says John Faria, who went to work for Steen as a sophomore and continued until he graduated in 2005. "Before I came here, I didn't know how to make a convincing scientific argument, and the only experiments I'd done were in chemistry lab, where we knew exactly what results we were supposed to get. With Professor Steen, for the first time, I didn't know the outcome. And whenever I ran into a problem, he was able to help me work through it."

Steen has always enjoyed working with undergraduates and generally has three or four working as part of his research group. ("You can try some of your riskiest ideas

For Steen's two daughters, 15-year-old Ana, whose passion is ballet, and 13-year-old Frances, who's currently studying classical guitar, the idea of walking on a ceiling is more than great — it's cool. As a family, Steen, his wife, Kyra Stephanoff, and the girls spend summers bicycling through the watersheds of Central New York and winters cross-country skiing around the Finger Lakes. It reminds Steen of his own childhood, playing in the woods, and in the quiet moments between hills, gives him a chance to think through those next obstacles: a more uniform array of switches and a smoother ribbon of aluminum.

"I get an incredible thrill from doing this work," says Steen. "It's still amazing to me that we have this way of connecting numbers to physical phenomena. The range of predicting and understanding instabilities is just a fundamental fascination for me. And underneath it all, I like the idea of taking a mathematical proof and seeing it connect with something we can all use."

## LATE-BREAKING NEWS

Steen has received a grant from DARPA (Defense Advanced Research Projects Agency) to demonstrate "capillarity-based reversible super-adhesion." This is a direct application of the parallel action of surface tension (capillarity) inspired by the palm beetle, and the idea can be illustrated with a bank of soap bubbles or liquid droplets controlled by electro-osmotic droplet switches. Steen, principal investigator on the project, is working with Vogel, who is principal scientist. Shakti Technologies of Palo Alto, Calif., will fabricate the prototype device.

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# Managing information

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# New major teaches students the design and uses of information systems

David Shmoys



Claire Cardie

By Jay Wrolstad

The potential for discovery and new applications in information science is limitless

We can't get enough information these days, and we can't get it fast enough. The Information Age's digital revolution, sparked by the Internet and its explosive growth, has taken computing to a level unimagined a generation ago as the steady stream of ones and zeroes flowing through vast networks has become a torrent that has forever altered the way we work and live.

As a result, those putting together the systems to handle the proliferation of digital information technologies face challenges that go well beyond writing computer programs to include issues relating to how goods are produced and sold, potential restrictions on what we are allowed to see and hear, and how people use the machines that are windows to the digital realm when they sit down and start tapping on the keyboard or moving the mouse.

Students in the College of Engineering are taking a closer look at these concerns through courses offered in the new Information Science, Systems and Technology (ISST) major, which combines the traditional study of how computer programs are designed with the ways they are used.

"We know how to make computers do their jobs well, but most people do not use them to do too much more than perform basic functions such as handle e-mail and conduct web searches," says David Shmoys, professor in the School of Operations Research and Industrial Engineering and co-director of the ISST undergraduate major. "That's what students find exciting; they have a sense that they will be on the cutting edge as information science evolves."

The new major evolved from a desire among students to create programs of study that branched out from the two traditional majors, computer science and operations research and industrial engineering, Shmoys explains. "It became clear that faculty in both CS and ORIE wanted to design a new major, and it made more sense to create a single, coherent major rather than two new programs."

What emerged from those discussions was an ISST major with two options, one in management science (ISST-MS) and one in information science (ISST-IS), which are administered separately by ORIE and CS, respectively. "There was an effort to align course requirements, and what made it all click was we sat down and compared what we wanted to require of the students," says Shmoys, who directs the ISST-MS component.

Some of those requirements are core programming and probability and statistics courses, to establish a sound engineering foundation; but while CS majors study computer

architecture, programming languages, operating systems, compiler design, and algorithms, those in ISST focus on how people *use* information systems as well as how to build them.

"If you are driving a car you don't have to understand everything about the mechanics of the vehicle. You need to know what capabilities are available to you as the driver, and how they control the car," says Claire Cardie, professor in the Department of Computer Science who directs the ISST-IS program. "This major is more about the points in information system design where computing meets people, rather than focusing on the hardware and operating systems."

That examination of both human and machine means that ISST students take courses not required of most of their peers in the college. There is a basic economics course that is not among the mandated offerings in either ORIE or CS, but is part of the ISST curriculum because it helps shape a broader view of the impacts of information science, says Shmoys.

Another example is an applied databases course that examines database techniques with a focus on the web and e-commerce. It is an ISST requirement, while CS majors can take it as an elective. "Often the courses are shared," Cardie says. "Some of the ISST required courses are electives in CS and OR, and vice versa."

The subjects studied extend to an examination of information in context, she notes, with discussions of copyright and intellectual property law, as well as the impacts of information science and technology on culture and the media. Other courses focus strictly on human-computer interaction.

"The question is, what are the right mechanisms for making that interaction as functional as possible?" Shmoys says.

"And what kinds of information can you extract from that relationship?" Cardie suggests that the applications are wide ranging, for example, creating computer games that are easier and more fun to play or improving search technology by studying how people look at a web page or scroll through the query results.

Given this background, some innovative ISST research projects have been launched that will provide valuable experience for future information science specialists. Some students are creating natural language processing techniques to expedite the painstaking process of passing new laws. As Cardie explains, Congress proposes a law, such as new stipulations for safety regulations. As part of this process, the public can submit comments on the proposed regulations.

"Those comments can currently be submitted via a web portal, but agencies are required by law to respond to all substantive issues raised in the comments and, for many rule makings, there can be thousands of submissions. Our program would enable indexing and extracting information from a database of these public documents," she says. "In this project students had to study the legal side of rule

making in addition to the information systems side."

Another group of students is studying Internet search specialist Google, turning their attention to where the eye focuses when a person retrieves query results, or where the person clicks on that page. Based on this feedback, the project's goal is to develop algorithms that can do better searches. "It's a case of paying attention to the human-computer interaction to get feedback for computer science engineers," says Cardie.

On the management science side, there is an Amazon.com project tying together information systems and operations research issues that address the massive amount of data handled by the online retailing giant. "The company has about 40 million items to track, so students have to think about when an order comes in, how do you manage the information so you know from which warehouse the product should be shipped?" Shmoys says. "This connects with traditional OR, but the area of supply chain management relies extensively on the role that information systems play to make business decisions."

It is the challenging, thought-provoking nature of such research and the broad array of topics covered by ISST that has students giving the nascent major rave reviews. Many had their sights set on careers as programmers, but found computer science too confining.

The first group of five students graduated with an information science major in 2005, followed by another 20 this year. Shmoys projects that growth to continue at a steady pace, noting that students can minor in information science as well. Different variants of the degree are offered in the colleges of Arts and Sciences and Agriculture and Life Sciences. Those majors are less technical in orientation than the Engineering version, focusing more on the social context of information systems and on human-computer interaction.

"The students want this major, because information technology affects so many people today," says David Williamson, director of undergraduate studies for the information science major. "It's still a small and friendly major at this point, and most of the students know each other and their professors pretty well."

Most students like the web design and programming course, he says, because those are things they are familiar with before arriving on campus, but now are able to take them a step further. "More students are becoming interested in information technology issues, such as how technology interacts with the economy, or law," says Williamson, who teaches a course on computer programming and web design. "Information is valuable, but is also very easy to distribute, so how can people protect their intellectual property?"

Colin Zhao sums up his interest in ISST succinctly, saying, "This is a major for the future. There is a demand for people who can program, but more companies today are looking for people who can apply technology to

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possible?

business processes and issues that affect society at large. With a background in information science, it's possible to understand how we can use technology to solve problems."

Zhao, a recent ISST-IS graduate, cites a strategic information systems course offered at Cornell's hotel school as particularly compelling in that it demonstrated how to apply information technology (IT) tools to a business setting. "You have to think about how IT meshes with organizational goals, and how to use it to gain a competitive advantage," he says. "This is thinking about technology in a new way; it has no intrinsic value—you need to examine the best set of tools for a particular situation."

He also says that examining how information technology has evolved over time is critical in understanding future impacts on society. "We talked about the legal ramifications of Google plans to scan all of the world's books and make them available online, and how that impacts intellectual property rights," he says. "It's good to have all of that information readily available, but there may be some adverse impacts on copyrights."

Junior Matt Leftwich has a similar view of ISST career

it would be a profitable venture."

Dhindsa, a sophomore ISST-MS major, will put that knowledge to good use when he reports for work at the RiskMetrics Group, a financial services firm, in the fall as a participant in the Engineering Cooperative Education Program. "It really fits my interests, working on data mining technologies and using programming skills to evaluate the value and risk of certain investments."

For Krystal Wang, ISST offers less theory and more practical information than CS. "I think there is more job security with this since there is a greater need for project management skills," she says.

Wang has her sights set on a job in the investment banking field or with an IT firm seeking people with engineering expertise. To prepare, she is looking into some business classes to complement the ISST-IS curriculum before her graduation next year.

Zhao, who will continue his information science studies while pursuing a master's degree in engineering at Stanford University, says, "In the future, there will be a place for programmers, but it will be important to have a purpose in

The first group of five students graduated with an information science major in 2005, followed by another 20 in 2006 (right). Shmoys projects that growth to continue at a steady pace.



ISST majors learn to apply technology to solve business problems. In this 3D visualization based on eye-tracking data, higher peaks indicate regions that draw viewers' attention on a web page at Amazon.com.

potential, contending that most employers today want people who have a grasp of both technology and business rather than more specific knowledge about one or the other. "In one course we took a look at the digital music industry and the impact on that industry from people who use new technologies, such as file sharing, to get their music. Another course involved building a web site backed by a database. What's interesting is that one course is technical in nature, and the other is studying how technology is used. Both are important, but not usually combined in one major like they are in ISST."

And, Leftwich says, because it is a new major, the instructors are particularly interested in student feedback, gauging their impressions of the courses. "As it evolves, the professors want input to determine what works and what doesn't. Both sides are learning from each other," says Leftwich, who is in the ISST-MS program.

Sahib Dhindsa says he made the switch from CS in large part because he was intrigued by learning more about law, psychology, economics, and accounting as well as web design and computer software.

"In the web design and programming course, we got to work with scripting languages and other technologies to create dynamic web sites," he says. "And in the information systems and analysis class, we developed a business plan, examining the creation of a new product while determining if

mind for that programming knowledge."

Shmoys suggests that this favorable response among undergrads stems in part from the fact that information science as a discipline is closer to the natural and physical sciences than computer science. "How do you come up with a model and extract an underlying principle that shows how the web may be characterized?" he says. "We can develop a hypothesis regarding a structure, but we can't control what the web will look like even six months from now."

The amount of data—including text, images, and multimedia content—that is available to the world at large is staggering and will only continue to grow, says Cardie. "And so the process of managing it all is getting worse, not better," she says. "We need people who can look at the bigger picture."

"It's the kind of major I would have liked as an undergrad," she adds, "because, in addition to computer science courses, it includes courses in optimization, cognitive science, and experiment design—topics not typically taught in a computer science curriculum." ■ ■ ■



Cornell student Richard Zhao conducts teacher training in Yujiang County of Jiangxi, China, as part of Operation DEEP.

**Why China?**  
Because I'm from  
there ... I know it  
well, and I want to  
do something that  
will have an actual  
impact.

## DEEP IMPACT

Cornell students change the lives of children in China.

Turning Krispy Kreme Doughnuts and fried rice into a brand new bricks-and-mortar school for children in rural China is nothing new for Cornell University junior Richard Zhao.

As a high school senior in Illinois, the mechanical engineering major founded an organization called Project Hope Committee of Lake Forest Academy. Through it, he spearheaded a fund-raising effort that resulted in the new school for children in Yujiang, a county in China's Jiangxi province.

Zhao brought his organization to Cornell, renamed it Operation Developing Elementary Education Possibilities in China, or DEEP, and began fund-raising activities on campus. With those funds, for three weeks in July, Zhao returned to Yujiang with two Cornell students, a Cornell alumnus, and an English-as-a-second-language teacher from Lake Forest Academy. Their goal: to reach 600-plus schoolchildren by teaching their teachers conversational English.

Why China? "Because I'm from there, because I know it well, and I want to do something that will have an actual impact," said Zhao, who was born in Los Angeles but spent much of his childhood in Shanghai. "We also want to let people in rural areas know the importance of education. Now that we're in the 21st century, the information age, without an education, you can't do anything."

According to DEEP's web site, <http://www.operationdeep.org>, more than 40 million primary and junior-high Chinese students live in poverty. Most of them are from less-developed rural areas, such as the neighboring villages of Jindun and Nixia, where the school was built, opening in 2005 and replacing each village's dilapidated school building.

The doughnut-and-fried-rice effort in Illinois raised \$12,000 that, when leveraged with local Chinese government funds, helped build the \$50,000 Jin-Ni Lake Forest Academy Hope Elementary School (the name combines Jindun and Nixia with Lake Forest Academy).

This summer's volunteer team from Cornell helped the school's teachers, whose lessons are generally limited to written English from outdated British texts, teach students how to speak English. Team members, picked from a Cornell applicant pool of more than 20, were:

Josh Fenn '07, a biology and society major, participant in Cornell's Chinese FALCON (Full-year Asian Language Concentration) program, and a DEEP board member who previously taught in Shanghai;

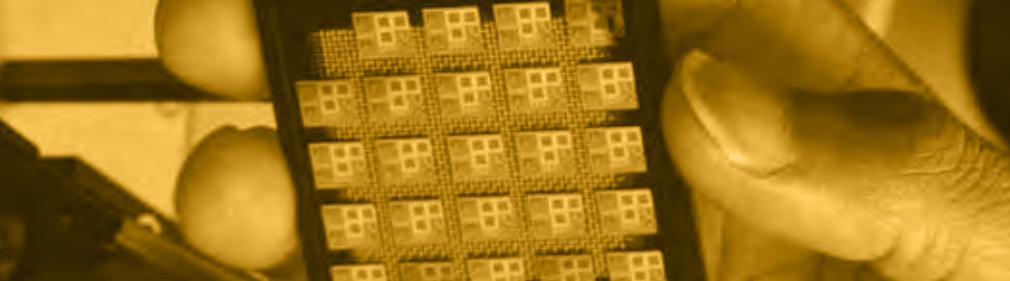
Michael Goulet '06, a mechanical engineering graduate, who specializes in helping underdeveloped communities find sustainable solutions to local needs; and

Hannah Rogers, a graduate student in science and technology studies who taught in China's Hubei province before coming to Cornell.

Each received up to \$500 for air travel in addition to covered expenses within China. Andrew Fleury, a junior majoring in economics and Asian studies and DEEP's project director and acting chair while Zhao attends an internship this fall, said the three were selected not only for their experience, but also for their dedication and passion.

The organization's long-term goal is to build a second school for children in a rural community in China.

—J.R. Clairborne, Cornell News Service



## GLOBAL COOKING



**H**is stay included guest lectures in astronomy and human sexuality (not at the same time); an orbit around downtown Ithaca's Carl Sagan Planet Walk; lunch with prospective graduate students; and a public lecture last spring titled "Everybody Talks About the Weather." Now Bill Nye's legion of admirers are left only with reruns of his Emmy Award-winning television show, "Bill Nye, The Science Guy"—although he says he will return to the campus periodically.

Nye, a 1977 graduate of Cornell's Sibley School of Mechanical and Aerospace Engineering, made his last trip to campus as a Cornell University Frank H.T. Rhodes Class of '56 Professor in March.

The weather, he told a packed crowd at Alice Statler Auditorium, is worth talking about. Take global warming. Few informed people would argue with the evidence of global climate change. But "warming" just doesn't sound, really, like a bad thing, he said, suggesting we should perhaps use different words.

Call it "global cooking," Nye suggested, or "really hot ... really fast." Even a modest change from "global warming" to "global heating" might spur people to action.

Climate change is not rocket science, he said. Last April—four months before Hurricane Katrina—he warned of the potential for a catastrophic 2005 hurricane season on TV news programs. "Am I a genius? No. I was just paying attention. And a lot of people aren't," he said.

Some evidence of global heating, he said, is found in ice core samples in a laboratory in Colorado and in carbon dioxide levels in the atmosphere. He showed the 2002 Intergovernmental Panel on Climate Change's "graph of death," which extrapolated three scenarios for rising global temperatures in the future.



During his term as a Rhodes Professor, Bill Nye, "The Science Guy," demonstrated fluid vortices using smoke in one of Professor Charles Williamson's classes in Upson Hall last fall.

He discussed the devastation of slash-and-burn logging and wasteful transportation choices. He noted that advocates of intelligent design and other nonscientific ideologies are most likely to distrust the evidence of global warming and argued for more emphasis on science education in schools.

To fellow and future Cornell alumni, Nye ended with a special appeal.

"It's such a big deal that it's hard for most people to get their minds around. You want to—pun intended—go with the flow," he said. "Don't. You guys are Cornellians. I want you to take a few seconds and realize you're part of this hopeful, wonderful legacy."

He showed an image of the Earth seen from space.

"I want everybody to take another few moments and look at this picture," he said. "Because it is this tiny, tiny world. Really, it is this perfect ball. ... And it's a sobering thought to realize that anyone who's ever lived—every corporate pig, every do-gooder environmentalist, every somewhere-in-between—has lived in this world. And it's not very big."

"There were 3 billion people in the year 1965; there are well over 6 billion now," he said. "And everybody's got to fit on here. We need more of these, and we've only got one—so I encourage you every day to think about global heating. To think about your place in the world, and think about your legacy as Cornellians and—dare I say it?—change the world."

—Lauren Gold, Cornell News Service

## RECOGNIZING POTENTIAL

Filip Radlinski, a Fulbright scholar from Australia, has won a two-year Microsoft Research Fellowship, awarded to outstanding Ph.D. students in computer science, electrical engineering, or math. He will use the fellowship to further his thesis research, which involves applying machine learning to ranking problems. The fellowship covers a variety of expenses, including tuition, fees, and conference travel, and provides a stipend and tablet PC.

"The competition for Microsoft Research Fellowships is intense," said Thorsten Joachims, assistant professor of computer science and Radlinski's adviser. "The fellowship is a tremendous asset to both Filip and to Cornell in how it recognizes the quality and the potential impact of his work on making search engines learn improved ranking functions."

Radlinski's research focuses on computer programs that can learn from experience, with particular application to search engines that adjust the ranking of their returns to what they have learned about the user submitting a query.

—Stephanie Specchio



## PROTECTING THE EARTH



At left, Matthew Perkins '08 is introduced by Ulrich Wiesner, professor of materials science and engineering, at the May 9 fellowships reception on the Johnson Museum's sixth floor.

An engineering undergrad, Matthew Perkins '08, was one of three Cornell University students who received the 2006-07 Morris K. Udall Scholarship. Nationwide, a total of 80 students were selected for the honor, given by the Morris K. Udall Scholarship and Excellence in National Environmental Policy Foundation.

The students garnered awards up to \$5,000 each from a field of 445 nominations from 224 institutions. They were selected by a 12-member independent review committee on the basis of commitment to careers in the environment, health care, or tribal public policy, leadership potential, and academic achievement. The students' selection places Cornell among only five U.S. institutions to have more than two Udall scholars.

Perkins, from Guilford, Conn., said he intends "to protect the earth's natural resources with a career of research and business development in sustainable energy technologies," and he plans to put his skills to work in China.

Perkins is former president of the Cornell stu-

dent group Kyoto Now! and a member of Cornell's Glee Club, the Cornell Biodiesel Initiative, and the Solar Decathlon team. The materials science and engineering major interned at the Yale School of Forestry and Environmental Studies as well as Chevron Energy Solutions. He has remained on the dean's honor roll since fall 2004 and is a Bert Hopkins Environmental Science Prize recipient.

The Udall Scholarship was authorized by Congress in 1992 to honor Congressman Udall's legacy of public service. Other Cornell winners were Tony Marks-Block '07 and Meredith Odato '08, both natural resources majors in the College of Agriculture and Life Sciences.

—J.R. Clairborne, Cornell News Service

## ACADEMY ELECTION

Two members of Cornell's engineering faculty—Toby Berger, the Irwin and Joan Jacobs Professor of Engineering emeritus, and Jean-Yves Parlange, professor of biological and environmental engineering—have been elected to the National Academy of Engineering. Election to the academy is among the highest professional distinctions accorded an engineer.

According to the academy, Berger was selected "for contributions to the theory and practice of lossy data compression." Berger's research embraces a broad range of topics in information theory, digital communication, and signal processing. His work on video compression led to the creation of software that allows full-motion videoconferencing on systems with very low bandwidth. After spending his entire career at Cornell, he retired last January and now holds a faculty position at the University of Virginia.

Parlange was chosen for "fundamental contributions to the formulation of water flow and solute (chemicals in a solution) transport in soils and groundwater." His research focuses on the use of water in agriculture. Often collaborating with scientists in the Agricultural Research Service of the U.S.

Department of Agriculture as well as academics from several universities, he has studied the way water moves over and through soils as well as erosion and sediment transport. He joined the Cornell faculty in 1985 after working at Yale, the University of Washington, and Griffith University in Brisbane, Australia.

Several Cornell alumni were also elected to the academy this year, including Samuel Bodman '60 ChE, the U.S. Secretary of Energy; M. Douglas McIlroy '54 EP, former head of the research department at Bell Laboratories and now adjunct professor of computer science at Dartmouth College; Surendra P. Shah, Ph.D. '65 CE, the Walter P. Murphy Professor of Civil and Environmental Engineering at Northwestern University; Ching Wan Tang, Ph.D. '75, distinguished research fellow at Eastman Kodak Co.; and Ali Galip Ulsoy, M.S. '75 ME, the William Clay Ford Professor of Manufacturing, University of Michigan, Ann Arbor.

—Bill Steele, Cornell News Service



Provided





## DESIGNING WOMEN

If it seems that women don't like video games, perhaps it is because game designers don't often design with women in mind. A computer game-design team at Cornell is helping to change that.

An all-female team of Cornell students recently captured the university's first computer game-design prize when their interactive game "Green, Eggs, and Pan" took first place at the Games4Girls programming competition in Urbana, Ill.

"I'm all for women in game design," said Sally Huang, a senior in film and the project's manager and programmer.

"We're the first Cornell team to win a game-design competition," said a smiling Lisa Marie Allen, a junior in biological engineering. Allen helped provide art for the game.

The national all-female competition was designed to promote women in computer science. The Cornell team, organized under the Game Design Initiative at Cornell (GDIAC), beat out entries from game-design programs at the Universities of Bradley, Buffalo, and California-Irvine, as well as Franklin and Ohio State universities. For first place,

each Cornell team member received \$1,000, and \$1,000 will go to GDIAC to support future female game-design activities.

In addition to Allen and Huang, team members and their roles included: Dora Helen Fraeman, a junior independent major in Engineering with a concentration in computer science, programmer; Brenda Chen, a junior in biological engineering, artist; and Pamela Chuang, a senior in electrical and computer engineering, musician.

"What we have are some phenomenal female game designers here at Cornell," said GDIAC director David Schwartz. "To win the contest shows Cornell has its foot in the door in terms of this new area in academia."

The Mario-style "Green, Eggs, and Pan"—available for download at <http://gdiac.cis.cornell.edu>—was described by one retreat participant as the "the best game ever."

—J.R. Clairborne, Cornell News Service



Members of the all-women team that created the prizewinning computer game "Green, Eggs, and Pan" are, from left, front row: Dora Helen Fraeman '07 and Lisa Marie Allen '07. Back row: Pamela Chuang '06, Sally Huang '06, and Brenda Chen '07.

## AMONG GOOD FELLOWS

Robert A. Buhrman, the John Edson Sweet Professor of Engineering and director of Cornell's Center for Nanoscale Systems, has been elected a fellow of the American Academy of Arts and Sciences.

Buhrman, who joined the Cornell faculty in 1973, studies the electronic and structural properties of thin-film systems and nanostructures that can resolve current problems in basic and applied condensed-matter physics. He earned his B.E.S. degree from Johns Hopkins University in 1967 and both his M.S. (1970) and his Ph.D. (1973) degrees from Cornell.

Three other members of the Cornell faculty were also elected this year: Dominick C. LaCapra, the Bryce and Edith M. Bowmar Professor of Humanistic Studies and director of Cornell's School of Criticism and Theory; William B. Provine, the Charles A. Alexander Professor of Biological Sciences and fellow of the American Association for the Advancement of Science; and Steven E. Stucky, the Given Foundation Professor of Composition and winner of the 2005 Pulitzer Prize in music.

They join other newly named fellows, including former U.S. presidents George H.W. Bush and Bill Clinton; Nobel Prize-winning biochemist and Rockefeller University President Sir Paul Nurse; and movie director Martin Scorsese.

The American Academy of Arts and Sciences, which has more than 4,000 fellows and over 600 foreign honorary members, was founded in 1780 by John Adams, George Washington, and James Bowdoin and is based in Cambridge, Mass. The new fellows will be inducted into the academy in October.

—J.R. Clairborne, Cornell News Service





## TRUE STORIES



In this illustration from the book *Changing Our World: True Stories of Women Engineers*, Marjolein van der Meulen measures the stress on a bone, part of her study of bone development in teenagers.

**M**arjolein van der Meulen, associate professor of mechanical and aerospace engineering at Cornell, is featured in a new book, *Changing Our World: True Stories of Women Engineers*, published by the Extraordinary Women Engineers Project. The book is intended to inspire and encourage young women to pursue careers in engineering and to address the long-standing underrepresentation of women in the engineering profession. It will be distributed primarily to school libraries and counseling centers.

In a section on bioengineering, the book describes van der Muelen's research on how bone mass develops during the teen years. Her research focuses on the human skeleton in the relatively new field of mechanobiology, which examines how mechanics influences biological systems. Van der Muelen also is an associate scientist with the Laboratory for Biomedical Mechanics and Materials at the Hospital for Special Surgery in New York City, the orthopedic affiliate for Weill Cornell Medical College.

The book was launched at the National Press

Club in Washington, D.C., in February during Engineers Week and is available in PDF format at <http://www.conveyinc.com/ewep/>.

The Extraordinary Women Engineers Project is a coalition of professional societies and educational institutions whose goal is "to inspire young women to enter the engineering field and to develop a new generation of role models for those in the field." The coalition plans to follow the new book with a television documentary, educational resources and training, and national outreach programs.

—Bill Steele, Cornell News Service



Provided

In January Weber-Shirk (right) and Cornell students met with representatives of the Honduran Partner organization Agua Para el Pueblo (APP) in Ojojona, Honduras. APP is currently building the second Cornell-designed water treatment plant that will provide affordable safe, clean water for Ojojona.

## SERVICE AWARD

**M**onroe Weber-Shirk, senior lecturer in civil and environmental engineering, has been awarded a 2006 Kaplan Family Distinguished Faculty Fellowship for outstanding public-service initiatives.

The Kaplan fellowships recognize the importance of civic engagement in higher education and include a \$5,000 award to enable the faculty members to further develop an ongoing community-based learning or research project, to initiate a new effort, or to seek the institutionalizing of a service-learning course. The award reinforces Cornell's tradition of service to society and fosters further extension of public scholarship to all facets of Cornell's mission.

Weber-Shirk's initiative, the Honduras Water Supply Project, aims to improve water-treatment technologies, so that communities can afford safe, clean water, while providing an exceptional educational experience for university students. The focus is on small-scale water treatment systems that can operate without an external power source and that can be maintained by rural communities.

The fellowships are part of the Kaplan Family Endowment for Public Service. Barbara Kaplan '59,

her husband, Leslie Kaplan, son Douglas Kaplan '88, and daughter Emily Kaplan '91 established the endowment in 2001 to support both the service-learning fellowship and the Kaplan Family Distinguished Lecture in Public Service. The endowment aims to inspire students, faculty, and staff to a life of service and civic engagement while creating opportunities for public scholarship and active participation in community life.

The Cornell Public Service Center coordinates and supports public service for members of the Cornell community.

—Susan S. Lang, Cornell News Service



## PERFECT PUTT

**W**ith an eye on the ball on learning, the science-themed Galaxy Golf miniature golf course at the Sciencenter has a new mini-golf putting green for children ages 4 and under, with a little help from two Cornell students and a grant from the Cornell Public Service Center (CPSC).

Michael Stocke '06 ME, who volunteers at the Sciencenter, a hands-on science museum in Ithaca for all age groups, was invited early last fall by museum staff members to help plan and build an addition to Galaxy Golf for preschoolers. After applying for and getting a Community Partnership Board grant for the project through CPSC last fall, Stocke invited his classmate William Culley to get involved as well. The two began working with other volunteers and members of the Sciencenter's exhibits team to design a prototype of a five-hole putting green. Stocke and Culley then built the actual green, completing it this May. The exhibit staff provided workspace and advice.

The octagonal mini-golf putting green they built resembles a standard miniature golf course hole, with bright green synthetic turf surrounding a live tree. However, the green itself features five separate challenges that encourage youngsters to experiment with the specially designed moveable wooden blocks and build structures that might make it easier to get a hole-in-one.

In addition, a sign with words and pictures shows how to build a ball run and how to play on the green. Special golf clubs and balls light and small enough for tiny hands are available for preschoolers, and there are benches on the side for parents to oversee activities.

One of the holes is surrounded by a raised area not much bigger than an anthill that Stocke and Culley hope will challenge pint-sized golfers to learn to control the motion of their golf balls. "The kids are creative and come up with new ways to play every time," said Stocke. The two observed test runs with preschoolers and on the Sciencenter's Members Night in April. "The kids were really smart," said Culley. "They made ball runs out of blocks that mounted the hill and delivered the ball right into the hole."

"Michael and Bill are dream volunteers," said Brian Gold, lead developer of Galaxy Golf. "From day one, they have embraced each opportunity with initiative and enthusiasm."

"We are very grateful to Michael and Bill for their efforts and the terrific end product," said Charlie Trautmann, Ph.D. '83 CE, executive director of the Sciencenter. "The mini-golf putting green they built engages the Sciencenter's youngest visitors in a meaningful way while they are outside



Hester Vermaak

Preschoolers test their ball run at the Sciencenter's new Galaxy Golf putting green.

having fun with their older siblings and parents. It offers them age-appropriate challenges and introduces them to an interactive environment that celebrates the wonders of science."

Stocke and Culley calculate they put in 600 hours combined—three mornings a week—during their 2006 spring semester, purchasing supplies and building the putting green and its features. They fabricated most of them in the Emerson Manufacturing Teaching Lab in Rhodes Hall and at the Sciencenter's shop.

The Sciencenter is located at 601 First St. in Ithaca. Its 19-hole Galaxy Golf miniature golf course was built in 2004 with assistance from MBA students at Cornell's Johnson Graduate School of Management as part of a Park Leadership Service Project. For information on the Sciencenter, visit their web site: <http://www.sciencenter.org>.

—Marina Yoffe '06 and Linda Myers, Cornell News Service



Michael Stocke, left, and William Culley, who have been fans of miniature golf since childhood, at the preschoolers' putting green they built for the Sciencenter's space-themed miniature golf course.

## GIVING CREDIT

In the spring 2006 issue of *Cornell Engineering Magazine*, an article titled "Zip Chip" described Prof. Rajit Manohar's semiconductor company, Achronix, which produces FPGA chips. Manohar would like to recognize graduate students in Electrical and Computer Engineering who made contributions toward the design of the software and hardware for the FPGA, including David Fang, Song Peng, and John Teifel, Ph.D. '04 EE.



# HOMETOWN HERO

For Catherine Marie Charlton, music and engineering are two gods in one pantheon. Graduating in 1995 with a self-designed major in engineering acoustics and a minor in music, she says with a laugh, "On graduation day, I didn't know who to go to. The chairman of the music department gave me my engineering diploma." While at Cornell, she was named a Laureate of the Tau Beta Pi Engineering Honor Society, an award given each year to no more than five members nationwide who excel in areas outside of engineering. Charlton used the grant money for a down payment on a Steinway grand piano.

She studied classical piano from the age of eight, practicing so incessantly her parents often asked her to stop. An opportunity to work at NASA, however, during her junior year in high school moved her to apply to Cornell engineering. "Plus," she explains, "everyone in my family is a scientist."

Although she enjoyed her engineering courses, Charlton says her goal was not a career in engineering. "I just really liked math and problem-solving. My favorite class was Systems Dynamics."

To design her own major, she worked with Professors Leigh Phoenix and Wolfgang Sachse in the Department of Theoretical and Applied Mechanics, under the rubric of the College Program (now called the Independent Major). "I wanted to study as much music as possible. I looked through the catalog for classes in acoustics and audio engineering."

Charlton says that for her there is no particular connection between engineering and music. "I don't improvise with my mind. All my music comes from an emotional and kinesthetic place. The way I create music is not the same way that I solve problems. That said, when I was at Cornell immersed in engineering studies, I wrote a lot of math-inspired pieces." The piece "Fuzzy Boundaries," for example, commissioned in 1995 for the 30th anniversary of the mathematical concept Fuzzy Logic, has been featured at international math symposia in Croatia and Brazil.

Her engineering degree has helped her tremendously, she believes, to attain what later became her goal: a career as a professional musician. "Right out of college," says Charlton, "I was able to get an amazing job in statistical analysis and technology management

at First USA Bank." Starting out on firm financial footing enabled her to buy a house and a car and to pay off the balance on her piano.

She worked at First USA for five years, teaching piano in the evenings. Getting chosen by her employer for an expenses-paid master's program in technology management, however, was the turning point in her career path. "After one semester of working full-time, teaching 10 piano students per week, going to grad school, and preparing for concerts, I was exhausted. I went to visit my brother in California and shared a new recording with him. He was particularly moved by the overwhelming emotion in the piece 'Winter Mist,' and said 'If you know the answer already, why haven't you acted on it?' I quit the master's program that week and quit my job a year later."

She increased her teaching load, and between grants, concerts, and sales of her recordings, Charlton has been supporting herself as a musician since 2000. Her four albums are broadcast on traditional, Internet, and cable radio around the world; her two most recent rose to the top of the worldwide instrumental music charts,

including "River Dawn," which debuted at No. 3, higher than new releases from Grammy winners Kitaro and George Winston. (For more information, see her web site: [www.catherinecharlton.com](http://www.catherinecharlton.com).)

Last spring Charlton brought her trio home to the Ezra Cornell Memorial Room in Willard Straight Hall on the Cornell campus as the 2006 selection for the Lauren Pickard Emerging Artist Series. On April 10—a lovely spring evening in Ithaca—Charlton played in the same room and on the same piano where she had played her first recital 14 years before. As the sky slowly darkened in the huge casement windows, Charlton and her bandmates, flutist/saxophonist Elliot Levin and drummer J. Jody Janetta, performed jazz standards, original pieces, and improvisations, several of the latter based on descriptive phrases collected from the audience. As Charlton played, she danced on her bench, swaying and stamping her feet. Turning around with a huge smile, she observed: "It's always fun to see where a piece is going to go."

One could say the same of an engineering degree.

—Melanie Bush

I just really liked  
math and problem-  
solving. My favorite  
class was Systems  
Dynamics.

## A TALENT FOR IMPROV

Catherine Marie Charlton  
fashioned her own  
engineering degree to  
support a career in  
music.



# Get connected: Join CEAA!

## Your Campus Connection: Cornell Engineering Alumni Association



Out of town doesn't have to mean out of touch. The Cornell Engineering Alumni Association (CEAA) is a close-knit community of engineering alumni that stretches around the world to keep graduates informed and connected to the College of Engineering and Cornell.

Established in 1905, CEAA provides opportunities for the college to get advice and support from alumni and for alumni to stay informed about the college and to participate in networking events.

CEAA members have the opportunity to

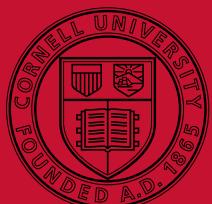
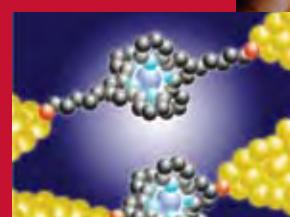
- influence the future direction of the college
- participate in guest lectures to engineering classes
- identify prospective employees among students and new grads
- assist in recruiting students and faculty to Cornell Engineering
- keep up to date on CEAA and Cornell Engineering events
- attend CEAA's annual engineering conference at a reduced rate
- help sponsor academic and student group awards
- register for the university's job search service
- enjoy social and networking opportunities with faculty, students, and fellow alumni

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