HOW CURRICULUM CAN CONNECT NEW STUDENTS DOES COLLEGE NEED TO BE LONGER ECE CREATES WAVES HONORING HOLONYAK SITTING IN THE BUDDY SEAT 10 ANSWERS FROM RAVI THAKKAR

RESONANCE

THE MAGAZINE OF ECE ILLINOIS

SPRING 2013

POWER WAVE

BLUE WATERS COMES TO SHORE

ILLINOIS

TOP OF MIND

When our campus's partnership with Coursera to offer massive open online courses (MOOCs) was announced last summer, our department was already committed to offering one such course. Professor Wen-mei Hwu's "Heterogeneous Parallel Programming"—an extremely popular course on the use of CUDA/OpenCL, OpenACC, and MPI for programming heterogeneous parallel computing systems – became one of our campus's first entries in Coursera's library.

As with every revolution, it is hard to predict outcomes. After the dust of change settles, what will be the effects of the rise of MOOCs and their impact on online learning? Truth be told, our teaching enterprise has been dry for so long that the dust cloud the MOOCs have stirred up is a massive one, causing anxiety and nervousness among academics as we ponder and argue the disruptive change the MOOCs may bring to the future of higher education.

The rising cost of higher education fuels the anxiety and the passion of the dialogue, as the accessibility of knowledge and its learning online challenge the value of the on-campus experience and its culmination in a university degree. This dialogue reminds us that MOOCs are not the novelty; rather, they are a powerful jolt to the inertia of our teaching enterprise, forcing us to get serious and busy putting the might of our high-tech sensing, computing, and communication technology to work to revolutionize the way people learn, irrespective of who they are or where they are.

I look forward to the change, and am excited at our opportunity to assume a leadership role in defining and spearheading its transformative impact. From online course content, course delivery, and student engagement, to the revolution of the on-campus student experience, the opportunities for educational innovation are breathtaking. Those who lead in this pursuit will define the University of the Future. Our tradition demands nothing less.

Adreas C. Cangellaris
Department Head
M.E. Van Valkenburg Professor
in Electrical and Computer Engineering

SHARE YOUR OPINION AT ECE.ILLINOIS.EDU/LINKEDIN

RESONANCE

Spring 2013

ECE Illinois
Engineering at Illinois
University of Illinois at Urbana-Champaign

ece.illinois.edu

Winter Agency
Design

Resonance is published twice a year by the Department of Electrical and Computer Engineering (ECE) at the University of Illinois at Urbana-Champaign. Comments and suggestions are welcome. Contact the editor, at the address below.

Electrical and Computer Engineering
University of Illinois at Urbana-Champaign
56 Everitt Laboratory, MC-702
1406 W. Green Street
Urbana, IL 61801
ece@illinois.edu

CONTENTS

_FEATURES

_DEPARTMENTS

"The kind of experiments people can do on this machine is truly amazing..."

Wen-mei Hwu,
Talking about Blue Waters, page 10

ACROSS THE SPECTRUM

GOOD DESIGN

GREEN IS GOOD

The design for the new ECE building has been awarded a 2012 Green Good Design Award. The award went to SmithGroupJJR, the architectural firm for the new building.

The Green Good Design Award recognizes the most important examples of sustainable design throughout the world. It also strives to raise awareness about companies that are doing outstanding work for sustainable design.

NORTH AMERICAN POWER SYMPOSIUM

The 2012 North American Power Symposium (NAPS) was hosted by the University of Illinois on September 9-11. ECE Assistant Professor Alejandro Dominguez-Garcia was the chair for the event. This year's conference featured scholars from universities such as Arizona State, Washington State, and the Indian Institute of Technology Madras in Chennai, India.

SENIOR DESIGN GONE WILD

Researchers with the Illinois Natural History Survey were interested in collecting data on movement and activity patterns of the state's newly restored populations of Illinois river otters. Several groups from ECE 445: Senior Design worked to design new devices to help with their efforts.

CHICAGO AFTER HOURS

On October 2, Chicago Mayor Rahm Emanuel and leaders from tech companies throughout Chicago came to the University of Illinois to tell ECE and CS students about the the city's thriving startup and technology culture.

Called Chicago After Hours, the evening featured two events: a leaders panel discussion and a reception featuring 39 companies from the Chicago area.

SONIC CENTER

Led by ECE Professor Naresh R. Shanbhag, a multi-university research team has received $30 million to launch the Systems On Nanoscale Information fabriCs (SONIC) Center. The center will focus on substantially enhancing the information processing power and storage capacity of integrated circuits (ICs) and related systems, which is critical in maintaining reliability as devices continue to shrink and improve in energy efficiency.

DID YOU KNOW?

THE AVERAGE STARTING SALARY FOR U OF I STUDENTS GRADUATING WITH A BS IN COMPUTER ENGINEERING IS $69,875. THAT'S MORE THAN $7,000 HIGHER THAN THE NATIONAL AVERAGE.

SONIC

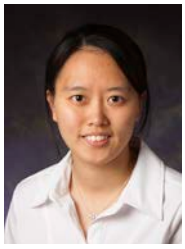
MARS CURIOSITY

ECE alumni Elaine Chapin (MSEE '92, PhD '96) and Ahmed Akgiray (MSEE '07) were two engineers who helped design and build the radar system that enabled Curiosity, the Mars Rover, to successfully land on the Red Planet. They designed a landing radar system that forgot its location every 50 milliseconds, an innovation that actually made the system more reliable.

DNA SENSING TECHNOLOGY

Oxford Nanopore Technology (ONT) recently announced an agreement with the University of Illinois to license DNA sensing technology and to fund future research. ECE Professor Jean-Pierre Leburton, ECE and Bioengineering Professor Rashid Bashir, and Physics Associate Professor Aleksei Aksimentiev will work to develop what has been a long sought-after goal in genomics research: low-cost, fast, reliable, and highly accurate sequencing of a person's whole genome.

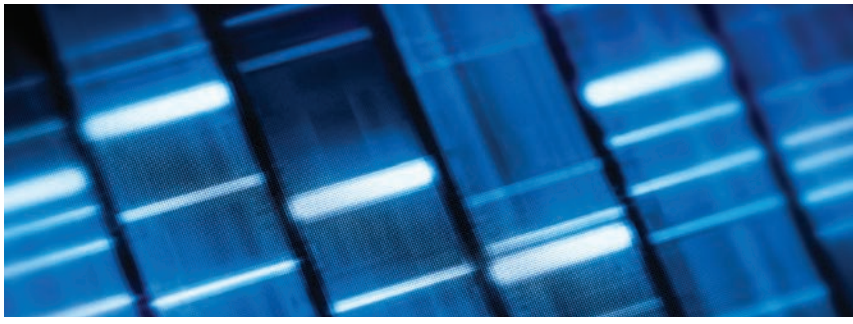
CAREER AWARD



ECE Assistant Professor **Yi Lu** recently received a CAREER Award, given by the National Science Foundation (NSF), to study dynamic scalability, the ability of a system to accommodate changing workload without interrupting service. She is designing low-complexity algorithms for Web services, data management, and measurement and monitoring in the cloud. The program awards junior faculty members who exemplify the role of teacher-scholar through outstanding research and education.

DID YOU KNOW?

THERE ARE 106 ECE PROFESSORS. YOU'LL FIND AN EXPERT HERE IN EVERY AREA OF ELECTRICAL AND COMPUTER ENGINEERING.



GRAINGER ENGINEERING BREAKTHROUGHS INITIATIVE

On January 28, the University of Illinois announced the establishment of the Grainger Engineering Breakthroughs Initiative, a $100 million investment in the future of Engineering at Illinois. Supported by a pledge from the Grainger Foundation, this initiative will have far-reaching impact on several ECE research areas and the educational mission of the department.

The initiative's funds will be used to support new named chairs and professorships across the College of Engineering, focusing on the areas of big data and bioengineering; support research in these areas; provide funding for engineering student scholarships; and help in a planned renovation of Everitt Lab for use by the Bioengineering Department.

Watch for a more in-depth look at this initiative in the next issue of *Resonance*.

TOP RANKING 2013

US News and World Report

ECE is ranked fourth for undergraduate electrical engineering.
ECE is ranked fifth for undergraduate computer engineering.

Academic Ranking of World Universities

In the category of Engineering/Technology and Computer Science, the University of Illinois at Urbana-Champaign placed 4th in the world and the university as a whole came in 25th in the world, according to The Center for World-Class Universities at Shanghai Jiao Tong University. The Center recently issued the 10th edition of its annual global university ranking.

INVESTITURE

On October 31, 2012, an investiture ceremony was held at the National Center for Supercomputing Applications.

There, ECE Professor **Martin D. F. Wong** was invested as the Edward C. Jordan Professor of Electrical and Computer Engineering, and ECE Professor **Naresh R. Shanbhag** was invested as the Jack S. Kilby Professor of Electrical and Computer Engineering.

FACULTY APPOINTMENTS

ECE Professor **Jennifer Bernhard** has been named associate dean for research in the College of Engineering. The Office of the Associate Dean for Research is responsible for proactively increasing the visibility and broadening of research collaborations with state, federal, and international agencies, as well as industry.

Marie-Christine Brunet, who had served as chief advisor in the ECE Department since 1998, is now the assistant dean for undergraduate programs in the College of Engineering. In her new position, she'll take the knowledge and skills she gained as an advisor for ECE and translate that to a collegewide advising role.

ECE Professor **Martin D. F. Wong** has been named the acting associate dean for academic affairs in the College of Engineering. He will have responsibility for all phases of faculty affairs, including promotion and tenure, sabbaticals, leaves of absence, named appointments, hiring and retention, and special projects in support of the college.

DID YOU KNOW?

THE APPROXIMATE NUMBER OF LIVING ECE ILLINOIS ALUMNI IS 21,000.

ALUMNI HONORED

Nine ECE alumni were honored at the Alumni Awards Banquet in September, 2012. The recipients represent a large range of fields of endeavor and achievement for ECE alumni.

DISTINGUISHED ALUMNI AWARD

This award honors alumni who have made professional and technical contributions that bring distinction to themselves, the department, and the university.

Thomas Cwik
BSEE '79, MSEE '81, PhD '86
Associate Chief Technologist
Jet Propulsion Lab

Robert Kennedy
BSEE '78
President and co-CEO
C-SPAN

Larry Nixon
BSEE '65, MSEE '66
President
Nixon & Vanderhye PC

Ken Hansen
BSEE '74, MSEE '77
Vice President and CTO
Freescale Semiconductor

Robert Munson
BSEE '63
Chief Scientist (retired)
Ball Aerospace

YOUNG ALUMNI ACHIEVEMENT AWARD

This award is given to alumni under age 40 who have made outstanding professional contributions to their field since graduation.

Hillery Hunter
BSEE '99, MSEE '02, PhD '04
Manager, Systems Technology and Architecture
IBM T.J. Watson Research Center

MARCIA PETERMAN AWARD

This award is presented annually to a former ECE Alumni Board member for dedicated service as a member of the board.

Douglas Criner
BSEE '64, MS Economics '65
Vice President (retired)
Burns & McDonnell Engineering

UNIVERSITY OF ILLINOIS LOYALTY AWARD FOR EXCEPTIONAL ALUMNI SERVICE

This award is bestowed upon alumni who have made significant, notable, and meritorious contributions, and who have consistently demonstrated exceptional loyalty, commitment, dedication, and service to the University of Illinois Alumni Association for the advancement of their Alma Mater.

Gale Beanblossom
BS Bioengineering '80, MSEE '82
Senior Manager
The Boeing Company

Todd Beanblossom
BSEE '80, MSEE '82
Chief Engineer
The Boeing Company

SEE MORE ALUMNI NEWS, VIDEOS AND AWARDS: WWW.ECE.ILLINOIS.EDU/ALUMNI

PROFESSORS IN THE NEWS

NARENDRA AHUJA

ECE Professor Emeritus Narendra Ahuja recently received the BITS Pilani Distinguished Alumnus Award for 2012 from his alma mater, the Birla Institute of Technology and Science.

RASHID BASHIR

Rashid Bashir has been recognized with the 2012 IEEE Engineering in Medicine and Biology Society Technical Achievement Award.

STEPHEN BOPPART

Stephen Boppart has been awarded the Hans Sigrist Prize, an international prize presented annually to a distinguished scientist in a selected field.

MARIE-CHRISTINE BRUNET

Marie-Christine Brunet was awarded the 2012 College of Engineering Rose Award for Teaching Excellence.

P. SCOTT CARNEY

P. Scott Carney was recognized by the College of Engineering and ECE students for excellence in teaching with the Everitt Teaching Award.

JAMES J. COLEMAN

James J. Coleman received the 2013 John Tyndall Award from The Optical Society and the IEEE Photonics Society. He was also named a Fellow of the International Society for Optics and Photonics.

BRIAN CUNNINGHAM

Two articles written by Brian Cunningham and his colleagues were selected by the editors of the *Journal of Biophotonics* and *Small* to be featured on their covers.

LYNFORD GODDARD

Lynford Goddard is the recipient of the 2012 Ronald W. Pratt Faculty Outstanding Teaching Award.

MARK HASEGAWA-JOHNSON

Mark Hasegawa-Johnson received the 2012 Dean's Award for Excellence in Research.

THOMAS S. HUANG

Thomas S. Huang was named a Swanlund Chair, the highest endowed title on the Urbana campus.

RAKESH KUMAR

Rakesh Kumar has received the Army Research Office's (ARO) Young Investigator Award. He will develop algorithmic techniques to make applications robust to numerical errors.

XIULING LI

Xiuling Li received the 2012 Dean's Award for Excellence in Research.

DANIEL LIBERZON

Daniel Liberzon recently won two, three-year research grants from the National Science Foundation, both related to hybrid systems.

JOSEPH LYDING

Joseph Lyding received the 2012 IEEE Pioneer in Nanotechnology Award.

THANK YOU

ALLSTON TRADING	Ameren	Bloomberg	BOEING
C3	CHOPPER TRADING	CISCO	jumptrading
facebook	Google	INTERACTIVE INTELLIGENCE	intel
JOHN DEERE	LinkedIn	LOCKHEED MARTIN	Microsoft
NORTHROP GRUMMAN	Palantir	QUALCOMM	riverbed
Rockwell Collins	S&C ELECTRIC COMPANY Specialists in Electric Power Switching and Protection	Sargent & Lundy LLC	StateFarm
ViaSat	TATA	UNION PACIFIC	YAHOO!

The Corporate Connection industry affiliates program is a partnership between ECE ILLINOIS and the Department of Computer Science. Through this program, sponsor companies have increased visibility and access to the more than 3,000 students in both departments. Thank you to our 2012-2013 sponsors!

For more information about The Corporate Connection, please visit **corporateconnection.ece.illinois.edu**.

THE CORPORATE CONNECTION

AN ILLINOIS CS-ECE-INDUSTRY PARTNERSHIP PROGRAM


POWER
WAVE
BLUE WATERS COMES TO SHORE

FROM THE MINUSCULE TO THE MASSIVE, FROM ATOMS TO AIRPLANES: BLUE WATERS FLOWS WITH POTENTIAL TO ADVANCE DISCOVERIES IN SCIENCE'S BIGGEST DILEMMAS.

BY STEPHANIE HENRY

For scientists, making predictions about the "where and when" of future earthquakes, seeing inside tornadoes, or understanding viruses and how they invade human cells are all science problems that come down to numbers and complicated numerical equations.

And these are just a few of science's biggest environmental and biological dilemmas that are asking to be solved in the numbers. And in a swelling wave of possibility, engineers are providing scientists with the tools they need to begin to deal with some of these numerical questions.

"There is a broad range of science and engineering problems that require the most powerful computers available to accurately solve the mathematical equations that describe the behavior of the associated systems—the Schrödinger equation for molecules, the Navier-Stokes equation for fluids, Newton's equations for N-body systems, and so on," explained Thom Dunning, director of The National Center for Supercomputing Applications at the University of Illinois. "The National Science Foundation recognized this need and decided to make a major investment in a computing system that would take full advantage of the most advanced computing technologies under development."

That "major investment" became a five-year supercomputing undertaking that Dunning says is completed. The team of faculty and architects working on the project are both "excited and exhausted" after making the mad dash to the end.

Dunning and his team have delivered Blue Waters, a supercomputer capable of sustained performance of 1 petaflop, equivalent to one quadrillion mathematical calculations per second on a range of real-world science and engineering applications. It is one of the most powerful supercomputers in the world. The system is housed at the National Petascale Computing Facility on campus.

This supercomputer will enable breakthroughs in all areas of science—the biological, chemical, and physical sciences. And many of these breakthroughs will have direct, immediate societal impact, Dunning said.

And as scientists wade in the tide of possibilities of discovery now that Blue Waters is being used by real science teams, ECE Professor Wen-mei Hwu, researcher in software systems, is already thinking ahead to the next generation of supercomputing.

Hwu was one of the five original principal investigators on the Blue Waters project. His work focused on designing hardware for the system, working with the difficulty of the programming and how fast code could be executed. He worked on the design of the 25,000 nodes used in Blue Waters, 3,000

"WE CAN DO A LOT OF THINGS TO PREPARE THE SCIENCE COMMUNITY TO MOVE INTO THE NEXT GENERATION. FROM A COMPUTER ARCHITECTURE RESEARCHER'S POINT OF VIEW, WE'RE HELPING THE COMMUNITY BUILD A VERY STRONG FOUNDATION OF THE NEXT GENERATION OF MACHINES."
-WEN-MEI HWU

BLUE WATERS

9600 GALLONS

WATER PUMPED THROUGH EVERY MINUTE

5500 SQ FEET

276 RACKS

X ONE MILLION

COMPUTING POWER OF NEARLY 1 MILLION PC'S

9 MONTHS TO MANUFACTURE AND INSTALL

of which are radical nodes, running at speeds four times higher than those for nonradical nodes. Though the use of radical nodes may allow scientists to run applications and equations that they could not have previously, new problems come with that kind of power.

One such problem is that not all science teams have programs that fully use the power of the radical nodes.

"The kind of experiments people can do on this machine is truly amazing," Hwu explained. "When NSF announced the Blue Waters program, there were several rounds of selection of teams who could run their applications. But if you look at the kind of software code of applications, only about one third of those applications can use these radical nodes."

In the initial solicitation for the sustained petascale computing system back in 2006, NSF listed more that 30 science and engineering problems that they felt could benefit from the development of such a system. NCSA initiated discussions with research groups representing sciences ranging from astrophysics to biology, cosmology, and climate, and from fluid dynamics, material and molecular science to physics and weather.

"The breadth of science and engineering problems envisioned for a petascale computer by NSF was, in fact, a critical element in our approach to selecting the technology used in Blue Waters and in configuring the compute, memory, and storage subsystems of Blue Waters," said Dunning.

Blue Waters, manufactured and installed in approximately nine months, has passed through its final phase of acceptance testing. Teams of approved users were selected to use the system during a "friendly-user" period, as the complex system underwent optimization, or a thorough shake-down. Already industry partners such as General Electric and Procter & Gamble have problems that the computing capability of Blue Waters can help solve.

The completed and tested Blue Waters system will play two critical roles in advancing science and engineering. First, it will allow for the highest fidelity simulations possible, greatly advancing scientists' understanding of the phenomena being studied.

"Scientists and engineers will be able to increase the resolution of their simulations to model features that were not possible to describe heretofore, e.g., the critical inner wall of a tornado, which plays a major role in whether a tornado will be formed in a thunderstorm or not," Dunning said. "This will lead to improved predictions of the birth, strengths, and paths of tornados."

Increased resolution is also important to other applications, such as climate simulations, cosmology simulations, combustion simulations, and so on. In other cases, Blue Waters will enable modelers to include more complete and accurate descriptions of the physical, chemical, and biological aspects of their models.

The second critical role Blue Waters will play is in reducing the approximations that scientists and engineers must make to solve

5 SUPER COMPUTERS IN THE WORLD

$1,000,000

POWER BILL PER MONTH

TO RUN COMPUTERS WITH RADICAL NODES

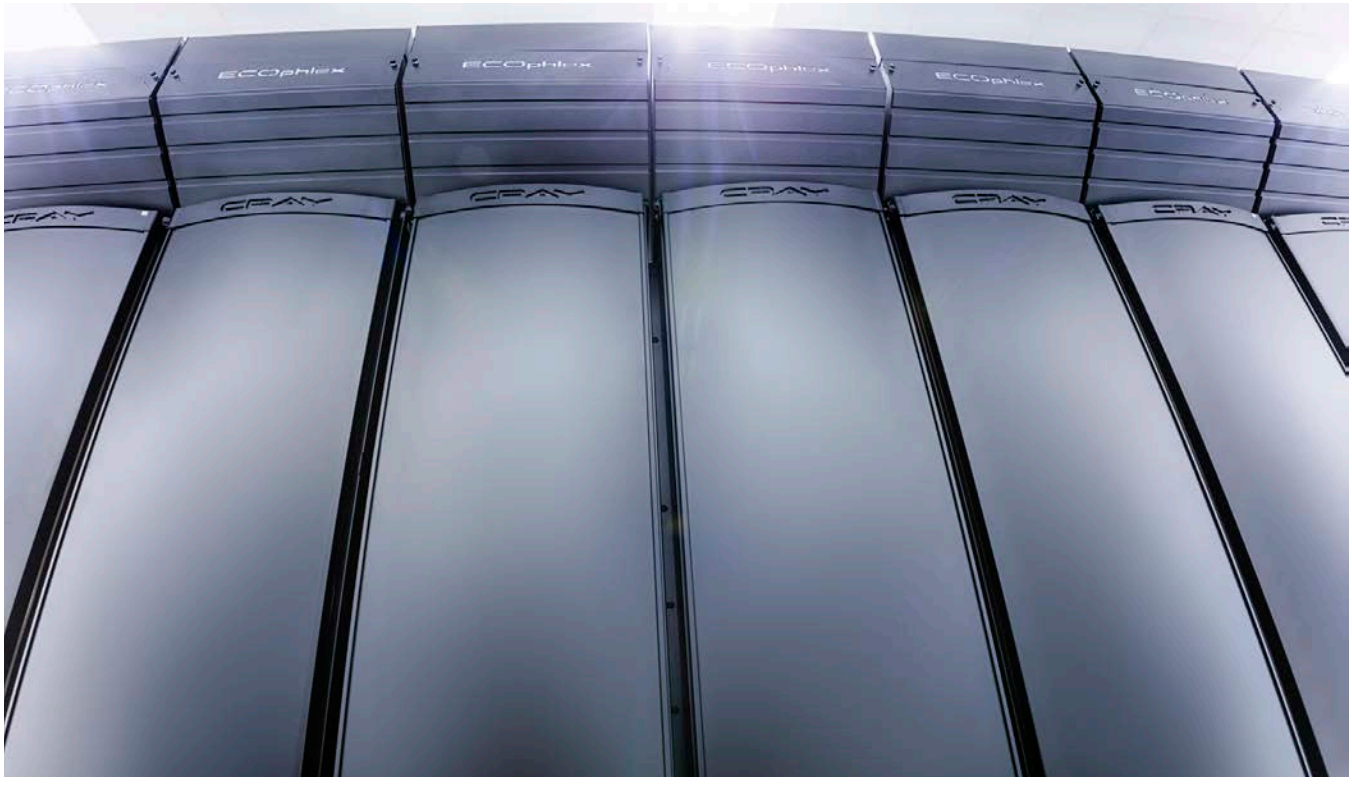
ARITHMETIC OPERATIONS PER SECOND

ONE QUADRILLION

MANPOWER

FULL TIME STAFF

60



the mathematical equations involved in the problems they face in their research fields.

"Few of the mathematical equations can be solved rigorously," Dunning said. "So, scientists and engineers invoke what they hope are well-founded approximations to simplify these equations. Scientists and engineers use powerful supercomputers like Blue Waters to assess the validity of these approximations."

Though researchers like Hwu look ahead to the future of supercomputing, he explains that he and the Blue Waters team have still been focused on making sure that the machine is usable to a variety of scientists and the questions they are investigating.

"Blue Waters is going to be the main workhorse for NSF science projects, and we had to make this machine as valuable as possible to all the application teams," Hwu said. "That's why even from a computational researcher point of view, I would love to have it built with all radical nodes so I can do experiments of my own. But from a bigger picture point of view, we still need to advance science, and two thirds of the science teams are not quite ready to do this. What I've been doing this last year is working with teams and vendors to increase the number of applications that can truly use these radical nodes."

As the science community continues to dive deeper into the possibilities waiting to be discovered on Blue Waters, Hwu continues to focus on what is needed to meet the future demands of supercomputing, such as programmers who are trained to use the radical nodes found in Blue Waters.

Hwu said ECE ILLINOIS is already offering courses that enable students to master the kind of programming skills that they need to program this kind of machine. A new grad level course teaches the basics of programming processors with massive amounts of power, such as four teraflops.

"From a computer architecture researcher's point of view, we're helping the community build a very strong foundation for the next generation of machines."

"THE HOPE IS THAT A BETTER UNDERSTANDING OF THE PROCESS BY WHICH THE VIRUS ENTERS THE CELL WILL ENABLE MEDICAL RESEARCHERS TO DEVELOP MORE EFFECTIVE ANTI-VIRAL MEDICINES."

-THOM DUNNING

BLUE WATERS' IMPACT

BY STEPHANIE HENRY

As integral contributors to the design and construction of the Blue Waters supercomputer, ECE researchers have helped to create a powerful new tool for tackling some of the world's most challenging problems.

Research concepts that teams have proposed for use on Blue Waters have the potential not only for great advances in scientific discovery but also for great strides in addressing significant societal problems.

One team, led by Illinois Physics Professor Klaus Schulten and his team in the Computational Microscope project, is using Blue Waters to peer into the workings of biological systems at atomic resolution. Schulten and his team studied the protein capsid that encases the HIV-1 genome. This study could lead to a greater understanding of the steps of HIV infection.

"Their goal is to better understand the process by which the virus enters the cell—a critical process for viruses must hijack the cell's DNA machinery to reproduce themselves," Dunning explained. "The hope is that a better understanding of this process will enable medical researchers to develop more effective anti-viral medicines."

One advance for Schulten's team is that Blue Waters provides enough computational power to allow scientists to see and describe the entire molecular machinery of a living cell. Previous computer power allowed them to see only in part. And in studying how HIV infects human cells, Schulten's team has been able to describe, for the first time, the entire structure of the HIV virus, which could lead to better treatment or even prevention of HIV infections.

Schulten said looking at the 15 million atoms in the capsid of the HIV virus, is "easy" on Blue Waters, and will aid in learning how to prevent the virus from proceeding into the human cell.

"It has tremendous implications for future treatments of HIV," he said. "The situation we are in now means we can do more work and better work."

Another Illinois team, led by Atmospheric Science Professor Bob Wilhelmson and Research Scientist Brian Jewett, is using Blue Waters to obtain a better understanding of the formation of tornados in supercell thunderstorms, invaluable research for advancing the ability to predict the birth and intensity of tornados, maybe even providing insights into their flight paths.

Blue Waters will enable Wilhelmson and his team both to increase the resolution of the models that they are using to simulate tornados and to obtain information about the structure of the inner wall of a tornado, where a tornado "starts." This research will help scientists to make better weather predictions.

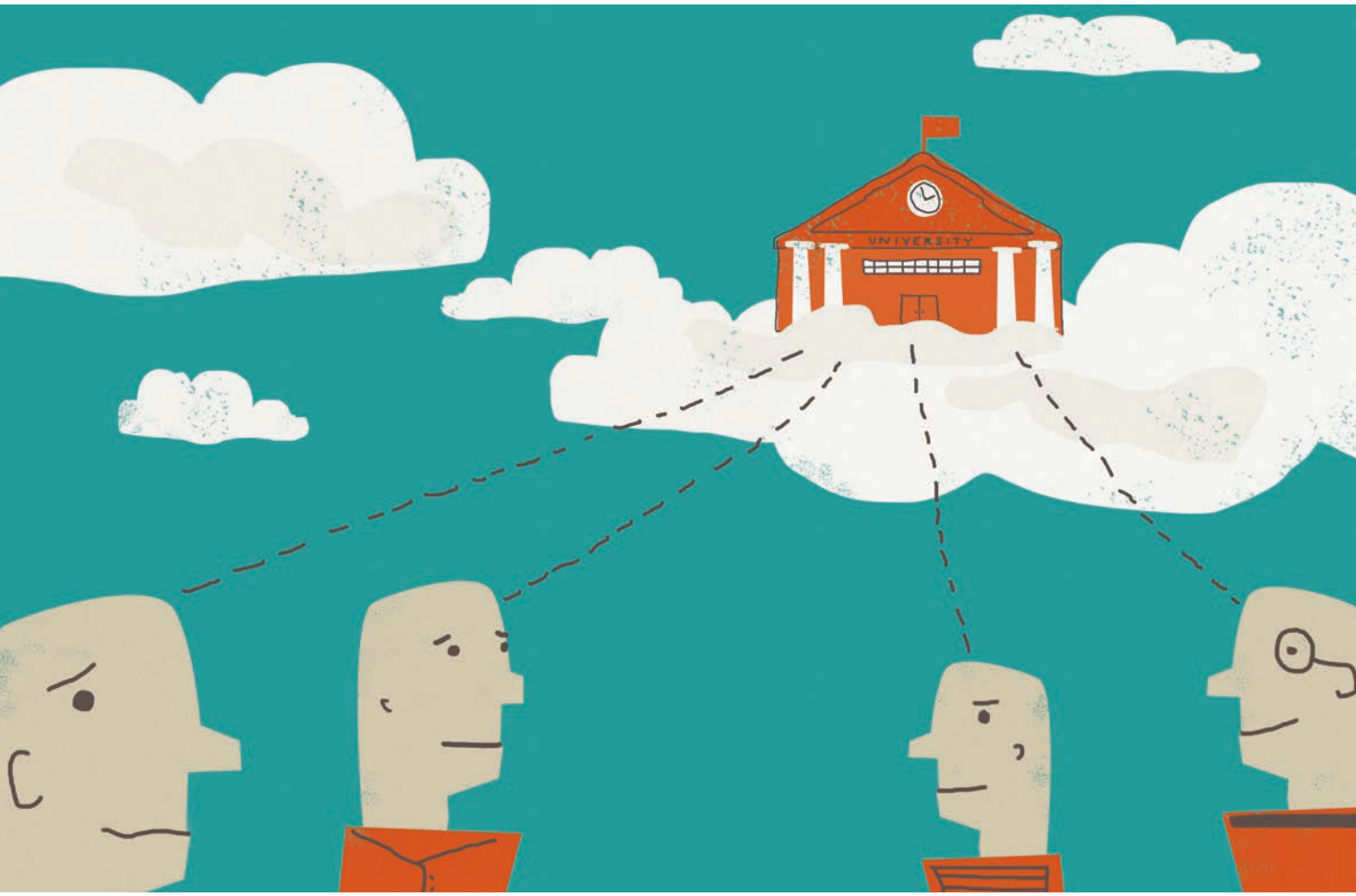
"We are not going to be able to exactly predict the path, but it can greatly enhance weather predictions for very severe storms," Dunning said.

From the Southern California Earthquake Center comes a project modeling the next big earthquake along the San Andreas fault in Southern California. Led by Tom Jordan of the University of Southern California, the team will explore potential earthquakes along the San Andreas fault and what's going to happen, especially to Los Angeles, when that fault ruptures.

The researchers have teamed up with civil engineers and other researchers from Carnegie Mellon University to consider ground motions and building construction. They will then make predictions about what's going to happen during an earthquake, for example, determining what buildings will fall down, what freeway overpasses will fall down and which will remain standing. They will share data with emergency responders and the county of Los Angeles to better prepare for such a disaster.

"Clearly the last thing you want to do is to put supplies in one location, then have a freeway come down, and not be able to get to those supplies," said Dunning. "It will be able to help them really plan, and be able to respond more effectively to a disaster."

CROSS TALK



MASSIVE OPEN ONLINE COURSES (MOOCS) ARE A HOT TOPIC ON MANY CAMPUSES ACROSS THE COUNTRY. ADMINISTRATORS AND FACULTY ARE THINKING THROUGH THE OPPORTUNITIES AND RAMIFICATIONS THEY PRESENT.

QUESTIONS ARE BEING ASKED LIKE: WHAT COURSES SHOULD WE OFFER? HOW DO WE JUSTIFY INVESTING RESOURCES IN THESE COURSES? HOW DO MOOCS IMPACT OUR ON-CAMPUS OFFERINGS? SHOULD WE PARTICIPATE AT ALL? ILLINOIS IS AN EARLY PARTICIPANT IN MOOCS. TWO OF THE FIRST PROFESSORS INVOLVED ARE ROB RUTENBAR AND WEN-MEI HWU. WE ASKED FOR THEIR THOUGHTS ON THIS IMPORTANT TOPIC.

CROSS TALK is a forum for individual opinions, not necessarily shared by ECE ILLINOIS. There's much more to say on the topic of MOOCs. Please share your opinion with us.

SHARE YOUR OPINION AT ECE.ILLINOIS.EDU/LINKEDIN

MOOC OPORTUNITIES

ROB RUTENBAR: Head, Department of Computer Science, University of Illinois

Since Illinois joined the MOOC universe by partnering with Coursera in July 2012, I've been continually surprised at the breadth of opportunities the technology affords. Let's start with the obvious: projecting the excellence of Engineering at Illinois to the widest possible audience. Since joining Coursera, we have seen nearly a quarter million enrollments in Illinois MOOCs—with the largest enrollments in our engineering courses. And I've had a huge number of conversations with colleagues across the breadth of engineering about how to turn their excellent courses in physics, in energy, in nanotechnology, in advanced materials, in Google-scale distributed systems, into new MOOCs.

Alumni are delighted at the opportunity to reengage with campus, and have deluged the campus registrar's office, asking, "How do we register for your MOOCs?" (Answer: www.coursera.org/illinois—just click on the course.) Faculty who run unique hands-on engineering labs report interest in building MOOCs to teach students how to use expensive and sophisticated laboratory equipment before they get to lab—to make best use of these precious lab hours and resources. Faculty who run summer programs to reach out to high school teachers, to give them fresh skills and materials to teach things like computer science in the K-12 years, have approached to ask "How can I turn this into a MOOC, and reach a lot more teachers?"

I've had many conversations with faculty interested in building sophisticated auto-grading software and exploring large-scale peer grading experiments who are beginning to engage with the Coursera MOOC platform, which allows us to try new things even for our regular, on-campus course offerings.

Every week brings a fresh idea to try something innovative in the rapidly unfolding MOOC world. Stay tuned: it's clear the best is yet to come.

OPINION: MOOCs

ONE STUDENT AT A TIME

WEN-MEI HWU: AMD Jerry Sanders Chair in Electrical and Computer Engineering, University of Illinois

When I agreed to offer "Heterogeneous Parallel Programming" through Coursera, I was uncertain about the approach that we should take, as well as the outcome that we can expect. We typically offer the campus version of this course to no more than 40 students so that we can give each student enough support. When I first saw that 25,000 students had registered for the course, I knew that everything will be drastically different from our campus offering. Now that we are approaching the end of the course, I would like to offer a few lessons learned.

First, the number of students truly justifies careful, high-quality production of lecture videos, quiz questions and lab infrastructure. Each video is viewed about 20,000 times; some students view a video multiple times. If a slide can confuse 1% of the students, we will hear from about 100 students! Second, no matter what we do, there are many students who like it and some who do not. It is interesting to go to some of the discussion forums and see the students' debate on what I should do more or less of.

Third, we built an automated programming assignment submission and grading system in the Amazon cloud. Any minor bug would affect hundreds of students—and they let us know! Finally, it is important for an instructor to stay emotionally anchored and keep focused on the needs of the entire student body, rather than the loudest complainers. The best way to gauge this is to have weekly surveys.

According to Coursera's log, we had active participation by more than 10,000 students from 126 countries. Recently, I received an e-mail from a PhD student in his thirties. He told me that he tried to learn to program massively parallel processors several times without success, and that he finally managed to succeed through this course. This is the type of feedback that motivates me to offer the course again. Yes, it is a MOOC, but we are still transforming the lives of one student at a time.

IN CONCERT: TESLA COILS

THOUSANDS OF VOLTS OF ELECTRICITY FLY THROUGH THE AIR, CREATING MUSIC IN THE PROCESS DURING THE 2013 ENGINEERING OPEN HOUSE.

ECE ILLINOIS
Department of Electrical and Computer Engineering

PHOTO BY DARYL QUITALIG

FIRST-YEAR EXPERIENCE

By Hayley Eselevsky

IEFX introduces freshman to the engineering profession

Illinois Engineering First-Year Experience (IEFX), which has been around since 2009, is a program for first-semester freshmen in the College of Engineering. Though a relatively recent program, it is already having positive effects on incoming freshmen.

All incoming engineering freshmen are required to participate. One intent of IEFX is to provide a community for incoming engineering students to keep them from feeling overwhelmed by the transition to the university. Students have opportunities to connect both with fellow engineering students and with faculty members.

"One main goal of the program is to get [students] connected to other students, but also to faculty members and staff because there is a huge disconnect," said Michelle Adeoye, IEFX program coordinator. "Freshmen usually don't get connected to faculty members unless they are conducting undergraduate research."

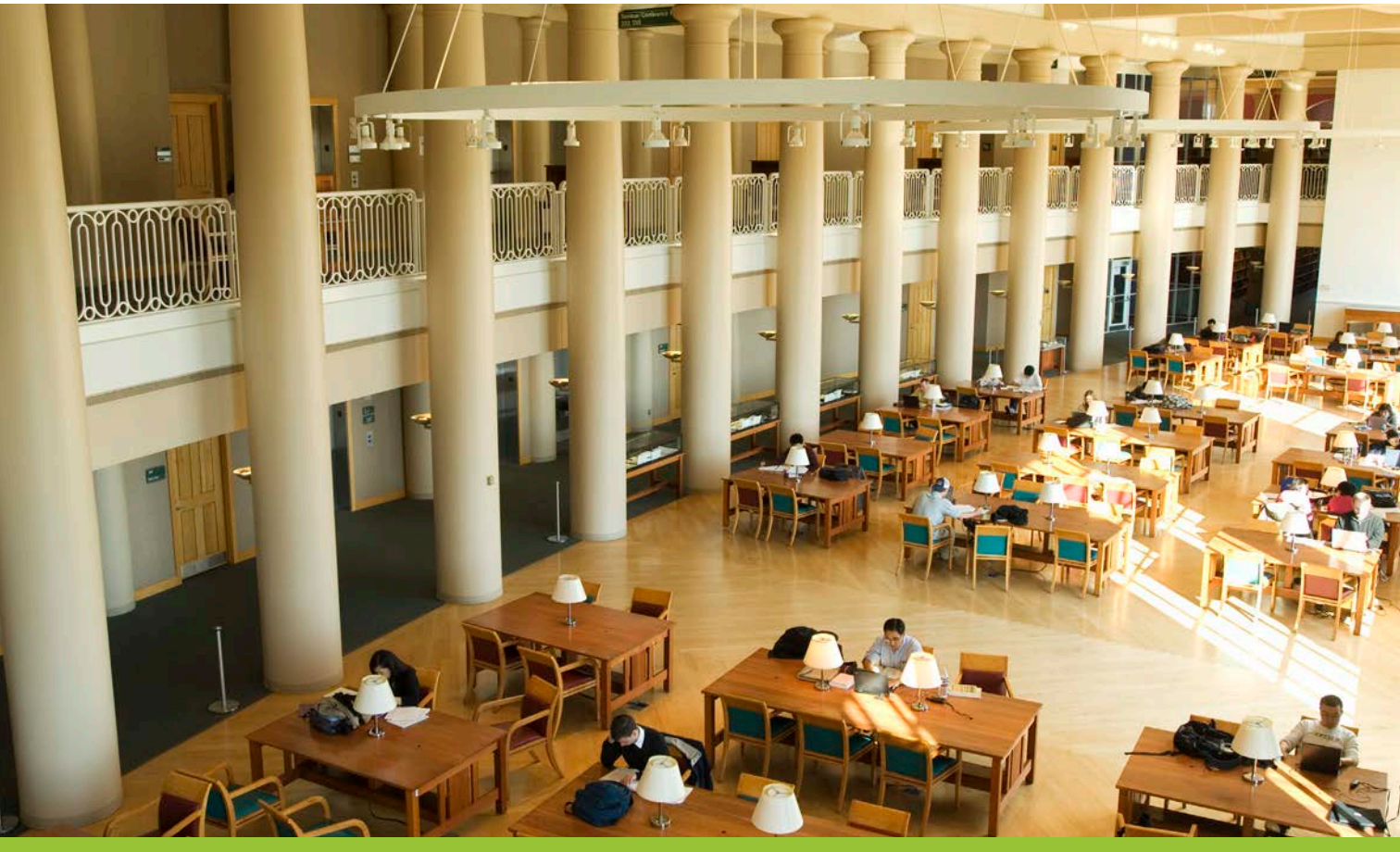
One part of IEFX is ENG 100: Engineering Orientation, a mandatory, four-week course for all incoming engineering students that serves as an introduction to the College of Engineering. This course is taught by undergraduate students, called Engineering Learning Assistants (ELAs), who also serve as mentors to the students.

Along with ENG 100, students can sign up for continuation courses. These 12-week courses allow students to explore personal areas of interest within the College of Engineering. These courses include Aspirations in Leadership, Renaissance Engineering, IEFX Projects, Engineering Grand Challenges, Essentials in MATLAB and Excel, Engineering for Global Development, Engineering at Illinois for Freshmen, Freshmen Undergraduate Research Seminar, International Dimensions of Engineering, and Special Visualization.

A new addition to the program last year was the Summer Scholars program. This program invited students to come to campus early and take classes to help with the transition to college. This past summer, 22 incoming engineering students participated in this program.

"I thought Summer Scholars was a really cool opportunity, because I know I was kind of knocked back on my heels when I was a freshman, and I didn't really have anyone to talk to and tell me that it happens to everyone," said Melissa Duyar, senior in civil engineering and resident project advisor (RPA) for the Summer Scholars Program. "I think that getting to engineering students earlier would just be a good opportunity for them and for me, even, to learn from them."

Duyar said that she wished the program existed when she was a freshman. "Being able to help out the freshmen and be superimpressed by their work was valuable for me and everyone involved," Duyar said.



"I THOUGHT SUMMER SCHOLARS WAS A REALLY COOL OPPORTUNITY, BECAUSE I KNOW I WAS KIND OF KNOCKED BACK ON MY HEELS WHEN I WAS A FRESHMAN, AND I DIDN'T REALLY HAVE ANYONE TO TALK TO AND TELL ME THAT IT HAPPENS TO EVERYONE." -MELISSA DUYAR

Alexis Clinebell, freshman in material science and engineering and summer scholar, said that this program helped her to "make a big school seem smaller" and assisted in her transition to college. "Getting here early and figuring out campus and classes was great," she said. "When I came back to school in the fall, I didn't feel like a freshman."

IEFX also encourages students to get involved around campus, whether it is joining RSOs, Engineering Council, or other clubs or societies outside of engineering. "As an engineer, you won't only be working with [other] engineers your whole life," Adeoye said. "In any job, you're going to be with tons of different people of different fields."

The beginning of the fall semester is celebrated by "Launch," the college's welcoming event for the IEFX students. Launch also serves as the kick-off event for ENG 100. "We use this as an inspirational time to tell them what the college is about, but also to tell them what their future may look like in engineering," Adeoye said.

At the end of the semester, IEFX hosts "Explorations," an event where students have the opportunity to show off what they have worked on in their continuation courses.

"[The students] have the opportunity to display their projects or whatever they have been working on for the semester in their continuation classes," Adeoye explained. "We invite corporate individuals to come to this event, and we invite faculty members. It's just an opportunity to show off what they've been doing all semester."

REIMAGINING EDUCATION

By Nathaniel Lash

Two ECE professors are teaming up to reimagine the computer engineering core for undergraduate students who make their way through the halls of Everitt Laboratory.

ECE Professor Douglas Jones and ECE Associate Professor Steven Lumetta received a Strategic Instructional Initiatives Program (SIIP) grant as part of a College of Engineering-wide effort to reengineer the large foundational courses that hundreds of students take at a time.

Their goal? To create "the world's best computer engineering core," an ambitious program to both restructure the sequence that both CompE and EE students go through, as well as improving the way those courses are taught.

"We're trying to bring students into the 21st century view of computer engineering," said Jones.

The core of Jones and Lumetta's project is breaking down the barriers between software and hardware courses, which have morphed over the last several decades into very much interwoven disciplines.

"There's no modern electronic product that doesn't have a computer in it," Jones said. "Nobody designs systems where they're pure hardware, pure software—it's all kind of mixed together. And our idea is that we want a curriculum that really reflects that."

"IN THE CAREER OF A FACULTY MEMBER, THE AMOUNT WE WOULD LIKE OUR STUDENTS TO LEARN IS PROBABLY DOUBLED. AND THAT MEANS ONE OF TWO THINGS: EITHER WE HAVE TO REFINE IT, OR WE NEED TO MAKE COLLEGE EIGHT YEARS."

-STEVEN LUMETTA

The computer engineering curriculum has been tweaked continuously since it was first introduced in 1969, a time when the construction of computers was very much divorced from programming. And indeed, ECE 190: Introduction to Computing Systems, the first course that exposes ECE students to computer engineering, has been at the forefront of introducing the material in a way that integrates software and hardware. But as engineering moves forward, ECE 190 may have to be rethought.

"We've shoved a little bit of hardware into that software course, some software into the hardware course, but now we're kind of stuck. If we want to move forward, we have to go in and cross the course boundaries in the course sequence. That's what we're all about," Jones said.

They took their first major steps in that regard through ECE 198JL: Introduction to Computer Engineering, an experimental course they offered to 60 freshmen in the fall 2012. That class showcased their integration of hardware and software content in a way they hope will excite the next class of ECE students.

Part of that task is finding better ways to deliver the content, whether it be online or in the classroom and lab. But some refinement of the course materials will also have to take place.

"It's important for people to go in and be willing to say, 'This was important when I was in school, but it's not critical for students to know in the future,'" said Lumetta. "We will be working on that refinement process, then shifting things around to make the material more exciting, more engaging; bringing in some of the technologies that people use every day and probably like to understand and make use of on their own."

In explaining the refinement process, Lumetta alluded to a theory of noted mathematician and Illinois alumnus Richard Hamming, who said that humanity's knowledge has doubled every 17 years since the time of Isaac Newton. For academics, particularly those teaching along the cutting-edge of technology, this poses some fairly significant problems.

"Roughly in the career of a faculty member, the amount we would like our students to learn is probably doubled. And that means one of two things: either at some point we have to refine it and decide what they really need to know, or we need to make college eight years," Lumetta said.

Lumetta is also engaged in creating a new machine to "grade" programs written by students in real time. Currently, analysis of programs rely on I/O-based test cases, which are limited in scope and requires considerable time to program. But currently, the only way to grade code more thoroughly is by hand, which faces its own limitations in being able to get feedback to students in a timely manner. Lumetta's project will find a way to provide partial credit based on what students turn in, rather than on I/O-based testing produces.

Other projects will call in researchers from all corners of ECE. Personify CEO and ECE Professor Sanjay Patel is on board to help rethink the way this course content will be delivered, through the use of new innovations such as the digital immersion technology developed by Personify. In total, 13 ECE faculty, educators and researchers are collaborating with Jones and Lumetta in reshaping the computer engineering core at ECE to make sure it remains "the world's best."

"THERE'S NOTHING QUITE LIKE SITTING IN THE BUDDY SEAT ON A CAT 795F AC, TUNING DC-LINK VOLTAGE REGULATION FOR A VARIETY OF OPERATING CONDITIONS."
—BRETT NEE

By John Caparoon

Brett Nee (BSEE '03, MSEE '04, PhD '07) is an engineering specialist and team lead in the Power Electronic Control System section of the electronics department at Caterpillar Inc., specializing in power electronics, electric machines, and controls.

Nee has always enjoyed building things. Whether it was woodworking, fiddling with little electric circuits or writing simple computer programs, it seems that engineering was always in his future.

As a high school student, Nee recalls taking the Armed Services Vocation Aptitude Battery (ASVAB). "The results basically said I was good at figuring things out—better known as having 'the knack.' So I decided to pursue a career in electrical engineering," he said.

After graduating high school, Nee attended Highland Community College in Freeport, Illinois, and also Saddleback Community College in Mission Viejo, California, before heading back to Illinois to pursue his electrical engineering degree at Illinois. During his first years in school, he was fortunate to land an internship at Hamilton Sundstrand. His experience there sparked an interest in electric machines and power electronics.

During the summer of his junior year, Nee did an independent study focused on optimizing the design of an induction machine rotor. "This gave me exposure to graduate studies at Illinois and it didn't look hard," he said. So he applied himself in the classroom and the laboratory and was admitted in the fall of 2003 for graduate studies under the guidance of former ECE Professor Patrick Chapman. He completed his PhD in 2007.

Since joining Caterpillar in 2007 as an electronic drive-controls engineer for two Cat® 340-ton large mining

Cat 795F AC
Reprinted courtesy of Caterpillar Inc.

trucks, Nee has had the opportunity to work on numerous projects, from embedded software to hardware-in-the-loop simulation for controls development and testing, modeling of electric machines and power converters for real-time simulation, and even involvement with the design and specification of power electronics. Currently, in his position as an engineering specialist, he leads a team responsible for controls software development for Caterpillar's low voltage electric drive programs.

"My two favorite things about working at Caterpillar are the daily interaction with my co-workers, and testing and tuning control algorithms on the machines," said Nee. "There's nothing quite like sitting in the buddy seat on a Cat 795F AC, tuning DC-link voltage regulation for a variety of operating conditions."

With such impressive educational achievements, one might think Nee credits his amassed knowledge for both his professional success and the fulfillment he finds in his role at Caterpillar. Not so. While he reflects fondly on his time at U of I—with great experiences, friends, and world class professors—when asked about his greatest asset as an engineer, he said, "I would have to say it is my communication and social skills. Eighty percent of my day consists of interaction with my team and other process partners at Caterpillar. Constant communication is key when delivering complex projects and working with new technologies. This [communication] makes problem solving pretty easy when you (or a team) can approach a problem from different perspectives."

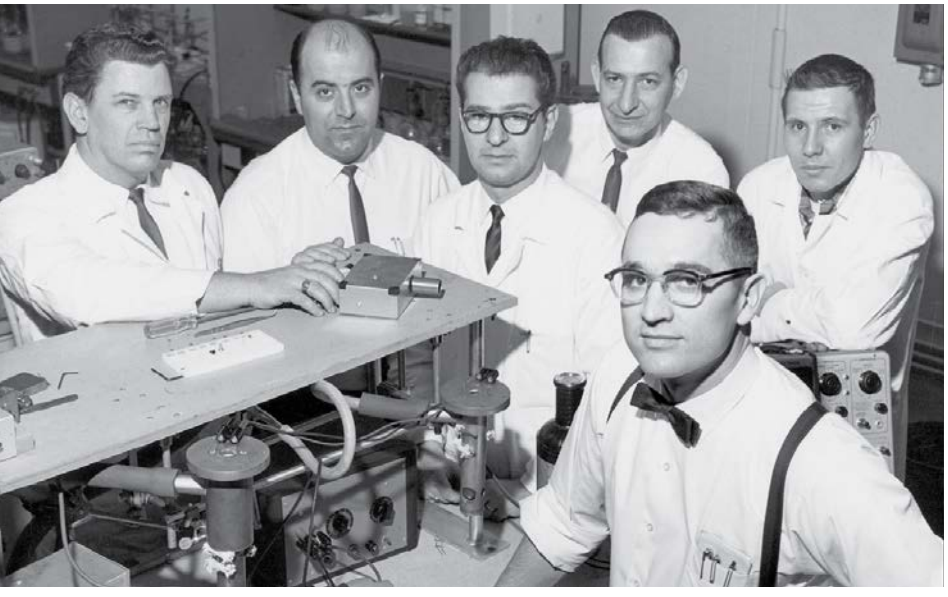
This focus on the communication and social aspects of his work—fostered in no small part, he says, by his time spent in the laboratory environment at Illinois, learning from and working with a diverse group of friends and mentors—allows Nee to enjoy functioning as a part of the bigger picture, both at Caterpillar, and globally, as well.

"Caterpillar is committed to sustainable development, and the electric drive programs that I work on play a key part in sustainability," he said. "My team and I are responsible for delivering Caterpillar's next generation drive trains, which will help those in the construction and mining industry achieve greater fuel efficiency or increase their productivity. The controls software that we develop is a huge enabling factor."

What's the next great thing for Nee at Caterpillar? "There exists the typical engineering aspects at Caterpillar, but one thing that is different from my perspective is the focus that we place on getting our software and controls engineers out to the machines and perform testing and tuning for validation. I can't really divulge anything about current or upcoming projects—but I can say that I always get to work on and with the latest and greatest stuff!"

FIELD REPORT LOOKS AT ECE ALUMNI AND THEIR WORK, SEEKING TO EXPLORE AND ILLUMINATE THE MANY FACETS OF TODAY'S ENGINEERING WORKPLACE, AND THE PART THAT ENGINEERS PLAY IN A VARIETY OF POSITIONS ACROSS MULTIPLE FIELDS.

IF YOU WOULD LIKE TO BE CONSIDERED FOR **FIELD REPORT**, PLEASE SEND AN EMAIL TO: ECE@ILLINOIS.EDU



LED

SYMPOSIUM HONORS HOLONYAK AND HIS INVENTION

By Tom Moone

On October 24, 2012, more than 250 participants gathered for the two-day LED 50th Anniversary Symposium that commemorated the first demonstration of the visible light-emitting diode (LED) in 1962 by its inventor, ECE alumnus and Professor Nick Holonyak Jr. (BSEE '50, MSEE '51, PhD '54).

There were more than 45 talks that covered the history of the LED, as well as the future outlook for this device.

After opening remarks by Anthony Maher (BSEE '68, MSEE '69) of Belmondo Capital, Holonyak gave his own take on the history of his invention. The visible LED had its roots at General Electric, where Holonyak worked in the early 1960s. It was in October 1962 that Holonyak first demonstrated his invention.

Many participants at this symposium had been students in Holonyak's lab. And many of these students are now leaders in the field of LED research and manufacturing.

"I'VE BEEN LOOKING FORWARD TO THIS DAY FOR A LONG TIME. WE'RE HERE TODAY TO HONOR SOMEONE REALLY SPECIAL, WHO UNDERSTOOD THE IMPORTANCE OF EDUCATION, THE IMPORTANCE OF RESEARCH. ONE OF THE MOST PROFOUND AND IMPORTANT THINGS NICK HAS DONE FOR OUR WORLD [WAS] INVENTING A TECHNOLOGY THAT HAS REALLY CHANGED OUR WORLD. IT SHOWED THE WORLD IN A WHOLE NEW LIGHT." -PAT QUINN

The talks and sessions were organized by the Technical Committee: M. George Craford (MS PHY '63, PhD PHY '67), SSL Fellow, Philips Lumileds; Russell D. Dupuis (BSEE '70, MSEE '71, PhD '73), Chaddick Endowed Chair, Georgia Institute of Technology; Milton Feng (MSEE '76, PhD '79), Holonyak Jr. Chair, Department of Electrical and Computer Engineering; Fred A. Kish (BSEE '88, MSEE '89, PhD '92), senior vice president, Infinera; Anthony Maher, managing director, Belmondo Capital; Donald Scifres, (MSEE '70, PhD '72), CEO, SDL Capital; and Masanobu Yamamoto, director, Sony.

Other participants at the symposium included Zhores Alferov (via video), vice president of the Russian Academy of Science and a Nobel Laureate; Anthony Leggett, Illinois professor of physics and a Nobel Laureate; Mike Krames of Soraa; Henry Pao, founder and CEO of Supertex; and Kenichi Iga, president of the Tokyo Institute of Technology.

One highlight of the event was a visit by Illinois Governor Pat Quinn. Quinn presented a proclamation declaring October 24, 2012, Nick Holonyak Day. Quinn said, "I've been looking forward to this day for a long time. We're here today to honor someone really special, who understood the importance of education, the importance of research. One of the most profound and important things Nick has done for our world [was] inventing a technology that has really changed our world. It showed the world in a whole new light."

In addition, local state representative Naomi Jackobsson presented a resolution from the state legislature recognizing Holonyak and his accomplishments.

A second highlight of the first day was an interview between Moira Gunn, host of the public radio program Tech Nation, and Holonyak following lunch. The audience heard more details about Holonyak's background, his interactions with his friend and mentor John Bardeen, and the invention of the visible LED.

In addition, a collection of artwork by German artist Emil Schult was displayed in the I Hotel on the first day of the symposium. The works celebrated the achievements of Holonyak and Bardeen.

The celebration of the LED continued into the Homecoming football game the following Saturday. Holonyak and his accomplishments were recognized during halftime, and at the end of the game, 30,000 LED flashlights were distributed to the game's attendees.

The symposium was presented by the University of Illinois at Urbana-Champaign and was sponsored by the College of Engineering, ECE ILLINOIS, the Micro and Nanotechnology Laboratory.

By Liz Ahlberg, U of I News Bureau

ENGINEERS ROLL UP THEIR SLEEVES—AND THEN DO SAME WITH INDUCTORS

On the road to smaller, high-performance electronics, ECE ILLINOIS researchers have smoothed one speed bump by shrinking a key, yet notoriously large, element of integrated circuits.

Three-dimensional rolled-up inductors have a footprint more than 100 times smaller without sacrificing performance. The researchers published their new design paradigm in the journal *Nano Letters*.

Inductors, often seen as the sprawling metal spirals on computer chips, are essential components of integrated circuits. They store magnetic energy, acting as a buffer against changes in current and modulating frequency—especially important in radio-frequency wireless devices. However, they take up a lot of space. Inductance depends on the number of coils in the spiral, so engineers cannot make them smaller without losing performance.

"IT'S A NEW CONCEPT FOR OLD TECHNOLOGY," SAID TEAM LEADER AND ECE ASSOCIATE PROFESSOR XIULING LI.

In addition, the larger the area the inductor occupies, the more it interfaces with the substrate the chip is built on, exacerbating a hindering effect called parasitic capacitance. Researchers have developed some three-dimensional inductor structures to solve the dual problems of space and parasitic capacitance, but these methods are complex and use techniques that are difficult to scale up to manufacturing levels.

The new inductor design uses techniques Li's group previously developed for making thin films of silicon nitrate, merely tens of nanometers in thickness, that roll themselves up into tubes. The research team used industry-standard two-dimensional processing to pattern metal lines on the film before rolling, creating a spiral inductor.

"We're making 3-D structures with 2-D processing," said Li, a researcher in the Micro and Nanotechnology Lab. "Instead of spreading this out in a large area to increase inductance, we can have the same inductance but packed into a much smaller area." Using the self-rolling technique, the researchers can shrink the area needed for a radio-frequency inductor to a scant 45 microns by 16 microns—more than 100 times smaller than the area that an equivalent flat spiral would require.

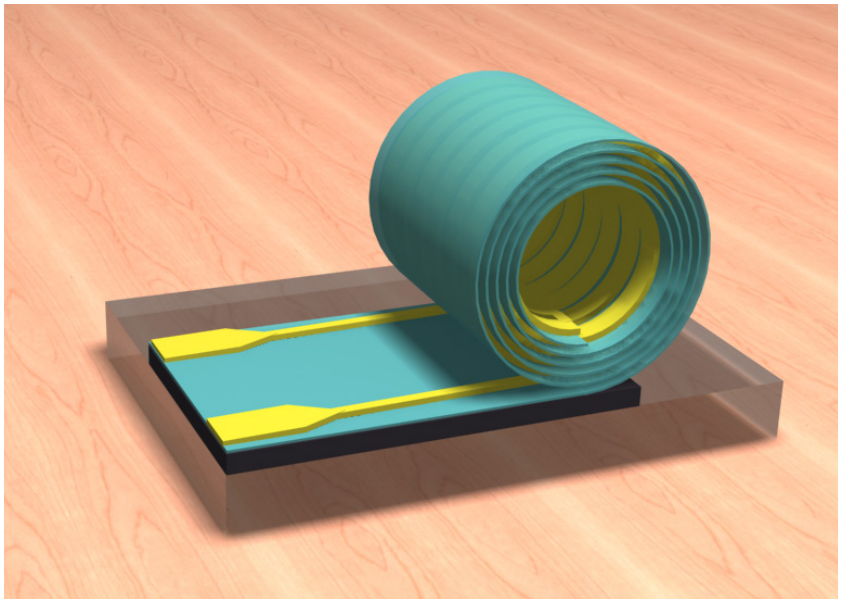
The design can be adjusted to fit target parameters including metal thickness and type, frequency, tube diameter, and number of turns. According to Li, this technique could be used for capacitors and other integrated circuit elements as well.

Now, Li's group is working to produce high-performance inductor prototypes in collaboration with ECE Professor Jose E. Schutt-Aine. Preliminary experimental data show strong correlation with the modeled designs.

"Once we have optimized this process, we should be able to make an integrated circuit with a completely different platform that could be much smaller," Li said. "It's an ambitious goal."

The National Science Foundation and the Office of Naval Research supported this work. Illinois visiting researcher Wen Huang, postdoctoral researcher Xin Yu, ECE graduate student Paul Froeter, and Mechanical Science and Engineering Professor Placid Ferreira were co-authors of this study. Li also is affiliated with the Beckman Institute for Advanced Science and Technology and the Frederick Seitz Materials Research Lab.

ECE Associate Professor Xiuling Li led a team of Illinois researchers who developed a new design paradigm for inductors. Processed while flat, the inductors then roll up on their own, taking up much less space on a chip.



canary software

By Elise King, Coordinated Science Lab

"THE IDEA OF A CANARY, IN THE CONTEXT OF PROCESSORS, IS THAT, IF YOU CAN BUILD SOMETHING INSIDE A PROCESSOR THAT WILL FAIL BEFORE YOUR PROGRAM FAILS, THEN IT'S A GOOD DETECTOR." -RAKESH KUMAR

ECE Assistant Professor Rakesh Kumar and ECE alumnus and University of Minnesota Assistant Professor John Sartori (MSEE '10, PhD '12) have received a $300,000, three-year grant from the National Science Foundation and the Semiconductor Research Corporation to research the use of software canaries in detecting hardware failures.

Kumar, a researcher in the Coordinated Science Lab, said the idea of a software canary can be explained by the analogy of canaries in mines. Miners would bring birds into mines to detect methane gas. When the canaries stopped singing, the miners knew the canaries had died and evacuated before they were harmed.

"The idea of a canary, in the context of processors, is that, if you can build something inside a processor that will fail before your program fails, then it's a good detector," said Kumar. "It means that maybe you can dial down the speed, or you can dial up the voltage so that your programs can work correctly."

Traditionally, the industry has used hardware canaries to check for problems. However, "when you're building a hardware warning system to check a different piece of hardware, you know it's a question of who checks the checker," Kumar said. The hardware canary will suffer from the same kinds of issues that the actual hardware would, so the system is very conservative.

However, a software canary can run on the same processor that the actual hardware runs on—as opposed to running alongside it—and therefore is less conservative and can potentially save power and enhance performance, Kumar said.

This grant is part of the NSF/SRC Joint Initiative in Failure Resistant Systems. "It's a big program," Kumar said. "They encourage impactful research in failure-resistant systems . . . and essentially they are looking for cross-cutting solutions," he said.

Kumar and Sartori have worked on projects together in the recent past when Sartori was a graduate student in Kumar's group. Kumar said he likes that this project gives them the opportunity to keep working together.

DONOR HONOR ROLL

January through December 2012

ECE ILLINOIS is grateful to the alumni, friends, and partners who have made contributions to the department. The following list includes financial donations, but we are just as grateful for the ongoing support you lend in other ways. ECE could not maintain its position as a great educational and research institution without you.

The following list includes charitable gifts designated for ECE and received between January 1, 2012, and December 31, 2012. Gifts to other campus units may be recognized in other campus publications.

CORPORATE AND FOUNDATION DONORS

Abbott Fund
Aero Engine Controls RR Goodrich Eng Control System
Agilent Technologies, Inc.
Ameren Services
American Electric Power Company
American Heart Association
APNA Consultancy LLC
Apple
Archer Daniels Midland Company
AT&T Foundation
Bank Of New York Mellon
Caterpillar Foundation
Caterpillar Inc.
CBI Foundation
Cisco Systems Foundation
Exelon
Exxon Mobil Corporation
Flanders Electric Motor Service, Inc.
Fortuna Realty Company
G & W Electric Company
GE Foundation
Google
Grainger Foundation Inc.
Haken Audio
Hans Sigrist Foundation
IBM Corporation
IBM Matching Grants Program
Inha University
Intel Foundation
Intermec Foundation
Johnson & Johnson Family of Companies Contribution Fund
Lisa Family Foundation, Inc.
Lockheed Martin Foundation
LyondellBasell
Micro Methods, Inc.
Microsoft Corporation
Motorola Mobility Foundation
Motorola Solutions Foundation
Northrop Grumman Aerospace Systems
Northrop Grumman Corporation
Northrop Grumman Foundation
Philips Electronics North American Corp.
Qualcomm Incorporated
Raytheon Company
Research in Motion Limited
Rockwell Automation Charitable Corporation
Rockwell Collins
Rockwell Collins Charitable Corporation
S&C Foundation
SC Johnson Fund, Inc.
Schad Family Trust
Schlumberger-Doll Research
Semiconductor Research Corporation
Silicon Valley Community Foundation
SolarBridge Technologies, Inc.
Srivastava Foundation
Texas Instruments Foundation
The Boeing Company
The Capital Group Companies, Inc.
The Clorox Company Foundation
The Medtronic Foundation
The P&G Company
The Procter & Gamble Fund
Union Pacific Railroad
United Technologies Corporation
Verizon Foundation
Wal-Mart Stores, Inc.
Xpeedic Technology, Inc.
Yahoo

THE LIST : DONORS

MAJOR GIFTS

Ackmann, Lowell E.
Alwan, Basil H.
Bahl , Lalit R. and Kavita Kinra
Beanblossom, Todd M. and Gale
Campbell, Edna M.
Chan, Chi Hou
Chang, Herbert Y. and Stella S.
Cioffi, John M/ and Assia
Coleman, James J. and A. Catrina
Day, Gordon W. and Katherine S.
Gilmore, Merle and Lisa
Grainger, David W.
Henderson, Joan K.
Hong, Se June and Karen McCully Hong
Horsley, Sherel D.
Jain, Kanti
Johnson, Carl J. and Margot A.
Jordan, Robert E.
Kommineni, Vamshidhar
Kurkowski, Hal and Nancy A.
Lachman, Phillip M.
Marcyk, Gerald and Michelle
Meyer, Derrick R.
Mittra, Raj and Jeannette
Nixon, Larry S.
Pao, Henry C.
Rao, N. Narayana and Sarojini N. Rao
Renwick, Brian L.
Saladi, Indira
Sample, Steven B. and Kathryn Brunkow
Srivastava, Sanjay K.
Sterling, Jennifer T.
Tolli, Dominic M. and Natalie J.
Trick, Timothy N. and Dorothy L.
Ben, Bin-Ming and Jamie Tsai
Veeravalli, Venugopal and
Starla L. Carpenter
Whitlock, Brent K. and Ellen S.
Yau, Leopoldo D. and Bella
Yeh, Margaret

GIFTS OF $1,000 TO $4,999

Adesida, Ilesanmi and Patience Okpaku
Allemong, John J.
Altenbaumer, Larry F. and Dheena E.
Ashbrook, Jonathan B.
Barth, Richard M.
Bernatowicz, Frank A. and Kathleen A.
Bishop, Stephen G. and Helene E.
Boppart, Stephen A. and Marni D.
Brown, Gary S. and Kathleen
Bruning, John H.
Camillone, Rosalie J.
Cangellaris, Andreas C.
Chow, Joe H. and Doris W.
Criner, Douglas E.
Dickmann , James William
Ernst, Barbara A.
Finnigan, Robert E. and Bette E.
Foudriat, Edwin C. and Jo Anne H.
Fuoss, Dennis E.
Gibbs, Kenneth Paul and
Claire VanderMeulen
Grohoski, Gregory F.
Hasegawa, Mark and Yu Hasegawa-Johnson
Hawthorn, Christy M.
Hegarty , Aran
Hieken, Milton H. and Barbara Barenholtz
Hirshman, Neil S. and Beth C.
Hudson, Matthew E.
Itoh, Tatsuo
Julifs, David H. and Roxann M. Marumoto
Kaskowitz, Michael D.
Kiesling, Robert W.
Kobayashi, Herbert K.
Konicek, Jeffrey C.
Krein, Philip T. and Sheila Fitzgerald
Leung, Kwok Wa
Link, Jonathan D. and Michelle L.
Magnuski, Henry S. and Cynthia Jose
Maitre, Matthieu
Malaise, Richard E.
McCrory, Kevin S.
Meixner, David P.
Mikulski, James J.
Mueller, Thomas O.
Newman, Leon A.
Novak, Thomas R.
Nudel, Barry and Sharon Jorgensen-Nudel
Oakley, Burks II
O'Brien, William D. and Wilma L.
Park, Ikmo
Pesavento, David R. and Nancy L.
Peterson, Andrew F.
Radnik, Robert C.
Reuter, Richard J.
Richards, Anthony L. and Rosario J.
Ryoo, Shane and Louise S. Lee
Sarwate, Dilip V. and Sandhya D.
Schaubert, Daniel H.
Schopfer, Don K.
Schutt-Aine, Jose E. and Patricia Fowler
Sognefest, Peter W.
Solari, James F.
Stahl, Alan L.
Starr, Thomas J. J.
Stein, Andrew J.
Tashima, Mark M.
Thomas, Sunil
Tomasic, Michael G. and Christina M.
VanBlaricum, Michael L. and
Pamela Calvetti
Wang, Yi-Min and Pi-Yu Chung
Webb, Kevin J.
Yu, Tianli and Yan Zhang

GIFTS OF $500 TO $999

Abdallah, Rami A.
Banerjee, Prith and Swati
Batcher, Kenneth E.
Bates, Cyril P.
Becker, Wiren D.
Berkwits, Leland
Bollman, Andrew M.
Breeding, Juliann B.
Carolan, Shawn T. and Jennifer M.
Chicoine, Michael R. and Caroline G.
Connors, Daniel P.
Cwik, Thomas A.
Fitzsimmons, Mike and Elaine Chapin
Galbraith, Amy M. and Robert E.
Gupta, Arun
Hajek, Bruce
Hallman, Kenneth B.
Jarboe, Kevin N.
Kennedy, Robert G. and Cynthia M.
Kohlrus, Karl E. and Christine C.
Kuchipudi, Srinivas
Liang, Zhi-Pei and Bo Liu
Lomelino, Dale L.
Makela, Julia P. and Jonathan J.
Merkin, Joel R. and Michelle B.
Meunier, Jeffrey A.
Miller, Anne A.
Moore, David Scott
Moreira, Jose E.
Niehaus, Jeffrey A.
Niemoeller, Benjamin Arthur
Owdom, Ronald S. and Sheryl S.
Parson, Kim and Nicolette
Phelps, Weldon L.
Poggio, Andrew J.
Predick, Paul R. and Christine T.
Sangai, Amit R.
Scarpelli, Nate F. and Sue A.
Schindler, William C.
Schmitt, Ross A.
Sherman, Glenn H. and Inamaria
Sipinski, Gene
Vaughn, Matthew W. and Kiva S.
West, Leslie Joe and LeAnn W.
Womeldorff, Porter J. and Marilyn P.

GIFTS OF $250 TO $499

Aksamit, Randy J.
Anderson, Richard E. and Carolyn B.
Arnold, Daniel J.
Blevins, Jack L.
Bloechle, Brian W.
Boatright Jr., David J.
Chu, Michael J.
Diekman, W. Michael
Dunn, Floyd and Elsa
Emert, Win H.
Erickson, Paul M.
Faber, John P.
Ferrara, Jeffrey F.
Follis, William J.
Gao, David Si-Wei
George, Christopher and Christina
Gohl, Thomas H.
Gordon, Richard H.
Green, Samuel I.
Gustafson-Breya, Margaret
Mardis-Hanley, Joseph R. and Kristy L.
Hannon, Stephen M.
Hansen, Timothy R.
Harris, William Dean and Peggy Marie
Husung, David L.
Johnson, Gary W.
Johnson, Roger Laverne
Kansal, Mayank M. and Reena Shah
Katz, Richard H. and Victoria L.
Kessler, Lawrence W. and Francesca
Kirkpatrick, George M.
Korb, Harold and Anne
Kreer, Vivienne M.
Labiak, William G. and Mabel
Lindroth, Dean C.
Maranowski, Steven A.
Martin, Gerald E. and Louise C.
Mitra, Samir G. and Sundari S.
Nichols, Jeanann
O'Brien, Vincent E.
O'Connell, Timothy C. and Megan E.
O'Neill, John G.
Owens, Joseph N. and Nancy J.
Owens, William R. and Carol J.
Pomernacki, Charles L. Jr.
Radant, Milton E. and Shirley
Ramos, Richard S.
Ravikanth, Rayadurgam and Malini
Viswanathan
Rosset, Sherwin and Natalie
Shah, Ketu K. and Priti
Stunkel, Craig B.
Swim, Alan D.
Tanaka, Jerry A.
Tidd, Jonathan G.
Tirva, Victor A.
Tran, Thanh T.
Tremain, Tim A.
Trick, Michael T. and Xiaowei Tian
Farley, Daryl and Douglas William Varney
Waldrop, Park D.
Ward, Robert D.
Weissman, Steven Jay and Suzanne Heisler
Wright, James W.
Wung, Peter Y.
Yeh, David C. and Michelle M.
Zillman, Daniel C.

GIFTS UP TO $249

Andersen, Mark A.
Anderson, Jeffrey M.
Anderson, Michael J.
Arbetman, Robert Bennett
Balabas, Jason T.
Balazs, Ronald Michael
Bales, James E.
Balzarini, Dennis L.
Bates, David L. and Mary Kathleen
Baumgartner, Richard A. and
Elizabeth M. Salzer
Benhabib, Jose
Berglund, Wallace A. Jr.
Berner, Jason
Berry, Gregory A.
Besich, Joanne M.
Beyers, Joseph W.
Bicknell, William E.
Bielat, Mark
Biewer, John A.
Birnbaum, Josh R. and Jessie
Blazeck, Thomas S.
Borchers, Jerald W.
Bridge, William A.
Brown, Douglas A.
Buenger, George L.
Calligan, Richard A. III and Patricia
Campbell, Robert J.
Carroll, Dennis J.
Chan, Chi K.
Chang, Allen Timothy
Chapman, Bruce E.
Chu, Dahwey
Chung, Joshua
Clark, Thomas T.
Cleland, Matthew J.
Cleveland, George M.
Cockrum, Scott D.
Collins, Dean Robert
Cook, Jeffrey J.
Darrow, Joseph A.
Darsch, Arnold P.
Davis, Paul R. and Janice R.
Davis, Richard D.
DeGroat, Joanne E.
Dillenburg, Brian J.

Donalek, Peter J.
Dowding, Fielder G.
Dunbar, Mark E.
Dzurisin, Michael J.
Eckhouse, Richard H. Jr.
Edelman, Mark N.
Edson, Donald T.
Eichelkraut, Craig A.
Eilts, Larry E.
Eisenmann, Bradley D.
Emery, Edith R.
Escovedo, Darcy T.
Etzel, Mark H.
Feher, James D.
Feng, Weishi
Fierro, Brenda I. and Andrew A. Caprio
Fisher, James L.
Flaig, George G.
Flucke, James M.
Foecking, Donald A. and Lucille A.
Fresina, Michael T. and Julie
Frizzell, Kathleen D. and Leon A.
Ganley, James T.
George, Thycodam V.
Germeraad, Colleen
Gerstenberger, Jeffrey S.
Gibbons, Scott G.
Gibes, Joseph G.
Gilchrist, Brian E.
Glazer, Marvin A. and Arlene R.
Gold, Barry H.
Graessle, Paul M. and Raeghan M.
Granzow, Kenneth D.
Grebner, Frank W. Jr.
Groch, Timothy J. and Nancy A.
Gromm, Bradley J.
Gross, Louis H.
Guerin, Michael R.
Gupta, Sandeep
Hajic, Earl James
Hall, Douglas C. and Catherine Martin
Handler, Michael L.
Hanes, Larry L.
Hanson, Allen W
Hart, Gerald W.
Haruch, John and Constance Y.
Hendrickson, Matthew L. and Monica B.
Herbeck, Allen E.
Herbener, Stephen R.
Higgerson, Clifford H.
Higgins, William E. and Margaret M.
Hislop, Arthur Q.
Holm, John G.
Honickman, Harris
Howard, Mark N.
Howland, Dennis R. and Mary Kaltenbach
Hruska, Jean M.
Huey-You, Albert Jr.
Ingram, Robert W.
Jablonski, Robert C.
Jacquot, Blake Charles
James, John T.
Jankowski, Chet F.
Jha, Niraj K. and Shubha Govind
Jones, Edwin C. Jr. and Ruth M.
Jones, Kristin M.
Jones, Robert Lee
Joshi, Tanuja A.
Jurewicz, Robert E.
Kaczmarek, Kurt A.
Kamikawa, Neil T.
Karim, Zia-Ul
Karwan, Henry P.
Kay, John C.
Kenyon, Richard Jay and Lois Belle
Kerr, J. Stephenson and Jean A. C.
Khajana, Ashwin
Khalil, Hassan Kamal
Kilty, Roger S.
Kirk, Donald E.
Kitazawa, Toshihide
Klein, Charles A. and Irene Traub
Knapowski, John T.
Kochan, David A.
Koktzoglou, Ioannis
Konrad, Steven Scott
Korblick, Jill M.
Krainc, James A.
Krueger, Dirk
Kuntz, Robert W. and Lynn A.
Kuo, Franklin F. and Dora Lee
Kwon, Howard A.
Kyu, Gregory Y.
Lackowski, Donald H.
Landauer, Michael C.
Landers, David J.
Landreth, Helen O.
Larkin, Michael E.
Larson, Richard W. and Neva M.
Laursen, Robert L.
Lauber, Larry F.
Layman, Terry J.
Li, Hang
Liu, Paul and Jean Shiau
Livengood, John D.
Luo, Xi
Maddila, Sanjeev R.
Maher, Robert C.
Manning, Patrick F.
Mariano, Gonzalo A.
Marinello, Gerald J.
Mattappally, Nidhin P.
May, David C.
Melle, Jane A.
Meyer, Charles F.
Mirande II, Michael A.
Mishkin, Bryan J.
Mitzel, Kevin R. and Angela S.
Moatesim, Ahmad
Moone, Thomas H.
Moorman, Jay R.
Moser, Brian G.
Moss, Randy H.
Myer , Jeffrey W. and Catherine L.
Mueller, Vernon C.
Munson, Bill A.
Nakamura, Otis S.
Narasim, Rajan Lakshmi
Navale, Nitin Shankarara
Neff, Alan L.
Nelson, Mark W.
Neuhalfen, Michael A.
Ng, Spencer W.
Nguyen, Cac T.
Nguyen, Kien C.
Niu, Xinning and Lu Yao
Norling, James A.
Nuspl, Stephen J.
O'Donnell, Martin E. and Emily
Olano, Thomas Marcolm
Olaniran, Qudus B. and Heather A. Lee
Olshan, Robert Z.
Overhauser, David V.
Padgitt, David G.
Pagones, Michael John
Park, Keundo
Parks, Rodney T.
Pasteris, Robert F.
Patha, Robert R.
Percival, Nell Culp
Perry, John S.
Peterson, Kathryn A.
Phillips-MacAdam, Sara J.
Pienkos, Richard J. and Julia A.
Plano, Mary A.
Plonus, Martin A.
Poeschel, Robert L.
Porter, Jeffrey S.
Pragides, Ronald J.
Printz, Daniel M.
Radke, William A. and Marie W.
Radosavljevic, Branko
Rajagopalan, Chithra
Reinhard, Linda S.
Repke, Joseph P.
Resman, John B.
Richardson, Michael A.
Richter, John P.
Rintoul, Bradley E.
Ritt, Jack A.
Ritzert, John A.
Rollenhagen, David C.
Rogers, Gregory P.
Romanelli, John and Gertrude J.
Ross, Monte
Rothlisberger, David P.
Rounds, David N.
Ruby, Robert A. and Susan E.
Rust, Charles L. Jr.
Ruwe, Ryan L.
Ryan, Patrick D.
Sacco, Gilbert F.
Sainati, Robert A. and Jill J.
Sarver, Megan L.
Sauer, Peter W. and Sylvia L.
Schad, Virgal L. Jr.
Schaeffer, Thomas G.
Schomer, Paul D.
Schrock, Anthony W.
Schwartz, Alan M.
Scontras, Stanley A. and Mary A.
Scott, Michael J. and Melanie M.
Seinfeld, Robert David
Senese, Thomas J.
Shapiro, Mark L.
Shemroske, Peter M.
Simmons, Jeffrey J.
Skouson, Mark B.
Slutsky, Gary S. and Beth
Snow, Julie A.
Solomon, Sergio E.
Sommers, Peter B.
Sparacino, Michael J.
Srinath, Mandyam D.
Stapleton, Jim and Michelle D.
Steinmetz, James D.
Stephens, Kenneth Leon
Stephenson, David T
Stout, Mark S. and Laura Fultz
Stuart, David C.
Stutzman, Warren L.
Sukhaphadhana, Christopher T.
Sullivan, Roderick B. Jr.
Swenson, George W. Jr. and Joy Janice
Tate, James E.
Taylor, Javin M. and Lynda
Terdina, James M.
Toomey, Patrick J. and Nancy C.
Trahan, Jerry L.
Trainor, Drew R.
Trimble, Philip K.
Tse, William C.
Usevitch, Bryan Edward
Vacchione, Joseph D.
Valleni, Robert R.
Varshney , Pramod K. and Anju
Vogel, Frederick M. and Marcelle A. Salamy
Wah, Catherine L.
Wah, Elaine Y.
Waineo, Douglas K.
Walker, Michael E.
Walker, Winston K.
Wang, Desmond Y.
Ward, David B.
Wasserman, Daniel M. and Melissa
Weatherspoon, C. Danny
Webb, James A. and Becky Ann
Westendorf, Brian M. and Kristin J.
Westendorf, Mark W. and Sharon R.
Whitson, Roger M.
Williams, Henry G.
Winn, James
Wirth, Robert D.
Woerner, Leo G.
Wojnowiak, Paul
Wytmar, Richard J. III
Xu, Peng
Yackish, Thomas M.
Yang, Kevin J.
Yavarone, Anthony E. Jr.
Yeh, Richard C. and Corina
Zarnow, David F.
Zhang, Yimin
Zivney, Terry L.

We strive to make this list as accurate as possible. If your name has been listed incorrectly or omitted, please accept our apologies.

To report an error or omission, or for information about making a gift, contact either Beth Katsinas or Martin O'Donnell.

Beth Katsinas
Director of Development
(217) 265-6567
katsinas@illinois.edu

Martin O'Donnell
Assistant Director of Advancement
(217) 333-5687
martinod@illinois.edu

TEN ANSWERS

Ravi Thakkar (BS CompE '07) is a senior manager of product management at Motorola Mobility in Chicago. He has held a variety of roles at Motorola including sales, business operations, and development. Ravi is currently pursuing his MBA at Kellogg School of Management at Northwestern University and is an active Illinois alumnus.

RAVI THAKKAR

WHAT WAS YOUR FAVORITE PLACE TO STUDY?
Fourth floor of Grainger Library.

HOW WOULD YOUR CLASSMATES REMEMBER YOU?
Student leader focused on innovation. I had the opportunity to launch Engineering Initiatives and Engineering Student Alumni Ambassadors (ESAA) while on campus with some very talented individuals.

WHAT IS ONE OF YOUR FAVORITE QUOTES?
When I was a student at the University of Illinois, I attended a summer leadership retreat called LeaderShape. Their motto was "have a healthy disregard for the impossible." This has stuck with me ever since.

WHEN YOU HAVE 30 MINUTES OF FREE TIME, HOW DO YOU PASS THE TIME?
Facebook!

WHAT IS YOUR GREATEST ACHIEVEMENT?
Knights of St. Patrick award from the College of Engineering for leadership, contribution, and character.

ARE YOU A MORNING OR NIGHT PERSON?
Definitely a night owl. I always used to stay up in college and that still hasn't changed.

ARE YOU A COLLECTOR OF ANYTHING?
I collect post cards from every city I visit around the world and have a wall full of postcards in my office.

ARE YOU MOSTLY A CLEAN OR MESSY PERSON?
I'm an organized person – physically and digitally.

WHO HAS BEEN THE BIGGEST INFLUENCE ON YOUR LIFE?
My brother, Vivek Thakkar. He has always inspired me. We both have computer engineering undergraduate degrees, work at Motorola, and will soon both be Kellogg grads.

IF YOU COULD BE ANY ANIMAL, WHAT WOULD YOU BE?
A penguin. Penguins are always dressed up.

RAVI ON VACATION IN RIVIERA MAYA.

TEN ANSWERS PROFILES AN ALUMNUS EACH ISSUE ASKING THE IMPORTANT QUESTIONS. DO YOU HAVE ANSWERS? EMAIL US AT ECE@ILLINOIS.EDU AND WE MAY FEATURE YOU IN A FUTURE ISSUE.

ALMA MATER GETS A MAKEOVER

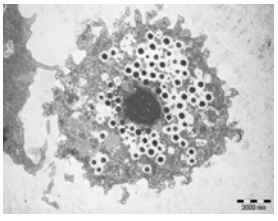
On August 7, workers removed the five-ton Alma Mater sculpture onto a truck and took it to Chicago for conservation work. The sculpture, unveiled on campus in 1929, is being conserved because years of water damage have affected its appearance and structural integrity. Donations collected through the Chancellor's Fund are paying for the work. Extensive repairs are underway and Alma is expected back on campus sometime during the 2014 academic year.

KICK THE HABIT

The Urbana campus will become smoke free this year, Chancellor Phyllis Wise said. The smoke-free campus, which will be instituted through a policy to be created over the next several months, is expected to be in place by November 2013. State law already prohibits smoking inside public buildings and within 15 feet of a building entrance. The Urbana campus policy would ban smoking on all university property – including sporting and entertainment events attended by the off-campus community.

THIRTEEN MILLION BOOKS

The Illinois Library has added its 13-millionth book to its collections, maintaining its status as the largest public university library in the country. "Ise Monogatari" (or "Tales of Ise"), the first illustrated Japanese printed book, is an anonymous compilation of 209 poems and 125 episodes from a poet's life. Enormously popular, "Tales of Ise" recounts the amorous exploits of an unnamed lover/poet, often identified with Ariwara no Narihira (825-80), one of the six "sages" of Japanese poetry. The library's copy is the first printed edition of the classic work and was published in 1608.



GIANT VIRUSES SHAKE UP TREE OF LIFE

A new study of giant viruses supports the idea that viruses are ancient living organisms and not inanimate molecular remnants run amok, as some scientists have argued. The study may reshape the universal family tree, adding a fourth major branch to the three that most scientists agree represent the fundamental domains of life. Led by Crop Sciences and Institute for Genomic Biology Professor Gustavo Caetano-Anollés, the researchers mapped evolutionary relationships between the protein endowments of hundreds of organisms and used the information to build a new universal tree of life that included viruses.

LINCOLN HALL REDEDICATED

A rededication ceremony for Lincoln Hall was held February 12. The ceremony, held on Lincoln's birthday, was 100 years to the day of the original building dedication. The two-year, $64 million top-to-bottom renovation project was funded with nearly $58 million in state capital development funds and almost $6 million from the university.

Department of Electrical and Computer Engineering
University of Illinois at Urbana-Champaign
56 Everitt Laboratory MC-702
1406 W. Green Street
Urbana, IL 61801

RETURN SERVICE REQUESTED

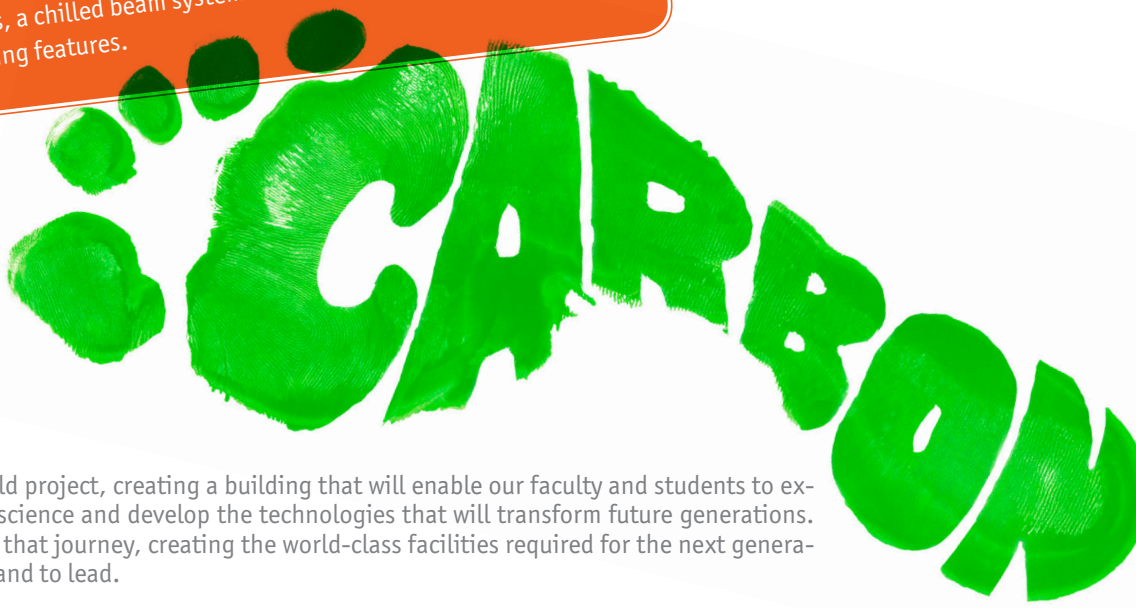
NONPROFIT ORG
U.S. POSTAGE PAID
BLOOMINGTON, IL
Permit No. 437

IMAGINE. BUILD. LEAD.

FACT #03

THE NEW BUILDING IS STRIVING FOR A NET-ZERO ENERGY DESIGN AND IS DETERMINED TO BE LEED PLATINUM CERTIFIED.

ECE will accomplish a minimal carbon footprint thanks to a vast array of photovoltaic cells, a chilled beam system to cool and heat the building, and other energy saving features.



ECE has embarked on a bold project, creating a building that will enable our faculty and students to explore the cutting edge of science and develop the technologies that will transform future generations. We invite you to join us in that journey, creating the world-class facilities required for the next generation to imagine, to build, and to lead.

More facts available online. Log on today!

ECE.ILLINOIS.EDU/BUILDINGCAMPAIGN

do your bit **DONATE TODAY**