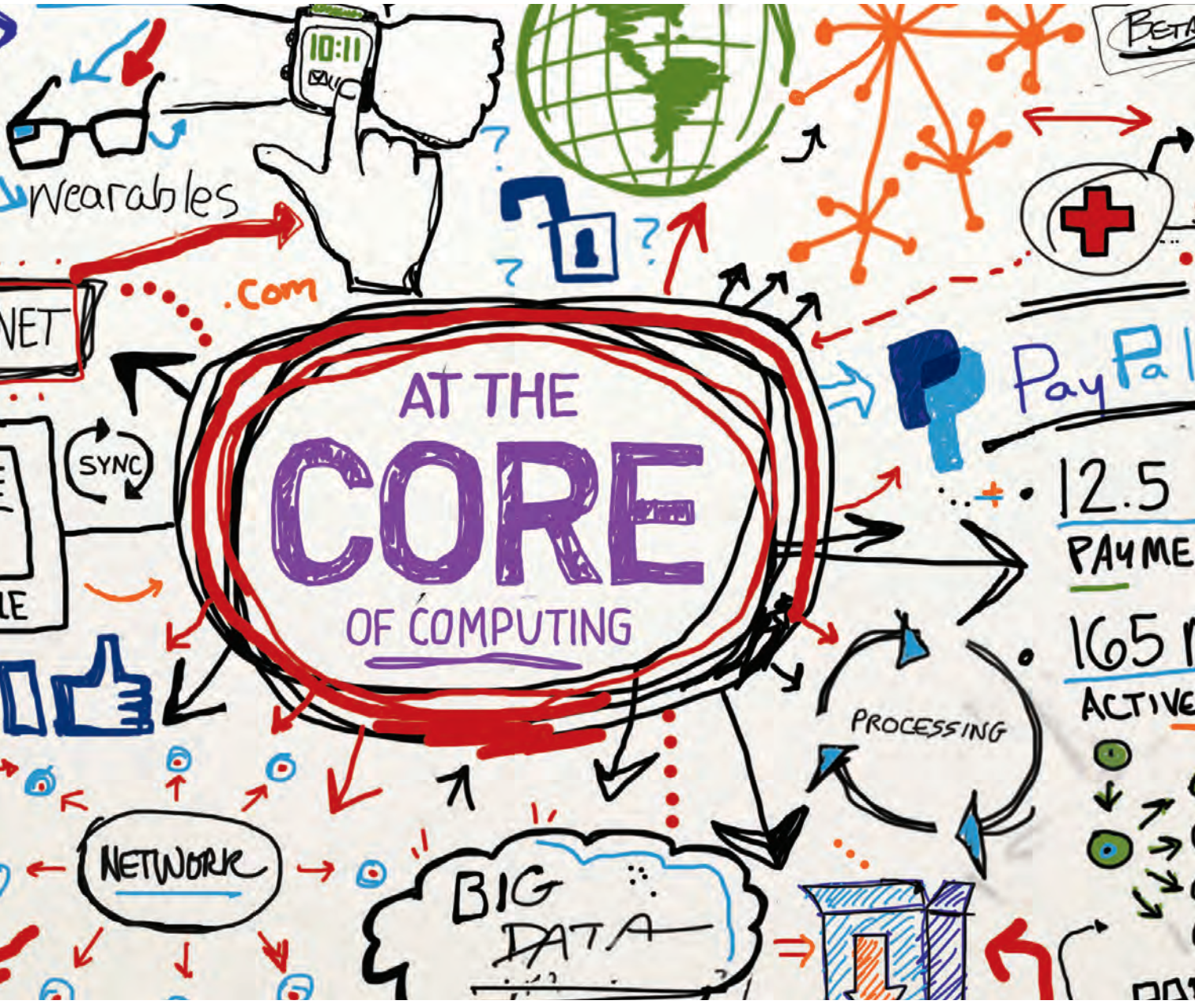
ENCOURAGING FEMALE ENGINEERS CHANGING STUDENTS' LIVES WITH SCHOLARSHIPS DESIGNING HYBRID AIRCRAFT ENCODING DATA IN DNA REMEMBERING EXTRAORDINARY FACULTY DEVELOPING THE NEXT GENERATION JAMMER

E RESONANCE

THE MAGAZINE OF ECE ILLINOIS FALL 2015



ILLINOIS

TOP OF MIND

Across Engineering at Illinois, our outstanding researchers and faculty members have a new charge: to help create the world's first engineering-based medical college. The Carle Illinois College of Medicine will become the Urbana campus' first new college in 60 years, and is tasked with transforming health care by training physician-scientists to address needs within the world of medicine.

The University of Illinois Board of Trustees approved the new college this spring. The Carle Health System has pledged $100 million in its first 10 years, an incredible show of support that proves the importance of this new institution.

ECE ILLINOIS researchers have a long, strong tradition of working at the intersection of health and engineering. They are uniquely qualified to contribute to the Carle Illinois College of Medicine as it begins. For example, Professor Brian T. Cunningham has developed low-cost photonic crystal-based biosensing devices that have allowed for the detection of cancer cells, including early-stage breast cancer, as well as the amount of HIV virus present in the human body. Associate Professor Gang Logan Liu has developed a smartphone-based sensor that provides accurate nitrate concentration measurements and has other health applications.

ECE ILLINOIS has several faculty members, including Stephen Boppart, William D. O'Brien Jr., Michael L. Oelze, Gabriel Popescu, and Zhi-Pei Liang, who have made strong contributions to the world of biomedical imaging. Their work has included developing cancer-detecting ultrasound, the first 3-D imaging of live cells, and new generations of MRI technology.

Professor Xiuling Li has developed stents only a few microns long that can speed up and direct neuron growth. These tiny structures might someday be a big help to those with Alzheimer's or traumatic brain injury. And Professors Ravishankar K. Iyer, Wen-mei W. Hwu, Steven S. Lumetta, Olgica Milenkovic, Venu V. Veeravalli, Shobha Vasudevan, Yi Lu, Minh Do, and Deming Chen all work on the CompGen Initiative, which will enable faster, more accurate DNA sequencing.

You can learn more about the new college at medicine.illinois.edu. We look forward to contributing to such an important mission on our campus, within the state of Illinois, and around the world.

Sincerely,

William H. Sanders
ECE Department Head
Donald Biggar Willett Professor of Engineering

RESONANCE

FALL 2015

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Eric Klinker (BSEE '91), CEO of BitTorrent

SATURDAY ENGINEERING FOR EVERYONE

Eight Illinois faculty members delivered Saturday Engineering for Everyone talks on topics ranging from high temperature superconductivity to the future of nanotechnology. This free lecture series is aimed at non-engineers of all backgrounds who have an interest in learning about new engineering developments. Watch the spring 2015 lectures online.

» go.ece.illinois.edu/SEEvideos

ECE ALUMNI AWARDS: MAKE YOUR NOMINATIONS ONLINE

Know an alumnus or alumna deserving of the ECE Distinguished Alumni Award, the Young Alumni Achievement Award, or the Marcia Peterman Award for service to **the** department? Make your nominations online. We're always happy to accept them, but we'll consider winners for 2016 with nominations submitted by Jan. 22, 2016. Questions?

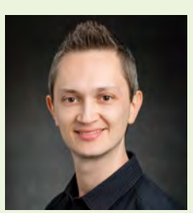
» Contact Audrey LeGrande: alegrand@illinois.edu

» go.ece.illinois.edu/alumniawards

TAKE THE TOUR

Whether you plan to visit campus or want to learn from home, check out our audio tour of the ECE Building. Professor Phil Krein, chairman of the new building committee, and SmithGroupJJR architect Coty Sandberg explain how the ECE Building uses an array of features as it targets net-zero energy.

» go.ece.illinois.edu/audiotour



ECE WELCOMES JARAMILLO

ECE ILLINOIS welcomed Juan Jose Jaramillo Jimenez (MS '05, PhD '10) to its faculty in January. Jaramillo serves as a lecturer for computer engineering classes.

Jaramillo most recently worked as an assistant professor at Universidad EAFIT in his native Colombia, and is looking forward to spending time with ECE ILLINOIS students and collaborating with faculty, as well. His research is in communications. "The research being conducted here is superb," Jaramillo said. "And from the teaching perspective, I'm looking forward to being challenged by our amazing students."

FORMER CHANCELLOR PHYLLIS WISE PRESENTS PROFESSOR EMERITUS NICK HOLONYAK JR.'S DRAPER PRIZE AT AN URBANA RECEPTION IN MARCH, AS PROFESSOR MILTON FENG LOOKS ON.

PIONEERS RECEIVE DRAPER PRIZE

Professor Emeritus Nick Holonyak Jr. and two of his former students are among the five pioneers of LED technology honored with the 2015 Draper Prize, one of the most prestigious awards in engineering.

Holonyak (BSEE '50, MS '51, PhD '54), Russell Dupuis (BSEE '70, MS '71, PhD '73), and George Craford (MS physics '63, PhD physics '67) were among five innovators honored by the National Academy of Engineering, which administers the $500,000 prize sponsored by Draper Laboratory.

Texas Instruments' Steve Lyle announces the company's support of a statue of a female engineer on the Illinois campus. Sakshi Srivastava, the ECE student who championed the idea, participated in the announcement, as well.

INSPIRING WOMEN IN ENGINEERING

At a dedication this March for two spaces in the Electrical and Computer Engineering Building, Texas Instruments' Steve Lyle, director of engineering workforce development, announced the company's next step in supporting engineering students at Illinois: funding for a statue depicting a female engineer. It's intended to inspire current and future women who aspire to attain a degree and career in engineering.

It's no secret that attracting the best minds to STEM disciplines, especially those of women, is a challenge for universities around the country, Lyle said. But Engineering at Illinois has tackled the challenge with pushes to increase both the number of incoming female students and faculty members.

"Different worldviews and approaches to solving problems are fundamental to creative thinking, and we are 100 percent behind the university's efforts to increase gender diversity in particular," Lyle said.

"Always be open to a new idea, and be prepared to move quickly."

Irwin Jacobs
said during his February visit to ECE Illinois.

Jacobs and Sivaraman

ECEPULSE

JACOBS SPEAKS AT ECE LAUNCH, PULSE

Irwin Jacobs, the Qualcomm co-founder, spoke as a part of ECE Pulse, a student-led conference, and ECE LAUNCH, a celebration of electrical and computer engineering at Illinois.

Pulse, a student-run conference, gave students an up-close look at the innovations in the field without the stress of a career fair. The annual conference has taken place every spring semester for the last four years. This spring, the event spanned an entire week, rather than being limited to weekends."I love everything we stand for and all the impact we have in the world in terms of innovation and engineering," Pulse Director Aswin Sivaraman said. "I think that this event and my vision for it are ways for me to give back to this department and show the world what ECE ILLINOIS is capable of doing."

LAUNCH

CELEBRATION EVENT

ECE LAUNCH will culminate in a celebration called Beyond, which is scheduled for Friday, Nov. 6, in the ECE Building on the Illinois campus. Leading ECE alumni and friends will share their thoughts on the future of electrical and computer engineering. For more information, please visit us online.

» go.ece.illinois.edu/launch

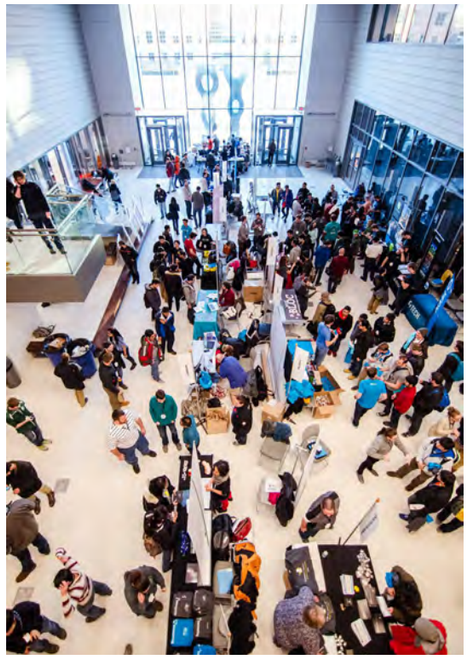
PROFESSORS INVESTED

Professor Brian T. Cunningham (BSEE '86, MS '87, PhD '90) was invested in February as the Donald Biggar Willett Professor in Engineering, in recognition of his intellectual leadership and outstanding research.

Cunningham is internationally recognized for his contributions to the advancement of photonic crystal-based biosensing. His work has allowed for the detection of cancer cells, including early-stage breast cancer, as well as the amount of HIV virus present in the human body.

Professor Weng Cho Chew was invested in December as the Fisher Distinguished Professor of Engineering.

At the ceremony, Chew's colleagues emphasized not only his dedication to excellence in teaching, but also his depth and breadth of engineering knowledge and intelligence. They praised him for his unrelenting approach to solving problems, and for the sheer intellect that he brings to conversation.



ECE'S CAFE OPENS

The ECE Building's café, the Daily Byte, opened in May. Café manager Jane Norder is pictured with senior Raj Vinjamuri, who won a student contest to name the space.

The Daily Byte features a full coffee bar and cold food items, and is decorated with photography by Jack Kilby (BSEE '47), the Nobel-prize winning inventor of the integrated circuit. Texas Instruments donated Kilby's photography to ECE ILLINOIS.

TEAM WINS SEASON, HOSTS HACKILLINOIS

The Illini Hackers, a team including ECE ILLINOIS and CS @ Illinois students, won Major League Hacking's Fall North America Season in 2014. They also hosted HackIllinois partly in the ECE Building in February.

Students from universities all over the country, from Georgia Tech to Carnegie Mellon, came to HackIllinois for three days of intense coding, designing, and building.

More than 1,200 students came to the ECE Building as a part of HackIllinois this winter.

BRATTON AND LEXTECH AWARDS

Fifteen ECE ILLINOIS seniors won the inaugural Michelle and Alex Bratton Senior Design Awards this year for their work in ECE 445, Senior Design.

Michelle and Alex Bratton Senior Design Instructor's Award
Lextech Senior Design Best Engineered Project Award
Lextech Senior Design Most Marketable Project Award

Senior Design is a capstone class that allows students to work with industry and community partners to solve problems through engineering. Students may work in teams or individually.

ECE ILLINOIS alumnus Alex Bratton (BSCompE '93) and wife Michelle established the awards this year in recognition of the class they believe best exemplifies the spirit of engineering. Bratton is CEO and chief geek of Chicago-based Lextech, an enterprise mobile development company. "For me, the Senior Design award is the perfect example of combining academic learning, understanding how things work, the core of ECE, and the real world," Bratton said. Visit us online to see a list of the Bratton Award Winners.
» go.ece.illinois.edu/brattonawards

Professor Scott Carney, Alex Bratton, Michelle Bratton, Iain Brearton (winner of the spring 2015 Bratton Senior Design Instructor's Award), Professor Michael Oelze, and Department Head William H. Sanders.

IT'S NO SECRET THAT ATTENDING OR WORKING AT **ECE ILLINOIS** CAN BE A FAMILY AFFAIR. WE WANT TO SHARE THESE STORIES ABOUT WHAT ECE HAS MEANT TO YOU: ACROSS GENERATIONS, AND AMONG SIBLINGS, EXTENDED FAMILIES, AND SPOUSES. WE MIGHT SHARE YOUR FAMILY STORIES THROUGH OUR WEBSITE, SOCIAL MEDIA, AND OTHER DEPARTMENTAL PUBLICATIONS.

GO.ECE.ILLINOIS.EDU/FAMILYSTORY

›PROFESSORS ›BAILEY ›BAYRAM ›CANGELLARIS ›CARNEY ›CHEN ›CHEW ›CHOQUETTE ›CUNNINGHAM ›DALLESASSE ›DOMINGUEZ-GARCIA ›EDEN ›HAJEK ›IYER ›JIN ›LI ›LYDING ›PILAWA-PODGURSKI ›POPESCU ›ROYCHOUDHURY ›SANDERS ›SAUER ›SCHUTT-AINE ›SMARAGDIS ›SRIKANT

FACULTY AWARDS

MICHAEL BAILEY
Associate Professor Michael Bailey won the Best Paper Award at the Association for Computing Machinery's Internet Measurement Conference for his "The Matter of Heartbleed" report.

CAN BAYRAM
Assistant Professor Can Bayram received the IEEE Electron Devices Society's Early Career Award.

ANDREAS C. CANGELLARIS
Engineering at Illinois Dean Andreas C. Cangellaris was named a 2015 honorary Knight of St. Patrick.

P. SCOTT CARNEY
Professor P. Scott Carney was named a fellow of the Optical Society of America.

DEMING CHEN
Associate Professor Deming Chen was named a Willett Scholar, which recognizes faculty members who, at a relatively early stage in their careers, are excelling in their contributions to the university.

WENG CHO CHEW
Professor Weng Cho Chew received the 2015 ACES Computational Electromagnetics Award from the Applied Computational Electromagnetics Society.

KENT CHOQUETTE
Professor Kent Choquette is serving as president of IEEE Photonics Society, 2016-2017.

BRIAN T. CUNNINGHAM
Professor Brian T. Cunningham was named director of the Micro and Nanotechnology Laboratory (MNTL) at the University of Illinois.

JOHN DALLESASSE
Associate Professor John Dallesasse was selected as a fellow of the IEEE.

ALEJANDRO DOMINGUEZ-GARCIA
Associate Professor Alejandro Dominguez-Garcia won the Dean's Award for Excellence in Research by the College of Engineering.

J. GARY EDEN
Professor J. Gary Eden was elected a fellow of the National Academy of Inventors, and was appointed to the Panel on Ballistics Science and Engineering of the Army Research Laboratory.

BRUCE HAJEK
Professor Bruce Hajek won the ACM SIGMETRICS Achievement Award.

RAVISHANKAR K. IYER
Professor Ravishankar K. Iyer won a 2015 Engineering Council Outstanding Advising Award.

JIANMING JIN
Professor Jianming Jin was named a fellow of the Applied Computational Electromagnetics Society (ACES).

XIULING LI
Associate Professor Xiuling Li was named a Willett Scholar, recognized as an IEEE Nano Technology Council Distinguished Lecturer, elected to the IEEE Photonics Society Board of Governors for 2014-16, and named deputy editor of *Applied Physics Letters*.

JOSEPH W. LYDING
Professor Joseph W. Lyding was elected a fellow of the AAAS, and won the 2014 Foresight Institute Feynman Prize.

ROBERT PILAWA-PODGURSKI
Assistant Professor Robert Pilawa-Podgurski won the Air Force Young Investigator Award from the Air Force Office of Scientific Research (AFOSR) for his research on inflight supercomputers.

GABRIEL POPESCU
Associate Professor Gabriel Popescu was named a fellow of the Optical Society of America.

ROMIT ROY CHOUDHURY
Associate Professor Romit Roy Choudhury won the 2015 ACM SIGMOBILE RockStar Award in recognition of outstanding early-career contributions and impact on the field.

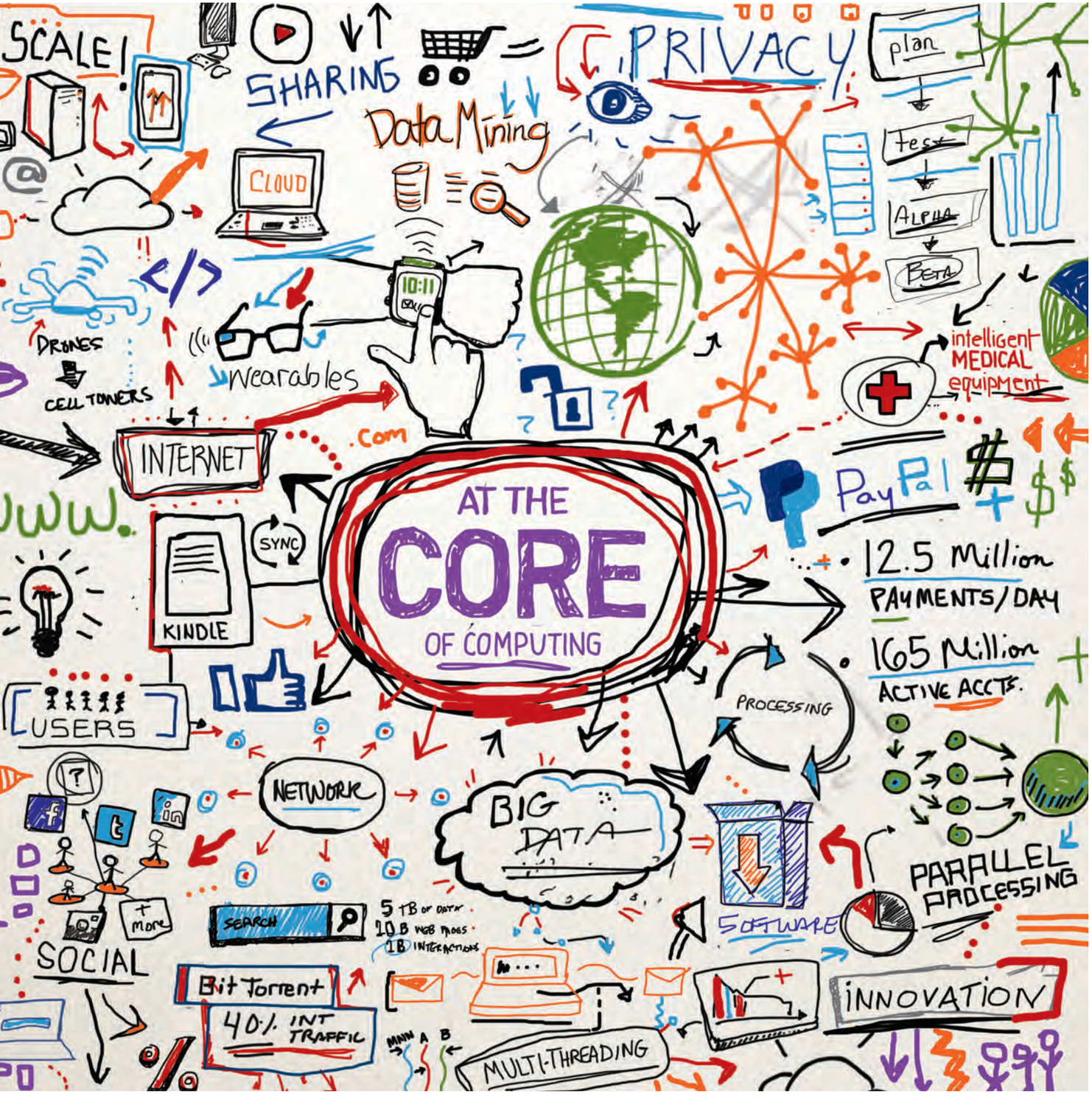
WILLIAM H. SANDERS
Department Head William H. Sanders was elected a fellow of the AAAS and appointed to the National Research Council (NRC)'s new roundtable, the Forum on Cyber Resilience.

PETER W. SAUER
Professor Peter W. Sauer received Engineering at Illinois' Tau Beta Pi Daniel C. Drucker Award, which recognizes his outstanding record of accomplishment both within and beyond the boundaries of Illinois.

JOSE E. SCHUTT-AINE
Professor Jose E. Schutt-Aine has been named a 2015 ABET Program Evaluator.

PARIS SMARAGDIS
Assistant Professor Paris Smaragdis was selected as a fellow of the IEEE.

R. SRIKANT
Professor R. Srikant won the 2015 INFOCOM Achievement Award and the 2015 INFOCOM Best Paper Award.



THE CORE OF COMPUTING:

ECE ILLINOIS IS CHANGING THE WORLD THROUGH TECHNOLOGY

BY DEB ARONSON

THE WORLD DOESN'T RUN WITHOUT COMPUTERS, FROM THE SOFTWARE POWERING TINY WEARABLES TO THE HARDWARE MAKING POSSIBLE WIRELESS NETWORKING AND COMPUTER PROCESSING. ECE ILLINOIS FACULTY AND ALUMNI ARE MAKING UNPARALLELED CONTRIBUTIONS TO THIS BRAVE NEW WORLD OF COMPUTING, THOUGH THEIR WORK SOMETIMES HUMS ALONG IN THE BACKGROUND.

"When people think of electrical engineering, they think of lightbulbs," Associate Professor Romit Roy Choudhury (MS '03, PhD '06) said. But ECE ILLINOIS' contributions are much greater, touching everything from smartphones and smart cars to the next generation of social networks, computer security, and data transmission.

Roy Choudhury compares ECE's pivotal role in computing to the work it takes to produce a movie. "Other than the hero and the heroine in the movie, you hardly know anyone else, but the director and editor make big contributions," he said. "Similarly, in many technologies, ECE plays a background role, much like the director, editor, camera man, and costume designer of a movie. These roles are incredibly important, but when it comes to popularity, people typically recognize the actors of the movies."

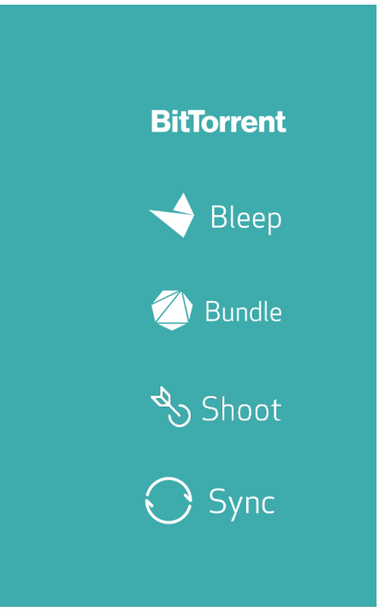
SERVING UP SMARTER SEARCHES

Ashutosh Garg (MS '00, PhD '03), co-founder and CTO of BloomReach, sees his company's search engine optimization tool as benefitting both consumers and businesses. How often have you searched for something, like red sneakers, only to be dumped into a big, generic site where you have to start your search all over again? Or, just as bad, get sent to a site that isn't quite right, like one featuring red boots?

BloomReach's technology helps users get what they want by making it easy to find what they're looking for and see relevant results. Its algorithms match an understanding of product content with web-wide demand to discern the similarities and differences between nuanced items like sneakers, shoes, boots, tennis shoes, and trainers. This ensures the right products show up for a user, regardless of platform. You might not be aware of Garg's work, but it makes your shopping experience far more efficient and enjoyable while significantly improving revenue for e-commerce sites.

BloomReach's core technology, the Web Relevance Engine, harnesses the power of Big Data, machine learning, and large-scale systems science to match relevant products to consumers at scale. Each day, it processes 5 terabytes of data, interprets 10 billion web pages, and analyzes 1 billion consumer interactions.

5 TERABYTES DATA **10 BILLION** WEB PAGES **1 BILLION** INTERACTIONS



SHARING DATA FASTER

Consider the need for sharing large amounts of data without having your computer grow cobwebs. Eric Klinker (BSEE '91), CEO of BitTorrent, is at the forefront of this field, striving to make the Internet more efficient for media by using the principle of decentralization. "Decentralization puts the end user first, is more resilient and efficient in resource utilization, and also has strong privacy properties," Klinker said.

With BitTorrent, which accounts for 40 percent of all Internet traffic, data can go directly to the other person's computer, bypassing the cloud or other centralized servers. It's faster, more private, and can handle large amounts of data. Klinker credits his ECE ILLINOIS education for his success. "My ECE background has given me both the inclination and ability to recognize the challenges we face as the Internet scales into the future," he said.

"When attacking some of the fundamental problems we face on the Internet, it helps to have a fundamental understanding of the Internet itself, including the protocols and infrastructure that collectively make up the network," Klinker added. "From basics in computing and communications, both theory and practice, ECEs around the world have helped create the foundation on which the entire Internet rests."

"WHEN ATTACKING SOME OF THE FUNDAMENTAL PROBLEMS WE FACE ON THE INTERNET, IT HELPS TO HAVE A FUNDAMENTAL UNDERSTANDING OF THE INTERNET ITSELF."
-ERIC KLINKER

PayPal

CREATING A NEW WAY TO PAY

From a young age, PayPal co-founder Luke Nosek (BSCompE '96) was a maker, always learning by doing. On the Illinois campus, he found camaraderie with other members of the Illinois chapter of the Association of Computing Machinery. Projects he worked on included an Internet-connected scrolling sign ("Twenty years ago, we were doing the Internet of Things. That's how far ahead in the future we were able to see") and helping to bring Illinois' library system online. He conducted research on massively parallel supercomputers, but found more of an affinity in programming and building Internet applications with software.

Through that progression—building things first for himself, then his classmates, then for the general public—he developed a passion for harnessing technology in useful ways.

PayPal evolved when Nosek worked with computer science alumnus Max Levchin to figure out a way cryptography could apply in a useful way to the general public. Money seemed like a great application.

As their company evolved, they looked for ways to improve its usability. "Our vision: Can everyone use PayPal? And now, everyone does," Nosek said. After selling the company and working with a group of friends and PayPal co-founders to create Founders Fund, Nosek applied those principles to venture capitalism. The Founders Fund philosophy: to invest in companies using technology to solve the world's most important problems, from sending man to Mars or curing cancer or AIDs.

12.5 M PAYMENTS PER DAY **165 M** ACTIVE ACCOUNTS

DEFINING THE FUTURE THROUGH NETWORKING AND MOBILE COMPUTING

Associate Professor Romit Roy Choudhury's research group is working on networking technologies and applications. Projects include, among other things, enabling drones to serve as flying cell towers. When people need high-quality network service or are at locations with weak signals, he said, a drone would recognize the situation, fly in, and hover at an optimal location to meet the clients' demands.

In addition, Roy Choudhury is working on various other technologies that leverage smartphone sensors to understand human activity patterns, gestures, and behaviors. Applications of such technologies are in indoor positioning systems, behavioral security, vehicular analytics, mobile health, augmented reality, and more.

MEASURING THE INTERNET

Associate Professor Michael Bailey, one of many ECE faculty members involved in security, or trustworthiness, measures computing "at scale." "At scale" means he looks at how the entire Internet behaves. That's exabytes (1,000 petabytes) of data from billions of users and devices. By analyzing the data at this level, Bailey can observe not just the properties of individual systems, but the properties of trustworthiness that emerge only at scale. By developing a better understanding of these emergent properties, Bailey hopes to inform governmental policy, predict future data breaches, and ultimately contribute to a more trustworthy Internet.

CONNECTING HARDWARE AND SOFTWARE THROUGH SYSTEMS

Alex Bratton (BSCompE '93), CEO and chief geek of two Chicago-based companies, Lextech and LexRay, knows the right app can transform a business—or save lives. He created LexRay's Mobile Operations Platform after seeing media coverage of school shootings and learning rescue workers couldn't access video on-site. "They couldn't see what was happening on the inside to prevent further loss of life," Bratton said. "That was just wrong."

The LexRay platform takes video and information systems out of fixed facilities and puts it into the hands of mobile users on the scene or en route. He's solved a different challenge in mobile computing, too: getting data from legacy back-end systems to mobile devices. "Most legacy systems did not have reliable ways to integrate with modern mobile environments," Bratton said. His mobile middleware platform pulls data from different back-ends and weaves it together. It strips unneeded data and runs business logic to proactively fetch information or add mobile-appropriate processing power. "It delivers data much more quickly and uses less bandwidth," Bratton said. "It mobile-enabled systems that would have been cumbersome to re-engineer."

Bratton is passionate about using computing to empower others. "Publishing my enterprise app strategy book, *Billion Dollar Apps*, and more recently the roll-out of the App Roadmap Workshop (approadmap.com) has allowed me to make a huge impact on businesses worldwide," he said. "I'm seeing organizations cut 50 to 90 percent from inefficient processes by applying the right apps."

UNDERSTANDING COMPUTER ARCHITECTURE

While Joel Emer's work may not be explicitly visible like the latest app, his work affects every computer user. Emer (PhD '79) has spent his career deep in the innards of computer machinery, working to make computers faster and more efficient. His techniques have established industry-wide practices and were the basis for the major textbook in the field. More recently, Emer provided a key insight: pioneering work developing simultaneous multi-threading, which uses hardware to improve the efficiency of the CPU. Many computers use this technology in their processors. In 2009, Emer received the prestigious Eckert-Mauchly Award, the highest professional recognition for contributions in computer architecture.

"There is no question that my adviser, (former Professor) Ed Davidson (PhD '68), was the one who instilled in me the importance of understanding systems quantitatively to see if a design idea was good or bad," said Emer, now a senior distinguished research scientist at NVIDIA and an MIT professor. Emer said it was not uncommon in industry in the early 1980s for engineers to promise things ("If you let me double the size of the cache I promise the machine performance will be doubled") with no data. "I worked hard to develop the methodology to allow us to evaluate things quantitatively," he said.

He was able to determine, for example, that on the VAX-11/780, the pre-eminent superminicomputer of the time, "the entire effect of the cache is approximately 10 percent, so if you make it zero, you'll only gain 10 percent." His work characterizing machine performance led to better understanding, which in turn enabled him to propose new architectural concepts that have appeared in many processors such as VAXes from Digital, Alphas from Digital/Compaq, and x86s from Intel.

CREATING THE KINDLE

Gregg Zehr (BSEE '76, MS '77) was drawn to Amazon for the opportunity to "work on something unique," he told *Verge* magazine. He's been president of Lab126, Amazon's research and development arm, since its founding in 2004. Zehr led efforts to transform the reading experience with Kindle. At first Zehr was lukewarm on the idea because he'd seen startups try and fail in this domain. But then he realized Amazon was the best player to make the digital book because of its access to vast amounts of content.

"Here was a company that said, 'We want content on a device. We have the content. We have the business relationship. We know how to sell it. We just don't know how to invent it,'" Zehr said. "Amazon had access to content. But they didn't have a device. So I thought, well, I know how to do a device, so great. Let's get going," he said.

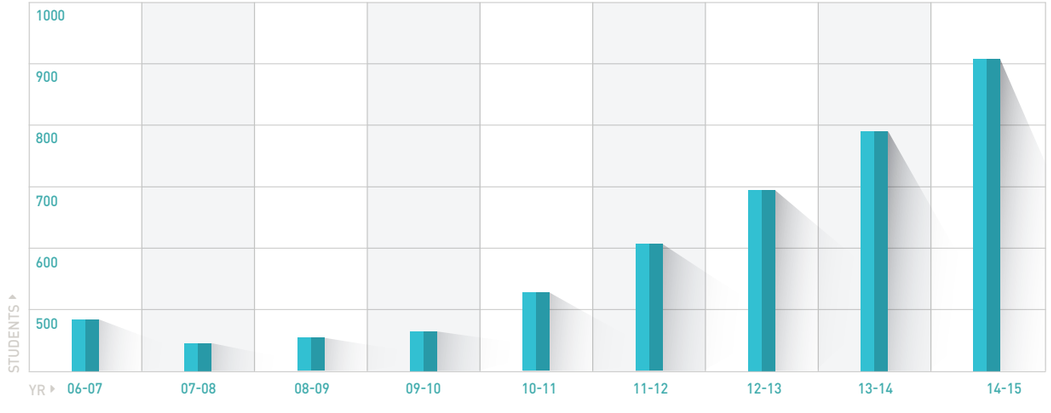
Despite technical challenges on everything from ergonomics to figuring out wireless connectivity, plus security, Kindle was a smash hit, selling out in five and a half hours the day it was released. "That's the fun of being the engineer at a company who's full of visionaries but not stuck in a box of what can be done," he said. "They're not biased by what can be done or what's hard or what's easier."

WRITING THE BOOK ON PARALLEL PROCESSING

Professor Wen-mei Hwu pioneered parallel processing education, and wrote a seminal textbook with NVIDIA Fellow David Kirk. Nearly 10 years ago, he saw parallel processing as the future of computing. Their textbook, *Programming Massively Parallel Processors*, has sold more than 16,000 copies.

"All computers have become parallel computers," Hwu said. "It's important that all our students are skilled in programming them." He credits working with what he calls "the best faculty and students" at ECE ILLINOIS in helping him succeed. "It would have been impossible to do my work without the collaboration with my colleagues," he said.

ENROLLMENT GROWTH IN ECE ILLINOIS' COMPUTER ENGINEERING PROGRAM



TOP TECH COMPANIES WORKING TO RECRUIT COMPUTER ENGINEERS

Illinois continues to develop outstanding electrical and computer engineers, and these students are highly sought by computing companies.

Andrew Gottlieb, Microsoft's Illinois recruiter, loves meeting ECE students. "We look for people passionate about problem solving, very interested in technology, and the world around them," he said. "It's not so much about the code they can write as being a good problem-solver, smart, articulate, mature, and poised. Some of the smartest engineers graduating today are coming from ECE ILLINOIS."

Their adaptive skillsets make them qualified candidates, said Tobias Marmann, Google Cambridge's tech university programs specialist. "At Google, we aspire to recruit versatile generalists who can adapt to the ever-changing environment we operate in," Marmann said. "At the University of Illinois, we find these kind of students and graduates. They are equipped with the necessary skills required to make an impact in our fast-paced industry."

FOCAL POINT

THE CUTTLEFISH

PROFESSOR STEPHEN BOPPART RAISES CUTTLEFISH AS HE RESEARCHES THE DYNAMIC OPTICAL AND MECHANICAL PROPERTIES OF THEIR SKIN.

LEARN MORE ONLINE: GO.ECE.ILLINOIS.EDU/CUTTLEFISH

ECE ILLINOIS
Department of Electrical and Computer Engineering

PHOTO BY RYAN NOLAN

KNIGHTS OF ST. PATRICK

FOUR ECE STUDENTS HONORED AS KNIGHTS OF ST. PATRICK

BY DANIEL DEXTER

ECE seniors Murtaza Haider, Bodecker DellaMaria, Siddharthan Sethupathi, and Sakshi Srivastava were selected this spring as Knights of St. Patrick in the Class of 2015. The award is one of the highest honors given to students at Engineering at Illinois.

BODECKER DELLAMARIA

As the chairman of the ECE Student Advancement Committee (ECESAC), Bodecker DellaMaria, a computer engineering major, has dedicated his time to enhancing the culture within ECE ILLINOIS. He believes the honor is an acknowledgement of the people who supported him. He added that seeing the accomplishments of ECE ILLINOIS' alumni has contributed to his growth as he pursues becoming a leader within his field.

"It's amazing to be recognized among a group of people who are so passionate about engineering. They will go on for the rest of their lives to do amazing things because of that spark that started here at Illinois," DellaMaria said. "I think all of the Knights are really thankful for the opportunities we have been given." Post-graduation, he joined a human capital management software company, where he works as a software development engineer.

MURTAZA HAIDER

Murtaza Haider, an electrical engineering major, has been at the forefront of organizing some of the largest events in the College of Engineering. Haider co-directed last year's Engineering EXPO, the largest student-run engineering career fair in the country, and helped streamline the process through the development of a mobile app that cut down on printing costs and improved student research capabilities.

Winning the Knight of St. Patrick honor was a humbling experience for Haider because it puts him the company of many incredibly successful alumni, he said. He believes ECE ILLINOIS gave him the tools to succeed. "Coming in as an international student, it was big change because you are not only adjusting to school life, you have to get used to a new country and a new environment," Haider said. "The ECE department has pushed me to my limits and given me the tools I need to succeed. This has given me the confidence to work on projects that can help others, and hopefully, I will continue doing so in the future."

Haider will spend a fifth year on campus before graduating. He's still considering his post-graduation options, but wants to choose a path that allows him to help others.

From left: Haider, honorary Knight Cangellaris, Sethupathi, Srivastava, and DellaMaria.

SIDDHARTHAN SETHUPATHI

Sid Sethupathi, an electrical engineering major, has been a leader within the College of Engineering since coming to Illinois. Serving on its executive board the past three years, Sethupathi served his senior year as president of Engineering Council. He has helped coordinate some of college's largest events, such as E-week and Engineering Open House.

He considers the Knight of St. Patrick award a recognition of not only his academics, but also the extra hours he and his fellow classmates have put in outside the classroom to help improve Engineering at Illinois and ECE ILLINOIS. "ECE has opened a lot of doors for me," Sethupathi said. "They have built a community that a lot of different colleges don't have. When I came in as a freshman, I felt that I was part of a community, and that's where I really want to give back and foster that community going forward."

Following graduation, he's working at a startup in Redwood City, Calif., that does analytics for pharmaceutical companies. He is excited about the opportunity to work at a small company that he can help build from the ground up.

SAKSHI SRIVASTAVA

For Sakshi Srivastava, an electrical engineering major, pursuing an ECE degree was not her first choice. As an incoming international student from India, she planned to major in engineering physics, but after her freshman year, she realized her true passion lies with ECE. "People ask me how much I like ECE, and I tell them that I like it so much that I switched my major, knowing I might jeopardize graduating on time," Srivastava said. "It's a wonderful feeling to be a part of an institution that not only has a great engineering program, but also helps as students develop leadership qualities."

Srivastava believes the Knight of St. Patrick award is an appreciation of the work she has put in to promote diversity within the College of Engineering, including her pursuit of a female engineer statue on campus, a project Texas Instruments is supporting.

Sakshi is enrolling this fall as a graduate student at ECE ILLINOIS and plans to study electromagnetics. She ultimately hopes to become a professor.

The tradition of the Knights of St. Patrick at the University of Illinois began in 1950. The award honors students who show leadership, excellence in character, and exceptional contributions to Engineering at Illinois and its students. Each student group affiliated with the college's Engineering Council may nominate two students. Deans and department heads may also nominate two students. Between eight and 15 students are chosen by a selection committee. Since 1950, 795 students have been named Knights of St. Patrick. Nearly 63,000 students have graduated from Engineering at Illinois during that time.

PHOTO: SCOTT CHRISTENSON, MEMORY LANE PHOTOGRAPHY

WOMEN IN ENGINEERING

ENCOURAGING MORE WOMEN TO BECOME ENGINEERS HAS BEEN A CHALLENGE FOR BOTH HIGHER EDUCATION AND INDUSTRY IN THE UNITED STATES.

ALUMNA GALE BEANBLOSSOM (MS '82) SHARES HER EXPERIENCES AS A FEMALE WHO WORKED MORE THAN 32 YEARS IN INDUSTRY, AND ENGINEERING AT ILLINOIS' SUSAN LARSON, THE DIRECTOR OF THE COLLEGE'S WOMEN IN ENGINEERING PROGRAM, SHARES SOME REASONS WHY WOMEN HAVEN'T YET OVERCOME THE GENDER DISPARITY IN ENGINEERING, AND SOME STRATEGIES FOR IMPROVEMENT WITHIN THE REALM OF EDUCATION.

GALE BEANBLOSSOM: Retired Senior Electrical Engineering Manager, Boeing

In social situations and at work, I often experienced a surprised look when responding to the "What do you do" question with, "I'm the electrical engineering manager." More than once, it was followed with, "You must be pretty smart ... for a female."

This was not just my peers either, nor in the distant past. My most recent work experience was focused on recruiting, hiring, and retention of electrical engineers, with an emphasis on recent grads. Many times, recent grads assumed I was HR, despite introducing myself or signing my emails as the electrical engineering skills manager. At career fairs, candidates would ask me to introduce them to someone in engineering. I choose not to be defined by what others think, but that's easier said than done. I believe confidence in choosing interests and careers must be instilled early, and that available organizations celebrating and promoting women in engineering are vital to allow all those qualified to choose engineering.

I'm grateful I grew up in a household where I was never told, "You can't do that because you're a girl." I don't want to be thought of as a woman engineer. I want to be thought of as an engineer qualified for the job, fully engaged and excited by assignments, and seeking professional improvement. The fact that I'm a woman should be leveraged >>

Alumna Gale Beanblossom (BS '80 Biology, MS '82) worked for more than 32 years in the aerospace industry. She served as both an electrical engineer specializing in digital/ASIC development and later, as a senior electrical engineering manager.

(for example, the diversity of my experience, problem-solving skills, and interests, to name a few) and not hold me back. This is no different than the varied background of any other engineer.

A variety of people inspired — or pushed — me: my parents, teachers, and some friendly competition. I took math classes beyond the required. This enabled me to switch gears more easily when I went from pre-med biology to the bioengineering option that had just been introduced at Illinois when I was a student.

For me, nothing is as effective for instilling a concept or scientific fact as applying it. The first time you smoke a circuit board, you certainly learn from it! You will also get an idea of what work you like and don't like. Everyone, not just women, needs to realize that asking questions is key to growing our knowledge and ultimately, our contributions. No one should be expected to know it all. In my experience, women in the engineering work environment may feel they are exposing their lack of knowledge by asking questions or seeking counsel, rather than viewing it as an opportunity to become a better engineer. We also need to ask ourselves if we are making assumptions. For example, if a special assignment is coming up, are team members chosen because of their skills, or do we assume that the women on the team with children won't be able to commit to the hours or travel? Such decisions should be made based on facts.

We, as a society, have a ways to go in terms of recognizing people for their talent, regardless of their gender or other differences. It is imperative to address the current and future technological challenges, that all qualified have an opportunity to make engineering their career choice.

"WOMEN CLEARLY DESERVE TO BE HERE, AND WE NEED THEIR TALENT."

-SUSAN LARSON

SUSAN LARSON: Director, Women in Engineering at Illinois

The question, "What do you want to be when you grow up?" is tricky for children. For many children, and arguably, especially for girls, the possibility of "an engineer" could be limited by a variety of factors.

Law and medicine have overcome large gender disparities: in 1975, about 20 percent of law school classes and 25 percent of medical school classes in 1975 were women. Four decades later, women now make up about half of the nation's enrollment in law and medical schools. Engineering has an even larger deficit to make up: women were about 2 percent of the students studying engineering in 1975. Today, less than 20 percent of engineering students are women.

At Engineering at Illinois, about 17 percent of undergraduate students are women. Given our size, this percentage still represents a good number of female students. In fact, according to data collected by the American Society of Engineering Education, Illinois is ranked fifth in the number of women (282) who received engineering bachelor's degrees from U.S. schools in 2012-2013.

Our own recent analysis showed women graduate from Engineering at Illinois at the same rates and earn statistically the same GPAs as their male counterparts. Women clearly deserve to be here, and we need their talent. Good teaching, supportive environments, and societal applications are all important ways education can address the gender disparity. High-school preparation is also an important factor.

A 2015 study by Illinois researchers Joel Malin, Asia Fuller Hamilton, and Don Hackmann showed 30.8 percent of high school girls nationwide enroll in science, technology, engineering, and math (STEM) courses that would prepare them to study engineering. However, only 15.4 percent of girls in Illinois high schools do so. (In comparison, 69.2 percent of boys take STEM-related high school classes nationwide, and 84.6 percent of Illinois boys do.)

The researchers assert that work toward gender equity in STEM preparation needs to be done by state, local, and federal policy-makers, as well as by school leaders. >>

Efforts are being made at the university level as well. Illinois has many programs to support and encourage women to choose and succeed in engineering. High school outreach programs, such as Girls' Adventures in Math, Engineering, and Science (GAMES), Worldwide Youth in Science and Engineering (WYSE), and Girls Engaged in Math and Science (GEMS) help pre-college students discover engineering.

The Office for Mathematics, Science, and Technology Education (MSTE) works with researchers, teachers, administrators, and students to enhance STEM teaching and learning. The College of Engineering's Women in Engineering program focuses efforts on recruiting and retaining female engineering students. The Center for Academic Resources in Engineering (CARE) fosters a culture of collaboration and success. Learning in Community (LINC) courses demonstrate the strong impact of engineering on society. The Women in Math, Science, and Engineering (WIMSE) living-learning community offers a supportive residential hall experience. Organizations like the Society of Women Engineers, Engineers without Borders, and Women in Electrical and Computer Engineering allow students opportunities to grow socially and professionally in the engineering disciplines.

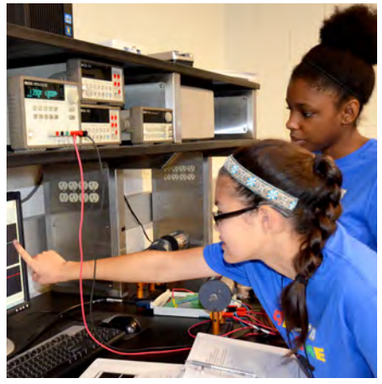
Our own students have started to speak up, as well. A student-generated code of conduct has been posted in the Association for Computing Machinery's office, and a studentled campaign will result in a new statue of a female engineering student on campus.

The under-representation of women in engineering is found not only in undergraduate programs, but also in engineering positions in industry, management, and academia. Beyond the issues of access and equity, increasing the numbers of women in engineering will benefit and strengthen the engineering field and society as a whole. It's an effort in which we all need to make a dedicated investment.

Susan Larson, an assistant dean and a faculty member in the Department of Civil and Environmental Engineering, is the director of the Women in Engineering program at Illinois. Her research focuses on the behavior of air pollutants and has been recognized with a Presidential Young Investigator Award and an Illinois Junior Xerox Award.

ECE ILLINOIS is working hard to recruit and retain women, adding four female tenure-track faculty members during 2014 and expecting more female faculty members to join soon. Last year's freshman class had our highest percentage of women yet, and we are working to continue that upward trend by offering more than $1 million in scholarships to female applicants.

CAMP ENCOURAGES YOUNG WOMEN TO LEARN MORE ABOUT ECE



GLEE CAMP » go.illinois.edu/games
WYSE CAMPS » go.uillinois.edu/WYSEcamps
GEMS CAMPS » go.illinois.edu/GEMScamp
GAMES CAMPS » go.illinois.edu/games

In one of its many efforts to create a more inclusive environment, ECE ILLINOIS hosts an annual summer camp called Girls Learning Electrical Engineering (GLEE). It's a part of Engineering at Illinois' GAMES Camp and gives high-school girls a week-long opportunity to develop their interests through interactive activities and exposure to ECE's research areas.

GLEE serves a vital purpose by introducing girls to the societal impact they can make with an ECE degree, said Associate Professor Lynford Goddard, the camp's director. "Many studies have shown that recruitment and retention in STEM during the middle- and high-school years are critical to increasing representation in college engineering degrees," Goddard said. "We want to enable the girls to form a social and mentoring network and to have fun doing engineering."

Participants enjoy hands-on experiments, like fabricating solar cells in the Fab Lab and then measuring the voltage across the junction and the generated current. Camp enrollment increased to 24 girls in 2015, and for the first time, campers had the opportunity to work directly with previous participants who are now helping with the camp as ECE ILLINOIS undergraduates. Go online to learn more about Illinois' offerings for young women.

Tori Fujinami and Department Head William H. Sanders

ECE ILLINOIS students earned more than $670,000 in departmental scholarships, fellowships, and awards during the 2014-15 school year. Read more online.
» **go.ece.illinois.edu/banquet**

DONORS MAKE A DIFFERENCE IN THE LIVES OF STUDENTS

THE SCHOLARSHIPS, FELLOWSHIPS, AND AWARDS MADE POSSIBLE BY DONORS, CORPORATE PARTNERS, AND FRIENDS ARE MAKING AN INCREDIBLE DIFFERENCE IN STUDENTS' LIVES. HERE'S HOW.

TORI FUJINAMI

ECE senior Tori Fujinami is determination personified. She will graduate a semester early, in December, with a bachelor's degree in electrical engineering. She is also a member of the University of Illinois gymnastics team. She's received support throughout her academic career through the Napier Award in Electrical and Computer Engineering, the Harriet and Robert Perry Scholarship, and the Marcia Peterman Memorial Award.

"The amount of support, financial and otherwise, I have received from this school is truly humbling," Fujinami said. "Specifically, the financial support I have received meant that I did not have to work. Without worrying about working, I have been able to go this school, focus on classes, and still do gymnastics." Fujinami found her focus by realizing that her undergraduate experience would be fleeting. "Gymnastics and classes are such short-term things, and I would much rather get the most I can out of the things that matter most," she said.

MICHAEL JO

For ECE ILLINOIS graduate student Michael Jo, recognition through departmental fellowships and awards has supported him in several different ways. He's won the Harold L. Olesen Undergraduate Teaching Award, the E.A. Reid Fellowship, and the Harriett and Robert Perry Fellowship. They have allowed him to attend ECE ILLINOIS, where his research focuses on nanotechnology.

"I have developed ideas that extend to biomedical applications. I enjoy this research, and I believe it could save lives," Jo said. "This would have been difficult without such support, because the cost of jumping into a new field is a challenge for a student." He believes receiving these awards has also helped him develop the confidence to be successful in such a rigorous program. "They remind me that I'm heading in the right direction," he said. "I feel confident that I can confront failure and use it to improve my skills."

KYLIE PETLAK

As a high school senior, Kylie Petlak accepted her admission into community college because she couldn't afford to attend Illinois. "I felt impossibly guilty—I knew that the cost was too much financially, but I still felt like I was cut out for so much more, that all of my hard work since the first grade shouldn't just fall to the wayside," Petlak said. Three days later, ECE ILLINOIS notified her that she'd received the Frank D. and Irene M. Low Scholarship, as well as the Illinois Engineering Enhanced Scholarship. "These scholarships have changed the course of my life," Petlak said, and receiving them allowed her the opportunity to study at Illinois.

YOUR INVESTMENT CAN CHANGE A LIFE. LEARN MORE ONLINE.
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FLOYD DUNN

CELEBRATING THE LIFE OF THE ULTRASOUND PIONEER

BY MEG DICKINSON

Floyd Dunn in Belgium during World War II in 1944.

Floyd Dunn, a groundbreaking pioneer in the science of ultrasound and bioacoustics, died Jan. 24, 2015. A veteran of the World War II Battle of the Ardennes, he was 90 years old. His death came 30 days after wife Elsa's. They'd been married more than 64 years.

Dunn attended ECE ILLINOIS, arriving in 1946 as an undergraduate student and earning three degrees, including his PhD in 1956.

He remained at Illinois for 50 years and retired in 1995. For more than 20 years, Dunn directed the U of I's Bioacoustics Research Laboratory (BRL), the laboratory his research adviser William J. Fry started with his brother, Frances J. Fry, in 1946.

"Dunn had an extraordinarily creative science and engineering career at the interface between diagnostic and therapeutic ultrasound," said current BRL Director and Professor William D. O'Brien Jr.

From a converted, 19th-century power plant deep within the engineering campus, Dunn mentored generations of students, some of whom preceded him into retirement. His recognized contributions afforded him decades of opportunities to teach and lead research in the U.S., the former USSR, the United Kingdom, and for more than 40 years, in Japan.

Dunn's remarkable career showcased the completeness with which he approached difficult scientific questions. Dunn's study of ultrasonic toxicity, which resulted in worldwide safety regulations, enabled ultrasounds to be used on virtually every pregnant woman's fetus, O'Brien said. "He was involved in the first major blossoming of biomedical ultrasound in the '50s," O'Brien said. "In the '60s, there were a few years when he almost single-handedly managed to keep the field alive. Now, biomedical ultrasound is a major industry. No single scientist is more responsible for this success than Floyd Dunn."

PAUL MAYES

A FACULTY MEMBER DEDICATED TO HIS RESEARCH, STUDENTS

BY JENNIFER BERNHARD

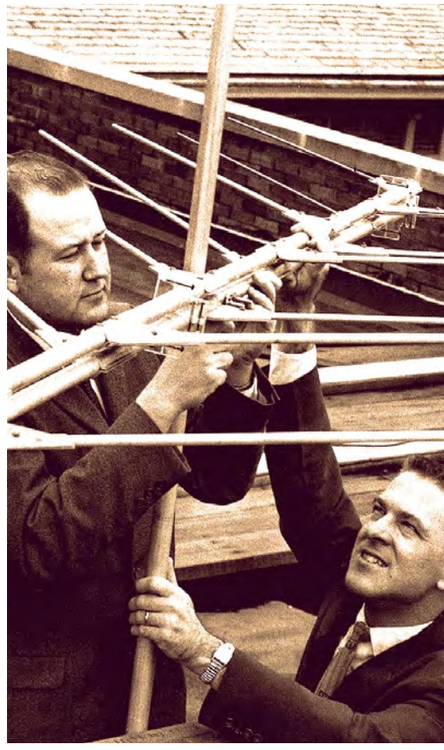
Professor Emeritus Paul E. Mayes died Friday, Dec. 12, 2014, surrounded by his family at CU Rehab and Nursing in Champaign. He was 85. Mayes was known by his colleagues and generations of students as someone who deeply understood both the theoretical electromagnetics of antennas and the practical constraints of their operation and real applications.

Born on Dec. 21, 1928, in Frederick, Okla., Mayes received his BSEE from the University of Oklahoma in Norman, Okla., in 1950, his MSEE from Northwestern University in Evanston in 1952, and his PhD from Northwestern University in 1955.

Mayes joined ECE ILLINOIS in 1954. He was a faculty member in the department, and became director of the Electromagnetics Lab in 1990 until his retirement in 1993. After four decades of research, teaching, and advising, Mayes was an acknowledged international authority on the theory and development of broadband and electrically small antennas. He authored the graduate-level textbook, *Electromagnetics for Engineers*, in 1965.

He advised more than 55 degree candidates and was awarded 13 patents. In addition, he chaired the annual Antenna Applications Symposium at Allerton Park in Monticello from 1977 until 1993. He consulted for more than 10 industrial firms and was the founder and owner of Tele-Comm Company in Champaign.

Hugh Smith (BSEE '84, MS '86, PhD '91) remembers Mayes as an adviser who gave his undivided attention to students. "(Mayes) did not lend himself to extremes, but rather calmly addressed the various agonies and occasional victories routinely encountered in research," Smith said. "He imparted an excellent understanding of the theoretical aspects of electromagnetics, yet also gave his students the practical knowledge of electromagnetics through experimentation. His teaching of both the theoretical and experimental aspects of electromagnetics has greatly benefited me throughout my career, as I use both nearly on a daily basis."



The Bioacoustics Research Laboratory celebrated his life with an event on campus Aug. 21-22, 2015. To see event photos, visit dunn.ece.illinois.edu.

Paul Mayes was known for being generous with his knowledge and his time as an educator and a mentor.

BRINGING SUPERCONDUCTORS TO THE SKY

BY ASHISH VALENTINE

Rubber shrieks against tarmac as a Boeing 747 ramps up its speed. Its wings slice through the air, forcing wind under twin blades. A slight tug on a joystick later, the aircraft's wheels gently leave the ground and retract into the frame, and hundreds of tons of metal begin gliding up into the clouds. This procedure, usually over in a matter of minutes, burns through up to 5,000 gallons of jet fuel. The airplanes of the future, as per NASA's vision, need to transition to hybrid and electric power in a future where fossil fuels are scarce and populations limit their greenhouse gas emissions.

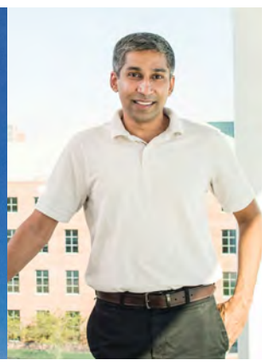
This is where Associate Professor Kiruba Haran comes in. He, with teams including co-investigators Professor Philip Krein and Assistant Professor Robert Pilawa-Podgurski, won two NASA research grants of a combined $2.8 million to pioneer the energy-efficient aircraft of the future.

“NASA is looking for truly disruptive clean technologies: think the Prius or the Tesla of the sky,” Haran said. “It isn’t going to be just one aspect of the machine that needs to be fixed. We need to look at a variety of facets, from the motor, the power electronic drive, the cooling mechanism, and the whole electromechanical system, to make significant changes in the technology’s power density.”

Haran’s first grant, $2 million from the Fixed Wing program, allows him to investigate a suite of design improvements, including cutting weight by replacing iron materials with lighter composites, integrating separate parts like the motor and the drive into combined systems, and making the aircraft more aerodynamic by distributing the motors differently.

His second grant, for $800,000 as part of NASA’s Leading Edge Aeronautics Research (LEARN) project, ties into the first by exploring another radical topic: using superconducting machines to power electric engines.

Superconducting materials are much better at carrying current than conventional materials like copper, and allow Haran to push his machines harder with far less energy. However, they create strong magnetic fields that tamper with other electromagnetics on board the aircraft, like GPS and control systems.



Kiruba Haran won two NASA grants to design clean aircraft engines of the future

To work around this effect, Haran borrowed an idea from MRIs. He calls it “active shielding”—surrounding the superconductor with electromagnetic coils. Current running through these coils generates a magnetic field that counters the one coming from the superconductor, keeping the force inside the motor instead of letting it reach out and interfere with other electromagnetic systems.

NASA’s Fixed Wing Manager Ruben Del Rosario is excited about the project ahead. “We believe Professor Haran’s proposal to push the state-of-the-art is very innovative and promising,” Del Rosario said. “We look forward to collaborating with his team on its winning research proposal to design, fabricate, and test new electric motor concepts that can deliver the power density needed for aviation applications without compromising efficiency.”

Haran’s collaborators include Mechanical Engineering Professor Andrew Alleyne, Krein and Pilawa-Podgurski in the Grainger Center for Electric Machinery and Electromechanics, the Air Force Research Laboratory, private companies like Magsoft and Automated Dynamics, and a team of graduate students at Illinois, including Haran’s student, David Loder, and Alleyne’s postdoctoral associate, Tim Deppen.

“This project could have a great impact on the environment by making airplanes cleaner,” Haran said. “As a professor, what also excites me is the opportunity to work with students, showing them how different aspects interact to make the design work.”

STORING BIG DATA IN DNA

BY DOUG PETERSON

ILLINOIS TEAM SEES DATA STORAGE IN DNA AS THE WAVE OF THE FUTURE

The envelope arrived in Heidelberg, Germany, through the normal postal service, and looked like an ordinary piece of mail. Inside, though, a speck of powder contained a treasure trove of information.

Encoded in 1 gram of powder were all of William Shakespeare's sonnets, plus an MP3 clip of Martin Luther King Jr.'s "I Have a Dream" speech, a photo of a laboratory at Cambridge University in England, and an image file of the DNA double-helix structure. The powder was synthesized DNA, on which a Cambridge research team stored 739 kilobytes of information.

Professor Olgica Milenkovic believes DNA could be the storage system of the future—a way to archive massive amounts of data. So when she read the Cambridge scientists' report in a January 2013 issue of *Nature*, she was intrigued. But she also saw ways to build on what they had done. "The coding theory could be improved, and one had to enable some storage system features missing from the Cambridge prototype," said Milenkovic, whose specialty is coding theory and applications. As a result, she began leading an Illinois effort to improve the techniques for DNA storage.

"IN MY OPINION, EVERY BIG DATA PROBLEM STARTS WITH STORAGE, AND THERE IS NO STORAGE MEDIA LIKE DNA. IT IS JUST AN INCREDIBLE MOLECULE."
-OLGICA MILENKOVIC

One advantage of storing data on DNA is unprecedented durability. Scientists recently extracted a 30,000-year-old Neanderthal genome from an ancient bone, an indication that DNA can survive for tens of thousands of years. Some call DNA storage "apocalypse-proof." In addition to durability is density."Currently, nothing else has this storage capacity," Milenkovic said. "DNA has a density you can dream of." In fact, the Cambridge team reportedly found a way to store 2 petabytes of data on 1 gram of DNA, which is like storing 100 million hours of high-definition video in a teacup.

What the Cambridge system lacked, she said, was random access capability. If you wanted to read just one sentence from Shakespeare's sonnets encoded in the DNA, you could not do it. Milenkovic collaborated with other Illinois researchers to come up with a way to randomly access data encoded in DNA, and read out and rewrite small portions of the information. The team also included Jian Ma of bioengineering, Huimin Zhao in chemistry, ECE graduate student Hussein Tabatabaei Yazdi, and postdocs Yongbo Yuan, Hanmao Kia, and Gregory Pulleo.

The Illinois project started small, Milenkovic said, because researchers wanted to prove the concept before trying it with large amounts of data, which can be expensive. In their pilot program, funded by the Strategic Research Initiative on campus and the CIA, they encoded 17 kilobytes of data in DNA and successfully designed a way to randomly access the information.

In a traditional system, such as on CDs, data are stored in "nicely organized blocks, sectors, and tracks," Milenkovic said. But that's not the case with DNA, which encodes the information in "disorganized" fragments.

"There's no natural order that tells you this comes first, this comes second," she said. "You just have molecules floating around."To bring organization to this DNA soup, the Illinois team found a way to attach addresses to the blocks of information. These combinatorially constructed addresses made it possible to amplify and access select portions of the data.

The Illinois process is more expensive than the system used by the Cambridge team, Milenkovic said, but the cost to synthesize and sequence DNA has been plummeting. In the final six months of the project, the cost to synthesize a block of data in the DNA dropped from $2,000 to $150.

The idea of molecular storage goes as far back as the 1960s with physicist Richard Feynman. But it's taken a few decades for the technology to catch up with the dreams. In the meantime, the rise of Big Data has highlighted the need for new storage ideas.

"Everybody talks about Big Data," Milenkovic said. "But where are you going to store it? In my opinion, every Big Data problem starts with storage, and there is no storage media like DNA. It is just an incredible molecule."

THE DNA DILEMNA

Using nature's greatest coding system, DNA, to store Big Data shows great promise. But as Professor Olgica Milenkovic points out, there's a catch: "A big chunk of Big Data is DNA data." You can't very well store DNA data in a system that uses DNA for storage. To store DNA, Milenkovic said, you need to efficiently compress and store it on classical digital recording media.

To enable such storage, a team headed by Milenkovic and including Professors Deming Chen and Wen-mei Hwu, as well as Bioengineering Professor Jian Ma, recently received one of 15 inaugural Big Data to Knowledge (BD2K) Program Targeted Software Awards from the National Institutes of Health (NIH). According to Milenkovic, some institutions spend enormous amounts every year to store DNA data, so the financial incentives to find ways to compress this information are strong. "If anyone told you a few years back you would be using coding theory and information theory to deal with DNA data, most people would say, 'Surely you're joking, Miss So-and-So,'" she said. "But now, people realize we need new source and channel coding techniques for genomic data."

“HE TOLD ME THAT THE EASY THINGS HAVE BEEN SOLVED ALREADY. THE HARD THINGS ARE THE ONES YOU REALLY WANT TO SOLVE.”

—ANNE WOO

BY JOHN TURNER

It’s 2 a.m., and you’re alone on a classified mission deep over enemy territory. Your mission—and your life—depends on the latest piece of military technology tucked under your wing. It’s not a gun. Or the latest bunker-busting weapon. But it might just be your ticket to making it home alive. And if you do, Anne Y. Woo (BSEE ’01, MS ’03, PhD ’08) is on the list of people you might want to thank.

Forbes Magazine calls the Next Generation Jammer “the leading edge of a revolution in information warfare that will witness the convergence of electronic countermeasures, cyber operations, and signals intelligence in an integrated suite of technologies aimed at mastering the electromagnetic spectrum.”

More concisely, it’s an $8 billion project that will one day shield America’s most advanced planes from enemy radar. But for Woo, it’s just the latest in a long list of exciting projects she’s been involved with during her time at Raytheon. From a $2 billion Patriot Missile System upgrade for the United Arab Emirates to the Australian Navy’s Hobart Class destroyer, Woo has worked on a wide range of missions since completing her PhD at the ECE ILLINOIS in 2008. It was a tough program, but one she eagerly pursued, thanks in part to the advice she received from Andreas Cangellaris, Dean of Engineering at Illinois and her PhD adviser.

“He told me, ‘The easy things have been solved already. The hard things are the ones you really want to solve,’” Woo said. Since then, she’s pitched in wherever her expertise is needed at one of the world’s leading defense contractors.

From airborne radars to multi-spectrum jammers, she’s worked on a number of classified projects, most recently serving as a chief engineer and lead system engineer for the unmanned aerial vehicle on the Global Hawk program.

“I don’t think there are any two years at my job where I have felt that I was doing the same thing,” said Woo, with a smile in her voice that reflects a deep satisfaction with her work. Of course along with major job changes, there were major moves, from Massachusetts, to California, to the other side of the world.

“I’ve moved back and forth from the coast at least four times. It’s a crazy life, but it’s been wonderful.” Her drive and focus have served her well over the years. In college, she graduated with the highest honors, with no coffee and no all-nighters, prompting her friends to jokingly accuse her of being a Cylon.

Originally, she had been uncertain about pursuing a degree in electrical engineering. Fortunately, however, she followed the encouragement of her sister, Christine (BSEE ’00, MS ’01), who was then a student at ECE ILLINOIS and now a product manager for Lam Research in California.

Her sister’s passion quickly became her own, and Woo flourished, garnering internships from Bell Labs and Sun Microsystems. In graduate school, Intel funded her master’s while Qualcomm funded her PhD, leading to three summers in San Diego developing a methodology that the company used in future chip designs.

These days she’s on the other side of the table, overseeing many of Raytheon’s collaborative research projects with universities, including the University of Illinois. It’s her role as campus manager, however, that keeps her connected with the latest graduates coming from ECE ILLINOIS. “I go to MIT, Harvard and UCLA as well,” Woo said. “But I have to say that the brightest and the best are really from the University of Illinois, and I know it sounds like I’m tooting my alma mater’s horn, but it’s honest.”

PHD GRADUATES

AUGUST 2014

STUDENT	THESIS	ADVISER	COMPANY & TITLE
ZUOFU CHENG	Design of a Real-Time GPU Accelerated Acoustic Simulation Engine for Interactive Applications	Lippold Haken	Lecturer : ECE ILLINOIS
BRIAN DELLABETTA	Quantum Transport Theory of 3-D Time-reversal Invariant Topological Insulators	Matthew Gilbert	Chief Data Scientist : Learnmetrics
SCOTT DENENBERG	Magnetoquasistatic Sensors for Rapid Imaging of Steel Pipeline Properties	Andreas Cangellaris	Assistant Coach for Illinois Men's Tennis
YUELIN DU	Optimization for Advanced Lithography	Martin Wong	Software Engineer : Google
XUN GONG	Timing Channels in Traffic Analysis	Negar Kiyavash	Software Engineer : Google
HUAN HU	Nano-Electro-Mechanical Systems Fabricated by Tip-Based Nanofabrication	William King	Postdoctoral Research Scientist : IBM T. J. Watson Research Center
KATHERINE KIM	Hot Spot Detection and Protection Methods for Photovoltaic Systems	Philip Krein	Assistant Professor of ECE : Ulsan National Institute of Science and Technology (South Korea)
SOOBAE KIM	Power System Analysis Criteria-Based Computational Efficiency Enhancement for Power Flow and Transient Stability	Thomas Overbye	Senior Manager : Korea Electric Power Corporation
HA NGUYEN	Signal Representations: From Images to Irregular-Domain Signals	Minh Do	Postdoctoral Researcher : Swiss Federal Institute of Technology in Lausanne (EFPL)
LOGAN NIEHAUS	Robots as Language Users: A Computational Model for Pragmatic Word Learning	Stephen Levinson	
SEVINC OKTEM	Computational Imaging and Inverse Techniques for High-Resolution and Instantaneous Spectral Imaging	Farzad Kamalabadi	Assistant Professor : Middle East Technical Universtiy
CHRISTOPHER QUINN	Identification and Approximation of the Structure of Networks of Stochastic Processes	Negar Kiyavash	Assistant Professor, Industrial Engineering : Purdue University
ZHIDA XU	Black Silicon and its Applications in Photovoltaics and Biosensing	Gang Logan Liu	Lead Guest Editor : Journal of Nanomaterial; Postdoctoral Researcher : University of Illinois
HAN UL YOON	Assistive HRI Interface w/Perceptual Feedback Control: An Approach to Customizing Assistance Based on User Dexterity	Seth Hutchinson	Postdoctoral Research Scientist : Texas A&M University

DECEMBER 2014

STUDENT	THESIS	ADVISER	COMPANY & TITLE
ADITYA AGRAWAL	Refresh Reduction in Dynamic Memories	Josep Torrellas	Research Scientist : NVIDIA Research.
ADEEL AHMAD	Magnetomotive Dynamics of Magnetic Particles for Optical Imaging Contrast and Elastography	Stephen Boppart	Systems Engineer : Texas Instruments
DIMITRA APOSTOLOPOULOU	Enhanced Automatic Generation Control with Uncertainty	Peter Sauer	Postdoctoral Research Associate : University of Illinois at Urbana-Champaign
ROHAN BAMBERY	Development of Transistor Lasers for High-Speed Short-Haul Communication Links	Milton Feng	Process Integration Engineer : Intel Corporation
TAPOSH BANERJEE	Data-Efficient Quickest Change Detection	Venugopal Veeravalli	
ENRIQUE CARRION	Towards High Performance Graphene Nanoelectronics: Materials, Contacts and Interfaces	Eric Pop	Researcher : Stanford Pop Lab
YU CHEN	Measurement-Based Tools for Power System Monitoring and Operations	A.Dominguez-Garcia	Assistant Professor, Department of Electrical and Computer Engineering : University of British Columbia
HSIEN TING CHENG	Unsupervised Video Segmentation and its Application to Activity Recognition	Narendra Ahuja	Data Scientist : Baidu, Inc.
XINQI CHU	Layout-Aware Mixture Models for Patch-Based Image Representation and Analysis	Thomas Huang	Scientist : Institute for Infocomm Research
TIMOTHY DULY	Observations + Numerical Simulations of Electrified, Medium-Scale Traveling Ionospheric Disturbances in the Nighttime, Mid-Latitude Ionosphere	Jonathan Makela	Research Engineer : Atmospheric & Space Technology Research Associates (ASTRA)
CHRISTOPHER EDWARDS	Diffraction Phase Microscopy for Applications in Materials Science	Lynford Goddard	Research Scientist and Image Analysis Engineer at Intel
AIGUO HAN	Ultrasonic Characterization of Cell Pellet Biophantoms and Tumors Using Quantitative Ultrasound Models	William O'Brien	Visiting Scholar : the University of Illinois at Urbana-Champaign
THOMAS HOULAHAN	Pulsed Plasma Microjets: A New Tool for The Investigation of Plasma Kinetics and Molecular Spectroscopy	J. Gary Eden	XXX at Starfire Industries
SHARNALI ISLAM	Substrate-Dependent High-Field Transport and Self-Heating in Graphene Transistors	Eric Pop	Device Engineer : Intel Corporation
ERIC IVERSON	Wideband Direct Conversion IQ Modulators in Indium Phosphide DHBT Technology	Milton Feng	Visiting Scholar : University of Illinois at Urbana-Champaign
JEREMY KEMMERER	Modeling of Weak Scatterers in a Transducer Beam	Michael Oelze	Application Support Engineer : The MathWorks
ALI KHANAFER	Information Spread in Networks: Games, Optimal Control, and Stabilization	Tamer Başar	Data Scientist : Sysomos
ERIC KIM	Statistical Error Compensation for Robust Digital Signal Processing and Machine Learning	Naresh Shanbhag	
NOORI KIM	Analysis and Measurement of Anti-Reciprocal Systems	Jont Allen	Research Fellow : Nanyang Technological University (Singapore)
KAI-HSIANG LIN	Saliency in Audio and Visual Signals	Thomas Huang	Engineer : Industrial Technology Research Institute
SIVA THEJA MAGULURI	Optimal Resource Allocation Algorithms for Cloud Computing	R. Srikant	Research Staff Member, IBM T. J. Watson Research Center (Mathematical Sciences & Analytics Department)

STUDENT	THESIS	ADVISER	COMPANY & TITLE
SAIPRASAD RAVISHANKAR	Adaptive Sparse Representations and Their Applications	Yoram Bresler	Computational Modeling Engineering : SanDisk [two job titles on LinkedIn; ask advisor]
CHAITANYA SATHE	Computational Study of Graphene Nanopore Sensor for DNA Sensing	Jean-Pierre Leburton	RET Design Engineer : Intel Corporation
ANDREY SEROV	Electrical and Thermal Transport in 2-D Materials: Role of Environment and Imperfections	Eric Pop	Senior Engineer : SanDisk
NATHAN SHEMONSKI	In Vivo Human Computed Optical Interferometric Tomography	Stephen Boppart	Senior Scientist : Carl Zeiss Meditec AG
YAFANG TAN	Highly Sensitive Biosensors Using Photonic Crystal Enhanced Fluorescence	Brian Cunningham	Member of Technical Staff : Lam Research
ZHAOWEN WANG	Learning Sparse Representation for Image Signals	Thomas Huang	Research Scientist, Imagination Lab : Adobe Research
RUI WU	Learning Network Structure from Node Behavior	R. Srikant	Intern : Qualcomm
HUIMING XU	High-speed Type-II GaAsSb/InP DHBTs for Mixed-signal IC Applications	Milton Feng	Senior Device Technology Engineer : Spansion
JIAMING XU	Statistical Inference in Networks: Fundamental Limits and Efficient Algorithms	Bruce Hajek	Postdoctoral Researcher : Wharton School of Statistics, University of Pennsylvania
MINGFENG XUE	Unified Conformal/Nonconformal Domain Decomposition Methods for Solving Large-Scale Multi-Region Electromagnetic Problems	Jianming Jin	Engineer : Apple
BO ZHAO	Fast MRI with Sparse Sampling: Models, Algorithms, and Applications	Zhi-Pei Liang	Postdoctoral Fellow, Biomedical Imaging : Harvard Medical School
RENJIE ZHOU	Interferometric Light Microscopy for Wafer Defect Inspection and Three-Dimensional Object Reconstruction	Lynford Goddard	Postdoctoral Research Associate : Massachusettes Institute of Technology (MIT)

MAY 2015

STUDENT	THESIS	ADVISER	COMPANY & TITLE
NAVID AGHASADEGHI	Inverse Optimal Control for Differentially Flat Systems with Application to Lower-Limb Prosthetic Devices	Timothy Bretl	Senior Robotics Engineer : Rethink Robotics
KEVIN BASSETT	Selective Area Epitaxy of III-V Nanowires: Toward Nanowire-On-Silicon Tandem Solar Cells	Xiuling Li	Staff Scientist : CU Aerospace
ANDREW BEAN	Message Passing Algorithms - Methods and Applications	Andrew Singer	Senior Electrical Engineer : OceanComm, Incorporated
RAJESH BHANA	Methods to Ensure the Adequate Primary Frequency Response of Low Inertia Power Systems	Thomas Overbye	
SUJEETH BHARADWAJ	A Theory of (Almost) Zero Resource Speech Recognition	M. Hasegawa-Johnson	Visiting Researcher : Google
YEMAYA BORDAIN	Electrostatic Force Balance Microscopy	Gang Logan Liu	Internet of Things Engineer (Engineering Leadership Program) : Intel Corporation
HUY BUI	Image Restoration from Noisy and Limited Measurements with Applications in 3-D Imaging	Minh Do	Researcher : VanGogh Imaging
ANTHONY CHRISTODOULOU	A Subspace Approach to Accelerated Cardiovascular Magnetic Resonance Imaging	Zhi-Pei Liang	Post Doctoral Research Associate, Beckman Institute : University of Illinois at Urbana-Champaign
YANNICK DEGEILH	Stochastic Simulation of Power Systems with Integrated Renewable and Utility-Scale Storage Resources	George Gross	Consultant : Energy Exemplar
JAE WON DO	Selective Metallization and Electronic Self-Healing for High Performance Carbon-Based Nanoelectronics	Joseph Lyding	
ALEXANDER DUDA	Towards a Neocortically-Inspired ab initio Cellular Model of Associative Memory	Stephen Levinson	FTL Systems Engineer : Northrop Grumman
UMER HASSAN	A Microfluidic Biosensor to Electrically Enumerate Blood Cells at Point-Of-Care for Infectious Disease Diagnosis and Mgmt.	Rashid Bashir	Postdoctoral Research Associate, Micro and Nanotechnology Lab : University of Illinois at Urbana-Champaign
PO-SEN HUANG	Shallow and Deep Learning for Audio and Natural Language Processing	M. Hasegawa-Johnson	Research Scientist and Engineer : Clarifai
CHONG JIANG	Online Advertisements and Multi-armed Bandits	R. Srikant	Software Engineer : Google
MATTHEW JOHNSON	Fast, Accurate Power Measurement and Optimization for Microprocessor Platforms	Sanjay Patel	
AARON KING	Characteristic Mode Theory for Closely Spaced Dipole Arrays	Jennifer Bernhard	"Due to the nature of my work, I would prefer not to publish information about my employer and title"
JUSTIN KOEPKE	Atomic-Scale Assessment of Graphene-Substrate Interactions, Grain Boundaries, and Materials for Heterostructures	Joseph Lyding	
AVINASH KUMAR	Generic Camera Calibration for Omnifocus Imaging, Depth Estimation and a Train Monitoring System	Narendra Ahuja	Seeking full-time position
FAN LAM	A Subspace Approach to High-Resolution Magnetic Resonance Spectroscopic Imaging	Zhi-Pei Liang	Postdoctoral Fellow, Beckman Institute : University of Illinois at Urbana-Chamapign
JUI-NUNG LIU	Integrated Narrowband Guided Mode Resonance Photonic Filters for Advanced Mid-Infrared Microspectroscopy	Brian Cunningham	Postdoctoral Research Associate, Micro and Nanotechnology Lab : University of Illinois at Urbana-Chamapign
MATTHEW MAGILL	An Investigation of Electronic Pole Changing in High Inverter Count Induction Machines	Philip Krein	Senior R&D Electronics Engineer : Sandia National Labs
TOMASZ OLEWICZ	Coexistence of Surface Diffusion Mechanisms: Jump and Exchange for W on W(100)	Joseph Lyding	Product Engineer : Lam Research
PENGFEI QIAO	Surface-Emitting Lasers for Communications: Novel Metal-Cavity Microlasers and High-Contrast-Grating Tunable VCSELs	Weng Chew; Chuang	Postdoctoral Researcher : UC Berkeley
BRETT ROBBINS	Architectures and Algorithms for Voltage Control in Power Distribution Systems	Dominguez-Garcia	Senior Lead Engineer : PC Krause and Associates
ABHISHEK SINGH	Learning to Super-Resolve Images Using Self-Similarities	Narendra Ahuja	Research Scientist : Amazon Lab126
ANDRE LUIZ TARGINO DA COSTA	Far Touch: Integrating Visual and Haptic Perceptual Processing on Wearables	Minh Do	Researcher : ImmersiveTouch
PEI-CI WU	New Methods for Electronic Design Automation Problems	Martin Wong	
HONGHAI YU	Learning Compact Hashing Codes for Large-Scale Similarity Search	Pierre Moulin	Researcher : A*Star (Singapore)

Nadir Ahmad (BSCompE '01, BA economics '01) is founder and CEO of Dowling Street, a consultancy that combines classic management consulting with political strategy for business. Nadir also holds an MBA from the Kellogg School of Management at Northwestern University and a master's degree in public administration from the Harvard Kennedy School. Nadir is originally from Nebraska and now lives in Manhattan. He still believes that the best college basketball teams are from the Midwest.

NADIR AHMAD

WHAT MAKES YOU FEEL ENERGIZED?
I'm energized by helping people gain new perspectives that unlock strategies for problems. Seeing the optimism that comes with new options is powerful.

FAVORITE MEMORY FROM YOUR TIME ON CAMPUS?
My favorite memory from campus was building a model magnetic levitation (mag-lev) train in Ricardo Uribe's laboratory (ADSL). He pushed us to explore projects with endless curiosity and imagination. It was a playground to experiment with things that seemed outlandish or unconventional.

WHAT'S THE BEST ADVICE YOU'VE EVER HEARD?
Always assume positive intent in others. It's simple but it dramatically changes your outlook and allows you to be more fully present when an issue presents itself.

WHAT ASPECT OF YOUR CAREER ARE YOU MOST PROUD OF?
I'm most proud of starting Dowling Street, which merges my three passions: analytical thinking, management, and political strategy.

IN WHAT CIRCUMSTANCES ARE YOU MOST PRODUCTIVE?
I'm most productive as soon as I recognize the problem in front me is not the same as something I've seen before. As soon as that happens, I get into a zone of innovation and creativity. That's when the fun begins.

HOW DO YOU DEAL WITH AN OBSTACLE?
I approach these difficult situations with a healthy dose of curiosity and compassion. I believe the obstacle is often just the tip of a larger iceberg. I routinely ask the question, "What is really going on here?"

HOW DID YOUR TIME AT ILLINOIS AFFECT YOUR CAREER?
My time at Illinois shaped how I break down problems, understand information, and pay attention to details. I'm sure that most engineers could say the same, and I've found these same skills translate into non-engineering roles.

HOW WOULD YOU SPEND 30 MINUTES OF FREE TIME?
I'd call my parents. My travel schedule is really hectic and they do an impressive job of remembering where I am. Given a free moment, I check in with them.

WHAT TECHNICAL ADVANCEMENT COULD YOU NOT LIVE WITHOUT?
My smartphone (and the networks that make it possible). My life runs on that piece of technology.

WHAT TALENT DO YOU HAVE THAT SURPRISES PEOPLE?
I can recite lyrics for one-hit wonders that were released in the 1990s. Think Vanilla Ice, Sir Mix-a-Lot, and Skee-Lo.

TEN ANSWERS PROFILES AN ALUM EACH ISSUE, ASKING THE IMPORTANT QUESTIONS. DO YOU HAVE ANSWERS? EMAIL US AND WE MAY FEATURE YOU IN A FUTURE ISSUE. TO READ MORE ABOUT ALUMS, VISIT OUR WEBSITE.

» go.ece.illinois.edu/alumnews

COLLEGE OF MEDICINE APPROVED
The University of Illinois Board of Trustees voted March 12 to establish the Carle Illinois College of Medicine on the Urbana-Champaign campus. The college is a partnership between Illinois and Carle Health System. It will leverage Illinois' strong faculty in biomedical technologies, especially in ECE, to train a new generation of doctors working at the intersection of engineering and medicine.

EBERT CENTER IN PROGRESS
A new film and critical studies program at Illinois, the Ebert Center, is halfway to its $5 million fundraising goal. The project is named after the late Chicago Sun-Times film critic, longtime TV co-host of "At the Movies," and Illinois alumnus Roger Ebert. Ebert and his wife Chaz donated the first $1 million toward the program in 2009, and Chaz said its goal was "to realize Roger's dream for a crossroads of film studies, production, and ethics."

CROP YIELDS WILL NEED A BOOST
Researchers from Illinois and the CAS-MPG Partner Institute of Computational Biology in Shanghai argue in the journal *Cell* that plants' photosynthetic efficiency must be boosted to increase crop yields enough to feed a skyrocketing world population. The report proposes several methods using high-performance computing and genetic engineering to model photosynthesis and overcome bottlenecks in the process. Any solution scientists find will take years of scientific and political wrangling to implement, and co-writer Stephen Long said "We have to be doing today what we may need in 30 years" in order to effectively meet future demand.

PROGRAM ENCOURAGES DIVERSE PHD STUDENTS
The Alfred P. Sloan Foundation's expanded Minority PhD Program awarded Illinois a $3 million grant to establish a campuswide center supporting under-represented minority doctoral students in STEM fields. The center's goal will be to double the number of applications, offers, and enrollments of under-represented STEM students. Illinois will supplement the grant with its own funds to provide selected students tuition, a stipend, and professional development over the next three years.

$12 MILLION GIFT WILL CREATE LEARNING CENTER
The Department of Mechanical Science and Engineering recently announced a $12 million commitment from its alumnus, Sidney Lu, to build the Sidney Lu Center for Learning and Innovation. Construction of the Lu Center will coincide with the renovation of the entire Mechanical Engineering Building, which is expected to start in early 2017. The five-story, 36,000 square-foot addition will feature an open-architecture innovation and design commons. Lu serves as the first chairman and CEO of Foxconn Interconnect Technology which provides joint-design, joint-development, manufacturing, assembly, and after-sales services to computer, communication, and consumer electronics companies.

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University of Illinois at Urbana-Champaign
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IT TAKES ONE TO GROW ONE.

For every visionary who pushed the boundaries or charted an unknown course, there was another who saw his or her value and invested in that dream. As a recipient of the Engineering Visionary Scholarship, ECE student Michael Goldstein knows something about that.

In his time so far at ECE ILLINOIS, he's applied his skills to proprietary software used by a large investment company and partnered with other students to make an app that connects students with life-saving care in an emergency.

What will your gift inspire? Give today. And help us nurture the countless passionate visionaries who are making today's ideas tomorrow's innovations.

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TO LEARN MORE, VISIT OUR WEBSITE.
AND MAKE THE INVESTMENT THAT MAKES
A DIFFERENCE TODAY.

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