

# INVENTING

WINTER 2016

# TOMORROW

A MAGAZINE FOR ALUMNI AND FRIENDS OF THE COLLEGE OF SCIENCE AND ENGINEERING

## RECIPE FOR SUCCESS

A CSE education pays off for alumni across the country >>



### ALSO INSIDE:

Students go global with new opportunities >>

Researchers are making headway on traffic safety >>

## Leadership changes coming in 2016

**A**s I wind down my time as dean over the next few months, it is a good time to look back at our past successes and look forward to new challenges.

Last July, I informed our faculty and staff that I will step down as dean of the College of Science and Engineering at the end of August 2016. By then, I will have been dean for nearly 12 years making me the second longest-serving dean in the 80-year history of the college.

During my time as dean, I have had the good fortune of working with an outstanding group of associate deans and department heads, as well as a capable and dedicated staff.

Together we have been able to accomplish many good things:

- ▶ We have completed \$230 million in building projects across the college. In 2017, when renovations are complete for Mechanical Engineering and the Tate Science and Teaching Building, the number will be \$375 million.
- ▶ Thanks to the generosity of our alumni and friends, we have raised more than \$250 million to support faculty and staff, students, facilities, and academic programs.
- ▶ In 2005, we had about 2,500 applications for the freshman class and the average composite ACT score for the 800 students who enrolled was 28 (out of 36). For 2015, we had more than 13,000 applications for a freshman class of 1,076, and the average ACT score was 31.5, the highest at the University.
- ▶ Finally, we have expanded the number of faculty members from 400 in 2005 to 433 this year, the highest ever. Included in this group are eight Regents Professors, 12 members of the National Academy of Engineering, and four members of the National Academy of Sciences.




I think you will agree with me when I say that this is a solid foundation on which to build in 2016 and beyond.

I have enjoyed my time as dean, but all organizations can benefit from a change of leadership, and, despite past successes, I think the time is right for a change this year in the College of Science and Engineering.

I thank you for your support over the years. I am proud to have served as leader for what I believe is the best college at one of the best universities in the country.


### Join us on social media


 Facebook:  
[facebook.com/umn.cse](https://www.facebook.com/umn.cse)

 Flickr:  
[cse.umn.edu/flickr](https://www.flickr.com/photos/cse.umn.edu/)

 Twitter:  
[@UMNCSE](https://twitter.com/UMNCSE)

 LinkedIn:  
[cse.umn.edu/linkedin](https://www.linkedin.com/company/cse.umn.edu/)

 YouTube:  
[youtube.com/umn.cse](https://www.youtube.com/umn.cse)

 Google+:  
[cse.umn.edu/google+](https://plus.google.com/cse.umn.edu/)

### We're online!

The College of Science and Engineering's *Inventing Tomorrow* publication is available electronically.

To view an interactive online version of the current *Inventing Tomorrow* or to see past issues, visit our archives at: [cse.umn.edu/inventingtomorrow](http://cse.umn.edu/inventingtomorrow).



## INVENTING TOMORROW

Winter 2016 • Vol. 41, No. 1

### ADMINISTRATION

Dean  
Steven L. Crouch

Associate Dean, Research and Planning  
Mostafa Kaveh

Associate Dean, Undergraduate Programs  
Paul Strykowski

Associate Dean, Academic Affairs  
Christopher Cramer

### EDITORIAL STAFF

Communications Director  
Rhonda Zurn

Managing Editor  
Silva Young

Contributors  
Richard G. Anderson  
Greg Breining  
Eve Daniels  
Kermit Pattison

Design  
Sysouk Khambounmy

Printing  
University Printing Services

© 2016 Regents of the University of Minnesota. All rights reserved.

*Inventing Tomorrow* is published by the College of Science and Engineering communications team twice a year for alumni and friends of the college. The publication is available in alternative formats for those visually impaired by calling 612-624-8257.

Email  
csemagazine@umn.edu

U.S. Mail  
*Inventing Tomorrow*  
College of Science and Engineering  
105 Walter Library  
117 Pleasant Street SE  
Minneapolis, MN 55455

Phone: 612-624-8257  
Fax: 612-624-2841  
Web: cse.umn.edu

ADDRESS CHANGE?  
Send us your new address to keep receiving *Inventing Tomorrow*.

♻️ Printed on recycled paper

On the cover: Leon Binitie-Cassidy  
Photo by: Cody Duty

## TECH DIGEST / 4

### FEATURES

**Recipe for Success / 6**  
*CSE graduates find technical skills and education pay off.*

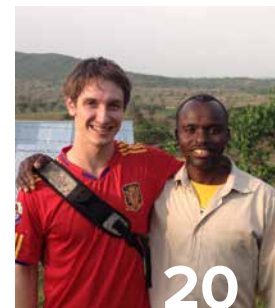
**Ruling the Road / 14**  
*CSE researchers are making commutes safer, vehicles smarter, and destinations accessible.*

**Global Exposure / 20**  
*Students are gaining global experiences through new programs and opportunities.*

## GIVING MATTERS / 28

## ALUMNI NEWS / 32

## RETROSPECT / 34



# WEB EXTRAS

To see these videos and more featuring College of Science and Engineering faculty, students, and alumni, visit our page on YouTube at [youtube.com/umnscse](https://www.youtube.com/umnscse).



**Why I love Neutrinos**  
Marvin Marshak, professor of physics, spotlights mysterious, ghostly particles known as neutrinos.



**Eolos Wind Energy Research Center**  
See from the top of the 130-meter-tall wind turbine at the University's Eolos Wind Energy Research Center.



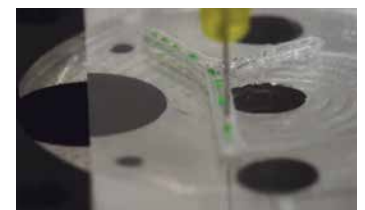
**Day in the Life**  
See all of the action in one day on the University of Minnesota campus in just over one minute.



**Vision-based control for UAV**  
University researchers have developed an autonomous quadrotor that uses vision to navigate by itself.



**To the Stars We will Go**  
Chick Woodward, professor of physics, highlights NASA missions, planet habitability zones, and more.



**3D printing of a nerve regeneration**  
Michael McAlpine, mechanical engineering professor, creates a nerve regeneration guide with 3D printing.

# TECH DIGEST

## U geospatial center to create elevation maps of Arctic

The University's Polar Geospatial Center researchers, with support from the National Science Foundation, are leading a project to create the first publicly available, satellite-based elevation maps of Alaska and the Arctic. The project, called Arctic DEM, is part of a national initiative recently announced by President Barack Obama. Researchers will be able to use the maps to learn how warming in the region is affecting the rural landscape. To learn more, visit [z.umn.edu/mappingarctic](http://z.umn.edu/mappingarctic)

## New hope for those with nerve injuries or disease

More than 200,000 people annually with paraplegia, quadriplegia, and other forms of paralysis could potentially benefit from a first-of-its-kind, 3D-printed guide specifically designed to help regrow the sensory and motor functions of complex nerves after injury. The groundbreaking research, led by Michael McAlpine, a mechanical engineering professor, was published recently in *Advanced Functional Materials*. To learn more: [z.umn.edu/regrownerves](http://z.umn.edu/regrownerves)



## Supercomputer fuels research to limit carbon emissions

University chemistry researchers are running modeling software to develop more efficient and cost-effective ways to capture carbon dioxide emissions before they reach the atmosphere with Mesabi, the University of Minnesota's fastest supercomputer. At a speed 3,864 times faster than a typical personal computer and with 8,700 times the memory, scientists like Laura Gagliardi, professor of chemistry, are conducting compute-intensive research using complex computer modeling programs. To learn more, visit [z.umn.edu/supercomputer](http://z.umn.edu/supercomputer)

## Physicists release first results from neutrino experiment at NOvA lab

Scientists on the NOvA experiment saw their first evidence of oscillating neutrinos, confirming the extraordinary detector built in northern Minnesota for the project not only functions as planned but also is making great progress toward its goal of understanding the cosmos, including antimatter, dark matter and the Higgs boson. For more information, visit: [z.umn.edu/novaexperiment](http://z.umn.edu/novaexperiment)

## Cougars likely to repopulate American Midwest in next 25 years

A new study by University researchers shows a strong likelihood that the United States mid-section will become home to healthy populations of cougars within the next 25 years.

To learn more: [z.umn.edu/cougarpopulation](http://z.umn.edu/cougarpopulation)





## Cleaner air could save millions of lives

A recent study says improving air quality could potentially reduce millions of pollution-related deaths each year. The results come from a team of environmental engineering and public health researchers, including Julian Marshall, associate professor of civil, environmental, and geo- engineering, who developed a global model of changes in air pollution, which could mean changes in heart attack, stroke, and lung cancer rates. Meeting the World Health Organization's particulate air quality guidelines could potentially prevent 2.1 million deaths each year. To learn more: [z.umn.edu/airpollution](http://z.umn.edu/airpollution)

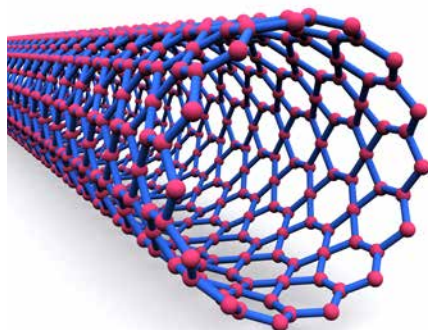


## Telltale traits of bacteria offer clues for improved colorectal cancer treatment, prevention

Dan Knights, assistant professor of computer science and engineering, is among University researchers who have uncovered a telltale link between colorectal cancer and specific traits of bacteria found in the digestive tract. The findings could improve colorectal cancer treatment and prevention. For more information: [z.umn.edu/colorectalcancer](http://z.umn.edu/colorectalcancer)

## Researchers land \$20 million grant to study environmental impact of nanotechnology

University researchers are part of a team of researchers from the Center for Sustainable Nanotechnology (CSN) who recently received a \$20 million grant to study the effects of nanotechnology on the environment. While there are hundreds of products that use nanomaterials in various ways, there is still much to be learned about how nanoparticles affect the environment and the organisms—from bacteria to plants, animals, and people—that are exposed to them. To learn more: [z.umn.edu/nanoenvironment](http://z.umn.edu/nanoenvironment)



## UAV flight system, designed at U and used at NASA, getting a major upgrade

A team of aerospace engineering researchers at the University's Uninhabited Aerial Vehicle Laboratory are creating the next generation of research aircraft flight control system. The lab is continuing to develop its "Goldy" system, which serves as the brain of UAVs used for scientific research. The system, which originated in 2006, has garnered recognition for its use in aerospace research at government agencies like NASA and the German Aerospace Center. To learn more, visit: [z.umn.edu/flight](http://z.umn.edu/flight).



## Fossil teeth point to early exodus from Africa

University of Minnesota researcher R. Lawrence Edwards, professor of earth sciences, and his colleagues dated human teeth that were found to be between 80,000 and 120,000 years old. They used methods developed by Edwards and his colleagues. The 47 fossil teeth were found in an excavation of Fuyan Cave in China's Hunan Province, and provide evidence that humans exited Africa at least 20,000 years earlier than previously thought. To learn more: [z.umn.edu/teeth](http://z.umn.edu/teeth)

# Recipe FOR

# SUCCESS

DRIVE, DETERMINATION, AND A CSE EDUCATION  
PAY OFF FOR THESE YOUNG ALUMNI

Written by KERMIT PATTISON

Jenna Shaw didn't suffer much senior angst. The engineering student didn't have to worry about what to do with her life after graduation. Four years of diligent preparation left her with a resume bristling with qualifications: a major in biomedical engineering, an array of extracurricular accomplishments, research experience, and internships at major corporations. By midway through her senior year, she had two job offers.

"I knew what I wanted to do," said Shaw, now a senior design engineer with Medtronic. "I had everything lined up...I graduated and hopped on a plane to Hawaii. Then I came back and started work."

Her case provides one example of a broader phenomenon: graduates of the College of Science and Engineering are quickly gaining traction in the professional world and making their degrees pay off. Students and families are painfully aware of the rising cost of higher education.

Fortunately, statistics show that the investment pays off for graduates of CSE.

According to a survey of May 2015 graduates, 95 percent of 2015 graduates had a job or were enrolled in graduate school within six months of graduation. They found jobs at leading local companies including Boston Scientific, 3M, Cargill, General Mills, Medtronic, St. Jude Medical, Ecolab, and many others. The average CSE student receives 1.75 job offers.



Biomedical engineering graduate Jenna Shaw, who works as a senior mechanical design engineer at Medtronic, decided on a career in medical devices after her sister suffered a traumatic brain injury.

RICHARD G. ANDERSON

## Recipe

*"The professors in my department were always throwing curveballs at us. They were teaching us how to think and how to solve a problem. That happens every day in the workplace. You need to come up with a creative solution."*

— JENNA SHAW

and coaching becomes more intense as students approach their junior and senior years.

The hallmarks of these efforts are the twice-yearly career fairs, held in the fall and spring of each year. The Fall 2015 career fair attracted more than 3,140 students and alumni over two days. About 260 companies participated, an increase of about 40 percent over the previous year. These companies include giants such as Google, Amazon, Microsoft, ExxonMobil, Fortune 500 companies, and many large and small companies from the Twin Cities area.

"Employers want to hire students earlier and earlier," Froistad said. "Some even want to hire students as freshmen so they can build their pipeline and hope they stay on and work for the company full time. It's a good time to be a CSE student."

### JENNA SHAW: DEVICES WITH A MISSION

Jenna Shaw, 28, earned many honors as a student: commencement speaker and president of the biomedical engineering society, just to name a couple. But the young Medtronic

According to those surveyed, starting salaries range from the mid to high five figures. In some cases, salaries may begin in the six figures in certain high-demand fields such as computer science and computer engineering, electrical engineering, and chemical engineering.

"It's an incredible investment, as evidenced by the companies that want to hire these students, how quickly they are getting hired, and the number of job offers they're getting," said Angie Froistad, assistant director of the CSE

Career Center. "They are going into positions directly related to their majors. It's not always easy obviously—it's a very, very challenging curriculum—but once they finish, they find it's incredibly rewarding."

Career counselors provide a variety of services to help students enter the job market, which includes resume reviews, interview coaching, practice interviews, job search strategies, and networking with alumni and employers. Students are exposed to these services during freshman orientation

engineer traces her professional drive to a childhood event—a car accident that left her baby sister with a traumatic brain injury.

Shaw grew up visiting hospitals while her parents sought care for their youngest daughter. She witnessed first-hand how medicine and technology helped her sister and other patients overcome serious injuries and illnesses. (Her sister eventually recovered and now is enrolled in graduate school.) Those years stamped Shaw with a desire to pursue a career in medicine and technology—and that attracted her to the University’s biomedical engineering program.

“The professors in my department were always throwing curveballs at us,” she said. “They were teaching us how to think and how to solve a problem. That happens every day in the workplace. You need to come up with a creative solution.”

During college, she threw herself into extracurricular activities. She served as president of the Biomedical Engineering Society. She volunteered as a mentor in Girls Excel in Math, a group that promotes math and science among junior high school girls. She also served on the senior design team, where she helped plan a new algorithm for pacemakers based on physiological signals, an experience that foreshadowed her later work with Medtronic.

By networking through CSE connections, she secured two valuable internships. First she interned at 3M, where she gained first-hand experiences in

scientific testing in an industrial setting. Next she got a second internship at St. Jude Medical, a Twin Cities-based medical device company where she worked in manufacturing. Both experiences proved invaluable in helping her land a full-time position after graduation.

Midway through her senior year, Shaw had two job offers. She went to work at Medtronic and has advanced through several engineering positions over the last six years. She now works as a senior mechanical design engineer in the Medtronic implantable neurostimulator group within the neuromodulation business. The group makes small devices implanted in the body that deliver electrical signals to treat conditions such as chronic pain, essential tremor, and Parkinson’s disease.

“At the end of the day, we always say it’s for the patients,” said Shaw. “For me, it’s more personal. What if someone in my family needed this?”

### **TAYLOR TRIMBLE: FEATHERING THE NEST**

Taylor Trimble likes an audience. In college, he used his engineering skills to stage light shows and concerts. Now the 23-year-old former CSE student, who attended 2010-14, and majored in computer engineering connects with customers right where they live by writing software for Google’s Nest in-home products.

## *Recipe*

*“That [Undergraduate research] pretty much changed my life. I got really into iPhone programming.”*

— TAYLOR TRIMBLE

In high school, Trimble became interested in both technology and art—and found a good combination of the two in theater. He also worked with his high school marching band as an audio engineer. He considered a career in lighting design, but his parents pressured him to pursue a more marketable skill when he enrolled in the University of Minnesota, so he started out by majoring in electrical engineering.

He sought research experience but had trouble finding the right opportunity. Then he walked into the office of Marvin Marshak, a professor of physics and the director of undergraduate research. Marshak discovered that Trimble had an interest in programming and offered him \$100 to develop an iPhone app. “That pretty much changed my life,” Trimble said. “I got really into iPhone programming.”

He taught himself programming through online tutorials and books. He built numerous programs, which included an iPhone calculator and another app that drew Bezier curves. He switched majors to computer engineering and took classes in programming, embedded devices, and microcontrollers.



He still found a way to connect his technology to his other passion—performance. He joined a student club called Tesla Works and played a leading role in organizing the CSE Winter Light Show in the fall of 2011. “I’ve always been a person for big shows,” he said. “An audience is really important for me.”

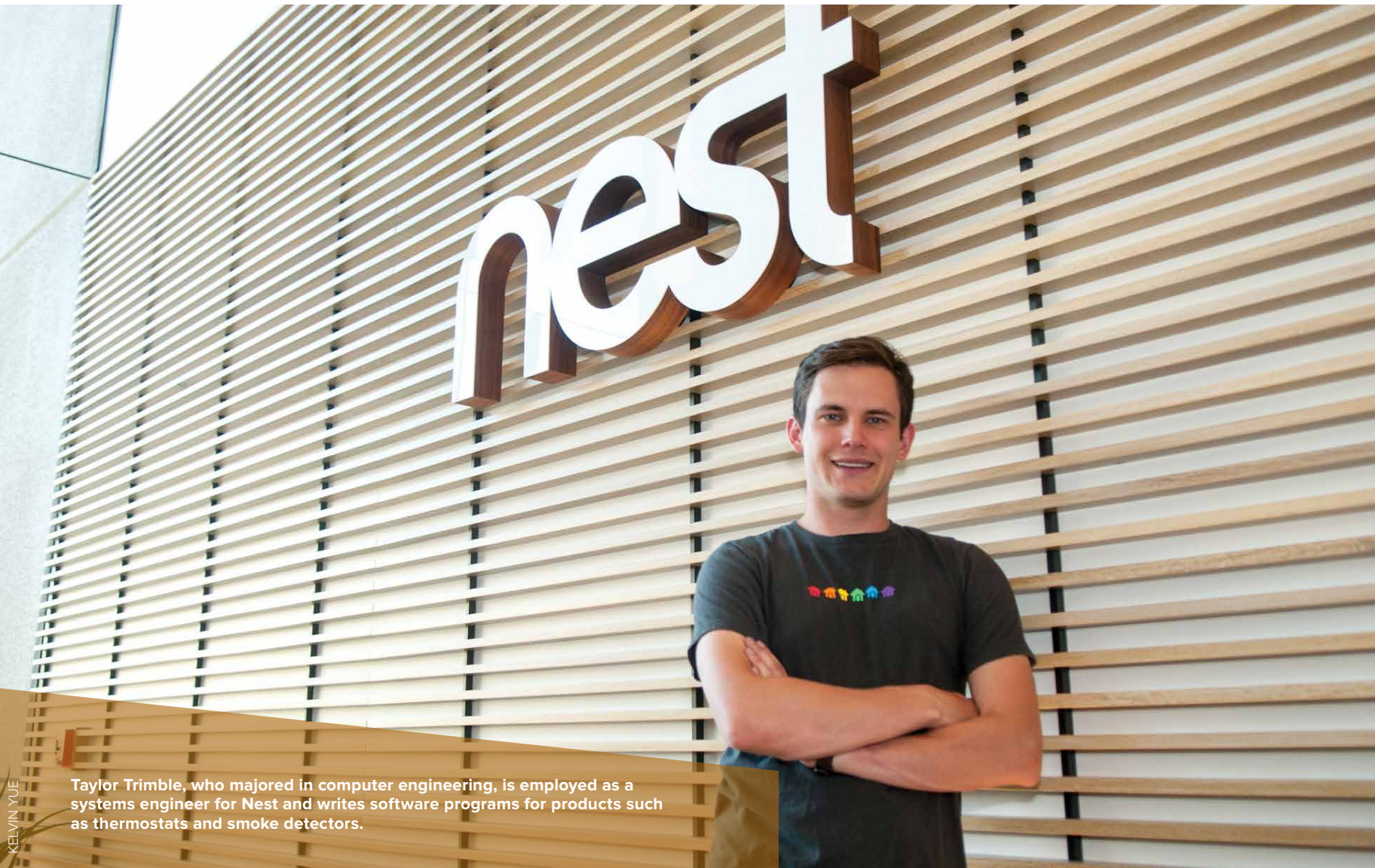
Trimble’s programming skills helped him secure an internship with

National Instruments Corporation in Austin, Texas, between his sophomore and junior years. The following summer he got an internship with Nest Labs in Silicon Valley. This opportunity drew upon the University’s alumni network. Grant Erickson (EE ’96, M.S. ’98) was one of the early employees at Nest, and helped recruit Trimble.

Such internships provide valuable real-world experience, credentials,

and often become a pipeline for recruitment. So it was with Trimble. At the end of the summer, Nest tried to convince him to drop out of school and work full-time. Trimble faced a dilemma well known to many tech wunderkinds—return to school or chase a career opportunity? His family became alarmed at the possibility that he would not finish his degree.

“It was literally traumatic for my mother,” Trimble said.



Taylor Trimble, who majored in computer engineering, is employed as a systems engineer for Nest and writes software programs for products such as thermostats and smoke detectors.

KELVIN YUE

## Recipe

*"I learned how to manage my schedule and really prioritize working very effectively. When we had these big projects, I learned it wasn't about how much time you put in; it was about how effective you were."*

— DAVID HOLT

RICHARD G. ANDERSON

Trimble returned to the University for his final year, but had a job offer at Nest waiting for him the following spring. Midway through his senior year, there was exciting news. Tech giant Google announced its purchase of Nest.

A few months later, Trimble returned to the company as an embedded systems engineer. He writes software programs for products such as the Nest thermostat, smoke and carbon monoxide detectors, and web camera.

He no longer manipulates lights and sounds to make people gasp, cry, cringe, or laugh. But in a sense he is still playing to the crowd. "I certainly do have an audience—a much larger one!" he said.

## DAVID HOLT: ENGINEERING A NEW CUSTOMER EXPERIENCE

In college, David “DJ” Holt studied how technology could improve health care. Now he is trying to re-engineer health care itself.

Holt, a healthcare attorney, co-founded the startup, miVoyce, which educates consumers to be more savvy about purchasing and using medical care.

Holt came to the University in 2006 to study biomedical engineering. In high school, he read the works of futurist Ray Kurzweil and became entranced by the evolution of medicine and the possibility of replacing body parts with biotechnology.

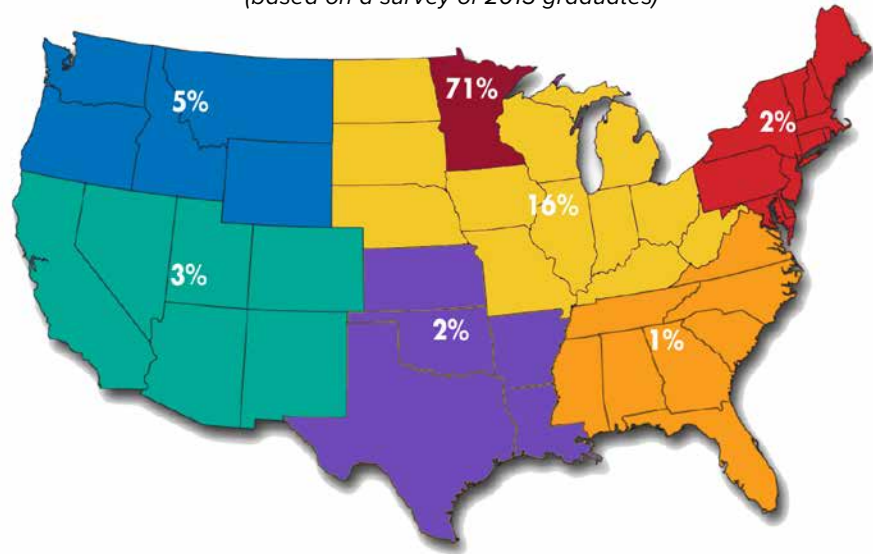
“I was going to be the guy who built all these cool devices before they make it into people’s bodies—pacemakers,

hip replacements, tissue organs,” he recalled. He pursued a career in tissue engineering and secured an undergraduate research position in the University’s Stem Cell Institute. Holt’s research led to a valuable discovery—that the life of a lab

scientist was not for him. “I was sitting in the lab alone at 3 a.m. cultivating stem cells,” he recalled. “I wanted to be a little closer to people, not just sitting at a computer screen, cultivating cells, or in the traditional scientist role.”

## Where do CSE graduates find employment?

(based on a survey of 2015 graduates)



## By the Numbers



The percentage of 2015 graduates who were employed or enrolled in graduate school within six months of graduation.



The percentage of graduates who are satisfied or very satisfied with their current employment



More than 260 companies attended the 2015 Fall CSE Career Fair to recruit students

He began to step out of the shell of a self-described “introverted, nerdy, geeky guy.” He volunteered as an orientation leader for Welcome Week, served on the CSE student board, and founded a student cribbage club (fundraising shirt: “Your crib or mine?”).

His interests shifted toward health policy. The time was right. Congress was debating and passing the Affordable Care Act. As an undergraduate, Holt once negotiated a health care bill from \$350 down to \$40. This piqued his curiosity. How did the health billing system work? Was there leeway to adjust fees on the customer’s behalf?

He has remained focused on health care ever since. After graduating, he went to law school. Holt and his business partner, David Dubé, founded miVoyce.com (formerly cutmedicalbills.com). The service helps consumers navigate the medical bureaucracy and reduce costs. “There’s not a whole lot of incentive on the health insurance company or the provider to truly educate the patient about what’s covered and how much stuff costs,” Holt said.

The startup aims to fill that gap and empower consumers to act as their own advocates. According to Holt, the average customer saves about 40 percent off their original medical bills. Holt also runs a small solo law practice in healthcare and business law. He now divides his time between his startup and practice.

He still puts his engineering education to work. Instead of devices, he aspires to build a more transparent, fair

and equitable system for delivering care. “I developed a very strong work ethic,” he said of his CSE education. “I learned how to manage my schedule and really prioritize working very effectively. When we had these big projects, I learned it wasn’t about how much time you put in; it was about how effective you were.”

### **LEON BINITIE-CASSIDY: GOOD CHEMISTRY**

Leon Binitie-Cassidy, 26, didn’t know much about Minnesota when he started looking at colleges.

He grew up halfway around the world in Lagos, Nigeria, and the North Star State wasn’t exactly on his radar. His knowledge of Minnesota boiled down to two essentials—the Timberwolves and Kevin Garnett. Then another thing caught his attention—the ranking of the University’s chemical engineering program.

That was enough to bring Binitie-Cassidy from West Africa to Minnesota in 2006. He vividly remembers, sometimes painfully, the demands posed by the engineering curriculum.

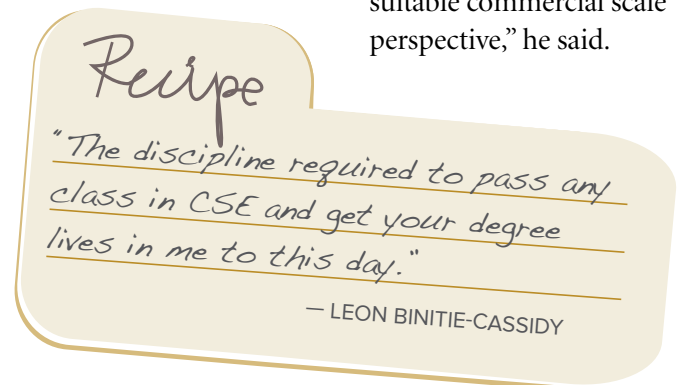
“The discipline required to pass any class in CSE and get your degree lives in me to this day,” said Binitie-Cassidy, an engineer with G2 Partners in Houston. “Heaven knows, we had homework, and homework, and homework.”

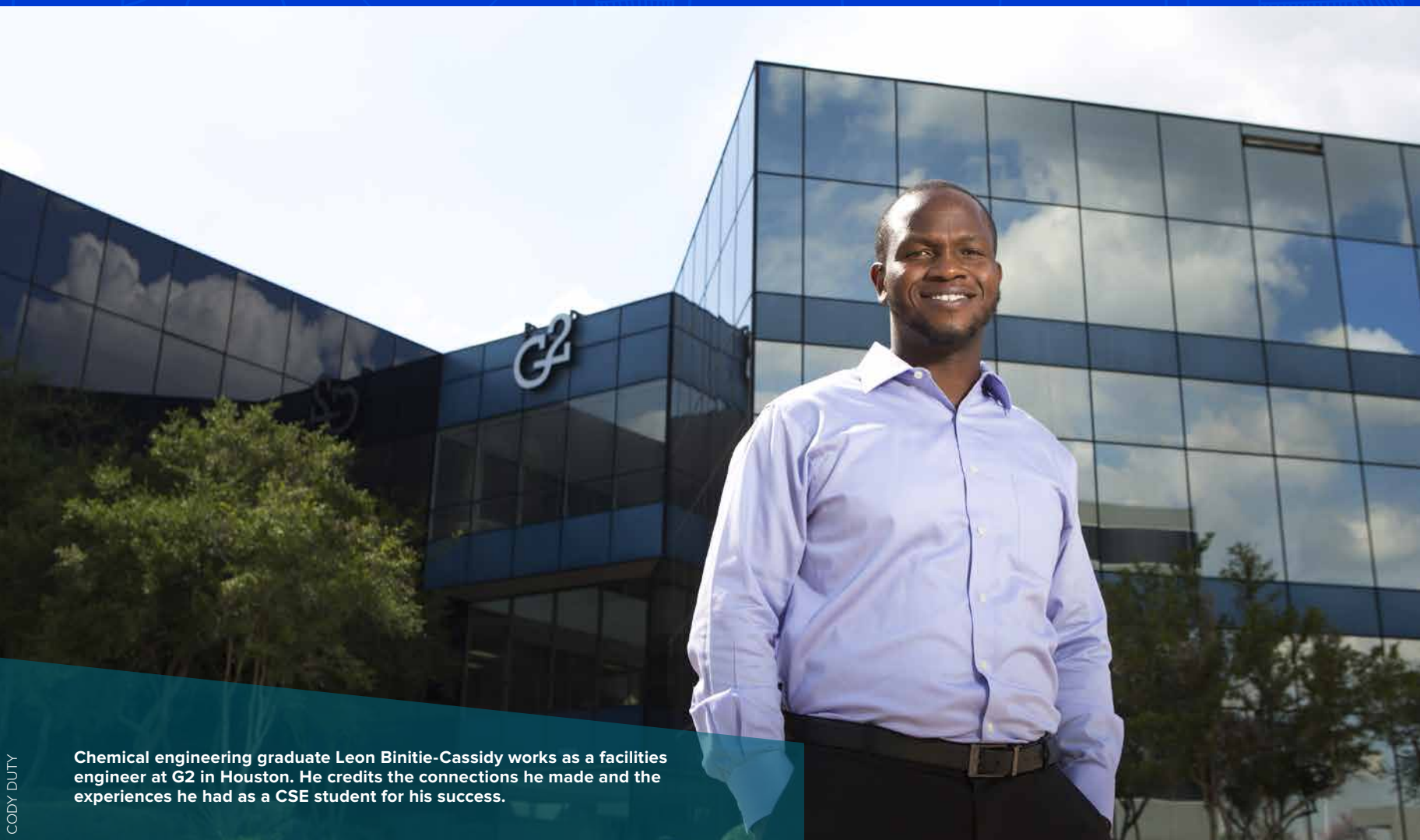
He also led a busy life. He joined the National Society for Black Engineers, a fraternity, and a service organization called Students Today Leaders Forever. He worked for the University’s Disability Services.

He won an array of awards, including the President’s Student Leadership and Service Award, Outstanding Multicultural Ambassador, Distinguished Kappa Alpha Psi Scholar, Scholarly Excellence in Equity and Diversity (SEED) Award, and the Outstanding Service Award from the National Society of Black Engineers.

“I can honestly say that the friends and the connections I made through those experiences have had the greatest impact on the person I am today,” he said. “It helps you understand how to interact with people from different backgrounds. Those experiences made my life richer.”

He worked as an undergraduate research assistant—an experience that proved invaluable in preparing him for the workforce. “It opened my eyes to how research is done and how to analyze and translate trends in experimental data from a lab pilot scale perspective to a suitable commercial scale perspective,” he said.



A photograph of Leon Binitie-Cassidy, a Black man with a short beard, smiling and wearing a light blue button-down shirt and dark trousers. He is standing in front of a modern, multi-story office building with a glass facade. The building has a large 'G2' logo on its side. The sky is blue with some clouds. The image is partially overlaid by a dark teal banner at the bottom left.

Chemical engineering graduate Leon Binitie-Cassidy works as a facilities engineer at G2 in Houston. He credits the connections he made and the experiences he had as a CSE student for his success.

After graduation, he landed a job as a product development engineer at 3M. He later was recruited by PPS in Houston to work as a project engineer building a \$150 million natural gas processing plant in his native Nigeria. He now works at G2, another Houston firm, which helps to design and manage oil and natural gas facilities and pipelines across the

United States and Canada. He hopes to return home someday and work in Nigeria's burgeoning oil and gas industry.

"Something I remember vividly," said Binitie-Cassidy, "was during my senior year. One professor pointed out that you may have the best idea or the best invention, but as an engineer

if you do not communicate your ideas to business people and laypeople in non-technical terms, you'll never get anywhere. I feel that captures everything about my education in Minnesota. It prepared me not only from a technical and professional standpoint, but also how to communicate effectively with different types of people."

**WHEN IT COMES TO IMPROVING OUR  
TRANSPORTATION NETWORKS, CSE  
RESEARCHERS ARE IN THE DRIVER'S SEAT.**



# Ruling the Road

Written by EVE DANIELS

Photos by SCOTT STREBLE



Imagine a world without traffic jams, car crashes, or highway pileups. A future where smartphones are no longer a distraction from safe driving, but rather a safety tool. A future where it's easier for everyone to get where they need to be, whether they're driving, busing, biking, or hoofing it.

This future may happen sooner than later, thanks to advancements from the University of Minnesota. Researchers in the College of Science and Engineering are helping to make our commutes smoother, our vehicles smarter, and our destinations more accessible.

Yearly delay per auto commuter is 47 hours in the Twin Cities, according to the Texas A&M Transportation Institute. That's an entire workweek stuck in traffic (ironically, on our way to and from work). While the Twin Cities aren't as notorious for traffic problems

as, say, Los Angeles (where delay is 80 hours per year), there's always room for improvement.

How to reduce congestion is one of many questions that need answering. How do we reduce or eliminate crashes? How do we keep drivers focused on the road? In which modes of public transit should we invest the most heavily? Where do we need to improve access to jobs, schools, hospitals and parks?

While these problems are global in scope, solving them at the University of Minnesota makes sense for a few reasons—starting with the Minnesota Department of Transportation. “MnDOT is probably the most forward-thinking state DOT in the country,” said Max Donath, professor of mechanical engineering and director of the Roadway Safety Institute. “They provide us with access

"The problem with vehicle-to-vehicle communication is that it only works if all vehicles are instrumented, and it will be at least 20 years until the entire fleet is replaced."

— JOHN HOURDOS



John Hourdos, research associate professor of civil, environmental, and geo-engineering, is working to improve driver safety and traffic mobility.

to the roads, to their data, to their networks, and they are great people to work with."

There's also no shortage of knowledge here. From the Center for Transportation Studies to the Roadway Safety Institute, the Minnesota Traffic Observatory to the Intelligent Vehicles Lab, the University of Minnesota is home to a veritable blue book of experts.

Here, we get to know three experts from the College of Science and Engineering.

### John Hourdos: Connecting the DOT

No matter how great we are at driving, we've all had our moments of testing fate. Double-checking our Google map. Fiddling with the radio, the heater, the mirrors. Daydreaming about our next new car...

In most cases, fate gives us a free pass. That is, unless we're driving west on Interstate 94 near downtown Minneapolis, during afternoon peak hours. At that place and time, there is at least one fender-bender every two days.

John Hourdos, director of the Minnesota Traffic Observatory (MTO), says we can blame it on "unforgiving conditions." Typically, the conditions around our vehicles are forgiving, meaning that we can safely let our mind wander for a second or two.

But not there, and not then.

"In that location, a lot of people are trying to change lanes, and it's very difficult to find a gap," Hourdos said. "You're looking over your shoulder longer than normal, and you're not paying attention to someone stopping in front of you."

SE Washington Av

*"You use a single tap to survey the environment and find out street names, direction and other information, and a double tap to confirm the crossing direction and request a walk signal."*

— CHEN-FU LIAO

Chen-Fu Liao, a researcher in the Center for Transportation Studies, has developed a Mobile Accessible Pedestrian Signal (MAPS) system to help people who are visually impaired.





To find ways to better manage this area and locations like it, Hourdos and his colleagues rely on a network of video and radar detectors, which provide continuous coverage and transmit the data back to the observatory. Along with live video footage, the data include individual vehicle speeds and headways as well as complete trajectories of vehicles involved in crashes and near-crashes.

All together, this technology makes the MTO laboratory feel like a top-secret operation. Enter the Civil Engineering Building on the East Bank, take the elevator down seven floors, and you'll find a room full of screens and projections of our bustling traffic landscape. MnDOT supplies the MTO with 16 switchable video feeds from across the metro area.

Hourdos is drawing on this information to develop new connected vehicle systems, which he considers "the realistic stage before autonomous vehicles." This technology enables wireless communication among vehicles, the infrastructure, and the passengers' communications devices, ultimately improving driver safety and traffic mobility.

The first stage of Hourdos' work is reminiscent of the talking LED sign in the early '90s film, "L.A. Story." Using existing sensors and infrastructure, the sign displays warnings for drivers depending on their location. In a few months, we'll see the signs in action around the I-94 test site.

Hourdos hopes to implement the second stage, vehicle-to-infrastructure (V2I) technology, within a test vehicle sometime next spring or summer.

With V2I technology, the driver will receive messages targeted to that vehicle.

And the "dream stage," said Hourdos, is to implement advanced vehicle-to-vehicle technology (V2V) in pilot locations. In that stage, everything will happen within the vehicle. Cars will communicate directly with each other, alerting drivers when they should slow down, avoid changing lanes, and so on. Blind spots will no longer be an issue.

"The problem with V2V communication is it only works if all vehicles are instrumented, and it will be at least 20 years until the entire fleet is replaced," Hourdos said. If that sounds like the distant future, remember growing up without power windows, cruise control, mobile navigation, and airbags? Seems like only yesterday.



Visit [z.umn.edu/hourdos](http://z.umn.edu/hourdos) to view a one-minute video about John Hourdos' research.

### Chen-Fu Liao: Safer crossings

Today, more than 20 million Americans are visually impaired, and more than 80,000 of them live in Minnesota. That's just the people who reported vision loss, as many are reluctant to identify themselves. By 2030, the numbers are expected to double nationwide.

If we don't have vision loss, it's easy to take our sight for granted. But for the visually impaired, who rely on walking and public transit to get around, everyday tasks like crossing the street present a lot of challenges.

Current pedestrian signal systems aren't the answer. There's no standard location for push-button audio signals, so visually impaired pedestrians must deviate from their path to request a signal, making it even harder to navigate. And not all intersections are equipped with this technology, which, incidentally, costs a lot to maintain.

Fortunately, Chen-Fu Liao, Center for Transportation Studies researcher, has developed a solution. It's called the Mobile Accessible Pedestrian Signal (MAPS) system, and it provides signal and intersection geometry information at signalized intersections via a smartphone app.

"You use a single tap to survey the environment and find out street names, direction and other information, and a double tap to confirm the crossing direction and request a walk signal," he explains. The app wirelessly requests signal timing and phasing information from the traffic signal controller. Along with auditory cues, the phone vibrates when the walk sign is on, and again when time is running out.

In the early stages of development, Liao interviewed 10 visually impaired Minnesotans to find out what kind of app they would find most useful. Based on the survey feedback, he came up with a simple yet effective interface. It won't replace or interfere with the white cane, but rather serve as a supplement.

MAPS has already been field-tested at intersections in Minneapolis and Golden Valley, Minn., with promising results. Now, Liao is working with central traffic control vendors to implement the system in a 10 by 10

---

## By the Numbers



The average time your eyes are off the road while texting. When traveling at 55 mph, that's enough time to cover the length of a football field blindfolded.



The yearly cost to each driver stuck in congested traffic.



The number of visually impaired Americans who could benefit from a pedestrian app.

---

block area near the Vision Loss Resources centers in Minneapolis or St. Paul. Eventually, the system will incorporate bus stops and work zones using a Bluetooth low energy module.

It may also expand to subways. Recently, Liao presented the system to the New York City DOT and they expressed serious interest. "They're watching the progress in Minneapolis to make their decision," he said.

Beyond his research and testing, Liao learns a lot from casual conversations. Every other Monday, he volunteers as part of a walking group for Vision Loss Resources clients. "We walk around in the mall and the clients discuss what's happening in their lives," he said. "Through this process, I see the need, and I've developed a love for the work."



Visit [z.umn.edu/liao](http://z.umn.edu/liao) to view a one-minute video about Chen-Fu Liao's research.

### David Levinson: Access for all

"One day, soon-ish, you will awake, give a voice command to a car, and never again touch a steering wheel, gears, accelerator or brakes. ... You will step into your car, tell it where to go, and not think about traffic. The window in front of you will be a heads up display giving you information and entertainment, while allowing you to see the road coming up."

If you love to drive, you might find this excerpt from "The End of Traffic and the Future of Transport" unsettling. If you love your life, it's hopeful. But the book's co-author, David Levinson, believes a world of autonomous vehicles is inevitable—and he's looking forward to it.

"If you live in a city, you'll be able to summon a car in a few minutes, so you won't need to own one," said Levinson. "Single-passenger cars can be skinnier, lanes can shrink, and

cars will be able to follow each other more closely. And we won't consider time spent driving as onerous as we do today, since we can do work in motion."

While robots are driving on the streets today, it will be a few decades before they replace all vehicles, and there are transportation problems that need attention now. So when he isn't writing about the future, Levinson is informing decisions on how to solve today's issues.

One of those issues is accessibility, or the ease of reaching our most valued destinations.

"Traditional transportation performance measures have looked at the speed of the network, but on its own, that doesn't tell us very much," said Levinson. "We always use the example of Manhattan, Kansas, versus Manhattan, New York. Obviously the network

speeds in Kansas are higher than New York, but in 10 minutes I can reach a lot more jobs in New York than I can in Kansas.”

“So it might be a lower speed, but much higher accessibility,” he added.

One of Levinson’s latest projects, the National Accessibility Evaluation, will measure how many jobs you can reach in specific amounts of time, when traveling by car, bus, train, streetcar, bike, ferry, or foot. These measurements rely on existing schedule data from public transit agencies, bicycle and pedestrian network data from OpenStreetMap, and road

network and speed profile data from TomTom.

Within the next year, the study will produce a heat map showing accessibility to jobs for the 11 million-plus census blocks in the United States. From there, urban planners, policy-makers, and other stakeholders can evaluate their transportation networks like never before.

“We should be looking at policies and investments that maximize accessibility subject to their cost—maximize output, minimize input,” said Levinson, adding that jobs are the first criteria, but the analysis will

expand to schools, hospitals, parks, restaurants, and other points of interest.

“Getting and presenting this information in a systematic way opens up a lot of opportunities on how investments are allocated,” said Levinson. “But knowing is the first step.”



Visit [z.umn.edu/dlevinson](http://z.umn.edu/dlevinson) to view a one-minute video about David Levinson's research.



“If you live in a city, you’ll be able to summon a car in a few minutes, so you won’t need to own one.”

— DAVID LEVINSON

David Levinson, professor of civil, environmental, and geo-engineering, focuses one of his research projects on accessibility issues, which includes how easy it is to reach our most valued destinations—home and work.

# Global Exposure

Written by GREG BREINING



*CSE students are gaining global experience through new learning abroad programs and opportunities*



**Kelsey Harper, a mechanical engineering student, spent last winter break in Germany and Belgium as part of the Freshman Global Technical Seminar “Research Across the Borders in the European Union.”**

College-sponsored travel abroad has long been popular—even a rite of passage—among students in the liberal arts. Not so much in the College of Science and Engineering, where a large credit load and long list of required classes make it more challenging to fit a semester of travel into a four-year curriculum. As a result, fewer CSE students have studied or traveled as part of their college experience than their liberal arts counterparts.

“That has been changing over the past few years,” said Adam Pangel, CSE international programs director. “New programs, including a new freshman seminar launched

last year, are giving our students more opportunities to travel, study, and meet colleagues—and still graduate on time. Going global has never been easier.”

Travel pays off for students in several ways—stronger resumes, sharper skills, and one more way to make an impression in an interview with a global company.

Travel helps students gain a global perspective, said Beth Stadler, professor of electrical and computer engineering. In January 2015, Stadler led one of the first freshman Global Technical Seminars to Germany and Belgium.

“It’s sort of the ‘world is flat’ mentality—that there’s a lot of commonality with people,” she said. “When you’re in your hometown or your home country, you feel that there’s a certain way things are done to be done right. When you go abroad, you realize things can be done differently and still work. But the fundamental things that matter to people are the same worldwide.”

CSE’s longest-standing travel programs have relied on partners and exchange programs, which CSE continues to expand. For example, the college just signed an agreement with the National University of Singapore to send Minnesota

students to Singapore and vice-versa. “So it’s a true back and forth, which is usually more affordable for our students than traditional study abroad,” Pagel said.

The greatest growth has come from shorter-term programs, such as CSE’s Global Technical Seminars. More than 100 students each year take advantage of the May and January seminars, sandwiched between semesters. Led by CSE faculty, the seminars usually run about three weeks. Students earn three credits and financial aid and scholarships apply.

“It actually accelerates the students’ graduation because they’re adding three more credits to that year,” said Pagel. “So it shouldn’t delay anyone.”

In January 2015, CSE launched a similar program—but just for freshmen. Held during winter break, 74 freshmen attended nine-day seminars in Hong Kong, Italy, and

Germany and Belgium. The seminars reinforced a sense of community among incoming students, gave them time to get to know faculty, helped them imagine what it would be like to work in their engineering field, and taught them basic travel skills.

“Employers don’t necessarily say that study abroad is essential when they’re considering a candidate,” Pagel said. “But when you do ask them what’s high on the list, they often refer to things that are enhanced by going abroad—communication skills, adaptability, leadership, and teamwork. I don’t think a student can expect to sit down and say, ‘I spent a semester in England; you should give me a job.’ But if they talk about the experience and what they gained from it—when they do it eloquently, it’s really an attention grabber.”

### Kelsey Harper: Exploring Belgium and Germany

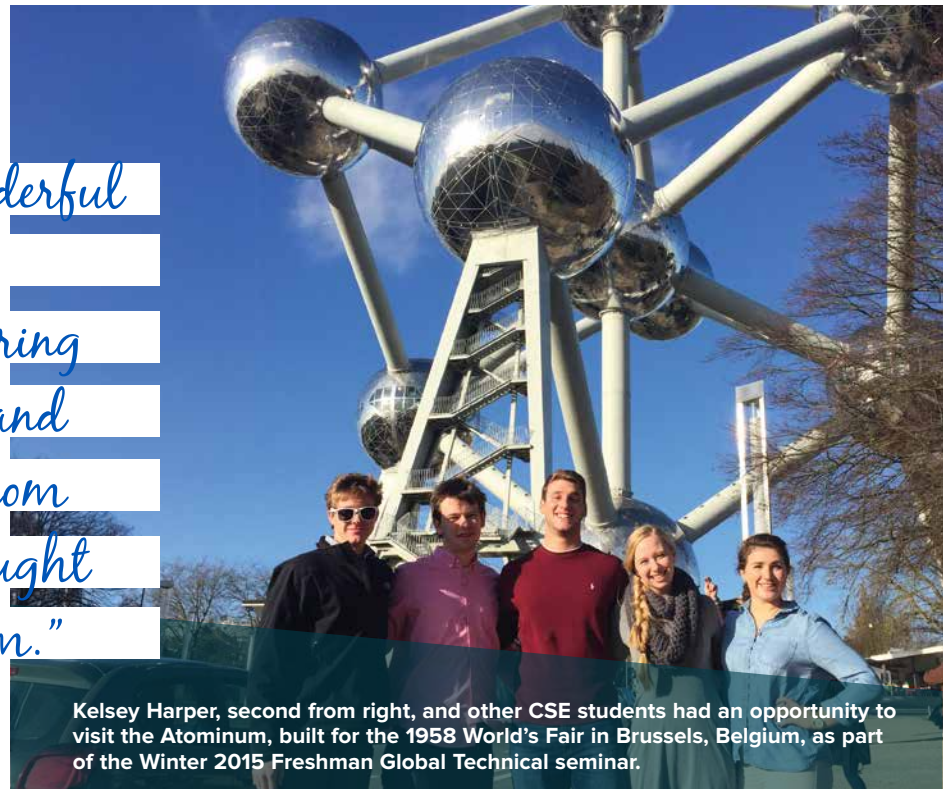
“My parents were all about traveling,” said Kelsey Harper, a mechanical engineering sophomore who traveled to London her first trip abroad. “I don’t remember some of it because I was in second grade,” she said. “But judging by the pictures, I had a great time.”

In high school, Harper toured Spain, France, and Germany with a class and fell in love with international travel. So she jumped at the chance to go abroad again as a college freshman. She signed up for the Global Technical Seminar “Research Across the Borders in the European Union,” led by Beth Stadler, professor of electrical and computer engineering.

“I was excited to go back and see a different side of Germany,” she said.

*“The seminar was a wonderful opportunity to grow as a person and as an engineering student. The knowledge and independence you gain from traveling can never be taught in a traditional classroom.”*

— KELSEY HARPER



Kelsey Harper, second from right, and other CSE students had an opportunity to visit the Atomium, built for the 1958 World’s Fair in Brussels, Belgium, as part of the Winter 2015 Freshman Global Technical seminar.

# 2X

**LEARNING ABROAD** > CSE has doubled the number of students participating in some type of study abroad program in the last 10 years.

“The first time I went—it was a lot of museums, a lot of tours, which I think was wonderful. But I was looking forward to getting to know students my age and looking at the research side of things.”

Among the research sites they took in were Imec (formerly the Inter-

university Microelectronics Centre) in Leuven, Belgium; the Max Planck Institute of Microstructure Physics in Halle, Germany; and the Deutsches Elektronen-Synchrotron (German Electron Synchrotron) in Hamburg, where the students took a walk through a closed-down tunnel of the massive research particle accelerator.

“We actually got to go look inside of the accelerator and walk around the track where they would shoot the particles,” said Harper.

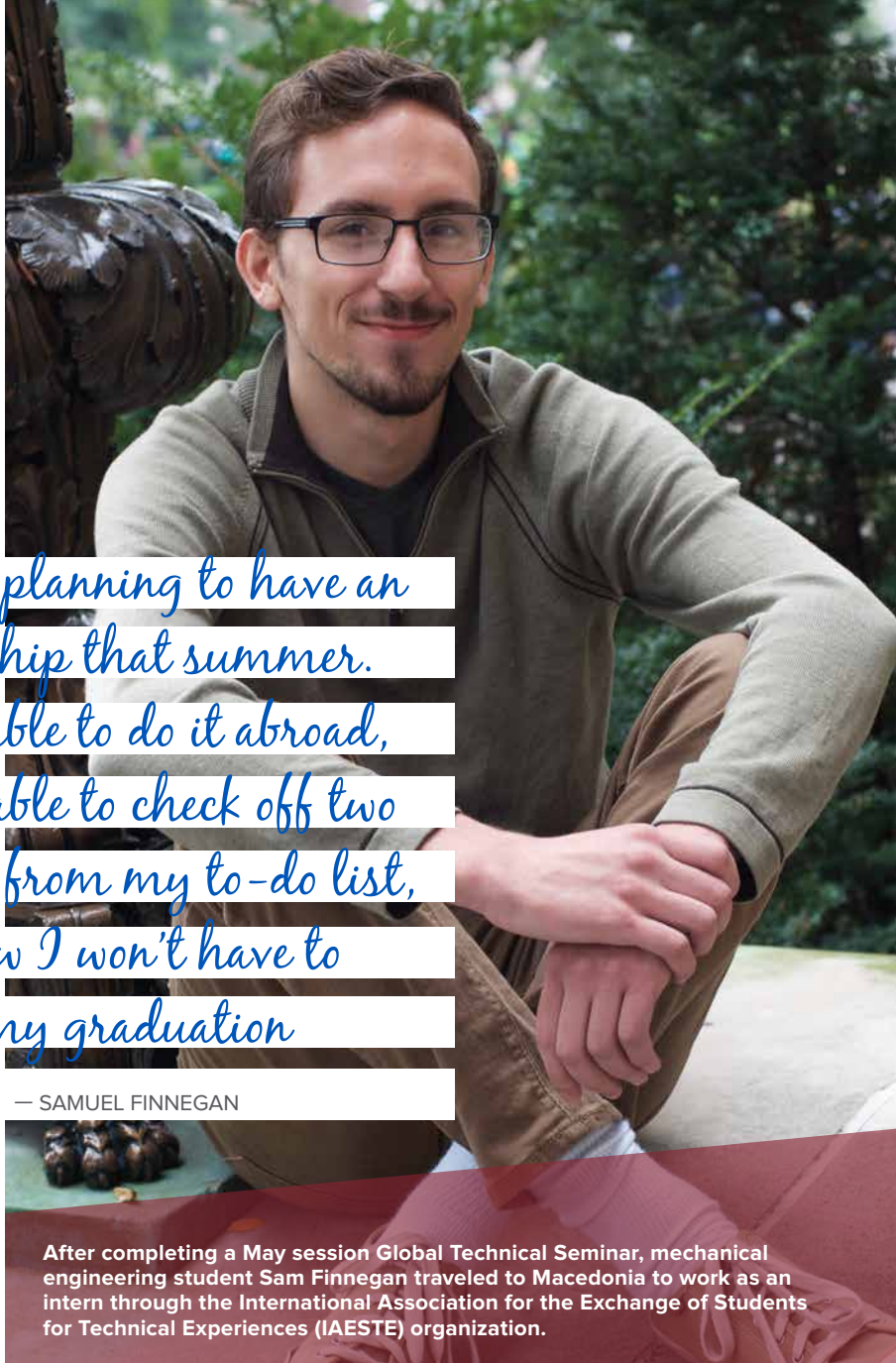
In addition to touring, the group interacted with faculty and students at the research institutions. “Meeting the students in Germany was a great

experience. We were able to compare our engineering experiences in our respective countries,” said Harper. “We also learned about research being done in both academia and industry in Germany and Belgium, and experienced many of the experiments in person.”

Her first day in Hamburg, she and a few other jet-lagged students decided to explore the city center. They got lost and because no one had an international data plan for their phone, the group used a paper map for the first time in years. “Picture five super tech-savvy engineers without all of our gadgets, who had just stepped off the plane, in the rain,



Sam Finnegan spent last summer in Macedonia as an intern modeling objects and machines in three dimensions using a software program. During his free hours, he visited sites such as the Monastery of Saint Naum located on a high cliff above Lake Ohrid.



*"I was planning to have an internship that summer. Being able to do it abroad, I was able to check off two things from my to-do list, and now I won't have to delay my graduation at all."*

— SAMUEL FINNEGAN

After completing a May session Global Technical Seminar, mechanical engineering student Sam Finnegan traveled to Macedonia to work as an intern through the International Association for the Exchange of Students for Technical Experiences (IAESTE) organization.

RICHARD G. ANDERSON

running on about four hours of sleep. That's essentially the situation we were in. Yet, it was freeing because in getting lost, I saw many things I otherwise wouldn't have noticed, like architectural details and small local restaurants," Harper said. "It made us all think about how much technology helps us day to day. I never realized how much I rely on things like my map app when I'm in a new place."

While wandering around the city on that first afternoon, they came upon a church steeple cloaked in scaffolding. It turned out to be the Church of St. Nicholas, whose 482-foot steeple survived World War II.

"We were able to go up into the bell tower and get a bird's-eye view of the entire city," said Harper. "We also saw sections of the church that had been left standing after bombings during

World War II and had been left as a memorial. It was incredibly moving."

"The trip was a wonderful opportunity to grow as a person and as an engineering student. The knowledge and independence you gain from traveling can never be taught in a traditional classroom," Harper said.

### Samuel Finnegan: From Minnesota to Macedonia

Last year, Samuel Finnegan, a senior in mechanical engineering, signed up for May session "Mechatronics in Switzerland" Global Technical Seminar. "When I signed up for that class I decided I wanted to stay in Europe longer than three weeks," he said. So he applied for a summer internship through IAESTE United States, an international organization promoting intercultural exchange between students in STEM fields across the globe.

He got an offer—from Saints Cyril and Methodius University in Skopje, the capital of Macedonia.

Yes, Macedonia, a country barely a tenth the size of Minnesota with only two million people. "Honestly, I didn't really know anything about Macedonia," said Finnegan. "I knew it was in the Balkans. I knew Alexander the Great ruled it at one time, and that it used to be part of Yugoslavia. So I thought, why not be adventurous?"

"Instead of flying back to the United States with the rest of the group, I flew to Macedonia," Finnegan said.





**EUROPE >** Europe is the most popular destination to study abroad for University of Minnesota students.

There he teamed up with a Macedonian post doc who was impact testing industrial materials. Finnegan's job was to use SolidWorks, a computer-aided design and engineering program to model objects and machines in three dimensions. The SolidWorks representation was a step in the complex math analysis of the impact testing.

His roommates were Polish and Swiss, and he worked with people from Hungary, Romania, the Czech Republic, Germany, Finland, and Norway. Finnegan considered himself the fortunate one as, "there were interns from all over the world and English turned out to be the common language. Yet, they weren't all fluent in English," he said.

What fascinated him most was the workplace milieu. It was much more relaxed than the internship he had in the United States the year before.

"In Macedonia the whole feel is a lot more laid back," Finnegan said. "There were some of the friendliest people I've ever met. Every night you go to a bar, you go to a cafe. That's the standard. It's more about the people. You always go to coffee. I went to coffee many times with my boss. I think the most valuable lesson learned was how important it is to cultivate personal relationships."

Even though Macedonia may not be on anyone's list of global high-tech centers, Finnegan said the internship was a "good decision."

A senior now, he anticipates looking for a job in advanced manufacturing. He figures employers will look for employees willing to "go out of their comfort zone."

"I was planning to have an internship that summer. Being able to do it abroad, I was able to check off two things from my to-do list, and now

I won't have to delay my graduation at all," Finnegan said.

### **Ben Gelhaus: Teaming up in Tanzania**

Ben Gelhaus, a chemical engineering senior, wanted to go abroad, but didn't want to delay graduation. So he looked at one of the winter break, shorter-term Global Technical Seminars.

"This one stood out to me," he said. The seminar was "Design for Life: Water in Tanzania," led by Paul Strykowski, CSE associate dean of undergraduate programs and professor of mechanical engineering.

CSE students who signed up for the seminar were sent to Tanzania to engineer solutions to water supply problems. Working with St. Paul Partners, a nonprofit organization, CSE students provide the plan, St. Paul Partners raises money, and local



**FRESHMAN GLOBAL  
TECHNICAL SEMINARS >**  
were held in France,  
Ireland, and Italy in  
January 2016.

Tanzanians provide the labor to complete the project months after the students have returned home.

In January 2015, Gelhaus traveled with 11 other CSE students to Dar es Salaam. Over a few days, they traveled by bus to Iringa and then to villages in the countryside. Gelhaus was one of four students sent to a hospital in Illula, a city of 28,000 where livestock run wild and children played everywhere.

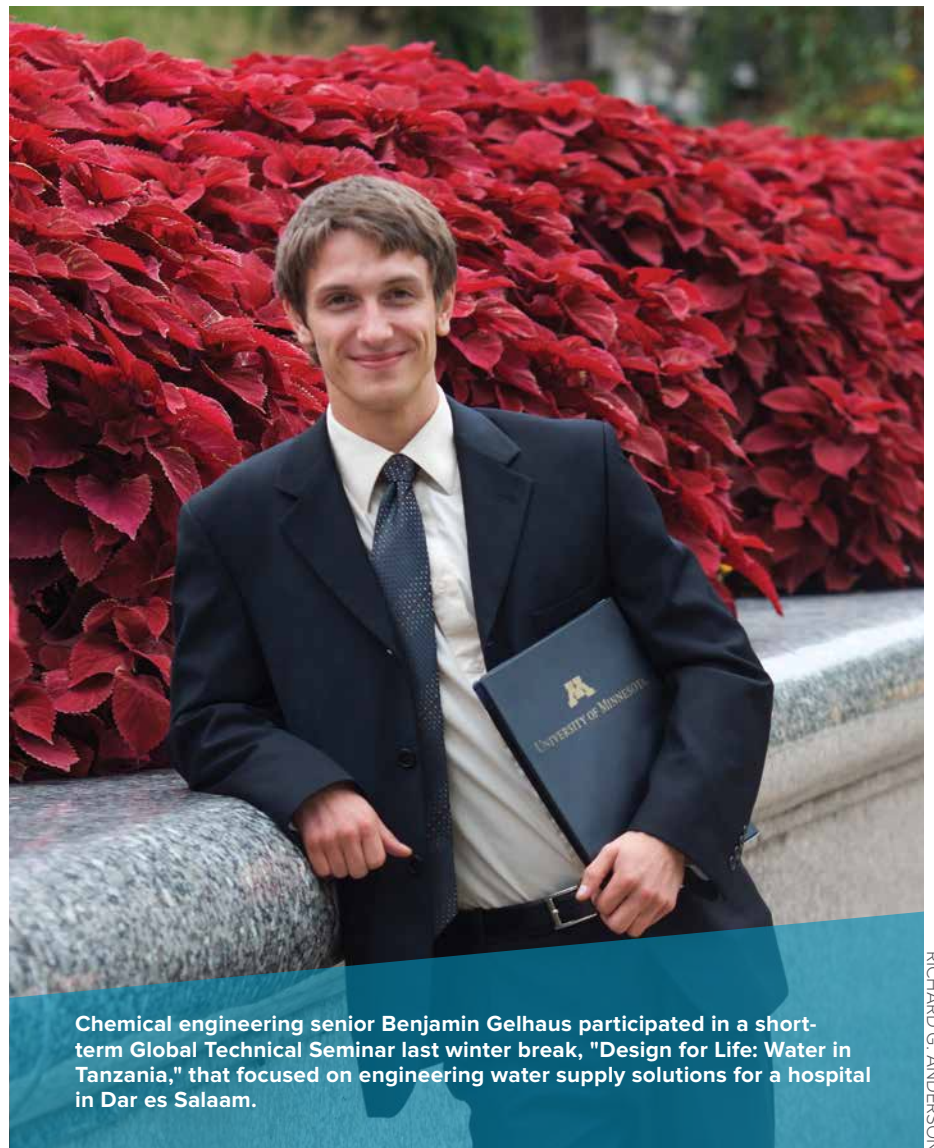
The hospital was a complex of small, clean buildings for care and housing—without adequate water. The local *fundi bomba*—Swahili for “plumber”—regularly had to open and close pipes to route the feeble supply to the various buildings.

“A better water system was needed for sure,” said Gelhaus. “Our challenge was to go in there and figure out how to get water to where it was needed.”

Gelhaus and the team soon confirmed the water supply was adequate. They did some quick calculations on the existing pipes. The design seemed proper, however, the students suspected that hard water had

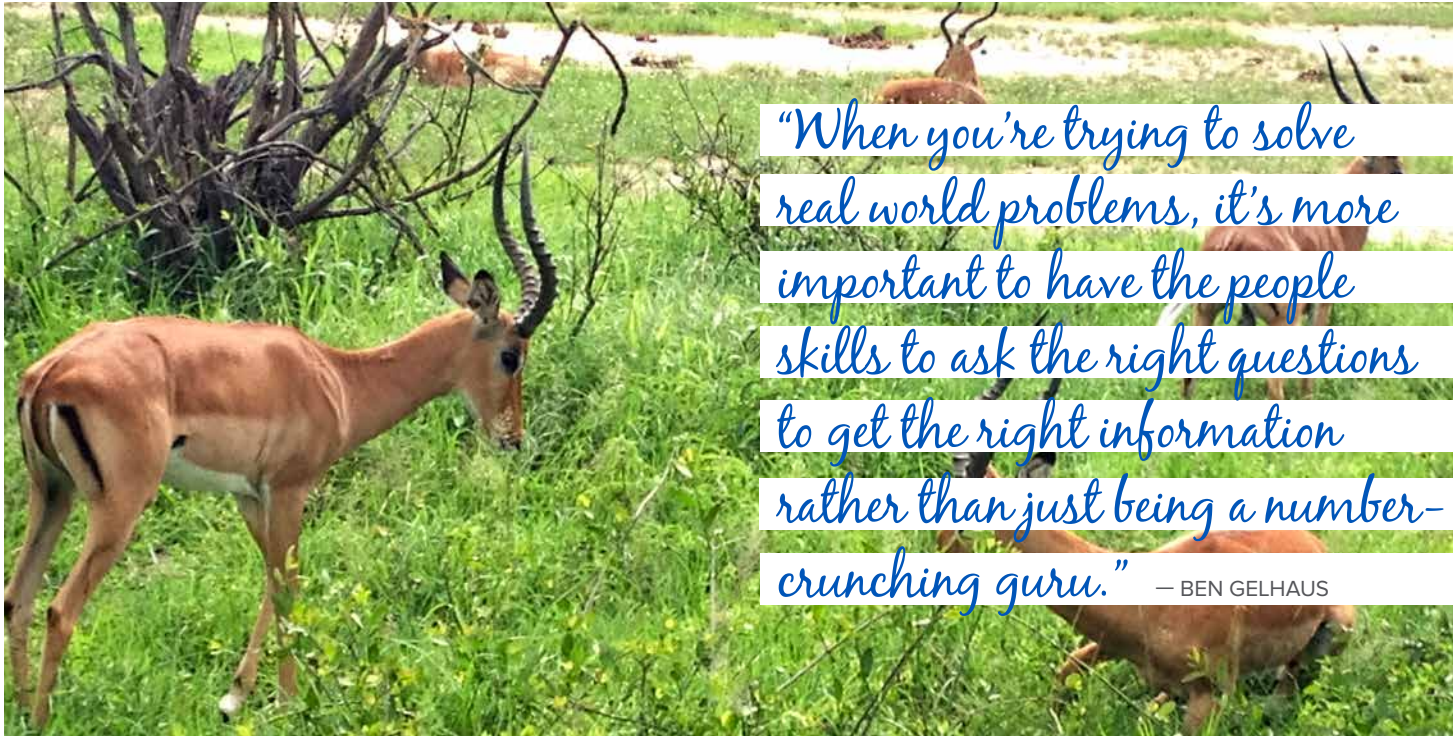
caused the pipes to scale. “The scale was decreasing the water pressure and increasing the friction so water couldn’t pass through the pipes,” Gelhaus said.

“It was all about collecting as much data as you possibly could,” he said. Team members interviewed hospital staff about the facility, water use, and water demand. Team members often heard widely varying answers to questions.



Chemical engineering senior Benjamin Gelhaus participated in a short-term Global Technical Seminar last winter break, “Design for Life: Water in Tanzania,” that focused on engineering water supply solutions for a hospital in Dar es Salaam.

RICHARD G. ANDERSON



“When you’re trying to solve real world problems, it’s more important to have the people skills to ask the right questions to get the right information rather than just being a number-crunching guru.” — BEN GELHAUS

“Usually you would have to ask the same question two or three times to get a general idea of what the real issue was,” Gelhaus said. The team spent a lot of time consulting the *fundi bomba*, a man named Habakkuk, who spoke broken English. “Our team of four became very close with Habakkuk,” he said.

Within days, they devised their solution, which was to re-plumb the hospital in stages with non-scaling plastic pipe. The work would be backbreaking but not high tech. “It’s getting the pipes, the resources to the village, and then digging to make sure the pipes can be buried underground,” Gelhaus said.

Gelhaus won’t see the results of his work. Student groups who traveled to Tanzania in January 2016 and the following year will complete the project; other groups will plan and design new projects.

Three weeks in Tanzania taught Gelhaus that communication skills can trump engineering knowledge.

“When you’re trying to solve real-world problems, it’s more important

to have the people skills to ask the right questions to get the right information rather than just being a number-crunching guru. Understanding your problem before you try to solve it is key,” he said.





**KIM DOCKTER**  
Director of  
External Relations

## Great news. IRA charitable rollover permanently extended.

Congress has finally passed a law permanently extending the popular tax-advantaged IRA Charitable Rollover provision. On Dec. 28, 2015, President Obama signed into law the **Protecting Americans from Tax Hikes Act of 2015**. The new law made the IRA charitable rollover retroactive to January 1, 2015, with no expiration date for future years.

Previously, the IRA charitable rollover provision—which was enacted by Congress in 2006 as a two-year temporary measure—had been extended in two-year increments through Dec. 31, 2013, and as a one-year increment through Dec. 31, 2014.

From now on, under the rollover provisions, **donors age 70½ or older are able to contribute up to \$100,000 annually from an IRA account and avoid federal tax consequences.** When the amount withdrawn from the IRA account is paid directly to the charity, it is not counted as federally taxable income. In addition, the IRA charitable gift amount counts against the donor's required minimum distribution (RMD). However, the gift may not be counted as a charitable deduction on federal tax returns.

Donors who wish to make a gift to benefit the College of Science and Engineering, or who are fulfilling an existing pledge, may want to make a Qualified Charitable Distribution.

Here are the specifics:

- Donors must be age 70½ or older at the time the gift is made.
- Only traditional IRAs are eligible.
- Donors must request a direct transfer of funds

from their plan administrator to a qualified public charity. It is important to not withdraw funds prior to a gift.

- Generally, gifts cannot be made to a private foundation.
- Gifts cannot be made to a donor advised fund.
- Gifts cannot be used to fund a gift annuity or charitable remainder trust.
- Each donor may give up to \$100,000 per year. For couples, each spouse can give up to \$100,000.
- Distributions made under this law can be used to satisfy the donor's required minimum distribution (RMD). The rollover allows for a charitable gift to fulfill the RMD without adding to tax liability.

### Making a gift to the University from an IRA

Contact your IRA plan administrator and request a direct Qualified Charitable Distribution from the IRA account to the University of Minnesota Foundation, a 501(c)(3) organization, with Tax ID number 41-6042488.

Mail the check to:

University of Minnesota Foundation  
Attn: IRA Gift Processing  
200 Oak Street SE, Suite 500  
Minneapolis, MN 55455

For more information or assistance with making an IRA gift, please contact **Kim Dockter** at 612-626-9385 or by email: [dockter@umn.edu](mailto:dockter@umn.edu).

*The U of M Foundation cannot give tax or legal advice. Please consult your own professional tax advisor about the best way to take advantage of this opportunity.*

## What Drives Your Curiosity?

**Nicole Sauer**

*Maple Grove, Minn.*

*Clifford Anderson Scholarship recipient*

“Every time I try something new, I think ‘this is even cooler than the last thing I did,’” said Nicole Sauer, a CSE junior majoring in chemical engineering.

Since high school, she has been chasing down exciting experiences. She exhausted all of her high school elective classes on a three-year course for building search and rescue robots, in which her high school placed eighth at the international competition.

As she considered her college options, Sauer factored in scholarship offers and national rankings. The University of Minnesota was the clear choice for her to continue fueling her curiosity in science and engineering.

Being financially independent because of her scholarships, she wasted no time filling her time outside of classes, which would have otherwise been spent working, with valuable experiences.

Sauer got involved in the Society of Women Engineers (SWE) and the Women in Science and Engineering (WISE) initiative, and has spent time volunteering with both organizations.

Anxious to work in the laboratory, Sauer sought out undergraduate research opportunities after her freshman year. She participated in research studying zeolite membranes in order to reduce the energy needed for certain chemical separations; therefore, making the process more cost-effective and feasible in industry.

While completing a co-op at Cargill, Sauer spent 10 months absorbing relevant knowledge about the energy use, technology, and processes used in creating corn products such as ethanol and animal feed.

Sauer sees every experience as an opportunity to build her understanding of all the moving parts in industry. Every experience gathered adds more understanding to the way she can tackle challenges such as supporting the world’s food needs. After graduation, she wants to contribute to feeding the growing population by designing industrial plants that operate efficiently and sustainably.



RICHARD G. ANDERSON

“Because of [the Clifford Anderson] scholarship, I know there are always people who are supporting me and want me to succeed. Even when classes are tough, it’s great to know somebody believes in me, and that has helped set me up for success,” Sauer said.

## Renovation of Tate Laboratory Begins

A \$92.5 million renovation project has started on the historic Tate Laboratory of Physics (Tate), which will turn obsolete labs and antiquated classrooms into new teaching and research spaces, while preserving the building's architectural character as part of the Northrop Mall Historic District.

For 89 years, Tate has been home to the University of Minnesota's School of Physics and Astronomy, which offers the core courses required to prepare students for a wide range of engineering and science careers. Nearly 4,500 students from dozens of majors pass through its halls each year to receive instruction in physics and astronomy.

When the renovation is completed in 2017, the 230,000-square-foot-building will become the joint home of the Newton Horace Winchell School of Earth Sciences and the School of Physics and Astronomy. Research in experimental physics research is now primarily located in the Physics and Nanotechnology Building that opened in 2014.

In addition to state-of-the-art classrooms and seminar rooms, the building includes 26 teaching labs for physics and astronomy courses and four teaching labs for earth sciences courses. The building also will include research labs—five for physics and astronomy and 16 for earth sciences. Approximately 350 faculty, post-doctorates, graduate

students, and visiting researchers will be housed in Tate.

Highlights of the renovation include the new Van Vleck auditorium that will serve as a main location for classes and public events. A four-story atrium with skylight will be added in the center of the space, and the historic rooftop observatory will be restored and improved, providing more space for public viewings of the night sky.

The 2014 Minnesota Legislature approved \$56.7 million for the renovation, the standard two-thirds of the project cost. The University is responsible for the remaining \$35.8 million and fundraising to help offset a portion of that commitment.



▲ A groundbreaking ceremony for the \$92.5 million Tate Science and Teaching renovation was held Sept. 30, 2015. Featuring vibrant, flexible spaces that will bolster instruction, research, and support services, the building will house approximately 350 faculty, post-doctorates, graduate students, and visiting researchers.

Watch the Tate Science and Teaching renovation on the live webcam at: [z.umn.edu/tatewebcam](http://z.umn.edu/tatewebcam).

If you are interested in supporting the Tate renovation, a giving fund has been established. Visit [give.umn.edu](http://give.umn.edu) and search "Tate Building Renovation Fund."

▼ The renovation, which will be completed in 2017, features a new entrance on Church Street.



# GIVING MATTERS

You can help invent the future. Today's challenges demand creative, educated minds—innovators who will ask the critical questions and work to uncover the answers. Private funding helps to advance innovation and research for solutions to many of the world's most pressing problems. Every year, the College of Science and Engineering produces talented scientists and engineers capable of tackling humanity's most serious challenges.

Your gifts, large or small, support the college in numerous ways:

- **Scholarships to deserving CSE students.** Scholarships can help transform the lives of promising students by helping to relieve the financial strain of college costs.
- **Enhanced student experience.** Learning opportunities outside of the classroom such as First-Year Experience, Solar Vehicle Project team, Engineers Without Borders, and more help students see tangible connections between their coursework and career goals.
- **State-of-the-art facilities.** A school is more than its buildings, but its buildings and equipment have a profound impact on the quality of the education it delivers.
- **Endowed faculty support to attract and retain world-class faculty.** Endowed chairs and professorships help us to recognize the talents of CSE top faculty by supporting their work with funds for graduate students and equipment, by offering more competitive salaries, and by honoring their work and achievements.



Give to CSE today. Visit [cse.umn.edu/giving](http://cse.umn.edu/giving)

## External Relations Team



**Kim Dockter**  
External Relations Director  
612-626-9385  
dockter@umn.edu



**Joslyn Bieber**  
Corporate Relations Director  
612-625-6798  
biever@umn.edu



**Jennifer Clarke**  
Senior Development Officer  
612-626-9354  
jclarke@umn.edu



**Anastacia Quinn Davis**  
Senior Development Officer  
612-625-4509  
aqdavis@umn.edu



**Sue Eaton**  
Annual Giving & Development  
Services Coordinator  
612-624-4294  
eato0008@umn.edu



**Joelle Larson**  
Director of Alumni Relations  
612-626-1802  
jblarson@umn.edu



**Mary Mahto**  
External Relations Assistant  
612-626-7637  
mahto005@umn.edu



**Megan Orr**  
External Relations Special  
Events Manager  
612-625-3767  
mlorr@umn.edu



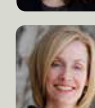
**Kathy Peters-Martell**  
Senior Development Officer  
612-626-8282  
kpeters@umn.edu



**Brenna Sonke**  
Development Officer  
612-626-6874  
sonke@umn.edu



**Shannon Weiher**  
Senior Development Officer  
612-624-5543  
seweiher@umn.edu



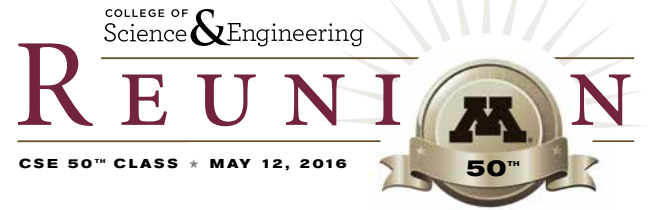
**Shannon Wolkerstorfer**  
External Relations Officer  
612-626-6035  
swolkers@umn.edu

**Office of External Relations**  
College of Science and Engineering  
105 Walter Library  
117 Pleasant Street SE  
Minneapolis, MN 55455  
csedevelopment@umn.edu  
cse.umn.edu  
612-624-5537  
800-587-3884

### TO MAKE A GIFT

To support a project you've read about in *Inventing Tomorrow* or to designate a gift for any purpose, please contact a development officer directly or call 800-587-3884 for more information.

## THE VALUE OF ATTENDING A REUNION—RETURN AND SEE FOR YOURSELF



In this day and age of social connect- edness, some may question the value of attending a reunion. Why take the time to return to a place—a physical place? Is it more meaningful to recon- nect with classmates face-to-face?

Reconnecting with the people and places of your past allows you to truly experience the richness of the pres- ent. Take in the sights and sounds of campus—alongside fellow alumni. Talk about what has changed, what continues to be and what innovations will change the world. Think about reunion as a chance to link your past with your present...and be a part of what is next.

“I truly enjoyed reconnecting and learning what my classmates had accomplished over the years,” said Ken Albrecht (ME ’58), who served on the College of Science and Engineering’s first reunion organizing committee.



▲ Touring TCF Bank Stadium.

### Campus, classmates, and camaraderie

When the College of Science and Engineering, (formerly the Institute of Technology) holds its 50-Year Reunion honoring the Class of 1966 in May, it may be the first time many class members have set foot on campus in 50 years. And while much has changed during their absence—including the name—one thing remains the same: the college holds a special place in their hearts.

CSE held its first 50-year class reunion in 2008, which honored the Class of 1958. This class also became the inaugural members of Golden Medallion Society—those alumni who have reached the 50<sup>th</sup> anniversary of their graduation. Any CSE graduate who has reached this milestone is invited to return to campus each year for the event.

Attendance for the annual event has more than doubled over the past eight years. The committee anticipates that more than 100 people will attend this year, including CSE Dean Steven L. Crouch who is a member of this year’s honored class.

The honored class is invited to a reception, which is on the Thursday evening prior to the CSE undergradu- ate commencement, where each class

member will be inducted into the Golden Medallion Society and receive a medallion.

The following day’s agenda includes presentations, breakout sessions, keynote lunch, and free time to explore campus. Following a picnic- style dinner, members of the 50-year honor class will participate in the undergraduate commencement ceremony by leading the procession.

“The graduation ceremony is a very symbolic part of reunion,” said Anasta- cia Quinn-Davis, CSE Senior External Relations Officer. “You will don robes, hats, and tassels. You will truly gradu- ate again. Alumni walk alongside cur- rent graduates—one group reflecting upon all the places they have been, the other poised to experience all the great adventures of life.”

### Reminisce, reconnect, and rediscover

Roger Haxby (ME ’58) encourages alumni to take the 50<sup>th</sup> trip back home when it’s their time. “I enjoyed meet- ing the class members, some of whom I only knew by sight, to learn of their varied careers and special passions. Literally all classmates had lived a good, useful, and meaningful life,” he said.





▲ *Classmates are recognized at a special reception.*

We urge you to come back to school—for a day—and we promise there will be no pop quizzes. Come back and walk along the very paths that you walked 50 years ago. This time you will see the majestic buildings that lined the mall when you were a student, and you will also see new buildings housing state-of-the-art technology. Sit in a classroom, just as you did 50 years ago. The topics may sound familiar—with new twists and perspectives, or the lecture may be on topics that no one could have even imagined 50 years ago.

Take time to honor your experience here at the University of Minnesota.

Let us honor your accomplishments and experiences. For all that technology gives us, it cannot allow us to smell the familiar scent of a bound book in Lind Hall, or to hold a circuit board, to truly grasp the excitement of a student who is building water supply systems in Honduras. Just come back.

If you are interested in helping with reunion planning, consider serving on the host committee. Members from the Class of 1966 are already planning for this May. Please contact Joelle Larson, director of alumni relations, [jblarson@umn.edu](mailto:jblarson@umn.edu) or 612-626-1802.

## SAVE the DATE

**50-Year Reunion and  
Golden Medallion Society**  
Thursday, May 12, 2016  
Friday, May 13, 2016

Details will be sent in a separate mailing.

## CSE alumni receive Outstanding Achievement Awards

Two College of Science and Engineering alumni were recently honored with the Outstanding Achievement Award (OAA) for 2015. The award is given to University of Minnesota graduates, or former students of the University, who have attained unusual distinction in their chosen fields or professions or in public service, and who have demonstrated outstanding achievement and leadership on a community, state, national, or international level.

Alumni receiving awards are:

**Tu Chen** (Metal Eng M.S. '64, Ph.D. '67, ChemE '67)  
Co-founder and retired Board Chairman of Komag, Inc.

Often recognized as the father of the modern disk drive, Chen is honored for his work in developing a revolutionary sputtering process to produce vastly improved magnetic thin films and disks. To capitalize on this technology, he co-founded Komag, Inc. in 1983 and directed its research and development activities. He built the company into the world's largest independent supplier of hard disk media, a pivotal development in the growth of the personal computer industry. A superlative model of the international citizen and scientist, Chen actively supports political reform and technological development in Taiwan, his home country.

**Thomas Rusch** (EE '68, M.S. '70, Ph.D. '73, M.S. MOT '93)  
Co-founder and Chief Technical Officer, Xoft, Inc.

Rusch is honored for his work in developing electron and ion spectroscopies for surface chemical characterization. To bring his innovations to the marketplace, he founded Creekside Technologies, a consulting and device company. Considered an outstanding medical pioneer, Rusch co-founded Xoft, Inc. in 1998, and led the development of a microtube X-ray system that has already treated more than 6,000 patients with early-stage breast cancer in a minimally-invasive manner. As an extraordinary business leader, Rusch combines incisive knowledge and a keen ability to focus with warmth and humor, bringing out the best in his employees.



▲ *University President Eric Kaler and CSE Dean Steven Crouch congratulate Outstanding Achievement Award winners Tu Chen and Thomas Rusch at the CSE Leadership event last fall.*

Written by SILVA YOUNG

## STARS

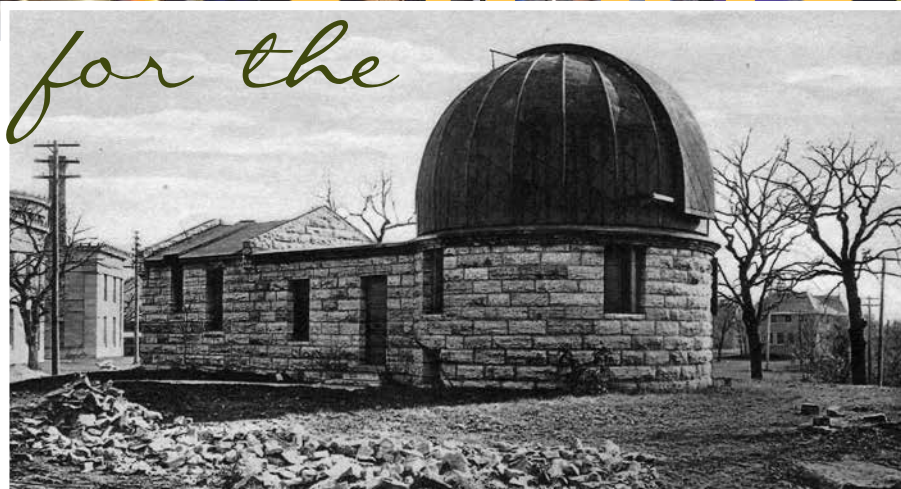
## Reaching for the

**F**or more than 50 years, public viewings at the Tate Observatory have delighted stargazers every Friday night during the fall and spring semesters. The evening begins with graduate students giving talks on comets, planetary orbits, supernovas, black holes, and more. After a few minutes of questions and answers, the group is led into a copper-green rooftop dome where they can gaze at the sky through the lens of a 120-year-old telescope.

It's one way the University of Minnesota's Institute for Astrophysics (MifA) has been bringing astronomy to the public and capturing the imagination of future scientists.

Those who have visited the observatory can view the sky through a huge black telescope that points upward like a cannon barrel. Those who haven't visited will have to wait a bit longer. The telescope has been safely secured, wrapped in plastic, while the historic Tate Laboratory of Physics undergoes a \$92.5 million renovation.

"While the telescope was never used for any groundbreaking research, it does bring people to the University,



▲ The University's first observatory building was located near the Mississippi River across from downtown Minneapolis.

it gets them interested in science, and, most of all, it is a priceless antique," said Terry Jones, CSE professor of astronomy.

### Looking forward and upward

The telescope was built by Warner & Swasey Company of Cleveland, Ohio in 1896, and the 10.5-inch, hand-ground double lens was made by John A. Brashear Company of Allegheny, Penn. Brashear was a Pittsburgh astronomer and instrument builder who gained worldwide respect with his optical elements and precision instruments. Nearly every observatory at the time purchased Brashear instruments for science and industry for their quality.

"In the late 1800s, if you were a university of any note, or aspired to be, you had an observatory and telescope," Jones said. "Ours is in very good shape."

As early as 1879, University officials discussed the need for a working observatory to instruct students, to stimulate science interest, and to contribute to astronomical knowledge. Yet, it would be 1894 before University President Cyrus Northrop recommended that the Minnesota Legislature make a \$10,000 appropriation for an observatory and telescope.

The 500-lb. telescope finally arrived on campus in 1897 at a cost of \$6,800. It was installed in an observatory located near the Mississippi River

bank behind Coffman Memorial Union. Francis P. Leavenworth, a professor of astronomy, was named the first director of the observatory and served until 1927.

Leavenworth used the telescope extensively to study double or variable stars (which include Polaris and the North Star), research that was important for the insight it provided into the mass of stars and basic questions of astrophysics.

“Making these observations were important, if for no other reason than they were recordings of phenomena that were not greatly understood at the time,” Jones said.

By the late 1920s, an alternative location was needed to house the telescope because of increasing light pollution from downtown Minneapolis.

The University Board of Regents applied for a Public Works Administration (PWA) grant in January 1937 to construct an Astronomical Observatory on top of the Tate Lab of Physics, which was completed in 1926. The cost was estimated at \$14,273 and was designed by C. H. Johnston, who designed a number of University of Minnesota buildings.

In June 1938, the University accepted a PWA grant of \$6,422, completed the observatory, and moved the telescope to its current location on top of Tate at the end of 1938.

### Friday night lights

Friday night viewings at Tate have been ongoing since the 1960s, and have grown in popularity over recent

years. “According to some reports, crowds as large as 100 people were in attendance last year,” said Melanie Beck, public outreach coordinator and astrophysics graduate student.

With responsibility for MifA’s general outreach programs, Beck says that they have coordinated activities for about 70 groups over the past three academic years.

“The majority have been elementary and middle schools, followed by Boy Scout and Girl Scout troops, Rotary clubs, Lions clubs, and astronomy hobby clubs,” Beck said. “We also participate in the College of Science and Engineering’s booth at the Minnesota State Fair.”

In addition to hosting a series of public lectures throughout the year, the MifA offers Universe in the Park, an outreach program funded by the National Science Foundation. The presentations, which are held in Minnesota area state and local parks on summer weekends, cover a variety of topics, followed by telescope viewings.

“Promoting science is awesome and making a complicated topic understandable for younger generations is a great way to engage students and hopefully encourage them to pursue a STEM field themselves,” Beck said. “I love when people see Saturn’s rings for the first time. There’s not much more awe-inspiring than that.”

*Although Friday night viewings at the Tate observatory are discontinued until renovations on Tate are complete in 2017, the MifA has teamed up with the University’s Bell Museum. Stargazers can hear presentations*



▲ Astronomy students in the 1980s.

*on astronomical topics followed by outdoor telescope observing on the first Wednesday of each month. Visit the Bell Museum After Hours program at [z.umn.edu/stargazers](http://z.umn.edu/stargazers) to learn more.*

### Join us. Support us.

In addition to bringing exciting astrophysical research to the community through its outreach programs, the Minnesota Institute for Astrophysics hosts public lectures each semester. Join us on **April 21, 2016**, when Adam Riess, Johns Hopkins University astrophysicist and recipient of the Nobel Prize in Physics, will be the featured lecturer as part of the Karlis Kaufmanis Lecture Series. Visit [z.umn.edu/kaufmanis](http://z.umn.edu/kaufmanis)

If you are interested in supporting our outreach missions, contributions may be directed to: **MifA General Fund #3773** and **Kaufmanis Lectureship Fund #3800**.


Join our networks!

 [facebook.com/umn.cse](https://facebook.com/umn.cse)

 [@UMNCSE](https://twitter.com/UMNCSE)

 [youtube.com/umncse](https://youtube.com/umncse)

 [cse.umn.edu/linkedin](https://cse.umn.edu/linkedin)

 [cse.umn.edu/flickr](https://cse.umn.edu/flickr)

 [cse.umn.edu/google+](https://cse.umn.edu/google+)

# WHAT DRIVES FRANK BATES TO THINK MOLECULAR “BAND-AIDS” COULD BE USED FOR HEART REPAIR?



How can you mend a broken heart? Imagine if you could do it with a band-aid. Soon, doctors may be able to do just that, with band-aids made from molecules that can repair tears in muscle cells and cell membranes. That vision is what drives Dr. Frank Bates and other researchers at the University of Minnesota to transform how doctors treat patients with congenital heart defects or who are recovering from heart attacks. “We could save thousands of lives each year,” Bates says, “Not bad for a band-aid.”

Read more: [umn.edu/bates](https://umn.edu/bates)



UNIVERSITY OF MINNESOTA

**Driven to Discover<sup>SM</sup>**