Breaking down barriers for success

Implicit bias. While this terminology has only been around for a decade or two, the implications of negative unconscious stereotypes toward women and other under-represented groups in science, technology, engineering, and mathematics (STEM) fields has permeated our society for hundreds of years.

Most of the women in this issue of Inventing Tomorrow have experienced implicit bias in their past, but have found ways to overcome these barriers to succeed. As the new dean of the college, it is my hope to lead more efforts to break down these barriers for our students and faculty.

In my previous job at the University of Michigan, I was a member of the implementation committee for a National Science Foundation (NSF) ADVANCE grant aimed at improvements we made was to train faculty for increasing representation and advancement for these barriers to succeed. As the new dean of the college, it is my hope to lead more efforts to break down these barriers for our students and faculty.

We are also making progress on the student front. Just 10 years ago, 19.5 percent of the incoming freshmen were women. This past fall, 30.7 percent of the incoming freshmen were women. This increase in just 10 years is outstanding and can be attributed to many of the K-12 outreach programs aimed at girls in STEM, and providing faculty role models.

By increasing the pipeline, retaining women in STEM, and providing faculty role models, we are working to minimize “implicit bias” and its insidious effects on academic careers. Our hope is that women will advance based on their merits. This is good for all of us who will benefit from their discoveries and solutions to the global grand challenges.
Making medicines work faster and more efficiently
Researchers from the University of Minnesota and Dow Chemical have discovered a new method for customizing ingredients that help oral medications dissolve in the body and be absorbed into the bloodstream faster and more efficiently. To learn more, visit z.umn.edu/fasterdrugs

Engineering the perfect soap
University chemical engineering researchers have invented a soap molecule that could dramatically reduce the number of chemicals in cleaning products and their impact on the environment. Made from renewable sources like soy, corn, and coconut oil, the soap molecule, called Oleo-Furan-Surfactant, has been patented by the University and licensed to a Minnesota startup company. To learn more, visit z.umn.edu/soapmolecule

Artificial blood vessels could help pediatric heart patients
In a groundbreaking feat, University of Minnesota biomedical researchers have successfully implanted lab-grown artificial blood vessels in young lambs that are capable of growth within the recipient. The breakthrough could prevent the need for repeated surgeries in children with congenital heart defects. To learn more, visit z.umn.edu/vessels

Did a supernova trigger solar system formation?
Using new models and evidence from meteorites, University researchers suggest that a low-mass supernova may have triggered a collapse in a cloud of gas and dust millions of years ago, which eventually led to the formation of our sun and planets around it. To learn more, visit z.umn.edu/supernova

DOE grant awarded to study materials
The University of Minnesota was awarded a $2.6 million grant over the next three years from the U.S. Department of Energy Office of Basic Energy Sciences to study materials that could improve technologies including data storage, superconductors, fuel cells, and electrical power plants. To learn more, visit z.umn.edu/doenergygrant

NCI awards grant for cell migration simulator
The National Cancer Institute (NCI) awarded the University of Minnesota an $8.2 million Physical Sciences in Oncology Center grant over the next five years to develop a cell migration simulator that will predict how cancer cells spread in the body. To learn more, visit z.umn.edu/ncigrant

Breakthrough: Mind-controlled robotic arm
University researchers have made a major breakthrough that allows people to control a robotic arm using only their minds. The research has potential to help millions of people who are paralyzed or have neurodegenerative diseases. To learn more, visit z.umn.edu/roboticarm

Map reveals genetic wiring of cellular life
University of Minnesota and University of Toronto researchers have created the first map that shows the global genetic interaction network of a cell. The work will help in searching for genetic networks that play an important role in human disease. To learn more, visit z.umn.edu/geneticmap

Grant awarded to study Parkinson’s Disease therapies
The University of Minnesota was awarded a $9.07 million grant that will be used to develop therapies for Parkinson’s Disease. Part of the funds will be used to establish a Udall Center of Excellence in Parkinson’s Disease Research, joining eight other centers around the country. To learn more, visit z.umn.edu/udall

Testing safer, stronger structures
Researchers at the Multi-Axial Subassemblage Testing (MAST) Lab can test how structures and building components hold up against the strain of enormous natural forces, from simulated earthquakes and tornadoes to soil pressure. The lab’s capabilities make it an unparalleled nationwide resource. To learn more, visit z.umn.edu/masttest

Central China caves show history of natural flood patterns
University researchers have found evidence of precipitation and flooding patterns in caves in central China, a discovery that should bolster flood forecasting and climate modeling. To learn more, visit z.umn.edu/caves

Artificial blood vessels could help pediatric heart patients
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Testing safer, stronger structures
Amy Abouelenein (ChemE ’89, M.B.A. ’96), vice president of innovation, technology and quality for General Mills Global Baking platform, says the company has created an environment for work-life balance.

After Jane Lansing (CivE ’76) entered the engineering world, she felt the sting of slights familiar to many women in male-dominated fields. Customers wouldn’t address her directly but instead talked to her male colleagues. Clients asked her to get the coffee for meetings.

When she wrote about her experiences in *Fortune* magazine last year, she expected her essay would sound like so many war stories from the past. She was astounded when many professional women thanked her for shining a light on snubs they experienced all the time.

“I was frankly blown away by the number of young, super-smart, capable women in the organization today who sent me notes to say they completely resonated with it,” said Lansing, vice president of marketing for Emerson Automation Solutions, a $9 billion global technology and engineering company based in Bloomington, Minn. “It was a little sad, too, I should say.”

At-work attitudes can create a sense of isolation at school and work for many women.

“Being in a program where there weren’t very many women, it was natural for me to look around and think, maybe I’m just not good at this stuff—I’m a woman. Maybe this field isn’t where I belong,” said Nancy Daubenberger (CivE M.S. ’97), now an assistant commissioner at the Minnesota Department of Transportation.

To today, females are making gains in STEM. Girls outnumber boys in high school pre-calculus and advanced biology classes, according to the National Academies’ Collaborative Project. Nearly as many women as men earn STEM college degrees, though not in all degree areas and not at all colleges. Some schools graduate as many women engineers as men. But most, including the University of Minnesota and many other big public universities, graduate about four men to every one woman.

Women also remain outnumbered on the job. Many women graduates decide against STEM jobs or soon drop out of the STEM workforce. According to U.S. News and World Report, citing U.S. Bureau of Labor Statistics, “women comprise 39 percent of chemists and material scientists, 28 percent of environmental scientists and geoscientists, 16 percent of chemical engineers and just 12 percent of civil engineers.”

“Numerous explanations have been offered for this discrepancy,” according to MIT News, reporting on an MIT study, “including a lack of mentorship for women in the field; a variety of factors that produce less confidence for female engineers; and the demands for women of maintaining a balance between work and family life.”

Amy Abouelenein (ChemE ’89, M.B.A. ’96), vice president of innovation, technology and quality for General Mills Global Baking platform, says finding a job in a food-based company was key to maintaining her interest. She doubts she would have toughed it out at a chemical or oil company.

“I may have said, I’m married, I’m having kids, I’m done.”

How do women succeed in engineering? Five University of Minnesota science and engineering graduates who have risen to the top of their professions say hard work, leaning on the support of other women, and finding their passion have enabled them to flourish. Here are their stories.

**AMY ABOUELENEIN: Serving the world by making food people love**

If Amy Abouelenein’s experience is any indication, women excel in engineering fields when they work for institutions that value having women in their workforce and place them in key positions.
I think women have a lot to offer in terms of their skill sets, their knowledge, and their ability to look at problems from a different point of view. Women make great scientists, great researchers, and great business leaders.

At General Mills, “there are a lot of benefits that are not specific to women, but I think in terms of creating an environment where women feel like they can do their job as an employee and do their job as a mom or spouse or daughter—we have programs in place to support those needs,” Abouelenein said. In her function, Innovation, Technology and Quality, women slightly outnumber men. “I think a lot of it has to do with senior leadership’s commitment to advancing and maintaining women in our organization and trying to understand what is necessary to retain women in the workplace,” she said.

When she was a chemical engineering student, she interviewed with companies of all kinds. “What I liked about General Mills is that it had brands I was familiar with. I grew up eating products like Betty Crocker cakes, Yoplait yogurt, and Lucky Charms. I interviewed in a lot of different industries, but the one I felt the most passion about was food,” she said. General Mills is where she went after graduation in 1989. Taking advantage of General Mills’ continuing education program, Abouelenein returned to school one year later to get an M.B.A. at the University of Minnesota Carlson School of Management. “I thought with an M.B.A. I would be a more effective business leader,” she said.

General Mills has a culture and programs that make it easier for a mother like Abouelenein to excel—mentoring programs, women networking groups, flex-work arrangements, extended maternity leave, phase-back-to-work, and on-site daycare. The company, she said, looks “for opportunities to retain women by giving them ways to develop and be challenged by doing different assignments.”

Retaining women is important. “We always want to make sure that we are living our ‘consumer-first strategy,’” Abouelenein said. “To do that, we have to have empathy for our consumer base. Women (and moms) are primary shoppers. So we have to have people who are working on our businesses and brands who are that consumer, right?”

Abouelenein said there are many reasons for companies to hire more women. “I think women have a lot to offer in terms of their skill sets, their knowledge, and their ability to look at problems from a different point of view,” she said. “Women make great scientists, great researchers, and great business leaders.”

Abouelenein recommends young women in engineering learn as much as possible about different opportunities in a company. “Be curious,” she said. “The first few years are where you build your technical foundation—learning about the business, learning the technologies, and having an impact. At General Mills in particular, we encourage people to try different types of roles, to really figure out where their passion lies.”

By the Numbers

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<tr>
<td>Percent of the U.S. workforce that are women</td>
<td>47%</td>
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<tr>
<td>Percent of women in the U.S. who work in STEM fields</td>
<td>24%</td>
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<td>Number of living female CSE alumnae</td>
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NANCY DAUBENBERGER: Building bridges

Since she was good at math and enjoyed building things, Nancy Daubenberger (CivE M.S. ’97) thought becoming an architect would be a good fit. Soon she discovered architecture had a big aesthetic component, and she enjoyed the nuts and bolts better. So she switched to civil engineering.

“’That was a hurdle—changing my major and just trying to understand what engineering was about,’ she said.
After graduation and working as a consultant for a couple years, she came to the Minnesota Department of Transportation’s (MnDOT) Bridge Office. She became an area engineer in the south Twin Cities Metro and then moved back to the Bridge Office as a planning engineer, just a few months before the deadly collapse of the I-35W bridge over the Mississippi River in Minneapolis. “It was a tragic and very challenging time for MnDOT,” she said. “But we’ve made changes in the way we do things because of what we learned from that.”

Daubenberger faced a common obstacle for women in the workplace—balancing work and family. After her second child was born and in daycare, both children would often come down sick with colds and ear infections. “Suddenly I felt like, wow, my husband and I are both missing a lot of work to take care of our children. Maybe this whole gig with trying to be a mom and an engineer at the same time is not going to work,” she said.

A supervisor gave her encouragement. “He said, ‘Don’t give up. My wife and I went through the same thing—working full-time, kids in day care, they get sick more often. Hang in there, you will get past this tough time,’” Daubenberger said. “He was absolutely right. I find myself giving that advice to young moms.”

Men still outnumber women in her field, especially in engineering and management, but that’s changing. “Over the years as I sit in meetings and look around the table, very rare is it that I’m the only woman in the room anymore,” Daubenberger said. “On the other hand, though, when I go to meet with our construction contractors, I find myself in the small minority as a woman sitting at the table with them.”

Yet it’s important to achieve greater parity. “In the science and engineering fields, we need to represent the communities in which we work and for which we provide our services and products,” she said. “We can only do a good job in advancing our field if we can bring diverse perspectives to the table.”

For women in college or just entering the job market, Daubenberger recommends finding peers for support and help in landing jobs. She suggests students connect with working scientists and engineers through student organizations of professional groups, such as the American Society of Civil Engineers.

Finally, she recommends young women build confidence through public speaking. “The more we get used to speaking in front of groups, the more comfortable we are,” she said. “It’s not about overcoming fears of public speaking then. Instead, you can focus your energy on the messages you’re trying to send.”

**MICHELE BREKKE: Aiming higher**

Michele Brekke (Aero ’75, M.S. ’77), who dreamed of becoming an astronaut, recently retired from NASA after 37 years and now works for Boeing helping to develop a commercial aircraft to carry astronauts to the International Space Station.

**MICHELE BREKKE:**

Michele Brekke (Aero ’75, M.S. ’77) was just 16 years old when Apollo 11 landed on the moon in 1969. She had been mildly interested in space previously, “but not with the passion that I watched the first moon landing. As I watched the astronauts bounding on the moon, I said, ‘I want to do that!’”

Even though NASA wasn’t hiring female astronauts then, she enrolled in the University’s aerospace engineering program. There, she was taken under the wing of Professor Helmut Heinrich, who ran a lab testing parachute designs.

“Heinrich asked if I could type. The only job he offered was secretary. I said ‘OK, even though it wasn’t what I had in mind,’” Brekke said. “Every couple of months I would remind him that I really wanted to work in the lab.”

“Later he asked if I could sew. They needed someone to construct parachutes. But that got me an actual position in the lab. Before long I was operating the wind tunnel and testing the parachutes that I was making,” Brekke said. “Just because you accept a position as secretary doesn’t mean you have to stop there. You should reach beyond your grasp.”

Heinrich also helped her find confidence in her instincts. “We were working on a parachute and he asked, I think in the science and engineering fields, we need to represent the communities in which we work and for which we provide our services and products. We can only do a good job in advancing our field if we can bring diverse perspectives to the table."
I had to get a tutor, and I had to really bust my butt to just get Cs." 

Studying hard was the hallmark of her career. "I have to honestly say, I do not believe I was ever the victim of any kind of a bias against women," she said. "Except for the astronaut position, I always got the position that I wanted. My biggest struggle was to make sure I did my homework, prepare myself, and meet my own standard."

JEANNETTE BROWN: Compounding chemicals

Jeanette Brown (Chem M.S. ’58) confounded two stereotypes of scientists—not only was she a woman but, she was also an African-American woman. 

Graduating from the University of Minnesota with a master’s in chemistry in 1958, Brown attended in an era when few women or African-Americans entered science.

In her long career as a chemist in the pharmaceutical industry, she was often the only African-American woman in her department. Yet she doesn’t complain that she felt isolated by either race or gender. A bookworm as a child, she was used to working alone, either race or gender. A bookworm as a child, she was used to working alone, she moved to Staten Island in New York, where she was one of few black kids in high school.

“I guess because I had grown up in New York with so many white folks, it didn’t bother me because I was used to being alone,” she said. “I’m an only child as well.”

With her degree in organic chemistry, she began applying for work. Showing up for one interview, “the secretary looked at me and went in to talk to her boss. She came back out and said, ‘Oh, we’re sorry. That job has been filled.’ I was really upset,” Brown said. Despite that setback, she joined Swiss pharmaceutical company CIBA, where she developed drugs for tuberculosis and coccidiosis, a parasitic disease affecting livestock. In 1969, she moved to Merck Research Laboratories. “I loved working to go, she said. “I loved working in the lab because I was in control.”

Soon, Brown found herself being a mentor to the increasing number of women coming into the company. “Being the only black woman, when young women came into the lab, I wound up being the mentor,” she said. “If they had a problem, before I knew it, I would be listening.”

After retiring from Merck, she continued teaching at the New Jersey Institute of Technology, where she also helped recruit black students to enter STEM fields and worked on science education issues in the state. Since then, she has written a book, entitled African American Women Chemists, and is at work on a second book of profiles. She has also been involved in the leadership of the American Chemical Society and has been a career consultant for the organization.

Brown advises young women entering the scientific fields to plow ahead despite the inevitable slights that will come their way. “You just got to keep going,” she said. “You can’t stop. If you stop, you’re not going to get what you want.”

“Secondly, go straight for a Ph.D. Do not stop at a master’s degree,” she said. “If you’re a Ph.D., then you’re the boss.” Finally, she recommends going to a school where “you think you’re going to be happy. The same thing in industry—make sure you find a job where you’re going to be happy, where you’re going to have friends.”

Whether you’re managing employees or recalling the old days with other retirees, good personal relationships are important, she says. “Why would we have 20 or so of us all eating breakfast together when we’re retired?” she asks. “We still like each other!”

For more females to go into engineering, you have to create a pipeline. You have to get young girls interested in science and engineering, and some of those young students are frightened by math. “I did not do those young students are frightened by math,” Brekke said. “I did not do any kind of a bias against women,” she said. “Except for the astronaut position, I always got the position that I wanted. My biggest struggle was to make sure I did my homework, prepare myself, and meet my own standard.”

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Jane Lansing (CivE ’76) had nearly completed her degree in civil engineering, with plans to build dams and bridges for the U.S. Army Corps of Engineers, when she took “the obligatory freshman programming class that I put off for years,” she said. “Then I fell in love—with programming, that is,” she said.

Her first job was working for Control Data as a software engineer writing programs to run water and wastewater plants. “Programming back then wasn’t hot or cool. I had a lot of angst about taking it,” she said. “But it was the smartest thing I ever did. It was something I loved. I think I got to where I am today because I did things I loved.”

In 1984, she decided she wanted to get into the marketing and business side of things. She found an opportunity at Emerson as a control system marketing engineer.

She felt the awkwardness of being one of the very few women in her industry. “The engineering workplace is not particularly friendly or welcoming in a way that’s natural—because it’s just not your environment. It’s an environment that’s defined by others. So you spend a lot of time figuring out how to fit into an environment defined by others,” she said. “I spent the first several years trying to fit in. But if you go through your whole career that way, you’ll end up kind of leaving part of you at home—not contributing.”

Her turning point came during a psychological interview. The analyst said she appeared to be far more committed to the goals of the organization than to her own. “The analyst asked, ‘What do you think is the profile of a leader?’ I said, ‘I think it’s exactly that, you know, committed to the organization.’ He said, ‘No, it’s exactly the opposite,’” Lansing recalls. “That was a light bulb moment. It made me understand if I am not bringing something unique of myself, I’m actually not moving the organization forward, which is good for the company. It’s also better for me.”

So she began journaling. “I needed to figure out what drove me,” she said. “What gave me energy? What sucked energy away?”

As a result, she changed direction. She took a job in Emerson’s Netherlands office as the company’s marketing director for Europe. “I just started moving down a different career path,” she said.

Lansing says it’s important for women to find their way in an organization. “There’s a lot of data that shows if you’ve got teams that are half men and half women, they’re significantly more creative,” she said. “I think women bring a sense of collaboration that is really important to innovation and problem solving.”

To help retain women, Emerson has a very active Women in STEM organization and supports industry events for women. It also has a mentoring program specifically for women.

“I mentored young women and had people informally come and talk to me. I also think women being present, being themselves, being natural in the environment is as important as formal one-on-one mentoring. I often say one of my goals is to be a girl at work—girl in air quotes,” Lansing said. “I want to wear my job like a comfortable jacket. I don’t want to be in a job that doesn’t fit me, and I don’t fit it.”

There’s a lot of data that shows if you’ve got teams that are half men and half women, they’re significantly more creative. I think women bring a sense of collaboration that is really important to innovation and problem solving.”
onnie Lu remembers the day she looked into the audience and imagined a place for herself. It happened during her recruiting visit to the Department of Chemistry at the University of Minnesota. Lu—who boasted an impressive CV with degrees from MIT and Caltech and a postdoc at the Max Planck Institute—saw many attractions to Minnesota. Two senior faculty members already did impressive work in Lu’s field of bioinorganic chemistry. One-quarter of the chemistry department faculty was female—high by national standards in a male-dominated field. She wondered if the University would be a welcoming place for a young woman who hoped to start a family some day. During her undergraduate years, Lu’s few female professors seemed to sacrifice everything for their careers. Lu hoped for more work-life balance.

When it came time for Lu to give a talk on her research, she looked into the audience and saw a young female chemistry professor—and she was pregnant. And before she earned tenure. It was visual confirmation that the department would be family-friendly. Lu decided she would be comfortable in Minnesota.

This episode represents one small anecdote in a major challenge that faces the College of Science and Engineering and all of academia—the under-representation of female faculty in science, technology, engineering, and math (STEM) fields. Today about 15 percent—or 65 women—of all faculty in the College of Science and Engineering at the University of Minnesota are female.

There has been some progress—the number of women faculty has more than doubled since 2004—but the gender gap remains in many fields. According to Christopher J. Cramer, associate dean for Academic Affairs, “attention continues to be focused on improving this percentage, and indeed on increasing the number of faculty from all historically underrepresented groups.”

“We’re definitely not the worst, but we’re definitely not the furthest ahead,” said Brenda Ogle, associate professor in the Department of Biomedical Engineering and chair of the Women’s Faculty Cabinet. “Minnesota, being a progressive state with a history of forward-thinking social change, I would hope it would be farther ahead than it is. Yet, I am encouraged by recent improvement.”

In many STEM fields, representation of women declines as aspiring academics progress through undergraduate, graduate, post-doctoral and faculty positions. “The pipeline is ‘leakiest’ from grad school to postdocs, and postdocs to first academic position,” Ogle said. “There are two primary elements there—culture and family.” Parental leave has been a prime concern of the university’s Women’s Faculty Cabinet (WFC). Founded in 2006, the WFC includes 16 members from colleges across the university and serves as a forum for issues such as equitable pay, diversity, and parental leave. It recently drafted new procedures for parental leave that will be incorporated into university-wide tenure guidelines.

Until then, departments dealt with parental leave on an ad hoc basis—often not until new parents returned to work. Some faculty brought babies to work; others would switch teaching duties mid-semester. Clearly a more uniform policy was needed. The
Brenda Ogle, associate professor of biomedical engineering, serves as chair of the University of Minnesota Women’s Faculty Cabinet.

Ogle knows first-hand the difficulties of balancing career and family. She and her husband (the CEO of a medical device company) both manage demanding careers while raising three children. In her own research, Ogle investigates mechanisms of stem cell differentiation, especially in the cardiovascular system. Her team develops replacement tissues for the heart, mostly for the new parent, “Ogle said.

For students, it’s a powerful motivator. It gives them that spark—Wow, there are other people like me. I’m not weird.”

The main impression people get from the conference—Wow, there are a lot of women here. For students, it’s a powerful motivator. It gives them that spark—Wow, there are other people like me. I’m not weird.”
CONNIE LU: Changing times

The times were changing when Connie Lu entered academia.

Lu, associate professor of chemistry, became accustomed to academic rigor at an early age. She grew up as the second of three daughters in a family that had emigrated from Taiwan. Her father, unsatisfied with the curriculum in the suburban Miami public school they attended, assigned his daughters extra math homework. “My father gave us textbooks and expected us to learn,” Lu recalls. “He wasn’t actually a great teacher, but he had high demands. I guess that’s where my problem solving skills really started.”

It paid off. The two eldest daughters both went to MIT. “I only had two female professors in the department of chemistry,” Lu recalls. “They were giants in their field, but I knew they didn’t have families. There was definitely a disconnect between how I saw my male professors living versus how I saw my female professors living.”

She was not the only one who noticed the disparity. In the 1990s, a group of women faculty at MIT began discussing their shared career challenges and prompted the university to investigate gender equity at one of the world’s premier technological institutions. A committee investigated and reported valuable new types of catalysts; potential applications include alternative fuels (CO2), may be converted into useful resources. The MIT administration embarked on a series of reforms to create a more equitable environment. The report drew national attention and sparked discussion and policy changes across academia.

Lu decided to pursue an academic career just as mindsets began to change. In graduate school at the California Institute of Technology, Lu saw female colleagues a few years ahead of her getting tenure-track jobs. “Because of that momentum, I never felt I had to break barriers,” she said. “It was changing.”

In 2009, Lu joined the faculty at the University of Minnesota. Her contract guaranteed a position for her husband, an astrophysicist. Lu’s research explores how simple gases, such as dinitrogen (N2) and carbon dioxide (CO2), may be converted into useful chemicals. Her team seeks to innovate new types of catalytic potential applications include alternative fuels or industrial processes.

She also hopes to catalyze interest in science among young women. Her department has a chapter of Women in Science and Engineering (WISE), which holds an annual workshop for middle school girls. The students conduct hands-on experiments, such as making soap, creating glowing chemicals, and using liquid nitrogen to make ice cream—then eating it. She also serves on the department diversity committee.

In graduate school at the University of Michigan, she was the first African-American woman in her microwave engineering program. The year she graduated, only six African-Americans (male and female) earned engineering Ph.D.s in the entire U.S.

She has made a commitment to ensure the path will not be so unusual to those who follow. Franklin, the mother of a high school student, speaks at schools and encourages students to imagine themselves in a profession where they can make a difference despite the lack role models among friends or family that look like them. She keenly remembers the difference that a few key supporters made in her own life, especially her advisor and research group.

“It takes 22 years to grow an engineer,” she said. “This is an expensive resource. We should support it and help it thrive. I hope in my career I can thrive and not just survive. "Thankfully, engineers are introverts," she said. "I don’t need a whole lot of people to keep me going. I’ve been fortunate along the way to meet just the right person when needed among family, friends, and my academic community.”

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Another outreach program helped open doors. She won a master’s and eventually doctoral fellowship to attend graduate school sponsored by The National GEM Consortium, a network of universities, government laboratories, research institutions and corporations. The fellowship supported students from underrepresented communities to pursue graduate education in applied science and engineering. Franklin spent three summers at the Lawrence Livermore National Laboratory, her sponsor, which gave her research experience, professional mentors who helped her identify her research interest, and the confidence to blaze a path in academia.

In 1998, she joined the Department of Electrical and Computer Engineering faculty at the University of Minnesota. That year she received the prestigious Presidential Early Career Award for Scientists and Engineers from President Bill Clinton for her research area on packaging and integration methods to combine microwave electronic circuits with optical ones in communication systems. Franklin was not only the first woman to earn tenure in her department as an assistant professor, but is also the first African-American woman to do so in both her department and the entire college.

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In graduate school at the University of Michigan, she was the first African-American woman in her microwave engineering program. The year she graduated, only six African-Americans (male and female) earned engineering Ph.D.s in the entire U.S.

Another outreach program helped open doors. She won a master’s and eventually doctoral fellowship to attend graduate school sponsored by The National GEM Consortium, a network of universities, government laboratories, research institutions and corporations. The fellowship supported students from underrepresented communities to pursue graduate education in applied science and engineering. Franklin spent three summers at the Lawrence Livermore National Laboratory, her sponsor, which gave her research experience, professional mentors who helped her identify her research interest, and the confidence to blaze a path in academia.

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In 2012, Lu and her husband had a daughter. Her department gave her a respite from teaching responsibilities for the semester and has continued to do so with other young parents. “That was a huge relief,” said Lu. “That made my life a whole lot simpler.”

Svitlana Mayboroda, professor of mathematics, encountered more than gender barriers in her early academic career. She notes that academics may face numerous barriers besides gender. Mayboroda herself encountered a few. She grew up in Ukraine at a time when an academic career seemed impossible. Her parents were educated as engineers, but went into business due to the dearth of professional opportunities. She earned the equivalents of a master’s degree in applied math and M.B.A. in finance in 2001. In those years following the breakup of the Soviet Union, opportunities in academia looked bleak.

Then a professor suggested she pursue graduate school at a far-away place called Missouri. “It sounded like the moon,” Mayboroda recalls. “It sounded like Missouri.”

Her biggest hope is that universities remove structural and social barriers to full participation. Social expectations are equal, and it is as common for a man to take off time for family as it is for a woman. “I would like to see a society in which the opportunities are equal and the expectations are equal and it is as common for a man to take off time for family as it is for a woman,” Mayboroda said. “At this point, a very important component of such efforts should be University-wide attention to spousal hiring, as well as generous policies for family leaves.”

Mayboroda said such measures will help balance the equation when it comes to gender. “The goal of the entire exercise should be to say it’s possible,” she said. “If you only underline the fact that it’s tremendously difficult and biased, we’re not going to attract anyone. We have to move to different locations to advance their careers. What should be underlined is that it’s possible and rewarding to be a woman as successful as possible and rewarding to be a woman.”

She earned her Ph.D. in math at the University of Missouri in 2005, got postdoctoral positions at several universities, and quickly advanced through her field. She had a tenure-track position at Purdue University when the University of Minnesota recruited her. At the time, the department had only one other tenured female professor. Mayboroda continued to make a mark. In 2011, she won a CAREER award from the National Science Foundation (NSF) for her work in partial differential equations in non-smooth media.

Three years later, she earned an interdisciplinary NSF award of $800,000 for her work at the interface of mathematics, physics, and engineering. More honors came quickly. The Association for Women in Mathematics awarded Mayboroda the first-ever Sadosky Award, which recognizes women in early stages of their careers. She was elected as a fellow of the American Mathematical Society. In 2016, the University of Minnesota named her a Northrop Professor, a prestigious recognition for scholars who make significant contributions in their fields.

“Mathematics, perhaps as much as other scientific fields, is often perceived as a game of the young,” Mayboroda said. “You are supposed to be continuously on track in the early years of your career. This is very difficult for women because of family factors. You cannot take three years off after graduate school and come back just as successfully.”

Much of the bias is structural: academics are expected to show peak performance early in their careers—the same stage in life when professionals start families and raise children. The attrition rate among female mathematicians shows that women are most likely to drop out of the field during these years.

Shortly after arriving in Minnesota, Mayboroda began organizing workshops for women on harmonic analysis and elliptic partial differential equations. The workshops targeted women in the early stages of math careers—the point where the pipeline is especially leaky. Nationally, women earn 42 percent of undergraduate mathematics degrees and 31 percent of Ph.D.s in math. Yet women comprise only 19 percent of mathematics postdocs and 12 percent of tenure track faculty.

“I felt extremely privileged to have been able to gather so many absolutely outstanding women in the field and to run a very powerful workshop for women,” said Mayboroda, who has organized three such events. “There are more coming along. I’m very happy to see a strong and ambitious young cohort, and I hope that the workshops have helped them a little bit.”

Her biggest hope is that universities remove structural and social barriers to full participation. Social expectations still make it more likely that women will interrupt their careers to raise families, particularly when two partners have to move to different locations to advance their careers.

“I would like to see a society in which the opportunities are equal and the expectations are equal and it is as common for a man to take off time for family as it is for a woman.”

Mayboroda said such measures will help balance the equation when it comes to gender. “The goal of the entire exercise should be to say it’s possible,” she said. “If you only underline the fact that it’s tremendously difficult and biased, we’re not going to attract anyone. What should be underlined is that it’s possible and rewarding to be a woman and to be successful in this field.”

"I would like to see a society in which the opportunities are equal and the expectations are equal and it is as common for a man to take off time for family as it is for a woman."
I her father wasn’t an engineer, Adeola Isola doubts she would have seen it as a career possibility for herself. “I probably would have become a doctor or something,” said Isola, a senior majoring in electrical engineering. “You just don’t see a lot of females in this field.” Isola’s family moved to Minnesota from Nigeria six years ago. In Nigeria, as in the United States, women are underrepresented in engineering. That’s why she was so excited when she came here. “One of the things I was so glad to see when I first got to the U was an African-American female professor, Rhonda Franklin. It really helps to see more female professors in engineering,” Isola said.

Hiring more professors who are women and/or people of color is one of many ways the College of Science and Engineering is working to diversify its historically homogeneous student body. According to Susan Kubitschek, CSE assistant dean of Collegiate Life, the efforts are bearing fruit. In the past decade, the percentage of women in majors like engineering, and chemistry that have more obvious humanitarian relevance. “When women enter CSE, that’s when the real work begins. What can we do to support them?” Kubitschek isn’t just concerned about increasing the number of women who apply and are accepted to CSE; she’s just as focused on retaining those women. A 2016 Massachusetts Institute of Technology study found that group dynamics in male-dominated undergraduate classes can discourage female students, who often end up marginalized, even patronized by their majority-male classmates.

“Recently, one faculty member came to me and said, ‘We need more women to choose this major.’ I said, ‘What are you doing to reach women?’ The first thing I did was pull up their home page. It was a photo of four white guys in a lab and the background was blue,” Kubitschek recalls. “I said, ‘Simple things like gender-neutral background colors—how about maroon and gold?—including photos of women and people of color would also help.’” Kubitschek isn’t just concerned about increasing the number of women who apply and are accepted to CSE; she’s just as focused on retaining those women. A 2016 Massachusetts Institute of Technology study found that group dynamics in male-dominated undergraduate classes can discourage female students, who often end up marginalized, even patronized by their majority-male classmates.

“Given that the University’s overall student body is 51 percent female, there is still plenty of room for improvement,” Kubitschek said. However, the encouraging trend suggests CSE’s efforts are paying off. The college’s strategy to increase the number of women graduates includes thoughtfully designed K-12 outreach, support programs, mentorship opportunities, leadership development, and more.

According to the National Girls’ Collaborative Project in 2013, just 19.3 percent of all engineering degrees and 17.9 percent of all computer science degrees went to women in the U.S. Meanwhile, women earned more than half of all bachelor’s degrees in the biological sciences. Theories abound about why.

“Some studies have suggested that women tend to be drawn to careers that promote societal good,” Kubitschek said. She believes the more engineering fields can communicate their importance in improving the world, the better. “Women really need to see how the work is going to impact, in the long run, the human condition,” she said. “That’s part of the reason there are relatively larger percentages of women in majors like biomedical engineering, industrial and systems engineering, environmental engineering, and chemistry that have more obvious humanitarian relevance.”}

**Outreach, support, mentorship**

When women enter CSE, that’s when the real work begins. What can we do to support them? This is something I’ve been very passionate about,” Kubitschek said. “Corporate America experiences some of the same issues as higher education. We want to retain 100 percent of our female students, and we’re doing whatever we can to make that happen.”
Many female students who are new to CSE are busy and stressed with classes and homework. They would like to join a student group for the connection and support, but can’t commit on an ongoing basis. The Women in Science and Engineering (WISE) Initiative was designed for these students.

“There are several great student organizations for women,” said Dorothy Cheng, scholarship coordinator in CSE and a WISE co-leader, “but not everyone can be part of them at any given time. WISE isn’t a specific group that you have to join. We offer connection and community through events. Students love that you can pick and choose—you can go to every WISE event or just one.”

WISE sponsors panel discussions, informal study groups, a book club, and other activities for CSE women who often sit in male-dominated classes and long to spend time with their female peers across the college. WISE is deliberate about “not duplicating things that are already being done,” Cheng said. “The initiative often highlights the efforts of existing student groups.”

WISE took its name from the WISE House, a Living Learning Community in the University’s Frontier Hall for female CSE students. About 30 to 40 women live in the WISE House each year.

The initiative began three years ago as a means to give female students another way “to find their community and their network,” said Kubitschek. With input from three student representatives, Cheng and WISE co-leader Madalyn Radlauer, a postdoctoral researcher in chemistry, seek to offer learning, solidarity, and networking opportunities for women across the college. WISE programs and events are developed and offered based on student feedback, including that gleaned on social media, and from a 2016 survey of female CSE students. “Students want to know more about research. They want to know more about career services—how to interview, how to write a resume. They want to connect with the professional engineers who are out there doing it,” Cheng said. “They want to hear about the experience of being a woman in science and engineering.”

Events hosted through the WISE Initiative can be as general as relieving stress at a restorative yoga class to building leadership skills at a one-day Catalyst seminar. Savereide hopes that newer students find WISE offerings as helpful as she did. From study sessions to purely social gatherings, the initiative helped her feel truly at home in CSE.

“I loved that they would email me and say, ‘Come and have free food with nice people!’ And they’d always deliver—I never met anyone at a WISE event that I didn’t like,” Savereide said. “It’s nice to meet and invite other students who you’re not super close with yet. They want to go grab appetizers and talk to other girls who like physics.” All of a sudden, you have a new friend you have something in common with and to do homework with.”

Connecting women

Coming from a community college, electrical and computer engineering senior Adeola Isola was a bit daunted when she transferred to the College of Science and Engineering. “The size of the campus, the fact that her major—electrical engineering is disproportionately male—left her without a support network, both could have led her to feel isolated. “Feeling alone makes it easy to quit,” Isola said. “Coming here and finding women who were experiencing the same things was definitely helpful.”

She did that through several student groups, including ECE (Electrical and Computer Engineering) Women in Engineering. “The support is great. We’re able to study together and to figure out problems together,” Isola said. “There were times I would second-guess myself and think that this just isn’t for me. Then you would hear from a working engineer, ‘I went through the same struggles. You’re going to get through it just fine.’”

Isola has been a member of other student groups, including the University’s Solar Vehicle Project team—an experience she calls “really cool!” But it’s the experiences with ECE Women in Engineering, including her stint as secretary last year, that have been uniquely helpful in giving her opportunities to socialize and network with other engineering women.

Isola, who came to Minnesota from Lagos, Nigeria in 2011 says she would like to use her engineering skills to help those back home. “I want to find the most efficient and best way to help the power systems back home,” she said. “I would like to find better ways to get electricity to as many people as needed in Nigeria so having electricity can become more of a lifestyle and not a privilege.”

There are five student groups in CSE that support women: Alpha Sigma Kappa, the Association for Computing Machinery for Women, the Association for Women in Mathematics, ECE Women in Engineering, and the Society of Women Engineers (SWE). According to Kubitschek, in addition to fostering connection, all are terrific vehicles for leadership development.

“Employers tell us that what they want from our science and engineering students are excellent communication and leadership skills,” Kubitschek said. “They want women, in the long run, to move into leadership roles.”

All together, the five groups serve more than 1,400 female CSE students. The largest group, SWE, has more than 250 members. “It’s an outreach and recruiting powerhouse,” Kubitschek adds, “bringing in girls from hundreds of high schools each year to learn about life as a woman in CSE. Women will find their sense of community here.”
Grace Aysta, a sophomore studying electrical and computer engineering, can attest to that statement. Aysta, who participated in one of CSE’s outreach technology camps as a young student, worked with Klaers as an outreach assistant and CSE camp counselor last summer. In that role, she researched the question of when and why many students disengage from math and science. “A lot of it happens around third grade. That’s when you start either thinking science is really cool, or nerdy and dorky,” Aysta said.

“Grittiness factor,” which is the value of persistence, of trying and failing and then trying again, as well as a growth mindset. “What we mean by growth mindset is using the approach, ‘I can be better at math’ instead of ‘I’m bad at math.’ Women are harder on themselves, and it starts very young. Math is for everyone, and we’re not perpetuating that storyline anymore.”

CSE’s newest summer day camp combines math and biology for girls and was created by associate professor of mathematics Jasmine Foo. Called “Girls Solve It!,” the academically competitive camp aimed at 11th and 12thgrade girls explores the role of mathematical modeling in treating disease. It includes hands-on experiments, lectures, and lab tours. In 2016, its first year, 32 high-achieving students were admitted to the camp—several more than it had the capacity for.

The college’s Discover STEM day camp is also designed for 11th and 12th-grade students. Last year, Discover STEM served a total of 50 students over two weeklong sessions. Aysta had attended an earlier version of that camp after her junior year of high school. Last summer, she helped run the camp and enjoyed seeing younger girls grow in similar ways.

“Girls Solve It!” is offered in partnership with the Minneapolis YWCA’s Eureka!, is offered in partnership with the Minneapolis YWCA’s. As a high school participant, the biggest thing I got out of it was seeing myself on a college campus, ” Aysta said. “In our camps, we don’t ask, ‘What do you want to major in?’” she said. “We ask, ‘What problems do you want to solve?’”

CSE’s largest and most ambitious camp, Eureka!, is offered in partnership with the Minneapolis YWCA’s Girls Inc. The five-year summer and school year program for underrepresented middle-school girls from the Twin Cities offers an opportunity to explore STEM careers and prepares them for the next steps in their post-secondary education. The program has had a 93 percent retention rate, compared to 79 percent nationally. Eighty percent of the participants identify themselves as girls of color, and one in three of the girls will be the first generation of their families to attend college. “We want to provide young students with a rich experience with, we hope, lasting impact,” Klaers said. “Our goal is to motivate students toward STEM, showing them real-world connections, and helping them see that science and engineering can be a viable career for them.”

By the Numbers

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent of CSE freshmen who were women in fall 2016</th>
<th>Number of women in five CSE student groups serving women</th>
<th>Number of CSE undergraduate degrees awarded to females in 2016</th>
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<tbody>
<tr>
<td>2016</td>
<td>30.0%</td>
<td>1,400</td>
<td>310</td>
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Outreach programs like Eureka! offer underrepresented middle-school age girls an opportunity to learn about STEM careers and how to prepare for the next steps.
AJ’s story
AI Kleinsinsowski initially followed her mother’s profession as a bookkeeper and majored in accounting when she entered college at the University of Wisconsin at Milwaukee. As she progressed through her business classes, she discovered how much she enjoyed working with the computers used in finance. Eventually, AI changed her major to computer science, receiving an undergraduate degree in engineering, rather than business.

AI chose the University of Minnesota for her graduate studies due to its extensive and well equipped laboratory. The U’s Minnesota Nano Center was particularly impressive. AI was also impressed by David Lilja, electrical and computer engineering professor, because of his prompt, thorough, and professional email responses to her abundant questions.

In her second year of graduate studies, AI received the IBM Fellowship, which provided her with financial support and a recurring internship at IBM’s Research and Development facilities in Austin, Texas. In 2004, AI completed her Ph.D. in microelectronics. She continued this research at IBM after graduating and then transitioned to a design engineering role at the Boeing Company.

AI credits the timelines of her academic progress to the scholarships she received as an undergraduate and the fellowship she received as a grad student. When she and her husband, Kevin Kleinsinsowski (CompE.M.S ’05), paid off their student loans, they initiated a named scholarship and fellowship at the University of Wisconsin and at the University of Minnesota. Initially, these gifts were meager and the redirection of their loan payment amount. As their careers progressed, they increased their level of giving and leveraged their employer’s matching funds. “I am honored to be a successful professional who inspires students and provides financial support for their studies,” AI said. “I highly value the University of Minnesota and the infrastructure they provide for their students.”

These are just a couple of examples of the philanthropic leadership our female graduates have provided. If you would like information about supporting students, please contact Kim Dockter at 612-626-9385 or email her at dockter@umn.edu.

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What Drives Your Curiosity?

Written by Olivia Hultgren

Deandra Bardell
Fridley, Minn.
Isaac Benjamin Segal Scholarship recipient

Many science and engineering students are fortunate enough to get their homework assignments done in a few hours, but things are a bit more complicated for College of Science and Engineering student Deandra Bardell. She was born with a fractured skull and suffers from cerebral palsy, a neurological disorder that weakens motor function, resulting in impaired body movement and coordination. Because of her muscular limitations, her homework assignments take much longer than that of her peers. She has to type out her work one key at a time on her computer.

The junior from Fridley, Minn., who is majoring in mathematics and minoring in computer science, has been in math for as long as she can remember. From sorting toys by color to doing puzzles with her eyes, Bardell expressed her love for problem solving at a very young age.

In high school, Bardell taught herself how to type math problems into Microsoft Word, which proved faster and more efficient than telling other people to write out the solutions for her. After being accepted to the University of Minnesota, Bardell decided she needed something more powerful. She adapted her own equipment for her computer and started using LaTeX, an advanced application designed for processing scientific documents.

Despite being so bright, one of her biggest challenges is convincing others of her intelligence. She constantly feels the need to prove that she belongs at such a prestigious school, especially among her fellow students. “Being at a large university, my peers are always changing,” Bardell explains. “Class sizes are big. With the constant changes, it’s hard to be a part of a group long enough for them to see past my disability and get to know me.”

Getting around the University’s sizable campus is a significant challenge for Bardell, who uses a wheelchair. However, her family makes sure she gets to classes every day on time. “They’ve been with me every step of the way,” Bardell said. “They have and continue to sacrifice so much for me. There’s no way I can ever pay them back. I wish I could.”

Even though she is limited by the time constraints of coursework and transportation, Bardell takes 12-14 credits per semester. She plans to graduate in Spring 2018, and she is not sure exactly what she wants to do after graduation. Finance, data analysis, and software development are merely a few of her interests, and she also expresses intrigue in the fields of healthcare and innovative technology.

As Bardell admits, even though it may take her five years to graduate because of her needs, she never loses sight of her goal and dream of joining the work world. She is thankful for the Isaac Benjamin Segal Scholarship that helps her financially, and she is grateful to her scholarship donors for giving her incentives to learn and grow. “It’s motivation and inspiration to keep working hard,” Bardell said. “I understand the late Isaac Benjamin Segal absolutely loved math and published work as an undergraduate. He was also passionate about giving everyone opportunities, regardless of circumstance. In some small way I hope to help his spirit live on.”

“All my life I’ve had people, even experts, tell me and my family ‘no’ and that I’d never be able to do anything,” Bardell said. “They see my disability instead of my abilities. I think my biggest accomplishment is refusing to listen or accept what people say my life will be. I’ll prove them wrong.”

CSE mathematics student Deandra Bardell, who lives with cerebral palsy, has overcome many challenges with the help of her family.
Four CSE alumni receive Outstading Achievement Awards

The University of Minnesota Board of Regents recently honored four College of Science and Engineering alumni with the Outstanding Achievement Award (OAA). The award is given to University graduates, or former students, 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. The alumni receiving awards are:

**John Bowers (Physics ’76)**
Professor, Department of Materials and Electrical and Computer Engineering
University of California-Santa Barbara

Considered an expert in the fields of electronic devices, device physics, and materials, Bowers is honored for his accomplishments in optoelectronics, including monolithic integration and coupling design for very different semiconductor materials. In his groundbreaking research, he has made important strides in integrating photonics with silicon semiconductor technology in order to add substantial new functionality to today’s computer chips.

**Bruce KenKnight (ME ’84, EME M.S. ’91, Ph.D. ’97)**
Vice President, Emerging Therapy for Heart Failure
LiveNuo

KennKnight, a noted biotechnical medical devices innovator, is honored for his pioneering devices and therapies. With nearly 150 patents and 50 peer-reviewed publications related to innovative medical devices and therapies for cardiac rhythm management and heart failure, KenKnight’s work on fibrillation and defibrillation contributed to the fundamental understanding of the topic and played a significant role in expanding Boston Scientific’s product line.

**Gary Brudvig (Chem ’76)**
Chair, Department of Chemistry
Yale University

A pioneering researcher, Brudvig is recognized for his contributions to our understanding of the oxygen-evolving events in plants and in artificial photosynthetic systems, and for his extensive service contributions to the scientific community and to the New Haven Teachers Institute. With solar energy conversion as the focus of his research, Brudvig has made highly significant contributions to understanding the molecular details of photophysics and the development of new oxygen-evolving catalysts.

**Bradley Peterson (Physics ’74)**
Professor Emeritus, Department of Astronomy
The Ohio State University

Peterson, a well-recognized leader in research, departmental stewardship, and NASA community service, is honored for developing and using the technique of “reverberation mapping” to determine the structure of the inner regions of quasars and their supermassive black holes. Quasars are the most luminous objects in the universe and can outline entire galaxies like our Milky Way, with its 100 billion stars. He has demonstrated leadership through his career at Ohio State as well as in the U.S. astronomical community.

Two CSE alumni honored with UMAA’s Alumni Service Award

**Robert Graber (CSE ’86) and Charles Lo (ME ’70, M.S. ’72, MBA ’93)** have been awarded the University of Minnesota Alumni Association’s Alumni Service Award, which is given to University of Minnesota alumni by the Board of Regents recognizing their service to the University or its schools, colleges, or departments; or service to the University of Minnesota Alumni Association.

Graber is a former chair of CSE’s Alumni Society Board. He led the restructuring of the board to align more closely with the needs of the External Relations office. He currently serves on the executive committee. He also has been a member of the Solar Vehicle Project Advisory Board helping Architecture and Engineering wherever he is needed. He served as a member of the CSE Campaign Cabinet and Steering Committee, students secure funds and in-kind support, space to build the vehicle, and provides ongoing advice to group members. He is an enthusiastic CSE supporter.

Lo is a dedicated volunteer who works to improve the experience of CSE students and alumni. He volunteers his services full-time to the Department of Mechanical Engineering wherever he is needed. He served as a member of the CSE Campaign Cabinet and Steering Committee, students secure funds and in-kind support, space to build the vehicle, and provides ongoing advice to group members. He is an enthusiastic CSE supporter.

CSE grad receives UMAA U40 Alumni Leader Award

Rebekah Feist (Chem ’02, EE M.S. ’04, Ph.D. ’07) has received the University of Minnesota Alumni Association’s U40 Alumni Leader Award. The award is given to a graduate of the University of Minnesota, age 40 or younger, who has excelled in a career or public service.

A three-time graduate of the University of Minnesota, Feist, 36, has dedicated her career to addressing one of today’s most critical world challenges—discovering alternative, renewable energy sources.

Her career with Dow Chemical Company began in 2007 as a research scientist with Dow Solar where she helped develop the Dow POWERHOUSE solar shingle system. Commercialized in 2011, the system provided the world with a new renewable energy option. Since September 2014, Feist has served as a Core Research and Development Strategy Leader, where her responsibilities touch on solar energy, photovoltaics, alternative energy, and personal care. She is an innovator in the field of photovoltaics (the conversion of solar energy to electricity), with more than 25 patent applications, in addition to more than 25 publications.

**Plan to attend the 50-Year Reunion and Golden Medallion Society Event in May**

Mark your calendars for the College of Science and Engineering’s Class of 1967 50-Year Reunion on Thursday and Friday, May 11-12. If you graduated in 1967, this is an opportunity to catch up with classmates, reconnect with faculty, and get a look at new initiatives, innovative research, and the students of today.

On Thursday, May 11, alumni who have marked the 50th anniversary of their graduation are invited to attend an evening reception that will feature induction into the College of Science and Engineering Golden Medallion Society. Those alumni who were previously inducted into the Golden Medallion Society, which includes the Class of 1967 and earlier, are invited to attend the all-day reunion on Friday, May 12. Those attending will participate in tours, discussions, lectures, and have free time to explore campus.

Members of the Class of 1967 will be invited to join the academic procession during the 2017 College of Science and Engineering commencement ceremony later that evening on May 12.

Watch your mailbox for further details. Information will also be posted on our website at cse.umn.edu/50reunion.
In order to move forward, it’s good to look back to see how far women faculty have advanced in the College of Science and Engineering. Even though change comes slow, the early female faculty helped to break barriers, overcome stereotypes, and chart a new course for women to be successful in science and engineering.

Before CSE (then called the Institute of Technology) was formed, one of the earliest women faculty members, Lillian Cohen, was appointed to the Department of Chemistry. She was the first woman to receive a doctorate in chemistry from the University of California-Berkeley. Before coming to the University, she was a research associate scientist at Lockheed Missiles and Space Company. She joined the School of Mathematics in the mid-1960s as an associate professor of mathematics. She became a tireless advocate for equality when women’s opportunities were more limited and the pay gap was wide. Today, the Charlotte Streibel Equity Award annually recognizes a University faculty or staff member of outstanding dedication to the advancement of women.

In 1964, Gaal joined the School of Mathematics as a lecturer. She was promoted to an associate professor in 1970 and served in that capacity until 1998.

Another early female faculty member was Phyllis S. Freier (1921–1992) who spent most of her career in the School of Physics and Astronomy. After receiving bachelor’s and master’s degrees in physics, she worked at the Naval Ordnance Laboratory in Washington D.C. during World War II. After the war, she resumed her doctoral studies in physics at the University, working with Edward Ney and Frank Oppenheimer studying cosmic rays using high altitude balloons. She became the first person to see tracks in nuclear emissions.

Freier received her Ph.D. in 1950, and worked as a research associate in the physics department. At the time, the University’s nepotism policy prevented her from joining the same department in which her husband, George Freier, taught. In 1970 the University relaxed its nepotism rules and appointed her an associate professor. She achieved full professor in 1973, continuing her work until her retirement in 1990.

Changing times

Things began to change after Roberta Humphreys was hired as an assistant professor of astronomy in 1972. Humphreys, who is CSE’s longest-tenured female faculty member, rose to the rank of full professor and set a college milestone by becoming the first woman to be named a Distinguished Professor. She also became associate dean for academic affairs in 2002. But before Humphreys was named to the position, Sally Kohlstedt was hired as associate dean in 1989. Her specific charge was to attract more women to the technology fields. At the time, only 6 percent of the college’s faculty were women. Kohlstedt served until 1995. She is now a professor in the college’s History of Science and Technology program.

Now nearing retirement, Humphreys says women have been encouraged since the 1960s to pursue science and engineering degrees and there is more support for those women. During Humphreys’ tenure as associate dean, she began meeting with small groups of women faculty to create a network where they could voice their issues and concerns.

“I initiated a number of activities that included lunches, social events, and bringing in speakers,” Humphreys said. “Some women would get involved, others would say they didn’t need a support group. Still our goal remained to network and retain women in the college.”

Despite the barriers and challenges she encountered during her early days in the college, Humphreys never let anyone stop her from pursuing her goals. “Years ago, when I came to the University, it was a different world with different standards. White men dominated the college and there was a lot of resistance in accepting female faculty. For example, in 1980 when my son was born, there was no maternity leave, and there were not many daycare options. Yet, you told yourself you had to be better. You had to be better than the men or you didn’t make it. That’s the way it was,” she said.

Numbers still unbalanced

A total of 431 CSE faculty members, today are 65 women, or about 15 percent. The number of women faculty has more than doubled since 2004, but some fields remain stubbornly unbalanced. According to the National Science Foundation, women earned about half of all bachelor’s degrees in science and engineering in the U.S. between 2004 and 2014. Yet, in 2014, they earned only 23 percent of engineering Ph.D.s and 21 percent of computer science Ph.D.s.

“The good news—there is a larger pool of women entering the science and engineering fields,” Humphreys said. “At the end of the day, the more women we can recruit to these fields, the more will stay to graduate school, and those eventually will become tomorrow’s faculty.”

The slow integration of women faculty in CSE has been a historic problem. As men flooded back into the workforce and academia after World War II, the number of women faculty dwindled to zero in the college. It would not be until 1964 that the next woman was hired, when Marian Pour-El joined the School of Mathematics, followed quickly by two more women, Charlotte Streibel in 1966 and Lisl Gaal in 1970. Pour-El (1928-2009), who earned a master’s degree in mathematics and a Ph.D. in mathematical logic from Harvard, served on the School of Mathematics faculty until her retirement in 2000. Her research interests included computability and functional analysis, and applications to physical theory.

The number of women faculty in CSE has grown slowly.
What if we could make better medical decisions that would improve health outcomes and save costs? Diana Negoescu, assistant professor of industrial and systems engineering, is developing mathematical models to learn how disease evolves in patients. Using data from available patient outcomes, Negoescu simulates, optimizes, and evaluates ways to treat chronic disease. “Using tools that predict outcomes and quantify competing risks will help physicians prescribe the most efficient and effective treatments specific to their patients’ needs, saving healthcare costs, and improving patient outcomes,” she said.

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