

2020 - 2021

ANNUAL REPORT



UNIVERSITY *of*
DENVER

DANIEL FELIX RITCHIE SCHOOL
OF ENGINEERING & COMPUTER SCIENCE

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A Note from Dean Sabick



It is good to be back! The beginning of the 2021-2022 academic year has been marked by an unmistakable feeling of optimism throughout the Ritchie School and across the University of Denver campus. We are in person, on campus, and interacting authentically with one another again. There is conversation and laughter in hallways that have been empty for over a year. The enthusiasm of being back permeates faculty meetings and is evident in the classroom. What were once routine interactions are now a cause for gratitude in our campus community.

As Dean of the Ritchie School of Engineering and Computer Science, I have the privilege of leading this outstanding organization at this transformational time during its history. We are growing and adapting to prepare computer scientists and engineers to address the needs of a rapidly changing society. We have updated our curricula and added new programs in emerging fields. One thing that has not changed is that we are motivated by our institutional mission – to be a great private university dedicated to the public good. As we continue to grow and evolve, I assure you that the Ritchie School will always be student focused and committed to our mission. I hope you will continue to follow our progress and show your support for our outstanding students, staff, and faculty.



Our goal is to develop students into ethical leaders who cannot only innovate, but who can anticipate the effects of the technologies they develop on society. Ritchie faculty members demonstrate the same skills we are developing in our students. They work with students to develop socially assistive robots to improve the quality of life for people suffering from Alzheimer's disease. They bring diversity-focused material into first year computing classes. They develop enhanced security for next generation smart grids using quantum computing and improve the function of artificial joints. They drive ethical innovation for the public good.

While the last year was difficult, I am grateful to the dedicated faculty and staff who persevered through stress and uncertainty. We not only survived, we thrived, celebrating faculty promotions, research grants, teaching awards, and well-deserved retirements. I am also grateful for the continued support of our industry partners, alumni, donors, and friends. Your commitment to our students and faculty resulted in a successful fundraising year for our School under incredibly difficult circumstances. Thank you!



A handwritten signature in black ink that reads "Michelle B. Sabick". The signature is written in a cursive, flowing style.

Ritchie School Leadership Team

Dr. Michelle Sabick
Dean

Dr. Haluk Ogmen
Senior Associate Dean

Dr. Breigh Roszelle
Associate Dean

Ms. Suzanne Abler
Assistant Dean

Dr. Chris GauthierDickey
Chair, Computer Science

Dr. David Wenzhong Gao
Chair, Electrical & Computer Engineering

Dr. Peter Laz
Chair, Mechanical & Materials Engineering

Dr. Scott Leutenegger
Director, Justice Equity Diversity & Inclusion

Dr. Kimon Valavanis
Director, Research and Innovation

Mrs. Tali Thomason
Director, Marketing & Communications

PROMOTIONS

Michael Caston

Promoted to
Professor of the Practice

Dr. Goncalo

Martins

Promoted to
Teaching Associate Professor

Dr. Jason

Roney

Promoted to
Teaching Professor

AWARDS

Tim Bouraoui

KEEN Entrepreneurial
Mindset Award

Ryan Dunagan

Student Service Award

Mackenzie Looney

ECE Chair's Award

Declan Kahn

CS Chair's Award

Malak Rafik

MME Chair's Award

Lexxi Reddington

Graduate Student
Scholar Award

William Robertson

Student Service Award

Mbidi Santos

Graduate Teaching
Assistant Award

Jordan Smith

Undergraduate Student
Scholar Award

Renée Carvalho

Dean's Award

Justin Huff

Staff of the Year Award

Dr. Daniel

Pittman

Teacher of the Year Award

Dr. Paul
Rullkoetter

Scholar of the Year Award

Dr. Susanne
Sherba

Citizen of the Year Award

Tali Thomason

Dean's Award

EQUITY IN STEM PROGRAM CULTIVATES POTENTIAL

by Nika Anschuetz

From their first weeks on campus until their last, Sydney Young (BS '21), Esabella Irby (BS '21) and Margarita Soltero Gutierrez (BS '21) found plenty of academic support from the University of Denver's Equity in STEM (E-STEM) program. Without that support, they might have opted for other fields or even left the University entirely, convinced that higher education wasn't for them.

Instead, they graduated in June, ready to take on the world with newly minted degrees that position them for promising careers in computer science, engineering and health care.

Created in 2017 to address the inequities facing many first-generation college students from underrepresented groups, E-STEM serves roughly 100 students in four cohorts each year. Young, Irby and Soltero Gutierrez were among the first cohort, numbering more than 20 students, to collect their diplomas at summer Commencement ceremonies.

According to E-STEM director Anthea Johnson Rooen, the program enlists a holistic approach to reducing and removing social and academic barriers. "It's not only about graduation, but it's about finding their niche—[it's about] when they start connecting and when they start to realize their own potential," Johnson Rooen says.

When Young, Irby, and Soltero Gutierrez look back on their experience, they note that their first year was the most challenging of all. That's a common sentiment among E-STEM participants, and that's why the program emphasizes a student's first year at DU, striving to help them transition into higher education and navigate the academic and social challenges associated with work in the STEM disciplines (science, technology, engineering, and mathematics). With these challenges in mind, the program helps students form good study habits, connect with professors and find community with one another.

It begins the first week that participants step on campus with a pre-orientation experience called "Bridge Week," where students meet others in their cohort.

"As a first-year [student], you definitely need that kind of support," Young, who majored in computer science, says. "If you don't have that kind of support group, it's more difficult to get through STEM and want to keep going through it."



Sydney Young



Anthea Johnson Rooen



Margarita Soltero Gutierrez

For the first E-STEM cohort, Bridge Week offered the opportunity to build lasting relationships with students who shared their hopes and misgivings and who supported each other through the inevitable difficulties. Young and Irby, for example, found themselves in the same 8 a.m. computer science class, and from there, formed an unbreakable bond. “We took every computer science class together so we wouldn’t fail,” Irby says. “If someone didn’t understand something, the other person did.”

An intentional community built on inclusion and accessibility, Irby notes, isn’t found on every college campus. “Quite a few of my friends [at other institutions] have gone into the sciences. I can tell the difference from the support system I had compared to the support system they had,” she says. “They were really on their own. I had a friend who dropped out, because he didn’t have a support system and didn’t think he could do it. He was afraid to ask for help.”

Before enrolling at DU, Soltero Gutierrez says, she described herself as passionate but shy. Through E-STEM, she found her voice.

“E-STEM is not just checking a box of helping a student get through college,” Soltero Gutierrez, who graduated with a degree in biology, says. “We’re helping this student with their personal life. A lot of students will go through personal things that will affect their studies. We are helping students as a whole.”

It isn’t just a sense of belonging and community that sets the E-STEM program apart. Students credit Johnson Rooen’s approach to mentoring with the program’s success.

“She told me, ‘You are the living and breathing entity of your ancestors’ wildest dreams,’” Soltero Gutierrez recalls.

The E-STEM program’s holistic philosophy grows out of Johnson Rooen’s formative experience in building student communities. That dates back to 1992, when she was a hall director at the University of Colorado Boulder. Since then, she has put her observations and experiences to work creating the kind of community that keeps students engaged and primed to meet challenges.



Esabella Irby

"It's about ... really building their confidence," she says. That requires giving students the resources to solve problems. "You belong here," she tells them. "You're going to be the one at these higher levels doing problem-solving, doing politics, affecting change. It's important here."

Programs like DU's E-STEM address social and market realities. The need for diverse students in these disciplines is growing, particularly if they are to reflect the society they serve. As the U.S. Census Bureau reports, 40% of Americans identify with a race or ethnic group other than white.

E-STEM students bring different perspectives to the classroom and laboratory, Johnson Rooen says, adding that their lived experiences are a significant asset to solving real-world problems. "Because they are there and because of what they know and because of what they see in the communities they are in, they are able to say, 'Hey, wait a minute. This might not work in 'X' community,'" Johnson Rooen says.

RITCHIE SCHOOL ALUM HAYDEN WILSON GEARS UP FOR THE FIGHT AGAINST COVID-19

by Tali Thomason

When Hayden Wilson graduated with his Master of Science in Mechanical Engineering in 2018 he couldn't have anticipated the global pandemic that would impact our world just two years later. Nor did he know the important role he would play in keeping Americans safe.

Wilson joined Outdoor Research as a Design Engineer in December of 2018 as it came time to for them to build a new production plant in Los Angeles.. At the time, Wilson's work focused on technical outerwear with an emphasis on tactical and military applications. Wilson headed to the Seattle headquarters to learn more about operations and best practices before opening the Los Angeles Factory.



In February 2020, Wilson took a trip to Milan for a tradeshow and that is when COVID-19 hit. Wilson and his supervisor returned to the United States as quickly as possible. "At that time, it still was not being taken seriously, here in the US. So we actually ended up shutting our factories down to keep everyone safe as more information became available" said Wilson. "And then I moved back up to Seattle for what initially was going to be a couple of weeks or potentially a month, and then ended up staying up there for around seven months as we got into the medical space."

Wilson elaborated, "you can somewhat think of it as two separate business units and objectives, one of which is the commercial side, so everything you'd see at REI, or on our website, and then we have a large government contract business. We provide military apparel and equipment. And that's what I've been involved with from the beginning. That's what we were opening in Los Angeles, more domestic manufacturing to meet those government contracts. When COVID broke out the need for fabric face coverings became a need for bases and other military locations. So, we started developing that product with a non-medical intent. And then from there, we had a lot of latent capability, given that we were a domestic manufacturer with a strong engineering team, and we had a close relationship with the domestic supply chain. We were aware of the critical shortage of medical PPE specific surgical masks, and N95 respirators, and began looking into how we could help."

Over the next several months, Outdoor Research invested in the specialized machines, materials, and personnel needed to produce medical products and achieved the first FDA Emergency Use Authorization for a surgical mask that could be used in healthcare settings. Shortly thereafter, Outdoor Research brought to market an N95 respirator authorized for use in healthcare settings under CDC/NIOSH Public Health Emergency approval. "What we did not realize as we began this project is that creating a product that meets the performance specifications is one thing, but we had to fully develop quality systems able to meet strict regulatory requirements. That is where the bulk of my efforts were focused," said Wilson.

While the situation was high-stress Wilson was inspired by how their team really rose to meet the needs for protection from COVID-19. There was also a need for Wilson's unique experience in the field of medical devices that he got while he was doing research with Dr. Chadd Clary. "Hayden has always demonstrated strong technical skills and a desire to learn," Clary said. "It's been great to see him translate those skills onto a very pressing, real-world problem so early in his career. When your skill set aligns with a desperate need, it opens the door to accomplish great things, and he has done that."

Wilson has returned to live in the Denver area after getting the plant and production into a sustainable flow. Wilson enjoys continuing his work with Outdoor Research while enjoying the outdoor playground that is Colorado.

DR. MATT GORDON LOOKS BACK AT HIS DECADE AS CHAIR OF MECHANICAL & MATERIAL ENGINEERING

by Tali Thomason



In 2011 Wikipedia celebrated its ten-year anniversary. Chromebooks made their debut, Snapchat was founded, and the last Oprah Winfrey show aired. That same year, Doctor Matt Gordon joined the Ritchie School of Engineering and Computer Science at the University of Denver. Gordon began his DU faculty journey as Chair of the Mechanical and Materials department. After ten impactful years in that role, Gordon has stepped down as chair and we got a chance to catch up with him.

What made you decide to step down now?

I always said I wasn't going to go more than ten years. I really think, especially in positions like this, that it's not good for the person, the institution, or the department to stay static. Everything gets stale.

What were some of the biggest changes in your time as Chair?

I knew we did well, but we did really well. When I started, we were graduating about 13 graduate students a year in MME. Now we've almost quadrupled that. We've also had growth in our faculty and staff and research productivity. We've consistently promoted our faculty. Mechanical and Materials Engineering faculty and staff have also won about half of the Ritchie School awards for the last decade.

You were instrumental in bringing Tau Beta Pi back to DU. What motivated you to do that?

I guess the closest to my heart is Tau Beta Pi (TBP) honor society because I had a very good experience with TBP as an undergrad when I was Chapter President. I got lucky. I was chapter president, the 100th anniversary year of Tau Beta Pi and we had kind of a special conference. There were big speakers of the day, Isaac Asimov and Lee Iacocca to name a few. TBP called us a few years ago when the National Convention was in Denver. It took some work, but it was the right time and they reinstated the University of Denver chapter [it had gone dormant in the 70s]. Tau Beta Pi is all engineering disciplines. I think it helps us celebrate everything we're doing and not get so micro-focused on academics. That's one thing I really like.

You have seen a lot of Senior Design Symposiums in your lifetime. What Senior Design Project stands out to you most?

I don't know if there is actually an individual project that stands out to me. For me, it's more seeing the evolution of our program. I mean, there are one-minute pitches, those are great. I can't remember exactly when we added those. But I think that was a huge addition. Then, of course, the interactions during the symposium with alumni, faculty, industry, and our students. I think they just love it. The students are so vested. And for us to be sure to give them an opportunity to share with lots of people, I think it's just so important. I think that's probably what we're doing best.

What advice do you have for the incoming Chair?

My advice is don't try and take it all on yourself. There are so many great colleagues and resources, leverage them.

FIRST COHORT OF GRAND CHALLENGES SCHOLARS GRADUATES

by Lorne Fultonberg



Oli Hassan knew she had a tough decision to make. On the one hand, there was her dedication to the environment. Growing up oceanside in Miami, she recognized the importance of water and the devastating effects of pollution. She wanted to do something about it. On the other hand, there was the University of Denver, which boasted a brand-new engineering building, a beautiful campus and access to rock climbing, but lacked an environmental engineering program.

"I came here because I loved this place," Hassan says, acknowledging that her decision required sacrifices. "I had to give up doing something I really love." That changed when the Grand Challenges Scholars Program (GCSP) came along.

As a member of the program's seven-student inaugural GCSP class at DU's Ritchie School of Engineering and Computer Science, Hassan found she could pursue her passion after all. With its highly personalized path to graduation, GCSP provides an opportunity to approach the world's next big problems with a wide-angle lens. Breigh Roszelle, a teaching associate professor and the Ritchie School's associate dean of undergraduate studies, says the program is a more accurate representation of what students could encounter in the real world. "I think when people think of engineering, they think, 'Oh, you're really good at math,'" she says. "We like the idea of a holistic engineer. There are so many aspects of engineering and design outside of making a product." The National Academy of Engineering created its grand challenges program in 2008 with a goal of making a more sustainable, secure, healthy and joyful world. The Ritchie School hopped on board in 2017, building a five-pronged syllabus that includes:

- an interdisciplinary curriculum that encourages coursework outside of the Ritchie School
- entrepreneurship education and experiences
- a global focus, either through study abroad or Engineers Without Borders
- community service
- research related to one of 14 Grand Challenges issue areas, ranging from building smart cities to improving medicine to enhancing the efficiency of solar power

For Hassan, that topic was improving access to clean water. In the summer of 2019, she traveled to the Dominican Republic to help underserved communities construct water-filtration and sanitation systems. Later that year, she took her research to London, representing DU at a Grand Challenges summit, networking with students and professionals from across the globe, with whom she stays in touch. "It was cool to work with universities all over the world and have those connections," Hassan says. "It's probably the biggest impact of my college career."



Jordan Smith, meanwhile, zeroed in on engineering better medicine. With his research, which he started as a sophomore, Smith hopes to help medical professionals catch neurodegenerative disorders like Parkinson's disease earlier. Beneficial as his time conducting research was, Smith's experiences outside the lab proved just as critical to his education.

"Most engineering majors don't study abroad in Belize and Vienna or found an after-school program for STEM education or get their leadership studies minor," he says. "All of these experiences have been teaching me how to deal with different types of people, different groups, how to tackle different challenges."

How students take on those challenges, Roszelle says, is largely up to them. The autonomy students receive to pursue their interests is one of the program's hallmarks. Another is a focus on equity for women and students of color. GCSP, for example, enrolls a higher percentage of female students than many entire engineering and computer science programs.

Those outside of the GCSP still reap the benefits of the program, Roszelle says. A tight-knit student body means the GCSP cohort is frequently partnering with classmates on projects, research and initiatives.

"This is a class of trendsetters," Roszelle says of the scholars. "If they do something, they do it big. They definitely have the attitude of 'I'm going to do this, and I'm going to do it right.'"

DU's first cohort of scholars will take a number of different paths. Hassan is applying for jobs in water and waste management engineering. Smith will stay with DU to pursue a master's degree in systems engineering while working a job at Lockheed Martin.

No matter their next steps, Smith says his cohort will be forever bound by the ideals that brought them to the program in the first place. "I know everyone in the Grand Challenges program cares about something — something outside of getting their degree," he says. "Grand Challenges adds that idea of 'you are not a calculator, you are an innovator,' and I think this program is the key starting point to obtain those skills."

CAROLINE CREIDENBERG (BS '17) KEEPS WEDDINGS GOING DURING THE PANDEMIC

After graduating Caroline Creidenberg began work as a software engineer but the culture of the industry wasn't a fit. After researching female-dominated industries Creidenberg found a need for fully online wedding planning and built a platform to meet the need. When the pandemic hit, Creidenberg's company, Wedfuly, found itself in the spotlight with their virtual wedding services. Wedfuly has been featured in national media including the Today show. Now couples have an easy choice for planning their weddings whether they're online, hybrid, or in-person.



DU INNOVATION LABS MAKE FACE SHIELDS TO FIGHT CORONAVIRUS

by Lorne Fultonberg

In just 30 seconds, a laser cutter carves up a sheet of polycarbonate material. Isaiah Silva fastens the transparent barrier to a piece of plastic that fits the forehead. As a final step, he snaps an elastic piece on the back, similar to an adjustable baseball cap.

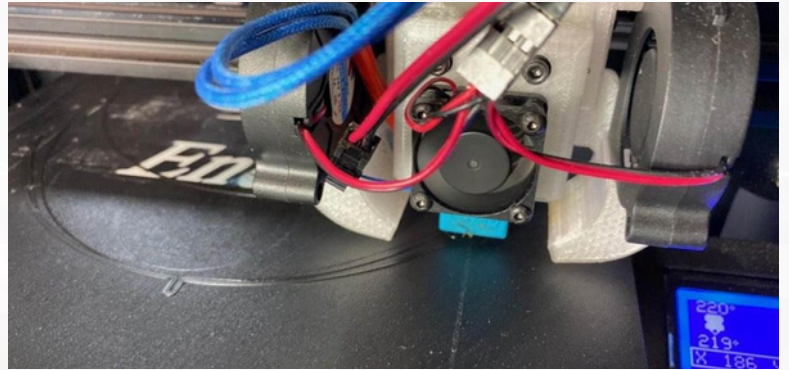
The finished product is a face shield, ready to protect people on the front lines fighting the coronavirus pandemic. With the University of Denver's resources, Silva (BS '19) and his team of students and alumni entrepreneurs can create 200 pieces of personal protective equipment every month.

"It was very clear that this is something that needed to happen," says Silva, an operations manager at the Innovation Labs at the Ritchie School of Engineering and Computer Science. "It's a really terrible event that's happening. But at the same time, I see this as being something that creates a lot of good."

Using a design released by the National Institutes of Health, Silva and his colleagues produced 50 shields at the end of April, which they are distributing to the "second responders" staffing nursing homes. DU's Knoebel Institute for Healthy Aging has helped identify recipients who need the shields most.

Silva first got to work last month, using personal equipment from his startup company, Atomata. "Now," he says, "DU is leveraging our resources, and I'm able to do way more than I ever could [on my own]."

DU faculty members Michael Caston and Kerstin Haring have facilitated the use of the University's 3D printers, which have been instrumental in growing the effort as the pandemic stretches on.



"I think the innovation lab is prepared to at least serve the DU community in terms of the needs of PPE production. Isaiah has put in best practices and a lot of different software systems that help us expedite our progress. I'm really impressed with what he's done."

Also leading the charge are several DU students and alumni Ben Niesen, Jacob Goldman, and Rob Paddock. Goldman and Paddock are using the equipment from their startup company, Ahead Wind, to expedite production.

As the pandemic progresses, Silva says the team may shift its approach, recognizing that demand could shift to products other than face shields. But right now, Silva is focused on operating as a stopgap for the supply chain until it's able to mass-produce the items he's creating at his home and on campus. When he gets stuck, Silva trades ideas with a network of similarly minded people at institutions across the country. In addition to physical distancing and wearing a mask, Silva says, 3D printing is a way he can contribute.

"It's really just a matter of digging in and identifying what you can do," he says. "For us, I know that we are exceptional at prototyping and rapid manufacturing. It's awesome that we're in a position where it's not just DU persisting at a time like this, it's all the universities."

Student Profiles

UNDERGRADUATE PROFILE

Total Enrollment 563

ENROLLMENT BY MAJOR

- Applied Computing 14
- Computer Engineering 50
- Computer Science 221
- Electrical Engineering 53
- Game Development 31
- Mechanical Engineering 153
- Exploratory (undeclared) 41

INTERNATIONAL REPRESENTATION

- International Students 47
- Countries Represented 17

FEMALE ENROLLMENT

- Female Students 129

GRADUATE PROFILE

Total Enrollment 382

ENROLLMENT BY MAJOR

- Bioengineering 5
- Computer Engineering 1
- Computer Science 24
- Cybersecurity 19
- Data Science 185
- Electrical & Computer Engineering 10
- Electrical Engineering 8
- Engineering 6
- Material Science 6
- Mechanical Engineering 23
- Mechatronic Systems Engineering 18
- Non-Degree Seeking 15
- Systems Engineering 62

INTERNATIONAL REPRESENTATION

- International Students 69
- Countries Represented 17

FEMALE ENROLLMENT

- Female Students 99

2020-2021 Highlights

- **Grand Challenges Scholars Program** students Brooke Bernier, Lilly McAfee, and Asia Flores placed second in the GCSP Entrepreneurial Experience: Health virtual competition with their a solution to reduce the 5.9 million tons of medical waste produced internationally each year currently single-use medical supplies.
- First-year students Sam Adams and Bryce Sweringen competed in the **Engineering Without Borders Engineering for People Design Challenge US Grand Finals** with their "Agriculture for the Community" design to help rural Peruvian communities succeed in sustainable farming.
- Professor and Department Chair of Electrical & Computer Engineering **Dr. David Wenzhong Gao, PhD, was named an Institute of Electrical and Electronics Engineering (IEEE) Fellow.** He was recognized for contributions to grid integration of wind power and electric vehicle technology. Gao has made seminal contributions to sustainable energy systems including wind turbine generators and electric vehicles, and their seamless integration into the power grid.
- **Dr. Scott Leutenegger and Dr. Matt Gordon** developed a pilot Justice, Equity, Diversity, and Inclusion and Ethics in Tech Living and Learning Community to launch in Fall 2021.
- **Dr. Kimon Valavanis** just signed a contract for a new book on Robust Formation Control for Multiple Unmanned Aerial Vehicles, a joint effort by faculty from three universities, Beihang University, University of Denver, and the University of Texas Arlington.
- **Dr. Mohammad Mahoor** and researchers at the Knoebel Institute for Healthy Aging are collaborating on a research grant funded by NIH/NIA to use Ryan companion robot for assisting elderly people with early Alzheimer’s disease (AD). The successful development of Ryan will improve patient well-being, make caregivers more efficient and effective, provide significant financial benefits to the healthcare industry, and assist families and caregivers who are looking for ways to better assist older adults with AD.
- **Dr. Rui Fan** received a grant from the Department of Energy/Pacific Northwest National Laboratory for a project entitled “Learning to adapt and control for complex power systems”. The grant which is a \$150,000 3-year subcontract to develop a robust artificial-intelligence-based optimization and adaption framework for enhancing the resilience of power systems with increasing uncertainties and dynamics.
- In May 2021, **Dr. Zhihui Zhu** received a four-year NSF grant to fund “Collaborative Research: CIF: Medium: Structured Inference and Adaptive Measurement Design in Indirect Sensing Systems”. This project, in collaboration with the Colorado School of Mines, will leverage modern machine learning and optimization techniques.
- **Dr. Zhu** co-organized a workshop on Seeking Low Dimensionality in Deep Learning on November 2020. This two-day workshop held virtually brought together experts in machine learning, applied mathematics, signal processing, and optimization to share recent progress and foster collaborations.

Ritchie School At A Glance



STUDENTS

563

UNDERGRADUATE

332

GRADUATE

32

DOCTORAL

18

NON-DEGREE

25% FEMALE ENROLLMENT

13% INTERNATIONAL ENROLLMENT



DEGREES AWARDED

109

UNDERGRADUATE

68

GRADUATE

18

DOCTORAL



FACULTY

25

TENURE TRACK

13

TEACHING TRACK

7

RESEARCH SERIES

3

PROFESSOR OF THE PRACTICE

75% OF FACULTY PUBLISHED

2 USPTO PATENTS AWARDED



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DENVER

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