CU ENGINEERING

SPRING 2020

BIOMEDICAL BOOST
College launching new degrees in fall 2020

SAFEGUARDING YOUR DNA
Team exploring cybersecurity for genetic data

SUPERBUGS BEWARE

Student group on a mission against antimicrobial resistance

University of Colorado **Boulder**

STAY CONNECTED
TO CU ENGINEERING

We may not have been able to see you in person this spring, but we're still working hard on ways to stay connected to the college and your fellow alumni.

Alumni Webinar Series
Featuring interactive, educational sessions with our faculty and other experts, where they'll share the big ideas they're working on. Watch your email for details.

Leading with Impact in Denver
Rescheduled for Wednesday, Oct. 14, at the Hyatt Regency Denver Tech Center. Watch for announcements soon about dates for upcoming events in the San Francisco Bay area, Houston, Seattle and Southern California.
colorado.edu/engineering/LWI

Homecoming Tailgate
Our third-annual on-campus event is scheduled for Saturday, Oct. 24. Registration will open soon.

Other ways you can stay engaged:

Stay in the know!
Update your email address or other contact info.
colorado.edu/engineering/be-connected

Upcoming events
colorado.edu/engineering/alumni

Contact the alumni engagement staff
engalumni@colorado.edu

MESSAGE FROM THE DEAN

@KeithMolenaar

Dear CU Engineering community,

This is a rare moment in history as our global society responds to the COVID-19 public health crisis. As a college and a campus, we are united around our students to ensure they can continue their education and graduate with the least amount of disruption. As a community, we are focused on our health and well-being as we adapt to new learning, teaching and working environments and norms. Our thoughts are also with you and your families. We are all Buffs together.

I am honored to be serving the college as the interim dean as we navigate these dramatic changes and plan for the future. All three of my degrees are from the College of Engineering and Applied Science, and I have been a full professor at the college since 2011. I am extremely proud of how our college has responded and grateful for our faculty and staff who are leading in their own ways.

At the college, our faculty have partnered with researchers across the CU system to design and build a wide range of personal protective equipment for Colorado hospitals. Learn more about their effort at Make4Covid.co**.** Now, more than ever, the world needs engineering solutions to drive the economy, security and quality of life of our state and nation.

We planned this issue of the magazine months before current events began to unfold, but the topics are even more relevant today. This year, the college began offering undergraduate and graduate degrees in biomedical engineering. This field focuses on fundamentals in mechanics and electronics, preparing graduates for opportunities in medical devices and instrumentation, prosthetics, imaging systems, and many other fields.

As you will read in this issue, leadership and innovation in the health sciences will come from every area of the college, from alumnus Joey Azofeifa, founder of Arpeggio Biosciences, to the student group leading the charge against antimicrobial resistance.

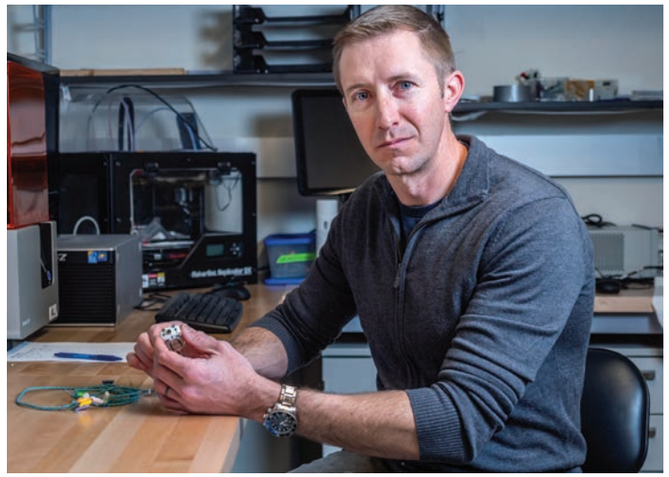
In any crisis, there is the opportunity for growth and innovation. As we practice a new level of care, concern and respect for each other, we will grow stronger as a community. What we will remember most from this difficult time is how we came together for support and how kindly we treated each other.

Keith Molenaar
Interim Dean

ABOUT INTERIM DEAN MOLENAAR
colorado.edu/engineering/interim-dean

CUENGINEERING

VOLUME 37 | ISSUE 1 | SPRING 2020



Brodie Hoyer will apply skills from PhD research to mentoring West Point cadets, page 14

FEATURES

/cuengineering

@CUEngineering

@CUEngineering
@KeithMolenaar

University of Colorado Boulder College of Engineering & Applied Science

MANAGING EDITOR
Emily Adams

CREATIVE DIRECTOR
Michelle Wiese

CONTRIBUTORS
Eric Butterman
Matt Goodman
Emily Hatton
Jonathan Raab
Josh Rhoten
Oksana Schuppan
Kellen Short
Jeff Zehnder

PHOTOGRAPHY
Glenn Asakawa
Josh Barrett
Patrick Campbell
Bill Cotton
Kate Mooney
Timothy Park

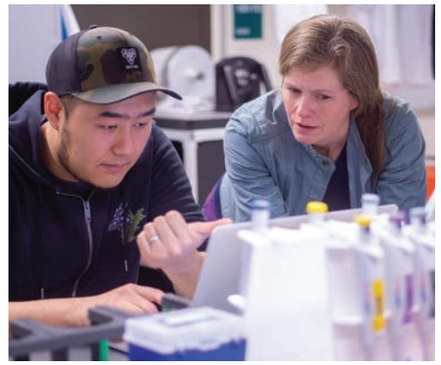
COPY EDITOR
Paul Beique

ALUMNI PROFILES

STUDENT PROFILES

RESEARCH

NOTEWORTHY



Biomedical breakthroughs: Assistant Professor Maureen Lynch, page 28

CUENGINEERING ONLINE
colorado.edu/cuengineering/spring2020

Computer science celebrates 50 years, page 9

Flexing their Engineering Buffs spirit

Mechanical engineering student Anthony Javier has some fun with Chip the Buffalo during the second annual Engineering Homecoming Tailgate in November. See more tailgate photos on page 10. This year's event is scheduled for Saturday, Oct. 24, and will feature food, drinks and live music.

CU ENGINEERING HOMECOMING TAILGATE
colorado.edu/engineering/homecoming-tailgate

From left, Western Colorado University President Greg Salsbury, donor Paul M. Rady and former CU Engineering Dean Bobby Braun tour the new Paul M. Rady School of Computer Science & Engineering building in Gunnison during construction in June 2019.

Mechanical engineering department named for Colorado businessman

Paul M. Rady Department of Mechanical Engineering becomes second named department

The highly ranked mechanical engineering department at CU Boulder has been named after Colorado philanthropist and businessman Paul M. Rady, thanks to his generous support of the college.

Rady has committed $15 million in philanthropy to CU Boulder, most recently with the goal to initiate and grow an engineering partnership program between CU Boulder and Western Colorado University. A majority of Rady's giving is designated to expand and upgrade facilities for use by CU Boulder's mechanical engineers. In recognition of Rady's generosity and support, the university has named the College of Engineering and Applied Science's Department of Mechanical Engineering in his honor.

Mechanical engineering is ranked No. 15 for undergraduate education and No. 18 for graduate education in the nation among public university mechanical engineering programs. The department is also one of the largest in the college and has strength in many areas, including materials, thermos/fluids, controls and mechanics. Groundbreaking research by mechanical engineering faculty has applications in human health, security, energy and environment, air quality, quantum devices, and robotics.

The Paul M. Rady Department of Mechanical Engineering becomes only the second named engineering department at CU Boulder, joining the Ann and H.J. Smead Department of Aerospace Engineering Sciences, which was named in 2017.

Celebrating 50 years of computer science

In 1970, the University of Colorado Board of Regents voted to establish CU Boulder's first Department of Computing Science. A few months later, the name was updated to the Department of Computer Science, and Lloyd Fosdick was appointed as the founding chair.

Since that time, the department has grown into a dynamic group of researchers, students and alumni dedicated to diversity in computing, entrepreneurship and innovations that tackle important societal challenges. From its start as a small unit in a barely recognized field, the department has grown to more than 70 faculty, 2,000 undergraduates and 400 graduate students in what many consider the world's most pivotal discipline.

Throughout 2020, the department will celebrate by sharing faculty and alumni memories. The anniversary year will culminate on Saturday, Oct. 10, with a daylong flagship event to welcome back alumni and past faculty, salute their founders, and celebrate the continued impact of CU Boulder computer science.

Join the celebration

colorado.edu/cs/50-years

Top: Students in the 1990s. Bottom: CU Boulder alumnus Alan Kay speaks on campus in an undated photo. Kay is known as a pioneer of object-oriented programming, personal computing and graphical user interfaces.

Department of Computer Science today

70	400	2,000
FACULTY	GRADUATE STUDENTS	UNDERGRADUATE STUDENTS

2019 CU ENGINEERING HOMECOMING TAILGATE

More than 250 engineering alumni returned to the Engineering Center on Nov. 9 for our second annual Homecoming Tailgate. The event featured food, lawn games and music from the band Paper Moonshine.

Three alumni-owned businesses provided drinks for the event—Bootstrap Brewing Co., owned by Steve Kaczeus (MechEngr'82); Ratio Beerworks, owned by Jason zumBrunnen (ChemEngr'97); and Stem Ciders, owned by Phil Kao (MMechEngr'08, PhD'10).

CU ENGINEERING HOMECOMING TAILGATE
colorado.edu/engineering/homecoming-tailgate

Professor Anseth earns international recognition


Kristi Anseth

Professor Kristi Anseth has received one of the most prestigious recognitions in the life sciences: a L'Oreal-UNESCO For Women in Science award.

Anseth, a Distinguished Professor and Tisone Professor in the Department of Chemical and Biological Engineering, is being recognized for her "outstanding contribution in converging engineering and biology to develop innovative biomaterials that help tissue regeneration and drug delivery," according to UNESCO.

She is one of only five women in the world, and the only recipient in North America, to receive the recognition this year.

Environmental engineering turns 20

CU Boulder's Environmental Engineering Program celebrated its 20th anniversary in October with an event that brought together faculty, students and alumni.


Daniela Brandao

The evening's keynote speaker was Daniela Brandao, the program's first graduate, who works as a senior project manager for the San Francisco Public Utilities Commision. She spoke about what the program has meant for her and how her experiences at CU Boulder helped her succeed in her career.

Several faculty and staff were also honored for important contributions to the program. Among them were former directors Angela Bielefeldt, Jana Milford, Joe Ryan and Scott Summers; former advisor Laurels Sessler; advisor Joanne Uleau; and program coordinator and communications specialist Laurence Lambert.

Engineering Center goes plastic-free

In September, the Engineering Center became the first building on campus to go plastic-free for single-use beverage containers.

The move included replacing plastic containers in vending machines with glass or aluminum, and working with the Gravity Cafe coffee shop to stock compostable lids, straws and other service items. The college also worked with caterers and restaurants around Boulder to compile a list of vendors who agree not to use single-use plasticware.

The plastic-free initiative coincided with the announcement of a partnership between Ball Corp.—a longtime partner of CU Engineering—and CU Boulder to introduce Ball's recyclable aluminum cup at Folsom Field during the 2019 football season.

BIOMEDICAL BOOST

By Eric Butterman

New undergraduate major and graduate degrees build on college's strengths

A 3D-printed heart? A robotic surgeon? Biomedical engineering has come a long way from the invention of the scalpel. And now, it's getting a boost at CU Boulder with a new undergraduate major and graduate programs launching in fall 2020.

Mechanical engineering Professor Mark Borden served on the committee that brought the program to fruition and will serve as its first director.

> "STUDENTS ARE GOING TO HAVE THEIR EYES OPENED BY THE TYPE OF SUBJECT MATTER OFFERED, AND THEY WILL BE INSPIRED."

"This a terrific opportunity for our high-ranking program," said Borden, who teaches Introduction to Biomedical Engineering as part of the existing minor. "Students are going to have their eyes opened by the type of subject matter offered, and they will be inspired."

The career opportunities won't hurt, either, he said.

"In fact, *Forbes* ranked this the No. 1 major, and its national median annual wage is $88,000. For Colorado, it's even higher at $96,000."

It's also a STEM major that attracts a diverse student body, Borden added.

"So many people who go down this route have a story of someone close to them that was affected by a medical issue," he said. "It moves people to make a difference. Our inaugural class is actually projected to have 50 to 60 students, so right away it's keeping up favorably with the other majors in the engineering school."

Anushree Chatterjee, assistant professor of chemical and biological engineering, is excited about how the program will bolster research opportunities for both students and faculty.

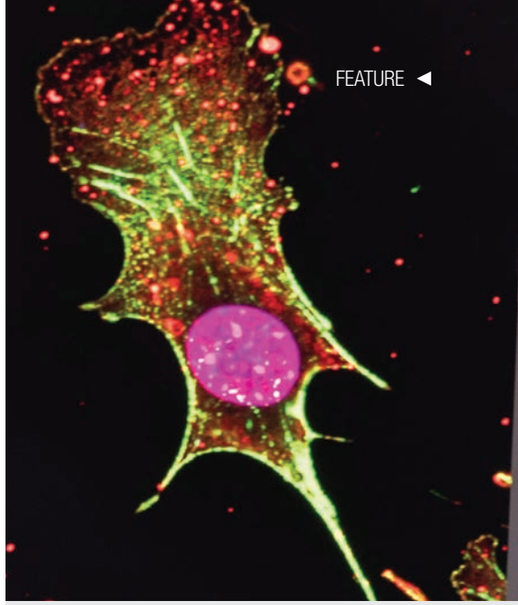
"We have a quality medical school for students to have a larger involvement with, and they can find themselves matching up further with professorial research," she said. "There are technologies they can understand for clinical applications. If they have the skills, they can have valuable additional experience for their résumé, and they can be incredibly helpful in our work."

Won Park, professor in electrical, computer and energy engineering whose research focuses on biomedical uses for nanomaterials, also sees the major as a key interdisciplinary opportunity.

"The school has very strong programs in chemical engineering, mechanical engineering and electrical engineering, and these are the three disciplines that have a strong component that are relative to biomedical engineering," said Park, who, like Chatterjee, also served on the committee. "Aerospace and computer science are also important contributors. In my work in bladder cancer, it could help a great deal. We will now be even more free to pursue greater amounts of interdisciplinary research in biology and medicine (with the help of students)."

And who knows how many people will have their quality of life improved by the work of an inspired biomedical engineering student or maybe even owe their lives to their ingenuity someday?

"It's an exciting avenue," Borden said. "And our students are just the people to take on its challenges."



BIOMEDICAL ENGINEERING

A multidisciplinary field that lies at the interface of medicine, biology and engineering, and focuses on fundamentals in mechanics and electronics.

FOCUS AREAS

- Biomechanics
- Medical devices
- Imaging and diagnostics
- Therapeutics

#1
MAJOR (*FORBES*)

$96,000
COLORADO MEDIAN SALARY

CU BOULDER DEGREES

- Undergraduate Minor
- Bachelor of Science
- Master of Science
- PhD

LEARN MORE

colorado.edu/bme

Brodie Hoyer's research focuses on improving the efficiency of tiny medical robots inside the gastrointestinal tract.

A PATH BACK TO TEACHING

By Oksana Schuppan

Veteran will apply skills from PhD research to mentoring West Point cadets

For PhD student Brodie Hoyer, the opportunity to instruct and mentor cadets at the U.S. Military Academy at West Point is well worth the rigor of getting his PhD in three years.

Having attended West Point himself, he wanted to return to share with students what he learned during deployments to Afghanistan, Iraq, Kuwait and various locations throughout the U.S.

After receiving his master's degree from Stanford University in 2013, Hoyer taught at West Point for three years. Soon, he'll be returning with his mechanical engineering PhD and tons of research experience.

"My PhD is ultimately a path back to teaching," Hoyer said. "The three years I taught at West Point were the most rewarding years of my military career."

Associate Professor Mark Rentschler, Hoyer's PhD advisor, said he recognized a sense of purpose in Hoyer from the very beginning.

"My PhD is ultimately a path back to teaching. The three years I taught at West Point were the most rewarding years of my military career."

"Brodie's goal was clear in that he wants to be an instructor," Rentschler said. "When you're committed and know why you're doing what you're doing, you'll make it happen."

He said there are no shortcuts to receiving a PhD at CU Boulder. Hoyer is doing what most do in about half the time.

Bill Doe, a research development officer with the College of Engineering and Applied Science, went through a very similar program 30 years ago and also graduated from West Point. He said Hoyer is a clear leader among his peers, an intelligent, diligent and humble engineer of deep character.

Hoyer's research investigates how microtextured surfaces interact with soft tissue, particularly useful in improving the efficiency of medical robots inside the gastrointestinal tract.

"Imagine treads on a small mobile robot," Hoyer said. "We're trying to predict what qualities those treads need in order to move efficiently and without damaging tissue."

The lab group aims to model how these treads create traction, so they can predict how a robot will move inside the body.

"It's always energizing to be in an environment where people are excited to come to the lab and are passionate about their research," Hoyer said.

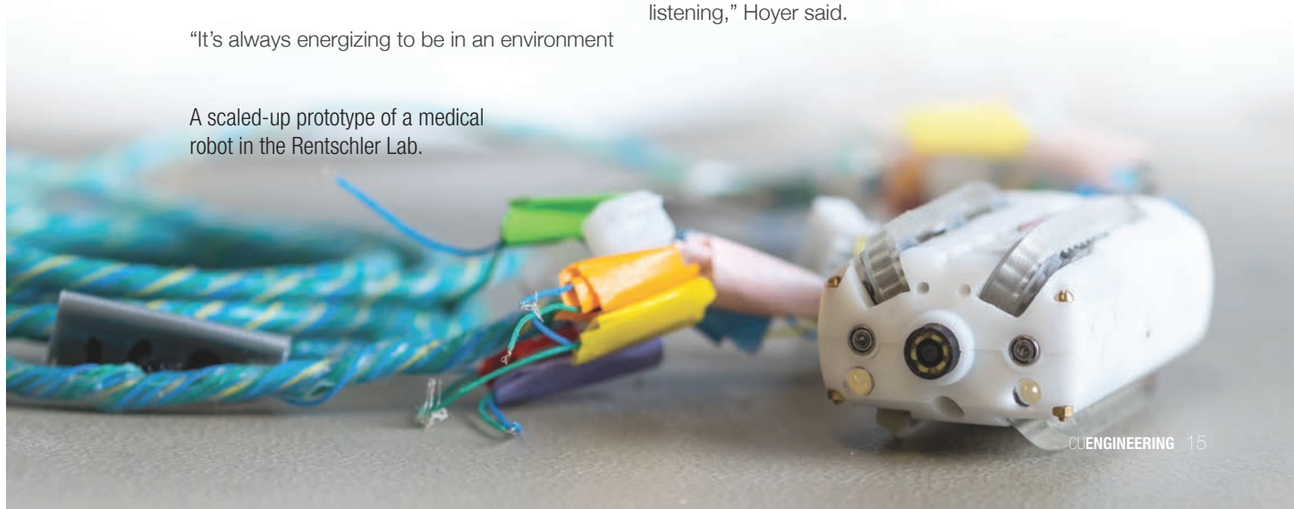
Many skills Hoyer acquired as a leader in the military translate well to his research.

"Being a leader in the military generally entails being confronted with vague or poorly defined problems that can change rapidly with potential for catastrophic consequences," Hoyer said. "I think leaders develop a sense of when they have enough information to make the best decision possible."

Hoyer said there is a saying that a 70 percent solution now is better than a 100 percent solution later.

Hoyer said he also believes the military does a good job in helping leaders and soldiers develop their ability to express themselves confidently and clearly in speaking and writing, a skill that will continue to impact his teaching career to come.

"Whether it's briefing your soldiers on a combat mission or teaching beam theory to a classroom of cadets, there is a common need to speak clearly and concisely, understand your audience and encourage active listening," Hoyer said.



A scaled-up prototype of a medical robot in the Rentschler Lab.

DNA: Goldmine for hackers?

By Josh Rhoten

Students explore security risks around genetic data collection

Genetic data is some of the most valuable personal information we have. But protections and assurances around its collection and storage lag behind those built into consumer products, like Social Security numbers.

Shifting that dynamic to favor user security is a problem that students in the Technology, Cybersecurity and Policy Program are exploring as part of a graduate capstone project funded by GeneInfoSec. The goal is to research and document potential security vulnerabilities in this area, starting with the genetic sequencing machines used to collect and process this data through the interconnected ecosystem of labs and servers where it is stored and accessed.

Their work could eventually help protect those who have willingly shared their DNA to better understand their ancestry and those who need genetic testing to help with treatment of rare diseases or cancer.

"This project is a very good opportunity for us to apply the skills we have learned during the program and also contribute comprehensively," master's student Arya Thaker said. "This is absolutely the kind of work I—or any student pursuing cybersecurity—would love to do as a career."

Thaker and his team visited sequencing centers all along the Front Range, including at Colorado State University, CU Anschutz Medical Campus and industry providers. At each stop, they conducted interviews and gathered data to understand existing security measures and problems that may not have been considered at all.

What they find will be collected into a comprehensive report—a sort of "state of the union" of interest to many parties working in this area.

The need for heightened security

Sharing of personal genetic information has become common. According to MIT Technology Review, consumers purchased the same number of at-home DNA tests in 2018 as in all previous years since 2012 combined.

From left, Ashish Yadav, Cory Cranford, Arya Thaker and Garrett Schumacher.

If that trend continues, companies like 23andMe could house the genetic information of more than 100 million people within two years. That total doesn't include those who shared data for medical reasons.

It also means there's more incentive for bad actors to try to access the data. Genetic information can be used to identify personal traits like height and ethnicity or diseases you are predisposed to. It can even be used to simulate your face or voice.

Securing that information is vital, since it could be used to tailor a disease to attack only certain portions of the population or to find and hack into people's bank accounts.

TCP students looking at those possibilities found that potential protections required consideration of health privacy standards in addition to traditional cybersecurity concerns, which start with hardware in each lab space.

The team performs penetration testing on a gene sequencing machine at Colorado State University.

'Setting the tone'

Garrett Schumacher is a co-founder of GeneInfoSec and a staff member with TCP. He is co-advising students on the project and said that in the near future, you won't be able to get medical treatment until you get your DNA tested. That means the pool of people potentially at risk will only increase over time.

"If you have a financial data breach, you can change numbers and accounts—you can react to that," he said. "But your DNA? You can't change that."

The work has implications for industry, as well. Genetic data from those with rare diseases is valuable in a medical research setting and could be stolen by competitors. Concealing genetic information can also secure animal breeding programs and hide private knowledge about breeding stocks.

Schumacher said the project was a great example of the interdisciplinary work going on in the TCP Program.

"The findings these students come up with need to be understood by policymakers, IT specialists, electrical engineers and biologists, to name just a few interested parties," he said. "The students understand that and are among the first working on this problem through that lens. We are really setting the tone for this work going forward."

SPECIAL DELIVERY

By Jonathan Raab

Researchers exploring ways to make drug delivery safer and more effective

By looking at health problems through an engineering lens, CU Engineering researchers are creating ways to make drug therapy delivery safer and more effective. By working across departments, disciplines and research units, our engineers are innovating solutions for the world's health challenges.

Associate Dean for Research Massimo Ruzzene said these new delivery systems and techniques are just a few of the ways students and faculty are changing how patient treatment occurs "at every level."

"These outstanding results are great examples of how the combined expertise of our college—coupled with partners across campus, the nation and the world—are drastically impacting this important area of medicine."

LIGHT-ACTIVATED POLYMERS FOR BLOOD BIOSTASIS

Storing and transporting critical organic materia—including donated organs, blood and vaccines—requires a complex logistical "cold chain" of refrigeration. The Defense Advanced Research Projects Agency and the Army Research Office are investing more than $7 million into the research of Professors Kristi Anseth and Chris Bowman of the Department of Chemical and Biological Engineering and Sabrina Spencer of biochemistry to meet this challenge.

Anseth, Bowman and Spencer are working on a method of injecting biological material such as blood with specialty light-activated molecules. When exposed to one type of light, these molecules gel and fill blood cells to prevent their degradation. This creates a biostasis that can be reversed when exposed to a second type of colored light.

"If this approach is successful, we would enable better potential treatment of disease, infections or traumatic wounds where buying time could be beneficial," Bowman said.

> **"IF THIS APPROACH IS SUCCESSFUL, WE WOULD ENABLE BETTER POTENTIAL TREATMENT OF DISEASE, INFECTIONS OR TRAUMATIC WOUNDS WHERE BUYING TIME COULD BE BENEFICIAL."**

BREAKING THE VACCINE COLD CHAIN

Other researchers are exploring another method to break the cold chain, specifically for vaccines. Professor Robert Garcea of the BioFrontiers Institute and Professor Theodore Randolph of chemical and biological engineering are combining extant particle atomic layer deposition technology – developed by their colleague Professor Al Weimer – with new thermostabilization techniques to create vaccine formulations that do not require refrigeration. They recently received $1.2 million in grant funding from the Bill and Melinda Gates Foundation.

They have stabilized vaccine formulations for anthrax, botulinum toxin, ricin and, most recently, the Ebola virus. By creating vaccines with this unique thermal stability characteristic, the researchers hope to provide solutions to supply chain problems in war, cases of bioterrorism and remote, rural health care.

MICROBUBBLES DELIVER THERAPIES

Alec Thomas began his research into biomaterial that can be formed into microscopic bubbles while he was a PhD student studying under Associate Professor Mark Borden of the Paul M. Rady Department of Mechanical Engineering. Since earning his PhD, he has continued that research at Oxford University.

When injected with a blood clotting agent, Thomas' magnetically controlled microbubbles provide a noninvasive method to deliver their payload to a trauma site, halting internal bleeding.

The method can eliminate the need for surgery in certain situations. It also creates a contrast easy to spot on an ultrasound, which helps medical professionals see and understand what is happening at the trauma site.

FLUID DYNAMICS IN AEROSPACE MAY LEAD TO BREAKTHROUGHS IN DRUG DELIVERY

Research Professor Jim Brasseur of the Ann and H.J. Smead Department of Aerospace Engineering Sciences is working to apply the mechanical principles of fluid flow and molecular transport that underlie rocket science to the release and delivery of drug molecules – particularly biologics like insulin.

Brasseur is leveraging his expertise in both aerodynamics and gastrointestinal physiology to analyze the transport and absorption of these drug molecules.

"The release, transport and absorption of drug molecules is essentially a mathematical mechanics problem," Brasseur said.

Many biological molecules are too large to pass across the barrier of intestinal lining and must be taken intravenously. Overcoming this obstacle by developing an orally administered tablet is considered by some researchers to be the holy grail of this field of research.

ACADEMIA MEETS ACTIVISM

STUDENT GROUP TACKLES ANTIMICROBIAL RESISTANCE

By Kellen Short

ARMOR team leaders Colleen McCollum, Jocelyn Campos and Dana Stamo spread the word about antimicrobial resistance on campus in February.

Antimicrobial resistance—the ability of bacteria, viruses and fungi to adapt to common remedies, leading to increasingly difficult-to-treat superbugs—represents a looming threat to global health.

In labs at CU Boulder and around the world, researchers are exploring strategies for revamping antibiotics to work in the face of resistant superbugs and investigating new, adaptive therapies that work in completely different ways.

Now, a group of student researchers at CU Boulder is taking steps to improve public awareness of antimicrobial resistance. They hope to show that the average person doesn't have to wait around, fingers crossed that scientists and policymakers will offer a solution—we all can play a role in curbing the problem.

In early 2019, they created ARMOR, which stands for Antimicrobial Resistance Mediation Outreach. The organization, which has a half-dozen core members, meets weekly to discuss tactics for spreading the word on campus and beyond. ARMOR was created under the Antimicrobial Regeneration Consortium initiative, which aims to bring together global scientific expertise in academia and industry to tackle this major health crisis.

"We kind of decided that we needed to do more," said Colleen McCollum, a PhD student in chemical and biological engineering. "There's a lot that you can do in academia, but without the public behind you, there's only so far you can go."

Each year in the U.S. alone, at least 2.8 million people are infected with antibiotic-resistant bacteria, and more than 35,000 die as a result, according to the Centers for Disease Control and Prevention. The evolution of resistant microorganisms occurs naturally, but scientific consensus suggests that human activity is accelerating the pace.

At its worst, antimicrobial resistance could make today's curable infections more difficult or impossible to treat. Common conditions like a urinary tract infection or stomach bug could spell hospitalization, while procedures like chemotherapy, joint replacement or C-section births could become impossibly risky. In this scary scenario, even a paper cut could lead to death.

ARMOR is taking several steps to address these urgent and emerging issues.

The members have created informational pamphlets about antibiotic resistance now being distributed at the campus's Health and Wellness Services that explain how antibiotics work and why they might not be prescribed for every illness.

They visited the Boulder County Farmers Market to talk to local producers about their approaches to antibiotic use, and they talked with people at the Boulder County wastewater treatment facility to understand how antimicrobials accumulate in our water and ecosystem.

They even hosted a soap-making event to provide natural alternatives to antibacterial soaps that have flooded the market.

"There is a disconnect between discoveries in academia and what's actually making it to the public," PhD student Dana Stamo said. "The value of ARMOR is bridging that gap and finding out, how do we bring those discoveries to the public?"

Clockwise from top left: Students show off their homemade soap during an ARMOR-sponsored event last fall.

Homemade soap, stickers and informational pamphlets from ARMOR.

Graduate student Colleen McCollum talks to a passerby at an ARMOR tabling event in February.

Meet the ARMOR team: colorado.edu/engineering/ARMORpodcast

SMALL STEPS YOU CAN TAKE

AT THE DOCTOR'S OFFICE

Keep in mind that antibiotics can treat only bacterial infections. The common cold, flu and many coughs and sore throats stem from viruses, so antibiotics won't be effective. Wait until tests confirm the source of your illness, or ask your doctor if there are steps you can take to feel better without using antibiotics.

IN YOUR HOME

Don't use hand soaps marked "antibacterial." For most healthy people, they aren't necessary and have not been proven to be any more effective than plain soap and water, according to the U.S. Food and Drug Administration. Over time, less demand may lead to less supply of these products.

AT THE GROCERY STORE

Consider purchasing meat and dairy products from sources that don't treat animals with antibiotics. The FDA already monitors antibiotic residue in meat, so the problem isn't ingesting residual drugs – it's about the other ways that resistant bacteria can enter the food chain during the slaughtering process.

AT THE GYM

Wipe down your gym equipment after use with cleaners that don't use antimicrobial chemicals. Bacteria on your skin or in your sweat could be resistant, and shared equipment at the gym is an easy place to pick up a bug the last user left behind.

IN THE LAB

In Professors Anushree Chatterjee and Prashant Nagpal's labs in the Department of Chemical and Biological Engineering, several promising strategies have already been identified to fight antibiotic resistance.

First, the team devised a way to use quantum dots – minuscule crystals of semiconductors, activated by light—to produce a substance toxic to bacteria that doesn't harm surrounding healthy cells. The dots are cheap and easily manufactured, making them excellent candidates to fight superbugs around the globe.

More recently, the Chatterjee lab found a way to use CRISPR DNA editing techniques to alter genes in bacteria that stunt their ability to evolve and reproduce. The tweaked gene expressions build up stress in the bacterial cell until it fails and becomes susceptible once again to current treatments. The technique is called Controlled Hindrance of Adaptation of OrganismS, or CHAOS, because of the mayhem it produces in the resistant cells.

Chatterjee's lab also has developed a Facile Accelerated Specific Therapeutic platform, or FAST, that can generate novel antimicrobial therapeutics in less than a week to counter multi-drug-resistant bacteria.

Those techniques together, along with other promising therapies being developed around the world, may one day stop antibiotic resistance in its tracks.

Genomics + Machine Learning

By Jeff Zehnder

‘30 under 30’ winner’s startup focuses on pinpointing why pharmaceuticals work

Joey Azofeifa (PhDCompSci’18) is bringing together machine learning and state-of-the-art RNA sequencing technology to create better, safer prescription drugs.

Azofeifa is the founder of Arpeggio Biosciences, a startup company that grew out of his research as a graduate student at CU Boulder.

“It’s a general problem in pharmaceutical work that we don’t understand the mechanism of why a particular drug works for a particular person,” Azofeifa said. “We can see that a drug is working, but not why.”

The company’s work is earning national attention. *Forbes* magazine recently named Azofeifa to its 2020 “30 under 30” health care leaders list.

Arpeggio pinpoints a drug’s mechanism of action by distinguishing primary drug targets from aftereffects that can obscure the message. This is priceless information for pharmaceutical companies, which waste millions of dollars and years of research and development on drug candidates that fail due to misunderstood mechanisms.

The key for Arpeggio is combining genomics with machine learning.

“We’re collaborating across disciplines. Half of the company team is software and half is in a lab with pipettes,” Azofeifa said.

The company’s patent-pending process monitors how RNA changes over time when exposed to drugs. Past researchers have looked at RNA—which acts as a messenger carrying instructions from DNA to where proteins are assembled—but only at the end of experiments. Arpeggio is doing it continuously to pick up on changes throughout a drug’s action.

Its algorithms are able to transform a sea of previously indecipherable genomic data—the human genome has some 3.2 billion base pairs—into a gold mine of crucial information for drug development and patient selection in medical trials.

> “It’s a general problem that we don’t understand the mechanism of why a particular drug works for a particular person.”

With seven employees, six of whom are CU Boulder graduates, Arpeggio is a small but growing company. Its offices will be familiar to many engineering alumni; it’s located in the Jennie Smoly Caruthers Biotechnology Building, one of several businesses with university connections sharing campus facilities.

Arpeggio has already worked with more than 20 companies and completed a round of fundraising last summer that brought in $3.2 million.

“I originally wanted to just do science for science’s sake, but I love that we are solving real-world problems in health and medicine,” Azofeifa said. “Creating safer and more effective drugs? Heck, yeah.”

ENGINEERING A MEDICAL CAREER

By Eric Butterman

Architectural engineering alumna finds her light as an OB-GYN

Regan Gage thought she would be an engineer when she left Boulder with her bachelor's degree in architectural engineering in 2000.

After all, she had a passion for lighting design, and she was starting work for engineering firm Flack + Kurtz in San Francisco during the dot-com boom, even designing lighting for the education center at the San Francisco Museum of Modern Art.

But the light for her ultimately was somewhere else.

"I had fun projects to work on, but I decided I needed a different connection with people," she said. "I found that as an OB-GYN."

That's not to say that she doesn't use her skills from her undergraduate days.

"My engineering education taught a way to think, and you could see application," she said. "Take when I was in medical school. I was really good at cardiology, and you could say, in a way, it's similar to electrical systems for buildings but it's involving a body."

She added that engineering taught her how to problem-solve when problems occur in the operating room.

"It can be many things, even figuring out how to get someone's ovary out in a difficult situation," Gage said.

She is one of several doctors at East Cascade Women's Group in Bend, Oregon, where wondrous mountains are never far away. If she has a bit of the home field advantage, it might not be just because she spent so much time here on vacations growing up. Her grandfather Al was the first pediatrician in town and even served as mayor.

"I was really good at cardiology, and you could say, in a way, it's similar to electrical systems for buildings but it's involving a body."

"Of course, they let many people be mayor," she said, laughing. "It was kind of like, 'OK, it's your turn.'"

Although, not everyone has a park in town named after them. And not everyone will have a legacy that stretches to a granddaughter seeing patients who once saw him.

Gage's journey also includes walking in the footsteps of Darwin, living in the Galapagos Islands in 2003 and returning multiple times as a guide.

"I heard a friend's experiences, and I liked the idea that it was so remote, so I had to do it," she said. "The animals were amazing. Hammerhead sharks everywhere. Being woken by sea lions near your door. Snorkeling every day and seeing great sea life. It was incredibly special."

That adventurous spirit came in handy when she decided to finally take the leap into medicine. It would mean returning to school at 29, while many that age were already into their medical careers. Still, she enrolled in George Washington University's medical school in 2007 ready to tackle her studies as one more challenge.

"I don't know if I realized how hard it was going to be," she said. "If I had gone sooner, I don't know if I would have stayed with it. I may have had wanderlust. You feel there's a reason for things."

She looks back on her time at CU Boulder in a similar way, particularly appreciating the encouragement of professors who often let her go where her passions took her.

"They really encouraged us to be creative, and I felt I could express myself while addressing technical aspects of projects we were working on," she said. "It made my undergraduate experience more freeing."

Gage doesn't know when her next Galapagos Islands-like adventure will be, as she enjoys life with her daughters, ages 2 and 6, and her many patients. But she realizes adventure is in wonderful relationships as much as unusual locales.

"People are trusting you when they make you their OB-GYN," she says. "They can have nerves and can have anxiety, postpartum depression, so many things. They rely on you to help them through. I know I'm very lucky to be invited into people's lives as much as I am. I take it all in and think: This is a gift."

Biomedical BREAKTHROUGHS

From machine learning to real-time imaging, CU Engineering researchers are changing the way medical treatment is imagined, designed and delivered

A new approach to stopping the spread of cancer

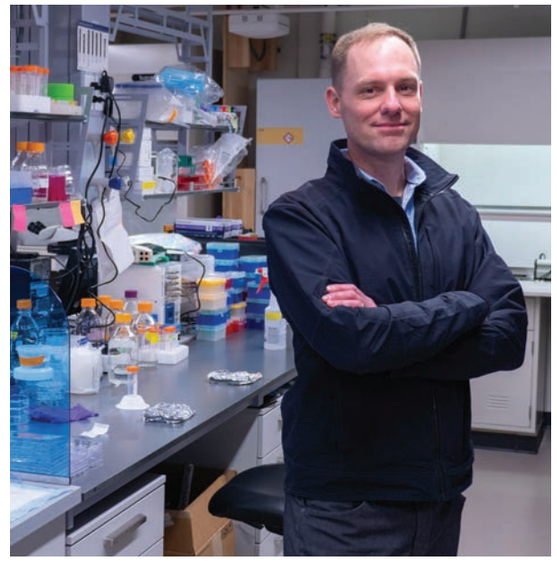
Assistant Professor Maureen Lynch | Mechanical Engineering

The three most common cancers in the United States are breast, lung and prostate cancer, all of which preferentially spread to the bone. To combat metastasis, or the spread of cancer from one site to another, Assistant Professor Maureen Lynch is exploring the problem through the lens of a mechanical engineer. Her team researches how forces applied to bone affect not only skeletal health but management of cancer. Their data suggests that mechanical forces have an anti-tumorigenic effect in bone metastatic breast cancer. To understand this effect, Lynch develops loading platforms, creates three-dimensional models of tissues and studies how cancer in mice responds when exposed to forces that simulate exercise. “Current cancer treatments have been able to slow down metastasis and bone fragility, but they haven’t figured out a way to turn it off completely,” she said. Because mechanical loading turns on cell pathways that prevent metastasis, Lynch hopes her research will lead to a new drug that turns on the same pathway with the same cancer-fighting effect.

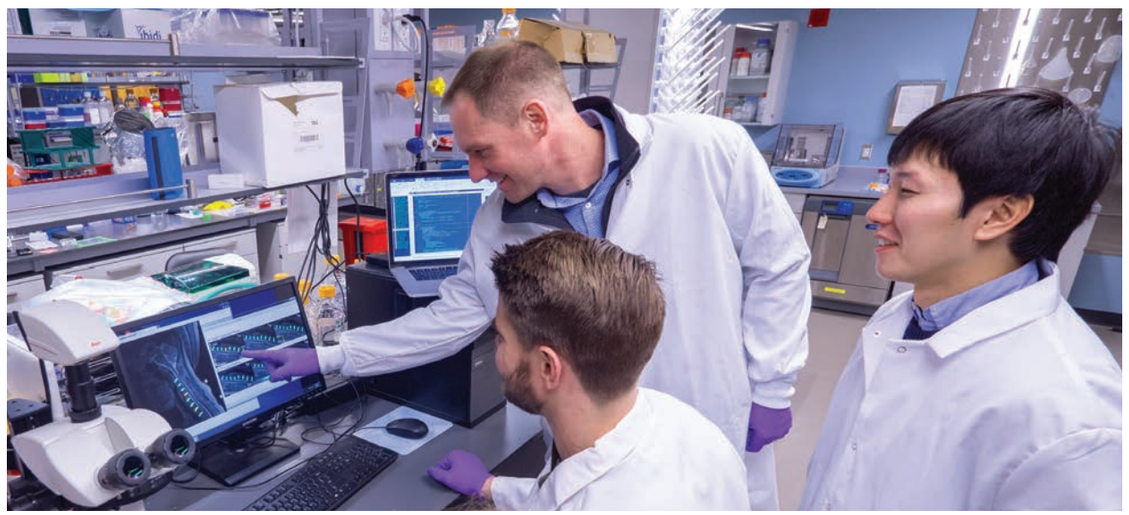
Imaging technique allows earlier diagnoses of osteoarthritis

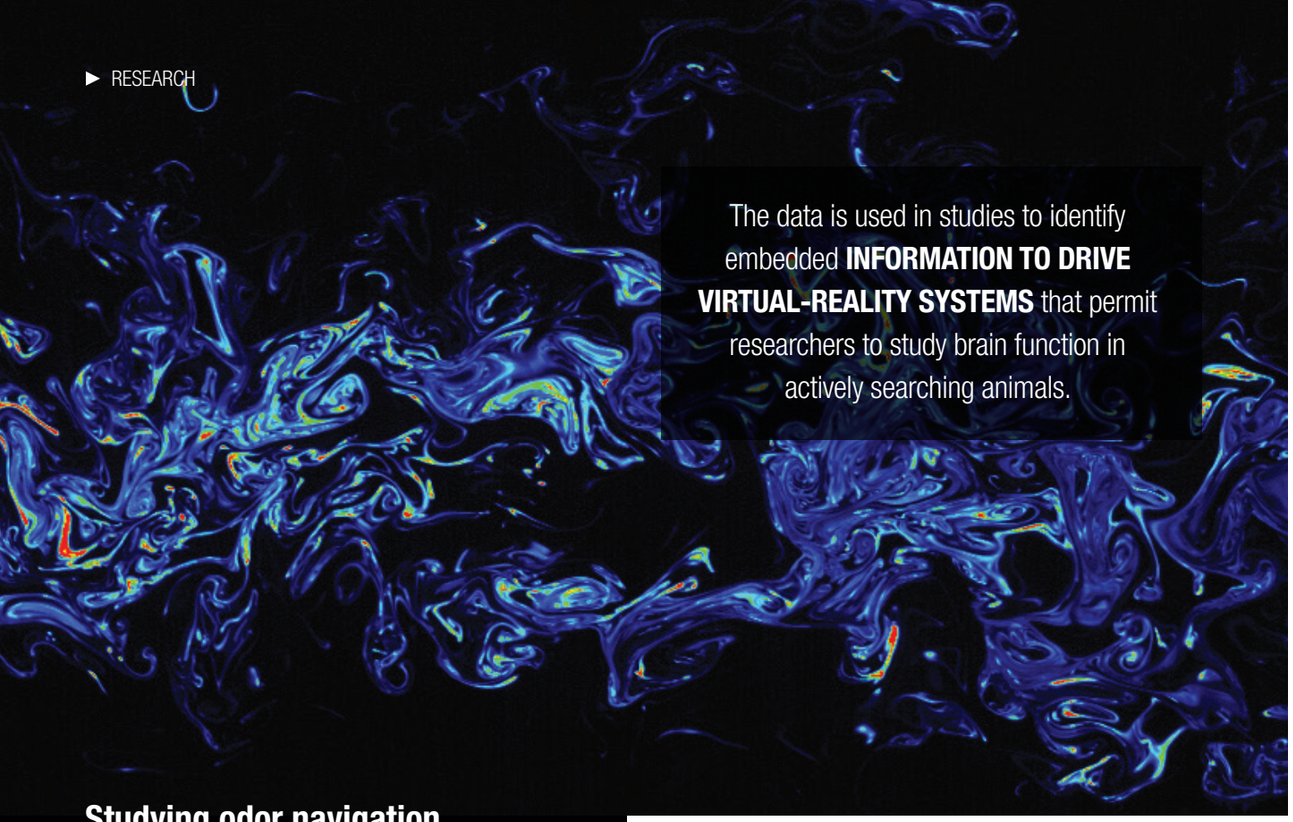
Associate Professor Corey Neu | Mechanical Engineering

Neu is working with colleagues at the University of Colorado Anschutz Medical Campus to detect early osteoarthritis, allowing younger patients to seek treatment earlier and possibly ward off the most severe treatment plans. To do this, his team is determining whether functional imaging methods—which focus on assessment of cartilage health and elasticity in the knee—can predict osteoarthritis in humans. Early prediction would allow patients to begin treatments like physical therapy or minimally invasive arthroscopy long before something as serious a joint replacement is their only option. To do the work, Neu will be leveraging a state-of-the-art MRI scanner and focusing on patients younger than 45 who will be undergoing ACL reconstruction. That is because those with ACL injuries are likely to develop cartilage degeneration, enabling researchers to track early progression of the disease more reliably. An MRI will be taken with the patient’s leg connected to a device that applies force on the knee to mimic walking. As the leg moves, changes in cartilage are mapped over time. Steady levels of strain or material properties indicate a healthy joint, while large, abnormal measurements indicate early stages of osteoarthritis.



TO DO THE WORK, Neu will be leveraging a state-of-the-art MRI scanner and focusing on patients younger than 45.



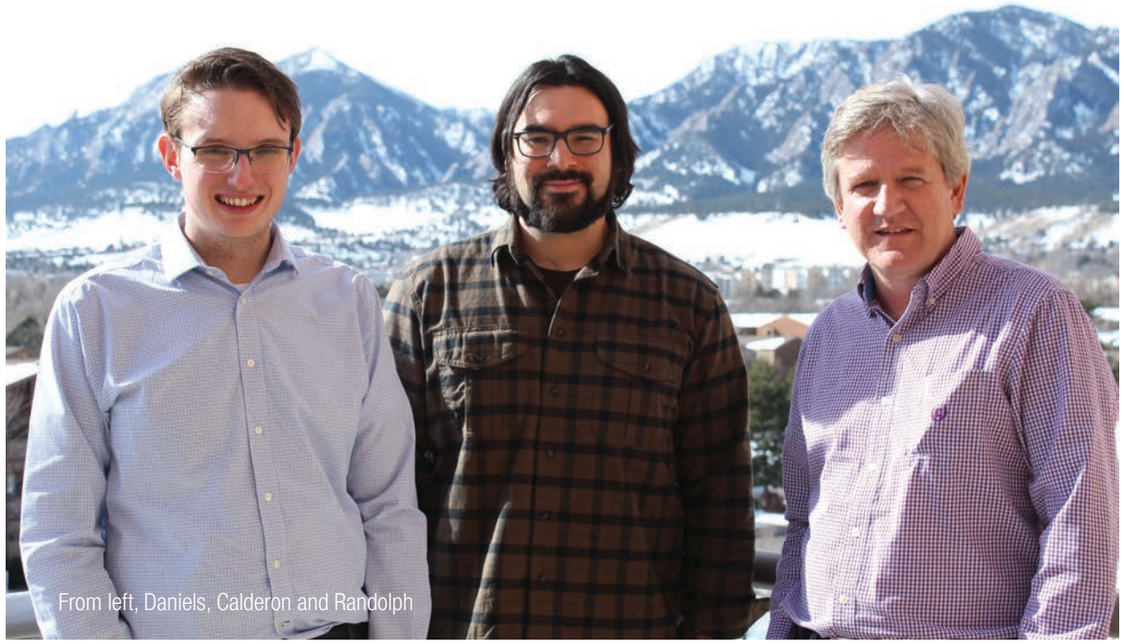


The data is used in studies to identify embedded **INFORMATION TO DRIVE VIRTUAL-REALITY SYSTEMS** that permit researchers to study brain function in actively searching animals.

Studying odor navigation in animals to understand brain function

Professor John Crimaldi | Civil, Environmental and Architectural Engineering

Since 2015, Crimaldi and his team have been leading a multi-university effort to study how animals use their sense of smell to determine the location of an odor source. The work is focused primarily on developing an understanding of brain function at different organizational levels—within the brain and across species. This is done by studying how various animals identify, detect and follow odors. Results from the work will be important for practical applications, including human rescue in natural disasters or locating natural resources. The resulting data is also used in analytical studies to identify embedded information to drive virtual-reality systems that permit researchers to study brain function in actively searching animals. Crimaldi is leading a larger international team of investigators that seeks to understand more generalized animal responses to odors. They are finalists in the NSF Next Generation Networks for Neuroscience competition. He also recently started working with other CU Engineering faculty developing advanced miniature microscopes to record information from the brain of freely moving animals.



From left, Daniels, Calderon and Randolph

Real-time imaging of living tissue

Professor Rafael Piestun | Electrical, Computer and Energy Engineering

Controlling the process by which light waves travel into and through complex media, such as blood and skin, is a growing area of imaging research. Unfortunately, spatial light modulation devices, which allow this by varying the properties of a beam of light in useful ways, are limited in speed. This prevents real-time applications such as imaging of live tissue or imaging through turbulent flow, which are constantly changing by the millisecond. Piestun's lab has created impressive improvements in this area, developing a light wave control technique that is faster than any other available technology by more than one order of magnitude and demonstrating a record high-speed wave shaping. Applications for this technique in the medical field are as varied as they are intriguing. By enabling imaging through multimode fibers, which are thinner and more efficient than existing endoscopes, this technique could open a window into previously inaccessible regions of the human body. Another potential application is in focusing light deeper into skin tissues for medical evaluation.

Machine learning to identify and treat infections faster

Randolph and Calderon Groups | Chemical and Biological Engineering

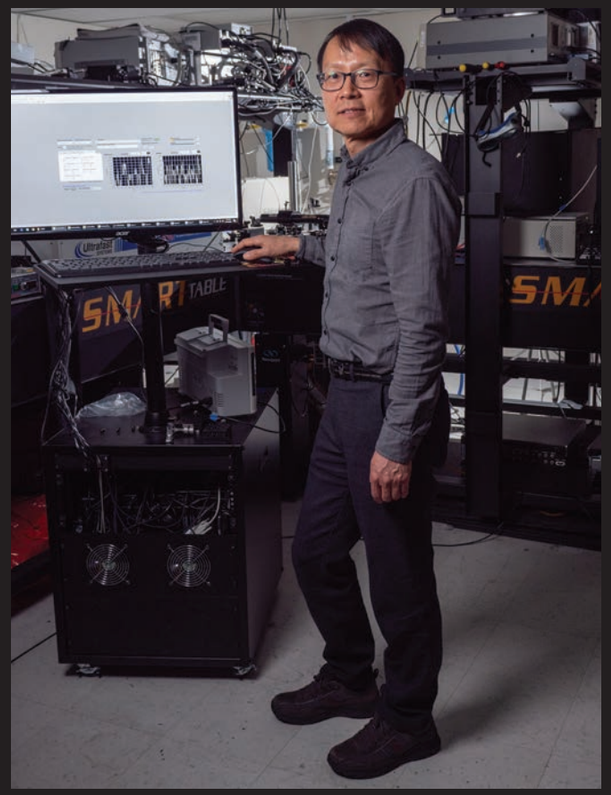
Researchers in the Department of Chemical and Biological Engineering have developed a machine-learning-based technique that may help doctors identify pathogens in blood samples in a fraction of the time of current methods. This could lead to faster deployments of life-saving treatments in patients suffering from sepsis. Professor Theodore Randolph, Adjunct Assistant Professor Christopher Calderon and graduate student Austin Daniels originally developed the technique to identify and characterize types of particles found in pharmaceutical formulations of therapeutic proteins. They soon realized that they could use this same analysis method to detect and identify invasive bacteria in a single drop of blood. Blood samples are sent through microfluidic channels under a microscope, and millions of photographs are taken of objects slightly larger than one-tenth of a micron in length. These images are then reviewed by the machine learning algorithm, which can identify specific microbial organisms in a fraction of the time of traditional tests. This process could be particularly valuable when treating sepsis in newborns, where methods currently used for identifying blood infections are slow in comparison to the rapid, frequently fatal progression of the disease, forcing physicians to take best guesses as to which antibiotic might provide the most appropriate course of therapy.

Blood samples are sent through microfluidic channels under a microscope, and **MILLIONS OF PHOTOGRAPHS ARE TAKEN.**

Speeding up clinical trials around Type 1 diabetes

Associate Professor Sriram Sankaranarayanan | Computer Science

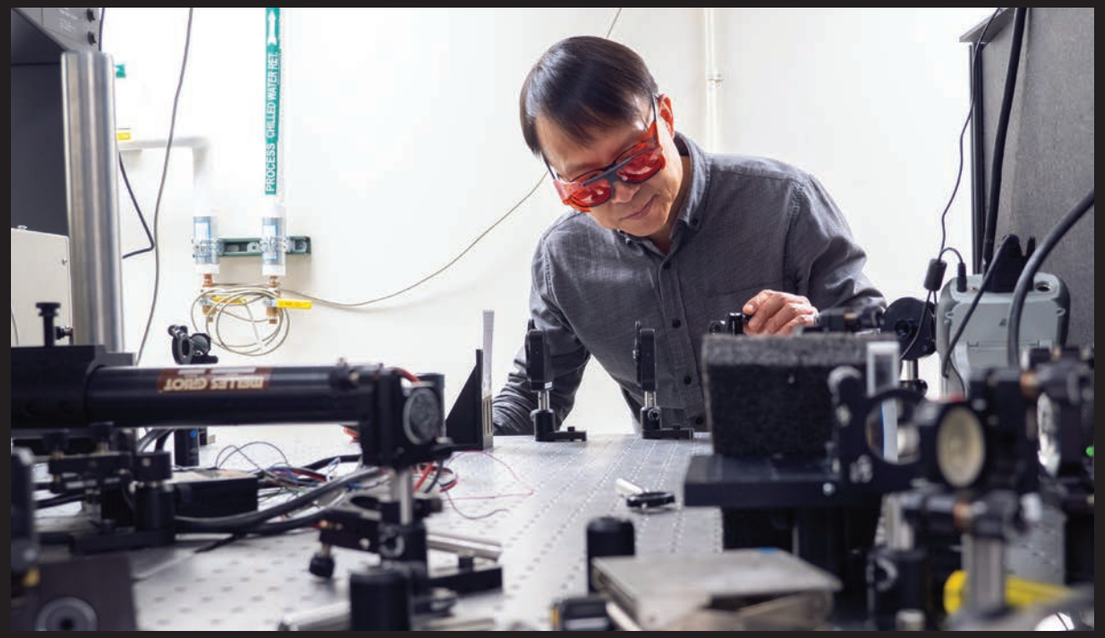
Sankaranarayanan's group has created virtual clinical trials for an artificial pancreas that could significantly improve treatments for those with Type 1 diabetes. People with this disease can't make insulin with their own pancreas and require frequent doses of the hormone to regulate blood glucose levels, either through injections or a pump system. Creating an artificial pancreas to autonomously deliver the insulin is complicated, requiring sophisticated computer, electronic and physical components. At its core is an algorithm that must automatically decide how much insulin to provide based on available health and timing data—but a wrong decision could be dangerous. Sankaranarayanan's project tested a variety of artificial pancreas designs to see if they could fail, break or otherwise harm a patient by giving them too much or too little insulin. They did this by using a formal verification tool called S-Taliro that his group had previously helped develop to check the correctness of car vehicle systems. These virtual trials are much cheaper than clinical trials and may allow patients to select the best device for their needs or better tune the device they are using.



Improving cancer detection and therapy

Professor Wounjhang Park | Electrical, Computer and Energy Engineering

Park's lab is using plasmonic nanostructures to diagnose and treat cancer. If successful, the technique they are developing could simultaneously image and kill cancer cells. Their work and testing focus on bladder cancer, the fourth most common non-skin cancer among men in the U.S. The team uses a gold nanorod bonded with an antibody that targets bladder cancer cells. When inserted into the bladder, it selectively binds to cancer cells, which can then be destroyed through irradiation by laser induced heating. Another application is through irradiation where a laser would create a hole in the cancer cell through which a chemotherapy drug can be delivered to destroy the cell. This process would allow for a highly targeted chemotherapy. Park and his collaborators have new patents related to this technique, which was recently described in *Materials Science and Engineering C*.



Western **Buffs**

> "When I heard about the (partnership) program, it was the best of both worlds."

Partnership program helps students engineer their own CU experience

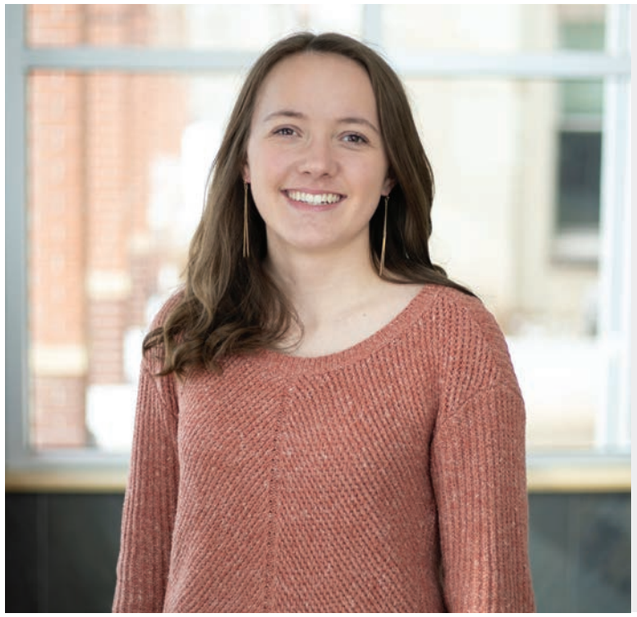
In 2018, the CU Boulder College of Engineering and Applied Science launched a partnership program with Western Colorado University's Paul M. Rady School of Computer Science and Engineering. The program allows students to earn Bachelor of Science degrees in computer science or mechanical engineering as graduates of CU Boulder. They complete their first two years as Western students, and the balance of their education as CU Boulder students, all while remaining on the Western campus in Gunnison, Colorado.

Forty students enrolled in the inaugural class in fall 2019, and they're already making their mark.

"We are fortunate to have these talented students as part of our CU Engineering community," Interim Dean Keith Molenaar said. "We look forward to working with them on their journey to becoming professional engineers and scientists."

Here is a look at two of the stand-out students of the Class of 2023 who are taking advantage of the opportunity to get their CU Boulder degrees in a small-school atmosphere.

Partnership program
western.edu/rady



Victoria Bowen, Mechanical Engineering

Working in aerospace has been at the top of Victoria Bowen's list for a while.

While searching for the right college to get her to NASA, she found touring giant lecture halls intimidating. CU Boulder's partnership program with Western offered her the best of both worlds: a prestigious degree and intimate classes.

"I was like, 'Well, like that's pretty much perfect,'" Bowen said. "It's awesome getting one-on-ones with professors; you can get your questions answered in class, and that helps me succeed."

Bowen is pursuing a degree in mechanical engineering, moving toward her goal of working on "anything with airplanes or satellites or rockets."

In this smaller program, she knows everyone in her engineering classes. She and her classmates even have a group text where they can reach out for help understanding concepts from class.

Bowen's academic prowess earned her the Rady Merit Scholarship, covering her two years of Western tuition. Beyond easing her student debt, the scholarship encourages Bowen to succeed.

"It really motivates me to do well because I know someone else is wanting me to do well, too," she said.

Gunnar Marquardt, Computer Science

Gunnar Marquardt found himself hooked on computer science in elementary school.

Now, the first-year student from Green Mountain Falls is pursuing a bachelor's degree in computer science through the partnership program.

In an attempt to build his own video game in middle school, Marquardt learned his first computer language, Java. In high school, he saw that goal come to fruition in a programming class, followed up by an independent study for computer science and AP Computer Science Principles.

His interest in the industry only grew as he learned about cybersecurity and attended a conference focused on the field.

"I find it super interesting, all that goes into the encoding and cryptography, playing both sides of making it easy to use while not easy to hack," Marquardt said.

His career goals lie in that field now, likely in private sector penetration testing where he can assess other companies' security systems.

Marquardt knew he wanted to go to CU Boulder to learn in the outstanding computer science program, but he prefers studying in a smaller environment.

"When I heard about the (partnership) program, it was the best of both worlds," he said. "I end up with a degree and an education from Boulder, but I get to be in Gunnison and I get that small-school, more one-on-one teacher aspect."

DISTINGUISHED ENGINEERING ALUMNI AWARDS

The Distinguished Engineering Alumni Awards (DEAA) are granted annually to individuals who have distinguished themselves through outstanding personal qualities, knowledge and significant contributions to their fields.

David Gupta
(ArchEngr'85)

CEO, SDI
DEAA: Industry & Commerce

David A. Gupta founded IT consultancy and managed services provider SDI Presence in 1996 and today continues to lead the firm as chief executive officer. The company is based in Chicago, with offices in Sacramento and Los Angeles, and has served some of the largest and most complex utilities, government agencies and airports in the world. The company has repeatedly been recognized as a Best Place to Work by *Crain's Chicago Business*, the *Chicago Tribune* and BuiltIn Chicago.

Gupta volunteers his time and expertise through pro bono consulting and hands-on opportunities, as well. His volunteer efforts focus on children, education, economic empowerment, and science and technology. SDI has graduated over 150 students through its internship and apprentice programs, and Gupta supports a host of charities, including the CU Boulder College of Engineering and Applied Science. Gupta has four children (including one CU Boulder graduate) and lives in Chicago with his wife, Dawn.

Dena Lund
(ChemEngr'89)

Executive Vice President/COO, Sterling Energy Investments LLC
DEAA: Industry & Commerce

Dena Lund is the executive vice president and chief operating officer of Sterling Energy Investments LLC. Throughout her time at Sterling, Lund has taken the lead on several projects that helped turn the company around. In 2016, she successfully led a facility consolidation and cost restructuring effort that buoyed the company through a difficult price environment. For her technical and volunteer contributions, she received a 2016 Top Women in Energy Award from the *Denver Business Journal*.

Lund has made significant contributions to CU Boulder since she graduated, and she has done so in a unique way. Lund was a member of the Chemical Engineering Advisory Board in 1996. At her urging, the advisory board recommended that the capstone design course be radically changed and consider real projects from industry. The faculty took this recommendation to heart and revamped the course with great success.

Roger McNamara
(MAeroEngr'86, PhD'95)

Director of Launch Abort System/ AA-2 Project Orion, Lockheed Martin Space Systems
DEAA: Industry & Commerce

Roger McNamara's notable contributions to the aerospace industry and community over his 40-year career include early research into and characterization of the hazards of orbital debris to space vehicles and operations, and potential mitigation strategies; improvements in space vehicle design and development for manned and unmanned systems; and most significantly, leadership in advancing technological innovation for the new era of human deep space exploration.

McNamara has served as an adjunct professor at the University of Denver in the Mechatronics Systems Engineering Master's Degree Program, focusing on launch vehicles, orbital mechanics and space environments. McNamara has maintained close involvement with the University of Colorado through the Smead Department of Aerospace Engineering Sciences and the Colorado Center for Astrodynamics Research.

Mark Strobel
(MChemEngr'79)

Corporate Scientist, 3M Co.
DEAA: Industry & Commerce

Mark Strobel joined 3M Co. in St. Paul, Minnesota, in 1979 after receiving his MS in chemical engineering at CU Boulder and his BS in chemistry from the University of St. Thomas in St. Paul. He has spent his entire career in 3M's Corporate Research Process Laboratory, leading the surface modification technology platform.

Strobel's success is a reflection of the education he received as a CU student, but since his graduation in 1979, he has worked tirelessly to establish deeper connections and a closer relationship between 3M and CU. These efforts culminated in the 2019 signing of a master research agreement between CU and 3M that is expected to fund 5-10 research projects each year at CU, totaling up to $1 million in annual funding.

RECENT ALUMNI AWARD

Recognizes exceptional alumni for early career achievements, continued involvement with the university and college, and outstanding personal qualities within 10 years of graduation.

Christina Barstow
(BS MCivEngr'10, PhD'16)

COO, Bridges to Prosperity

Christina Barstow is the chief operating officer for Bridges to Prosperity, a nongovernmental organization providing access to remote communities through the construction of pedestrian footbridges. She is working across programs mostly in East Africa and Latin America overseeing the installation of a planned 355 pedestrian footbridges, a more than $25 million program reaching potentially millions of people with improved access to basic services.

While at CU Boulder, Barstow was president of the CU Boulder chapter of Engineers Without Borders. Barstow remains engaged with CU Boulder as an alumna, through mentorship of several CU students, employment of CU alumni, participation in events including the CU WASH Symposium, and research partnerships with the Mortenson Center in Global Engineering.

DEAA SELECTION COMMITTEE

DEREJE AGONAFER
(AeroEngr'72)

RON BLACKWELDER, CHAIR
(AeroEngr'64)

CHERYL ENGLISH
(ArchEngr'81)

MIKE MCATEE
(ChemEngr'84)

DOUG SMITH
(CivEngr'71, MS'75)

JILL TIETJEN
(Past award winner, past faculty)

KATHRYN TOBEY
(ChemEngr'84, MA'94)

RAA SELECTION COMMITTEE

JON ANDERSON
(MechEngr'18)

VANESSA APONTE
(AeroEngr PhD'06)

PAUL HAMILTON
(CivEngr'75, MS'77)

JACK KAWELL
(CompSci PhD'23)

ERIK MAGNUSON
(ChemEngr'17)

SYDNEY SLOAN
(ApMath'16)

Going for GOLD

By Matt Goodman

Reenergized volunteer group looks forward to engaging young alumni

Steven Vogel (MechEngr'12) credits the College of Engineering and Applied Science for helping him make a successful leap from college to the workforce.

"I felt that the college did an excellent job of preparing me to transition from school to the workplace," he said. "Connecting to a diverse set of recent graduates to discuss their experience after graduation was a great way to prepare for my own transition."

So when the college put out a call last year for new members of the Graduates of the Last Decade (GOLD) Board, Vogel jumped at the chance to give back. He now co-chairs the board with Brock Kowalchuk (AeroEngr'11).

The GOLD Board was created as a way to strengthen the college's alumni network. Its mission is to enhance the relationship between the college and its recent graduates in ways that add value for both parties.

Last year, the college's alumni engagement team set a goal to reenergize the board. Thanks in part to nominations from past board members and college faculty and staff, the search garnered a lot of interest, said Cameron Deverel-Rico, the college's program manager for alumni engagement.

The board is now filled with a diverse group of engineers representing almost every department and degree program. Each member will serve a two-year term with an option to stay on for another two years.

Student outreach is one of three priorities for the board. It has also established committees focus on recent alumni engagement and on philanthropy, including volunteering and giving.

"Whether it's to join fellow Buffs in watching a football game, or to seek support in times of transition when moving to a new location or job, all graduates can benefit from a strong network of fellow alumni," Vogel said.

GOLD Board Members

Jon Anderson
BS 2018, Mechanical Engineering

Melissa Anderson
BS 2015, Chemical and Biological Engineering

Tommy Benning
BS 2011, Mechanical Engineering

Lillian Herrick-Reynolds
BS 2016, Mechanical Engineering

Morgan Hill
BS/MS 2013, Mechanical Engineering

Yev Kaufman
BS/MS 2012, Civil Engineering

Brock Kowalchuk (Co-chair)
BS 2011, Aerospace Engineering

Erik Magnuson
BS 2017, Chemical Engineering

Kevin Martin
BS 2016, Mechanical Engineering

Julia Miller
BS 2014, Civil Engineering

Sierra Murphy
BS 2015, Computer Science

Nikki Ritsch
BS/MS 2018, Civil Systems Engineering

Christopher Rouw
BS/MS 2018, Aerospace Engineering Sciences

Jannine Rouw
BS 2018, Engineering Plus Aerospace Engineering

Sydney Sloan
BS 2016, Applied Math

Steven Vogel (Co-chair)
BS 2012, Mechanical Engineering

Get involved!

cameron.deverelrico@colorado.edu

Boost Your Gift

To Engineering Entrepreneurship

A trailblazing collaboration between the College of Engineering and Applied Science and the Leeds School of Business is set to open in fall 2021. The Rustandy Building will physically join the two colleges and serve as a nexus of business and engineering at CU Boulder.

In the spirit of entrepreneurship and the unique opportunities for students this expansion will provide, Boulder entrepreneur Dan Caruso and Leeds Advisory Board member Cindy Caruso are donating $1 for every $2 committed to the building expansion project, up to $1.2 million.

For more information on how you can become an integral part of this campaign, please contact Erin Gage at erin.gage@colorado.edu.

Business + Engineering Expansion

colorado.edu/business/engineering

Why Invest in the Future of Business and Engineering?

Many engineering students are already involved in business and entrepreneurship through programs like the business minor, entrepreneurial senior capstone options and the Catalyze CU business accelerator. The new building will facilitate important connections with fellow students, business faculty and industry partners that will help students in their careers, whether they go to work for a company or start their own.

University of Colorado Boulder
College of Engineering and Applied Science
422 UCB
Boulder, CO 80309-0422