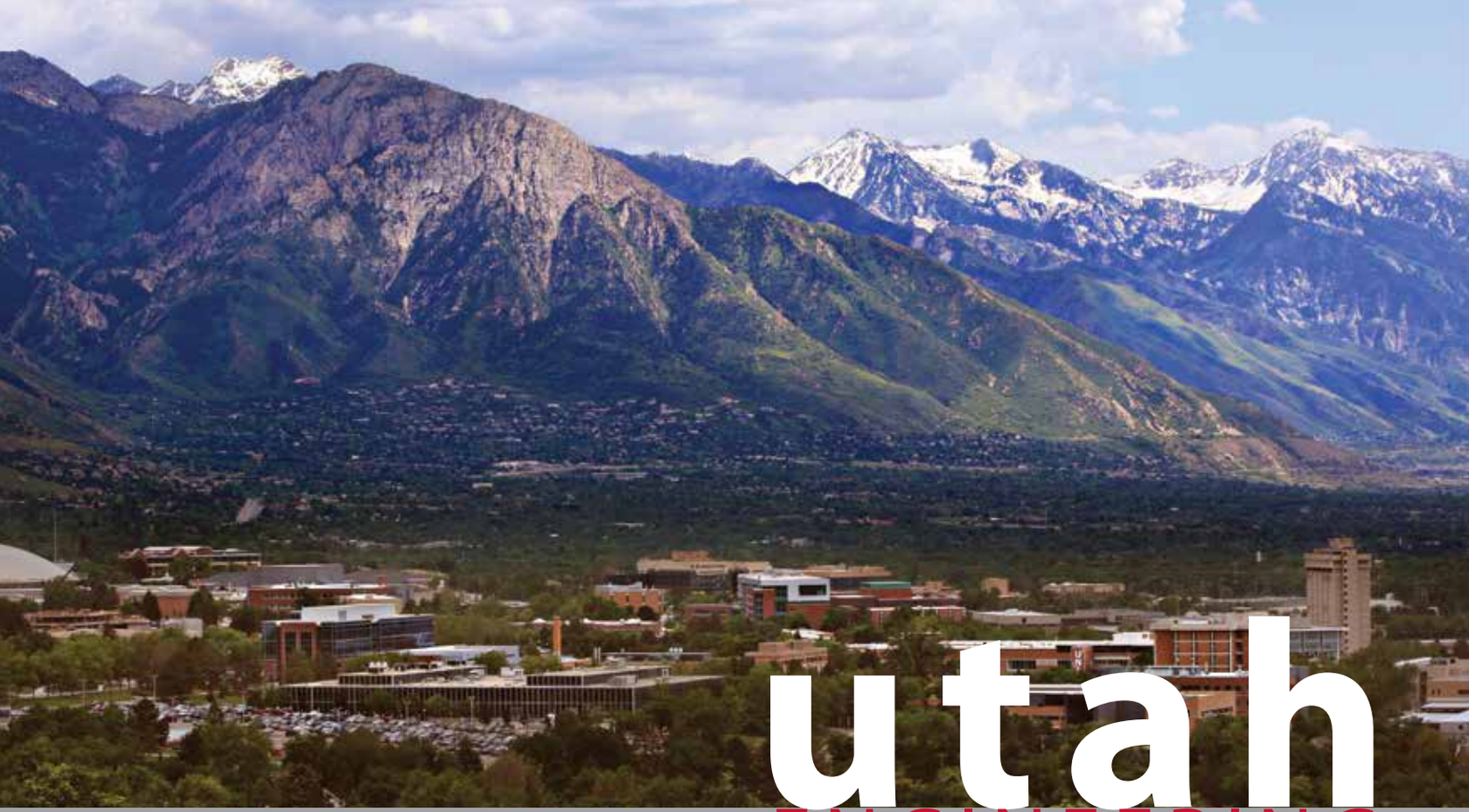


utah ENGINEERING

SUPER AGREEMENT EXPANDS RESEARCH OPPORTUNITIES

THE UNIVERSITY OF UTAH • COLLEGE OF ENGINEERING NEWSLETTER

SPRING 2022

UNSTOPPABLE ALLIANCE

For more than a decade, the University of Utah and the Idaho National Laboratory (INL) have been engaged in collaborative research that has advanced energy technologies, improved national security and more. Now, the two institutions have signed a formal agreement that will make their partnership even more valuable.

This newly signed Strategic Understanding for Premier Education and Research, or SUPER agreement, allows the U and INL to explore deeper research collaborations and expand opportunities for students, faculty, and researchers. The five-year renewable agreement solidifies what had been individual peer-to-peer agreements between laboratory researchers and university faculty members. Those have been replaced with a broad institutional memorandum encouraging greater collaboration including shared academic materials, visiting research scholars and cooperative symposia, seminars, workshops, and conferences. The U is one of only three research universities in the country with which INL, a U.S. Department of Energy laboratory managed by Battelle Energy Alliance, has such an agreement.

The signed Memorandum of Understanding with INL was announced during a news conference Wednesday, Feb. 23, at the Utah State Capitol in Salt Lake City. Those who spoke included University of Utah President Taylor Randall, INL Director John Wagner, Utah Congressman Chris Stewart, U College of Engineering Dean Richard B. Brown, U VP for Research Erin Rothwell and leaders of the Utah Legislature.

"This SUPER agreement will create another inflection point in the growth of research at the University of Utah," Brown said. "Since 2006, the College of Engineering has spun out 98 companies. The U can play a role in helping INL commercialize the technologies that come from our joint research efforts."

The laboratory and the U's College of Engineering have been collaborating on research in areas including nuclear energy, power grid security, and high-performance computing for more than a decade. In 2018, INL opened an office on the University of Utah campus focused on further developing a wireless technology that grew out of one of these collaborations to help first responders and law enforcement agencies communicate time-sensitive information, even when airwaves are congested. More recently, the laboratory began working with the school's nuclear engineering faculty on a medical isotope project that could dramatically improve certain cancer treatments.

INL has also been integral in the work of the Utah FORGE project, a dedicated underground field laboratory near Milford, Utah sponsored by the Department of Energy. The lab is used for developing, testing, and

accelerating breakthroughs in Enhanced Geothermal Systems technologies. Other engineering-related projects with INL researchers includes those on power and water systems resiliency and using machine learning in the development of a materials database.

"[The partnership] allows both institutions to have a greater impact than what we would have on our own," said INL Director John Wagner. "It will allow our institutions to really build on what has already been a 10-year relationship with many successes."

These enhanced collaborations will take advantage of a future computing and engineering building for the U's College of Engineering, one that has received initial funding from the state as well as a generous gift from philanthropists John and Marcia Price. This new $120-million building is scheduled to include a "sensitive compartmented information facility," or SCIF, in which government researchers like those with INL and U engineers can work together on classified projects related to national security.

"What it basically means — to put it in football parlance — is we have just been invited to the engineering Rose Bowl, and we're going to win this one because we can't lose," said U President Taylor Randall.

This agreement is just the latest sign of the College of Engineering's tremendous growth and rising importance in feeding new engineers to local and national economies. Currently, there are more than 6,400 students enrolled in the college with an eye of increasing that to 10,000. And in the last 20 years, engineering-related expenditures at the U have grown from $20 million to $99 million per year.

"When we talk about engineering . . . at the University of Utah, we want it to drive new industry, to drive new discovery," Randall said. "Our College of Engineering already has that history if you think about the companies that came out of its graduates. This type of agreement will drive the education for new leaders of industry."

NEW COMPUTING DEGREE AND CERTIFICATES

The University of Utah's School of Computing, one of the leading computer science departments in the nation, has received more than $1.4 million from the State of Utah to launch a new graduate-level degree and course certificates for students interested in three emerging fields in computer science: cybersecurity, deep learning in artificial intelligence, and fairness in artificial intelligence.

DEEP LEARNING

The U's School of Computing will develop a graduate-level Deep Learning Certificate Program, a 15-credit-hour curriculum that will teach students all aspects of deep learning in society. The money will be used to purchase computer systems with high-powered graphics processors, for faculty support, and to help establish internships with companies.

"Deep learning" refers to a type of machine learning in which algorithms duplicate human thinking. It's through deep learning that computers learn how to identify objects in images, translate languages, power robots, or drive cars autonomously.

SECURE COMPUTING

Nearly every aspect of our lives involves computers and the internet, so keeping data and systems secure is paramount.

The School of Computing is establishing both a Master of Science in Secure Computing and a Graduate Certificate in Secure Computing that will boost a student's prospects of working in the cybersecurity industry. The 15-credit-hour certificate program can be applied to the master's degree and will also be available online.

"Our entire lives and all of our critical infrastructure are now networked and use computers, and we have to protect that," says U School of Computing professor Sneha Kasera. "There's going to be a huge investment in cybersecurity, and we want a superior workforce to deal with security threats and establish our world leadership in cybersecurity."

FAIRNESS IN AI

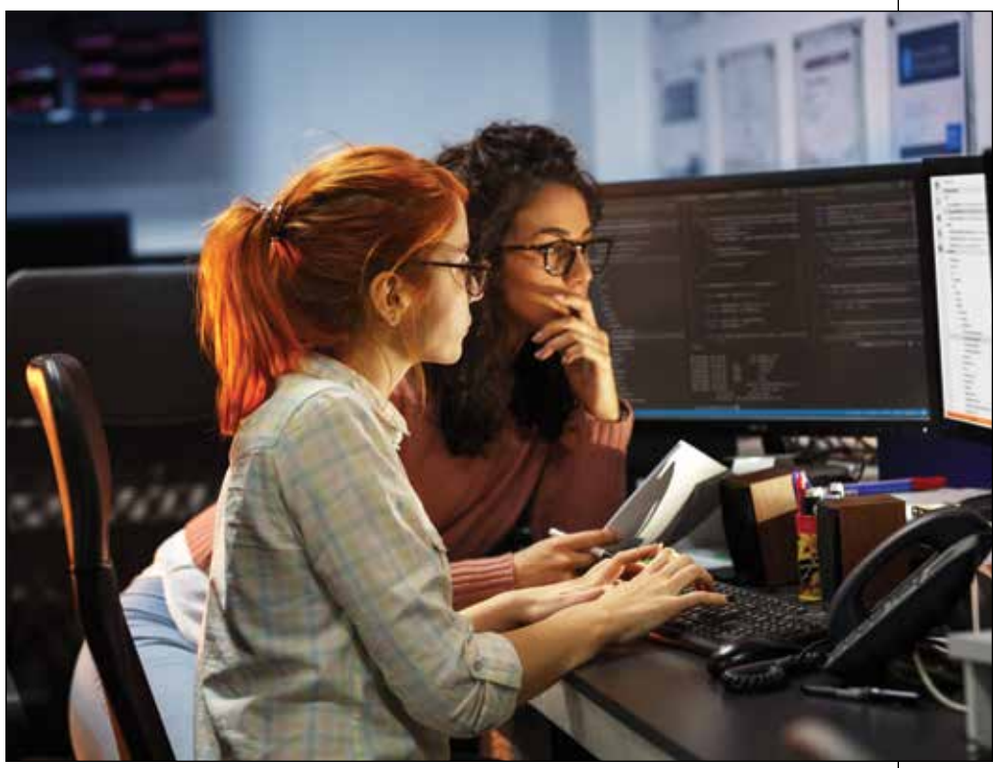
Artificial intelligence systems are used in a variety of functions such as determining financial, business, medical or legal risks or in helping weed out candidates for job interviews. While these algorithms can be better than humans at these tasks, emerging research has shown they can also discriminate against protected groups. This can impact millions of people as well as pose legal challenges for companies.

U School of Computing assistant professor Bei Wang Phillips, together with David Eccles School of Business marketing professors Arul Mishra and Himanshu Mishra, would use their grant to develop two new courses that address this issue. "Fair Algorithms for Business Decisions" would be taught to graduate students by the business school and focus on better understanding the use of fair algorithms in business decisions and maintaining that fairness during their development and deployment. The "Fair Machine Learning" course would be taught in the School of Computing to undergraduate students and centers on how to ensure biases in both the data and the model do not lead to algorithms that treat people unfavorably.

The U is one of five Utah universities that have received these "Deep/Emerging Technologies" grants from the state, funding that is designed to help develop curricula in areas such as advanced materials, AI, augmented and virtual reality, quantum computing, and biotechnology.

The new certificates and degree offered by the U are open for students sometime this year.

The U alone produces 46% of the state system's BS, MS and Ph.D. computer science and computer engineering graduates each year and has 1,929 students enrolled in those fields, a number that has consistently grown each year.



FACULTY BECOME NAI FELLOWS

University of Utah mechanical engineering Chair Bruce Gale and electrical and computer engineering and materials science and engineering Distinguished Professor Gerald Stringfellow were both elected Fellows of the National Academy of Inventors for 2021.

Stringfellow is known for his work with light emitting diodes and proposing a process called organometallic vapor-phase epitaxy for the growth of new semiconductor alloys in which aluminum, gallium, indium and phosphorous are deposited on a substrate to create red, orange, yellow and green LED crystals. His work, alongside the development of blue LEDs by three Japanese researchers, led to the advancement of flat-screen LCD televisions (LEDs illuminate the LCD panels), cellphones, solar cells, and new LED light bulbs.

Gale's research is focused on the biomedical applications of microfluidics as well as the design and manufacturing methods for medical devices such as biosensors, microarrays, micropumps, and microneedles. He has developed tools for drug development, pathogen detection, fast PCR technologies, and more.

In addition to the patents Gale has received for his work, he has also spun off multiple companies. The earliest company, originally Wasatch Microfluidics and now called Carterra, provides technology that helps discover new antibody-based drugs.

The NAI Fellows Program highlights academic inventors, with more than 1,400 fellows worldwide. This distinction is given to those who demonstrate a "prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development, and the welfare of society."

GEORGE NAMED TO FORBES "30 UNDER 30"

University of Utah electrical and computer engineering assistant professor Jacob George, director of the Utah NeuroRobotics Lab who is also helping develop the "LUKE Arm" motorized prosthetic arm, was named one of Forbes' "30 Under 30" in the Science category for 2022.

For 10 years, the finance magazine has named 30 young innovators, entertainers, and others each in a variety of categories from art and design to games, media, and sports. These are considered by the editors to be the ones to watch out for in their respective fields.

George joined the U in 2021 as an assistant professor in both the Department of Electrical & Computer Engineering and the Department of Physical Medicine & Rehabilitation. He also has adjunct appointments in both the U's Department of Biomedical Engineering and the Department of Mechanical Engineering.

His research involves augmenting biological neural networks with artificial neural networks and bionic devices to treat neurological disorders and further our understanding of neural processing.

He and U biomedical engineering associate professor Gregory Clark are part of the development team for the "LUKE Arm," a motorized prosthetic arm that mimics the way a human hand feels objects by sending the appropriate signals to the brain.

IN MEMORIAM

The University of Utah's College of Engineering has lost three beloved former faculty members recently, each a cherished educator and researcher who has affected the lives of thousands of students.

Richard E. Turley Sr., former mechanical engineering associate professor who was also Utah's first state science advisor and an Emeritus General Authority for The Church of Jesus Christ of Latter-day Saints, passed away Oct. 10, 2021. He was 90.

Turley received his bachelor's from the U in mechanical engineering and returned to the campus to teach nuclear engineering courses in the mechanical engineering department while earning his master's degree. While a professor at the U., Turley arranged to have the university's first nuclear reactor shipped to campus for use in his courses.

After receiving his doctorate at Iowa State University, he again taught at the U's mechanical engineering department in 1967 while also working as the executive director of the Utah Nuclear Energy Commission.

Turley helped launch Utah's Advisory Council on Science and Technology and was the state's science advisor for five years while he continued to teach and conduct research at the U. He was also director of the Industrial Engineering Division for the U's College of Engineering.

He was a life-long member of The Church of Jesus Christ of Latter-day Saints and served in the Second Quorum of the Seventy from 1997 to 2000.

Carl Hodson Durney, a professor of electrical engineering and bioengineering who spent 34 years with the university and is known for his contributions to the dosimetry of electromagnetic fields for models of the human body and animals, died Nov. 29, 2021, in a Payson, Utah, hospital. He was 90 years old.

Durney briefly worked for both Boeing Airplane Co., in Seattle, and Bell Telephone Laboratories in New Jersey before he joined the staff of the U in 1963 as an electrical engineering research assistant professor. He was appointed an assistant professor in electrical engineering in 1967, an associate professor in 1968, and professor in 1975. He was also a research professor of the then bioengineering department (now Department of Biomedical Engineering) in 1975. He was appointed chair of the U's Department of Electrical and Computer Engineering from 1977 to 1982.

Durney's research focused on electromagnetic field theory, physical electronics, electromagnetic biological effects and medical applications, and he is known worldwide for his research in NMR imaging, hyperthermia for cancer therapy, and mechanisms of electromagnetic-biological interaction.

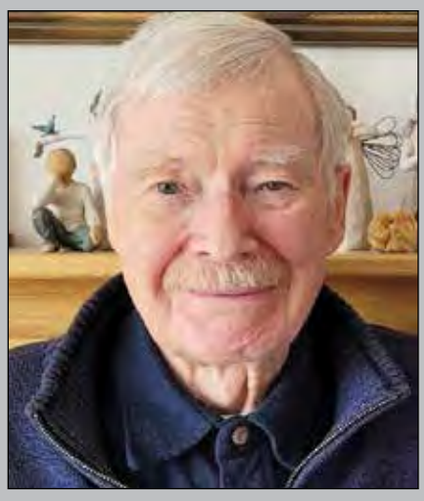
Gary E. Lindstrom, a member of the School of Computing for 30 years whose research pushed the boundaries of data management and verification, passed away Jan. 10 at his Salt Lake City home. He had just turned 78 two days earlier.

Lindstrom started his academic career as an assistant professor of computer science at the University of Pittsburgh in 1970. During that time, he also was a Visiting Scientist with the University of Grenoble, the Institut National de Recherche en Informatique et en Automatique, both in France, and at the Department of Applied Mathematics and Computer Science at MIT.

He joined the University of Utah as an associate professor of computer science in 1977 and was named professor in 1987. He was appointed the department's associate chair from 1992 to 1993. He retired from the university in 2007.

During his years with the U, his research focused on programming language design, specification and implementation, with special emphasis on the programming aspects of parallel and distributed systems.

Richard Turley Sr.



Carl Durney

Gary Lindstrom

ALUMNUS SPOTLIGHT
MICHAEL STUBBLEFIELD

Every day, Michael Stubblefield witnesses firsthand the power of science and its ability to benefit the world.

The 1994 University of Utah graduate in chemical engineering is the President and CEO of Avantor, a Pennsylvania-based provider of mission-critical products and services for the biopharma, healthcare, and advanced technologies and applied materials industries. His company plays an instrumental role in partnering with scientists on breakthroughs as they innovate new therapies and treatments to cure some of the world's most challenging diseases.

One major example is the role Avantor played in supporting researchers during the race to develop and produce COVID-19 vaccines.

Avantor provided high-purity materials, equipment and services during the research and manufacturing of COVID-19 vaccines. These vaccines, which are proven to be more than 90% effective at preventing death or serious illness from the coronavirus, are responsible for what many hope is now a shifting tide in the pandemic as cases and hospitalizations drop. His company has also aided pharmaceutical companies in developing the monoclonal antibody cocktails used to combat COVID-19 infection.

"I'm passionate about science, and it has been exciting to see the power of science in action," said Stubblefield, referring to how quickly these effective vaccines were created. "This experience has been extremely satisfying. This is the kind of work we do every day. I meet customers and patients and hear these kinds of stories constantly, and they give purpose and meaning to what we do."

While growing up in a small northwestern Colorado town where his father was a mining engineer, Stubblefield was deciding which direction to take after high school — business or engineering. But the pull of science was too great, he said, thanks to a family already immersed in engineering (in addition to his father, his sister was working as a chemical engineer).

"My dad and I drove to Salt Lake, and we toured the school and the Department of Chemical Engineering," he remembered about his visit to the U. "I just fell in love with the campus. It felt right, and I loved the department."

With a scholarship in hand, Stubblefield enrolled in the U's chemical engineering program. The experience he had on campus would be the foundation for a wildly successful career in both engineering and business.

Out of college, he got his first engineering job with Celanese, a Texas-based chemicals and materials company. He worked in both the manufacturing and commercial aspects of the company for nearly 20 years. While at Celanese, he also earned an MBA from Texas A&M University and later was promoted to managing many of the company's divisions. "I worked in virtually every division they had, from plastics to chemicals to some of their paint and coatings businesses," he said. "It was a pretty broad background."

In 2014, he was recruited to head Avantor, which offers process chemicals and reagents, lab supplies and equipment from filtration systems to analytical instruments, as well as lab and digital services for a wide variety of industries. During the pandemic, the company provided vaccine developers products and services for testing, equipment used in the research, scale-up production, and more.

"Nothing like this was ever done at this scale before," he said about the herculean effort to develop an effective vaccine in so little time. "To have all that done, from the research and development, scale-up, clinical trials and regulatory approval, as well as mobilizing an entire supply chain, is nothing short of a miracle."

But Stubblefield's drive to push science and technology further and faster has been a lifelong mission, something he's so far been successful at, he says, thanks to what he learned as a University of Utah student.

"With engineering, there is no better education for teaching critical thinking and problem solving," he said. "It was so satisfying to have those kinds of opportunities — to be able to leverage the foundational education I got at the U. That was a really pivotal moment in helping shape my career. Our family will forever be grateful to the U, and I will always be proud to be a Ute."

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STUDENT LIFE

ENGINEERING SCHOLARS PROGRAM TO EXPAND

For more than 20 years, the University of Utah Engineering Scholars Program has introduced first-year students to the excitement of important and ground-breaking research. Now the College of Engineering wants to build on that success.

Dean Richard B. Brown plans to expand the program from 10 students per year to as many as 350 to entice more top-level students to the U's College of Engineering and keep them enrolled through graduation.

In the reimagined Engineering Scholars Program, first-year students will spend one semester touring labs and getting training and career development to acquaint themselves with college resources and university life. In the second semester, students will either be paired with a senior design project team or a research lab to gain hands-on experience.

"ESP students will have an enhanced opportunity to be engaged in real-world problems as they develop critical thinking and engineering skills right off the bat," said Emily Howsley, who is heading the program ramp-up, "ESP students will be able to go beyond the classroom with a rich variety of opportunities to develop personally and professionally."

As part of the program's expansion, the college proposes inviting members of its Engineering Alumni Association to conduct seminars, practice interviews, and mentoring. Students will tour local tech companies to acquaint them with Utah industry. And speakers will be brought in to discuss entrepreneurism and other vital topics. The college is putting an emphasis on how to commercialize

technology and created the Engineering Entrepreneurial Certificate to give students valuable instruction on how to turn their ideas into money-making ventures.

Meanwhile, the college will work with local industry to connect these students with more internships, and there will be more social activities held by departments to build a stronger sense of community.

Finally, the college will ask companies, private foundations, and the state for support to generate the additional funding necessary for the program's growth.

These new features are designed to build a more robust program for first-year students that will familiarize them with engaging and valuable research and give them the much-needed hands-on experience to excel after college.