utah ENGINEERING

MARY HALL

//simplifying supercomputing

THE UNIVERSITY OF UTAH • COLLEGE OF ENGINEERING NEWSLETTER

SPRING 2019

COMPUTING POWER

The most powerful computers in the world can simulate complicated phenomena including the properties of energy, the climate, even how cancer advances. The problem is these supercomputers sometimes require equally complex programming to produce efficient simulations, and researchers would rather spend time doing the science rather than writing code.

University of Utah School of Computing professor Mary Hall believes there is an easier way to program supercomputers. It begins with a different foundation in the underlying code. She's part of a six-year U.S. Department of Energy program to develop compiler technologies that would make it much easier to write software for these high-performance machines.

"That way they [researchers] can spend less time writing the software, and the software will run faster on the hardware," she said. "It gives them the results faster, and they can use their resources better."

Hall is part of the DOE's Exascale Computing Project (ECP), which was launched to prepare the simulations and underlying software technology for anticipated exascale supercomputers. Hall's work with ECP is to create a new automated mapping of the foundational code for supercomputers so programmers can be more productive while programming them. Exascale computers will operate at the rate of at least one exaFLOPS, or a quintillion calculations per second. Such computers will be used by the government and researchers for energy simulations, ground water and weather simulations or simulating the power of our nuclear arsenal.

"It takes too much human effort as well as very high-skilled individuals to program these supercomputers," she said. "It is getting harder because computer architectures are becoming more complex."

A graduate of Rice University in Houston with bachelor's, master's and doctorate degrees in computer science, Hall began researching ways to create a better computing foundation for high-performance computers. She is developing compiler and programming systems that automate performance tuning, and she is researching ways to optimize applications for fluid dynamics simulations and machine learning.

While her work helps a niche group that works with the world's most powerful computers, companies are also taking an interest in Hall's research because compiler technology can also improve the scalability of deep learning in datacenter computers used by companies like Google, Facebook or Netflix. For example, Google uses deep-learning algorithms to automatically identify someone in a picture.

"The kind of software technology you need for deep learning is not that different than what you need for scientific computing," she said. "So there is a convergence of these two areas."

Boosting Participation

While growing up in her hometown of Beaumont, Texas, Mary Hall became fascinated in computing in part because her mother was an early adopter.

"When I was in high school, my mother got interested in computer science, and she started taking classes at the local university," Hall said. "She was teaching computer literacy. And though no one had computers in their home, we had one of these Radio Shack TRS-80s in our house."

Hall, who is now a professor in the University of Utah's School of Computing, knows the importance mentors like her mother can have on influencing young students in STEM. So she has devoted her career to encouraging female students and those from underrepresented communities to become computer scientists.

"For people of color, the impoverished, those with disabilities, and gender — we don't have enough computer scientists, and we need to step up," Hall said.

Hall is chair of the Women in Engineering Faculty Advisory Council for the U's College of Engineering as well as chair of the School of Computing's diversity committee. She has implemented diversity-advocacy workshops for faculty as well as a mentoring program where she connects female senior faculty members with new female assistant professors. She's studied the booming enrollment in computer science and its impact on colleges and the diversity of the student body.

At the U's School of Computing, Hall said progress is being made. "When I came here in 2008, less than 4 percent of computer science undergraduates were women, and now it's about 15 percent," she said. "But we still have a lot of work to do."

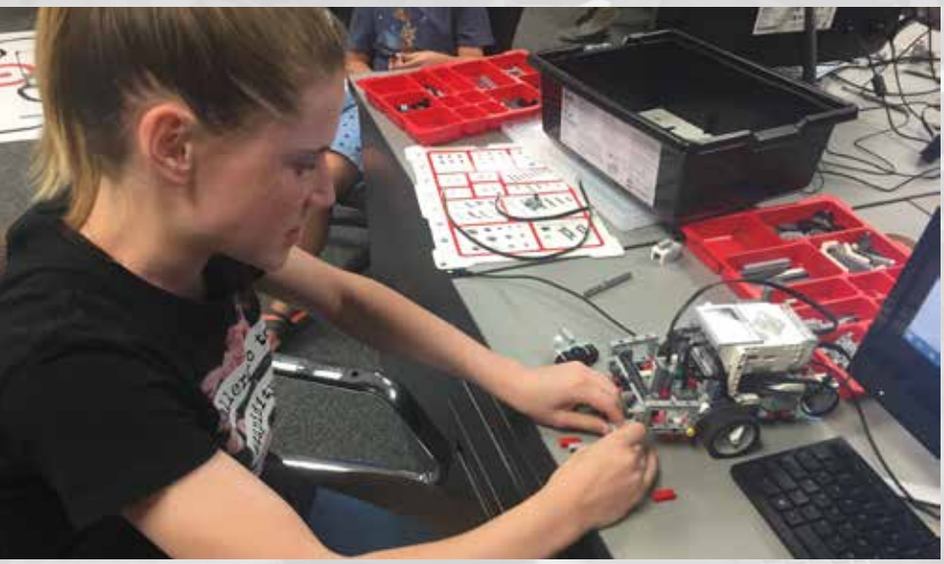
To help other schools understand what they can do to increase the number of women and people of color in computer science, Hall received a National Science Foundation grant to launch a web-based resource for the Computing Research Association called "Broadening Participation in Computing Efforts."

This portal at Bpcnet.org connects computer science faculty with national programs geared for recruiting and retaining more students from underrepresented groups.

GREAT WAY TO SPEND THE SUMMER

For 10 years the University of Utah's GREAT Camps have certainly been that, a splendid and awe-inspiring summer camp for 4th- through 12th-grade students who learn about the fascinating world of computer science.

Now starting its 11th year, the GREAT (Graphics and Robotics, Exploration with Amazing Technology) Camps will again invite more than 450 students to come to the College of Engineering campus for one-week hands-on experiences with robots, computer code, and video game development. There will be six week-long sessions held throughout the summer.



This is not just an ordinary summer computer camp, said director Dave Johnson, who is also an assistant professor (lecturer) for the U's School of Computing. "We offer many different kinds of sessions, so campers can see different sides of computer science," he said. "In addition, we have a whole set of devoted campers that return year after year as they progress through the material and age groups."

For the week, the students will program robots to accomplish different tasks such as running a maze or sliding down a zipline, write computer code to create image filters or interactive art programs, develop classic arcade games, and create interactive graphics and animations.

The camp, which is held in both the Warnock Engineering Building and Merrill Engineering Building, is run by a team of public school teachers as well as undergraduate and graduate computer science students.

"It's been great working with both kids in the community and with the undergraduate students who have been hired as instructors," Johnson said. "I'm always amazed by my students' enthusiasm and their desire to share their knowledge with the next generation of computer scientists."

COE AT SILICON SLOPES

In February, the University of Utah College of Engineering had a large presence at this year's Silicon Slopes Tech Summit at the Salt Palace Convention Center, touting new programs that can benefit the careers of Utah's tech employees.

The summit attracted more than 24,000 attendees, many of whom got to learn about our new degree programs such as ECE's online master's program and the Master of Software Development.

Also on display were adaptive sports technology designed by mechanical engineering associate professor Andrew Merryweather, including a sitski for people with physical disabilities and a tetra fishing pole with a sip-and-puff controller.

The annual two-day summit, put on by the nonprofit Silicon Slopes, is designed to lure up-and-coming tech startups to locate their businesses to Utah. The state has one of the fastest-growing tech sectors in the U.S.

ALUMNI SPOTLIGHT
ED CATMULL

CATMULL RECEIVES ACADEMY AWARD

University of Utah College of Engineering alum, Ed Catmull, the president of Pixar Animation and Walt Disney Animation whose technological advancements in computer animation revolutionized Hollywood movies, was awarded his sixth scientific and technical Academy Award last February.

Catmull received the Academy's Scientific and Engineering Award for his original concept behind "subdivision surfaces as a modeling technique in motion picture production," according to the Academy of Motion Picture Academy of Arts and Sciences, which hands out the awards. Computer graphics researchers Jos Stam and Tony DeRose also received the award for their scientific and practical implementation of the concept.

"Subdivision surfaces" is a method in computer graphics to produce a smooth surface of an object over a digital wire mesh. Catmull discovered the process in 1978 along with fellow U alum, Jim Clark.

This method would be an early milestone in the development of computer graphics and animation. Catmull also helped create the computer animation software known as RenderMan, which would be the core program used in the development of Pixar's animated movies such as "Toy Story" and "Monster's Inc."

Catmull first attended the University of Utah in 1963 as a physics student but later took computer science classes as graphics were emerging as a new technology. In the late 1960s and '70s, he was paving new ground in computer technology along with other noted U pioneers that included interface designer Alan Kay, Silicon Graphics founder Jim Clark, Adobe founder John Warnock and Nolan Bushnell of Atari.

During his time at the U in 1972, Catmull would produce a landmark film, a computer-animated version of his left hand that would be the first in computer animation. In 1979, movie mogul George

Lucas hired Catmull to head the computer animation division for Lucasfilm, producing special effects for a number of movies. In 1986, Apple co-founder Steve Jobs purchased Lucasfilm's computer animation division and created Pixar with Catmull. In addition to dozens of short films, Pixar so far has produced 20 feature-length computer animated films that have earned more than $13 billion globally at the box office. In 2006, Pixar merged with Disney, and Catmull remained as president of the company while also becoming president of Disney's Animation Studios.

As the president of Pixar Animation Studios, based in Emeryville, Calif., Catmull was responsible for the company becoming the most distinguished computer animation studio in the world with other box office hits such as "Finding Nemo," "Up," and "Coco." In all, the film studio has garnered 15 Academy Awards, nine Golden Globes and 11 Grammys. Simultaneously, his tenure as the president of Walt Disney Animation Studios produced such hits as "Frozen," "Big Hero 6," and "Moana."

Catmull has earned four other scientific and technical Academy Awards for both the concept of subdivision surfaces and for the creation of the RenderMan software. He is also the recipient of the Academy's Gordon E. Sawyer Award, which is given to an individual in the motion picture industry "whose technological contributions have brought credit to the industry."

Catmull retired from both Pixar and the Walt Disney Company at the end of 2018 but will remain on as a consultant until July. He is also a member of the college's Engineering National Advisory Council.

IN BRIEF

GRAINGER RECEIVES ETHICS AWARD

University of Utah biomedical engineering chair and Distinguished Professor David Grainger is one of this year's recipients of the Daniels Fund Ethics Initiative Leadership in Education Award.

Grainger is also a professor and former chair of pharmaceutics and pharmaceutical chemistry at the U. His research focuses on improving drug delivery methods, implanted medical device and clinical diagnostics performance, and nanomaterials toxicity.

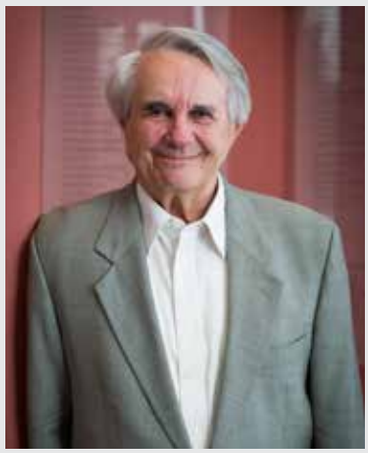
The award honors "faculty and staff across the campus of the University of Utah for their successful efforts to create new ethics-related courses, to integrate new business ethics content into existing courses, to mentor students on ethics initiatives and to help make business ethics a permanent fabric of our business school and other University of Utah academic programs and curricula." The awards are bestowed by the Daniels Fund Ethics Initiative at the U's David Eccles School of Business.

DEVRIES LAB DEDICATION

The College of Engineering and Department of Mechanical Engineering dedicated the new Kay and Larry DeVries Strength of Materials Laboratory in the Merrill Engineering Building.

The lab in room #1186 is where testing can be done on certain materials, including for tension, buckling, twisting and more. The lab was recently refurbished with new floors, ceilings, tables, chairs and a television monitor for lectures. It also has been steadily receiving new material testing systems.

The new laboratory was named after mechanical engineering Distinguished Professor K.L. "Larry" DeVries, a faculty member of 55 years who retired from the University of Utah last December.



KOPEČEK NAMED TO NAI

University of Utah biomedical engineering Distinguished Professor Jindřich Henry Kopeček, who pioneered research in the design of polymer-drug conjugates and hydrogel biomaterials, was one of 148 academic inventors named as a Fellow of the National Academy of Inventors for 2018.

Kopeček, who has been with the U for more than 30 years, formulated and implemented a comprehensive approach to the design of nanosized water-soluble polymer-drug conjugates and provided tools to manipulate the tissue and subcellular localization of therapeutics. This work initiated worldwide research and applications of polymeric drug carriers for the design of new therapeutics to treat cancer and musculoskeletal diseases. He designed, synthesized and characterized hydrogels for clinical applications, contributing to fundamental studies of biocompatibility of synthetic polymers.

Election to NAI Fellow status is the highest professional distinction given to academic inventors who have demonstrated a 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," according to the NAI.

Past University of Utah fellows include College of Engineering Dean Richard B. Brown; chemical engineering Distinguished Professor and former U President David W. Pershing; electrical and computer engineering professor Cynthia M. Furse; materials science and engineering Distinguished Professor Anil Virkar; and the late Stephen C. Jacobsen, Distinguished Professor of mechanical engineering.

IN MEMORIAM

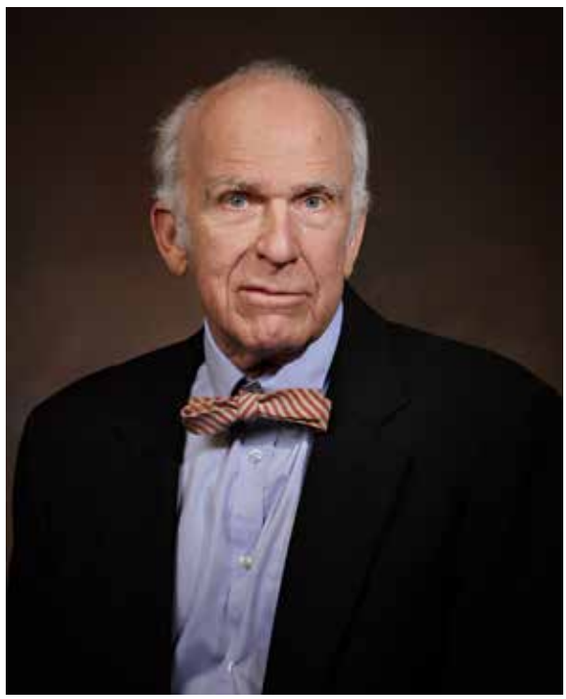
PETER D. MELDRUM

University of Utah chemical engineering graduate, Peter D. Meldrum, co-founder of Myriad Genetics whose research team was the first to develop a commercial test for the breast cancer gene, died Dec. 20 following an accident. He was 71.

Meldrum, who was once named one of *Scientific American*'s Top 50 Scientific Visionaries in the world, was a lifelong benefactor of the U's College of Engineering and a founding member of its Engineering National Advisory Council.

He graduated from the University of Utah with a bachelor's degree in chemical engineering and earned a master's in business administration. In 1991, he and U genetics researcher and professor Mark Skolnick launched their company, Salt Lake City-based Myriad Genetics. Under Meldrum's leadership, Myriad's research teams would be the first to develop a commercial test for the BRCA1 and BRCA2 hereditary genes responsible for breast and ovarian cancers. The test could predict whether or not a patient was more likely to get a disease in the future. Today, Myriad produces more than a dozen products — mostly in the form of blood tests — that inform patients whether they carry a particular gene that increases the risk of cancer.

NOEL DE NEVERS



University of Utah chemical engineering Emeritus Professor Noel de Nevers, celebrated author, air quality researcher and stalwart of the College of Engineering for more than 50 years, died Jan. 4 at his home in Salt Lake City. He was 86.

De Nevers, whose research focused on air pollution control and energy policy, began at the University of Utah in 1963 and was named Emeritus Professor in 2002. He was also associate dean of the U's College of Engineering from 1969 to 1971.

During his tenure at the U, de Nevers authored or contributed to more than 85 textbooks, articles and other publications on subjects including thermodynamics, fluid mechanics, petroleum and energy policy, and air pollution. His articles have appeared in a variety of journals including *Scientific American* and *Chemical Engineering Science.*

He also published a book, *The Kolob Tragedy: The Lost Tale of a Canyoneering Calamity*, about a disastrous youth trip near Zion National Park in 1993. He also dabbled in poetry and won the title Poet Laureate of Jell-O Salad at the 1983 Last Annual Jell-O Salad Festival in Salt Lake City with three limericks and a quatrain.

THE UNIVERSITY OF UTAH

COLLEGE OF ENGINEERING
OFFICE OF THE DEAN
72 S. Central Campus Drive
Salt Lake City, UT 84112-9200
www.coe.utah.edu

Follow us:

@UtahCoE

facebook.com/utahcoe

@UtahCoE

STUDENT LIFE
ARCS SCHOLARS

ARCS Foundation Utah honored its 2018 scholars during its 10th anniversary awards luncheon held Oct. 17 in the John A. Moran Eye Center Auditorium. ARCS Foundation Utah Chapter is part of the national nonprofit women's organization throughout the country which helps U.S. students. The Utah chapter of the foundation supports students in doctoral programs in engineering and ophthalmology at the University of Utah.

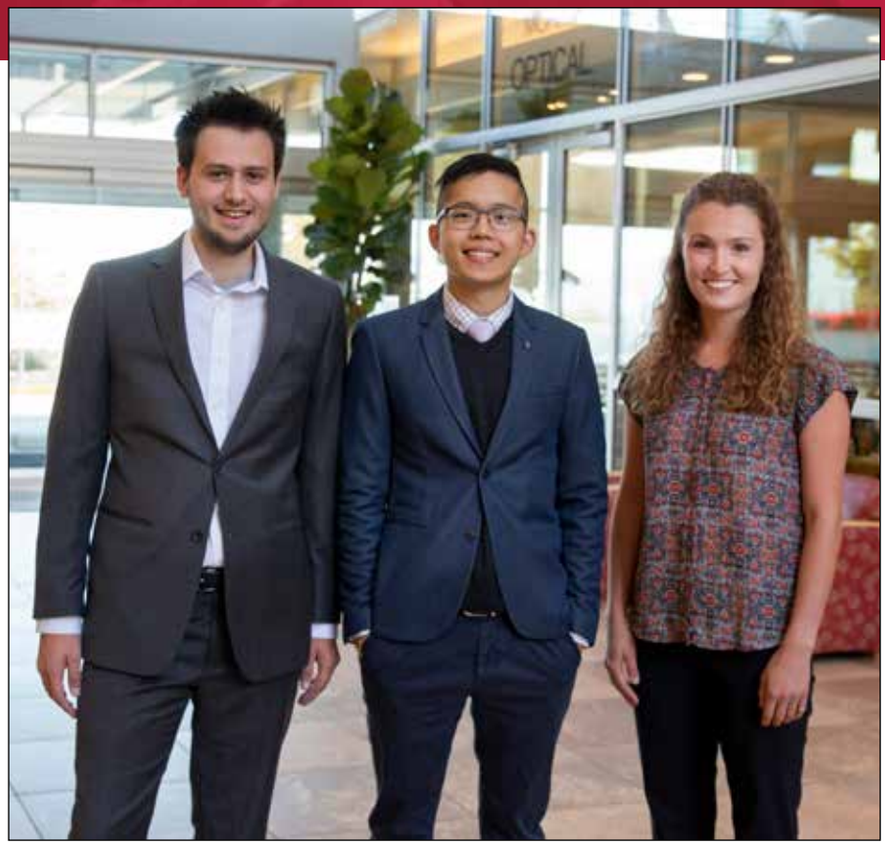
This year's engineering scholars include:

BRAM HUNT
(BIOMEDICAL ENGINEERING)

Bram Hunt (pictured, left) is a first-year doctoral student in biomedical engineering at the U. His research is in cardiac electrophysiology and biophysics, and he hopes to solve problems of reliability in medicine using machine learning and automation. He comes from Albuquerque, New Mexico, where he graduated summa cum laude with a bachelor's degree in chemical engineering. He received a departmental Outstanding Senior Award in recognition of his academic excellence and outstanding contributions to the school community.

ANTHONY YIN
(MECHANICAL ENGINEERING)

Anthony Yin (pictured, center) graduated magna cum laude in mechanical engineering with a biomechanics minor from the University of Florida. As an undergraduate, he worked on developing a microscale tensile tester to study the effects of tensile loading on cell behavior. At the University of Utah, he is pursuing a doctoral degree in mechanical engineering with research focused on biomaterials and bone cements under the direction of assistant professor Steven Naleway.



ANNA DELERAY
(BIOMEDICAL ENGINEERING)

Anna Deleray (pictured, right) is pursuing a doctoral degree in biomedical engineering. She plans to research biomaterials and therapeutics. Prior to the University of Utah, she conducted protein engineering and biosensor design research at Los Alamos National Laboratory. This research helps solidify her intention to pursue graduate studies and a career in bioengineering. She completed her B.S. in chemical and biochemical engineering at the Colorado School of Mines.