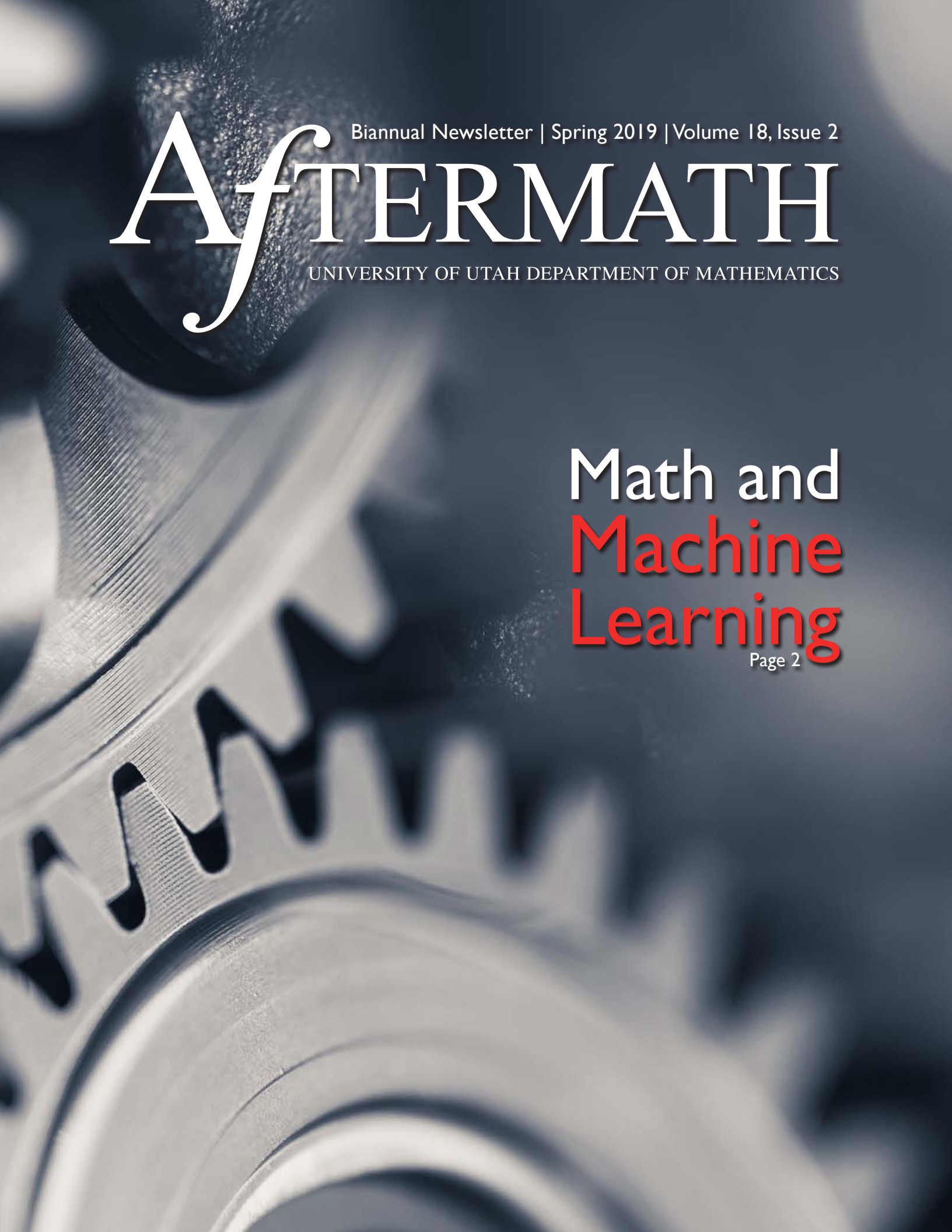


Biannual Newsletter | Spring 2019 | Volume 18, Issue 2

AfterMath

UNIVERSITY OF UTAH DEPARTMENT OF MATHEMATICS

Math and Machine Learning

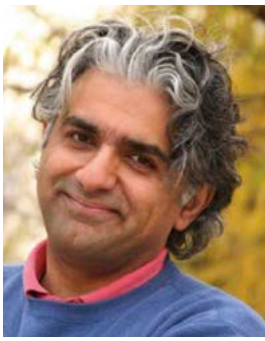
Page 2

In This Issue

The Crocker Science Center is housed in the historic and newly renovated George Thomas Building. The center serves as a world-class facility for science education with state-of-the-art teaching laboratories and flexible classroom spaces. The building also has integrated advising and tutoring centers.

Message from the Chair

Our faculty continues to be recognized for their excellent research, teaching, and mentoring. Christopher Hacon, McMinn Presidential Endowed Chair and Distinguished Professor of Mathematics, was elected to the Royal Society of London. Firas Rassoul-Agha, professor of mathematics, was named a member of the 2019 Class of Fellows of the Institute of Mathematical Statistics. Tommaso de Fernex, professor and associate chair of the Mathematics Department, and Peter Trapa, professor and former chair of the Mathematics Department and currently chair of the Physics & Astronomy Department, were named members of the 2019 Class of Fellows of the American Mathematical Society. Mladen Bestvina, Distinguished Professor of Mathematics, received the U's Distinguished Scholarly and Creative Research Award. Akil Narayan, assistant professor of mathematics, is a recipient of a prestigious National Science Foundation (NSF) CAREER award, and Kelly MacArthur, assistant chair and instructor (lecturer) of mathematics, was twice recognized for excellence in teaching: once through the Career Services Faculty Recognition Award and a second time with the Excellence in Education Award. On a wider basis, the department is the recent recipient of a celebrated grant from the NSF (Research Training Groups in the Mathematical Sciences) in pure mathematics. We are very proud of our talented faculty, and I thank them for their commitment to the highest level of excellence, the department, and the university.



Davar Khoshnevisan

I am excited to tell you that we will be welcoming several new faculty members in July. I will provide more information about them in our next newsletter.

This year, we trained hundreds of mathematics majors, with approximately 90 undergraduates who have completed a bachelor's degree in mathematics, and thousands of non-majors, campus wide. It is wonderful to see that we continue to excel in following our mission of providing Utah's students with a rigorous and effective mathematical education that will help them succeed in pursuing careers not only in academia, but in government and in industry.

We were saddened by the death of Michael Zhao. Michael was a promising mathematician who graduated with honors in mathematics from the U. He was awarded the prestigious Churchill Scholarship, and was subsequently pursuing a Ph.D. in mathematics at Columbia University when he passed away. The department has established an undergraduate scholarship in Michael's name. The first recipient of the Michael Zhao Memorial Scholarship is senior Taylor Walker.

Please consider supporting the Crimson Laureate Society, established by the College of Science to build a community of alumni and friends who are passionate about advancing scientific research and education at the U. For more information on how to support the Math Department through the Society, please visit https://science.utah.edu/cls, or call 801-581-6958. Thank you for your support.

Sincerely,

Davar Khoshnevisan
Professor and Chair
Department of Mathematics

Math and Machine Learning

Akil Narayan, assistant professor of mathematics, is also a computer scientist who combines his expertise to develop computational tools and software.

Recently, Narayan helped biomedical engineers at the U build a simulation codebase for understanding how physiological factors influence the ability of human blood to carry and release oxygen. The codebase used mathematical work that Narayan had developed to understand optimal ways to build computational emulators for physical models.

"Much of my work is actually driven by scientists who seek tools to solve a particular problem," he said. "In this sense, my research is motivated by an application that someone will find useful."
Narayan has received a prestigious National Science Foundation CAREER Grant to help with his research.

Interdisciplinary Work

"At the U, I'm fortunate to enjoy the support of two departments—Mathematics and the Scientific Computing and Imaging Institute (SCI Institute)—in creating a collaborative culture," says Narayan, "and I find that there's quite a bit of overlap between them. For example, work in the SCI Institute helps to provide a codified science that transforms mathematical formalisms—such as proofs and theorems—into simulation tools for modelers and engineers." At the same time, Narayan's work in the Mathematics Department provides foundational theory and algorithms for accomplishing some of the most difficult computational tasks today.

Founded in 1994, the SCI Institute has become an internationally recognized leader in developing applications and creating new scientific computing

techniques, tools, and systems. The Institute encourages collaboration between different disciplines at the U, such as mathematics, biomedical engineering, neurology and neurosurgery, neuromodulation research, visualization design, and scientific computing.

"The modern availability of large experimental datasets makes the possibility of learning predictive models from data a realistic goal. However, the underlying mathematics and algorithms to accomplish this complex task in learning are still being developed," says Narayan.

Narayan is currently investigating tools for approximations in higher dimensions, which is a necessary step to achieve many computational goals.

"There are situations when conducting research in the higher dimensions of math can overwhelm today's technology, but by shifting focus and using the tools available in data science and machine learning, we can manipulate data and create predictive tools with exciting results."

Historically, large data sets were analyzed manually, where scientists relied on human cognition to exploit patterns and structures to gain understanding of the data. Today, the mathematics, statistics, and computing power are sufficient to enable the mining of large data sets using computational cognition.

"Since computers can manipulate and investigate data much faster than humans, this advance has the potential to revolutionize the advancement of science," says Narayan.

He received an undergraduate degree in electrical engineering and engineering sciences and applied mathematics from Northwestern University and obtained a Ph.D. from Brown University.

Akil Narayan

"THERE ARE SITUATIONS WHEN CONDUCTING RESEARCH IN THE HIGHER DIMENSIONS OF MATH CAN OVERWHELM TODAY'S TECHNOLOGY, BUT BY SHIFTING FOCUS AND USING THE TOOLS AVAILABLE IN DATA SCIENCE AND MACHINE LEARNING, WE CAN MANIPULATE DATA AND CREATE PREDICTIVE TOOLS WITH EXCITING RESULTS."

—Akil Narayan

Using Math
to Describe Physical Phenomena

He first became interested in computing and programming while watching his older brother use a computer to create things and learn to program. Later, Timo Heister's own interest in scientific computing and numerical analysis evolved naturally from his knowledge of programming as well as a keen interest in mathematics.

"Scientific computing makes math usable by other scientists and gives it purpose," said Heister, assistant professor in the U's Mathematics Department and a faculty member at the U's Scientific Computing and Imaging Institute (SCI). "Scientific computing also allows us to visualize mathematical structures, and this is what motivates me—using mathematics to enable other scientists to do their work." To that end, Heister develops software distributed as open source code to small or large international communities, allowing scientists to use these tools in their research.

Timo Heister

Algorithms and PDEs

Heister uses algorithms to solve partial differential equations (PDEs) on a computer. PDEs are useful in describing all kinds of physical phenomena: the flow of air in a room; how materials, such as steel, bend under force or develop fatigue; how airplanes fly; how blood flows through arteries, etc. "Underlying all of these phenomena is math because all of these physical things can be described by energy balance equations," said Heister.

Initially, Heister thought he would have a career as a software engineer, but when he took his first classes at the University of Goettingen in Germany, he loved the structure, precision, and logic of mathematics. He received a Ph.D. in mathematics from the same university and then joined Texas A&M University as a visiting professor. He was recently an assistant professor at Clemson University before he joined the U in 2018.

When he isn't writing software, Heister is an avid cyclist, participating in bike races, or just riding—often with friends—in the mountains.

Heister is confident there will always be new and challenging computational problems to solve. "Technology is always developing, so we'll continue to have newer, bigger, and faster supercomputers that come with new challenges," said Heister. "In the meantime, I'll continue to work on making scientific computing and software more accessible to allow scientists to do their work and teach the next generation of scientists. That's what keeps me going."

Math Professor Named Fellow of the Institute of Mathematical Statistics

Firas Rassoul-Agha has been named a member of the 2019 Class of Fellows of the Institute of Mathematical Statistics (IMS) The Institute is an international professional and scholarly society devoted to the development, dissemination, and application of statistics and probability. IMS Fellowship recognizes the outstanding research and professional contributions of its members.

"I'm honored to become a member of this exceptional group of mathematicians," said Rassoul-Agha, professor of mathematics. "It's always gratifying to be recognized by my colleagues for contributing to the profession."

Firas Rassoul-Agha

Rassoul-Agha's research is on the interface of probability theory and rigorous aspects of statistical mechanics. "I work on understanding the evolution of systems with complex interactions, such as particles moving in a disordered environment, heat diffusing in an inhomogeneous alloy, cars navigating their way through traffic, the rough surface of a growing crystal, and the boundary of an infected tissue," he said. "Complexity is captured by the randomness in the model, both in the environment with which the particles interact or in which the crystal grows, and in the interaction or growth process itself. I focus on developing the mathematical laws that govern such systems such as quantifying the particle density evolution, the roughness of the growing interface, and the properties of the optimal particle trajectories."

He obtained a Ph.D. from New York University's Courant Institute of Mathematical Sciences in 2003 and was a visiting assistant professor and postdoctoral researcher at Ohio State University. He joined the U as an assistant professor in 2005; an associate professor in 2009; and a professor in 2014.

He has received numerous awards throughout his career, including a Simons Foundation Fellowship and a National Science Foundation CAREER Award.

When he isn't in the classroom or doing research, he is with his wife, Alla Borisyuk, associate professor of mathematics and the department's director of undergraduate studies, and their two sons.

Peter Trapa Selected as New Dean of the College of Science

University of Utah senior vice president for Academic Affairs Dan Reed announced that Peter Trapa has accepted an offer to serve as the next dean of the College of Science.

Trapa is currently chair of the university's Department of Physics & Astronomy and previously served as the chair of the Department of Mathematics and special assistant to the dean of the College of Science. Trapa also was the inaugural presidential fellow in 2016-17 under former U President David Pershing. He was named a fellow of the American Mathematical Society in 2019.

Peter E. Trapa

"Trapa is regarded as an excellent and innovative administrator, a strong advocate for students, staff and faculty, and an outstanding scholar," Reed said. "He is a great communicator who is able to develop consensus and cultivate a positive culture. His deep understanding of the university and the state will serve the College of Science well as it continues to rise among its peers."

The College of Science consists of three departments—chemistry, mathematics and physics and astronomy—and the School of Biological Sciences. It also includes several interdisciplinary centers. It has annual research expenditures of approximately $40 million.

Following completion of the appointment approval process, Trapa will assume his position on July 1, 2019.

"I'm honored to be named the next dean of the College of Science," Trapa said. "It's an exciting time for the college, and I look forward to working to advance its world-class research reputation and further propel its central educational mission both within the university and the state of Utah."

Trapa joined the U's Department of Mathematics in 2001; he was named chair of the department in 2011, serving in that position until 2017. He served as special assistant to Henry White, current dean of the College of Science, in 2017-2018.

He has served as chair of the Department of Physics & Astronomy since 2018, where he has overseen development of a model graduate program, reorganized departmental leadership and staff, and implemented a strategy to recruit exceptional and diverse faculty.

Trapa received undergraduate degrees in mathematics and integrated science from Northwestern University and a doctoral degree in mathematics from the Massachusetts Institute of Technology. He did postdoctoral work at Harvard University and the Institute for Advanced Study at Princeton before joining the U.

U Mathematician Elected to Royal Society

Christopher Hacon, McMinn Presidential Endowed Chair and Distinguished Professor of Mathematics, can now add another honor of a lifetime to his already stellar resume: Election to the Royal Society of London.

Hacon, born in England, is one of 50 eminent scientists elected as a Fellow of the Royal Society, along with 10 Foreign Members, in 2019. Founded in 1660, the Royal Society is the oldest national scientific institution in the world. Through its history, the society has named around 1,600 Fellows and Foreign Members, including around 80 Nobel laureates.

"Of course it is a great honor to be elected to the Royal Society and I am very happy and excited for the positive light it sheds on my research and my department," Hacon said.

Christopher Hacon

"Over the course of the Royal Society's vast history, it is our fellowship that has remained a constant thread and the substance from which our purpose has been realized: to use science for the benefit of humanity," said Royal Society president Venkatraman Ramakrishnan in a release. "It is with great honor that I welcome them as Fellows of the Royal Society."

"Christopher Hacon," according to the Royal Society's biography page, "is a mathematician who specializes in the field of algebraic geometry which, loosely speaking, is a branch of mathematics that studies the geometric properties of sets defined by polynomial equations. Together with his co-authors, Hacon has proved many foundational results on the geometry of higher dimensional algebraic varieties including the celebrated result on the finite generation of canonical rings." Because algebraic geometry is closely connected to other fields within and beyond mathematics, Hacon's work has had broad impact.

He has been honored with prestigious awards such as the 2018 Breakthrough Prize in Mathematics, the 2016 EH Moore Research Article Prize, the 2015 Distinguished Scholarly and Creative Research Award from the University of Utah, the 2011 Antonio Feltrinelli Prize in Mathematics Mechanics and Applications, the 2009 Frank Nelson Cole Prize in Algebra and the 2007 Clay Research Award. He is a member of the American Academy of Arts and Sciences, a fellow of the American Mathematical Society, a member of the National Academy of Sciences and holds the U's McMinn Presidential Chair in Mathematics.

Hacon and other newly elected fellows will be formally admitted to the society in July, when they will sign the Charter Book and the Obligation of the Fellows of the Royal Society.

The Development of Universal Life Insurance

Throughout the University of Utah's remarkable 169-year history, there have been many outstanding alumni who have made a significant impact in Utah, the country, and the world.

College of Science alumnus Lynn C. Miller, BS'63 in Mathematics, is an excellent example. As the Chief Actuary at E.F. Hutton Life, in 1978, he was instrumental in the development of a revolutionary form of life insurance known as Universal Life.

Lynn grew up in Salt Lake City near the University of Utah campus. His father, Clyde Miller, BA'34 in Business, spent the majority of his career in Utah politics. Clyde ascended the legislative ranks and eventually served as the Secretary of State and Lieutenant Governor for the State of Utah from 1965-1977. Although Lynn did not follow in his father's footsteps in the political forum, Lynn's mastery of diplomacy would become a great asset to complement his mathematics skills.

Lynn C. Miller

A Passion for Statistics

Lynn was a fervent University of Utah basketball fan, and he attended many games at the Einar Nielsen Field House. His enthusiasm for basketball would fuel his passion for mathematics and statistics. For example, he used probability modeling to create a dice game that could statistically simulate a basketball game. His interest in mathematical analysis and statistics would eventually lead to a career in mathematics and actuarial science.

However, when Lynn enrolled at the U as a student, it wasn't always smooth sailing. "I lacked the focus and confidence to initially thrive," says Miller. "In fact, due to my early academic struggles, I was placed on academic probation!"

During his junior year, Lynn found the confidence and commitment to academics, due to the kindness and encouragement of Mathematics Professor, J.D. Smith. Professor Smith took a special interest in Lynn's success and encouraged him to realize his true potential.

"I credit the University for supporting me. In addition to my degree, I also received valuable life lessons of hard work, dedication, and perseverance," says Miller.

After graduating from the U, Lynn began his professional career at the Hercules Powder Company in Magna, Utah. His job allowed him to apply his mathematical skills to analyze test firings for quality control. While at Hercules, one of his colleagues witnessed Lynn's mathematical brilliance and mentioned that he should look into becoming an actuary, a specialized math discipline based on the measurement and management of risk and uncertainty.

Lynn seized upon an opportunity at Surety Life Insurance in Salt Lake City and began his career as an actuary. For eight years Lynn juggled his advanced actuary classes and exams, worked long hours, and along with his wife, helped to raise his young family. Ultimately, due

to the job at Surety Life, Lynn found himself leveraging his mathematics and actuary skills to the pathway of disrupting the life insurance industry.

In 1972, Lynn discovered that E.F. Hutton had an opening for a senior vice president and chief actuary. Lynn interviewed and, eventually, won the position. During his time at E.F. Hutton, Lynn became one of the key individuals to reinvent the life insurance industry. Lynn shared that a big part of his career growth was due to his awareness of opportunities and faith in his abilities to succeed.

Beginnings of Universal Life Insurance

In the late 1970s, traditional whole life insurance came under heavy criticism from the investment community. Policy cash values were being credited with very low interest rates in the 2-3% range, while external new money rates exceeded 10%. In addition, the rigid nature of a typical contract made it difficult to adapt to changing needs of the client. This created an ideal environment for the creation of a Universal Life type product that offered the following:

- An open, fully disclosed architecture that allows flexibility in the amount and timing of premium payments and in the balance between the savings (cash value) and pure insurance elements.
- An earnings rate on cash values that reflected the high investment yields available at that time. This provided a significant advantage over established companies who were burdened with investment portfolios earning well under new money rates.

It's not surprising that Universal Life created significant controversy, turmoil, and resistance from established insurance companies.

In fact, Mass Mutual and other large mutual companies launched expensive ad campaigns that tried to disparage and rebuke the new Universal Life product. Lynn met with many groups and key individuals including the IRS, U.S. Treasury, federal and state legislators, tax attorneys and even fellow industry antagonists to convince them of the attributes and legitimacy of Universal Life.

In 1981, the IRS provided a Private Letter Ruling, which held that Universal Life was a legitimate insurance product. The ruling was challenged in 1984. This led to an effort to permanently enact into law what constitutes a legitimate life insurance product. Lynn was extensively involved in this effort and was one of the original authors of the federal income tax definition of what constitutes life insurance for policyholder and company tax purposes. (Enacted in the DEFRA Tax Act of 1984).

Universal Life has since become the dominant form of life insurance for the past quarter century. Last year it represented more than 60% of permanent cash value type life insurance sales.

In 1999, Lynn moved to Pacific Life Insurance Company and became the chief actuary for the life insurance division. In 2002, he was promoted to executive vice president and head of their life insurance division. He retired in 2012.

His stellar career positively impacted millions of life insurance customers, and their families, who have benefited from Universal Life Insurance.

Lynn and his wife, Sue, reside in San Diego, Calif. and are strong supporters of Utah athletics. They have season football tickets and attend many home games in Rice-Eccles Stadium.

Kelly MacArthur
Receives U Teaching Awards

"This is a kind, inclusive, brave and failure-tolerant class." — Kelly MacArthur

Kelly MacArthur, assistant chair and an instructor lecturer in the U's Mathematics Department, has received two teaching awards from the U—the Career Services Faculty Recognition Award and the Excellence in Education Award. Both awards are given annually with students nominating faculty.

"An Amazing Teacher"

Career Services recognizes outstanding faculty who have made significant contributions to their students' professional development in helping students find resources, guide their career paths, and realize their potential. Since 2005, the Latter-Day Saint Student Association has given the Excellence in Education Award.

"Kelly is an amazing teacher and role model," said Shams Al-shawbaki in nominating MacArthur for the Career Services Faculty Recognition Award. "Not only is she great at her job and understands the responsibility behind what she does, but she shows passion and care towards her students. Kelly has affected me in positive ways in math as well as in my self-confidence and career at the University of Utah. We need more teachers like her."

Aubrey Mercer, who nominated MacArthur for the Excellence in Education Award, was initially nervous about taking calculus as a freshman, but it turned out to be her favorite class. "Kelly creates such a welcoming environment," said Mercer. "She really cares about our success." Both students noted that MacArthur makes a point to learn the names of every student in her class—no small feat since MacArthur often teaches between 150-200 students each semester.

Teaching Students to Fail

Kelly MacArthur

MacArthur said her teaching style has evolved over 25 years, especially during the last decade. Every day she writes the same sentence on the whiteboard: "This is a kind, inclusive, brave and failure-tolerant class." She created the statement to encourage a sense of community and collaboration within the context of math class. "Failure tolerance is so important, and permission to fail often gets lost in math if students are only looking for the "right" answer," said MacArthur. "It's important to create an environment where students feel safe and free to make mistakes. My goal is to humanize the classroom and teach human beings. Teaching math is not the primary goal—it's learning about my students and what speaks to them."

In addition to teaching, MacArthur co-created and appears in the Math Department's public lecture videos. She has developed math materials for elementary and secondary teachers; developed an online math course for non-STEM majors, organized the Math Department's involvement in the Ndahoo'ah American Indian summer outreach project in the Mohave Valley on the Navaho Reservation; and created a math program for men and women at the Utah State Prison. She serves on the Math Education Committee and on the Undergraduate Mathematics Curriculum Committee. She is also chair of the U's Senate Advisory Committee on Diversity, among other administrative positions.

MacArthur received a bachelor's degree in mathematics from Arizona State University and a master's in mathematics from the U. She is currently working on a Ph.D. in undergraduate mathematics education.

50 Years of the Thomas Andrew Hurd Mathematics Scholarship

Tom Hurd

Tom Hurd excelled at the subjects that interested him, and he was definitely talented in both mathematics and physics. The youngest of five children, he grew up on Salt Lake City's east side, attending Stewart School (formerly on the University of Utah campus), Roosevelt, and East High.

After a stint in the Utah National Guard following high school, Hurd had matured and began his studies at the U with a sense of purpose and discipline. He was majoring in math at the time of his untimely death in June 1969—the result of an automobile accident.

Devastated by the loss of their son, Wallace and Jeannette Hurd, established the Thomas Andrew Hurd Memorial Scholarship in Mathematics. Now in its 50th year, the scholarship is given annually to an undergraduate student working towards a degree in mathematics who has demonstrated scholastic ability and financial need.

Family and friends have great memories of Tom. His brother, Michael, remembers that "Tom loved using math to solve basic problems. He and my dad put in a sprinkler system at my parent's house, and Tom enjoyed the challenges of designing and making it work. The sprinkler system did more than water the yard—it brought Tom and my dad together."

Karren (Kelly) Hammer, a classmate from East High and the U said, "Tom was one of my two tutors in physics at the U. Tom was hysterically funny, so studying for physics was a pure joy! I think he came to class in his "Golden Nugget" and sat on the back row with us where the physics lecture just sunk into his bright mind. I, on the other hand, was trying to take every note I could. He was such a dear person." The "Golden Nugget" was a 1958 gold Volkswagen Beetle that Tom had purchased (with help from his sister Maggie Hurd Barton) for driving around the city.

Reid Barton, Hurd's brother-in-law, is pleased that so many students have benefitted from the scholarship. "Tom was such a smart and nice guy. We've often wondered what he would have done with his life had he lived. It's comforting to know that his legacy lives on through these students."

In 2018 the scholarship was awarded to Miriam Galecki, who is pursuing degrees in mathematics, business, and economics.

"The Hurd Scholarship has enabled me to continue to pursue my goals in both academics and athletics. Without this support I wouldn't have been able to focus on these endeavors. It has allowed me to study and train without worrying as much about finances." Galecki plans to graduate in the summer of 2020 and believes that her math background—whether in consulting, data analytics, investments, teaching, or a startup—has prepared her with the necessary analytical skills to succeed. "I am both thankful and grateful for the gracious generosity of the Hurd Scholarship."

Distinguished Professor Mladen Bestvina Receives U Award

Distinguished Professor Mladen Bestvina has received the University's Distinguished Scholarly and Creative Research Award for 2019.

"I am very honored and humbled by the award, and I appreciate the recognition very much," said Bestvina. "But I should emphasize that a lot of credit for my work goes to my collaborators."

Bestvina's research focuses on symmetries of objects (called "groups" in mathematics) from the point of view of geometry and topology. For example: Imagine an infinite chess board—the plane with the usual tiling into squares (ignore the colors of the squares that a chess board would have). What is the group of symmetries? An example of a symmetry is a translation of the entire board by a whole number of squares in the direction of a side of a square. In the language of geometric group theory, this group is "virtually Z+Z."

Mladen Bestvina

"Conversely, suppose someone hands you a group and asks you to understand it," said Bestvina. "Then you would build an object (a "space") whose group of symmetries is the given group. If the group is virtually Z+Z, you would build the plane and understand the group using Euclidian geometry you learned in high school. There are more complicated groups, and building corresponding spaces and understanding their geometry is a lot of fun," he said.

Professors are nominated for the research award, and here is what a nominator said about Bestvina: "In addition to his excellent work in the field, he has been an extensive promoter of the field and its problems. This is not only through advising many students over the years, but also in mentoring postdocs and organizing many conferences and programs around the topic of geometric group theory. …I regard Bestvina as one of the top people in the areas of geometric group theory."

Bestvina was born in Croatia and received a Ph.D. in mathematics from the University of Tennessee. He joined the U as a professor in 1993 and became a Distinguished Professor in 2008.

He is the father to three teenagers and enjoys hiking, bicycling, and playing chess.

Scholarship Honors Late Math Scholar

Michael Zhao

Michael Zhao loved sushi, travel and classical music. His lifelong passion and ardent pursuit, however, was always mathematics. His fascination with math took him from the 100 Club in kindergarten to Cambridge University as a Churchill Scholar. On December 8, 2018, while at Columbia University in New York City chasing his goal of becoming a college professor, Zhao passed away due to a sudden heart attack.

But on April 18, Zhao's zeal for math continued with the naming of the first recipient of the Michael Zhao Memorial Scholarship. Taylor Walker, a senior studying mathematics and computer science, is the first awardee.

"The scholarship aims to recognize a truly outstanding mathematics student," said Davar Khoshnevisan, chair of the Department of Mathematics, "which is consistent with celebrating Michael's memory."

Zhao grew up in Salt Lake City and attended Skyline High School, where he was first chair in flute and served as captain of the debate team while also attending Canada/USA Mathcamp and taking math courses at the U. As an undergraduate at the U, Zhao received the Eccles Scholarship that supported his studies in the Honors College. Zhao was intrigued by the breadth of study the Honors College offered—a place where he could read Thomas Aquinas and David Hume, while also studying Eastern philosophy and literature from texts like the Bhagavad Gita and the Daodejing.

In 2017 he was the second U student to win the prestigious Churchill Scholarship. "It's a common perception that skill in mathematics is only due to talent, but hard work counts for much more" Zhao said. "Having mentors is also extremely helpful, and I am indebted to many faculty members, graduate students, and engineers for their guidance and encouragement."

Many of the faculty in the U's Math Department have fond memories of working with Zhao. In an interview in 2017, professor of mathematics Gordon Savin, who served as Michael's honors thesis advisor, said, "Mike is one of the strongest undergraduate students we have had since I have been at the University of Utah, in more than 20 years. For someone his age, he already has an incredible level of maturity and mathematical knowledge."

He also worked with Dragan Miličić. In the same interview, Miličić said, "We often have discussions on various topics related to algebraic geometry, number theory, and representation theory. I was always impressed that talking to Mike feels more like talking with a colleague and not a student."

Another professor who worked with Zhao was Braxton Osting, who said, "Many people remember Michael as a brilliant student, excelling under an almost impossible course load covering a large range of topics in mathematics and computer science. In spending time with Michael, I also came to know him as a genuinely kind person, generous with his time and helpful to his fellow students."

After Zhao passed away, math department faculty and fellow Churchill Scholars approached Khoshnevisan with the idea of establishing a scholarship in Zhao's name. Khoshnevisan got approval from Zhao's parents. They, along with colleagues, friends and even his high school math teacher, reached out to their community for donations.

The new scholarship, partly funded by the Department of Mathematics and partly by donors, keeps Zhao's memory alive. If you'd like to contribute to this scholarship, please make checks payable to the Michael Zhao Memorial Scholarship and send donations to the following:

Tiffany Jensen
Department of Mathematics
155 South 1400 East, JWB 233
Salt Lake City, UT 84112

Taylor Walker is the first recipient of the Michael Zhao Memorial Scholarship. She's a senior majoring in mathematics and minoring in computer science and plans to graduate in the spring of 2020.

"The financial assistance provided by the scholarship will be of great help to me in paying for my educational expenses, and it will allow me to concentrate more of my time on studying," said Walker. "After graduating, I plan on entering the workforce in a math-related field. I hope to honor Michael's legacy in mathematics as I continue to learn about a subject we both enjoy."

Overview of Mathematics Department Graduates

This year, approximately 90 undergraduates will receive a bachelor's degree in mathematics. At the graduate level, two students will receive a master's degree; five will receive the Master of Statistics degree; and 12 will receive the Master's in Mathematics Teaching degree.

Students who will receive a Ph.D. in the spring or summer of 2019 are:

Adam Brown
Huachen Chen
James Farre
Stephano Filipazzi
Greg Handy
John Hull
Jenny Kenkel
Sean McAfee
Joaquin Moraga
Franco Rota
Daniel Smolkin
Weicong Su
Rebecca Terry
Ryan Viertel
Dawei Wang
Qing Xia
Hanlei Zhu

Department of Mathematics Distinctions

UNIVERSITY FACULTY AWARDS

Mladen Bestvina—Distinguished Scholarly and Creative Research Award

OTHER FACULTY AWARDS

Tommaso de Fernex—elected fellow of the American Mathematical Society

Christopher Hacon—elected fellow of the Royal Society

Graeme Milton—Visiting Distinguished Professor at the Rothschild Fellow at the Newton Institute—2018-19

Akil Narayan—National Science Foundation CAREER Grant

Firas Rassoul-Agha—elected fellow of the Institute of Mathematical Statistics

Peter Trapa—elected fellow of the American Mathematical Society

APPOINTED TO EMERITUS RANK

Grant Gustafson, Professor of Mathematics

Domingo Toledo, Professor of Mathematics

COLLEGE OF SCIENCE STAFF EXCELLENCE AWARDS

Mary Levine, assistant to Chair of Mathematics

James Muller, director of the Mass Spectroscopy Laboratory in Chemistry

Mathematics Department Awards in 2019

UNDERGRADUATE AWARDS

Calvin H. Wilcox Memorial Scholarship
Delaney Mosier

Junius John Hayes Diversity Scholarship
Tina Greimes

Junius John Hayes Endowed Scholarship
Jess Campbell
Makayla Stewart

The Golden Scholarship
Alexsis Lever
Caleb Walker

D. Keith Reed Memorial Scholarship
Lucas Katsanevas

Michael Zhao Memorial Scholarship
Taylor Walker

Susan C. Christiansen Memorial Scholarship
Ruby Bowers

Thomas Andrew Hurd Mathematics Scholarship
Camiryn Toeun

Tom and Cathy Saxton Scholarship
Sarah Marshall

C. Bryant and Clara C. Copely Scholarship
Veronica Riker

Continuing Department Scholarship
Miriam Galecki
Jason Hoag
Mckay Jensen
Calvin Lee
Winston Stucki
Thomas Wadlington

Mathematics Department Scholarship
Kristen LeFort
Alexander Evans
Nathan Sartnurak

J.L. Gibson Senior Award
Shalynne Orth

Putnam Award
Wei Yao

Undergraduate Problem-Solving Contest
(Top Problem Solver)
Mckay Jensen

Undergraduate Problem-Solving Contest
(Student Representative)
Matteo Sogne

Pi Mu Epsilon
Jacob Argue
Dane Lacey
Sarah Marshall
Delaney Mosier
Makayla Stewart
Julia Walljasper

GRADUATE AWARDS

T. Benny Rushing and Gail T. Rushing Fellowship
Jihao Liu

Outstanding Graduate Student Award
James Farr
Samantha Hill

Don H. Tucker Postdoctoral Fellow Award
Chris Janjigian

Outstanding Postdoctoral Award
Gil Moss
Thomas Polstra

Faculty Award
Tom Alberts

Outstanding Staff Award
Natasha Carlton
Gail Howick

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