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WINTER 2022

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Oregon State University
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On the cover —Methane hydrate, frozen deposits of
natural gas found primarily in the Arctic and sub-ocean
sediments, such as Lake Baikal in Siberia. When these
ice-like deposits melt, they release methane gas into the
atmosphere. Malgo Peszynska's research models help
mitigate and contain the methane. Read more on page 8.

From the head

Bill Bogley

Department Head

Dear Mathematicians and Friends of Mathematicians,

I want to acknowledge the dedication of our faculty, students and staff during these challenging times. Together we are teaching, learning, discovering and sharing mathematics. The pandemic and social upheavals have impacted us all, but the work goes on, and I am so proud of the resilience exhibited by the OSU mathematics community during 2021.

The department is committed to improving opportunities for more women and underrepresented minority faculty and students. Led by the members of our Diversity, Equity, Justice, Access and Inclusion (DEJAI) committee, the department adopted a statement of core values in 2021 and this year will focus on actions to support the College of Science Diversity Action Plan (see **science.oregonstate.edu/dap**). As part of this process, we are deliberately reassessing the diversity of the candidate pool at each step of our three tenure-track searches this year to ensure that implicit bias is not filtering diversity from our community.

Our tenure-stream faculty are 40% female (compared to 25% nationally), and our female colleagues continue to lead. Holly Swisher received a three-year National Science Foundation grant to support her research in number theory. Malgo Peszynska was elected Fellow of the American Association for the Advancement of Science, joining an elite group of just 25 previously selected AAAS Fellows from OSU and one of just eight mathematicians selected this year. As Malgo returns from a two-year stint as program director at the National Science Foundation, Elise Lockwood begins her two-year tenure in that role, helping to sustain OSU's leadership role on the national mathematics research scene.

Three mathematics alumni were recently honored by the College of Science. Judy Faucett ('70) and Ron Schoenheit ('65) received the 2020 and 2021 Distinguished Alumni Achievement Awards, respectively, and Michael Waterman ('64, '66), received of the 2020 Lifetime Achievement in Science Award. These recognitions underscore the far-reaching impact of mathematics and mathematicians in today's world.

We celebrate the retirements and career contributions of Professors Tom Dick, Tevian Dray, David Finch, Robert Higdon, Juha Pohjanpelto, Mina Ossiander and Ralph Showalter.

These are exciting transitional times for OSU and the mathematics department as we continue to fulfill a critical educational need for OSU. Please visit us online at **math.oregonstate.edu**.

At the helm

Advancing mathematics through leadership

Swati Patel and Axel Saenz Rodriguez

Vrushali Bokil

Introducing a new vision

Congratulations to **Vrushali Bokil**, who started a new position as associate dean for research and graduate studies for the College of Science in October 2021. As associate dean, Bokil will advocate for and provide a vision for the College's research and graduate student educational opportunities. She is deeply motivated to enhance diversity, equity and inclusion. Bokil has served in a number of leadership roles since joining the mathematics department in 2006.

"I am confident she will have a significant impact on the College's research excellence, transformative educational opportunities, initiatives for faculty innovation, and productive collaborations across departments and colleges," said Dean Roy Haggerty.

Congratulations to Math faculty on their promotions!

The following faculty have received a promotion and/or tenure for the 2020-21 academic year.
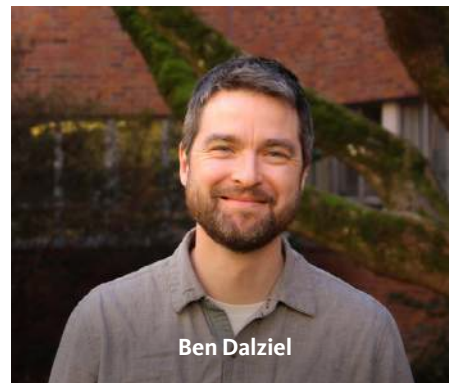
Ben Dalziel

Ben Dalziel was promoted to associate professor with tenure. With joint appointments in the Departments of Integrative Biology and Mathematics, Dalziel's research uses mathematical models and data to study the spread of infectious diseases, particularly how population structure affects the frequency and severity of epidemics and the risk posed by emerging pathogens.

Hoe Woon Kim was promoted to Senior Instructor II. Kim's research interests include partial differential equations, mathematical physics and probability and stability.

Nathan Gibson was promoted to professor. Gibson's research focuses on computational electromagnetics, uncertainty quantification and inverse problems.

Nathan Gibson

Mathematics getting out there

The December 2020 issue of SIAM News features an article co-authored by **Nathan Gibson** that describes the Mathematical Contest in Modeling, organized by the Consortium for Mathematics and Its Applications and mentions the many ways in which the OSU mathematics department has supported and mentored successful teams since 2006.

Examining the geometry of black holes

The December 2020 issue of the American Mathematical Monthly (published by the Mathematical Association of America and available online at maa.org) features an article by **Tevian Dray** in which they give an elementary treatment of the curvature of surfaces of revolution in the language of vector calculus, using differentials rather than an explicit parameterization. They illustrate some basic features of curvature using embedding diagrams and then use such a diagram to analyze the geometry of the Schwarzschild black hole.

## The mathematics department is growing!

In fall 2020, we welcomed five new instructional faculty members:

Brittanney Adelmann earned a Ph.D. in 2016 from Florida Atlantic University. Her research focus is in the field of Quantum Cryptography but she is currently researching the use of undergraduate learning assistants in mathematics courses for improved success of all students, especially underrepresented minorities.
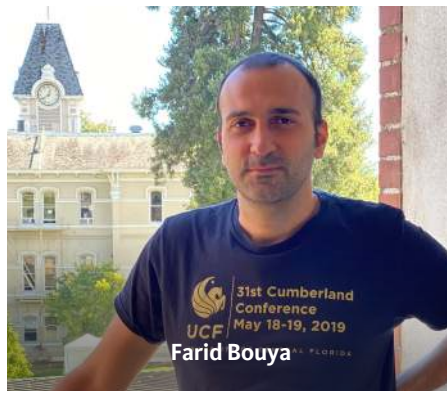
Farid Bouya

Dionysus Birnbaum earned his Ph.D. from OSU (advisor Bill Bogley). Birnbaum's research is on low-dimensional topology and group theory, particularly asphericity. He also enjoys the mathematics of origami.

Originally from Iran, **Farid Bouya** earned his Ph.D. in 2020 from Louisiana State University. He is most passionate about teaching and is especially interested in teaching competitive math to high school students and undergraduates.
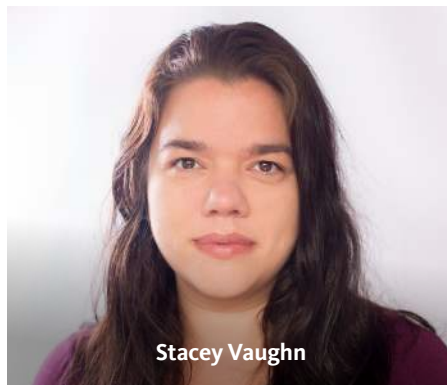
Stacey Vaughn

Stacey Vaughn earned her master's degree from OSU (advisor Mary Beisiegel). Her primary focus has always been teaching, with an emphasis on students and student experiences in undergraduate mathematics. Vaughn wants her students to feel that mathematics and their mathematics education is accessible, equitable and useful.

Samaneh Yourdkhani earned a Ph.D. from the University of Alaska, Fairbanks. Her research interests have revolved around mathematical biology and, specifically, concerns developing new mathematical methods of inferring evolutionary relationships between species from their sequenced genomes — a fundamental question for many areas of science and medicine.

In fall 2021, we added eight more to our faculty and instructional staff:

Swati Patel and spouse **Axel Saenz Rodriguez** joined the mathematics department as tenure-track assistant

Elise Lockwood appointed to top research agency

The National Science Foundation has selected Elise Lockwood to serve as a rotating program director within the Education and Human Resources (EHR) Directorate, a position she started in August 2021. Specifically, Lockwood works within EHR's Division of Undergraduate Education, which focuses on strengthening STEM education at colleges and universities. Lockwood will review national research proposals and make crucial funding recommendations during her term. The unique opportunity will enable Lockwood to help shape the future of the field of mathematics education. Lockwood has relocated to Alexandria, VA during her time in this rotating position.

Ann Sitomer

David Fifty

David Collett

professors in September 2021. Patel and Rodriguez earned their Ph.Ds. in mathematics from the University of California Davis. A mathematical biologist by training, Patel applies numerical models to understand genetics and population dynamics, as well as other ecological and evolutionary processes that shape our world. Rodriguez's research explores the interaction of geometry, representation theory and probability. One main draw to Oregon State for Patel and Rodriguez was the College's emphasis on diversity, equity and inclusion. In 2019 Patel co-founded Math for All in New Orleans, an annual conference that fosters inclusivity in mathematics. She held a satellite conference at OSU in February 2022. Rodriguez's goal is to help recruit more diverse graduate students to the department.

Ann Sitomer is a visiting faculty member who earned her Ph.D. from Portland State University. Her research focuses on department-

level learning and change in the context of postsecondary STEM education change initiatives.
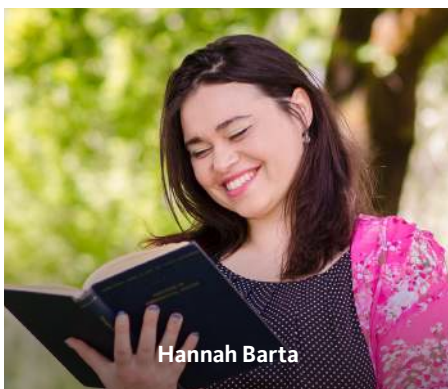
David Fifty joined us as a postdoctoral scholar. He earned his Ph.D. in December 2020 from the University of New Hampshire. He is part of an NSF grant that is developing and implementing a program to help graduate teaching assistants learn equitable, inclusive and engaging teaching practices.
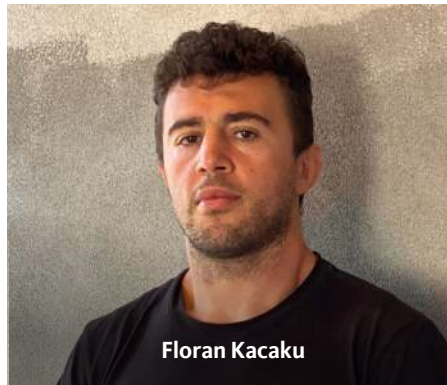
Floran Kacaku

Hannah Barta, David Collett, Floran Kacaku and **Roger Roybal** are new instructional faculty members in the department.

Barta earned her master's degree at OSU in 2021 (advisor Elaine Cozzi). She loves exploring complex mathematical topics with students for the first time and is especially interested in helping students become more introspective about their own ways of thinking and problem solving.

Collett received his master's degree from the University of Oregon. For the past 10 years, he has taught for Lane Community College and the University of Oregon.

Kacaku earned his Ph.D. from Northeastern University in 2015. His research is in the field of partial differential equations. He spent the last six years teaching mathematics across multiple universities in the Greater Boston Area.

Roybal earned his Ph.D. from the University of California, Santa Barbara in 2005 under advisor Mihai Putinar. His research focus was in Operator Theory.

Roger Roybal

We also welcomed **Bea Michalik** as the new coordinator of the Mathematics and Statistics Learning Center. Before starting this position in fall 2021, she worked as an instructor at Linn-Benton Community College and served as President of the Part-Time Faculty Association.

Hannah Barta

Fond farewells

We also say goodbye to several retiring faculty members. **Tom Dick, Tevian Dray** and **Mina Ossiander** have each entered retirement in the past year.

Tom Dick completed his Ph.D. in mathematics education at the University of New Hampshire in 1984. He joined OSU in the fall of 1986. Dick served as faculty director of the Mathematics Learning Center for several years, founded the OSU Math Excel program and served as department chair from 2011 to 2014. Dick has had visiting faculty appointments at UNC-Charlotte, ITESM (Monterrey, Mexico), University of Montana and the University of Melbourne in Australia.

Dick's research interests include the study of factors related to mathematics achievement and participation, cognitive science as applied to the learning of advanced mathematics, uses of technology in the learning of mathematics and mathematical discourse. He has served as the chair of the editorial panel for the Journal for Research in Mathematics Education and as chair of the College Board's Advanced Placement Calculus Development Committee. He has served as PI for several NSF grants related to mathematics teacher development, including the Oregon Mathematics Leadership Institute and the OSU's Noyce Teaching Fellow program.

TOM DICK

Dick has received the College of Science Carter Award for Inspirational Teaching, the Fred Horne Award for Sustained Excellence in Teaching and the Olaf Boedtker Award for Excellence in Academic Advising. He has also been awarded the university-wide Elizabeth P. Ritchie Distinguished Professor Award and the Distinguished Teacher Award for the Pacific Northwest Section of the Mathematical Association of America (MAA). In 2008 Dick was inducted to the Oregon Mathematics Education Hall of Fame.

Tevian Dray received his Ph.D. in mathematics from Berkeley in 1981 and joined OSU in the winter of 1988, having first held postdoctoral positions in Germany, the Netherlands and England, as well as at the Institute for Advanced Study in Princeton. He has been a Senior Member at the Mathematical Sciences Research Institute, the Noyce Visiting Professor at Grinnell College and the Hutchcroft Visiting Professor at Mount Holyoke College.

Dray's research spans differential geometry, abstract algebra and science education, leading to over 100 publications, including three textbooks. A common theme in both his research and teaching has been working to bridge the gap between mathematics and physics. He has led national efforts to improve the teaching of second-year calculus and was a founding member of OSU's nationally-renowned Paradigms in Physics program, which has been continuously funded by the NSF for 25 years.

Dray was a Fulbright Scholar twice (to India and Australia), is a Fellow of the American Physical Society and has won numerous teaching awards, including the Horne and Carter awards from the College of Science, the university-wide Ritchie Award and the Haimo Award of the MAA, its most prestigious teaching award.

TEVIAN DRAY

Dray continues to work at OSU part-time but is enjoying no longer having the pressure of full-time employment.

Mina Ossiander retired at the end of 2020 after more than 30 years with the mathematics department. As an undergraduate, Ossiander majored in costume and textile design at the University of Washington. With a growing interest in statistics, she received her master's degree in statistics in 1982 and her Ph.D. in statistics in 1985, also from the University of Washington. She joined the mathematics department in 1988 and was the first woman to become a full professor.

Her mathematical research encompassed both theoretical and applied areas of probability, with contributions ranging from central limit theory in function spaces to statistical modeling and analysis in the geosciences. She served as principal investigator and co-investigator on a number of grants from NSF and other governmental agencies.

In addition to instructional duties, she contributed extensively to curriculum and course development for mathematics students. She advised graduate students in both the departments of mathematics and statistics, with six students completing Ph.D.s under her supervision. For many years, she served as advisor for undergraduate mathematics majors enrolled in the popular Statistics Option.

Thinkers & Doers

## Mathematics at forefront of alumni awards

Mathematics alumni received three of the four awards at the combined 2020 and 2021 College of Science Alumni Awards ceremony on November 12, 2021. Along with their love of mathematics, the award winners were also first-generation college students.

Father of computational biology receives lifetime achievement award

Michael Waterman ('64, '66) is one of the College of Science's most decorated and influential alumni. Known as the 'Father of Computational Biology,' Waterman applies mathematics, statistics and computer science techniques to various problems in molecular biology. He developed the algorithm that formed one of the theoretical cornerstones to unlock the mysteries of the human genome, which has opened up new ways to treat diseases and improve human health. It also marked the turning point when mathematics and the life sciences become integrated.
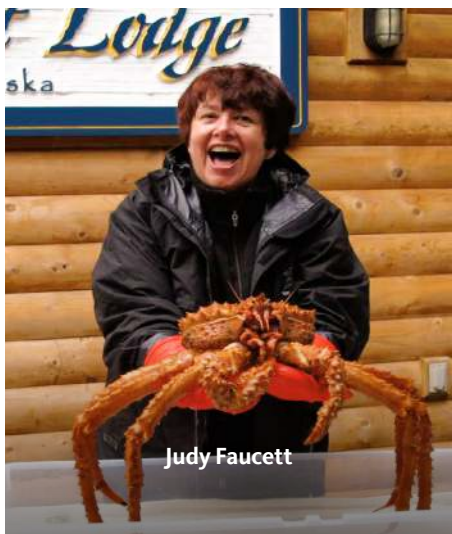
Judy Faucett
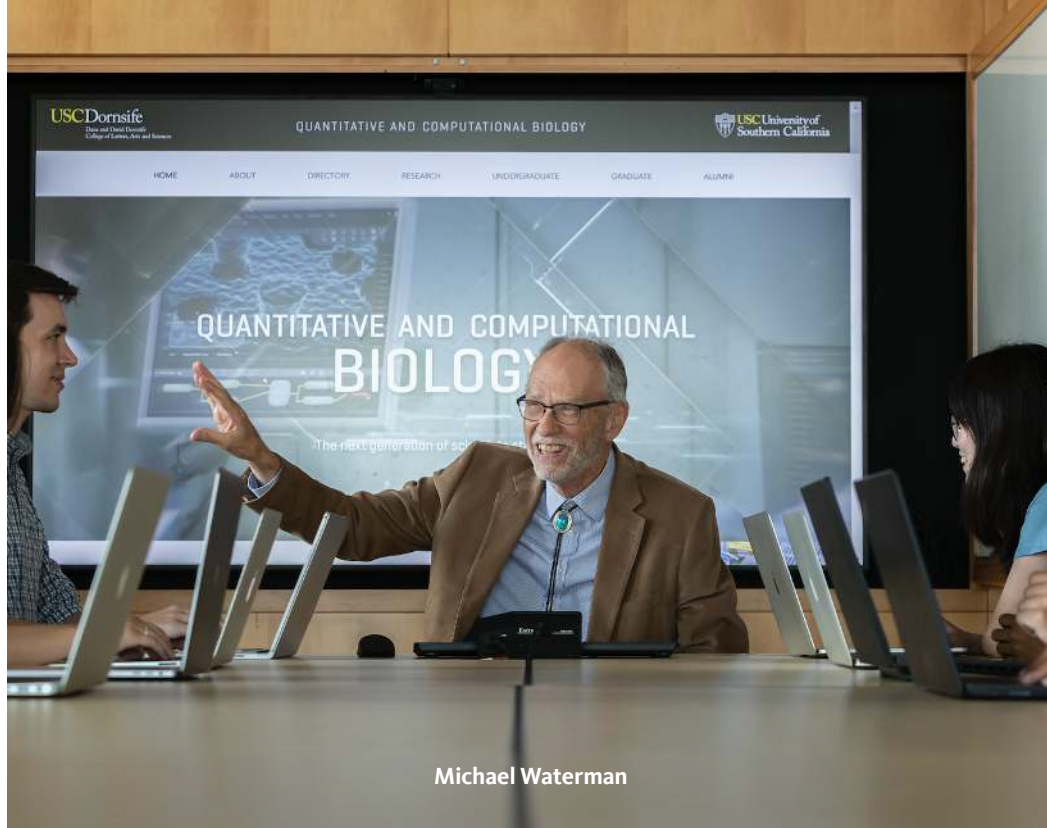
Michael Waterman

Waterman received his bachelor's and master's degrees in mathematics from the College of Science in 1964 and 1966. He then earned a Ph.D. in statistics and probability at Michigan State University in 1969, which propelled him to become a founder and leader of computational biology. "For me, OSU was the doorway to the rest of the world," he said. Inspired by his experience, he established the Michael and Tracey Waterman Scholarship in 2016 to open doors for other first-generation science students.

Currently an Emeritus University Professor at the University of Southern California and a Distinguished Research Professor at the University of Virginia, Waterman's work continues to play an important role in DNA sequencing. Waterman is a Guggenheim Fellow and the founding editor of the Journal of Computational Biology. He is a member of the U.S. National Academies of Sciences and Engineering, the American Academy of Arts and Sciences, the French Academy of Sciences and the Chinese Academy of Sciences. In 2020, Waterman was awarded the prestigious William Benter Prize in Applied Mathematics.

In the fall of 2021, Waterman delivered the College of Science Distinguished Lecture, received the Lifetime Achievement Award and was featured in the Oregon Stater magazine. Read the story: bit.ly/fall21stater-desktop

A lifetime of breaking barriers for distinguished alumna

Judy Faucett ('70) is used to being the only woman in the room. She was the only woman in the 90-person advanced calculus class at OSU. She was one of the first women to be hired by Pacific Mutual Life, and the first to complete the company's actuarial training program. "I was extremely motivated to prove that women could succeed as actuaries," she recalls.

Her career took her into the offices of top actuarial firms in the country.

Corina Constantinescu

Alexander Chick

Ron Schoenheit

After a career with Pacific Life, where she rose to become vice president, Faucett's expertise was sought by national companies including PricewaterhouseCoopers and Equitable Life Assurance, before her retirement in 2004.

An active supporter of the College for more than 40 years, Faucett is passionate about helping hard-working students achieve their dreams. She is the founder of the Rise Scholarship, the first scholarship at Oregon State that exclusively serves students with disabilities — comprising 11 percent of College of Science students. "These young people are going to change the world," she said. She received the 2020 Distinguished Alumni Award.

Lover of mathematics combines function and beauty

Ron Schoenheit ('65) founded Cascade Coil Drapery in 1987, building on what his grandfather established in 1921. Today, the company makes metal curtains that serve a variety of purposes — from the backdrop for a Rolling Stones concert tour, to providing blast protective window coverings for embassies overseas. The innovation and flexibility of the company model has consistently adapted to diverse uses for its environmentally friendly, sustainably designed metalworks.

In addition to his past support of the Summer Undergraduate Research Experience program, Schoenheit recently made a five-year commitment to help sustain the Learning Assistants Program in the College, which puts high-achieving undergraduate assistants in large enrollment, often first- and second-year STEM classrooms, to facilitate and strengthen undergraduate learning. Schoenheit received the 2021 Distinguished Alumni Award.

A passion for financial inclusion leads to leadership role

After graduating from OSU with her Ph.D. in 2006 (advisor Enrique Thomann), **Corina Constantinescu** was a postdoctoral researcher and then worked as an actuary, leading the life insurance department of one of the first private Romanian insurance companies. She also helped develop theoretical analyses of ruin probabilities in case of disasters or extreme shocks for insurance-like risk pools for the European Union RARE Network.

A more recent research interest is financial inclusion, namely correctly pricing and regulating micro-finance and micro-insurance practices. In 2020, she was one of two academics named on the Cranfield University School of Management '100 Women to Watch' list. She is now a professor of mathematics and the director of the Institute for Financial and Actuarial Mathematics in the Department of Mathematical Sciences at the University of Liverpool.

Where are they now?

The graduate program has seen many students complete the requirements for their master's and Ph.D. degrees in recent years. Here is what some of those graduates are doing now.

Azhar Alhammali – Assistant professor at Imam Abdulrahman Bin Faisal University in Saudi Arabia and Fellow for Advance HE
Alexander Chick – Data Scientist at Convr
Branwen Schaub – Professor at Wenatchee Valley College
Choah Shin – Internal consultant at Ab Initio
Dallas Foster – Postdoctoral position at Massachusetts Institute of Technology
Diane McMillan – Attending law school at Lewis and Clark College
Sebastian Naranjo – Postdoctoral research fellow at Universita degli Studi di Milano-Bicocca in Italy
Wasmon Jantai – Instructor at Chulalongkorn University in Thailand

We welcome updates from our alumni about what they are currently doing. Please send updates to **Nikki.Sullivan@oregonstate.edu.**

Azhar Alhammali

Branwen Schaub

Choah Shin

Diane McMillan

Sebastian Naranjo

Wasmon Jantai

FEATURE STORY

Using mathematics to unlock solutions for a changing world

The scientific community continues to honor the exceptional accomplishments of **Malgorzata (Malgo) Peszynska,** who has forged a global reputation as a leading developer of mathematical tools to solve our planet's core issues.

Peszynska was one of 489 scientists elected as 2020 Honorary Fellows of the American Association for the Advancement of Science (AAAS). Founded in 1848, the AAAS is the world's largest multidisciplinary scientific society and publisher of the leading journal Science.

Peszynska, elected in the section on Mathematics, is only the 18th faculty member in the College of Science to be elected as an AAAS Fellow. This brings the number of professors at Oregon State University elected AAAS Fellows since 1965 to 42. Peszynska was honored as "for outstanding contributions to multidisciplinary mathematical and computational modeling of flow and transport in porous media." She is one of only eight mathematicians chosen nationwide in 2020, and the first one in Oregon.

Photo: Methane bubbles frozen in the ice of Lake Baikal

Malgorzata Peszynska

A career of problem-solving

In 2021 Peszynska also received the Society for Industrial and Applied Mathematics (SIAM) Geosciences Career Prize. Established in 2008, the highly competitive prize is awarded every two years to "an outstanding senior researcher for broad and distinguished contributions to the solution of mathematical and computational problems in the geosciences."

"Peszynska is held in the very highest esteem for her record of excellence in all facets of productive academic activity," said Bill Bogley, head of the Department of Mathematics. "Her record of engagement and leadership leaves no doubt that colleagues from Oregon State University, the nation and the world all recognize and seek to engage with her energy and expertise." He commended her notable history of mentorship and advocacy for her students, including a 2006 Mortar Board Top Professor award and 2016 Department of Mathematics Graduate Faculty award.

"It is extremely rewarding for my work to be recognized. I stand on the shoulders of the giants in the field and I am grateful for their passion which inspired mine," said Peszynska. "I share this award with my family and the extended family of students and collaborators, whose support has been unwavering. My goal is to continue paying it forward."

Discoveries and contributions to the world of applied mathematics

Born and raised in Warsaw, Poland, Peszynska received a master's degree in applied mathematics from the Warsaw University of Technology (WUT), a Ph.D. in mathematics from the University of Augsburg in Germany, and a habilitation degree from WUT. She held research and teaching positions at the Polish Academy of Sciences, WUT, Purdue University and The University of Texas, Austin, before joining Oregon State University in 2003. She was also a 2019-20 Fulbright Research Fellow. In 2019-21, Peszynska served as the rotating Program Director within the National Science Foundation (NSF) Division of Mathematical Sciences in Washington, D.C.

Malgo has published more than 70 articles, many with the postdocs, graduate and undergraduate students she has trained, advised and mentored. To date, eight Ph.D. and 15 master's students have completed their degrees under her guidance, and she has supervised more than ten undergraduates in research. Peszynska notes that of all her professional accomplishments, she is most proud of her work with students who are now enjoying fruitful careers in industry, academia and national labs.

Applying computational mathematics to real-life problems

Peszynska's research applies to current hot topics in environment and energy resources linked to climate change. Her algorithms and analyses of nonlinear flow and transport phenomena apply at a microscopic scale, such as to solar cells and energy storage devices, as well as to the interactions of microbial species in carbon sequestration. She also studies macro-scale porous media models that can support clean-up of contaminated aquifers and lead to a better understanding of permafrost warming. "What's happening with permafrost is absolutely incredible, and is a problem ripe for more and more modeling," said Peszynska.

She is particularly proud of her work on computational mathematics aspects of models for methane hydrate evolution. Methane hydrate, frozen deposits of natural gas found primarily in the Arctic and sub-ocean sediments, is a double-edged fuel source. When these ice-like methane hydrate deposits or permafrost thaw, large volumes of methane gas may escape into the atmosphere and potentially cause explosions. "We aim to provide reliable and accurate models for simulation of various scenarios to help mitigate and contain the possible disasters," said Peszynska.

She is also known for her pioneering efforts in computational upscaling of coupled processes in complex pore-scale environments (such as soil or the human body). Her work has been supported by NSF and Department of Energy grants involving several interdisciplinary collaborations within OSU and beyond, most recently by two awards of $384K for 2015-21 and another for $224K for 2019-22.

Jennifer Smucker

Delivering impact
Students make their mark through mathematics

UNDERGRADUATE STUDENTS

From the farm to graduate school

Jennifer Smucker ('21) grew up in Harrisburg, a farming community near Corvallis. In her freshman year she dual-enrolled at Oregon State University and Linn Benton Community College, attending classes at Linn Benton the first two years. Through this program, her transfer to OSU as a junior in 2019 was seamless. Her junior year was her first year on campus and began well, but as so many stories the last two years go … "and then COVID." Between her jobs and pandemic restrictions, Smucker missed out on some of the college activities she normally would have joined.

Smucker has always loved the logic of math and found she enjoyed teaching. Teaching opportunities opened for her well before graduation: As a junior, she taught middle and high school science at a small private school. As a senior, she tutored students in physics at Linn Benton.

"Part of the reason I chose math as a major was because it had a good helping of both math and science," Smucker says. "What I like about science is that it takes along that math and makes it useful and applies it. But math is the thing I know the most of and understand the best."

When figuring out what came after graduation, her advisor, Tom Dick, helped her find the best fit. Dick clearly laid out options and requirements for master's and Ph.D. programs, and Smucker determined she was most interested in a Ph.D. in mathematics. This fall, the newly-minted Oregon State grad began her Ph.D. in mathematics at Virginia Tech.

Math double major wins Goldwater Scholarship

Junior **Emily Gemmill** was awarded the 2021 Goldwater award, the top undergraduate award in the country for sophomores and juniors in the fields of science, technology, engineering and mathematics. Gemmill is pursuing a double major

in biochemistry and biophysics and mathematics, with a minor in chemistry and options in advanced biophysics and mathematical biology.

"I chose the advanced biophysics option for my biochemistry degree and the mathematical biology option for my mathematics degree, which complement each other well as they both apply rigorous analytical methods

Emily Gemmill
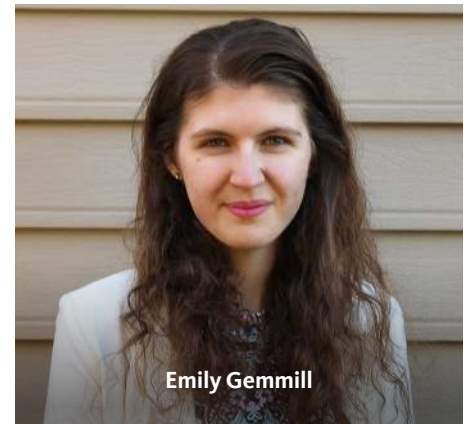
to biological systems," said Gemmill. Gemmill transferred to Oregon State from Portland Community College where she was a student in the honors program. There, she was awarded
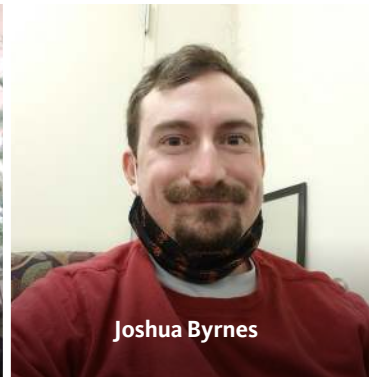
Luis Garcia-Lamas

Josie O'Harrow

Austin Bosgraaf

Joshua Byrnes

an Oregon Space Grant Consortium research fellowship to support her work on developing a mathematics fluid-based model on mitigating traffic flow in Portland.

Gemmill has pursued ambitious research goals with the help of a Summer Undergraduate Research Experience (SURE Science) scholarship. After graduation, she plans to pursue a research career at the intersection of mathematics and biophysics.

Summer research and internships a stepping stone to the future

Senior **Luis Garcia-Lamas** ('22) spent the summer of 2021 conducting full-time paid research on corn genetics, using statistical modeling and data analysis to predict phenotype outcomes. He appreciated the opportunity to apply his mathematics and statistics knowledge to a problem in biology. "It really shows that statistics can be applicable in many different fields," he said.

Thanks to his SURE scholarship, instead of worrying about finances, he was able to enjoy the work and earn money at the same time. "I come from a low-income background, so scholarships mean a lot to me. This research is fundamental to my upcoming graduate school applications," said Garcia-Lamas. "It's a stepping stone to my future."

Garcia-Lamas has gained a wealth of leadership experience in his time at Oregon State, serving as vice president of the Society for Advancement of Chicanos/Hispanics and Native Americans, or SACNAS. He also held multiple leadership positions for the Actuarial Science Club and tutored students through the TRiO program, which serves low-income, first generation and students with documented disabilities.

Josie O'Harrow, a mathematics junior, participated in a summer undergraduate research program at Yale University. There, she worked on a project with three other students from universities across the country that examined gap distributions for the slopes of saddle connections on translation surfaces. As part of this experience, she also served on the Diversity, Equity and Inclusion committee for her cohort, which included picking reading and learning resources for the group.

Lodewyk Petrus Jansen Van Rensburg

Lodewyk Jansen Van Rensburg, a sophomore mathematics and computer science major, worked for a software company in Atlanta called EPI-USE which specializes in implementing a wide variety of human resource software solutions. Lodewyk worked on a team with three software engineers for six weeks on a project involving the analysis of the flow of information within a graph database.

GRADUATE STUDENTS

2020-2021 cohort highlights

The Mathematics department welcomed its first COVID cohort of graduate students who began their programs virtually. The 15 students come from nine different states; one joins us from Sri Lanka. Twelve came with bachelor's degrees and three join us with their master's degrees:
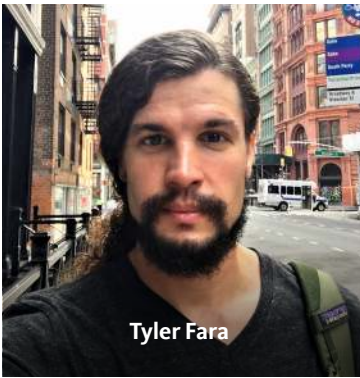
Austin Bosgraaf received his bachelor's and master's degrees in mathematics from Wichita State University.

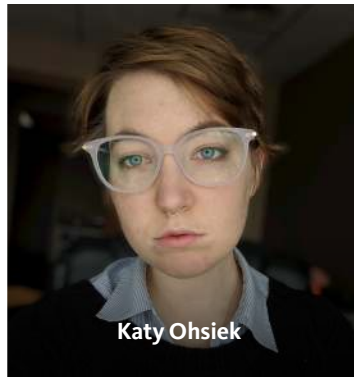**Joshua Byrnes** joins us from the University of Montana with his master's degree.

Peter Cowal received his bachelor's degree in mathematics from Pomona College in 2019.

Tyler Fara received his master's degree from Colorado State University.
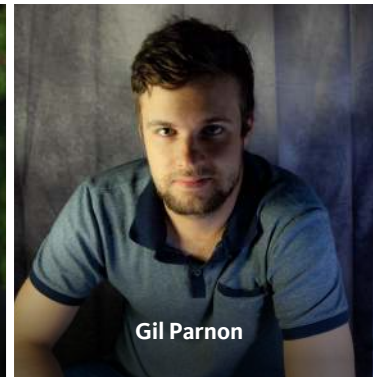
Tyler Fara

Katy Ohsiek

Nico Pantuso

Gil Parnon

Lars Gunderson received his bachelor's degree from Oregon State.

Praveeni Mathangadeera received her bachelor's degree in mathematics from the University of Sri Jayewardenepura, Sri Lanka in 2018.
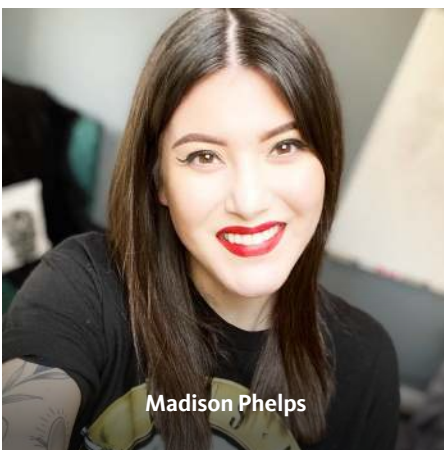
Katy Ohsiek completed her bachelor's degree in mathematics from Willamette University in 2017.

Nico Pantuso received his bachelor's degree from the University of Texas, Arlington.

Gil Parnon graduated with his bachelor's degree in 2020 from Portland State University.

Lucas Perryman-Deskins completed his bachelor's degree from Willamette University in 2020.

Madison Phelps received her bachelor's degree from the University of Washington Tacoma in 2020.

Madison Phelps

Alex Pierson completed his bachelor's degree from Duke University.

Katy Price received her bachelor's degree in 2020 from the University of Alaska, Southeast.

Katy Price

Dante Salas graduated with his bachelor's degree in 2020 from the University of Colorado Boulder.

Rachel Wofford received her bachelor's degree in 2020 from Whitworth University. During the summer of 2021, Rachel participated in an NSF Mathematical Sciences Graduate Internship through Oak Ridge National Laboratory.

Of the 15 new students, six received scholarships: **Peter Cowal** received the Wei Family Scholarship and **Rachel Wofford** is an ARCS Foundation Award recipient. **Katy Ohsiek, Lucas Perryman-Deskins** and **Madison Phelps** are Provost Scholars,

and **Kathryn Price** was awarded the inaugural Ramanujan-Hardy Fellowship in Pure and Applied Mathematics.

Modeling for the climate to come

Jeremy Lilly, a graduate student in his third year with the department, received an award from the Office of Science Graduate Student Research Program, which is sponsored by the U.S. Department of Energy (DOE) Office of Science and is aimed at preparing graduate students for STEM careers critically important to the DOE.

This award gives Lilly the opportunity to work with members of the climate, ocean and sea ice modeling group at Los Alamos National Laboratory, as well as continue working with his Ph.D. advisor, Robert Higdon. Lilly began this work in January 2022 and is collaborating on work with local time-stepping schemes within MPAS-Ocean, a multi-resolution model that is being developed at the laboratory.

OSU having broader engagement

The SIAM CSE (Computational Science and Engineering) Conference met virtually from March 1 to 5, 2021 and featured a strong presence by OSU mathematics students. The virtual setting made the various activities both exciting and challenging. Ph.D. students **Lisa Bigler, Choah Shin** and

Lisa Bigler

Jeremy Lilly

The NSF Mathematical Sciences Graduate Internship (MSGI) program is administered by the Oak Ridge Institute for Science and Education. All of the paid research internships were conducted virtually due to COVID-19 pandemic restrictions.
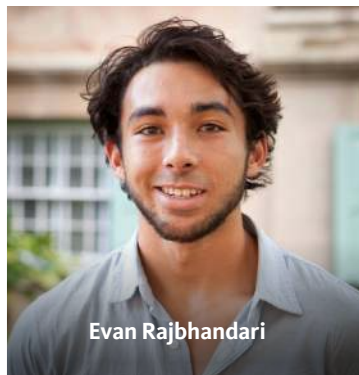
Wofford, Bigler and Krotz worked with researchers from Oak Ridge National Laboratory. Wofford's project examined how socioeconomic status impacts cancer patients. Bigler's research involved implicit time-stepping methods for phase-field equations. Krotz, who graduated with his master's degree in 2021, worked on hybrid algorithms for the numerical simulation of complex particle systems. Krotz was also chosen to participate in the highly selective Gene Golub SIAM Summer School on the Theory and Practice of Deep Learning, which took place virtually this year hosted by the African Institute for Mathematical Sciences South Africa.

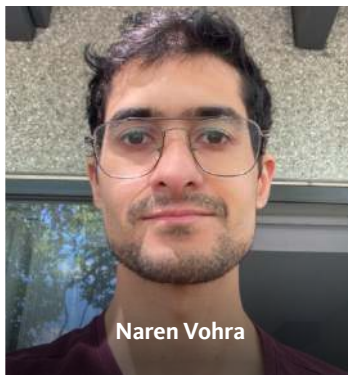Vohra's project was sponsored by Los Alamos National Lab and was related to a numerical permafrost model.

Wei Xi Boo, mathematics graduate student, was selected to participate in a workshop on data-driven mathematical and statistical modeling for graduate students hosted by the Statistical and Applied Mathematical Sciences Institute in North Carolina.

Naren Vohra, as well as recent Ph.D. alum **Sebastian Naranjo** gave invited talks in mini symposia and Bigler, Shin and **Evan Rajbhandari** presented research posters.

Bigler and Shin also participated in and were supported by the Broader Engagement (BE) program which featured a rich scientific program mentoring career and professional development to students from underrepresented and underprivileged backgrounds who aspire to broaden their experience in research-based professional activities. Shin even served as a teaching assistant in the BE tutorial on "Fundamentals of Accelerated Computing with CUDA C/C++."

Summer internships in national labs

Graduate students **Rachel Wofford, Lisa Bigler, Johannes Krotz**, and **Naren Vohra** were each selected for prestigious National Science Foundation (NSF) sponsored summer internships in 2021.
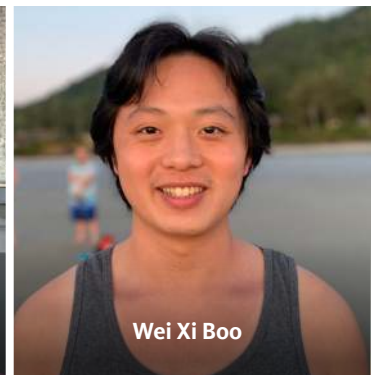

Peter Cowal

Evan Rajbhandari

Naren Vohra

Wei Xi Boo

Rich and intricate discoveries

Holly Swisher was recently awarded a three-year $200K National Science Foundation grant to investigate some of the field's most fundamental questions in number theory pertaining to modular and automorphic forms, which play a crucial role in various branches of mathematics and mathematical physics. These include combinatorics, algebra, analysis, arithmetic geometry, number theory and string theory.

An expert in number theory and combinatorics, branches of classical mathematics, Swisher's research focuses on the mathematical areas of partition theory, modular forms, mock modular forms and hypergeometric series as well as the interrelationships among them.

Modular forms are complex valued functions on the upper-half of the complex plane that are highly symmetric. The complex plane is a way to geometrically represent complex numbers as points on a plane on the Cartesian coordinate system where the x-axis represents the real part and the y-axis represents the imaginary part of each number.

Due to their special symmetry properties, modular forms can be found in fundamental proofs and theorems in other branches of
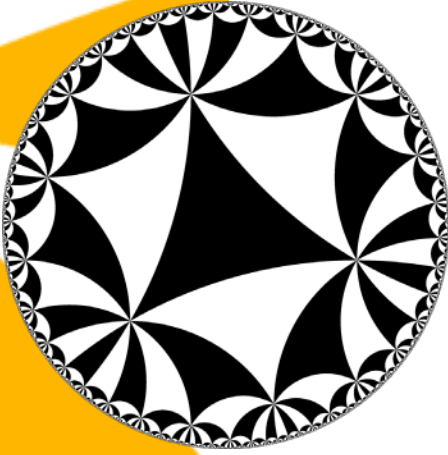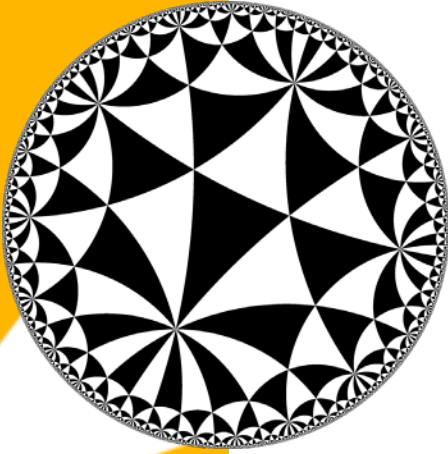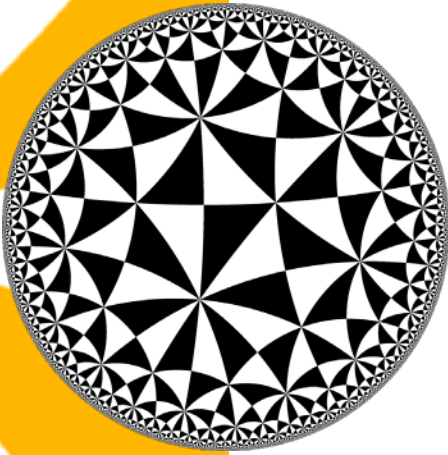
mathematics throughout the twentieth century. Major research problems deeply intertwined with modular forms include the proof of Fermat's Last Theorem, the Langlands Program, the Taniyara-Shimura conjecture (now the Modularity Theorem) and several open questions in superstring theory.

At the foundation of Swisher's inquiry lies the central and intriguing role played by modular forms in many major problems in number theory over the last century.

"One of the beautiful things about number theory is that seemingly simple questions, when deeply investigated, can blossom into rich and intricate discoveries," said Swisher.

She will explore the relationships between several types of modular forms such as quantum modular forms, harmonic Maass forms and mock modular forms, which were first theorized by the famous Srinivasa Ramanujan in 1920.

Swisher explores this project through the mathematics of combinatorial functions as a testing ground for the theory of modular forms. This strand of research will pay particular attention to combinatorial functions related to the theory of partitions (a branch of number theory and combinatorics) to better understand modularity of combinatorial functions. According to Swisher, examples arising from combinatorial generating functions historically have been a rich source of varied types of modularity behavior, and determining a general theory for the modularity of combinatorial generating functions would be a significant piece of the puzzle.

Swisher, who leads the Research Experiences for Undergraduates (REU) site in mathematics at Oregon

State, has co-authored several articles proving important results on combinatorial objects and modular properties with her REU students. Through this new project, Swisher will work with her students to research hypergeometric functions, with respect to the larger modular and automorphic forms landscape, which have been of great importance to many areas of science, including mathematics, engineering and physics.

Swisher is a member of one of the most ambitious mathematical collaborations in recent times, the L-functions and Modular Forms Database. She has been an associate editor of a team of more than 70 mathematicians from 12 different countries who are working to create a massive mathematical database which catalogs objects of central importance in number theory and maps out the intricate connections between them. The goal is to describe the data in ways that faithfully exhibit the connections between these objects and prompt further exploration and discovery. The database is supported by grants from the U.S. National Science Foundation, the UK Engineering and Physical Sciences Research Council and the Simons Foundation.

Swisher has been involved with the Women in Number Theory (WIN) community since 2008, participating in the first WIN conference at the Banff International Research Station for Mathematical Innovation and Discovery, and publishing a paper in the corresponding conference proceedings volume entitled "Women in Numbers: Research Directions in Number Theory," published by the Fields Institute. Swisher has since published papers in proceedings of each of the WIN subsequent workshops, up to WIN4, and is currently leading a project for WIN5.

Out there

Diversity, outreach, news and events

Michael Allen

Mary Beisiegel

Genevieve Connolly

Dominic Doprano

Carrie Manore

Peter Oberly

Trevor Reid

Tyler Schimelck

Lonseth awards persist despite pandemic

Established in 1985, the Lonseth Awards recognize students and faculty who excelled throughout the previous year. The awards are named in honor of Arvid T. Lonseth, professor emeritus and former chair of the mathematics department.

2021 Lonseth Award Recipients

Brenna Beyer ('21) received the Gary L. Musser Award, which recognizes the outstanding mathematical achievement for a prospective elementary or middle school teacher.

Elaine Swanson

Jennifer Smucker ('21), **Elaine Swanson** ('20), **Tanner Fromcke** ('21) and junior **Eli Winkelman** received the Edward H. Stockwell Award for outstanding work in mathematics.

Junior **Josie O'Harrow** received the Harry and Molly Goheen Memorial Scholarship, which recognizes an outstanding junior or senior mathematics or computer science major who expresses the desire to work in those two fields following graduation.

Genevieve Connolly ('21) received the WIC Award for outstanding mathematical writing.

Junior **Dominic Doprano**, graduate student **Trevor Reid** and **Tyler Schimleck** ('21) received the Botand Gabor Eross Math Memorial Scholarship for outstanding work in mathematics.

Junior **Luis Garcia-Lamas** received the Actuarial Science Award.

Branwen Schaub received the Graduate Student Achievement Award.

Michael Allen received the Graduate Student Excellence Award.

Lisa Bigler and **Adam Eide** received the William F. Burger Graduate Teaching Award.

Junior **Matthew Gillespie** received the Joel Davis Award for outstanding work in mathematics.

Peter Cowal received the Graduate Student Award for Excellence in Qualifying Exams.

Paul Dalenberg, Chung-Ping Lai, Jeremy Lilly, Jordan McCaslin, Peter Oberly, Slade Sanderson and **Naren Vohra** received the Graduate Student Outstanding Performance in Coursework Award.

Mary Beisiegel, associate professor, received the Graduate Faculty Award.

Panels, conferences and more in a virtual world

The College of Science hosted a panel of women in leadership in celebration of International Women's Day on March 8, 2021 that featured several mathematics department faculty, students and alumni. **Vrushali Bokil**, associate dean of research and graduate studies and professor of mathematics, and

Branwen Schaub, Ph.D. mathematics student, served as two of the three moderators. **Carrie Manore** (Ph.D. '11, advisor Bokil), staff scientist at the Los Alamos National Laboratory, was one of the panelists.

As part of the Teachers Teaching with Technology International Conference in February 2021, **Tom Dick** organized an all-day virtual conference for Advanced Placement (AP) calculus teachers to discuss issues and challenges they face.

The 13th annual Northwest Undergraduate Mathematics Symposium took place in April 2021 as a virtual meeting for the second year in a row. The meeting was co-hosted by **Nathan Gibson**. Undergraduate student **Josie O'Harrow** received the second-place presentation prize for her talk entitled "More Reducibility Among Combinatorial Problems."

In fall 2021, **Tevian Dray** and his wife, Corinne Manogue, professor of physics, taught a virtual graduate class with the African Institute of Mathematical Sciences (AIMS) in South Africa as part of its master's degree in mathematical sciences program. Dray and Manogue hope to be able to offer their course in person once again at some point in the future!

Tevian Dray and Corinne Manogue

In Memoriam

Former faculty member **Donald Akers Jones** passed away in June 2021. Jones was a senior faculty member in the mathematics department from 1990 until his retirement in 1998, having come here from a successful academic/ actuarial career at the University of Michigan. He was a co-author of one of the most influential texts in the field of actuarial mathematics.

Embedding Diversity, Equity, Justice, Access and Inclusion

In May 2021, the Department of Mathematics adopted a new Values and Acknowledgment statement, developed by our Diversity, Equity, Justice, Access and Inclusion (DEJAI) Committee. The statement acknowledged systemic failures within higher education, at OSU and the mathematics community to engage minority and underrepresented communities in mathematics. It then stated a commitment to listen, learn and evolve to better identify and change the systems and structures that contribute to the lack of inclusiveness. The goal of the DEJAI committee's work is "to create a climate in which people from any background feel invited and welcome to join in creating and promoting knowledge and the appreciation of mathematics. By establishing a welcoming community of faculty, staff and students in all their departmental roles that draws on the diversity present in the state, the country and the world, we can develop and share meaningful mathematical ideas that equip and empower our students with the tools for success at OSU and beyond."

The department has since set up a website with resources for faculty, staff and students to aid in personal learning about DEJAI work. The site contains links to organizations dedicated to increasing diverse representation in mathematics, professional development opportunities in DEJAI work and resources for DEJAI teaching. See **math.oregonstate.edu/dejai**.

The committee's work is situated in a larger effort by the College of Science to enhance diversity, racial justice and inclusion in science, including the development of a Diversity Strategic Action Plan, "Embedding Equity, Access and Inclusion." Read more at **science.oregonstate.edu/diversity-plan**.

Oregon State University
College of Science

Department of Mathematics

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