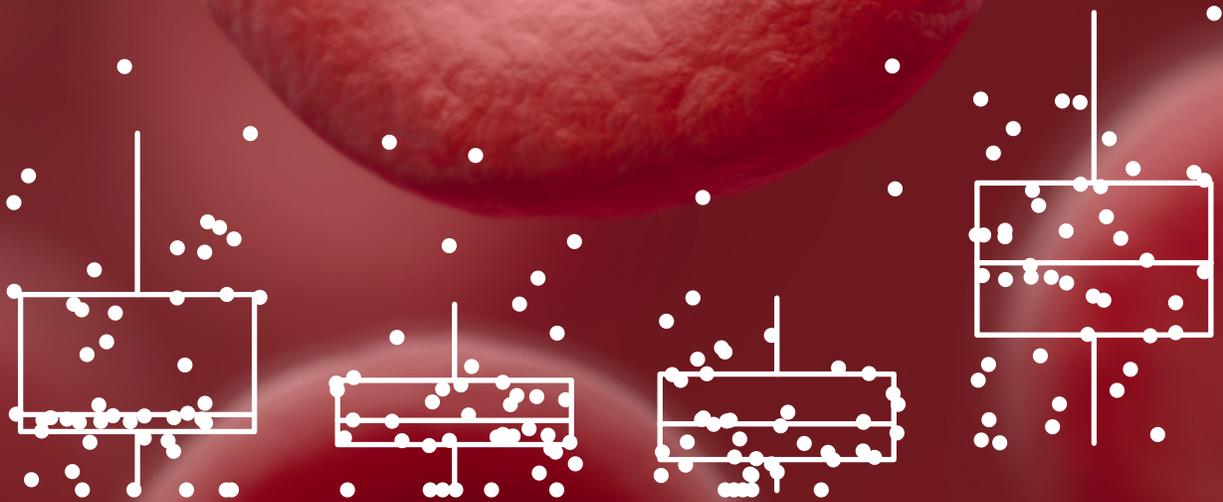


MATH IN THE VALLEY

WINTER 2018 Alumni Newsletter



Oregon State
University

MATH IN THE VALLEY

Winter 2018

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On the cover — At the intersection of mathematics and human health, mathematician David Koslicki's research has revealed that individuals with schizophrenia have different blood microbiomes than those without. See p. 9.

FROM THE HEAD

Bill Bogley
Department Head



Dear alumni and friends,

Greetings from our outgoing Department Head Enrique Thomann and our incoming Department Head Bill Bogley, who assumed his new role on July 1, 2018. It is a pleasure for us to share our winter 2018 newsletter, which highlights some of the many accomplishments by our students, alumni and faculty, and elements of our history that have contributed to our department's fabric.

This has been a banner year for faculty promotions, especially for women in our department: Vrushali Bokil and Holly Swisher are now full Professors; Mary Beisiegel, Elaine Cozzi and Elise Lockwood were promoted to Associate Professor with tenure;

and Torrey Johnson and David Wing were promoted to Senior Instructor I. Congratulations to these outstanding researchers and teachers!

Our research continues to attract external funding from the National Science Foundation, Simons Foundation and other major funding agencies. We are thrilled to announce that David Koslicki is the first faculty member of the department to receive funding from the National Institutes of Health. In more good news, Mary Beisiegel is a co-PI on a five-year, \$1 million grant from the Howard Hughes Medical Institute Inclusive Excellence Initiative, again a first. Juan Restrepo was named a Fellow of the Society for Industrial and Applied Mathematics—the first

faculty member in our department to achieve this outstanding international recognition for his research. Seven faculty members, who are known across campus as “Team Math,” received OSU’s 2018 Faculty Senate Student Learning and Success Teamwork Award, which recognized their efforts to improve student success in college algebra.

We are deeply saddened to relate that Professor Bob Burton passed away on June 23, 2018. Bob was a valued friend and leader for a generation of students and faculty. He retired on June 30, 2017 along with Ed Waymire. This year, Mary Flahive and Marie Franzosa also retired. Please read about their invaluable contributions in this newsletter.

Thanks to the College of Science and an anonymous donor, the Mathematics and Statistics Learning Center (MSLC) benefited from a fresh upgrade with an open floor concept and new furniture that makes it a more welcoming environment for students, tutors and faculty. The MSLC remains the backbone for beyond-the-classroom academic support for all students taking mathematics courses at Oregon State University.

We appreciated hearing from all who have sent comments on past newsletters. Please stay in touch! We hope to see you in the coming year.

Cheers,
Enrique Thomann and Bill Bogley

Special thanks to the Newsletter Committee for producing this edition of Math in the Valley, including Vrushali Bokil (Chair), Sara Clark, Nathan Gibson, Joy King, David Koslicki, Torrey Johnson, Clayton Petsche, Ralph Showalter and

David Wing. Thanks also to Tom Dick for the article on the MSLC.

To all mathematics alumni and friends: Your success is the measure of our success. Your support and

suggestions help us better fulfill our mission.

Please drop Bill a line at Bill.Bogley@oregonstate.edu to let us know how we are doing.

AT THE HELM

Advancing mathematics through leadership

New leader for mathematics

We extend a warm welcome to **Bill Bogley** in his new role as Head of the Department of Mathematics, effective July 2018. He has served as associate chair in the department from 2011–12 and as head undergraduate advisor for mathematics students.

Bogley brings significant leadership experience to his new role. He has been active in shared governance and served on many committees at OSU. He served as Associate Dean of the Honors College from 2005–10 and as OSU's Director of Academic Programs, Assessment and Accreditation, where he led the implementation of general education learning outcome assessment protocols for the university.

Bogley joined the department in 1990 and holds the rank of professor. His research is in the areas of combinatorial and geometric group theory. He has received several teaching awards, including the Lloyd Carter and Fred Horne awards in the College of Science

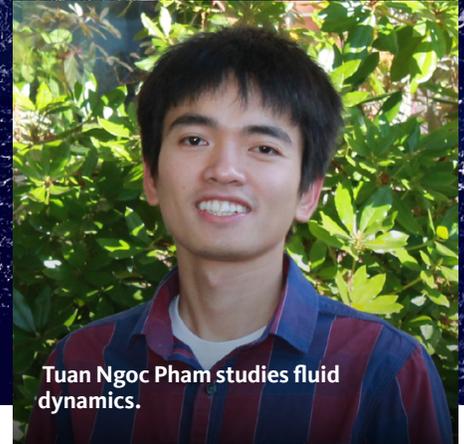
He received his bachelor's degree from Dartmouth College and earned both his master's degree and Ph.D. from the University of Oregon.

Welcome new faculty!

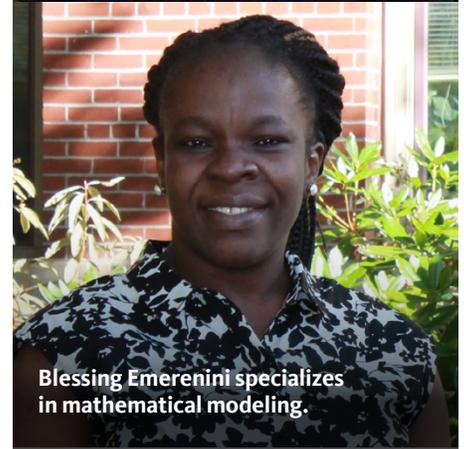
This past year we hired two fixed-term assistant professors, Blessing Emerenini and Tuan Ngoc Pham, who arrived in Fall 2018. We are thrilled to welcome them into our community.

Tuan Pham earned his bachelor's degree in mathematics and computer science from the University of Science in Ho Chi Minh City, Vietnam, and earned a master's degree in applied mathematics from the University of Orléans in Orléans, France. Pham spent the summer of 2011 as an intern at Ecole Polytechnique (Palaiseau, France) where he worked on his master's thesis. He received his Ph.D. from the University of Minnesota, Twin Cities in 2018. Pham's dissertation dealt with several regularity issues of the 3D Navier-Stokes equations in fluid dynamics, and his research focuses on partial differential equations.

Blessing Emerenini specializes in mathematical modeling, numerical simulation and mathematical analysis of infectious diseases and microbial, ecological and biological systems. She holds a bachelor's degree in mathematics and computer science from the Federal University of Technology Owerri in Nigeria. She earned two master's degrees in industrial and



Tuan Ngoc Pham studies fluid dynamics.



Blessing Emerenini specializes in mathematical modeling.

applied mathematics from Eindhoven University of Technology in Eindhoven, Netherlands and from Johannes Kepler University Linz in Linz, Austria. She received her Ph.D. in applied mathematics from the University of Guelph in Ontario, Canada, in 2015.

Excellence in research, service and teaching

Malgorzata Peszynska has been elected President of the Pacific Northwest Section (PNWS) of the Society for Industrial and Applied Mathematics (SIAM). The SIAM PNW Section sponsors conferences and promotes collaboration for both basic research and applications of mathematics to industry and science. Peszynska previously served as vice-president of SIAM PNWS.

Juan Restrepo was recognized as a 2018 Fellow of SIAM for his exemplary contributions to the mathematical and computational modeling of the ocean and atmosphere. He was one of 28 researchers from across the world in the 2018 Class of SIAM Fellows.

Mary Beisiegel was recognized by graduate students with the 2018 Graduate Faculty Award during the 33rd annual Lonseth Lecture.

Global recognition for research in undergraduate education

Elise Lockwood, a recent NSF CAREER grant awardee, received the (biennial) John and Annie Selden Prize for Research in Undergraduate Mathematics Education (RUME) from the Mathematical Association of America. The international award honors a researcher with a significant record of publications in

undergraduate mathematics education and who has worked in the field for no more than 10 years.

“I am extremely honored to receive the Selden Prize. The RUME community has been tremendously formative in my professional development. I have felt encouraged and supported since the beginning of my career, and my RUME colleagues continue to challenge me to become a better researcher,” said Lockwood.

Team Math wins award for exceptional teamwork and teaching

A team of mathematics faculty—which includes Sara Clark, Liz Jones, Scott Peterson, Lyn Riverstone, Daniel Rockwell, Katy Williams and David Wing — has received OSU’s 2018 Faculty Senate Student Learning and Success Teamwork Award for their efforts to enhance student performance in

introductory mathematics courses such as college algebra. The award recognizes departments or interdisciplinary groups at Oregon State that have demonstrated exceptional teamwork in creating and sustaining an exemplary teaching and learning environment to advance student success.

Leadership in mathematical research across the nation and the world

Mathematics faculty have had a busy year organizing over a dozen international, national and regional conferences.

David Koslicki co-organized the annual National Institutes of Health-sponsored Computational Genomics Summer Institute at UCLA, July 6–8, 2017, an event which brings together mathematicians, computer scientists and biologists interested in computational genomics research.

OSU hosted the first biennial SIAM PNW section meeting, co-located with the Pacific Northwest Numerical Analysis Seminar, in Corvallis in October 2017, which featured over 150 participants from the region. **Malgo Peszynska** was the chair of the organizing committee. The local organizing committee consisted of Elaine Cozzi, Nathan Gibson, Bob Higdon, Mina Ossiander and Ralph Showalter.

Yevgeniy Kovchegov co-organized Frontier Probability Days at OSU on March 29–31, 2018, to bring together leading researchers and students in probability theory and its applications. The conference received funding from the National Science Foundation (NSF) and honored professors **Bob Burton** and **Ed Waymire** on the occasion of their retirements.

Kovchegov was also a co-organizer and speaker at the workshop Random



Tenure and promotions: Committed to excellence in mathematics

The mathematics department successfully promoted seven faculty members in 2017–18, five of whom are women. Associate Professors **1** Vrushali Bokil and **2** Holly Swisher

were both promoted to full Professor. **3** Mary Beisiegel, **4** Elaine Cozzi and **5** Elise Lockwood have been promoted to Associate Professor with tenure. **6** Torrey Johnson and **7** David Wing were both promoted to Senior Instructor I. Congratulations to all of these outstanding researchers, scholars and teachers!

Trees: Structure, Self-Similarity and Dynamics at the Centro de Investigación en Matemáticas in Guanajuato, Mexico, April 23–27, 2018. The meeting celebrated Waymire’s contributions to the field of mathematics. Speakers included alumnus **Jorge Ramirez** (Ph.D. ‘07) and **Evgenia Chunikhina** (MS ‘14), as well as colleagues from the United States and Mexico.

Christine Escher co-organized the NSF-sponsored conference Representations of Riemannian Geometry in Philadelphia, August 10–13, 2017, to honor the 65th birthday of Professor Wolfgang Ziller of the University of Pennsylvania. At least half of the speakers were women, which is highly unusual in the field of differential geometry.

Research funding surges

The mathematics department has been quite successful in obtaining external funding on awards totaling over \$2 million in the last year alone. Below we highlight some of our successes.

Clayton Petsche and **Holly Swisher** are co-organizers of Oregon Number Theory Days, an NSF-supported triennial distinguished lecture series that rotates between three Oregon universities.

Swisher was awarded continuing grant support of \$288K to organize and host an eight-week summer research experience for undergraduate students from around the country each year throughout the three-year duration of the project. The goal is to advance undergraduate research in mathematics and theoretical computer science with a particular focus on number theory, probability and cryptography. Petsche and Yevgeniy Kovchegov are also supported by this grant.

David Koslicki was awarded \$292K by the NSF to investigate mathematical approaches for analyzing communities of microorganisms from their sampled DNA. Koslicki is also co-PI on an \$849K National Institutes of Health award as part of the National Center for Advancing Translational Science. The goal of this project is to build a Biomedical Translator, a software system that connects various distributed databases of biomedical knowledge and has the capability to “reason” over these data sources to answer biomedical questions such as: What genetic conditions might be protective against malaria?

From left, Zackery Reed (Ph.D. ‘18) and Elise Lockwood with colleagues in Norway.



Malgo Peszynska with graduate students Azhar Alhammali (L) and Choah Shin (R) in Munich, Germany

Out there: Representing OSU around the world

Last year, our faculty participated and gave invited talks in over a dozen countries. Here are a few highlights.

Malgo Peszynska gave an invited talk at the workshop “Numerical Analysis of Coupled and Multi-Physics Problems with Dynamic Interfaces,” organized by the Banff International Research Station, July 29–August 3, 2018, in Oaxaca, Mexico.

Tevian Dray was a plenary speaker on the geometry of vector calculus at the XX Semana de la Enseñanza de la Física, Bogotá, Colombia, September 25–29, 2017, where he and physicist Corinne Manogue also presented a joint workshop to future physics teachers on the geometry of electromagnetism.

Other faculty, including **Bill Bogley**, **Vrushali Bokil**, **Christine Escher**, **Elise Lockwood** and **Tom Dick**, also gave talks in England, China, Germany, Norway and France, respectively.



Recent retirees Ed Waymire, Mary Flahive and Marie Franzosa

Mary Beisiegel is co-PI on a five-year \$1 million grant from the Howard Hughes Medical Institute to increase inclusion and success of diverse students in mathematics, life sciences and chemistry classes. The grant will help OSU develop a cohort-based professional learning community for designing STEM curricula that will improve the performance of underrepresented ethnic minorities, first-generation and economically disadvantaged students.

On to the next adventure

Ed Waymire received his Ph.D. from the University of Arizona in 1976 where he worked under the direction of Rabi Bhattacharya. Waymire and Bhattacharya have co-authored books on probability theory and stochastic processes. Waymire's work has been recognized with the Milton Harris Award in Basic Research and the F. A. Gilfillan Memorial Award by the College of Science at OSU. He is a Fellow of the Institute of Mathematical Statistics (IMS), winner of the Carver Medal for service awarded by the IMS and past president of the Bernoulli Society. Recognized widely as an extraordinary mentor to junior faculty and students, Waymire continues to combine research and service with gusto and intensity. He will alternate living

between Corvallis and Tucson. He retired in June 2017.

Mary Flahive received her Ph.D. from the Ohio State University in 1976 under the direction of Alan Woods. She joined OSU in 1990 as an associate professor after working at the University of Massachusetts Lowell. While at OSU, Flahive held visiting positions at Flinders University in Australia, Salzburg University in Austria and the Radon Institute for Computational and Applied Mathematics in Linz, Austria. She has published two monographs and more than 25 papers. Flahive's service to OSU and the mathematics department exemplifies her generous personality. She served as head undergraduate advisor and associate head. Flahive retired in August 2018.

Alumna **Marie Franzosa** received her Ph.D. at OSU in 1988 under the supervision of Robert M. Burton. She was an assistant professor at Western Oregon University and then at St. Cloud State University in Minnesota before returning to Corvallis. She was hired as a full-time instructor at OSU in 1991, focusing first on pre-college mathematics courses and later on the mathematical preparation of pre-K-8 teachers. Franzosa retired in 2018 and plans to enjoy her retirement traveling and spending time with family.



Bob and wife Vicki

Remembering Bob Burton

In 1977, Bob Burton joined OSU after receiving his Ph.D. in mathematics from Stanford University where he worked under the direction of Donald Ornstein. He was associate chair and then chair of the department (1997–2001). Burton retired from OSU in June 2017 after 40 years.

Burton held visiting positions at several universities in Germany, the Netherlands, Canada and the United States. His collaborations were vast and highly productive.

In March 2018, a special session recognizing Bob's immense contribution to mathematics was held as part of the Frontier Probability Days conference at OSU. Several of Bob's collaborators and former students were able to attend. The department took this opportunity to recognize Bob's exquisite taste in mathematics, elegance in presentation and overall ingenuity in solving problems that served to motivate students and colleagues.

Bob was a voracious reader and music lover with a great sense of humor. He will be sorely missed.



From left, clockwise: Jesse Rodriguez '18, the mathematics graduate class of 2017, Mirek Brandt '18, Kirana Bergstrom '18

THINKERS AND DOERS

The triple crown of science

Jesse Rodriguez (B.S. '18) is a first-generation college student who graduated with majors in mathematics, physics and nuclear engineering. He was awarded the 2017 Botond Gabor Eross Math Memorial Scholarship for outstanding performance in mathematics at Oregon State.

Jesse has begun doctoral research in plasma physics at Stanford University as a Department of Energy Computational Science Graduate Fellow (DOE CSGF)—a highly prestigious fellowship that provides four years of financial support with a stipend of \$36,000 per year. The DOE fellowship trains the next generation of leaders in computational science who use math and computers to advance scientific discovery. Jesse is one of 26 fellows chosen from across the country for the DOE CSGF class of 2018.

Big strides by alumni

Kyle Bradford (Ph.D. '13, Advisor: Kovchegov) is an assistant professor of mathematics at Georgia Southern University. Prior to that, Bradford was an assistant professor in Korea for two years.

Kirana Bergstrom (M.S. '17, Advisor: Restrepo) is a software development engineer working on the Intel® Math Kernel Library (Intel MKL) team. Specifically, she works on the components of Intel MKL that provide functionality to solve systems of equations, eigenvalue problems and singular value problems, as well as the related matrix factorizations.

Duncan McGregor (Ph.D. '16, Advisors: Bokil and Gibson) began a postdoctoral appointment at Sandia National Laboratories in the computational multiphysics group.

He was quickly promoted to Senior Member of Technical Staff. McGregor utilizes his graduate training by contributing to several computational plasma physics projects at Sandia. His Ph.D. research was in the area of compatible methods for transient electromagnetics in media.

Kirk McDermott (Ph.D. '17, Advisor: Bogley) is an assistant professor of mathematics at Slippery Rock University in Pennsylvania.

Thomas Morrill (Ph.D. '17, Advisor: Swisher) started a postdoc in analytic number theory at the University of New South Wales, Canberra, Australia in 2017. He will work collaboratively on the Riemann zeta function.

Forrest Parker (Ph.D. '17, Advisor: Bogley) began working at Google, Inc., in October 2018. His team is focused on automating the process of analyzing

the computational and storage utilization at Google's data centers around the world, and forecasting future demand via the use of a variety of statistical techniques and machine learning models.

Puttha Sakkaplangkul (Ph.D. '17, Advisor: Bokil) is a lecturer in the Department of Mathematics at King Mongkut's Institute of Technology Ladkrabang in Thailand. Prior to that he was a postdoctoral fellow at Michigan State University.

Vanessa Bean (B.S. '17) graduated with a major in mathematics and a minor in both statistics and actuarial science. Recently, she was hired as an investment analyst with RVK (formerly known as R. V. Kuhns & Associates), an investment consulting firm located in downtown Portland, Oregon.

Jetjaroen Klangwang (Ph.D. '18, Advisor: Swisher) is a visiting assistant professor of mathematics at Union College in Schenectady, New York.

Zackery Reed (Ph.D. '18, Advisor: Lockwood) is a postdoctoral fellow in the mathematics department at Oklahoma State University.

Caitlin Berger (B.S. '18) is Associate Solutions Architect with Amazon Web Services in Seattle. Caitlin holds a B.S. in mathematics with the statistics option and a computer science minor.

Gregory "Mirek" Brandt (B.S. '18) will attend the University of California-Santa Barbara (UCSB) for a Ph.D. in physics. Brandt has received a Paxton Summer Fellowship in theoretical astrophysics from UCSB. He graduated with a bachelor's in mathematics and physics.

Jill Weimer (B.S. '18) is an analyst in the finance department for Comcast in Beaverton, Oregon.

MATHEMATICS FOR LIFE

Cavaiani's gift will support the department's first endowed professorship.



Over a period of about 17 years, **Thomas Cavaiani** earned two bachelor's degrees, a master's degree and a doctorate from Oregon State University. He earned his first degree, a B.S. in mathematics, in 1971 and bid a final farewell to OSU with a Ph.D. in mathematics education in 1989. Interspersed with his studies at OSU, Cavaiani pursued careers in teaching at Boise State University (BSU) in Idaho.

"Every time I finished my degree, my professors asked me to continue," recalls Cavaiani. He completed his doctoral dissertation under the guidance of Howard Wilson, currently professor emeritus of mathematics and mathematics education.

Cavaiani recently retired as faculty from BSU where he taught courses in programming, statistics, networking and telecommunications in the Department of Information Technology and Supply Chain Management.

Besides playing an important role in developing educational technology, Cavaiani has enjoyed a rewarding and multi-faceted career as an informational technology expert and a corporate training consultant for various companies including Hewlett-Packard.

Born in New Orleans, Louisiana, Cavaiani had a peripatetic childhood because of his father's career in the Navy. He attended school in California, Kansas and Nebraska. After his parents

settled in Redding, California, Cavaiani began his mathematics major at the University of California-Berkeley.

Finding UC-Berkeley "too big and impersonal," Cavaiani left after just one year and transferred to OSU. He attributes his success to his mathematical training at OSU.

"My math education helped me think linearly — how to solve a problem by breaking it down, how to structure a solution and acquire the ability to think in a way that solves a knotty issue," Cavaiani states. "This scientific method of problem solving has proven useful throughout my career in teaching and corporate training."

A passionate proponent of STEM learning, Cavaiani has made a planned bequest to establish the Thomas P. Cavaiani Endowed Professorship, which will support a faculty position dedicated to innovative teaching and research in mathematics. This would be the first endowed professorship in the mathematics department.

Cavaiani's legacy gift will help a greater number of students succeed in mathematics as well as inspire more students to major in mathematics. "I thought this way you can get more young people to study math," remarks Cavaiani.

MATH IN THE WORLD

Modeling phenomena, finding solutions

Mathematics faculty are involved in world class research that is deep in mathematical innovation, broad and diverse in its application, and collaborative, interdisciplinary and international in its nature. We highlight here some of our ongoing research.

Never heard of methane hydrates?

Malgo Peszynska says that might be good news. In a recent article that was published in the premier news publication in applied mathematics, *SIAM News*, Peszynska describes her international collaborative research on methane hydrate, abundantly found in deep ocean sediments and in Alaska. Methane hydrate is an ice-like crystalline substance, and is considered a “smoking gun” in environmental and (paleo-) climate studies because dissociation of gas hydrates can dramatically increase the amount of methane in the atmosphere, contributing to the overall balance of other greenhouse gases.

This research on the mathematical modeling of methane hydrate, funded by the National Science Foundation (NSF), has involved several mathematics graduate students including **Joe Umhoefer**, **Choah Shin**, and former students **Tim Costa**, **Patricia Medina** and **Ken Kennedy**, and students outside mathematics such as Wei-Li Hong from the College of Earth, Ocean and Atmospheric Sciences (CEOAS). Originally started in collaboration with CEOAS professors Marta Torres and Anne Trehu, the

project involved mathematics faculty, including **Ralph Showalter**, **Nathan Gibson** and **Justin Webster**.

Understanding random disturbances in populations

How can we construct a mathematical framework to understand how population-reducing events of varying frequency and intensity, like fires, floods, storms and droughts, can affect a species’ ability to survive? **Patrick De Leenheer’s** collaborative work identifies “critical growth thresholds” for species subjected to random events that immediately and substantially impact the species’ population levels. The research was motivated in part to try to predict the effects of global climate change which may alter the characteristics of these events.

De Leenheer’s work, funded by the NSF, was published in the *Journal of Mathematical Biology*. Collaborators included **Edward Waymire**, professor emeritus of mathematics, and alumnus **Scott Peckham**, who is a geophysicist at the University of Colorado.

Tackling a destructive plant virus

Vrushali Bokil’s international team of collaborators came up with a mathematical model to understand the

spread of maize lethal necrosis in Kenya and strategies for its control. **Carrie Manore** (Ph.D. ’11), Bokil’s advisee, was part of the research team. Manore is currently a staff scientist at Los Alamos National Laboratory.

The research was conducted at the National Institute for Mathematical and Biological Synthesis as part of a working group on Multiscale Vectored Plant Diseases, and is now published in the journal *Phytopathology*. This work can not only help improve our understanding of maize lethal necrosis but could also help inform the management and control of other destructive plant diseases caused by combinations of pathogens.

Intertwining topology and geometry

Christine Escher is conducting joint work with Catherine Searle, associate professor from Wichita State University, on classifications of Riemannian manifolds with non-negative sectional curvature. Manifolds with non-negative sectional curvature have been of interest since the beginning of global Riemannian geometry. Some of the oldest conjectures in the field, for example the Hopf conjecture, also fit into this subject. One part of this project includes graduate student **Zheting Dong**, whom Searle and

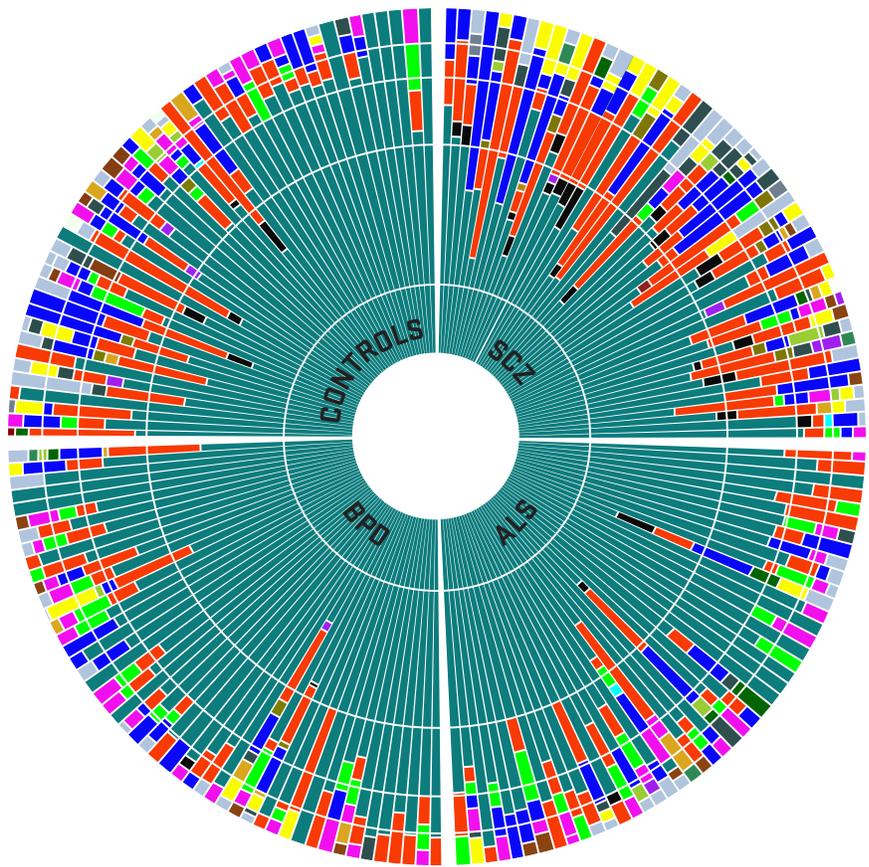
Escher are co-advising. Escher has received several grants including funding from the Mathematical Sciences Research Institute, the Association for Women in Mathematics and the Max Planck Institute in Bonn, Germany to pursue this research. Escher recently also received funding from the Simons Foundation’s Mathematics and Physical Sciences division for a collaboration grant for mathematicians.

During 2017–18, Escher ran a seminar in a new field called topological data analysis. The goal is to use tools from algebraic topology and lately also differential geometry to study the structure of large data sets.

Fighting misconceptions about climate science

Juan Restrepo published a study in *SIAM News*, “Uncertainty in Climate Science: Not Cause for Inaction,” in which he and co-author Michael Mann, a professor at Pennsylvania State University, use simple mathematical arguments to show that observational climate data are not consistent with a fundamental property of data that is in a statistically steady state. The authors also show how uncertainties in the data and models can be taken into account when making predictions of future global climate.

The concept of uncertainty in climate science is often misrepresented, asserts Restrepo, and a greater public understanding of uncertainty analysis and its impact on the science of climate change would help dispel misconceptions that tend to influence policy.



Each slice represents the blood microbiome of an individual with (clockwise): schizophrenia (SCZ), amyotrophic lateral sclerosis (ALS), bipolar disorder (BPD) or no disorder (control)

- | | | | |
|------------------|-------------------|----------------------|------------------|
| ■ Acidobacteria | ■ Thaumarchaeota | ■ Crenarchaeota | ■ Euryarchaeota |
| ■ Actinobacteria | ■ Thermotogae | ■ Cyanobacteria | ■ Firmicutes |
| ■ Aquificae | ■ Verrucomicrobia | ■ Deferribacteraceae | ■ Fusobacterium |
| ■ Spirochaetes | ■ Bacteroidetes | ■ Deinococcus | ■ Nitrospirae |
| ■ Synergistetes | ■ Chlamydiae | ■ -Thermus | ■ Planctomycetes |
| ■ Tenericutes | ■ Chloroflexi | ■ Elusimicrobia | ■ Proteobacteria |

ON THE COVER

Schizophrenics’ blood has more genetic material from microbes

The blood of schizophrenia patients contains more genetic material from more types of microorganisms than that of people without the debilitating mental illness, based on new research by mathematical biologist **David Koslicki** as part of an international collaboration. Scientists at the Universities of California at Los Angeles, Davis, and San Francisco; the University Medical Center at Utrecht and Wageningen University collaborated on the study, the first to use unmapped

non-human reads to assess the microbiome from whole blood.

Koslicki and collaborators performed whole-blood transcriptome analyses on 192 people, including healthy people as well as those with schizophrenia, bipolar disorder and amyotrophic lateral sclerosis (ALS), or Lou Gehrig’s disease. The findings were published in *Translational Psychiatry* in May 2018.

The National Institutes of Health, the National Institute of Mental Health and the National Science Foundation supported this research.

DELIVERING IMPACT



Morgan Pearson '18

UNDERGRADUATE STUDENTS

Winning at baseball with mathematics

Morgan Pearson (B.S. '18) just graduated with a major in mathematics and both a minor and option in statistics. But he started his career in summer 2018 with the Major League Baseball team the Texas Rangers.

Pearson started working as an international assistant for the Rangers in Arlington, Texas, where his primary responsibilities are international scouting and assisting upper management with projects related to statistics and baseball analytics. This combines player development with analytics, giving him opportunities to travel, interact with and scout for players. As part of his job, he will travel to Puerto Rico, Japan and the Dominican Republic to identify the best talent to bring to Texas.

Students make their mark through mathematics

At the age of 21, Pearson became the youngest intern to be hired by a Major League Baseball team in the summer of 2017 when he worked with the Texas Rangers as an analytics assistant with their analytics team.

"My classes in mathematics and statistics taught me to deliver what the Rangers needed," said Pearson, who used his knowledge of single, multiple and logistic regression to evaluate and spot the differences among the players.

Pearson traces his strength with baseball analytics to his classes on data analysis, mathematical statistics, stochastic modeling and probability. Some of his favorite statistics and mathematics classes were with professors Mina Ossiander, Robert Burton and Sarah Emerson.

The math behind softball

Sarah Hoechlin is yet another mathematics senior who is bridging the worlds of numbers and sports. Having played softball since she was five, Hoechlin was on track with her goals as captain of the softball team at Clark College in Vancouver, Washington, where she was also a

mechanical engineering major. But big changes were on the horizon.

First, Hoechlin discovered that she enjoyed her mathematics classes far more than her engineering ones. Then two successive knee injuries ended her sports career. The Springfield, Oregon native transferred to OSU to study mathematics. Much to her delight, she also got a foothold on the OSU softball team as a manager.

Hoechlin was recently promoted to head manager of the team where she is thrilled to assist Head Coach Laura Berg — the most decorated USA Softball Olympic athlete in history — on player statistics, batting average, analysis of patterns and player positions.

"We are making sure we are putting the best player in the best position in every single game and I am here to help with that," says Hoechlin. Her dream is to see the OSU softball team win a national championship soon.

Hoechlin is excited about adding an option in statistics and taking statistics courses. She aspires to be a sports statistician after graduation.

Her favorite mathematics classes so far have been the advanced calculus series where she explored the basis of calculus and its applications.

Preparing for future careers through summer research

Our undergraduates have gained valuable research and scholarly experiences through participation in NSF-funded Research Experiences for Undergraduates (REU) in collaboration with mathematics faculty. This form of experiential learning prepares our students very well for non-academic careers as well as graduate school.

Associate Professor **Clay Petsche** recently published a paper with students participating in the mathematics REU at OSU. With Kenneth Allen and David DeMark, Petsche published a paper, titled, “Non-Archimedean Hénon maps, attractors, and horseshoes” in the journal *Research in Number Theory*.

Jeremy Lilly participated at the REU at Clemson University in South

Carolina. The REU was focused on coding theory, number theory and cryptology. Lilly’s project is an intersection between coding theory and number theory.

Anthony Netz attended the REU at Illinois State University in mathematics education.

Sara Tro participated in an REU program in Computational and Applied Mathematics at UCLA. The project she worked on is called “Classifying body worn video data.” Tro writes about the project, “The Los Angeles Police Department has collected massive amounts of data from cameras worn by officers while on active duty. It is impossible to curate these videos manually, and new algorithms are needed to analyze the videos to classify officer activity, and the people that officers interact with.”

Noah Langlie worked with Professor Vrushali Bokil on nonlinear Maxwell models with applications to nonlinear optics. This work was funded by an NSF REU supplement.

Mathematical excellence, 2017–18

Joel Davis Award for outstanding work in mathematics
Dang Dinh

Botond Gabor Eross Math Memorial Scholarship for excellence in mathematics

Andrea Lanz
Evan Tufte
Catharine Ordway
Lucy Huffman
Jeremy Lilly

Edward H. Stockwell Award for excellence in mathematics

Sara Tro
Sean Pitman
Michael Aimonetto

Actuarial Science Award for excellence in mathematics

Joel Belsterling
Michael Papendieck
Benjamin Sharkansky
Logan Wooldridge

Gary L. Musser Award for outstanding mathematical achievement for prospective elementary or middle school teacher

Melissa Scarborough
Marissa Downing

WIC Culture of Writing Award for outstanding work in mathematical writing

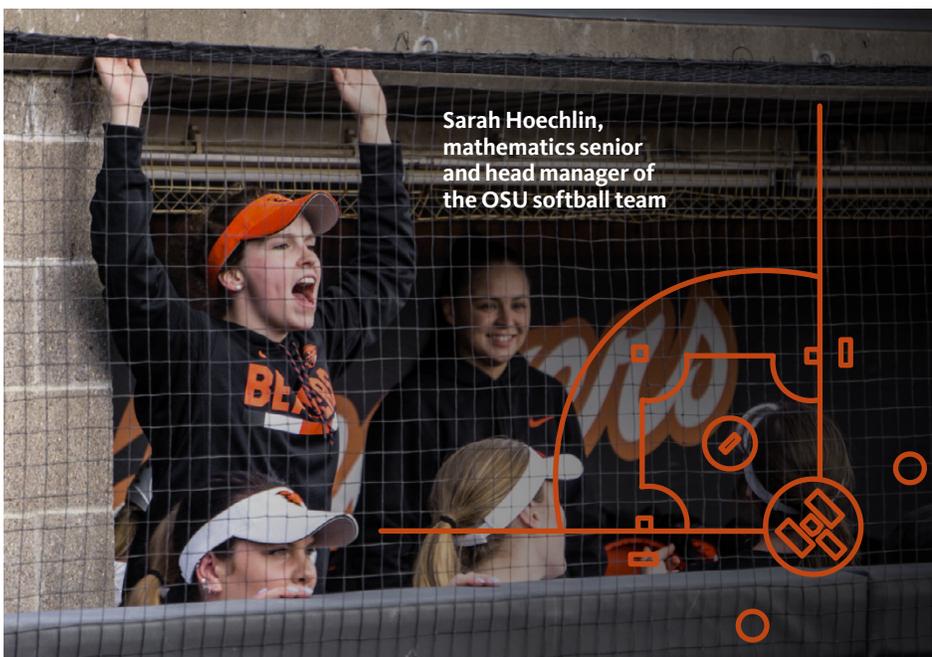
Brandon Farmer

Virginia Tech Regional Mathematics Contest

Melissa Scarborough

William Lowell Putnam Mathematics Competition

Patrick Flynn
Jesse Johnson
Melissa Scarborough



Sarah Hoechlin,
mathematics senior
and head manager of
the OSU softball team

GRADUATE STUDENTS

Future mathematicians

The graduate cohort in 2018–19 has 23 students entering their first year at Oregon State, one exchange student from France, and another who is getting a concurrent degree in engineering. We also have three students beginning their Accelerated Masters Platform ramp year. Two in this cohort have received recruitment awards: **Hannah Barta** is a Provost Scholar, and **Nachuan Zhang** is a recipient of the Wei Family Scholarship.

Research excellence, 2018

The Graduate Student Excellence Award, which is the highest honor given to graduate students by the department, was awarded to both Azhar Alhammali and Samantha Smith.

Azhar Alhammali (Advisor: Peszynska) conducts research in applied and computational mathematics on how microbes form protective biofilm in complicated domains, depending on the availability of nutrients and other environmental conditions. Alhammali

earned her master's degree from King Saud University in Saudi Arabia.

Samantha Smith (Ph.D. '18, Advisor: Bogley) completed her degree in just three years. Her thesis is focused on symmetries that are present in certain geometric objects called hyperbolic buildings. Smith will be a tenure-track instructor at Green River College in Auburn, Washington.

Combining math skills with marine science

Three mathematics graduate students participated in transdisciplinary research projects as part of the National Science Foundation Research Traineeship (NRT) program on "Risk and Uncertainty Quantification in Marine Science" at OSU.

Will Mayfield (Advisor: Restrepo) worked on a project developing a methodology that aims to provide uncertainty information for sea surface elevation in near-shore regions after a disturbance (such as a tsunami). His NRT training culminated with an internship at the Pacific Northwest

National Laboratory in Washington, where his work involved supporting projects related to national security.

Andrew Jensen (Advisor: Koslicki) studied the relationship between changing oceanic and environmental conditions, Dungeness crab distributions, and their socio-economic effects through three sub-studies. He got to experience mathematical research from ecological and social science perspectives.

Sebastián Naranjo Álvarez

(Advisor: Bokil) collaborated with faculty and students from ecology and anthropology on a project that explores the concept of cultural importance of particular species in risk, and uncertainty analysis in the context of the indigenous communities of Oregon. He developed a mathematical model for the spread of opinions in different types of communities. As one of the core requirements of the NRT project, Alvarez also participated in an internship at Los Alamos National Laboratory in New Mexico to work on problems in computational electromagnetics.



(Left) Awardees Azhar Alhammali and Samantha Smith. (Right) NRT participants Will Mayfield, Andrew Jensen and Sebastián Naranjo Álvarez

Inventing our future

Charles Camacho won a Certificate of Achievement for presenting a poster at the Latinx in Mathematical Sciences conference at UCLA, March 2018. The conference focuses on showcasing leading Latinx scientists and mathematicians, and encourages underrepresented minorities to pursue careers in the sciences, industry and academia, bringing a more diverse future to STEM fields.



Awards for top scholars

Mathematics graduate students have garnered prestigious scholarships in 2017–18. **Michael Lopez** won the Thurgood Marshall Graduate Scholarship, and **Maria-Inez Carrera** received the Graduate Laurels Block Grant scholarship. Three students received the Oregon Lottery Graduate Scholarship: **Zackery Reed**, **Emerald Stacy**, both in 2017–18 and **Azhar Alhammali** for 2018–19. **Allison Arnold Roksandich**, **Zack Reed** and **Emerald Stacy** received Graduate School travel awards, while **Azhar Alhammali**, **Choah Shin** and **Joseph Umhoefer** received College of Science travel awards. Congratulations to these students!

Next-gen teachers

Ricardo Reyes Grimaldo (M.S. '18) and **Allison Stacey** shared the 2017–18 William F. Burger Graduate Teaching Award, which recognizes outstanding teaching by graduate students in the department. Reyes Grimaldo completed his master's degree in mathematics, with an emphasis on mathematical biology. Stacey is doing research in topology as part of her doctoral studies with Associate Professor Ren Guo.

High-powered activities

Daniel Erickson, Alireza Hosseinkhan and Naveen Somasunderam, University of Houston Summer School on Dynamical Systems.

Michael Allen, University of Connecticut Summer School in Number Theory.

Sebastián Naranjo Álvarez, Colorado State University Summer Graduate School on Wave Propagation in Random Media.

Choah Shin, 9th Annual Scientific Software Days in Austin, Texas.

Jhij-Jyun Zeng, Summer Graduate School on Fluids and Waves at Gran Sasso Science Institute, Italy.

Alex Putnam, internship at Maiden Re, a Bermuda-based insurance company.

Disseminating research

Summer internships at the Department of Energy national labs with funding from the labs, the National Science Foundation and other sources. Choah Shin, Joe Umhoefer, Diana Gonzalez, Will Mayfield, Sebastián Naranjo Álvarez.

Mathematical Sciences Research Institute in Berkeley, California.

Lisa Bigler, summer 2018, MSRI school on "Representation of High Dimensional Data."

Talks/Posters at SIAM Geosciences Conference, Erlangen, Germany, September 2017. Choah Shin, Azhar Alhammali and Joe Umhoefer.

Presented at the Joint Mathematics Meetings, San Diego, January 2018. Zachery Reed, Branwen Purdy, Emerald Stacy, Claire Gibbons and Charles Camacho.

Presented at the American Mathematical Society Sectional Meeting, Portland, April 2018.

Azhar Alhammali, Allison Arnold Roksandich, Charles Camacho, Eleanor Holland, Huanqun Jiang, Stephen Krughoff, Zack Reed, Choah Shin, Ally Stacy and Joe Umhoefer. In all, 23 students participated at the meeting.

1st Biennial Meeting of SIAM PNWS, Corvallis, October 2017.

Student volunteers: Azhar Alhammali, Zachary Barry, Lisa Bigler, Ali Chick, Diana Gonzalez, Will Mayfield, Sandra Nguemto, Ricardo Reyes-Grimaldo, Choah Shin, Joe Umhoefer, JJ Zeng and Cynthia Sanchez-Cruz.

OUT THERE

Diversity, outreach, news and events



Left and top right photos: OSU Noyce Teaching Fellows program their robotic vehicles during the Ambitious Mathematics and Science Teaching Institute in June 2018; Sarah Hagen at the Public Library; (L to R) Sarah Hagen, Branwen Purdy and Emerald Stacy

Impact on our community

In addition to busy schedules filled with research, teaching and coursework, graduate students **Sarah Hagen**, **Branwen Purdy** and **Emerald Stacy** have been dedicating their talents toward sharing their love of mathematics with the broader public.

Hagen has given talks on mathematics for the general public at the Corvallis Public Library, Tsunami Books in Eugene, the Da Vinci Days Festival and the OSU Space Grant Festival. Hagen developed an interactive presentation (with many props and much audience participation) for Pi Day. She is excited to see the strong interest in the broader

community and is honored to be an informal math ambassador.

Purdy volunteers at the Coffee Creek Correctional Facility, a women's prison in Wilsonville, Oregon, that works with Portland Community College to offer educational opportunities to women, including a GED certificate program. Specifically, Purdy works with women who are preparing to enter this program and need to refresh their mathematics skills.

Purdy was accepted into the Oregon Museum of Science and Industry (OMSI) Science Communication Fellowship in 2018. She has participated in several OSU public

events, such as Meet-A-Scientist Day and OMSI After Dark, to share hands-on learning experiences about her research in topological data analysis.

Last April, Stacy was an invited speaker at the March for Science in Salem, Oregon. She discussed the roles of women and marginalized groups in science and research, and the need for physical spaces in science education to be accessible to everyone. In particular, she spoke about the importance of access to bathrooms, collaborative learning spaces and seats in classrooms that can accommodate large or pregnant bodies. Stacy will be an assistant professor at Washington College in Chestertown, Maryland.

Math club hosts comedian and cryptologist

OSU Math Club was busy organizing many social and professional development activities for students this year. Led by officers who are undergraduate mathematics majors and advised by Dan Rockwell, members participated in outreach as well as celebrated Pi Day. The Math Club traditionally sells pies to raise funds on Pi Day, but this year they also held a pie-throwing fundraiser. The event allowed lucky participants to throw pies at faculty, including the Dean of the College of Science, Roy Haggerty. The Math Club developed several fun, hands-on math projects for children.

The fundraiser helped support the club's participation in Discovery Days, which is an outreach program for elementary and middle-school students.

The Math Club also hosted nationally recognized "math-comedian" Sammy Obeid, a Lebanese-American mathematician-turned-comedian, and an engaging performance by internet star and renowned Acme Klein Bottle entrepreneur Dr. Clifford Stoll. The events were a great success, with 80 people attending Obeid's performance.

The club hosted a featured talk on cryptology by National Security Agency employee and OSU alumnus Ben Livingston, who discussed innovative methods and principles related to cryptology and career opportunities for mathematics and computer science majors.

Making mathematics cool at Da Vinci Days

Da Vinci Days, Corvallis's wildly popular community festival, featured five science and arts lectures, one of which was a talk by **Sarah Hagen** on

"Ancient Greek Astronomy." The mathematics department also hosted an immensely successful booth that featured a crowd-sourcing effort to approximately calculate pi via discrete trials of the Buffon Needle problem.

Ambitious Math and Science Teaching Institute

"Ambitious teaching deliberately aims to get all kinds of students — across ethnic, racial, class, and gender categories — not only to acquire, but also to understand and use knowledge, and to use it to solve authentic problems." —M. Lampert & F. Graziani

This notion of ambitious teaching is a central focus of a new project at OSU titled "Ambitious Math and Science Teaching Fellows." The project is funded through the National Science Foundation's Robert Noyce Teacher Scholarship and is being led by mathematics Professor **Tom Dick**. This program seeks to address the critical need for K-12 teachers of science, technology, engineering, and mathematics (STEM) by encouraging talented students and professionals to pursue teaching careers in elementary and secondary schools.

The Ambitious Math and Science Teaching Institute, co-sponsored by the Oregon Department of Education, was hosted on OSU's campus for a second year. Approximately 50 middle and high school math and science teachers, education leaders and administrators from across the state enjoyed a dynamic and engaging opportunity to work with and learn from national and regional STEM education leaders.

The Institute featured STEM learning innovations such as mathematical modeling, virtual reality, drone technology, coding and robotic

vehicles. Participants had the opportunity to explore several of OSU's research facilities, such as the Wave Research Lab. The program offers opportunities for networking and discussions of problem-based learning in the classroom.



Advancing diversity, equity and inclusion in STEM

Vrushali Bokil was named an OSU 2018 ADVANCE Faculty Fellow. The Oregon State ADVANCE program, funded by the NSF with \$3.5 million for five years through June 2019, seeks to create an equitable and socially just academic climate for women scientists and other underrepresented minority faculty at the university.

Bokil's specific project is focused on embedding a systems-of-oppression perspective into OSU's graduate student professional development seminars. She successfully piloted such a seminar in the mathematics department with former Ph.D. student Emerald Stacy, and trained several faculty in every College of Science department to create ADVANCE seminars for their colleagues.

FEATURED LECTURE**Renowned ecologist talks about predator-prey models**

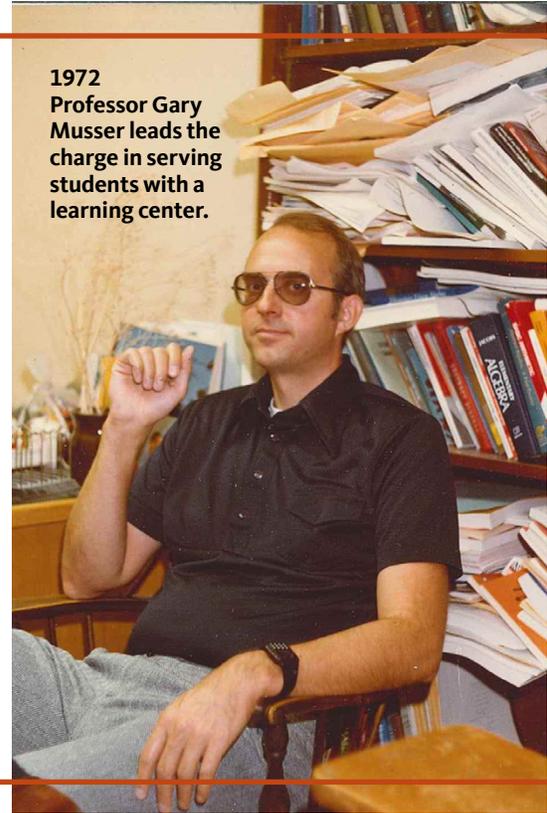
In May 2018, the 33rd Annual Lonseth Lecture featured Henri Berestycki, fellow of the American Mathematical Society 2013 inaugural class of fellows and chair of mathematical analysis and modeling at the École des Hautes Études en Sciences Sociales in Paris, France. In his talk, “Of Predators and Prey,” Berestycki discussed the classical Lotka-Volterra system that describes predator-prey interactions, one of the cornerstones of mathematical ecology. He presented an extension of the original Lotka-Volterra system that aims at showing how territories are formed as a result of strong competition between packs of predators.



LEARNING TOGETHER FOR 40+ YEARS

The Mathematics and Statistics Learning Center continues its long-standing mission of student success

1972
Professor Gary Musser leads the charge in serving students with a learning center.



The Mathematics and Statistics Learning Center (MSLC) has gotten a facelift, having been recently expanded, remodeled and equipped with new furniture through the support of the College of Science and generous donors. The new main study area layout was designed by OSU Design Club students, led by club president Courtney Smith, as part of their 2016–17 project “students helping students.”

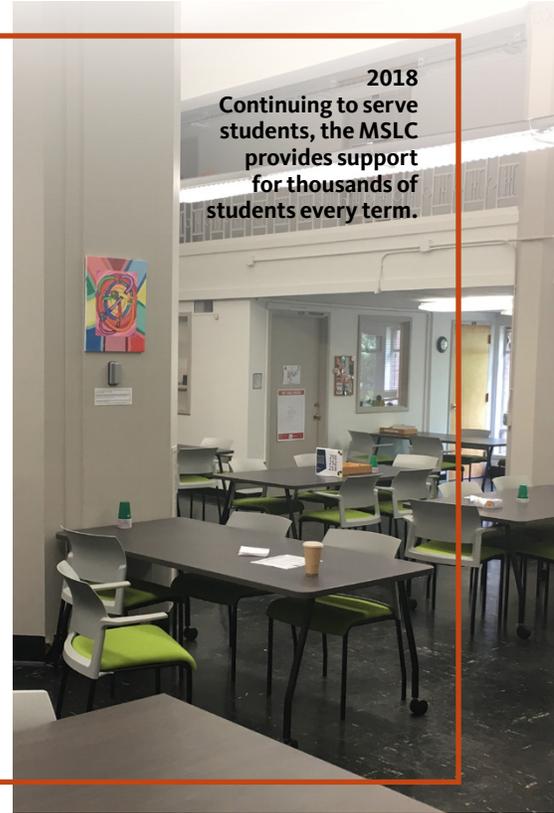
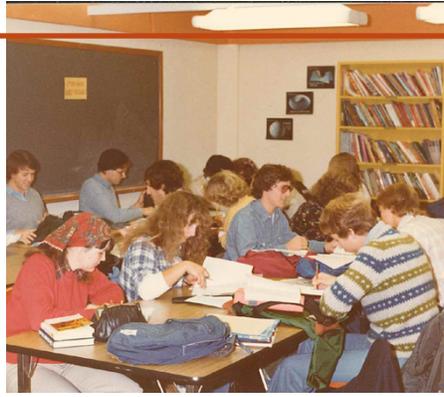
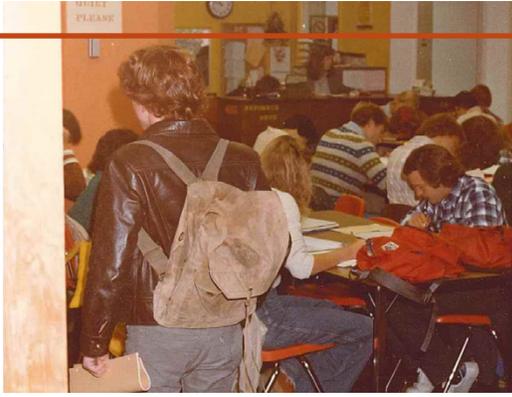
The MSLC represents the mathematics department’s major contribution to enhancing student success for over 40 years. Here is a brief history of the MSLC from its inception to the present.

MSLC Beginnings

In 1972, Professor **Gary Musser** was hired by the Department of Mathematics to lead its mathematics preparation program for K-8 teachers. Musser visited several other colleges with math learning centers and came

away with the firm belief that OSU’s math department could better serve its students with such a center. A trial drop-in help center opened in the fall of 1973, using an available classroom in Kidder a few days a week. Its early popularity led immediately to Musser’s efforts to continue and enlarge the center, with enthusiastic encouragement from Chair James Brown, College of Science Dean Robert Krauss and Dean of Undergraduate Studies Stuart Knapp.

Locating the learning center near the mathematics department was a priority. Musser found a recently vacated space on the main floor of Kidder Hall (formerly home of the University Archives when Kidder Hall was OSU’s library) and the department was assigned this space in 1974. Linda Middleton was hired as the first director of the MSLC (that abbreviation stood for “Mathematical Sciences Learning Center” at the time) and Kathy Martin was hired to manage



the large study area, now furnished with tables and chairs with spaces for volunteer faculty and graduate student tutors to answer questions. Martin served in this role for many years and was affectionately known as the “Mother of the MSLC.”

As the MSLC grew in popularity, Musser secured two additional large rooms adjacent to the study area — one used as a testing center and the other as an instructional computer laboratory. Additional staff were hired to assist Martin (Marilyn Wallace and David Kendricks) so that the MSLC could expand to evening hours. The MSLC had a series of full-time directors serving three-year terms, including Linda Thompson, Stuart Thomas, Karen Swenson, Dianne Hart, Kathy Seagraves Higdon and Judy DeSzoeka.

MSLC in the 1990s

Due to university budget cuts in the 1990s, the MSLC staff was eliminated,

and the direction of the center was assigned to a faculty member. However, the most important service of the MSLC — the drop-in tutoring help provided by graduate teaching assistants and faculty volunteers — was preserved.

Musser retired in 1996. **Tom Dick** has served as faculty director of the learning center since 1997. Faculty **Scott Peterson, Marie Franzosa,** and **Dianne Hart** have provided outstanding assistance over the years with coordination of the MSLC operations, such as scheduling tutors and student clerks, overseeing the computer lab, and providing instructional leadership in the MSLC’s laboratory classroom for the math courses for K-8 teachers.

Dick founded the OSU Math Excel program in 1998, based on Uri Treisman’s Emerging Scholars Program (and named after University of Kentucky’s program). Math Excel

brings students together in a social atmosphere to work collaboratively in solving mathematics problems related to their introductory coursework. The workshop sessions are often held in the laboratory classroom of the MSLC.

MSLC today

Since fall 2018, evening hours in the center have returned and a full-time MSLC coordinator, Wendy Aaron, has been hired. The MSLC remains a vibrant academic support system for literally thousands of OSU students each term, continuing to offer free drop-in tutoring assistance for students in all first-year and sophomore-level mathematics courses as well as some statistics courses. The Center is also a popular place for mathematics majors to study together, and a gathering spot for math clubs and organizations.

If you are visiting campus sometime soon, we hope you will drop in and see the MSLC’s fresh look!



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