



# RECORD-BREAKING

19 students earn  
Ph.D.s in 2018

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# N { Math News }

Fall 2018

A publication of the Department of Mathematics at the University of Nebraska–Lincoln

## Peterson reaches 50 years at UNL

Four faculty members earned 50-year Service Awards from the University of Nebraska–Lincoln in 2018.

One was the math department's own Allan Peterson.

Peterson joined fellow Professors Edward Becker, Roger Bruning, and Brett Ratcliffe in receiving the award from Chancellor Ronnie Green in September. Peterson also was recognized at the Department's April reception.

Peterson has taught 51 years without interruption — he has never taken a sabbatical since he arrived in 1968, because he loves teaching so much.

"In the history of the math department, I've taught more than anybody," Peterson added.

However, he plans to retire at the end of 2018-2019 academic year for health reasons. Peterson was diagnosed with prostate cancer three years ago.

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LINDSAY AUGUSTYN/UNL CSMCE

Allan Peterson accepts a gift from the Department and Chair Tom Marley (left) at the April 2018 recognition reception.

## VIEW FROM THE CHAIR

Tom Marley

It has been a year of records for the Nebraska Department of Mathematics. Professor Al

Peterson's achievements, as well as his completion of 50 years as a faculty member, are nothing short of remarkable. He has published over 200 research articles, supervised 32 Ph.D. students, and consistently been regarded as one of the top teachers in the Department for five decades. In chatting with Al about his early days at Nebraska, I was reminded that his job interview in 1968 took place on the same day that Bobby Kennedy

delivered a campaign speech on UNL's campus in advance of the Nebraska primary. This anecdote brought home to me that Al's tenure has covered some truly fascinating times and seen many changes. However, through it all, Al has been a steady beacon for excellence in research and teaching and a role model for our faculty.

The Department also hit a new milestone by graduating 19 Ph.D.s

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# Research News

## *Larios streamlines turbulence models*

If you have ever looked up at the clouds and marveled at their seemingly unlimited complexity, or watched the cream in a cup of coffee spiral into ever more intricate patterns until it diffuses into a brownish haze, then you have glimpsed the strange and chaotic world of turbulence. Turbulence is nearly ubiquitous in science as well as everyday life, appearing in diverse areas such as weather prediction, aerospace technology, and blood flow in the heart. Understanding, quantifying, and predicting turbulence have become extremely important, yet elusive goals in science and engineering.

On a mathematical level, turbulent fluids (including air and gasses) are thought to be governed by the Navier-Stokes equations, a system of partial differential equations (PDEs) that is simple to write down, but is so difficult to work with that, in 2000, the Clay Mathematics Institute issued a \$1 million prize to show mathematically whether the solutions remain physically realistic for all times. This problem has been open since the work of Jean Leray in 1932. Nevertheless, the effort to find accurate, practical tools for predicting turbulence continues. The research of Assistant Professor Adam Larios has helped to further this effort.

To describe Dr. Larios' work, we need to understand the notion of a dynamical system. A dynamical system consists of a starting condition and some laws that describe how things change in time. Picture a group of dancers just before the dance starts, frozen in their starting positions. In a dynamical system, this is known as the initial condition. Suddenly, the music starts, the scene comes to life, and the dance progresses according to its internal choreography. This choreography is analogous to the governing laws of the dynamical system. The Navier-Stokes equations of fluids are a dynamical system governing the motion of fluids. Given



*Adam Larios*

the initial state of a fluid, the equations choreograph the motion of the fluid.

Imagine trying to predict how a particular dance would progress, given only the starting positions of the dancers, and a description of the choreography. For a slow simple dance, we might have some luck, but to bring the analogy closer to turbulence, imagine a fast, highly chaotic dance involving billions of dancers. Also imagine that the choreography is only a list of local rules for how dancers should interact with their nearest neighbors. Such a dance might take on wildly complex, large-scale patterns that would be nearly impossible to predict and may be highly dependent on starting positions. In turbulent fluids, the local rules are given by the Navier-Stokes equations, and the large-scale patterns are things like hurricanes, solar storms, or rapidly varying ocean currents.

Although the Navier-Stokes equations are hard, there is an even more fundamental difficulty: In real life, one typically does not fully know the initial condition. For example, in weather prediction, the current state of the weather is measured at locations spaced apart by roughly 1 kilometer on average, but the Navier-Stokes equations require initial data at every location in space, down to roughly millimeter scales. One option is to interpolate the data, e.g., by assuming the data vary linearly in between weather stations, but such a scheme introduces a tremendous amount of error into the initial condition, which then grows exponentially fast in time due to the system's underlying chaos. Such an idea was tried by mathematician Lewis Fry Richardson in 1922, in the first-ever attempt at numerical weather forecasting.

Richardson's careful calculations were incorrect by two orders of magnitude for a six-hour forecast.

To get around these difficulties, modern researchers use a class of techniques known as data assimilation. Data assimilation eliminates the need for complete initial data. It instead incorporates incoming data into simulations by asking the simulated solution to strike a balance between following the rules of the dynamical system, and staying close to the observed data. It is as if, in trying to predict the outcome of our billion chaotic dancers, we had livestreaming video cameras set up in several locations to get an idea of the current state of the dance as it progressed. This data could be fed into a computer running a simulation that knows the local rules, but was started with inaccurate initial data.

Classic data assimilation is based on a set of techniques known as the Kalman filter. However, the Kalman filter is computationally expensive to compute and limited in what it can be applied to. In a 2014 paper by A. Azouani, E. Olson, and E. Titi, a new approach was proposed (now called the AOT algorithm). The idea abandons the expensive statistical methods of the Kalman filter and instead uses a feedback-control term at the PDE level. This new approach is far less expensive and was mathematically proven to force the simulation to converge to the true solution exponentially quickly in time. This paper set off a storm in the research world, with over 30 papers based on the AOT algorithm coming out in the last four years.

Larios' recent research has proposed several modifications to the AOT algorithm. The first was a nonlinear version of the algorithm, which resulted in super-exponential convergence rates. In 2017, Larios was awarded an individual investigator grant by the National Science

*See RESEARCH on Page 6*



# Department News }



## Renovations add new Calculus classrooms

Things are looking different for Math 106 and 107 (Calculus I and II) students this semester. Based on the positive feedback from the Brace Labs renovations, the Math Department transformed five rooms in Louise Pound Hall (formerly CBA) into active learning classrooms to allow for more student collaboration.

Classrooms that used to look like rows of desks facing one instructor now feature projectors, document cameras, whiteboards on every wall, and oval tables for groups of six students, which encourage discussion.

Professor and Vice Chair Allan Donsig submitted a proposal for the new classrooms when CBA was being renovated last year.

The renovations are “part of a larger effort to change the way we teach Calc recitations,” Donsig said. Other changes include putting together course packets, extending class time, preparing lessons for instructors, and setting up weekly recitation leader meetings.

“Classrooms are the icing on the cake that make these changes possible,” Donsig said.

Lecturer Janet Emery, who has taught a range of introductory courses for more than 15 years, said she uses the interactive features of the new boards in the classrooms as much as she can, which helps her students pay more attention.

Undergraduate math and secondary math education major Elizabeth Tyler (see Page 17) has been teaching recitations for five semesters and has seen a dramatic increase in attendance, which she credits to these renovations. Last year, she taught in a traditional classroom, which she said hindered the students from working in groups and sharing their work in front of the entire class.

Tyler said the new six-person tables prompt students to collaborate and learn from one another, and having whiteboards on every wall makes it easier for them to show their work as they go.

“My students this semester are significantly more involved in the work and eager to work with each other on the material,” Tyler said. “It is easier for

*See POUND on Page 7*

## *2018 Ph.D. class breaks records with many firsts*

2018 marks the 120th year since Albert Candy earned the first Ph.D. in mathematics awarded by the University of Nebraska. It would take 55 years for Clinton Burke Gass to become the mathematics department's 10th Ph.D. in mathematics and 65 years for Mildred Gross to become the first woman to earn a Ph.D. in mathematics. That year, 1963, was a banner year as the Department awarded four Ph.D.s, including the Department's 19th Ph.D.

It is interesting to contrast the Department's early doctoral education history with 2018, a year in which 19 outstanding graduate students earned a Ph.D. from the Department of Mathematics. This was the most Ph.D.s ever awarded in one year, breaking the record of 15, which was set in 2015.

The 2018 Ph.D. class is unusual in several ways. First, the majority of the class is female (10). This compares well with the fact that, nationally, only about 26% of new Ph.D.s are women, and continues the Department's reputation as being a place where female graduate students are successful. The new Ph.D.s come from 14 different states and one foreign country, which is unique for a discipline where approximately 50% of new Ph.D.s are international students.

Another first is that Erica Miller became the Department's first Ph.D. graduate whose research is in mathematics education. Dr. Miller is now a tenure-track faculty member at Virginia Commonwealth University. Two of this year's Ph.D.s, Jessica De Silva and Jessie Jamieson, arrived at UNL with a prestigious National Science Foundation Graduate Research Fellowship in hand.

*See DEGREES on Page 19*



LINDSAY AUGUSTYN/UNL CSMCE

Professor Dave Benson began his Rowlee Lecture with examples of symmetry occurring in nature, art, architecture, music, and even grade-school arithmetic.

## Exploring symmetry in math

Professor Dave Benson, the 6<sup>th</sup> Century Chair of Mathematics (Emeritus) at the University of Aberdeen in Scotland, delivered the 21<sup>st</sup> annual Howard Rowlee Lecture, “Symmetry in Mathematics,” on April 27, 2018.

Benson received his Ph.D. from Cambridge University under the direction of John Thompson.

Early in his career, Benson was involved in the famed classification of finite simple groups. His thesis gave the first non-computer-assisted proof that the sporadic group  $J_4$  is simple. Since then, Benson has published extensively in a wide range of mathematics. He has nearly 150 publications to his name, including a popular two-volume manuscript on representation theory and cohomology. Benson is also the author of “Music: A Mathematical Offering,” a 500-page treatise on the mathematics of music, including applications of groups to music theory.

In recent years, Benson has co-authored with Iyengar and Krause (later joined by Pevtsova) an influential series of 12 papers with the goal of

See BENSON on Page 6

# Games and entropy

Visiting professor in the Nebraska Department of Mathematics Ruy Exel, emeritus professor of mathematics at the Federal University of Santa Catarina, in Florianópolis, Brazil, gave the second of two Rowlee lectures in 2018, on Nov. 2.

His area of research is operator algebras with applications to dynamical systems, statistical mechanics, semigroups, and K-theory.

Exel’s Rowlee Lecture, “Twenty Questions, Mastermind and Entropy,” dealt with the problem of measuring the value of information. Here’s the idea: Consider a game played by Alice and Bob. The game has a table on which is placed a large number of objects of different colors, shapes, weights, sizes, flavors, smells, etc. Alice thinks of one of the objects and challenges Bob to guess it. Bob is allowed to ask Alice a series of questions about one of the characteristics of the object (e.g., the object’s color, shape, or which side of the table it is located). The game continues until Bob finally guesses Alice’s object. Which characteristic should Bob ask about first? If all objects are white, except for a red one, is it a good strategy for Bob to start by asking which color it is? If Bob gets red as an answer, Bob wins the game, but it is much more likely Alice will say white, and Bob is back to square one. Exel’s lecture gave a precise way to measure the value of the information obtained by each of Bob’s questions.

Born in Brazil, Exel studied at the University of São Paulo, where he earned both his bachelor’s and master’s degrees. He completed his Ph.D. in 1985 from the University of California, Berkeley under the supervision of Marc Rieffel and then conducted postdoctoral research in Warwick (England) and Canberra (Australia).

Exel’s work in operator algebras is closely related to work being done by Nebraska Professors Allan Donsig and David Pitts. Exel and Pitts have been working on analysis and synthesis for operator algebras, similar to what is done in Fourier analysis, but for certain classes of linear operators instead. (Roughly speaking, analysis is the problem of deciding what “frequencies” are in an algebra, and synthesis is the problem of reconstructing an algebra from the frequencies it contains.)

Exel’s other professional appointments include the University of São Paulo and the University of New Mexico, and he has taught mini-courses in Lisbon, Madrid, Ottawa, and New Zealand. He is a member of the World Academy of Sciences and the Brazilian Academy of Sciences, as well as a Commander of the National Order of Scientific Merit in Brazil. Exel also was a plenary speaker at the Latin American Congress of Mathematics in 2016 and an invited speaker at the International Congress of Mathematicians in 2018.

- David Pitts }



Professor Ruy Exel throws the non-regular die he made for his Nov. 2, 2018, Rowlee Lecture titled “Twenty Questions, Mastermind, and Entropy” for a demonstration of entropy.

LINDSAY AUGUSTYN/UNL CSMCE



## PI MU EPSILON LECTURE

# Reformulation of multivariable calculus

Robert Ghrist of the University of Pennsylvania gave the 12th annual Pi Mu Epsilon address “A New Look at an Old Calculus” on Oct. 19, 2018, following the induction of 17 new undergraduate members into the Nebraska Alpha chapter of Pi Mu Epsilon.

One important objective of the Pi Mu Epsilon lecture series is to provide an opportunity for math major undergraduates to meet a distinguished professor from another university who can provide a glimpse into the interesting problems and projects they are working on.

Ghrist, Andrea Mitchell University Professor in Mathematics and Electrical/Systems Engineering, argued that calculus instruction can be reformulated to not only raise the level of mathematics students see in multivariable calculus, but also make the course more relevant to honest applications that students care about today.

Ghrist discussed his frustrations with current Calculus content and the mode of visualization, which he believes has not kept up with innovation. A brief sampling of calculus textbooks used at most universities revealed that the content covered has not changed much over the years. Chalk, blackboard, paper, and pencil have remained the enduring standard of classroom instruction.

“I’m not a big fan of LaTeX fonts, and I’m not a big fan of plotting vector fields,” Ghrist said. “So much of the notation is a holdover from early 20th century physics and doesn’t fit the way we as mathematicians do things.”

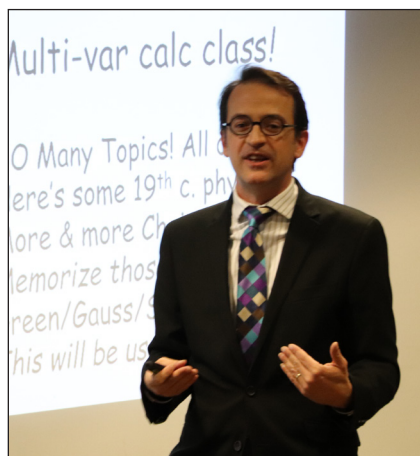
Ghrist shared his own solutions to these issues by exploring and summarizing his new multivariable calculus text, “Calculus Blue.” Both the e-text and supplementary visual “v-text” on YouTube are presented in high-definition comic-book style.

The text is different not only in format, but also in content. It introduces matrices and elementary linear algebra as foundational material



PHOTOS BY STEPHANIE VENDETTI/UNL CSMCE

Seventeen students were inducted into the Nebraska Alpha Chapter of Pi Mu Epsilon (PME) on Oct. 19, 2018. Back row, left to right: Alexandra Seceleanu (PME faculty advisor), Laurel Lund, Addison Waller, Alex Schroeck, Savannah Howard, Michael Schneider, Shannyn Bird (PME chapter president), Lara Quiring, Victoria Salinas, Miles Davis, Manying Wang, Qianyu Dong, Luke Diego Galvan, Ge (Grace) Chai, Robert Ghrist (PME lecturer), Alessandro De Stefani (Math Club faculty advisor); front row: Mia Nguyen, Alex Heitzmann, Luis Tuarez, Thuan Luong.



Professor of Mathematics and Electrical Engineering Robert Ghrist of the University of Pennsylvania delivers the 12th annual Pi Mu Epsilon address.

for the rest of the course, particularly as it applies to the visualization and manipulation of data. This higher-dimensionality is illustrated through applications such as the kinematics of robots, wireless signals, machine learning and artificial intelligence.

Ghrist’s text teaches derivatives as linear transformations that are motivated by applications such as game theory, particularly Nash equilibrium. Double and triple integrals appear later in great detail.

Ghrist’s text also includes a “baby” version of differential forms on top of the standard concepts of vector calculus such as curl and divergence, giving students a taste of things to come should they take higher-level math courses.

“There are lots of ways to teach calculus, and there are lots of good ways to teach calculus,” Ghrist said. “My goal is to put up a bunch of resources that students can use, that anybody can use in order to make their class a little more interesting and potentially transformative.”

Ghrist was awarded the 2013 Chauvenet Prize for “Barcodes: The Persistent Topology of Data” and the 2014 Gauss Lectureship of the German Mathematical Society. He also received a Presidential Early Career Award in 2002. Ghrist is known for his work on topological methods in applied mathematics, specifically for applying topology to data analysis and to the study of sensor networks.

The Nebraska Alpha chapter is currently celebrating its 90th anniversary and is supported by the Department of Mathematics and the National Science Foundation.

- Miles Davis }

# Math debuts free open-resource textbook

With an established environment for supporting active learning, the Department of Mathematics is infusing active learning into its first-year courses, from administrative structures to curriculum resources.

Part of this path to implement active learning includes supplementing the Department's courses with an open educational resource (OER), a digitized resource freely open to students, teachers, and self-learners that encourages engagement.

An OER is fundamentally live, meaning that once it is developed, it will not sit static like a textbook. Rather, it will go through a continual cycle of feedback and updates, always staying current. Further, the Department's OER is completely free to everyone, ultimately saving students up to \$150 a term and allowing a more equitable experience in the mathematics classroom.

During the summer of 2018, Nathan Wakefield and Allan Donsig

received support from the Open Education Resources Kelly Grant, along with internal Department of Mathematics support. Taran Funk, Ariel Setniker, Karina Uhing, and Nathan Wakefield collated, edited, and wrote materials to form a textbook covering Intermediate Algebra, College Algebra, and College Trigonometry. Using the PreTeXt authoring system, the team placed the OER on the department server, opening the text to be accessible to anyone worldwide.

A high-quality OER calls for strong interactivity, which necessitates student engagement rather than a passive read. In all sections of the current version of the OER, students have opportunities to interact as they work through a topic. This ranges from required clicks to see sequential parts of a worked-out example to being able to link back to previously learned knowledge immediately within the OER (the OER combines not only the courses mentioned prior,

but also pre-intermediate algebra level mathematics).

The highlight of the interactivity, however, is the inclusion of wholly interactive graphs developed by new Assistant Professor of Practice Joshua Brummer, where users can drag points and lines around to solidify connections between the text and the visual. Additionally, the team is working to integrate these dynamic manipulatives with the WeBWorK online homework system.

An OER is fundamentally a live resource that undergoes continual improvements. The department took an important step in providing students with a free resource for learning mathematics with this initial project. Future steps will improve functionality and seek to provide students rich, open opportunities to learn mathematics.

- Ariel Setniker and  
Nathan Wakefield }

## RESEARCH *From Page 2*

Foundation to develop nonlinear data assimilation. This research involves tools from functional analysis and topology as well as large-scale tests on the supercomputers at UNL's Holland Computing Center.

Recently, along with his Ph.D. student Collin Victor, Larios developed an AOT-method for moving measurement devices, allowing measurements to come from sensors attached to satellites, drones, or moving vehicles. He showed that allowing the sensors to move can result in an order of magnitude reduction in the number of sensors required, which could drastically reduce equipment costs for scientists. In addition, along with his Ph.D. student Elizabeth Carlson and Dr. Joshua Hudson at the Johns Hopkins University Applied Physics Laboratory, Larios is developing AOT-based techniques for estimating the underlying parameters of the dynamical system on-the-fly. These latest innovations will result in more robust simulations of turbulence. }

## BENSON *From Page 4*

putting the theory of modules and representation theory on a new foundation.

Benson began his Rowlee Lecture with examples of symmetry occurring in nature, art, architecture, music, and even grade-school arithmetic. For example, snowflakes often exhibit the symmetries of the dihedral group with 12 elements, and tilings from buildings in the Middle East in the 1400s exhibit even more exotic kinds of symmetry. In grade-school arithmetic, the procedure of addition of integers with a carry describes a 2-cocycle, and gives a generator for the second cohomology group of the cyclic group of order 10.

Benson proceeded to talk about symmetries in the history of mathematics, including the work of Gauss, Cayley, and Galois. For example, Galois exploited the symmetries enjoyed by the roots of a polynomial to prove that there is no formula for solving the general quintic polynomial by radicals, and thereby launched what is now known as Galois

Theory. Cayley is credited with being the first to formulate the axioms of a group, although the idea was present already in Gauss' work.

Benson concluded his lecture by discussing more modern aspects of group theory and representation theory. In particular, he discussed briefly Alperin's Conjecture, which predicts a relationship between the number of simple representations in characteristic  $p$  of a finite group and its  $p$ -subgroups.

Benson has given numerous talks at premier conferences over the years, including an invited talk at the International Congress of Mathematics in Hyderabad, India, in 2010.

A single continent did not suffice to honor the occasion of Benson's 60<sup>th</sup> birthday: In 2015 and 2016, there were conferences in Vancouver, Canada, and on the Island of Skye in Scotland, both to commemorate his many accomplishments.

In 2017, Benson was elected as a Fellow of the Royal Society of Edinburgh.

- Mark Walker }



## CAREER PERSPECTIVES IN MATHEMATICS

## Sposato: From UNL to Intel

Nebraska alumna Tina Sposato gave the fifth Career Perspectives Lecture on March 8, 2018, highlighting her journey from graduating with a bachelor's degree in mathematics in 1997 to earning a master's degree in chemical engineering from Texas A&M University and now working at Intel Corporation as a staff engineer.

Sposato was hired straight from graduate school into the highly selective Rotational Engineers Program for Intel's microprocessor fab in Rio Rancho, New Mexico.

She went on to also work for Intel's development fabs in Santa Clara, California, and Portland, Oregon, doing process development for the next generation of microprocessors or flash memory in the department of lithography. She currently resides in Phoenix, Arizona, and works for Intel's



Tina Sposato

yield department as a staff engineer for Intel's new microprocessor fab, which was built to manufacture the next generation of computer processors. As a yield integration engineer, she compares tools' yield against each other at each operation of the manufacturing process, i.e. how the litho, etch, and films work together. She works directly with the process engineers to improve the yield.

Sposato also will be one of the invited panelists at the Nebraska Conference for Undergraduate Women in Mathematics in 2019. She is married to a Husker alum and has two children, Sarah and Thomas. }

POUND *From Page 3*

students who are struggling a little bit to get involved in this setting."

There are about 1,500 students in Math 106 and 107 each fall and 1,000 each spring, and almost all of them are now using the active learning classrooms.

The university funded the classroom renovations and furniture. "We appreciate the resources committed by the university to active learning," Donsig said. "Dedicated classrooms are a major commitment."

Success in mathematics is highly correlated with retention and graduation rates, he added.

"Very few people today make a great living sitting in a room by themselves," Donsig said. "Group work, interacting and explaining material with peers is crucial and builds skills for students, whatever their careers may be."

- Alli Davis and  
Lindsay Augustyn }

## Genocide survivor returns to share her story

At the age of 13, Channy Chhi Laux was marched into Khmer Rouge labor camps at the start of the Cambodia genocide in 1975.

After surviving four years of horrific conditions and starvation in the "Killing Fields," Laux and her family were settled in Lincoln as refugees. Not knowing a word of English and after not being allowed to attend school since the sixth grade, Lau felt overwhelmed entering a 10th-grade classroom.

But, through the kindness of strangers who became an extended family, Laux graduated from Lincoln High School and went on to earn a bachelor's degree in mathematics and computer science from the University of Nebraska-Lincoln.

"Lincoln was a second chance at life," she said. "When I came, I felt everyone was ready for me and wanted me to succeed."

After college graduation, Laux moved to California and enjoyed a 30-year engineering career at various companies in California's



COURTESY PHOTO

Channy Chhi Laux (right) meets with mathematics students in Avery Hall.

Silicon Valley. While she flourished in the Golden State, Laux considered Nebraska home and desired to give back to the community that helped her family rebuild.

That feeling of gratitude brought her back to campus April 18, 2018, for a day of talking with students about the Cambodian genocide and the challenges she faced in a male-dominated career field.

She met with students in a women, gender, and science class where she spoke about workplace

equality and the way she addressed discrimination in her career.

She also met with mathematics students to talk about her own experiences in math at the University and in her career.

While revisiting the horrors of her youth often brought tears to Laux's eyes, she said sharing the story with young people is extremely important.

"I feel really blessed to be here with an opportunity to give back, to show that even as a refugee, there are ways to help people," Laux said. "Continuing to share my story is important to help people understand what we go through and to inspire them to decide how they want to shape the world."

Laux retired from engineering in 2010, when she committed to finishing her book, "Short Hair Detention: Memoirs of a 13-Year-Old Girl Surviving the Cambodian Genocide." The book was published in December 2017.

- Deann Gayman, University  
Communications }

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Contributions to the math department funds can be made at <http://www.math.unl.edu/give> or through the mail (see Page 15 for donation form).

## CHAIR *From Page 1*

in a single calendar year, surpassing our previous high of 15 in 2015. This tremendous accomplishment is a testament to our high-quality students (almost all of who landed impressive positions in academia, industry, and government; see Pages 3 and 19) and faculty, as well as the many reforms our department has implemented, which have made our graduate program a national model. Notably, it also occurs at a time when the size of our graduate faculty is at a modern-day low (currently at 31, including faculty with full-time administrative appointments).

I also would like to mention an anniversary of sorts. As Jim Lewis notes in his article on our latest Ph.D.

cohort, Albert Candy received the first Ph.D. from our department in 1898. He would later become chair of the Department from 1917-1934. Almost exactly 100 years ago, in a document dated February 15, 1919 (which he notes as the 50th anniversary of the University of Nebraska), Candy established in his will the Candy Mathematical Fellowships, 26 years before his passing. He writes that he does not desire to assist anyone “whose purpose is to get as much out of society as he can and give as little as possible in return. Hence, I [Candy] wish that everyone who accepts this Fellowship might feel under obligation to give someone, in some way, at some time, at least as much as he receives from this foundation.” This sentiment still

resonates 100 years later.

I am pleased to say that the Candy Fund is still thriving and continues to help support our graduate program, illustrating the long-lasting impact of such gifts. As chair, my principal goal is to support our students, faculty, and staff attain excellence in their teaching, learning, and scholarship. Thanks to the generosity of Albert Candy and other donors over the years, I have the means to say “yes” more often than not when requested to support a worthy project. (A case in point is Michelle Homp’s productive trip to Senegal this past summer; see Page 9.) Every donation is highly valued and goes a long way to supporting our department’s mission. I wish all of you a very happy holiday season. }



# Faculty News }

## Connecting continents



I have been a faculty member at the University of Nebraska-Lincoln since 2005, serving both the Center for Science, Mathematics and Computer Education (CSMCE) and the Department of Mathematics. A significant portion of my role is to coordinate and teach graduate courses for K-12 teachers of mathematics continuing their education or working toward earning a master's degree. One of UNL's graduate programs is called Primarily Math. It is a renowned and highly effective program for elementary teachers (largely of primary grades) who wish to strengthen their mathematical content and pedagogical knowledge while earning UNL's designation as a K-3 Mathematics Specialist.

In July of this past summer, I had the privilege of traveling to Africa to introduce the Primarily Math program to seven teachers from the Senegalese-American Bilingual School (SABS) in Dakar, Senegal. This experience was one component of the 2018 Afrimath Summer Program. Headquartered in Dakar, Afrimath is an initiative designed to strengthen mathematics education in Senegal and all of Africa by engaging students and teachers in rich learning experiences that deepen their knowledge of mathematics and mathematics pedagogy.

Afrimath founder and director, Masake (Kane) Ly, is a Senegalese native who was a high school math teacher at SABS while she earned her Master of Arts for Teachers degree through UNL's online program. I served as her online instructor for several courses, and she asked me to be her advisor. Ly traveled to Nebraska to take a summer graduate course, and we



(Photo left) Michelle Homp (left) with Masake (Kane) Ly (far right), the Afrimath founder and director. (Photo right) Students and counselors attending the Afrimath Summer Camp shared their experiences at the Dakar Forum on Mathematics and Education Forum.



developed a friendship that led to our collaboration.

Afrimath consisted of a teacher program and a summer camp for middle school students and culminated in The Dakar Forum on Mathematics and Education. Ly provided the overall coordination for the program and led the summer camp while I led the professional development sessions for the teachers. Our plan is to train a small group of teachers from SABS to become teacher leaders, who will in turn offer the Primarily Math experience to more elementary teachers in Dakar. It is my hope that I can return to Dakar to help make this happen.

I learned a lot about the people, the education system, and the culture of Senegal. While nearly all instruction is provided in French, the "official" language of Senegal, this is not the native language of the majority of the people. The language most commonly spoken in Senegalese homes is Wolof, and there are more than 30 additional dialects spoken in other regions. Nearly every student attending school is a French-language learner while they are learning other subject matter, which adds a layer of complexity to mathematics education in the elementary schools in Senegal.

It was interesting to see the similarities and differences between the traditional algorithms for the basic operations used in Senegal and those used in the U.S.

The people of Senegal are

welcoming and generous. They pride themselves on being known as "the country of *teranga*," the Wolof term for hospitality. Everywhere I traveled, people went out of their way to offer assistance or show me kindness. Even simple cultural traditions emphasize the importance of hospitality, both to guests and to fellow citizens. Each morning of the program, the students and teachers would gather for an opening warm-up session in an outdoor courtyard. Part of the daily routine was to clap and sing a traditional song that nearly everyone in Senegal would have learned as a child. The song was about having pride in your community, whether that community is as small as your class or as large as your country and how extending hospitality within your community brings success and happiness to everyone.

The most generous act of all, for which I was a recipient, was when I was given a Senegalese name. It is traditional for guests to be given the last name of their host family (more evidence of their hospitality), so my Senegalese surname already was "Kane" (pronounced *kahn*). To determine a first name, the students and teachers met privately to decide. When the selection was made I was ceremoniously led into the room and given the name "Maty" (pronounced *mah' tee*), so I now answer both to Michelle and to Maty Kane. Nothing could have made me feel more welcome. }

## PETERSON *From Page 1*

Peterson said he is very proud of his record number of citations in the American Mathematical Society's MathSciNet database.

"Overall, I've been cited 4,115 times by 1,538 different authors," Peterson said. "And of all the math books and math research publications, in the year 2001, my book on time scales, 'Dynamic Equations on Time Scales,' is the second-most cited."

Peterson, who has written eight books and more than 200 papers, was an assistant professor at Nebraska from 1968 to 1972, when he was promoted to associate professor with tenure. He became a full professor in 1976 and was awarded the Charles Bessey Professorship in 2006. In 1983, he also received a Distinguished Teaching Award. Over the years, Peterson has earned nine Recognition Awards for Contributions to Students at UNL; has served on the editorial board for 17 journals; and has had two conferences held in his honor: one at UNL in 2013 and another in Novacella, Italy, in August 2007.

Thirty-two doctoral students graduated with Peterson as their advisor, and he has two current students: Wei Hu and Ariel Setniker. From 2001 to 2014, Peterson mentored 51 REU students (Research Experiences for Undergraduates) and one McNair Scholar, Raegan Higgins, who is now an associate professor in the Department of Mathematics and Statistics at Texas Tech University.

In 1997, 2002, and 2009, Peterson was one of two main speakers at the University of Wyoming Rocky Mountain Mathematics Consortium Summer Conference, where he gave 10 75-minute lectures. He is one of only two mathematicians who have co-coordinated this conference three times.

Besides the starting salaries (his was \$10,500 in 1968), Peterson said the main differences between the Department 50 years ago and now are the number of people doing research and the emphasis placed on teaching evaluations. What hasn't changed since he arrived is his Differential Equations Seminar on Tuesdays and Thursdays — and not teaching over the lunch hour.

"I always ask not to teach between 11:30 and 1 because I go to the YMCA and workout. For years it was racquetball and now it's power pump and cycling. I still go five days a week,"

Peterson said.



Allan Peterson

Peterson chose to come to Nebraska because of Professor Lloyd Jackson, one of the nation's leading scholars in ordinary differential equations. Peterson

heard Jackson give several lectures at a conference in 1967 and thought he was "an excellent teacher."

Peterson met several of Jackson's students at that conference, including Professor Emeritus Lynn Erbe.

"I have known Al since we were both in Boulder, Colorado, in the summer of 1967, attending some special lectures given by John Barrett, his Ph.D. supervisor from the University of Tennessee, and my supervisor, Lloyd Jackson, from Nebraska," Erbe said. "Al is well known through his extensive research in ordinary differential equations and his books on ODEs, difference equations, and fractional difference equations. When Al arrived in Lincoln, he was very involved in continuing the study of ODEs and teaching graduate courses using ideas and methods pioneered by Lloyd Jackson."

For years, Peterson taught one graduate course, usually in ODEs, and one calculus course. For at least a decade, he taught a course called Honors Calculus, in which he covered all three sections of Calculus in two semesters.

He is also well known on campus because of the jokes he tells in his lectures, Erbe said.

"I used to tell jokes at the beginning, but now I tell a joke at the end of every class," Peterson said. "I was teaching Math 104 one semester, and I was telling the joke at the beginning of the period. But what happened was, I would tell the joke and then about six people would get up and leave. So I said, 'I'm not telling the joke at the beginning of the period anymore.'"

## Graduate Students Advised by Al Peterson

James Spencer .....	1973
Dwight Sukup .....	1974
Darrell Hankerson .....	1986
Gerald Diaz .....	1989
Timothy Peil .....	1990
John Schneider .....	1992
Ferhan Atici .....	1995
Betty Harmsen .....	1995
Michael Morelli .....	1996
Douglas Anderson .....	1997
Richard Avery .....	1997
Robert Krueger .....	1998
Elvan Akin .....	2000
Jo Hoffacker .....	2001
Kirsten Messer .....	2003
Jennifer Langdon .....	2005
Bobbi Buchholz .....	2007
Jacob Weiss .....	2007
Heidi Feller .....	2008
Raegan Higgins .....	2008
Rajendra Dahal .....	2009
Chris Ahrendt .....	2010
Michael Holm .....	2011
Khulud Alyousef .....	2012
Christopher Goodrich .....	2012
Tanner Auch .....	2013
Pushp Awasthi .....	2013
Abigail Brackins .....	2014
Julia St. Goar .....	2016
Kevin Ahrendt .....	2017
Areeba Ikram .....	2018
Scott Gensler .....	2018
Wei Hu .....	current
Ariel Setniker .....	current

Michelle Homp, now an assistant professor of practice in the Department, shared one of Peterson's jokes: "My favorite is one where I initially didn't realize he was telling a joke. It was near the end of our class period, and Al started talking about applications of mathematics to real-world phenomena. One such connection was how bifurcations were believed to be related to the patterns observed in leopard spots. For his final example, he asked with a straight face, 'And have you noticed when you see birds migrating in a V-shape that one side is always longer than the other? Do you know why that is?' We paused in expectation of a complicated mathematical explanation. And then Al said, 'Because there are more birds on one side.'"

Peterson has fond memories of his students, especially his Ph.D. students. "A lot of my Ph.D. students call me Dad," Peterson said, smiling.

Johnny Henderson, Distinguished Professor of Mathematics at Baylor University, who was advised by Lloyd Jackson, relayed this story: "After I had accepted an offer to join the faculty at the University of Missouri at Rolla for the 1981-1982 academic year, I had to wait for UNL's July 1981 commencement for my Ph.D. to be awarded. A few weeks after commencement, I was in Al's office, of course reading the sports section of his newspaper, and Al just nonchalantly asked me how I thought I would do at UMR. I nonchalantly replied, 'I think I'll be OK.' He continued the conversation by saying, 'I mean, how do you think you will do with the research?' And I replied, 'I think I can write a paper or two every year,' as that was what I had perceived as sufficient. Al said, 'What if that won't be enough?'"

Peterson said Henderson has far exceeded that goal.

Born March 9, 1942, in Buffalo, New York, and raised in Sioux Falls, South Dakota, Peterson received his bachelor's and master's degrees from the South Dakota School of Mines and Technology and his Ph.D. in 1968 from the University of Tennessee, Knoxville.

"My dad was a candy salesman, and he was a very hard worker," said Peterson, who has four siblings. "I feel like that really rubbed off on me. And my mother was either the smartest or second-smartest in her class. She always talked about wanting to go to college."

Peterson, an avid Husker athletics fan (he has season tickets to Nebraska football, women's basketball, and softball) and stamp collector (he has over 1 million), met his wife, Tina, of 56 years, at the South Dakota School of Mines, where they both worked in the cafeteria. They are very proud of the accomplishments of their three children and eight grandchildren.

"I hope I'm remembered for trying to show my love of mathematics," said Peterson, who said he feels very blessed to be a professor at Nebraska and to have such wonderful colleagues in the Department. "I also really like that I got to have so many Ph.D. students. That's the most anybody's had in the Department."

- Lindsay Augustyn }

## Hermiller joins AMS Fellows

Susan Hermiller of the University of Nebraska-Lincoln Department of Mathematics has been named a fellow of the American Mathematical Society.



Susan Hermiller

Hermiller, Willa Cather Professor of Mathematics, has joined the esteemed group of mathematicians from around the globe, joining the seven Nebraska faculty previously inducted.

The AMS fellows program recognizes those who have made outstanding contributions to the creation, exposition, advancement, communication, and utilization of mathematics. Hermiller is one of 65 who were elected fellows in the class of 2019.

Hermiller was inducted for her contributions to combinatorial and geometric group theory and for service to the profession, particularly in support of underrepresented groups.

Hermiller's research in geometric

group theory focuses on the study of algorithmic, growth, and homological properties of groups, as well as applications to low dimensional topology and computational algebra. In much of her research, she finds large classes of groups for which algorithmic problems have particularly tractable solutions, and she uses geometric properties to obtain bounds on the complexity of those solutions. Conversely, in her work she also determines what algebraic, asymptotic, geometric, or topological properties of a group are implied by such algorithms. She is known for her work on rewriting systems for groups, and in particular, developing algorithms using computers with a finite amount of memory, with applications to the study of 3-manifolds (topological spaces that locally look like 3-dimensional Euclidean space) and the study of groups of piecewise linear homeomorphisms.

Hermiller's service to the profession includes serving on the

See HERMILLER on Page 14

## Walker named AWM Fellow

Judy Walker, Aaron Douglas Professor of Mathematics and associate vice chancellor for faculty and academic affairs, has been named



Judy Walker

a fellow of the Association for Women in Mathematics for her dedication to creating a more inclusive community within mathematics fields.

The fellows program recognizes individuals who have demonstrated a sustained commitment to the support and advancement of women in the mathematical sciences. Fellows epitomize the mission of the association, which is to promote equitable opportunities and support for women and girls in the mathematical sciences.

Walker was chosen for her

leadership in promoting girls and women in mathematics and STEM (science, technology, engineering and mathematics) fields, mentoring activities, service to the profession, mathematical exposition, and excellence in teaching and research. She was nominated by Petronela Radu, Olson Professor of Mathematics, and Sylvia Wiegand, professor emerita of mathematics. Wiegand is a member of the 2018 inaugural class of AWM fellows.

Among Walker's many efforts toward increasing the success and visibility of women in math are co-founding the annual Nebraska Conference for Undergraduate Women in Mathematics, co-creating the All Girls/All Math summer camp for high school girls, and leading a National Science Foundation INCLUDES funded project aimed at increasing the number of women with mathematics doctorates. }



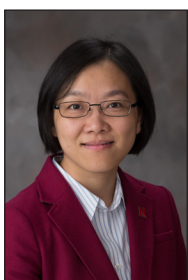
## AWARDS AND PROMOTIONS



Allan Donsig

Professor of Mathematics **Allan Donsig** has been selected to the inaugural class of Faculty Fellows for Student Success for the 2018-2019

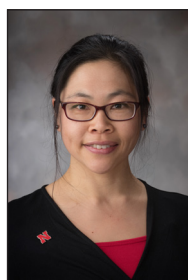
academic year by the Executive Vice Chancellor's Office. Fellows will spend the year learning about student retention, engaged learning, and degree completion.



Yu Jin

**Yu Jin** has been promoted to associate professor in the Department of Mathematics.

Assistant Professor **Yvonne Lai** is the 2018 recipient of the College Distinguished Teaching Award. This \$1,000 award is given in recognition of excellence in teaching. Lai also received



Yvonne Lai

a Top Three Paper award for a proceedings paper for the 2018 Conference on Research in Undergraduate Mathematics Education.



Petronela Radu

**Petronela Radu** has been promoted to full professor of mathematics and received the Leland J. and Dorothy H. Olson Professorship in 2018. In

May, she co-organized and served as a project leader of a **Women in Mathematics of Materials workshop** (<https://mcaim.math>.

[lsa.umich.edu/events/women-in-mathematics-of-materials-workshop/](https://lsa.umich.edu/events/women-in-mathematics-of-materials-workshop/)). The workshop was featured in the **AWM October newsletter** (<https://sites.google.com/site/awmmath/home>). Radu and Mikil Foss were also invited to speak at the 10th Workshop on Dynamic Systems in Southern Italy.



Alexandra Seceleanu

Assistant Professor of Mathematics **Alexandra Seceleanu** was presented with the \$5,000 Harold and Esther Edgerton Junior Faculty Award in 2018,

which honors an outstanding junior faculty member who has demonstrated creative research, extraordinary teaching abilities, and academic promise. Seceleanu also was awarded a \$25,000 FIRST (For Inspiration and Recognition of Science and Technology) Award from Nebraska EPSCoR in 2018 for her proposal "Homological Algebra for Geometric and Computational Applications." The FIRST Award program is designed to help early career faculty initiate their research programs and compete more effectively for NSF CAREER grants.



Wendy Smith

**Wendy Smith**, research associate professor in the Center for Science, Mathematics and Computer Education, was awarded the

2018 Don Miller Distinguished Service Award from the Nebraska Association of Teachers of Mathematics. The NATM board established the Don Miller Distinguished Service Award in 1989. Its purpose is to honor mathematics educators for their contribution to the improvement of mathematics education in the state.

## Additional research grants:

**Susan Hermiller:** Simons Collaboration grant

**Tri Lai:** Simons Collaboration grant

**Kyungyong Lee:** NSF Individual Investigator grant, University of Nebraska Collaboration Planning grant with UNL mechanical engineering and UNK mathematics

**Xavier Perez Gimenez:** Simons Collaboration grant

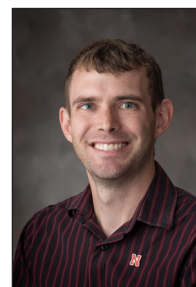
**Richard Rebarber:** Simons Collaboration grant

**Alexandra Seceleanu and Richard Rebarber:** NSF Conference grant Central States Mathematics Undergraduate Research (held at UNL April 20-21)

**Wendy Smith:** NSF Computer Science for All grant Adapt, Implement, and Research for Nebraska (AIR@NE; see story at [go.unl.edu/airne](https://go.unl.edu/airne)), NSF I-USE grant NIC-Transform, NSF Noyce research track grant Teacher Leadership (T-LEAD), NSF Noyce Master Teaching Fellows grant NebraskaSTEM

**Mark Walker:** NSF Conference grant

## NEW FACULTY

**Josh Brummer**

Assistant Professor of Practice Josh Brummer earned his Ph.D. in the summer of 2018 from

Kansas State University, where he studied Fourier analysis. Being a Kearney native, he is excited to have made a return to his home state of Nebraska. His current work relates to boundedness properties of various pseudodifferential operators, but he also is interested in contributing to mathematics education research, specifically how students learn best by using interactive math applets and technology.

# Orr returns to native Scotland

In 2011, John Orr left Nebraska Mathematics after 20 years to work at Google in California.

During his time with the Department, he was vice chair; taught dozens of courses (Math 203 and Math 825 were his favorites, he said); and created the online testing system used by thousands of University of Nebraska-Lincoln students every year.

Now, seven years later and still at Google, Orr has made another big move, this time back to his native Scotland.

At Google in California, Orr developed e-commerce payment systems that handled over \$1 billion in transactions and open-source educational software platforms used by millions of students worldwide. His current work at Google London continues his interest in education at scale, building software for projects such as “CS First,” which aims to help teachers and parents develop kids’ interest and skills in computer science.

Orr also keeps a toe in the waters of mathematics, having published a few papers during his time at Google, and is very glad to finally know the answer to a question which he had worked on all his years at Nebraska (see <http://JohnOrr.us#24> for details).

Orr and his family are living in the rural Scottish Borders not far from Edinburgh where he grew up, and he keeps in sync with work thanks to fibre-optic broadband and frequent trips to London.

“Returning to Scotland after so many years living in England, Canada, and the U.S. has been a remarkable experience,” Orr said. “I often think of that line of T S Eliot, ‘We shall not cease from exploration, and the end of all our exploring will be to arrive where we started and know the place for the first time.’ There is definitely some feeling of that sort here.”

See <http://JohnOrr.us> for more about Orr’s activities. }



COURTESY PHOTO

*John Orr and his family are living in the rural Scottish Borders not far from Edinburgh where he grew up. His current work at Google London continues his interest in education at scale and building software for projects.*

## NEW POSTDOCTORAL FACULTY



### Thomas Kindred

Postdoc Thomas Kindred earned his Ph.D. in Mathematics in 2018 from the University of Iowa. His research in low-dimensional topology focuses on surfaces in link exteriors. The basic idea is that the space around a knotted circle carries a wealth of mathematical data, and surfaces help parse this data.

Before starting graduate school in Iowa, Kindred taught high school math for a year in his hometown of Columbus, Ohio, and for three years in the small town of Potts Camp, Mississippi. He currently serves on the Putnam Exam Committee.



### Amanda Laubmeier

Marilyn M. Hitz Postdoctoral Faculty Fellow Amanda Laubmeier earned her Ph.D. in Applied Mathematics from North Carolina State University and her B.S. from the University of Arizona. Her work is in the area of mathematical ecology, and she is serving as the faculty sponsor for the undergraduate AWM chapter.

## NEW STAFF



### Doug Pellatz

Doug Pellatz joined the Department in April 2018 as the undergraduate advisor. He advises current undergraduate students in Mathematics and Physics, meets with potential undergraduate students, and serves as the campuswide contact for math placement and the Math Placement

Exam. Doug comes to our department after spending about four and a half years as an advisor and the liaison to the Department in the College of Arts and Sciences Academic and Career Advising Center, and he is looking forward to learning more about the staff and faculty in Mathematics. Doug was born and raised in rural Plainview, Nebraska, but he did move around the state as a child. He earned a Bachelor of Science in Interdisciplinary Sciences with an emphasis on Atmospheric Sciences from the South Dakota School of Mines & Technology in 2007. He originally came to Lincoln to pursue a graduate degree in Meteorology/ Climatology, but ended up working for the Athletic Department as an assistant academic counselor where he tutored math and meteorology. Doug is currently pursuing a master’s degree in higher education administration, and he devotes much of his spare time to his wife, Mary, and their families.

# { Alumni News

## *The art of applied analysis*

Linda Bors was in first grade when she realized how much she loved numbers. In seventh grade, the Crete, Nebraska, native started imagining pursuing a career in math.

As an undergraduate math education major at the University of Nebraska-Lincoln, Bors turned those imaginings into reality.

She's grateful for the personal connections she had with her instructors, in particular her undergraduate advisor Jim Lewis, considering the large size of Nebraska.

"I was a very serious student and really appreciated math professors noticing that I always came to class prepared and asked questions as needed," Bors said.

After graduation, Bors pursued her MBA while teaching at Morton Junior High School in Omaha. She took 6 credits each semester while teaching a full-time program that emphasized teacher-developed worksheets.

"I did not take much time for fun, but fortunately, I enjoyed my business classes very much," Bors said.

She wanted to use math background and business skills in her career, so she became a market research analyst at InterNorth in the Liquid Fuels Division. A later change in leadership meant she would have to move to Houston, which was out of the question for Bors.

Instead, she became an Air Force civilian at the U.S. Strategic Command. She was able to use her math, computer, and business skills



Linda Bors

in her work, which included programming, military modeling and simulation, developing advanced spreadsheets, and determining military requirements for various programs. She also put her analytical and financial skills to good use as her division's financial manager when it received millions of dollars for new modeling development.

An especially proud moment for Bors came when she was asked to analyze the value of flying hours in the training bomber and tanker crews, a task which had been previously unsuccessful.

"I used learning curve concepts in the 'art' of conducting this quantitative analysis and was successful," Bors said. "I received both an award and a salary increase for this work."

One takeaway she had from these experiences was being able to see the relationship between her academic background and the real world.

"Although mathematics is considered a science, applied analysis is also considered an art due to the creativity needed in developing an analytical technique for a specific application and being able to apply it," Bors said.

Since retiring in 2017, Bors attends events such as community theater shows, Omaha Broadway

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**"Although mathematics is considered a science, applied analysis is also considered an art due to the creativity needed in developing an analytical technique for a specific application and being able to apply it."**

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- Linda Bors

shows, and events focused on community betterment and public policy. She takes on major projects in her neighborhood. She also volunteers by planning and organizing events and offering computer support for communications, research, and database development.

Her travels have included places inside the continental U.S. and Costa Rica, and she plans to visit China and Germany soon.

Bors' Czech heritage has always been an important part of her life, but she didn't become interested in local history until she did ancestry research in 2014. "Czech foods and way of life were all around me" through childhood, Bors said.

The advice Bors gives to current students comes from her experience combining a variety of skills in her career: "There's a need to keep up with today's technological world from many perspectives."

- Alli Davis }

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### HERMILLER *From Page 11*

AMS Council and Science Policy Committee, and chairing the development committees for both the GRE subject test and the Major Field Test in mathematics. Her work to

improve the representation of women in mathematics includes service on the AMS-ASA-AWM-IMS-MAA-NCTM-SIAM Joint Committee on Women in the Mathematical Sciences, as a co-author of UNL's NSF-ADVANCE best practices documents, and as an initial co-organizer of the Nebraska

Conferences for Undergraduate Women in Mathematics.

As Graduate Chair for the math department, she has greatly enhanced the placement of many Nebraska students in prestigious internships and non-academic careers both locally and nationally. }



# Class Notes

**Eric Eager (Ph.D. '12)** provides analytical insights to all 32 NFL teams and over 40 college football clients in his position as a data scientist for Pro Football Focus. Eager was a professor for six years before joining PFF in July 2018.

**Matt James (MAT '13)** got married on June 2, 2018. James is a math teacher at Lincoln Southwest High School, and his wife, Bridgette, is a nurse in a heart cath lab.

**Tim Rolling (BS, '16)** is in his third year as a graduate student and teaching assistant at Purdue University. His research area is probability theory.

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## WHERE HAS YOUR MATH SHIRT TRAVELED?



*Graduate student Taran Funk (left) with family in Colorado*



*Math teachers at Walnut Middle School in Grand Island, Nebraska*

**Send your photos to: [nebraskamath@unl.edu](mailto:nebraskamath@unl.edu)**

Campaign Code: 1LA&S18-MATH

## *I want to support the Nebraska Department of Mathematics.*

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☐ Enclosed is my check for \$\_\_\_\_\_. Please make check payable to the University of Nebraska Foundation.

☐ Please charge \$\_\_\_\_\_ to my: ☐ Visa ☐ Mastercard ☐ Discover ☐ American Express

Card Number

Exp. Date

Signature

☐ I would like my gift to support the Mathematics Department Fund. This is an expendable fund that is used to support department priorities such as faculty and student professional travel and outreach activities.

☐ I would like my gift to support Fund # \_\_\_\_\_. See our website, <http://www.math.unl.edu/give>, for a listing of funds that support the Department of Mathematics and the funds' purposes.

Please mail your contribution to: University of Nebraska Foundation, 1010 Lincoln Mall, Suite 300, Lincoln, NE 68508

**Contributions also can be made at <http://www.math.unl.edu/give>.** We invite friends of the Department to contact Chair Tom Marley to discuss creating a new fund for a specific purpose. Thank you for your support.

# { Student News

## Math before dessert

### *Scottsbluff native puts love of UNL, knowledge first*

When Lawrence Seminario was growing up in Scottsbluff, Nebraska, his parents helped him sharpen his math skills by having him read math books and do practice problems under their supervision before he could have any pie for dessert. Seminario didn't mind it, though, because through that time he spent studying, he realized mathematics was far more than just "problem solving."

"I got to see that mathematics is a precise language that allows us to logically navigate through the mind, which must always be coupled with reality," Seminario said. "Because of doing my math studies as a kid, I came to comprehend that I wanted to be a mathematician."

Seminario decided to pursue a degree in Mathematics at the University of Nebraska-Lincoln for various reasons, one being the trip he made with his high school for UNL's annual Math Day.

Seminario's parents, who are both originally from Peru, also had an impact on his desire to study mathematics. His father's engineering and teaching background and his mother's involvement in her family's business were evidence that mathematical skills could greatly benefit one's career.

The president of UNL Math Club (Pi Mu Epsilon), he is also a member of the National Society of Collegiate Scholars and the National Society of Leader and Success. He has also participated in research studies through the UCARE program, while tutoring other students in the Math Resource Center. He takes great pride in his love for Husker football,



COURTESY PHOTO

*Lawrence Seminario graduated from Nebraska with his bachelor's degree in mathematics in May 2018 and will pursue his Ph.D. in applied mathematics at UNL.*

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**"I am a Cornhusker deep  
in mind, body, and soul,  
and I can never forget  
my great Husker pride."**

**- Lawrence Seminario**

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which he considers one of the most important activities in which a student can take part at UNL.

Seminario said the pursuit of a college education opens up challenging doors with well-paid opportunities.

"College will add market value to your person, and it will make you more competitive in the job place," Seminario said. "Don't forget that knowledge is power and enthusiastic persistence is the way to go."

On the occasion that he is not focusing on school, Seminario said he loves to spend time at UNL's Campus Recreation Center, where he enjoys lifting weights, running on the treadmill, swimming, and playing ball. He also enjoys strategy and skill games such as chess, billiards, and bowling, and he even does some drawing on top

of all that. Some of his newest hobbies include playing the harmonica and writing poetry.

Thanks to Seminario's Peruvian heritage, he is also fluent in Spanish and enjoys spending his summer breaks visiting his family in Peru.

"I have always had a strong admiration of the ancient Peruvian culture, and I like to go visit some of the archeological sites and Inca ruins down there - most notably, Machu Picchu," Seminario said.

Seminario said he knows he still has a lot to learn about life, and that one day, he hopes to benefit society with his knowledge. He has decided to pursue a Ph.D. in applied mathematics. He was recently accepted into five graduate schools, but he knew that UNL was where he wanted to be.

"I chose UNL because it has exactly what I'm looking for from a knowledge perspective, and because of its outstanding, supportive math professors," Seminario said. "Besides, I am a Cornhusker deep in mind, body, and soul, and I can never forget my great Husker pride."

*- Alli Davis }*



# Mills earns postdoc research fellowship from NSF

Former mathematics doctoral student Matt Mills was awarded a prestigious Mathematical Sciences Postdoctoral Research Fellowship (MSPRF) by the National Science Foundation (NSF) in 2018. Mills, who earned his doctorate from the University of Nebraska-Lincoln in May, will conduct his research at Michigan State.

Mills will study topics related to cluster algebras, a field of mathematics that is only 20 years old and lies in the intersection of algebra and combinatorics.

The \$150,000 fellowship covers three years of full-time research in the sciences and is highly sought-after funding by students to support their transition from graduate studies to professional careers.

Mills, who earned a bachelor's degree in mathematics and physics at Kalamazoo College in Michigan before coming to Nebraska, said he will have the first year of the fellowship to focus solely on research and a reduced teaching load for the next two years.

"I started down this path when my advisor Kyungyong Lee suggested a research project in this field in my graduate linear algebra course," Mills said.

Lee provided not only the suggestion for the project that sparked Mills' interest in the field, but also the funding for Mills to travel to various conferences early in his career.



LINDSAY AUGUSTYN/UNL CSMCE

*Matt Mills will conduct his postdoctoral research at Michigan State and study topics related to cluster algebras.*

"In fact, it was at one of these conferences that I found the research problem that became my thesis," Mills said.

Mills was one of about 35 students to be chosen out of 260 applicants. The award is designed to give recipients flexibility in choosing research environments that will have maximal impact on their future scientific development.

– Alli Davis }

## GET TO KNOW UNDERGRADUATE

### Elizabeth Tyler



**Where are you from?** Omaha, Nebraska (Westside High)

**Favorite math class or instructor?**

My favorite math class was definitely Intro to Modern Algebra with Professor Mark Walker. I really loved the way he taught an introduction to proofs, and I learned

a lot about groups and modular arithmetic. I also got to do a little bit of extra proof work with him outside of class, which was so much fun.

**What are you excited about doing after graduation?** I am a secondary math education major as well as a math major, so I will be getting a job as a math teacher after graduation. This has been the job I've wanted since I was 5 years old.

**What is a goal you have accomplished as a Husker?**

Before coming to UNL, teaching meant office supplies, grading, and getting to do math everyday with students who may not be as excited as me, but could maybe learn to be excited. Over the past four years, I have found that teaching is so much more about relationship building, being a positive role model, and doing everything in your power to help make your students successful. Math just happens to be the medium through which to do that. I would not have learned all of this without my position as a Calculus I TA for the past three years, so for that I have the math department to thank.

**What do you hope to cross off your "bucket list" in the next few years?** I am really hoping to travel to Finland. }

## GET TO KNOW GRADUATE STUDENT

### Elizabeth Carlson



**Where are you from?** Helena, Montana (Carroll College)

**What is the best advice you have been given regarding graduate school or your career?**

Knowing what to expect in graduate school helped me understand what I was getting into. I knew beforehand

it was possible to go into a class and not be able to understand what the professor was saying. Going into a situation with as much information as possible helps mitigate the stress by providing a guide to separate the typical versus the unusual situations that come up.

**What types of jobs are you interested in pursuing after graduation?**

At this point, my plan is to find a job that would allow me to continue to do research in fluid dynamics.

**What is a goal you have accomplished as a Husker?**

This past year I got my Master of Arts in mathematics and was surprised and honored to receive a fellowship from the National Science Foundation's Graduate Research Fellowship Program for my proposed thesis work in fluid dynamics. I have been working with Math Club to get students interested in math modeling competitions, which I was passionate about as an undergraduate (see Page 18).

**What do you hope to cross off your "bucket list" in the next few years?** I have always wanted to go to Chile; my friend and former neighbor who taught me Spanish grew up there, and it is a beautiful country with diverse natural habitats. }



# UNL hosts international math modeling challenge

Six undergraduates participated in an international math modeling competition called the SIMIODE Challenge Using Differential Equations Modeling on Oct. 27, 2018.

The UNL Department of Mathematics had two student teams,

both of whom won Meritorious awards (the levels being Successful, Meritorious, and Outstanding). Allison Cruikshank, Jianzhi Lou, and Thuan Luong comprised one team, and Pratap Biswakarma, Derek Chew, and Qianyu Dong comprised the other.

They worked on this project for the week prior to the contest, and then presented and were judged on their work on Challenge Saturday.

The contest was organized by mathematics third-year graduate student Elizabeth Carlson. }

## Undergraduate Awards

**Chair's Prize** *Awarded to an outstanding senior mathematics major*

Rebecca Sorsen and Collin Victor

**Special Scholarships Awards**

*Note: 56 scholarships were awarded for the 2018-19 academic year.*

**Dean H and Floreen G Eastman Memorial Scholars**

*(for Nebraska high school graduates)*

Fatima Barragan-Herrera, Alexander Batelaan, Derek Baumfalk, Tomohide Bessho, Emmalee Bielenberg, Richard Bouma, Amber Bridgeford, Zach Cairney, Emily Cleveland, Allison Cruikshank, Grace Dickas, Collin Dougherty, Stanley Drvol, Brandon Geren, Andrew Haar, Alexander Heitzman, Robert Hutchinson, James Janvrin, Matthew Meacham, Sean Michel, Ray Nierman, Nicholas Nguyen, Hannah Oh, Jesse Osnes, Jared Ott, Michael Purcell, Lara Quiring, Amanda Rowley, Isabel Safarik, Simon Schoenbeck, Jarod Schwinck, Elizabeth Spaulding, Moriah Tiemann, An Tran, Elizabeth Tyler, Zachary Van Roy, Nicholas Verdoni, Zach Warneke, Jacob Warner, Lane Weidner, Qixuan Yang

**Irwin Dubinsky Memorial Scholars**

Miles Davis, Alexander Schroeck

**Senior Honors Thesis and Graduated with Distinction**

*(directed by):*

Rebecca Sorsen (Alex Zupan and Mark Brittenham)

**Joel Stebbins Fund Scholarship**

Clay Christensen, Ge (Grace) Chai, Savannah Howard, Claire Kamas

**Putnam Participants**

Derek Chew, Andrew Haar, Alex Heitzman, Zach Warneke

**Renneman/Luebbers Scholarship**

Lixin Cao, Jordan Schmitz

**Drusilla Winchester Scholarship**

Kushagra Kapil

**Ruby Matzke Wittemore Scholarship**

Leenah Bouzid

**Sylvia and Hans Jeans Mathematics Scholarship**

Sanat Bhandari, Shannyn Bird, Samuel Carrasco

**Milton E. Mohr Biotechnology Fellowship**

Shannyn Bird (also inducted into the American Society for Biochemistry and Molecular Biology Chi Omega Lambda Honor Society)

## Bachelor's degrees

**December 2017:** Michael Arnold, Nicholas Bartholomai, Nathaniel Benes, Casey Christensen, Ryan Flynn, Sarah Greenwood, Abigail Hall, Yuance He, Ian Howell, Florentia Kalogeraki, Zachary Legband, Jingyi Liu, Linh Mai, Ankit Pant, Gunnar Eugene Peterson, Tanner Rasmussen, Dilraj Singh, Caston Stack, Jun Sun, Hao Wu, Yi Xie, Xuehua Zhong

**May 2018:** Nasam AlTwal, Alexandria Barone, Roshan Bengali, Shayla Bentley, Tyler Bienhoff, Jason Corbaley, Simon Deng, Michael Faber, Madalyn Fania, Elizabeth Galliart, Mustafa Hasan, Claire Henrichsen, Derek Holtz, Alexandria Janvrin, Yiwen Kang, Jae Yong Lee, Curtis Nelson,

Don Nguyen, William O'Connell, Jacob Pearson, Spencer Prockish, Henry Recker, Ethan Romary, Edwin Schooler, Lawrence Seminario-Romero, Adam Shafer, Rebecca Sorsen, Quynh Tran, Katherin Tucker, Elizabeth Vandergrind, Collin Victor, Li Wang, Caitlin Wilkins, Elise Wordekemper, Yuanfeng Zhang

**August 2018:** Chun Yin Ho, Nathan Johnston, Han Liu, Zachary Rouzee

## Graduate Program Awards & Fellowships

**Don Miller Award for Outstanding Teaching by a Graduate Student**

Mitch Hamidi

**Grace Chisholm Young and William Henry Young Award**

Robert Huben

**Outstanding Qualifying Exam**  
Michael DeBellevue

**Walter Mientka Teaching Award**  
Michelle Haver

**Outstanding First-Year Student Award**  
Catherine Godfrey

**Bill Leavitt Award**  
Taran Funk

**Lloyd Jackson Award**  
Aurora Marks

**Amy Bouska GTA Leadership Award**  
George Nasr

**Linda Bors Fellowships**  
Lara Ismert, Matt Reichenbach, Karina Uhing

## DEGREES *From Page 3*

Ten women earned their mathematics Ph.D. in 2018. It is noteworthy that the Department did not award its 10th Ph.D. to a woman until 1995 when Ferhan Atici, Nancy Campbell, Betty Harmsen, and Kristin Pfabe earned their degrees. Now, 92 women have earned the Ph.D. from the mathematics department, including 45 in the past 10 years. Looking ahead, it is reasonable to predict that in 2020 the Department will award its 100th Ph.D. to a woman.

The Department's doctoral education could not have such a successful year without dedicated work by the faculty teaching graduate courses, mentoring students, and supervising doctoral dissertations. The 19 new Ph.D.s were supported by 16 different faculty members serving as

their advisor or co-advisor. Three of the faculty, Jamie Radcliffe, Petronela Radu, and Mark Walker, were each the advisor or co-advisor for three students, while Christine Kelley, Al Peterson, and emeritus professor Roger Wiegand each had two students.

The Department encourages and supports its graduate students by offering awards and supplemental fellowships funded by donations to the University of Nebraska Foundation. For example, there are cash awards to the outstanding first-year student and the outstanding qualifying exam, as well as two teaching awards named for Don Miller and Walter Mientka. The Emeritus Faculty Fellowship fund honors the Department's emeriti faculty (over 112 graduate students have received an Emeritus Faculty Fellowship since 1991), and the Grace Chisholm Young

and William Henry Young Award honors emerita faculty member Sylvia Wiegand's grandparents who also were mathematicians. The two newest awards of this type are the Amy Bouska GTA Leadership Award and the Linda Bors Fellowships. See <http://www.math.unl.edu/give> for the list of funds that support the Department of Mathematics.

To date, the Department has awarded 320 Ph.D.s. The 100th was awarded in 1986, the 200th in 2008, and the 300th in 2017. The 2010s will stand out for the dramatic growth of the Department's Ph.D. program. With one year to go, 103 students have been awarded the Ph.D. in mathematics. Thus, with another strong year in 2019, the total number of Ph.D.s awarded in the 2010s might double the previous high of 56 Ph.D.s in the 1990s.

- Jim Lewis }

## Doctoral degrees

**Beemer, Allison** *Design and Analysis of Graph-based Codes using Algebraic Lifts and Decoding Networks*, advised by Christine Kelley

**Bolkema, Jessalyn** *Graph-theoretic aspects of polar codes*, Judy Walker

**Canton, Eric** *F-purity, Strong F-regularity, and long canonical thresholds using Berkovich spaces*, Wenliang Zhang, Mark Walker and Brian Harbourn

**De Silva, Jessica** *Graphs with few spanning substructures*, Jamie Radcliffe

**Gensler, Scott** *Fractional Difference Operators and Related Boundary Value Problems*, Al Peterson

**Gheibi, Mohsen** *Geometric Linkage and Gorenstein Dimension*, Mark Walker and Roger Wiegand

**Groothuis, Corbin** *Four Mathematical Results on a Theme by Paganini*, John Meakin and Jamie Radcliffe

**Ikram, Areeba** *Green's Functions and Lyapunov Inequalities for Nabla Caputo Boundary Value Problems*, Al Peterson

**Jamieson, Jessie** *On the Well-posedness and Global Boundary Controllability of a Nonlinear Beam Model*, George Avalos (Daniel Toundykov)

**Kass, Nicholas** *Damped wave equations of the  $p$ -Laplacian type with supercritical sources*, Mohammad Rammaha

**Kirsch, Rachel**  *$K_{1,\Delta+1}$ -free and  $K_{\omega+1}$ -free Graphs with Many Cliques*, Jamie Radcliffe

**Lindokken, Seth** *Resolutions of Finite Length Modules over Complete Intersections*, Mark Walker

**Mayer, Carolyn** *On Coding for Partial Erasure Channels*, Christine Kelley

**Miller, Erica** *Using Examples in Precalculus: How Can We Maintain the Cognitive Demand?* Yvonne Lai

**Mills, Matthew** *On maximal green sequences, local-acyclicity, and upper cluster algebras*, Kyungyong Lee

**Steinburg, Neil** *Torsion in the Tensor Product*, Roger Wiegand

**Wells, Kelsey** *Properties and convergence of state-based Laplacians*, Petronela Radu

**White, Laura** *Behavior of Solutions to Nonlocal Hyperbolic Equations*

and Doubly Nonlocal Cahn-Hillard Equations, Petronela Radu

**Wright, Cory** *Existence and Regularity of Minimizers for Nonlocal Functionals*, Mikil Foss and Petronela Radu

### Cover Photo of Class of 2018:

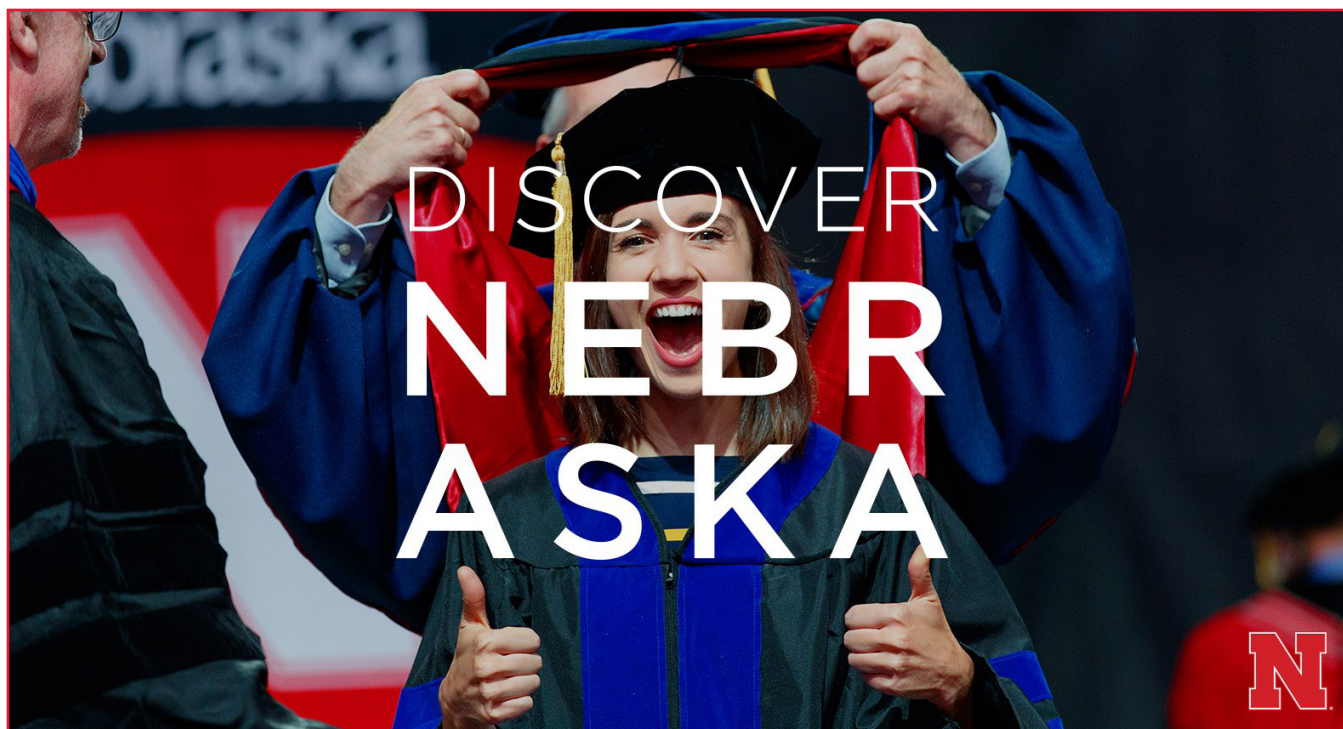
The department's biggest graduating class of doctorates since 1898 includes (from left to right, back row) Erica Miller, Matt Mills, Jessalyn Bolkema, Carolyn Mayer, Rachel Kirsch, Allison Beemer, Eric Canton; (middle row) Jessica De Silva, Corbin Groothuis, Kelsey Wells, Laura White, Cory Wright, Nick Kass, Jessie Jamieson; (front row) Areeba Ikram, Neil Steinburg, Scott Gensler, Seth Lindokken, and Mohsen Gheibi.

## Master's degrees

**2018 (MAT):** Jared Dixon, Grant Doerr, Emily Dvorak, Chelsey Grassel, Wendi Herbin, Elizabeth Hock, Kristina Pearson, Jordan Sis, John Strand

**2018 (MS/MA):** Laila Awadalla, Stephen Becklin, Elizabeth Carlson, Andrew Hayes, Jie Kang, Dana Lacey, Emily McMillon, John Murphree, Erica Musgrave, George Nasr, Kelsey Quigley, Adam Volk

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*Jessica De Silva gets hooded at the May 2018 commencement with her Ph.D. advisor Professor Jamie Radcliffe (at left). De Silva has a tenure-track position at California State University, Stanislaus, her alma mater. Photo from University Communications.*

Math News is a newsletter published for the Nebraska Department of Mathematics community. To receive Math News via email, please register online. Comments regarding newsletter content should be sent to Tom Marley ([tmarley1@unl.edu](mailto:tmarley1@unl.edu)), Chair, Nebraska Department of Mathematics, 203 Avery Hall, Lincoln, NE, 68588-0130.

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