Math News

A PUBLICATION OF THE NEBRASKA DEPARTMENT OF MATHEMATICS

Teaching in times of a pandemic

PHOTO ILLUSTRATION BY LINDSAY AUGUSTYN | UNL CSMCE

Associate Professor of Mathematics Adam Larios teaches Math 812T: Geometry for Geometry Teachers on Zoom in July 2020 to high school mathematics teachers from across the U.S. Read more about the course on pages 11 and 13.

When the COVID-19 pandemic caused an end to all spring semester in-person classes at the University of Nebraska–Lincoln in March of 2020, the Department of Mathematics only had two weeks to transition all courses and departmental resources fully online and meet all of its students' needs.

Fortunately, the department was prepared. Since 2012, the First Year Math Task Force, led by Allan Donsig, has been working to improve instruction and student learning in introductory large-enrollment mathematics courses, including providing consistent instructional resources for the course instructors.

"We wanted to keep everyone's lives manageable by having them all put their minds together to create the things needed to support all of our students—and one another," said Josh Brummer, assistant professor of practice.

Brummer was managing Math 102 and Math 106; Nathan Wakefield was handling Math 100A, Math 101, and Math 103; Michelle Homp coordinated Math 203; and Kevin Gonzales and Cheryl Kane handled Math 104. In each course, the convener supported the instructors to work as a team to deal with the challenge of moving to all asynchronous courses for the rest of the spring semester.

{ INSIDE }

Virtual events: AGAM Camp, Math Day, NCUWM & courses for K–12 teachers

Alumni updates: Katie Haymaker, Lucas Sabalka, Don Schneider & more

Meet new faculty: Eloísa Grifo & Jack Jeffries

Dear alumni and friends,

As we look back on the past year, it has become a popular sentiment—and a fashionable slogan on T-shirts—to wish 2020 "good riddance." Of course, there are many good reasons behind that feeling: the year brought us a global pandemic, widespread unemployment, and a contentious election. On campus, we have heard the words budget cuts, layoffs, and hiring freezes far too often. Closer to home, the department was met with the sad news of the passing of professor emeritus Mel Thornton and 2013 Ph.D. alumnus Ben Nolting. However, while it is important to recognize this year has brought setbacks and unprecedented (another word we have heard too many times!) challenges, it is equally important to reflect on how we have met those challenges.

Tom Marley

At the department level, I believe there is much for which we should be proud. In these pages, you'll read stories highlighting the innovative efforts by faculty and graduate students to meet the challenge of online and hybrid instruction head-on, including creative approaches for maintaining active learning in Zoom classrooms, the development of novel online assessment tools, and adapting our Math Resource Center to an effective online help center for students. We managed to continue our outreach efforts, including successfully hosting an online All Girls/All Math summer camp and a virtual Math Day.

This year also brought good news. We hired two outstanding tenure-track faculty, Eloísa Grifo and Jack Jeffries, and two postdocs, Amy Been Bennett and Animesh Biswas—all fortunately hired before the pandemic hit. We also saw four faculty honored with named professorships, two faculty receive distinguished teaching awards, and many faculty being awarded external grants. Among the many accomplishments by our graduate students this year, Collin Victor was awarded a highly competitive NSF Graduate Research Fellowship.

Looking ahead to 2021, the department expects to award its 100th Ph.D. to a woman in its history, which is an especially important milestone. We have worked diligently over the past 30 years to make our graduate program equally supportive for students of all genders and been nationally recognized for our efforts. In recognition of this milestone, the department is planning a major celebration post-pandemic for all friends and alumni of the department, and we hope many of you will be able to attend.

Finally, a word about giving. Many donors prefer to give to our general mathematics fund, allowing the department maximum flexibility in how their donations are utilized. Some prefer to support specific aspects of our mission, such as research, teaching, or our outreach programs; others prefer to establish their own funds targeted toward a particular purpose. Four examples of such funds are given on the back of this newsletter. I'd like to discuss in detail a fund that is near and dear to many of our graduate alumni: the Emeritus Faculty Fellowship Fund. This fund was established in 1989 through regular donations from the mathematics faculty under the leadership of then-chair Jim Lewis. The purpose of this fund is to support our graduate program, primarily through the awarding of graduate fellowships. Since the establishment of this fund, 128 graduate students have received an Emeritus Faculty Fellowship. An option for donors is to make their donations in tribute to particular emeritus faculty members. When donations in honor of a particular emeritus reach $20,000, we then award a permanent annual fellowship to honor this faculty member. Currently, we have emeritus fellowships named in honor Lloyd Jackson and Bill Leavitt. We hope to see that list grow.

I would like to once again thank Lindsay Augustyn for her tremendous work in putting together this newsletter. I would also like to say how thankful I am to all members of our community (current and former students, faculty, and staff) for making this department such a wonderful place to work and learn. Best wishes for the holidays and new year.

This symbol next to a story signifies the topic is related to teaching in the pandemic or the transition of a conference or workshop to an online event.

DON SCHNEIDER:
Leading Penn State astronomy since 2011

Professor Donald Schneider has been teaching the yearlong sophomore introductory class for astronomy majors at Pennsylvania State University for over a quarter-century.

Each fall he encounters dozens of talented students who, previously, were not challenged in their classes, cruising to top grades without much effort.

In September, they bitterly complain to him that the homework is "impossible."

However, after a couple of months, these students discover that, with some effort, they can conquer these seemingly insurmountable questions.

"One of the most rewarding aspects of my position is when former students stop by my office and comment on how grateful they were for my class as it caused them to reach their full potential," said Schneider, a Nebraska native who graduated from the University of Nebraska–Lincoln in 1976 as a Chancellor's Scholar with majors in mathematics and physics (astronomy option).

Schneider, the department head of astronomy at Penn State, has published over 950 peer-reviewed articles on a variety of subjects, from asteroids and exoplanets to the large-scale structure and evolution of the universe.

After UNL, he entered the graduate program in astronomy at the California Institute of Technology. Schneider received his Ph.D. under supervisor James Gunn in 1982, and remained at Caltech for three years as a research fellow, as an assistant to Maarten Schmidt. Schneider and a fellow Caltech postdoc invented a new technique to measure the distances to galaxies in the mid-1980s.

His Ph.D. thesis involved one of the first uses—if not the first—of a new electronic detector, called a CCD, for an astronomical survey.

"Since at the time there was essentially no software available to process these digital images, a fellow graduate student and I wrote an image processing system that was used in many astronomical projects. This work led to the Palomar Quasar Survey, which I performed with Professors Schmidt and Gunn; this effort found the most distant known object (at the time) in the universe," Schneider said. "The techniques developed for the survey were the basis for the Sloan Digital Sky Survey, which has been an exceptionally productive program for the past two decades."

In 1982, Schneider also was a member of the team that obtained the first image of Comet Halley as it approached the inner solar system for its 1986 passage by the sun.

COURTESY PHOTO

Don Schneider (Class of 1976), department head of astronomy, Penn State University

In 1985, Schneider received an appointment as a long-term member at the Institute for Advanced Study in Princeton, New Jersey, working with John Bahcall. With Professor Bahcall, he worked on several projects with the Hubble Space Telescope, and was responsible for the development of the software required to process the data for their programs.

Schneider remained at the IAS until joining the faculty at Penn State in 1994 as an associate professor. Since becoming department head in July 2011, Schneider said his greatest satisfaction has been the outstanding talent that he has been able to recruit to the faculty.

"I had not taught a course until I was at Penn State, and was somewhat apprehensive about how I would fare. I quickly found that I enjoyed teaching immensely," said Schneider,

SCHNEIDER { PAGE 4 }

SCHNEIDER
{ FROM PAGE 3 }

who in 2006 received Penn State's Eberly College of Science's highest teaching award.

Decades later, teaching during a global pandemic has brought its fair share of new challenges. Schneider has adopted what is termed "synchronous remote instruction": during the scheduled lecture times, he delivers the classes over Zoom.

"This fall both the students and I have adapted much better to this mode than in the spring, but the video teaching is, in my opinion, not as effective as the in-person lectures," Schneider said. "I did immediately learn one important lesson: when the students' microphones are muted and their cameras are not running, do not tell jokes. I assure you that this action will produce a most painful experience."

Born in Hastings, Nebraska, and raised on a farm near Heartwell, Schneider attended Heartwell school through sixth grade and then junior and senior high at Minden.

Science always piqued his interest. Through first grade he was fascinated by dinosaurs and wanted to be an archeologist, but viewing the dark Nebraska skies, combined with the excitement of the race to the moon (John Glenn went into orbit when Schneider was in first grade) and the first interplanetary missions, inspired him to become an astronomer. In fifth grade, a fascination with nuclear physics nearly steered him another direction, but in sixth grade, he made his decision to pursue astronomy for a career.

"My father was unimpressed with this announcement, asking, 'Do they actually pay people to do this job?'" said Schneider.

During his senior year at Minden, Schneider participated in the Westinghouse Science Talent Search and received ninth place at the competition's finals in Washington, D.C.

After meeting Professor Kam-Ching Leung, the head of UNL's astronomy program, Schneider, a first generation college student, decided to attend UNL with a four-year Regents Scholarship. He completed his undergraduate honors thesis on binary stars with Leung.

During his first semester at Nebraska, Schneider took Differential Equations with Professor Gordon Woodward and later Matrices with Professor Jim Lewis. Schneider fondly remembers these courses, as well as his Advanced Calculus and Tensor Calculus experiences with the department. He recalls not only the high quality of teaching he received but also the high quality of the other students in Lewis's matrices course.

"I've rarely been surrounded by so much talent," said Schneider. "I don't know where I ranked in the class, but if I managed to be in the top ten, I would consider that one of my most impressive achievements as an undergraduate."

Particularly rewarding was his two-year experience as an undergraduate mathematics counselor. For two evenings a week, in the dining areas of the dorm complexes, Schneider would assist students with questions they had involving their math courses.

In 2002, Schneider came back to UNL to visit the math department and deliver the public talk "Fire and Ice," which referred to the two possible fates of the universe: a halt to the expansion and a collapse into a fiery pit, or a perpetual expansion into a frozen future. "Based on current observations, I would recommend purchasing a parka," Schneider said.

Schneider also recommends to college students that they should pursue a career that brings them joy and satisfaction. He emphasized that no matter how talented you are, if you wish to undertake an academic or research career, you must realize that you are facing global competition.

"We Americans frequently state that one's future is in your own hands, and to some extent that is true," Schneider said, "but I could never have had my career without the exceptional and caring teachers at Nebraska in the math and the physics departments, the gifted research supervisors with whom I had the great fortune to interact, or the many colleagues who have enriched my life."

ZOOM REUNION

In September 2020, **Judy Walker**, Aaron Douglas professor of mathematics and associate vice chancellor for faculty and academic affairs in the Office of the Executive Vice Chancellor, invited a few women Ph.D. alumnae of the department to a Zoom reunion. Word spread and excitement built with 11 alumnae joining the call.

Top row (left to right): Katie Johnson, Florida Gulf Coast University; Walker; Ashley Johnson, Northern Alabama University. *Second row:* Katie Morrison, University of Northern Colorado; Nora Youngs, Colby College; Allison Beemer, University of Wisconsin-Eau Claire. *Third row:* Anisah Nu'man, Spelman College; Lauren Keough, Grand Valley State University; Christina Edholm, Scripps College. *Fourth row:* Jessalyn Bolkema, Harvey Mudd College; Julia St. Goar, Merrimack College; Courtney Gibbons, Hamilton College. *Bottom row:* Amanda Croll, Concordia University Irvine.

KATHRYN HAYMAKER: Awarded MAA honor for expository paper

Nebraska alumna Kathryn Haymaker, an associate professor of mathematics at Villanova University, was a 2020 recipient of the prestigious Carl B. Allendoerfer Award from the Mathematical Association of America (MAA).

Haymaker and her research collaborator Beth Malmskog are one of two groups of collaborators who have been named as the recipients of the award, in recognition of their 2019 expository article, "What (Quilting) Circles Can Be Squared?" published in Mathematics Magazine.

"Our collaboration on the article began when Beth introduced me to a question that she had received from a non-mathematician friend. Beth had worked on the problem and created a blog post on her partial results, and then we collaborated to expand on what she had already done," said Haymaker, who started teaching at Villanova at the same time as Malmskog, in Fall 2014.

The findings of the article are that for a round-robin quilt exchange, it is possible to arrange the exchange so that every quilter visits every other when the number of quilters is composite—for example, for 4 or 15 people, Haymaker explained. When the number of quilters is prime, for small cases, it cannot be done. However, the feasibility for a prime number of quilters is unknown for numbers higher than 11. The quilting exchanges can be modeled as objects called row-complete Latin squares, and the article illustrates this connection, along with other results.

Another area of interest for both Haymaker and Malmskog is an outreach opportunity that started with the State Correctional Institute (SCI) Graterford, now SCI Phoenix. Together they started a monthly Math Circle in 2016, in which they worked with students and alumni of the Villanova program at Graterford (a college degree program that started in 1972).

Following Malmskog's move to

COURTESY PHOTO

Katie Haymaker and her husband, Nathan Corwin (who is also a Nebraska Ph.D. alumnus in mathematics), and their son, Leon, attended the 2019 Joint Mathematics Meetings together.

Colorado College in 2017, Haymaker is still involved with the Math Circle, sending math packets by mail in 2020 due to the restrictions imposed due to COVID-19, and in the spring of 2021, she will be teaching a correspondence course there.

Teaching is a passion for Haymaker, which she discovered while working as a math tutor as an undergraduate. Currently teaching Mathematical Communities and Calculus II at Villanova, Haymaker said she enjoys working with students of all levels, especially undergraduates just starting out in the program and graduate students pursuing work on their master's capstone research.

Haymaker, who graduated from the UNL Department of Mathematics with her Ph.D. in May 2014, was able to collaborate on a research project in 2017 with current research assistant Sally (Robertson) Ahrens in the UNL Center for Science, Mathematics and Computer Education, when Ahrens was a master's student at Villanova. The Enumerating Tilings project resulted

in the 2017 publication, "Counting Colorful Tilings of Rectangular Arrays," in the Journal of Integer Sequences.

"Sally and I collaborated to find a recursion for the number of ways to tile certain types of rectangles with squares, dominoes, and trominoes," Haymaker recalled. "The tilings portion was a new area for me to work on, so I want to credit Sally with being a wonderful collaborator and for working diligently to make that project a success."

Looking back at her time as a graduate student at Nebraska, Haymaker has fond memories of what led her to the program.

"I had heard from my undergraduate professors that UNL had a reputation as a supportive graduate program, and so I applied. At the time I was really interested in algebra and that was another feature that drew me to UNL," Haymaker said. "I was thrilled to be offered a spot in the program. I did find a lot of support from the department during my grad school years, from my advisor Dr. Christine Kelley, and from all of the professors and staff I had the opportunity to work with."

Even before Kelley officially advised Haymaker, Kelley brought Haymaker to a research conference

IN MEMORIAM: Ben Nolting

Dr. Ben Carse Nolting, a bright graduate of the University of Nebraska–Lincoln's Mathematics Ph.D. program whose compassion and sense of wonder uplifted his peers and professors alike, passed away at the age of 38 on Aug. 2, 2020.

Nolting's insatiable curiosity was cultivated at an early age. Born in Sitka, Alaska, on Feb. 19, 1982, Nolting was adopted by the local Tlingit tribe as a member of the Kiksadi clan and spent the majority of his youth exploring all the outdoors had to offer. This early exposure to the beauty and abundance of nature fostered Nolting's deep appreciation for the natural world, which ultimately motivated him to pursue a career in mathematical biology.

During his undergraduate career at the University of Alaska Anchorage, Nolting quickly garnered an incredible reputation among faculty. A mathematics major with both the talent and the drive to spearhead research, he frequently sought opportunities to expand his own knowledge on the subject. With the encouragement of his mathematics professors, Nolting applied for the Barry M. Goldwater Scholarship—a prestigious scholarship awarded to outstanding undergraduate students in the engineering, mathematics, and natural sciences fields—and became the university's second mathematics student to receive this honor.

Following his immense success at the University of Alaska Anchorage, Nolting continued his education at UNL as a graduate student studying theoretical ecology and applied mathematics. His Ph.D. advisors were David Logan in the math department and Chad Brassil in biology.

Nolting continued to shine at UNL; he amassed a large network of close friends and mentors who nourished his potential and helped hone his ability to solve the most complex of equations. His intense curiosity and interest in research propelled his career, and before graduating from the master's program, Nolting received recognition from the Ecological Society of America for authoring the best graduate research paper of the year at an annual ESA meeting.

After receiving his master's degree, Nolting stayed at UNL to complete his doctorate. His acclaimed Ph.D. dissertation, which explored foraging behavior, theory and simulation, earned him a postdoctoral opportunity at Case Western Reserve.

From fellow colleagues to students seeking help on online math forums, Nolting selflessly devoted his time and mathematical talents to help others succeed in the field. Many of his former colleagues recall the gentle encouragement that was a hallmark of Nolting's teaching.

"Ben was one of the kindest, most generous people I've ever met. He would repeatedly go out of his way to reach out, listen well, and help others. Whenever you talked to him, you had the sense that he was actually listening," said Mike Janssen, Nolting's friend and an associate professor of mathematics at Dordt University. "He was a brilliant mathematician. During the IMMERSE bridge program at UNL in 2007 it was a running joke that Ben was constantly solving problems in the most convoluted ways, but in reality it was a self-deprecating joke; he got to correct solutions much faster than most (certainly than I)."

Donate to the Dr. Ben Carse Nolting Fund at the University of Nebraska Foundation at *https://nufoundation.org/fund/01153370*, which was established to benefit UNL undergraduate and graduate students pursuing study in mathematics, with preference for the disadvantaged.

HAYMAKER { FROM PAGE 5 }

early on, and Haymaker found Kelley's area of research to be an ideal mix of pure math ideas, with applications.

"Katie and I started working together soon after we both arrived at UNL, and we navigated the process together. I was fortunate to start out with such a strong student," Kelley said. "She was always up for my suggestions, like meeting on the weekend to read a huge a stack of papers! Along with sharing ideas, we shared many laughs, something we continue to this day."

Since graduation, Haymaker has had the opportunity to work with Kelley on writing papers, including one in 2019 in which they both collaborated with fellow Nebraska alumna Allison Beemer. The topic overlapped all of their interests, in a paper called "Absorbing sets of codes from finite geometries," which appeared in Cryptography and Communications.

Juggling her current research and teaching responsibilities, Haymaker was candid about the difficulties: "Having increased childcare needs for my toddler during COVID-19 has effectively halted my research progress at the moment, and I am far from the only parent in this position. It is a national problem. I hope that the situation gets better soon, but these are systemic issues."

Looking forward, Haymaker hopes to get back to a practice that blends her interests in both teaching and research.

"I have found that being able to incorporate research into my teaching when possible helps me to keep both fires going, so to speak. For example, the last time I taught the graduate capstone seminar, it sparked a research collaboration with a graduate student that ended up being a yearlong project. I have also done a few independent studies with students that helped me to maintain some research momentum," Haymaker said. "Villanova has been supportive with opportunities, such as the summer grant, a grant-writing workshop, and travel support. My department colleagues at Villanova are truly wonderful."

– Stephanie Vendetti

OCUVERA:
Department, alumni forge partnership

By employing machine learning, computer visioning, and algorithms, Nebraska alumnus Lucas Sabalka gives the gift of time to the medical field through his work at Ocuvera, a Lincoln-based Nebraska Global company.

Inspired from the Latin for "true eye," Ocuvera is lending a camera's eye view on protecting hospital patients, with the goal of fall prevention.

"We use the camera to see the patient, and my job is to teach the computer how to monitor the patient, how to watch the video stream, and automatically detect when the patient is doing something that might increase their risk of falling," said Sabalka, who graduated in 2002 with degrees in mathematics, computer science, and history from the University of Nebraska–Lincoln. "Getting the mathematics behind those algorithms correct" is at the heart of his work, he added.

The end result of training machines to predict patients' movements is an increased capability to have patients monitored 24/7 in a way that human monitors are not able to provide. When a nurse might need to step away to take care of other patient concerns, a computer is still able to maintain the patient oversight, freeing up the nurse to handle other tasks as they occur.

Working with Bryan Health hospitals, Ocuvera began data collection and recording in 2014 and has since gathered and analyzed data recording footage totaling around 200,000 hours. "That's about 23 years when played back-to-back," said Sabalka, who received his Ph.D. in mathematics from the University of Illinois Urbana-Champaign in 2006.

In 2016, Ocuvera was able to begin working with the hospital to send alerts to nurses through the Ocuvera camera and monitoring system. The initial focus is on medical surgical units in

COURTESY PHOTO

Lucas Sabalka uses the Ocuvera system at Bryan Health in Lincoln. Ocuvera is lending a camera's eye view on protecting hospital patients, with the goal of fall prevention. Dr. Sabalka's job is to teach a computer how to monitor a patient and automatically detect when the patient is doing something that might increase their risk of falling.

hospitals, but the company hopes to expand to other locations where falling is a major problem.

Sabalka recently spoke about his work at Ocuvera with UNL's STEM CONNECT Scholars (see page 15), a group of students focused on pursuing careers that incorporate computer science and mathematics. Sabalka, whose interests have woven together mathematical problem solving, geometric group theory—and for a time, mathematics research—painted a picture for the group describing his own path, and the plethora of possibilities in these complementary fields.

Nebraska Global, and Ocuvera, also see the value in partnering with the Mathematics and Computer Science departments on research, seminars, and internships. In the summer of 2019, current UNL mathematics graduate student Michael DeBellevue participated in an Ocuvera internship, working with Sabalka and fellow Nebraska alumni Josh Brown Kramer.

"One challenge I've encountered about learning software development is that some skills are difficult to learn because you don't even know to learn them. One thing that I appreciated about working with Lucas and Josh was how patiently they worked to help me

grow my skill set," DeBellevue said.

DeBellevue was one of eight of the latest group of UNL math and computer science interns to work at Ocuvera, a startup composed of 12 full-time and eight part-time employees. Two current math graduate students, Meraiah Martinez and Nikola Kuzmanovski, are just beginning their internships in the winter of 2020.

"Essentially, when an opportunity for collaboration comes up, we take it," Sabalka said. "We recognize the value of education and research, and we believe that close collaboration is the best way for us to identify future product improvements and potential hires."

Sabalka first began working with Nebraska Global in 2012 for its portfolio company EliteForm, where he teamed up with Brown Kramer. Brown Kramer graduated from UNL with a bachelor's degree in mathematics and computer science in 2001 and then went on to earn his Ph.D. at UNL in mathematics in 2007. The two worked together on a project that helped athletes track weightlifting and fitness goals, using the Microsoft 3D Kinect camera. This project first gained popularity with Husker Athletics, but soon garnered the interest of other college athletics

CLASS NOTES AND IN MEMORIAM
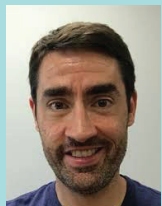
Josh Brown Kramer (BS '01, Ph.D. '07), an applied mathematician at Lincoln-based Ocuvera (see page 7) has set up a website that allows people to upload an image of themselves and zombify it for free. Makemeazombie.com uses StyleGAN2, a set of machine-learning frameworks that allows computers to analyze photos and recreate the facial features of humans. Brown Kramer was able to set up his own program to take a photo of a human and turn it into a zombie with eerie similarities. For the site, Brown Kramer hand-filtered more than 300 images of zombie makeup and masks from Pinterest and Google, curating the data so images put through the program would come out crisp and quite zombie-like. Read more in the Lincoln Journal Star at: *https://tinyurl.com/yxemkb5w*.

Courtney Gibbons (Ph.D. '13), associate professor of mathematics at Hamilton College, volunteered to mentor Clemson's COURAGE REU (organized by Sean Sather-Wagstaff, who was a postdoc at UNL), since so many REUs were canceled. Her team worked on a combinatorial commutative algebra problem, and together they got some nice results about nearly complete intersections. She also has taken advantage of Zoom to invite speakers to her algebra senior seminar. Gibbons said she hopes that the trend of virtual visits and community-building continues even when teaching goes back to "normal." She is the chair of the AWM's Policy and Advocacy Committee, and will be rotating off in January. The P and A Committee continues to assemble a resources page for COVID-19, *https://awm-math.org/covid-19/*, and welcomes community input. Gibbons also participated in Talk Math With Your Friends, a weekly virtual colloquium, on Oct. 8. She presented "The real friends are the Betti numbers we calculated along the way."

Mark Scheidies (BS, '76) of Longmont, Colorado, died at age 65 on April 30, 2020, surrounded by his family after being paralyzed in a fall a few days earlier. He was born in Minden, Nebraska, on Aug. 19, 1954, and raised on a nearby farm. Mark graduated co-valedictorian from Minden High School in 1972, and received a full Regents Scholarship to the University of Nebraska where he graduated in 1976 with degrees in math, physics, and computer science. There, he met his wife, Jennifer Marcy, and they married in 1976. Mark earned an expert ranking in tournament chess and made it into the "Jeopardy!" contestant pool six times. In 2013, he walked every street in Longmont. It took 1.5 million steps, but he met his goal and chronicled every mile on *http://www.longmontstreetwalker.com*.
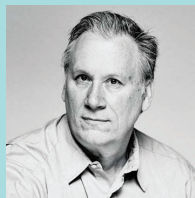
William Wolesensky (Ph.D., '02) was the 2020 recipient of the Regents' Outstanding Teaching Award from the University of Texas system. Wolesensky started as faculty at The University of Texas in the fall of 2012. While at UT Austin, Wolesensky has taught a wide range of undergraduate math courses and served on several committees. Highlights of his work at UT Austin include serving as the calculus coordinator; working with Dr. Lorenzo Sadun to create and develop the courses Differ ential and Integral Calculus for Sciences and Differential and Integral Calculus for Business and working with Dr. Michael Starbird on the Effectiv e Thinking Calculus Project. He has received institutional grants from UT Austin to increase quantitative reasoning opportunities in calculus as well as introduce experiential learning components into several calculus courses. He enjoys gardening and spending time with his family and four dogs.

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OCUVERA
{ FROM PAGE 7 }

programs around the globe.

Soon after, Sabalka and Brown Kramer both transitioned to working on Ocuvera's computer vision team, along with Ben Rush.

"Josh and I frequently work closely together and occasionally work on the same problems or with the same code, but usually we have separate specific problems we're trying to solve. For instance, lately our focus has been on machine learning, and I've been working on data acquisition while Josh has been working on model training," Sabalka said.

Over the years, Brown Kramer and Sabalka have published four papers and received nine patents together. (See more on Brown Kramer's zombify website on page 8.)

Recently, Ocuvera has garnered much attention as the recipient of the Microsoft Corporation 2020 Health Innovation Award, of which only one is awarded each year in the category of AI and Machine Learning.

"Working with Microsoft has been great. With them we've received a large amount of free Azure credit, early access to their Azure Kinect camera that forms the basis of our sensor, and opportunities to engage their hospital customers through their numerous sales channels," Sabalka said.

In the past seven years, Ocuvera has moved from idea to product development to testing throughout Nebraska, and, now, to a product that's available for a national market. "Optimistically, I hope to see Ocuvera expanding market segments, to international locations or other venues such as nursing homes or in-home applications, within five years —once we've proven our model works for our initial target setting," Sabalka said.

Microsoft CEO Satya Nadella and other Microsoft executives bring up Ocuvera in private and public comments, which has been invaluable for this small startup.

"I am very excited for what the next 12 to 24 months will bring," Sabalka said.

– Stephanie Vendetti

GERRYMANDERING: Traveling talk merges mathematics, politics

For two years, Steve Dunbar and Kristie Pfabe have been collaborating on a traveling talk about the timely subject of gerrymandering and the ways in which mathematics can be used to address this societal issue and help to eradicate it.

Since Dunbar, professor emeritus of the Department of Mathematics at the University of Nebraska–Lincoln, and Pfabe, professor and department chair of mathematics at Nebraska Wesleyan University, discovered their shared interest in the subject, they have given the talk to 22 different groups, ranging from a 15-minute presentation to a four-week mini-course for adults.

"My hope for the talk is that people will understand what gerrymandering is so that they can speak of it in simple terms to family, friends, and neighbors, and that people will understand that with mathematics and computer science, it is possible both to measure the extent of gerrymandering and to make the redistricting process far more objective," Pfabe said.

Nationwide, there is currently a much greater awareness of the abuses and misuses of the redistricting process, Dunbar said.

"This is partly due to some high-profile gerrymandering court cases in Pennsylvania, North Carolina, and Maryland, and partly due to the fact that mathematicians, data scientists, political scientists, citizens, and advocacy groups have some new tools to uncover gerrymandering practices. As a result of both trends, in 2018 and 2020, Colorado, Michigan, Missouri, and Virginia have passed laws and constitutional amendments to put redistricting in the hands of non-partisan redistricting commissions, joining Arizona and California," Dunbar said.

Dunbar cited his interest in the

COURTESY PHOTO

Since Steve Dunbar, professor emeritus of the Department of Mathematics at the University of Nebraska–Lincoln, and Kristie Pfabe, professor and department chair of mathematics at Nebraska Wesleyan University, discovered their shared interest in the subject of gerrymandering, they have given a talk to 22 different groups since 2018.

intersection of mathematics and politics—probability theory (specifically the Markov Chain Monte Carlo method) and learning about graph theory and working with large data—as his inroad to the subject of gerrymandering.

"I've always had an interest in the applications of mathematics to biology, economics, and political science," Dunbar said, "so I was intrigued by mathematicians getting involved in a political issue and bringing some mathematical tools and viewpoints to the redistricting process."

Pfabe's interest in gerrymandering comes from her broader concern about voter suppression. She wrote an article for the Lincoln Journal Star against a voter ID bill and twice testified before the Nebraska Unicameral's Committee on Government, Military and Veterans' Affairs on such legislation.

She feels mathematicians play an important role in explaining and

informing local and national issues. She has written social media posts to explain why giving voter information to the Election Integrity Commission would have been dangerous; to show how taxation of food disproportionately affects families on the lower end of the economic scale; to share the mathematics behind 'pooled COVID testing'; and to share why the case fatality rate is not a good measure to say how well a country is doing in fighting the virus.

Besides speaking to groups such as the Kiwanis Club, Rotary Club, UNL's STEM CONNECT Scholars group, and the League of Women Voters (their first talk), Dunbar and Pfabe added hands-on activities when speaking to the Lincoln Area Math Teachers' Circle and the Osher Lifelong Learning Institute.
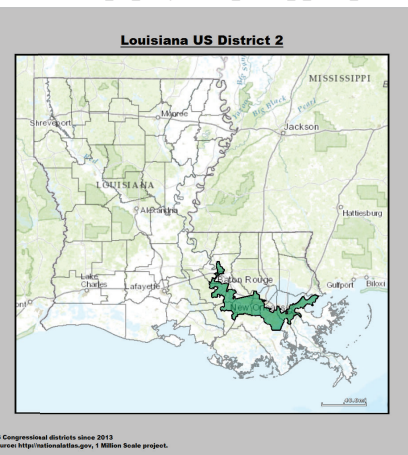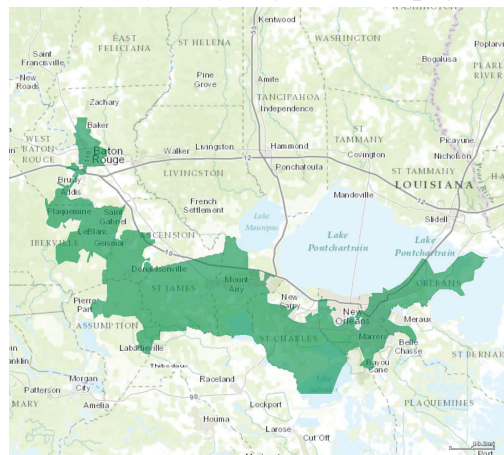
"We used games and exercises

GERRYMANDERING
{ FROM PAGE 9 }

to illustrate some of the ideas, like gerrymandering a mythical State of Squaretopia. We also used pipe-cleaners to illustrate the idea that a circle encloses the greatest area with a fixed perimeter," Dunbar said.

Frequent Math Teachers' Circle presenters, Dunbar and Pfabe have a working relationship that goes back to their days at UNL when Pfabe was a graduate student and Dunbar was faculty.

The journey to their gerrymandering talk partnership began for Pfabe with a pivotal moment in which she attended the Metric Geometry and Gerrymandering Group conference on Geometry of Redistricting in the fall of 2017. This first conference, held in Boston, Massachusetts, stemmed from a working group under the leadership of faculty at Tufts University and the Massachusetts Institute of Technology and set off a series of regional conferences, one of which Dunbar attended at the University of Wisconsin-Madison later in 2017.

Following his attendance of the conference in Wisconsin, Dunbar gave a solo talk on gerrymandering to UNL's discrete mathematics seminar. A Wesleyan colleague, who received announcements of these seminars, mentioned to Pfabe that Dunbar had

https://en.wikipedia.org/wiki/Louisiana%27s_congressional_districts (Louisiana_US_Congressional_District_2_(since_2013).tif)

An example of gerrymandering is the boundaries for Louisiana's 2nd U.S. Federal Congressional District. The district starts in New Orleans and follows the Mississippi River up to Baton Rouge. Note that there is one area that is about as wide as an interstate, in order to include north Baton Rouge, Scotlandville, and Baker. One third of all Democratic voters in Louisiana reside in this district.

attended a conference on gerrymandering. Pfabe subsequently reached out to Dunbar to ask for some advice on her upcoming solo talk to the Nebraska section meeting of the American Mathematical Association for Two-Year Colleges. And so began their collaboration.

"It's been a really neat experience for me to work with one of my professors from graduate school," Pfabe said. "Steve and I have different strengths, and I feel that we have used these strengths to improve our presentations; the first talk we gave is pretty different from the last one."

Besides the fun factor, Dunbar also appreciates the chance to present complementary viewpoints.

"This talk raises awareness of not only the abuses of gerrymandering and how it biases the political environment and robs votes, but it also shows that mathematicians have a lot to contribute to modern social and political issues," Dunbar said. "It shows people that mathematics can be fun, useful, interesting, and different from what is encountered in school."

Dunbar and Pfabe both feel mathematicians can use their skills and knowledge to actively engage in what they refer to as "civic math."

"It is important to me to use my skills this way and to communicate the mathematics of civic life in simple terms," Pfabe said.

– Stephanie Vendetti

Campaign Code: 1LA&S20-MATH

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NMSSI: K–12 teachers learn in place

Over the past two decades, the Department of Mathematics at the University of Nebraska–Lincoln has made a major commitment to offer graduate courses designed specifically for K–12 mathematics teachers.

What began as a partnership with local teachers in Lincoln has grown to a global contingent of nearly 500 teachers who have earned master's degrees since 2006. The department currently has 17 mathematics courses and two statistics courses for teachers that are officially a part of the graduate curriculum. All courses share the common purpose of emphasizing mathematical knowledge for teaching.

Apart from this past summer, the Nebraska Math and Science Summer Institutes (NMSSI) has delivered face-to-face instruction over one or two weeks, as well as fully online graduate courses, for teachers. The flexibility the program offers allows teachers to take courses that fit nearly any schedule. The opportunity to teach K–12 teachers synchronously online for several hours per day in the summer provided invaluable experience for faculty, especially those in the early part of their career, to prepare for online teaching this fall.

Delivery of live instruction

In the immersive experience of the NMSSI, the learning is highly interactive and group-oriented, with very little lecture. Instructors are charged with modeling high-leverage, pedagogical practices so the teachers can experience learning using methods that would be comparable to those used in their own classrooms. It was clear to NMSSI director Michelle Homp, associate professor of practice, that the one-week schedule of 40 hours of live instruction via Zoom would not work. Yet, having teachers interact with one another, as well as with the instructor on a personal level, was a high priority. A fully live ("synchronous") setup was unrealistic; turning every course into fully on-demand ("asynchronous") was less likely to promote the desired peer-to-peer engagement.
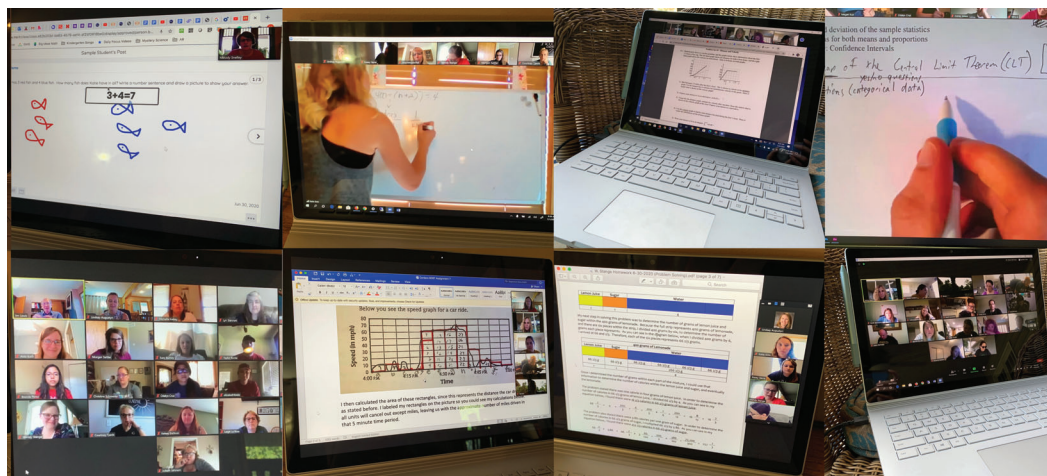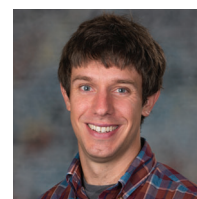

PHOTO ILLUSTRATION BY LINDSAY AUGUSTYN | UNL CSMCE

As a result, the most common synchronous model for Summer 2020 was for classes to meet over a two-week time period, using various strategies to limit synchronous requirements to three to four hours per day. These synchronous hours generally consisted of two or more cycles of whole class, teacher presentations; small group work time/discussion; group presentations; and whole class wrap-up. Outside of that time, teachers could continue to work in small groups or work on their own to complete homework assignments or review material in preparation for the next day. Virtual office hours were often offered in the late afternoon or evening.

As follows are examples of two outstanding researchers in the UNL Department of Mathematics who used a blend of live and on-demand activities in their synchronous summer courses: Alex Zupan, assistant professor; and Adam Larios, who was recently promoted to associate professor. The first highlights the development of community, still with asynchronous support, and the second follows an instructor's journey navigating technology and techniques for effective instruction

Alex Zupan: Creating an engaging online environment

Math 811T: Functions for High School Teachers met synchronously every day for two weeks from 8 a.m. to noon, with a half hour of break time. In early June, I taught this course, which was the first of the summer to test this format. I diligently worked to maintain student engagement by breaking the meetings into periods focused on lecturing and periods focused on solving problems in breakout rooms, monitored by myself and a graduate teaching assistant.

Asynchronous learning opportunities supported the live class sessions. Roughly 24 hours prior to each class period, I would post readings about the topics for the next day along with the exercises the teachers would complete in the breakout rooms. Designing breakout session problems was certainly one of the more time-consuming aspects of writing these notes. I wanted to include problems that would involve some kind of discovery learning, in which teachers organically encounter formulas and ideas on their own instead of merely following an algorithm or a sequence of steps. At the same time, I needed to scaffold the exercises appropriately so that they could get started on their own. Finally, I needed to make sure that the difficulty level was appropriate so that the groups could complete the problems in

COVID MATH MODELING LESSON

A new resource by UNL professor emeritus of mathematics **Glenn Ledder** allows students and the general public to conduct their own experiments to learn about the population dynamics of COVID-19.

Ledder developed a mathematical model to help people study these dynamics and make their own conclusions based on real-world scenarios. The module embeds a simple model designed specifically for the COVID-19 pandemic into an environment where students can easily design experiments and observe possible outcomes. The model can be a source for teachers who are struggling to find relevant course material during this time that helps their students learn about this defining moment in history.

"With humanity facing a worldwide crisis like nothing any of us have experienced, we really need to learn as much as we possibly can about every aspect of the COVID-19 danger," Ledder said.

Using a workbook that functions like a "sandbox," students can define experiments with up to three scenarios and receive results about three diff erent population percentages: people who died, people who remain susceptible and people who need to be hospitalized.

"Experts on population dynamics of infectious diseases are the people who can best judge the correctness of claims made about what directions the epidemic can take and how social policy choices will affectt he outcome," Ledder said.

The material, available at *www.math.unl.edu/covid-module*, is suitable for K–12 students, members of the general public and college students in lower level mathematics courses. Ledder also has recorded two demonstration videos on the site. Teachers can email gledder@unl.edu for the answer key.

MATH DAY 2.0: Bowl only

The 31st annual Nebraska Math Day was held online on Dec. 3, 2020, with 68 teams from 41 schools across the state. The event, which consisted of only the bowl team competition, was held on Zoom in 18 different rooms and hosted by UNL Mathematics facilitators.

Referred to as "Math Bowl 2.0," the bowl tournament was a Swiss-system style of play where two teams were paired using a set of rules designed to ensure that each competitor plays opponents with a similar running score, but does not play the same opponent more than once. The team competitions was divided into two classes, Competitive and Recreational, with 38 teams in Competitive and 30 in Recreational. Each class was guaranteed five rounds of play for each team.

Trophies were given to the top four teams in each class: 1st place Competitive: Lincoln East C1, 2nd place Competitive: Scottsbluff C1, 3rd place Competitive: Scottsbluff C2, 4th place Competitive: Millard North C1, 1st place Recreational: Omaha Brownell-Talbot R1, 2nd place Recreational: Lincoln East R1, 3rd place Recreational: Lincoln Southwest R1, and 4th place Recreational: Bellevue East R1. Results also at: *go.unl.edu/md2020results*.

Recruiters from 18 UNL departments and units hosted "open house" Zoom rooms throughout the day to discuss STEM majors with the middle school and high school students.

NCUWM: Undergrads will present, network virtually

The 23rd Annual Nebraska Conference for Undergraduate Women in Mathematics (NCUWM) will be held online January 22-24, 2021.

Plenary speakers are Drs. Cecilia Aragon, Ruth Haas, and Talitha Washington.

Aragon is the director of the Human Centered Data Science Lab and professor in the Department of Human Centered Design and Engineering at the University of Washington, Seattle.

Haas is the president of the Association for Women in Mathematics and professor and graduate chair of mathematics at the University of Hawaii, Mānoa.

Washington is the inaugural director of the Atlanta University Center Data Science Initiative and professor of mathematics at Clark Atlanta University. Washington is also a former program director at the National Science Foundation (NSF).

Other invited guests are Karoline Pershell, chief operating officer of Service Robotics and Technologies; Julia Read-LaBelle, global supply and inventory analyst at Nike, Inc.; Shanise Walker, assistant professor of mathematics of University of Wisconsin-Eau Claire; Laura White, aerospace engineer at NASA Langley Research Center; and Martha Yip, assistant professor of mathematics at the University of Kentucky.

Women, and particularly women of color, are underrepresented in the mathematical sciences, especially among jobs that require graduate education. UNL recognizes the need to encourage and mentor undergraduate women in mathematics to pursue graduate study in mathematics and to seek mathematical careers. NCUWM provides role models, insider knowledge, opportunities to present undergraduate research, and a growing community of peers interested in issues related to creating a supportive environment for women in mathematics.

NCUWM is open to all undergraduate students age 19 or older and their faculty advisors.

NCUWM is made possible with generous support from the National Science Foundation and the National Security Agency. Learn more at *go.unl.edu/ncuwm*.

NMSSI

a certain time frame without finishing too quickly.

Being particularly concerned with encouraging active participation, I took deliberate actions to set an appropriate tone at the outset of the course. The initial breakout session allowed for a free and open discussion of familiar topics, beyond just introductions. I also scheduled individual meetings with each teacher during my office hours. In fact, the teachers themselves were the primary factor in determining the success of the breakout sessions. Each time they entered a new breakout room (created randomly), one or more people would assume a leadership role and initiate the discussion within each group. They were also technologically prepared to work together online. Many teachers had a tablet and stylus with which to share their thoughts, and several even had a document cam, which they had obtained to present online to their own students the previous spring.

"Alex did an amazing job at displaying how a classroom type environment can be formed via Zoom. I admit to being quite skeptical at the start of the summer as to how these courses would play out. I learned a lot and found ways to really make the most of this type of learning," one teacher said.
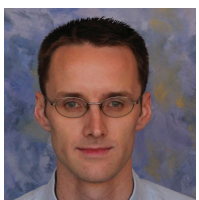
Adam Larios: Navigating technology

After teaching online for the first time in Spring 2020 due to COVID-19, I welcomed an opportunity in the summer to teach Math 812T: Geometry for Geometry Teachers, a fully online, synchronous course to secondary mathematics teachers on non-Euclidean geometry. After positive feedback from Alex and other instructors, my July course also met every day for two weeks from 8 a.m. to noon.

In the spring with asynchronous instruction, I knew the importance of still maintaining a connection with students. I believe that math lectures feel more tactile when the writing being done is live (think of visceral clicking of chalk writing on a blackboard versus the sterility of a PowerPoint presentation), so I wanted my face to be visible and my writing to be live when recording presentations for online learning. I kludged together a setup where the camera in my phone was held in place a few feet above a piece of paper; the setup was a stack of books with some plastic rods sticking out, and the phone held on by rubber bands. I found a way to make my computer display my phone's camera, then had my computer's webcam display my face on screen, and finally recorded the whole screen using a free video program called OBS Studio.

For the summer, I chose to structure Math 812T to cycle between synchronous presentations and small group explorations, avoiding asynchronous lecture videos as much as possible. Teaching non-Euclidean geometry requires many hands-on demonstrations, so I prepared the teachers in advance. For example, Lénárt spheres (large plastic spheres with a markable and erasable surface) were used to explore spherical geometry in the face-to-face course but would not be available online. Thus, before the course began, I asked participants to find a spherical object in their house that they could mark on, which turned out to be both effective and entertaining. Students used apples, oranges, beach balls, volleyballs, or even their own fist. One student even used his own head, which turned into a source of comic relief for everyone. Students also used bagels, donuts, and children's stacking toys to explore torus shapes, while others explored shapes using Geogebra.

One teacher appreciated the visuals and remarked: "It is highly beneficial when you demonstrate for us on your yellow sphere. A lot of times, I can't visualize what we are trying to picture, but seeing it from you helps tremendously." (See cover photo illustration.)

Learning in place

Although the NMSSI had been successful in attracting teachers to take courses for nearly a decade, the program directors faced a new and unfamiliar challenge with all courses being remote instruction.

With Homp and Lindsay Augustyn, assistant director and communications coordinator of UNL's Center for Science, Mathematics, and Computer Education, at the helm, using the slogan "Learn in Place" they launched a marketing campaign to let K–12 teachers know the changes that UNL had instituted for Summer 2020 courses.

Since all courses went fully online, the originally intended in-person courses were now available to anyone. The advertising described the NMSSI's range of course delivery methods. Teachers could now choose to take a course for two, three, four, five or eight weeks, either synchronously or asynchronously. UNL waived nearly all fees for summer courses and made online tuition per credit hour the same cost as in-person resident tuition, making courses much more affordable for all of the teachers, regardless of resident status or geographic location.

Just as people were encouraged to shelter in place during the pandemic, the NMSSI emphasized the importance of learning in place. Nebraska teachers and out-of-state teachers alike were no longer limited by the location of the course. Non-Nebraska residents were able to take a course more affordably and, if they chose a synchronous course, interact with peers virtually. With the learn in place concept, the adjusted programming could emulate the NMSSI promise of 40 hours of face-to-face instruction with highly engaging web conferencing that kept the mission of peer interaction that focused on learning.

UNL's Summer 2020 NMSSI program included nine courses that used a synchronous approach and eight that used an asynchronous approach. Fourteen were math/stat courses and three were math education courses. In total, there were 263 registrations, with some teachers taking three or even four courses. Looking back, the 2020 registrations were 27% higher than in 2019 with most of the courses taught in person. Thus, the program was quite successful despite the pandemic and the need to have all courses online.

— *Michelle Homp and Lindsay Augustyn*

AGAM: A lesson in adaptation

Transitioning the 24th annual AGAM high school summer camp to an online experience turned into a lesson in creative adaptation for the camp's undergraduate coordinator.

Originally created by Professors Wendy Hines and Judy Walker in 1997, AGAM has grown to be a nationally renowned summer program that fosters lasting connections amid talented young mathematicians.

When Samantha Wolff, a senior secondary science education major who is graduating in December 2020, joined the AGAM staff as undergraduate coordinator at the beginning of the year, she was determined to help continue the program's mission of providing high school students with an opportunity to network and sharpen their math skills during the one-week residential camp at UNL. However, when the university announced its switch to remote operations until the fall semester, she and the coordinating staff had to rapidly shift gears.

Without a clear model for transitioning an in-person camp to a virtual setting, Wolff and the AGAM team of faculty and staff quickly recognized that preserving the camp's sense of community would be both the largest planning obstacle and the most necessary focus of this year's program.

While this year's applicants were given the option to defer their acceptance to the program until 2021, one student from Brazil and 14 campers from across the United States opted to attend AGAM, at no cost, online. It was possible to offer the camp for free because of the generous support of the American Mathematical Society's Epsilon Fund, the Nebraska EPSCoR grant from the National Science Foundation, private donations to the University Foundation, and the UNL Center for Science, Mathematics, and Computer Education (CSMCE).

The CSMCE program staff understood that to foster tight-knit friendships in an online camp, it was imperative to incorporate effective and engaging virtual activities throughout the weeklong schedule that would mitigate the loss of in-person interaction.

After months of consulting with the lead instructor Dr. Marla Williams and events coordinator Stephanie Vendetti to brainstorm ways to conduct an impactful online experience, Wolff and the staff felt confident in the adjusted camp curriculum. Coupled with a little bit of practice using Zoom, Wolff's creative thinking led the team to successfully execute an innovative virtual camp from July 12–18.

Williams and Wolff worked closely to ensure that collaboration would be a central component of the campers' daily cryptology and number theory course. Because the students were not assigned homework during the online camp, extra class-time gave them opportunities to solve difficult problems and discuss solutions together, which served to strengthen their bond as a group.

Wolff also enlisted the help of UNL mathematics major Taylor Bartek to design interactive networking activities online to keep the 15 campers engaged. The campers took

PHOTO ILLUSTRATION BY LINDSAY AUGUSTYN | UNL CSMCE

part in solving a virtual escape room, went on virtual tours of Duncan Aviation and the Nebraska State Capitol, and participated in online workshops with Morrill Hall and the National Museum of Mathematics in New York City.

They also fired off questions to two panels—one on careers with women mathematicians from a variety of fields and one with undergraduate students in STEM majors at UNL.

A week before camp, Wolff created a GroupMe to help the campers get acquainted, and all of the students worked as one team throughout the week.

"By the time they logged on for the first day of camp, they had already established a banter and familiarity among themselves that energized the rest of the week," Wolff said.

The camp kicked off with the students eagerly opening their mailed surprise boxes, filled with swag, together on Zoom. They were welcomed by Associate Professor Yu Jin, camp faculty director; Professor Tom Marley, chair of the Department of Mathematics; and camp alumna Magnolia Chinn. Chinn discussed how the camp motivated her to seek out similar opportunities in STEM as an undergraduate student.

While the majority of AGAM online maintained a similar structure to the in-person camp, instead of attending a mini-course on a different mathematics topic every day, the girls had one course on the model of infectious diseases on the last day of camp to help them learn more about the applications of math to the current global health crisis.

"Show and share," a Zoom talent show that allowed the campers to display their other various skills and interests, proved to be the highlight of the week. After witnessing the campers' show of support and excitement for one another, it became clear to Wolff that this activity truly solidified the camaraderie that they had been developing all week online.

The next AGAM camp, for all genders, will be online from July 11–17, 2021. Find out more information and apply at *https://www.math.unl.edu/programs/agam*.

– Gabrielle Cottraux and Lindsay Augustyn

STEM CONNECT: Two cohorts of Scholars join UNL, SCC, WNCC

The STEM CONNECT grant, funded by the National Science Foundation, has chosen its Spring 2020 and Fall 2020 Scholars to its scholarship program and STEM community partnership between the University of Nebraska–Lincoln, Southeast Community College, and Western Nebraska Community College.

The grant focuses on students who are majoring in computer science, computer engineering, mathematics, and software engineering. The following students have joined STEM CONNECT in 2020 (high school in parentheses after hometown; Nebraska unless otherwise noted):

University of Nebraska–Lincoln

Michael Bean, Bellevue (Bellevue West)

Philip Chohon, Wahoo (Bishop Neumann)

Eric Corrado, Okinawa, Japan (Kadena Air Force Base)

Ronit Gandhi, Omaha (Millard West)

Santiago Giraldo, Cambridge (Cambridge Public School)

Macy Howe, Lincoln (North Star)

Sorawish Kittikhankul, Omaha (Millard South)

Nicole Livingston, Spokane Valley, Washington (Central Valley)

Emmanuel Lopez Mateo, Saline County (Crete)

Theresa Mai, Lincoln (Pius X)

Caleb Marcoux, Roca (homeschool)

Arielle Monson, Orion, Illinois (Orion)

https://scimath.unl.edu/stem-connect

Alexander Muenster, Sioux Falls, South Dakota

Brandon Ramos, Scottsbluff (Scottsbluff)

Braeden Schmer, Ogallala (Ogallala)

Lexus Root, Lincoln (Lincoln High)

Michael Sanders, Omaha (Central)

Spencer Schmidt, Diller (Diller-Odell)

Abby Seibel, Elkhorn (Elkhorn High)

Alexandra Sierra-Mendoza, Seward (Seward)

Sawyer Smith, Colorado Springs, Colorado (Discovery Canyon Campus; see page 24)

Spencer Supik, Central City (Central City)

Hadley Susie, Firth (Norris)

Southeast Community College

James Berg (Midland High School, Univ of South Dakota Vermillion)

Rayonna Gearhart (Lincoln East)

Frederic Herbert Bekoo minko (Sangmelima Tech, Cameroon)

Nori Khalaf, Duhok, Iraq

Brian Marmon, Wymore (Southern)

Mohammed Sbai

Victoire Letissia Nana Noundou, Yaounde, Cameroon (Pi and Ju Angelsaxone College)

Anaelle Nimpa

Raoul Patrick Nya Wandji (Cegt Malangue, Doueala, Litoral)

Gideon Ray (Lincoln Pius X)

Wyatt Ray (Lincoln Pius X)

Susanne Rott (GED)

Shawn Shonerd (Lincoln Northeast)

Jared Thomas (Rock Port R-Ii, Missouri)

Matthew Thomas (Lincoln High)

Brittany Thompson (Humphrey Junior-Senior High)

Logan Wessel, Wexford, Pennsylvania (North Alleghendy)

Western Nebraska Community College

Destany Hill, Scottsbluff (Scottsbluff)

Adam Ouderkirk, Bayard (Bayard)

Alan Ouderkirk, Bayard (Bayard)

Gracey Perez, Rushville (Gordon Rushville)

Braeden Stuempler, Rushville (Gordon Rushville)

Kade Thunderbull (Gering High)

Tate Carson (Torrington High, Wyoming)

Shawn Rabine (Chadron High)

Elli Winkler (Gering High)

STEM CONNECT PROFILES

Read more about all of the Scholars at *https://scimath.unl.edu/stem-connect/profiles* and more in-depth here:

Abby Seibel *go.unl.edu/ycg2*

Michael Sanders *go.unl.edu/geo6*

Brandon Ramos *go.unl.edu/nm_ramos*

Rapid Response grant focuses on transition plan

A team from the Department of Mathematics is one of 20 UNL research teams selected for internal funding from the Office of Research and Economic Development's COVID-19 Rapid Response Grant Program. The grants support short-term activities that responded to the pandemic.

Allan Donsig, as principal investigator (PI), and co-PIs Wendy Smith, research professor, and Nathan Wakefield, associate professor of practice, were awarded $31,728 for their proposal "Communities of Practice in First Year Math Courses: Investigating the Transition to Remote Learning."

The purpose of the grant was to study how the sudden transition to online instruction affected both students and graduate student instructors in first year mathematics courses.

The research emphasized the role of existing supports, particularly the established community of practice, a community of instructors who are working together.

Communities of practice are important to long-term change in a department's instructional practice. This transition was an opportunity to see clearly the role of a community of practice in supporting instructors' adoption of teaching practices. Using extensive data on student outcomes, the department aimed to understand how the community of practice affected students' learning and their perceptions of instruction.

"We looked at what we did, how things worked, and what our instructors' experiences were," Donsig said. "We found diverse partner institutions to try to build upon this study through a proposal to NSF. How do we do this for an institution like a commuter campus where people are teaching courses in different places? How can you build a high-quality instructional system in a department that supports instructors who are not necessarily all in the same building for eight hours a day? How do they collaborate when you know physical proximity is not the glue that makes everything work?"

When hallway conversations in Avery disappeared and every communication had to be either a Zoom meeting or an email, keeping everyone synchronized became much more complicated.

"I'm learning how to continue to empower the instructors, even when we can't be with them in the same room," Wakefield said.

Grant funds learning assistant mentoring program

In the spring, Josh Brummer led the department to receive a $50,000 collaborative Seeding Student Success grant from the university's Center for Transformative Teaching.

Along with Rachel Funk, doctoral student in mathematics; Kasey Linde of the College of Business; Ashok Samal of computer science and engineering; and Nathan Wakefield, Brummer's active learning project "Developing a Cross-Disciplinary Learning Assistant Support Program" impacts students enrolled in first- and second-year courses and more senior students assisting in those courses.

The purpose is to develop and implement an extensive pedagogical and peer support program benefitting learning assistants (LAs) and tutors across campus. This interdisciplinary professional development program is for undergraduate students who help facilitate active learning classrooms, known as LAs.

LAs have been a staple in some 100-level math courses for several years, working closely with graduate student instructors to foster collaboration and active engagement among students. The LA program expanded in the Fall 2020 semester to connect with instructors of courses ranging from Intermediate Algebra up through Business Calculus, supporting the active learning of upwards of 2,000 students. With this expansion came the timely introduction of a cross-disciplinary support program for LAs.

All 31 LAs in the math department are supported by a weekly general pedagogy seminar taught by Brummer, wherein math LAs join with tutors and other LAs from different disciplines to learn about and discuss topics such as learning theories and mindsets, becoming a reflective teacher, and cognitive demand. Meetings every other week with the cohort of LAs for a single course are led by each course's associate convener.

Existing research suggests that underrepresented minority students may particularly benefit from having an LA in the classroom, and LAs can help increase student engagement and contribute to the development of an equitable and inclusive classroom environment, which can be particularly beneficial to students at risk of dropping, failing, or withdrawing from a course. Funk is organizing research associated with this project to examine the impact of the support program on the professional development and teaching knowledge of LAs. Survey and interview data is being gathered throughout the academic year in support of this project.

TEACHING
{ FROM PAGE 1 }

"It was not everybody for themselves, doing their own thing and each individually building their own 'online instruction wheel.' It was a collective effort led by Josh and Nathan and the conveners and associate conveners," said Donsig, who chairs the task force and is vice chair of the department. "In the midst of, in what is effectively a teaching crisis, the investment the department has put into supporting instruction—by having people who are good at instruction and coordination—made a huge difference to our ability to implement systematic solutions at scale in a very short period of time. And that was a remarkable achievement."

The Friday before the students left for spring break, and to return home for the semester, Wakefield and Homp led a workshop showcasing best practices for online courses. In the last decade, Homp has taught many online courses for teachers across Nebraska, experience she generously shared during the sudden transition.

Brummer took the lead in setting up the Math Resource Center online. The MRC website now has a table with all of the time slots for the week and a link for each course.

"We tried to coordinate projects as much as possible. For example, in Calculus I, all of the recitation instructors switched to discussion boards, and they worked together to create
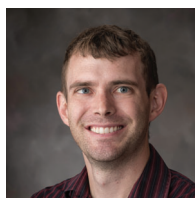
Josh Brummer

Allan Donsig

Nathan Wakefield

more thought-out templates and prompts," Brummer said. "Then, everyone would share, and we would centralize those on a Wiki. Other instructors could post and let their students discuss and then we would monitor those discussions."

One positive result of the extra work of the spring shutdown was that the task force had previously discussed the desire to make supplemental videos for the courses' content, which could be embedded in the open resource textbook or made accessible to students as optional, additional materials. To assist the instructors, the department bought several iPads, as they are highly suitable for recording a lecture and have the ability to write on the slides as lecturers' present. As a result, the department quickly had its collection of recorded lectures.

Spring courses were fully asynchronous to support all students regardless of their technological resources at home. Summer courses were completely online from the start and most were synchronous, where students met and discussed course material, working in groups in much the same way as with in-person classes.

"The summer mode allowed instructors to focus on delivering content online. Their focus was not split between in the classroom and online. It allowed our instructors to become experts in one area instead of trying to balance multiple areas," said Wakefield, an associate professor of practice.

Wakefield also shifted the pedagogy course for graduate students to focus on the online and hybrid

models in the spring, and then the summer orientation focused on how to operate in the hybrid model for the fall. The second-year graduate students coming into the fall semester had 24 hours' worth of orientation work, and they had been meeting for two-and-a-half hours a week for continued professional development, plus homework to complete on their own.

For the fall, the university put a priority on in-person instruction, to better meet students' expectations. What has to come to bear is that the students prefer their overall college experience to be in-person, while the format of their classes can vary, depending on the course.

"I think there are some students for whom being able to come in-person is incredibly important, and other students are happy to be on Zoom all the time and they can make that work. It's kind of split by student preference," Donsig said.

Wakefield added: "The biggest challenge of the fall format is an inconsistency of approach because students come to class one day and then they have to figure out how to do it online for two days. When we've got students doing the same thing, consistently, they tend to do it much better."

In Spring 2021, UNL has mandated that every student in an in-person class should have the opportunity to attend in-person at least once a week, a requirement math department courses already met this fall.

Policies and guidance developed last spring by the task force can now be implemented in Spring 2021.

"This spring, we're going to be able to have instructors teaching with full focus on a single type of student engaging in the course, so small groups in the classroom or larger online sections, supported with a few learning assistants. But, no matter what, all students are attending the same way. That will have a good impact," Brummer said.

— Lindsay Augustyn

# OPEN ACCESS: Workshop builds communities of practice

The Nebraska Open Access Materials (NOAM) Online Workshop, organized by Nathan Wakefield, Karina Uhing, and Josh Brummer, brought together around 40 mathematics instructors from across the state of Nebraska to showcase the active learning materials used in first year math courses at the University of Nebraska–Lincoln.

Participants, including faculty from UNL, the University of Nebraska at Omaha, the University of Nebraska at Kearney, Southeast Community College, Western Nebraska Community College, Metropolitan Community College, and Central Community College, learned how to access and teach with the NOAM for courses ranging from Intermediate Algebra through Calculus II and Contemporary Mathematics. These materials include online textbooks (otherwise known as Open Educational Resources or OERs), online homework problems, and course packet materials developed within the department. Participants also discussed innovative teaching ideas during the global pandemic and ways in which participants could leverage the community of practice to become change agents in their own institutions.

Over the course of three days, interactive online sessions were hosted around effectively engaging classrooms of diverse sizes and backgrounds using active learning, choosing and incorporating innovative technologies, managing data and communicating the impact of classroom efforts, and becoming a departmental change agent. Participants benefited from discussions with others at their same institution about implementation strategies for the myriad new ideas and resources presented at the workshop. The overarching message that emerged from the workshop was the great opportunity present within Nebraska for instructional collaboration in first year mathematics courses.

In particular, the workshop laid the foundation for a
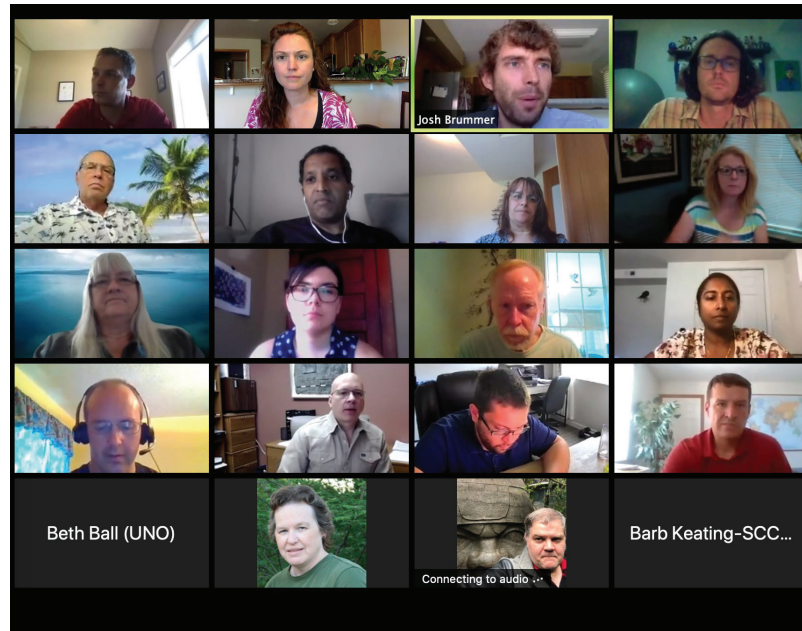
community of practice built around collaborating to continue to build and instruct with the NOAM materials and to adapt the materials to the many local contexts of institutions across the state.

At the conclusion of the workshop, participants were invited to consider further collaboration, and this invitation was received with an overwhelmingly positive response rate. To this end, the group plans to continue to meet to determine how the community will grow. Both SCC and UNO have courses that are running pilots using NOAM materials. Other institutions have expressed interest in the materials. The department expects to see further pilots as this community of practice develops.

NEW GRANTS

George Avalos, The KUMUNU-ISU Conference in PDE, Dynamical Systems and Applications, National Science Foundation (NSF)

Huijing Du, Embracing the uncertainty: Make big data bigger and radiomics models better, University of Nebraska Collaboration Initiative (see page 21)

Mikil Foss and Yu Jin, All Girls/All Math 2020, American Mathematical Society

Yu Jin, Population Dynamics in Heterogeneous Environments, Simons Foundation

Christine Kelley, Glenn Ledder, and Alex Zupan, Nebraska Conference for Undergraduate Women in Mathematics, NSF

Adam Larios (with Florin Bobaru), Corrosion-Induced Fracture and Failure: Transforming Computations from Micrometers and Minutes to Meters and Years, NSF

Christopher Schafhauser, Classifying *-Homomorphisms, NSF

Alexandra Seceleanu, Conference on Unexpected and Asymptotic Properties of Algebraic Varieties, NSF and National Security Agency

Alex Zupan, Interactions of 3- and 4-Dimensional Topology, NSF

NEW FACULTY: Eloísa Grifo and Jack Jeffries

The University of Nebraska–Lincoln Department of Mathematics is pleased to welcome commutative algebraists Jack Jeffries and Eloísa Grifo to its faculty as tenure-track assistant professors. While Jeffries began teaching at UNL in Fall 2020, Grifo will begin her appointment officially in Fall 2021.

Eloísa Grifo

"UNL has been a huge commutative algebra center for many decades, so I'm very excited to join the department," Grifo said. "Truly, there's nothing I'm more proud of than being able to do the job that I love every day—especially considering how difficult the job market is these days."

Both Grifo and Jeffries already have connections with UNL that go back several years. A collaborator on Jeffries's first paper was then-UNL graduate student Courtney Gibbons, and Jeffries's first research conference talk was in the basement of Avery Hall at KUMUNUjr.

Jeffries also collaborated with former UNL faculty member Carina Curto and past UNL graduate students Katherine Morrison and Nora Youngs on "Algebraic signatures of convex and nonconvex codes," which was published in the Journal of Pure and Applied Algebra in 2019, as well as "What makes a neural code convex?" which appeared in the SIAM Journal of Applied Algebra and Geometry in 2017.

Grifo's most recent paper, "A stable version of Harbourne's Conjecture and the containment problem for space monomial curves," was published in the Journal of Pure and Applied Algebra in 2020, and she was scheduled to give the talk "A survey on Harbourne's Conjecture" at UNL's BrianFest in May, but the conference was postponed. She has

collaborated with former UNL postdoc Alessandro De Stefani (with Jeffries); current UNL faculty member Alexandra Seceleanu; and former UNL graduate students Ben Drabkin and Josh Pollitz.

Jack Jeffries

Before coming to UNL, Grifo was an assistant professor at the University of California, Riverside, first arriving there in July 2019 as a visiting assistant researcher. Jeffries was an Investigador Titular A (tenure-track faculty) in the pure math group at the Centro de Investigación en Matemáticas, A.C. (CIMAT) in Guanajuato, México. Grifo and Jeffries both spent time in the University of Michigan mathematics department prior to those appointments, Grifo as a postdoctoral assistant professor and Jeffries as a National Science Foundation postdoc in the Department of Mathematics.

Both Grifo and Jeffries were involved in math outreach at Michigan and participated in Wolverine Pathways, a program for high school students.

"It was a Saturday extracurricular program for students in districts in the greater Detroit area that are underrepresented at the University of Michigan. Students who participate throughout high school and are accepted to the University of Michigan receive free tuition," Jeffries said. "A group from the math department would show up and lead Math Circle-type activities. The program is still relatively new, but I'm optimistic it will make a big impact there."

Grifo received her bachelor's and master's degrees in mathematics from the Instituto Superior Técnico in Lisbon, Portugal, and her Ph.D. at the Univer-
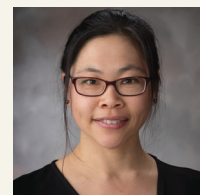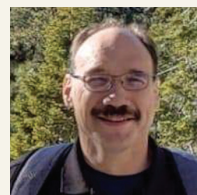
AWARDS

Alexandra Seceleanu and **Alexander Zupan** both earned College Distinguished Teaching Awards. These awards honor faculty in the College of Arts and Sciences with a record of consistently excellent teaching.

Milton Mohr professorships were awarded to **George Avalos** (top left), **Yvonne Lai** (top right), and **Richard Rebarber** (left). See more about the Milton Mohr Fund on page 28.

Brian Harbourne has been awarded a Willa Cather professorship from the Office of the Executive Vice Chancellor. The professorship was established in 2001 to recognize faculty members with the rank of full professor who have established exceptional records of distinguished scholarship or creative activity. Harbourne is an internationally recognized researcher in the area of algebraic geometry. He has published more than 70 peer-reviewed articles during his career, which have appeared in top journals and been cited more than 1,000 times. Harbourne has given more than 60 invited conference and colloquium talks over the past decade and organized high-profile conferences and workshops.

PROMOTIONS

Adam Larios was given tenure and promoted to associate professor of mathematics. **Wendy Smith** was promoted to research professor. **Michelle Homp** and **Nathan Wakefield** were promoted to associate professors of practice.

POSTDOCS

Amy Been Bennett is excited to return to the Department of Mathematics as the Marilyn M. Hitz postdoctoral faculty. As an undergraduate mathematics major at UNL, she worked with the Center for Science, Mathematics, and Computer Education on the NCUWM organizing committee and as the AGAM undergraduate coordinator. She received her master's degree in mathematics and her Ph.D. in teaching and teacher education from the University of Arizona. Her current research focuses on studying equitable, evidence-based instructional practices in undergraduate mathematics courses, as well as developing mathematical modeling curricula at the K–12 and post-secondary levels. Bennett, a native Nebraskan, is again serving on the NCUWM organizing committee and enjoys collaborating with colleagues via the Mathematics Education Doctoral Seminar.

Animesh Biswas earned his Ph.D in the area of partial differential equations (PDEs) from the Iowa State University in July 2020. After that, he joined University of Nebraska–Lincoln Department of Mathematics in August. His work is in the area of PDEs and harmonic analysis. Biswas, whose hometown is Berhampore, India, is serving on the Putnam Exam organizing committee.

GRIFO AND JEFFRIES { FROM PAGE 19 }

sity of Virginia in 2018 under advisor Professor Craig Huneke. At Virginia, Grifo was president and founding member of the Association for Women in Mathematics Student Chapter and worked with K–12 students through the Math Ambassadors program.

"When I was in high school, I got very interested in origami and its connections to math," Grifo said. "I ran some workshops with elementary and middle school kids where we would start with some simple, fun origami constructions, leading up to some fun math questions like how to trisect an angle with paper folding—which you can't do with a compass and a ruler, but you can do by folding the paper."

Grifo was born and raised in Leiria, Portugal, a city of about 100,000 people two hours north of Lisboa. During her time at Riverside, Grifo most recently taught Commutative Algebra and Calculus for the Life Sciences II.

Jeffries, who is originally from Cincinnati, Ohio, received his bachelor's degree from The Ohio State University and his Ph.D. from the University of Utah, under advisor Professor Anurag K. Singh in 2015. Jeffries's research interests include invariant theory,

positive characteristic techniques, differential operators, p-derivations, local co-homology, generalized multiplicities, symbolic powers, and applications to neuroscience.

Jeffries taught Math 314: Linear Algebra at UNL in Fall 2020 and previously taught D-modules and Applications to Commutative Algebra and Commutative Algebra at CIMAT.

"The success I'm most proud of is my students, even though the success was more their own than mine. This last summer, I graduated an undergraduate thesis student, Sandra Sandoval, and a master's student, Luis Palacios, from, CIMAT. They did incredible work!" said Jeffries, shown in the photo on this page with his partner, Grifo, (and a corn mascot) celebrating their UNL hiring.

"One long-term goal I have is to build connections between UNL and my former institution, CIMAT. When things are more 'normal,' I hope to bring students and faculty from there here, and vice versa," Jeffries said.

– Lindsay Augustyn

Weekly faculty meetings become virtual tea time

One aspect of the Mathematics department that its members appreciate is the sense of collegiality among graduate students and faculty. At the beginning of the semester, the department, led by Alex Zupan and Adam Larios, sought a way to foster camaraderie while navigating the challenges posed by the ongoing pandemic. They landed on the idea of "Zoom Tea," a weekly Zoom meeting on Friday afternoons during which members of the department could come together for an hour to connect and to socialize.

In addition, the Zoom Tea also served as a virtual pre-colloquium reception whenever the department had colloquium speakers.

Typically, 15 to 20 people attend, and to facilitate smaller, more inclusive discussions, they would break out into rooms of four to six, reshuffling the groups if time permitted. People discuss best teaching practices, research challenges, and funny personal anecdotes.

Zoom Tea is a great way to build community in a time of stress and isolation, even though faculty and graduate students are only seeing one another virtually. The department plans to resume Zoom Tea in Spring 2021.

– Alex Zupan and Adam Larios

NU awards Du radiomics grant
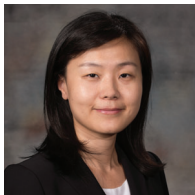
Assistant Professor Huijing Du of the University of Nebraska–Lincoln Department of Mathematics has been awarded a University of Nebraska Collaboration Initiative grant of $149,890. The multi-year grant, titled "Embracing the uncertainty: Make big data bigger and radiomics models better," began July 1 and ends in 2022.

The purpose of this grant program from the Office of the Executive Vice President and Provost of the University of Nebraska system is to grow Nebraska's research capacity and enhance the NU system's competitiveness.

Du's collaborators are Dr. Dandan Zheng of the University of Nebraska Medical Center, Dr. Hongfeng Yu, of the Department of Computer Science at UNL, and Dr. Chi Zhang in the UNL School of Biological Sciences. Du, the grant's principal investigator, has expertise in optimization, dynamic system, and mathematical modeling.

In healthcare, radiomics, a new big-data-based "omics" branch, has come into existence and shed new light on disease characteristics, particularly in oncology. Radiomics comes from medical imaging, the value of which is firmly established in routine oncologic practice, yet it digs deeper into the data behind medical imaging and offers image-based biomarkers through big-data-based machine learning.

Radiomic profiling, i.e., the extraction and analysis of hundreds of quantitative 'radiomic' features from medical images (such as CT, PET or MR), has been shown to be superior to conventional approaches in differentiating benign versus malignant lesions, forecasting tumor prognosis, and predicting tumor responses to treatments.

The exponential growth of radiomics research in recent years has shown the immense potential of radiomics to improve knowledge in tumor biology and guide the management of patients. However, there exists a critical challenge that often one radiomics model would predict well for the patients on whom the model is developed, but do much poorer on a different group of patients—a problem called lack of generalizability. Fundamentally, this is because individual patients not only differ from one another biologically and clinically (the signal) but also technically in the radiomics analysis process (the noise). Current methods cannot separate the noise from the signal, causing radiomic models to lack generalizability.

Currently, the field of radiomics lacks the systematic knowledge of the uncertainty involved in the radiomics measurements as well as the processes. Therefore, there is an urgent need for strategies that address such uncertainties to yield predictive models with widely generalizable validity.

Building on previous expertise on methodology development, clinical application, as well as uncertainty investigation in radiomics, this multidisciplinary team across the UNMC and UNL campuses aims to show that its approach will enhance the radiomics model quality in terms of generalizable validity and allow heterogeneous data integration to further improve the model quality.

IN MEMORIAM: Melvin Thornton
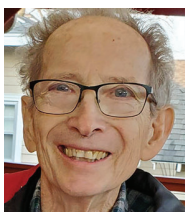
Professor emeritus Melvin Thornton, a passionate educator whose contributions to the University of Nebraska–Lincoln Department of Mathematics have left an inspiring legacy of compassion and innovation, passed away at the age of 84 on May 30, 2020.

A native Iowan, Thornton first came to UNL as an undergraduate student in 1953, enrolling as a mathematics major on a Naval scholarship. Thornton, with his friendly and engaging demeanor, thrived during his time at the university. He graduated in 1957, and, the following year, he married Rosemary, his college sweetheart.

After Thornton's graduation, he served in the Navy as a lieutenant junior grade on the troop transport ship The Calvert for two years. However, when he returned from service, he knew he wanted to pursue a higher level of education. Thornton and his wife moved to Champaign, Illinois, and he was accepted into the University of Illinois's graduate program. He graduated in February 1965 with his doctorate in mathematics and was promptly offered his first post-grad teaching position at the University of Wisconsin.

When he returned to UNL as a mathematics professor in 1969, Thornton was the primary instructor of Math 350, a geometry course, and an array of other mathematics courses for elementary education majors.

"He was especially fond of teaching teachers, both future teachers and the teachers who were part of the grant programs in which he was involved," said Jim Lewis, Aaron Douglas professor of mathematics and one of Thornton's long-time colleagues.

Thornton's natural aptitude and initiative with primary educators proved to be invaluable assets. During his 31-year career with the department, he assisted with and directed several nationally funded programs that enhanced the quality of math education both at UNL and throughout the Cornhusker State.

In 1986, Thornton was named a co-principal investigator for the Nebraska Mathematics Scholars Program for Secondary School Teachers alongside

THORNTON
{ FROM PAGE 21 }

Jack Eidswick and the late Don Miller. The Nebraska Mathematics Scholars Program for Secondary School Teachers began with an $833,892 grant from the National Science Foundation with the intent to fund a three-year professional development program for 66 outstanding high-school math teachers who earned a master's degree in mathematics from UNL.

These educators traveled in three cohorts to attend five-week summer sessions at UNL, Hastings College and Chadron State College. Each cohort visited one institution a summer in the span of these three years, and during the academic year, the program offered dissemination activities to keep the established cohorts of instructors connected and engaged.

Met with incredible enthusiasm from participants and other state educators, Miller and Thornton decided to add a fourth year to the program. The Scholars Program ultimately reached over 100 educators, cultivating a talented community of strong leaders within the network of secondary math teachers across Nebraska.

Following the success of the Nebraska summer program, Thornton and Miller sought to emulate Nebraska's educator development program on a larger scale. After receiving another $1.1 million Teacher Enhancement grant from the NSF in 1991, the duo served together again as co-PIs of the Western Mathematics Scholars Program for middle and secondary math educators across Nebraska, South Dakota, and Wyoming.

During the program's second year, Thornton became the project director and led Western Math Scholars to new heights. An advocate for non-traditional students, Thornton added an alternate assessment seminar to the curriculum because he wanted to help rural educators better meet the needs of their diverse classrooms.

In 1991, Thornton also served as

> When Don Miller passed away in 1992, Mel Thornton and Jim Lewis established the Don Miller Fund to support faculty working to improve mathematics teaching and learning in Nebraska. Today, this fund is used to offer partial fellowships for teachers enrolled in graduate courses.

a co-PI for the Nebraska Statewide Systemic Initiative, later renamed the Nebraska Math and Science Initiative, with Miller and Lewis. This $10 million grant continued the effort to improve the quality of and engagement with math and science programs in schools across Nebraska by creating new modes of instruction for teachers.

Within this initiative, Thornton was named the project leader for developing Math Vantage, a middle school Pre-Algebra 1 curriculum that included a series of videos designed to communicate with middle school students. While working to create videos, Thornton concurrently taught a televised synchronous math course for 140 elementary school teachers from various Nebraska schools. Jokingly referred to as "MTV mathematics" for the flashy music and professional acting included throughout the series, the Math Vantage videos aimed to make math fun for middle school students while giving them the tools they needed to be successful in algebra.

The Math Vantage videos were produced by Nebraska Public Television as a free resource for teachers across the state. The video rights were also sold through MTV and various other national groups, and most statewide public television channels purchased the videos themselves, in turn generating royalties for Math Vantage.

When Miller passed away in 1992, Thornton and Lewis established the

Don Miller Fund with the royalties from the videos to provide funding to support faculty working to improve mathematics teaching and learning in Nebraska. Today, this fund is used to offer partial fellowships for teachers enrolled in graduate courses, primarily via the Nebraska Math and Science Summer Institutes.

A dedicated and encouraging professor to all, Thornton's work garnered the respect and recognition of his mathematics colleagues both at UNL and across the nation. In 1987, Thornton was awarded the AMACO University-wide Distinguished Teaching Award for helping his students have positive experiences in math education.

In the 1990s, Thornton earned a Parents Association and Teaching Council Recognition Award for Contributions to Students, the Heads Together Award for his work to make UNL's campus a more accessible environment for disabled students, and the Award for Distinguished University Teaching of Mathematics from the Nebraska Section of the Mathematics Association of America. Most notably, Thornton was named Nebraska Professor of the Year by the Carnegie Foundation in 1994—he also received the university's Outstanding Teaching and Instructional Creativity Award that same year—and in 1995, UNL named Thornton to the Academy of Distinguished Teachers. Thornton retired from teaching on July 1, 2000, the day before his 65th birthday.

"As evidenced by the awards he received, Mel was an outstanding teacher," Lewis said.

Thornton is remembered by the UNL community as a mathematics visionary who not only enhanced the quality of math education throughout Nebraska but also enriched the lives of those who had the privilege of working with him.

– Gabrielle Cottraux

*Obituary: https://wyuka.com/ 2020/06/02/melvin-chandler-thornton*

'MATH NEWS' VIA EMAIL

If you would prefer to receive this newsletter in your inbox instead of your mailbox, sign up at *www.math.unl.edu/friends*.

COLLIN VICTOR: Earns NSF Graduate Research Fellowship

Collin Victor, an applied mathematics graduate student at the University of Nebraska–Lincoln, was one of four graduate students at UNL to receive a Graduate Research Fellowship from the National Science Foundation (NSF) in Spring 2020.

Victor joined two other current graduate students in mathematics who have received the fellowship: Jordan Barrett, a second-year student, who transferred to UNL from Syracuse University last year; and Elizabeth Carlson, who is in her fifth year in Nebraska's graduate program.
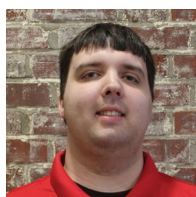
Collin Victor

The Graduate Research Fellowship Program (GRFP) recognizes and supports outstanding graduate students in NSF-supported STEM disciplines who are pursuing research-based master's and doctoral degrees at accredited United States institutions. As the oldest graduate fellowship of its kind, the GRFP has a long history of selecting recipients who achieve high levels of success in their future academic and professional careers.

Fellows benefit from a three-year annual stipend of $34,000 along with a $12,000 cost of education allowance for tuition and fees (paid to the institution), opportunities for international research and professional development, and the freedom to conduct their own research at any accredited U.S. institution of graduate education they choose.

NSF Fellows are anticipated to become knowledge experts who can contribute significantly to research, teaching, and innovations in science and engineering.

GET TO KNOW GRADUATE STUDENT:

GEORGE NASR

Where are you from?
Newbury Park, California

What is your research area of interest?
Algebraic combinatorics. (But I hope to explore other topics in the future!)

What is the best advice you have been given regarding graduate school or your career?
Well, most of the good advice I got was during my first year here, but these memories were thoroughly purged immediately after I finished taking my qualifying exams. (I promise I'm kidding… mostly…)

Actually, the best advice I got was from a professor at my undergrad (California Lutheran University). He shared an anecdote with me before I came to UNL. He had a hard time his first year of graduate school and failed his topology qualifying exam. But he worked tirelessly, and, on his second attempt, he ended up getting the best score on the topology qual at his institution. Now, he is an active researcher in topology.

I synthesized this into the following advice: The first year may not go as you planned, but that's OK. What really matters is your willingness to put in the time and effort to learn the material.

What is a goal you have accomplished as a Husker?
Passing my qualifying exams was a big deal to me—I still remember the moment I was notified that I qualified. I will also say that I am proud that our Graduate Student Mentoring program in the department is now in its third year. (It has grown up so fast!)

What types of jobs are you interested in pursuing after graduation?
I'm actually currently on the job market. Right now, I'm aiming for a postdoc because I'm enjoying research, but long term I know I'll be happiest in a job where I have a good balance of research, teaching, and mentoring. I discovered my passion for mathematics in a discrete math course in undergrad, so I have a positive affinity for teaching undergraduate mathematics. (Fun fact: When I took that class, I wasn't even a math major yet!)

What do you hope to cross off your "bucket list" in the next few years?
Personally, I hope to start making music more. It's something I really enjoy doing, but I've continuously put it off during my time in grad school.

Professionally, I don't know if this will happen in the next few years, but I've recently thought about writing a free online textbook (OER). This is partly inspired by some things I've developed for my students and the OER our department has created, but it's also inspired by some reflection I've done on equity issues in education.

CAREER SCHOLARSHIP: Program helps university meet state's workforce needs

Students interested in working where Nebraska needs them most could be awarded scholarships of at least $8,000 per year under a new program being launched at the University of Nebraska–Lincoln and other University of Nebraska institutions.

The new scholarships will be available as early as January 2021 to incoming Husker freshmen and transfer students with strong academic potential who are interested in careers such as engineering, mathematics, and computer information systems. Recipients are required to complete a Nebraska-based internship before they graduate.

The scholarships were created through the Nebraska Career Scholarships Act proposed by Gov. Pete Ricketts in January and passed by the Legislature in August.

"The Nebraska Career Scholarships Act provides a much-welcomed tool that will further enable the university to strengthen our Nebraska communities, while transforming lives and learning," Chancellor Ronnie Green said.

The scholarships will be offered to undergraduate students at all four University of Nebraska institutions — the University of Nebraska–Lincoln, the University of Nebraska at Kearney, the University of Nebraska at Omaha and the University of Nebraska Medical Center. Approved as Legislative Bill

At Nebraska, students in the following majors will be considered for the scholarships: agricultural engineering, athletic training, biological systems engineering, civil engineering, communication science disorders, computer engineering, computer science, construction engineering, electrical engineering, mathematics, mechanical engineering and software engineering.

1008, the initiative allocates $2 million per year to the NU system for undergraduate students pursuing high-demand careers to help fill Nebraska's critical workforce needs. LB 1008 also allocated scholarship funds to state and community colleges.

The scholarships fit within UNL's multi-pronged strategy to fill high-skill, high-demand, and high-wage jobs in Nebraska. For example, during the past year the university has announced ambitious plans to expand its College of Engineering and to consolidate computer science, computer engineer-ing, software engineering, and other technology-centric programs as an interdisciplinary School of Computing within the College of Engineering.

"The Career Scholarships Act provides another direct connection between the classroom and jobs. This program supports our students not only financially, but through hands on-learning experiences they can use to build a foundation for their entire careers," said Abby Freeman, director of admissions. "We are excited to offer an exceptional education at a great value while supporting the workforce needs of our state. It's a win-win."

High school seniors and transfer students who wish to enroll at Nebraska in Fall 2021 should apply for admission by March 1 for priority consideration and May 1 for subsequent consideration while funding remains. Awards are based on holistic review, so students are encouraged to complete the Free Application for Federal Student Aid for fullest consideration.

Nebraska will award the scholarships based upon academic performance. The funds may be used for tuition, fees, room and board, or relevant tools and equipment. The scholarships are renewable if students maintain a 2.5 cumulative GPA and complete 30 credit hours per year.
– Leslie Reed, University Communication

MATH STUDENT SMITH CHOSEN AS RFI FELLOW

Sawyer Smith, a senior mathematics, computer science, and psychology major, was selected as a University of Nebraska 2020 Rural Futures Institute Fellow by the Rural Futures Institute.

Smith, originally from Colorado Springs, Colorado, is also a STEM CONNECT Scholar (see page 15). Of the 17 students selected as RFI Fellows, 14 are University of Nebraska–Lincoln students.

Together, the fellows will move future-focused strategies forward with 17 rural Nebraska communities. In Summer 2020, the immersion of students in communities and interactions among students and community members looked different—online instead of in-person, across the room instead of side-by-side, small groups instead of main street events—but the enthusiasm was the same.

Students underwent online training and the community innovators joined them for three days of interactive Zoom sessions led by inclusive leadership development expert Helen Fagan, director of the RFI Fellows program.

The Fellows' community projects aim to improve workforce development, economic development, access and recruitment and retention of residents with specific focus on: early childhood education; community marketing and communications; entrepreneurship; mental health services; and inclusion.

Undergraduate awards

Chair's Prize
Awarded to an outstanding senior mathematics major
Jared Ott

Special Scholarships Awards
Note: 53 scholarships were awarded for the 2020–21 academic year.

Dean H and Floreen G Eastman Memorial Scholars
For Nebraska high school graduates
Samantha Bannister, Alexander Batelaan, Ciara Baumert, Tomohide Bessho, Kasey Brabec, Zach Cairney, Dylan Chapin, Allison Cruikshank, Collin Dougherty, Stanley Drvol, Zoe Engelbert, Grace Farson, Luke Galvan, Anjaneshwar Ganesan, Elizabeth Griggs, Joshua Gromowsky, Andrew Haar, Ryan Lampe, Jackson Lederer, Benjamin Lohrman, Aleah Miller, Nicholas Nguyen, Ray Nierman, Jesse Osborn, Jesse Osnes, Anthony Palmesano, Ana Podariu, Lara Quiring, Lexus Root, Amanda Rowley, Joshua Schmidt, Spencer Schmidt, Simon Schoenbeck, Jarod Schwinck, Margaret Scott, Nicholas Scott, and Nicholas White

Chancellors Scholars
Jordan Case and Jesse Kruse

Joel Stebbins Fund Scholarship
Cheyenne Warren

Renneman/Luebbers Scholarship
Meghan Ryan and Thomas Walton

Drusilla Winchester Scholarship
Thomas Walton

Ruby Matzke Wittemore Scholarship
Ciara Baumert

Irwin Dubinsky Memorial Scholars
Will Brunner

Sylvia and Hans Jeans Mathematics Scholarship
Alexander Batelaan, Will Brunner, Alexander Fetzner, Michael Schneider, Liam Seper, Luke Van Drie, and Cheyenne Warren

Dr. Hubert Schneider Memorial Scholarship
Luke Van Drie

Senior Honors Thesis and Graduated with Distinction (directed by):
Rebecca Fitzgarrald (Herman Batelaan, Physics & Tim Gay, Physics) – May 2020

Savannah Howard (Huijing Du, Math & Mark Wilson, Biochemistry) – May 2020

Kushagra Kapil (Etsuko Moriyama, Biological Sciences & Jitender Deogun, Computer Science) – December 2020

Jesse Kruse (Tim Gay, Physics & Herman Batelaan, Physics) – May 2020

Gallup UNL Math Day Scholarship
Lixin Cao

Linda Bors Mathematics Scholarship
Grace Farson

Bachelor's degrees

August 2019: Almulham Albusaidi, Hannah Botten, Kai Cheng, Qianyu Dong, Noah Lazaro, Yuyao Tian, Elizabeth Tyler, Botao Wang, and Zhibo Zhang

December 2019: Jordan Burgener, Jiayuan Fei, Yibin Huang, Robert Hutchinson, Zachary Larson-Wurl, Yiwen Lyu, Taylor Price, Michael Purcell, Hannah Schultz, Diem Tran, Shu Wang, Manying Wang, Lane Weidner, Wenlong Xiao, and Qixuan Yang

May 2020: Yaseer Al Rahbi, Matt Andersen, Michael Anthony, Masen Bachleda, Fatima Barragan Herrera, Sanat Bhandari, Grace Billig, Matthew Boeding, Robin Bouma, Jordan Case, Derek Chew, Emily Cleveland, Alex Clough, Miles Davis, Grace Dickas, Madeline Diedrichsen, Justin Ernst, Brady Farnham, Rebecca Fitzgarrald, Zhuojia Fu, Dane Gallentine, Duane Green, Hayley Haakenstad, Katherine Hartten, Alex Heitzman, Savannah Howard, James Janvrin, Hyunseok Kim, Jesse Kruse, Cal Leising, Xinyi Lin, Michael Mason, August McClenahan, Matthew Meacham, Taylor Minger, Fatima Mohammed, Shuhao Mu, Nancy Nguyen, Vida-Michelle Nixon, Hannah Oh, Jared Ott, Vince Rice, Judd Salem, Jordan Schmitz, Karl Shaffer, Tianyu Shen, Jacob Shiohira, Jessica Smith, Dylan Thompson, Evan Thornton-Kolbe, Wei Young Tian, Amy Tran, Dyllan Usher, Thu Phung Vu, Marc Wade, Qichang Yang, Fangyi Zhai, Chi Zhang, Zeping Zhang, and Ji Zhou

Doctoral degrees

Becklin, Andrew *Hadamard well-posedness for two nonlinear structure acoustic models*, advised by Mohammad Rammaha

Drabkin, Benjamin *Symbolic powers in algebra and geometry,* advised by Alexandra Seceleanu

Jamieson, William *Individual based model to simulate the evolution of insecticide resistance,* advised by Richard Rebarber and Brigitte Tenhumberg

McMorris, David *Optimal allocation of two resources in annual plants*, advised by Glenn Ledder

Nir, JD *Two questions about properties of large graphs: On generalized Turan numbers and the chromatic number of random lifts*, advised by Jamie Radcliffe

Reichenbach, Matt *Spectral properties of a non-compact operator in ecology*, advised by Richard Rebarber and Brigitte Tenhumberg

Uhing, Karina *Exploring pedagogical empathy of mathematics graduate student instructors*, advised by Nathan Wakefield

Williams, Marla *Trisections of surface bundles over surfaces*, advised by Mark Brittenham and Alex Zupan

Master's degrees

MS/MA: Allison Ganger, Scott Hootman-Ng, Brittany Johnson, Nikola Kuzmanovski, Colby Lamb, Kathleen Lee, David Lieberman, Nicholas Meyer, Valerie Morris, Sara Myers, Lawrence Seminario-Romero, Jason Vander Woude, Collin Victor

MAT (through May): Amber Clausen, Christina Jackson, Emily Kohmetscher, Michelle Ledford, Sarah Mack, Michael Maurer, Amanda Nielson, Jinjin Shen, Timothy Smith, Geena Taite, Melissa Usasz, Rebecca Workman

Graduate program awards & fellowships

Don Miller Award for Outstanding Teaching by a Graduate Student
Hayley Olson

Grace Chisholm Young and William Henry Young Award
Vincent Longo

Outstanding Qualifying Exam
Greg Faurot

Walter Mientka Teaching Award
Brittany Johnson

Amy Bouska GTA Leadership Award
Nicole Buczkowski

GET TO KNOW UNDERGRADUATE:

DIEGO GALVAN

Where are you from?
Bellevue, Nebraska

What excites you about math? I am constantly fascinated by the application of math to the world. The world has a lot of unsolved physical problems that would benefit society if worked on.

What has been your favorite math class at UNL? Math 424: Partial Differential Equations convinced me to switch to a math major during my second year. I realized then there was much more application out there than I had originally thought.

What is a goal you have accomplished as a Husker? One goal in particular that I accomplished was familiarizing myself with the research side of mathematics. In working with Associate Professor Adam Larios, I have learned and gained more skills than I ever thought possible. Collaboration is an important side of mathematics!

What do you hope to cross off your "bucket list" in the next few years? I hope to publish a research paper before I graduate. Also, I may attempt to run a full marathon at some point, too!

What are you excited about doing after graduation? I am very excited to pursue graduate school and discover what my next step is. I love working hard and devoting myself to things.

Read about undergraduates in mathematics at *https://www.math.unl.edu/life-nebraska-undergrad*

Graduate students start directed reading program

In Spring 2020, a group of math graduate students designed and implemented the department's inaugural Directed Reading Program, or DRP. The DRP pairs graduate student mentors with undergraduate mentees to complete semester-long reading projects in mathematical topics that are advanced or otherwise not covered by a standard undergraduate curriculum.

The DRP is meant to be an enriching experience for both undergraduate and graduate students. The mentee gets to see mathematics beyond the usual undergraduate curriculum and develops the skills necessary to learn mathematics in a more independent setting, while the mentor gets to teach and work with passionate students and gains valuable experience as an instructor.

While the onset of the COVID-19 pandemic disrupted the Spring 2020 DRP to an extent, the program still had a successful first semester. Students completed projects in a wide range of topics, from knot theory and algebraic geometry to extremal graph theory.

Reflections from mentors and mentees spoke to this success. Graduate student Matt Reichenbach, who studied mathematical models of tumor growth with undergraduate Allison Cruikshank, said, "Through the DRP, both myself and my mentee had the opportunity to learn a new field together. She had more experience with the biology than I did, and I could explain some of the more difficult mathematics; together, we got farther in one semester than either of us could have alone."

Cruikshank added: "The DRP provided me with experience I would not have gained in a normal classroom setting. I was able to do in-depth research on an interesting topic while having insightful, mathematical conversations with my mentor."

The DRP ran remotely for the Fall 2020 semester and likely will for the Spring 2021 semester. For more information, see *http://www.math.unl.edu/~mbachmann2/drp.html*.

The department looks forward to building the DRP into an institution that serves grads and undergrads alike.

—*Austin Eide*

AWARDS { FROM PAGE 25 }

Outstanding First-Year Student Award
Meraiah Martinez

Bill Leavitt Award
Eric Hopkins

Lloyd Jackson Award
Sara Myers

Emeritus Faculty Fellowships
Dylan McKnight

Linda Bors Fellowships
Michael DeBellevue, Emily McMillon, and Ana Wright

2019–2020 Steven Haataja Award for Outstanding Exposition by a Graduate Student
Paula Egging

Internships and summer schools

Greg Faurot, Groundwork for Operator Algebras Lecture Series, Summer 2020

Nikola Kuzmanovski, Ocuvera, Winter 2020

Aurora Marks, Northrup Grumman, Summer 2020

Meraiah Martinez, Ocuvera, Winter 2020

Matt Reichenbach, Geospatial Research Laboratory, U.S. Army Corps of Engineers, Summer 2020

Alyssa Whittemore, Data Science Bootcamp, PI4 at University of Illinois at Urbana-Champaign, funded by the IMA, Summer 2020

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1 Milton E. Mohr Fund: Established by Mr. Mohr, a Nebraska engineering alum and former chairman, president, and CEO of Los Angeles-based financial data firm Quotron Systems, Inc., the Milton E. Mohr Distinguished Professorship Fund recognizes and supports outstanding research by mathematics faculty. The fund now supports three Milton E. Mohr professorships, held by George Avalos, Yvonne Lai, and Richard Rebarber (see page 19).

2 Howard E. Rowlee Fund: Established in 1996 to support mathematics research in the department. Started the annual Rowlee Lecture Series in 1997 to bring world-renowned mathematicians to UNL, including two Fields Medalists and 11 members of the National Academy of Sciences. Mr. Rowlee, a longtime friend of the department, often attended department research seminars and conferences. A multi-day research conference is held in conjunction with the Rowlee Lecture annually.

3 Jim and Doris Lewis Fund: Established in 2000 through a generous gift from Marilyn and Richard Hitz, the fund is named in honor of their daughter Doris and her husband, Jim Lewis, current Aaron Douglas professor of mathematics. Preference is given to projects that encourage participation of women in mathematics or encourage excellence in instruction of mathematics (see the NMSSI on page 11). This fund also supports the Hitz postdocs in mathematics (see page 20).

4 Emeritus Faculty Fellowship Fund: This fund was established in 1989 through regular donations from the mathematics faculty under the leadership of then-chair Jim Lewis. The purpose of this fund is to support the graduate program, primarily through the awarding of graduate fellowships. Donations can be made in tribute to particular emeritus faculty members (see page 2).

A donation form for mailing can be found on page 10.

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