



Fall 2013

# Math News

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

## VIEW FROM THE CHAIR

Judy Walker



It's been another terrific year for the Department of Mathematics, with wonderful things happening in all aspects of our mission.

Our faculty have been exceptionally active this year, and many congratulations are in order: Srikanth Iyengar and John Meakin were named Fellows of the AMS; Stephen Hartke and Meakin were awarded Fulbright Fellowships; Iyengar won the Outstanding Research and Creativity Award for the Sciences from the UNL College of Arts and Sciences; and Daniel Toundykov received the Harold and Esther Edgerton Junior Faculty Award. The Nebraska Conference for Undergraduate Women in Mathematics was recognized by the AMS with its Programs that Make a Difference Award.

The department continues to provide an outstanding education for its students. In addition to the above

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## NCUWM: A program making a difference

The Nebraska Conference for Undergraduate Women in Mathematics (NCUWM) held at UNL has been nationally recognized for encouraging more women into the field of mathematics.

The American Mathematical Society announced in April 2013 that the conference has been chosen as the winner of its annual Programs that Make a Difference Award for "its significant efforts to encourage women to continue in the study of mathematics," according to the announcement published in the Notices of the AMS.



The conference became an annual event in the Department of Mathematics 15 years ago with a direct goal of encouraging women

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## 2 named AMS Fellows

John Meakin, Milton Mohr Professor of Mathematics, and Srikanth B. Iyengar, Willa Cather Professor of Mathematics, have become Fellows of the American Mathematical Society, an esteemed group of mathematicians from across the world. Five Fellows from UNL also were inducted in 2012.

The AMS Fellows program recognizes those who have made outstanding contributions to the creation, exposition, advancement, communication and utilization of



Srikanth Iyengar



John Meakin

mathematics. Iyengar and Meakin are among 50 mathematicians who

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# Research News

ORDINARY DIFFERENTIAL EQUATIONS

## The legacy of Jackson, Peterson, Erbe

UNL's prominence in differential equations began with University of Nebraska-Lincoln Professor Lloyd Jackson (1922-2009) who had a profound effect on not only research



Lloyd Jackson

in ordinary differential equations, but also on the people of the Department of Mathematics.

Jackson, who was born in Fairbury, Neb., demonstrated an early aptitude

for mathematics and by the time he arrived in Lincoln in September 1939 to begin his undergraduate studies at UNL, he had already mastered most of the material in the first two years of mathematics. Jackson received his A.B. degree in mathematics in 1943, and, after serving in the military, he returned to UNL and earned an MA in 1948. He went on to earn a Ph.D. in mathematics at the University of California, Los Angeles in 1950.

Jackson returned to UNL as a faculty member that same year. During his career at UNL, he established himself as one of the nation's leading scholars in ordinary differential equations. Jackson received a distinguished teaching award from UNL in 1964 and became the department's first named professor, UNL Regents Professor, in 1967.

It was in 1967 that Jackson had a life-changing effect on now UNL Professor Allan Peterson, who was then a University of Tennessee, Knoxville doctoral student. Jackson was one of four main speakers at an eight-week NSF-sponsored conference at the University of Colorado. Another of the main speakers was John Barrett, Peterson's adviser at Tennessee. It was at this conference that Peterson met Jackson

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### Conference honors Peterson's achievements

The Peterson Conference celebrated the impact its namesake, Professor Allan Peterson, has had on mathematics and recognized his 45 years of teaching service at UNL.

Held Oct. 25-27, 2013, the three-day conference was organized around the subject of the calculus of time scales with a goal of creating collaborations between recent Ph.D.s, graduate students and established leaders in the field.

Participants at the Peterson Conference came from around the world, including Sydney, Australia; Ankara, Turkey; and more than 24 different colleges and universities located across the U.S.

Five distinguished guest speakers gave plenary talks: Dr. Ravi Agarwal, Texas A&M University-Kingsville; Dr. Martin Bohner, Missouri University of Science and Technology; Dr. Saber Elaydi, Trinity University; Dr. John Graef, University of Tennessee at Chattanooga; and Dr. Johnny Henderson, Baylor University. In addition to the talks by invited plenary speakers, 18 talks were selected to be given by recent Ph.D.s and current grad students.

The Peterson Conference was a very timely event, set to coincide not only with the 45-year anniversary of Peterson's teaching at UNL (Peterson

began teaching at UNL in 1968), but also the 25-year anniversary since the emergence of time scales analysis. Conference organizers saw the fulfillment of their goals for the conference in the discussion of nonlinear oscillation theory, integral transform theory, fixed point theory, and particularly fractional calculus, which has had recent important developments.

Speakers were encouraged

to explore the applications to economics, engineering and biology. Other research areas explored for interaction included differential equations, difference equations and q calculus.

A group of Peterson's former students who attended the conference

presented him with a framed copy of his mathematical family genealogy given to him by the department. This genealogy traces Peterson's roots back to well-known mathematicians such as Leonhard Euler in 1726 and Jacob and Johann Bernoulli in 1690.

"It is a privilege to have Al Peterson as a colleague," said Judy Walker, professor and chair of the math department. "He is a wonderful mentor, teacher, and scholar, and he has made a tremendous impact on our department and in his field. I am thrilled that the department was able to host this conference in his honor."



MARILYN JOHNSON/UNL MATH DEPT.

A group of Peterson's former students at the conference presented him with a framed copy of his mathematical family genealogy.

# \$5.5 million grant invests in improving math education

Helping students improve their math skills by investing in outstanding math teachers is behind the logic of a \$5.5 million grant made by two Omaha foundations.

The Sherwood Foundation® and the Lozier Foundation have partnered to provide the grant to the University of Nebraska Foundation to support a three-year partnership between Omaha Public Schools and UNL's Center for Science, Mathematics and Computer Education.

The funding supports the NebraskaMATH Omaha Public Schools Teacher Leader Academy, a community of OPS K-12 mathematics teachers dedicated to strengthening mathematics teaching and learning in Omaha. Through the program, teachers will have access to continuing education and graduate coursework centered on math education.

The OPS Teacher Leader Academy builds on a foundation laid by three National Science Foundation grants to UNL: NebraskaMATH, Math in the Middle and NebraskaNOYCE. Nearly 75 OPS teachers have participated in those programs, forming a base of teacher leaders for the new program.

Jim Lewis, UNL mathematics professor and director of the Center for Science, Mathematics and Computer Education, said the goals of the OPS initiative are to strengthen mathematics learning in Omaha classrooms, narrow student achievement gaps between different populations and conduct research that continues to inform school improvement efforts.

The academy offers various programs for teachers, including Primarily Math, a program for K-3 teachers; Math in the Middle, a master's degree program for grades 4-8 teachers; and fellowships to enable OPS K-12 math teachers to take math courses at no cost to the teacher. Courses are offered in Omaha at the OPS TAC Building. The grant also supports six K-3 and two middle-grade math coaches for OPS.



LINDSAY AUGUSTYN/UNL CSMCE

UNL Vice Chancellor for Research Prem Paul (from left), Dianne Lozier of the Lozier Foundation, Chancellor Harvey Perlman, Professor Jim Lewis, Jerry Bexten of The Sherwood Foundation®, Dr. Renae Kehrberg of OPS and OPS Superintendent Mark Davis attend the OPS Teacher Leader Academy grant announcement on July 15, 2013.

## NebraskaMATH

Omaha Public Schools Teacher Leader Academy

In addition, university faculty will study the impact of professional development on teachers' beliefs and knowledge, student outcomes and the impact school culture has on student achievement. They also will establish a studio classroom as a model for implementing instructional change in K-3 classrooms. This project and its research results will provide a national model for effective mathematics teacher education, Lewis said.

In July 2013, a new cohort of 24 K-3 teachers began the Primarily Math program, and 29 teachers of grades 4-8 began the Math in the Middle program. In addition, three other courses for teachers were offered at the TAC Building in July. Additional cohorts of OPS teachers will begin the program in Summer 2014.

As part of a strategy to build the capacity of OPS teachers to provide professional development for their peers, the program makes heavy use of teachers as part of instructional

teams for the courses. In Summer 2013, the participating OPS master teachers were: Tanya Archie, Connie Colton, Marni Driessen, Katie Garcia, Mandy German, Patty Hastings, Kesha King, Jessica Korth, Phil LaFleur, Brent Larson, Dianne Lee, Jill Luschen, Paula Millerd, Greg Sand and Matthew Timm. In addition, one LPS teacher, Kyla Hall, worked as an instructor for one course. All of these teachers have previously participated in NSF-funded graduate programs, and nine have a master's degree from UNL's Department of Mathematics.

In Summer 2013, instructional teams also included college faculty from UNL (Lewis), the University of Nebraska at Omaha (Angie Hodge and Janice Rech) and Nebraska Wesleyan (Kristie Pfabe). Collaborating with Lewis at UNL are co-principal investigators Ruth Heaton and Wendy Smith.

More information about the OPS Teacher Leader Academy, including program applications for teachers, is available at <http://scimath.unl.edu/opstla>.

– University of Nebraska Foundation  
and Lindsay Augustyn

ODE *From Page 2*

and decided he would like to teach at UNL and have Jackson as his mentor.

Thanks to Peterson's adviser, Jackson arranged for him to give a talk at UNL in the spring of 1968. As it turned out, Peterson's talk wasn't the only one on campus that day.

"The same day I gave my talk, Bobby Kennedy was giving a talk in the Coliseum," Peterson said. "Lloyd Jackson really liked Bobby Kennedy, but he came to my talk instead of going to see him." An overflow crowd of 12,000 heard Kennedy's anti-war message that day at UNL.

Peterson also met another mathematician at the 1967 conference who would later play a major role in his career: Lynn Erbe.

"Lynn graduated the same year I did [1968], and he was one of Lloyd's Ph.D. students whom I met at the conference," Peterson said. "I liked every one of Lloyd Jackson's students that I met."

While Erbe went on to teach at the University of Alberta, Peterson graduated from Tennessee and began teaching at UNL. Nearly 30 years later, in 1997, the pair began advising Ph.D. students together at UNL.

Both Erbe and Peterson's research on differential equations was impacted by the work of Jackson.

In a tribute to Jackson in the *Journal of Mathematical and Computer Modelling* on his 75th birthday, Erbe and Peterson dedicated the papers to Jackson's "kindness, dedication to mathematics, and influence on others" and said "it was the case, as pointed out by one of his former students, that whatever was written down was always correct and precisely stated."

Jackson published his notes from that illustrious conference in 1967. The paper, "Subfunctions and Second Order Differential Inequalities," was published in *Advances in Mathematics*, one of the most prestigious mathematics journals, and it continues to have a profound effect on the work done in this and related areas by numerous researchers. In a sense, this paper was the culmination of much of the work that had occupied Jackson up to that time.

Over the next two decades, many results were obtained for solutions of second-, third-, and higher-order



COURTESY PHOTO

Graduate students Bin Chen (from left), Julia St. Goar, Kevin Ahrendt, Pushp Awasthi, Abby Brackins and Tanner Auch stand with Professor Allan Peterson (fifth from left) and Professor Lynn Erbe (second from right).

## PREVIEW: PDEs

*The next edition of Math News will highlight the department's continuation of faculty working on partial differential equations and their recent accomplishments in this field.*

nonlinear boundary value problems, by Jackson and many of his students.

One of Jackson's greatest legacies is the large number of quality Ph.D. students that he produced at UNL. Of his 14 students, at least seven have become a chair of a mathematics department: Elwood Bohn, Ohio University; Jerrold Bebernes, University of Colorado; Lynn Erbe, University of Alberta; Kenneth Heimes, Iowa State University; Ronald Mathsen, North Dakota State University; Klaus Schmitt, University of Utah; and Keith Scradler, University of Missouri.

Between 1997 and 2013, Erbe and Peterson have co-advised 12 Ph.D. students at UNL. Erbe advised another four students while at Alberta, and Peterson has advised another 15 UNL students on his own.

"I really like working with Ph.D. students; that's one of my favorite things," Peterson said. "You're teaching them something, but of course they are teaching you something too. They are taking the problems you give them, and they solve things that you didn't even know about."

Peterson, a Charles Bessey Professor of Mathematics, has published 168 research papers and authored and/or co-authored seven textbooks (with another two in progress) that are frequently cited

in the field. Peterson also participates on the editorial review boards of 14 mathematical journals and has been involved with the Research Experiences for Undergraduates (REU) site at UNL, which was just renewed for another three years. He also has served on the board of the International Society of Difference Equations since it was formed. Erbe has published about 250 research papers and has written one textbook.

Erbe said that Peterson has shown his dedication to mentoring students by never taking a sabbatical and by making a point of being available to his students during the summers.

Several of his former students came back to honor him at the Peterson Conference, held at UNL in October 2013 (see page 2). Peterson had several fond memories of the conference: "First, I was able to thank my family for their support during these 45 years of teaching at UNL. Then I had my attending Ph.D. students stand, and I told them it was a privilege for me to work with them. I consider my students my extended family. Finally, I was glad to have the opportunity to thank my colleagues for the honor of working with them."

While Peterson's research started in boundary value problems with Jackson, it evolved to difference equations after 1988, then to time scales, and now to fractional calculus. Erbe and Peterson have collaborated to build one of the foremost research centers in the country in the emerging field of dynamic equations on time scales.

—Lindsay Augustyn and  
Stephanie Vendetti

## Interacting with invariants

*Hopkins incorporates audience into lecture on notions of surfaces*

As part of his bi-annual visit to the UNL Department of Mathematics, Michael Hopkins delivered a public lecture, “Mathematical Invariants: How to Know the Answer in Advance,” on Thursday, Nov. 14, 2013. The audience included members of the math department, undergraduates, university administrators, and even elementary, middle and high school students who filled the Union Auditorium. His talk was live-streamed over the web and a recording of it remains available for viewing at <http://www.math.unl.edu/events/special/hopkins2013>.

Mike worked the audience with the stage presence of a professional comedian. Members of the audience, including an enthusiastic young boy sitting front and center, were incorporated into his lively and highly interactive presentation. The energy and wit Mike displayed surely served as an inspiration to the many young people in audience, and all stereotypes of mathematicians as being dull or socially awkward were demolished during his performance.

Mike started out demonstrating the idea of an invariant by using the notion of parity to dispel the mystery of a popular card trick, as acted out to great comic effect by members of the audience called up onto the stage. He proceeded to explore the Euler characteristic of surfaces. Mike recruited members of the audience to subdivide various ballons and balls (surfaces of genus 0) into “pastures,” by drawing fence posts connected with fences on them. The volunteers reported back the value of the number of “pastures” minus the number of “fences” plus the number of “fence posts”; it will not be a surprise to any mathematician to learn that the answer was two



STEPHANIE VENDETTI/UNL CSMCE

*Mike Hopkins, professor at Harvard University and a visiting research professor at UNL, addresses the audience during his presentation, “Mathematical Invariants: How to Know the Answer in Advance” on Nov. 14, 2013.*

in each case. Mike introduced the idea of surfaces of higher genus and their Euler numbers by using bleach bottles and a torus-shaped balloon, among other items.

All of this transitioned into a discussion of the much more sophisticated notion of “surgery of surfaces.” In this context, surgery refers to modifying a surface by cutting out a (typically short) cylinder and replacing it with two discs. For example, Mike illustrated how both a torus and a Klein bottle can be transformed into a sphere by doing surgery. Poincare believed he had a proof that every surface was equivalent to a sphere via repeated surgery maneuvers, but his proof was false. Indeed, much like the Euler characteristic, it is now known that the Kervaire invariant is an obstruction for transforming certain (stably framed) surfaces (and higher dimensional manifolds) into each other via surgery. For example, Boy’s surface (an immersion of the projective plane into three space, as depicted in a well-known sculpture at Oberwolfach) has Kervaire invariant one, and hence it cannot be transformed into a sphere via surgery.

### Presentation online

To view Hopkins’ lecture, go to: <http://go.unl.edu/hopkins>

Mike even managed to touch a bit upon his recent and seminal work with Mike Hill and Doug Ravenel. The three of them recently settled a 50-year-old question about the Kervaire invariant:

Theorem (Hill-Hopkins-Ravenel): If  $M$  is a smooth, stably framed manifold of Kervaire invariant one, then the dimension of  $M$  is 2, 6, 14, 30, 62 or 126.

At the end of the talk, Mike fielded a variety of interesting questions from diverse members of the audience. Thanks to the live streaming of the event, Mike was even able to respond to a question posed by former UNL graduate student Courtney Gibbons, who viewed the talk live from her new home at Hamilton College.

- Mark Walker



GREG NATHAN/UNIVERSITY COMMUNICATIONS

Chancellor Harvey Perlman presents the ADVANCE-Nebraska Initiative Award to Dr. Judy Walker on Feb. 1, 2013.

## Math wins ADVANCE award

On Feb. 1, 2013, Chancellor Harvey Perlman awarded the third annual ADVANCE-Nebraska Initiative Award for a STEM department that has creatively furthered the objectives of the ADVANCE initiative to the Department of Mathematics.

The Award was accepted on behalf of the department by Dr. Judy Walker, the department chair.

ADVANCE Administrative Co-Director Evelyn Jacobson said of the award: “Mathematics has always been and continues to be committed to the goals of ADVANCE – by welcoming a woman as chair, one of only two UNL STEM department chairs; having promoted women into the ranks of full professors; having supported [female] faculty for prestigious national awards; having achieved a percentage of [female] faculty that exceeds the percentage of [female] assistant and full professors at CIC peer institutions; and by having succeeded in modeling the success in and the necessity of planning for dual career situations.”

Biochemistry and Biological Systems Engineering were the other two departments nominated, and both showed that they were making strides in increasing the number of women in the department, and were creatively addressing issues of retention, climate, and professional development.

– ADVANCE-Nebraska

## Woodward’s retirement leads to advising changes

This fall has seen a change in the advising faculty and staff in the Department of Mathematics. Following the retirement of Professor Gordon Woodward (see page 12), Professor Tom Marley has taken over as Chief Undergraduate Advisor and Lori Mueller and Professor Steve Cohn as Academic Advisors.

Marley is now advising students following their completion of the calculus sequence. Mueller advises the student populations of non-majors, transfers, and freshman and sophomore math majors, and also works with the math placement process in conjunction with Cohn. Cohn works with transfer credits for international students, determining class eligibility for Calculus I and higher level classes, and coordinates the math placement exam for new freshman, grads, transfers and those who are missing credits. Although the leadership in advising has changed, the goal of increasing enrollment of math majors to more than 250 has not changed; with more than 190 majors currently, this goal is in sight.

Marley said he has many goals for the undergraduate program. Among Marley’s goals for the undergraduate major is to see an increase in the number of students participating in opportunities such as summer REUs (Research Experiences for Undergraduates), Penn State’s MASS program

or study abroad programs like the Budapest Semester in Mathematics. He also intends to maintain a strong connection with students after graduation, tracking their career paths.

Both Mueller and Marley said they will look continuously at the course offerings to determine when they need updating and to make sure classes are offered on a predictable and reliable rotating schedule with enough sections to satisfy demand. Other desired changes in the future could include offering a larger variety of 400-level courses and making more advanced classes that are accessible to undergraduates, while not being combined with graduate students.

The advising team is currently working on new print materials and updating its website to “showcase the unique benefits of the UNL Math Department and its strengths,” Marley said. Mueller emphasized, “Math is complementary to so many other disciplines, making it a great option for a double major.”

Among the assets that the advisors credit with the strength of the UNL Department of Mathematics in regard to resources for undergrads are the Math Resource Center (MRC) and the Math Club. Math Club offers a way for undergraduate students to interact with one another and to disseminate information to them about REUs, give them previews to upcoming courses, and listen to speakers talk about job opportunities and graduate school. There also are many different employment possibilities that exist for our majors, such as MRC tutor, grader or calculus teaching assistant.

Opportunities such as these, combined with the support of advisors, who as Mueller said “want students to feel comfortable within the department and feel like they can stop and visit with faculty and staff,” strengthen the UNL math program and help to define it as a program that cares about the well-being of its students and alumni.

– Stephanie Vendetti



Tom Marley



Lori Mueller



Steve Cohn

# Wiegands help residents escape flooding in Colorado

September 24, 2013

Later, after he had skirted authorities and helped shepherd dozens of people over a roaring Colorado creek and he and Sylvia were headed back to Lincoln in a borrowed Audi, Roger Wiegand felt just a little foolish.

A 70-year-old?

Driving a convertible?

\*\*\*

Three creeks come together near Glen Haven, Colo., about half a dozen miles northeast of Estes Park.

Roger and Sylvia Wiegand bought a home on Hummingbird Hill, 80 feet above Fox Creek, in 1983 and have spent more time there since retiring two years ago as University of Nebraska-Lincoln math professors.

So they were in Colorado on Sept. 9, when record rain started falling on the Front Range. It was still falling two days later when they drove to Colorado State University, where their daughter, Andrea Williams – director of international studies – was holding a panel discussion on Syria.

They drove back in the dark.

“The canyon was rather scary,” Roger said. “There were huge waterfalls coming down, and there were boulders in the road we had to dodge. It was very scary getting back.”

Early the next morning, their phone rang with an emergency message: All roads in Glen Haven were impassable, all bridges were out.

That was scary, too. Their daughter had borrowed their Honda and left 15 minutes earlier to get to her classroom in Fort Collins. She returned minutes after the call, the CR-V stuck in the washed-out edge of the first bridge she tried to cross.

“That seemed like a major, major crisis, and it’s just funny: As the whole disaster unfolded, it made that seem more and more minor,” Andrea said. “In the grand scheme of things, it’s just a car. But at the time, it felt huge, it felt terrible.”

They lost power soon after that.

“By Thursday morning, the creek was terribly swollen and there was a constant roar, and we’d thought it’d be over in one day,” Roger said. “But Friday, it was worse. And Saturday, it

was even worse.”

They took walks uphill, away from the water. They cooked out. They shared meals with neighbors they hadn’t yet met.

Then they decided not to wait to be rescued.

\*\*\*

Andrea works as a climbing guide during the summer, and with help from friends on the other side of West Creek, they strung a zip line between trees about a mile upstream from Glen Haven.

That Saturday, they put about 30 people in harnesses and pulled them across to the east side of the creek – and to the roads that led to shelter and safety.

“We did get a lot of people across – and their dogs and their pets and their suitcases,” Andrea said.

Another climber strung a second line near the General Store in Glen Haven.

They learned of a helicopter evacuation planned for that afternoon.

“We were ready, and we waited and waited,” Roger said.

The lift was re-scheduled for Sunday morning. Again, the community gathered.

When they realized no chopper was coming, they decided to use the zip line near the store.

And that was where Roger would get frustrated.

“We waited, in pounding rain, somewhat patiently across from what had been the General Store, as officials made their way across to our ‘island’ and sort of took charge, quite incompetently,” he wrote in an account to friends.

He sent Sylvia across when nobody was looking, but authorities didn’t let anyone else over. They wouldn’t even ferry luggage. They worried about the safety of the line, he said.

As more rain fell into the creek, Roger worried about the danger of not moving.

“The main thing that was worrisome is that in an hour and a half,

nothing happened. I thought it was time to get out of there.”

Father and daughter communicated by hand signals from opposite sides of the creek, surreptitiously at first, then more directly. They were amused, then frustrated, then made plans to meet at the other zip line.

They moved upstream. They spread the word quietly.

“We met over there and started sending people and dogs across, and more and more people started coming to where we were,” Roger said.

He spent four hours on the banks of the swollen creek, helping about 30 people to safety in what he called a “contraband operation.” But it wasn’t entirely illegal – passing firefighters gave them the thumbs up and National Guard troops didn’t question it when they showed up to give people rides to the Red Cross shelter in Estes Park.

\*\*\*

Roger Wiegand doesn’t see himself as a hero. He credits his daughter and her climbing buddies. And everyone else there that weekend.

“Everyone was just coming together and working like mad

on this. Everybody was working hard.”

The Honda their daughter borrowed was washed downstream. But their house wasn’t damaged.

They know people who lost everything.

That Sunday, after the National Guard drove them to Estes Park, they made their way to Denver, where Andrea’s mother-in-law lives.

Roger has been a member of the Chicago Mountaineering Club since 1964. He climbed the Matterhorn in the Swiss Alps after turning 70. He had just helped friends and strangers escape deadly flooding.

Two days later, he and Sylvia climbed into their son-in-law’s convertible and headed east across Nebraska.

“I feel a little bit silly driving such a car at my age,” he said.

– Peter Salter, *Lincoln Journal Star*



COURTESY PHOTO

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## CHAIR *From Page 1*

awards, I wish to congratulate Professor Brian Harbourne on receiving the Hazel R. McClymont Distinguished Teaching Fellow Award from the UNL College of Arts and Sciences. Those of you who have had the privilege of taking a course from Brian will be surprised neither by his receipt of this award nor by the fact that he donated a portion of the prize to establish an award for graduate students in memory of Steven Haataja.

Our graduate program continues to thrive, with 13 students earning Ph.D.s in 2013 and a class of 20 strong first-year graduate students. The incoming class includes two National Science Foundation Graduate Fellows, Jessica De Silva and Jessie Jamieson. Jessie wrote us in April, as she accepted our offer of admission, saying "The entire week following the Sunday I received word of the NSF Fellowship was chock-full of phone calls from universities and math departments from the east coast to the west coast asking me if I had made any commitments to any universities yet. When I told them I

had, or that I was planning on accepting one from UNL, each and every one of them gave the department great accolades. The department representatives also said that they were working to try to make their departments more like UNL's, and repeated that it was a great, impressive department, and that I had made a great choice."

Our initiatives at the undergraduate level are beginning to pay off. Despite losing long-time Chief Undergraduate Advisor Gordon Woodward to retirement, we are up to 192 mathematics majors, and a jaw-dropping 516 students are currently pursuing minors in mathematics. I am currently teaching several of our majors in our honors section of differential equations, and they're a great bunch. I was especially pleased to learn that one, a sophomore double-majoring in math and meteorology from San Jose, Calif., was first introduced to UNL when she participated in All Girls/All Math as a high school student.

We have continued to make important contributions to the mathematical education of teachers, granting 13 MAT degrees and offering

45 graduate-level mathematics courses for 400 in-service teachers during the summer. Jim Lewis has continued to be a national leader in this field, and the CBMS publication "The Mathematical Education of Teachers II," for which Jim chaired the writing team, came out this year. We are pleased to welcome Yvonne Lai to our department as a tenure-track assistant professor with expertise in the mathematical knowledge needed for teaching.

We could not do this work without your support. We sincerely thank our friends and donors. Just in the past year, your donations have gone to support scholarships for undergraduates, travel funding and awards for graduate students and undergraduates, student activities, research conferences, research visitors, named professorships and postdoctoral fellows, our work with the mathematical education of teachers, and many aspects of our extensive educational outreach program. Any contributions you are able to make, large or small, will have an impact on what we are able to accomplish.

# Former chair Leavitt taught by example

William G. “Bill” Leavitt, Professor Emeritus, Mathematics, UNL, passed away peacefully on Aug. 1, 2013. He was born on March 19, 1916, to Fredrick and Mattie (Knapp) Leavitt in Omaha. He earned his B.A. in 1937 from UNL and his M.A., also from UNL, in 1939. Bill served in the U.S. Navy during WWII as a navigation



Bill Leavitt

instructor, teaching young Navy pilots the basics of aerial navigation. He continued in the Naval Reserve after the war, retiring in 1968 as a Lt. Commander. Bill received a Ph.D. in mathematics from the

University of Wisconsin in 1947. He came to UNL that year where he began his distinguished career in mathematics. He was chair of the mathematics department from 1954-1959 and 1960-1964. He served on the UNL faculty for nearly 40 years.

In a long and prolific career, Bill published 65 research papers in eight different decades, from the 1930s to the 2000s. Bill’s field of study was Ring Theory, a branch of Abstract Algebra. He is most well-known for discovering a new type of algebra that later researchers dubbed “Leavitt path algebras.” Bill retired from UNL in 1986 but continued to remain active in his field. He traveled the world, attending math conferences in places like Hungary,

## Leavitt path algebras

Most of the rings we encounter have what is now called the *invariant basis property*, that is, the *rank* (number of elements in a basis) of a free module is well-defined. In other words, if  $R^m \cong R^n$ , then  $m = n$ . Over the ring  $R$  of linear transformations on an infinite-dimensional vector space, however, it’s easy to see that  $R \cong R^2$ , and of course it follows that  $R^m \cong R^n$  for all positive integers  $m$  and  $n$ . But is there a ring  $R$  such that  $R^7 \cong R^{10}$  and with no other such relations except those that follow trivially from this one ( $R^m \cong R^{m+3} \cong R^{m+6} \cong \dots$  whenever  $m \geq 7$ )? In an amazing 1962 paper in the Transactions of the American Mathematical Society, Bill showed that such a ring does indeed exist. This example is said to be of *type* (7, 3) (and the easy example of linear transformations has type (1, 1)). He constructed rings of type  $(n, k)$  for every pair of positive integers  $n$  and  $k$ !

His intricate construction has recently attracted a lot of attention in the guise of “Leavitt path algebras”. These algebras lie on the frontier between algebra and functional analysis and are of great interest to researchers in both camps. The subject has really taken off in the last couple of years: MathSciNet has reviews of 21 papers since 2011 with the string “Leavitt path algebras” in the title.

– Roger Wiegand

China, South Africa, and Tasmania.

Bill loved to take walks and long bike rides. He especially loved biking around Lincoln and the nearby countryside. He and wife, Janie, were out there almost every evening, piling up the miles. He had an odometer on his bike and he was very proud of the miles he would rack up, often several thousand miles per year. In his retirement years Bill frequently visited the UNL math department, attending seminars and social functions. He considered the math department as family, with many good friends there. When Bill turned 90 and again when he reached 95, the math department held special seminars in his honor.

Roger Wiegand recalls taking Bill for a hike in Colorado, when Bill was well into his 80s. They followed a rough trail Roger was unfamiliar with. It involved about 7 miles of rock scrambling, fording of streams, and confusing route finding. Bill loved it.

Bill was the kind of man who

taught by example by the way he lived his life. He was steadfast in supporting his family, whether in good times or bad, with great kindness and generosity. As chairman of the math department he led a very busy life, but he always found time for his family. He was an avid Husker fan as well. From the early 1960s until the 2000s he attended games with his wife, Janie, and son, Bob. When he could no longer attend games he gave his tickets to family members, giving some their first chance to see the Huskers play.

Survivors: son, Bob Leavitt, daughter-in-law, Connie Leavitt; daughter, Carol Eveland and son-in-law, Don Eveland, all of Lincoln; five grandchildren and six great-grandchildren. Preceded in death by wife, Janie (Tollefsen) Leavitt; daughter, Betty Rupprecht; parents; brothers, David and Paul Leavitt; half-sister, Carolyn Leavitt Hale; and half-brothers, Joe and George Bennett.

– Lincoln Journal Star and UNL

## NCUWM *From Page 1*

to continue their studies and pursue careers in math.

Judy Walker, chair of UNL’s mathematics department, said the conference was started in celebration of the department’s 1998 Presidential Award for Excellence in Science, Math and Engineering Mentoring.

“That award was made on the basis of the department’s success with women graduate students,” Walker said. “At the

awards ceremony at the White House, we were challenged to spend the small NSF grant that came with the award in a manner that would build upon and extend the work that led to the award.

“The conference was created as a way of extending the mentoring to women at the undergraduate level, with the explicit goal of encouraging them to stay in mathematics and to continue their mathematical studies in graduate school.”

Since its inception in 1999, the conference has welcomed more than 2,600 women to campus to motivate

and energize them to pursue further educational opportunities in mathematics. Through various activities, attendees are encouraged to pursue graduate studies in the field and are offered a clearer picture of where a career in mathematics can take them.

In the article, one-time attendee Kalyani Madhu said: “It would be no exaggeration to say that the Nebraska Conference for Undergraduate Women in Mathematics changed my life.”

For more, see <http://go.unl.edu/Orf>.

– University Communications

# Faculty News

## Orr enjoying new view at Google

Two years ago, mathematics professor and vice chair John Orr left the UNL campus for the Google campus. While he greatly misses the Lincoln bike trails and coffee shops, this campus on the San Francisco Bay provides a much different view.

The Google campus in Mountain View, Calif., resides next to a park and nature preserve on the shore of the Bay. There also are restaurants all over campus and well-stocked kitchens in all of the buildings. But, working at Google is about much more than just the abundance of good food and a great location.

“Google has an extraordinarily good work environment,” Orr said. “Google is packed full of extremely smart people who are passionate about what they are doing and are eager to share ideas. On one hand everyone is extremely smart; on the other they’re busy doing stuff that’s never been done before. So everyone is willing to listen to new ideas or ask questions.”

As a senior software engineer, Orr recently has been developing Course Builder, an open-source tool for creating and running Massive Open Online Courses (MOOCs). Course Builder’s goal is to promote improved access to high quality education through open platforms.

“It’s used by universities around the world, and also by other institutions wanting to offer courses, including Google itself, which has run courses on Web Accessibility, YouTube, and advanced search,” Orr said. “Google also has recently partnered with edX, and our team is working with edX on open platforms to enable any academic institution, business and individual to create and host online courses.”

Orr has contributed to Course Builder by creating authoring tools for instructors to build their courses online; developing an extensible component model to enable embedding widgets, such as videos, documents, and questions, in lessons; and enhanced



COURTESY PHOTO

*John Orr outside Google headquarters.*

security and reliability. The platform powers more than 100 courses offered by Google and external partners such as Harvard, National Geographic, The Saylor Foundation and Stanford University.

From 2011 to early 2013, Orr worked on the GeoCommerce/Payments team, where he developed the server-side architecture for receiving Google Wallet payments from a browser, which is used by Google Play, YouTube, and Google Drive, as well as external merchants.

Orr currently works with a small team of just four engineers, but his last team consisted of 12. The organization of the engineering teams is very flat, with people contributing wherever they can. Google also places an emphasis on student internships, and Orr has worked with interns on both of his teams.

“With Course Builder, it was particularly useful to have current undergraduates working on the team, and both of our summer interns contributed important features to the product,” Orr said. “Google student internships are a great opportunity to be part of

### Google Internships

#### Technical internships:

Build new features and improve products (and get some extra guidance along the way).

#### Product Management Internships:

Get a head start on learning how to drive product development while working at Google speed.

John Orr said his advice to students wanting a career in software engineering is to get started building some products of your own right away. “Cloud computing, powerful techniques like HTML5, Ajax, and CSS, and amazing development tools like Chrome have really lowered the bar for people to build great scalable web apps.”

<http://www.google.com/about/jobs/students/>

the company. If you saw the movie ‘Internship,’ the great food and the cool environment were real – the artificial and arbitrary competition was fantasy. In reality, engineering interns are integrated right into teams and work side-by-side with full-time team members, often developing features which are launched in Google products.”

The opportunity to be a part of so many different new products is definitely a draw for Orr.

“I love what I’m doing right now, but almost every other team at Google is doing stuff that’s so cool I’d love to be part of it too,” Orr said. “People do move around between teams quite a lot, probably for this reason, so I’ll likely be doing something different soon enough.”

While the cost of living has been tough to get used to, Orr said the California weather has more than made up for it: “I like to say, housing is really expensive but it comes with an awesome snow-removal service!”

## NEW FACULTY

**Yvonne Lai**

Assistant Professor Yuan-Juang Yvonne Lai was born in Ottawa, Ontario, Canada, but was raised in New Jersey. Lai earned her SB

in mathematics from MIT in 2002, and her Ph.D. in mathematics from the University of California, Davis in 2008. She went on to a postdoctoral position at the University of Michigan in math, followed by a postdoc in math education. Her past research has been in hyperbolic geometry and geometric group theory, and she is currently focusing on mathematics education, particularly what it takes to teach proving and reasoning.

**Saeed Nasseh**

Postdoctoral fellow Saeed Nasseh was born and raised in Iran. He earned his bachelor's and master's degrees from Sharif University of Technology in Tehran, Iran,

in pure mathematics, and his Ph.D. from North Dakota State University in mathematics. His research area is commutative algebra and homological algebra.

## AWARDS AND PROMOTIONS

*Brian Harbourne*

**Brian Harbourne**, professor of mathematics, was awarded the Hazel R. McClymont Distinguished Teaching Fellow Award in April 2013. This award

honors faculty who have demonstrated and sustained a record of exemplary teaching in the College of Arts and Sciences and carries a \$6,000 award for the recipient. Recipients teach in a manner that promotes critical and creative thinking, and they empower their students to become active learners in a global society.

*Stephen Hartke*

**Stephen Hartke**, associate professor of mathematics, has been selected as a Fulbright Scholar at the Alfréd Rényi Institute of Mathematics, Hungary, for 2013-2014.

**Srikanth Iyengar**, professor of mathematics, won the College of Arts and Sciences' Outstanding Research and Creative Activity award for the Sciences in 2013. He was also named an AMS Fellow.

**Christine Kelley** has been promoted to associate professor and granted

*Christine Kelley*

tenure in the department of mathematics.

**John Meakin**, professor of mathematics, has earned a Fulbright-Nehru Scholarship to

teach and conduct research in India for five months alongside his Indian colleague, K.S.S. Nambooripad. Meakin will depart in December 2013 for Thiruvananthapuram and will teach at the University of Kerala. Meakin also was named an AMS Fellow.

*Daniel Toundykov*

**Daniel Toundykov**, assistant professor of mathematics, received the Harold and Esther Edgerton Junior Faculty Award in 2013. The Edgerton Junior Faculty

Award is in recognition of creative research, extraordinary teaching and academic promise. Toundykov joined UNL in 2007 as a research assistant professor. He was hired as an assistant professor in 2010. His research emphasis is in the field of nonlinear evolutionary partial differential equations. In addition to his research accomplishments, he maintains a strong dedication to his students, both in and out of the classroom.

## Award established in memory of Haataja

The Steven Haataja Award for Outstanding Exposition by a Graduate Student is in memory of Steven Haataja, 1960-2006, who received his Ph.D. from UNL in 2006 for his thesis "Amalgamation of inverse semigroups and operator algebras," written under the guidance of Professors Allan Donsig and John Meakin. Professor Brian Harbourne established this award.

Haataja earned his master's degree from UNL in 1987 and stayed on as a TA until 1991, when he left to teach at

*Steven Haataja*

Augustana College for two years. The following six years he worked in industry before returning for his Ph.D.

Haataja had broad mathematical interests, ranging from Penrose

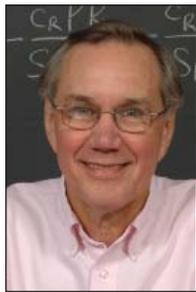
tilings to semigroups to geometric group theory to  $C^*$ -algebras, and

displayed a love for mathematics and mathematical exposition. Throughout his years in the math department he gave many wonderful talks (in one such talk, he explained how to prove the Banach-Tarski paradox using free groups). His enthusiasm for mathematics was obvious to all who were around the department in the evening as Steve was preparing his talks; Steve would gladly give them a detailed preview.

The inaugural award was given in 2013 to Kathryn Haymaker.

## RETIREMENT

**Gordon Woodward** retired as Professor of Mathematics in August 2013. He obtained his Ph.D. at the University of Maryland in 1971 and joined the UNL department later that year. His 42-year career at UNL was distinguished for his many contributions to students.



In 1988, Gordon became the department's Chief Undergraduate Advisor, and he served in that capacity for 25 years. He was singled out by name for his contributions to undergraduate students by the external review team in their 2001 Academic Program Review when they wrote: "This department nurtures its undergraduates and has the most impressive collection of majors we have ever seen."

Gordon was individually recognized for his contributions many times including a 2002 College of Arts and Sciences Teaching Award, the 1999 UNL Student Association/Builders Award for Excellence in Undergraduate Advising, honorary membership in Mortar Board in 2002, two occasions when he won Mortar Board's "People Who Inspire" Award, and the Parents Association Recognition Award for Contributions to Students on 11 occasions. Gordon was Principal Investigator or co-PI for approximately \$1.9 million in NSF grants that funded opportunities for students. The grants include the Nebraska Research Experience for Undergraduates in Applied Mathematics grant that Gordon and Richard Rebarber first received in 2002 and that has been refunded continuously to the present day with others assuming leadership for the grant; CSEMS scholarships for students in math, computer science and engineering; and the Nebraska Math Scholars grant. In 1990, Gordon

and colleague Rao Chivukula created UNL Math Day and Gordon served as co-director or director of Math Day for 23 years until his retirement. Other examples of his leadership with respect to recruiting students to UNL and mentoring undergraduates include serving as director of the department's Junior Mathematics Prognosis Test (JUMP) for nine years, director of the Math Excel program, and serving on countless college and university committees that impacted UNL undergraduate students.

Gordon was a leader in the department's MAT (Master of Arts for Teachers) program that has resulted in more than 150 teachers earning a master's degree since 2006. He created the department's capstone sequence for secondary mathematics majors, Math 407/807 and 408/808 as well as the modeling option, Math 409/809, and he regularly offered special topics courses for teachers as part of the Nebraska Math and Science Summer Institutes.

AMS *From Page 1*

were elected fellows this year.

Meakin, who was chair of the mathematics department from 2003 to 2011, was inducted for contributions to semigroup theory and for his exemplary service as department chair. He said it was gratifying to be recognized by his peers and to receive an acknowledgement of contributions to the profession.

Meakin has focused on algorithmic problems in semigroup theory and connections between semigroups and other areas of mathematics and theoretical computer science — particularly geometric group theory, automata theory, formal language theory, topology, geometry and mathematical logic. He is known for his work with Stuart Margolis and several students in initiating the development of the combinatorial theory of inverse semigroups. Recently, he also was awarded a Fulbright Scholarship to conduct research and teach in India.

He also was recognized for the department's accomplishments. The AMS recognized the department in 2009 for

an Exemplary Program or Achievement in a Mathematics Department.

"We've long held a balanced view toward our research, education and outreach missions, and we've expanded on that," Meakin said.

The AMS recognized Iyengar for his contributions to commutative algebra, representation theory, homotopy theory and algebraic geometry.

His prolific research career has focused on taking ideas from homotopy theory to solve problems in commutative algebra, in collaboration with AMS Fellow Luchezar Avramov of UNL. Iyengar also has used his expertise in commutative algebra in other areas of mathematics. He's collaborated with researchers from the University of Notre Dame; the University of Sheffield and the University of Aberdeen in the U.K.; and Bielefeld University in Germany.

"Nebraska has had a long tradition of strong researchers in my area," he said. "And working with Avramov has been extremely fruitful. We have more than 20 joint publications and continue to work together."

Iyengar has published more than

50 papers and received a Simons Foundation Fellowship that allowed him to spend the 2012-13 academic year at the Mathematical Sciences Research Institute at the University of California, Berkeley, where he was one of the organizers of a Special Year in Commutative Algebra. He is also the Principal Investigator on a National Science Foundation grant that will run through 2017.

Iyengar said he was thankful for the support of his colleagues.

"It's an award from the entire mathematical community. It's good to know that the community values the work you're doing," he said.

The first class of AMS Fellows included five current UNL faculty: Luchezar Avramov, Dale M. Jensen Chair of Mathematics; Jim Lewis, Aaron Douglas Professor and Director of the Center for Science, Mathematics and Computer Education; Judy Walker, Aaron Douglas Professor and Chair of the Department of Mathematics; Roger Wiegand, Willa Cather Professor Emeritus of Mathematics; and Sylvia Wiegand, Professor Emerita of Mathematics.

— Deann Gayman, *University Communications*

# Alumni News



*Math graduates Josh Brown Kramer (left) and Lucas Sabalka now work together at Nebraska Global in the Haymarket. The “N” they are standing on is from the old turf on Memorial Stadium that was replaced in 2013.*

LINDSAY  
AUGUSTYN/  
UNL CSMCE

## Nebraska Global reunites two grads

They even took the “History of China” together.

Nebraska alumni, friends and colleagues Josh Brown Kramer and Lucas Sabalka have crossed paths several times over the past two decades.

After meeting at Lincoln Northeast High School, Brown Kramer and Sabalka both graduated from the University of Nebraska-Lincoln with bachelor’s degrees in mathematics and computer science, even taking a history course together along the way; went on to earn Ph.D.s in mathematics at separate institutions; collaborated on research as faculty; and, as of May 2013, both work in Lincoln at Nebraska Global as applied mathematicians.

The career potential at Nebraska Global was the driving factor behind both of their returns to the state, as well as being closer to their families in Lincoln.

“If it wasn’t for Nebraska Global, I would probably still be teaching at

Illinois Wesleyan,” said Brown Kramer, who was an assistant professor at Illinois Wesleyan from 2007 to 2011. “I think there is a fairly unique mix at Nebraska Global. They are working on problems where they need someone who has a background in mathematics and a strong background in problem solving, and they are also doing interesting things. Nebraska Global is doing something special.”

Nebraska Global, which started in 2009, is a venture capital firm that focuses on building a sustainable tech environment by establishing software businesses within the state. Brown Kramer knew one of its employees and wished to get back into more of a research environment. He joined the team in 2011, after asking Sabalka for his advice.

With Brown Kramer established at Nebraska Global, Sabalka consulted for the company in the summer of 2012, getting a feel for the company. In

the fall, Sabalka started a tenure-track position at Saint Louis University, but after one year living in St. Louis, he and his wife decided they didn’t enjoy living there. When Sabalka got an offer from Nebraska Global in 2013, he took it.

Presently, Brown Kramer and Sabalka work on computer vision applications with two other Nebraska Global employees.

“These are applications where we are making a computer see,” Brown Kramer said. “The first project I did before Lucas came on board was called Elite Form, which is a weightlifting product. There is a camera mounted to a weight rack and you get in and do squats or bench presses, and it watches what you are doing and calculates the speed of your reps. It’s also counting them and keeping track of the power you have generated. That’s the core algorithm that I helped put together as part of a small research team. Another

*See GLOBAL on Page 14*

GLOBAL *From Page 13*

team put together the reporting aspect of it. It will synch up on a network so a coach can go to a website and look at his team and see how they've been improving in terms of their power generation. The Husker football team uses it. Several teams around the country have bought it. It's being used, and it's doing well."

The color RGB camera in this technology is based on a depth camera and is the same camera used in the Xbox Kinect.

"The reason Nebraska Global needs mathematicians [on these projects] is because you're talking about color and you're talking about depth and time, so you've got this geometry in five-dimensional space that you have to try and analyze and pick out the important objects," Sabalka said.

But, their job is about much more than just mathematics.

"Problem solving has been the biggest asset that we've brought to the company. There's matrix theory that has to be done in order to do manipulations in 3D space that probably Lucas and I are the only ones at Nebraska Global who could do it reliably. Other than that, we're not strictly doing stuff that we learned in math class," Brown Kramer said. "Another asset we bring is the ability to go through and digest research papers and learn quickly what the state-of-the-art [technology] is and what other people have done. Now we're working on something called Health Ventures, and we're applying this computer vision technology to the healthcare industry."

While Sabalka tried out working at Nebraska Global many years after his college graduation, he strongly recommends that math undergraduates try to find opportunities in the field they are potentially considering as a career, including research experiences and internships.

"When you are an undergraduate, you can really get a lot of valuable experience in a short amount of time," he said. "People are looking for short, three-month stints where you can get a feel for them and they can get a feel for you, and you can really know if that's what you want to do for the rest of your life."

Born in California, Brown Kramer



LINDSAY AUGUSTYN/UNL CSMCE

*Josh Brown Kramer demonstrates the Elite Form project.*

moved to Lincoln in 1993. After graduating from Northeast, he graduated from UNL with a bachelor's degree in mathematics and computer science in 2001. He then went on to earn his Ph.D. at UNL in mathematics in 2007 and became an assistant professor at Illinois Wesleyan University before joining Nebraska Global. Brown Kramer and his wife, Carolyn, married in 2002 and have two sons, Liam and Alex. Carolyn earned her Ph.D. in psychology from UNL in 2009.

Sabalka, who was born and raised in Lincoln, graduated from Northeast and then earned his bachelor's degree from UNL in mathematics, computer science and history, with minors in physics and psychology, in 2002. He received his Ph.D. in mathematics from the University of Illinois Urbana-Champaign in 2006. He did a postdoc at the University of California, Davis from 2006 to 2008. In 2009, he began another postdoc at Binghamton University in New York, to be at the school where his wife, Stacie, is working on her Ph.D. He then got a tenure-track professorship at Saint Louis University in 2012 and came to Nebraska Global in May 2013.

In 2008 and 2009, when Sabalka was a postdoc and Brown Kramer was at Illinois Wesleyan, the two did collaborate on two research papers, one in combinatorics and one in robot navigation.

Both Brown Kramer and Sabalka heeded the advice of several UNL mathematics professors in their decision making during their academic careers.

"Gordon Woodward was fantastic. He gave me lots of great advice. I would go to him all of the time. He pushed me toward participating in the MASS [Mathematics Advanced Study Semi-

nars] program at Penn State. Because of him and the Penn State program, I was done with all of my core math courses by the end of my third semester," Sabalka said. "I also wrote an undergraduate honors thesis with Susan Hermler and John Meakin, who were fantastic advisers. Every week, or every other week, for two years I would meet with them.

Gordon set all of that up. He organized and directed my career and helped me get where I am."

They both also credited Judy Walker's course on group theory as formative to their careers.

"My favorite professor was Judy Walker," said Brown Kramer, who also still keeps in contact with his thesis adviser Jamie Radcliffe. "I think it was my sophomore year I took her course in group theory, and it was the first time I had to do hard-core proofs and got to see the abstraction of mathematics, and I really loved it. After taking that course, that's when I really decided that I was going to be a math major."

Sabalka added, "Eventually I went into my specialty as a mathematician in geometric group theory so that course certainly informed my eventual career."

Sabalka also was influenced early on by UNL lecturer and former Northeast math teacher Bill Rogge, who was the mentor to the high school's math club of which both he and Brown Kramer were members.

"Bill was my inspiration. He really catalyzed my love of math and my pursuit of a mathematics career. I knew when I was going from high school to college that I would get a math major. I also had some scholarships from UNL Math Day, so that was a no-brainer," Sabalka said.

Keeping in contact with each other and UNL professors over the years has also allowed them to make their academic and career decisions with confidence.

"You should seek the advice of people whose opinion you respect and trust, and listen to it," Brown Kramer said, "rather than try to make all of these decisions on your own."

—Lindsay Augustyn

# Loves of math, music come together

The connections between mathematics and music fascinate Barbara Zach.

The executive director of Lincoln's Symphony Orchestra (LSO), Zach was a dual mathematics and piano performance major at UNL and has found a satisfying career that unites her two favorite subjects.

"I read a book called 'Mathematics: The Science of Patterns,' and it points out that math and music are the only two disciplines with their own language that can only be read by someone skilled, but can be appreciated or understood by anyone," Zach said. "In math, that translates into complicated equations that can also be shown visually in graphs that you can understand. In music, complicated sheet music can be understood if someone plays it for you and you can hear it. There is something about the way that you synthesize information for both fields that is similar."

Since graduation, Zach has been working for the orchestra. She started out as orchestra manager, coordinating all of the details for concert production, and then was promoted to executive director in 2005. The position has exceeded all of her expectations.

"I was thinking about grad school or a job in the field of mathematics, and I thought I would find part-time employment in Lincoln while I was looking," Zach said.

As it turned out, LSO was combining three part-time positions into one full-time orchestra manager position, which she was happy to accept. "I didn't realize that this would be the perfect career for me. I absolutely fell in love with the art form. As a solo pianist, I spent a lot of time alone, and there is something really beautiful about the community in an orchestra and all these musicians coming together from completely different perspectives, even musically, and creating something that is so compelling."

As executive director, Zach focuses on thinking about the "big picture," through strategic planning and fund raising. She oversees the orchestra's \$1 million budget, of which only 25 per-



COURTESY PHOTO

*Barbara Zach, who was a math and piano performance dual major at UNL, is now the executive director of Lincoln's Symphony Orchestra.*

cent comes from ticket sales and the rest from donations. Primarily, she enjoys sitting with Edward Polochick, LSO's music director who is on the faculty at the Peabody Conservatory in Baltimore, dreaming artistically, and keeping "a running list of dream projects."

But her favorite part of the job is a performance week. The musicians, who receive their music two weeks before rehearsals begin, prepare alone, but then see one another for four nights before the concert, each



*Kristie Pfabe*



*Edward Polochick*

with a two-and-a-half hours-long rehearsal. Eighty percent of the musicians are teachers or professors, and all of them but the concertmaster live in Nebraska. Some even have math degrees.

"Ed, our conductor, and our principal flute player studied math as undergraduates, and one of our violinists, Kristie Pfabe, is the math de-

partment chair at Nebraska Wesleyan," Zach said. In fact, Pfabe received her Ph.D. in mathematics from UNL.

Zach also leads an effort to change the image of the orchestra within the community.

"We made a huge push to show that we have a very welcoming personality as an organization. People think of orchestras as being stuffy and only for an elite few," Zach said, "but we exist to serve this community. To see the diversity of our audience grow exponentially in the last couple of years since we lowered our ticket prices and moved to the Lied, and see that the size of our audience has doubled, that has been very rewarding to me."

It was actually an experience singing with the LSO as a freshman in the UNL choir that persuaded Zach to add music as a major.

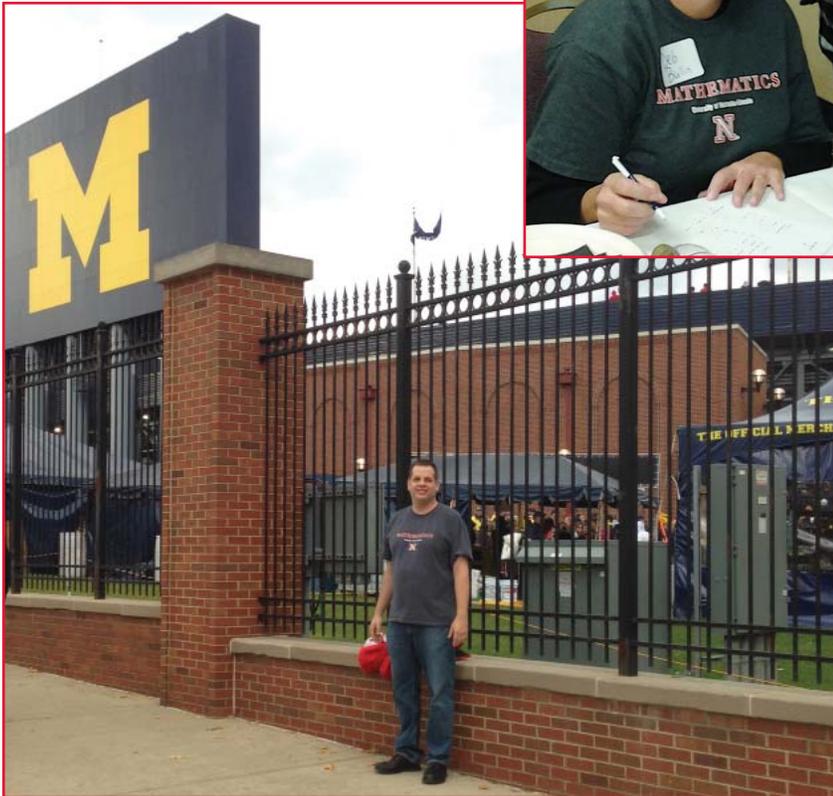
"I went from just playing piano when I was younger, just popular stuff and playing by ear and not really learning how to read music, to really wanting to pursue classical music seriously so I auditioned for the School of Music," said the Omaha native and Westside High School graduate.

Before the opportunity with the LSO, Zach was thinking of becoming a high school or college math teacher

See ZACH on Page 16

# { Where has your Mathematics T-shirt been? }

*Below: Dan Augustyn (BS '99) wore his math T-shirt to the Nebraska football game at Michigan on Nov. 9, 2013.*



*Above: Deb Bulin (left), a current Master of Arts for Teachers student, wore her math T-shirt to the NATM Conference's NebraskaMATH event on Sept. 29, 2013. She is pictured here with Pari Ford, a mathematics assistant professor at UNK who earned her Ph.D. at UNL in 2008, and Angela Blank, a Nebraska mathematics teacher who was a 2011 MAT graduate.*

## ZACH *From Page 15*

and adding an education degree as well because of her other love besides music: math.

"I love the complexity," she said. "Really intelligent people have the capacity at once to understand that nothing is ever simple so they don't just take things on face value, and they understand that there are complex underpinnings to every decision. But then at the same time, they are able to take really complex subjects and make them easy to understand. That was one thing I loved about teaching math: it's not a simple subject but almost anyone

can grasp some exciting concepts."

Her experience in Dr. Mark Sapir's Math 314 course, "the hardest class I ever took in college," not only challenged her as a student but also helped her learn life skills that she uses today in her profession.

"When I'm giving speeches about music education and how important it is, I talk about the experience of working in an ensemble and how it teaches you to cooperate and listen to other people. In the same way, this class was really great because all of our homework was done in groups of three. Everyone contributed a beneficial perspective, and it was really great

to learn from other people. In this class, it was never about just having the answer," Zach said.

For Zach, the critical thinking skills and fascinating mathematics knowledge acquired from upper-level mathematics are worth the struggle through the foundational courses.

"The discipline of thinking logically will serve you well the rest of your life," Zach said. "Math teaches you the discipline of not accepting faulty logic or lazy thinking and forces you to really wrap your brain around difficult and complicated concepts, let them percolate and then find a creative solution."

– Lindsay Augustyn

# Class Notes

**Scott Blunk (MA '82)** is a Senior Supervisor Engineer at BAE Systems doing research on the mixed integer program. Blunk is married with two daughters, one who attends UNL as an industrial engineering major and the other attends Papillion-La Vista South High School.

**William Bosch (Ph.D. '70)** is retired from the University of Northern Colorado and now lives in Spearfish, S.D., with his wife, Peggy. He hangs out at the Black Hills State University mathematics department and volunteers his time tutoring students, in between fishing trips. His email address is [wbosch@spe.midco.net](mailto:wbosch@spe.midco.net) and he would like to hear from former graduate student friends from the 1965-71 era.

**John Bullock (MA '04)** is Senior Staff Actuary in fixed and income annuity valuation at Ameriprise Financial. He lives in Farmington, Minn., with his wife, Amy, and two kids, Ainsley and William. He has worked at Ameriprise since graduating from UNL. He received ASA (Associate in the Society of Actuaries) in 2008, MAAA (Member of the American Academy of Actuaries) in 2009 and CERA (Chartered Enterprise Risk Analyst) in 2011. Bullock also has enjoyed refereeing high school basketball since 2007.

**April Christensen (BS '09)** earned her M.D. from Vanderbilt in 2013. She is now an internal medicine intern at Vanderbilt University Medical Center in Nashville, Tenn.

**Andrew Clements (BS '06)** is a life actuary at Lincoln Financial Group. He

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has been married to his wife, Brooke, for five years, and started working at Lincoln Financial Group after graduation. He obtained the Fellowship of the Society of Actuaries (FSA) credential. His hobbies include playing competitive bridge and running.

**Lisa Davis (BS '99)** went on to her earn her MS in industrial and operations engineering at the University of Michigan in 2004 and her MBA from Emory University's Goizueta Business School in 2006. She now works at the Office of the Secretary of Defense as an Operations Research Analyst. She provides independent analysis on topics of interest to the Secretary of Defense. She previously worked at IBM as a supply chain strategy consultant. Davis is married to Tim and has a daughter, Amelia, born in May 2012.

**Greg Erdmann (MA '71)** is retired from Agilent Technologies, where he was an engineering consulting manager on semiconductors. Having also earned an MBA, Erdmann was a mathematician for five years with the US Navy, then spent 14 years as an applications engineer or in sales and marketing for Hewlett Packard, and 22 years at Agilent Technologies. His current hobbies are golf, running half marathons, choral singing, and teaching adult Sunday school classes.

**Gopi Goda (BS '00)** earned her Ph.D. from Stanford University in 2007 in economics. She worked as an actuarial associate at Northwestern Mutual before attending graduate school at Stanford. After graduate school, she spent two years as a Robert Wood Johnson Scholar in Health



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Policy Research at Harvard University before returning to Stanford as a researcher at the Stanford Institute for Economic Policy Research. She and her husband, Sunil, welcomed their first son, Milan, in July 2012.

**Gary Gruenhage (BS '69)** is a Professor of Mathematics and Statistics at Auburn University, after having earned his Ph.D. at the University of California, Davis, in 1973. His research area is topology. He recently received an award from Auburn and was asked to give a talk to a general audience about his research. The Auburn Graduate School posted the talk on YouTube at: [http://www.youtube.com/watch?feature=player\\_](http://www.youtube.com/watch?feature=player_embedded&v=MSEICqc3shY)

**Karl Hinman (MS '77)** is retired from Raytheon as a systems engineer. He met his wife, Judy (Serbousek), when they had neighboring offices in Oldfather Hall as TA's in 1976. They now live in Richardson, Texas, where they have both had long careers, starting at Texas Instruments, Judy moving to E-Systems, and then Raytheon buying out both defense departments. Their backgrounds gained at UNL in the math and computer science departments were the starting key to both of their long and successful careers.

**Matthew Kutscher (BSEd '98, MA '04, Ph.D. '08)** is now an Assistant Professor in Secondary Education at Doane College in Nebraska, after earning his BS in math education, MA in curriculum and instruction and Ph.D. in educational studies, all from UNL.

# Staff News

Accountant **Tom Danaher** has recently joined the College of Arts & Sciences Staff Council. He holds a position on the sub-committee for staff recognition. Danaher also received the College of Arts & Sciences annual

Applause Award. He has been with the department for eight years. **Lori Mueller** is now in a new role as an Academic Advisor (more on page 6). Systems manager **Rex Dieter** has been the go-to tech man for the department for the last 18 years. He is in the process of installing Windows 7 on department computers. Graduate program assistant **Marilyn Johnson**

has organized several events for the department within the last year, including the Peterson Conference (see page 2). Johnson has been with the math department/CSMCE for 18 years. Secretary **Liz Youroukos** has taken on helping with searches to fill job openings. She has been with the department for eight-and-a-half years.

# Student News



*Emma Reid (third from the right) stands in a wind tunnel at the NASA Langley Research Center during her LARSS internship in 2013. To apply for one of the three annual internship sessions, go to <http://nia-cms.nianet.org/LARSS-2012/index.aspx>.*

## Reid interns at Langley

Emma Reid, a junior math major from Lincoln, was selected for the highly competitive internship program at Langley Aerospace Research Student Scholars (LARSS) program in the summer of 2013.

Located in Hampton, Va., LARSS is a paid research internship program through NASA for undergraduate and graduate students pursuing degrees in STEM fields. LARSS receives about 1,000 applications annually, from which 200 students are accepted.

Reid, a graduate of Lincoln Southeast High School, was paired with mentor Eric Walker in the National Transonic Facility. Mentors assign interns a project and work with them on it for more than 10 weeks. Reid was

modeling the temperature distribution within the transonic wind tunnel as a tool for the test engineers, and collaborated with four other interns.

“The experience was amazing,” Reid said. “Though you work a lot, there is also so much to see at the center. We toured wind tunnels on-site [see photo] as well as heard speakers on topics such as the HIAD and game-changing development. At the end of the program, there is a poster session where many of the interns present on their projects to the general public and other NASA employees.

“The experience inspired me to broaden my horizons with math and consider many other career paths and applications.”

## Burke earns graduate research fellowship

Mary Burke of Wahoo, Neb., was awarded a National Science Foundation Graduate Research Fellowship to pursue a Ph.D. in Computer Science. She graduated with a bachelor’s degree in mathematics from UNL in May 2013 and returned to UNL for graduate school.



Other math- *Mary Burke*

emantics undergraduates to receive NSF Graduate Fellowships recently include Heather Flores, a dual math-biology major, in 2005, and both Lucas Sabalka (see page 13) and Ellen Veomett in 2002. In addition, first-year UNL mathematics graduate students Jessica De Silva and Jessie Jamieson currently hold these prestigious fellowships.

Burke will be working on a project built upon her current research in Constraint Satisfaction Problems (CSPs). She is investigating strategies for learning and summarizing no-goods to improve the performance for solving binary CSPs. She proposed new strategies that are applicable to non-binary CSPs that exploit higher learning order consistencies, which are the result of recent research at the Constraint Systems Laboratory.

“My undergraduate math courses have prepared me a great deal for graduate school and my upcoming research projects,” Burke said. “Throughout my undergraduate curriculum, many of my math professors shared personal experiences about research projects and work in the industry during class, as well as during office hours. These encounters both in and outside of the classroom encouraged me to participate in undergraduate research opportunities and pursue graduate studies.”



### MAT memories

*Nebraska high school mathematics teachers (from left) Heather Lander, Heather Peters, Gina Vifquain, Julianne Meier, John Sweeney, Carrie Kopf, Sarah Scofield and Megan Lund graduated in August 2013 from UNL with their MAT degrees.*

2012-2013

## Undergraduate Awards

**Chair's Prize** Awarded to the graduating senior with strongest mathematics record  
Katie McKeon

### Special Scholarships Awards (over \$1,000 per year)

Note: 77 scholarships of \$1,000 or more were awarded for 2013-14 academic year.

### Dean H and Floreen G Eastman Memorial new freshmen scholars (for Nebraska high school graduates)

Cashous Bortner, Shimin Deng, Megan Han, Ryan Haynatzki, Terran Merriman-Honerkamp, Avi Knecht, Steven Koontz, Matthew O'Dell, Tanner Pfeiffer, Carter Svec, Devan Varrelli, Xuehua Zhong

### Irwin Dubinsky Memorial Scholar

Cassandra McKay

### Joel Stebbins Fund (available to all)

Alexander Burch, Claire Schirle, Karly Williams

### Rennemann/Luebbers (out of state)

Emily Krumbach

### Winchester Fund (available to all)

Nikolas Bravo

### Graduated with Honors from Honors Program

Alexander Estes, Ryan Gunderson, Katie McKeon, Evan Nash

### Senior Honors Thesis and Graduated with Distinction (directed by):

Amy Been (Christine Kelley), Alex Estes (Allan Peterson), Ryan Gunderson (Mark Walker), Katie McKeon (Christine Kelley and Judy Walker), Evan Nash (Stephen Hartke)

### Putnam Participants

Joseph Becker, Nikolas Bravo, Evan Nash, Alexander Estes, Ryan Gunderson, Rollin Metzger (Mentor: Mikil Foss)

### UCARE Awards for Math Majors

Mary Burke (CSCE), Jessica Burow (Christine Kelley), Elyssa Drouillard (Biochemistry), Casey Griffin (Meteorology), Sook Kin Ho (Statistics), Grant Langdon (Psychology), Chaoyu Liu (Petronela Radu), Evan Nash (Stephen Hartke)

## Graduate Awards

### NSF Graduate Fellowships

Jessica DeSilva and Jessie Jamieson

### Folsom Distinguished Dissertation Award

Christopher Goodrich

### University Presidential Fellowship

Kathryn Haymaker

### Chancellor's Doctoral Fellowship

Derek DeSantis

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

Tanner Auch, Joseph Geisbauer-Honorable Mention

### Grace Chisholm Young and William Henry Young Award

Michael Brown

### Outstanding Qualifying Exam

Maranda Franke

### Walter Mientka Teaching Award

Sara Reynolds

### Outstanding First-Year Student Award

Michael Brown

### Emeritus Faculty Fellowship

James Carraher (Bill Leavitt Award), Nora Youngs (Lloyd Jackson Award), Sarah Behrens, Lauren Keough

### Othmer Graduate Fellowship

Jessalyn Bolkema, Neil Steinburg

### GAANN Fellowships

Melanie DeVries, Courtney Gibbons, Ashley Johnson, Lauren Keough, Jason Lutz, Anisah Nu'Man, Christopher Schafhauser

### MCTP Trainees

Advanced (Fall) - Tom Clark, Amanda Croll; Advanced (Spring) - Philip Gibson; First-Year: Eric Canton, Jill Jessee

### Steven Haataja Award for Outstanding Exposition

Kathryn Haymaker

## Bachelor's degrees

**May 2013:** Rachel Ahrens, Amy Been, Cameron Bravo, Dylan Broad, Caleb Brown, Brittany Bunker, Mary Burke, Taylor Clark, Susan Cooper, Kenneth Cutler, Tanner Dozark, Alexander Estes, Leo Fogel, Casey Griffin, Corbin Groothuis, Ryan Gunderson, Sook Kin Ho, Joseph Lenzo, Peigeng Li, Collin Lysford, Katie McKeon, Evan Nash, Jared Roths, Joseph Ruiz, Matthew Shuman, Zachary Skokan, Yusheng Song, Rachel von Kampen, Xuchen Zhou, Luze Zhou

**August or December 2012:** Jessica Burow, John DeLong, Tyler Hoehn, Ryan Saenz, Mallory Slama, Matthew Spencer, Derek Wietjes

## Master's degrees

**2013 (MA/MS):** Kristen Chockley, Douglas Dailey, Maranda Franke, Kyle Kalail, Rachel Kirsch, Brent McKain, John Myers, Nicholas Owad, Christopher Schafhauser, Brittney Turner, Ethan Twisdale, Emily Young

**2013 (MAT):** Bret Beermann, Chara Guthrie, Carrie Kopf, Heather Lander, Megan Lund, Julianne Meier, John Myers,

Kathy Niedbalski, Heather Peters, Sarah Scofield, Audrey Smalley, John Sweeney, Gina Vifquain

**2012 (MA/MS):** Brittany Hinds, Muhammad Inam

**2012 (MAT):** Brian Stevens

## 2013 Doctorates

**Auch, Tanner** (Oklahoma Baptist University) *Development and application of difference and fractional calculus on discrete time scales*, Lynn Erbe and Allan Peterson

**Awasthi, Pushp** *Boundary value problems for discrete fractional equations*, Lynn Erbe and Allan Peterson

**Boeckner, Derek** *Directed threshold graphs and directed graph limits*, Jamie Radcliffe

**Corwin, Nathan** (Rutgers University) *Embedding and nonembedding results for R. Thompson's group V and related groups*, Mark Brittenham and Collin Bleak

**Croll, Amanda** (Concordia University, Irvine, Calif.) *Periodic modules over Gorenstein local rings*, Srikanth Iyengar

**Denkert, Annika** (Postdoctoral, University of Nebraska-Lincoln) *Results*

*on containments and resurgences, with a focus on ideals of points in the plane*, Brian Harbourne

**DeVries, Melanie** *Unknotting moves of virtual knots*, Mark Brittenham and Susan Hermiller

**Geisbauer, Joseph** (Nebraska Book Company/Neebo) *Regularity for solutions to parabolic systems and nonlocal minimization*, Mikil Foss

**Gibbons, Courtney** (Hamilton College, Clinton, N.Y.) *Decompositions of Betti diagrams*, Luchezar Avramov and Roger Wiegand

**Janssen, Michael** (Hyland Software, Inc.) *Symbolic powers of ideals in  $k[P^N]$* , Brian Harbourne

**Johnson, Ashley** (University of North Alabama) *Closure properties and other examples of (Auto)stackable groups*, Mark Brittenham and Susan Hermiller

**Nolting, Ben** (Postdoctoral, Case Western Reserve, Cleveland, Ohio) *Random search models of foraging behavior: theory, simulation, and observation*, David Logan and Chad Brassil

**Yu, Xuan** (University of Antwerp, Belgium) *Geometric study of the category of matrix factorizations*, Mark Walker

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

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