THE UNIVERSITY OF ARIZONA
Department of Mathematics

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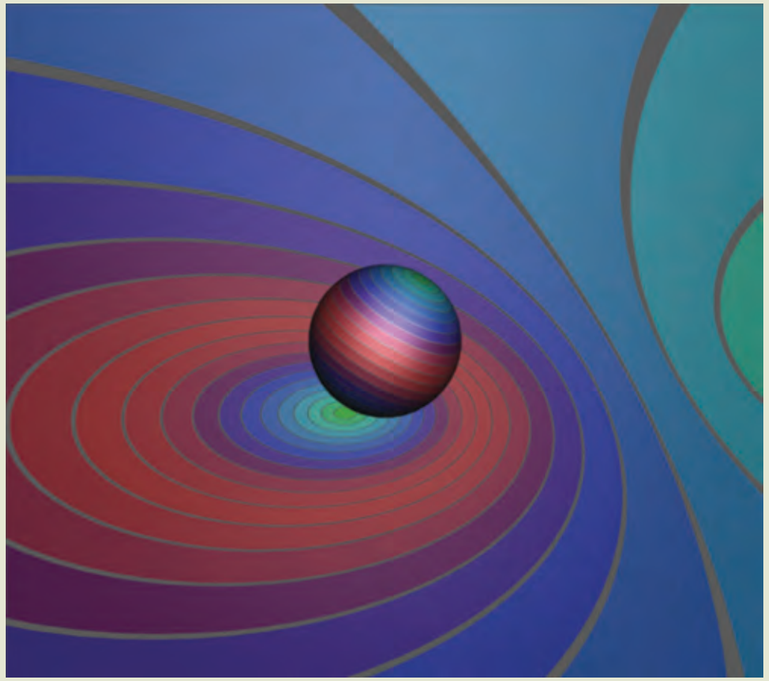

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MATHEMATICS

UA SCIENCE

A View from the Chair

William G. McCallum, Department Head and University Distinguished Professor of Mathematics

Elias Toubassi, who retired a couple of years ago after a distinguished career of service to the department, dropped by my office last August with the wonderful news that his son Jamil was endowing an undergraduate scholarship in his honor. Jamil's generous contribution has been augmented by Elias's family and friends, and by our faculty, in a great tribute to Elias's life work. The first Toubassi Award was awarded to Sean Howe. Please join me in thanking Jamil, honoring Elias, and congratulating Sean.

The other unexpected good news this year was a bequest in honor of Marianne Cooke Johnson, an undergraduate here who went on to become a school teacher. The bequest will fund a scholarship for a promising female undergraduate with an interest in education.

We are also grateful once again to Linda Lohse for another large addition to the endowment for the Dr. Roy F. Graesser Endowed Chair in Mathematics.

The School of Mathematical Sciences, a collaboration between the Department of Mathematics, and the graduate interdisciplinary programs in Applied Mathematics and Statistics has recently been approved by the faculty senate and Arizona Board of Regents. The School will foster collaborative work between the three units and showcase the centrality of mathematics to the university community and beyond. In this newsletter we highlight two new members of the new Statistics GIDP, assistant professor Selena Niu and graduate student John Bear.

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Son honors father's hard work with endowment

By Karen Schaffner
Administrative Assistant

When Elias Toubassi, 66, was a little boy in Israel, moving to the United States was the last thing on his mind. Tucson, Ariz.? Never heard of it.

"True. I had not heard of Tucson. I did watch movies of the West with actors like Gary Cooper," Toubassi said. But Toubassi did come to the U.S. and spent his career—37 years—as a professor of mathematics at the University of Arizona. His research focused on abelian groups and mathematics education. He retired from the Department of Mathematics in 2007 and is now an emeritus professor.

"I can't imagine a better professional experience. I really feel blessed to be a part of the department," Toubassi said.

To honor his father's work, Jamil Toubassi has donated the seed money for the Elias Toubassi Scholarship Endowment in Undergraduate Mathematics, an annual $1,000 scholarship for an undergraduate math or math education major. The Mathematics Department has pledged to fund the scholarship for the first three years while the Endowment interest is being capitalized. The first scholarship will be awarded in the Spring of 2010 at the department's annual awards ceremony. To date (Dec. 8, 2009), 10 donors have given to the scholarship fund, for a total of $4,350, in addition to the original gift.

Jamil Toubassi, left, shares a happy moment with his father, Professor Emeritus Elias Toubassi, right. Jamil Toubassi is honoring his father by establishing a scholarship in his father's name in the Math Department. The Elias Toubassi Scholarship Endowment in Undergraduate Mathematics will provide a $1,000 scholarship each semester for an undergraduate student majoring in math or math education.

"I thought that would be a good way to recognize what my father did, keep his name around for a good while," Jamil Toubassi said.

Toubassi said the announcement was a big surprise.

"On my birthday Jamil took us out to dinner and he said, 'We started this for you.' I had no inkling that this was in the offing," he said. "It was overwhelming. It wasn't something that was on my radar at all. My wife was just shocked."

The youngest of three boys, Toubassi began his career in education when he graduated from high school and got a job teaching elementary school in 1960 "without training or anything," he said. Toubassi hadn't considered a U.S. education until his oldest brother, who worked for an agency attached to the American Embassy, brought home literature on American colleges and universities. "That opened up the vision to come to the U.S.," Toubassi said.

In 1961 that brother left to study in the U.S. The next brother, who also worked at the aid agency at the embassy, made his plans to come to the U.S. In 1962, he won two scholarships. Because he could only take one, Toubassi "got the idea I could use the leftover (scholarship)." The college, Texas Wesleyan College, agreed and at the age of 19, the youngest Toubassi found himself alone in Fort Worth, Texas, a math and physics major. "It was a shock to my parents. That two sons would be leaving," he said. Although his family was poor, he had $900 in his pocket. "That's all there was. I worked for room and board. I protected that ($900) for emergencies."

Still, Tobassi said there were a lot of nice people at Texas Weslyan and it made the adjustment easier. He knew English from having attended a Scottish missionary school so he was ready for academia. "I came with the mindset to fit in. I was open to the style and food, and the people. I tried to blend in," he said. "I developed a taste for American food. I always found Jello interesting as a salad because it's sweet."

A year and a half later, Toubassi transferred to Bethel College in Kansas. His junior year he met Jane Douglass. They have been married for 42 years and have two sons, Jamil and Garrick, and three grandchildren, with a fourth on the way. "I got lucky there too; (she's) a good wife, a good mother, a good partner," he said.

After graduating from Lehigh University with his Ph.D. in 1970, Toubassi came to the University of Arizona. The Sonoran Desert was not what he expected. "When I think of the desert, I think of the Sahara. I expected to see a sandy desert," he said. But it's the way students have changed and evolved that really surprises Toubassi.

"I think current students have a bit more expectations from their instructors. They think they deserve certain things. They overestimate their understanding. The students of the 70s were willing to accept your counsel; they were more patient. They were willing to work and not argue with you," Toubassi said. "On the other hand, (today's students) are much more open-minded. They are much more curious and willing to take leaps of faith. It's the two sides of that coin."

As he looks back, it's clear Toubassi considers himself a fortunate man.

"There are some students that I've enjoyed immensely...the math teachers in high school and middle school, I admire their professionalism and the work that they do. I have respect for the adjuncts and postdocs. They have contributed immensely to the department. I've had some nice collaborations in the department. I've had a wonderful life, a wonderful career, and wonderful friendships. I've been fairly blessed," Toubassi said.

For information on the Elias Toubassi Scholarship Endowment in Undergraduate Mathematics, contact David Gonzalez at gonzalez@math.arizona.edu, or 520-621-1486. Tax deductible donations may be made by check. It should be made payable to the University of Arizona Foundation, and the memo line should say, Elias Toubassi Scholarship Fund. Checks may be sent to David Gonzalez, Business Manager Sr., Grants and Contracts Office, Department of Mathematics, University of Arizona, 617 N. Santa Rita, Room 112, Tucson, AZ, 85721.

Elias Toubassi spent 37 years in the UA Department of Mathematics before retiring in 2007.

Reflections on 37 Years at the University of Arizona

By Elias Toubassi
Professor Emeritus

I joined the Mathematics Department in the fall of 1970 after earning my Ph.D. degree from Lehigh University in Pennsylvania. My primary focus during the early years was on my research in abelian groups. In the fall of 1972 I was fortunate to sponsor a special semester in abelian groups funded by Science Development Funds provided by the National Science Foundation. Laszlo Fuchs from Tulane University was a professor in residence for the entire semester and eight leading figures in the field visited the department for one week at various times to give a week-long series of lectures. It culminated in a special publication of all the lectures given during the semester.

During my career I had the privilege to collaborate with a number of colleagues. These include Don Lawver, Laszlo Fuchs, and my advisor, Samir Khabbaz. However, the two individuals who had the most impact on my research are department colleague Warren May, and Otto Mutzbauer from the Math Institute in Wuerzburg, Germany. Those collaborations lasted for many years and led to a number of publications and a lifelong friendship. I attended and presented at a number of national and international conferences including ones at New Mexico State, Colorado State, Connecticut, Montreal, Padua, and Oberwolfach.

My administrative service started in 1977 when Hanno Rund (then department head) asked me to serve as his Associate Head. At that time the teaching environment was under a lot of pressure. More and more students arrived on campus underprepared for university work in mathematics. This was coupled with cutbacks in resources for the department. By 1983 the situation had gotten so bad that Provost Niels Hasselmo created a University task force to look into lower division mathematics courses. One of the main conclusions of the committee report said that the department needed additional resources to fulfill its teaching mission. This led to a flow of additional funding for the department, partly from the university and partly from the state via decision packages.

In order to earn the university's trust and demonstrate that the department could turn the situation around, the Entry Level Committee, consisting of Bill Conway, Richard Pierce, Fred Stevenson, and I, drafted a five-year plan. The cornerstones of the plan were:

1. Restructure the curriculum for entry level courses
2. Transition pre-calculus and calculus courses into small classes
3. Hire a group of adjunct faculty with proven teaching credentials
4. Develop meaningful partnerships with mathematics teachers in junior high and high school

Several other events were taking place in the 1980s that created a critical mass for change. First, the Arizona Math Project was organized by David Gay and me. We brought together school districts, the business community, and the university to address issues in math and science education with President Henry Koffler as keynote speaker. Second, the Co-Op Program, a partnership between the university and school districts, was initiated.

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Rodel Scholarship for Promising Student Teacher

When senior mathematics major Elizabeth Wright looks to the future, she sees hope.

As a math teacher in training, Wright, 23, is deeply interested in students in need, no matter how much money their household generates or what their primary language is. She knows they will have the hardest time succeeding, so she wants to even the playing field.

"Basically, students who are in high poverty areas tend to not do as well as their suburban student counterparts, and I want to eliminate that difference. The income level of a student's parents should not be an indicator of how well they can do in school," she said. "Every student should have the (same) opportunity as the next student."

It turns out others like the way she thinks, including the Rodel Charitable Foundation of Arizona, who named Wright a Rodel Promising Student Teacher for the Spring of 2010. The appointment carries with it a $1000 scholarship for student teaching. After graduation if she completes three years in a high-needs school—that's a school where 70 percent or more of the students qualify for a reduced or free lunch—Wright will also receive a $10,000 savings bond. Rodel's vision is to improve Arizona's public schools from pre-kindergarten through 12th grade to the point where it's recognized as one of the best in the country, all this by 2020. It's a lofty goal, but Wright is ready for the challenge.

"I've always wanted to teach, since I was little. I love to help people learn. I love to see that spark in their eyes when they finally get it," she said. Wright was encouraged to apply for the scholarship by her Methods of Teaching Mathematics in Secondary Schools class instructor, Suzanne Weinberg. She applied on a Monday and the following Wednesday was interviewed by Rodel representative Michael Rivera. Others present at the interview were Weinberg, Cynthia Anhalt, and Mary Schumacher, all from the Math Education Group here in the Department of Mathematics. The interview lasted 45 minutes, and the group asked about Wright's commitment to students who attend high-needs schools — how she would structure a lesson plan, why teaching, and why math? Ten minutes later, the interviewers told Wright she had won.

Elizabeth Wright and her daughter, Rebekah. Wright was named a Rodel Promising Student Teacher for the Spring of 2010. When Wright accepted the award, Rodel representative Michael Rivera explained that as a Rodel student teacher she would be expected to perform to the highest standards.

"She was spot-on on all the answers," Michael Rivera said. He's a program administrator with Rodel. "She demonstrated a passion for working with, and believing in the abilities of high-needs students."

But the award came with a warning.

"They really emphasized that if I accepted this honor, I was in for a lot of work. I would be held to very high standards of achievement, and more would be expected of me than of my student teaching peers that are not a part of the Rodel program," Wright said.

Wright credits her interest and commitment to teaching to her family, where she is in the middle of nine children. "My family is very strong on education," she said. "There was never a question of if any of us were going to college. It was always a discussion of what we would do when we got there.

"I've always heard [my dad] talk about education with just about everyone we know. He's served on the State Charter School Board, and helped a lot of my cousins [whose parents didn't go to college] set up their college education plans…often directing

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Statistical research brings new ways of thinking

By Selena Niu, Assistant Professor

Probability and statistics is a very powerful and concise language for describing our complicated world. I have been studying statistics for the past ten years, and have found myself more and more interested in the subject.

The availability of massive data and challenges from the frontiers of research and development is reshaping statistical thinking, data analysis and theoretical studies. Technological innovations allow us to collect observations with curves, images or movies, along with many other variables. For example, in biomedical studies, huge numbers of magnetic resonance images (MRI) and functional MRI data are collected for each subject with hundreds of subjects involved. Satellite imagery is being used in natural resource discovery and agriculture, collecting thousands of high resolution images. My research focuses on Nonparametric and Semiparametric Modeling in Microarray data analysis and Statistical Genetics.

DNA microarrays are widely used in monitoring simultaneously mRNA expressions of thousands of genes in many areas of biomedical research. There are two popularly-used techniques: c-DNA microarrays and Affymetrix GeneChip arrays. The former measures the abundance of mRNA expressions by mixing mRNAs of treatment and control cells or tissues, which hybridize with cDNA on the chip. The latter uses combined intensity information from 11-20 probes which interrogate a part of the DNA sequence of a gene, measuring separately mRNA expressions of treatment and control cells or tissues.

In the analysis of cDNA data, the first statistical challenge is to remove systematic biases due to experiment variations such as intensity effect in the scanning process, block effect, dye effect, batch effect, amount of mRNA and DNA concentration on arrays. This is collectively referred to as normalization in the literature. Normalization is critical for multiple array comparisons. Statistical models are needed for estimation of these systematic biases in the presence of high-dimensional nuisance parameters from treatment effects on genes. For instance, Lowess normalization, semiparametric model-based normalization, and robust normalization are several popular normalization methods. We have made several contributions related to choosing the normalization method that most effectively removes the systematic biases. We approach the problem by constructing statistics to test whether there are any systematic biases in the expression profiles among replicated spots within an array. P-values are estimated based on a normal or $\chi 2$ approximation. The validation test statistics can be regarded as measures of effectiveness of normalization. Smaller measurements correspond to less discrepancy among repeated measurements, and a more effective normalization method. For a given array, we choose from several normalization methods the one that has the smallest test statistic. The associated P-value gives an idea as to the extent to which expression profiles have been normalized. The power of the validation test depends on the number of data points in the testing set. Excessively large test sizes result in overpowering of the tests and rejection of even tiny systematic biases.

The test statistics involve estimating genewise variances. In addition to the application in the validation test, genewise variances are also important for selecting the genes that are statistically differentially expressed among treatments and controls. Traditional genewise variance estimators are very unreliable due to the relatively small number of replicated genes and thus directly impact the sensitivity and specificity of the t-test.

The key problem in genewise variance estimation is the lack of degree of freedom due to the small sample size, resulting in an extended Neyman-Scott problem. We approach the problem by introducing a two-way nonparametric model. The problem itself poses interesting challenges because the number of nuisance parameters is proportional to the sample size and it is not obvious how the variance function can be estimated when measurements are correlated. In such a high-dimensional nonparametric problem, we propose two novel nonparametric estimators for genewise variance function and semiparametric estimators for measurement correlation, via solving a system of nonlinear equations. By largely increasing the degree of freedom, our estimators possess good finite sample performance.

Bioinformatic tools are being widely used in the areas of genomics, proteomics, gene networks, structure prediction, disease diagnosis and drug design. The breakthroughs in biomedical imaging technology allow scientists to monitor large amounts of diverse information on genetic variation, gene and protein functions, gene-gene interactions in regulatory processes and biochemical pathways. Genomic sequence analysis permits us to understand the homologies among different species and infer their biological structures and functionalities. These quantitative biological problems raise many new statistical and computational problems, which create golden opportunities for the development of mathematical sciences.

Grad stats program sometimes a challenge but some days are good

By John Bear

Statistics Graduate Student

A few years ago I was working at a job in Silicon Valley that had me reading statistics. We were working on algebra tutoring software, and I was reading about statistical ways of automatically deciding whether to move a student forward through the curriculum, or have the student review some sections. I decided I liked reading about statistics, and wanted to get a Ph.D. in statistics. I had never had an actual course in statistics, though, and I figured no admissions committee would take me seriously unless I first learned some of the basics. As luck would have it, there was a university not far from where I was living that had a master's degree program in statistics, so I applied, enrolled, and did a lot of studying. I still remember my first day of class. I had to ask the professor what some bit of notation meant. It was the tilde notation that means, "is distributed as." It was notation that anybody in a graduate program in statistics should already know, sort of like in math, asking what an integral sign means.

Getting the master's degree was something of a big step. I quit my job and started going to school. The bigger step, however, came when I decided to move from California and start the Ph.D. program here in Tucson at The University of Arizona. On and off during my first month here I found myself wondering what on earth I was doing. I had already had a 20-year career as a computational linguist. I had published papers and had my name on two patents. Now I was back in school doing something quite different, where instead of being confident and knowledgeable, I felt ignorant and confused. I had managed to prepare myself for the statistics courses, but alas, not for the pure math. I'm sorry to say the first time through, real analysis kicked my butt. This semester, having spent some time over the summer brushing up, I'm giving it another try and not feeling quite so overwhelmed.

Now that I'm in my second year and have passed my qualifying exams, I am tremendously happy I'm here. The professors and administrators I've met have all been remarkably supportive. The pure math students and the applied math students I've met have been welcoming and friendly. The other statistics students are people I'm glad to know.

At the end of the year, I received the First-Year Student Award in Statistics[1]. That came as a surprise. We first-year statistics students had been studying for, and fretting about the quals (qualification exams—a necessary step toward getting a Ph.D.). When I got the phone call, I thought it was possible that it would be bad news, that I would need to take the quals again. Instead Professor Piegorsch[2] told me first, I had passed (yippee), and second, I had won an award (double yippee). Not only that, but the award came with some cold hard cash (triple yippee). That was a pretty good day. The next day I used the cash from the award to buy a couple more statistics books. I still like reading statistics.

[1]This annual award, given by the GIDP's Executive Committee, recognizes superior academic achievement by a Statistics student completing her/his first year.

[2]Professor Walter Piegorsch is the chair of the Graduate Interdisciplinary Program in Statistics and professor of mathematics.

New People in UA Mathematics

Alejandra Alvarado, Adjunct Instructor, graduated with her Ph.D. in mathematics from Arizona State University. Her research interest lies in arithmetic progressions on curves. She also enjoys swimming, biking, and especially running; and is very happy to be back at the University of Arizona.

Matthew Beauregard, a Visiting Assistant Professor, already knows the UA well as he earned his Master's degree and his Ph.D. in applied math from the University. Prior to becoming a visiting assistant professor, he was a VIGRE Research Assistant.

Stacey Black, Adjunct Instructor, attended the University of Arizona as an undergraduate and obtained a Bachelor of Science degree in chemistry with a minor in math and physics. She has seven years' experience teaching in Tucson and has taught a range of math and science courses. She spends her weekends working in a community-based pharmacy, but when the weather is right, she likes to spend weekends in Northern Arizona snowboarding with her husband.

Mary Bouley, a Project Manager for the G-Teams and support for an NSF planning grant for a Noyce Master Teacher program, is an experienced educator with a background in school/university partnerships, project management and professional development for teachers. She participated on the management team for three NSF GK-12 Fellowship programs and has extensive experience with programs focusing on underserved students. Bouley has a professional network that includes colleagues from every local school district as well as many university faculty and staff.

Jennifer Eli, Assistant Professor in Mathematics Education, holds a Master's in mathematics from the University of Kentucky and a Ph.D. in education sciences with emphases in mathematics education and educational research from the same institution. Jennifer has been involved in several large NSF-funded projects including the Appalachian Mathematics and Science Partnership (AMSP), and the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM). Through these projects, Eli facilitated professional development workshops and distance education courses for K-12 teachers, and developed content courses for prospective middle grades teachers. Her research interests include mathematics knowledge for teaching and the role of mathematical connections in prospective teacher preparation. In her spare time, Eli and her husband enjoy hiking and traveling.

Alimjon Eshmatov, Richard S. Pierce Visiting Assistant Professor, was born in Tashkent, Uzbekistan. He received his Ph.D. from Cornell University in 2009 under the supervision of Reyer Sjamaar. His research focuses on the symplectic geometry and equivariant cohomology. Recently he has been also working on infinite-dimensional algebraic groups.

Leslie Jones is a Visiting Assistant Professor. She grew up on a farm in Georgia and loves the wide-open space and natural beauty of Arizona. She earned her Ph.D. from Baylor University and is working in the area of biomathematical modeling. She is an Army spouse with two kids (Lanie, 11, and Nate, 6), has lived in six states and Germany, and enjoys jogging.

Evelyn Lunasin is one of the new Visiting Assistant Professors in the Mathematics Department. She received her Ph.D. from the University of California in Irvine and comes to us from the University of California, San Diego, where she was a postdoc research associate.

Selena Niu is an Assistant Professor in Statistics. She is originally from the northern part of China. Her Ph.D. is from Princeton University and she spent 6 months at Yale University as a postdoc. Her research area of interest is nonparametric and semiparametric modeling in bioinformatics and statistical genetics. She loves sports and almost became an athlete in track and field in high school but now focuses on jogging and swimming. (See article, page 6).

Emily Ronshausen, a Teaching Postdoc, received her Ph.D. from Washington University in St. Louis in dynamical systems this past May. She loves to see Broadway musicals and go hiking, and spends a lot of her free time reading.

Nicholas Stanford, Adjunct Instructor, was recently married—August 30, 2009—no kids yet. Born in San Diego, Nicholas has lived in Washington and Oregon most of his life. He likes to read non-fiction, bicycle, hike, and cook. His hobby: making beer (and maybe wine someday too.). He received his bachelor's degree in mathematics from Central Washington University in 2005 and his Master's degree in mathematics from Oregon State University in 2007.

Guada Lozano Teran has joined the Math Department as the Executive Director of the Institute for Mathematics and Education. She earned her Ph.D. in the geometry of integrable systems from the UA under the watchful eye of Nick Ercolani. She then spent three years as a postdoctoral assistant professor at the University of Michigan; and during the last two years held a faculty position in the mathematics department at the University of New Mexico in Albuquerque. Lozano Teran and her husband have two toddler boys. She also loves step-aerobics, is an expert cabinet/door restorer, and just earned her ham radio operator's license.

Caroline Torres, a mathematics teacher at Sahuarita High School, is with us this year as a Mathematics Education Specialist with the Arizona Teachers Institute. Prior to teaching she was President of a geochemical company in Mexico. She initiated a Math Engineering Science Achievement Club (MESA) both at Sahuarita and at Catalina High Magnet School. She is the 2007 recipient of the Milken Family Foundation Educator Award.

Graham Wilks, a Visiting Professor, graduated BSc and PhD in Applied Mathematics from Manchester University, England in 1963 and 1967 respectively. His thesis in Boundary Layer Theory underpinned his subsequent research career in fundamental and industrial fluid mechanics and in solution methods for parabolic differential equations. He has contributed particularly to the heat transfer fluid mechanics of convection and condensation, film inundation and drainage and jet assimilation into accelerating and decelerating ambient streams utilizing a variety of analytic and computational techniques. Wilks is particularly associated with Keele University, England, where he served as Head of Department for 20 years. He also served as Dean of Natural Sciences and Pro Vice-Chancellor. On the UK national scene Wilks was also the Chair of the Conference of Professors of Applied Mathematics and Chair of the Heads of Department of Mathematical Sciences. His research standing was acknowledged when he was elected to the UK National Mathematics Research Assessment Panel 2001. Active in musical theatre, he recently performed the role of the Major General in Gilbert and Sullivan's Pirates of Penzance. He was, with confidence, able to assure his audience that, "I'm very well acquainted too with matters mathematical, I understand equations both the simple and quadratical."

Michelle Woodward is a Math Tutoring Specialist. She did her undergraduate work at Northern Arizona University and earned her Master's degree here at the UA, where she has also worked as the Director of the Math and Science Tutoring Resource. She taught math at Zama American High School in Tokyo and was an Honors Physics Teacher at Salpointe High School.

Undergraduate opportunities equals student success

By William Velez

Associate Head, Undergraduate Program, and University Distinguished Professor of Mathematics

The two articles by students in this issue of our newsletter highlight very nicely our work with undergraduates. The undergraduate mathematics major experience consists of much more than just taking classes. Our students are given the opportunity to communicate mathematics to others, to carry out research projects and to travel and present their results. In Caree Wheeler's article we see these components come to the foreground.

The Center for the Recruitment and Retention of Mathematics Teachers created a one-unit course, Math 196a, to give students the opportunity to learn about tutoring in the high schools. This course is taken by many of our mathematics majors, some of whom are then attracted to the teaching profession and choose to become mathematics teachers. Other students take this course and use the skills learned to communicate mathematical ideas in other venues.

Research Experiences for Undergraduates (REUs) play an important role in the development of young mathematicians. Through REUs, students are introduced to open-ended questions and participate in the creation of new knowledge. The fact that many of our faculty give so generously of their time to work with undergraduates on these projects is evidence of how serious the department views the integration of research and education. Robert Sims, assistant professor, and Shankar Venkataramani, associate professor, who were mentioned by Caree and Raymundo Navarrete, have supported several students on research projects.

The undergraduate mathematics major program continues to grow and to attract truly gifted students to the study of mathematics. These two students are wonderful examples of the mathematical talent that exists in this country. The article by Raymundo describes two very important components of our recruiting efforts. First of all there is the importance of telling students that there is such a thing as a mathematics major. The Math Center sends out thousands of messages each semester inviting students to take "the next math course" and consider adding mathematics as another major. However, the most important recruiting tools in our arsenal are the mathematics that we teach and our teaching staff. Over and over again we receive comments from students that it was a mathematics course that they took here at The University of Arizona that motivated them to "take the next course" and then continue on.

Our undergraduate mathematics major program is a testament to the vitality of research in the department and to the concern that we have for communicating mathematics to our students.

Rodel Scholarship

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them to fill out their FAFSAs and apply for the grants they need to pay for schooling. You can't spend your whole life around a man like that and not understand that education is hugely important.

"Also, after my youngest brother started school, my mom went back to school to get her bachelor's [degree]. It was a great motivator while I was in high school to see how even after having her family, and becoming a grandmother, her education was still important enough to go back and finish after so many years away. Most importantly, though, my parents never doubted for a second that I would reach my goal of becoming a teacher," Wright said.

Next semester Wright will student teach math at Flowing Wells High School with a Rodel teacher, Demetria Murray. It's a big step, but Wright is fully aware of how important it is for her students to succeed. "Math is a huge indicator of whether a student can succeed in college," she said. "Some people think, 'Well, [students in high-needs schools] will never go to college, so why bother teaching them this?' But the better we teach them the better chances those students have at getting a scholarship and pulling themselves and their families out of a cycle of poverty by qualifying for better, higher paying jobs."

Career possibilities endless for this math major

By Ray Navarrete

Hi, I'm Ray Navarrete, a mathematics and physics major at The University of Arizona.

Raymundo Navarrete takes a side trip from his research to the mountains. It wasn't until he spoke with William Velez that Navarrete realized he could major in mathematics. Since then, with the support of Professor Shankar Venkataramani, he has written about his research. His paper, "Determining the Behavior of the Rotating Disk Electrode System," analyzed the Convection-Diffusion Equation.

Ever since I learned that "numbers never end" for the first time in kindergarten, mathematics has always amazed me. It just seems incapable of becoming uninspiring and boring. Once I discovered that math was my favorite subject during seventh grade, I was able to progress fairly quickly, to the point of learning differential equations my junior year of high school. For this reason, the advice that I heard from many of my teachers in middle and high school was, "Become a mathematician."

"A mathematician? Is that a job?" I asked.

I was born in Arizona but grew up in a small town in Mexico, where the term, "higher education," was not often used. My parents didn't have the chance to get a degree or the money to pay for one, and since we didn't know about the existing opportunities for students in the United States, as a child I wasn't sure if going to college was a possibility. Of course, my doubts disappeared after I completed high school and received the necessary scholarships for college. Even today, I can hardly believe that I'm really living this dream. For this reason, a bachelor's degree was all I wanted during my first year of college. My goal was to obtain a bachelor's degree in something that I thought was employable and to start working as soon as possible. Since I didn't know how employable a math degree could be, I opted to do something else.

At the beginning of my college career my mentality was set to earn a degree in engineering, which was best suited to my old goals. Mathematics was out of the question; I only had to complete a vector calculus class that first semester and I would never take a math class again. I was already so certain about this decision that when I received an email from a faculty member of the mathematics department asking me to meet with him to talk about the possibility of continuing my math education I didn't even respond. What I didn't know at the time was there was a huge difference between what I thought was better for me and what my passion really was. I ended up loving that "last" math class so much I decided to at least take an extra one. I'm glad I did. During that second semester the same person from the department, who would later become my advisor, sent me a new email asking me to meet with him. This time I responded. The day and time of the appointment came and twenty minutes later I was already thinking about the new possibilities I had learned about. For example, I learned that a mathematics degree by itself is useful not only for teaching but in many other areas. This was also the first time I heard I could actually go to graduate school for free, and I'm not forced to finish my education after getting my bachelor's degree. Since it became obvious to me that continuing my math education could only be beneficial, I became a math major that same day.

As a math major, I have been able to participate in many exciting activities that otherwise I would have never experienced. Compared to other majors, even in the sciences, math majors have plenty to choose from. For example, I have participated in two ten-week internship programs during the last two summers: one program in statistics at Rice University during the summer of my freshmen year and the other program in eco-informatics at Oregon State University during the summer of my sophomore year. I was even paid by the Mathematics Department to do research in a topic of my choice during this past spring semester, which is definitely the best half-time job a student can get. The faculty member that supported my research last semester is Shankar Venkataramani. My research consisted of analyzing the Convection-Diffusion Equation

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There's more to math than what's found in the classroom

By Caree Wheeler

During the summer of 2008 I attended a pre-Research Experiences for Undergraduates at Texas A&M University. It was a great experience!

Along with 18 other students, I studied signal and image analysis as well as processes for compressing data. The program consisted of taking classes and attending labs in order to work on problems assigned by our professor. At the end of the five-week program, we presented our projects to an audience of professors, math majors, graduate students, and REU participants.

Some side benefits of the pre-REU included: having the opportunity to attend seminars put on by math professors and researchers once a week, learning more about graduate-level opportunities around the country, working closely in the classroom with an experienced research professor, experiencing the mathematics department of a university other than The University of Arizona, and making friends with math and science majors from all over the country. Attending a pre-REU is a terrific way to become more experienced in the field of mathematics and to prepare for applying for full REUs in the future.

The year following my pre-REU experience I had the opportunity to attend the Southwestern Undergraduate Mathematics Research Conference (SUNMARC). I traveled with Professor William Velez and several other UA students to Albuquerque, N.M., where I was able to present my research completed at Texas A&M University. The conference lasted two days and I enjoyed listening to, and viewing, other undergraduates' presentations on work they had completed over the last year. Probably the greatest benefit from attending the SUNMARC conference was having such an excellent opportunity to meet so many math majors from different parts of the Southwest.

Concerning opportunities offered at the UA, I have been very fortunate to participate in several wonderful programs, the first being Tutoring in the Schools (MATH 196A). I took this course the

Caree, Madelyne, Dania, Benjamin, Brittany, Thomas and Dr. DeBlassie at Texas A&M.

fall semester of my sophomore year (in 2008). The course involved attending a one-hour seminar once a week where we learned tutoring tactics and teaching techniques. However, the main benefit from the course was having the opportunity to work in a secondary school in Tucson and enjoy one-on-one interaction with younger students. I worked at Sierra Middle School in seventh grade classrooms and got to know and teach math students.

During the spring semester of my sophomore year I got involved with the Undergraduate Teaching Assistant (UTA) program. This offered me the chance to work with Professor Fred Stevenson as he taught MATH 323 (Formal Mathematical Reasoning and Writing). I often attended his classes, graded homework, and offered review sessions to students before exams. Being a UTA allowed me a better first-hand experience in working for a university mathematics department, and more especially the opportunity to work one-on-one with a professor.

This semester I am working with Professor Robert Sims as an Undergraduate Research Assistant (URA). I am learning about his work involving quantum spin systems. We are currently studying time evolution of infinite anharmonic systems. So far this has been an insightful experience for me and I have learned a great deal that I would not have otherwise been able to learn in my required courses as a math major.

Overall, I consider my experiences both at the UA and away from Tucson to have been greatly beneficial in my career as a student. I have had the opportunity to explore several areas of mathematics, even outside of the curriculum of typical math courses at the University.

A View from the Chair

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The rich intellectual life of the department continues to attract the best students in the University. Ray Navarrete and Caree Wheeler write about their experiences, including their research with faculty members Shankar Venkataramani and Robert Sims, and we have a profile of Elizabeth Wright, who was named Rodel Promising Student Teacher for Spring 2010.

Please save March 22 for this year's Bartlett Lecture, which will be given by Tom Banchoff from Brown University. Tom was a visitor to the Institute for Mathematics and Education this winter, and will give a talk on "The Fourth Dimension and Salvador Dali", describing a series of meetings with the famous artist from 1975 to 1985.

Last semester saw the retirement of faculty member Ginny Horak and Mary Schumacher after many years of distinguished service to the secondary teacher education program. We wish them both well!

Finally, let me thank Karen Schaffner, who is also leaving us, for the excellent job she has been doing in producing this newsletter.

Reflections on 37 years

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Third, the Math Instruction Colloquium was created by Steve Willoughby. Fourth, the curriculum innovation work by several faculty including Deb Hughes Hallett, David Lomen, David Lovelock, and Bill McCallum. Fifth, the outreach math camps created by Dan Madden and Fred Stevenson. During that time NSF and the Arizona Board of Regents funded several large teacher enhancement projects such as PRISM AND PRIME with junior high and high school math teachers. Many of these projects occurred under the headship of Alan Newell, who supported and fostered these activities.

Several additional programs were developed after 1995. The Teaching Post-Doctoral Program has, and continues to have, a tremendous impact on the department. These energetic and creative individuals participated in many aspects of the department's teaching and outreach programs and contributed immensely to their success. Other important programs initiated by the faculty include MAPPS by Marta Civil and David Gay; CEMELA headed by Civil; the Institute for Mathematics and Education headed by McCallum; the Arizona Teacher Institute headed by Madden; and the Center for Recruitment and Retention, headed by Stevenson, Adams, and Modica.

I feel fortunate to have accepted a position at the University of Arizona and had the opportunity to work with many outstanding and dedicated faculty members. I have no doubt that the department will continue to play a major role in the research and teaching arena at the local, national, and international level.

Career possibilities

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(a partial differential equation that is used to describe the effect of convective and diffusive processes on incompressible fluids) as applied to the Rotating Disk Electrode (RDE) system (a battery-like experimental setup used by electrochemists). I have also attended many conferences in different states to learn more about mathematics, graduate school, and possible career choices. Needless to say, I have really enjoyed participating in all of these activities.

Having these varied experiences has really helped me to determine what I like to learn now and what I want to do in the future. My goal now is to obtain a Ph.D., most likely in the mathematical sciences, and ultimately use what I'll learn to return some of the good I have received. I still haven't decided exactly what degree I will pursue in grad school, but I will make sure that it will allow me to learn the math I want to learn. It's not as though I could run away from math anyway! For example, even as I was working in a highly applied project during my eco-informatics internship this past summer, it was necessary for me to learn some topics in analytical geometry, which is fairly abstract and is not taught at the undergraduate level. I loved the subject so much that I even decided to change my schedule for this school year in order to take two of the most abstract undergraduate math courses available (real analysis and abstract algebra) in order to be ready to take graduate level courses in topology during my senior year.

Salvador Dali: Where surrealism and mathematics intersect

By Thomas Banchoff, Brown Professor of Mathematics and Karen Schaffner, Administrative Assistant

What do a surrealistic painting of Christ on a cubist cross and mathematics have in common?

Brown University mathematics professor Thomas Banchoff knows. In the third annual Daniel Bartlett Memorial Lecture, "The Fourth Dimension and Salvador Dali," he will describe his meetings with the artist Salvador Dali and discuss the ways Dali incorporated mathematical ideas into his paintings, particularly "Corpus Hypercubicus." That 1954 painting shows Christ on a four-dimensional unfolded cross that also figured in Ph.D. thesis in geometry of higher dimensions. The event is set for March 22, 2010 in the Gallagher Theater here at the University of Arizona.

Banchoff said it began in 1967 at Brown University, when he and colleague Charles Strauss, a Ph.D. in computer graphics, produced, "The Hypercube: Projections and Slicing," a film showcasing a tour of an object from a fourth spatial dimension. Nearly ten years later, the Washington Post published an article about their work, with a picture of "Corpus Hypercubicus" in the background. A few weeks after the article appeared, Banchoff got a phone call from someone saying she was Salvador Dali's appointments secretary. She said Dali wanted to meet with the pair in New York City. They didn't know what to think. They agreed "it's either a hoax or a lawsuit, but the worst we can get out of it is a good story," Banchoff said.

The following week Banchoff, Strauss, and Dali met in the lounge of the posh St. Regis Hotel in New York City, where, surrounded by lots of "Beautiful People," they discussed stereoscopic oil paintings and the background of "Corpus Hypercubicus. "It was very professional," Banchoff said, "and very illuminating." That meeting began a 10-year professional relationship with Dali, where they would meet at least once a year to discuss their current projects. It turns out, "Dali really liked talking to scientists and mathematicians," Banchoff said. "He was very well-read and up-to-date on scientific topics."

Over the course of their meetings, Banchoff gained an insight into how Dali worked. He saw three or four works in various stages of completion. One of the last times they met was in 1985, a few years before the artist died, when Banchoff was summoned to Dali's castle residence in Pubol, near Barcelona. "He wasn't seeing very many people," Banchoff said. Even though Dali was at the end of his life, he continued to learn. "He was very interested in catastrophe theory and he especially wanted to see our films on that topic."

Banchoff is the third speaker in the lecture series, which honors Daniel Bartlett, a graduate student who loved mathematics. Daniel died of sudden cardiac arrest on August 8, 2006, just before starting his fourth year of graduate school in mathematics at The University of Arizona. Other speakers have included Barry Mazur, Daniel's undergraduate advisor at Harvard University; and Jeff Weeks, an independent mathematician who works with cosmologists to explore what astronomical observations imply about the large-scale structure of the universe.

What we do when we aren't doing math!

It can't be math all the time. From the sublime to the fun, here are a few of the ways we spend our free time.

One for the road—Graduate student Veronica Marino Salazar takes a turn around the Mathematics Building on her unicycle, a skill she taught herself when she was 10. She said her father built her first one and she learned to ride in a corridor, using the walls as support. Although she makes it look easy, "I've fallen many times," Marino Salazar said with a laugh.

It's a juggle out there—Professor Fred Stevenson demonstrates his juggling technique using four balls. Stevenson said he began juggling as a freshman in college, when his roommate taught him, first using two balls, then three. Today he can juggle five balls. Instead of balls, however, Stevenson mostly uses ball-shaped beanbags his wife made him. He said when he practiced and dropped balls, the noise and rolling around annoyed her.

Bean Town Ball—Ji Li, an Arizona Teacher Institute postdoc, began taking pictures two years ago as a way to remember what happens around her. She said she now sees photography as blogging with images and credits the art with helping her develop a sense of color and composition. Li uses a Canon 450d with a Sigma 18-200mm lens and most prefers to shoot cityscapes, sometimes with people in them. This picture of Copley Square in Boston was taken in March of 2009.

Fretting About It—Jordan Schettler, a graduate student studying Iwasawa theory of elliptic curves, plays the guitar for fun. The 27-year-old, who is mostly self-taught, has been playing since he was 10 and in the fifth grade. Although he has several guitars, his favorite is this Anniversary 500 series Ovation, which his dad gave him. Favorite song to play? "After the Gold Rush," by Neil Young.

You're Rumba Arrest—Graduate student Brenae Bailey spends Wednesday nights on her feet, marching to a beat with a foreign accent. She enjoys international folk dancing, something she has been practicing for about 25 years. Her favorite dances are from the Balkans (Bulgaria, Macedonia, Romania, Serbia), but she does dances from other parts of Europe and a few from Africa and Asia.

Paper Chase—Professor Emeritus Yash Mittal knows her way around a piece of paper. She has been mountain and valley folding for 12 years now, creating dioramas, boxes, balls, and flowers, among other things. So far her crowning achievement is a scene of skull racing, where each individual rower and boat has been folded from a sheet of paper. Mittal learned the art of origami from her brother and feels the skill used in origami complements math nicely, that practicing origami enhances math skills learning.

Excellent Reception—Guada Lozano Teran, Executive Director of the Institute of Mathematics and Education, has found a way to keep in touch with her family, even when they are deep in the Gila Wilderness and she's in Tucson. She uses a ham radio. Not the big bulky ham radios of old, but one that attaches to the console of her car and looks no different than her car stereo. Her handheld radio is no bigger than a cell phone. Lozano Teran has had her ham license for a little more than a year now.

Wine and Dine—Marty Greenlee, Professor Emeritus, likes to spend his time finding just the right partnership between food and wine. He became interested in learning more about wine 12 years ago when his daughter married a man from France who was knowledgeable about wine. Greenlee's favorite pairing to date is a relatively inexpensive Nerelo del Bastardo, which goes for about $12, with pasta. The sauce that's pictured, he said, is from a certain famous movie. "For the recipe watch, "The Godfather," and listen up during the kitchen scene," he said.