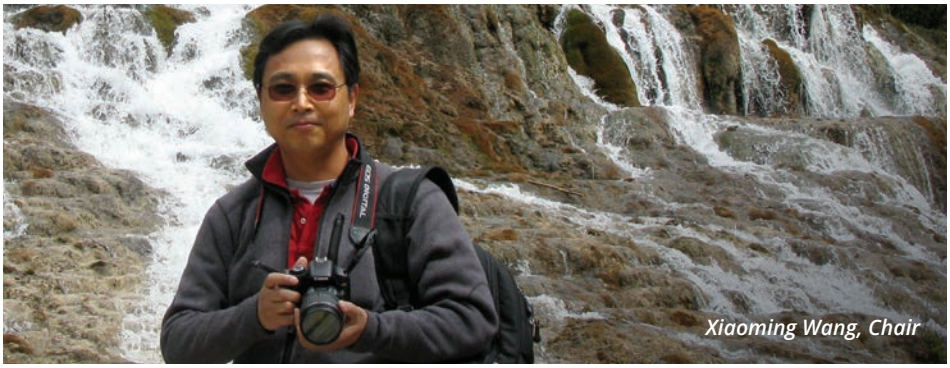
DEPARTMENT OF MATHEMATICS
AT FLORIDA STATE UNIVERSITY

DECEMBER 2014 · WWW.MATH.FSU.EDU

Letter from the Mathematics Department Chair


Xiaoming Wang, Chair

Dear Friends of the FSU Department of Mathematics,

It has been another banner year for the Florida State Department of Mathematics! Our students, faculty and staff continue to excel in teaching, research and service.

I am happy to report three new additions to the Department. Nick Moore joined us in August as an Assistant Professor. Nick is an applied mathematician with expertise in fluids applications. I'm pleased to say that I have already received quite a lot of positive feedback about Nick. We also have two new staff members: Clare Harrison who is an Account Specialist, and Craig Stevens, who is a Financial Associate. (Our previous accountant, Kevin Eady, is now with the Sponsored Research Office. We wish him well with his new job.) I am also happy to report that the Dean has authorized the hiring of two more tenure-track faculty members this academic year. The hiring of new faculty is a crucial part of our effort to become a top twenty-five program among public universities in the nation.

Our faculty and students have received numerous honors during the past year. Our inaugural FSU Math Fellow, Washington Mio, has become a Fellow of the American Mathematical Society. He is the first current faculty member who has become an AMS Fellow. Monica Hurdal and Ishkhan Grigorian were each awarded an FSU Undergraduate Teaching Award. Ziad Muslimani received a German Academic Exchange Services (DAAD) award. Harsh Jain received an Early Career Award from the Mathematical Biology Institute. Eriko Hironaka has been appointed as the second Brennan Professor of Mathematics, beginning in January 2015. The Society of Mathematical Biology has featured our biomathematics graduate program twice this year. One of our doctoral students, Daozhi Han, earned a presentation award at this year's SIAM-SEAS Meeting. Our faculty's research on sinkhole formation and collapse has been featured on FSU Headlines and NPR. Our faculty and students have been invited to give presentations at numerous conferences and workshops. In particular, Mark van Hoeij will deliver one of the invited addresses at the AMS Fall 2015 Southeastern Sectional Meeting in Memphis.

The Department's productivity remains high. We now have 417 undergraduate majors, breaking our previous record. This is the second year that our number of majors has exceeded 400. We have awarded 17 doctoral degrees, 36 master degrees, and 114 bachelor degrees in the past year. We will soon be classified as a "Group I Public" department by the American Mathematical

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Eriko Hironaka Named FSU Marion Brennan Professor of Mathematics

Beginning in 2012, The Marion Bradley Brennan Professorship in Mathematics supports an internationally known scholar in the field of mathematics, with a proven track record in research, teaching, and especially mentoring undergraduate and graduate students. The professorship is named after Ms. M. Carol Brennan's mother, Marion Bradley Brennan. Carol herself is an esteemed alumnus of Florida State University, earning a BS in 1975 and MS in 1978 within the field of Applied Mathematics.

Dr. Eriko Hironaka has been named as Marion Brennan Professor of Mathematics, holding the professorship for the 2014-2016 academic years. The previous Brennan Professor was Dr. Paolo Aluffi. Dr. Hironaka joined the department in 1997 as an Assistant Professor, was promoted to Associate Professor in 2002, and gained her full professorship in 2011. She currently serves as Director of the Pure Mathematics program for the second-time, having first served as Director from 2008 to 2010.

As our new recipient of the award, Dr. Hironaka answered a few questions regarding her thoughts on research, teaching, and especially mentorship.

What was your reaction to finding out you would be our next Brennan professor?
I am touched and honored that I should be chosen this year to represent the faculty in research, teaching and service. At FSU Math, we have so many faculty members who excel in these areas. I see every day how faculty members at FSU Math pour their energies into pursuing their research and sharing their ideas and knowledge with students and colleagues.

With relatively few faculty members, our department supports four diverse programs. Despite all the work this entails, faculty members go beyond their official teaching assignments, and do extra work: organizing and participating in seminars, conceiving and carrying out innovative instruction techniques for their classes; participating in outreach programs and conference organization both at FSU Math and in the profession; and, as I well know from having gathered news for our newsletter and webpages, our faculty members have made their presence known both locally and globally in terms of research. It is a department that is easy to be proud of.

When did you realize you wanted to be a mathematician?
I did not know that I even liked mathematics until I was in my junior year in college. From childhood I loved puzzles, and I used to beg my mother for books on mind-benders and math challenges. Strangely, it never occurred to me that this fun activity might someday lead to "becoming a mathematician." In the 1970's and early 80's, when I was in high school and college, math was not something girls were supposed to do, except possibly as a hobby. This counteracted somewhat the benefits of having a father who was a mathematician himself. During my junior year in college, I decided to take an upper-level mathematics course almost as a lark. I was hooked almost immediately, and though I still did not think I could make a career of mathematics, I worked hard my senior year, taking every math course I could. Then I applied to mathematics graduate school and was accepted into Brown University, much to the surprise of my parents. There I continued to enjoy the beauty as well as the problem-solving aspect of mathematics and got a Ph.D. in 1990, I went through several postdocs before landing a job at FSU, and now find myself having been a professional mathematician for going on 25 years!

How has your area of expertise evolved over the years?
I started out in algebraic geometry. It was considered the "beautiful field" of mathematics to the people around me. Exemplified by the work of giants such as Zariski and Grothendieck, algebraic geometry combines algebra and geometric visualization, the two areas of mathematics that attracted me the most. Some years after receiving my PhD, I stumbled across a simple number theory problem that struck me as being the key to understanding some of the fundamental differences between the objects of algebraic geometry and what had been a side interest of mine: low-dimensional topology. In the past ten years, my focus has shifted almost completely to the latter, but one of my current students has kept me thinking about the connections between the two fields.

How has your approach to teaching evolved during your time at FSU?
At first I taught basic mathematics courses like calculus and linear algebra, the idea being to free up my time for research in preparation for tenure. After I became a tenured professor, I started to take on more and more upper-level undergraduate and graduate courses. One of the things I have enjoyed most in teaching is getting to know students. FSU has a diverse student body with differing backgrounds, interests, and goals. Connecting with them has been one of my favorite aspects of teaching.

ERIKO HIRONAKA Continued on page 17

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New Faculty Member, **Dr. Nick Moore**

Dr. Nick Moore, who joined us in August 2014, is our most recent faculty member. Dr. Moore's research interests fall under the theme of fluid structure interactions, including how fluids affect and are affected by solid structures. Dr. Moore states that, "although the mathematical equations that describe fluid flows are known (and have been known for hundreds of years), there is no method to solve them that works in every possible scenario. Therefore, one must figure out what simplifying assumptions can be made in a particular situation (e.g. water flow in Wakulla springs, or air flow around bird wings). This sometimes gives a mathematical problem that you can work with and gain insights from." Some applications of this research can be used to study the morphologies resulting from fluid flows and rock dissolution. This research can then be applied to developing preventative measures for potential sinkholes. Additionally, as with the case of airflow and liquids in relation to birds' wings, this information can be used to mimic nature in devices such as underwater vehicles.

To potential graduate students, especially those interested in applied mathematics, Dr. Moore recommends a "diversified" selection of courses. These should be "practical courses that help broaden your exposure" so you can keep yourself sharp as a student and have a wide knowledge base beyond your specific field of interest. "Find what interests you before continuing your studies."

Dr. Moore's interests not only lie in math but in a variety of other fields such as physics, geology, and biology. The interdisciplinary nature of applied mathematics works well with his interests and provides him with an outlet for his varied research topics. His mathematical career started at the University of Tennessee-Knoxville and then the University of North Carolina- Chapel Hill for his Ph.D. Now starting his career at FSU, Dr. Moore finds everything to be "pretty wonderful". The students have been largely outgoing and responsive, there is great potential for interdepartmental, combined research projects, and there are a variety of natural recreational spaces available: "This has just been a great experience so far." ■

Letter, *from pg. 1*

Society, joining many elite departments (most of which have more resources than we do). We have received 8 new external grants this year; twenty-three of our current faculty members enjoy some kind of external research support. This is a historical high! These external grants illustrate the peer recognition enjoyed by our fine faculty, and bring in much-needed additional resources to individual faculty, graduate students, and the department.

The Department has also organized quite a few activities this year. The third annual FSU High School Math Contest had 46 participants representing all six-area high schools. The second annual Math Fun Day was another smashing success, with more than 400 participants and almost 100 volunteers. Updates regarding next year's event can be found on the "FSUMathFunDay" Facebook page. Our 16th Financial Mathematics Festival was yet another success. The Department has also hosted the NSF funded "Clifford Analysis and Related Topics" conference in December 2014.

I am extremely proud of everything that our faculty, staff, students and alumni have accomplished. I am also very grateful to all of you for your support of the Department this past year, particularly to John and Bettye Crowe for establishing the DeWitt Sumners Endowed Fund. This year's Honor Roll of Donations can be found on our webpage: **www.math.fsu.edu/membership.**

I hope you will enjoy reading about the stories highlighted in this newsletter.

I wish you and your family a great holiday season and a happy new year!

Xiaoming Wang,
Chair

Teaching Award Recipients Monica Hurdal (left) and Ishkhan Grigorian (right)

2014 FSU Faculty Awards

Monica Hurdal and Ishkhan Grigorian Honored with 2014 FSU University Teaching Awards

The University Teaching Award program recognizes faculty for excellence in undergraduate and graduate teaching, as nominated by students and alumni. For the 2013-2014 academic year, the Mathematics department is proud to have three eligible faculty nominated, with two winning the award. Dr. Monica Hurdal, Dr. Alec Kercheval, and Mr. Ishkhan Grigorian were all nominated for a University Teaching Excellence Award, with Monica Hurdal and Ishkhan Grigorian honored as recipients of the award. Only 22 University Teaching Awards were presented to the entire FSU faculty in 2013-2014.

The selection committee for the award uses nominations from students, staff, and alumni, as well as a portfolio including the instructor's teaching statement, coursework, grade distributions, and questionnaires distributed to their former students. Mr. Grigorian was "thrilled and extremely excited" when he heard the news since the "honorable award is very hard to get." Dr. Hurdal was also "extremely honored to receive this award. Teaching is a very difficult job that is very time consuming. I spend a lot of time and effort trying to make the material I teach understandable and relevant to my students. I constantly try to provide examples from the real world to make the material more interesting while ensuring that I teach the material they need to know for their future courses. To be nominated by my students and selected by my peers for this award helps make all the hard work worthwhile."

Grigorian's love of math grew from a childhood interest in the subject and has turned into an enjoyable career. His teaching philosophy reflects his passion for mathematics, and an understanding that some students may come to appreciate math in different ways: "The first thing I feel I need to do is to help my students to gain a fundamental understanding for the concepts behind the material, and to know how and when these concepts may be applied, within both mathematics and life." Dr. Hurdal follows a similar philosophy, as she believes "it is extremely important to make mathematics accessible in the classroom and provide students with problem solving tools and techniques they can use beyond university."

Dr. Hurdal's own research began with an interest in both the fields of mathematics and biology and it has helped her in her teaching: "Working in the interdisciplinary field of biomathematics allows me to bring new applications and relevance to my classes. I think this helps students realize that mathematics can

be used in many exciting and innovative ways." Within her own research, she collaborates with neuroscientists and medical doctors, and uses mathematics in order to help them understand how the brain develops and changes through disease and aging. Many of the methods she uses are based on concepts and ideas students learn in Calculus 2 and 3, as well as Differential Equations. By using her research as an example, Dr. Hurdal gives her students an indication of the relevance their coursework may have in various fields.

Both instructors find that FSU students are hard workers. While mathematics may be a challenging subject, Dr. Hurdal recommends that those interested in mathematics should "consider doing a double major in mathematics or consider research." She finds that every class has great teaching moments such as the moment when a student who has been struggling "gets it" or when she assigns group projects, such as forming student groups to act as consulting companies and work on mathematical models with real world applications. Although most students have never been assigned a project in a mathematics class and begrudgingly work on the assignment, the end result is always rewarding. "By the end of the project, students are actively engaged and extremely enthused by it. It is a new experience that opens their eyes to applicability of mathematics around them and students think this was an amazing task to experience first-hand." Professor Grigorian states, "I enjoy the interactions and communications with students in lectures," and occasionally he will joke with his students in order to "get their attention and make the lecture more enjoyable." His favorite teaching moments are when he sees his students successfully apply their knowledge on quizzes and tests. He advises that "as a teacher, [you] must be tough but friendly at the same time," and to, "help your students as much as you can because math can be the hardest subject for some."

Dr. Hurdal's absolute favorite thing about teaching is when alumni reach out to their former professor, such as a former undergraduate student who is currently a Research Assistant at the University of Maryland's Cardiovascular Behavioral Medicine Laboratory. While pursuing a Master's degree in Mathematics, this student reached out to thank Dr. Hurdal for being a major influence on his pursuit of advanced study in mathematics and biological psychology: "You talked with me about applications of Mathematics in Neuroimaging, and your TAs provided help and encouragement to someone who was frustrated and dangerously close to giving up...your course and encouragement reignited my love of programming, computing, and changed the direction of my education." Dr. Hurdal adds, "Receiving an email from a student many years after I taught them, saying how much they enjoyed my course and how it influenced them, is very rewarding. As a teacher, I often never know what impact I have on my students. Praise and compliments like that are very special and can't be beat!"

Both Dr. Hurdal and Mr. Grigorian also attribute a successful learning environment to an overall sense of encouragement across the department. Dr. Hurdal believes this is because the people in the Mathematics Department are friendly. "The Department wants to see people succeed—both faculty and students." The Department offers innovative programs such as biomathematics and financial mathematics which can help students experience, "new and exciting mathematics courses that are traditionally not offered at other universities." Additionally this provides opportunities for students to work alongside faculty on research. Grigorian also works to convey his passion for those students who are required to take mathematics courses and may find a new love for the subject through the class: "I try to make the courses I teach a pleasant and enjoyable experience for my students. I recognize that not all of the students share my own love of mathematics, and indeed most of them dislike the subject. As such, I try to present the material in lectures with a level of enthusiasm which communicates a love of mathematics, so that they may gain some measure of appreciation with the material."

AWARDS Continued on page 17

NEW!

Math Puzzler

In this issue we present a Math Puzzler. The question comes from this year's FSU High School Math Contest. A prize* will be awarded for the best solution with the clearest explanation. The answer must be submitted by **March 31, 2015** to **newsletter@math.fsu.edu**. We hope you are challenged by this Puzzler!

> Suppose all the integers from 1 to 1,000,000,000 are written down (in the usual base 10). What is the sum of all the digits written?

**FSU Mathematics faculty and their families, and those affiliated with the 2014 FSU High School Math Contest (sponsors, participants, math club members, etc.) are not eligible for the prize. The newsletter editor and staff will determine prize eligibility.*

Dr. Washington Mio Inducted Into the 2015 Class of AMS Fellows

This November, The American Mathematical Society honored Dr. Washington Mio for his work in topology as well as to mathematics, statistics, and applications of shape analysis. Mio was inducted as an AMS Fellow "in recognition of his outstanding contributions to the creation, exposition, advancement, communication, and utilization of mathematics." The 2015 Fellows class is chosen by an AMS selection committee, to create "an enlarged class of mathematicians recognized by their peers as distinguished for their contributions to the profession…and to support the advancement of mathematicians in leadership positions in their own institutions and in the broader society." This year, 62 members were inducted as Fellows of the organization. Dr. Mio joins three of his FSU Math Department colleagues, John Bryant, Robert Gilmer, and De Witt Sumners, who were named AMS Fellows in 2014.

As an undergraduate in the engineering field, Mio found his interests switching directions towards "the mathematical foundations of the methods used to solve problems." In pursuit of the "fascinating world of mathematics," Mio pursued mathematics at the Courant Institute; he served as an Assistant Professor at the Instituto de Matematica Pura e Aplicada in Brazil before pursuing post-doc positions at New York University, Cornell University, and University of Pennsylvania. Mio made his way to FSU in 1990 and became a full professor in 2005. For many years, his research was based in pure mathematics. Mio worked on very abstract, theoretical problems in the area of geometric topology. As rewarding as those years were, he found himself wanting to spend part of his career applying mathematics to the solution of "real-world" problems. About a decade ago, he began to study patterns underlying data, particularly information contained in shapes and images. This naturally led to interdisciplinary work that has added new dimensions to his research. Mio is currently working on federally-funded research topics as varied as "Developmental Mechanisms Underlying Genotype-phenotype correlations," and "Breaking through the Taxonomic Barrier of the Fossil Record," "Genetic Determinants of Orofacial Shape and Relationship to Cleft Lip/Palate," and "Topological Methods for Parsing Shapes and Networks and Modeling Variation in Structure and Function." Mio stated, "I find it very exciting to see that mathematics has much to offer to the solution of challenging problems at the frontiers of such disciplines as evolutionary and developmental biology, ecology, and medicine. The problems range from organization and indexing of complex data to the challenges of transforming data into knowledge, with so much in-between. One of the great things about mathematics is that it helps you uncover common threads in seemingly disparate problems. Finding these links, developing new mathematical models, and using them to solve problems is very rewarding."

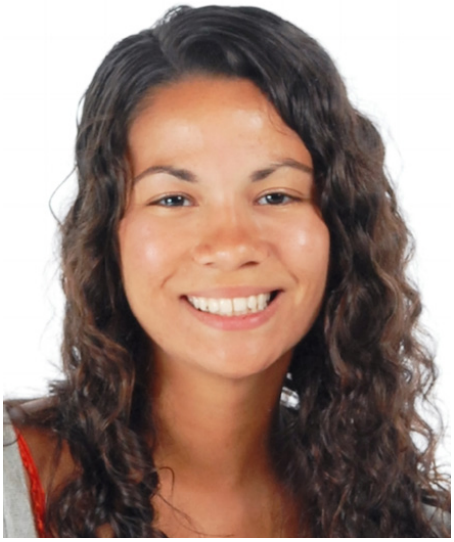
One of his favorite research moments occurred in the 1990s with another FSU Mathematics colleague and AMS Fellow, Dr. John Bryant. Together they worked on a "conjecture in the theory of topological manifolds that had resisted several prior attempts to a solution." Mio said, "Cracking that problem after working on it for many years was very special." While he currently experiences great moments in his line of work, Mio likes to "take an optimistic view" and

consider the special moments still to come. He says, "The greatest ones have been the Aha! moments by my students. It really feels great seeing them developing into mathematicians."

In regards to the FSU Mathematics Department, Dr. Mio finds his colleagues to be "an energetic bunch" within a mission driven department that has added many accomplishments to its name over the years. "The broad mathematical landscape has evolved significantly in the last two decades, with interdisciplinary activities increasingly playing a larger role. The department embraced these changes early on, successfully incorporating new interdisciplinary programs to the more traditional core. This has posed new challenges, but we are on a very solid track and the future looks bright!"

To anyone considering pursing the field of mathematics, Dr. Mio recommends, "Go where your thoughts and passion take you. That is a great place!" ■

Graduate Student Profile
Angela Jarrett



Angela Jarrett,
5th year Biomathematics Graduate Student

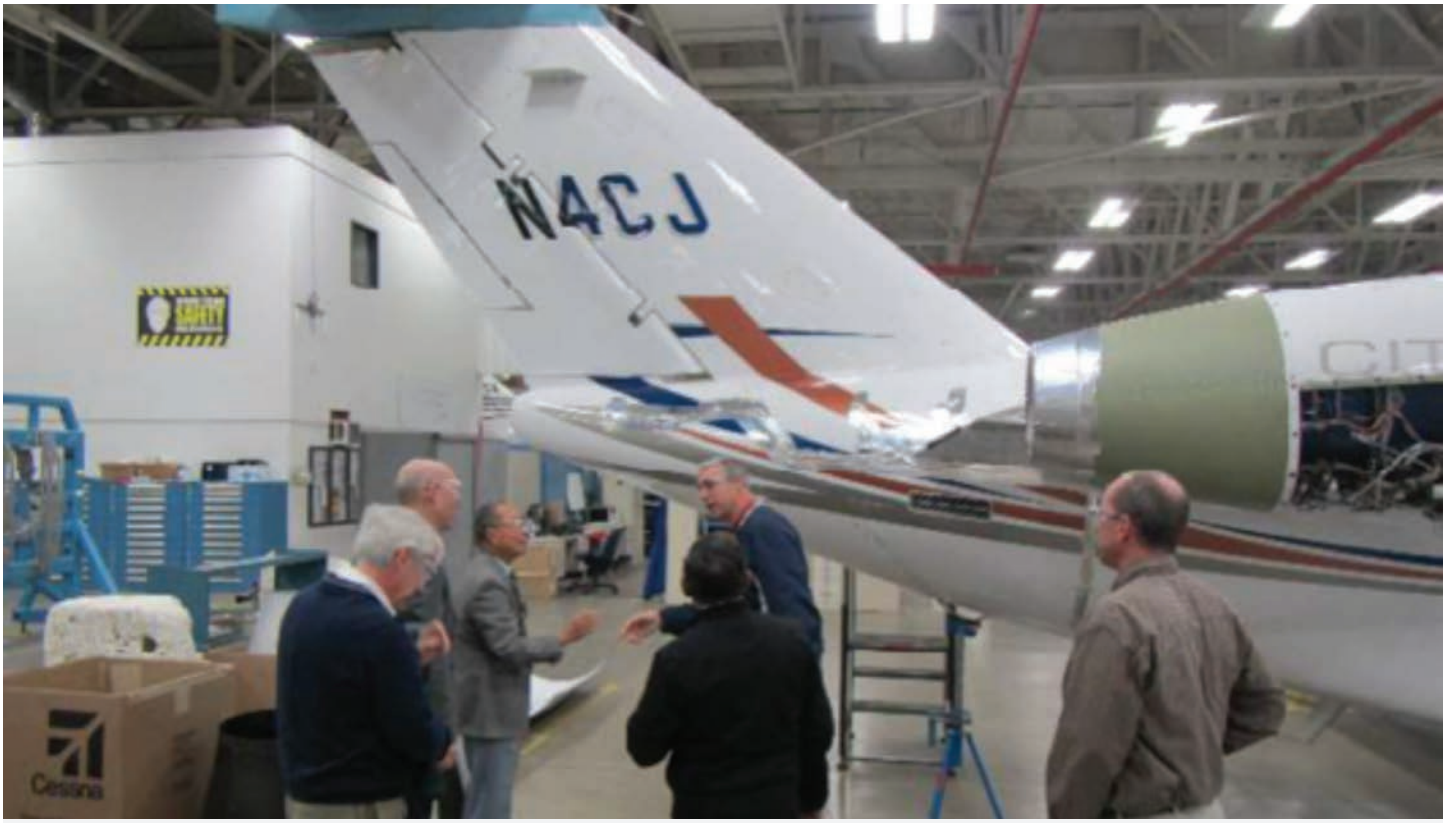
Angela Jarrett is currently a 5th year graduate student within the Biomathematics program, working under the supervision of Drs. Nick Cogan and M. Y. Hussaini. This year, she presented a contributed talk at the Society for Mathematical Biology on "Modeling the immune response to MRSA and insights from global sensitivity analysis," and published articles in the Journal of Mathematical Biology and Mathematical Medicine and Biology. Recently, Jarrett was interviewed by the Society for Mathematical Biology as part of a series to highlight graduate students and postdocs in Mathematical Biology. She is also the current secretary to the FSU SIAM student chapter; member of Pi Mu Epsilon, a national mathematics honors society; and was previously a recipient of a GAAN Fellowship. Jarrett was initially recruited for graduate study at FSU as part of the combined Bachelor and Master degree program, through which she began taking graduate coursework as an undergraduate biomathematics student.

During her undergraduate studies, Angela was a Biology major intending to attend medical school upon graduation. However, as she continued to take more math courses, particularly those blending biology, math modeling and programming, she enjoyed discovering the relationships between biology and mathematics: "I found it fascinating that life can be so messy and chaotic yet still be explained using the logical framework of mathematics. After a few undergraduate research projects (modeling an outbreak of zombies, using game theory to understand the adaptations of bacteria, and studying the phenomenon of 'persisters' in antibiotic resistant bacteria), I realized I had a talent and passion for biomathematics research."

> *"I found it fascinating that life can be so messy and chaotic yet still be explained using the logical framework of mathematics..."*

Jarrett's research interests involve "the application of mathematics to biological processes, specifically with medical impact such as bacterial infections, specifically MRSA [a strain of staph bacteria resistant to antibiotics], using ordinary and partial differential equations." Her current project deals with the "phenomenon of S. aureus nasal carriage" including a "PDE system to model the behavior of the infection and immune response in the nasal mucus." Currently, she is expanding her research to investigate optimization processes for data assimilation for their ODE model, and working with her collaborators to create experiments to measure the sensitivity of the model components. In the coming year, Jarrett has already been accepted to present her research at the SIAM Conference on Applications of Dynamical Systems and the annual Society of Mathematical Biology conference in Atlanta, GA.

Jarrett believes one of the major challenges in Biomathematics is that "the smallest changes in the biological details require substantial changes in the mathematical approaches and require a variety of methods to understand. [Mathematician] von Neumann said 'If people do not believe that mathematics is simple, it is only because they do not realize how complicated life is.'" A researcher does not exist in a vacuum, and Jarrett cites her advisors, collaborators, department faculty, and friends for making her success possible: "It takes a village to raise a child, and I am no different...their guidance along with my awesome support system of friends and family has been invaluable to me for my progress and planning my future." Jarrett's proudest moment in the program thus far arrived when her first paper was published: "Initially we had a really rough time about it, but it was accepted, and I felt that my hard work had finally been recognized." ■



Dr. Tam (third from left) discussing his tone suppressing ideas with Cessna engineers

Faculty Research

The Story of a Nine Million Dollar Aircraft

By Christopher Tam

My research areas are computational mathematics and aeroacoustics (flow noise; aircraft and transportation noise in particular). Aeroacoustics is a very active field in industry and I have often been asked to consult for special projects. The story below is based on my most recent consulting experience.

Cessna Aircraft specializes in building executive jets. The company, located in Wichita, Kansas, has 7,000 employees and an annual aircraft export of 2 billion dollars. Three years ago, they began marketing a new 9 million dollar high-end executive jet, the CJ4-Proto. Soon, it became one of their top sale aircrafts. Unfortunately, an unexpected event happened a year and half later. It is Cessna's practice to fly each potential client for a test flight before concluding a sale. On one of these occasions, the flight started out well until the plane reached an altitude of 30,000 feet, when a tone was heard in the cockpit and in the passenger cabin. As the plane accelerated to the cruising speed and altitude, the tone frequency changed steadily but the intensity remained high. This annoying tone persisted until the plane came down below 30,000 feet during landing. The client complained about the tone after reaching the terminal and refused to accept the plane. The presence of a tone at high altitude was known to Cessna since the plane's first test flight. It was not deemed a matter of concern, as it was not a safety issue. Since a client had refused to accept the aircraft, the tone problem was elevated to a client dissatisfaction issue. Cessna is keenly aware of their brand association with clientele who see their private planes as a status symbol. It could seriously hurt the company's bottom line should it become widely known that one of them had refused to accept a 9 million dollar plane because of an annoying tone.

Dr. Christopher Tam

A team of engineers was assigned to look into the matter and to develop a tone suppression device or scheme.

The engineering team immediately thought it was a mechanical vibration problem. For six months, all possible mechanical vibrations were checked. In some cases, suppression devices were deployed but nothing that the engineers did affected the tone. The situation became desperate and the management was extremely worried and unhappy.

One day, one of the engineers came across two papers I wrote some years ago on an aeroacoustic phenomenon known as jet screech tone. My papers gave tone frequency prediction formulas and a physical explanation of the tone generation mechanism. For many years, screech tones have been known to be emitted from supersonic laboratory scale jets. However, screech tones had never been reported to be a problem in full size jet aircrafts and had not been a concern of the aircraft industry.

To verify whether the Cessna tone was a jet screech tone, the engineer used a frequency formula from my paper to predict how the tone frequency varied with flight speed. He found a good match between the theoretical prediction and flight measurements. The tone was no longer a mechanical vibration problem but an aeroacoustics problem.

The engineer reported his findings to the chief acoustics engineer who presented the case to the management. A few days later, I received a phone call from the chief acoustics engineer. The phone call was followed by a long email explaining the tone problem, which offered me a time-limited consulting agreement. The project was to reduce or eliminate the tone. I hesitated. I had never been involved in the design of a noise suppression device. This is not what mathematicians usually do – not in the job description. I eventually convinced myself that this was a real challenge and that their offer would, for sure, take me out of my comfort zone. I accepted the challenge and became a Cessna consultant.

A jet flow is intrinsically unstable. It supports instability waves (i.e. coherent fluid motion) in the form of waves that grow in amplitude as the waves propagate downstream. There are two dominant instability waves: an axisymmetric and a helical mode. When a jet aircraft climbs to a high altitude, the ambient pressure decreases. This causes the jet flow coming out of the nozzle to become supersonic even though the aircraft is flying at a subsonic speed. In the plume of a supersonic jet are quasi-periodic shock cells. According to my theory, the interaction of the instability waves and the shock cells is what generates the two modes of screech tones: one axisymmetric and one helical. With this understanding in mind, it became clear to me that they needed a device that would break up the two modes of instability waves.

“According to my theory, the interaction of the instability waves and the shock cells is what generates the two modes of screech tones: one axisymmetric and one helical. With this understanding in mind, it became clear to me that they needed a device that would break up the two modes of instability waves.”

I flew to Wichita to inspect the tail part of the CJ4 aircraft. I noticed that the pylon that held the engine to the airframe was also very close to the jet. It was, therefore, feasible to mount a wedge device on the pylon that penetrates the jet flow to disrupt the jet flow instability waves. On my return to Tallahassee, I designed a faceted wedge and submitted the design to Cessna. Of course, I had no idea whether it would work or not, although logically it should. For a long while, I waited for the flight test report. After a month, the report finally came. I was happy to learn that the faceted wedge did significantly reduce the level of the helical mode screech tone. It also somewhat reduced the level of the axisymmetric mode screech tone. Cessna was jubilant and excited, for this was the first device that had a real impact on the tones. I was invited to improve the wedge design. Now, I knew what I needed to do. I enlarged the wedge and increased its penetration into the jet flow. I reasoned that a larger and taller wedge would destroy the axisymmetry of the jet flow and hence the axisymmetric instability wave and screech tone. A month and half later, I received a new flight test report. The modified faceted wedge worked well. The tone level was reduced to an acceptable level.

This brought my consulting job to an end and I had no regrets. I actually felt pretty good. It certainly did not hurt to receive a reasonably sized check for my consulting fee, but the experience was more meaningful as a sense of accomplishment. I never thought that I was capable of making a real impact on an actual aircraft. Now, I am forever linked to the Cessna CJ4-Proto. ■

Alumna Profile **Kim Ruane**

"Do you have a vision of what you see yourself doing when you get your PhD? Or not?" asks Dr. Kim Ruane, currently the Director of Graduate Studies at Tufts University. As part of the Fall Colloquium series, Dr. Kim Ruane visited with our own FSU Math graduate students during their weekly Graduate Student Seminar. While giving insight on the graduate school process and upcoming job search, Ruane narrated her own path toward the PhD.

During Ruane's undergraduate studies at Kennesaw State University, she worked with Dr. Chris Schaufele, an FSU alumna (PhD 1964), on her undergraduate thesis. Dr. Schaufele reached out to Dr. De Witt Sumners, telling him about this amazing student he had who should be encouraged to pursue graduate study. Ruane's decision to pursue study at FSU was ultimately based on her desire to work on a project with Dr. De Witt Sumners on applications of topology to DNA research.

Her growing interest in knot theory led her to geometric group theory, which she would study and research under the supervision of Dr. Phil Bowers. Ruane recalled going to Dr. Bowers and asking him about this topic. He responded that he didn't know much about it either, but they would figure it out together. Ultimately, Ruane ended up leading multiple presentations on geometric group theory through the weekly Topology seminar. She owes "a debt of gratitude to the group of faculty and graduate students that sat and listened to me fight through the details of handwritten notes on hyperbolic groups and many other topics." Through conversations with the faculty and graduate students within the seminar, Ruane slowly found her way through the topic. Her research culminated in a dissertation on "Boundaries of CAT(0) Groups" in 1996, and she began a three-year post-doctoral position at Vanderbilt University upon graduation. She followed this position with another post-doc at ETH in Zurich, Switzerland, and then a tenure-track position at Tufts University in 2000. Ruane is currently a full professor in the Mathematics department and serves as Director of Graduate Studies.

Ruane cited the weekly Topology seminar as a major step for building her presentation skills: "It's a lot of work, but it's worth it to get the experience of really talking about mathematics in front of other mathematicians and building up that immunity. It teaches you how to say I don't know, but here's what I think. You have to be able to do that and be confident about it. It can be a very important skill for research talks." Ruane urged graduate students to gain teaching experience and to be comfortable with research talks. "Even for teaching, the ability to have that confidence about having that exchange about mathematics in front of a room of people is what you're going to be doing for your job. As an academic, you'll have to talk to students, peers, or even someday an administrator."

Kim Ruane,
Director of Graduate Studies at Tufts University

For students at the beginning of their program, Ruane encouraged them to be proactive about choosing an advisor as it can be one of their most critical decisions. It is critical for students to be aware of their own needs as a student, and to seek out an advisor who complements their vision of success. Often a student may find they work better with a particular type of advisor, whether it is the "task-master" or the "friend."

> *"It's a lot of work, but it's worth it to get the experience of really talking about mathematics in front of other mathematicians and building up that immunity."*

Students should reach out to potential advisors over a cup of coffee: "In fifteen minutes, you'll know if you want to work with them. Try having a conversation with them before you agree to choose them as your advisor." Students need to seriously consider the kind of experience they want out of the work they complete with their advisor.

Students on the job market, Ruane insists, should start the job market conversation with where they see themselves working, and then pursue that ideal job. Students should move away from "blanket applications" and focus on their strengths and where they eventually see themselves in their professional careers: "If you really think there's a chance that you might want to continue in the research track, you probably shouldn't rush into a teaching job right off the bat because it'll be hard to get your research back on track." Part of the job search also requires building a strong teaching or research statement. As part of her university's hiring committee, Ruane has a two-sided perspective on the job market. She encouraged students to use keywords that appear on the job ad, and to say something relevant that addresses the criteria within the ad.

After taking questions from graduate students, Ruane closed with the advice for students to develop a vision of themselves with the PhD, and to pursue it with as much ambition and focus as possible. For those worried about their hiring prospects, Ruane encourages them to see it in another light: "The bad news: I have no control over it. The good news: I have no control over it." ■

Alumni Profiles
Mariel Vazquez and Javier Arsuaga

The "two-body problem" in academia refers to the challenge couples face when trying to find academic positions in the same geographical area. The term is a spin-off from the two-body problem in classical mechanics. FSU Mathematics alumni Mariel Vazquez and Javier Arsuaga have found a solution to their own two-body problem. This fall they were both appointed as Full Professors in Mathematics at University of California-Davis. Previously, they both held positions at San Francisco State University. Vazquez and Arsuaga are married with children, but they met as graduate students in the Department of Mathematics at FSU and shared the same advisor, (now retired) Professor De Witt Sumners.

Vazquez and Arsuaga both graduated with their PhDs in 2001 from the Department of Mathematics at FSU and have successful academic careers. Both receive federal funding for their research, and have many publications, including some together. Arsuaga applies topology and stochastic methods to molecular biology and genetics, including developing topological and statistical methods for the reconstruction of 3D chromosome structure across organisms. Vazquez is considered a pioneer in the field of DNA topology, where she uses knot theory to study the entanglement of DNA as it packs tightly into living cells. Notably, Vazquez recently received the prestigious NSF Early Career Award while a professor at San Francisco State University in 2011. She then received the Presidential Early Career Award for Scientists and Engineers (PECASE), the nation's highest honor for researchers in the early stages of their career. PECASE awardees are selected for their innovative research and commitment to community service. The PECASE award citation states that Vazquez is honored for her "excellent interdisciplinary and international research at the interface of mathematics and biology, and for creativity and dedication to recruiting, training, mentoring, and helping students from underrepresented groups achieve their goals."

Dr. Mariel Vazquez,
FSU Mathematics Alumna

Recently, Drs. Vazquez and Arsuaga returned to FSU to give presentations in the Colloquium and Biomathematics Seminar series. While with us, they answered a few questions on their career and solving the two-body problem.

What drew you to FSU to pursue your graduate education?

MV: It was definitely the opportunity to study with Dr. De Witt Summers. Prior to FSU, I did my undergraduate degree at the National University of Mexico, in Mexico City, and in my sophomore year De Witt gave a series of talks at the university. I didn't really understand everything at the time, but I knew I really loved the ideas he was exploring in his research. In Mexico, the undergraduate degrees are much more focused, so I was studying only mathematics and not any biology, but I always had a strong interest in biology, and from the beginning I planned on pursuing a masters in molecular biology after graduation. However, I soon realized I liked my pure math courses much more than my applied math courses, and I was concerned that I wouldn't enjoy studying biology from a mathematical perspective as a result. But once I heard De Witt's talks and saw how he was applying pure mathematics, particularly topology, to solve problems in biology, I knew right away that this was something I would enjoy studying.

JA: My motivation was similar. I was taking knot theory in my third year as an undergraduate at Zaragoza University in Spain, and a professor mentioned to me that there were mathematicians at FSU applying knot theory to biology. Similar to Mariel, I didn't have a particular interest in the research questions of pure mathematics, but I was drawn to it over applied math because I preferred the techniques pure mathematicians used to explore problems. My dream was to find tools in pure math that could be used to solve problems in biology, a subject I was already quite interested in, and in pursuing this interest I came across the work of De Witt Summers. My senior year I received a fellowship to pursue interdisciplinary research in this area, and after I graduated I contacted De Witt and he recommended I to apply to FSU. After receiving my acceptance, the decision to attend FSU was an easy one.

Can you describe the transition to life in the United States? Were there any notable differences from life in your home country, particularly in the academic environment?

JA: One difference was that in Spain we weren't assigned homework, so it was a bit of a shock being required to complete regular assignments. I was accustomed to a more independent academic environment, where the professors would assign work for the students to complete on their own, but it wasn't a requirement for a grade. Instead, we had a more traditional grading structure based on one midterm and a final. It was also a bit of a transition adjusting to my TA duties at FSU. At Zaragoza, I was a TA for linear algebra, but at FSU I was TAing classes that weren't necessarily aimed at mathematics majors, and the class sizes were much larger as well.

MV: Life in Tallahassee was a welcome change from the hectic life I was accustomed to in Mexico City. My undergraduate university had somewhere around 200,000 students, which is comparable to the entire population of Tallahassee, so it was a nice transition moving to a smaller city for graduate school. Academically, my transition was similar to that of Javier. The universities in Mexico have a similar grading structure to those in Spain, with no homework assignments and a bit more independence, so it took about a semester to adjust to the academic environment at FSU. Thankfully, Javier and I met the same day we arrived in Tallahassee to meet with De Witt, and we became friends immediately.

You both shared the same academic advisor, Professor De Witt Sumners. Did you have many opportunities to work together as graduate students?

MV: We worked together all the time. We did homework together; we studied for exams together, we studied for prelims together … it was a huge advantage being able to work with one another. It was an excellent way to learn the material together and it was much easier to brainstorm ideas. Graduate school was a very fun time for us. Some students who work more in isolation find graduate school to be very stressful, but we realized early on the advantages of collaboration, and it made a tremendous difference not only in our outlook but in the learning process as well.

After completing your graduate education at FSU and beginning the search for jobs in academia, did you imagine you'd be able to find positions at the same university? Did you have a particular strategy for finding work in the same area?

MV: Our hope from the outset was to find positions in the same geographical area, but we couldn't imagine we would be so fortunate to find positions at the same university.

JA: We definitely made that one of priorities in the job search, and we worked very hard to find positions in the same area. We were upfront during the application and interview process that it was important that we remain close to one another. It took a lot of time and effort, but eventually the hard work paid off.

Prior to your positions at UC-Davis, you both had positions at San Francisco State University. Can you describe the teaching and research environment at SFSU? Have you had any opportunities to collaborate?

JA: Yes, we actually share a number of grants together. Although SFSU only offers master's degrees in mathematics, there is a growing research climate. As it is, we are required to maintain a 50/50 ratio of teaching to research, so we stayed quite busy with teaching.

MV: At SFSU, we were typically required to teach four courses a semester, but we've both been able to substitute a class with additional research, and this has thankfully given us a little more freedom to focus on our research.

Your research interests lie at an interesting intersection between pure and applied mathematics. What drew you to approach real-world problems from such an abstract perspective? Which came first, the interest in mathematics or biology?

MV: In my case, my interest in this type of research developed early on, even before I learned any advanced mathematics. Since high school, I've been very interested in both mathematics and molecular biology, but I wanted to apply math to solve problems in molecular biology.

JA: My interest developed similarly. Even now, our research is driven by real-world problems in molecular biology. This is really the key to our work, since the wide variety of interesting and accessible problems in biology motivates some fascinating mathematics.

Professor Vazquez, you recently received a prestigious NSF Career Award, followed by a Presidential Early Career Award for Scientists and Engineers. Has this changed your approach to research?

MV: In a way, it has really helped me focus my research. Before receiving the awards, I was juggling several projects, whereas now I'm able to more effectively focus on a single direction. But it also comes with a lot of responsibility to communicate my research to the academic community and to promote interest in mathematics outside of academia. In particular, I teach math to elementary school students. I was surprised at how much the children have enjoyed learning about our research, specifically about knot theory. They really love it, and it's been extremely satisfying to spread our passion to young people.

Javier Arsuaga,
FSU Mathematics Alumnus

How would you describe your approach to teaching? Was your experience with Professor Sumners influential in developing your own style?

MV: To be an effective teacher, I think it's important to show your students how passionate you are about your research and to incorporate this in some way into your teaching. For example, I teach an introduction to proofs course. Even though it's an entry-level class, I still try to expose the students to research by assigning a research project: they write a paper, give an oral presentation, and do their own independent research. It's an excellent experience for the students, and I think if I hadn't worked with De Witt and experienced his passion for research, I wouldn't have adopted this perspective on teaching.

JA: Another thing I learned from De Witt was to view math not an isolated subject, but as a vibrant field that's a common ground for many fields of research. It can be studied in and of itself or for its own enjoyment, but it's also a powerful tool that can be successfully applied to solve a variety of research questions. ■

2014 FSU Mathematics PhD Recipients

Spring 2014

NAME	AREA	ADVISOR	THESIS TITLE
Ahmed Derar Islim	Financial Math	David Kopriva	Pricing and Hedging Derivatives with Sharp Profiles using tuned High Resolution Finite Difference Schemes
Andrew Winters	Applied/Computational	David Kopriva	Discontinuous Galerkin spectral element approximations for the reflection and transmission of waves from moving material interfaces
Wen Huang	Applied/Computational	Kyle Gallivan & P.A. Absii	Optimization Algorithms on Riemannian Manifolds with Applications

Summer 2014

NAME	AREA	ADVISOR	THESIS TITLE
Ming Zhu	Financial Math	Warren Nichols	Radically Elementary Stochastic Summation with Applications to Finance
Matthew Donahue	Biomathematics	Nick Cogan	Modeling the Effect of Biofilm
Vijay Kunwar	Pure Math	Mark van Hoeij	Hypergeometric Solutions of Linear Differential Equations with Rational Function Coeffficients
Matt Jemison	Applied/Computational	Mark Sussman	An asymptotically preserving method for multiphase flow
Yingyuen Shen	Biomathematics	Mike Mesterton-Gibbons	Mathematical Models of Dengue Fever and Measures to Control It
Nghuyet Nguyen	Financial Math	Giray Okten	Probabilistic methods in estimation and prediction of financial models
Ivan Dungan	Pure Math	Ettore Aldrovandi	n-butterflies: modeling weak morphisms of strict n-groups

Fall 2014

NAME	AREA	ADVISOR	THESIS TITLE
Sevgi Sengul	Biomathematics	Richard Bertram & Joel Tabak-Sznajder	Unveiling Mechanisms for Electrical Activity Patterns in Neurons and Pituitary Cells Using Mathematical Modeling and Analysis

Department News

Alumni News

Gregory Toole *(PhD 2013, Hurdal)*, faculty at Polk State College, published the paper "Pattern Formation in Turing Systems on Domains with Exponentially Growing Structures" in Journal of Dynamics and Differential Equations 26 (2), 315-332, 2014. Co-authors are Monica K. Hurdal.

Candace Ohm (*PhD 2013, Mesterton-Gibbons)* Business Analyst for Spiceworks, Austin, Texas.

Yingyun Shen *(PhD 2014, Mesterton-Gibbons)* Analyst for Wells Fargo, Charlotte, North Carolina.

Sevgi Sengul *(PhD 2014, Bertram)* postdoctoral Fellow at the University of Istanbul. She published the paper "Determining the Contributions of Divisive and Subtractive Feedback in the Hodgkin-Huxley Model" in the Journal of Computational Neuroscience in 2014. Co-authors are Robert Clewley, Richard Bertram, and Joel Tabak.

Arij Daou *(PhD 2013, Bertram)* published in "Two Neural Streams, One Voice: Pathways for Theme and Variation in the Songbird Brain" in Neuroscience in 2014. Co-authors are Richard Bertram, Richard Hyson, Frank Johnson, and Wei Wu.

Vijay Kunwar is a faculty member in the Mathematics and Computer Science Department at Albany State University.

Yongjae Cha is an Algorithm Developer at RobArt GmbH. He was recently featured in a magazine on robotics called Chef Info.

Andy Novocin is a faculty member at the Computer & Info Sciences Department at the University of Delaware.

Contribute your Alumni News to the FSUmath Newsletter or be added to the newsletter distribution list by emailing **newsletter@math.fsu.edu**.

Graduate Student News

SPRING 2014

Kerr Ballenger *(expected PhD Spring 2015, Major Prof. Craig Nolder)* gave a talk in a special session at the national Joint Mathematics Meeting in Blatimore in the special session "Complex and Geometric Analysis" in January 2014. His talk title was "Boundary Values of Components of Monogenic Functions."

Kerr Ballenger also presented at the Southeastern Analysis Meeting at Clemson University on "Boundary Values of Components of Monogenic Functions." **people.clemson.edu/~mmitkov/seam/index.html**

John Emanuello *(expected PhD Spring 2015, Major Prof. Craig Nolder)* gave a talk in a special session at the national Joint Mathematics Meeting in Baltimore in the special session "Complex and Geometric Analysis" in January 2014. His talk title was "Projective Compatification of R^{1,1} and its Mobius Geometry."

Vijay Kunwar *(expected PhD Spring 2014, Major Prof. Mark van Hoeij)* gave a talk in a special session at the Annual Joint Mathematics Meeting in Baltimore in January 2014. His talk title was *Hypergeometric Solutions of Second Order Linear Differential Equations with Five Singularities.*

Nguyet Nguyen *(expected PhD Spring 2014, Major Prof. Giray Okten)* gave a talk at the AMS national meeting in the special session "Big Data: Mathemaitcal and Statistical Modeling, Tools, Services and Training." The talk title was "Hidden Markov Model for High Frequency Data."

Congratulations to this year's Financial Mathematics grad student poster competition winners: 1st Place ($100): Nguyet Nguyen, 2nd Place ($75): Tony Wills, and 3rd Place ($50): David Yao.

SUMMER 2014

Justin Cole received a SIAM student travel grant to give a talk at the SIAM Conference on Nonlinear Waves and Coherent Structures. The conference was held at Churchill College at the University of Cambridge on the dates 8/11-8/14. **siam.org/meetings/nw14** At the conference he chaired a contributed paper session called "Nonlinear Schrodinger Equations and Related Problems" and gave a talk on "Spectral Band Gaps and Lattice Solitons for the Fourth Order Dispersive Nonlinear Schrodinger Equation with Time Periodic Potential." **meetings.siam.org/sess/dsp_programsess.cfm?SESSIONCODE=19686**

Tugba Karabiyik gave a talk entitle "Respect Versus Disrespect for Ownership: An Iterated Hawk-Dove Game with Relocation Costs" at the 2014 SIAM Conference on the Life Sciences in Charlotte, North Carolina, August 2014.

FALL 2014

Patrick Fletcher published "Interpreting Frequency Responses to Dose-Conserved Pulsatile Input Signals in Simple Cell Signaling Motifs" in PLoS One in 2014. Co-authors are Frederique Clement, Alexandre Vidal, Joel Tabak, and Richard Bertram.

Daozhi Han published the following papers in 2014:

- (with **Xiaoming Wang**, **Hao Wu**) Existence and uniqueness of global weak solutions to a Cahn-Hilliard-Stokes-Darcy system for two phase incompressible flows in karstic geometry, Journal of Differential Equations 257(2014), 3887-3933.
- (with **Xiaoming Wang**) Initial-boundary layer associated with the nonlinear Darcy-Brinkman system, Journal of Differential Equations 256(2014), 609-639.
- (with **Dong Sun**, **Xiaoming Wang**) Two phase flow in karstic geometry, Mathematical Methods in the Applied Sciences 37(2014), 3048-3063.

Biomath PhD student **Angela Jarrett** and PhD advisor **Dr. Nick Cogan** were featured in the Society for Mathematical Biology Digest, September 2014: **smb.org/publications/newsletter/vol-27no3.pdf**

The BioMath graduate program was featured in a survey by the Society for Mathematical Biology. **smb.org/resources/education/degree_survey.pdf**

PhD Student **Mehmet Aktas** was awarded an NSF travel grant to attend the Texas Topology and Geometry Conference in Austin, Texas, November 14-16, 2014. **ma.utexas.edu/tgtc2014**

Daozhi Han gave an invited talk at the 2014 SIAM Southeastern Atlantic Section Conference and won a presentation award. **my.fit.edu/~abdulla/SIAM-SEAS-2014**

Daozhi Han received an AMS Travel award to attend the Jan. 2015 Joint Mathematics Meeting, in San Antonio TX.

Corey Harris published an article, "Monomial principalization in the singular setting," in the Journal of Commutative Algebra.

Tugba Karabiyik was awarded the Distinguished Teaching Assistant Award, the Dwight B. Goodner Mathematics Fellowship, and the Ermine M. Owenby Travel Award from the College of Arts and Sciences.

Tugba Karabiyik co-authored "The iterated Hawk-Dove game revisited: The effect of ownership uncertainty on Bourgeois as a pure convention". Authors are M. Mesterton-Gibbons, T. Karabiyik and T. N. Sherratt appearing in Dynamic Games and Applications, Volume 4, pp. 407-431, December 2014.

Faculty Awards

Ziad Musslimani has won a fellowship from the German Academic Exchange Services (DAAD) to spend his sabbatical year at the University of Dusseldorf during the academic year 2013-2014.

Monica Hurdal and **Ishkhan Grigorian** received the 2013-2014 FSU University Teaching Award. Only 22 University Teaching Awards were presented to the entire FSU faculty in 2013-2014.

Washington Mio has been named a 2015 Fellow of the American Mathematical Society. The Fellows of the American Mathematical Society program recognizes members who have made outstanding contributions to the creation, exposition, advancement, communication, and utilization of mathematics. Washington was inducted into the 2015 Class of Fellows for contributions to topology as well as to the mathematics, statistics, and applications of shape analysis. See more at: **ams.org/profession/ams-fellows/new-fellows**

Eriko Hironaka has been appointed Marion Bradley Brennan Professor of Mathematics 2015-2017.

Monica Hurdal was invited to be a long term visiting researcher at the Mathematical Biosciences Institute in Columbus, Ohio for Spring 2014. **mbi.osu.edu**

Alec Kercheval was nominated for a 2013-14 FSU University Teaching Award.

Harsh Jain won an Early Career Award from the MBI at Ohio State to spend Spring 2015 in residence and participate in ther cancer modeling thematic year. **mbi.osu.edu/participate/early-career-award**

Washington Mio is co-investigator on the NIH grant titled "Developing 3D Craniofacial Morphometry Data and Tools to Transform Dysmorphology", 2014-2019.

Craig Nolder has been awarded an NSF grant to host a conference "Clifford Analysis and Related Topics", December 15-17, 2014 at FSU.

Mika Seppala has been awarded an NSF grant. The title of his project is "Shape of Educational Data."

Mark Sussman and **Yousuff Hussaini** have been awarded an NSF grant. The title of their project is "A spectrally accurate hybrid moment-of-fluid and level set method for multiphase flows."

Chris Tam has been awarded an Aeroacoustics Research Consortium grant. The tile of his project is "Modeling and Simulating the Generation, Propagation of Indirect Combustion Noise of a Simple Engine."

Paolo Aluffi has been awarded an NSA Mathematical Sciences Program grant for his work on "Segre classes as integrals over polytopes and other problems in intersection theory."

Washington Mio has been awarded an NSF grant. Washington will serve as the PI on the project "Collaborative Research: Topological Methods for Parsing Shapes and Networks and Modeling Variation in Structure and Function."

Eric Klassen has been awarded a five year Simons Foundation Collaboration Grant. The title of his project is "Shape Analysis of Curves and Surfaces."

Alec Kercheval has been awarded a Simons Foundation Collaboration Grant. The title of his project is "Topics in Financial Mathematics."

David Kopriva has been awarded an FSU Sabbatical Award for Fall 2015. He will use it to visit Mathematical Institute at the University of Cologne, attend a workshop at Oberwolfach entitled "Recent Developments in the Numerics of Nonlinear Hyperbolic Conservation Laws", and visit the Institute for Gasdynamics at the University of Stuttgart partially supported by a Simons Visiting Professorship. **mfo.de/scientific-programme/meetings/simons-visiting-professors**

Monica Hurdal has been awarded an NSF subcontract grant from the Mathematical Biosciences Institute at Ohio State University. The title of her project is "Frontiers in Imaging, Mathematics, and the Life Sciences".

Faculty News

SPRING 2014

The WEPS Academy Open Courses is an online calculus program developed by **Mika Seppala**. It has been implemented on a partial basis at FSU, and also for a 31 student class in Zimbabwe, organized by the US Embassy in Harare. Plans are in progress for a more full implementation at FSU.

Monica Hurdal was an organizer of the Spring 2014 Emphasis Program on Frontiers in Imaging, Mathematics, and the Life Sciences at the Mathematical Biosciences Institute (MBI) in Columbus, Ohio. Four workshops/conferences have been planned for this program. See **mbi.osu.edu/programs/emphasis-programs/previous-programs/frontiers-imaging-mathematics-and-life-sceinces** for more information.

Mika Seppala was invited to the White House Education Datapalooza and the Safety Datapalooza held in January 2014.

Paolo Aluffi gave an invited five-lectures series at a workshop on "Curves and equations" in Levico Terme, Italy, February 5-8, 2014.

Alec Kercheval organized the 16th Annual FSU Financial Mathematics Festival, Feb 21-22, 2014, on the FSU campus. Visit **www.math.fsu.edu/finmath/FMF/FMF16th2014.math**

Sergio Fenley gave a minicourse on "Pseudo-Anosov flows and toroidal manifold", Mar.10-14, 2014 at Tokyo Institute of Technology, Japan. 3 days of lectures.

Monica Hurdal was an invited colloquium speaker at the Mathematical Biosciences Institute (MBI) in Columbus, Ohio and gave a lecture on "Modeling and Analyzing Cortical Folding Patterns of the Human Brain in Development, Aging, and Disease", March 11, 2014.

Monica Hurdal organized a conference on Integrating Modalities and Scales in Life Science Imaging at the Mathematical Biosciences Institute (MBI) in Columbus, Ohio, March 17-21, 2014. There were 25 speakers and over additional 30 participants. Visit **mbi.osu.edu/event/?id=280** for more information.

Monica Hurdal was an invited colloquium speaker in the Biophysics Seminar at Ohio State University in Columbus, Ohio and gave a lecture on "Cortical Folding Patterns in the Brain", March 19, 2014.

Mika Seppala is organizing an event: "Big Data in Education" at the Mason Inn Conference Center March 20-23, 2014.

Paolo Aluffi is co-organizing a special session on "Singularities and Physics" with Mboyo Esole from Harvard University at the AMS Sectional Meeting at Knoxville, Tennessee, March 21-23, 2014.

Eriko Hironaka and **Kate Petersen** co-organized a special session on "Geometric Topology and Number Theory" at the AMS Sectional Meeting at Knoxville, Tennessee, March 21-23, 2014.

Mark Sussman, Xiaoming Wang, and Nick Cogan are organizing a conference on "Mathematical Models And Numerical Methods For Multi-Phase Flows" SIAMSEAS March 2014 **my.fit.edu/~abdulla/SIAMSEAS-2014/sess/mini/index.htm**

Alec Kercheval gave an invited talk "Jump dependence and multidimensional default risk: a new class of structural models with stochastic intensities"' at the American Mathematical Society Western Sectional Meeting}, Albuquerque, NM, April 5-6, 2014.

Giray Okten is organizing a special session titled "Monte Carlo and quasi-Monte Carlo in finance", at the Eleventh International Conference on Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing, KU Leuven, Belgium, April 6-11, 2014.

SUMMER 2014

Monica Hurdal was invited to speak at the SIAM Conference on Imaging Science, to be held May 12-14 in Hong Kong. She spoke in the mini-symposium Geometry, Imaging and Computing and her lecture is on Mathematical and Computational Models for Understanding Brain Development and Function.

Nick Cogan was a keynote speaker at a summer school in Nice, France (June 2014) Title: "Models for bacterial biofilms formation: mathematical, physical and biological perspectives."

Richard Bertram has been invited to serve as the Chair for the Modeling and Analysis of Biological Systems (MABS) Study Section for the term beginning July 1, 2014 and ending June 30, 2015. This study section reviews NIH grant proposals with a significant amount of mathematical content. Bertram has been a standing member of the study section since July 1, 2010.

Kyounghee Kim gave talks at:

- The ICM satellite conference "Holomorphic Dynamics in one and Several Variables", August 23-26, 2014.
- Another ICM satellite conference "Pacific Rim Conference on Complex Geometry" in August, 2014.

Xiaoming Wang's research on predicting sink holes was featured on the FSU Headlines on NPR in August 2014: **news.fsu.edu/Watch-and-Listen/Radio-Stories/FSU-researchers-studying-sinkhole-patterns**

FALL 2014

Paolo Aluffi gave a talk at the SACNAS (Society for the Advancement of Chicanos and Native Americans in Science) national meeting in Los Angeles, Oct 2014.

Eriko Hironaka will give the main lecture at the semi-annual GATSBY (Geometry and Topology Seminar at Brown and Yale) Title: "Fibered Face Theory, Polynomials and Entropy", Dec 2014.

David Kopriva is co-organizing a mini-symposium at ICOSAHOM 2014. **icosahom2014.org**

David Kopriva is Plenary Speaker in "Recent Advances in Numerical Methods for

Hyperbolic Conservation Laws", Stuttgart, DE. www.**mathematik.uni-stuttgart.de/fak8/ians/veranstaltungen/Tagungen-WS/WS-Munz.html**

Richard Bertram has been elected to be the new Chair of the SIAM Life Sciences Activity Group. Among his duties will be organizing the SIAM Life Sciences conference in 2016.

Richard Bertram was elected to be the Chair of the NIH study section Modeling and Analysis of Biological Systems for 2014-2015.

Xiaoming Wang is co-organizing a ICIAM 2015 Satellite Conference on "Mathematics of Geophysical Flows and Turbulence" in Shanghai, China, in August 2015. **iciam2015.cn/List%20of%20Satellite%20Meeting.html**

Monica Hurdal has been invited to speak in the mini-symposium "Evolution Equations in Mathematical Biology" at the Ninth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, to be held in Athens, GA, April 1-4, 2015.

Mark van Hoeij has been invited to be a plenary speaker at the AMS Fall Southeastern Sectional Meeting, to be held in Memphis, TN, Oct 17-18, 2015. ■

Eriko Hironaka, *from pg. 2*

I had increasing contact with graduate students, in particular starting around 2007, when I became director of the pure mathematics program. In this role, I have spent many hours talking with graduate students about their milestones and options, and to prospective students about what our pure math program has to offer. At the same time, I started to direct doctoral students of my own. This has led me to think about the progression from upper level graduate courses to graduate school, and the challenges students face as they work toward a career in mathematics or a related field.

Finally, working on Math Fun Day these last two years has been a chance to see FSU undergraduates and graduate students in yet another light. It was gratifying to see the energy and initiative of the 50 or so student volunteers, and the positive feedback they got from the many rapt youngsters who participated in our activity areas. The event was an opportunity for our students to show their strengths as organizers, managers, and teachers without the constraints of a fixed assignment, or the worries of being evaluated.

What do you believe is the most important aspect of mentoring?
Keeping open avenues of communication between students and faculty is paramount. Many students are afraid to talk to professors or advisors when they have a problem, but one-on-one conversations can often clear up a confusion or misunderstanding, and even head off problems before they happen.

Who are your role models?
I have had several role models, and continue to find new ones. The nice thing about academia is that there is no clear break between being a student and being a teacher; one is constantly learning and growing, and appreciating things in new ways. Mathematically, people like Zariski and Grothendieck, and Gromov and Thurston are my heroes for the way they fundamentally change the way people think about algebraic geometry and geometric topology, respectively. On a day-to-day basis, several people in the department inspire me with the hard work, care, and cleverness they put into teaching and administration. I also learn a lot from my family, friends, neighbors, and even from total strangers.

As the senior female faculty member in the department, what does it mean to be a role model to others?
It is hard to imagine myself as a role model. Just as I appreciate many people and the wisdom they give me, I can only hope that the good things I manage to do, or simply the fact that I am a woman in mathematics, might have a positive effect on someone observing it.

Do you know your Erdös number?
Actually, I don't, but I remember someone telling me I have one. ■

Awards, *from pg. 5*

To future mathematics teachers, Dr. Hurdal recommends enthusiasm. "Every class has some very knowledgeable students and some struggling students. As a mathematics teacher and researcher, show your love and passion for mathematics to your students. You never know who you will influence to be a future mathematician or how you may influence someone in their future career."

From the students

On Grigorian: "He was tough, yes, an old grump down to his rotten core, sometimes, but I also genuinely believe he is the greatest math teacher I have ever had. My academic unofficial grandpa. He has fostered an incredible mathematical foundation in me. I owe this man so much; he changed my life, my perspective on learning, and I will treasure every moment I spent in his class for as long as I live."

On Hurdal: "Her passion for not only the course work but for teaching in general shines throughout each lesson she teaches...Her lessons are clear and she also provides real world applications of the content, making the lessons more interesting. Dr. Hurdal has made my transition from high school into a rigorous math class seamless, and I would not have wanted it any other way." ■

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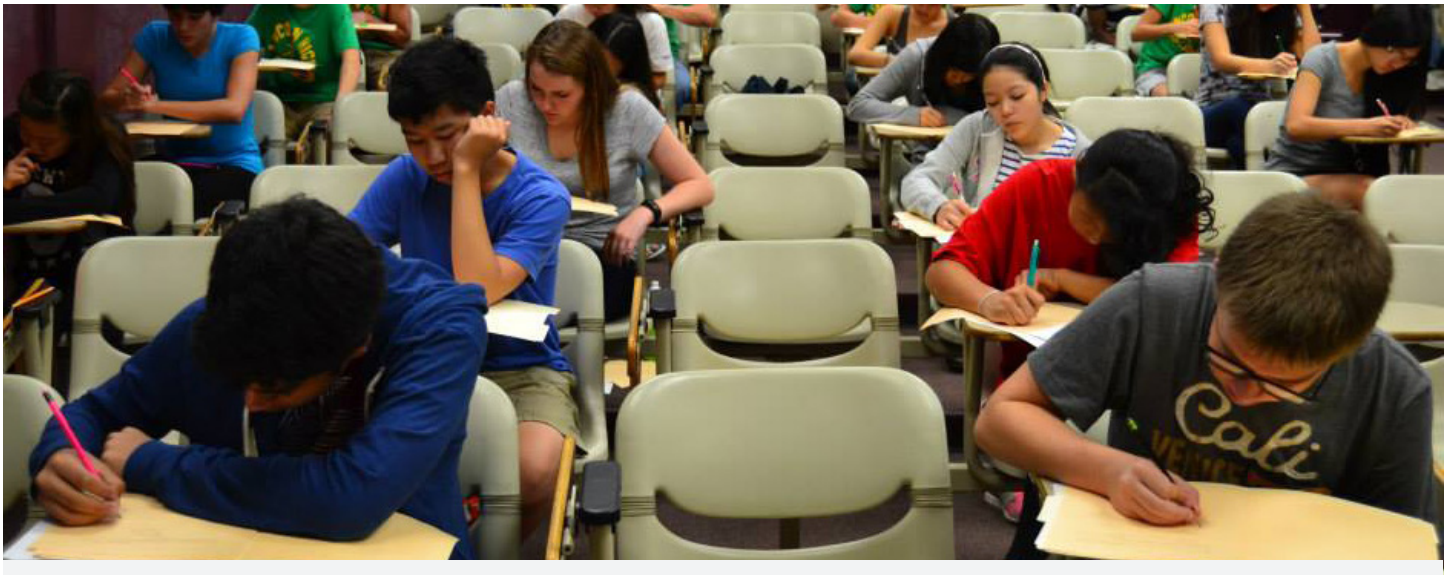


Students writing in the FSU High School Mathematics Contest.

Community Outreach

FSU High School Mathematics Contest

Recognizing the Department of Mathematics could provide more outreach to the Tallahassee community, Dr. Alec Kercheval and Dr. Steven Blumsack founded the FSU High School Mathematics Contest in 2012. Held annually in October, the contest has become a regular event on the Leon County High School Mathematics calendar, with this year marking the third annual contest. The contest offers high school students from across Leon County a chance to showcase their creativity and critical thinking along with their conventional math skills. Awards are given to first and second place, along with honorable mentions. For the most recent contest, forty-five students participated with representatives from all six Leon County high schools.

The First Annual FSU High School Mathematics Contest was organized by Blumsack and Kercheval and executed with help from the FSU Math Club and mathematics graduate students. Working through eight questions over three hours, contestants solve complicated problems, writing out their work and providing rationale for their responses. This was all by design; in contrast to high school math organizations that often employ lengthy, multiple choice tests with a short test time, emphasizing speed and test-taking skills rather than math, Blumsack and Kercheval focused the first contest to be more akin to prestigious competitions such as the Mathematical Olympiad that require explanations of solutions. This model worked well and has continued in subsequent competitions, with a team of FSU Mathematics faculty now writing the contest.

The inspiration for the exam, including its style and execution, came from Dr. Kercheval's own experiences as a student interested in math: "The contest idea was something I did when I was in high school. I kind of wanted to imitate that to some extent. We were dissatisfied with previous contest questions. We were thinking, 'What about the harder, longer problems?'" Dr. Blumsack recalls, "Alec and I both thought about this … to increase outreach in the department." Both were interested in exposing high school students to what Blumsack calls "real mathematics…as opposed to what passes for mathematics," giving interested students a taste of the kind of math being done at the university level. Dr. Kercheval adds, "The motive [for the contest] was noticing that we don't have any connection to the community really." He says it is clear that local middle and high school students are "thirsty for enrichment" that their own teachers simply do not have the time or means to provide. "We realized we weren't doing anything in the community."

The contest is held in mid-October but work begins in earnest each spring when invitations are sent out. The contest is open to all high schools in Leon County. Dr. Kercheval works with Mu Alpha Theta (high school mathematics honor society) sponsors to recruit students. The sponsors submit entrants to the contest, giving individual high schools more control over the process. The goal of this contest was not to give an extremely difficult test, or to have a high head count. Instead, Dr. Kercheval explains, "We wanted to accomplish two things: (1) a service impulse—to provide a service to ambitious math students; and (2) a recruiting angle—so that the best high school students in math would know who we are [as a department]."

Once the invitations are out, there is the matter of developing questions

and recruiting help for the day of the contest. The contest itself consists of two different exams—a junior division exam for the 9th and 10th graders, and a senior division exam for the 11th and 12th graders. For the first competition, Kercheval and Blumsack looked at questions from previous exams with similar structure, and questions in their personal archives, finally creating twenty questions and then choosing ten from those. Eight of the problems were shared across both tests, with two questions unique to each level. They designed the questions with students in mind, so that all participants could do reasonably well on at least two or three of them. Since Dr. Blumsack has "been collecting questions for about 30 years," the contest provided a great opportunity for him to look back. They also made an effort to involve other members of the department. Kercheval says, "We tried to think of what the format would be like, and thought of some questions. We solicited ideas from the faculty. I talked to the guy who organized the Santa Clare contest."

Now the test is written by a committee composed of FSU Mathematics faculty members: Kercheval, Blumsack, Dr. Brian Ewald, and Dr. Mark van Hoeij. Each committee member has their own experiences with mathematics contests: Ewald was National Math Counts Champion as a middle schooler; van Hoeij was on the Netherlands International Mathematical Olympiad team and currently runs a seminar for students participating in the William Lowell Putnam competition; and Blumsack has decades of experience with such things, with tons of problems in his back pocket. Kercheval begins the contest preparation in late spring by soliciting problem ideas from the committee. The committee narrows down choices over the summer, discusses candidate problems, and then edits/selects the final choices.

Blumsack said, "The exam emphasizes a lot of reasoning." By using fewer, more challenging questions and providing ample time to write out work and rationale, the FSU Math Contest intended its priority to be clear: developing an interest and insight in high school students for the kind of creative, intellectually stimulating math work done at the university level. As Kercheval notes, "They have to put different things together in a creative way." Students were required to justify their responses, for example, verifying not only the next item in a series, but also why the pattern continues in a particular way. High school faculty sponsors seemed to agree that the questions would be challenging, even to the more advanced students. On the day of the exam, the FSU Undergraduate Mathematics Club as well as graduate students assist with contest registration and proctoring. These enthusiastic volunteers also help with the time-consuming scoring demanded by a test of this structure. Two people grade each entrant's exam blindly to ensure a more objective result and afford the possibility of partial credit, with questions worth ten points apiece. The process is a good experience for the students. Kercheval is inspired by the model he recalls at Santa Clara College where "students run the show." He's interested in getting the math majors more involved with math faculty and high school students.

During the contest, high school sponsors and FSU Math faculty have discussed what we can do as a community to help each other, and to help the students. Dr. Kercheval explains, "There seems to be some interest for forums for the teachers to discuss things with each other. We're thinking about how [the FSU Math Department] can help them." Ideas include giving brief talks about new topics in math, hosting a math activity, discussing FSU's math program with students at other local high school math contests, and a math contest for 4th to 8th graders. These tasks leave room for even greater participation from middle school, high school, undergraduate, graduate students, and faculty, enabling all students to have a better experience. ■

Contest Results

3RD ANNUAL MATH CONTEST FALL 2014 RESULTS

The Department of Mathematics is pleased to announce the winners of the FSU High School Mathematics Contest. Held in October each year, the contest is a 3 hour written exam consisting of eight questions requiring problem solving skills, mathematical ingenuity, and explanations of solutions. There are two different exams: a junior division exam for 9th–10th graders, and a senior division exam for 11th–12th graders. Approximately 50 students from all 6 Leon County high schools have been participating in the contest each year. Congratulations to all participants, and particularly the first and second place winners and honorable mentions.

Junior Division Grades 9-10

1st Place
Graham O'Donnell
(Lincoln)

2nd Place
Justin Chen
(Chiles)

Honorable Mentions:
Cynthia Wang (Chiles), Jason Kang (Chiles), Joanna Wang (Chiles), Jasmine Zou (Rickards)

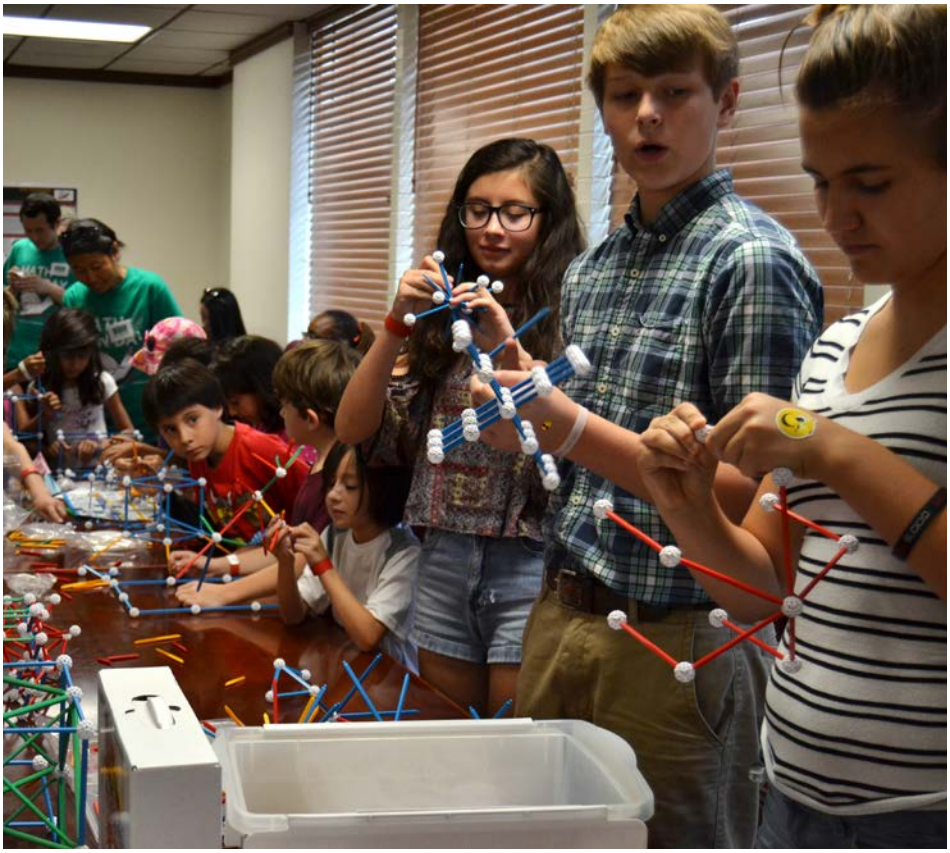
Senior Division Grades 11-12

1st Place
Jamie Gao
(Chiles)

2nd Place
Arya Okten
(Chiles)

Honorable Mentions:
Nilay Patel (Chiles), Jessie Chi (Chiles)

FSU Second Annual Math Fun Day



Children, parents, and teachers from all over greater Tallahassee brought their curiosity and imaginations to Florida State University's second annual Math Fun Day held October 11, 2014.

This year Math Fun Day took place at FSU's Moore Auditorium, and the adjacent Oglesby Union. Despite many competing events on the sunny October afternoon, roughly 400 people participated in hands-on activities, games, videos, demos and interactive lectures, including a special featured lecture by MacArthur Fellow Jeffrey Weeks.

The younger crowd (elementary to middle school) chose from activities located in an outdoor area and three rooms involving geometric constructions, fractals, and games, and an interactive lecture on Coding and Decoding. The ideas for each area were conceived and realized jointly by teams of FSU faculty members, undergraduates and graduate students.

Short lectures given by faculty members on probability (Dice Game), theory of numbers (Generating Very Large Numbers), and visualizing relativity were geared toward middle and high school students, in addition to adults. Larger lectures were held at the Moore Auditorium on topics in Music and Mathematics, Traffic Flow Analysis, and Ranking Sports Teams Using Past Outcomes.

As always, one of the highlights of holding Math Fun Day is sharing our joy of mathematics with the public, and seeing how the essential ideas of mathematics can excite children of all ages. Those of us involved at various levels of research had the time to recall and enjoy the simple yet deep wonders that attracted us to mathematics.

The crowning event of the day was Jeffrey Week's lecture on investigating the shape of the universe. Jeffrey Weeks is a freelance mathematician who received his B.A. from Dartmouth College in 1978, and his Ph.D. in mathematics from Princeton University in 1985, under the supervision of William Thurston. He became a MacArthur Fellow in 1999 for his expository work in describing two, three and four-dimensional geometry; he is well known for his geometry video games, and recent book *The Shape of Space.*

The department cannot thank enough the 70+ faculty members and students who freely volunteered their time, effort and enthusiasm during the busy mid-semester period. Our appreciation also goes to the Dean of the College of Arts and Sciences, the Brennan Professorship, and the Friends of FSU Math without whose generous funding Math Fun Day would not have been possible.

We are already starting to make plans for Math Fun Day 2015. One idea we are floating around is to add more outdoor activities to our offerings, such as juggling and the mathematics of sports. Please send suggestions and comments to mathfunday@math.fsu.edu or post them on Facebook: FSUMathFunDay. Also visit **www.math.fsu.edu** for more information about our department, and consider becoming a Friend of FSU Math!

Video Room

A room was devoted to videos related to various aspects of Mathematics, covering topics such as fractals, the golden mean, the concept of infinity and different types of infinities, games of chance, and mathematical modeling of sink holes. Both children and adults enjoyed the videos. Particular favorites were 'Hilbert's Hotel' and the 'Monty Hall problem'. Several adults spent the majority of their day watching the videos while their children participated in other activities.

Game Room

The games room featured five game stations. At one station, participants played the matching game Set (both the standard version and a simplified version). A poster described how finding a set is really the same thing as identifying a winning move on a multidimensional tic-tac-toe cylindrical tic-tac-toe board. Another sta-

tion was dedicated to dominoes, which used strategic counting. A third station challenged participants to a peg game, where modular counting was used to understand the geometry of a winning strategy. At a fourth station, a penny game used modular arithmetic to find a winning strategy. A fifth station was devoted to different tic-tac-toe games, including standard tic-tac-toe, 4x4 tic-tac-toe, 3x3x3 tic-tac-toe, tic-tac-toe on a cylinder, and multi-dimensional rotational tic-tac-toe. For those who could not stay to play, handouts were provided for playing a dots and boxes game, one with the standard square grid of dots and a second with the hexagonal grid.

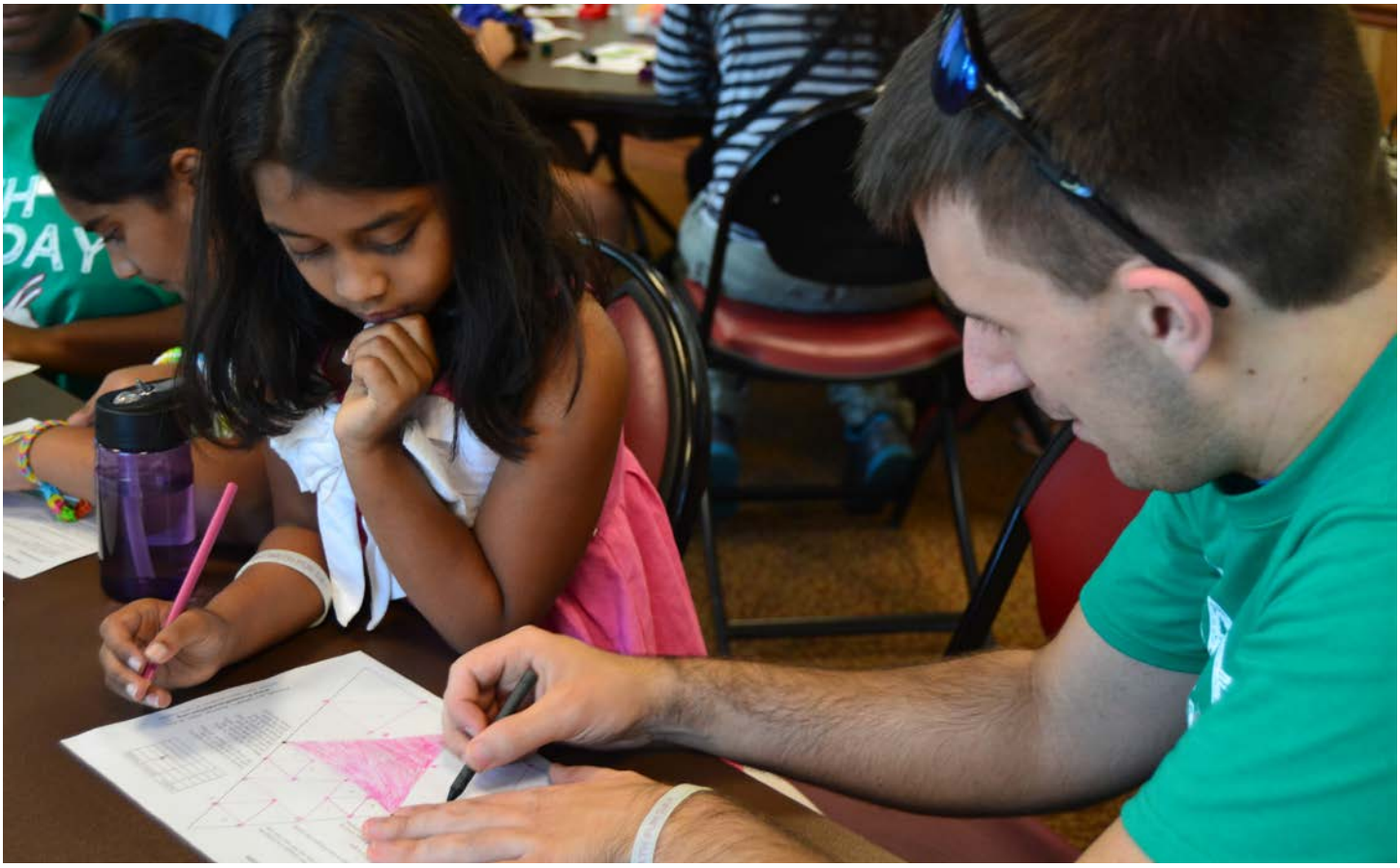
Fractal Room

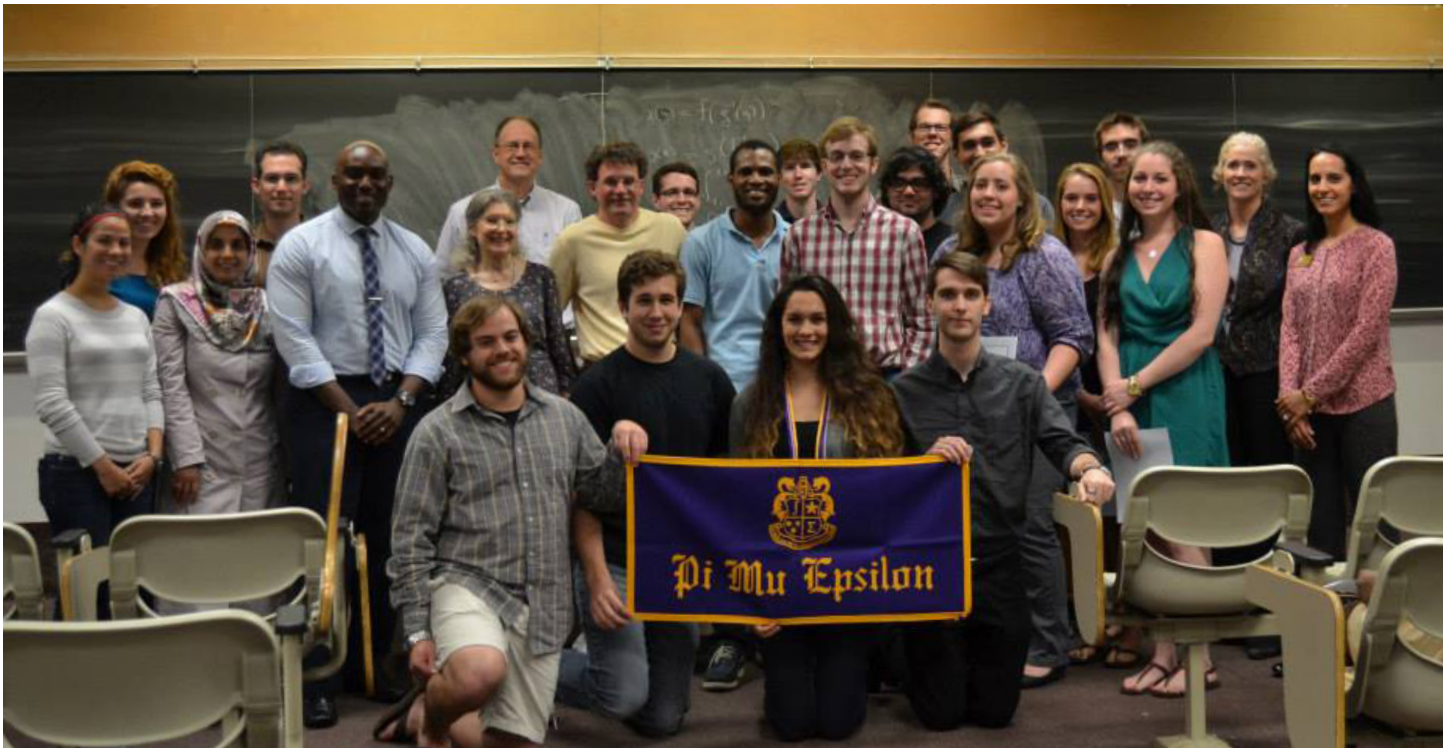
Upon entering the Fractal Room at Math Fun Day, people were amazed by the beautiful images of fractals presented around the room. A fractal is an object or quantity with repeating or self-similar patterns across different scales (or sizes). There were a number of activities where people learned about fractals while having fun! People learned that they could construct fractals geometrically, called base-motif fractals, or using mathematical equations such as those used to create the famous fractals of the Mandelbrot Set and the Julia Set.

Every hour there was a short lecture to introduce people to the "Mathematics of Fractals", where mathematical ideas behind fractals, including complex numbers, iteration, recursion, and bounded orbits, were presented with easy to understand examples. There were many hand-on activities to construct two-dimensional fractals, such as Sierpinski's Triangle and the Koch Snowflake, as well as construct three-dimensional fractals, such as the Menger Sponge (a 3D version of the Sierpinski Carpet) and a Fractal Tetrahedron (a 3D version of the Sierpinski Triangle). An engaging activity was the Sierpinski Challenge where people had to calculate how many black and white tiles were needed to build the largest Sierpinski Carpet in the room. In addition, people were able to experiment with computer software to create their own fractals using mathematical equations.
facebook.com/FSUMathFunDay

Geometric Constructions Areas

Several areas of Math Fun Day were devoted to hands-on geometric constructions. Building off the themes of the special featured lecture by Jeffrey Weeks, several construction activities were geared toward building regular solids and polytopes, and visualizing 4-dimensions using origami and construction tools such as Zome and Qubits. The activities filled large tables with a colorful chaos of geometric shapes coming from the imaginations and focussed energy of children ages 7-15. As Jeffrey Weeks and others noticed, the activity brought out the children's excitement in individual and shared discovery. At other areas children traced out Fibonacci spirals on pine cones with glitter glue, at the same time making colorful ornaments.
youtube.com/watch?v=ahXIMUkSXX0
Another popular construction activity that was reprised from last year was folding hexaflexagons. Many smiling children brought home their creations from these stations. **youtube.com/watch?v=VIVIegSt81k**





Mathematics Honors Day

Every year in the spring, the Department of Mathematics recognizes graduate and undergraduate students for their teaching, academic, or sevice achievements. The following are the award winners from the Annual Honors Day event in Spring 2014.

Dwight B. Goodner Mathematics Fellowship

Recognizes teaching excellence in mathematics by two graduate students.

Dane Mayhook
Tugba Yildirim Karabiyik

Kenneth G. Boback Award

This scholarship is presented to an outstanding senior undergraduate majoring in Mathematics.

Lawrence Dunn

Betty Anne Case Actuarial Science Award

This award is presented to an outstanding undergraduate student majoring in Actuarial Science.

Amy Buchanan

Bettina Zoeller Richmond Award

Presented to two graduate students for outstanding service to the department.

Ahmed Derar Islim
Andrew Winters

Distinguished Teaching Assistants

The Department recognizes graduate students who have demonstrated several semesters as successful teaching assistants and are in good standing in the Mathematics Department.

Kerr Ballenger
Matthew Donahue
John A. Emanuello
Patrick Allen Fletcher
Angela Michelle Jarrett
Tugba Yildirim Karabiyik
Sevgi Sengul
Bo Zhao
Guifang Zhou

Financial Math Festival Poster Competition Winners

1st Place: **Nguyet Nguyen**
2nd Place: **Tony Wills**
3rd Place: **David Yao**

Other Honors

- **11 students** were inducted into the Florida Beta Chapter of Pi Mu Epsilon, an academic, national scholarly society in mathematics
- **21 students** received SOA/CAS exam reimbursements for Exam P/1
- **31 students** received SOA/CAS exam reimbursements for Exam FM/2
- **2 students** received SOA/CAS exam reimbursements for Exam MLC

Become a friend of **FSU Math** in 2015!

Community members are invited to become a **Friend of FSU Math** by donating to the Florida State University Foundation. Any amount will be truly appreciated and will help us achieve our department goals in teaching and servicing the community. Your past gifts have been used in a variety of ways to support FSU Math. These include alumni networking efforts such as: the newsletter and social media, awards for excellence in teaching and service for graduate students and faculty, research training and support, distinguished visitors and guest lectures, and community outreach programs like Math Fun Day and the FSU High School Mathematics Contest. Your generosity will help us continue to offer a strong academic program, foster connections to the community, and create opportunities for life and career after graduation for our students.

You can send your tax-deductible gift to
FSU Foundation Mathematics, Fund No. 0223
208 Love Building
1017 Academic Way
Tallahassee, FL 32306-4510

To give online, please visit **www.math.fsu.edu/donate** and choose "Mathematics" from the designated drop-down menu. For information about donations with special targets including outreach, named awards, or lecture series, please contact **chair@math.fsu.edu**.

DEPARTMENT OF
MATHEMATICS
AT FLORIDA STATE UNIVERSITY

Season's Greetings from the Department of Math