#### UCCS MATH DEPARTMENT

All the v's that's Fit to Print

Volume 17 Number 1

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## LAS Outstanding Student Awards

During the "end of year awards ceremony" in May 2013, the following mathematics students were honored for their academic achievements during the Academic Year 2012/2013 by the College of Letters, Arts & Sciences:

#### **Outstanding Undergraduate Students**

- Outstanding BA in Mathematics Lindy O'Neil
- Outstanding BS in Mathematics Jonathan Thompson
- Lorch Scholarship Shannon Stiverson

#### **Outstanding Graduate Student**

• Ben Schoonmaker



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## UCCS Students & Faculty attend AMS Conference in Boulder, CO

A number of UCCS faculty were involved in the two-day American Mathematical Society Sectional Conference, held April 13/14 at the University of Colorado Boulder. **Greg Oman** and **Zak Mesyan** co-organized a Special Session on Associative Rings and Their Modules; **Gene Abrams** and **Kulumani Rangaswamy** gave 20-minute presentations in that session. **Barbara Prinari** co-organized (with colleagues from CU Boulder, U Northern Colorado, and Colorado School of Mines) a Special Session on Nonlinear Waves and Integrable Systems; **Sarbarish Chakravarty** gave a 20-minute presentation in that session. **Bob Carlson** also attended a portion of the conference.

Compellingly, a number of UCCS math majors attended that AMS conference as well! In attendance were **Kevin McCaw**, **Taylor Klotz**, and **Charity Qualls**. Kevin described some of the activities: "All three of us attended the first invited address: it was a 50 minute talk by Gunnar Carlsson of Stanford University, titled 'The Shape of Data'. It was about how ideas from topology are being used to understand large data sets. Then, we together briefly explored the Boulder campus, and got lunch on The Hill. After which, Taylor went to attend talks he had flagged earlier, while Charity and I went to the Associative Rings and Modules session." [editor's note: it is nice that students can experience a research gathering of mathematicians, especially so close to home ...]

#### Lorch Scholarship Awarded

The family of former UCCS Professors Bob and Barbara Lorch established the Robert S. and Barbara R. Lorch Department of Mathematics Endowed Scholarship in 2009. The late Drs. Lorch taught political science and sociology, respectively, for more than 30 years. Bob and Barbara's son John earned a B.A. degree in mathematics at UCCS in 1988, went on to earn his Ph.D. in mathematics, and is now a faculty member at Ball State University in Indiana. The funding provides for merit-based scholarships for junior or senior math majors.

In this, the fifth year of its existence, the department awarded the Lorch scholarship to



**Shannon Stiverson**. "I would just like to say that I am very thankful for all the wonderful opportunities I have had here at UCCS and for all the support I have received from both faculty and classmates. I was very honored to be chosen for the Lorch Scholarship; it has allowed me to expand my studies for this last semester even more. I will be continuing my education after graduation, and I plan on studying Mathematical Biology."

Congratulations, Shannon!

## UCCS Math Incline & the Putnam Competition

The Math Incline is a problem-solving seminar geared towards UCCS students who are interested in staying "mathematically fit" by attempting to solve challenging problems based on the undergraduate curriculum. The Incline was initiated in 2011. It is sponsored by **Dr. Cascaval**, who helps organize and deliver the Friday sessions. See <a href="http://www.uccs.edu/rcascava/mathincline">http://www.uccs.edu/rcascava/mathincline</a> (The Incline *de*clined during Spring 2013 while Radu was out of the country on sabbatical, but has *re*inclined in a big way during Fall 2013.)

Math Incline derives its name from the Manitou Incline, the old Pikes Peak train whose abandoned railbed now provides an incredibly exhausting venue for runners of all fitness levels. (editor's note: in 2013, using the Manitou Incline was made officially legal, after decades of 'wink-wink' illegality...) In part, Math Incline activities serve as a warm-up for the annual Putnam Exam. The Putnam Competition is one of the most prestigious of all mathematics undergraduate competitions; universities throughout United States and Canada compete in this problem-solving challenge, which takes place annually on the first Saturday of December.

This year UCCS's Putnam team consisted of two students: **Katrina Eidolon** and **Allan Gardner**. Information about the Putnam Exam can be found at <u>http://www.maa.org/awards/putnam</u>. Any reader interested in the Math Incline activities, the Putnam Competition, or other math department undergraduate activities should contact Dr. Cascaval (rcascava@uccs.edu).



### Front Range Applied Mathematics Student Research Conference



Department Chair **Greg Morrow** co-organized (with Lynn Bennethum of UC Denver and Anne Dougherty of UC Boulder) the 2013 Front Range Applied Mathematics Student Research Conference. The annual conference (partially sponsored by SIAM, the Society for Industrial and Applied Mathematics) was held in Denver on March 2.

Talks were given by two groups of UCCS mathematics students. The first talk was a description of the problem completed by the team of **Danny Dauwe**, **Taylor Klotz**, and **Jessica Gronski** as part of the COMAP Modeling Contest (see article about the Contest in a separate Newsletter piece), titled: "A Guide to Make the Ultimate Brownie Pan."

The other UCCS talk was given by **Jewell Anne Hartman**, who is a PhD student in Physics at UCCS, as well as an instructor in the UCCS Math Department. Her talk was titled: "Partial Differential Equations for a Statistical View of Biological Dynamics for the Interdisciplinary Studies of the Mathematical and Physical Biology of the Cell in the Advancement of Medicine."

Not only was UCCS represented as organizers of and participants in the SIAM Student Research Conference, but as a creative force as well: the conference poster was designed and produced by our own **Emanuelita Martinez**!

#### Ph.D Program Notes

The College of Letters, Arts, and Sciences houses the degree program Ph.D. in Applied Sciences. The math department offers a mathematics-based Ph.D. as part of this program. The Ph.D. in Applied Sciences, established in 2009, is one of the most recent Ph.D. programs at UCCS. The Math department admitted its first Ph.D. student in Spring 2011. Currently, the department has five PhD students, representing both U.S. and international students. They are: **Mike Popovic, Abobaker Abominjil, Chuck Fessler, James Eberle** and **Awatif Zawali**.

The department has so far identified five core areas in which to offer graduate courses in support of the Ph.D. program, specifically: Real & Functional Analysis; Complex Analysis; Differential Equations & Applied Math; Probability; and Ring Theory. Since 2012, the department has also started offering a small number of Graduate Teaching Fellowships to support Ph.D. students. The current GTFs are Mike Popovic and Chuck Fessler; Mike is the first student to join the Ph.D. program, while Chuck enrolled just this fall.

#### **COMAP** Modeling Competition

The team of UCCS mathematics students **Taylor Klotz**, **Danny Dauwe**, and **Jessica Gronski** participated in the Mathematical Contest in Modeling (MCM), held over a 96 hour period from Thursday Jan. 31, 6pm, through Monday Feb. 4, 6pm. Teams from universities all around the world participate in the MCM. Teams choose to complete one of the two problems they are handed at the start of the competition; the problem attempted by Team UCCS ("The Ultimate Brownie Pan") is given below.



The 2014 version of the MCM will take place Feb 6 - 10, 2014. This competition, however, is not for those who are weak at heart! But if you love math and can manage

on less than 20 hours of sleep in a four-day period, then this may be just the challenge for you! Contact **Dr. Cascaval rcascava@uccs.edu** if you are interested.

#### 2013 Mathematical Contest in Modeling. PROBLEM A: The Ultimate Brownie Pan

When baking in a rectangular pan heat is concentrated in the 4 corners and the product gets overcooked at the corners (and to a lesser extent at the edges). In a round pan the heat is distributed evenly over the entire outer edge and the product is not overcooked at the edges. However, since most ovens are rectangular in shape using round pans is not efficient with respect to using the space in an oven. Develop a model to show the distribution of heat across the outer edge of a pan for pans of different shapes - rectangular to circular and other shapes in between.

#### Assume

- 1. A width to length ratio of W/L for the oven which is rectangular in shape.
- 2. Each pan must have an area of A.
- 3. Initially two racks in the oven, evenly spaced.

Develop a model that can be used to select the best type of pan (shape) under the following conditions:

- 1. Maximize number of pans that can fit in the oven (N)
- 2. Maximize even distribution of heat (H) for the pan
- 3. Optimize a combination of conditions (1) and (2) where weights p and (1-p) are assigned to illustrate how the results vary with different values of *W/L* and *p*.

In addition to your MCM formatted solution, prepare a one to two page advertising sheet for the new Brownie Gourmet Magazine highlighting your design and results.

# CONGRATULATIONS 2013 Graduates!

Here is the list of the graduates from each of the department's degree programs in 2013. An impressive list, to be sure.

Undergraduate Degrees

#### **B.A.** Mathematics

- Alex Betty
- Christina Buco
- Andre Ellis
- Matthew Jones
- Lindsay Olson
- Lindy O'Neil\*
- Rachael Sellers
- Shannon Stiverson\*\*\*
- Justin Tropp

#### **B.S.** Mathematics

- Daniel Dauwe
- Christopher Funari
- Taylor Klotz
- Todd Linden
- Jessica Shonts
- Dianne Soto
- Jonathan Thompson \*
- Richard Von Hendy
- Colton Williams

#### Graduate Degrees

#### **M.S. Applied Mathematics**

- Gaetan Delavignette
- Andrea Essler
- Kevin Ewing
- Katie Hendricks
- Robert Marion
- Henri Ndaya
- Benjamin Schoonmaker\*\*

\*Outstanding Undergraduate Student Award

\*\*Outstanding Graduate Student Award

\*\*\*Lorch Scholarship



## Colorado Springs Undergraduate Research Forum

The 2013 version of CSURF was hosted by UCCS on April 13. Students from UCCS, Colorado College, and the US Air Force Academy took part. Both oral presentations and poster sessions were utilized to allow students to share their research with others.

Two UCCS math majors, **Jessica Gronski** and **Audrey Szarka**, gave presentations at the Research Forum. Jessica gave a 20-minute powerpoint presentation on the research she has been working on with Dr. Prinari. Audrey presented a poster, which describes some of the work she has been involved with regarding K-12 student achievement in math and science.

Jessica commented: "Overall, I thought it was a great experience. It was interesting to see what research is being conducted in other scientific departments, and it is great practice if you're not used to speaking in front of large groups!" Audrey thought that the wide variety of research topics made for a really stimulating day: "I learned about a lot of different things outside of math, from criminal behavior models used to identify repeat offenders, to the antibacterial properties of hippopotamus glandular skin secretions."

[editor's note: well done, Audrey and Jessica!]

**Presenter:** Jessica Gronski **<u>Title:</u>** Artificial Neural Networks as a Predictive Mathematical Modeling Tool **<u>Faculty Mentor:</u>** Dr. Barbara Prinari

**Abstract:** An artificial neural network (ANN) is a mathematical/ computational model inspired by the structure and functional aspects of biological neural networks: it is an interconnected group of artificial neurons that finds the relationship of certain inputs and their corresponding outputs. Artificial Neural Networks are trained through a trial and error process in which the network learns how to reproduce the correct outputs from the given inputs by adjusting the statistical weights on the connections between different layers of neurons. For the specific problem, we will examine the relationship within the complex dynamics of a medical ward, given an ample amount of various input data sets (consisting of positive and negative events, number of medical staff present and admittance and discharge of patients in the ward) and their corresponding outputs (the ward atmosphere ranging from calm to chaotic). The goal of an ANN-based mathematical modeling approach is to produce a quantitative analysis of the system, which at the same time has a chance to be integrated with the more qualitative psychosocial information, thus gaining the attention of both fields as a useful tool of investigation.

#### Presenter: Audrey Szarka

**<u>Title:</u>** Self-Efficacy and Other Influences of STEM Careers: Investigating Differences among Underrepresented Students

Joint work with: Peter Marle, Lisa Decker, and David Khaliqi, UCCS Center for STEM Education

**Description of work:** The analysis of pre and post surveys from the UCCS Center for Science, Technology, Engineering, Mathematics Education (CSTEME) programs provided insight on the ability of science and math self-efficacy and advantage variables to predict STEM career interest of students in grades 5-12. Results showed various levels of predictability between sources of self-efficacy (mastery experience, social persuasions, physiological state and vicarious experience) and advantage (family, teacher and peer encouragement, self-concept and motivation for career) on interest in STEM and non-STEM careers. Additionally, differences between gender, first-generation status, race, grade level and ethnicity were studied. Results showed science self-efficacy and advantages typically predicted student interest in science and engineering careers. Math self-efficacy and advantages were able to predict interest in technology careers. Thus, the science and math self-efficacy and advantage variables seem to predict student interest in science, math and engineering careers. This research may develop more effective practices among STEM programs and increase the number of college graduates pursuing STEM jobs.

Poster available online at: http://www.petermarle.com/pres/pospres13.pdf

## Math Distinguished Lecture Series

The fifth Mathematics Distinguished Lecture, "Secrets from Deep Human History", was presented on October 17 by Joseph Watkins, Professor of Mathematics and Chairman of the Interdisciplinary Program in Statistics at the University of Arizona.

Modern DNA sequencing has opened several avenues for exploring the remote history of humans. In some cases ancient DNA has been recovered from ancestral bones. Such methods have led, for instance, to a direct comparison of Neanderthal DNA and modern human DNA. A different path compares the DNA sequences within the modern human population, looking for historical traces in the DNA variations carried with the gene pool. Professor Watkins presented research, carried out with a number of colleagues, which compared DNA sequences of modern African populations. Based on sequence analysis, probability models, intensive computation, and



statistical methods, this research group concluded that an ancient branch of humanity had split off from our main ancestral group, remained genetically isolated for hundreds of thousands of years, then reconnected with the main group, leaving genetic traces in the modern gene pool.

Professor Watkins' talk, accompanied by numerous slides and photos, provided a fascinating look into this beautiful application of mathematics into both history and science for the more than 100 people in attendance.

## Around the Department

(In REVERSE alphabetical order...)

#### Yu Zhang

**Yu Zhang** continued his research work throughout 2013; this work is for the most part focused on the *reinforced random walk* model. Yu finished an article that was accepted for publication in the journal "Probability Theory and Related Fields." He is currently working jointly with Professor Chow of the Institute of Mathematics, Academia Sinica (Taipei) on a follow-up article.

This past summer Yu also gave a talk in the Academy of Mathematics, Chinese Academy of Sciences (Beijing). He noted that "I'm glad to see that some young researchers in China are working on percolation theory now".

In November, Yu Zhang made a very nice presentation in the UCCS Math Department Colloquium Series, titled *Large Deviations in The Reinforced Random Walk Model on Trees,* in which he explained (in very basic and leisurely terms!) the ideas behind this line of research. The audience consisted of both faculty and students.



#### George Rus

The year 2013 was a busy one for **George Rus**. In the Spring semester, Dr. Rus took on a big instructional challenge when he offered to teach one of the capstone courses, Mathematical Modeling. Even though the course preparation and management was very demanding, George considers the course to be quite a success.

At the end of the Spring semester, George was rewarded for his hard work and dedication to students by winning the **LAS Outstanding Teaching Award for Full-Time Instructors**. (editor's note: NICE, George!)

Additionally, George continued his work with the Extended Studies Program, teaching three courses through *MathOnline*. George also continued collaborating with undergraduate and graduate students.

#### Kulumani Rangaswamy

Professor Emeritus **Kulumani Rangaswamy** had a busy time both academically and travel-wise during 2013. During January and February, he visited family and friends in India. In March he gave a talk at the

Southern Regional Algebra Conference (held at the University of Southeastern Louisiana); then in April, he gave a talk at the special session on noncommutative rings at the American Mathematical Society

meeting in Boulder, Colorado.

But the first four months of 2013 were merely a warm-up for subsequent travels! During May and June he was a visiting scholar at two

universities in Spain (Autonomous University of Barcelona, and the University of Málaga). Collaborative work with Pere Ara (Barcelona) and with Mercedes Siles Molina and Gonzalo Aranda Pino (Malaga) resulted in the completion of a couple of research papers on Leavitt path algebras. In August Ranga visited Turkey, where he first gave a talk at the international conference in Algebra held at the Balikeshir University in Burhaniye, and then gave a lecture on Leavitt path algebras at the Dogus University in Istanbul.

In October he gave a talk at the special session on non-commutative rings and modules at the American Mathematical Society meeting in Saint Louis. To round out the year, Ranga and his wife Sarah traveled back to India for a few weeks in November - December. (Editor's note: *There's much meritus to being emeritus!*)

#### Barbara Prinari

**Barbara Prinari's** seemingly inexhaustible energy was again manifest in 2013. Barbara hosted four visiting scholars (from three different Italian universities) at UCCS over the course of the year. She was again involved in a SQuaRE research group through the American Institute of Mathematics (Palo Alto, CA); in particular, she coauthored a blog contribution to "Mathematics of Planet Earth 2013" <u>http://mpe2013.org/2013/02/27/report-from-aim-nonlinear-wave-equations-and-integrable-systems-mathematics-for-a-nonlinear-planet/</u>

In June, Dr. Prinari obtained her second collaborative National Science Foundation grant, this time as leading Principal Investigator. She had a number of research articles both submitted to journals and appearing in print. Barbara also obtained a grant from the Mathematical Association of America to support the **2014 Pikes Peak Regional Undergraduate Mathematics Conference**, which will be hosted by our university in February 2014.

*Not so close to home*: Barbara did some serious traveling this year. In additional to coorganizing special sessions at conferences in both Boulder and Athens (Georgia), she also gave invited talks at international conferences in Norway and in Florida.

*Closer to home*: Barbara was appointed co-chair of the UCCS Faculty Assembly Women's Committee. She also continued her work with undergraduate math major **Jessica Gronski** on an ongoing project in the area of artificial neural networks.

*Actually AT home*: "On a more personal level, I moved, and bought a nice mortgage... in the south west part of Colorado Springs, by Quail Lake." [Editor's note: Congrats on that, Barbara!]

#### James Parmenter

**James Parmenter** finished teaching his first academic year as an Instructor at UCCS. He added Calculus 2 to his repertoire of courses; James will be teaching that course again in the Spring of 2014. James also took on the responsibility of teaching the math 1310/1320 yearlong calculus class, " ... which so far seems to be going pretty well." Outside of work James and his wife Katy visited Chicago during Spring break and absolutely loved it; they look forward to visiting there again soon.



#### Greg Oman

Assistant Professor **Greg Oman** published two research papers during 2013. He also gave three talks on his research - one at Florida Atlantic University, another in Boulder, and the third at Ohio State University. He is excited to be advising both undergraduate research (with Tori Slattum) and a master's project (with Peter Boeting). As he has done so often in the past, Greg contributed some "Posed Problems" to various undergraduateoriented mathematics journals, including two to College Mathematics Journal and one to the American Mathematical Monthly.

Following Barbara Prinari's lead, Greg also affixed his signature on a mortgage; in fact, he bought a place right across the street from her! Greg is hoping to absorb some of Barbara's fine cooking skills by osmosis, while simultaneously absorbing some of her home country's fine wine (likely by the usual method).

The three "Posed Problems" appear later in this Newsletter.

#### Greg Morrow

**Greg Morrow** continued in his role as chair of the UCCS Department of Mathematics. In March, Professor Morrow gave a presentation to a general audience (as part of the UCCS Curiosity Unlimited series) on topics in probability, including coin tossing and the so-called "**gambler's ruin**". Preparing this talk led Greg to think about and subsequently develop some new research ideas, involving an exact computation of the generating function for the number of coin tosses between returns to the original fortune in the gambler's ruin. This investigation in turn leads to the distribution of the number of coin tosses until the "last visit" to the original fortune value before the gambler reaches her target fortune or goes broke.

Dr. Morrow continues to find interesting combinatorial results along this line of study, such as the distribution of the number of runs before return to the origin in simple random walk. Greg comments: "It's really nice when looking at old problems, in order to review and explain them to a general audience, serves to stir up mathematics on different levels." At the end of July, Greg visited Boulder for the 36<sup>th</sup> Stochastic Processes and Applications Conference. [editor's note: it's always nice to find a nearby conference in one's research field!]

#### Shannon Michaux

**Shannon Michaux** continued to enjoy teaching and working on course coordination for the Department. This past Spring Semester was the first semester in which the Math Department used the computer course registration system to enforce course prerequisites. This has helped students do a better job of selecting the math courses most appropriate for them, which in turn has helped to improve their successful completion rates. Shannon is thrilled to see this change and has continued to work to insure that the program runs smoothly.

As the year has gone by, she has also done quite a bit of work to help coordinate the College Algebra, Precalculus and Business Calculus courses. She led the effort to shift our College Algebra curriculum in order to better prepare students for subsequent courses. She also worked on selecting a new Precalculus book and developing curriculum for that book. This book will be implemented in the Spring of 2014, and the Department is hopeful that the sharper focus of the course will help more students succeed in Calculus.

Just before the Fall semester started, Shannon worked with department colleagues Jenny Dorrington, George Rus and Greg Oman to lead a new training program for our Department's Graduate Teaching Fellows. The training seminar began with several days of meetings that featured lots of interactive teaching experiences. The seminar continued through the first half of the semester and gave GTFs the opportunity to improve their teaching through various assignments and class observations.

#### Zachary Mesyan

During 2013 Assistant Professor **Zak Mesyan** wrote two research papers, both of them in collaboration with other mathematicians. One of these papers resulted from work done during a very fun two-week trip to Wroclaw, Poland. "The only unfortunate aspect of this trip was that instead of hanging out in the beautifully-restored medieval center of Wroclaw, my Polish collaborator insisted that we spend much of our time there at a Starbucks in the industrial part of town," lamented Dr. Mesyan. Zak also co-organized (with UCCS math department member Greg Oman) a special session at an American Mathematical Society Sectional Conference in Boulder, and gave a talk at another such conference in St. Louis. In addition, Zak presented a lecture in the UCCS Mathematics Colloquium Series in August, in which he described for both students and faculty some of the elementary ideas (specifically: matrix multiplication!) which have provided a springboard for a portion of his recent research work (in which he has provided a partial answer to a decades-old question about various types of functions on matrices).

During the year Zak and his wife Maria explored a little bit more of Colorado, by visiting Fort Collins, Glenwood Springs, and Breckenridge. "The road from Denver to Glenwood Springs must be one of the most beautiful in the world!" [editor's note: Not to be outdone by Barbara and Greg O., Zak and Maria also signed their names on a mortgage in 2013 ...]

#### Jenny Dorrington

As usual, **Jenny Dorrington**'s time this past year was taken up primarily with the Math Center and its needs. In the spring, Dr. Dorrington, together with Dr. Gaddis (Director of the Excel Centers and Director of Student Retention) and Dr. Dandapani (Dean of the College of Engineering and Applied Science), and with much input from UCCS IT and Facilities, devised a plan to swap space between the Math Center and the engineering computer lab on the second floor of the Engineering Building. That move was completed in August, and the Math Center is now in its beautiful new location, with a full wall of windows. Student visitors and the tutors all appreciate having one big room and a lot of natural light. The number of students using the center continues to rise, especially with the addition of tutors to help with computer science (3 tutors), electrical engineering (1 tutor), and mechanical engineering (1 tutor). In addition to overseeing the Math Center's move, Jenny created and implemented a new training program that requires all new tutors to complete 8 hours of training before they begin work in the center. All math tutors now also complete a series of content quizzes during each semester, to keep them up to date on the material they will be tutoring.

Math Center aside, the highlight of Jenny's academic year was teaching an introductory Topology course to six students, and advising independent studies in Algebraic Topology for two graduate students last spring. On a personal note, her second granddaughter was born in October: "I'm lucky enough to live only two blocks away, so I get to see the baby often!"



#### Sarbarish Chakravarty

**Sarbarish Chakravarty** continues to do research work on nonlinear waves and completely integrable systems. His recent work has focused on describing "beach waves" (these are shallow water wave patterns found on flat ocean beaches) using the so-called KP equation. He gave a talk on this topic at the American Mathematical Society Sectional meeting at CU Boulder in April. He was also an invited speaker at the NSF-CBMS Regional Research Conference "Solitons in Two-Dimensional Water Waves and Applications to Tsunami" at the University of Texas – Pan American in May. Professor Chakravarty continues to serve as chair of the graduate committee of the math department, and as such has helped get the department's recently-established Ph.D. program off the ground.

#### Radu Cascaval

**Radu Cascaval** spent the first six months of the year at the Universita degli Studi di Salerno, Italy, visiting the Dipartimento di Ingegneria dell'Informazione, Ingegneria Elettrica e Matematica Applicata. Besides getting fully immersed in a different (and interesting) academic culture,

Dr. Cascaval initiated collaborations with several faculty there and ran a seminar for Ph.D. students. Dr. Cascaval also had the opportunity to make several research visits: one at INRIA - Sophia Antipolis, France, attending the Workshop on "Traffic Modeling and Management: Trends and Perspectives"; another one at Universitat Bielefeld, Germany, entitled "Discrete and Continuous Models in the Theory of Networks"; and finally one at an international symposium, entitled "Modeling of Physiological Flows", on the spectacular island of Sardegna. These activities are representative of the current research interests Dr Cascaval is pursuing. On the domestic front, Dr. Cascaval spent most of his energies wearing the Undergrad Chair hat, organizing and sponsoring various departmental activities geared towards our math majors (advising, assessment, curricular improvement). He also ran the weekly Math Incline (see the article on *Math Incline* elsewhere in this Newsletter.)

#### Robert Carlson

Modeling problems blending complex networks and biology continue to motivate much of **Bob Carlson**'s research. Biological networks such as the circulatory system, nervous system, and ecological systems in rivers, have complex geometric structures with strong effects on system behavior. Bob is interested in identifying and solving problems that clarify the interactions of network geometry and biological behavior.

During the fall semester he completed two projects. The first was the submission of a research paper entitled 'Myopic Models of Population Dynamics on Infinite Networks'. This work tackles the problem of modeling the growth of populations (think: *disease-causing microorganisms*) in very large networks (think: *the entire human population*). An important goal is to maintain high fidelity in a region of interest, while coarsely modeling populations in remote regions. The second project was an NSF proposal to support related research. After the usual revision cycle, last year's collaboration with Kurt Anderson and Jonathan Sarhad from the UC Riverside Biology Department resulted in the publication of their paper 'Population Persistence in River Networks' in the Journal of Mathematical Biology. (This research was partially supported by a UCCS Biofrontiers grant.) Bob and Jonathan both presented talks on this work at the January meeting of the American Mathematical Society in San Diego.

#### Peter Braza

Dean of the College of Letters, Arts and Sciences **Peter Braza** had an extremely busy 2013. While a college deanship is an incredibly demanding job in and of itself, Peter found it important to keep his hand in the classroom; specifically, he taught a class of 51 Calculus 1 students

during Fall semester, "... and thoroughly enjoyed it!" In addition to his administrative duties, Dr. Braza has found some time to continue working on a research article on damped pendulum dynamics; although he's been able to work out the details of the mathematics, he is having a hard time trying to work out the details of finding time to write up the work in publishable form. [editor's note: sorry, Peter, even as Dean you're still only allotted 24 hours in each day ...]

#### UCCS MATH DEPARTMENT

#### Gene Abrams

**Gene Abrams** greatly enjoyed a productive and satisfying 2013. In Spring semester he was on sabbatical assignment, during which time he was able to continue some research projects and do some traveling. In February he (along with his wife Mickey) had the opportunity to spend three weeks in Australia, in and around the Sydney area. Gene gave some plenary lectures at a conference at University of Western Sydney on his current research interest (Leavitt path algebras). He was also honored to be asked to deliver the inaugural lecture of the Australian



Mathematical Science Institute National Seminar Series. His talk (physically delivered on the UWS campus) was simultaneously broadcast to eight other universities throughout Australia, with an electronic Q/A session afterwards. In April Gene gave talks at University of Victoria, and at the Banff International Research Station. The highlight of his travel year was the eleven weeks during the summer that he and Mickey spent in residence at the University of Padova, Italy. While there, Dr. Abrams taught a 12 hour course on Leavitt path algebras to faculty and Ph.D. students, and also gave a general colloquium in the university's *Colloquia Patavina* lecture series. This was simultaneously fun and humbling: Galileo Gallilei gave colloquia as part of the very same lecture series, more than 400 years ago! (Galileo was chairman of the math department at Padova from 1592 to 1610.) The Italian lifestyle suited both Mickey and Gene quite well. [editor's question: is there anywhere in Colorado Springs where they sell tomatoes having even half the flavor of Italian tomatoes??]

In Fall 2013 Gene returned to the UCCS classroom, teaching two sections of Calculus 1. He quite enjoys teaching first year calculus: "It's rewarding to get feedback from students who find that they really can be successful in math, even if they had not had particularly satisfying



experiences with the subject in the past." The year 2013

was also the final year of the six-year Partnership in Innovative Preparation of Educators and Students (PIPES) grant, the past five years of which Gene had been the Principal Investigator. He found it great fun and quite enriching to work with middle school math teachers to help them improve their math skills, and increase their confidence with mathematics in their classrooms.

#### UCCS MATH DEPARTMENT



Try your hand at Greg Oman's Offerings

#### College Mathematics Journal 44 (2013), no. 5, p. 437. Problem #1011.

Let G be a group in which every non-identity element has order 2. Suppose that  $f: G \rightarrow G$  is an injective map with the property that if H is a subgroup of G, then f(H) (the image of H under f) is a subgroup of G. Must f be a group homomorphism? Prove or find a counterexample.

#### College Mathematics Journal 44 (2013), no. 4, p. 325. Problem #1006.

Find all finite (nontrivial) commutative rings R with identity (up to isomorphism) for which the polynomial ring R[x] has only trivial units, that is, for which 1 and -1 are the only units of R[x].

#### American Mathematical Monthly 120 (2013), no. 4, p. 365. Problem #11702

Find all nonzero rings R (not assumed to be commutative or to contain a multiplicative identity) with these properties:

(a) There exists an element x in R that is neither a left nor a right zero divisor, and

(b) Every map f from R to R that satisfies f(x+y) = f(x) + f(y) also satisfies f(xy) = f(x)f(y).

(That is, every additive homomorphism on R is a ring homomorphism.)

#### **Mathematics Honors Track**

Mathematically "inclined" students are encouraged to apply to the Honors' track (preferably in their sophomore or junior years). This track was recently created within the BS and BA Math Degrees to encourage qualified students to take on challenges beyond the standard math curriculum. The highlight is a written report on some undergraduate research project, a senior thesis or a senior project in an advanced course, under the supervision of a faculty advisor.

Currently, four of our majors are participating in the Honors Track: **Katrina Eidolon, Jessica Gronski, Amber Heavner, and Tori Slattum.** For detailed description and application form, visit http://www.uccs.edu/math/undergraduate-programs/math-honors-track.html

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