UNCG

1891

Department of Mathematics & Statistics Annual Report 2015-2016

Table of Contents

1. Summary ---------- 4

2. Faculty and Staff ---------- 9
2.1 Faculty ---------- 9
2.2 Staff ---------- 13

3. Tenure & Promotion, Awards & Honors ---------- 14

4. Faculty Research Profile ---------- 17
4.1 Research Groups ---------- 17
4.2 Refereed Articles Published in 2015 ---------- 24
4.3 Book Chapters, Books, and Monographs Published in 2015 ---------- 28
4.4 Conference Proceedings Papers Published in 2015 ---------- 28
4.5 Refereed Articles Accepted in 2015 ---------- 28
4.6 Book Chapters, Books, and Monographs Accepted in 2015 ---------- 31
4.7 Conference Proceedings Papers Accepted in 2015 ---------- 31
4.8 2015 Research Presentations ---------- 32
4.9 Department Journals ---------- 37

5. External Grants ---------- 39
5.1. External Grants ---------- 39
5.2. Internal Grants ---------- 42

6. Undergraduate Program ---------- 44
6.1. Programs ---------- 44
6.2. Recruitment and Retention ---------- 49

7. Undergraduate Research Program ---------- 50
7.1 2016 National Research Experience for Undergraduates Program ---------- 51
7.2 2016 National Science Foundation Funded Research Experiences for Undergraduates Program (REU site) ---------- 53
7.3 Student Authored Articles and Presentations ---------- 57

8. Graduate Program ---------- 59
8.1 Year in Review ---------- 59
8.2 New M.A. Concentrations ---------- 68
8.3 New Courses ---------- 72
8.4 Course Renumbering ---------- 72

8.5 Graduate Teas ---- 73
8.6 Professional Development Series ---- 74
8.7 New Policies ---- 75
8.8 Graduate Recruitment ---- 76

9. Funding Opportunities for Students ---- 79
9.1 Departmental Scholarships ---- 79
9.2 Undergraduate Research Awards ---- 80
9.3 Graduate Assistantships ---- 80
9.4 Other Scholarships ---- 82

10. Mathematics Education Program ---- 83

11. Lecture Series, Colloquia, Seminars and Research Visitors ---- 86
11.1 Helen Barton Lecture Series in Computational Mathematics ---- 86
11.2 Helen Barton Lecture Series in Mathematical Sciences ---- 89
11.3 Joint JSNN and Department of Mathematics & Statistics Colloquia ---- 90
11.4 Colloquia ---- 91
11.5 External Seminar Speakers ---- 91
11.6 UNCG Seminar Speakers ---- 92
11.7 Research Visitors ---- 93
11.8 Carolina Topology Seminar ---- 96

12. Service Profile ---- 97
12.1 Math Help Center ---- 97
12.3 Math Emporium ---- 98
12.3 Statistical Consulting Center ---- 99
12.4 State Math Contest ---- 101

13. Collaboration with the Institute for Mathematics and its Applications (IMA) ---- 102

14. UNCG Math/Stat Conferences ---- 103
14.1 UNCG Regional Mathematics and Statistics Conference – 2015 ---- 103
14.2 UNCG Summer School in Computational Number Theory – 2016 ---- 106
14.3 SEARCDE 2015 ---- 108
14.4 Triangle Lectures in Combinatorics ---- 110

15. Student Clubs and Organizations ---- 111
15.1 UNCG Student Chapter of the Association for Women in Math ---- 111

15.2 UNCG Math Club ---------- 112
15.3 Pi Mu Epsilon ---------- 113

16. Departmental Expansion/New Spaces ---------- 115

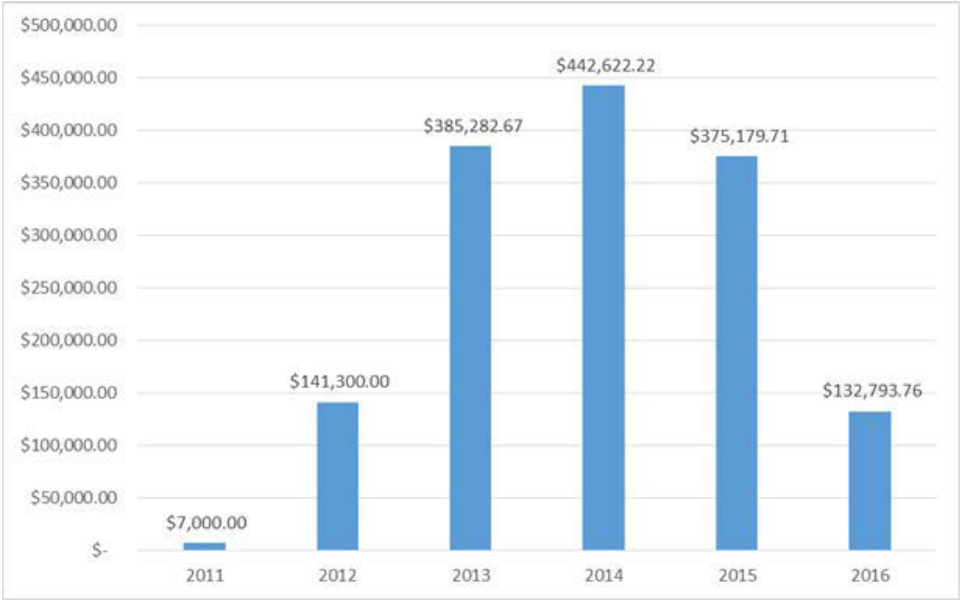
1. Summary

Ratnasingham Shivaji,
H. Barton Excellence Professor & Department Head

It has been a great pleasure to be a part of and to lead a very productive department with very talented faculty and staff members. During the academic year 2015-16, we had seven full professors, ten associate professors, four assistant professors, one academic professional, one senior lecturer, two lecturers and three staff members. In Fall 2016, one of our assistant professors will be promoted to the rank of associate professor and our academic professional will be promoted to senior academic professional.

The Department had a remarkable year in terms of research productivity. During the calendar year 2015 the faculty published 38 refereed journal articles, 1 refereed book chapter, and 2 refereed conference papers for a total of 41 refereed publications. The faculty made 62 presentations, with 22 at international destinations. Thanks to our enhancement of grant proposal submissions, we continued a healthy success rate in securing funding in the academic year 2015-16. This includes receiving several competitive research grants from NSF, from NSA, and from the Simons Foundation. Please see below data on our funding record for the 2011-2016 years.

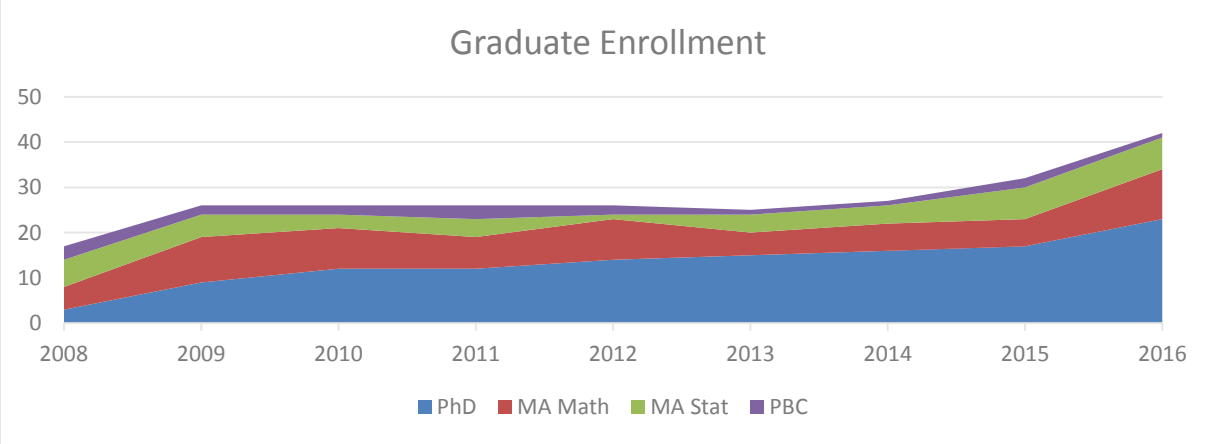
Grant Awards by Academic Year (Note: 2016 has pending grants)



The Department continued to be home to *Journal of Statistical Theory and Practice* (a Taylor and Francis publication) and *Topology and its Applications* (an Elsevier publication), two internationally renowned journals. Our department is also home to *The North Carolina Journal of Mathematics and Statistics,* which was established in 2014.

The Department continued to host the Helen Barton Lecture Series in Computational Mathematics and the Helen Barton Lecture Series in Mathematical Sciences, along with a Colloquium series and Seminar series in Applied Mathematics, Mathematical Biology, Algebra, Combinatorics & Number Theory, Topology, and Statistics. This includes a Joint Applied Mathematics Seminar series with Wake Forest University and NC A&T, and joint colloquia with the Joint School of Nanoscience and Nanoengineering (JSNN). Since Fall 2011, the Department has hosted over 90 research visitors. The Department hosted the 35th annual Southeastern Atlantic Regional Conference on Differential Equations (SEARCDE) in October, 2015 (attended by 128 participants), the 11th Annual UNCG Regional Mathematics and Statistics Conference in November 2015 (attended by 169 participants), the 13th meeting of the Triangle Lectures in Combinatorics in February 2016, (attended by 52 participants), and the Summer School in Computational Number Theory in summer of 2016 (attended by 23 participants). External funding support was provided by NSF and NSA.

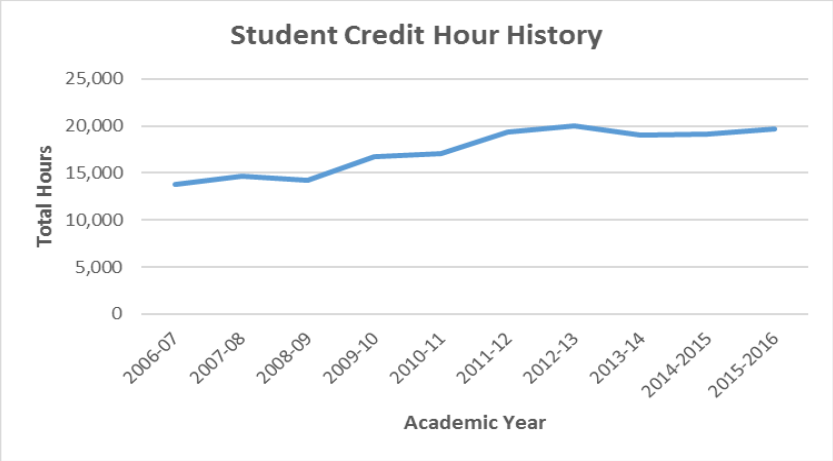
We continued enhancements to our Ph.D. program in Computational Mathematics. We also established two new concentrations in our M.A. program in data analytics and actuarial mathematics. We made concerted efforts towards graduate student recruitment through visits to many institutions in the US and abroad, and through participation in graduate recruitment events hosted by the American Mathematical Society (AMS), Mathematical Association of America (MAA), and the Society of Industrial and Applied Mathematics (SIAM). Our efforts to attract students included the mailing of information about our graduate programs to schools in the United States and abroad. Please see the chart below for details of our graduate enrollment growth.



The “Graduate Tea” hosted by us for our students served as a good venue to discuss many useful issues with the students. The Department’s continued membership with IMA (Institute of Mathematics and its Applications) has allowed for continued participation of graduate students (and members of our faculty) in various workshops and conferences organized by the IMA. We also began a Graduate Professional Development Lecture Series. The first lecture was given in Summer 2016.

We continued our efforts to build a positive image for the Department among other units at UNCG, as well as outside UNCG. As part of this effort, we hosted the State Math Contest and lent support and assistance at the Spartan Showcase, Fall and Spring Faculty Phone-a-Thons, and Destination UNCG events. In addition to these efforts aimed at increasing recruitment, we have taken several measures to help improve student retention. Examples of these measures are the lowering of class sizes for our 100-level courses; an enhanced Math Help Center to provide answers and clarifications to students’ questions; and a Math Emporium Lab combining the best components of traditional and online classes in College Algebra and Precalculus courses (for approximately 400 students).

As part of our efforts to improve instruction and enhance opportunities for students, we have collected data for the past four years on the “DFW” rates in all our 100-level classes and are currently working with the course coordinators on strategies that can help achieve better results. We feel that the root cause for the students’ struggle with these courses is that they either lack the prerequisite knowledge or have forgotten what they had learned. We are looking at the possibility of providing these students with opportunities to learn/review this prerequisite material during the first few weeks of the classes. The Department also created a new course, MAT 190 Precalculus, which is a one-semester version of our two-semester precalculus sequence. The course is designed to allow students with a sufficiently strong high school mathematics background to speed up their entrance into the calculus sequence. It is especially suitable for science majors. The Department continued to offer funding for undergraduate research via the Undergraduate Research Awards in Mathematics and Statistics and the new campus- wide Research Experience in Statistics program. This year, we had 110 total undergraduate first majors and 12 undergraduate students who are majoring in mathematics as a second major. Please see the chart below for details of our Student Credit Hour growth.



Our Student Credit Hours (SCH) grew 42.6% during the period 2006-07 to 2015-16. During the period (2010-11 to 2015-16), our student credit hours have increased by 15.4%. We are the fourth largest SCH producing unit (SCH: 19,686) in the College behind the Departments of Biology (SCH: 25,754), Languages, Literature & Cultures (SCH: 24,190), and English (SCH: 23,319).

The Math Club of our Department continues to be very active. The goal of this club is to create a community for Undergraduate and Graduate Math enthusiasts. The 2015-16 academic year marked the fifth year of the Math Club's official recognition by UNCG. The club continues to meet every other Wednesday. The meetings are centered around talks given by the Department's very talented faculty and graduate students. Also, 2015-16 marked the third academic year the Association for Women in Mathematics Student Chapter (AWM) has been active. Our MAA Student Chapter has also been active in recent years.

In recent years, donations to the Department's enrichment fund and to existing scholarships were provided by: Ms. Peggy Aldridge, Ms. Joan Andersen, Ms. Linda Bennetts, Ms. Lillian Boney, Mrs. Marilou Bradley, Dr. Jeremy and Ms. Lou Bray, Ms. Wendy Louise Bullis, Mr. Michael Burris and Mrs. Doris Burris, Mr. Karl Busick and Mrs. Judy Busick, Mrs. Katherine Bland Davis, Ms. Linda Eason and Mr. Clifton Eason, Mr. Edwin Edmonson and Mrs. Thelma Edmonson, Ms. Kaye Edwards, Ms. Shirley Fraley, Mrs. Nancy Geller, Mrs. Martha Gwyn, Mrs. Patti Grimm, Mrs. Barbara Hagaman, Ms. Becky Halsey, Mrs. Kathy Hamilton, Mr. Bill Hawthorne and Mrs. Doris Hawthorne, Mr. William Howell and Mrs. Dorothy Howell, Mrs. Frankie Hubbard, Mrs. Mary Jackson, Mrs. Julie Lambert, Mr. Gene Langley and Mrs. Vicky Langley, Mr. Tommy Maness, Mr. William McCarthy and Mrs. Ashley McCarthy, Mr. Lance McCluney, Mrs. Margaret McQuain, Mr. Gregg Miller, Dr. Sharon Morgan, Dr. Thomas Mullikin and Mrs. Mildred Mullikin, Mr. Carl Nilsson and Mrs. Jean Nilsson, Mr. Thomas Parrish, Mrs.

Linda Philips, Mrs. Christine Posey, Mrs. Jean Roosa, Mrs. Martha Schall, Mrs. Susan Blanton Senn, Mr. Jimmy and Mrs. Anelia Shelton, Mrs. Teresa Sink, Dr. Thomas Stafford, Jr. and Mrs. Stafford, Mrs. Brownie Stancil, Mr. William Tallon and Mrs. Becky Tallon, Ms. Nancy Taylor, Ms. Gloria Thornton, Mr. John and Mrs. Cynthia Triplett, Mrs. Nancy Tucker, Mr. Larry Vest and Ms. Joyce Vest, Mrs. Mary Weatherspoon, Ms. Betsy Jordan Whitson, and Ms. Walker Weigel. **Very recently we have also been informed of a major gift by Ms. Lillian Boney who donated $747,000 towards the Helen Barton Mathematics Scholarship in her will.** Our sincere gratitude goes to all our donors.

In closing, I am delighted to say that the success of our Department is due to the diligent work of our faculty, staff, and students. Our students authored a significant number of journal publications, and also presented several talks at research conferences. Here follows selected highlights of our faculty's recent achievements: Dr. Thomas Lewis was a Mathematical Association of America Project NExT (New Experience in Teaching) Fellow; Dr. Thomas Lewis and Dr. Talia Fernós received Dean's Professorship awards; Dr. Jan Rychtář and Dr. Jonathan Rowell hosted National Science Foundation (NSF) funded Summer Research Experiences for Undergraduates (REU) Programs at UNCG; Dr. Jan Rychtář, Dr. Clifford Smyth, Dr. Xiaoli Gao and myself received Simons Foundation research grants; Dr. Clifford Smyth and Dr. Dan Yasaki received National Security Agency (NSA) research grants; and Dr. Talia Fernós , Dr. Haimeng Zhang, and myself received NSF research grants.

Enjoy reading in this report all the details of our various activities and achievements.

2. Faculty and Staff

2.1 Faculty

Greg Bell, Associate Professor

Director of Graduate Studies

Dr. Bell earned a Ph.D. in 2002 from the University of Florida and joined the UNCG faculty in 2005. He currently serves as the Director of Graduate Studies. His research focus is on geometric group theory, geometric topology, and asymptotic invariants of groups.

Maya Chhetri, Professor

Director of the Math Help Center & Coordinator of the Math Emporium

Dr. Chhetri earned a Ph.D. in 1999 from Mississippi State University and joined the UNCG faculty in 1999. Her research focus is on nonlinear elliptic boundary value problems.

Igor Erovenko, Associate Professor

Dr. Erovenko earned a Ph.D. in 2002 from the University of Virginia and joined the UNCG faculty in 2002. His early career research focus was on combinatorial properties of discrete groups, most notably the bounded generation property of arithmetic groups. His current research interests lie in the field of mathematical biology.

Richard Fabiano, Professor

Dr. Fabiano earned a Ph.D. in 1986 from Virginia Tech and joined the UNCG faculty in 1996. His research focus is on applied mathematics, differential equations, and control theory.

Talia Fernós, Assistant Professor

Dr. Fernós earned a Ph.D. in 2006 from the University of Illinois at Chicago and joined the UNCG faculty in 2010. Her research focus is on infinite groups from both geometric and analytical perspectives.

Xiaoli Gao, Associate Professor

Dr. Gao earned a Ph.D. in Statistics from the University of Iowa in 2008. She joined the UNCG faculty in 2013. Her research interests include high-dimensional data analysis, shrinkage analysis, statistical genetics, change point and survival analysis.

Sat Gupta, Professor
Associate Head

Dr. Gupta earned a Ph.D. in Mathematics from the University of Delhi in 1977 and a Ph.D. in Statistics from Colorado State University in 1987. He joined the UNCG faculty in 2004. His research focus is on sampling designs, time series forecasting, and biostatistics.

Tracey Howell, Academic Professional

Dr. Howell earned a Ph.D. in Teacher Education and Higher Education from UNCG in 2013. She was appointed to an Academic Professional position starting from Fall 2013. Her research focuses on instructional practices that support students' mathematical argumentation, instruction in highly-impacted schools, and teacher learning of students' mathematical thinking.

Thomas Lewis, Assistant Professor

Dr. Lewis earned a Ph.D. in Mathematics from the University of Tennessee in 2013. He joined the UNCG faculty in 2013. His research focuses on numerical PDEs and applied mathematics.

Sebastian Pauli, Associate Professor

Dr. Pauli earned a Ph.D. from Concordia University in Montreal in 2001. He joined the UNCG faculty in 2006. His research focus is on computational number theory, computational class field theory and the distribution of the zeros of the derivatives of the Riemann Zeta function.

Scott Richter, Professor
Director of the Statistical Consulting Center

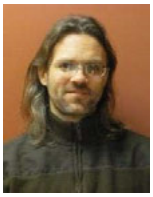
Dr. Richter earned a Ph.D. in 1997 from Oklahoma State University and joined the UNCG faculty in 2001. His research focus is on nonparametric methods, multiple comparisons, and interdisciplinary research.

Jonathan Rowell, Assistant Professor

Dr. Rowell earned a Ph.D. in 2003 from Cornell University and he joined the UNCG faculty in 2012. His research focus is on the application of game theory and differential equations to biological problems ranging from the cellular level to the population level.

Dohyoung Ryang, Assistant Professor

Dr. Ryang earned a Ph.D. in 2005 and an Ed.D. in 2010 from the University of Alabama, Tuscaloosa. He joined the UNCG faculty in 2010. His research focus is on mathematics education, and geometric group theory.



Jan Rychtář, Professor

Dr. Rychtář earned a Ph.D. in 2004 from the University of Alberta and joined the UNCG faculty in 2004. His research focus is on mathematical biology, game theory, and functional analysis.

Filip Saidak, Associate Professor

Dr. Saidak earned a Ph.D. in 2001 from Queen's University in Ontario and joined the UNCG faculty in 2005. His research focus is on classical questions concerning prime numbers and their distribution, and the location of zeros of the Riemann zeta function and its derivatives.

Carol Seaman, Associate Professor

Program Coordinator for Secondary Licensure in Mathematics

Dr. Seaman earned a Ph.D. in 2000 from Central Michigan University and joined the faculty at UNCG in 2008. Her research focus is on undergraduate mathematics education.

Insuk Shim, Lecturer

Ms. Shim earned an M.A. in 2006 from the University of Alabama, Tuscaloosa and joined the UNCG faculty in 2011. Her research interests include the “Multivariate Markovian arrival process” in Statistics.

Ratnasingham Shivaji, H. Barton Excellence Professor

Department Head, W.L. Giles Distinguished Professor Emeritus of Mathematics (Mississippi State University)

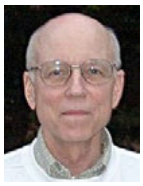
Dr. Shivaji earned a Ph.D. in 1981 from Heriot-Watt University in Edinburgh, Scotland and joined UNCG in 2011. His research focus is on nonlinear elliptic boundary value problems, reaction diffusion equations, and mathematical ecology.

Clifford Smyth, Associate Professor

Dr. Smyth earned a Ph.D. in 2001 from Rutgers University and joined the UNCG faculty in 2008. His research focus is on combinatorial probability, computational complexity, and discrete geometry.

Brett Tangedal, Associate Professor

Dr. Tangedal earned a Ph.D. from the University of California at San Diego in 1994 and joined the UNCG faculty in 2007. His research focus is on algebraic number theory with a particular emphasis on explicit class field theory.

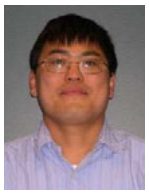


Jerry Vaughan, Professor

Dr. Vaughan earned a Ph.D. in 1965 from Duke University and joined the UNCG faculty in 1973. His research focus is on general topology, set theory and logic, functional analysis, and set-theoretic topology.

Walker Weigel, Senior Lecturer

Ms. Weigel earned an M.A. in 1967 from UNC-Chapel Hill and joined the UNCG faculty in 1985. Her interests include new approaches and improvements to teaching through the use of online components, iclickers, and other pedagogical tools.



Dan Yasaki, Associate Professor

Dr. Yasaki earned a Ph.D. in 2005 from Duke University and joined the UNCG faculty in 2008. His research focus is on modular forms, particularly the connection between explicit reduction theory of quadratic forms and the computation of Hecke data for automorphic forms.

Haimeng Zhang, Associate Professor

Dr. Zhang earned a Ph.D. in Applied Mathematics (Statistics) from the University of California in 1998. He joined the UNCG faculty in 2013. His research focuses on the statistical analysis of global-scale processes and phenomena.

2.2 Staff

Richard Cheek
Systems Administrator

Mr. Cheek earned an M.S. degree in Computer Science from UNCG in 1998 and has been the Systems Administrator for the Department since 1999.

Haley Childers
University Program Associate

Ms. Childers earned a B.A. in Art History from UNCG in 2009 and an M.S. Degree in Library and Information Studies from UNCG in 2012. She joined the Department in December of 2005.

Alyssa Wharton
Administrative Support Associate

Ms. Wharton earned a B.A. in Design from UNCG in 2013. She joined the Department in August 2015. She resigned in May 2016 to pursue full-time employment as a Digital Media Technician in the Digital Media Commons at Jackson Library, UNCG.

Carri Richter
Administrative Support Associate

Mrs. Richter earned a B.S. in Mathematics and Education from the University of Tulsa in 1993 and an M.S. in Statistics from Oklahoma State University in 1996. She will join the Department in August 2016.

3. Tenure, Promotion, Awards & Honors

Promotions

Dr. Tracey Howell will be promoted from Academic Professional rank to Senior Academic Professional rank starting in Fall 2016.

Tenure and Promotions

Dr. Talia Fernós will be promoted from Assistant Professor rank to the Associate Professor rank with tenure starting in Fall 2016.

Awards

Dr. Clifford Smyth was awarded a two-year (2013-2015) National Security Agency (NSA) research grant. The funding supported his *Correlation Inequalities* project. Dr. Smyth also received a Simons Foundation Grant for his Project titled, "Collaboration in Combinatorics." This award will run from 2015 to 2020.

Dr. Talia Fernós was awarded a three-year (2013–2016) National Science Foundation (NSF) research grant. Grant work has focused on rigidity of isometric Hilbert space actions using the tool of low dimensional cohomology. She also held a Candace Bernard and Robert Glickman Dean's Professorship in the College of Arts & Sciences for the academic year 2015-16.

Dr. Haimeng Zhang was awarded a two-year (2013-2015) NSF research grant. The work on this grant focused on the statistical analysis of global-scale processes and phenomena.

Dr. Thomas Lewis was selected as a Project NExT Fellow (New Experiences in Teaching). Project NExT is a professional development program for new or recent Ph.D.'s in the mathematical sciences, and is sponsored by the Mathematical Association of America (MAA). He has been selected to receive a Candace Bernard and Robert Glickman Dean's Professorship in the College of Arts and Sciences for the academic year 2016-17.

Dr. Ratnasingham Shivaji received a five-year (2014-2019) Simons Foundation Grant for his Project titled, "Analysis of nonlinear eigenvalue problems and applications." He was also awarded a three-year (2015-2018) NSF research grant for his project titled, "Collaborative Research: Mathematical and Experimental Analysis of Ecological Models: Patches, Landscapes and Conditional Dispersal on the Boundary". Due to the receipt of this NSF grant, the Simons Foundation Grant had to be returned to the sponsors in September 2015.

Dr. Xiaoli Gao was awarded a Simons Foundation Grant for her Project titled, "Robust Estimation and Signal Approximation for High-dimensional Data." This award will run from 2015 to 2020.

Dr. Jan Rychtář was awarded a five-year (2012-2017) Simon's Foundation grant for his project titled "Game-theoretical models in biology". Dr. Rychtář was also selected as the recipient of the 2015 Thomas Undergraduate Research Mentor Award presented by the Undergraduate Research, Scholarship and Creativity Office at UNCG.

Dr. Jonathan Rowell (co-PI) and **Dr. Jan Rychtář** (PI) were awarded a three-year (2014-2017) NSF Research Experiences for Undergraduates site grant. The title of the program is Mathematical Biology at UNCG.

Dr. Dan Yasaki was awarded a two-year (2015-17) NSA Young Investigator's Grant for his project titled, "Voronoi Eduction Theory and Applications to Arithmetic Groups."

Richard Cheek received one the 2016 College of Arts and Sciences Staff Excellence Awards.

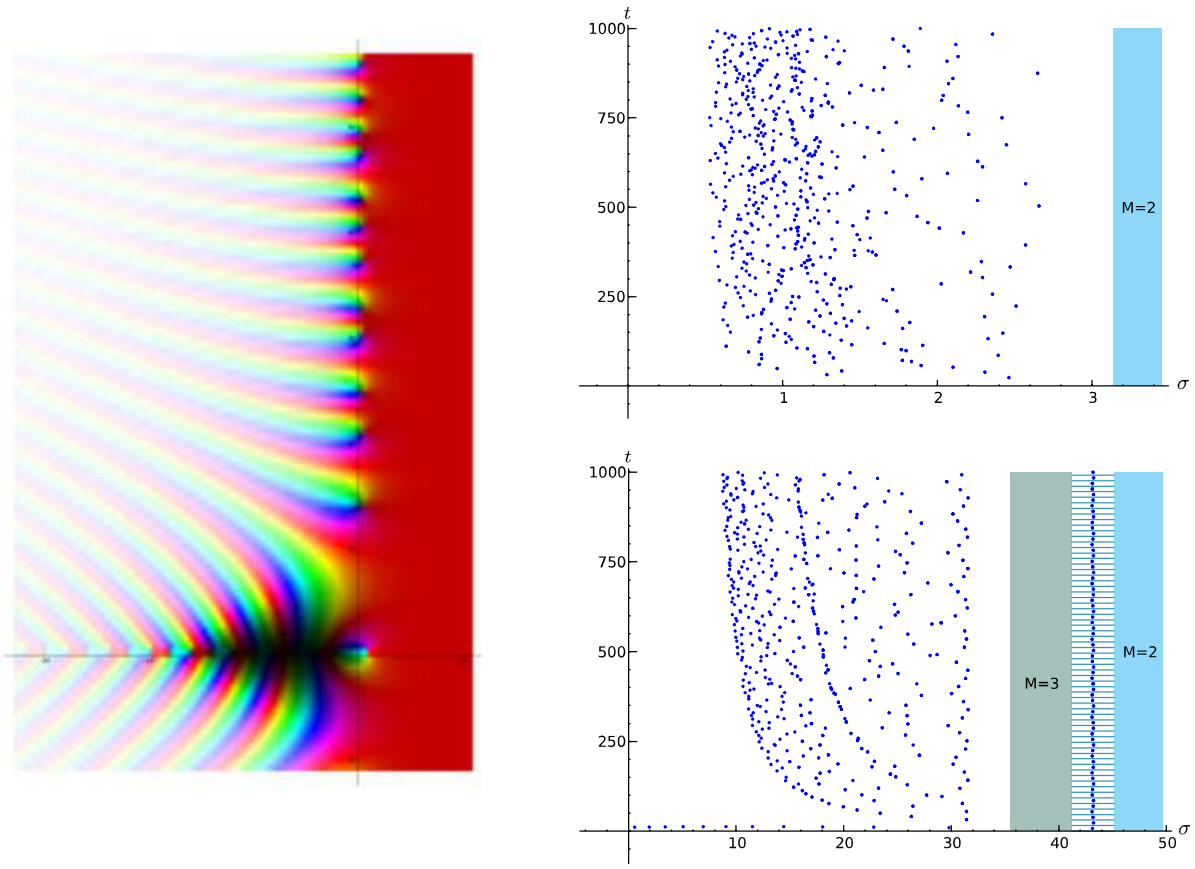
Richard Cheek receiving the College of Arts and Sciences Staff Excellence Award in 2016

4. Faculty Research Profile

4.1 Research Groups

Number Theory

Number theory is one of the oldest research areas in pure mathematics. It is concerned with the study of integers (in particular prime numbers) and generalizations thereof. In the last 30 years, number theory has found many applications, especially in cryptography.



The plot on the left shows the Riemann zeta function for -33 ≤ σ ≤ 11 and -11 ≤ *t* ≤ 57, where the magnitude is indicated by brightness and the argument is represented by hue. The plots on the right show the distribution of the zeros of the 1st and 38th derivative of the Riemann zeta function on the complex plane along with the zero free regions.

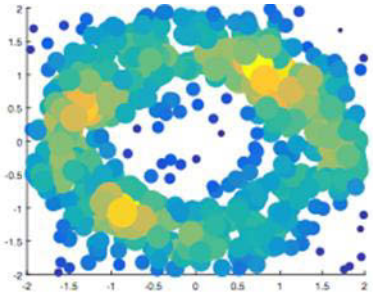
The members of the number theory group at UNCG work in several areas, including algebraic, analytic, and computational number theory, and modular forms. The members of this research group are Sebastian Pauli, Filip Saidak, Brett Tangedal, and Dan Yasaki. Current Ph.D. students in number theory are Ricky Farr and Jonathan Milstead. Current M.A. students in number theory are Lance Everhart and Sandi Rudzinksi. Brian Sinclair (Ph.D. 2015) is an alumnus of this group, and is currently at the Bureau of Labor Statistics.

Sebastian Pauli with Ph.D. student Ricky Farr.

2015 UNCG Summer School in Computational Number Theory

Since 2012, the Number Theory group has organized the annual UNCG Summer School in Computational Number Theory. This project is supported by UNCG, the NSA and the NSF. More information can be found at http://www.uncg.edu/mat/numbertheory/.

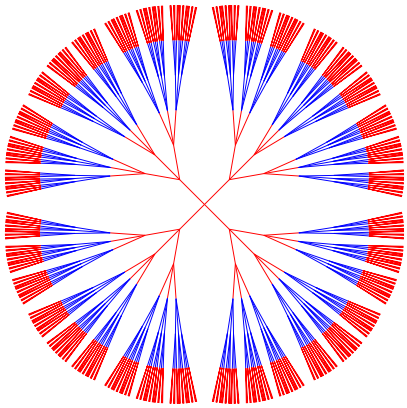
Combinatorics, Group Theory, and Topology



UNCG has strong researchers in combinatorics, group theory, and topology. These faculty include Greg Bell, Talia Fernós, Clifford Smyth, and Jerry Vaughan.

Clifford Smyth with Ph.D. student James Rudzinski

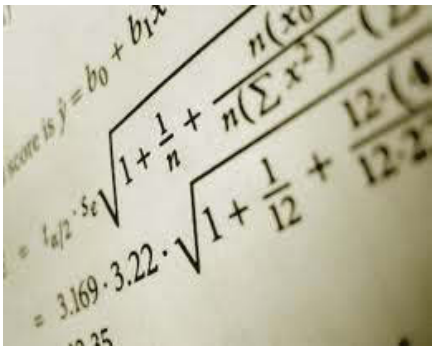
The national and international reputation of this small research group is impressive. In 2016 Cliff Smyth organized the 13th Triangle Lecture in Combinatorics at UNCG. This attracted researchers from around the east coast and Midwest. He also received a Simons Foundation grant and gave an invited talk at an AMS meeting. Talia Fernós spent time at the prestigious Mathematical Sciences Research Institute at Berkeley and spent time collaborating in France in 2015-16. She will return to MSRI for a semester in Fall 2016 to participate in their special program in Geometric Group Theory with some of the most well-known geometric group theorists in the world. Greg Bell traveled to Seattle to speak on his work with Cliff Smyth concerning computational topology. He also traveled to Poland to give a series of talks on coarse geometry. Jerry Vaughan delivered a plenary address in Pittsburgh, an invited talk in Ireland, and three invited talks in China.

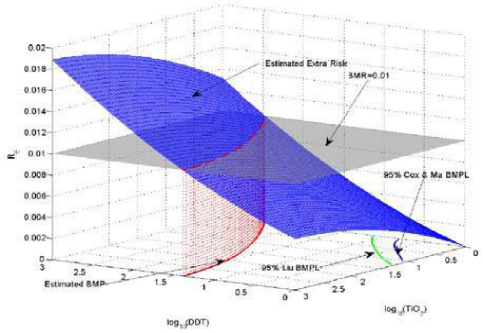


Austin Lawson, Joshua Martin, and James Rudzinski are the current students in this research area. Recent past students include Catherine Payne (M.A. 2010) who is currently a Ph.D. student in Applied Mathematics at UNCG and Dani Moran (Ph.D. 2014) who is currently an assistant professor at Guilford College.

Greg Bell with Ph.D. student Austin Lawson

Applied Statistics





The statistics group in the Department consists of four full-time faculty (Sat Gupta, Scott Richter, Haimeng Zhang, and Xiaoli Gao).

Sat Gupta with Ph.D. student Jeong Sep Sihm

The focus of Gupta's research is in the area of sample surveys. Richter specializes in nonparametric methods and multiple comparisons. Zhang specializes in survival analysis, spatial statistics and applied probability, and Gao specializes in high-dimensional data analysis and statistical genetics. The statistics group is engaged in both disciplinary research in their respective areas of specialty as well as interdisciplinary research in collaboration with other on-campus/off-campus researchers. They also serve as co-investigators or key personnel on externally funded projects.

Xiaoli Gao with M.A. student Bin Luo

The Statistics group also provides support through the Statistical Consulting Center to researchers across many disciplines at all stages of research, including assistance with articulating research questions and designing data collection, often for grant proposals, subsequent data analysis and interpretation, and manuscript preparation. These collaborations often lead to peer-reviewed journal articles.

Haimeng Zhang with Ph.D. student Chris Vanlangenberg

Ph.D. students in statistics are Charith Elson, Wei Chen, Jeong Sihm, Chris Vanlangenberg, and Tanja Zatezalo. Four of these students have completed all requirements for the Ph.D. degree except for defending the dissertation.

Applied Mathematics

Pattern formation in fish is governed by processes which can be described using bifurcation theory.

Applied mathematics is a discipline that develops mathematical techniques and concepts that can be used to understanding the natural and social sciences. Researchers at UNCG carry out research in differential equations, control theory, game theory, and mathematical biology. Areas of application include modeling of reaction-diffusion processes, stealing behaviors, and the behavior of random networks. Faculty are actively involved in organizing conferences in specific research areas as well as annual conferences targeted only for students. Most faculty in this group have also worked with undergraduate students. The work resulted in journal publications as well as numerous conference presentations. Faculty involved in this research group are Maya Chhetri, Igor Erovenko, Richard Fabiano, Thomas Lewis, Jonathan Rowell, Jan Rychtář, and Ratnasingham Shivaji. Ph.D. students in these areas are Quinn Morris, Catherine Payne, Nalin Gampola and Byungjae Son.

Reaction-diffusion equations can be used to model many problems in combustion theory.

Rich Fabiano with Ph.D. student Catherine Payne

Ratnasingham Shivaji with Ph.D. students Byungjae Son, Quinn Morris, and Catherine Payne

Mathematical Biology

The Department of Mathematics and Statistics is proud to be part of several research projects in Mathematical Biology. This includes understanding the evolution of cooperation, modeling disease transmission and vaccination decisions, understanding the effects of structured populations, modeling plant pollination, and analyzing genomic data. The primary faculty involved in this research group are Jonathan Rowell, Jan Rychtář, and Igor Erovenko with many other faculty, including Maya Chhetri, Xiaoli Gao, Sat Gupta, Sebastian Pauli, Scott Richter, Filip Saidak, and Clifford Smyth contributing as well. We have also developed close collaboration with Drs. Rueppell, Kalcounis-Rueppell, Remington, Schug, Wasserberg, and other members of the Department of Biology at UNCG.

2016 NSF Math Bio-REU Participants

The blue footed booby has been shown to exhibit both positive and negative density dependent dispersal depending on population density.

Further, Ratnasingham Shivaji is involved in collaborative research funded by the National Science Foundation (NSF) with Dr. James Cronin, an ecologist at Lousiana State University, and Dr. Jerome Goddard at Auburn University at Montgomery. They study population models that explore the effects of habitat fragmentation, conditional dispersal, predation, and interspecific competition from the patch level to the landscape level. Ph.D. students working on this project are Quinn Morris and Catherine Payne.

Math Ecology team (UNCG, LSU, & Auburn)

In Fall 2015, UNCG's research magazine published an article entitled, "Mathematicians walk on the wild side in growing UNCG focus". This article featured Rychtář, Shivaji, Pauli, and Rowell.

Olav Rueppell, Jan Rychtář, Ratnasingham Shivaji, Sebastian Pauli, Matina Kalcounis-Rueppell, and Jonathan Rowell

For more information, you can find this article at the following web site:

http://www.uncg.edu/mat/news/mathbiofall2015.pdf

4.2 Refereed Articles Published in 2015

Greg Bell

G. C. Bell and D. Moran, On constructions preserving the asymptotic topology of metric spaces, *North Carolina Journal of Mathematics and Statistics,* Vol. 1, 46-57.

Maya Chhetri

M. Chhetri, P. Drabek, and R. Shivaji, Existence of positive radial solutions for a class of *p*-Laplacian superlinear semipositone problems, *Proceedings of the Royal Society of Edinburgh*, Vol. 145 No. 5, 925-936.

Xiaoli Gao

X. L. Gao, Penalized weighted low-rank approximation for robust recovery of recurrent copy number variations, *BMC Bioinformatics*, Vol. 16, 407.

Sat Gupta

J. Shabbir, **S. Gupta**, and Z. Hussain, Improved estimation of finite population median under two-phase sampling when using two auxiliary variables, *Scientia Iranica*, Vol. 2 No. 3, 1271-1277.

S. Yadav, C. Kadilar, J. Shabbir, and **S. Gupta**, Improved family of estimators of population variance in simple random sampling, *Journal of Statistical Theory and Practice*, Vol. 9 No. 2, 219-226.

Z. Khan, J. Shabbir, and **S. Gupta**, Generalized systematic sampling, *Communications in Statistics – Simulation and Computation*, Vol. 44 No. 9, 2240-2250.

W. Shen, J. Baldwin, B. Collins, L. Hixson, K. Lee, T. Herberg, J. Starnes, P. Cooney, C. Chuang, R. Hopkins, T. Reid, **S. Gupta**, and M. McIntosh, Low level of trans-10, cis-12 conjugated linoleic acid decreases adiposity and increases browning independent of inflammatory signaling in overweight Sv129 mice, *Journal of Nutritional Biochemistry*, Vol. 26, 616-625.

D. A. Dingman, M. Schulz, D. Wyrick, D. Bibeau, and **S. Gupta**, Does providing nutrition information at vending machines reduce calories per item sold? *Journal of Public Health Policy*, Vol. 36, 110-122.

R. Stoesen, **S. Gupta**, L. Deaton, and K. McLamb, Weight loss through lap-band bariatric surgery – some Issues, *Collaborative Mathematics and Statistics Research. Springer International Publishing*, 125-133.

Q. Zhang, H. Kazi, and **S. Gupta**, Modeling risky sexual behaviors among college students – predictors of STD, *Collaborative Mathematics and Statistics Research. Springer International Publishing*, Vol. 109, 75-79.

J. S. Sihm, **S. Gupta**, A two-stage binary optional randomized response model, *Communications in Statistics – Simulation and Computation*, Vol. 44 No. 9, 2278-2296.

S. Gupta, and J. Shabbir, Estimation of finite population mean using two auxiliary variables in stratified two-phase sampling, *Communication in Statistics-Simulation and Computation*, Vol. 44 No. 13, 2798-2808.

J. Zinn, F. Wood, **S. Gupta**, V. Swofford, M. Morgan, and D. Green, Examining neurosurgical surgical site infections, *OR Nurse Journal*, Vol. 9 No. 3, 28-38.

G. Kalucha, **S. Gupta**, and B. K. Dass, Ratio estimation of finite population mean using optional randomized response models, *Journal of Statistical Theory and Practice*, Vol. 9 No. 3, 633-645.

S. Mishra, **S. Gupta**, S. Yadav, and S. Rawat, Optimization of fuzzified economic order quantity model allowing shortage and deterioration with full backlogging, *American Journal of Operations Research,* Vol. 5 No. 5, 103-110.

Sebastian Pauli

T. Binder, **S. Pauli**, and and F. Saidak, Zeros of high derivatives of the Riemann zeta function, *Rocky Mountain Journal of Mathematics*, Vol. 45 No. 3, 903-928.

Scott Richter

S. J. Richter, Simultaneous confidence intervals using medians and permutation tests, *AStA Advances in Statistical Analysis*, Vol. 100, 189-205.

C. P. Aichele, D. Venkataramani, J. E. Smay, M. H. McCann, **S. J. Richter**, M. Khanzadeh-Moradillo, and M. T. Ley, A comparison of Automated Scanning Electron Microscopy (ASEM) and Acoustic Attenuation Spectroscopy (AAS) for particle sizing, *Colloids and Surfaces A: Physiochemical and Engineering Aspects*, Vol. 479, 46-51.

S. Phillips, **S. J. Richter**, S. Teglas, I. Bhatt, R. Morehouse, E. Hauser, and V. Henrich, Feasibility of a bilateral 4-6kHz notch as a phenotype for genetic association analysis, *International Journal of Audiology*., Vol. 54 No. 10, 645-652.

J. Taylor, J. Waxman, **S. J. Richter**, and S. Shultz, Evaluation of the effectiveness of anterior cruciate ligament injury prevention program training components: a systematic review and meta-analysis, *British Journal of Sports Medicine*, Vol. 49 No. 2, 79-87.

Jonathan Rowell

J. Rowell, Solution sequences to the keyboard problem and its generalizations, *Journal of Integer Sequences,* Vol. 18 Article 15.10.7.

E. Thompson, J. Everett, **J. Rowell**, J. Rychtář, and O. Rueppell, The evolution of cooperation is affected by the persistence of fitness effects, the neighborhood size and their interaction, *Letters in Biomathematics*, Vol. 2, 67-78.

D. Suarez, P. Suthaharan, **J. Rowell**, and J. Rychtář, Evolution of cooperation in mobile populations, *SPORA – A Journal of Biomathematics*, Vol. 1 No. 1, 2-7.

J. Rowell and J. Rychtář, Cooperative behavior in theory and practice: leading undergraduate research in behavioral mathematical biology, *Letters in Biomathematics*, Vol. 2, 29-45.

Jan Rychtář

E. Thompson, J. Everett, J. Rowell, **J. Rychtář**, and O. Rueppell, The evolution of cooperation is affected by the persistence of fitness effects, the neighborhood size and their interaction, *Letters in Biomathematics*, Vol. 2, 67-78.

D. Suarez, P. Suthaharan, J. Rowell, and **J. Rychtář**, Evolution of cooperation in mobile populations, *SPORA – A Journal of Biomathematics*, Vol. 1 No. 1, 2-7.

J. Rowell and **J. Rychtář**, Cooperative behavior in theory and practice: leading undergraduate research in behavioral mathematical biology, *Letters in Biomathematics*, Vol. 2, 29-45.

M. Broom, M. Johanis, and **J. Rychtář**, The effect of fight cost structure on fighting behavior, *Journal of Mathematical Biology*, Vol. 74 No. 4, 979-996.

J. Everett, H. Smith, M. Jasim, and **J. Rychtář**, H. Oh, modeling the Asian carp invasion using mathematical evolutionary game theory, *Springer Proceedings in Mathematics & Statistics*, 81-90.

M. Broom, C. Lafayette, K. Pattni, and **J. Rychtář**, A study of the dynamics of multi-player games on small networks using territorial interactions, *Journal of Mathematical Biology*, Vol. 71 No. 6, 1551-1574.

C. Ross, **J. Rychtář**, and O. Rueppell, A structured population model suggests that long life and post-reproductive life span promote the evolution of cooperation, *Journal of Theoretical Biology*, Vol. 369 85-94.

D. Sykes and **J. Rychtář**, A game theoretic approach to valuating toxoplasmosis vaccination strategies, *Theoretical Population Biology*, Vol. 105, 33-38.

M. Johanis and **J. Rychtář**, A three player singled out game, *Journal of Statistical Theory and Practice*, Vol. 9 No. 4, 882-895.

S. Sun and **J. Rychtář**, The screening game in plant-pollinator interactions, *Evolutionary Ecology,* Vol. 29 No. 479, 480.

K. Crawford, A. Lancaster, H. Oh, and **J. Rychtář**, A voluntary use of insecticide-treated cattle can eliminate African sleeping sickness, *Letters in Biomathematics*, Vol. 2 No. 1, 91-102.

K. Pattni, M. Broom, L. Silvers, and **J. Rychtář**, Evolutionary graph theory revisited: when is an evolutionary process equivalent to the Moran process?, *Proceedings of the Royal Society A*, Vol. 471 No. 2182.

Filip Saidak

T. Binder, S. Pauli, and **F. Saidak**, Zeros of high derivatives of the Riemann zeta function, *Rocky Mountain Journal of Mathematics*, Vol. 45 No. 3, 903-928.

Ratnasingham Shivaji

R. Dhanya, E. Ko, and **R. Shivaji**, A three solution theorem for singular nonlinear elliptic boundary value problems, *Journal of Mathematical Analysis and Applications*, Vol. 424 No. 1, 598-612.

E. Ko, M. Ramaswamy, and **R. Shivaji**, Uniqueness of positive radial solutions for a class of semipositone problems on the exterior of a ball, *Journal of Mathematical Analysis and Applications*, Vol. 423 No. 1, 399-409.

M. Chhetri, P. Drabek, and **R. Shivaji**, Existence of positive radial solutions for a class of *p*-Laplacian superlinear semipositone problems, *Proceedings of the Royal Society of Edinburgh*, Vol. 145 No. 5, 925-936.

Brett Tangedal

C. Greither, X. Roblot, and **B. Tangedal**, Corrigendum to the Brumer-Stark conjecture in some families of extensions of specified degree, *Mathematics of Computation,* Vol. 84, 955-957.

Jerry Vaughan

J. Vaughan and C. Payne, Continuous real valued functions on psi spaces, *Topology and its Applications Special Issue in Memory of Mary Ellen Rudin*, Vol. 195, 256-264.

Dan Yasaki

S. Donnelly, P. E. Gunnells, A. Klages-Mundt, and **D. Yasaki**, A table of elliptic curves over the cubic field of discriminant -23, *Experimental Mathematics*, Vol. 24 No. 4, 375-390.

4.3 Book Chapters, Books, and Monographs Published in 2015

I. Han, **D. Ryang** and J. Kim, *Mathematics Education in Korea Vol. 2: Curricular and Teaching and Learning Practices*, ch. Development of mathematics education in Korea: The role of the Korean Society of Mathematical Education, World Scientific Publishing.

4.4 Conference Proceedings Papers Published in 2015

X. Zhao, K. Zhao, **X. L. Gao**, and J. Deng, Leveraging big data analytics to investigate online sellers' pricing strategies, *14th Workshop on E-Business*.

J. Milstead, **S. Pauli**, and B. Sinclair, Constructing splitting fields of polynomials over local fields, *Topics from the 9th Annual UNCG Regional Mathematics and Statistics Conference, Springer Proceedings in Mathematics & Statistics*, Vol. 109, 101-124.

4.5 Refereed Articles Accepted in 2015

Greg Bell:
G. C. Bell and D. Moran, On constructions preserving the asymptotic topology of metric spaces, *North Carolina Journal of Mathematics and Statistics*.

Talia Fernós:
I. Chatterji, **T. Fernós**, and A. Iozzi, The median class and superrigidity of actions on cat(0) cube complexes, *Journal of Topology*.

T. Fernós and P. Singla, On images of real representations of special linear groups over complete discrete valuation rings, *Glasg. Math. J.*

Xiaoli Gao:
X. L. Gao, Penalized weighted low-rank approximation for robust recovery of recurrent copy number variations, *BMC Bioinformatics*.

Sat Gupta:
S. Gupta, G. Kalucha, and J. Shabbir, A regression estimator for finite population mean of a sensitive variable using an optional randomized response model, *Communications in Statistics – Simulation and Computation*.

J. Shabbir and **S. Gupta,** On generalized exponential chain ratio estimators under two-phase stratified random sampling, *Communications in Statistics - Theory and Methods.*

S. Mishra, **S. Gupta**, S. Yadav, and S. Rawat, Optimization of fuzzified economic order quantity model allowing shortage and deterioration with full backlogging, *American Journal of Operations Research*.

G. Kalucha, **S. Gupta**, and J. Shabbir, A two-step approach to ratio and regression estimation of finite population mean using optional randomized response models, *Hacettepe Journal of Mathematics and Statistics*.

J. Shabbir and **S. Gupta,** A generalized class of difference type estimators for population median in survey sampling, *Hacettepe Journal of Mathematics and Statistics.*

D. Engels, M. Austin, L. McNichol, J. Fencl, **S. Gupta**, and H. Kazi, What factors may contribute towards the development of pressure ulcers in patients that have been to the operating room?, *AORN Journal*.

Thomas Lewis:
W. Feng, **T. Lewis**, and S. Wise, Discontinuous Galerkin derivative operators with applications to second order elliptic problems and stability, *Mathematical Meth. In App. Sciences*.

Scott Richter:
S. Richter and M. McCann, Simultaneous confidence intervals using medians and permutation tests, *AStA Advances in Statistical Analysis*.

C. Aichele, D. Venkataramani, J. Smay, M. McCann, **S. Richter**, M. Khanzadeh-Moradillo, and M. Ley, A Comparison of Automated Scanning Electron Microscopy (ASEM) and Acoustic Attenuation Spectroscopy (AAS) for particle sizing, *Colloids and Surfaces A: Physiochemical and Engineering Aspects*.

S. Phillips, **S. Richter**, S. Teglas, I. Bhatt, R. Morehouse, E. Hauser, and V. Henrich, Feasibility of a bilateral 4-6kHz notch as a phenotype for genetic association analysis, *International Journal of Audiology*.

Jonathan Rowell:
J. Rowell, Solution sequences to the keyboard problem and its generalizations, *Journal of Integer Sequences*.

E. Thompson, J. Everett, **J. Rowell**, J. Rychtář, and O. Rueppell, The evolution of cooperation is affected by the persistence of fitness effects, the neighborhood size and their interaction, *Letters in Biomathematics*.

D. Suarez, P. Suthaharan, **J. Rowell**, and J. Rychtář, Evolution of cooperation in mobile populations, *SPORA – A Journal of Biomathematics*.

J. Rowell and J. Rychtář, Cooperative behavior in theory and practice: leading undergraduate research in behavioral mathematical biology, *Letters in Biomathematics*.

N. Galanter, D. Silva Jr, **J. Rowell**, and J. Rychtář, The Territorial Raider Game and Graph Derangements, *Discrete Applied Mathematics.*

Jan Rychtář:
M. Broom, C. Lafayette, K. Pattni, and **J. Rychtář**, A study of the dynamics of multi-player games on small networks using territorial interactions, *Journal of Mathematical Biology*.

C. Ross, **J. Rychtář,** and O. Rueppell, A structured population model suggests that long life and post-reproductive life span promote the evolution of cooperation, *Journal of Theoretical Biology*.

J. Rowell, and **J. Rychtář,** Cooperative behavior in theory and practice: leading undergraduate research in behavioral mathematical biology, *Letters in Biomathematics*.

D. Sykes and **J. Rychtář,** A Game theoretic approach to valuating toxoplasmosis vaccination strategies, *Theoretical Population Biology*.

M. Johanis and **J. Rychtář,** A three player singled out game, *Journal of Statistical Theory and Practice*.

S. Sun, and **J. Rychtář,** The screening game in plant-pollinator interactions, *Evolutionary Ecology*.

K. Crawford, A. Lancaster, H. Oh, and **J. Rychtář,** A voluntary use of insecticide-treated cattle can eliminate African sleeping sickness, *Letters in Biomathematics*.

E. Thompson, J. Everett, J. Rowell, **J. Rychtář**, and O. Rueppell, The evolution of cooperation is affected by the persistence of fitness effects, the neighborhood size and their interaction, *Letters in Biomathematics*.

D. Suarez, P. Suthaharan, J. Rowell, and **J. Rychtář,** Evolution of cooperation in mobile populations. *SPORA - A journal of Biomathematics*.

K. Pattni, M. Broom, L. Silvers, and **J. Rychtář,** Evolutionary graph theory revisited: when is an evolutionary process equivalent to the Moran process?, *Proceedings of the Royal Society A.*

M. Broom and **J. Rychtář,** A model of food stealing with asymmetric information, *Ecological Complexity.*

M. Broom and **J. Rychtář,** Nonlinear and multiplayer evolutionary games, *Annals of International Society of Dynamic Games.*

Ratnasingham Shivaji:
R. Dhanya, Q. Morris, and **R. Shivaji**, Existence of positive radial solutions for superlinear semipositone problems on the exterior of a ball, *Journal of Mathematical Analysis and Applications.*

E. Lee, **R. Shivaji**, and B. Son, Positive radial solutions to classes of singular problems on the exterior domain of a ball, *Journal of Mathematical Analysis and Applications*.

R. Shivaji and B. Son, Bifurcation and multiplicity results for classes of p,q-Laplacian systems, *Topological Methods in Nonlinear Analysis.*

Jerry Vaughan:
J. Vaughan and C. Payne, Continuous real valued functions on ψ spaces, *Topology and its Applications Special Issue in Memory of Mary Ellen Rudin*.

Dan Yasaki:
M. Dutour Sikiric, H. Gangl, P. E. Gunnells, J. Hanke, A. Schurmann, and **D. Yasaki**, On the cohomology of linear groups over imaginary quadratic fields, *Journal of Pure and Applied Algebra*.

Haimeng Zhang:
C. Huang, S. Robeson, and **H. Zhang**, Intrinsic random functions and universal kriging on the circle, *Statistics and Probability Letters*.

4.6 Book Chapters, Books, and Monographs Accepted in 2015

Greg Bell
G. Bell, Office hours with a geometric group theorist, ch. *Asymptotic dimension*, Princeton University Press.

4.7 Conference Proceedings Papers Accepted in 2015

Xiaoli Gao:
X. Zhao, K. Zhao, **X. L. Gao**, and J. Deng, Leveraging big data analytics to investigate online sellers' pricing strategies, *14th Workshop on E-Business*.

Thomas Lewis:
T. Lewis, Distributional derivatives and the stability of discontinuous Galerkin finite element approximation methods, *Elec. J. Diff. Eq.*

X. Feng, **T. Lewis,** and M. Neilan, Discontinuous Galerkin finite element differential calculus and applications to numerical solutions of linear and nonlinear partial differential equations, *J. Comput. Appl. Math.*

Ratnasingham Shivaji:
J. Shi and **R. Shivaji**, Uniqueness of positive solutions for cooperative Hamiltonian elliptic systems, *Electronic Journal of Differential Equations Conference Series.*

R. Dhanya, E. Ko, and **R. Shivaji,** A three solution theorem for a two-point singular boundary value problem with an unbounded weight, *Electronic Journal of Differential Equations Conference Series.*

4.8 2015 Research Presentations

Greg Bell
On coarse property C, Topology and Geometry Seminar, Wroclaw University, Wroclaw, Poland.

On coarse property C and decomposition complexity, IMPAN Topology Seminar, Mathematical Institute -- Polish Academy of Sciences, Warsaw, Poland.

Maya Chhetri
Asymptotically linear systems, Differential Equations Seminar, UT Knoxville.

Asymptotically linear system of three equations, Spring Western Sectional Meeting, Las Vegas, Nevada.

Continua of solutions for asymptotically linear system of three equations, Joint Mathematics Meetings, San Antonio, TX.

Talia Fernós
New examples of groups with property (FC), Spring Topology and Dynamics Conference, Bowling Green State University.

The roller boundary and CAT(0) cube complexes, Topology Festival, Cornell University.

Playing ping-pong with free groups, Modern Math Workshop, SACNAS National Conference, Washington DC.

The Poisson-Furstenberg boundary and CAT(0) cube complexes, Dynamics Seminar, Northwestern University.

The Poisson-Furstenberg boundary and CAT(0) cube complexes, Geometric and Probabilistic Methods in Group Theory and Dynamical Systems, Texas A & M University.

Xiaoli Gao
Robust variable selection and subgroup identification, The 25th Annual TIES Conference, United Arab Emirates (UAE) University, Al Ain, United Arab Emirates.

Penalized adaptive weighted least squares regression, The 2015 International Workshop on Perspectives on High-Dimensional Data Analysis (HDDA) V, University of Victoria, Victoria, British Columbia.

Penalized adaptive weighted least squares regression, The 24th International Workshop on Matrices and Statistics, Hainan, China.

Penalized adaptive weighted least squares regression, Department of Statistics and Operational Research, University of North Carolina, Chapel Hill.

Sat Gupta
Estimating finite population mean for sensitive variables, The Jaypee Institute of Information Technology, Noida, UP, India.

Lies, damn lies, and statistics – a myth or reality? PGDAV College, University of Delhi, India.

Role of quantitative methods in academic and non-academic settings, NC A&T State University, Greensboro, NC.

Stochastic scrambling and descrambling of sensitive data, UNCG math-bio REU, Greensboro, NC.

Improved ratio and regression estimation of finite population mean using optional randomized response models, University of Southern Maine.

Ratio and regression estimators of finite population mean using optional RRT models, Brock University, St. Catharine, Ontario, Canada.

Efficiency of two stage optional RRT models, University of Central Florida.

Ratio and regression estimation of mean of sensitive variables, University of Texas at Dallas.

Applied side of statistics, Winston Salem State University, Biomedical Research Infrastructure Center, Winston-Salem, NC.
Ratio and regression estimation of the mean of sensitive variables, IIT Bombay, India.

Applied side of statistics, some real case studies, Tata Institute of Fundamental Research, Mumbai, India.

Data confidentiality and respondent privacy – Presidential Address at the 69th Annual Conference of the Indian Society of Agricultural Statistics, University of Kota, Rajasthan, India.

Tracey Howell
Using an Emporium Model in precalculus: lessons learned and next steps, The annual meeting of the Research Council on Mathematics Learning, Las Vegas, NV.

Elizabeth Lewis
The congruence-based zero-divisor graph, Maryville College, Maryville, TN.

Thomas Lewis
Convergent finite difference methods for fully nonlinear second order partial differential equations, Joint Math Meetings --AMS Session on Numerical Analysis and Computer Science, San Antonio, TX.

The dual-wind discontinuous Galerkin method, SIAM Central States Section Meeting --Special Session on Recent Advances in Finite Element Methods, Rolla, MO.

Numerical differentiation and its application to boundary value problems, Winthrop University REU -Bridging Applied and Theoretical Mathematics, Rock Hill, SC.

Numerical differentiation and its application to boundary value problems, Math-Bio REU at UNCG, Greensboro, NC.

Distributional derivatives and the stability of DG methods, University of Tennessee Computational and Applied Mathematics Seminar, Knoxville, TN.

Generalized monotone LDG methods for second order fully nonlinear PDEs, The Finite Element Circus, North Dartmouth, MA.

Generalized monotone finite difference methods for approximating viscosity solutions, Conference on Nonlinear PDEs, Numerical Analysis, and Applications, Pittsburgh, PA.

Numerical differentiation and approximating differential equations, Maryville College Division of Mathematics & Computer Science Seminar, Maryville, TN.

Scott Richter
Comparing treatments when data points are empirical distribution functions, 2015 Joint Statistical Meetings, Seattle, WA.

Jonathan Rowell
Behavioral plasticity in cooperation as a defense against kleptoparasitic invasions and fluctuating environments, Eighth Annual International Symposium on Biomathematics and Ecology: Education and Research, Illinois State University, Normal, IL.

Jan Rychtář
The Territorial Raider Model with strategic movement and multi-group interactions, Biomathematics & Ecology: Education and Research, Normal, Illinois.

Optimal aggression in kleptoparasitic interactions, Biomathematics & Ecology: Education and Research, Normal, Illinois.

Mentoring interdisciplinary research projects, 2015 Joint Mathematics Meeting, San Antonio, Texas.

Habitat selection game in structured populations, 2015 Joint Mathematics Meeting, San Antonio, Texas.

Game-theoretical models of aggression, Analysis Seminar, Virginia Commonwealth University, Richmond, Virginia.

Carol Seaman
Using an emporium model in precalculus: lessons learned and next steps. Research Council on Mathematics Learning, Las Vegas, Nevada.

A state-wide collaboration to develop elementary school mathematics leaders, Association of Mathematics Teacher Educators, Orlando, Florida.

Ratnasingham Shivaji
Semipositone problems, VII Symposium on Nonlinear Analysis, SNA 2015, Torun, Poland.

Proving uniqueness results for steady state reaction diffusion equations – an introduction, UNCG and Wake Forest University Joint Applied Math Seminar.

Semipositone Problems I, 3rd Workshop in Nonlinear Analysis and Partial Differential Equations, Sergio Arboleda University, Bogota, Columbia.

Semipositone Problems II, 3rd Workshop in Nonlinear Analysis and Partial Differential Equations, Sergio Arboleda University, Bogota, Columbia.

A positivity challenge in steady state reaction diffusion problems, Indian Institute of Technology, Department of Mathematics, Chennai, India.

Bifurcation and multiplicity results for classes of reaction diffusion equations, Indian Institute of Technology, Department of Mathematics, Chennai, India.

Existence results for classes of steady state reaction diffusion equations, City University of New York Graduate Center, New York, NY.

Proving uniqueness results for steady state reaction diffusion equations – an introduction, Kennesaw State University, Kennesaw, GA.

Clifford Smyth
A probabilistic characterization of the dominance order on partitions, AMS Fall Southeastern Sectional Meeting, University of Memphis, Memphis, TN.

Jerry Vaughan
On ψ-spaces, Pittsburgh Topology Conference 2015, University of Pittsburgh, Pittsburgh, PA.

Nets, transfinite sequences and the Ordering Lemma, 30th Summer Conference on Topology and its Applications, National University of Ireland, Galway, Ireland.

Recent results on the class of ψ-spaces, Capital Normal University, Beijing, China.

Nets, transfinite sequences and the Ordering Lemma, 1st Pan Pacific International Conference on Topology and Applications, Minnan Normal University, Zhangzhou, China. (continuation of Galway Talk).

The general class of ψ-spaces, Northwest University, Xian, China.

Dan Yasaki
Genus 2 Curves, LMFDB Mini-Workshop, University College, Dublin, Ireland.

Torsion in the cohomology of arithmetic groups, Computational Representation Theory in Number Theory, Orgeon State University.

Haimeng Zhang
Covariance structures of axially symmetric spatial processes on the sphere, 2015 IMS-China Conference on Statistics and Probability, Kunming, China.

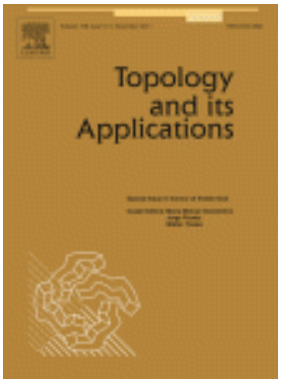
Intrinsic random functions and universal kriging on the circle, ICSA China Statistics Conference, Shanghai, China.

Probabilistic recurrence relations, College of Applied Mathematics, Xiamen University of Technology, Xiamen, China.

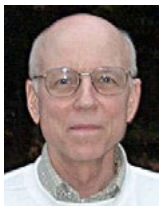
Intrinsic random functions and universal kriging on the circle, Joint Statistical Meetings, Seattle, WA.

4.9 Department Journals

Topology and its Applications



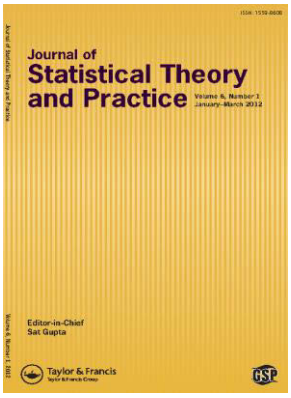
http://web.math.ucsb.edu/~long/TAIA/TopApp.htm



Jerry Vaughan, Editor-in-Chief

Topology and its Applications is a journal primarily concerned with publishing original research papers in topology. In 2015 the journal published 375 articles (4942 pages), an increase over 2014, in which the journal published 260 articles (3009 pages). The journal publishes papers in algebraic, general, geometric, dynamics, and set-theoretic facets of topology as well as areas of interactions between topology and other mathematical disciplines, e.g. topological algebra, functional analysis, theoretical computer science, category theory. As the roles of various aspects of topology change, so does the scope of the journal, staying on the forefront of the research in topology.

The Journal of Statistical Theory and Practice



http://www.tandfonline.com/loi/UJSP20/

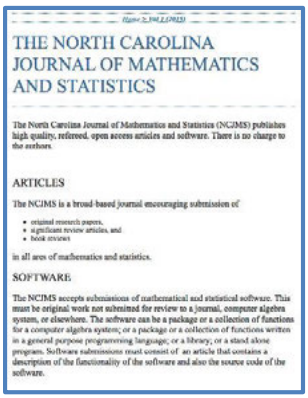
Sat Gupta, Editor-in-Chief

The Journal of Statistical Theory and Practice was conceived and started in 2007 by Professor Sat Gupta, who continues to serve as its Editor-in-Chief. It is published by Taylor and Francis. Its editorial board boasts of some of the most eminent statisticians such as C. R. Rao (Penn State), Joe Gani (Australian National University), Alan Gelfand (Duke University), Sergio Verdu (Princeton University), Dan Zelterman (Yale University), Sastry Pantula (Oregon State University), and Pranab Sen (UNC Chapel Hill).

The main goal of JSTP is to publish expeditiously original research papers covering theory and applications of statistics. Each paper is refereed by two anonymous referees in addition to one of the Associate Editors. The usual turnaround time for the first review is 90 days. From time to time, the journal also publishes biographies of eminent statisticians in its Life and Work sequence. Some of the eminent statisticians/mathematicians who have been featured include R. A Fisher, S. N. Roy, Leonhard Euler, Jack Kiefer, C. R. Rao, and Charles Heyde.

The journal publishes four issues every year, with 51 papers appearing in Vol. 9, 2015. Twenty-five of these papers were grant supported. This volume also published a special issue – Distribution Theory, Estimation and Inference, guest edited by Carlos Coelho and Filipe Marques (New University of Lisbon) and Barry Arnold (U C Riverside).

The North Carolina Journal of Mathematics and Statistics


THE NORTH CAROLINA JOURNAL OF MATHEMATICS AND STATISTICS

The North Carolina Journal of Mathematics and Statistics (NCJMS) publishes high quality, refereed, open access articles and software. There is no charge to the authors.

ARTICLES

The NCJMS is a broad-based journal encouraging submission of

- original research papers,
- significant review articles, and
- book reviews

in all area of mathematics and statistics.

SOFTWARE

The NCJMS accepts submissions of mathematical and statistical software. This must be original work not submitted for review to a journal, computer algebra system, or elsewhere. The software can be a package or a collection of functions for a computer algebra system; or a package or a collection of functions written in a general purpose programming language; or a library; or a stand alone program. Software submissions must consist of an article that contains a description of the functionality of the software and also the source code of the software.

http://ncjms.uncg.edu/

Jan Rychtář and Sebastian Pauli, Managing Editors

The North Carolina Journal of Mathematics and Statistics is a broad-based journal encouraging submission of original research papers, significant review articles, book reviews, and software in all areas of Mathematics and Statistics. Special issues on targeted topics will be published from time to time.

The North Carolina Journal of Mathematics and Statistics was conceived and started in 2014 by Professor Jan Rychtář, Department of Mathematics and Statistics at the University of North Carolina at Greensboro. It is an online open access journal that publishes high quality, refereed articles as well as software from all areas of mathematics and statistics.

The editorial board currently consists of Greg Bell, Maya Chhetri, Sat Gupta, Sebastian Pauli, Jan Rychtář, Filip Saidak and Jerry Vaughan from UNCG as well as of Chad Awtrey (Elon University) and Stephen Robinson (Wake Forest University). The board is expected to grow and to encompass most of Departments of mathematics and statistics in NC.

The first issue containing 7 articles was published in December 2015. The second issue is appearing in 2016.

5. External Grants

5.1 External Grants

New Awards Administered by Mathematics and Statistics:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
15-0295	**Fabiano, Richard**	**Chhetri, Maya; Lewis, Thomas**	Southeastern Atlantic Regional Conference on Differential Equations 2015	8/01/15	4/30/16	National Science Foundation	$24,000
15-0198	**Shivaji, Ratnasingham**		Collaborative Research: Mathematical and Experimental Analysis of Ecological Models; Patches, Landscapes and Conditional Dispersal on the Boundary	8/15/15	7/31/18	National Science Foundation	$203,834
15-0301	**Smyth, Clifford**		Collaboration in Combinatorics	9/1/15	8/31/20	Simons Foundation	$35,000
15-0290	**Gao, Xiaoli**		Robust Estimation and Signal Approximation for High Dimensional Data	9/1/15	8/31/20	Simons Foundation	$35,000
N/A	**Rychtář, Jan**	**Shivaji, Ratnasingham; Bell, Greg; Yasaki, Dan; Pauli, Sebastian**	Preparation for Industrial Careers in Mathematical Sciences (PIC Math)	1/1/16	5/31/16	Mathematical Association of America	$6,500
15-0126	**Pauli, Sebastian**	**Tangedal, Brett; Yasaki, Dan**	UNCG Summer School in Computational Number Theory	3/1/16	2/28/17	National Science Foundation	$22,274
16-0053	**Pauli, Sebastian**	**Tangedal, Brett; Yasaki, Dan**	UNCG Summer School in Computational Number Theory	4/1/16	3/31/19	National Science Foundation	$8,775

Continuing Awards Administered by Mathematics and Statistics:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	Award End Date	Sponsor	Award Amount
12-0323	**Rychtář, Jan**		Game-theoretical models in biology	9/1/12	8/31/17	Simons Foundation	$35,000
13-0171	**Fernós, Talia**		Low Dimensional Cohomology and the Geometry of Hilbert Space	8/15/13	12/31/16	National Science Foundation	$115,952
13-01314	**Rychtář, Jan**	**Chhetri, Maya; Gupta, Sat; Shivaji, Ratnasingham**	The Annual UNCG Regional Mathematics & Statistics Conference	9/1/13	8/31/17	National Science Foundation	$42,000
14-0209	**Zhang, Haimeng**		Collaborative research: Axially symmetric processes and intrinsic random functions on the sphere	12/4/13	8/31/15	National Science Foundation	$47,468
13-0114	**Yasaki, Dan**	**Tangedal, Brett; Saidak, Filip; Pauli, Sebastian**	UNCG Summer School in Computational Number Theory	2/28/14	3/31/16	National Science Foundation	$17,916
14-0054	**Rychtář, Jan**	**Rowell, Jonathan;** Rueppell, Olav	REU Site: Mathematical Biology at UNCG	3/11/14	4/30/17	National Science Foundation	$275,952
14-0252*	**Shivaji, Ratnasingham**		Analysis of nonlinear eigenvalue problems and applications	5/14/14	8/31/19	Simons Foundation	$35,000
N/A	**Rychtář, Jan**	Oh, Hyunju; Oh, Joon-Yeoul	National Research Experience for Undergraduates Program (NREUP)	5/1/15	7/31/15	Mathematical Association of America	$25,716

* Due to the receipt of an NSF grant, the Simons Foundation Grant has to be returned to the sponsors in September 2015.

14-0087	**Yasaki, Dan**		Voronoi Reduction Theory and Applications to Arithmetic Groups	5/1/15	5/1/17	National Security Agency	$40,000
15-0213	**Rychtář, Jan**	Oh, Hyunju	Vaccination games	6/1/15	6/30/16	BYU CURM	$3,000

Future Awards Administered by Mathematics and Statistics:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
16-0199	**Rychtář, Jan**	**Chhetri, Maya; Erovenko, Igor; Gupta, Sat; Lewis, Thomas; Rowell, Jonathan**	Annual UNCG Regional Mathematics & Statistics Conference	8/1/16	7/31/19	National Science Foundation	$31,730

New Awards Administered by other Departments:

PROP #	Department	Mathematics and Statistics Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
16-0118	School of Education	**Seaman, Carol**	Core Mathematics Instructional Practices in Secondary Schools (CMaPSS)	2/15/16	6/30/17	UNCGA North Carolina Quest	$281,247

Continuing Awards Administered by other Departments:

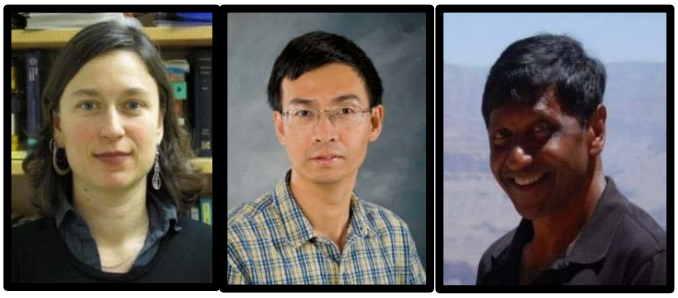
PROP #	Department	Mathematics and Statistics Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
11-0407	School of Nursing	**Richter, Scott; Gupta, Sat**	TRIAD-2 Center for Health Disparities Research	6/1/12	4/30/16	National Institute of Health	$60,768.95
14-0139	School of Education	**Seaman, Carol**	Core-Math III: Supporting Teachers in Using Learning Trajectories to Implement the Common Core State Standards for Mathematics	4/1/14	9/30/15	UNCGA North Carolina Quest	$149,928

5.2. Internal Grants

New Awards Administered by Mathematics and Statistics:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
N/A	**Gao, Xiaoli**		New Faculty Grant	8/1/15	6/30/16	UNCG- Office of Research and Economic Development	$4,000
N/A	**Chhetri, Maya**		Faculty First Summer Scholarship Award	4/18/16	6/30/16	UNCG- Office of Research and Economic Development	$5,000

Recent Major External Award Recipients



Fernós **Zhang** **Shivaji**

NSF Grants

Yasaki Smyth

NSA Grants

Rychtář **Gao** **Smyth** **Shivaji**

Simons Foundation Grants

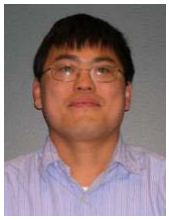
Lewis

MAA Project NExT Fellow

Rychtář **Rowell**

NSF REU Grant

6. Undergraduate Program



Dan Yasaki, Director of Undergraduate Studies

6.1 Programs

Mathematics is an excellent major for the student whose immediate objective is to acquire a strong liberal arts education. The goal of all of the Department's programs is to produce students who are both technically competent and sufficiently well-grounded in theory that they can contribute to fundamental research in their chosen specialty. There are many opportunities for the undergraduate majors in mathematics in industry, government, business, and secondary school teaching. Graduates may go on to work as an actuary with insurance companies; as a data analyst with pharmaceutical, biotechnology, or health care companies; as a quality assurance specialist with engineering companies; or in government agencies such as FDA, EPA or USDA.

An undergraduate major in mathematics also provides excellent preparation for graduate studies in many areas, including actuarial sciences, computer science, economics, engineering, law, mathematics, operations research, and statistics. The majors can be specialized to allow preparation for any of these goals.

Degree Programs

The Department of Mathematics and Statistics offers undergraduate programs leading to

- B.A. in Mathematics with concentration in Mathematics;
- B.A. in Mathematics with concentration in High School Teaching Licensure;
- B.S. in Mathematics with concentration in Mathematics;
- B.S. in Mathematics with concentration in Statistics.

The B.A. program is more flexible than the B.S. program. It allows one to specialize in mathematics and at the same time either to follow a broad liberal arts program or to specialize in a second area (possibly even taking a second major). The B.S. program is more technically oriented; it provides solid preparation for work or study in mathematics or a related field. Students wanting to go to graduate school are encouraged to consider the B.S. degree or the new Accelerated Degree Program (ADP) to earn a B.S. and M.A. in 5 years. We also offer minors in mathematics and statistics.

Curriculum

We continue our efforts in teaching service courses as well as in producing graduates that are better prepared for the STEM (Science, Technology, Engineering, and Math) fields. As part of our commitment to high quality instruction in the classroom, we have continued to keep the sizes of all lecture sections in mathematics and statistics classes at 50. Class size caps go down to 35 starting at Calculus and drop to 25 in courses at the 300 level and above.

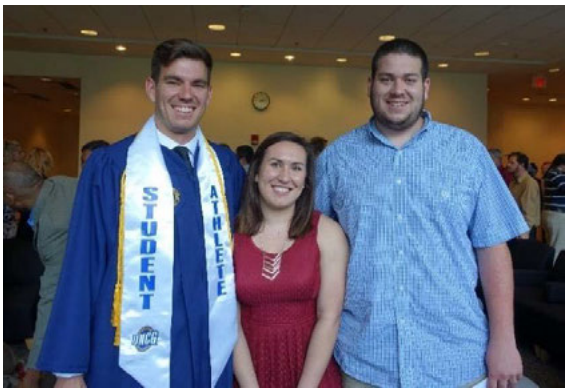
The math placement test, which is used to decide the initial placement of a student into a math course, has undergone significant revision and is now administered to all freshmen STEM majors at SOAR before they begin their studies at UNCG. This is done to ensure timely graduation by placing students in proper first-year courses. We began collecting empirical data measuring the readiness of the students in MAT 191. These data will be used to design additional services and support for these STEM majors to lower DFW rates and help at-risk students succeed.

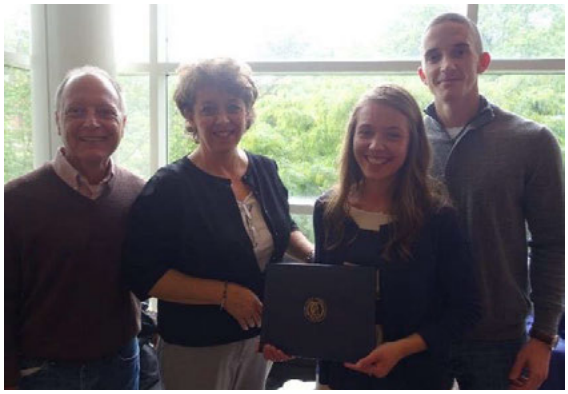
Beginning in Fall 2015, only those courses in which a student earns a C or better will count toward the major or minor. The desired outcome of this policy would be producing more competent graduates

Graduates

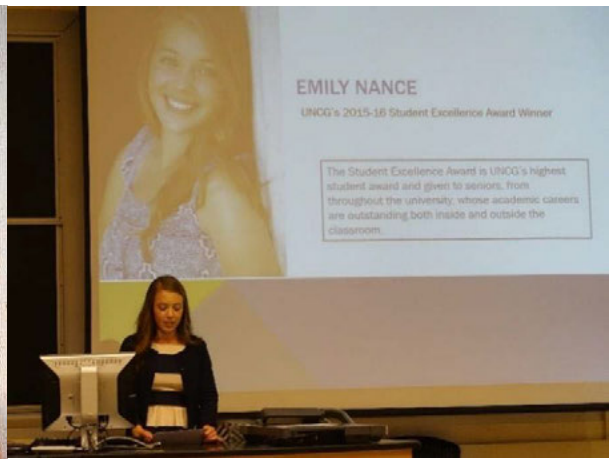
During the 2015-16 academic year, 18 students earned a Bachelor's degree in mathematics: Bukola Adaramola, Christopher Bonner, Anna Burton, Ryan Degabriel, Andrew Edwards, Xinyu Feng, Michael Finney, Kristen Fisher, Ivanti Galloway, Chelsea Gardon, Zoe Goodnight, Mingyan Li, Emily Johnson, Kayla Moore, Alicia Muller, Logan Rohde, John Sanders, and Marwan Zamamiri. The Department Graduation Ceremony was held on June 6, 2016.

Graduates, faculty, and families at the 2016 Graduation Ceremony Reception & Ceremony





Graduates with their family at the 2016 Graduation Ceremony

Emily Nance presenting at the 2016 Graduation Ceremony

Emily Nance won the Student Excellence Award for 2015-16 academic year. The Student Excellence Award is UNCG's highest student award. It is given to seniors from throughout the university whose academic careers are outstanding both inside and outside the classroom. At the graduation ceremony, Emily gave a presentation on her experience as an undergraduate student at UNCG. She shared her positive experience with the faculty and staff of our department while working on her Statistics Concentration as a math major.


B.A. and B.S. graduates at our Graduation 2016 Ceremony

B.A. and B.S. graduates at our Graduation 2016 Ceremony



B.A. and B.S. graduates at our Graduation 2016 Ceremony

6.2 Recruitment and Retention

Over the last several years, the Department of Mathematics and Statistics has been working to increase the number of undergraduate mathematics majors at UNCG and to retain those students in the Department throughout their years at UNCG. To help recruit new students to our Department, we participate in numerous events throughout the academic year, including the Spartan Showcase, the Fall Faculty Phone-a-Thon, the Spring Faculty Phone-a-Thon, and Destination UNCG. To help retain our majors, we have lowered the class sizes of our 100-level mathematics courses and provided a Mathematics Help Center where students can come for assistance with their mathematical questions. We teach approximately 400 College Algebra and Precalculus students each semester in our Mathematics Emporium Lab, combining the best components of traditional and online classes into these hybrid-model courses. Finally, Tracey Howell serves as advisor to all undergraduate students during their first year with our Department.

Tracey Howell, Carrie Miller, and Kayla McReynolds at Spartan Showcase

7. Undergraduate Research Program

Background and history

The major push for undergraduate research in the Department started in 2005 with the establishment of a math/biology research group by Drs. Rychtář, Chhetri, and Gupta from the Department of Mathematics and Statistics, Drs. Rueppell and Remington from the Department of Biology, and Dr. Crowe from the Office of Undergraduate Research. The group has been funded by two major NSF grants; 0634182 (2006-2010) and 0926288 (2009-2013). Over the years, this research has involved 16 faculty and over 45 undergraduate students. The students and faculty received 33 awards and recognitions, gave over 250 presentations, and published over 40 research articles in major international journals.

NSF Math-Bio Undergraduate Fellowship

Overview & Evolution

- Initial research projects started in 2006
- Team consisted of 6 faculty and 10 students
- Current funding till 2012
- Research team grew to 16 faculty
- Trained 23 undergraduate students in total
- Enrolling 9 students per year on average
- Creating additional opportunities for faculty and students
- Building a network of former students and graduates
- Networking with local high-schools

Outreach

- Presentations of our research to minority high school students at the Ecology summer camps
- Presentations of our research in NC Research in the
- Capital and meeting with senators.
- Visits of local pharmaceutical companies to investigate potential career in math in sciences.
- Presentations at local high schools
- Social activities including common lunches, barbecue at professor's and student's houses, bowling nights, etc.

Sample Research Projects

Resource Allocation in Arabidopsis Lyrata
(Drs. Remington and Rychtář)
- The goal is to study and create mathematical models of how a plant allocates resources between reproductive and maintenance efforts and to determine which mechanisms are and which are not genetically controlled.

Oyster Reef Systems and Fish Populations in Coastal Ecosystems
(Drs. Chhetri and Rueppell)
- Students will develop an ODE model of the relationship between oyster reef systems and fish populations in southeastern coastal regions. The emphasis will be given to understanding of the sustainability of harvesting.

Video Surveilence of Bats and Mice
(Drs. Kalcounis-Rüppell, Pauli and Suthaharan)
- The goal is to observe and measure the behaviors of bats and mice in their natural habitat. Further investigation of animal interactions with animal tracks will also be conducted.

Social Apoptosis in Honey Bees
(Drs. Rueppell and Chhetri)
- The goal is to understand why, when and how honey bee workers commit suicide once infected by a disease. Students design the experiment to develop and a mathematical model to support a hypothesis.

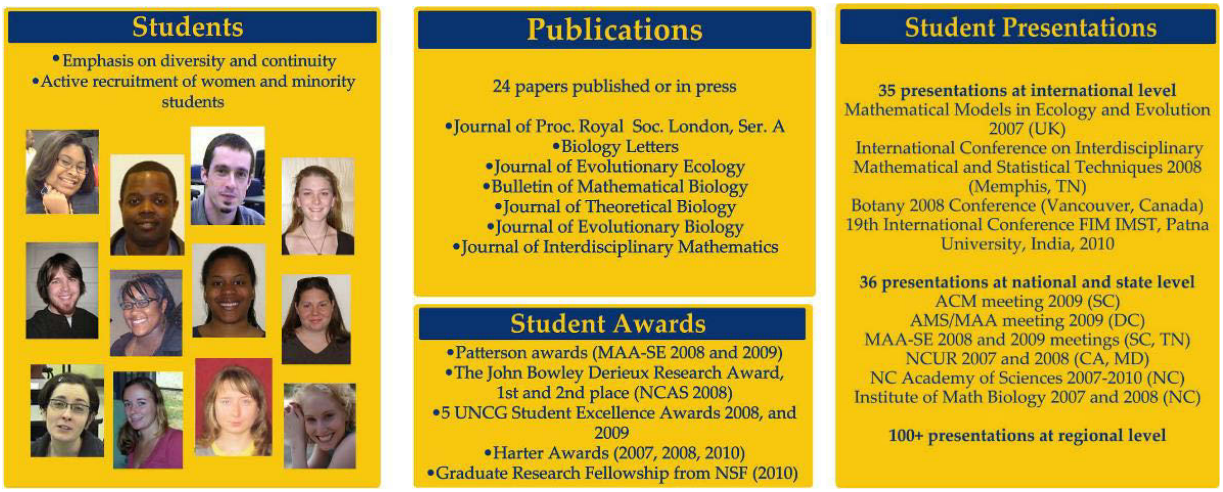
Brood Parasitism in the Dung Beetle Onthophagus Taurus
(Drs. Crowe and Rychtář)
- The goal is to develop a game theoretical model of brood parasitism in a small paracoprid dung beetle. Students design and perform field and lab experiments to test the model.

Randomized Response Models for Medical Sciences
(Drs. Gupta and Crowe)
The goal of this project is be to generalize a commonly used RRT model, the Unrelated Question Model of Greenberg et al. (1969) toallow optional scrambling. The model will then be analyzed mathematically, via computer simulations as well as field tested.

Education

We have developed and from Spring 2008 we offer a math modeling course open to all UNCG students. It focuses on:
- Developing math models of biological problem
- Training in biology of bees, beetles, fish and plants
- Training in math (ODEs, PDEs, game theory)
- Training in computer simulations

We also regularly conducted separate workshops on:
- Ethics of Research
- Writing a CV/personal statement
- Applying to graduate school
- Presentation and public speaking



7.1 2016 National Research Experience for Undergraduates Program

Summary

Hyunju Oh (Bennett College) and Jan Rychtář (UNCG) received funding from the Mathematical Association of America (MAA) for the “Game Theory and Applications” project. The award is part of the National Research Experience for Undergraduates Program funded through MAA by the National Science Foundation's Division of Mathematical Sciences. During the 6 weeks, from May 15, 2016 to June 25, 2016, Rychtář and Oh engaged four African-American female undergraduate students from Bennett College, Greensboro, NC in research projects. The students were introduced to the fundamental game-theoretical concepts such as Nash equilibria and evolutionarily stable strategy. They were taught how to use computational and analysis tools (optimization and linear algebra), to identify such strategies in real game theoretical models with applications in medicine - “vaccination games” where individuals have to make decisions whether to protect themselves from infectious diseases by taking costly actions such as taking a vaccine. The students were trained in all aspects of research, starting with the ethics code, going through the workshops on using library and online resources and ending with training in delivering oral presentations as well as in using LaTeX to write mathematical papers. We expect that each student will submit at least one research paper and present her findings at at least 2 conferences (held in NC during Fall 2016).

This project is part of the growing collaboration between UNCG and Bennett College (HBCU), which is in its third year in 2016.

Projects

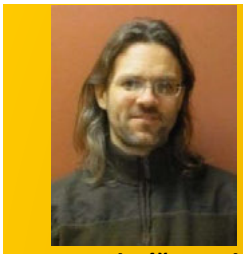
Toxoplasmosis vaccination

Over 60 million people in the United States carry the parasite Toxoplasma Gondii, and the Center for Disease Control (CDC) has classified Toxoplasmosis among the Neglected Parasitic Infections disease group targeted for control by the CDC. In recent years, there has been significant progress towards the development of a practical vaccine, so vaccination programs may soon be a viable approach to controlling the disease. Anticipating the availability of a toxoplasmosis vaccine, we are interested in determining when cat owners should vaccinate their own pets. To investigate this, we will create a mathematical model describing the conditions under which vaccination is advantageous for a person living with cats. The core of the conflict in this (and similar games) is that if all cat owners decide to vaccinate their cats, there will be only a very small chance of an unvaccinated cat contracting the parasite and the disease. Consequently (especially if the vaccine is expensive, either in the form of a dollar cost or bad side effects), it may become beneficial for cat owners to leave their cats unvaccinated. On the other hand, if almost nobody vaccinates their cats, the risk of getting the disease is large and thus the cat owners should vaccinate their pets. The important question thus is, given the cost of the vaccine, what is the appropriate level of pet vaccination? The project will be built on recent results by Rychtář and his students published in Theoretical Population Biology.

Ruminant Vaccination to Control Rift Valley Fever (RVF) virus

RVF virus is transferred among animals and humans by mosquitoes. It was first isolated in Kenya in 1930, but there is a growing concern it can spread to the US. Currently, there are two types of vaccines (for animals) available. One is relatively expensive but safe; the other is relatively cheap but with many dangerous side effects such as abortion and fetal abnormalities. In this project, we propose to build on results from 2014 NREUP where we developed models for the control of African sleeping sickness by spraying cows with insecticide (manuscript appeared in Letters in Biomathematics 2015 2:1, 91-102) and controlling dengue fever by using insect repellent (currently under minor revisions in Bulletin of Mathematical Biology). We will adopt the techniques used in those two papers for the RFV virus.

7.2 2016 National Science Foundation funded Research Experiences for Undergraduates Program (REU site)



Jan Rychtář, Lead Principal Investigator

Jonathan Rowell, Principal Investigator

Olav Rueppell, Investigator

Xiaoli Gao

Igor Erovenko

Jan Rychtář, Jonathan Rowell, and Olav Rueppell received the NSF grant "REU Site: Mathematical Biology at the University of North Carolina at Greensboro," which supports undergraduate students during the summer months of 2014, 2015 and 2016. For ten weeks in 2016 (mid-May to the end of July), Rychtář, Rowell, Rueppell, Erovenko and Gao worked with nine undergraduate students that came from UNC, UNCG, University of Portland, Wake Forest University, Wentworth Institute of Technology, Western Carolina University, Western State Colorado University, and Winston Salem State University.

The 2016 cohort consisted of 6 female and 3 male students. Three out of nine students came from under-represented minorities, specifically two were African American females and one was a Hispanic male. Student maturity varied from freshmen to seniors, and their prior course work in mathematics, statistics, and biology varied extensively.

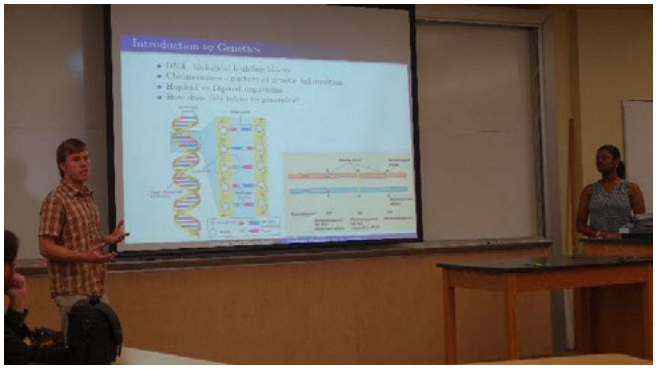
The ten-week program consisted of two distinct phases. In the first two-week period, the students underwent a broad training suitable for the preparation of mathematical biologists. Morning sessions covered technical subjects such as programming in Matlab and typesetting with LaTeX, while the afternoons were devoted to instruction in a number of topics in mathematics and biology as well as general academic skills. Quinn Morris, a doctoral student within our Department, was responsible for the morning

Jan Rychtář presenting to the REU participants

sessions. He offered programming and mathematical consultancy during the research phase of the program. The PIs provided the bulk of the mathematical and biology training in the afternoon. Elliott Hollifield and Michael Leshowitz, also graduate students within our Department, led discussions on reviewing the literature, academic writing and other skills. In addition to this instruction, the students undertook daily mini-projects that encapsulated the lessons of the day and in which they would need to work together to prepare a finalized report.

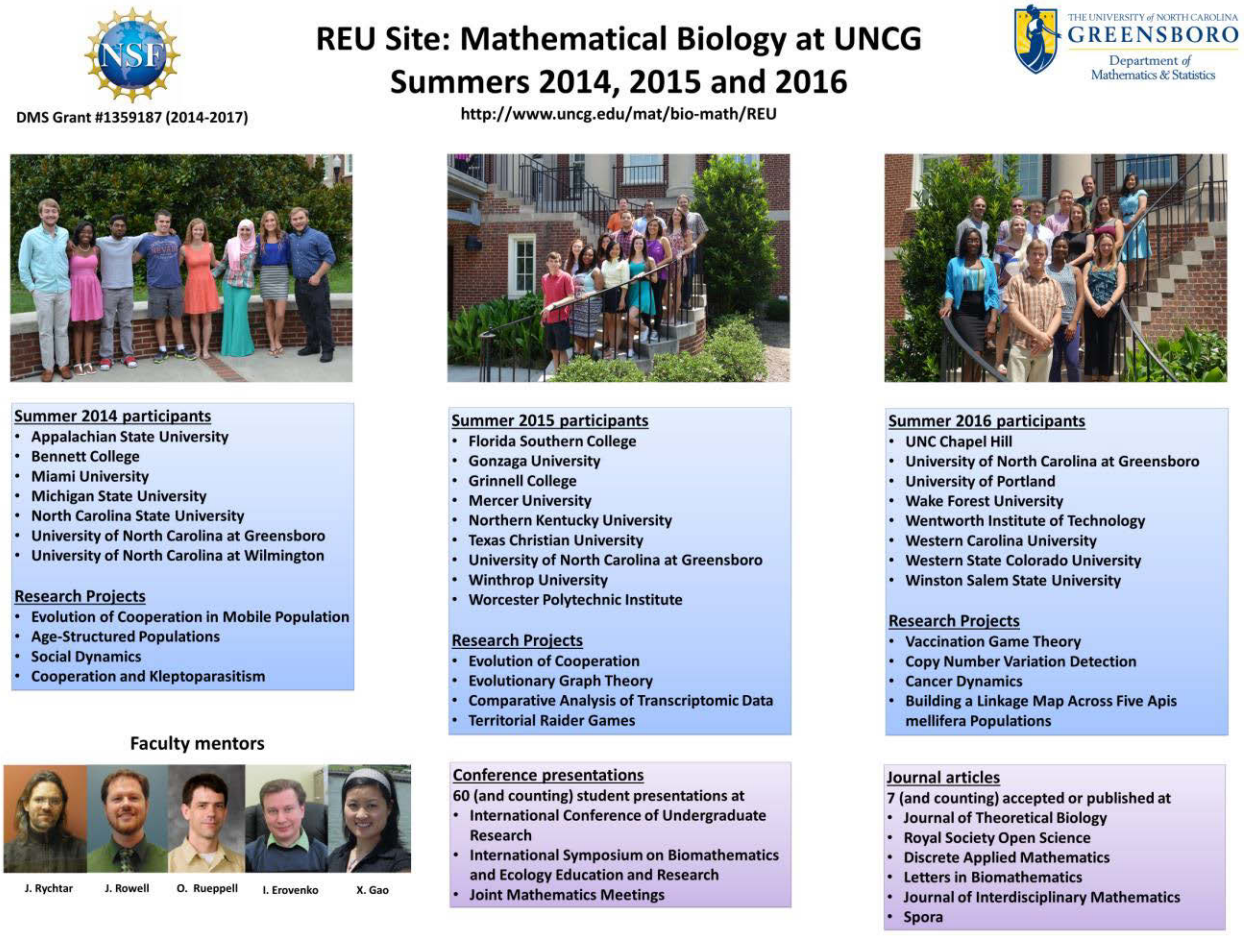
For the remaining eight weeks of the program, the students worked on their research projects. They were required to give short synopses of their work as well as weekly formal presentations.

The REU program culminated with student presentations in a formal symposium attended by faculty from across the University. Research and writing have continued for each team since the conclusion of the summer.



REU undergraduate student presenters, Tim DeLory of Western State Colorado University and Karen Funderburk of UNCG

2016 Summer NSF-REU Participants, faculty & graduate student mentors



Research projects

The students were split into 4 groups and each group worked on one of the following research projects.

Weighted Hard Threshold Signal Approximation for Robust Change Point Detection with Application to Copy Number Variation Detection

Copy number variation (CNV) detection becomes an important issue in cancer research since CNVs can confer risk to complex disease. However, most CNV data are noisy and outliers and human errors are often involved during or after the normalization process. In this project, we propose a Weighted Hard Threshold Signal Approximation (WHATSA) method for robust detection of copy number variation change points. There are two important contributions from this project: 1) improve the robustness and efficiency of the true DNA copy number signals recovery from existing methods and 2) develop a unique approach for simultaneous outlier

detection with the signal approximation. The project will involve: a) CNV microarray data collection; b) formalization of WHATSA method for signal approximation; c) large amount of simulations by comparing WHATSA method with selective existing methods; d) preparation of an efficient algorithm for WHATSA and publicly available R program.

A Game-Theoretical Model of Cholera With Optimal Personal Protection Strategies

Cholera is a diarrheal disease that affects millions of people around the world every year, the majority of whom reside in the developing world. Cholera's virulence and large area of affect make it an extremely important public health concern. The disease is spread through water by the vibrio cholerae bacterium. We will extend a traditional SIR mathematical model to include a restriction on the rate of infection and incorporate the option for the availability of clean water sources and their ability to prevent infection by cholera. We then develop a game-theoretical model for this personal protection strategy, in which individuals decide whether or not to drink from clean water sources dependent on the cost of the disease and the cost of the personal protection strategy. We will analyze the outcomes of this optimal personal choice model and in particular we will study how close to the eradication of cholera the population can get.

Game theoretical model of cancer dynamics with four cell populations

We take an evolutionary game theory approach to heterogeneous cancer cell interactions to develop an understanding of how different phenotypic and morphological traits of cells affects tumor development and growth. Our game includes four cell strategies that interact one-on-one allowing the synthesis of differential equations, pairwise dominance interactions, and invasibilities/counter-invasibilites to find equilibriums and coexistences amongst populations. We also implement a spatial model that creates a dynamic for the cell interactions to occur in a given environment and observe the change in cell population frequency over time.

Building a Linkage Map Across Five *Apis mellifera* Populations: Physical and Digital Concepts

We will study the phenomenon of meiotic recombination and next generation gene sequencing. Through the lens of bioinformatics, we will construct high density linkage maps for five different populations of the western honeybee, *Apis mellifera.* We will study the implications intraspecific variation in rates of recombination.

7.3 Student Authored Articles and Presentations (UNCG students in bold)

Articles

Nguyen, A., **Saini, J.**, Rowell, J., and Rychtář, J., Cooperation in finite populations: being alone helps, accepted in the *Journal of Interdisciplinary Mathematics*.

Suarez, D., Suthaharan, P., Rowell, J., and Rychtář, J., Evolution of cooperation in mobile populations, *SPORA – A Journal of Biomathematics*, Vol. 1, No. 2-7, 2015.

Sykes D. and Rychtář J., A game theoretic approach to valuating toxoplasmosis vaccination strategies, *Theoretical Population Biology*, Vol. 105, 33-38, 2015.

Ross, C., Rychtář, J., and Rueppell, O., A structured population model suggests that long life and post-reproductive life span promote the evolution of cooperation, *Journal of Theoretical Biology*, Vol. 369, 85–94, 2015.

Presentations

- **Emily Nance:** *Statistical comparison of student and preceptors perceptions in an emergency nursing academy*, UTK Undergraduate Math Conference, April 16, 2015.
- **Emily Nance:** *Analysis of perceptions of an emergency nursing academy*, UNCG-RMSC Conference, November 7, 2015.
- **David Suarez:** *Portfolio optimization with mixed Gaussian models*, UTK Undergraduate Math Conference in 2016 (Knoxville, TN), April 16, 2016.
- **David Suarez,** Praveen Suthaharan, Jonathan Rowell, and Jan Rychtář**:** *Evolution of cooperation in mobile populations*, International Conference of Undergraduate Research, September 29, 2015.
- **David Suarez:** *Portfolio optimization with mixed Gaussian models*, 14th Annual Summer Undergraduate Research Symposium (Raleigh, NC), July 29, 2015.
- **Ivanti Galloway**, Charles Allee, Jonathan Rowell, and Jan Rychtář: *The effects of mutation levels on the evolution of cooperation*, UNCG-RMSC conference, November 7, 2015.

- **Ivanti Galloway,** Charles Allee, Jonathan Rowell, and Jan Rychtář: *Evolution of cooperation*, The 7th Annual Undergraduate Research Conference at the Interface of Biology and Mathematics, November 21-22, 2015. Knoxville, TN.
- **Ivanti Galloway,** Charles Allee, Jonathan Rowell, and Jan Rychtář: *Evolution of cooperation*, International Conference of Undergraduate Research, September 29, 2015.
- **Ivanti Galloway,** Charles Allee, Jonathan Rowell, and Jan Rychtář: *Evolution of cooperation*, Joint UNCG NCA&T REUs minisymposium, UNCG, July 17, 2015.
- **Ivanti Galloway,** Charles Allee, Jonathan Rowell, and Jan Rychtář: *Evolution of cooperation*, Joint REUs minisymposium, Winthrop University, July 10, 2015.
- **Ivanti Galloway,** Charles Allee, Jonathan Rowell, and Jan Rychtář: *Evolution of cooperation*, Joint REUs minisymposium, NC State University, June 24, 2015.
- **Ivanti Galloway,** Charles Allee, Jonathan Rowell, and Jan Rychtář: *Evolution of cooperation*, Math biology minisymposium, Duke University, June 18, 2015.
- **Jay Saini**, Anh Ngueyn, Jonathan Rowell, and Jan Rychtář: *Cooperation in finite populations*: Being Alone Helps, UNCG-RMSC conference, November 7, 2015.
- **Jay Saini**, Anh Ngueyn, Jonathan Rowell, and Jan Rychtář: *Evolutionary games on graphs*, International Conference of Undergraduate Research, September 29, 2015.
- **Jay Saini**, Anh Ngueyn, Jonathan Rowell, and Jan Rychtář: *Evolutionary games on graphs*, Joint REUs minisymposium, Joint UNCG NCA&T REUs minisymposium, UNCG, July 17, 2015.
- **Jay Saini**, Anh Ngueyn, Jonathan Rowell, and Jan Rychtář: *Evolutionary games on graphs*, Joint REUs minisymposium, Winthrop University, July 10, 2015.
- **Jay Saini**, Anh Ngueyn, Jonathan Rowell, and Jan Rychtář: *Evolutionary games on graphs*, Joint REUs minisymposium, NC State University, June 24, 2015.
- **Jay Saini**, Anh Ngueyn, Jonathan Rowell, and Jan Rychtář: *Evolutionary games on graphs*, Math biology minisymposium, Duke University, June 18, 2015.

8. Graduate Program

Greg Bell, Director of Graduate Studies

8.1 Year in Review

- New courses
- Graduate Teas
- Course Schedules
- Professional Development
- 799 policy, exam policy changes

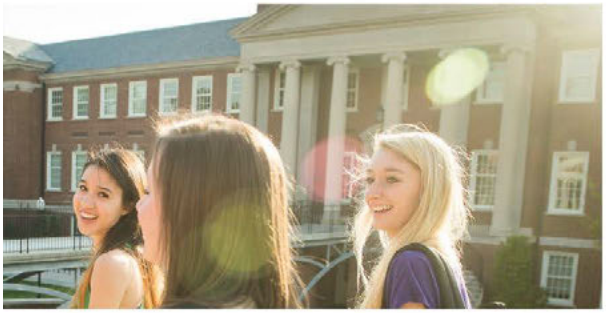
Our graduate students and the graduate committee were very active in the 2015-16 academic year. Our Graduate Teaching Assistants taught some 29 sections of mathematics and statistics courses comprising 4521 student credit hours. Our graduate students delivered 14 conference talks and coauthored 15 papers that were submitted, accepted for publication, or appeared in refereed journals in the discipline. Eight M.A. students graduated.

The graduate committee established two new concentrations in the M.A. program, established a new 700-level sequence in differential equations, and a new 600-level teaching practicum course. The committee also changed the qualifying exam and preliminary exam structure to a system that better aligns with the Graduate School's general Ph.D. expectations. A regular schedule of MAT courses will be offered from 2016-17 on and the college has changed the way that Ph.D. candidates are funded in a way that makes it much easier to fund students to completion of the Ph.D. degree.

Computational Mathematics Ph.D. Program

Departmental Areas of research include:

- Combinatorics
- Differential Equations
- Functional Analysis
- Group Theory
- Mathematical Biology
- Number Theory
- Numerical Analysis
- Statistics
- Topology



For more information, go to
www.uncg.edu/mat

THE UNIVERSITY of NORTH CAROLINA
GREENSBORO
Department of
Mathematics & Statistics

Graduate Assistantship
Academic Year:
$18,000+tuition waivers.
Summer support is also
often available.

Ph.D. Degrees Awarded To Date

In 2016, we have not had any new Ph.D. graduates. We expect to have 7 Ph.D. students graduate in the 2016-17 academic year.

In August 2014, Abraham Abebe was awarded the first Ph.D. in Computational Mathematics at UNCG. Abraham worked under the supervision of Maya Chhetri. His dissertation was titled *Positive solutions of nonlinear elliptic boundary value problems.* His dissertation focuses on the study of positive steady states to classes of nonlinear reaction diffusion (elliptic) systems on bounded domains as well as on exterior domains with Dirichlet boundary conditions. He studied such systems in the challenging case when the reaction terms are negative at the origin – so-called semipositone problems. He established several results that directly contribute to and enhance the literature on semipositone problems, including existence, non-existence, and multiplicity results for classes of superlinear and sublinear systems. His results were established via the method of sub-super solutions, degree theory arguments, *a priori* bounds, and energy analysis. Abraham works as a non-tenure track assistant professor at Temple University in Philadelphia, PA.

Abraham Abebe with his advisor, Maya Chhetri

In December 2014, Danielle Moran was awarded a Ph.D. in Computational Mathematics. Dani worked under the supervision of Greg Bell. Her dissertation was titled *Permanence results for dimension-theoretic coarse notions.* Her dissertation focused on an area of mathematics known as coarse topology. Coarse topology is the study of interesting topological properties of discrete spaces. She focuses on a coarse analog of dimension and several generalizations of it. After extending the class of metric spaces for which these properties are known, she generalizes these properties to all coarse spaces and explores the relationships between these generalized notions. Finally, she gives a brief discussion of computational topology, highlighting how to generate the Rips and Čech simplicial complexes from a set of data and provides code written to generate these complexes in Sage. Dani is currently a tenure-track assistant professor at Guilford College in Greensboro, NC.

Danielle Moran, with her advisor, Greg Bell

Brian Sinclair was awarded his Ph.D. in Computational Mathematics in May 2015. He worked under the supervision of Sebastian Pauli on his dissertation titled *Algorithms for enumerating invariants and extensions of local fields.* His work concerns the classification of field extensions and the decomposition of global ideals. The main goal of his work is to present efficient algorithms, leveraging the Newton polygons and residual polynomials, to solve many of these problems faster and more efficiently than present methods. Considering additional invariants, he extends Krasner's mass formula, dramatically improves general extension enumeration using the reduced Eisenstein polynomials of Monge, and provides a detailed account of algorithms that compute Okutsu invariants using the lens of partitioning the set of zeros of polynomials. Brian currently works for the Bureau of Labor Statistics.

Brian Sinclair with his advisor, Sebastian Pauli

MA Degrees Conferred in Academic Year 2015-16

- David Barron, August 2015, Mathematics
- Christopher Langewisch, May 2016, Applied Statistics
- Austin Lawson, May 2016, Mathematics
- Bin Luo, May 2016, Applied Statistics
- Joshua Martin, August 2016, Mathematics
- Nicholas Stewart, May 2016, Applied Statistics
- Arpad Szarka, May 2016, Applied Statistics
- Qi Zhang, August 2016, Applied Statistics

THE UNIVERSITY of NORTH CAROLINA
GREENSBORO
Department of
Mathematics & Statistics

UNCG offers an MA in Mathematics with concentrations in

- Mathematics
- Applied Statistics
- Actuarial Mathematics
- Data Analytics

Graduate Assistantship
Academic Year:

$10,800+tuition waivers.

Summer support is also often available.

For more information, go to
www.uncg.edu/mat


M.A. Graduate, Austin Lawson, with his mother and Greg Bell


M.A. Graduate, Arpad Szarka, with Syngenta colleagues and Greg Bell

Graduate Student Research

Research Papers Appearing in AY 2015-16 (Graduate students' names in bold).

- R. Dhanya, **Q. Morris**, and R. Shivaji, Existence of positive radial solutions for superlinear, semipositone problems on the exterior of a ball, *Journal of Mathematical Analysis and Applications,* Vol 434.2 (2016), 1533-1548.
- **Catherine Payne** and Jerry Vaughan, Fibers of continuous real-valued functions on ψ-spaces, *Topology Appl,* Vol. 195 (2015), 256-264.
- M. Budden and **A. Rapp,** Constructing r-uniform hypergraphs with restricted clique numbers, *The North Carolina Journal of Mathematics and Statistics*, Vol. 1 (2015), 30-34.
- M. Budden, J. Hiller and **A. Rapp**, Generalized Ramsey theorems for r-uniform hypergraphs, *Australasian Journal of Combinatorics,* Vol. 63 (2015), 142-152.

- **James Rudzinski** and Clifford Smyth, Equivalent formulations of the bunk bed conjecture, *The North Carolina Journal of Mathematics and Statistics*, Vol 2 (2016).
- **J. S. Sihm**, A. Chhabra and S.N. Gupta, An optional unrelated question RRT model*, Involve, A Journal of Mathematics*, Vol. 9 (2016), No. 2, 195—209.
- **J. S. Sihm** and S.N. Gupta, A two-stage binary optional randomized response model*, Commun. Stat. Simul. Comp.* Vol. 44 (2015), No. 9, 2278—2296.
- Eun Kyoung Lee, R. Shivaji and **Byungjae Son,** Positive radial solutions to classes of singular problems on the exterior domain of a ball, *Journal of Mathematical Analysis and Application*, Vol. 434 (2016), No. 2, 1597 -1611.

Papers Submitted or Accepted for publication

- Chad Awtrey, **Jonathan Milstead**, and Sebastian Pauli, Computing Galois groups of Eisenstein polynomials over p-adic fields, submitted.
- **Q. Morris**, R. Shivaji, and I. Sim, Existence of positive radial solutions for a superlinear p-Laplacian problem on the exterior of a ball, *Proceedings of the Royal Society of Edinburgh Section A.*, submitted.
- Richard Fabiano and **Catherine Payne**, A semidiscrete approximation scheme for linear neutral delay-differential equations which preserves adjoint convergence, submitted.
- M. Budden, J. Hiller, and **A. Rapp**, Hypergraph Ramsey Numbers Involving Paths, *Electronic Journal of Combinatorics*.
- R. Shivaji and **Byungjae Son**. Bifurcation and multiplicity results for classes of p, q-Laplacian systems, accepted in *Topological Methods in Nonlinear Analysis*.
- Maya Chhetri, Lakshmi Sankar, R. Shivaji and **Byungjae Son,** An existence result for superlinear semipositone p-Laplacian systems on the exterior of a ball, submitted.
- R. Shivaji, Inbo Sim and **Byungjae Son,** A uniqueness result for a semipositone p-Laplacian problem on the exterior of a ball, submitted.
- **Zatezalo Tanja**, Sat Gupta, Subhash Kumar Yaday, and Jadid Shabbir, Assessing the adequacy of the first order approximations in ratio type estimators, accepted in *Journal of Interdisciplinary Mathematics.*

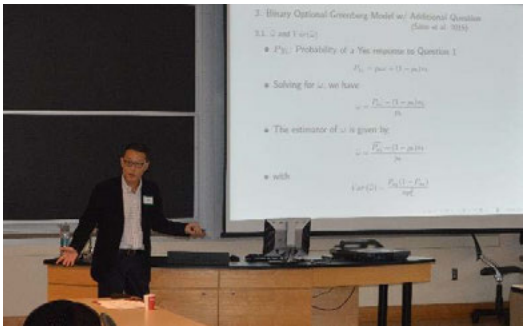
Student Presentations (Presenters' names asterisked.)

- **Jeff Lail*,** Angie Larsen, and Scott Richter, *Model II regression coefficient confidence intervals*, The 11th Annual UNCG Regional Mathematics and Statistics Conference, University of North Carolina at Greensboro, November 2015.
- Greg Bell, **Austin Lawson***, **Joshua Martin**, **James Rudzinsk**i, and Clifford Smyth, *Stability for multiparameter persistence*, The 11th Annual UNCG Regional Mathematics and Statistics Conference, University of North Carolina at Greensboro, November 2015.
- **Bin Luo*** and Xiaoli Gao, *Robust variable selection using penalized adaptive weighted least squares regression*, The 11th Annual UNCG Regional Mathematics and Statistics Conference, University of North Carolina at Greensboro, November 2015.

- Greg Bell, **Austin Lawson**, **Joshua Martin***, **James Rudzinsk**i, and Clifford Smyth, *A Vietoris-Rips Lemma for multiparameter persistence*, The 11th Annual UNCG Regional Mathematics and Statistics Conference, University of North Carolina at Greensboro, November 2015.
- R. Dhanya, **Q. Morris***, and R. Shivaji, *Positive radial solutions for superlinear, semipositone problems on the exterior of a ball*, The 35th Southeastern Atlantic Regional Conference on Differential Equations, University of North Carolina at Greensboro, October 2015.

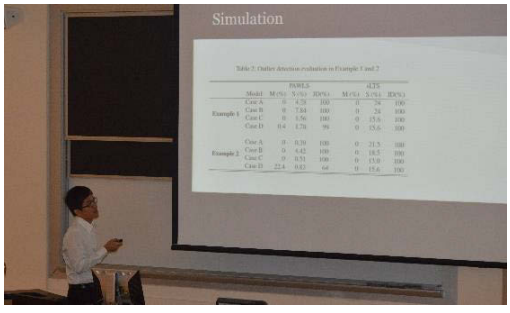
Austin Lawson presenting at the 11th Annual RMSC

- R. Dhanya, **Q. Morris***, and R. Shivaji, *Positive radial solutions for superlinear, semipositone problems on the exterior of a ball*, 2016 Joint Mathematics Meeting, Washington State Convention Center, January 2016.
- Richard Fabiano and **Catherine Payne***, *Stability conditions for linear neutral delay differential equations*, 2016 Joint Mathematics Meeting, Washington State Convention Center, January 2016.
- Richard Fabiano and **Catherine Payne***, *Stability conditions for linear neutral delay differential equations*, The 11th Annual UNCG Regional Mathematics and Statistics Conference, University of North Carolina at Greensboro, November 2015.



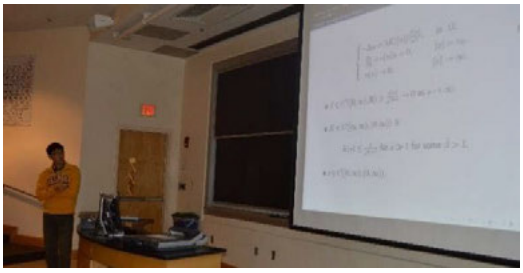
Jeong Sep Sihm presenting at the 11th Annual RMSC

- Sat Gupta and **Jeong Sep Sihm***, *A modified binary optional randomized response technique model*, The 11th Annual UNCG Regional Mathematics and Statistics Conference, University of North Carolina at Greensboro, November 2015.
- Eun Kyoung Lee, Ratnasingham Shivaji, and **Byungjae Son***, *Positive radial solutions to classes of singular problems on the exterior domain of a ball,* The 35th Southeastern Atlantic Regional Conference on Differential Equations, University of North Carolina at Greensboro, October 2015.
- Eun Kyoung Lee, Ratnasingham Shivaji, and **Byungjae Son***, *Positive radial solutions to classes of singular problems on the exterior domain of a ball*, The 11th Annual UNCG Regional Mathematics and Statistics Conference, University of North Carolina at Greensboro, November 2015.



Bin Luo presenting at the 11th Annual RMSC

- Eun Kyoung Lee, Ratnasingham Shivaji, and **Byungjae Son***, *Positive radial solutions to classes of singular problems on the exterior domain of a ball*, 2016 Joint Mathematics Meeting, Washington State Convention Center, January 2016.
- **A. Szarka***, C. Hayworth, W. Anderson, and R. Joseph, *Comparison of Pesticide Data Program and Registrant Generated Residue Data*, International Society of Exposure Science, Henderson, NV, October 2015.
- **Zatezalo Tanja***, Sat Gupta, Subhash Kumar Yaday, and Jadid Shabbir, *Assessing the adequacy of the First Oder Approximation*, The 11th Annual UNCG Regional Mathematics and Statistics Conference, University of North Carolina at Greensboro, November 2015.



Byungjae Son presenting at the 11th Annual RMSC

Conferences Attended by our Graduate Students

The following graduate students attended conferences without giving presentations.

- The 11th Annual UNCG Regional Mathematics and Statistics Conference, University of North Carolina at Greensboro, November 2015. Attended by **Victoria Hayes, Elliott Hollifield, Jonathan Milstead, and Sandi Rudzinski.**
- 6th Symposium on Analysis and PDEs, Purdue University, June 2015. Attended by **Byungjae Son.**
- 2015 PI Summer Graduate Program, University of Maryland, July 2015. Attended by **Byungjae Son.**
- Mathematical Modeling in Industry Workshop, University of Minnesota, August 2015. Attended by **Byungjae Son.**
- Nonlinear PDEs, Numerical Analysis, and Applications, University of Pittsburgh, October 2015. Attended by **Byungjae Son.**
- 46th Annual John H. Barrett Memorial Lectures, University of Tennessee, May 2016. Attended by **Quinn Morris, Catherine Payne, and Byungjae Son.**
- NIMBios investigative workshop, Game Theoretical Modeling of Evolution, April 2016. Attended by **Micheal Leshowitz.**
- The 35th Southeastern Atlantic Regional Conference on Differential Equations, University of North Carolina at Greensboro, October 2015. Attended by **Elliott Hollifield.**
- Triangle Lectures in Combinatorics (Duke 10/3/15; UNCG 2/27/2016). Attended by **Sandi Rudzinski.**

Awards

- **Bin Luo and Joshua Martin** were two of three winners of the Graduate Student division of the Outstanding Presentation award at the 11th Annual UNCG Regional Mathematics and Statistics Conference.

8.2 New M.A. Concentrations

Actuarial Mathematics

Actuaries are business professionals who specialize in risk management and understanding the financial consequences of uncertain events on individuals, companies, and governments. This career requires cross-disciplinary training in mathematics, statistics, economics, finance, and other quantitative fields.

Actuary has been consistently ranked as one of the best career choices in the US. In 2015, according to Business Insider, actuary was ranked as the #1 job in America in terms of income, outlook, environmental factors, stress, and physical demands, with an annual entry salary of $45,000 - $55,000 and an annual mid-level salary of $94,209. Salary increment is based on one's experience and actuarial exams passed. Students who have passed one or two actuarial exams can easily get summer internships and job offers after graduation. Upon employment, many companies will generally provide support for employees to pass additional actuarial exams, and necessary study time during the workday.

WANT TO BE AN ACTUARY?

INTERESTED?

- Get started with our Masters with a Concentration in Actuarial Mathematics
- Manage risk with a combination of business expertise, analytical skills, and knowledge of human behavior

WHO CAN APPLY?

- Bachelors in mathematics, statistics, computer science, business, finance, or other quantitative fields
- Students interested in pursuing a career as an actuary and preparing for actuarial exams

#1
Best Jobs of 2015
-Business Insider
http://www.businessinsider.com/best-jobs-of-2015-2015-4

High-demand professional opportunities with competitive salary in insurance/reinsurance companies, consulting firms, and government

For more information, go to
uncg.edu/mat
uncg.edu/mat/grad/actuarial

THE UNIVERSITY of NORTH CAROLINA
GREENSBORO
Department of
Mathematics & Statistics

To become an actuary, one must pass a series of exams administered by either the SOA or the CAS actuarial societies. The Actuarial Mathematics concentration within the Master's program in the Department of Mathematics and Statistics at UNCG prepares students to acquire the knowledge to pass the initial actuarial exams and to pursue a career as an actuary. In addition to providing students with a solid foundation in applied probability and statistical models, as well as their applications in the area of actuarial science, we have designated courses that cover the topics and materials for the first few actuarial exams. In particular, we offer actuarial exam preparation seminars to help students pass the initial exams.

The Actuarial Math concentration at UNCG requires a minimum of 30 hours including an optional 3-credit project. Applicants to the program are expected to have taken courses in multivariable calculus, linear algebra, statistics, and economics, and finance.

Data Analytics

A data analyst or data scientist is a professional who conducts data analysis and interprets results for data users. Data analysts use a variety of data analysis tools to analyze large amounts of raw and unstructured data with the intent to find useful information in it. One needs advanced data analysis training when handling big data from sources such as social media, healthcare industry, internet traffic, and genetics.

Data is the new frontier of the 21st century. Big Data is everywhere and there is an urgent need to collect, store, and examine whatever data are being generated. This has made data analytics a hot area with experts commanding very attractive salaries. CNBC.com comments that Data Analytics is the sexiest job of the 21st century. Edureka also lists 10 reasons why big data analytics is the best career move in 2015 with the top three reasons being 1) Soaring Demand for Analytics Professionals, 2) Huge Job Opportunities & Meeting the Skill Gap, and 3) Salary.

Data analysts typically have to deal with collection, storage, organization, and analysis of data followed by reporting of the results. Most data analytics jobs require a master's degree in mathematics, statistics, computer science, information management, finance or economics with a heavy emphasis on statistical and analytical skills.

The Data Analytics concentration within the Master's program in the Department of Mathematics and Statistics at UNCG prepares students with the skills required to pursue a career as a data analyst in the big data world. In addition to providing students with a solid foundation in applied statistical models as well as their real applications, the program offers

WANT TO BECOME AN EXPERT IN DATA ANALYTICS?

Get started with our Masters with a Concentration in Data Analytics

One of the Best Jobs of 2015

-Business Insider

http://www.businessinsider.com/best-jobs-of-2015-2015-4

WHO CAN APPLY?

- Bachelors in mathematics, statistics, computer sciences, or other quantitative fields
- Students interested in pursuing a career in data analytics

High-demand professional opportunities with competitive salary in finance, social networking, health sciences, auto industry, sports, and government

For more information, go to
uncg.edu/mat
uncg.edu/mat/grad/data-analytics

THE UNIVERSITY of NORTH CAROLINA
GREENSBORO
Department of
Mathematics & Statistics

specialized courses that help students handle complex big data. The program also offers opportunities to take courses from other Departments such as Computer Science, Economics, and Information Systems. We will encourage students in the program to seek internship opportunities with local entities in finance, social networking, auto industry, health sciences, sports, and government.

The Data Analytics concentration at UNCG requires a minimum of 30 hours including a project (3 hours) or thesis (6 hours) option. Applicants to the program are expected to have taken courses in multivariable calculus, linear algebra, and statistics.

8.3 New Courses

Three new courses were proposed and added to our regular course offerings in 2015-16.

MAT 603 is a Practicum in Teaching Mathematics. This 2-hour course pairs with the 1-hour MAT 601 Seminar in Teaching Mathematics course that is taken by our incoming graduate students. Unlike the seminar, the practicum will give new students hands-on experience in the classroom. Students will be matched with instructors of 100-level courses and will help the instructors to manage the course. It is hoped that by doing this, the new GTAs will be more comfortable in their own classes.

MAT 735 and MAT 736 comprise a new sequence in ordinary and partial differential equations. The courses cover fundamental topics in the theory such as existence and uniqueness, systems of linear, first order equations, nonlinear differential equations, stability theory, boundary value problems, linear partial differential equations, derivation of PDE models, elliptic equations and Green's functions, and PDEs of parabolic and hyperbolic type. This course is planned for students with an interest in writing a dissertation in a topic that uses differential equations.

8.4 Course Renumbering

In December of 2015, the Department proposed an overhaul to the course numbering system in MAT courses. The new numberings (at the 700 level) better reflect the intended audience for these courses, which is Ph.D. students. Moreover, all courses are numbered below 750 and, therefore, may be taken by M.A. students as well.

Course Name	Old Number(s)	New Number(s)	Course Name	Old Number(s)	New Number(s)
Numerical Mathematics	623, 624	723, 724	**General Topology**	697, 698	737, 738
Linear Algebra and Matrix Theory	647, 648	727, 728	**Modern Abstract Algebra**	691, 692	740, 741
Combinatorics	631	731	**Complex Analysis**	693, 694	743, 744
Graph Theory	632	732	**Real Analysis**	695, 696	745, 746
			Computational Algebra	671	748

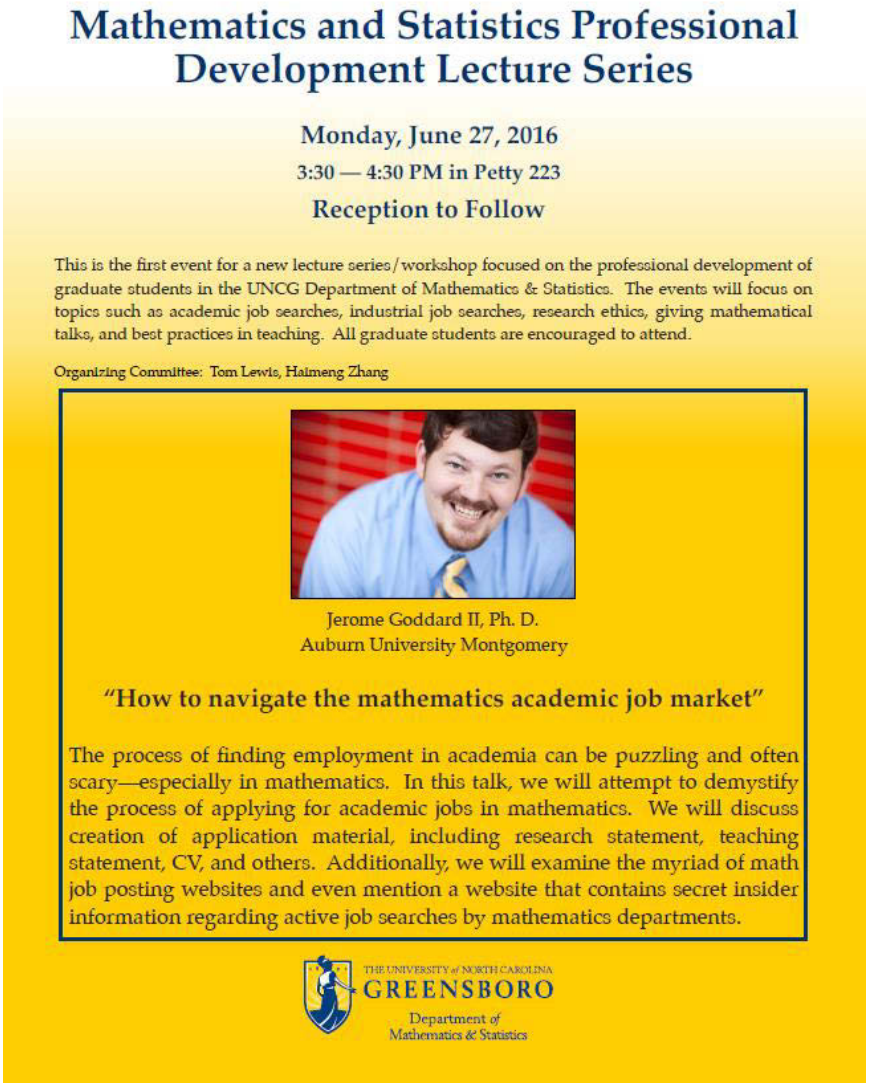
8.5 Graduate Teas

As in previous years, the Department hosted Graduate Teas this year. These informal gatherings serve as a place for faculty and students to get to know each other better while enjoying coffee, tea, and light snacks.

Graduate student response to these gatherings has been so positive that in the coming academic year we plan to have at least 3 such Graduate Teas per semester, on the final Monday of the month.

8.6 Professional Development Series

Beginning in June 2016, Tom Lewis and Haimeng Zhang are organizing a new Department lecture series focused on the professional development of graduate students in the Department. Events in this series will focus on topics such as academic job searches, industrial job searches, research ethics, giving mathematical talks, and best practices in teaching. In the Summer of 2016, Jerome Goddard II (Auburn University at Montgomery) presented a lecture on Navigating the Mathematics Academic Job Market. In the Fall of 2016, there will be two talks given by Omar Ali and Nadja Cech (UNCG) on the Art and Science of Teaching and Mentoring and Carol Seaman (UNCG) on Collaborating on Research, Grant Writing, and Instruction in STEM Education.



8.7 New Policies (799, course offerings)

Several new policies were introduced in 2015-16. These are described below.

Qualifying and Preliminary Exams

This year we changed the exam structure for students in our Ph.D. in Computational Mathematics program. We now have a two-tier exam structure. Qualifying exams are given in May and January and are based on the content of Mathematical Analysis, Linear Algebra, and Matrix Theory or Mathematical Statistics. All Ph.D. students must attempt at least one exam by the end of their first year; students must pass two exams prior to the start of their fifth semester.

The Preliminary Exam is held in two parts: written and oral. The exam is constructed by a committee appointed by the graduate director in consultation with the student's advisor. It covers material from at least three courses that are not included in the Qualifying Exams. Students will have at most two attempts to pass their Preliminary Exam. Students must have unanimous support of the exam committee to earn a pass on the exam.

MAT 799 and Candidacy

Although full-time graduate status is defined by taking at least 9 hours per semester, the graduate school has recently instituted a policy whereby students will be considered to be full time if they are Ph.D. candidates (i.e. have completed all requirements except the dissertation) and provided they are taking at least 3 hours of dissertation (MAT 799) that appears on their plan of study. To give students maximum flexibility, the Department will require that eligible funded students enroll in exactly 3 hours of MAT 799 as soon as possible.

Regular Course Offerings

In an effort to facilitate degree planning, we will begin to offer the following MAT courses on a two-year cycle. It will be possible for students to take a full-time 9-hour load each year for their first three years without repeating any courses. Moreover, after those three years, they can complete their Preliminary Exam, enter candidacy and take MAT 799 until they complete the dissertation.

2016-2017		2017-2018	
Fall	Spring	Fall	Spring
MAT 595 Analysis	MAT 596 Analysis	MAT 595 Analysis	MAT 596 Analysis
MAT 601, 603 Teaching	MAT 602 Software	MAT 601, 603 Teaching	MAT 602 Software
MAT 727 Comp Linear Algebra	MAT 728 Linear Algebra	MAT 728 Linear Algebra	MAT 727 Comp Linear Algebra
MAT 737 General Topology	MAT 745 Measure Theory	MAT 740 Groups, Rings, Fields	MAT 7XX Number Theory
MAT 748 Computational Algebra	MAT 742 Computational Number Theory	MAT 709 Topics in Computational Mathematics	MAT 747 Computational Topology
MAT 735 Ordinary Differential Equations	MAT 736 Partial Differential Equations	MAT 723 Numerical Analysis	MAT 746 Functional Analysis

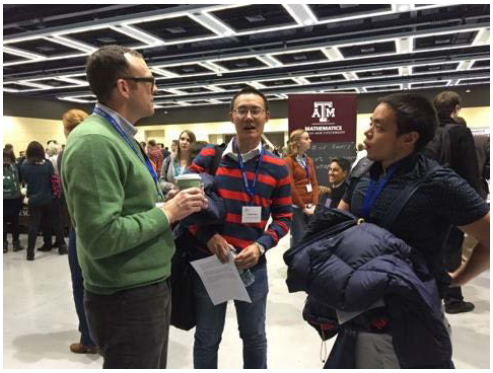
8.8 Graduate Recruitment

The Mathematics and Statistics Department has made significant efforts to recruit qualified graduate students.

The Department has a unique graduate program and small family-like atmosphere that becomes apparent at the various recruitment events that we attend. Students from smaller liberal arts colleges find our program especially attractive. These students are interested in teaching and typically have undergraduate research experiences. They would be an asset in the classroom as a TA and are well prepared for research. As such, we continue to aggressively recruit and fund such students. During the academic year 2015-16, we had an enrollment of 17 Ph.D. students, 13 M.A. students, and 2 Post-Baccalaureate Certificate in Statistics students.

Recruitment Efforts

Specific efforts were made to recruit students to our graduate programs and to advertise our new M.A. concentrations throughout the year. We continued our participation in recruitment fairs at both national and regional conferences such as the Joint Math Meetings, the Mathematical Association of America's Southeastern Sectional Meeting, and the National Institute for Mathematical and Biological Synthesis Undergraduate Research Conference.



Greg Bell at an AMS Recruitment event

Shivaji at an AMS Recruitment event

The Joint Math Meetings were attended by Greg Bell, Maya Chhetri, and Ratnasingham Shivaji in January 2016. This is the largest annual mathematics conference in the country and its graduate fair draws hundreds of potential graduate students. Faculty members included recruitment slides during invited talks that catered towards undergraduate and masters-level graduate students at Maryville College in east Tennessee, Winthrop University in South Carolina during their summer REU program, North Carolina A&T, and Wake Forest University. We have established new joint seminars with NC A&T and WFU as an effort to connect with local masters-level graduate students. We also presented recruitment information during our own summer REU program and to our math club. Lastly, informal recruiting through conversations, posters, and fliers was performed at the various conferences we held at UNCG including the AMS-SE Sectional meeting's banquet, SEARCDE 35, and the UNCG Regional Mathematics and Statistics Conference.

Tom Lewis at an AMS Recruitment event

Maya Chhetri at an AMS Recruitment event

Maya Chhetri and Thomas Lewis have begun work on a project to enhance recruitment efforts among North Carolina residents. To this end, they have drafted a letter

to be distributed to around 50 North Carolina schools that advertises our unique Department and its various graduate programs. Another draft of the letter to be sent to a shorter list of North Carolina schools volunteers our faculty to give a short research talk that will end with recruitment slides. The talks would be appropriate for math clubs and similar gatherings. Over time we can vary which schools we specifically visit to maximize the impact of our local recruiting efforts.

Our new concentrations in Data Analytics and Actuarial Mathematics are proving to be especially attractive to local students. We are currently reaching out to industries to promote our unique statistics programs with opportunities in data analytics. These efforts are being led by Sat Gupta and Haimeng Zhang. We have made all new promotional materials for the programs and are distributing them widely along with a recruitment letter for North Carolina schools. These posters have not only been sent to several academic institutions, but also to the industries in the region.

Beth Lewis at an AMS Recruitment event

In Spring 2016, Ratnasingham Shivaji made several recruitment visits. These visits were to Kennesaw State University in Georgia, the Indian Institute of Technology in Chennai-India, and The University of Sri Lanka in Paradeniya.

Shivaji on a recruitment visit in Sri Lanka, four of our new Ph.D students for Fall 2016 were recruited during this visit.

9. Funding Opportunities for Students

9.1 Departmental Scholarships

Thanks to our many generous donors, we are able to distribute thousands of dollars in math scholarships each year. Over $30,000 was disbursed in 2015-16. For more information, go to http://www.uncg.edu/mat/undergraduate/scholarship/.

- Helen Barton Scholarship
- Ione Holt Grogan Scholarship
- Vicky Langley Math Scholarship
- Judith L. Mendenhall Scholarship
- Mary D. Murray Scholarship in Mathematics
- Eldon E. and Christine J. Posey Mathematics Scholarship
- Cornelia Strong Scholarship
- Dr. Theresa Phillips Vaughan Math Scholarship
- Bertha Barnwell Vielhauer Endowed Scholarship

The 2015-16 scholarship recipients are listed below.

Helen Barton Scholarship: Bin Luo, Quinn Morris, Byungjae Son
Ione Holt Grogan Scholarship: David Suarez, AbaGayle Younts, Vicky Martin
Langley Math Scholarship: Jessica Nash, Jianhong Zhu
Judith L. Mendenhall Scholarship: Kristen Fisher, Ashley Jones, Joshua Safley
Mary D. Murray Scholarship in Mathematics: Austin Lawson, Joshua Martin
Eldon E. and Christine J. Posey Scholarship: Aaron Lee, Emily Nance
Cornelia Strong Scholarship: Bin Luo
Dr. Theresa Phillips Vaughan Math Scholarship: Bin Luo, Joshua Martin, Catherine Payne
Bertha Barnwell Vielhauer Endowed Scholarship: Kristen Fisher, Ashley Jones, Jessica Nash, David Suarez, Joshua Safley, AbaGayle Younts, Jianhong Zhu

9.2 Undergraduate Research Awards

The Department of Mathematics and Statistics offers Undergraduate Research Awards to undergraduate students who contributed to a research program of a Mathematics and Statistics faculty member. The award is a $500 stipend that can be earned multiple times for clearly defined projects. This opportunity is currently supported by the Helen Barton Excellence Professorship funds.

9.3 Graduate Assistantships

Many of our graduate students work as Graduate Teaching Assistants. Their duties include one or a combination of the following: teaching lower level mathematics or statistics courses, tutoring in the Math Help Center, or monitoring the Math Emporium Lab.

Graduate Assistantship levels:

TA Quinn Morris lecturing

• $10,800+tuition waivers for the M.A. in Mathematics (Mathematics/Applied Statistics Concentration)

• $18,000+tuition waivers for the Ph.D. program in Computational Mathematics

For the 2015−16 academic year, we funded thirteen full-time Ph.D. students and seven full-time M.A. students through Graduate Assistantships. We also provided partial funding to one student in computer science.

Math Emporium

TA Catherine Payne lecturing at the Math Emporium

2015-16 Graduate Teaching Assistants

Ph.D. Students		M.A. Students	
Wei Chen	Catherine Payne	Bukola Adaramola (Spring)	Austin Lawson
Nalin Fonseka	James Rudzinski	Monika Goel (Spring)	Michael Leshowitz
Charith Elson	Jeong Sep Sihm	Victoria Hayes	Bin Luo
Elliot Hollifield	Byungjae Son	Mingyan Li (Spring)	Joshua Martin
Aaron Rapp	Chris Vanlangenberg		Sandi Rudzinski
Jonathan Milstead			Tyler Wendell (CS)
Quinn Morris			Qi Zhang

9.4 Other Scholarships

- STAMPS (Science, Technology and Math Preparation Scholarships) awards of approximately $7000 per year in scholarship support to students who major in Biology, Chemistry & Biochemistry, Computer Science, Geographic Information Science & Earth Science, Mathematics & Statistics, or Physics & Astronomy.
- The College of Arts & Sciences UNCG Scholarships has several different scholarships for general arts and sciences. Many of these scholarships are available to undergraduate full-time students majoring in mathematics.

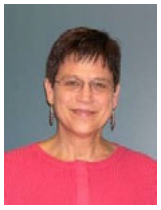
Research Experience in Statistics for Undergraduates (RESU) - Funded by UNCG Math/Stats Department

Program Description:
The program is designed to provide high-performing UNCG undergraduate students the opportunity to get involved in quantitative research. The program is open to all students irrespective of their major. However, interested students must have completed a course on statistical methodology equivalent to UNCG course STA 271 or higher. Transfer students will be evaluated on a case-by-case basis. Depending on student's background, the project may be computational in nature involving computer simulations to validate statistical models, or it can be an applied project involving modeling of some real life data. In some cases, it may even involve derivation of new theoretical results. Yet another possibility is for students to bring their own project from their home Department. In all cases, the work on the project is expected to lead to at least a poster presentation at some conference in the student's field of study. In some cases, the work will lead to a peer reviewed journal article.

The program will accept a maximum of 5 students in any semester. Some students may continue to work on the project for a maximum of one additional semester. The students in the program will be eligible for a small scholarship from the Department of Mathematics and Statistics if the research work leads to a peer-reviewed journal article, or a conference presentation (oral or poster). If a student continues the research work for an additional semester and the new work leads to an additional paper/presentation, the student will be eligible for additional scholarship.

Program Coordinator:
Sat Gupta, Professor of Statistics & Associate Head, Department of Mathematics and Statistics, UNCG. **The form and more details can be found at** http://www.uncg.edu/mat/urams.

10. Mathematics Education Program



Carol Seaman

Tracey Howell

The Mathematics Education Program is coordinated by the math education faculty, Dr. Carol E. Seaman, Associate Professor of Mathematics and Program Coordinator for Secondary Licensure in Mathematics and Dr. Tracey Howell, Academic Professional in Mathematics Education. They are responsible for teaching all courses that are specifically designated for undergraduate students seeking teaching licensure in mathematics, namely, MAT 330 (Axiomatic Foundations of Geometry), MAT 405 (Mathematics for Teaching and Teaching Mathematics I), MAT 406 (Mathematics for Teaching and Teaching Mathematics II), and MAT 465 (Student Teaching and Seminar – Secondary Mathematics). In addition, they teach the following 500-level courses for School of Education master's students in Mathematics Education: MAT 503 (Problem-Solving in Mathematics), MAT 513 (Historical Development of Mathematics), and MAT 520 (Non-Euclidean Geometry) for masters students and for mathematics majors.

In addition to the specific courses listed above, we also teach 100-level mathematics courses (Precalculus I and II, Calculus I) in which undergraduate students are first introduced to the learning of mathematics at the college level. In particular, Dr. Howell works within the Emporium Model (WLL courses), bringing her expertise in student-centered pedagogy and technology-mediated learning to the Precalculus series. Students enrolled in WLL courses are required to attend a 1-hour class meeting every week and to spend a minimum of 3 hours per week in our Math Emporium Lab working with online learning assignments. The goal of the weekly class meeting is to expand the students' understanding of selected course topics through problem solving, group work, and other pedagogical methods. During the 3-hour Math Emporium Lab, students complete online mathematics assignments. The Math Emporium Lab is facilitated by teaching assistants specifically trained to assist students enrolled in WLL courses.

Math Emporium Lab

Students seeking teaching licensure in secondary mathematics must complete all requirements for a B.A. in mathematics, including all general education and College of Arts and Sciences requirements, in addition to completing MAT 330, MAT 405, MAT 406, 12 hours of professional education coursework (in the School of Education), 100 hours of internship in local high schools, and a final semester of student teaching (MAT 465). Students must maintain a 3.0 overall GPA to

enter teacher education and also must maintain a 2.5 GPA in mathematics to qualify for student teaching. At the end of their program of study, students complete an electronic portfolio of licensure evidences (as specified by the state of North Carolina) and take the Praxis II in mathematics as part of their application to the state for a teaching license.

In addition to teaching mathematics courses for preservice and in-service teachers, they advise all undergraduate students in the B.A.-H.S. in mathematics major and all freshmen majoring in mathematics, participate in the Council of Program Coordinators (a School of Education initiative that administers all the professional requirements of the teacher preparation programs at UNCG). They write and administer grants related to mathematics education, lead Department efforts to recruit and retain mathematics majors, present professional development opportunities for teachers in local school districts, engage in scholarly research in undergraduate mathematics education, and make presentations about this research at national research conferences. In February 2016, they made presentations of our work at the national conference of the Research Council on Mathematics Learning in Orlando.

In addition to these activities within the Department, Dr. Seaman and Dr. Howell participate in the RISE (Research and Instruction in STEM Education) Network on campus and also in state and regional conferences that have a focus on mathematics education such as the Southeast Region of the MAA (MAA-SE), the North Carolina Council of Teachers of Mathematics (NCCTM), and the regional meetings of Project Kaleidoscope (NCPKAL). Dr. Howell and Dr. Seaman were co-conference chairs for the 2015 Annual Conference of NCCTM.

Tracey Howell with Math Major students

The Department supports several activities of the NCCTM that are designed for middle grades and secondary mathematics students within North Carolina. Every year we host the central region of the State Math Test at UNCG, providing local support for the event, including the help of our undergraduate pre-service teachers. Additionally, we participate in the State Math Fair held each year in Raleigh.

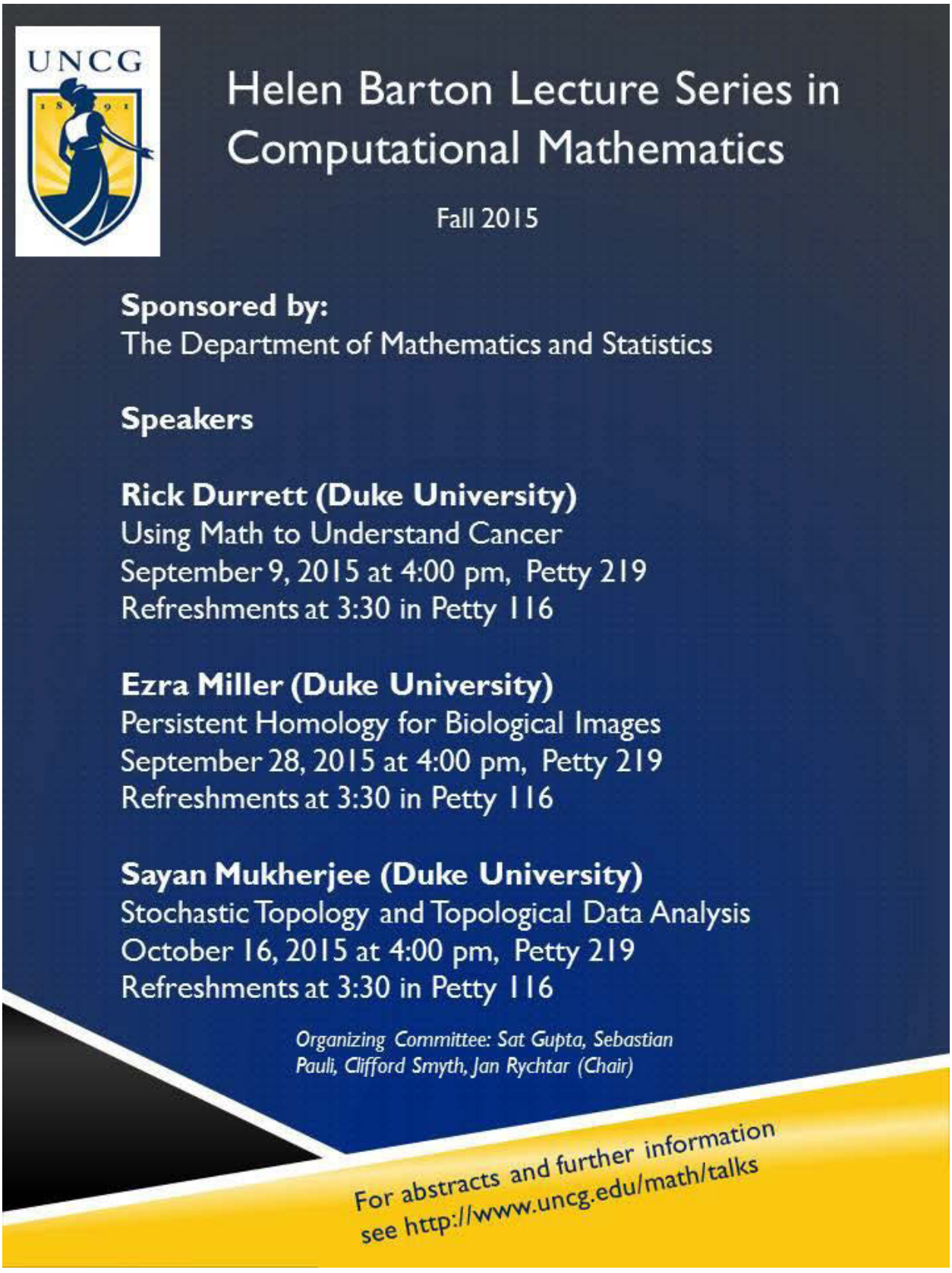
In the 2015-16 year, Dr. Seaman and Dr. Howell partnered with Dr. Holt Wilson of the Department of Teacher Education and Higher Education to write a grant proposal entitled CMaPSS: Core Mathematics Instructional Practices in Secondary Schools, which was funded through the NC Quest state grant program. In 2016-17, they will serve as mathematics consultants for the grant.

Senior B.A.-H.S. majors present findings from their student teaching experiences at the Triad Teacher Researcher Conference in April 2016.

11. Lecture Series, Colloquia, Seminars and Research Visitors

11.1 Helen Barton Lecture Series in Computational Mathematics

The Lecture Series in Computational Mathematics at UNCG has been organized by the Department of Mathematics and Statistics since Fall 2011. The target audience is graduate students and upper level undergraduate students as well as faculty members. Experts in their fields will cover a variety of topics in computational mathematics and computational statistics, as well as their applications in other disciplines. A particular aim of the lecture series is to spark interest in the newer trends in computational mathematics and its applications. The organizing committee of the lecture series consists of Sat Gupta, Sebastian Pauli, Jan Rychtář (chair), and Clifford Smyth.


UNCG
Helen Barton Lecture Series in Computational Mathematics
Fall 2015
Sponsored by:
The Department of Mathematics and Statistics
Speakers
Rick Durrett (Duke University)
Using Math to Understand Cancer
September 9, 2015 at 4:00 pm, Petty 219
Refreshments at 3:30 in Petty 116
Ezra Miller (Duke University)
Persistent Homology for Biological Images
September 28, 2015 at 4:00 pm, Petty 219
Refreshments at 3:30 in Petty 116
Sayan Mukherjee (Duke University)
Stochastic Topology and Topological Data Analysis
October 16, 2015 at 4:00 pm, Petty 219
Refreshments at 3:30 in Petty 116
Organizing Committee: Sat Gupta, Sebastian Pauli, Clifford Smyth, Jan Rychtar (Chair)
For abstracts and further information see http://www.uncg.edu/math/talks


UNCG
Helen Barton Lecture Series in Computational Mathematics
Spring 2016
Sponsored by The Department of Mathematics and Statistics
Speakers
John Voight (Dartmouth College)
Can you Hear the Shape of a Pinched Sphere?
February 17, 2016 at 4:00 pm, Petty 150
Refreshments at 3:30 in Petty 116
Hyeona Lim (Mississippi State University)
Image Processing Methods for Biomedical and Geoscience Applications
March 16, 2016 at 4:00 pm, Petty 150
Refreshments at 3:30 in Petty 116
John Stufken (Arizona State University)
Design of Experiments: From Small Data to Big Data
March 28, 2016 at 4:00 pm, Petty 150
Refreshments at 3:30 in Petty 116
Fadil Santosa (Institute for Mathematics and its Applications)
Magneto-acoustic Tomography -- Analysis and Algorithms
April 6, 2016 at 4:00 pm, Petty 150
Refreshments at 3:30 in Petty 116
Organizing Committee: Sat Gupta, Sebastian Pauli, Clifford Smyth, Jan Rychtar (Chair)
For abstracts and further information see http://www.uncg.edu/math/talks

11.2 Helen Barton Lecture Series in Mathematical Sciences

The Lecture Series in Mathematical Sciences at UNCG has been organized by the Department of Mathematics and Statistics since Spring 2012. The target audience is the same as in the Lecture Series in Computational Mathematics. This lecture series features a very distinguished mathematician who gives a series of three lectures on a topic in the mathematical sciences. The organizer for the lecture series is Maya Chhetri. Our Lecture Series in Mathematical Sciences originally scheduled for Spring 2016 was postponed. Our upcoming lecture series will be held in November, 2016 by Sujit Ghosh of North Carolina State University.

THE UNIVERSITY of NORTH CAROLINA GREENSBORO
Department of Mathematics & Statistics

Helen Barton Lecture Series in Mathematical Sciences

Dr. Sujit K. Ghosh

Professor of Statistics, North Carolina State University, Deputy Director, SAMSI

Professor Sujit Kumar Ghosh earned a Ph.D. in Statistics from University of Connecticut in 1996 and is currently a tenured full professor in the Department of Statistics at North Carolina State University (NCSU). He has over 20 years of experience in conducting, applying, evaluating and documenting statistical analysis of biomedical and environmental data. He has supervised over 33 doctoral graduate students and 5 post-doctoral fellows. He has also served as a statistical investigator and consultant for over 40 different research projects funded by various leading private industries and federal agencies (e.g., BAYER, CDC, GSK, MERCK, NIH, NISS, NSF, SAS, U.S.EPA, USDA-NASS etc.).

Professor Ghosh has published over 95 refereed journal articles in the area of biomedical, econometrics and environmental sciences and co-edited a popular book entitled "*Generalized Linear Models: A Bayesian Perspective*." He has given over 125 invited lectures and seminars at national and international meetings. He has also delivered several short courses and served as the visiting professor at leading institutions in various countries (e.g., Greece, India, Italy, Singapore, Thailand, and Turkey). Professor Ghosh's numerous honors include the International Indian Statistical Association (IISA) Young Investigator Award in 2008; election as a Fellow of the American Statistical Association (ASA) in 2009, and election as the President of the NC Chapter of ASA in 2013. Most recently he was awarded the Honorary Doctoral Degree in Statistics by Thammasat University (Thailand) in 2015 and elected president of IISA to begin his term in 2017.

Statistical Inference Subject to Shape Constraint

The statistical regression method is often used to explore the inherent relationships between several predictor variables and a response variable. In many practical settings, the predictors and the response are known to preserve certain shape restrictions (e.g., non-negativity, monotonicity, convexity and concavity etc.) but not necessarily based on a (known) parametric form. Some popular examples include the study of utility functions, cost functions, and profit functions in economics, the analysis of growth rates as a function of various environmental factors, the study of dose response curve in the phase I clinical trials, the estimation of the monotone hazard rates and the mean residual life functions in reliability and survival analysis, among others. Over the past decades, efforts have been devoted to search for a smooth and computationally efficient estimation method of a regression and density functions subject to a given set of shape constraints. The lecture series will provide: (i) an overview shape constraint regression and density estimation methods starting with simple linear models subject to linear inequality constraint and associated quadratic programming, (ii) nonparametric methods using Bernstein polynomial basis with single predictors and (iii) extensions to include multiple predictors. Various R packages to implement these methodologies will also be introduced with real data examples.

Lecture 1: *Introduction to Shape Constraint Statistical Methods*
Monday, November 14, 2016
Reception: Lounge, Petty 120, 3:30–4:00 PM
Lecture: Petty 136, 4:00 PM

Lecture 2: *Nonparametric Regression with Bernstein Polynomials*
Tuesday, November 15, 2016
Reception: Lounge, Petty 120, 3:30–4:00 PM
Lecture: Petty 224, 4:00 PM

Lecture 3: *Shape Constraint Regression with Multiple Predictors*
Wednesday, November 16, 2016
Reception: Lounge, Petty 120, 3:30–4:00 PM
Lecture: Petty 224, 4:00 PM

For more information, please see: http://www.uncg.edu/mat/talks/index.html or contact Dr. Maya Chhetri at maya@uncg.edu.

11.3 Joint JSNN and Department of Mathematics & Statistics Colloquia

UNCG's Department of Mathematics and Statistics and JSNN see the value in hosting a joint seminar/colloquium where the speaker can highlight the commonality within the units. Its purpose is to bring together faculty and students from both Departments and start a dialogue through the joint seminars which may lead to fruitful collaboration.

The Department of Mathematics and Statistics hosted the first joint colloquium in Spring 2016. We invited Professor Qi Wang of University of South Carolina (USC), who leads Nanoscale Theory, Modeling and Simulation Thrust at the Nanocenter at USC. JSNN is expected to host the next speaker in 2017.

11.4 Colloquia

Christopher Cashen	University of Vienna	9/23/2015	Random Groups, Generic Sets, and Fast Computations
Xiaoli Gao	UNCG	11/18/2015	Robust High-dimensional Data Analysis---Some Challenges and New Directions
Qi Wang	University of South Carolina	2/4/2016	Active Matter and Complex Biological Systems
Dan Yasaki	UNCG	4/13/2016	An Introduction to Modular Forms

11.5 External Seminar Speakers

Omar Rivasplata	University of Alberta	8/19/2015	Smallest Singular Value of Sparse Random Matrices
K.T. Arasu	Wright State University	9/3-9/5/2015	Partially Balanced Incomplete Block Designs and Cyclotomy
Rick Durrett	Duke University	9/9/2015	Using Math to Understand Cancer
Ezra Miller	Duke University	9/28/2015	Persistent Homology for Biological Images
Inbo Sim	University of Ulsan, Korea	10/5/2015, 10/26/2015, 11/9/2015	On p-Laplacian Problems with Strong Weight Function (3 Part Series)
Sayan Mukherjee	Duke University	11/6/2015	Stochastic Topology and Topological Data Analysis
Dewey Taylor	Virginia Commonwealth University	2/10/2016	Factoring Bipartite Graphs with Involutions
John Voight	Dartmouth College	2/17/2016	Can You Hear the Shape of a Pinched Sphere
Kai Zhang	UNC Chapel Hill	2/24/2016	Spherical Cap Packing Asymptotics and Rank-Extreme Detection
Hyeona Lim	Mississippi State University	3/15-3/17/2016	Image Processing Methods for Biomedical and Geoscience Applications

John Stufken	Arizona State University	3/26-3/28/2016	Design of Experiments: From Small Data to Big Data
Fadil Santosa	University of Minnesota, Institute for Mathematics and its Applications	4/5-4/7/2016	Magneto-Acoustic Tomography—Analysis and Algorithms
Kanishka Perera	Florida Institute of Technology	4/10-4/12/2016	N-Laplacian Problems with Critical Trudinger-Moser Nonlinearities
Gabor Hetyei	UNC at Chapel Hill	4/15/2016	Efron's nontransitive coins and semiacyclic tournaments
Chansook Park	NC A&T University	4/18/2016	Interaction of Multiple Respiratory Rhythm Generation Mechanisms
Vikram Kamat	Virginia Commonwealth University	4/20/2016	On Erdös--Ko--Rado Graphs
Kristin Doehler	Elon University	4/22/2016	A Randomization-Based Activity to Introduce ANOVA and review Sampling Distribution
Jerome Goddard II	Auburn University	6/26/2016	How to Navigate the Mathematics Academic Job Market

11.6 UNCG Seminar Speakers

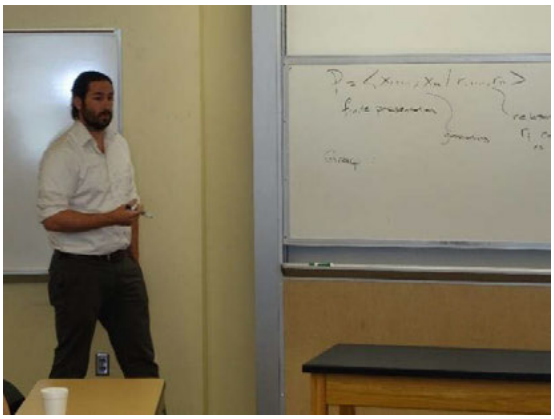
Jonathan Milstead	UNCG	9/16/2015	Computing Galois Groups
Ratnasingham Shivaji	UNCG	10/14/2015	Proving Uniqueness Results for Steady State Reaction Diffusion Equations - An Introduction
Xiaoli Gao	UNCG	11/5/2015	Robust High-dimensional Data Analysis---Some Challenges and New Directions
Tom Lewis	UNCG	2/8, 2/15, 2/22, 2/29/2016	The Finite Element Method

Ricky Farr	UNCG	4/11/2016	Overview of Methods of Fractional Calculus and its Relationship to the Hurwitz Zeta Function
Dan Yasaki	UNCG	4/13/2016	An Introduction to Modular Forms

11.7 Research Visitors

Research Visitor	Institution	Dates Visited	Host
Inbo Sim	University of Utah	7/15 –8/15/2015	Ratnasingham Shivaji
Suzanne Lenhart	University of Tennessee	7/16/2015	Maya Chhetri
Michal Johanis	Charles University Prague	7/23-8/5/2015	Jan Rychtář
Omar Rivasplata	University of Alberta	8/15/8/23/2015	Jan Rychtář
Christopher Cashen	University of Vienna	9/22-9/24/2015	Talia Fernós
Jaffar Ali Shahul Hameed	Florida Gulf Coast University	9/28-10/13/2015	Ratnasingham Shivaji
Pavel Drabek	University of West Bohemia, Czech Republic	10/5-10/15/2015	Ratnasingham Shivaji and Maya Chhetri
Petr Girg	University of West Bohemia, Czech Republic	12/5-12/21/2015	Maya Chhetri
Eunkyoung Lee	Pusan National University, South Korea	1/20-1/26/2016	Ratnasingham Shivaji
Peter Takac	University of Rostock, Germany	2/29-3/4/2016	Maya Chhetri
Mark Broom	City University London, UK	3/30-4/30/2016	Jan Rychtář
Karan Pattni	City University London, UK	3/30-5/30/2016	Jan Rychtář
Jerrold Griggs	University of South Carolina	6/27-6/28/2016	Cifford Smyth

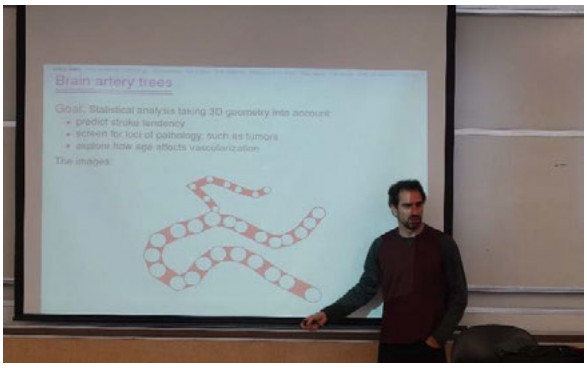
Some research visitors from the 2015-16 academic year



Christopher Cashen, University of Vienna

Qi Wang, University of South Carolina

Jerome Goddard II, Auburn University



Ezra Miller, Duke University

Kanishka Perera, Florida Institute of Technology

Fadil Santosa, University of Minnesota, Institute for Mathematics and its Applications

Hyeona Lim, Mississippi State University

Steve Robinson, Wake Forest University

John Voight, Dartmouth University

Vikram Kamat, Virginia Commonwealth University

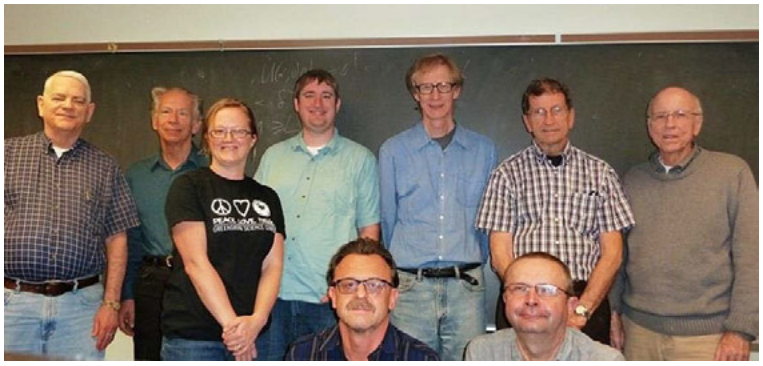
11.8 Carolina Topology Seminar

Jerry Vaughan, Organizer

The Carolina Topology Seminar is a research seminar devoted to topics in topology and its applications that are of interest to the participants. These topics currently include general topology, set-theoretic topology, set theory, and to a lesser extent, real analysis, complex Hilbert spaces and interactions between topology, logic and matroid theory. Presentations at the seminar include talks by invited visitors, talks on research by the participants, presentation of papers of interest to the seminar, and presentation of student work, including topics from Masters thesis and Ph.D. dissertations.

The seminar has proudly welcomed many distinguished guest speakers over the years. Speakers from the USA include Andreas Blass (Ann Arbor, MI) William Fleissner (Lawrence, KS), Paul Gartside (Pittsburgh, PA), Judy Roitman (Lawrence, KS), and Scott Williams (Buffalo, NY). International speakers include: A.V. Arhangelskii (Moscow), K.P. Hart (Delft), Istvan Juhasz, (Budapest), Jan van Mill (Amsterdam), Akihiro Okuyama (Kobe), Petr Simon (Prague), Paul Szeptycki (Toronto), Vladimir Tkachuk (Mexico City).

The origin of the seminar can be traced back to a series of mini-conferences that met once or twice a year mostly at UNC-Greensboro, but also at other universities and colleges in the Carolinas and Virginia, beginning around 1974. In the 1990's the mini-conferences were replaced by a series of special sessions at fall meetings of the Southeastern Section of the American Mathematical Society. In 2000 the seminar as currently constituted began meeting approximately every two weeks. Occasionally, photos of participants are posted on http://www.uncg.edu/~vaughanj/topseminar.html.



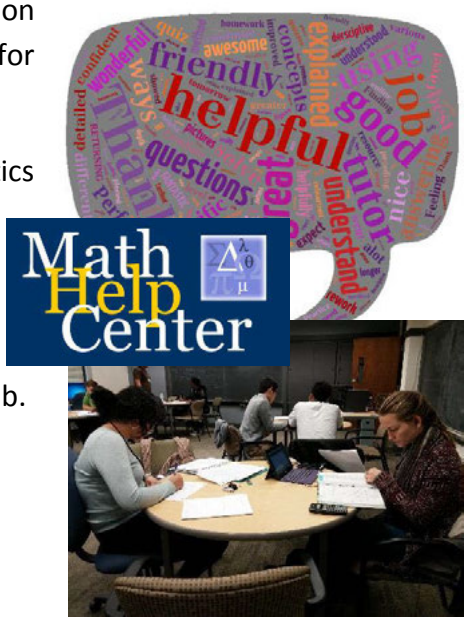
Jerry Vaughan with participants at the Carolina Topology Seminar meeting, May 7, 2016.

12. Service Profile

12.1 Math Help Center


Directors of Math Help Center: Maya Chhetri (through Summer 2016) and Tracey Howell (beginning Fall 2016)

The Math Help Center, located in Curry 210, provides services to UNCG students enrolled in 100-level MAT and STA courses as well as MAT 253, 292, 293, 310, 311, 390, 394 and STA 271/290. This is a free and walk-in service open Monday/Wednesday 9am-3pm and 5pm-7pm, Tuesday/Thursday 9am-7pm and Friday 9am-1pm. In addition to this tutoring service, MHC also arranges Review Sessions for 100-level courses upon the request of course coordinators.



The Director of MHC also hires undergraduate mathematics majors with math GPA higher than 3.0 to help instructors in grading, managing on-line materials, and proctoring exams for lower level courses. We also hire competent undergraduate math majors to become a TA at the Math Emporium Lab and they work alongside graduate TAs in the lab.

Fall 2015

- 12 Graduate Teaching Assistants tutored in the Math Help Center and some of them conducted review sessions before mid-term exams.
- 1892 student visits were recorded in the MHC.
- 15 undergraduate students helped instructors in their classes and with the Math Emporium lab.

Spring 2016

- 15.5 GTAs tutored in the Math Help Center and some of them conducted either weekly review sessions or before mid-term exams.
- 2200 student visits were recorded in the MHC.
- 12 undergraduate students helped instructors in their classes and with the Math Emporium lab.

Some reflections to plan for future

We no longer use a paper log-sheet to keep track of students' sign in and sign out. Each student is asked to sign in and sign out using their UNCG user name and enter their class information from the drop-down menu. They are able to leave feedback/comments/suggestions when they sign out including the experience they had with the tutor. One drawback to this system is that some students are not signing into the log sheet. The total number for Fall 2015 and Spring 2016 still appears too low compared to previous years even though anecdotal evidence suggests that the MHC service is utilized at least at the same level as previous years. A challenge for the incoming director will be to maintain an accurate record, without increasing costs.

Weekly Review Sessions for STA 108 and review sessions prior to mid-term exams for MAT 112 are well-attended. We plan to continue to offer these review sessions on a regular basis.

12.2 Math Emporium


Directors of Math Emporium: Maya Chhetri (through Summer 2016) and Tracey Howell (beginning Fall 2016)

In Fall 2013, ITS opened a new computer lab in 313 Graham Building. This is the largest teaching lab on campus with 60 client workstations. The lab is equipped with a SMART Podium (interactive pen display), a Mondopad (large touch tablet with videoconferencing capabilities), two SMART Boards (interactive white-boards), a Prometheum ActivBoard (an interactive whiteboard) and a Prometheum ActivExpression response system (a student response system that produces real-time results). (Taken from UNCG IT news). Math Emporium courses (WLL marker) get priority for lab reservations even though it is open to all students. Students in this course were always required to attend at least 3 hours of lab outside the meeting time with the instructor and we will continue to require that.

Math Emporium Lab

Fall 2015 – 352 students in MAT 115/150 (WLL) took the final exam.

Spring 2016 – 365 students in MAT 115/150/151 (WLL) took the final exam.

12.3 Statistical Consulting Center

Scott Richter, Director of Statistical Consulting Center

2015-16 Highlights

- Faculty and student consultants assisted researchers from many disciplines across campus, including: Biology, Chemistry and Biochemistry, Communication Sciences and Disorders, Computer Science, Genetic Counseling, Human Development and Family Studies, Information Systems, Media Studies, Nursing, Nutrition, Political Science, Psychology, Public Health Education and University Libraries.
- Faculty and student consultants assisted researchers affiliated with several off-campus entities, including Moses Cone Health System, Greensboro Police Department, Apex Analytics, University of Toronto, High Point University Pharmacy School, and Oklahoma State University School of Engineering.
- 18 students enrolled in STA 667 and worked with faculty consultants to complete graduate research projects.
- Six manuscripts appeared in 2015-16 stemming from SCC collaborations, and three others were submitted.
- Faculty consultants were involved as co-investigators in three interdisciplinary grant submissions to the National Institutes of Health, as well as on a continuing project, including the NIH-funded TRIAD 2 Center for Health Disparities Research, a collaborative effort involving the Schools of Nursing, Health and Human Sciences and College of Arts and Sciences, the Institute for Health, Science and Society; the Center for New North Carolinians at UNCG; and the Moses Cone Heart Center, the Guilford County School System and HealthServe Medical Clinic.

- The Quantitative Methodology Series (QMS), a joint effort between the SCC and the Office of Assessment, Evaluation and Research Services in the School of Education, offered 6 workshops, including 4 new workshops presented in the 2nd Annual Summer Workshop Series.

Quantitative Methodology Series
Summer 2016 - May 16 – 18, 2016
Co-Sponsored by: Statistical Consulting Center, Department of Mathematics and Statistics; Office of Assessment, Evaluation and Research Services, Department of Educational Research Methodology

Monday, May 16th
9:00 AM - 12:30 PM
Variable Selection in Low and High-dimensional Data Analysis
This workshop is designed to introduce tools and techniques of variable selection in linear regression modeling. We will begin with the basics of variable selection in low-dimensional linear regression, then introduce some techniques for variable selection in high-dimensional linear regression model, including

- What research questions one can answer using model selection
- When to use different types of variable selection techniques
- Model assumptions in high-dimensional data settings
- Implementation of variable selection in real data examples

Emphasis will be on practical issues to help researchers better apply variable selection techniques to help address their research questions and better understand and report their results.
Prerequisites: Regression Analysis workshop or similar background. A basic knowledge of simple and multiple linear regression is assumed.
Instructor: Dr. Xioali Gao,
UNCG Department of Mathematics and Statistics

1:30 PM - 5:00 PM
Introduction to SAS for Data Analysis
Introduction to using the SAS System for statistical analysis for those with little or no experience. Topics will include

- SAS environment
- Introduction to SAS syntax
- Getting data into SAS
- Data manipulation
- Creating summary statistics
- Simple plots
- Basic statistical analysis

Prerequisites: No previous experience using SAS is required.
Instructor: Dr. Scott Richter,
Department of Mathematics and Statistics and UNCG Statistical Consulting Center

Tuesday, May 17th
1:00 PM - 5:00 PM
Hierarchical Linear Modeling
The purpose of this workshop is to provide a gentle introduction to hierarchical linear modeling (HLM). Specifically, we will discuss four general types of research questions that can be answered and each of these translate to an HLM. The workshop will also discuss the use of the software HLM to estimate the model and how these results can be interpreted. Finally, we will discuss how an HLM can be used for growth modeling.

Prerequisites: Regression Analysis workshop or similar background. Individuals attending this workshop should have familiarity with basic inferential statistics and multiple regression.

Instructor: Dr. Robert Henson is Associate Professor in the Department of Educational Research Methodology

Wednesday, May 18
1:00 PM – 5:00 PM
Power and Sample Size for Research Studies

This workshop will provide an introduction to the meaning and logic of power in research studies, and determining sample size required to achieve desired power. We'll review what power means and how it relates to statistical tests, effect sizes, standard deviations, and sample size. Emphasis will be on the basic elements of a good power analysis, applicable to any analysis technique, and several illustrative examples for specific techniques will be presented.

Prerequisites: A working knowledge of basic statistical procedures, such as t-tests, analysis of variance and linear regression is assumed.
Instructor: Dr. Scott Richter, Department of Mathematics and Statistics and UNCG Statistical Consulting Center

For more information and to register, go to: https://workshops.uncg.edu

Goals for 2016-17

In addition to continuing active collaborations with researchers and UNCG and beyond, the SCC plans to continue developing offering regular QMS workshops. We will continue to expand and better organize the quantitative network on campus and help increase awareness of available statistical resources and further enhance quantitative research capabilities at UNCG. We also plan to increase involvement of graduate students in consulting activities.

12.4 State Math Contest

Tracey Howell at the 2016 State Math Contest

Tracey Howell, Organizer

The State Mathematics Contest is a problem-solving competition through which middle and high school students demonstrate their knowledge of more sophisticated and advanced mathematical concepts and ideas than are covered in traditional school curricula. The contest has been in existence for over 40 years in the state of North Carolina. During that time, over 100,000 students have taken part in the qualifying rounds and over 2,500 students have advanced to the state finals. Each year, the culmination of the contest is a final test that determines statewide winners. Currently, North Carolina is divided into three regions (Eastern, Central, and Western) and the final test is administered simultaneously at one site in each region.

On Thursday, April 28, 2016, the Department of Mathematics and Statistics hosted the Central Region State Mathematics Contest Finals. Sixty-two students from middle schools and high schools participated in one of three levels. Eighteen students competed in Level 1, 19 students competed in Level 2, and 25 students completed in Level 3. All students received a Certificate of Participation and the top 10 competitors in each level received trophies. Faculty from the Department along with several undergraduates assisted the students, their parents, and coaches throughout the day and helped to make the experience a rewarding and memorable one for the students.

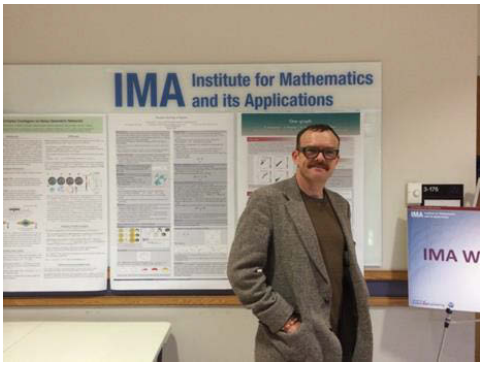
Some of the 2016 State Math Contest winners

13. Collaboration with the Institute for Mathematics and its Applications (IMA).

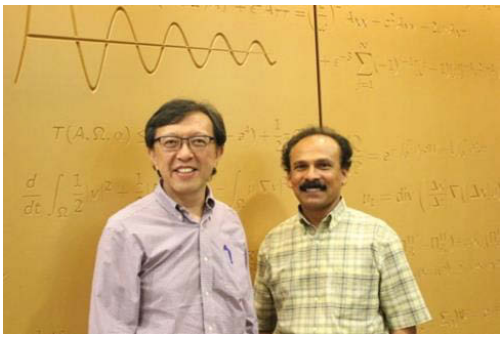
UNCG has been a participating institution member of the Institute for Mathematics and its Applications (IMA) at the University of Minnesota since January 2012. The IMA connects scientists, engineers, and mathematicians in order to address scientific and technological challenges in a collaborative, engaging environment, developing transformative, new mathematics and exploring its applications, while training the next generation of researchers and educators. Founded in 1982, it is an NSF-funded visitors' institute that has grown to become among the most influential math institutes in the world. Located on the University of Minnesota campus, it is one of eight NSF Mathematical Sciences Research Institutes. Our faculty and students have greatly benefited in participating in IMA events.
For more information, see the website http://www.ima.umn.edu.

Descriptions of faculty and students who have participated in IMA events this academic year.

IMA participants, including Ph.D. student Catherine Payne



Greg Bell at IMA



Dr. Fadil Santosa (Director of IMA) and Dr. Shan Suthaharan

Graduate student, Paula Hamby, at IMA event, *Career Options for Women in Mathematical Sciences.*

14. UNCG Math/Stat Conferences

14.1 UNCG Regional Mathematics and Statistics Conference – 2015

Narayanaswamy Balakrishnan presenting at the 2015 UNCG-RMSC

The Department is home to a prestigious NSF-supported annual student research conference called UNCG-RMSC. The conference is expanding every year and attracts bright student researchers.

The UNCG Regional Mathematics and Statistics Conference

Past Conference Highlights

Background & History

The UNCG Regional Mathematics and Statistics Conference started under the name UNCG–RUMC (The University of North Carolina at Greensboro Regional Undergraduate Mathematics Conference). The first edition of the conference took place in 2005 and we have run the conference each year since. The emphasis of the conference used to be on interdisciplinary mathematics with particular focus on mathematical biology. However, the topics of conference presentations by students were always open to all areas of research in the mathematical sciences, and recent conferences now include presentations by graduate students, as well as undergraduate students.

Conference in numbers

Year	Student presenters	Student attendees	Faculty	Schools represented
2005	12	23	12	5
2006	12	30	13	9
2007	15	36	14	9
2008	11	28	12	10
2009	20	44	21	12
2010	26	64	22	16
2011	48	132	30	27
2012	56	120	44	36
2013	57	115	42	35
2014	65	127	42	31
2015	49	128	41	35

Principal Speakers

Narayanaswamy Balakrishnan, *McMaster University*
Heejung Bang, *UC Davis*
Michael Dorff, *Brigham Young University*
Richard Fabiano, *UNCG*
Sujit Ghosh, *NC State University*
Jerome Goddard II, *Auburn University at Montgomery*
Katia Koelle, *Duke University*
Suzanne Lenhart, *University of Tennessee*
Laura Miller, *UNC Chapel Hill*
Jerry Reiter, *Duke University*
Stephen Robinson, *Wake Forest University*
Filip Saidak, *UNCG*
Jim Selgrade, *NC State University*
Laura Taalman, *MakerBot*
Simon Tavener, *Colorado State University*

Conference Funding

Funding and support for this conference series has been provided by the National Science Foundation, the Mathematical Association of America (MAA), Regional Undergraduate Mathematics Conferences program, the North Carolina Chapter of the American Statistical Association, the UNCG Department of Mathematics and Statistics, and the UNCG Office of Undergraduate Research.

Scientific Committee

Kristen Abernathy, Zachary Abernathy, Chad Awtrey, Maya Chhetri, Michael Dancs, Kumer Pial Das, Anda Gadidov, Jerome Goddard II, Sat Gupta, Elliot Krop, Hyunju Oh, Christopher Raridan, Jan Rychtář, Ratnasingham Shivaji, Shan Suthaharan, Irina Victorova

Background and history

The UNCG Regional Mathematics and Statistics Conference started under the name UNCG – RUMC (The University of North Carolina at Greensboro–Regional Undergraduate Mathematics Conference). The first edition of the conference took place in 2005 and we have run the conference each year since. The emphasis of the conference used to be on interdisciplinary mathematics with particular focus on mathematical biology; however, the topics of conference presentation by students were always open to all areas of research in mathematical sciences because the opportunity to listen to a wide variety of talks gives undergraduate students a better foundation for their choice of a more focused study program.

In 2008 one former undergraduate presenter returned to the conference as a graduate student and in 2009 we already had 3 presentations by returning graduate students (6 presentations by graduate students in total). In 2010, out of 26 student presentations, 11 were delivered by graduate students. The undergraduate students enjoyed the presentations of the more mathematically mature graduate students and the graduate students benefited as they tried to make their work accessible to an undergraduate audience. In 2013, we also had two presentations by high-school students and we will seek to attract high-school presenters in the future years as well.

The 11th Annual UNCG RMSC 2015

UNCG-RMSC is an annual one-day conference promoting student research in mathematics, statistics, and their applications in various fields. The 2015 conference was held on Saturday, November 7, 2015. Jan Rychtář served as conference chair, Sat Gupta, Maya Chhetri, and Ratnasingham Shivaji from UNCG, Chad Awtrey from Elon University, and Dewey Taylor from VCU were co-organizers. The conference featured two plenary presentations by invited speakers.

Jan Rychtář, Conference Chair

Dr. Laura Taalman, Content Strategist, Digital Harbor Foundation and Professor of Mathematics at James Madison University spoke on Bringing Abstract Mathematics into Reality: 3D Printed Catalan Wireframes.

Dr. Narayanaswamy Balakrishnan, Distinguished University Professor from McMaster University, Hamilton, ON, Canada who spoke on Cure Rate Modeling and Applications.

The conference was diverse. UNCG is helping to lead national efforts to increase opportunities for female and minority students in the science, technology, engineering and mathematics (STEM) fields. Over 50% (68 out of 129 students and 85 out of 169 total) participants were female and nearly 20% (25 out of 129 students) were racial minorities. Thirty-five different institutions were represented at the conference, including universities from North Carolina, South Carolina, and Virginia, but also from Texas, Washington, and Puerto Rico. The institutions with largest attendance were UNCG (37), Elon (20), Winthrop University (19), Bennett College (17) and UNCW (15).

The students delivered 49 presentations; 27 presentations were given by undergraduate students; 22 were given by graduate students. All presentations were evaluated by a group of faculty volunteers. The results of the best presentation competition are as follows:

The following 8 students won the award for the **outstanding student presentation**:

Graduate student category

- Ryan Grove, Clemson University
- Bin Luo, UNCG
- Joshua Martin, UNCG

Undergraduate student category

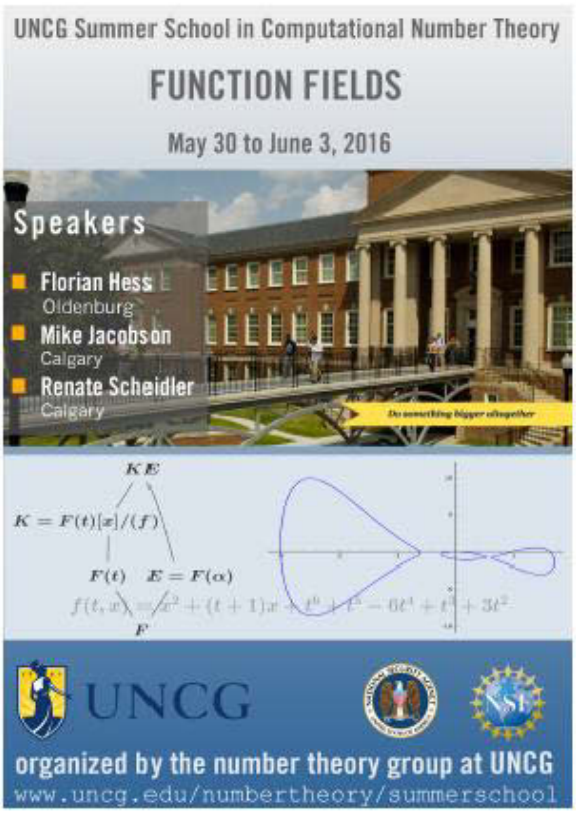
- Nina Galanter Grinnell College, and Dennis Silva, Jr., Worcester Polytechnic Institute
- Kevin McCall and Alex McCleary, Virginia Commonwealth University
- Stephen Steward, Winthrop University

All UNCG RMSC presenters were invited to submit papers to the refereed electronic journal, *The North Carolina Journal of Mathematics and Statistics*.

Funding from the National Science Foundation provided travel support for several students to participate in the conference. Other sponsors of the conference were, The Office of the Provost, The Office of Research and Economic Development, The College of Arts & Sciences, and the Department of Mathematics & Statistics.

14.2 UNCG Summer School in Computational Number Theory – 2016

From May 30 to June 3, 2016, the University of North Carolina at Greensboro hosted the UNCG Summer School in Computational Number Theory: Function Fields.

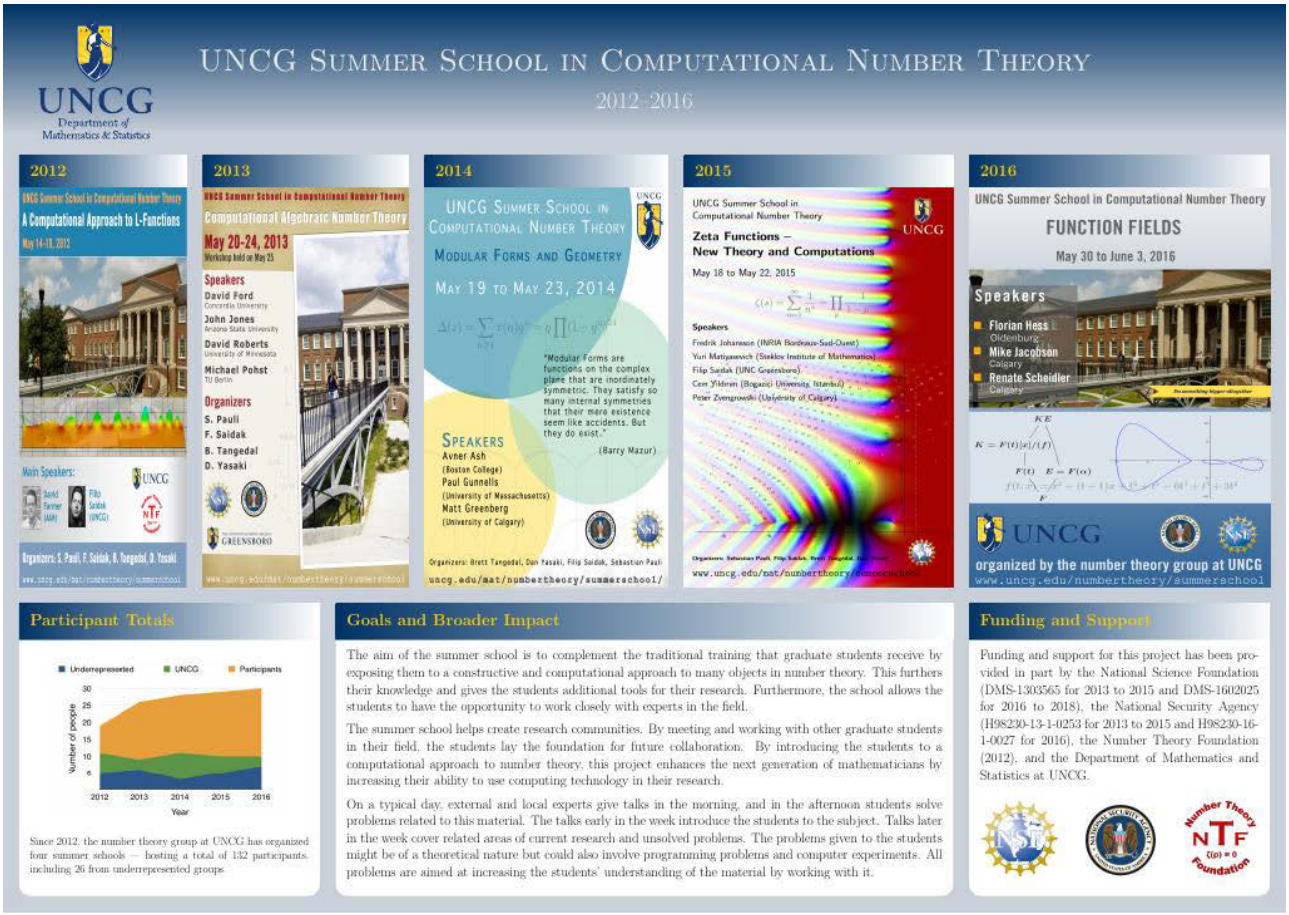


The speakers were

- Florian Hess (Universitat Oldenburg)
- Michael Jacobson (University of Calgary)
- Renate Scheidler (University of Calgary)

The summer school in computational number theory fills a gap in the education of many graduate students. Most graduate courses in number theory take a mainly theoretic approach with very little emphasis on the computational aspects of the subject. The goal of the UNCG Summer School in Computational Number Theory is to complement this with a constructive-algorithmic approach. Many of the algorithms used for number theoretic computations are non-trivial, which makes it difficult to cover them in a standard course.

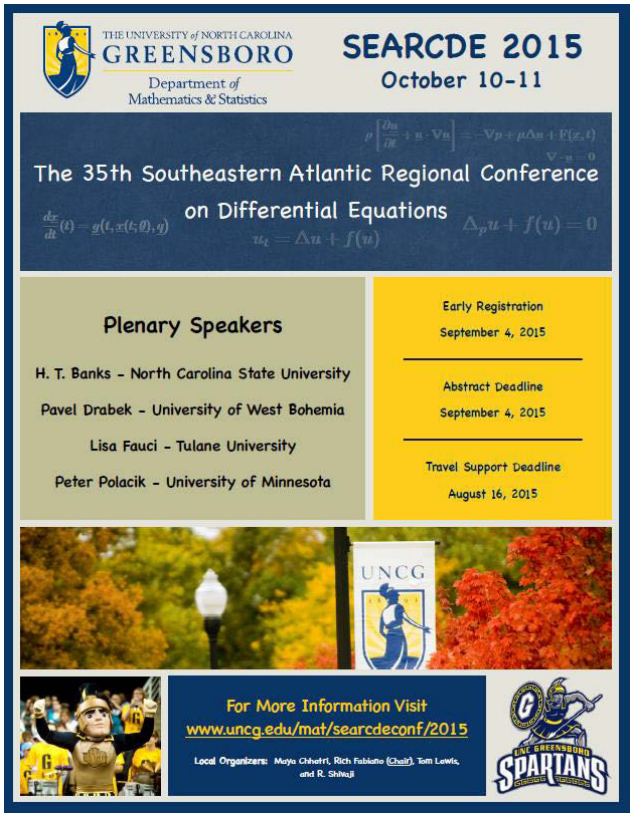
Participants of 2016 Summer School in Computational Number Theory



2016 UNCG Summer School in Computational Number Theory: Function Fields

On a typical day, the talks were given in the mornings, and in the afternoon students worked in groups to solve problems related to this material. The schedule can be found at the URL below. The talks early in the week introduced the students to the subject. Talks later in the week covered related areas of current research and unsolved problems. The problems given to the students included exercises of theoretical nature as well as programming problems and computer experiments. All problems were aimed at increasing the students' understanding of the material by working with it. This project is supported by UNCG, the NSA (H98230-16-1-0027) and the NSF (DMS-1303565). Additional information, including links, slides, and notes from some of the lectures, and problem sets can be found on the website www.uncg.edu/math/numbertheory/summerschool/2016.html.

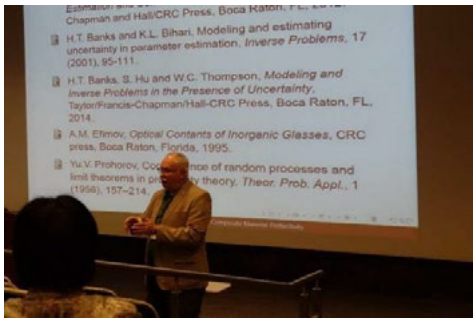
14.3 SEARCDE 2015



On October 10-11, 2015, the Department hosted the 35th annual Southeastern Atlantic Regional Conference on Differential Equations (SEARCDE). This annual conference began in 1981 at Virginia Tech, and the location of the conference rotates among universities in the southeastern United States. The Department is pleased that the conference steering committee selected UNCG to host the 2015 edition of the conference. This is the second time UNCG has hosted the conference, with the previous time being in 2006. The local organizing was performed by faculty members Maya Chhetri, Richard Fabiano, Thomas Lewis, and Ratnasingham Shivaji, and by staff members Richard Cheek, Haley Childers, and Simone Parker. In addition, Chhetri and Fabiano maintain the permanent conference web page (http://www.searcde.org), which they established several years ago.

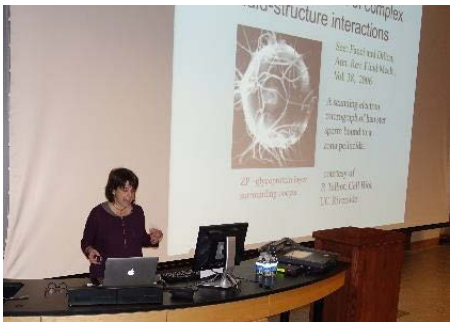
Dana Dunn, Provost and Executive Vice-Chancellor providing opening comments.

The conference brings together researchers in differential equations, a broad area of mathematics which includes theory as well as applications in diverse areas of science and engineering. There is a strong tradition of participation by young researchers, including graduate students and recent Ph.D. recipients, and the conference encourages collaboration and sharing of ideas between junior and senior participants. Indeed, many senior established faculty recall giving their first lecture as a student at a previous meeting of this conference. The conference program is designed so that junior participants present their research talks in the same sessions as senior researchers. The UNCG conference continued this



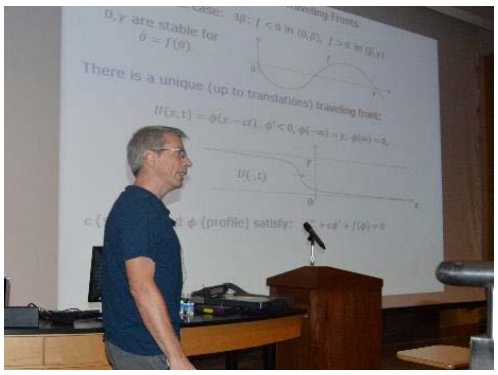
Tom Banks of North Carolina State University presenting at SEARCDE

tradition, and there were 95 contributed twenty-minute lectures. In addition, four distinguished international leaders in differential equations delivered one-hour plenary lectures. These were: H.T. Banks (N.C. State University) *Estimation of distributed parameters in permittivity models of composite dielectric materials using reflectance*, Pavel Drabek (University of West Bohemia) *Singular quasilinear elliptic problems on exterior domains*, Lisa Fauci (Tulane University) *Flagellar motility: negotiating sticky elastic bonds and viscoelastic networks*, and Peter Polacik (University of Minnesota) *Propogating terraces and the dynamics of front-like solutions of parabolic equations on the real line*.



Lisa Fauci of Tulane University presenting at SEARCDE

The conference had 128 attendees (97 male, 31 female), including 12 African-American and 3 Hispanic researchers. It was generously supported locally by the Department of Mathematics and Statistics, the College of Arts and Sciences, the UNCG Office of Research and Economic Development, and the Provost's Office. The conference was also supported by a grant from the National Science Foundation. The NSF grant provided travel support for 42 young researchers, including 23 graduate students and 19 recent Ph.D. recipients. Several of the doctoral students in the Department participated in the conference and three of the students presented their research: Quinn Morris *Positive radial solutions for superlinear, semipositone problems on the exterior of a ball*, Catherine Payne *Stability conditions for linear neutral delay differential equations*, and Byungjae Son *Positive radial solutions to classes of singular problems on the exterior of a ball*. Additional details about the conference are available at the conference website (http://www.uncg.edu/mat/searcdeconf/2015).



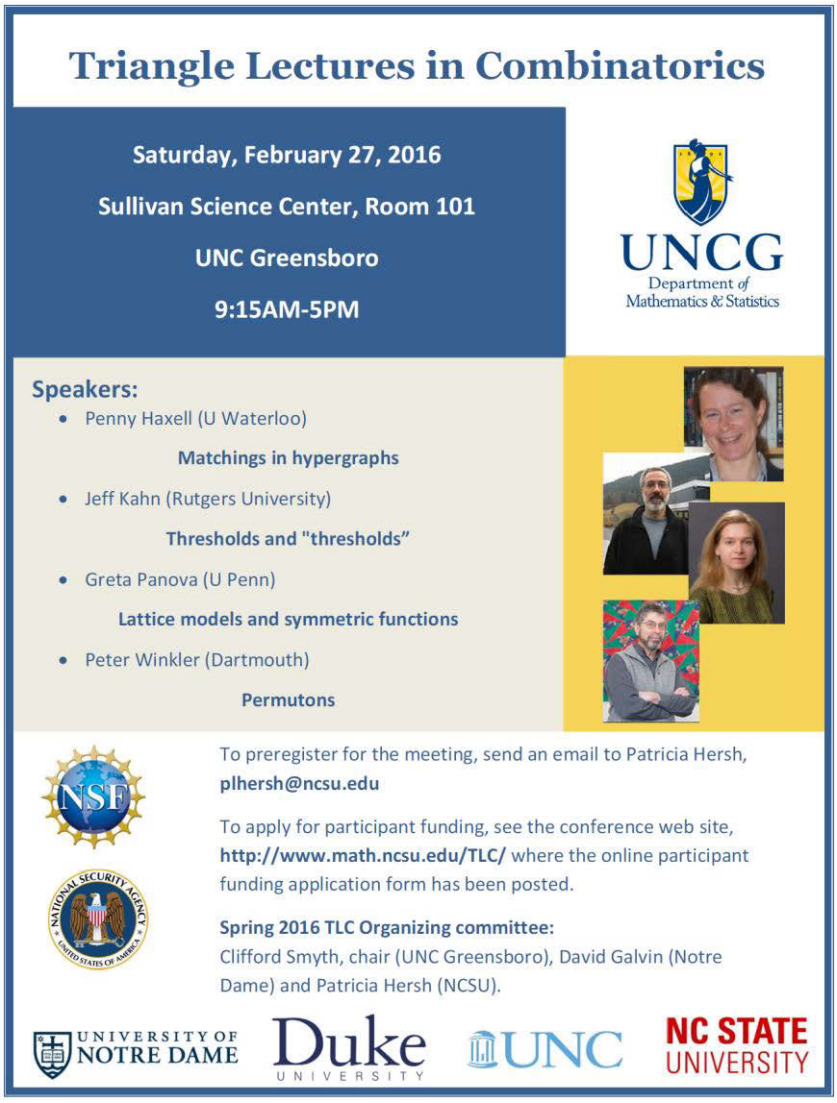
Peter Polacik of University of Minnesota presenting at SEARCDE

Pavel Drabek of the University of West Bohemia presenting at SEARCDE

14.4 Triangle Lectures in Combinatorics

Organizing committee chair, Clifford Smyth addressing the participants.

UNCG hosted the Thirteenth meeting of the Triangle Lectures in Combinatorics on Saturday, February 27, 2016. See https://web.math.ncsu.edu/tlc/ The invited speakers were Penny Haxell of the University of Waterloo, Jeff Kahn of Rutgers University, Greta Panova of the University of Pennsylvania, and Peter Winkler of Dartmouth University. In all there were 52 participants, including many graduate students. Attendees came from all the local universities but also from universities further afield, Georgia Tech, University of Kentucky, UIUC, and MIT.



15. Student Clubs and Organizations

15.1 UNCG student chapter of the Association for Women in Math

This is the fourth year of the AWM student chapter at UNCG. There were 4 meetings over the course of the 2015-16 academic year. During these meetings women and other underrepresented groups majoring in math and other STEM fields got together to discuss their stories and issues of concern to them. AbaGayle Younts continues to be president. She is trying to establish an outreach program for young girls through the local chapters of the Girl Scouts.

Talia Fernós, Faculty Advisor

From left to right: Carrie Miller, Sandi Rudzinski, James Rudzinski, Kayla McReynolds, Talia Fernós, and Ashley Jones

15.2 UNCG Math Club

The 2015-16 academic year was the fifth year of the UNCG Math Club, whose goal is to create a community for math enthusiasts. There were 16 meetings this year, including presentations from faculty members from UNCG and surrounding schools as well as student presentations. The topics included from current research, Q&A about graduate school, puzzles, and community outreach. The club also organized a table for Pi day (3/14). Additional information and photos can be found at the website. https://sites.google.com/a/uncg.edu/mathclub/home.

Dan Yasaki, Faculty Advisor

2015-16 Math Club.

Pi Day: 3/14

15.3 Pi Mu Epsilon

Rich Fabiano, Faculty Advisor

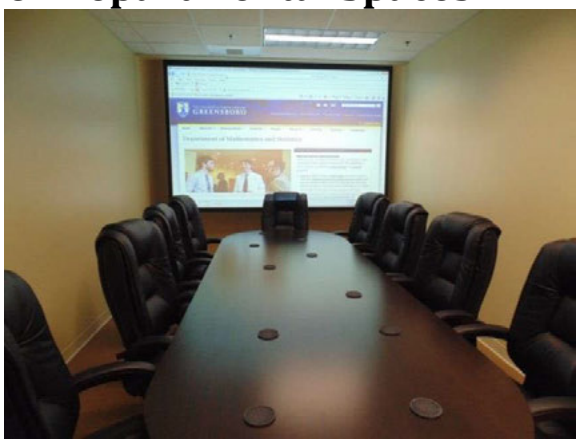
Each year the faculty carefully screen the academic records of mathematics majors and other students studying advanced mathematics. Those students who satisfy the rigorous induction requirements and receive the approval of the faculty are extended an invitation to join Pi Mu Epsilon. This year our North Carolina Pi Mu Epsilon chapter inducted six new members: Kristen Fisher, Ivanti Galloway, Megan McElroy, Emily Nance, David Suarez, and Jianhong Zhu.

We held an induction banquet to honor these students on April 19, 2016, at the Saigon Vietnamese Restaurant. The banquet was attended by new inductees and their guests, and several faculty members.

Faculty and students at the Pi Mu Epsilon Dinner

Inductees Emily Nance, Ivanti Galloway, David Suarez, and Jianhong Zhu

16. Departmental Spaces



Jerry and Theresa Vaughan Conference Room in Petty 146.

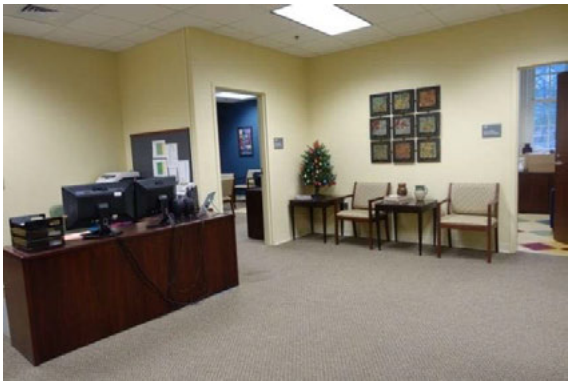
The **Math Emporium** is located in Graham 303.

The **Math Help Center** is located in Curry 210.

The **Undergraduate Lounge** is located in Petty 206.

The **Department library** is located in Petty 119.

The **faculty lounge** is located in Petty 120.



The **Math Department office** is located in Petty 116.

The **Statistical Consulting Center** is located in Petty 209.

Department of Mathematics & Statistics
116 Petty Building
317 College Avenue, Greensboro NC 27412
336.334.5836 • math_sci@uncg.edu
www.uncg.edu/mat