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125

CELEBRATING
125 YEARS OF
OPPORTUNITY
& EXCELLENCE

UNCG

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Department of
Mathematics & Statistics
Annual Report
2016-2017

Table of Contents

1. Summary

Ratnasingham Shivaji,
H. Barton Excellence Professor & Head

It has been a great pleasure to be a part of and to lead a productive department with talented faculty and staff members. During the academic year 2016-17, we had seven full professors, eleven associate professors, three assistant professors, one senior academic professional, one senior lecturer, one lecturer, two part-time lecturers, and three staff members.

The Department continues to excel in terms of research productivity. During the calendar year 2016, the faculty had 39 journal articles and 4 refereed conference papers, for a total of 43 manuscripts accepted for publication. The faculty made 65 presentations, with 16 at international destinations. Thanks to our enhancement of grant proposal submissions, we continued a healthy success rate in securing funding in the academic year 2016-17. 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 2011-2017 years.

Grant Awards by Academic Year (Note: 2017 has pending grants)

Year	Amount
2011	$7,000.00
2012	$141,300.00
2013	$385,282.67
2014	$442,622.22
2015	$375,179.71
2016	$132,793.76
2017	$353,154.84
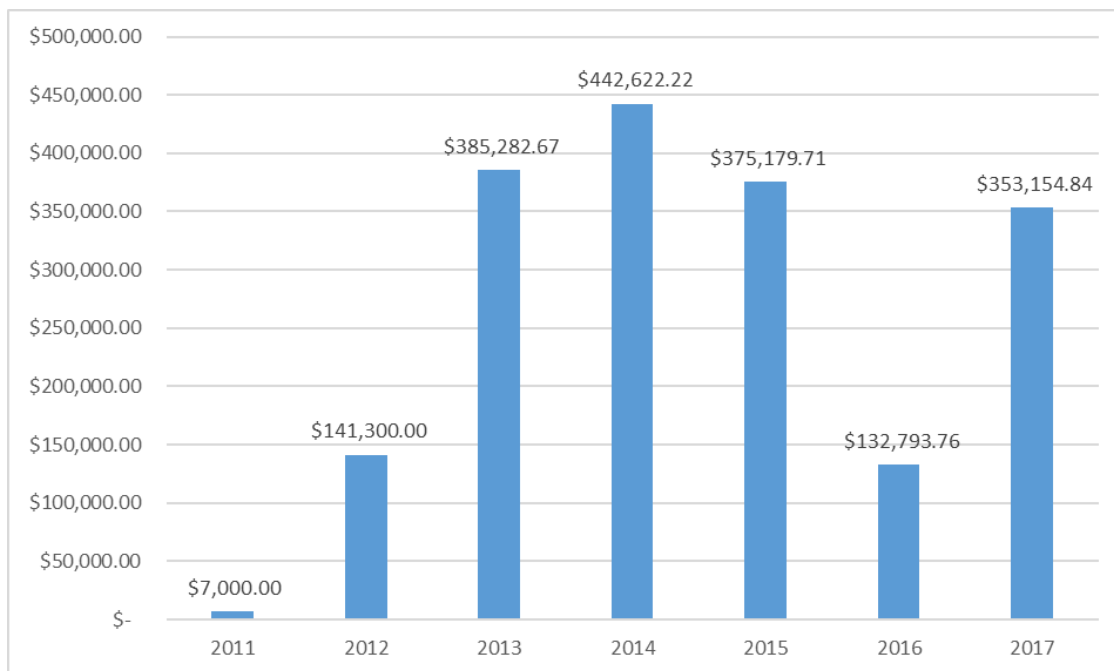
The Department continued to be home to *Journal of Statistical Theory and Practice* (a Taylor and Francis publication) and *Topology and its Applications* (an Elsevier publication), two internationally renowned journals. Our department is also home to *The North Carolina Journal of Mathematics and Statistics,* 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 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 104 research visitors. In 2016, the Department hosted the International Conference on Advances in Interdisciplinary Statistics and Combinatorics (attended by 160 participants), The 26th Palmetto Number Theory Series (PANTS XXVI) (attended by 44 participants), the 12th Annual UNCG Regional Mathematics and Statistics Conference (attended by 222 participants), the Summer School in Computational Number Theory (attended by 22 participants), and the Summer Research Experiences for Undergraduates (REU) Program in Math Biology (attended by 10 participants). External funding support was provided by NSF and NSA.

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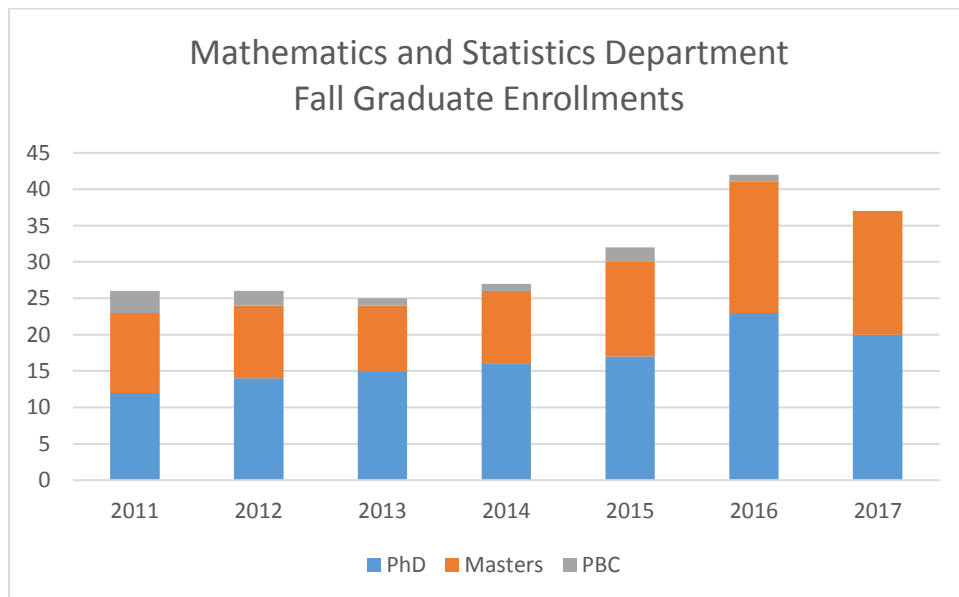
We made concerted efforts towards graduate student recruitment through visits to many institutions in the US and abroad, and through participation in graduate recruitment events hosted by the American Mathematical Society (AMS), Mathematical Association of America (MAA), and the National Institute for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

The "Graduate Tea" hosted by us for our students served as a good venue for students and faculty to interact informally. The Department's continued membership with IMA (Institute of Mathematics and its Applications) has allowed for continued participation of graduate students (and members of UNCG faculty) in workshops and conferences organized by the IMA. We also began a Graduate Professional Development Lecture Series. The first lecture was given in Summer 2016. This 2016-17 academic year, we began a professional mentoring program for our Ph.D. students. Each student was assigned a faculty member who would reach out to them periodically during the academic year and provide professional mentoring.

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 had research collaborations with Cone Health and the Greensboro Police Department. We also 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; working to improve the quality of our online courses; an enhanced Math Help Center to provide answers and clarifications to students' questions and to provide virtual tutoring for our distance learners; 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 five 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 continues to enhance 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 campus-wide Research Experience in Statistics program. This year, we had 116 total undergraduate first majors and 20 undergraduate students who are majoring in mathematics as a second major. Please see the chart below for details of our Student Credit Hour growth.

Student Credit Hour History - Totals Combined for PT and FT Faculty
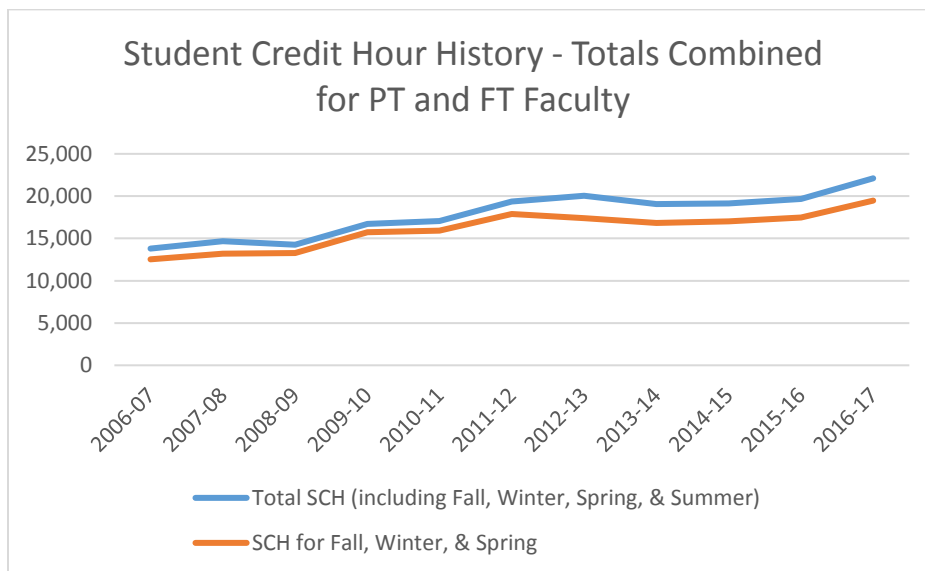
Our Student Credit Hours (SCH) grew 76.5% during the past 10-year period (2006-07 to 2016-17). We are the fourth largest SCH producing unit (SCH: 22,109) in the College behind the Departments of Biology (SCH: 27,894), English (SCH: 23,977) and Languages, Literature & Cultures (SCH: 23,726).

The Math Club of our Department continues to be active. The goal of this club is to create a community for Undergraduate and Graduate Math enthusiasts. The 2016-17 academic year marked the sixth year of the Math Club's official recognition by UNCG. The club continues to meet every Monday. The meetings are centered around talks given by the Department's very talented faculty and graduate students. Also, 2016-17 marked the fourth academic year the Association for Women in Mathematics Student Chapter (AWM) has been active.

In recent years, we have received several donations to the Department's enrichment fund and to existing scholarships. Please see page 6 for our recent donors list. 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. Many of our majors have won the University Student Excellence

Awards. Our Ph.D. program (which began in 2008) have now graduated eleven Ph.D. students. Our students have authored a significant number of journal publications and also presented several talks at research conferences. Here follows selected highlights of our faculty's and staff's achievements since 2011:   Sat Gupta was elected as a fellow of the American Statistical Association, he won the UNCG Senior Research Excellence Award and was a recipient of the Sankhyiki Bushan Award (given by the Indian Society of Agricultural Statistics); Jan Rychtář won the UNCG Junior Research Excellence Award and the UNCG Undergraduate Research Mentor Award; Thomas Lewis was a Mathematical Association of America Project NExT (New Experience in Teaching) Fellow; Thomas Lewis, Talia Fernós, Jonathan Rowell, and Clifford Smyth received Dean's Professorship awards; Paul Duvall won the College Teaching Excellence Award; Richard Cheek won the College of Arts and Sciences Staff Excellence Award; Haley Childers won the UNCG Staff Excellence Award; Jan Rychtář, Clifford Smyth, Talia Fernos, Xiaoli Gao and myself received Simons Foundation research grants; Clifford Smyth and Dan Yasaki received National Security Agency (NSA) research grants; and Talia Fernós, Haimeng Zhang, and myself received NSF research grants.

We have a fun-loving, hardworking, and professional group of faculty and staff.

Talia Fernós, Brett Tangedal, and Clifford Smyth relaxing during a department holiday party

Carri Richter, Shivaji, and Haley Childers celebrating sending the Annual Report off to the printers!

Enjoy reading in this report all the details of our various activities and achievements. For more information about the Department and its activities visit:

www.uncg.edu/mat

1.1   Recent Donors

Mr. Matthew Adams	Mrs. Kathy Hamilton	Mr. Thomas Parrish
Ms. Janet Agnew	Mr. Bill and Mrs. Doris Hawthorne	Mrs. Linda Philips
Ms. Peggy Aldridge	Ms. Janice Hite	Ms. Mary Pope
Ms. Joan Andersen	Mr. William and Mrs. Dorothy Howell	Mrs. Christine Posey
Ms. Linda Bennetts	Mrs. Frankie Hubbard	Mrs. Laura Peake Prill
Ms. Lillian Boney	Mrs. Roxanne Hunt	Ms. Lisa Randall
Mrs. Marilou Bradley	Mrs. Mary Jackson	Mrs. Jean Roosa
Mr. William Bradmon	Mr. Matt Jester	Mrs. Martha Schall
Dr. Jeremy and Ms. Lou Bray	Ms. Amy Kemp	Mrs. Susan Blanton Senn
Mrs. Shirley Brewer	Mr. Walter and Mrs. Krista Thomason	Mr. Pralad Shah
Ms. Wendy Louise Bullis	Mrs. Julie Lambert	Mr. Jimmy and Mrs. Anelia Shelton
Mr. Michael and Mrs. Doris Burris	Mr. Gene and Mrs. Vicky Langley	Mrs. Teresa Sink
Mr. Karl and Mrs. Judy Busick	Mrs. Sue and Mr. Luther Lawson	Dr. Thomas Stafford, Jr. and Mrs. Judy Stafford
Dr. Lisa Carnell	Mr. Zach Leach	Mrs. Brownie Stancil
Mr. Jason Cogley	Mrs. Phyllis Lupton	Mrs. Carolina Stauers,
Mrs. Katherine Bland Davis	Mr. Tommy Maness	Mr. William and Mrs. Becky Tallon
Mrs. Elaine Davidson	Mr. Franco Mandina	Ms. Nancy Taylor
Mrs. Sandra Donaghy	Mr. Benjamin Manifold	Mrs. Susanne Thatcher
Ms. Linda and Mr. Clifton Eason	Mr. William and Mrs. Ashley McCarthy	Mr. Danny Thompson
Mr. Edwin and Mrs. Thelma Edmonson	Mr. Lance McCluney	Ms. Gloria Thornton
Ms. Kaye Edwards	Mrs. Sylvia McCollum	Mrs. Sharon and Mr. Howard Traywick
Mr. Daniel Flores	Mrs. Lee Handy and Mr. Thomas McKee	Mr. John and Mrs. Cynthia Triplett
Ms. Shirley Fraley	Mrs. Margaret McQuain	Mrs. Nancy Turner
Mrs. Nancy Geller	Mr. Noel Melton	Mrs. Nancy Tucker
Ms. Aliesha Grady	Mr. Gregg Miller	Mr. Larry and Ms. Joyce Vest
Mrs. Martha Gwyn	Dr. Sharon Morgan	Mrs. Mary Weatherspoon
Mrs. Patti Grimm	Dr. Thomas and Mrs. Mildred Mullikin	Ms. Walker Weigel
Mrs. Barbara Hagaman	Mrs. Dawn and Mr. James Murchison	Ms. Betsy Jordan Whitson,
Ms. Becky Halsey	Mr. Carl and Mrs. Jean Nilsson	Mrs. Fran Williams

2. Faculty and Staff

2.1 Faculty

Greg Bell, Associate Professor
Director of Graduate Studies

Dr. Bell earned a Ph.D. from the University of Florida in 2002 and joined the faculty in 2005. His research focus is on geometric group theory, geometric topology, and asymptotic invariants of groups.

Maya Chhetri, Professor

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

Igor Erovenko, Associate Professor

Dr. Erovenko earned a Ph.D. from the University of Virginia in 2002 and joined the 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. from Virginia Tech in 1986 and joined the faculty in 1996. His research focus is on applied mathematics, differential equations, and control theory.

Talia Fernós, Associate Professor

Dr. Fernós earned a Ph.D. in from the University of Illinois at Chicago in 2006 and joined the 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 and joined the 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 faculty in 2004. His research focus is on sampling designs, time series forecasting, and biostatistics.

Tracey Howell, Senior Academic Professional
Director of the Math Help Center & Coordinator of the Math Emporium

Dr. Howell earned a Ph.D. in Teacher Education and Higher Education from UNCG in 2013 and 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 and joined the 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 and joined the 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. from Oklahoma State University in 1997 and joined the 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. from Cornell University in 2003 and he joined the 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 faculty in 2010. His research focus is on mathematics education, and geometric group theory.

Jan Rychtář, Professor

Dr. Rychtář earned a Ph.D. from the University of Alberta in 2004 and joined the 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. from Queen's University in Ontario in 2001 and joined the 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.
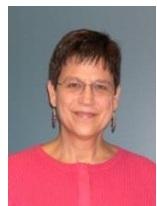
Carol Seaman, Associate Professor
Program Coordinator for Secondary Licensure in Mathematics

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

Insuk Shim, Lecturer

Ms. Shim earned an M.A. from the University of Alabama, Tuscaloosa in 2006 and joined the 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. from Heriot-Watt University in Edinburgh, Scotland in 1981 and joined the faculty 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. from Rutgers University in 2001 and joined the 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 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. from Duke University in 1965 and joined the 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. from UNC-Chapel Hill in 1967 and joined the 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. from Duke University in 2005 and joined the 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.
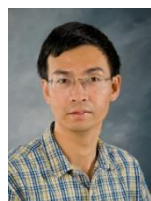
Haimeng Zhang, Associate Professor

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

Part-Time Faculty

Jonathan Milstead, Lecturer

Mr. Milstead earned an M.A. from Clemson University in 2009. During this academic year, he was a Ph.D. student at UNCG.

Catherine Payne

Ms. Payne earned an M.A. from UNCG in 2010. During this academic year, she was a Ph.D. student at UNCG.

New Faculty
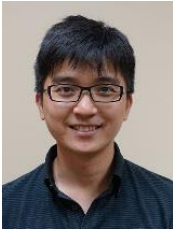
Yu-Min Chung, Assistant Professor

Dr. Chung earned a Ph. D. in Mathematics from Indiana University Bloomington in 2013 and will join the Department in August 2017. His research focus is on computational topology, topological data analysis (TDA), and dynamical systems.

Monika Goel, Lecturer

Ms. Goel earned an M.A. from UNCG in 2017 and will join the Department in August 2017.

Mauricio Rivas, Visiting Assistant Professor

Dr. Rivas earned a Ph.D. from the University of Houston in 2013 and will join the Department in August 2017. His research focus is on variational analysis for PDEs, Morse theory and its applications to PDEs and spectral theory, and dynamical systems and control theory for the use in mathematical physics, particularly in electromagnetic theory and quantum processes.
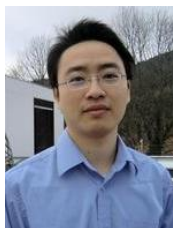
Yi Zhang, Assistant Professor

Dr. Zhang earned a Ph.D. from Louisiana State University in 2013 and will join the Department in August 2017. His research focus is on numerical PDEs, finite element methods, variational inequalities and numerical optimization.

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 2005.

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 joined the Department in August 2016.

3. Tenure, Promotion, Awards & Honors

Promotions

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

Tenure and Promotions

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

Dr. Xiaoli Gao received her tenure, which will be effective on August 1, 2017.

Awards

Dr. Talia Fernós was awarded a three-year (2013–2017) National Science Foundation (NSF) research grant. Grant work has focused on rigidity of isometric Hilbert space actions using the tool of low dimensional cohomology.

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. She was also awarded two UNCG Strategic Seed Grants.

Dr. Sat Gupta was elected a Fellow in the American Statistical Association in 2017. He also received the 2016-17 University Senior Research Excellence Award. Further, in 2016, the Indian Society of Agricultural Statistics awarded Sat Gupta the Sankhyiki Bhushan Award (person of eminence in statistics).

Dr. Thomas Lewis was selected for a Candace Bernard and Robert Glickman Dean's Professorship in the College of Arts and Sciences for the academic year 2016-17.

Dr. Jonathan Rowell was the co-PI on a three-year (2014-2017) NSF Research Experiences for Undergraduates site grant. He was also selected for a Candace Bernard and Robert Glickman Dean's Professorship in the College of Arts & Sciences for the academic year 2017-18.

Dr. Jan Rychtář was awarded a five-year (2012-2017) Simon's Foundation grant for his project titled "Game-theoretical models in biology". He was also the PI on a three-year (2014-2017) NSF Research Experiences for Undergraduates site grant.

Dr. Ratnasingham Shivaji was 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".

Dr. Clifford Smyth received a Simons Foundation Grant for his Project titled, "Collaboration in Combinatorics." This award will run from 2015 to 2020.

Dr. Dan Yasaki was awarded a two-year (2015-2017) NSA Young Investigator's Grant for his project titled, "Voronoi Reduction Theory and Applications to Arithmetic Groups."

Sat Gupta was named Fellow of the American Statistical Association. He was presented this honor by the ASA President Barry Nussbaum.

Sat Gupta receiving the 2016-17 University Senior Research Excellence Award from Chancellor Franklin Gilliam

Department of Mathematics & Statistics Distinguished Service Award

In 2014, the Department established the Award for Distinguished Service. The recipients are those whose performance has gone above and beyond the expectations of their position, resuting in a significant, positive impact on the overall goals and objectives of the Department.

Our most recent recipient of this award was Maya Chhetri. Maya was chosen for The Award for Distinguished Service because of her dedication to student success in mathematics and statistics, leading efforts to build a very successful Math Help Center, as well as promoting innovative pedagogy in the development of the Math Emporium. Both of these endeavors have garnered campus-wide recognition for the Department.

Maya Chhetri receiving the Distinguished Service Award in 2016

The two previous Awards for Distinguished Service were presented to Haley Childers and Jan Rychtář. Haley was honored for sustained excellence as Business Services Coordinator, her willingness to assist beyond normal expectations, consistent cooperation and helpfulness, and initiative in performing tasks. Jan was honored for his dedication to undergraduate research, spearheading efforts to obtain external funding to support undergraduate research, and building a student research conference that has gained a national reputation for the Department and the University.

Jan Rychtář and Haley Childers each receiving the Distinuished Service Award in 2014

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.
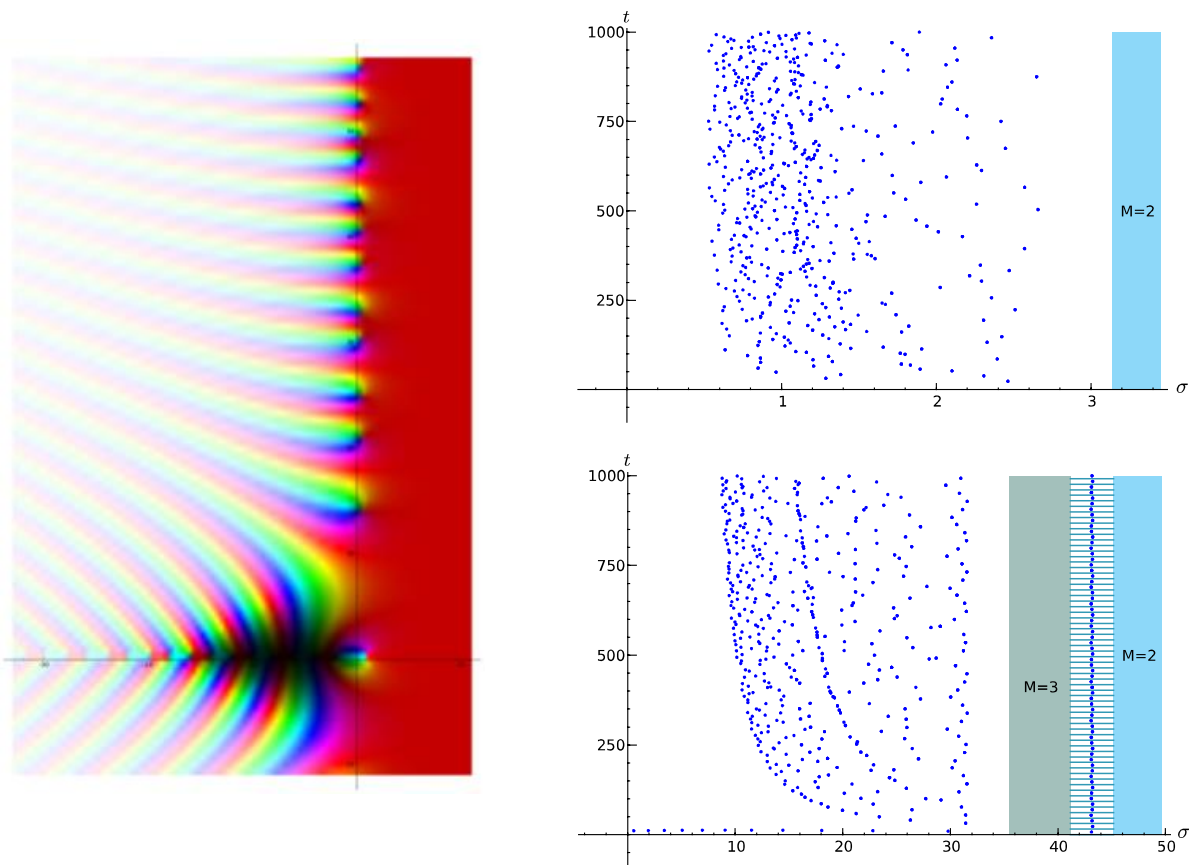
The plot on the left shows the Riemann zeta function for -33 ≤ σ ≤ 11 and -11 ≤ t ≤ 57, where the magnitude is indicated by brightness and the argument is represented by hue. The plots on the right show the distribution of the zeros of the 1st and 38th derivative of the Riemann zeta function on the complex 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. We currently have one Ph.D. student, Sandi Rudzinksi. Current M.A. students in number theory are Nathan Fontes and Debbie White. Brian Sinclair (Ph.D. 2015), Ricky Farr (Ph.D. 2017) and Jonathan Milstead (Ph.D. 2017) are recent alumni of this group.

Sebastian Pauli with Ph.D. student Sandi Rudzinski
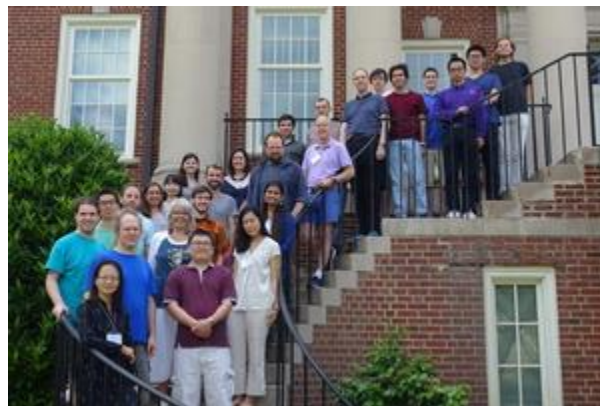
2017 UNCG Summer School in Computational Number Theory

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

The members of the combinatorics, group theory and topology group in 2016-17 were Greg Bell, Talia Fernós, Clifford Smyth, and Jerry Vaughan.

The structure of arctic ice and its dependence on depth

Yu-Min Chung, a new faculty in Computational Topology, will join the Department in Fall 2017. He received his Ph.D. from Indiana University at Bloomington in 2013 and held postdoctoral positions in the University of Kansas and the College of William & Mary before coming to UNCG. Yu-Min specializes in computational topology and his research focus lies in the interaction between topology and data analysis. He is currently working on two main projects. In one, he is investigating the structure of arctic ice with Dr. Keegan at University of Copenhagen. Together they are working on a grant proposal to be submitted to the Army Research Office. Yu-Min is also collaborating wit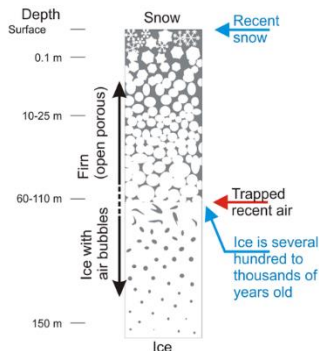h Dr. Costa of Harvard University to study the human red blood cell (RBC) to characterize and quantify the difference between newly born RBC and mature RBC.

Greg Bell gave several seminar and conference talks in 2016-17 including the Summer Conference on Topology and its Applications in Dayton, Ohio and the Joint Meetings of the AMS and MAA in Atlanta, Georgia. He also traveled to Warsaw, Poland where he collaborated with Andrzej Nagórko on projects in coarse geometry, Markov compacta, and Nöbeling spaces. He continues to work with PhD student Austin Lawson and MA student Neil Pritchard on projects in coarse geometry and computational mathematics.
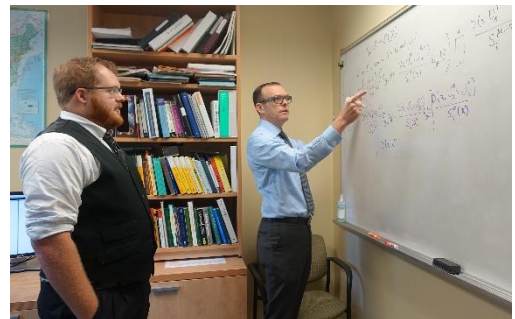
Greg Bell with Ph.D. student Austin Lawson

Talia Fernós investigates infinite groups through both analytic and geometric methods. CAT(0) cube complexes have interesting interconnections between geometry, analysis, and algebra, and so have fascinated her for some years now. 2016 was an exciting year for her. In the summer, she was a Missionary Scientific Guest at University of Paris Sud, and in the fall she was a Research Member at the prestigious Mathematical Sciences Research Institute (MSRI) at Berkeley. This jumbo program in Geometric Group Theory hosted five workshops, attracting experts from all around the world. She was an invited speaker in two of the workshops. She also had the pleasure of being an invited speaker at both the Spring Topology and Dynamics Conference 2017 and the

Mathematical Congress of the Americas, 2017, in Montreal, Canada. Her work for this period was partially supported by a Research Grant #1312928 from the National Science Foundation (2013-2017).

Talia is also active in the issue of equal representation in the mathematical sciences. She co-organized the Connections for Women workshop at the MSRI program, as well as a special session in Geometric Group Theory at the Association for Women in Mathematics Research Symposium 2017. She has also been nominated to serve on the Executive Committee of the AWM.

Cliff Smyth's research area is discrete mathematics and combinatorics. He is currently working on problems in symmetric chain decompositions with his Ph.D. student James Rudzinski, a project on the combinatorics of matrix inverses, and a project on vector-host coupling in disease systems with Gideon Wasserberg in the UNCG Biology department. In the past year, he has spoken at many conferences and seminars including Rutgers University and an invited talk at the Altanta Lecture Series, April 22-23, 2017. His work is currently supported by Simons Foundation grant (2015-2020).

Clifford Smyth with Ph.D. student James Rudzinski
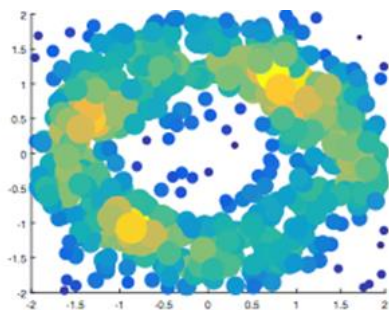
Recovering the shape of an annulus from a sample using persistent homology

Jerry Vaughan and Alan Dow, from UNC-Charlotte, organized a special session on Set-theoretic Topology at the Fall 2016 Southeastern Sectional Meeting at the North Carolina State University, Raleigh, NC. Jerry presented a research paper at that meeting, and he also presented research papers at the Prague International Topology Symposium in Prague, Czech Republic and at the 31st annual Summer Topology Conference at the University of Leicester, Leicester, England. He continues to moderate the Carolina Topology Seminar, which traces its beginnings back over 30 years, and he continues to serve as Editor-in-Chief of the international research journal "Topology and its Applications."

The current students in the group are Neil Pritchard (M.A.), Austin Lawson (Ph.D. with an M.A. in 2016) and James Rudzinski (Ph.D). Recent past students include Dani Moran (Ph.D. 2014) who is

currently an assistant professor at Guilford College, Joshua Martin (M.A. 2016), and Catherine Payne (M.A. 2010) who is currently an assistant professor at Winston Salem State University.

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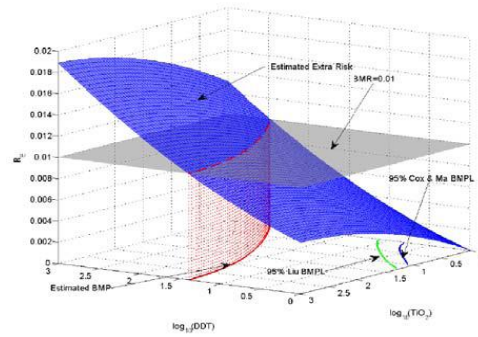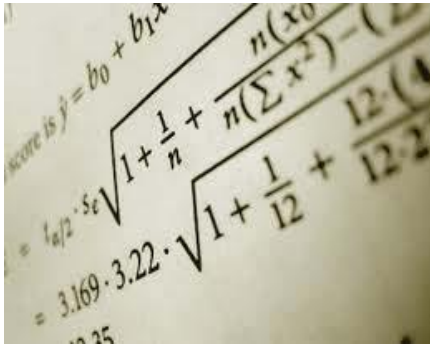
The statistics group in the Department consists of four full-time faculty (Sat Gupta, Scott Richter, Haimeng Zhang, and Xiaoli Gao).

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

Sat Gupta with Ph.D. student Jeong Sep Sihm

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

Xiaoli Gao with M.A. student Bin Luo

funded projects. In 2016, the stats group published 11 journal articles.

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

Haimeng Zhang with Ph.D. student Chris Vanlangenberg

collection, often for grant proposals, subsequent data analysis and interpretation, and manuscript preparation. These collaborations often lead to peer-reviewed journal articles.

Two PhD students specializing in computational statistics graduated in 2016. These were Chris Vanlangenberg (Advisor Haimeng Zhang) and Tanja Zatezalo (Advisor Sat Gupta). Other PhD students in 2016 were Charith Elson, Wei Chen, and Jeong Sihm. The group also directed four master's projects (Chris Langewisch, Jeff Lail, Nicholas Stewart, Arpad Szarka) and two master's theses (Qi Zhang and Bin Luo).

UNCG's research magazine published an article entitled, "Survey Says…". This article featured Sat Gupta.

SURVEY SAYS…

Were you born in April?

PUBLIC HEALTH IMPACT Gupta (right) and his colleagues have used Optional RRT to estimate rates of stimulant medication misuse, familial sexual abuse, and risky sexual behaviors among college students. The prolific researcher has more than 120 journal publications, maintains a robust statistical consulting portfolio, is the founding and current editor of the Journal of Statistical Theory and Practice, and serves as associate head in the Department of Mathematics and Statistics.

For more information, you can find this article at the following web site:
http://www.uncg.edu/mat/news/SurveySaysfall2016.pdf

Applied Mathematics

Human red blood cells possess vibratory motions, referred to as flickering. Characterizing dynamics of flickering is an open problem in Cell Biology.

Fluid can be modeled by certain differential equations, such as the Navier-Stoke equation. It has been used to model the weather, ocean currents, water flow in a pipe, and so on.

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, mathematical biology, and numerical analysis. The research focusses on both the theoretical analysis and the numerical approximation of solutions. Areas of application include fluid dynamics, modeling of reaction-diffusion processes, stealing behaviors, mathematical finance, optimal mass transport, and the behavior of random networks. Faculty are actively involved in organizing conferences in specific research areas as well as annual conferences targeted for students. Most faculty in this group have also worked with undergraduate students. The work has 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. 2017 Ph.D. graduates who worked in these areas are Quinn

Objects and regions need to be simplified geometrically so that they can be represented on a computer.

An example of an adaptive mesh used to resolve singularities at the free boundary and the reentrant corner

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

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

Morris (now Visiting Assistant Professor at Swarthmore College), Catherine Payne (now Assistant Professor at Winston-Salem State University), and Byungjae Son (now Post-doctoral Student at Wayne State University). Current Ph.D. students: Nalin Fonseka, Amila Muthunayake, Aaron Rapp, and Elliott Hollifield. Current Masters student: Keri Spetzer. Current undergraduate research students: Jackson Leonard and Aliya Al-habsha.

New faculty joining this group in Fall 2017 are Yu-Min Chung and Yi Zhang. Yu-Min Chung received his Ph.D. in Mathematics from Indiana University Bloomington in 2013 specializing in computational mathematics. His main research focuses are computational topology and applications to data analysis, called Topological Data Analysis. He has been collaborating with researchers from different scientific disciplines, including those from Dartmouth College to investigate ice at the Arctic, and those from Harvard Medical School to study human red blood cells. Chung's other research interest is computational dynamical systems. He and his group developed one of the first algorithms to compute inertial manifolds, an object from dynamical systems. Yi Zhang received his Ph.D. in Mathematics at the Louisiana State University, his M.S. in Applied Mathematics as well as his B.S. in Mathematics from Wuhan University, China. Prior to joining the faculty at UNCG, he was a postdoctoral research associate at the University of Tennessee, Knoxville and the University of Notre Dame. His research interests include numerical solutions of deterministic and stochastic partial differential equations, finite element methods, variational inequalities, PDE-constrained optimization and numerical optimization.

Shivaji with Masters student Keri Spetzer and Ph.D. student Nalin Fonseka

Tom Lewis with Ph. D. student Aaron Rapp.

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

Rich Fabiano with Ph.D. student Catherine Payne

Mathematical Biology

The Department of Mathematics and Statistics is proud to be part of several research projects in Mathematical Biology.

2017 NSF Math Bio-REU Participants

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.

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 (LSU), and Dr. Jerome Goddard at Auburn University at Montgomery (AUM). 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. 2017 Ph.D. graduates who worked on this project were: Quinn Morris (now Assistant Professor at Swarthmore College), Catherine Payne (now Assistant Professor at Winston-Salem State University), and Byungjae Son (now a Post-doctoral student at Wayne State University). Past undergraduate student who worked on this project: Jessica Nash. Current Ph.D. stduents working on this project: Nalin

Math Ecology team (UNCG, LSU, & AUM)

Fonseka and Amila Muthunayake. Current undergraduate students working on this project: Jackson Leonard and Aliya Al-habsha.

LSU ecology collaborators at the field site

Shivaji with research collaborators Jerome Goddard (AUM) and James Cronin (LSU)

Ratnasingham Shivaji working with undergraduate students Jackson Leonard and Aliya Al-habsha

Undergraduate Jessica Nash working with Ph.D. graduate Quinn Morris

UNCG's research magazine published an article entitled, "Mathematicians walk on the wild side in growing UNCG focus". This article featured Jan Rychtář, Ratnasingham Shivaji, Sebastian Pauli, Jonathan Rowell, Olav Rüeppell (Biology) and Matina-Kalcounis-Rüeppell (Biology)

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

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

4.2　Journal Articles Published in 2016

Maya Chhetri
M. Chhetri and P. Girg, Global bifurcation of positive solutions for a class of superlinear elliptic systems, *Journal of Differential Equations*, 261 (10): 5719–5733.

M. Chhetri and P. Girg, Asymptotically linear system of three equations, *Journal of Differential Equations*, 261 (10): 5900–5922.

M. Chhetri and P. Girg, On the solvability of asymptotically linear systems at resonance, *J. Math. Anal. Appl.,* 442 (2): 583–599.

A. Abebe, **M. Chhetri** and R. Shivaji**,** Positive solutions for a class of multiparameter elliptic systems, *Dynamics of Continuous, Discrete and Impulsive Systems (DCDS-A),* 23: 273-283.

Igor Erovenko
I.V. Erovenko and J. Rychtář, The evolution of cooperation in 1-dimensional mobile populations. *Far East Journal of Applied Mathematics* 95 (1): 63–88.

Talia Fernós
T. Fernós, I. Chatterji, and A. Iozzi, The median class and superrigidity of actions on CAT(0) cube complexes, *Journal of Topology*, 9 (2): 349–400.

T. Fernós and P. Singla, Images of real representations of SLn(Zp), *Glasgow Mathematical Journal*, 58 (1): 10 pages.

Xiaoli Gao
X.L. Gao, S. E. Ahmed and Y. Feng, Post selection shrink-age estimation for high-dimensional data analysis, *Applied Stochastic Models in Business and Industry*, 33 (2): 97-120.

X.L. Gao, A flexible shrinkage operator for fussy grouped variable selection, *Statistical Papers*: 1-24.

Sat Gupta
D. Engels, M. Austin, L. McNichol, J. Fencl, **S. Gupta**, H. Kazi, What factors may contribute towards the development of pressure ulcers in patients that have been to the Operating Room?, *AORN Journal*, 103 (3): 271-281.

A. Chhabra, B.K. Dass, **S. Gupta**, Estimating prevalence of sexual abuse by an acquaintance with an optional unrelated question RRT Model, *North Carolina Journal of Mathematics and Statistics*, 2: 1-9.

J. Sihm, A. Chhabra, and **S. Gupta**, An optional unrelated question RRT Model, *Involve,* 9 (2): 195-209.

S. Yadav, **S. Gupta**, S.S. Mishra, and S.S. Shukla, Modified ratio and product estimators for estimating population mean in two-phase sampling, *American Journal of Operational Research,* 6 (3): 61-68.

Thomas Lewis
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.,* Special Issue on Recent Advances in Numerical Methods for Systems of Partial Differential Equations, 299: 68-91.

Scott Richter
I. Bhatt, S. Phillips, **S. Richter**, D. Tucker, K. Lundgren, R. Morehouse, and V. Henrich, A polymorphism in human estrogen-related receptor beta (ESRRβ) predicts audiometric temporary threshold shift, *International Journal of Audiology*, 55 (10): 571-579.

S. Saari, M. Higgins, **S. Richter**, and S. Faeth, Urbanization is not associated with increased abundance or decreased richness of terrestrial animals – dissecting the literature through meta-analysis, *Urban Ecosystems*, 19: 1251–1264.

S. Richter, M. H. McCann, Simultaneous confidence intervals using medians and permutation tests, *AStA Advances in Statistical Analysis,* 100 (2): 189-205.

Jonathan Rowell
I. Reding, M. Kelley, **J. Rowell**, and J. Rychtář, A continuous ideal free distribution approach to the dynamics of selfish, cooperative, and kleptoparasitic populations, *Royal Society Open Science*, 3: 160788.

N. Galanter, D. Silva Jr., **J. Rowell**, and J. Rychtář, Resource competition and overlapping territories: the territorial raider model applied to multi-group interactions, *Journal of Theoretical Biology*, 412: 100-106.

A. Nguyen, J. Saini, **J. Rowell**, and J. Rychtář, Cooperation in finite populations: being alone helps, *Journal of Interdisciplinary Mathematics*, 19 (4): 799-809.

N. Galanter, D. Silva Jr., **J. Rowell**, and J. Rychtář, The territorial raider game and graph derangements, *Discrete Applied Mathematics*, 213: 13-16.

Jan Rychtář
I. Reding, M. Kelley, J. Rowell, and **J. Rychtář**, A continuous ideal free distribution approach to the dynamics of selfish, cooperative, and kleptoparasitic populations, *Royal Society Open Science*, 3: 160788.

I. Erovenko, and **J. Rychtář**, The evolution of cooperation in one-dimensional mobile populations, *Far East Journal of Applied Mathematics*, 95 (1): 63-88.

C. Dorsett, H. Oh, M. Paulemond, and **J. Rychtář**, Optimal repellent usage to combat dengue fever, *Bulletin of Mathematical Biology*, 78 (5): 916-922.

M. Broom, **J. Rychtář**, and T. Spears-Gills, The game-theoretical model of using insecticide-treated bed-nets to fight malaria, *Applied Mathematics*, 7 (9): 852-860.

M. Broom and **J. Rychtář**, A model of food stealing with asymmetric information, *Ecological Complexity*, 26: 137-142.

N. Galanter, D. Silva, J. Rowell, and **J. Rychtář**, The territorial raider game and graph derangements, *Discrete Applied Mathematics*, 213: 13-16.

A. Nguyen, J. Saini, J. Rowell, and **J. Rychtář**, Cooperation in finite populations: being alone helps, *Journal of Interdisciplinary Mathematics*, 19 (4): 799-809.

Filip Saidak
F. Saidak, A note on Euclid's Theorem concerning the infinitude of the primes, *Acta Univ. M. Belii*, 24: 25–26.

Ratnasingham Shivaji
R. Dhanya, Q. Morris, and **R. Shivaji**, Existence of positive radial solutions for superlinear semipositone problems on the exterior of a ball, *J. Math. Anal. Appl.*, 434 (2): 1533-1548.

E. K. Lee, **R. Shivaji**, and B. Son, Positive radial solutions to classes of singular problems on the exterior domain of a ball, *J. Math. Anal. Appl.*, 434 (2): 1597-1611.

A. Abebe, M. Chhetri and **R. Shivaji**, Positive solutions for a class of multiparameter elliptic systems, *Dynamics of Continuous, Discrete, and Impulsive Systems*, (DCDS-A), 23: 273-283.

R. Shivaji and B. Son, Bifurcation and multiplicity results for classes of p; q-Laplacian systems, *Topological Methods in Nonlinear Analysis*, 48 (1): 103-114.

Clifford Smyth
J. Rudzinski and **C. Smyth**, Equivalent Formulations of the Bunk Bed Conjecture, *North Carolina Journal of Mathematics and Statistics*, 2: 23-28.

Dan Yasaki
A. R. Booker, J. Sijsling, A. V. Sutherland, J. Voight, and **D. Yasaki**, A database of genus-2 curves over the rational numbers, *LMS J. Comput. Math*. 19 (suppl. A): 235–254.

M. Dutour Sikiric, H. Gangl, P. E. Gunnells, J. Hanke, A. Schürmann, and **D. Yasaki**, On the cohomology of linear groups over imaginary quadratic fields, *Journal of Pure and Applied Algebra*: 2564–2589.

Haimeng Zhang

M. B. Rao, **H. Zhang**, C. Huang, and F. Cheng, A discrete probability problem in card Shuffling, *Communications in Statistics - Theory and Methods*, 45: 612-620.

C. Huang, **H. Zhang,** and S. Robeson, Intrinsic random functions and universal kriging on the circle, *Statistics and Probability Letters*, 108: 33-39.

4.3 Refereed Conference Proceedings Papers Published in 2016

Rich Fabiano
R. Fabiano and C. Payne, A semidiscrete approximation scheme for linear neutral delay-differential equations which preserves adjoint semigroup convergence, *Proceedings of the 55th IEEE Conference on Decision and Control*: 2296-2301.

Thomas Lewis
T. Lewis, Distributional derivatives and the stability of discontinuous Galerkin finite element approximation methods, *Electron. J. Differential Equations*., Conf. 23: 59-76.

Ratnasingham Shivaji
J. Shi and **R. Shivaji,** Uniqueness of positive solutions for cooperative Hamiltonian elliptic systems, *Electron. J. Differential Equations*, Conf. 23: 155-173.

R. Dhanya, E. Ko, and **R. Shivaji**, Existence of three solutions for a two-point singular boundary-value problem with an unbounded weight, *Electron. J. Differential Equations*, Conf. 23: 131-138.

4.4 Journal Articles Accepted in 2016

Greg Bell
G. Bell, D. Moran, and A. Nagorko, Coarse property C and decomposition complexity, *Topology and its Applications*.

Maya Chhetri
M. Chhetri, P. Drabek and R. Shivaji, Analysis of positive solutions for classes of quasilinear singular problems on exterior domains, *Advances in Nonlinear Analysis*.

M. Chhetri and P. Girg, Asymptotically linear system of three equations near resonance, *Journal of Differential Equations*.

M. Chhetri and P. Girg, Global bifurcation of positive solutions for a class of superlinear elliptic systems, *Journal of Differential Equations*.

M. Chhetri and P. Girg, On the solvability of asymptotically linear systems at resonance, *J. Math. Anal. Appl*.

Igor Erovenko
I.V. Erovenko and J. Rychtář, The evolution of cooperation in 1-dimensional mobile populations, *Far East Journal of Applied Mathematics.*

Talia Fernós
T. Fernós, The furstenberg poisson boundary and cat(0) cube complexes, *Ergodic Theory & Dynamical Systems*.

Xiaoli Gao
X.L. Gao, S. E. Ahmed and Yang Feng, (Discussion paper) Post selection shrinkage estimation for high-dimensional data analysis, *Applied Stochastic Models in Business and Industry*.

X.L. Gao, A flexible shrinkage operator for fussy grouped variable selection, *Statistical Papers*.

Sat Gupta
J. Shabbir and **S. Gupta**, On estimation of finite population mean in simple and stratified random sampling using two auxiliary variables, *Communications in Statistics - Theory and Methods.*

A. Chhabra, B.K. Dass, and **S. Gupta**, Estimating prevalence of sexual abuse by an acquaintance with an optional unrelated question RRT Model, *North Carolina Journal of Mathematics and Statistics*.

S. Yadav, **S. Gupta**, S.S. Mishra, and S.S Shukla, Modified ratio and product estimators for estimating population mean in two-phase sampling, *American Journal of Operational Research.*

S. Ahmed, J. Shabbir, and **S. Gupta**, Use of scrambled response model in estimating the finite population mean in the presence of non response when coefficient of variation is known, *Communications in Statistics - Theory and Methods*.

T. Zatezalo, **S. Gupta**, S. Yadav, and J. Shabir, Assessing the adequacy of first order approximations in ratio type estimators, *Journal of Interdisciplinary Mathematics*.

J. Shabbir and **S. Gupta**, Estimation of population coefficient of variation in simple and stratified random sampling under two-phase sampling scheme when using two auxiliary variables, *Communications in Statistics – Theory and Methods*.

D. Suarez and **S. Gupta**, Variations of the Greenberg unrelated question binary model, *Involve.*

L. Khan, J. Shabbir, and **S. Gupta**, Unbiased ratio estimators of the mean in stratified ranked set sampling, *Hacettepe Journal of Mathematics and Statistics*.

Sebastian Pauli
S. Pauli and B. Sinclair, Enumerating extensions of (pi)-adic fields with given invariants, *International Journal of Number Theory*.

Scott Richter
S. Richter and M. McCann, Permutation tests of scale using deviances, *Communications in Statistics: Simulation and Computation.*

S. Saari, M. Higgins, **S. Richter**, and S. Faeth, Urbanization is associated with reduced abundance and species richness of terrestrial animals, *American Naturalist*.

I. Bhatt, S. Phillips, **S. Richter**, D. Tucker, K. Lundgren, R. Morehouse, and V. Henrich, A polymorphism in human estrogen-related receptor beta (ESRRβ) predicts audiometric temporary threshold shift, *International Journal of Audiology*.

Jonathan Rowell
I. Reding, M. Kelley, **J. Rowell**, and J. Rychtář, A Continuous ideal free distribution approach to the dynamics of selfish, cooperative, and kleptoparasitic populations, *Royal Society Open Science*.

N. Galanter, D. Silva Jr, J. **Rowell**, and J. Rychtář, Resource competition and overlapping territories: the territorial raider model applied to multi-group interactions, *Journal of Theoretical Biology*.

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

N. Galanter, D. Silva Jr, J. **Rowell**, and J. Rychtář, The territorial raider game and graph derangements, *Discrete Applied Mathematics*.

Jan Rychtář
I. Erovenko and **J. Rychtář**, The evolution of cooperation in one-dimensional mobile populations, *Far East Journal of Applied Mathematics.*

C. Dorsett, H. Oh, M. Paulemond, and **J. Rychtář**, Optimal repellent usage to combat Dengue Fever, *Bulletin of Mathematical Biology.*

M. Broom, **J. Rychtář**, and T. Spears-Gills, The game-theoretical model of using insecticide-treated bed-nets to fight malaria, *Applied Mathematics.*

N. Galanter, D. Silva Jr, J. Rowell, and **J. Rychtář**, The territorial raider game and graph derangements, *Discrete Applied Mathematics.*

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

I. Redding, M. Kelley, J. Rowell, and **J. Rychtář**, A continuous ideal free distribution approach to the dynamics of selfish, cooperative, and kleptoparasitic populations, *Royal Society Open Science*.

M. Broom and **J. Rychtář**, Evolutionary games with sequential decisions and dollar auctions, *Dynamic Games and Applications*.

M. Broom and **J. Rychtář**, Ideal cost-free distributions in structured populations for general payoff functions, *Dynamic Games and Applications*.

D. Sykes and **J. Rychtář**, Optimal aggression in kleptoparasitic interactions, *Involve*.

N. Galanter, D. Silva Jr, J. Rowell, and **J. Rychtář**, The territorial raider model applied to multi-group interactions, *Journal of Theoretical Biology*.

Filip Saidak
F. Saidak, A note on Euclid's Theorem concerning the infinitude of the primes, *Acta Univ. M. Belii*.

Ratnasingham Shivaji

D. D. Hai and **R. Shivaji**, On radial solutions for singular combined superlinear elliptic systems on annular domains, *J. Math. Anal. Appl*.

J. Goddard and **R. Shivaji**, Stability analysis for positive solutions for classes of semilinear elliptic boundary value problems with nonlinear boundary conditions, *Proceedings of the Royal Society of Edinburgh*.

M. Chhetri, P. Drabek, and **R. Shivaji**, Analysis of positive solutions for classes of quasilinear singular problems on exterior domains, *Advances in Nonlinear Analysis.*

R. Shivaji, I. Sim, and B. Son, A uniqueness result for a semipositone p-Laplacian problem on the exterior of a ball, *J. Math. Anal. Appl*.

Q. Morris, **R. Shivaji**, and I. Sim, Existence of positive radial solutions for a superlinear semipositone p-Laplacian problem on the exterior of a ball, *Proceedings of the Royal Society of Edinburgh.*

M. Mallick, **R. Shivaji**, B. Son, and S. Sundar, Bifurcation and multiplicity results for a class of $n \times n$ p-Laplacian system, *Communications on Pure and Applied Analysis.*

Cifford Smyth

J. Rudzinski and **C. Smyth**, Equivalent formulations of the bunk bed conjecture, *North Carolina Journal of Mathematics and Statistics*.

Jerry Vaughan

J. Vaughan, Companions of directed sets and the Ordering Lemma, *Topology and Its Applications*.

Dan Yasaki

A. R. Booker, J. Sijsling, A. V. Sutherland, J. Voight, and **D. Yasaki**, A database of genus-2 curves over the rational numbers. *LMS J. Comput. Math*.

4.5   Refereed Conference Proceedings Papers Accepted in 2016

Richard Fabiano

R. Fabiano and C. Payne, A semidiscrete approximation scheme for linear neutral delay-differential equations which preserves adjoint semigroup convergence, *Proceedings of the 55th IEEE Conference on Decision and Control*.

Xiaoli Gao

J. Deng, **X. Gao**, and C. Wang, Using bi-level penalized logistic classier to detect zombie accounts in online social networks, *Fifth International Conference on Network, Communication and Computing (ICNCC 2016)*.

Ratnasingham Shivaji

J. Shi and **R. Shivaji**, Uniqueness of positive solutions for cooperative Hamiltonian elliptic systems. *Electron. J. of Differential Equations*, Conf. Series.

R. Dhanya, E. Ko, and **R. Shivaji**, Existence of three solutions for a two-point singular boundary-value problem with an unbounded weight. *Electron. J. of Differential Equations,* Conf. Series.

4.6   Research Presentations in 2016

Greg Bell
Multiscale persistence, Joint Meeting of the AMS and MAA, Seattle, Washington.

On asymptotic property C, UNCG Topology Seminar, Greensboro, North Carolina.

On product-stability of asymptotic property C, University of Florida Topology Seminar, Gainesville, Florida.

Computational topology, UNCG REU in Mathematical Biology, Greensboro, North Carolina.

Maya Chhetri
Asymptotically linear systems, Joint UNCG-WFU Applied Math Seminar, Wake Forest University, Winston-Salem, North Carolina.

Asymptotically linear system of three equations, The 11th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Orlando, Florida.

On the solvability of asymptotically linear systems at resonance, The 11th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Orlando, Florida.

Global bifurcation of positive solutions for a class of superlinear elliptic systems, International Conference on Applications of Mathematics to Nonlinear Sciences, Kathmandu, Nepal.

Global bifurcation of positive solutions for a class of superlinear elliptic systems, Joint Mathematics Meeting, Seattle, Washington.

Igor Erovenko
Ideal free distributions with limited perception and population dynamics, International Symposium on Biomathematics and Ecology Education and Research, College of Charleston, Charleston, South Carolina.

Rich Fabiano
A semidiscrete approximation scheme for linear neutral delay-differential equations which preserves adjoint semigroup convergence, 55th IEEE Conference on Decision and Control, Las Vegas, Nevada.

Talia Fernós

Regular elements and CAT(0) cube complexes, Wasatch Topology Conference, Midway, Utah.

The poisson-furstenberg boundary and CAT(0) cub complexes, Geometry, Topology, and Dynamics Seminar, Orsay, France.

CAT(0) cube complexes and low dimensional cohomology, Connections for Women Workshop, MSRI, Berkeley, California.

Regular isometries of CAT(0) cube complexes are plentiful, Groups Acting on CAT(0) Spaces, MSRI, Berkeley, California.

Boundaries of CAT(0) cube complexes, Workshop on Boundaries of Groups, American Institute of Mathematics, San Jose, California.

Xiaoli Gao

Penalize weighted least absolute deviation regression, UNCG International Conference on Advances in Interdisciplinary Statistics and Combinatorics, Greensboro, North Carolina.

Recent advances in variable identification and regression analysis, ICSA Conference on Data Science, Yunnan, China.

Penalized weighted least squares for outlier detection and robust regression, The 4th Institute of Mathematical Statistics Asia Pacific Rim Meeting, The Chinese University of Hong Kong, Hong Kong, China.

Robust high-dimensional data analysis using a weight shrinkage rule, ICSA Applied Statistics Symposium, Atlanta, Georgia.

Sat Gupta

Improved estimators of mean of a sensitive variable using optional RRT models, University of South Florida, Tampa, Florida.

Applied statistics – some interesting applications, Elon University, Elon, North Carolina.

Respondent privacy through randomized response models, University of Maryland, College Park, Maryland.

Some interesting applications of statistics & undergraduate level research projects, Lamar University, Beaumont, Texas.
Testing for statistical significance, UNCG REU in Mathematical Biology, Greensboro, North Carolina.

Data confidentiality and respondent privacy protection, IISA conference at Oregon State University, Corvallis, Oregon.

Statistical consultant – representing the client in front of third parties – UNCG International Conference on Advances in Interdisciplinary Statistics and Combinatorics, Greensboro, North Carolina.

Challenges for a statistical consultant when representing a client, LSU Health Sciences Center, New Orleans, Louisiana.

Data security in the digital age, International Conference on re-envisioning economies, sustainability and inclusive growth, St Xavier's College, Jaipur, India.

Recent advances in randomized response models, International Conference on Interdisciplinary Mathematics, Statistics and Computational Techniques, Manipal University, Jaipur, India.

Tracey Howell
T. Howell and C. Seaman, *Our emporium model in precalculus: another year of learning and growing,* Research Council on Mathematics Learning, Orlando, Florida.

Thomas Lewis
Numerical moments and the approximation of fully nonlinear second order partial differential Equations, SIAM Annual Meeting - MS141 Recent Advances in Finite Element Methods for Nonlinear PDEs, Boston, Massachusetts.

Narrow-stencil finite difference methods for approximating viscosity solutions of Hamilton-Jacobi-Bellman equations, SEARCDE, Fort Meyers, Florida.

Difference quotients and numerical differential equations, UNCG REU in Mathematical Biology, Greensboro, North Carolina.

Scott Richter
Multiple comparison of scale using permutation tests, Joint Statistical Meetings, Seattle, Washington.

Jonathan Rowell
Mathematics and games in biology, University of North Carolina at Wilmington, Wilmington, NC.

Migration under biased perception: the distribution of specialists and generalists in a heterogeneous landscape with variably discounted resources, Ninth Annual International Symposium on Behavioral Ecology: Education and Research, College of Charleston, Charleston, South Carolina.

Life is but a game: using mathematics and game theory in biology, Maryville College, Maryville, North Carolina.

Sympathetic inhibition: understanding a dynamic paradox when inhibitors promote future expressions, The 11th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Orlando, Florida.

"An introduction to game theory" tutorial: game theoretical modeling of evolution in structured populations, University of Tennessee, Knoxville, Tennessee.

"Spatially structured biological games when neither players nor space are discrete" tutorial: game theoretical modeling of evolution in structured populations, University of Tennessee, Knoxville, Tennessee.

"Writing Matlab codes" tutorial: game theoretical modeling of evolution in structured populations, University of Tennessee, Knoxville, Tennessee.

Jan Rychtář
Territorial movement game, Biomathematics & Ecology: Education and Research, Charleston, South Carolina.

Territorial raider games, NIMBioS game theory tutorial, Knoxville, Tennessee.

Territorial raider games, Conflict, Competition, Cooperation & Complexity, Plon, Germany.

Evolutionary dynamics in finite structured populations, Joint Mathematics Meeting, Seattle, Washington.

Carol Seaman
Our emporium model in precalculus: another year of learning and growing, Research Council on Mathematics Learning, Orlando, Florida.

Ratnasingham Shivaji
Semipositone problems, International Confernece on Applications of Mathematics to Nonlinear Sciences, Kathmandu, Nepal.

Introduction to boundary value problems, University of North Carolina at Asheville, North Carolina.

A positivity challenge in steady state reaction diffusion problems, University of Sri Lanka, Peradeniya, Sri Lanka.

Proving Uniqueness results for steady state reaction diffusion equations-an introduction, Kennesaw State University, Kennesaw, Georgia.

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

A positivity challenge in steady state reaction diffusion problems, UNCG & NC A & T Joint Applied Math Seminar, NC A & T State University, North Carolina.

On radial solutions for singular combined superlinear elliptic systems on annular domains, AMS Sectional Meeting, Raleigh, North Carolina.

Brett Tangedal
Analytic expressions for roots of various polynomials, UNCG Colloquium, Greensboro, North Carolina.

Jerry Vaughan
Companions of directed sets, Prague Topology Symposium, Prague, Czech Republic.

Convergence and clustering of transfinite sequences associated with nets, 31st Summer Conference on Topology and Its Application, Leicester, England.

Companions of directed sets and the ordering lemma, American Mathematical Society Sectional Meeting, Raleigh, North Carolina.

Dan Yasaki
Perfect forms over CM quartic fields, Lattices and Applications in Number Theory Mathematisches Forschungsinstitut Oberwolfach (MFO), Oberwolfach, Germany.

Constructing explicit elements in algebraic K-theory, Research in pairs (RiP), Mathematisches Forschungsinstitut Oberwolfach (MFO), Oberwolfach, Germany.

Computing certain modular forms using polytopes, Southern New England Conference on Quadratic Forms and Modular Forms, Wesleyan University, Middletown, Connecticut.

Computing Bianchi modular forms using polytopes, Workshop on Bianchi Modularity, Université du Luxembourg, Luxembourg City.

Computation of certain modular forms using Voronoi polytopes, Computations in the Cohomology of Arithmetic Groups, Mathematisches Forschungsinstitut Oberwolfach (MFO), Oberwolfach, Germany.

Haimeng Zhang
Covariance and variogram estimators on the circle, UNCG International Conference on Advances in Interdisciplinary Statistics and Combinatorics, Greensboro, North Carolina.

Covariance structures and estimation for axially symmetric spatial processes on the sphere, 25th ICSA Applied Statistics Symposium, Atlanta, Georgia.

4.7   Department Journals

Topology and its Applications
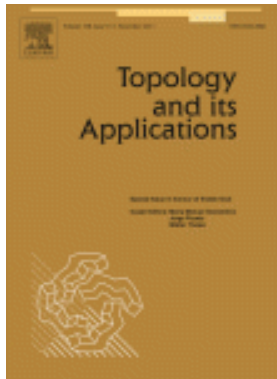
Topology and its Applications is a journal primarily concerned with publishing original research papers in topology. In 2016 the journal published 330 articles (4378 pages). The journal publishes papers in algebraic, general, geometric, dynamics, and set-theoretic facets of topology as well as areas 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 three major abstracting databases, Mathematical Reviews, Zentralblatt MATH, and Scopus index the journal.
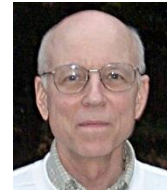
**Jerry Vaughan,
Editor-in-Chief**

The Journal of Statistical Theory and Practice

**Sat Gupta,
Editor-in-Chief**

http://www.tandfonline.com/loi/UJSP20/
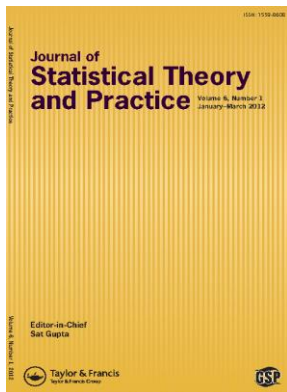
The Journal of Statistical Theory and Practice was conceived and started in 2007 by Professor Sat Gupta, who continues to serve as its Editor-in-Chief. It is published by Taylor and Francis. Its editorial board boasts of some of the most eminent statisticians such as C. R. Rao (Penn State), Joe Gani (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).
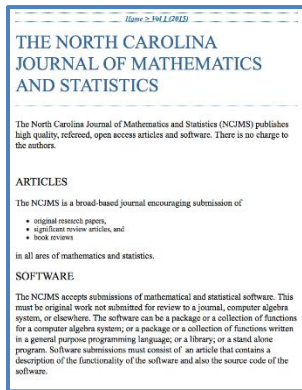
The journal published a total of 50 papers and one book review in 2016 accounting for a total of 611 pages.

The North Carolina Journal of Mathematics and Statistics

http://ncjms.uncg.edu/

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.

Jan Rychtář and Sebastian Pauli, Managing Editors

This journal 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 with 5 articles appeared in 2016. The third issues is being published in 2017.

5. 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
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

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
14-0209	**Zhang, Haimeng**		Collaborative research: Axially symmetric processes and intrinsic random functions on the sphere	9/15/12	8/31/16	National Science Foundation	$47,468
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
14-0054	**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	5/14/14	8/31/19	Simons Foundation	$35,000

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
			problems and applications				
14-0087	**Yasaki, Dan**		Voronoi Reduction Theory and Applications to Arithmetic Groups	5/1/15	4/30/17	National Security Agency	$40,000
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
15-0290	**Gao, Xiaoli**		Robust Estimation and Signal Approximation for High Dimensional Data	9/1/15	8/31/20	Simons Foundation	$35,000
15-0301	**Smyth, Clifford**		Collaboration in Combinatorics	9/1/15	8/31/20	Simons Foundation	$35,000
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

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

Future Awards to be Administered by Mathematics and Statistics:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
17-0037	**Rychtář, Jan**	**Erovenko, Igor; Gao, Xiaoli; Rowell, Jonathan; Saidak, Filip**	REU Site: Mathematical Biology at the UNCG	5/1/17	4/30/20	National Science Foundation	$304,959

N/A	Gupta, Sat	Gao, Xiaoli	Statistical and Machine Learning Approach to Complex Data Analysis	6/1/18	7/31/18	American Statistical Association/NSF	$38,600

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	4/30/17	National Institute of Health	$4,350,879
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
16-0118	School of Education	**Seaman, Carol; Howell, Tracey**	Core Mathematics Instructional Practices in Secondary Schools (CMaPSS)	2/15/16	6/30/17	UNCGA North Carolina Quest	$281,247

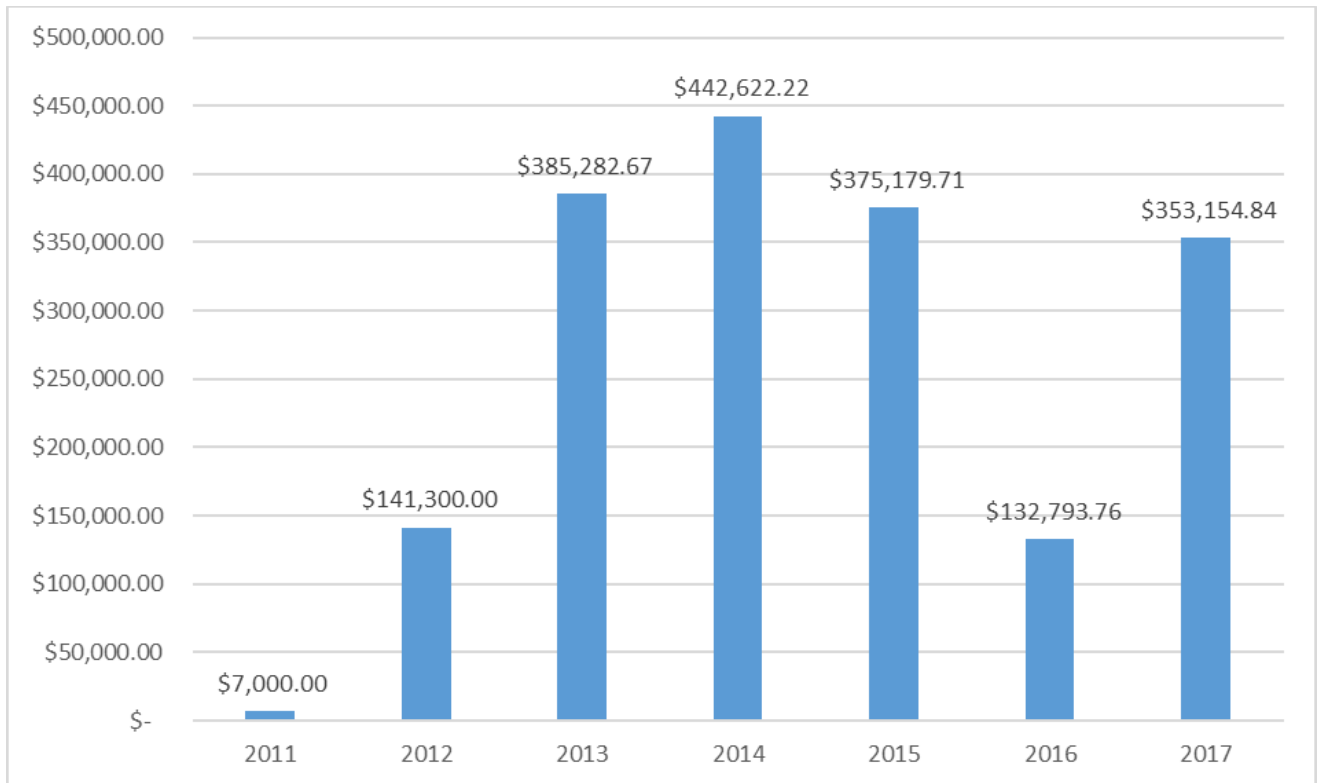## Future Awards to be Administered by other Departments:

PROP #	Department	Mathematics and Statistics Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
17-0190	**School of Education**	**Seaman, Carol; Howell, Tracey**	Sustaining Core Mathematics Instructional Practices in Secondary Schools (CMaPSS II)	7/1/17	6/30/18	UNCGA North Carolina Quest	$153,377

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	**Shivaji, Ratnasingham**		P-3: Infinite Semipositone Problems	2/16/16	7/31/17	UNCG – College of Arts and Sciences	$3,000
N/A	**Yasaki, Dan**		Faculty First Summer Scholarship Support Award	4/10/17	8/31/17	UNCG – Office of Research and Economic Development	$5,000
N/A	**Bell, Greg**		Faculty First Summer Scholarship Support Award	4/10/17	8/31/17	UNCG – Office of Research and Economic Development	$5,000
N/A	**Gao, Xiaoli**		Robust integrative data analysis for ontology-powered big biological data	5/1/17	4/1/18	UNCG – Strategic Seed Grant	$15,000
N/A	**Gao, Xiaoli**		Identifying High-Risk and Underserved Neighborhoods for Interpersonal Violence and Abuse in Greensboro Using GIS and Big Data Analysis	5/1/17	4/1/18	UNCG – Strategic Seed Grant	$25,000

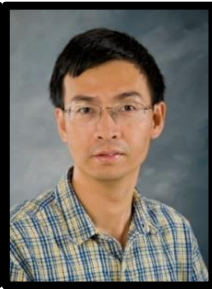# Grant Awards by Academic Year (Note: 2017 has pending grants)

Year	Amount
2011	$7,000.00
2012	$141,300.00
2013	$385,282.67
2014	$442,622.22
2015	$375,179.71
2016	$132,793.76
2017	$353,154.84

5.3   Recent Major External Award Recipients

Fernós   **Zhang**   **Shivaji**

NSF Grants

Yasaki   **Smyth**

NSA Grants

Rychtář   **Gao**   **Smyth**   **Shivaji**   **Fernós**

Simons Foundation Grants

Lewis

**MAA
NExT Fellow**

Gupta

**Fellow of ASA,
Sankhyiki Bhushan Award**
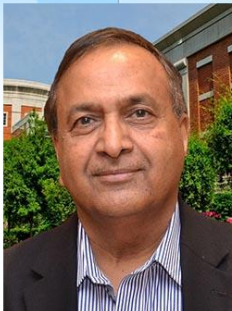
NSF and Simons Foundation Grants

Congratulations to Dr. Talia Fernós who is a recipient of a National Science Foundation (NSF) research grant titled, "Rigidity of Isometric Hilbert Space Actions Using the Tool of Low Dimensional Cohomology". Dr. Fernós is also a recipient of a Simons Foundation grant titled, "Low Dimensional Cohomology and the Geometry of Hilbert Space".

Simons Foundation Grant

Congratulations to Dr. Xiaoli Gao who is a recipient of a Simons Foundation grant for her project titled, "Robust Estimation and Signal Approximation for High-dimensional Data".

ASA Fellow and Sankhyiki Bhushan Award

Congratulations to Dr. Sat Gupta who has been elected a Fellow of the American Statistical Association in 2017.

He was also a recipient of the Sankhyiki Bhushan Award (given by The Indian Society of Agricultural Statistics) in 2016.

Project NExT Fellowship

Congratulations to Dr. Thomas Lewis who is a recipient of a Project NExT Fellowship.

Simons Foundation Grant

Congratulations to Dr. Jan Rychtář who is a recipient of a Simons Foundation grant for his project titled, "Game-theoretical Models in Biology".

NSF and Simons Foundation Grants

Congratulations to Dr. Ratnasingham Shivaji who is a recipient of a National Science Foundation (NSF) research grant titled, "Collaborative Research: Mathematical and Experimental Analysis of Ecological Models," and a Simons Foundation grant titled, "Analysis of Nonlinear Eigenvalue Problems and Applications".

NSA and Simons Foundation Grants

Congratulations to Dr. Clifford Smyth who is a recipient of a National Security Agency (NSA) research grant titled, "Correlation Inequalities", and a Simons Foundation grant titled, "Collaboration in Combinatorics".

NSA Grant

Congratulations to Dr. Dan Yasaki who is a recipient of a National Security Agency (NSA) Young Investigator's grant for his project titled, "Voronoi Education Theory and Applications to Arithmetic Groups."
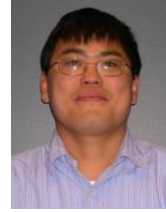
NSF Grant
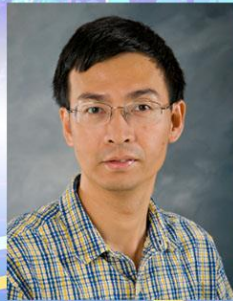
Congratulations to Dr. Haimeng Zhang who is a recipient of a National Science Foundation (NSF) research grant titled, "Statistical Analysis of Global-scale Processes and Phenomena.

6. Undergraduate Program

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

Dan Yasaki, Director of Undergraduate Studies

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 2016-17 academic year, 19 students earned a Bachelor's degree in mathematics: Asad Asad, Jason Carter, Dongyan Chen, Jason Cogley, Bryan Davis, Emily Farthing, Karen Funderburk, Michael Garrison, Stephen Hurley, Ashley Jones, Aaron Lee, Arthur Travis Morgenstern, Jessica Nash, Seung Min Park, Christopher Neil Pritchard, Joshua Safley, Alex Smith, David P. Suarez, and Kany Whitehead. The Department Graduation Ceremony was held on May 12, 2017.

Graduates, faculty, and families at the 2017 Graduation Ceremony Reception & Ceremony

Graduates with their family and some faculty at the 2016 Graduation Ceremony

Graduates with their family at the 2016 Graduation Ceremony

**Student Excellence Award Winners, Neil Pritchard
and Ashley Jones, at the 2017 Graduation Ceremony**

Neil Pritchard and Ashley Jones each won the Student Excellence Award for 2016-17 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, Neil and Ashley each presented on their experience as an undergraduate student at UNCG.

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 2017 Graduation 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 Surveillance 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) to allow 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 RVF virus.

7.2   2017 National Science Foundation Funded Research Experiences for Undergraduates Program (REU site)

Jan Rychtář, Lead Principal Investigator

Jonathan Rowell Principal Investigator

Olav Rueppell, Principal Investigator

Filip Saidak

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 2014-2016. Jan Rychtář and Olav Rueppell then received a continuation of the NSF REU grant for summers 2017-2019.

For nine weeks in 2017 (mid-May to mid-July), Drs. Erovenko, Saidak, Rueppell (Biology), and Oh (Bennett College) worked with ten undergraduate students that came from University of Minnesota-Twin Cities, Bowdoin College, Regis University, Bennett College, Northern Michigan University, Whitworth University and UNCG.

The 2017 cohort consisted of 5 female and 5 male students. Six out of ten students came from under-represented minorities, specifically five were Hispanic and one was African American. Student maturity varied from freshmen to seniors, and their prior course work in mathematics, statistics, and biology varied extensively.

The nine-week program consisted of two distinct phases. In the first week, 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.

Suzanne Lenhart (University of Tennessee at Knoxville and NIMBioS) was the evaluator for the REU program.

Michael Leshowitz, an MA student within our Department, was responsible for the morning 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. Prashant Waiker, a Ph.D. student at the Biology 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.

REU undergraduate student presenters, Rosa Rossi-Goldthorpe of Bowdoin College, Kyle Weishaar of Regis University, and Andrew Brettin of the University of Minnesota-Twin Cities

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.

2017 Summer NSF-REU participants, faculty, & graduate student mentors

REU Site: Mathematical Biology at UNCG
Summer 2017
http://www.uncg.edu/mat/bio-math/REU

DMS Grant #1359187 (2014-2017)
and #1659646 (2017)

Summer 2017 participants
- University of Minnesota – Twin Cities
- Bowdoin College
- Regis University
- Bennett College
- Northern Michigan University
- Whitworth University
- University of North Carolina at Greensboro

Research Projects
- Honey Bee Health – Analyzing Virus Transmission and Social Immunity in Complex Societies
- Vaccination Game Theory

Faculty mentors

J. Rychtář   J. Rowell   O. Rüeppell   F. Saidak   I. Erovenko   X. Gao   H. Oh

Conference presentations
60 (and counting) student presentations at
- International Conference of Undergraduate Research
- International Symposium on Biomathematics and Ecology Education and Research
- Joint Mathematics Meetings

Journal articles submitted:

9 (and counting) accepted or published at
- Journal of Theoretical Biology
- Royal Society Open Science
- Discrete Applied Mathematics
- Letters in Biomathematics
- Journal of Interdisciplinary Mathematics
- Spora

Research projects

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

Honey bee health - Analyzing virus transmission and social immunity in complex societies

Honey bees (Apis mellifera L) are of significant ecological and economic importance and present excellent experimental study systems. Usually, one reproductive queen lives with thousands of female workers in a cohesive colony, coordinated by a complex communication and division of labor system. The bee colony represents in many regards a functional unit that can be compared to a superorganism. Thus, the colony is a dense, integrated network of individuals, which makes it susceptible to diseases. Recently, honey bee health has declining dramatically, threatening the pollination services that the apicultural industry provides. Multiple disease agents have been identified and we studied an important virus, Israeli Acute Paralysis Virus from a practical and theoretical perspective. We investigated IAPV transmission in small experimental groups of honey

bees with varying transmission routes to understand the dynamic of a IAPV outbreak and individual infection risk. This work should contribute to understanding of honey bee‐virus interactions and help improving honey bee health.

Vaccination Game Theory

As witnessed by the recent outbreak of measles, there is a gap between interest of the individuals and the interest of the population as a whole. From the individuals' perspective, the benefits of vaccination (i.e. not getting the disease) may not be high enough to outweigh the cost of the vaccination (i.e. potential vaccine side effects) especially when majority of the population is vaccinated that the disease outbreak seems highly unlikely. Such scenarios are successfully modeled by game theory. The 2017 projects focused on voluntary vaccination policies to eradicate Ebola, optimal vaccination strategies to reduce endemic levels of meningitis in Africa, optimal vaccination strategies to combat S. Typhi transmission in South Asia.

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

J. Kobe, **N. Pritchard**, Z. Short, I.V. Erovenko, J. Rychtář, J. T. Rowell; A Game-Theoretic Model of Cholera With Optimal Personal Protection Strategies, submitted to Bulletin of Mathematical Biology.

D. Sykes, J. Rychtář. Optimal Aggression in Kleptoparasitic Interactions, Involve, 10 (5) (2017): 735-747.

A. Nguyen, **J. Saini,** J. Rowell, and J. Rychtář, Cooperation in finite populations: being alone helps, *Journal of Interdisciplinary Mathematics*, 19 (4) (2016): 799-809.

Presentations
- **Karen Funderburk**, Tim DeLory, Olav Rueppell, Genomic recombination across 6 populations of A. mellifera. 11th Annual Carolyn & Norwood Thomas Undergraduate Research and Creativity Expo, April 10, 2017, UNCG, Greensboro, NC.

- **Karen Funderburk**, Tim DeLory, Olav Rueppell, Genomic recombination across 6 populations of A. mellifera. 13th Southern Appalachian Honeybee Research Consortium Symposium, Greensboro, NC.

- **Neil Pritchard**, Julia Kobe, Ziaquiria Short: A Game-Theoretical Model of Cholera with Optimal Personal Protection Strategies, NIMBioS Undergraduate Math Biology conference, Knoxville, TN, 2016.

- **Jessica Nash**: Analysis of Steady States for Classes of Reaction-Diffusion Equations with Hump-Shaped Density Dependent Dispersal on the Boundary, UNCG RMSC, November 12, 2016.

- **David Perez-Suarez**: Greenberg Unrelated Question Binary RRT Model under Inverse Sampling, UNCG RMSC, November 12, 2016.

- **Neil Pritchard**, Julia Kobe, Ziaquiria Short: A Game-Theoretical Model of Cholera with Optimal Personal Protection Strategies, Joint UNCG, NCA&T and Winthrop University REU minisymposium, July 15, 2016.

- Tim DeLory and **Karen Funderburk**: Building a Linkage Map Across Five Apis mellifera Populations: Physical and Digital Concepts, Joint UNCG, NCA&T and Winthrop University REU minisymposium, July 15, 2016.

- **Neil Pritchard**, Julia Kobe, Ziaquiria Short: A Game-theoretical model of Cholera with Optimal Vaccination Strategies, Joint REUs minisymposium, NC State University, June 17, 2016.

- Tim DeLory and **Karen Funderburk**: Building a Linkage Map Across Five Apis mellifera Populations: Physical and Digital Concepts, Joint REUs minisymposium, NC State University, June 17, 2016.

8. Graduate Program

8.1   Year in Review

**Greg Bell, Director of
Graduate Studies**

Our graduate program consists of Ph.D. in computational Mathematics and M.A. in Mathematics with five concentrations: Mathematics, Applied Statistics, Actuarial Mathematics, Data Analytics, and Teaching College Mathematics. This year we graduated ten M.A. students and eight Ph.D. students. We also initiated Graduate Excellence Awards in Research and Teaching and a Professional Mentoring Program. We continued with our successful Teaching Mathematics seminar to our first year Graduate Teaching Assistants. Five new courses; Teaching Practicum in Mathematics (MAT 603), Project in Mathematics (MAT 687), Ordinary Differential Equations (MAT 735), Partial Differential Equations (MAT 736), and Modern Abstract Algebra (MAT 741); were approved by the University and we renumbered several courses from 600-level to 700-level. We also continued our active recruitment program and our successful Graduate Teas.

8.2 Programs & Certificates

THE UNIVERSITY of NORTH CAROLINA
GREENSBORO
Department of
Mathematics & Statistics

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**

Graduate Assistantship
Academic Year:
$18,000+tuition waivers.
Summer support is also
often available.
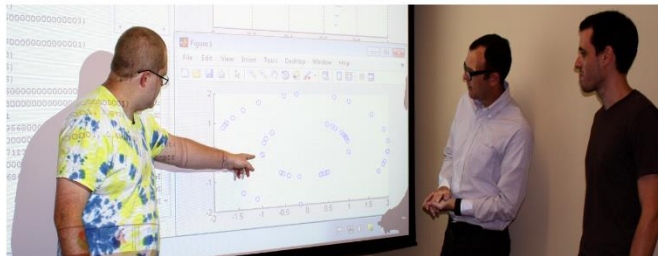
66

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

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

Graduate Assistantship
Academic Year:
$10,800+tuition waivers.
Summer support is also
often available.

WANT TO BECOME AN EXPERT IN DATA ANALYTICS?

Get started with our Masters with a Concentration in Data Analytics

WHO CAN APPLY?

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

One of the Best Jobs of 2015

-Business Insider

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
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Mathematics & Statistics

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

#1
Best Jobs of 2015

-Business Insider

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

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

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

POST-BACCALAUREATE CERTIFICATE IN STATISTICS

Enhance your Data Analysis skills

FLEXIBLE PROGRAM

We already offer a variety of courses during evening hours (after 4:00 pm) and we plan to offer fully online courses effective fall 2017 to make it possible to complete the requirements for Post-Baccalaureate Certificate in Statistics by way of fully online courses.

WHO CAN APPLY?

Anyone with an undergraduate degree with at least one statistics course and a strong desire to acquire advanced data analysis skills

REQUIREMENTS (12 CREDITS)

STA 661 Advanced Statistics in the Behavioral and Biological Sciences I

STA 662 Advanced Statistics in the Behavioral and Biological Sciences II

And
Two additional 500 level or above STA courses

For more information, go to
uncg.edu/mat
uncg.edu/mat/sta/postcert.html

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GREENSBORO
Department of Mathematics & Statistics

8.3 Degrees Awarded

Graduating this year with their M.A. Degree are Bukola Adaramola, Lance Everhart, Victoria Hayes, Michael Leshowitz, Joshua Safley, Ashwag Alghamdi, Monika Goel, Jeffrey Lail, Mingyan Li, and Jennifer Pettie.

In 2016-17, we had 3 new Ph.D. graduates. Christopher Vanlangenberg and Tanja Zatezalo earned their Ph.D. degrees in December 2016. In May 2017, Jeong Sep Sihm earned his Ph.D. Summer 2017 saw 5 additional Ph.D. graduates: Quinn Morris, Byungjae Son, Catherine Payne, Jonathan Milstead, and Ricky Farr. In the past, 2014-15, we had three Ph.D. graduates, bringing the total of Ph.D. graduates so far to eleven.

In December 2016, Christopher Vanlangenberg was awarded a Ph.D. in Computational Mathematics. Chris worked under the supervision of Haimeng Zhang. His dissertation was titled *Data Generation and Estimation for Axially Symmetric Processes on the Sphere*. Chris is currently employed at Apex Analytix in Greensboro, NC.
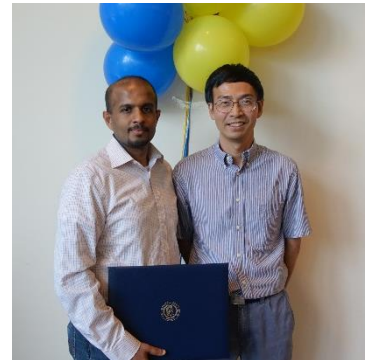
Christopher Vanlangenberg with his advisor, Haimeng Zhang

In December 2016, Tanja Zatezalo was awarded a Ph.D. in Computational Mathematics. Tanja worked under the supervision of Sat Gupta. Her dissertation was titled *Generalized Mixture Estimators for the Finite Population Mean*. Tanja is currently an adjunct math professor at the RTO Campus of Campbell University in Buies Creek, NC.

Tanja Zatezalo with her advisor, Sat Gupta

In May 2017, Jeong Sep Sihm was awarded a Ph.D. in Computational Mathematics. Jeong worked under the supervision of Sat Gupta. His dissertation was titled *Modified Binary Randomized Response Technique Models.* Jeong is currently a non-tenure track professor at Guilford College in Greensboro, NC.

Jeong Sep Sihm with his advisor, Sat Gupta

Summer Graduates that will be attending the December 2017 Commencement Ceremony

In August 2017, Quinn Morris was awarded a Ph.D. in Computational Mathematics. Quinn worked under the supervision of Ratnasingham Shivaji. His dissertation was titled *Analysis of Classes of Superlinear Semipositone Problems with Nonlinear Boundary Conditions*. Quinn is currently a visiting assistant professor at Swarthmore College in Swarthmore, PA.

In August 2017, Byungjae Son was awarded a Ph.D. in Computational Mathematics. Byungjae worked under the supervision of Ratnasingham Shivaji. His dissertation was titled *Analysis of Classes of Singular Steady State Reaction Diffusion Equations*. Byungjae is currently a Post-doctoral student at Wayne State University in Detroit, MI.

In August 2017, Catherine Payne was awarded a Ph.D. in Computational Mathematics. Catherine worked under the supervision of Richard Fabiano. Her dissertation was titled *Approximation of Neutral Delay-Differential Equations*. Catherine is currently an assistant professor at Winston-Salem State Unviersity in Winston-Salem, NC.

In August 2017, Ricky Farr was awarded a Ph.D. in Computational Mathematics. Ricky worked under the supervision of Sebastian Pauli. His dissertation was titled *Results about Fractional Derivatives of Zeta Functions*.

In August 2017, Jonathan Milstead was awarded a Ph.D. in Computational Mathematics. Jonathan worked under the supervision of Sebastian Pauli. *Computing Galois Groups of Eisenstein Polynomials over p-acidic Fields*.

Past Ph.D. Graduates

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.* Abraham works as a non-tenure track assistant professor at Temple University in Philadelphia, PA.

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.* Dani is currently a tenure-track assistant professor at Guilford College in Greensboro, NC.

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.* Brian currently works for the National Security Agency in Ft. George G. Meade, MD.

Ph.D. Graduate, Jeong Sep Sihm, with Haimeng Zhang (left) and Greg Bell (right)

Ph.D. Graduate, Christopher Vanlangenberg, with Ph.D. Graduate, Jeong Sep Sihm (left) and Greg Bell (right)

M.A. Graduates, Michael Leshowitz, Monika Goel, Victoria Hayes, and Joshua Safley at the 2017 Graduation Ceremony

M.A. Graduate, Monika Goel, with her family and Greg Bell

M.A. Graduate, Mingyan Li, with her family and Greg Bell

M.A. Graduates, Ashwag Alghamdi (left) and Michael Leshowitz (right), with Greg Bell

M.A. Graduates, Joshua Safley (left) and Victoria Hayes (right), with Greg Bell

8.4   Graduate Excellence Awards

The Department of Mathematics and Statistics is delighted to announce the establishment of two departmental awards for graduate students: one for excellence in teaching and one for excellence in research.

Graduate Student Teaching Excellence Award

Presented to students with an exceptionally strong record of teaching. The graduate committee will consider student feedback and faculty classroom visits in making this decision. The committee may also consider classroom management and course materials such as tests and homework assignments in making their decision. Successful candidates may have a consistently strong teaching record or may have shown a dramatic improvement.

Graduate Student Research Excellence Award

Presented to students with an exceptionally strong research program. The graduate committee considers papers submitted to, accepted in, or appearing in refereed journals and refereed conference proceedings. The quality of the journal is also considered. Successful candidates will also have a strong record of research talks given at conferences and in seminars. Successful candidates will be regular attendees at all departmental colloquia and lecture series talks as well as discipline-specific seminars.

The inaugural recipients of these awards are **Quinn Morris** (teaching) and **Byungjae Son** (research).

Quinn Morris: Recipient of the Graduate Student Teaching Excellence Award

Throughout his teaching career at UNCG, Quinn has taught some 11 sections of College Algebra and four sections of Business Calculus. These classes are among the more difficult courses to teach because the students are often ill-prepared and sometimes math-phobic. Despite this challenge, Quinn has impressed faculty reviewers, and his student evaluations are outstanding. Faculty comment on his ability to engage his students and maintain their attention throughout his classes. His students comment on

how approachable he is and how enjoyable his classes are. Many students go so far as to proclaim him the best professor they've ever had. It is clear that Quinn devotes a great deal of time and effort into his teaching. He is a model teaching assistant.

Byungjae Son: Recipient of the Graduate Student Research Excellence Award
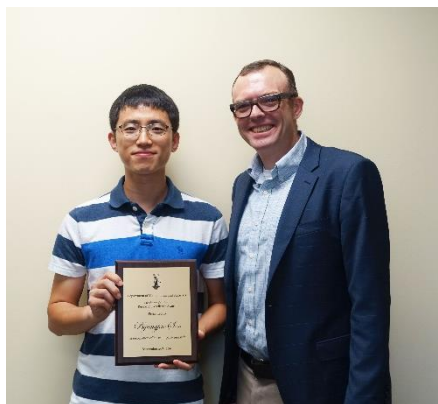
Byungjae Son's research is exceptionally strong. In 2015-16, Byungjae had a joint paper accepted to the Journal of Mathematical Analysis and Application (ranked A in the Australian Mathematics Journal List) and a further paper appeared in this same journal in 2016. He also submitted two joint papers to refereed journals in 2016. One of these has already been accepted into "Topological Methods in Nonlinear Analysis" (ranked B in the Australian Mathematics Journal List). He has been invited to speak at the AMS Fall Sectional Meeting in Raleigh in 2016; he has delivered talks at the Southeastern Atlantic Regional Conference on Differential Equations, the 11th Annual UNCG-RMSC, and the Joint Mathematics Meeting in Seattle. He gave a further four conference talks in previous years. He also attended an IMA Mathematical Modeling in Industry Workshop as well as many other conferences, workshops, and summer schools. Byungjae's research program serves as a model to which all PhD students should aspire.
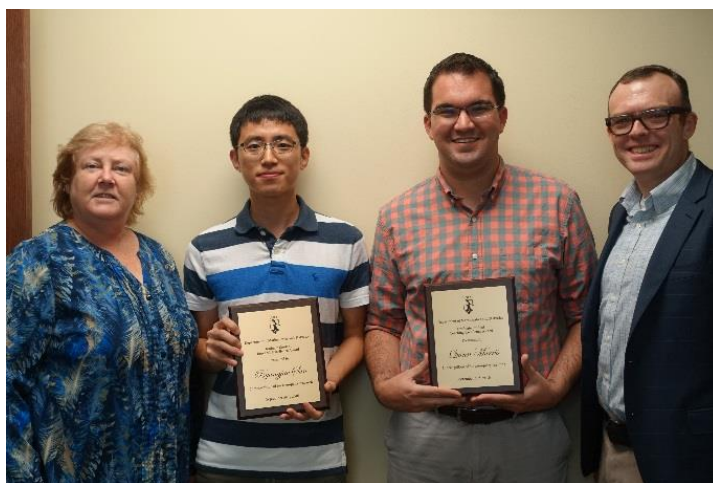
Kelly Burke, Vice Provost for Graduate Education, and Greg Bell with Quinn Morris and Byungjae Son

8.5   Professional Mentoring

This 2016-17 academic year, we began a successful professional mentoring program for our Ph.D. students. Each student was assigned a faculty member who would reach out to them periodically during the academic year. These meetings are documented and recorded. For the academic year 2017-18, we plan to have a rotating assignment for the mentors and mentees. Each Ph. D. student will be assigned a new faculty mentor each semester and meet with them a minimum of 2 times.

Igor Erovenko mentoring graduate student Joshua Safley

Rich Fabiano mentoring graduate student Padma Manthena

Talia Fernós mentoring graduate student Nalin Fonseka

Brett Tangedal mentoring graduate student Amila Muthanayake

Dan Yasaki mentoring graduate student James Rudzinski

Professional Development Series

The Department also began a new lecture series in 2016 that focuses on the professional development of our graduate students. The events focus on topics such as academic job searches, industrial job searches, research ethics, giving mathematical talks, grant writing, and best practices in teaching. The series was organized by Tom Lewis and Haimeng Zhang during the academic year and featured three events. Omar Ali (UNCG) and Nadja Cech (UNCG) presented "The Art and Science of Teaching and Mentoring" and Carol Seaman (UNCG) spoke on "Collaborating on Research, Grant Writing, and Instruction in STEM Education" during the Fall 2016 semester. Arthur Schwartz (Associate Property & Casualty Actuary in the North Carolina State Government's Department of Insurance) presented "A Career as an Actuary?" during the Spring 2017 semester.

Omari Ali and Nadja Cech presenting at our Professional Development Seminar

Arthur Scwartz presenting at our Professional Development Seminar

Shivaji and Greg Bell with graduate students Quinn Morris and Aaron Rapp doing a learning exercise with UNCG's Omari Ali and Nadja Cech during a Professional Development Seminar

Mathematics and Statistics Professional Development Lecture Series

Fall 2016

This is a new lecture series/workshop focused on the professional development of graduate students in the UNCG Department of Mathematics & Statistics. The events will focus on topics such as academic job searches, industrial job searches, research ethics, giving mathematical talks, and best practices in teaching. All graduate students are encouraged to attend.

Organizing Committee: Tom Lewis, Haimeng Zhang

Jerome Goddard II (Auburn University Montgomery)
How to Navigate the Mathematics Academic Job Market
Monday, June 27, 2016, at 3:30pm in Petty 223*

Omar Ali (UNCG) and Nadja Cech (UNCG)
The Art and Science of Teaching and Mentoring
Friday, September 30, 2016, at 3:30pm in Petty 150*

Carol Seaman (UNCG)
Collaborating on Research, Grant Writing, and Instruction in STEM Education
Monday, November 28, 2016, at 3:30pm in Petty 213*

For abstracts and additional information visit http://www.uncg.edu/mat/talks
*Reception to Follow

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Department of
Mathematics & Statistics

Mathematics and Statistics Professional Development Lecture Series

January 27, 2017
4:00 – 5:00 p.m. in Petty 313

This is a new lecture series/workshop focused on the professional development of graduate students in the UNCG Department of Mathematics & Statistics. The events will focus on topics such as academic job searches, industrial job searches, research ethics, giving mathematical talks, and best practices in teaching. All graduate students are encouraged to attend.

Organizing Committee: Tom Lewis, Haimeng Zhang

Arthur Schwartz, MAAA, FCAS
Member American Academy of Actuaries, Fellow Casualty Actuarial Society. Currently Associate Property & Casualty Actuary at North Carolina State Government's Department of Insurance.

"A Career as an Actuary?"

Abstract: What does it take to get your credentials as an actuary in the USA? What are the disadvantages and advantages of this career choice? What kind of work do actuaries do, on a day to day basis? What are some considerations for choosing this or any other career?

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Mathematics & Statistics

8.6   Teaching Mathematics Seminar

All funded first year graduate students are required to enroll in the department's Seminar in Teaching Mathematics, MAT 601. The purpose of this seminar is to train students to teach mathematics in a university or college classroom setting. Graduate teaching assistants are required to successfully complete this course before they can lead a course of their own in the department. In Fall 2016, the department began offering MAT 603, a 2-hour practicum in teaching mathematics, as a complement to the seminar course. This practicum provides a more hands-on experience for new teachers as they work alongside an experienced professor teaching an introductory class by attending lectures, creating assignments and tests, and delivering guest lectures.

Graduate student Neil Pritchard presenting in the Teaching Mathematics Seminar

Graduate student Emily Johnson presenting in the Teaching Mathematics Seminar

8.7   New Policies for Ph.D. Students

Each Ph.D. student must pass two qualifying exams and a preliminary exam. All students must attempt at least one qualifying exam before the start of their third semester in the program. All students must pass both qualifying exams at the PhD Pass level before the start of the sixth semester. Qualifying exams are offered in Analysis, Linear Algebra, and Statistics. Each exam is created and graded by a committee of three faculty members appointed by the Graduate Director. A grade of Fail on any qualifying exam may jeopardize continued funding.

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 and covers material from at least three courses beyond the qualifying exam courses. Students have at most two attempts to pass the preliminary exam. Students must have unanimous support of the committee to pass the exam.

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. We attract students from all over the world. Also, students from smaller liberal arts colleges find our program attractive. During the academic year 2016-17, we had an enrollment of 23 Ph.D. students, 18 M.A. students, and 1 Post-Baccalaureate Certificate in Statistics student.

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 2017 Joint Mathematics Meetings, the National Institute for Mathematical and Biological Synthesis Undergraduate Research Conference, and the Eighth Undergraduate Research Conference at the Interface of Biology and Mathematics at NIMBioS at the University of Tennessee. The Joint Mathematics Meetings were attended by Greg Bell, Tom Lewis, and Ratnasingham Shivaji in January 2017. 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, the University of Tennessee in Knoxville, the University of North Carolina at Wilmington, and the University of North Carolina at Asheville. We have continued hosting 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, updated posters, and fliers was performed at the various conferences we held at UNCG including the International Conference on Advances in Interdisciplinary Statistics and

Shivaji at the AMS 2017 recruitment event

Maya Chhetri at an AMS recruitment event

Combinatorics (AISC), the Palmetto Number Theory Series (PANTS XXVI), and the UNCG Regional Mathematics and Statistics Conference.

Maya Chhetri and Thomas Lewis worked on a project to enhance recruitment efforts among North Carolina residents. To this end, they sent a letter to around 50 North Carolina schools advertising our unique Department and its various graduate programs. To a shorter list of North Carolina schools, the team offered for a faculty member to give a short research talk that concluded with recruitment slides appropriate for math clubs and similar gatherings. Over time we will vary which schools we specifically visit to maximize the impact of our local recruiting efforts.

Greg Bell at the RMSC 2016 graduate booth

Our concentrations in Data Analytics and Actuarial Mathematics are proving to be especially attractive to local students. We are currently reaching out to various companies in industry to promote our unique statistics programs with opportunities in data analytics. These efforts are being led by Sat Gupta and Haimeng Zhang. We have continued efforts to distribute our promotional materials for our M.A. and Ph.D programs 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 industrial partners in the region.

Tom Lewis, Greg Bell, Catherine Payne, Byungjae Son, and Quinn Morris at the AMS 2017 recruitment event

8.9   Graduate Teas

As in previous years, the Department hosted several Graduate Teas this year. These informal gatherings serve as a place for faculty and graduate students to get to know each other better while enjoying coffee, tea, and light snacks. Currently, we host at least three Graduate Teas per semester.

Graduate Tea &
Teaching and
Research Excellence
Award Ceremony
September 26, 2016
3:30 – 4:30 p.m.

THE UNIVERSITY of NORTH CAROLINA
GREENSBORO
Department of
Mathematics & Statistics

Batty for Math! VAMPIRE

Halloween
Graduate Tea
October 31, 2016
3:30 – 4:30 p.m.

THE UNIVERSITY of NORTH CAROLINA
GREENSBORO
Department of
Mathematics & Statistics

87

Graduate Tea
January 30, 2017
3:30 pm – 4:30 pm

THE UNIVERSITY *of* NORTH CAROLINA
GREENSBORO

Graduate Tea

March 6, 2017

3:30 pm – 4:30 pm

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 $40,000 was disbursed in 2016-17. 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 2016-17 scholarship recipients are listed below.

Helen Barton Scholarship: Catherine Payne, Quinn Morris, Byungjae Son
Ione Holt Grogan Scholarship: Ashley Jones, Brandon Joyce, Aaron Lee, David Perez-Suarez, AbaGayle Younts, Jianhong Zhu
Judith L. Mendenhall Scholarship: Ashley Jones, AbaGayle Younts, Jianhong Zhu
Mary D. Murray Scholarship in Mathematics: Spencer Brown, Joshua Safley
Eldon E. and Christine J. Posey Scholarship: Brandon Joyce, Aaron Lee
Cornelia Strong Scholarship: Sara Feggeler
Dr. Theresa Phillips Vaughan Math Scholarship: Catherine Payne, Quinn Morris, Byungjae Son
Bertha Barnwell Vielhauer Endowed Scholarship: Phillip Gowins, Stephen Hurley, Ashley Jones, Brandon Joyce, Jessica Nash, David Perez-Suarez, 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 assisting 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 2016–17 academic year, we funded fifteen full-time Ph.D. students and eleven 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

Funded Ph.D. Students		Funded M.A. Students	
Wei Chen	Quinn Morris	Bukola Adaramola	Balaram Remala, CS (Spring)
Charith Elson	Amila Muthunayake	Xinyu Feng	Sandi Rudzinski
Indika Dewage	James Rudzinski	Nathan Fontes (Fall)	Keri Spetzer
Nalin Fonseka	Sandamalee Seneviratne	Monika Goel	Thomas Woosley (Fall)
Elliot Hollifield	Byungjae Son	Victoria Hayes	
Austin Lawson	Romesh Thanuja	Michael Leshowitz	
Bin Luo	Qi Zhang	Mingyan Li	
Aaron Rapp		Emily Johnson	

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

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, Senior Academic Professional in Mathematics Education. They are responsible for teaching all

Carol Seaman   Tracey Howell

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

Math Emporium Lab

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.

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, Dr. Seaman and Dr. Howell 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.

Tracey Howell with math major students

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).

The Department supports activities of 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 Contest 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 Durham.

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 served as mathematics consultants for the grant.

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.

Michael R. Kosorok, University of North Carolina at Chapel Hill

John Jones, Arizona State University

Slimane Aljerid, Virginia Tech

Dan Margalit, Georgia Tech University

Laura A. Miller, University of North Carolina at Chapel Hill

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 for Fall 2016 was 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. We invited Professor Qi Wang of University of South Carolina (USC), who leads Nanoscale Theory, Modeling and Simulation Thrust at the Nanocenter at USC.

THE UNIVERSITY of NORTH CAROLINA
GREENSBORO
Department of Mathematics & Statistics

Joint JSNN and Department of Mathematics & Statistics Colloquium

Professor Qi Wang

University of South Carolina

Thursday February 4, 2016

Refreshments:
3:30-4:00 in Petty 120

Talk:
4:00-5:00 in Petty 150

Active matter and complex biological systems

Abstract

Active matter is a very active research field in physics, materials science and engineering and life sciences. It encompasses the matter systems whose fundamental constituents can move. The source of energy drives the active matter system can be biological, chemical, electrical, photonic, etc. In this talk, I will discuss a general framework for developing models for active matter systems. This is termed the generalized Onsager principle. We will then study the basic mechanism for instability in the active matter models to understand how emergent structures form dynamically. Then, we apply a active matter model to study cellular dynamics in cytokinesis and cell migration on a solid substrate.

Bio

Qi Wang is the College of Arts and Sciences Distinguished Professor of Mathematics at the University of South Carolina (USC). He was appointed as the thrust leader for the theory, modeling and simulation thrust at the Nanocenter at USC in 2008. He got his PhD in Mathematics from the Ohio State University in 1991. Before joining USC, he was on the faculty at IUPUI from 1991 to 2001 and at the Florida State University from 2001 to 2009. His research area is in applied and computational mathematics with emphasis on complex fluids and applications to materials science and life science. His research has been continuously funded by federal grants from AFOSR and NSF since 1992. He currently serves on editorial boards of four journals and as the thrust leader for "Insilico study of cellular aggregate fusion" in SC EPSCOR project biofabrication. He has published over 120 peer reviewed papers so far.

For more information, please contact Dr. Maya Chhetri at maya@uncg.edu.

11.4   Colloquia

Krishnaswami Alladi	University of Florida	9/16/2016	Stage Productions on Ramanujan – A Comparison
Chad Awtrey	Elon University	11/9/2016	Polynomials Have Symmetries! Who knew?!?
Yu-Min Chung	William & Mary	3/7/2017	Computational Topology with Applications in the Natural Sciences
Filip Saidak	UNCG	4/12/2017	π in Context
Haimeng Zhang	UNCG	4/26/2017	Intrinsic Random Functions and Universal Kriging on the Sphere
Yi Zhang	University of Notre Dame	5/8/2017	Finite Element Methods for the Stochastic Allen-Cahn Equation

11.5   External Seminar Speakers

Petr Girg	University of West Bohemia, Czech Republic	8/31/2016	Initial-Value Problem for Parbolic p-Laplacian, Multi-Bump Solutions and Random Pattern Formation
Michael R. Kosorok	University of North Carolina at Chapel Hill	10/3/2016	The Evolution of Data Science and Statistics
John Jones	Arizona State University	10/7/2016	Arithmetic Statistics and Computations
Hiroki Endo	Tokyo University of Science	10/12/2016	The Theory of the Riemann Zeta Function and its Application
Slimane Aljerid	Virginia Tech	10/21/2016	Highly Accurate Immersed Methods for Interface Problems
John Gemmer	Wake Forest University	10/24/2016	Why is Lettuce So Wrinkly?
Kevin Milans	West Virginia University	11/11/2016	Forbidden Induced Posets in the Boolean Lattice
Amanda Diegel	Louisiana State University	11/11/2016	Phase Field Models and the analysis of their Numerical Schemes
Sujit Ghosh	North Carolina State University	11/14-11/16/2016	Statistical Inference Subject to Shape Constraint
Dan Margalit	Georgia Tech University	11/18/2016	Dynamical and Computational Aspects of Surfaces

Miaohua Jiang	Wake Forest University	11/21/2016	Approximating Individual Risk of Infection in a Markov Chain Epidemic Network Model with a Deterministic System
Suruchi Singh	University of Delhi	2/22/2017	Exponential B-Spline Collocation Method for Hyperbolic Partial Differential Equations
Swarn Singh	University of Delhi	2/22/2017	High Order Implicit Discretization for the Solution of Non-linear Parabolic Equations
Glenn Hurlbert	Virginia Commonwealth University	2/24/2017	The Erdos-Ko-Rado Theorem and Generalizations on Graphs
Laura A. Miller	University of North Carolina at Chapel Hill	3/24/2017	Using Computational Fluid Dynamics to Understand Organism Form, Function, and Behavior
Suzanne O'Regan	North Carolina A & T University	4/3/2017	Anticipating Elimination and Emergence of Infectious Diseases

11.6   UNCG Seminar Speakers

Greg Bell	UNCG	11/30/2016	On Product Stability of Asymptotic Property C
Sandi Rudzinski	UNCG	2/1/2017	Symbolic Computation of Resolvents
Talia Fernós	UCNG	3/6/2017	This Year, Fat Tuesday is Fatou's Day!
Mingyan Li	UNCG	4/24/2017	Volvo Truck Retail Sales Forecasting

11.7   Graduate Professional Development

Omar Ali	UNCG – Honors College	9/30/2016	The Art and Science of Teaching and Mentoring
Nadja Cech	UNCG – Chemistry and Biochemistry	9/30/2016	The Art and Science of Teaching and Mentoring
Carol Seaman	UNCG	11/28/2016	Collaborating on Research, Grant Writing, and Instruction in STEM Education

Arthur Schwartz	North Carolina State's Government Department of Insurance	1/27/2017	A Career as an Actuary?

11.8   Research Visitors

Research Visitor	Institution	Dates Visited	Host
Pavel Drabek	University of West Bohemia, Czech Republic	7/17-7/24/2016	Ratnasingham Shivaji and Maya Chhetri
Petr Girg	University of West Bohemia, Czech Republic	8/12-9/14/2016	Maya Chhetri
Geeta Kalucha	University of Delhi	9/2-10/7/2016	Sat Gupta
Javid Shabbir	Quaid-I-Azam University, Islamabad	9/29-10/4/2016	Sat Gupta
Eunkyung Ko	Ulsan National Institute of Science and Technology, Ulsan, South Korea	11/9-11/19/2016	Ratnasingham Shivaji
Mythily Ramaswamy	Tata Institute of Fundamental Research (TIFR) Centre For Applicable Mathematics, Karnataka, India	11/10-11/13/2016	Ratnasingham Shivaji
Pavel Drabek	University of West Bohemia, Czech Republic	11/9-11/19/2016	Ratnasingham Shivaji and Maya Chhetri
Petr Girg	University of West Bohemia, Czech Republic	12/3-12/20/2016	Maya Chhetri
Mark Broom	City University, London, UK	2/12-3/12/2017	Jan Rychtář
Karan Pattni	City University, London, UK	2/12-3/12/2017	Jan Rychtář
Glenn Hurlbert	Virginia Comonwealth University	2/23-2/25/2017	Cliff Smyth
John Engbers	Marquette University	3/14-3/16/2017	Cliff Smyth
David Galvin	University of Notre Dame	3/14-3/16/2017	Cliff Smyth
Pavel Drabek	University of West Bohemia, Czech Republic	3/29-4/6/2017	Ratnasingham Shivaji and Maya Chhetri
Patricia Hersh	North Carolina A & T University	4/16-4/18/2017	Cliff Smyth
Petr Girg	University of West Bohemia, Czech Republic	5/16-6/14/2017	Maya Chhetri
Joshua Cooper	University of South Carolina	5/31/2017	Cliff Smyth
Andrzej Nagorko	University of Warsaw, Poland	6/9-7/7/2017	Greg Bell

Other research visitors from the 2016-17 academic year

Petr Girg, University of West Bohemia

Chad Awtrey, Elon University

Glenn Hurlbert, Virginia Commonwealth University

**Krishnaswami Alladi, University of Florida**

Sujit Ghosh, North Carolina State University

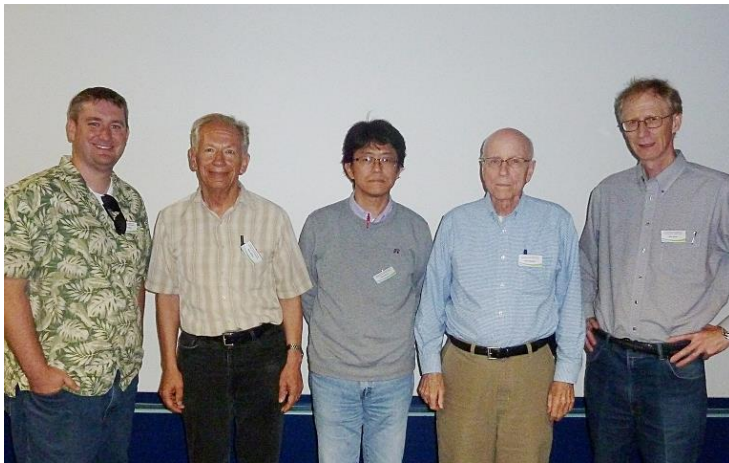**John Gemmer, Wake Forest University**

11.9   Carolina Topology Seminar

The Carolina Topology Seminar is a research seminar on 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, matroid theory and relativity. 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 master's thesis and Ph.D. dissertations.
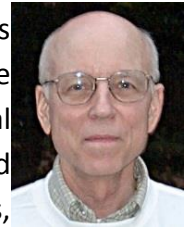
Jerry Vaughan, Organizer

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), Pankaj Joshi (Mumbai, India).

Jerry Vaughan with participants at the Summer Topology Conference 2016 in Leicester.

12. Service Profile

12.1   Math Help Center

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. Beginning in Fall 2016, the Math Help Center also offered virtual tutoring for students enrolled in D-sections of online MAT and STA courses. In addition to these tutoring services, MHC also arranges Review Sessions for 100-level courses upon the request of course coordinators. In Spring 2017, weekly review sessions were held for MAT 112, 115, 150, 151, and STA 108.

Tracey Howell, Director of Math Help Center

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 teaching assistants at the Math Emporium Lab and they work alongside graduate TAs in the lab.
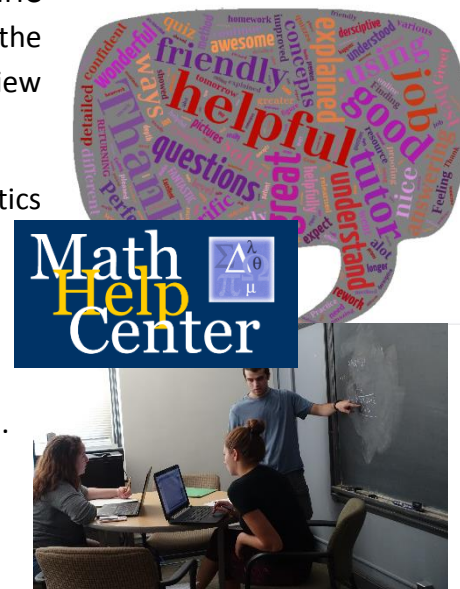
Fall 2016

- 13 Graduate Teaching Assistants tutored in the Math Help Center and some of them conducted review sessions before mid-term exams.
- 1754 student visits were recorded in the MHC.
- 15 undergraduate students helped instructors in their classes and with the Math Emporium lab.

Spring 2017

- 17 GTAs tutored in the Math Help Center and some of them conducted either weekly review sessions or before mid-term exams.
- 2453 student visits were recorded in the MHC.
- 13 undergraduate students helped instructors in their classes and with the Math Emporium lab.

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12.2   Math Emporium Lab

WLL courses are enhanced versions of online courses. 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 in Graham 313 working on 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

Tracey Howell, Director of Math Emporium Lab

pedagogical methods. As with online courses, each student is in charge of his or her own learning and must accept responsibility for spending time independently working on the course

assignments, collaborating with classmates when appropriate, and seeking assistance when needed. In addition to the 1 hour class meeting spent specifically with the course instructor, the 3 hours students are required to spend in the Math Emporium Lab working on online mathematics assignments are facilitated by teaching assistants specifically trained to assist students enrolled in WLL courses.

Math Emporium

12.3   Statistical Consulting Center

2016-17 Highlights

**Scott Richter,
Director of Statistical
Consulting Center**

- 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, Volvo, Stellenbosch University (S. Africa), and High Point University Pharmacy School.

- 20 students enrolled in STA 667 and worked with faculty consultants to complete graduate research projects.

- Several manuscripts appeared in 2016-17 stemming from SCC collaborations.

- Faculty consultants were involved as co-investigators in interdisciplinary grant submissions to the National Institutes of Health and US Department of Education Institute of Education Sciences (IES)

- 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 2 new workshops presented in the 2nd Annual Summer Workshop Series.

3rd Annual Summer Series on Quantitative Methodology: May 23 – 25, 2017

Co-Sponsored by: Statistical Consulting Center, Department of Mathematics and Statistics; Office of Assessment, Evaluation and Research Services, Department of Educational Research Methodology

Tuesday, May 23rd
9:00 AM - 12:30 PM

Introduction to Resampling Methods using R
Introduction to the basic concepts and methods of resampling, including monte carlo sampling, bootstrap procedures and permutation (randomization) tests. Topics will include

- Generating resamples using R
  - Sampling from theoretical distributions
  - Sampling from observed data
    - Randomization between groups
    - Bootstrap sampling
- Applications
  -
  - Simulations
  - Comparing groups/treatments
  - Contingency tables
  - Correlation and regression

Prerequisites: Knowledge of basic data manipulation and data analysis using R, e.g., the QMS workshop, "Introduction to R for Data Analysis".

Tuesday, May 23, 2017
1:30 PM - 5:00 PM

Categorical Data Analysis I: Associations with nominal and ordinal data
Introduction to description and inference for assessing association between variables measured on the nominal or ordinal scale. Practical recommendations for choosing the appropriate procedure for estimating and testing for association. Examples will illustrate use of several software packages, including R, SAS and SPSS. Topics will include:

- non-model-based measures and tests for nominal/nominal, nominal/ordinal and ordinal/ordinal association
- dealing with sparse contingency tables
- treating ordinal data as interval

Prerequisites: Familiarity with material typically covered in an introductory statistics course, including graphical displays, mean and standard deviation, normal distributions, t-tests and confidence intervals, analysis of contingency tables.

Thursday, May 25th
9:00 AM - 12:30 PM
Regression Analysis I
The Regression Analysis workshop is designed to deepen and expand understanding of linear regression modeling. The workshop will cover the basics of simple and multiple linear regression, with emphasis on topics commonly encountered in research, including

- types of research questions for which regression models are likely provide useful information
- model assumptions—their implications and ramifications of violations
- determining the validity of a model
- interpretation of regression parameters, especially
  - in multiple predictor models
  - after transformation
  - in models including interactions
- tests of subsets of regression parameters
- variable selection and model building, contrasted with model and parameter testing.

Emphasis on practical issues to help researchers better apply regression analysis to address research questions and better understand and report results.

Prerequisites: Familiarity with material typically covered in an introductory statistics course, including graphical displays, mean and standard deviation, normal distributions, t-tests and confidence intervals and simple linear regression.

Thursday, May 25
1:30 PM – 5:00 PM

Regression Analysis II
The Regression Analysis workshop is designed to deepen and expand understanding of linear regression modeling. The workshop will cover the basics of simple and multiple linear regression, with emphasis on topics commonly encountered in research, including

- types of research questions for which regression models are likely provide useful information
- model assumptions—their implications and ramifications of violations
- determining the validity of a model
- interpretation of regression parameters, especially
  - in multiple predictor models
  - after transformation
  - in models including interactions
- tests of subsets of regression parameters
- variable selection and model building, contrasted with model and parameter testing.

Emphasis on practical issues to help researchers better apply regression analysis to address research questions and better understand and report results.

Prerequisites: Regression Analysis I

Prerequisites: A working knowledge of basic statistical procedures, such as t-tests, analysis of variance and linear regression is assumed.

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

Goals for 2017-18

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 and begin offering drop-in consulting services.

12.4   State Math Contest

Tracey Howell, Organizer

The State Mathematics Contest is a problem-solving competition through which students interested in mathematics can become familiar with more sophisticated and advanced mathematical concepts and ideas that are not 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, May 4, 2017, the Department of Mathematics and Statistics hosted the Central Region State Mathematics Contest Finals. Fifty-five students from middle schools and high schools participated in one of three levels. Sixteen students competed in Level 1, 16 students competed in Level 2, and 19 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 2017 State Math Contest winners

12.5   Service to the Greensboro Community

Cone Health

The Department has been working to improve collaboration with the Greensboro community. Since 2011, Sat Gupta has led our statistics group in working with nurse researchers from Cone Health on various topics. This effort has led to several master's projects for our students and several journal articles, including some award winning articles.

Sat Gupta with graduate student Monika Goel meeting with some nurse researchers from Cone Health

Greensboro Police Department

Jan Rychtář and 15 undergraduate students have worked on a project for the Greensboro Police Department in Fall 2015 and Spring 2016 to study possible prevalence of racial profiling by GPD officers. This effort led to several presentations, including presentations at the national JMM and SIAM conferences and an award-winning presentation at the UNCG RMSC conference.


**Jan Rychtář,
faculty consultant**

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 has grown to become among the most influential math institutes in the world. Our faculty and students have greatly benefited in participating in IMA events. For more information, see the website http://www.ima.umn.edu.
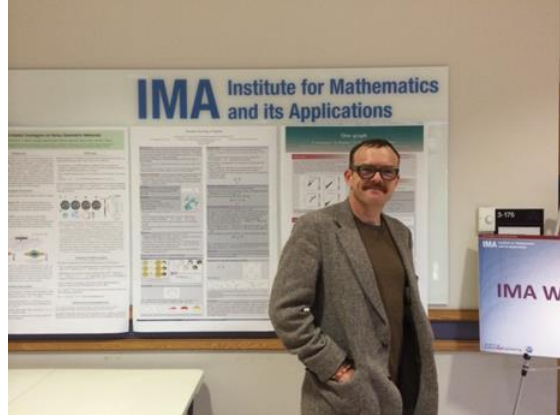
Some Descriptions of faculty and students who have participated in IMA events.

Tom Lewis and Yi Zhang are pictured here with other attendees at the IMA Conference – Recent Advances and Challenges in Discontinuous Galerkin Methods and Related Approaches – June 29-July 1, 2017.
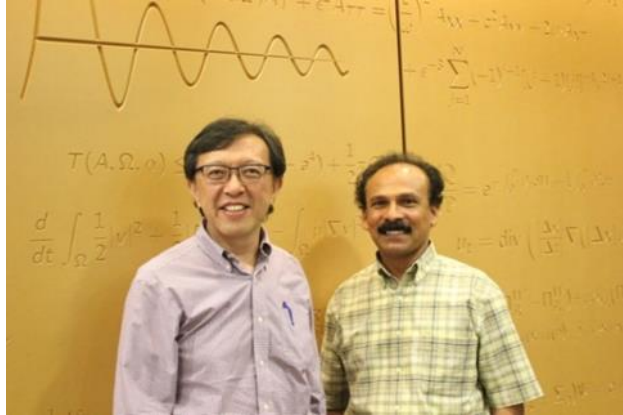
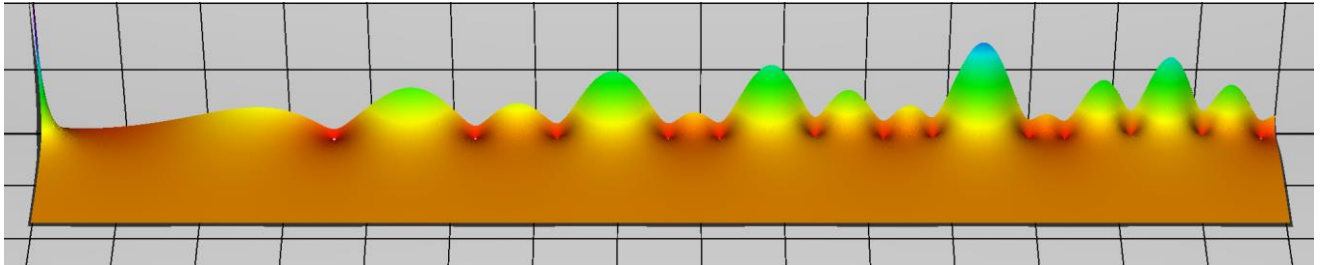**Dr. Fadil Santosa (Director of IMA) and Dr. Shan Suthaharan**

Greg Bell at IMA

IMA participants, including Ph.D. student Catherine Payne

14. Conferences

14.1 PANTS XXVI

The 26th Palmetto Number Theory Series (PANTS XXVI) meeting was held at UNCG on Saturday, September 17, and Sunday, September 18, 2016.

The Palmetto Number Theory Series (PANTS) is a series of number theory meetings held in South Carolina, the Palmetto State, and other places in the Southeast. The core members of the PANTS consortium are Clemson University and University of South Carolina.

See the PANTS home page for more information about PANTS and past and future meetings. http://people.math.sc.edu/boylan/seminars/pantshome.html

Invited Speakers:

- Krishnaswami Alladi (Plenary Speaker, University of Florida)

- Roger Baker (Plenary Speaker, Brigham Young University)

- David Roe (Postdoctoral Plenary Speaker, University of Pittsburgh)

- Nicolas Simard (Graduate Student Plenary Speaker, McGill University)

14.2   UNCG Regional Mathematics and Statistics Conference – 2016

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.

Dominic Klyve presenting at the 2016 UNCG-RMSC

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
2016	63	159	63	39

Plenary Speakers

Narayanaswamy Balakrishnan, *McMaster University*, 2015
Heejung Bang, *UC Davis*, 2011
Michael Dorff, *Brigham Young University*, 2012
Richard Fabiano, *UNCG*, 2005
Sujit Ghosh, *NC State University*, 2012
Jerome Goddard II, *Auburn University at Montgomery*, 2014
Katia Koelle, *Duke University*, 2012
Dominic Klyve, *Central Washington University*, 2016
Suzanne Lenhart, *University of Tennessee*, 2010
Laura Miller, *UNC Chapel Hill*, 2011
Jerry Reiter, *Duke University*, 2013
Stephen Robinson, *Wake Forest University*, 2008
Filip Saidak, *UNCG*, 2006
Jim Selgrade, *NC State University*, 2009
Laura Taalman, *MakerBot*, 2015
Simon Tavener, *Colorado State University*, 2013

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, Elon University's Chapter of Pi Mu Epsilon, the UNCG College of Arts and Sciences, the UNCG Office of the Provost, the UNCG Office of Research and Economic Development, 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, Ratnasingham Shivaji, Shan Suthaharan, Dewey Taylor, 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 12th Annual UNCG RMSC 2016

UNCG-RMSC is an annual one-day conference promoting student research in mathematics, statistics, and their applications in various fields. The 2016 conference was held on Saturday, November 12, 2016. Jan Rychtář served as conference chair, Chad Awtrey from Elon University, Hyunju Oh from Bennett College, and Dewey Taylor from VCU were co-organizers. and Igor Erovenko, Filip Saidak, and Jonathan Rowell from UNCG were local organizers. The conference featured one plenary presentation by an invited speaker.

**Jan Rychtář,
Conference Chair**

Dr. Dominic Klyve, Associate Professor of Mathematics at Central Washington University. Dr. Klyve spoke on "Mathematical Fights! The seedy underbelly of mathematical history".

The conference was very diverse as UNCG helps lead national efforts to increase opportunities for female and minority students in the science, technology, engineering and mathematics

(STEM) fields. Almost 60% (93 out of 159) of the student participants were females (with females attendees comprising more than 50% - 118 out of 222 total). Nearly 20% (31 out of 159 students) were racial minorities and 5 students were Hispanic. 39 different institutions were represented at the conference, including universities from NC, SC, VA but also from California, Utah, Washington, Michigan, and South Dakota. The institutions with largest attendance were UNCG (25), UNCW (25), Winthrop University (16), Concord University (16), Virginia Commonwealth University (13), West Virginia Wesleyan College (13), Bennett College (12) and Elon University (11).

The students delivered 68 presentations; 31 presentations were given by undergraduate students; 25 were given by graduate students; 11 posters were submitted by undergraduates; and 1 poster was submitted by a middle schooler. All presentations were evaluated by a group of faculty volunteers. The results of the best presentation competition are as follows:

The following 9 students won the award for the **outstanding student presentation or poster**:

Graduate student category
- Sameed Ahmed, University of South Carolina
- Lizzy Huang, Duke University
- Aswini Sen, UNCG

Undergraduate student category
- Mark Leadingham II, West Virginia Wesleyan College
- Joshua Scott Postel, University of Michigan
- Kelly Reagan, Elon University

Poster category
- Laura Layton, CW Stanford Middle School
- Adam O'Neal, Marshall University
- Jay Saini, UNCG

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 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.

14.3 International Conference on Advances in Interdisciplinary Statistics and Combinatorics

Sat Gupta giving the opening address at the AISC 2016.

The latest edition of the AISC conference series was hosted by the department during September 30-October 2, 2016. Professor Sat Gupta served as the conference Chair. The conference is held every other year and is co-sponsored by the North Carolina Chapter of the American Statistical Association. AISC 2017 was supported by IMA, SAS, NC-ASA, Pearson, Taylor and Francis, RTI, Rho, APEX Analytics, NISS, and ASA.

The conference featured 149 talks, including 23 talks by students and 12 by very senior plenary speakers. The plenary speakers included Jerry Reiter (Duke University), Michael Larsen and Tapan Nayak (George Washington University), N. Balakrishnan (McMaster University), Peter Bloomfield (N C State University), Jim Chromy (Senior Fellow Emeritus, RTI International), Merlise A. Clyde (Duke University), Frank Coolen (Durham University, UK), Ramesh Gupta (University of Maine), Peter Qian (University of Wisconsin- Madison), Bob Rodriguez (ASA President – 2012, SAS), Vishesh Karwa (Harvard).


UNCG Graduate students with Dr. Xiaoli Gao

There were 160 participants, with many coming from abroad. Awards were presented by Dr. Terri Shelton, Vice Chanceller for Research and Engagement. Three of the young researchers were recognized for outstanding presentations. These were PhD students Teague Henry (UNC Chapel Hill) and Ford Ramsey (N C State) and undergraduate student Sarah Robinson (University of Georgia). Four of the senior NC Statisticians were honored with the NC- ASA Chapter Distinguished Service awards.

These were Merlise Clyde (Duke), Peter Bloomfield (NC State), Bob Rodriguez (SAS, Former ASA President), and Jim Chromy (RTI International Senior Fellow Emeritus). Selected papers from the conference will appear in the journal REVSTAT. Additional conference details are available at the conference website http://www.uncg.edu/mat/aisc/2016/index.html.

Small Cultural Program was presented by current and former UNCG students during the conference banquet.
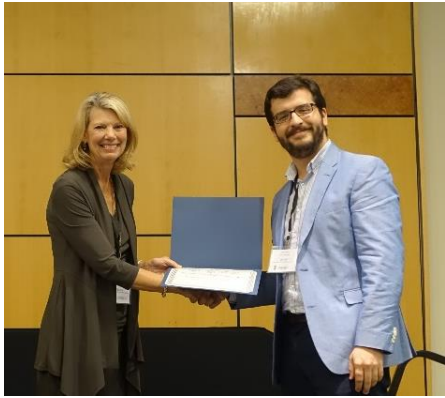
Austin Ford Ramsey won the Best Presentation by a Ph.D. Student award, presented by Dr. Terri Shelton of the Office of Research and Engagement.

Dr. John Kiss, Dean of the College of Arts and Sciences, addresses the participants.

Four of the senior NC Statisticians were honored with the NC- ASA Chapter Distinguished Service awards, presented by Dr. Terri Shelton of the Office of Research and Economic Development. Pictured left to right, these were Merlise Clyde (Duke), Peter Bloomfield (NC State), Bob Rodriguez (SAS, Former ASA President), and Jim Chromy (RTI International Senior Fellow Emeritus).

15. Student Clubs and Organizations

15.1 Student Chapter of the Association for Women in Math

**Talia Fernós,
Faculty Advisor**

This is the fifth year of the AWM student chapter at UNCG. During the AWM 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. During this academic year, AWM and Math Club had a joint meeting. This included a presentation on "This year, Fat Tuesday is Fatou's Day!" by Dr. Talia Fernós. AbaGayle Younts served as president.

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

15.2 Math Club

Science Everywhere 2017

Tom Lewis and Jonathan Rowell, Faculty Advisors

The 2016-17 academic year was the sixth year of the UNCG Math Club, whose goal is to create a community for math enthusiasts. The math club met almost every Monday afternoon during the academic year. Meetings included presentations by UNCG faculty and students as well as a visit to the Digital Media Commons to learn about 3D printers. Meeting agendas included research presentations, learning about Pi Mu Epsilon and honors societies, puzzles, community building, and community outreach. The club

119

recruited during the Welcome Week Kickoff, organized a table for Pi day (3/14) to celebrate with math/pie-themed games, and hosted three tables during the UNCG Science Everywhere (4/22) at which participants created their very own hexaflexagon while learning about flexigation. The math club also designed a t-shirt that the department purchased for the members of the club. Additional information and photos can be found at the math club website. https://sites.google.com/a/uncg.edu/mathclub/home.

Pi Day contest on March 8, 2017

15.3   Pi Mu Epsilon

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: Ashley Jones, Brandon Joyce, Jessica Nash, Neil Pritchard, Jasmeet Saini, and Alex Smith.

Rich Fabiano, Faculty Advisor

We held an induction banquet to honor these students on May 9, 2017, 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 (from left to right) Brandon Joyce, Neil Pritchard, Ashley Jones, Jessica Nash, Jay Saini, and Alex Smith

16. Departmental Spaces

Jerry and Theresa Vaughan Conference Room in Petty 146.

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

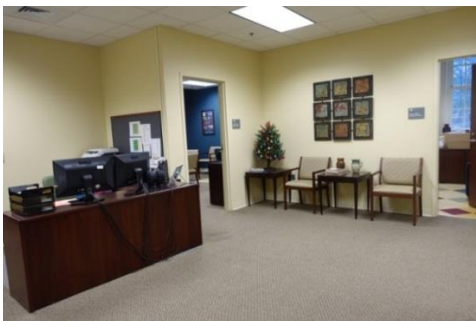The **Math Help Center** is located in Curry 210.

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.