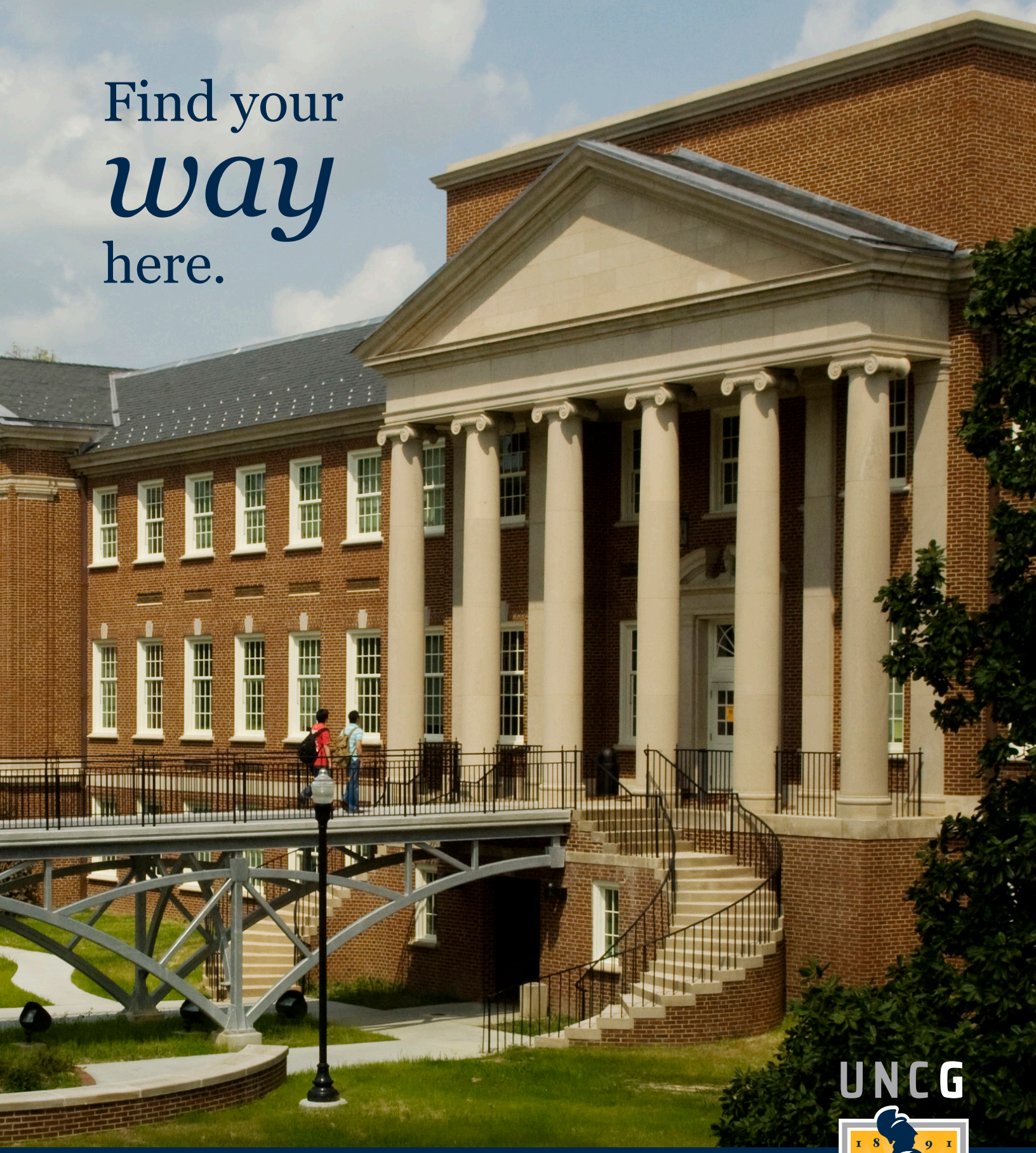


UNCG

1891

Department of Mathematics & Statistics Annual Report 2017–2018

Table of Contents

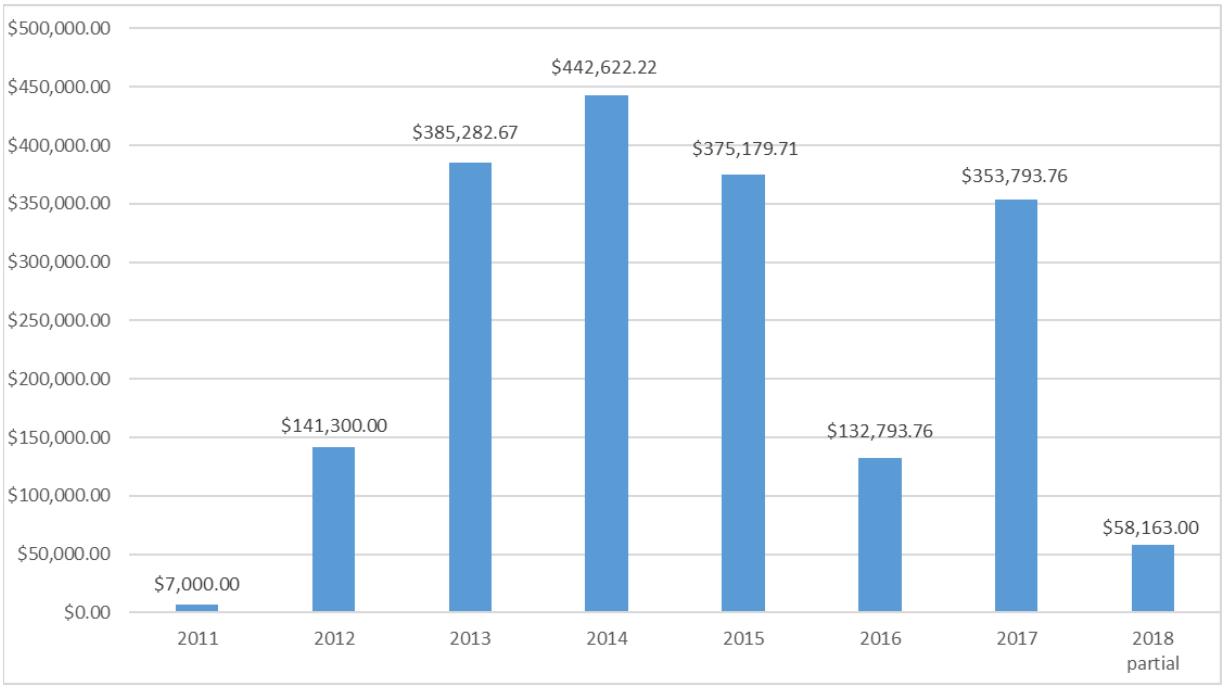
1. Summary

Ratnasingham Shivaji,
H. Barton Excellence Professor & Head

It has been a great pleasure to be a part of and to lead a dynamic department with talented faculty and staff members. During the academic year 2017-18, we had seven full professors, ten associate professors, four assistant professors, one senior academic professional, one senior lecturer, one lecturer, and three staff members.

The Department continues to excel in research productivity. During the calendar year 2017, the faculty had 33 journal articles and 1 refereed conference papers, for a total of 34 manuscripts accepted for publication. The faculty made 50 presentations, with 24 at international destinations. Thanks to our enhancement of grant proposal submissions, we have received $1,896,135 in grants since 2011. This includes receiving several competitive research grants from the National Science Foundation (NSF), from the National Security Agency (NSA), and from the Simons Foundation. Please see below data on our funding record for the 2011-2018 years.

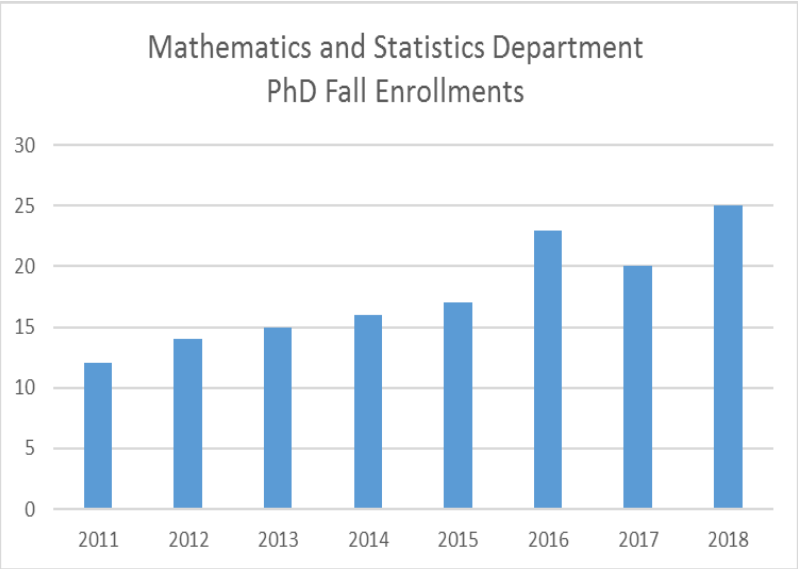
Grant Awards by Fiscal Year 2011-2018 (awards indexed to the year the proposal was submitted)



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, Geometry, Algebra, Number Theory & Combinatorics, Topology, and Statistics. Since Fall 2011, the Department has hosted over 129 research visits by researchers from around the world. In 2017-18, the Department hosted the 13th Annual UNCG Regional Mathematics and Statistics Conference (attended by a record number of 255 participants), the Summer School in Computational Number Theory (15 participants), the Summer Research Experiences for Undergraduates (REU) Program in Math Biology (9 participants), the REU program in Statistics (6 participants), the National Research Experience for Undergraduates Program (NREUP) (4 participants), as well as the joint REU on Local Fields and Galois Groups with Elon University (9 participants). External funding support was provided by NSF, NSA, American Statistical Association (ASA), and the Mathematical Association of America (MAA).

We continued enhancements to our Ph.D. program in Computational Mathematics. Our concentrations in our M.A. program in data analytics and actuarial mathematics are proving to be attractive to local students. Our Ph.D. program enrollment has seen an excellent growth-currently we have 25 students enrolled in our program. Please see the chart below for details of our Ph.D. students enrollment growth.



Ph.D. graduates celebrating at our Departmental Graduation Ceremony

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), 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 department is also working to build a collaborative relationship with international institutions.

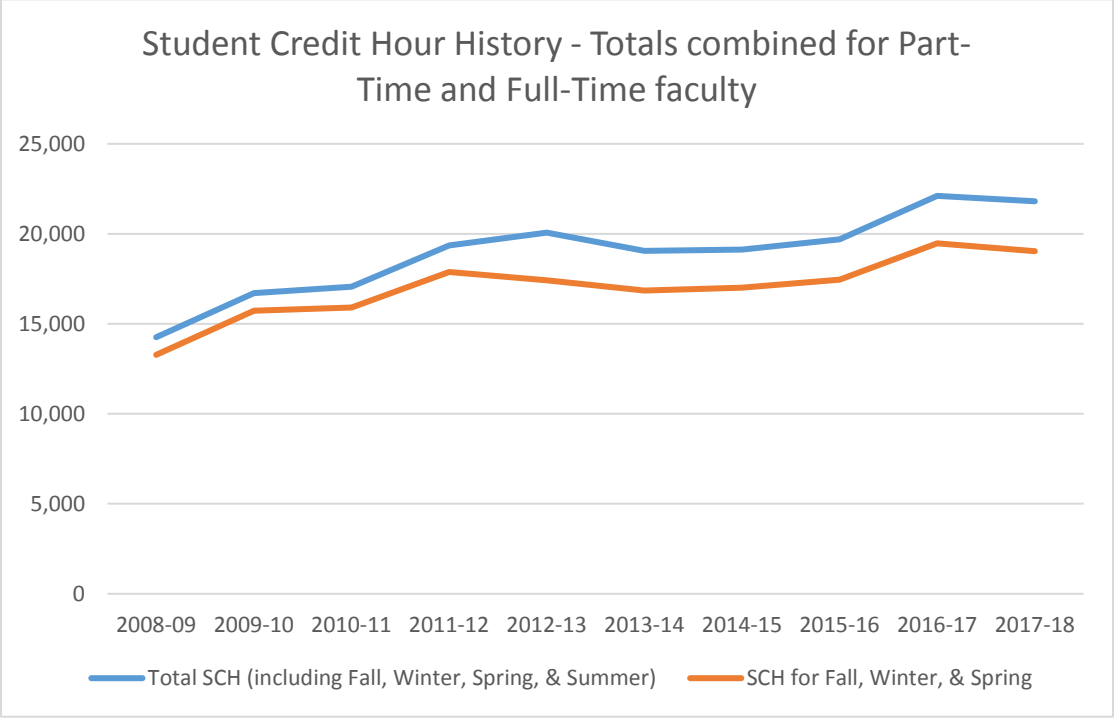
The "Graduate Tea" hosted by us for our students served as a good venue for students and faculty to interact informally. The Department's continued membership with the Institute of Mathematics and its Applications (IMA) has allowed for continued participation of graduate students (and members of UNCG faculty) in workshops and conferences organized by the IMA and visits by researchers from IMA participating institutions and industries. We also host a Graduate Professional Development Lecture Series. We continued the 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.

Graduate Tea Collage

We continued our efforts to build a positive image for the Department among other units at UNCG, as well as outside UNCG. We had research collaborations with Cone Health. 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).

Some of the 2018 State Math Contest winners

As part of our efforts to improve instruction and enhance opportunities for students, we have collected data for the past six years on the "DFW" rates in all our 100-level classes and are 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. This year, we had 115 total undergraduate first majors and 17 undergraduate students who are majoring in mathematics as a second major. Please see the chart below for details of our Student Credit Hour growth. Beginning in Spring 2018, The University of North Carolina System has engaged with the Charles A. Dana Center to mobilize mathematics faculty in North Carolina to improve student success in mathematics courses. The goal is to establish effective mathematics pathways at scale that will dramatically increase student success, modernize entry-level mathematics programs, and improve alignment with K-12 mathematics. The UNC System Math Pathways Task Force includes two members of the UNCG Department of Mathematics and Statistics faculty, with one serving as a co-chair.



Our Student Credit Hours (SCH) grew 53% during the past 10-year period (2008-09 to 2017-18).

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 2017-18 academic year marked the seventh year of the Math Club's official recognition by UNCG. The club continues to meet weekly. The meetings are centered around talks given by the Department's very talented faculty and graduate students. Also, 2017-18 marked the fifth academic year the Association for Women in Mathematics Student Chapter (AWM) has been active. We added 2 new clubs during this 2017-18 academic year, π-Stem (for under-represented persons in a STEM program at UNCG) and an AMS Student Chapter.

In recent years, we have received several donations to the Department's enrichment fund and to existing scholarships. Please see page 7 for our recent donors list. 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) has now graduated twelve 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 College of Arts and Sciences Senior Teaching Excellence Award, 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 College of Arts and Sciences Teaching Excellence Award, 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 and Carri Richter 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. Haley Childers, Jan Rychtář, Maya Chhetri, and Greg Bell won the Department of Mathematics & Statistics Award for Distinguished Service. Also, I was recently elected as a fellow of the American Mathematical Society.

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

Faculty and students at a Pi Mu Epsilon dinner

Graduate students socializing together at a Graduate Tea

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

Greg Bell dressed in costume at a Graduate Tea

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

I will be completing my second four-year term as Department Head in July 2019. It has been an exciting, rewarding, and enjoyable journey to serve as Head of this excellent department. I sincerely thank the faculty and staff for the tremendous support they have given me throughout my tenure here to aim for excellence in all our activities. My best wishes to Sat (Gupta) who will be taking over the headship from August 1, 2019.

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	Ms. Mishele Hare	Ms. Mary Pope
Ms. Janet Agnew	Mr. Bill and Mrs. Doris Hawthorne	Mrs. Christine Posey
Ms. Peggy Aldridge	Miss Victoria Hayes	Mrs. Laura Peake Prill
Ms. Joan Andersen	Ms. Janice Hite	Mrs. Ann Speckman Przygocki
Mrs. Mary Jo Austell	Mr. William and Mrs. Dorothy Howell	Ms. Lisa Randall
Ms. Linda Bennetts	Mrs. Frankie Hubbard	Mrs. Jean Roosa
Mrs. Maria Bernot	Mrs. Roxanne Hunt	Mr. Nathan P. Ross
Ms. Lillian Boney	Mrs. Mary Jackson	Mrs. Martha Schall
Mrs. Marilou Bradley	Mr. Matt Jester	Mrs. Susan Blanton Senn
Mr. William Bradmon	Mr. John and Mrs. Gail Johnson	Mr. Pralad Shah
Dr. Jeremy and Ms. Lou Bray	Ms. Amy Kemp	Mr. Jimmy and Mrs. Anelia Shelton
Mrs. Shirley Brewer	Mr. Walter and Mrs. Krista Thomason	Mrs. Teresa Sink
Mr. Mervin Brown	Mrs. Julie Lambert	Mrs. Kim Smith and Mr. David Smith
Ms. Wendy Louise Bullis	Mrs. Vicky Langley	Mr. Joseph Splawn
Mr. Michael and Mrs. Doris Burris	Mrs. Sue and Mr. Luther Lawson	Dr. Thomas Stafford, Jr. and Mrs. Judy Stafford
Mr. Karl and Mrs. Judy Busick	Mr. Zach Leach	Mrs. Brownie Stancil
Dr. Lisa Carnell	Mrs. Jane and Mr. John Lomax	Mrs. Carolina Stauers
Mr. Jason Cogley	Mrs. Phyllis Lupton	Ms. Penny Stelljes
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. Walter and Mrs. Krista Thomason
Mr. Edwin and Mrs. Thelma Edmonson	Mr. Lance McCluney	Mr. Danny Thompson
Ms. Kaye Edwards	Mrs. Sylvia McCollum	Ms. Gloria Thornton
Mr. Xinyu Feng	Mrs. Lee Handy and Mr. Thomas McKee	Mrs. Sharon and Mr. Howard Traywick
Mr. Daniel Flores	Mrs. Valerie and Mr. Tyrone McMillian	Mr. John and Mrs. Cynthia Triplett
Ms. Shirley Fraley	Mrs. Margaret McQuain	Mrs. Nancy Turner
Mrs. Nancy Geller	Mr. Noel Melton	Mrs. Nancy Tucker
Mrs. Monika Goel	Mr. Gregg Miller	Mr. Larry and Ms. Joyce Vest
Ms. Aliesha Grady	Dr. Sharon Morgan	Mrs. Mary Weatherspoon
Mrs. Patti Grimm	Dr. Thomas and Mrs. Mildred Mullikin	Ms. Walker Weigel
Mrs. Martha Gwyn	Mrs. Dawn and Mr. James Murchison	Ms. Betsy Jordan Whitson
Mrs. Barbara Hagaman	Mr. Carl and Mrs. Jean Nilsson	Mrs. Fran Williams
Ms. Becky Halsey	Mr. Thomas Parrish	Mr. David Wright
Mrs. Kathy Hamilton	Mrs. Linda Philips	

If you are interested in donating to the department, please go to www.uncg.edu/mat and scroll to the bottom of the page, then click on the "Give to this Department" yellow ribbon.

2. Faculty and Staff

2.1 Faculty

Greg Bell, Associate Professor

Associate Vice Provost of Graduate Education

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

Director of Graduate Studies

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.

Yu-Min Chung, Assistant Professor

Dr. Chung earned a Ph. D. in Mathematics from Indiana University Bloomington in 2013 and joined the faculty in 2017. His research focus is on computational topology, topological data analysis, and dynamical systems.

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.

Monika Goel, Lecturer

Ms. Goel earned an M.A. from UNCG in 2017 and joined the Department in 2017.

Sat Gupta, Professor

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, & Program Coordinator for Secondary Licensure in Mathematics

Dr. Howell earned a Ph.D. in Teacher Education and Higher Education from UNCG in 2013 and was appointed to an Academic Professional position in 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

Director of Undergraduate Studies

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.

Mauricio Rivas, Visiting Assistant Professor

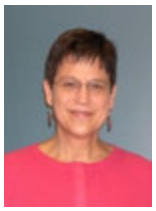
Dr. Rivas earned a Ph.D. from the University of Houston in 2013 and joined the Department in 2017. His research focus is on variational analysis for PDEs, Morse theory and its applications to PDEs and spectral theory, and dynamical systems and control theory for the use in mathematical physics, particularly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

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

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. She retired in the Summer of 2018 after 10 years at UNCG.

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. She retired in the Summer of 2018 after 33 years at UNCG.

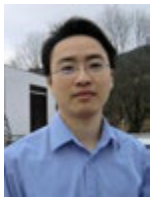
Dan Yasaki, Associate Professor

Associate Head

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, 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.



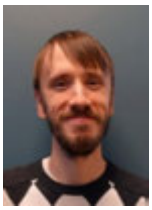
Yi Zhang, Assistant Professor

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

New Faculty

Jianping Sun, Assistant Professor

Dr. Sun earned a Ph. D. in Statistics Pennsylvania State University in 2011 and joined the faculty in 2018. Her research focus is on both statistical methodology and applied research in high-dimensional complex genomic data.



Matt Jester, Lecturer

Mr. Jester earned an M.A. from UNCG in 2018 and joined the faculty in 2018.

Sahana Balasubramanya, Visiting Assistant Professor

Dr. Balasubramanya earned a Ph.D. from Vanderbilt University in 2018 and joined the faculty in 2018. Her research focus is on geometric group theory, acylindrical actions, and actions on hyperbolic spaces.

Beth Lewis, Visiting Assistant Professor

Dr. Lewis earned a Ph.D. from University of Tennessee in 2015 and joined the faculty in 2018. Her research focus is on mathematics education.

2.2 Staff

Richard Cheek
Systems Administrator

Mr. Cheek earned an M.S. degree in Computer Science from UNCG in 1998 and joined the Department in 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 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 2016.

3. Tenure, Promotion, Awards & Honors

Promotions

Dr. Haimeng Zhang received his promotion to Professor, which was effective on August 1, 2018.

Tenure and Promotions

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

New and Continuing Awards (July 1, 2017 to date)

Dr. Igor Erovenko was awarded a CURM (Center for Undergraduate Research in Mathematics) mini-grant for the 2018-19 academic year. CURM is funded by the National Science Foundation.

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 received the 2017-18 College of Arts and Sciences Senior Teaching Excellence Award.

Dr. Thomas Lewis received the 2017-18 College of Arts and Sciences Junior (Tenure-Track) Teaching Excellence Award. He was also awarded a Regular Faculty Grant from the Office of Research and Engagement.

Dr. Jonathan Rowell was selected for a Candace Bernard and Robert Glickman Dean's Professorship in the College of Arts & Sciences for the academic year 2017-18. He was also the co-PI on an NSF Research Experiences for Undergraduates site grant (2014-2018).

Carri Richter received one of the 2018 College of Arts and Sciences Staff Excellence Awards.

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 two NSF Research Experiences for Undergraduates site grants, one from 2014 to 2018 and the other from 2017 to 2020.

Dr. Ratnasingham Shivaji was awarded an NSF research grant (2015-2019) for his project titled, "Collaborative Research: Mathematical and Experimental Analysis of Ecological Models: Patches, Landscapes and Conditional Dispersal on the Boundary". He was also recently elected as a fellow of the American Mathematical Society (AMS).

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

Dr. Yi Zhang was awarded a New Faculty Grant from the Office of Research and Engagement.

Sat Gupta receiving the 2017-18 College of Arts and Sciences Senior Teaching Excellence Award

Tom Lewis receiving the 2017-18 College of Arts and Sciences Junior (Tenure-Track) Teaching Excellence Award

Carri Richter receiving the 2017-18 College of Arts and Sciences Staff Excellence Award

Shivaji was elected to the 2019 class of Fellows of the American Mathematical Society

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, resulting in a significant, positive impact on the overall goals and objectives of the Department.

Our most recent recipient of this award was Greg Bell. Greg was chosen for The Award for Distinguished Service because of his outstanding service as Director of Graduate Studies and leading efforts beyond normal expectations towards achieving excellent growth to the Ph.D. Program in Computational Mathematics. Dean Emeritus Tim Johnston formally made this presentation to Greg at one of our Graduate Teas.

Greg Bell receiving the Distinguished Service Award in 2017

Maya Chhetri receiving the Distinguished Service Award in 2016

The three previous Awards for Distinguished Service were presented to Maya Chhetri, Haley Childers, and Jan Rychtář. Maya was chosen 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. 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.

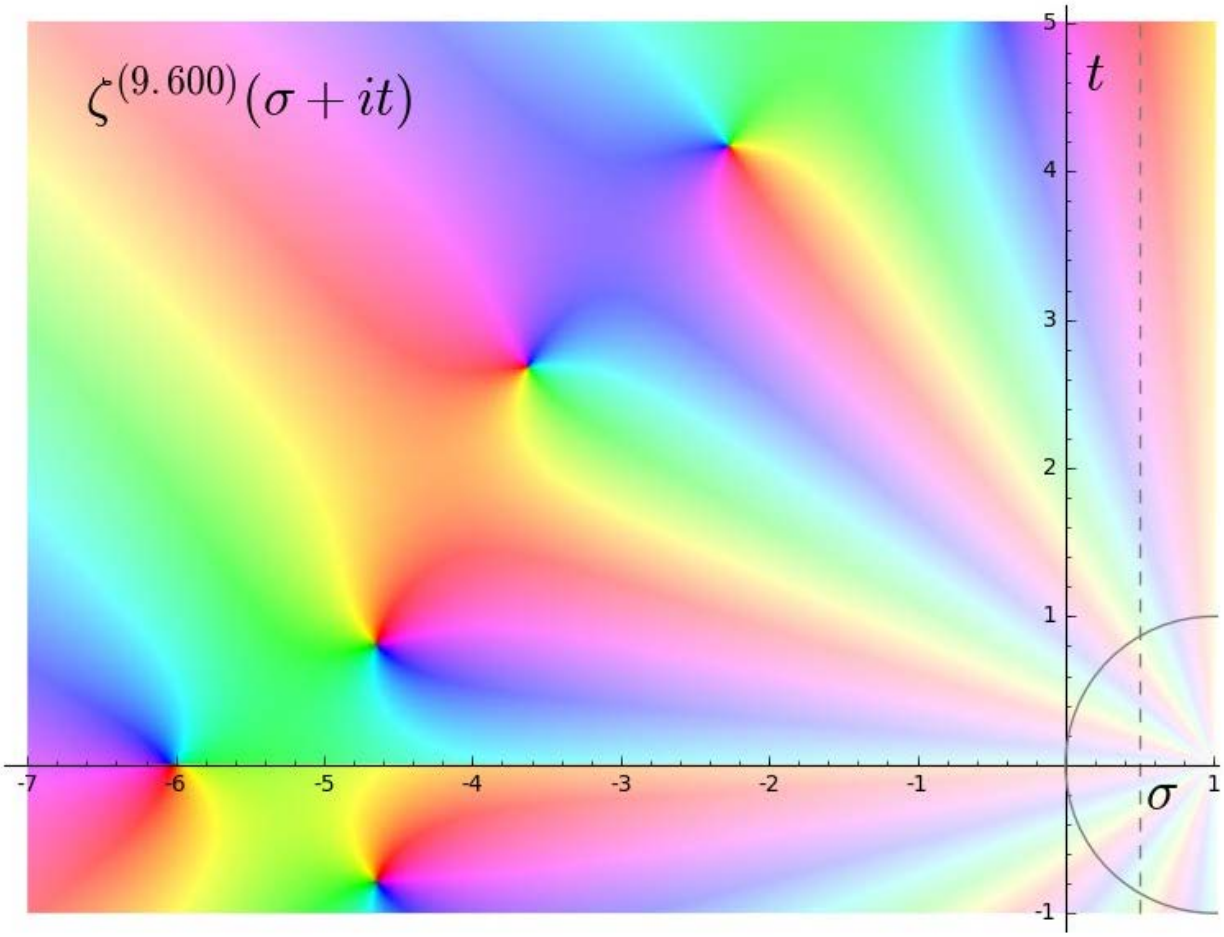
Jan Rychtář and Haley Childers each receiving the Distinguished Service Award in 2014

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 9.6th Grünwald-Letnikov fractional derivative of the Riemann zeta function. The argument of the complex values of the function is represented by hue and the absolute value by brightness. The darker points with a complete rainbow around them are zeros and the pole of the function is at 1.

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 two Ph.D. students, Sandi Rudzinkski and Kalani Thalagoda, and one M.A. student, Cole Love.

Sebastian Pauli with Ph.D. student Sandi Rudzinski

Nathan Fontes (M.A. 2018), Debbie White (M.A. 2018), Ricky Farr (Ph.D. 2017), Jonathan Milstead (Ph.D. 2017), Lance Everhart (M.A. 2016), and Brian Sinclair (Ph.D. 2015) are recent alumni of this group.

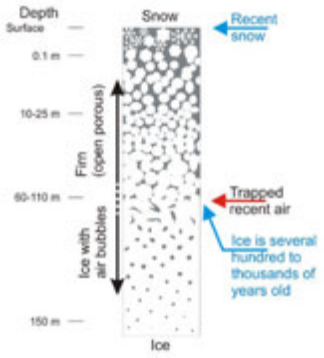
Since 2012, the Number Theory group has organized the annual UNCG Summer School in Computational Number Theory. This project is supported by UNCG, the NSA and the NSF.
In Summer 2018 a REU in number theory was jointly organized with Chad Awtrey at Elon University.

2018 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 2017-18 were Greg Bell, Yu-Min Chung, Talia Fernós, Clifford Smyth, and Jerry Vaughan.



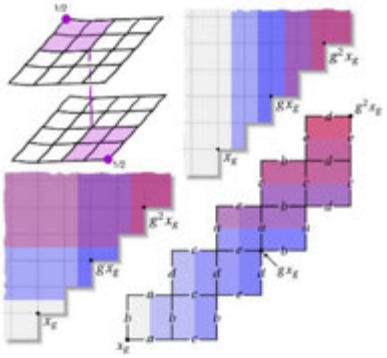
The structure of arctic ice and its dependence on depth

Yu-Min Chung, a new faculty in Computational Topology, joined 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 with 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 with Ph.D. student Austin Lawson

Greg Bell gave several seminar and conference talks in 2017-18 including the Spring Conference on Topology and Dynamics at Auburn and the Summer Conference on Topology its Applications at Western Kentucky University. 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 students Austin Lawson and Neil Pritchard on projects in coarse geometry and computational mathematics.

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. Talia spent her summer traveling in Israel and France, attending and speaking in international conferences and workshops. In February of 2018 calendar year, Talia started serving on the AWM Executive Committee as well as on the RISE Advisory



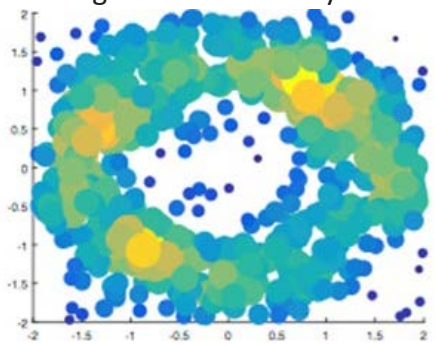
Board at UNCG. She has also been busy co-organizing multiple conferences both in the US and abroad.

Talia is active in the issue of equal representation in the mathematical sciences. She co-organized the WINRS Symposium at University of Virginia, and the upcoming AWM Panel at the Joint Math Meetings in January 2019. She also was the faculty founder of PI-STEM (promoting inclusion in STEM) which is a STEM graduate student group focused on increasing representation at every level of academia.

In the fall of this year, Talia taught a freshman seminar course where students could earn their general math education credits by studying current and interesting topics such as gerrymandering and voting theory. Talia is also working with MA student Jenny Beck on the topic of linear groups.

Clifford Smyth with Ph.D. student James Rudzinski

Cliff Smyth's research area is combinatorics. He is currently working on algorithms to generate all isomorphism classes of certain families of graphs with his Ph.D. student James Rudzinski and is mentoring Ph.D. student Matt Farmer in his project on non-crossing bond posets. He is also working on the combinatorics of multiplicative and compositional inverses if formal power series, a project with Ph.D. student Austin Lawson and faculty member Yu-Min Chung on skin lesion analysis, and a project on vector-host coupling with Gideon Wasserberg of the UNCG biology department. He is part of a UNCG Giant Steps grant with Gideon Wasserberg, Malcolm Schug, and Matina Kalcounis-Ruppell of the Biology department to analyze the incursion of Lyme disease into North Carolina. In the past year he has spoken at the UNCG AISC, the AMS meeting at the University of Michigan, and the National Taiwan University. He co-organized a special session at the University of Michigan AMS meeting and the 19th Triangle Lectures in Combinatorics to be held at Wake Forest University in Spring 2019.



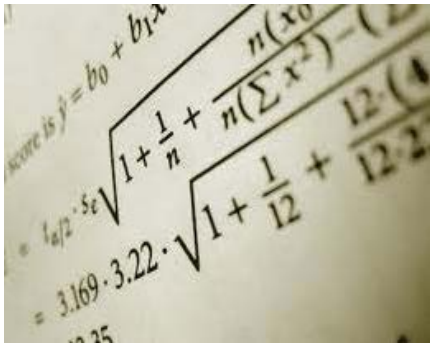
Recovering the shape of an annulus from a sample using persistent homology

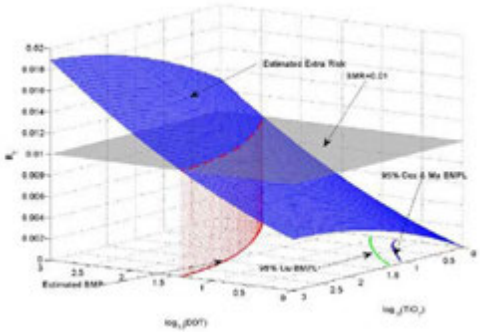
Jerry Vaughan and Alan Dow, from UNC-Charlotte, organized a special session on Set-theoretic Topology at the Fall 2016 Southeastern Sectional Meeting at the North Carolina State University, Raleigh, NC. Jerry presented a research paper at that meeting, and he also presented research papers at the Prague 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 MA students Jenny Beck, Matt Farmer, and Neil Pritchard, Ph.D. student Austin Lawson and Ph.D. student James Rudzinski. Recent past students include Joshua Martin (M.A. 2016), Dani Moran (Ph.D. 2014) who is currently an assistant professor at Guilford College, and Catherine Payne (M.A. 2010) who is currently an assistant professor at Winston Salem State University.

Applied Statistics





In 2017, the statistics group in the Department consisted of four full-time faculty (Sat Gupta, Scott Richter, Haimeng Zhang, and Xiaoli Gao). A new member, Jianping Sun, will join the group effective August 2018.

Scott Richter with Ph.D. student Charith Elson

Xiaoli Gao with Ph.D. student Bin Luo

The focus of Gupta's research is in the area of sample surveys. Richter specializes in nonparametric methods and multiple comparisons. Zhang specializes in survival analysis, spatial statistics, and applied probability, and Gao specializes in high- dimensional data analysis and statistical genetics. The statistics group is engaged in both disciplinary research in their respective areas of specialty as well as interdisciplinary research in collaboration with other on-campus/off-campus researchers. They also serve as co-investigators or key personnel on externally funded projects. In 2017, the stats group published 12 journal articles.

Haimeng Zhang with a recent (2018) Ph.D. graduate Wei Chen

In 2017, the statistics group received ASA/NSF funding for the first ever statistics REU in the Department with Sat Gupta as PI and Xiaoli Gao as Co-PI. For more information, visit https://www.uncg.edu/mat/undergraduate/2018asareu/.

2018 Summer ASA/NSF-REU participants and faculty mentors.

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

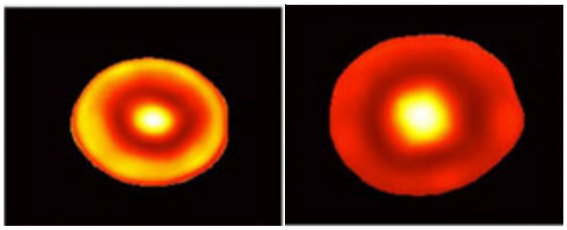
Jeong Sep Sihm, a PhD student specializing in computational statistics, graduated in 2017. Other PhD students in 2017 were Badr Aloraini, Saragan Balasubramaniam, Wei Chen, Charith Elson, Bin Luo, Romesh Thanuja, and Qi Zhang. The group also directed one master's thesis and three master's projects.

In 2017, Sat Gupta won the UNCG Senior Research Excellence Award. The story can be found at the website https://research.uncg.edu/spotlight/2016-17-research-excellence-awards/.

Also, UNCG's research magazine published an article featuring Sat entitled, "Much More Than Numbers". For more information you can find this article at the following web site: https://researchmagazine.uncg.edu/spring-2018-issue/much-more-than-numbers/.

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

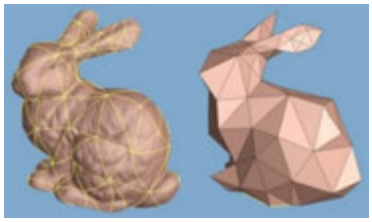
Applied Mathematics



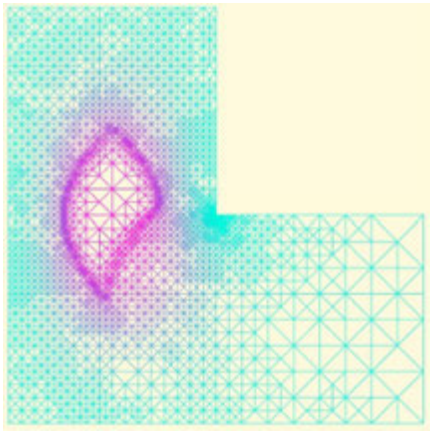
Human red blood cells possess vibratory motions, referred to as flickering. Characterizing dynamics of flickering is an open problem in Cell Biology.

Fluid can be modeled by certain differential equations, such as the Navier-Stokes 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 for 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, Yu-Min Chung, Igor Erovenko, Richard Fabiano, Thomas Lewis, Jonathan Rowell, Jan Rychtář, Ratnasingham Shivaji, and Yi Zhang. Recent Ph.D. graduates



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.

who worked in these areas are Quinn Morris (now an Assistant Professor at Appalachian State University), Catherine Payne (now an Assistant Professor at Winston-Salem State University), and Byungjae Son (now a Postdoc at Wayne State University). Recent MA graduates who worked in these areas are Indika Gunawardana, Sandamalee Seneviratne, and Keri Spetzer. Current Ph.D. students working in the Applied Mathematics area include Ananta Acharya, Shalmali Bandyopadhyay, Nalin Fonseka, Elliott Hollifield, Amila Muthunayake, and Aaron Rapp. Aliya Al-habsha, Sara Feggeler, Jackson Leonard, and Jonathan Machado Bilbraudt, are undergraduate research students in this area.

New faculty that joined the group recently are Yu-Min Chung and Yi Zhang. Yu-Min Chung received his Ph.D. in Mathematics from Indiana University Bloomington. 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 investigating ice at the Arctic and those from Harvard Medical School studying human red blood cells. Chung's other research interest is computational dynamical systems. He and his collaborators 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 and 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 both the University of Tennessee 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.

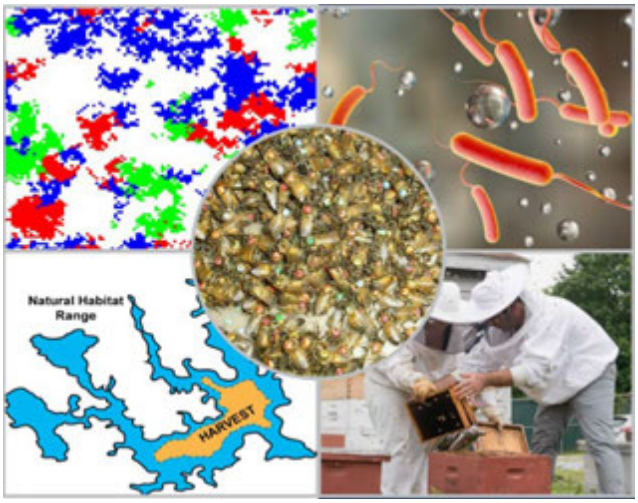
Maya Chhetri with Ph.D. student Elliott Hollifield

Tom Lewis and Yi Zhang with Ph. D. student Aaron Rapp

Shivaji with M.A. graduate Keri Spetzer and Ph.D. student Nalin Fonseka

Rich Fabiano with Ph.D. graduate Catherine Payne

Mathematical Biology



The Department of Mathematics and Statistics is proud to be part of several research projects in Mathematical Biology. This includes adaptive movement, bacterial recombination, behaviorial epidemiology, evolutionary game theory, evolutionary graph theory, evolutionary theoretical ecology, individual-based modeling, modeling complex systems, kleptoparasitism, sexual selection, signaling theory, and spatial ecology. The Department faculty involved in this research group are Igor Erovenko, Jonathan Rowell, Jan Rychtář, Ratnasingham Shivaji, and Clifford Smyth. Other UNCG faculty who collaborate in the mathematical biology area are Louis-Marie Bobay, David Remington, Olav Rüeppell, Matina Kalcounis-Rüeppell, and Gideon Wasserberg, all of whom are faculty in the Biology Department. We also worked with researchers outside of UNCG, namely, Mark Broom of City, University of London, James Cronin of Louisiana State University, Jerome Goddard of Auburn University at Montgomery, Suzanne Lenhart of University of Tennessee, Garrett Street of Mississippi State University, and Shan Sun of Lanzhou University. Current Ph.D. students involved in this research area are Nalin Fonseka and Joshua Safley.

2018 NSF Math Bio-REU Participants

Thanks to the sponsorship by NSF of a Research Experiences for Undergraduates (REU) program in mathematical biology at UNCG since 2014, this group has hosted 46 undergraduate students, including 8 UNCG students. These UNCG students were (in chronological order of participation in this program), David Suarez, Jay Saini, Vee Galloway, Karen Funderburk, Neil Pritchard, Jonathan Machado Bilbraut, Eric Sanchez, and Sara Rubio Correa.

Further, Ratnasingham Shivaji is involved in collaborative research funded by the National Science Foundation (NSF) with James Cronin, an ecologist at Louisiana State University, and Jerome Goddard at Auburn University at Montgomery. They study population models that

explore the effects of habitat fragmentation, conditional dispersal, predation, and interspecific competition from the patch level to the landscape level. We currently have one Ph. D. student, Nalin Fonseka, and undergraduate students Jackson Leonard, Sara Feggeler, and Jonathan Machado Bilbraut working on this project. Quinn Morris (Ph. D. 2017), Byungjae Son (Ph. D. 2017), Catherine Payne (Ph. D. 2017), Keri Spetzer (M.A. 2018), and Jessica Nash (B.S. 2017) are recent alumni who worked on this project.

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

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 2017

Greg Bell

G. Bell, D. Moran, and A. Nagórko, Coarse property C and decomposition complexity, *Topology Appl.*, 227:30–50.

G. Bell, Asymptotic dimension, *Office hours with a geometric group theorist*, Princeton Univ. Press, 219–236.

Maya Chhetri

M. Chhetri and P. Girg A global bifurcation result for a class of semipositone elliptic systems, *J. Math. Anal. Appl.*, 453 (1): 255-270.

M. Chhetri, P. Drabek and R. Shivaji, Analysis of positive solutions for classes of quasilinear singular problems on exterior domains, *Advances in Nonlinear Analysis*, 6 (4): 447-459.

Talia Fernós

T. Fernós and A. Valette, The Mayer-Vietoris sequence for graphs of groups, property (T), and the first ℓ^2-Betti number, *Homology Homotopy Appl.* 19 (2): 251-274.

Xiaoli Gao

X. Gao, S. Ahmed,and Y. Feng, Rejoinder to Post selection shrink-age estimation for high-dimensional data analysis, *Applied Stochastic Models in Business and Industry*, 33 (2): 131-135.

Sat Gupta

J. Shabbir and **S. Gupta**, A generalized class of difference type estimators for population median in survey sampling, *Hacettepe Journal of Mathematics and Statistics*, 46 (5): 1015-1028.

S. Gupta, G. Kalucha, and J. Shabbir, A regression estimator for finite population mean of a sensitive variable using an optional randomized response model, *Communications in Statistics – Simulation and Computation*, 46 (3):2393-2405.

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*, 46 (16): 8113-8133.

M. Yaqub, J. Shabbir, and **S. Gupta**, Estimation of population mean based on dual use of auxiliary information in non-response, *Communications in Statistics – Theory and Methods,* 46 (24): 12130-12151.

S. Gupta, T. Zatezalo, and J. Shabbir, A generalized mixture estimator of the mean of a sensitive variable in the presence of non-sensitive auxiliary information, *Statistics and Applications*, 15 (1-2): 27-36.

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*, 46 (20): 10135 – 10148.

G. Kalucha, R. Sousa, **S. Gupta**, and J. Shabbir, Improved ratio and regression estimators of a sensitive variable in stratified sampling, *Statistics and Applications*, 15 (No. 1-2): 63 -78.

J. Shabbir and **S. Gupta**, Estimation of finite population mean using two auxiliary variables in stratified two-phase sampling, *Communications in Statistics – Simulation and Computation*, 46 (2): 1238 – 1256.

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*, 46 (17): 8435-8449.

Sebastian Pauli

S. Pauli and B. Sinclair, Enumerating extensions of (π)-adic fields with given invariants, *International Journal of Number Theory*, 13 (8): 2007-2038.

Jonathan Rowell

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

Jan Rychtář

K. Pattni, M. Broom, and **J. Rychtář**, Evolutionary dynamics and the evolution of multiplayer cooperation in a subdivided population, *Journal of Theoretical Biology*, 429: 105-115.

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

T. Hagedorn, A. Li, **J. Rychtář**, and D. Taylor, Introduction to the special issue on perspectives and experiences on mentoring undergraduate students in research: Part I, *PRIMUS*, 27 (3): 315-319.

T. Hagedorn, A. Li, **J. Rychtář**, and D. Taylor, Introduction to the special issue on perspectives and experiences on mentoring undergraduate students in research: Part II, *PRIMUS*, 27 (4): 437-441.

D. Sykes, and J. **Rychtář**, Optimal aggression in kleptoparasitic interactions*, Involve*, 10 (5): 735–747.

Filip Saidak

F. Saidak, The prime numbers without the sieve of Eratosthenes, *The Fibonacci Quarterly*, 55 (4): 352-356.

Ratnasingham Shivaji

D. D. Hai and **R. Shivaji**, On radial solutions for singular combined superlinear elliptic systems on annular domains, *J. Math. Anal. Appl.*, 446 (1), 335-344.

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., 445 (1), 459-475.*

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: Section A Mathematics*, 147 (5), 1019-1040.

M. Chhetri, P. Drabek, and **R. Shivaji**, Analysis of positive solutions for classes of quasilinear singular problems on exterior domains, *Advances in Nonlinear Analysis,* 6 (4): 447-459.

A. Castro, D. Costa, and **R. Shivaji**, Multiple positive solutions for a class of variational systems, *Topological Methods in Nonlinear Analysis*, 50 (1).

D. D. Hai and **R. Shivaji**, Positive radial solutions for a class of singular superlinear problems on the exterior of a ball with nonlinear boundary conditions, *J. Math. Anal. Appl.*, 456 (2), 872-881.

Jerry Vaughan

J. Vaughan, Companions of directed sets and the Ordering Lemma, Topology and its Applications, Special Issue in Memory of Alex Chigogidze, Guest Editor Vesko Valov, Topology Appl., Vol. 227, 15 August 2017, 169-177.

Yi Zhang

S. Brenner, J. Gedicke, L. Sung, and **Y. Zhang,** An a posteriori analysis of C^0 interior penalty methods for the obstacle problem of clamped Kirchhoff plates, *SIAM J. Numer. Anal*, 55: 87-108.

X. Feng, Y. Li, and **Y. Zhang,** Finite element methods for the stochastic Allen-Cahn equation with gradient-type multiplicative noises, *SIAM J. Numer. Anal*, 55:194-216.

4.3 Refereed Conference Proceedings Papers Published in 2017

Igor Erovenko

S. Gupta, **I. Erovenko**, H. Oh, J. Rychtář, D. Taylor, Undergraduate students can do meaningful research, *Special Proceedings of 19th Annual Conference of SSCA held at SKUAST,* Jammu (India).

Sat Gupta

S. Gupta, I. Erovenko, H. Oh, J. Rychtář, D. Taylor, Undergraduate students can do meaningful research, *Special Proceedings of 19th Annual Conference of SSCA held at SKUAST,* Jammu (India).

Jan Rychtář

S. Gupta, I. Erovenko, H. Oh, **J. Rychtář**, D. Taylor, Undergraduate students can do meaningful research, *Special Proceedings of 19th Annual Conference of SSCA held at SKUAST,* Jammu (India).

4.4 Journal Articles Accepted in 2017

Greg Bell

G. Bell and Andrzej Nagórko, On stability of asymptotic property C for products and some group extensions*, Algebr. Geom. Topol.*

Maya Chhetri

M. Chhetri, L. Sankar, B. Son and R. Shivaji, An existence result for superlinear semipositone p-Laplacian systems on the exterior of a ball, *Differential and Integral Equations*.

M. Chhetri and P. Girg - Superlinear elliptic systems with reaction terms involving product of powers, *Applied Mathematics Letters*.

M. Chhetri and P. Girg -A global bifurcation result for a class of semipositone elliptic systems*, Journal of Mathematical Analysis and Applications*.

Igor Erovenko

G. Street**, I. Erovenko**, and J. Rowell, Dynamical facilitation of the ideal free distribution in non-ideal populations, *Ecology and Evolution.*

A. Brettin, R. Rossi–Goldthorpe, K. Weishaar, and **I. Erovenko**, Ebola could be eradicated through voluntary vaccination, *Royal Society Open Science.*

Richard Fabiano

R. Fabiano and C. Payne**,** Stability of the solution semigroup for neutral delay differential equations, *Journal of Differential and Integral Equations*.

Talia Fernós

T. Fernós and A. Valette, The Mayer-Vietoris sequence for graphs of groups, property (T), and the first $`l^2$-Betti number, *Homology Homotopy Appl.*

T. Fernós, J. Lécureux, and F. Mathéus, Random walks and boundaries of CAT(0) cubical complexes, *Commentarii Mathematici Helvetici*.

Xiaoli Gao:

X. Gao, S. Ahmed,and Y. Feng, Rejoinder to Post selection shrink-age estimation for high-dimensional data analysis, *Applied Stochastic Models in Business and Industry*.

X. Gao and Y. Feng, Penalize weighted least absolute deviation regression, *Statistics and its Interface*.

Sat Gupta

S. Ahmed, J. Shabbir**,** and **S. Gupta**, Predictive estimation of population mean in ranked set sampling, *REVSTAT*.

S. Khalil, **S Gupta**, and M. Hanif, A generalized estimator for finite population mean in the presence of measurement errors in stratified random sampling, *Journal of Statistical Theory and Practice.*

S. Gupta, Z. Khan, and J. Shabbir, Modified systematic sampling with multiple random starts, *REVSTAT.*

S.Gupta, S. Mehta, J. Shabbir, and S. Khalil, A unified measure of respondent privacy and model efficiency in quantitative RRT models, *Journal of Statistical Theory and Practice.*

S. Gupta, T. Zatezalo, and J. Shabbir, A generalized mixture estimator of the mean of a sensitive variable in the presence of non-sensitive auxiliary information, *Statistics and Applications*.

S. Yadav, S. Mishra, and **S. Gupta**, An efficient estimator for population variance using parameters of an auxiliary variable, *Journal of Statistics and Management Systems.*

Z. Khan, J. Shabbir, and **S. Gupta**, Circular versions of systematic sampling in the presence of linear trend, *Communications in Statistics – Theory and Methods.*

G. Kalucha, R. Sousa, **S. Gupta**, and J. Shabbir, Improved ratio and regression estimators of a sensitive variable in stratified sampling, *Statistics and Applications*.

Jonathan Rowell

G. Street, I. Erovenko, and **J. Rowell**, Dynamical facilitation of the ideal free distribution in non-ideal populations, *Ecology and Evolution*.

Jan Rychtář

K. Pattni, M. Broom, and **J. Rychtář**, Evolutionary dynamics and the evolution of multiplayer cooperation in a subdivided population, *Journal of Theoretical Biology*.

K. Pattni, M. Broom, and **J. Rychtář**, Evolving multiplayer networks: Modelling the evolution of cooperation in a mobile population, *Discrete and Continuous Dynamical Systems - Series B*.

K. Barton, C. Smith, **J. Rychtář**, and T. Sendova, Modeling of breast cancer through evolutionary game theory, *Involve*.

C. Hadjichrysanthou, M. Broom, and **J. Rychtář**, Models of kleptoparasitism on networks: the effect of population structure on food stealing behavior, *Journal of Mathematical Biology*.

M. Broom, M. Johanis, and **J. Rychtář**, The effect of fight cost structure on fighting behaviour involving simultaneous decisions and variable investment levels, *Journal of Mathematical Biology*.

T. Hagedorn, A. Li, **J. Rychtář**, and D. Taylor, Introduction to the special issue on perspectives and experiences on mentoring undergraduate students in research: Part II, *PRIMUS*.

T. Hagedorn, A. Li, **J. Rychtář**, and D. Taylor, Introduction to the special issue on perspectives and experiences on mentoring undergraduate students in research: Part I. *PRIMUS*.

Filip Saidak

F. Saidak, The prime numbers without the sieve of Eratosthenes, *The Fibonacci Quarterly*.

Ratnasingham Shivaji

M. Chhetri, L. Sankar, **R. Shivaji**, and B. Son, An existence result for superlinear semipositone *p*-Laplacian systems on the exterior of a ball, *Differential and Integral Equations*.

J. Goddard, Q. Morris, **R. Shivaji**, and B. Son, Bifurcation curves for singular and nonsingular problems with nonlinear boundary conditions, *Electron. J. Differential Equations*.

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

A. Castro, D. Costa, and **R. Shivaji**, Multiple positive solutions for a class of variational systems, *Topological Methods in Nonlinear Analysis*.

D. D. Hai and **R. Shivaji**, Positive radial solutions for a class of singular superlinear problems on the exterior of a ball with nonlinear boundary conditions, *J. Math. Anal. Appl*.

Clifford Smyth

C. Smyth, A Probabilistic Characterization of the Dominance Order on Partitions, *Order*.

Brett Tangedal

B. Tangedal and J. Sands, Computing Annihilators of Class Groups from Derivatives of L-Functions, *Mathematics of Computation*.

4.5 Refereed Conference Proceedings Papers Accepted in 2017

Igor Erovenko

S. Gupta**, I. Erovenko,** H. Oh, J. Rychtar, D. Taylor, Undergraduate students can do meaningful research, *Special Proceedings of 19th Annual Conference of the Society for Statistics and Computer Applications,* Jammu (India).

Sat Gupta

S. Gupta, I. Erovenko, H. Oh, J. Rychtar, D. Taylor, Undergraduate students can do meaningful research, *Special Proceedings of 19th Annual Conference of the Society for Statistics and Computer Applications,* Jammu (India).

Jan Rychtář

S. Gupta, I. Erovenko, H. Oh, **J. Rychtar,** D. Taylor, Undergraduate students can do meaningful research, *Special Proceedings of 19th Annual Conference of the Society for Statistics and Computer Applications,* Jammu (India).

4.6 Research Presentations in 2017

Greg Bell

On product stability of asymptotic property C, 32nd Summer Conference on Topology and its Applications, Dayton, OH.

Asymptotic Dimension of Groups, Joint Meeting of the AMS and MAA, Atlanta, GA.

Maya Chhetri

Population dynamics model with harvesting, Symposium for South Asian Women in Mathematics, Kathmandu, Nepal.

On a class of asymptotically linear systems, Sectional AMS Meeting, Buffalo, NY.

Positive solutions for a class of singular programs on exterior domains, The Third Pacific Rim Mathematical Association (PRIMA) Congress Oaxaca, Mexico.

On a class of asymptotically linear systems, Emerging issues in nonlinear elliptic equations: singularities, singular perturbations and non-local problems, Bedlewo, Poland.

Asymptotically linear systems, Colloquium, Tata Institute of Fundamental Research – Centre for Applied Mathematics, Bangalore, India.

Asymptotically linear systems, Colloquium, Indian Institute of Sciences, Bangalore, India.

Asymptotically linear systems, Colloquium, Northern Arizona University, Flagstaff, AZ.

Asymptotically linear systems, Research Seminar, University of West Bohemia, Czech Republic.

Yu-Min Chung

AMS Special Session on Statistical Methods in Computational Topology and Applications, 2017 Joint Mathematics Meeting, Atlanta, GA.

Igor Erovenko

Dynamical facilitation of the ideal free distribution in non-ideal populations. Mathematical models in ecology and evolution, City, University of London, London, UK.

Dynamical facilitation of the ideal free distribution in non-ideal populations. Conflict, competition, cooperation and complexity: using evolutionary game theory to model realistic populations, City, University of London, London, UK.

Talia Fernós

The mathematics of gerrymandering, Carolinas Women in Math Symposium, UNCC, Charlotte, NC.

Regular Isometries of CAT(0) cube complexes are plentiful, Mathematical Congress of the Americas, Montreal, Canada.

Random walks and CAT(0) cube complexes, Analysis on Groups and Measured Group Theory, Northwestern University, Evanston, IL.

Xiaoli Gao

Weighted adaptive hard threshold signal approximation for robust change point detection, 10th International Conference of the ERCIM WG on Computational and Methodological Statistics & 11th International Conference on Computational and Financial Econometrics, University of London, UK.

Penalized Adaptive Weighted Least Absolute Deviation Regression, IMS-China, Guangxi, China.

Penalized Adaptive Weighted Least Absolute Deviation Regression, HDDA-VII: The Seventh International Workshop on the Perspectives on High-Dimensional Data Analysis, Guanajuato, Mexico.

Sat Gupta

Some Variations of the Greenberg Unrelated Question Binary RRT Model, PGDAV College, University of Delhi.

Variations of the Greenberg Unrelated Question Binary RRT Model, Annual Conference of the Society of Statistics Computer and Applications, Jammu, India.

Statistical Consultant, Summer 2017 Math/Bio REU students at University of North Carolina-Greensboro, NC.

Assessing the Quality of Quantitative Randomized Response Models, Symposium on Professional Development of New Generation of Research Scholars, COMSATS, Lahore, Pakistan.

Publishing Journal Articles –An Editor's Perspective, Symposium on Professional Development of New Generation of Research Scholars, COMSATS, Lahore, Pakistan.

Practicing Statistics, GC University, Lahore, Pakistan.

Assessing the Quality of Quantitative Randomized Response Models, Quaid-I-Azam University, Islamabad, Pakistan.

Respondent Privacy and Data Security through Randomized Response Models, IASSL Conference, Colombo, Sri Lanka.

Various Shades of Statistical Consulting, University of Peradeniya, Sri Lanka.

Tom Lewis

Finite Difference Methods for Approximating Fully Nonlinear Partial Differential Equations, Mid-west Numerical Analysis Day, Omaha, NE.

Scott Richter

Simulation study of methods for comparing treatments when data points are empirical distribution functions (with M. H. McCann), 2017 Joint Statistical Meetings, Baltimore, MD.

Statistical comparison of particle size distributions, 2017 ASA Conference on Statistical Practice, Jacksonville, FL.

Jonathan Rowell

An Introduction to Ideal Free Movement and Its Consequences Under Limited Perception, North Carolina A&T Mathematics Colloquium, Greensboro, NC.

Jan Rychtář

Joint Program for PIC Math between Two Institutions, Joint Mathematics Meeting, Atlanta, Georgia.

Ratnasingham Shivaji

Uniqueness results for nonlinear eigenvalue problems – an introduction, IV International Workshop in Nonlinear Analysis, Manizales, Colombia.

Uniqueness results for classes of semipositone problems, IV International Workshop in Nonlinear Analysis, Manizales, Colombia.

Uniqueness results for semipositone problems*,* Indian Institute of Technology, Department of Mathematics, Chennai, India.

A positivity challenge in steady state reaction diffusion equations, Southern Methodist University, Dallas, TX.

Uniqueness results for classes of semipositone problems, Emerging issues in nonlinear elliptic equations: singularities, singular perturbations and non-local problems*,* Bedlewo, Poland.

S-shaped bifurcation diagrams in exterior domains, AMS Annual Meeting, San Diego, CA.

Clifford Smyth

Restricted Stirling and Lah numbers matrices and their inverses, Wake Forest Discrete Math Seminar, Winston-Salem, NC.

Restricted Stirling and Lah numbers and their inverses, Atlanta Lecture Series, Georgia State University, Atlanta, GA.

Combinatorial formulas for restricted Stirling and Lah number matrices and their inverses, Combinatorics Seminar, University of South Carolina, Columbia, SC.

Brett Tangedal

L-Functions and their arithmetic properties, UNCG Colloquia, Greensboro, NC.

Jerry Vaughan

Companions of partially ordered sets and the Ordering Lemma, 32nd Summer Topology Conference, University of Dayton, Dayton, OH.

On the paracompactness of linearly stratifiable spaces, DMS Special Conference in Set-Theoretic Topology, Auburn University, Auburn, AL.

Haimeng Zhang

Covariance and variogram estimators on the sphere, Joint Statistical Meetings, Baltimore, MD.

Probabilistic recurrence relations, REU Research Seminar, UNCG, Greensboro, NC.

Intrinsic random functions on the sphere, Department of Mathematics and Statistics Colloquium, UNCG, Greensboro, NC.

Yi Zhang

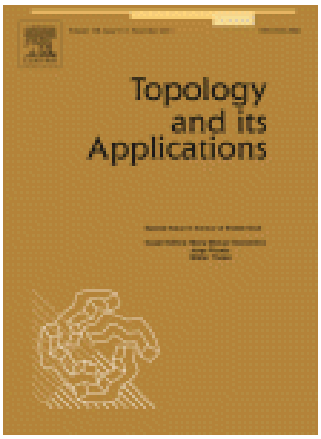
Adaptive C^0 interior penalty methods for a fourth order variational inequality, efficient methods for PDEs and applications, The 3rd Annual Meeting of SIAM Central States Section, Colorado State University, Fort Collins, CO.

Finite element methods for the stochastic Allen-Cahn Equation with gradient-type multiplicative noise (poster), IMA Special Workshop: Recent Advances and Challenges in Discontinuous Galerkin Methods and Related Approaches, IMA, Minneapolis, MN.

Finite Element Methods for the Stochastic Allen-Cahn Equation, The University of North Carolina at Greensboro, Greensboro, NC.

4.7 Department Journals

Topology and its Applications

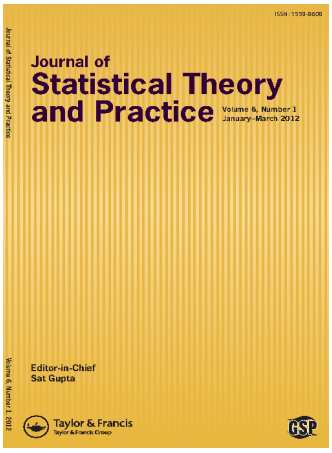


Jerry Vaughan, Editor-in-Chief

Topology and its Applications is a journal primarily concerned with publishing original research papers in topology. 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, and 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.

The Journal of Statistical Theory and Practice

Sat Gupta, Editor-in-Chief



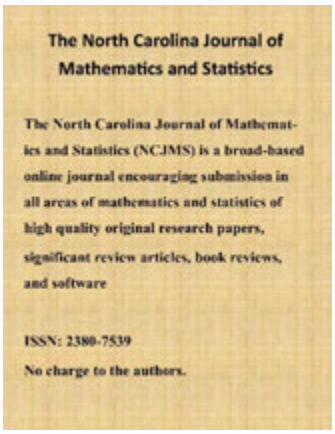
http://www.tandfonline.com/loi/UJSP20/

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 (Eberly Professor Emeritus, Penn State University), Alan Gelfand (J. B. Duke Professor, Duke University), Sergio Verdu (Eugene Higgins Professor, Princeton University), Dan Zelterman (Yale University), Sastry Pantula (ASA President 2010, Oregon State University), Pranab Sen (Cary C. Boshamer Professor, UNC Chapel Hill), and John Stufken (Charles Wexler Professor, Arizona State University).

The journal published a total of 45 papers in 2017 accounting for a total of 809 pages, including two special issues: *Discrete Choice Experiments*, guest-edited by John Stufken (Arizona State University), Abhyuday Mandal (University of Georgia) and M.L. Aggarwal (Memphis University), and *Advances in Statistics and Simulation*, guest-edited by Dieter Rasch (University of Natural

Resources and Life Sciences, Vienna) and Viatcheslay Melas (St. Petersburg State University, Russia).

The North Carolina Journal of Mathematics and Statistics



http://ncjms.uncg.edu/

Jan Rychtář and Sebastian Pauli, Managing Editors

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

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).

So far, the journal received over 50 submissions and published 17 manuscripts.

5. Grants

5.1 External Grants

New Awards (July 1, 2017-June 30, 2018) Administered by Mathematics and Statistics:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
18-0418	**Gupta, Sat**	**Gao, Xiaoli;** Mohanty, Somya	UNCG Research Experience for Undergraduates: Statistical and Machine Learning Approach to Complex Data Analysis	6/1/18	7/31/18	American Statistical Association/NSF	$38,666
18-0494	**Erovenko, Igor**		Center for Undergraduate Research in Mathematics (CURM)	6/5/18	8/31/19	CURM/NSF	$5,250
18-0113	**Pauli, Sebastian**		REU: Computational Research on Local Fields and Galois Groups	6/1/2018	3/31/19	NSA	$16,037

Continuing Awards Administered by Mathematics and Statistics:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	Award End Date	Sponsor	Award Amount
12-0323	**Rychtář, Jan**		Game-theoretical models in biology	9/1/12	8/31/17	Simons Foundation	$35,000
13-01314	**Rychtář, Jan**	**Chhetri, Maya; Gupta, Sat; Shivaji, Ratnasingham**	The Annual UNCG Regional Mathematics & Statistics Conference	9/1/13	8/31/17	NSF	$42,000
14-0054	**Rychtář, Jan**	**Rowell, Jonathan;** Rueppell, Olav	REU Site: Mathematical Biology at UNCG	5/1/14	4/30/18	NSF	$275,952

15-0198	**Shivaji, Ratnasingham**		Collaborative Research: Mathematical and Experimental Analysis of Ecological Models: Patches, Landscapes and Conditional Dispersal on the Boundary	8/15/15	7/31/19	NSF	$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	4/1/16	3/31/19	NSA	$22,274
16-0053	**Pauli, Sebastian**	**Tangedal, Brett; Yasaki, Dan**	UNCG Summer School in Computational Number Theory	4/1/16	3/31/19	NSF	$8,775
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	NSF	$31,730
17-0037	**Rychtář, Jan**	**Erovenko, Igor; Gao, Xiaoli; Rowell, Jonathan; Saidak, Filip**	REU Site: Mathematical Biology at UNCG	5/1/17	4/30/20	NSF	$304,959

Future Awards (after July 1, 2018) to be Administered by Mathematics and Statistics:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
18-0116	**Tangedal, Brett**	**Fernos, Talia; Pauli, Sebastian; Saidak, Filip; Yasaki, Dan**	UNCG Summer School in Computational Number Theory	9/15/18	7/31/19	NSF	$9,000

New Awards (July 1, 2017-June 30, 2018) Administered by other Departments:

PROP #	Lead PI	Other 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

Continuing 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 Engagement	$5,000
N/A	**Bell, Greg**		Faculty First Summer Scholarship Support Award	4/10/17	8/31/17	UNCG – Office of Research and Engagement	$5,000
N/A	**Gao, Xiaoli**	Manda, Prashanti	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**	Murray, Christine	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

New Awards (July 1, 2017-June 30, 2018) Administered by Mathematics and Statistics:

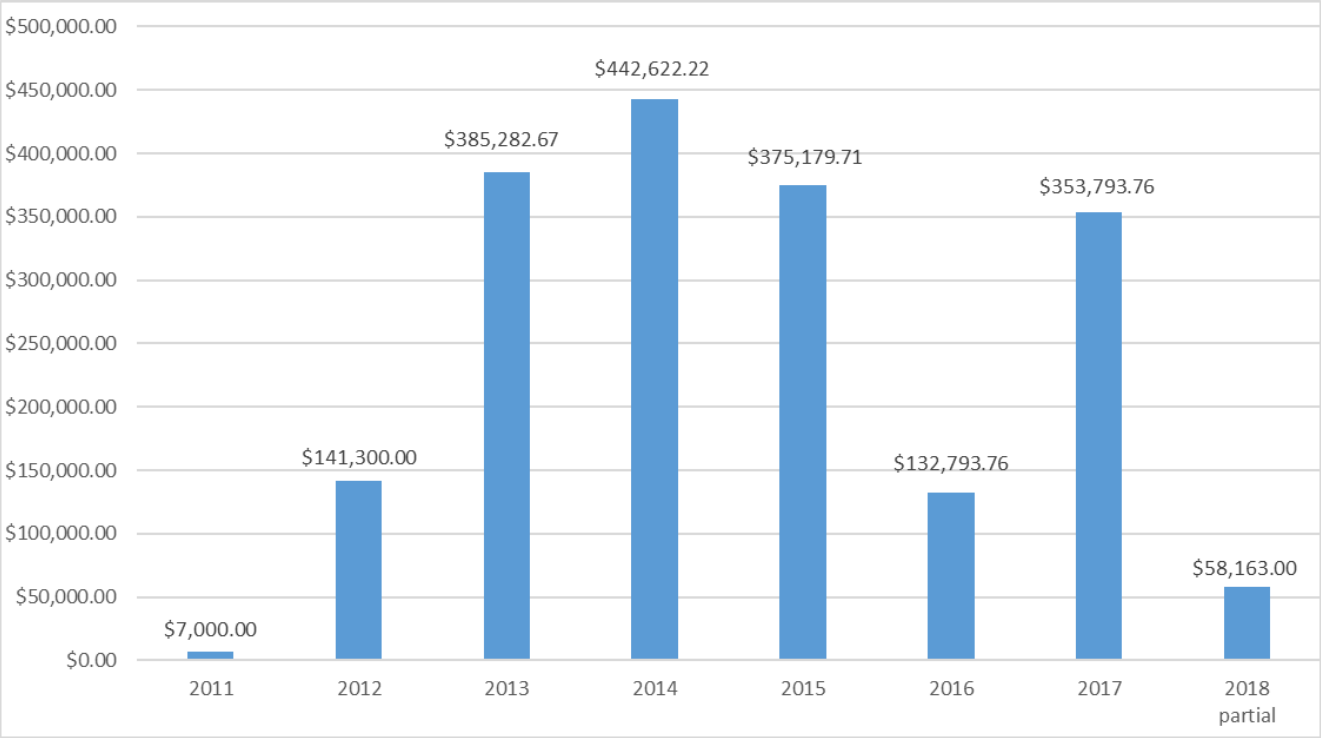
PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
NA	**Shivaji, Ratnasingham**		P-3: NSF proposal	08/01/2017	05/31/18	UNCG – College of Arts and Sciences	$3,000
NA	**Zhang, Yi**		New Faculty Grant	4/10/18	7/31/18	Office of Research and Engagement	$5,000
NA	**Lewis, Tom**		Regular Faculty Grant	4/10/18	7/31/18	Office of Research and Engagement	$5,000

Future Awards (After July 1, 2018) Administered by Mathematics and Statistics:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
NA	**Smyth, Clifford**	Wasserberg, Gideon; Schug, Malcom; Kalcounis-Rüeppell, Matina	Characterization of Lyme disease spread from Virginia into North Carolina: the role of topographic corridors and anthropogenic forest fragmentation	01/01/18	12/31/18	UNCG Giant Steps grant	$25,000
NA	**Gupta, Sat**		P-3: NSF proposal	08/01/18	05/31/19	UNCG – College of Arts and Sciences	$2,000
NA	**Erovenko, Igor**		Research student stipends	08/01/18	05/31/19	UNCG – College of Arts and Sciences	$1,500

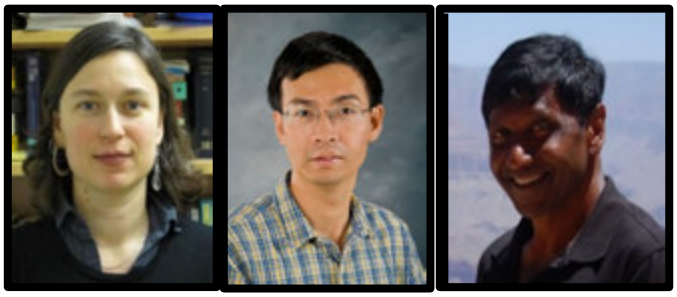
NA	**Gupta, Sat**	**Shivaji, Ratnasingham; Zhang, Haimeng**	International Conference on Advances in Interdisciplinary Statistics and Combinatorics	08/01/18	7/31/19	Institute of Mathematics and its Applications	$5,000
NA	**Yasaki, Dan**	**Howell, Tracey**	Moving the Metrics: Calculus Corequisite Pilot	01/01/19	07/31/20	Provost Office and College of Arts & Sciences	$28,490

Grant Awards by Fiscal Year 2011-2018 (awards indexed to the year the proposal was submitted)



Total grant dollars since 2011 is $1,896,135.

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

Shivaji

Fellow of the AMS

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 and AMS Fellow

Congratulations to Dr. Ratnasingham Shivaji who was elected to the 2019 Class of Fellows of the American Mathematical Society. He is also 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

Sebastian Pauli, Director of Undergraduate Studies

6.1 Programs

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

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

Degree Programs

The Department of Mathematics and Statistics offers undergraduate programs leading to

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

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

Curriculum

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

The math placement test, which is used to decide the initial placement of a student into a math course, has undergone significant revision and is now administered to all freshmen STEM majors at SOAR before they begin their studies at UNCG. This is done to ensure timely graduation by placing students in proper first-year courses. We began collecting empirical data measuring the readiness of the students in MAT 191. These data will be used to design additional services and support for these STEM majors to lower DFW rates and help at-risk students succeed. In Spring 2019, we will offer a co-requisite course to MAT 191 for the first time. This course is designed to give additional support to students when they need it.

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 2017-18 academic year, 14 students earned a Bachelor's degree in mathematics: Lara Alghaben, Spencer Brown, Maribeth Edson, Bradley Froelich, Phillip Gowins, Justin Hamby, Caitlin Hampton, Brandon Joyce, Carrie Miller, Tyrone Molison, Christopher Nem, Fatima Williams, Abagayle Younts, and Jianhong Zhu. The Department Graduation Ceremony was held on May 4, 2018.

Graduates, faculty, and families at the 2018 Graduation Ceremony Reception & Ceremony

B.A. and B.S. graduates at our Graduation 2018 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 of our undergraduate majors during their first year.

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

7. Undergraduate Research Program

Background and history

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

NSF Math-Bio Undergraduate Fellowship

Overview & Evolution

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

Outreach

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

Sample Research Projects

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

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

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

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

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

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

Education

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

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

7.1 2018 National Research Experience for Undergraduates Program

Summary

Ajanta Roy (Bennett College) and Igor Erovenko (UNCG) received funding from the Mathematical Association of America (MAA) for the “Vaccination Games” 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 June 11, 2018 to July 20, 2018, Drs. Erovenko and Roy engaged two African-American female undergraduate students from Bennett College (Greensboro, NC), one African-American and one Hispanic female undergraduate students from UNC Greensboro in two research projects. The students were introduced to the mathematical modeling of infectious diseases and basics of game theory. They were taught how to set up and solve game-theoretic models with applications in behavioral epidemiology, called “vaccination games.” In a vaccination game, individuals decide whether to protect themselves from an infectious disease by taking potentially costly actions such as vaccinating. The students attended tutorials on MATLAB and LaTeX and were trained in many aspects of research including responsible conduct of research, searching literature, preparing and delivering oral presentations, and scientific writing.

Each of the two student groups presented the results of their summer work in the poster session of the 14th Annual UNCG Regional Mathematics and Statistics Conference. One student is scheduled to deliver a poster presentation at the Joint Mathematics Meeting in January 2019 in Baltimore. Both student projects resulted in papers being prepared for publication in peer-reviewed journals.

This project is part of the ongoing collaboration between UNCG and Bennett College (HBCU), and the 2018 NREUP was the fourth such joint program; the first three programs were led by Hyunju Oh (Bennett College) and Jan Rychtář (UNCG).

Projects

Optimal Condom Usage to Prevent Chlamydia

Chlamydia is a common STD that can infect both men and women. It can cause serious, permanent damage to a woman's reproductive system. This can make it difficult or impossible for her to get pregnant later on. Chlamydia can also cause a potentially fatal ectopic pregnancy (pregnancy that occurs outside the womb). Chlamydia is acquired by having vaginal, anal, or oral sex with someone who has chlamydia. To protect themselves from chlamydia, individuals should use latex condoms every time they have sex. We used an existing epidemiological model of chlamydia transmission to construct a game-theoretic model where rational selfish individuals are looking for optimal (Nash equilibrium) levels of condom usage to prevent chlamydia.

Optimal Personal Protection Strategies for MERS

Middle East Respiratory Syndrome (MERS) is viral respiratory illness that was recently recognized in humans. It was first reported in Saudi Arabia in 2012 and has since spread to several other countries, including the United States. Most people identified as infected with MERS-CoV developed severe acute respiratory illness, including fever, cough, and shortness of breath. Many of them have died. Currently, there is no vaccine to prevent MERS-CoV infection. Individuals can protect themselves from MERS by taking everyday preventive actions such as washing hands with soap, cleaning and disinfecting frequently touched surfaces, and avoiding personal contact with sick people. We used an existing model of MERS transmission to construct a game-theoretic model where rational selfish individuals are looking for optimal (Nash equilibrium) levels of the adoption of these preventive actions against MERS.

2018 Summer NREUP participants

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

Jan Rychtář, Lead Principal Investigator

Jonathan Rowell Principal Investigator

Olav Rueppell, Principal Investigator

Louis-Marie Bobay

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 ten weeks in 2018 (mid-May to mid-July), Drs. Bobay (Biology), Erovenko, Rowell, and Rueppell (Biology) worked with nine undergraduate students that came from Coastal Carolina University, Georgia Southern University, Rutgers University, St. Mary's College of Maryland, St. Mary's University, Truman State University, University of California Berkeley, Western Carolina University, and Xavier University.

The 2018 cohort consisted of 4 female and 5 male students. Two out of nine students came from under-represented minorities. Student maturity varied from freshmen to seniors, and their prior course work in mathematics, statistics, and biology varied extensively.

Math-Bio REU joined with Statistics REU for a presentation by Matina Kalcounis-Rüppell (Biology Department).

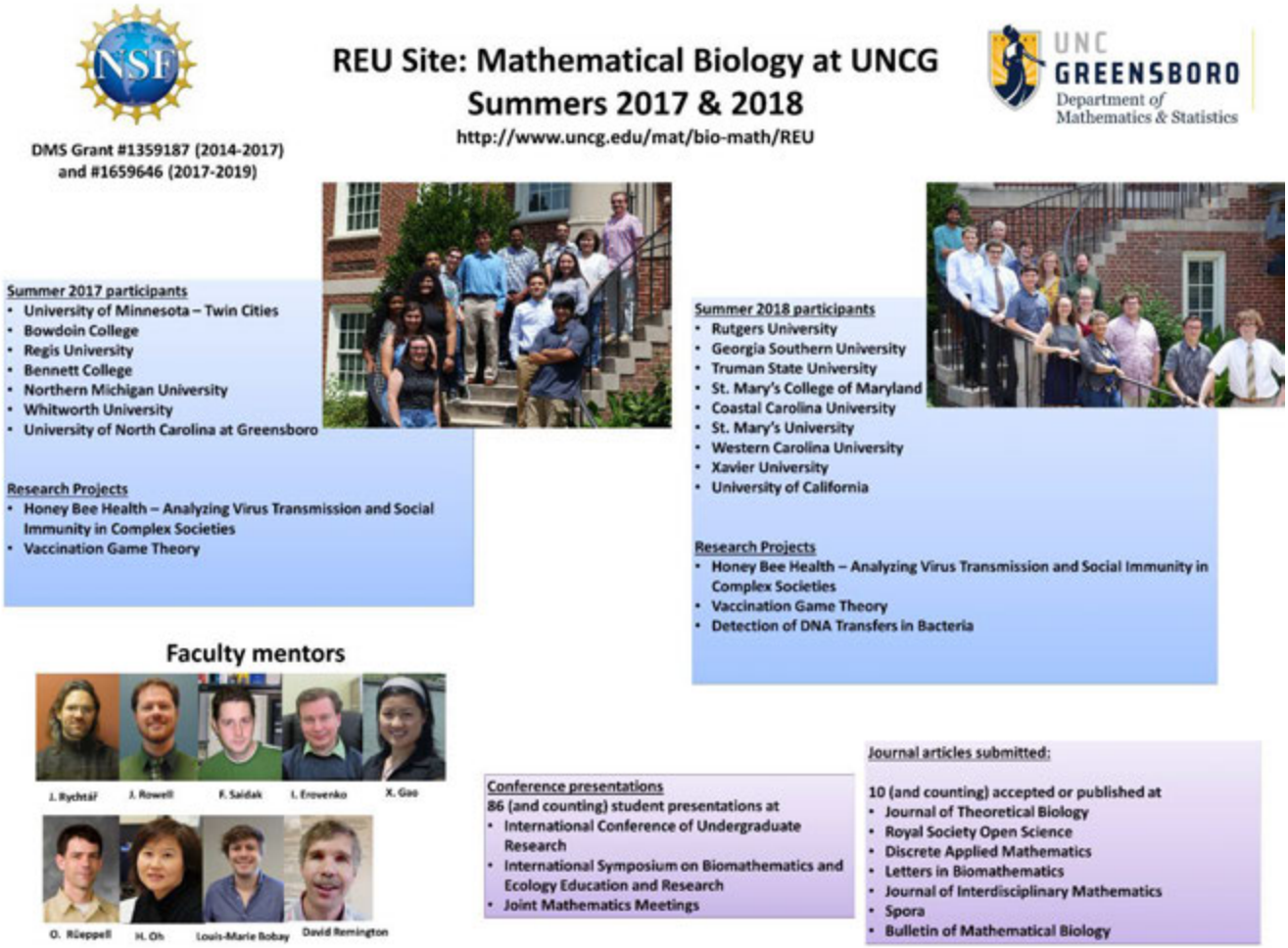
The ten-week program consisted of two distinct phases. In the first two weeks, the students underwent a broad training suitable for the preparation of mathematical biologists. Morning sessions covered technical subjects such as programming in Matlab and R and typesetting with LaTeX, while the afternoons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

Joshua Safley, a PhD student within our Department, and Prashant Waiker, a PhD student at the Biology department, conducted Matlab and LaTeX tutorials and led discussions on reviewing the literature, academic writing, and other skills. In addition to this instruction, faculty mentors delivered several professional development workshops. For the remaining eight weeks of the program, the students worked on their research projects in three teams of three students each. They were required to give short synopses of their work as well as weekly presentations.

REU undergraduate student presenters, Alex Foster of Coastal Carolina University, Sylvia Klein of St. Mary's College of Maryland, and David Feagins of the St. Mary's University

The REU program culminated with final student project presentations in a formal joint REU–NREUP symposium comprised of the UNCG math-bio REU, statistics REU, and math-bio NREUP students. The joint symposium was open to the public.

2018 Summer NSF-REU participants, faculty, & graduate student mentors



Research projects

The students were split into 3 groups and each group worked on one of the following research projects.

Experimental Investigation and Simulation of Division of Labor within Hygienic Behavior in *Apis mellifera*

Honey bees (*Apis mellifera*) are eusocial insects known for their complex colony structure and contribution to agriculture through pollination. In recent years, the health of honey bee colonies has declined. Currently, the *Varroa* mite (*Varroa destructor*), a highly specialized parasite, is considered the most dangerous factor affecting *Apis mellifera* colonies. Hygienic behavior, the process of removing diseased or dead brood from the hive, is a natural defense against *Varroa*. Numerous studies have addressed hygienic behavior, but the mechanistic process of this behavior is still poorly understood. By implementing direct observations from an experimental assay into an agent-based model, we explored aspects of division of labor in hygienic behavior against

Varroa mite infestation. Our model simulates a bee colony by incorporating both bee and mite lifecycles. We then introduced a behavioral component to the model through which bees differentially perform the tasks associated with hygienic behavior. Experimentally, we have found evidence of division of labor within hygienic behavior. Our simulation suggests that hygienic behavior is improved by the bees' ability to divide their labor into different subtasks by decreasing the number of false positive removals of brood. The combination of empirical observation and theoretical model will provide insights into hygienic behavior and help combat a major factor of declining honey bee health.

A Game Theoretic Model for Protective Measures Against Chikungunya Virus on Reunion Island

Chikungunya virus is a mosquito-borne fever-rash-arthritis syndrome that is often accompanied by chronic arthritis. The disease was relatively unstudied until an outbreak on Reunion Island in 2004 infected nearly a third of the population. This led to the creation of mathematical models to explain the transmission of the disease for this island. Here we look at preventing transmission with the use of mosquito repellent. We construct a game-theoretic model where individuals choose how often they spray themselves with repellent. We find that as the cost of insect repellent decreases, compared to the cost of infection, the strategies of rational individuals results in a reduction of infectivity of the disease, but does not eliminate it.

Estimating bacterial recombination rates

Bacteria are commonly regarded as clonal organisms, inheriting genetic information from a single parent cell. However, evidence shows that bacteria undergo homologous recombination where they incorporate foreign DNA into their genomes. Recombination is most impactful when transferring genes that increase survivability. For example, the transfer of genes for antibiotic resistance can lead to ``superbugs:'' strains that are resistant to many classes of antibiotics. Recombination is not yet well understood as several studies have come to inconsistent conclusions regarding the rate at which it occurs. However, homoplasies, which are sections of shared DNA not inherited from a common ancestor, are easier to detect, and they arise from either recombination or convergent mutation. Thus, estimating convergent mutations allows us to indirectly infer the rate of recombination. Employing a probabilistic model verified by simulation, we gain insight into which bacterial species undergo recombination and how frequently they do so. Ultimately, an accurate metric for recombination rate provides a better understanding of bacterial evolution and adaptation.

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

E. Hurlbut, E. Orthega, I. V. Erovenko, J. T. Rowell. Game theoretical model of cancer dynamics with four cell phenotypes. Games 9(3):61, 2018.

S. Sun, **M. Leshowitz**, J. Rychtář. The signalling game between plants and pollinators, Scientific Reports, (2018) 8:6686.

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, Bulletin of Mathematical Biology 80(10):2580-2599, 2018.

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

- K. Weishaar, Ebola could be eradicated through voluntary vaccination, 15th Annual Pikes Peak Regional Undergraduate Mathematics Conference, February 2018.

- A. Martinez, J. **Machado, E. Sanchez**, Optimal vaccination strategies to reduce endemic levels of meningitis in Africa. Summer STEM Research Symposium, Whitworth University. October 2017.

- **J. Machado**, A. Martinez, **E. Sanchez**, Optimal vaccination strategies to reduce endemic levels of meningitis in Africa. 13th UNCG RMSC, UNCG. November 2017.

- **J. Machado**, A. Martinez, **E. Sanchez**, Optimal vaccination strategies to reduce endemic levels of meningitis in Africa. Ninth Annual Undergraduate Research Conference at the Interface of Biology and Mathematics at NIMBioS, University of Tennessee. November 2017.

- E. Estes, **S. Rubio-Correa, B. Joyce**: Social Networks in honey bees and IAPV transmission. Winthrop University Joint REU minisymposium, July 2017.

- **J. Machado**, A. Martinez, **E. Sanchez**, Optimal vaccination strategies to reduce endemic levels of meningitis in Africa. Winthrop University Joint REU minisymposium, July 2017.

- E. Estes, **S. Rubio-Correa, B. Joyce**: Social Networks and IAPV transmission in honey bees. NC State University Joint REU minisymposium, July 2017.

- **J. Machado**, A. Martinez, **E. Sanchez**, Optimal vaccination strategies to reduce endemic levels of meningitis in Africa. NC State University Joint REU minisymposium, July 2017.

- **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.

7.3 American Statistical Association (ASA)/ NSF REU

In 2017, the Department received the first ever ASA/NSF REU funding for statistics where Sat Gupta was the PI, and Xiaoli Gao and Somya Mohanty (Computer Science) were Co-PIs. The program ran from May 14 to July 20, 2018. As part of this REU, four (4) nationally recruited students did research on Statistical and Machine Learning Approaches to Complex Data Analysis. We received 52 applications for the program and selected two female students (Ms. Amber Young, Purdue University; and Ms. Stacey Miertschin, Winona State University), and two male students (Austin Miller, University of Wyoming, and An Dinh, Eastern Oregon University, GPA 3.93). In addition to the 4 NSF funded students, we included 2 locally funded UNCG Math/Stats students (Ryan Parks and Xuechen Zhu) with support from the UNCG Office of Undergraduate Research and the Department of Mathematics and Statistics to form three research teams. One of the teams worked with Sat Gupta as mentor and explored **Variations of the Greenberg Unrelated Question Binary RRT Model by Introducing Optionality in the Inverse Sampling Design**.). Another team worked with Xiaoli Gao as mentor on **Robust Linear Trend Filtering with Application to Stock Price Estimation**. The third team of three students (one student opted to do two projects) was mentored by Somya Mohanty on developing **Predictive Models for Detection of Diabetes and Cardiovascular Diseases using Electronic Health Records (EHR).** The team explored the effectiveness of supervised models such as Support Vector Machines (SVM), Random Forests, and Gradient Boosted Trees for ensemble models on

Dayna Touron, Associate Dean of the College of Arts and Sciences, addressing the Statistics REU participants on the first day.

Sat Gupta addressing the Statistics REU participants on the first day.

high-dimensional data consisting of patient demography, laboratory, and survey results. All three teams have submitted abstracts for the Advances in Interdisciplinary Statistics and Combinatorics (AISC 2018) conference to be held at UNCG in October 5-7. The teams will also be submitting abstracts to additional conferences, such as UTK's Undergraduate Math Conference, the Annual State of North Carolina Undergraduate Research & Creativity Symposium (SNCURCS), and the MAA Regional Undergraduate Mathematics Conferences. Work done by each team will soon be submitted as a journal article also.

The students in this program took part in a wide range of professional development activities. These included workshops on R, LaTeX, Python, and invited lectures on diversity, responsible conduct of research, research with human subjects, publishing journal articles, practicing statistics, and the significance of undergraduate research. They also visited research centers including SAS, SAMSI, and the Joint School of Nanoscience and Nanoengineering. Living in the same residence hall on campus and taking part in various extramural activities helped inculcate in them a spirit of team work.

2018 Summer ASA/NSF-REU participants and faculty mentors.

7.4 REU Computational Research on Local Fields and Galois Groups

A Research Experience for Undergraduates (REU) on Local Fields and Galois Groups took place at Elon University in North Carolina from June 4 to July 27, 2018. The REU was organized by Chad Awtrey (Elon) and Sebastian Pauli (UNCG) and attended by nine students from nine universities all over the country. They conducted research together under the supervision of the organizers, Sandi Rudzinski (a graduate student at UNCG), and Scott Zinzer (Aurora University).

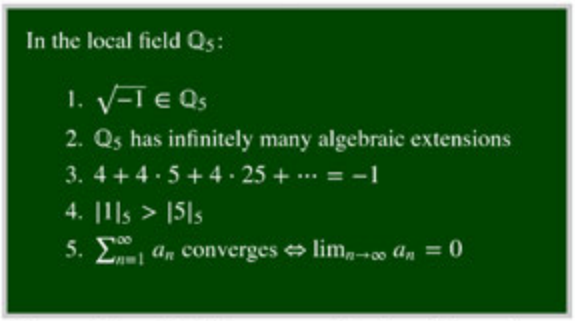


Figure 1: Local fields are more fun than the real numbers.

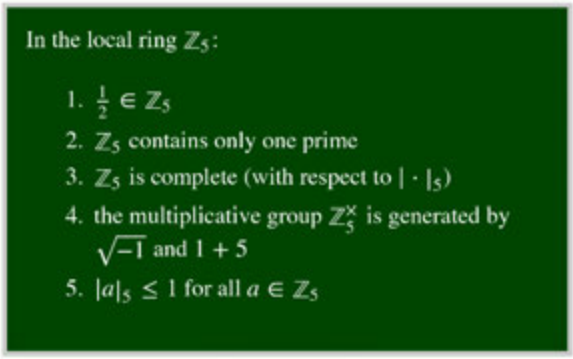


Figure 2: Local rings are more fun than the integers.

The topic of the REU was an area of number theory that can be approached abstractly as well as explicitly and still leaves room for new discoveries. Starting with the computation of numerous examples the students observed patterns in the generating polynomials of extensions, mad conjectures, and proved the conjectures for special cases. Currently three articles on the results from the REU are being prepared.

The REU Computational Research on Local Fields and Galois Groups is supported by Elon University, UNCG, and the National Security Agency (NSA).

More information can be found at https://www.uncg.edu/mat/numbertheory/reu

2018 Summer REU participants and faculty mentors at Elon University.

8. Graduate Program

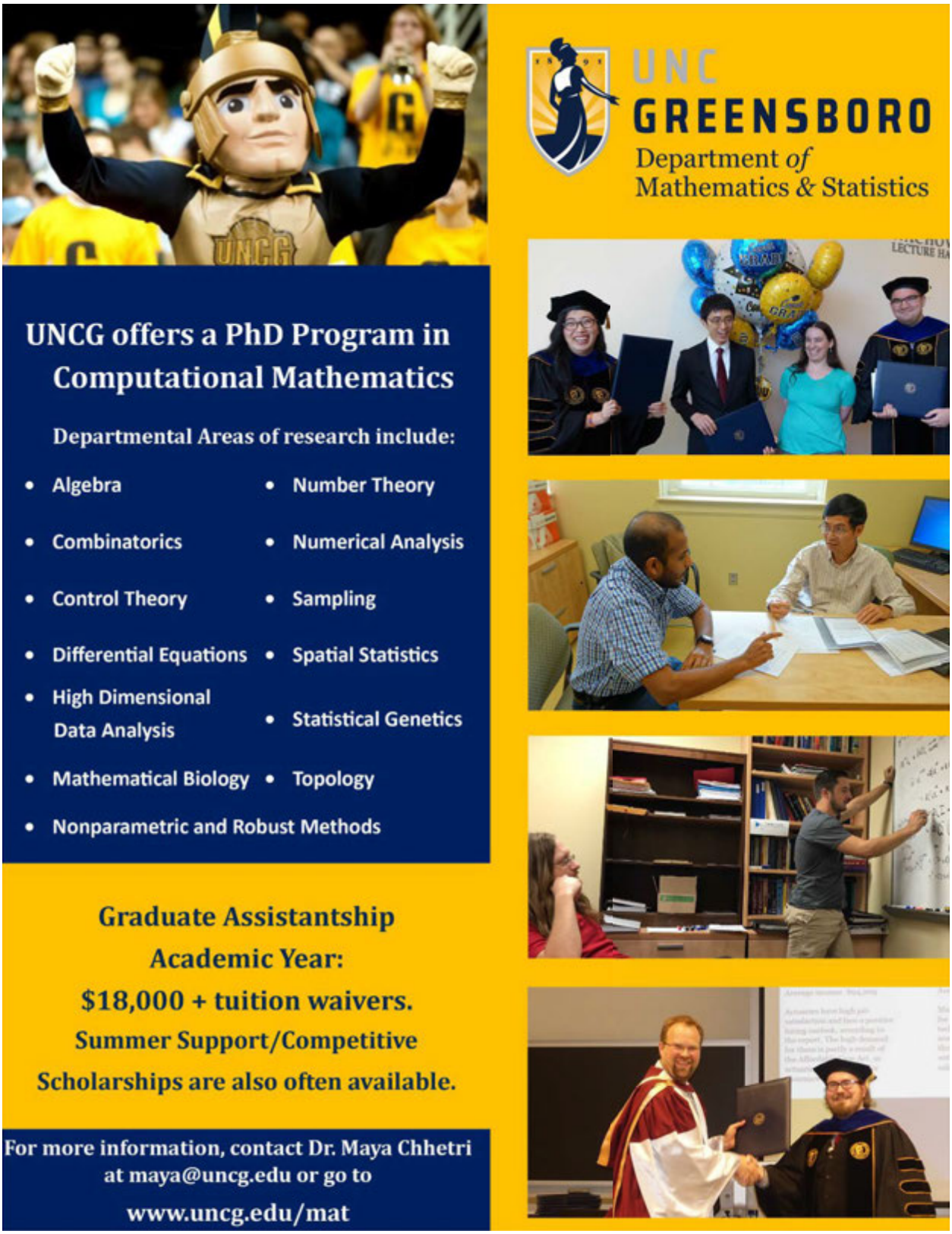
Maya Chhetri, Director of Graduate Studies

8.1 Year in Review

- Programs Offered
- Graduates
- Professional Mentoring
- New Teaching Assistant Training
- Graduate Recruitment
- Scholarships/Fellowships and Internships
- Graduate Teas

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. Our active recruitment program led to the enrollment of seven new Ph.D. students and five M.A. students. This year we graduated ten M.A. students and one Ph.D. student. Our graduate students authored or co-authored three published articles and further submitted eight journal articles. Our graduate students presented total eleven talks during 2017-18. We continued with our successful Teaching Mathematics Seminar combined with Teaching Practicum to our first year Graduate Teaching Assistants. We also continued our very enjoyable monthly Graduate Teas.

8.2 Programs & Certificates



UNCG offers an MA in Mathematics with concentrations in

- Mathematics
- Applied Statistics
- Actuarial Mathematics
- Data Analytics
- Teaching College Mathematics

For more information, contact Dr. Maya Chhetri at maya@uncg.edu or go to www.uncg.edu/mat

MATHEMATICIAN IS #2

STATISTICIAN IS #5

THE 2018 CAREERCAST JOBS RATINGS

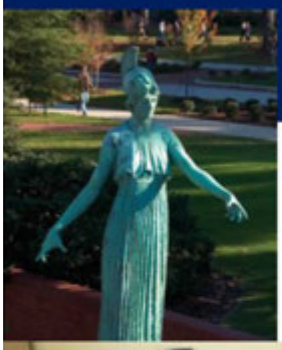
ACTUARY IS #10

DATA SCIENTIST IS #7

UNC GREENSBORO
Department *of* Mathematics & Statistics

Graduate Assistantship
Academic Year:
$10,800 + tuition waivers.
Summer Support/Competitive Scholarships are also often available.

WANT TO BECOME AN EXPERT IN DATA ANALYTICS?



Get started with our Masters with a Concentration in Data Analytics

MATHEMATICIAN IS #2

STATISTICIAN IS #5

THE 2018 CAREERCAST JOBS RATINGS

ACTUARY IS #10

DATA SCIENTIST IS #7

WHO CAN APPLY?

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

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

For more information, go to

www.uncg.edu/mat

www.uncg.edu/mat/grad/data-analytics

Or contact Dr. Xiaoli Gao at x_gao2@uncg.edu

UNC GREENSBORO

Department *of* 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

MATHEMATICIAN IS #2

STATISTICIAN IS #5

THE 2018

CAREERCAST

JOBS RATINGS

ACTUARY IS #10

DATA SCIENTIST IS #7

WHO CAN APPLY?

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

www.uncg.edu/mat

www.uncg.edu/mat/grad/data-analytics

Or contact Dr. Haimeng Zhang at h_zhang5@uncg.edu

UNC GREENSBORO

Department *of* Mathematics & Statistics

POST-BACCALAUREATE CERTIFICATE IN STATISTICS

Enhance your Data Analysis skills

MATHEMATICIAN IS #2

STATISTICIAN IS #5

THE 2018 CAREERCAST JOBS RATINGS

ACTUARY IS #10

DATA SCIENTIST IS #7

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
www.uncg.edu/mat
www.uncg.edu/mat/grad/data-analytics
Or contact Dr. Haimeng Zhang at h_zhang5@uncg.edu

UNC GREENSBORO
Department *of* Mathematics & Statistics

8.3 Degrees Awarded in Academic Year 2017-18

Graduating this year with their M.A. Degree are Xinyu Feng, Nathan Fontes, Indika Gunawardana, Matthew Jester, David Perez-Suarez, Christopher Neil Pritchard, Sandamalee Seneviratne, Keri Spetzer, Ping Wang, and Debbie White.

In 2017-18, Wei Chen graduated with PhD in Computational Mathematics. This brings the total of our PhD graduates since the inception of the program to twelve since 2014 - Abraham Abebe, Ricky Farr, Jonathan Milstead, Danielle Moran, Quinn Morris, Catherine Payne, Jeong Sep Sihm, Brian Sinclair, Byungjae Son, Christopher Vanlangenberg, and Tanja Zatezalo.

In May 2018, Wei Chen was awarded a Ph.D. in Computational Mathematics. Wei worked under the supervision of Haimeng Zhang. Her dissertation was titled *Spectral Estimation for Random Processes with Stationary Increments*. Wei is currently employed at UNCG as a Lecturer.

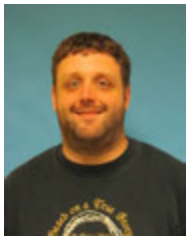
Summer 2017 Graduates who attended the December 2017 Commencement Ceremony and the 2018 Department Graduation Ceremony

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 was a visiting assistant professor at Swarthmore College in Swarthmore, PA during the 2017-18 academic year. He is currently (beginning Fall 2018) a Tenure-Track Assistant Professor at Appalachian State University in Boone, NC.

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 researcher 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-adic Fields*. Jonathan is currently a lecturer at UNCG.

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.

In May 2015, Brian Sinclair was awarded his Ph.D. in Computational Mathematics. 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.

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.

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 faculty at North Carolina Central University in Durham, NC.

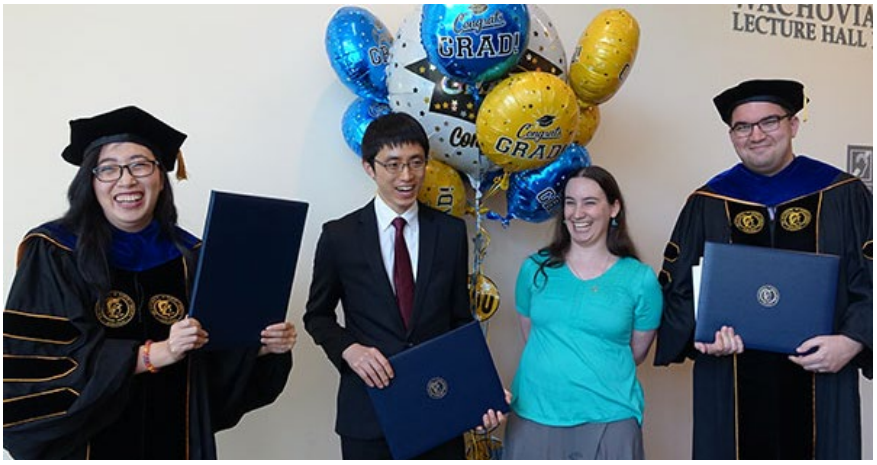
In May 2017, Jeong Sep Sihm was awarded a Ph.D. in Computational Mathematics. Jeong worked under the supervision of Sat Gupta. His dissertation was titled *Modified Binary Randomized Response Technique Models.* Jeong is currently a non-tenure track assistant professor at Guilford College in Greensboro,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

Ph.D. Graduate, Wei Chen, with dissertation advisor, Haimeng Zhang

Ph.D. Graduate, Quinn Morris, with dissertation advisor, Ratnasingham Shivaji

Ph.D. Graduate, Catherine Payne, with dissertation advisor, Rich Fabiano

Ph.D. Graduate, Byungjae Son, with dissertation advisor, Ratnasingham Shivaji

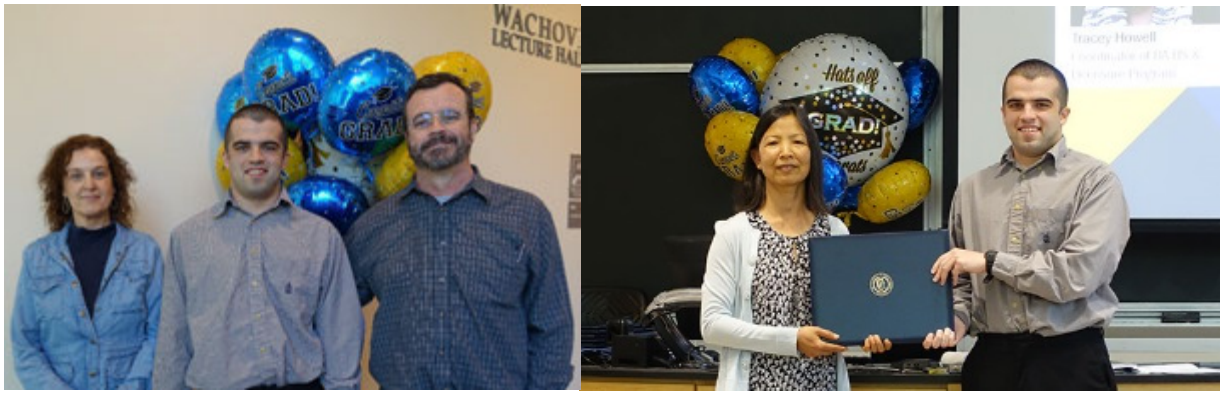


Ph.D. Graduates, Wei Chen, Byungjae Son, Catherine Payne, and Quinn Morris, at the 2018 Graduation Ceremony

M.A. Graduates, Nathan Fontes, Debbie White, Neil Pritchard, David Suarez, Matt Jester, Xinyu Feng, Indika Gunawardana, Keri Spetzer, Ping Wang, and Sandamalee Seneviratne, at the 2018 Graduation Ceremony

M.A. Graduates, Indika Gunawardana (left) and Sandamalee Seneviratne (right), with Maya Chhetri

M.A. Graduates, Matt Jester, Neil Pritchard (left), and Keri Spetzer (above), with Maya Chhetri



M.A. Graduate, David Suarez, with his family and Maya Chhetri

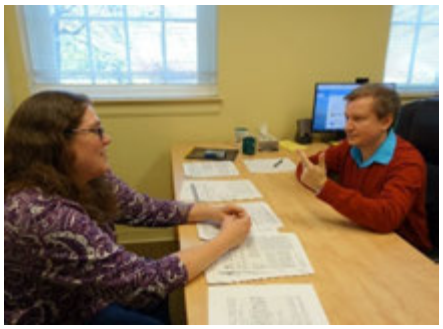
M.A. Graduate, Xinyu Feng, with his family and Maya Chhetri

M.A. Graduate, Nathan Fontes, with his family and Maya Chhetri

M.A. Graduate, Ping Wang, with her family and Maya Chhetri

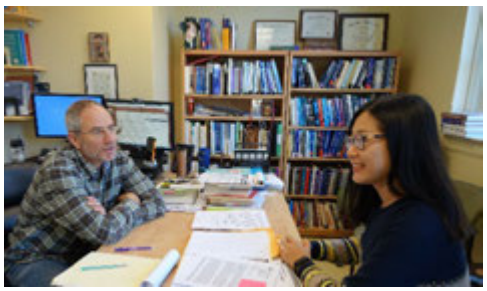
M.A. Graduate, Debbie White, with her family and Maya Chhetri

8.4 Professional Mentoring



Igor Erovenko mentoring graduate student Sandi Rudzinski

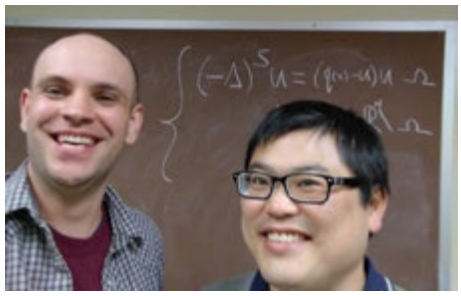
During the 2016-17 academic year, we began a successful professional mentoring program for our Ph.D. students. Each student was assigned a faculty member who would reach out to them periodically during the academic year. These meetings are documented and recorded. For the academic year 2017-18, we implemented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



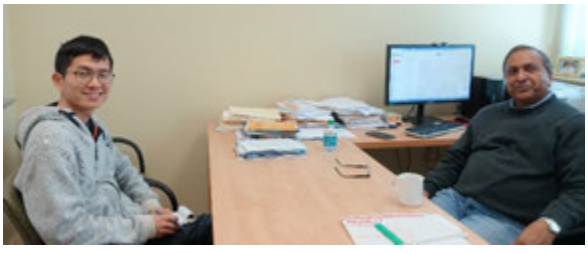
Scott Richter mentoring graduate student Qi Zhang

Talia Fernós mentoring graduate student Sarangan Balasubramaniam

Brett Tangedal mentoring graduate student Romesh Thanuja



Dan Yasaki mentoring graduate student Elliott Hollifield



Sat Gupta mentoring graduate student Bin Luo

Rich Fabiano mentoring graduate student Charith Elson

Professional Development Series

The Department also began a 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 is organized by Tom Lewis and Haimeng Zhang. During the academic year, our Department featured two events. Julie Barnes (Western Carolina University) presented "Preparing for a Career as a Mathematician in a Department that Only Awards Bachelor's Degrees" during the Fall 2017 semester. Sat Gupta (UNCG) spoke on "Publishing Journal Articles - An Editor's Perspective" during the Spring 2018 semester.

Sat Gupta presenting at our Professional Development Seminar

Julie Barnes 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

This lecture series/workshop focuses 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.

Organizers: 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*

Arthur Schwartz, MAAA, FCAS (NC State Government's Department of Insurance)
A Career as an Actuary?
Friday, January 27, 2017, at 4:00pm in Petty 313*

Julie Barnes, (Western Carolina University)
"Preparing for a Career as a Mathematician in a Department that Only Awards Bachelor's Degrees"
Friday, November 17, 2017, at 4:00pm in Petty 150

Sat Gupta (UNCG)
"Publishing Journal Articles - An Editor's Perspective"
Friday, February 23, 2018, at 4:00pm in Petty 219

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

THE UNIVERSITY of NORTH CAROLINA GREENSBORO
Department of Mathematics & Statistics

8.5 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 a class.

Graduate student Neil Pritchard presenting in the Teaching Mathematics Seminar

Graduate student Emily Johnson presenting in the Teaching Mathematics Seminar

8.6 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. During the academic year 2017-18, we had an enrollment of 20 Ph.D. students, 18 M.A. students, and 1 Post-Baccalaureate Certificate in Statistics student.

Recruitment Efforts

Talia Fernós at the AMS 2018 recruitment event.

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 2018 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 Talia Fernós, Tom Lewis, and Ratnasingham Shivaji in January 2018. 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 Combinatorics (AISC), the Palmetto Number Theory Series (PANTS XXVI), and the UNCG Regional Mathematics and Statistics Conference.

Maya Chhetri at an AMS recruitment event

Shivaji at the AMS 2018 recruitment event.

Jonathan Rowell at the NIMBioS 2017 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, with prospective students, at the AMS 2018 recruitment event.

With the help of Dr. Haimeng Zhang and Dr. Xiaoli Gao, the department is working to build a collaborative relationship from institutions in China.

8.7 Scholarships/Fellowships and Internships

Many of our continuing students were awarded competitive departmental *Helen Barton Scholarship* for 2018-2019 - Nalin Fonseka, Elliott Hollifield, Bin Luo, Aaron Rapp, Romesh Arachchige.

Aaron Rapp received *Inclusiveness Award Scholarship* from the Graduate School for 2018-19. Elliott Hollifield and Bin Luo received Summer Research Scholarship to advance their research program during Summer 2018.

In addition, several incoming students for Fall 2018 were awarded with the Graduate School fellowships or scholarship. Neil Pritchard received prestigious ***Alumni / Excellence / Hayes Fellowship*** which paid $22,000 stipend and came with a complete tuition remission for one year. Ivanti Galloway and Shalmali Bandyopadhyay received the *Moore Fellowship* for one year.

Bin Luo had been offered a Summer Internship at Volvo and Qi Zhang secured a summer internship with ConvaTec, a global medical products and technologies company during Summer 2018.

8.8 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: August 30, 2017 3:30-4:30pm

Graduate Tea: October 30, 2017 3:30-4:30pm

Graduate November 27, 2017 3:30-4:30pm

Graduate Tea: January 29, 2018 3:30-4:30pm

Graduate Tea: March 26, 2018 3:30-4:30pm

Graduate Tea: April 18, 2018 3:30-4:30pm

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 $108,000 was disbursed in 2017-18. 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 2017-18 scholarship recipients are listed below.

Helen Barton Scholarship: Nalin Fonseka, Elliot Hollifield, Bin Luo, David Perez-Suarez, Aaron Rapp
Ione Holt Grogan Scholarship: Sara Feggeler, Robert Izydore, Jonathan Machado Bilbraut, Eric Sanchez, Ciera Tucker, AbaGayle Younts, Jianhong Zhu
Vicky Martin Langley Math Scholarship: Spencer Brown
Judith L. Mendenhall Scholarship: Jianhong Zhu
Eldon E. and Christine J. Posey Scholarship: Sara Feggeler
Dr. Theresa Phillips Vaughan Math Scholarship: Sara Feggeler, Nalin Fonseka, Robert Izydore, Bin Luo, Jonathan Machado Bilbraut, Aaron Rapp, Jianhong Zhu
Bertha Barnwell Vielhauer Endowed Scholarship: Spencer Brown, Brandon Joyce, Jonathan Machado Bilbrout, Juan Quiroa, Eric Sanchez, Ciera Tucker, 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 Elliott Hollifield lecturing

• $10,800+tuition waivers for students in the M.A. in Mathematics Program

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

For the 2017–18 academic year, we funded sixteen full-time Ph.D. students and sixteen full-time M.A. students through Graduate Assistantships.

Math Emporium

TA Aaron Rapp lecturing

Funded Ph.D. Students		Funded M.A. Students	
Sarangan Balasubramaniam	Aaron Rapp	Jenny Beck	Matt Jester
Wei Chen	Amila Muthunayake	Indika Dewage	Emily Johnson
Charith Elson	James Rudzinski	Xinyu Feng	Neil Pritchard
Nalin Fonseka	Sandi Rudzinski	Nathan Fontes	Sandamalee Seneviratne
Elliot Hollifield	Joshua Safley	Monika Goel	Keri Spetzer
Austin Lawson	Byungjae Son	Victoria Hayes	Stephen Steward
Cole Love	Romesh Thanuja	Michael Leshowitz	David Suarez
Bin Luo	Qi Zhang	Mingyan Li	Debbie White

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)

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. The students in the program will be considered 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).

Program Coordinator:
Sat Gupta, Professor of Statistics, 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

Tracey Howell

The Mathematics Education Program is coordinated by the math education faculty, Dr. Tracey Howell, Senior Academic Professional in Mathematics Education and Program Coordinator for Secondary Licensure in Mathematics. She is responsible for teaching all courses that are specifically designated for undergraduate students seeking teaching licensure in mathematics, namely, 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).

Math Emporium Lab

In addition to the specific courses listed above, Dr. Howell also teaches 100-level mathematics courses (Precalculus I and II) in which undergraduate students are first introduced to the learning of mathematics at the college level. In particular, Dr. Howell works within the Emporium Model (WLL courses), bringing her expertise in student-centered pedagogy and technology-mediated learning to the Precalculus series. Students enrolled in WLL courses are required to attend a 1-hour class meeting every week and to spend a minimum of 3 hours per week in our Math Emporium Lab working with online learning assignments. The goal of the weekly class meeting is to expand the students' understanding of selected course topics through problem solving, group work, and other pedagogical methods. During the 3-hour Math Emporium Lab, the 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 with High School Licensure Concentration, 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 edTPA, 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 teachers, Dr. Howell advises all undergraduate students in the B.A. in Mathematics with High School Licensure Concentration, participates in the Collaborative for Teacher Preparation (a School of Education initiative that administers all the professional requirements of the teacher preparation programs at UNCG), serves on the CEP Leadership Council, and participates in STEP: Secondary Teacher Education Program. She writes and administers grants related to mathematics education, leads Department efforts to recruit and retain mathematics majors, presents professional development opportunities for teachers in local school districts, engages in scholarly research in undergraduate mathematics education, and makes presentations about this research at national research conferences.

Tracey Howell with math major students

In addition to these activities within the Department, Dr. Howell participates in state and regional conferences that have a focus on mathematics education such as the North Carolina Council of Teachers of Mathematics (NCCTM). She also serves as the Central Region Vice President for Colleges on the board of NCCTM. 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.

Beginning in Spring 2018, The University of North Carolina System has engaged with the Charles A. Dana Center to mobilize mathematics faculty in North Carolina to improve student success in mathematics courses. The goal is to establish effective mathematics pathways at scale that will dramatically increase student success, modernize entry-level mathematics programs, and improve alignment with K-12 mathematics. The UNC System Math Pathways Task Force includes two members of the UNCG Department of Mathematics and Statistics faculty, with one serving as a co-chair. The task force has been charged with the creation of formal recommendations on the implementation of mathematics pathways in North Carolina. This aligns with the University's strategic plans for increasing completion rates in a timely manner (5 years or less) as well as increasing completion rates in certain at-risk populations (low-income, rural), whose mathematics preparation or experience in college courses may not be sufficient to succeed in their gateway courses without additional support. The UNCG campus team includes five faculty members from the Department of Mathematics and Statistics as well as the Director of the College of Arts & Sciences Advising Center. This year, the Task Force is completing the initial phase of the project, creating the formal recommendations for the individual institutions.

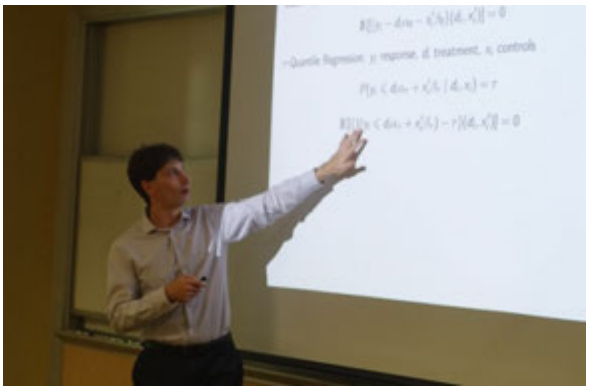
11. Lecture Series, Colloquia, Seminars, and Research Visitors

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.

Robert Calderbank, Duke University

Delaram Kahrobaei, City University of New York



Alexandre Belloni, Duke University

Patricia Hersh, NC State University

Helen Barton Lecture Series in Computational Mathematics

2017 - 2018

Sponsored by The Department of Mathematics and Statistics

Speakers for Fall 2017

Robert Calderbank (Duke University, Charles S. Sydnor Professor of Computer Science)
Data +
Friday, September 22, 2017 at 4:00 pm, Petty 150
Refreshments at 3:30 in Petty 116

Delaram Kahrobaei (City University of New York)
Computational/Algorithmic Problems in Geometric Group Theory and their Applications in Post-quantum Cryptography
Friday, October 20, 2017 at 4:00 pm, Petty 150
Refreshments at 3:30 in Petty 116

Alexandre Belloni (Duke University, Fuqua School of Business)
Inference with High-Dimensional Parameters of Interest and Many Controls
Friday, October 27, 2017 at 4:00 pm, Petty 150
Refreshments at 3:30 in Petty 116

Speakers for Spring 2018

Patricia Hersh (NC State University)
From poset topology to combinatorial representation theory
Friday, April 6, 2018 at 4:00 pm, Petty 213
Refreshments at 3:30 in Petty 116

Organizing Committee: Xiaoli Gao (Chair), Yu-Min Chung, Igor Erovenko, Clifford Smyth, and Yi Zhang

For abstracts and further information
see http://www.uncg.edu/mat/talks

11.2 Helen Barton Lecture Series in Mathematical Sciences

The Lecture Series in Mathematical Sciences at UNCG has been organized by the Department of Mathematics and Statistics since Spring 2012. The target audience is the same as in the Lecture Series in Computational Mathematics. This lecture series features very distinguished researchers presenting three lectures on a topic in the mathematical sciences. The organizer for the lecture series is Maya Chhetri. Our lecture series for Spring 2018 was held in February 2018.

Erik Van Vleck, University of Kansas

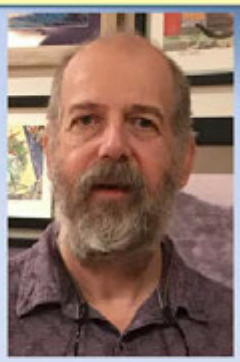
THE UNIVERSITY of NORTH CAROLINA
GREENSBORO
Department of Mathematics & Statistics

Helen Barton Lecture Series in Mathematical Sciences Spring 2018

Dr. Erik S. Van Vleck

Professor of Mathematics

University of Kansas



Erik S. Van Vleck is Professor of Mathematics at the University of Kansas. He received his PhD in Applied Mathematics from Georgia Institute of Technology in 1991, MSc at the University of Colorado-Boulder in 1987, and BS from the University of Kansas in 1985.

Dr. Van Vleck's research areas are in numerical analysis, differential equations and dynamical systems, and applications of mathematics to problems in science and engineering. His primary research interests are in computation of time dependent stability spectra and applications of these techniques, and analysis and computation of lattice differential equations with applications in materials, physiology, and biology. In recent years, his interests have expanded to include applications in climate science including modeling and analysis of cloud dynamics, competition models for forests and grasslands, and data assimilation techniques and their application.

He has published over 75 articles on topics ranging from numerical analysis and analysis of differential equations to applications of mathematics to materials, biology, and climate science.

Erik is an active member of the Mathematics and Climate Research Network (MCRN) and is active in developing distributed learning environments for undergraduate and graduate mathematics students in the mathematics of climate and sustainability. His pedagogical interests include active learning and project oriented techniques for the teaching of mathematics. He has held visiting positions at NIST, IMA, UC-Berkeley, Sussex, and Auckland. During Spring 2018, Dr. Van Vleck is a visiting research fellow at SAMSI for the Program on Mathematical and Statistical Methods for Climate and the Earth System.

Time Dependent Stability: Theory, Computation, and Applications

Dynamical systems of many different types are employed in science and engineering as models of physical and biological phenomena. These dynamical systems include linear and nonlinear mappings, ordinary and partial differential equations, delay equations and other non-local equations. Mathematically, the first step in understanding the behavior of solutions is to determine the existence and uniqueness of solutions. This is often followed by analysis of the stability of solutions, typically equilibrium or steady state solutions. Stability of solutions determine whether nearby solutions are attracted or repelled. If they repel nearby solutions, then it is of interest to understand the types of perturbations associated with such repelling behavior. Spectral analysis of linear operators or matrices provides insight into the stability of time independent solutions. For time varying solutions such as periodic orbits, e.g., via Floquet theory, and for more general time dependent solutions stability analysis depends on understanding time dependent linear operators or matrix functions. Lyapunov exponents as first developed in the thesis of A.M. Lyapunov are among time dependent stability theories that provide information on the stability of time dependent solutions as well as other information (existence of chaotic behavior, dimension of attractors, entropy, etc.). In general, stability spectra for time dependent solutions play the role that the real parts of eigenvalues play for linearization about time independent solutions.

In these lectures, we discuss the theoretical development of time dependent stability, uses of stability spectral, computational techniques for their approximation, and applications of these techniques. For time dependent linear differential equations, stability spectra such as Lyapunov exponents and Sacker-Sell spectrum are extracted via time dependent change of variables based upon continuous matrix factorizations (QR and SVD) of fundamental matrix solutions. We derive these numerical techniques for the approximation of stability spectra, justify the usa of these techniques, and develop a quantifiable error analysis on the approximation both in terms of rates of growth and decay and the associated time dependent subspaces. We illustrate the use computational stability spectra with applications in climate science, the detection of stiffness in the numerical solution of differential equations, and time dependent splitting techniques in data assimilation.

Lecture 1: Motivation and Theory

Monday, February 12, 2018

Reception: Petty 116, 3:30–4:00 PM

Lecture: Petty 219, 4:00 PM

Lecture 2: Computation and Numerical Analysis

Wednesday, February 14, 2018

Reception: Petty 116, 3:30–4:00 PM

Lecture: Petty 219, 4:00 PM

Lecture 3: Applications

Friday, February 16, 2018

Reception: Petty 116, 3:30–4:00 PM

Lecture: Petty 219, 4:00 PM

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

11.3 Helen Barton Lecture Series Speakers

Robert Calderbank	Duke University	9/22/2017	Data +
Delaram Kahrobaei	City University of New York	10/20/2017	Computational/Algorithmic Problems in Geometric Group Theory and their applications in Post-quantum Cryptography
Alexandre Belloni	Duke University	10/27/2017	Inference with High-Dimensional Controls and Parameters of Interest
Erik S. Van Vleck	University of Kansas	2/12-2/16/2018	Time Dependent Stability: Theory, Computation, and Applications
Patricia Hersh	NC State University	4/6/2018	From Poset Topology to Combinatorial Representation Theory

11.4 Colloquia Speakers

Paul Bendich	Duke University	10/13/2017	Doing Machine-Learning and Statistics with Topological and Geometric Features: three examples
Whitney Huang	SAMSI	11/10/2017	Modeling Precipitation Extremes Using Log-Histospline
Sat Gupta	UNCG	11/29/2017	Model Efficiency vs. Respondent Privacy in Quantitative Randomized Response Models
Jianping Sun	GeneCentric, Inc.	2/15/2018	A Method for Analyzing Multiple Continuous Traits in Rare Genetic Variant Association Studies
Francis Motta	Duke University	4/4/2018	Topological Data Analysis: Applications and Directions
Ezra Miller	Duke University	4/13/2018	Algebra for Geometric Data

11.5 External Seminar Speakers

Alfonso Castro	Harvey Mudd College	8/21/2017	The Laplace-Beltrami Operator on Manifolds of Revolution
Quefeng Li	University of North Carolina at Chapel Hill	9/13/2017	Robust Analysis of High-Dimensional Data
Yishi Wang	University of North Carolina Wilmington	10/6/2017	Two Sample Order Free Trend Inference with an Application in Plant Physiology
John Gemmer	Wake Forest University	10/16/2017	Least Action Methods and Noise Induced Transitions in Periodically Forced Systems
Pavel Drabek	University of West Bohemia	10/23/2017	Convergence to Higher-Energy Stationary Solutions of a Bistable Equation with Nonsmooth Reaction Term
Joshua Hallam	Wake Forest University	10/25/2017	Whitney Duals of Graded Partially Ordered Sets
Marcello Lucia	City University of New York	11/20/2017	Non-Degeneracy for Some Nonlinear Problem Arising in Chern-Simons Theory
Myung Hwan Seo	Seoul National University	1/17/2018	Factor-Driven Two-Regime Regression
Troy Schaudt	Wolfram Research, Inc.	2/21/2018	Mathematica 11 in Education and Research
Elmas Irmak	Bowling Green State University	2/26/2018	Abstract Simplicial Complexes and Mapping Class Groups of Surfaces
Xingjie Li	University of North Carolina Charlotte	4/16/2018	Consistent Coupling of Local and Nonlocal Models
Mark Broom	City University, London, UK	4/27/2018	Modelling Evolution in Structured Populations Using Multiplayer Games

11.6 UNCG Seminar Speakers

Talia Fernós	UNCG	08/29/2017	The Mathematics of Gerrymandering
Yu-Min Chung	UNCG	11/13/2017	Inertial Manifolds Computations
Brett Tangedal	UNCG	11/30/2017	L-Functions and Their Arithmetic Properties

Maurcio Rivas	UCNG	2/7/2018	Using Topology and Symplectic Geometry in Mathematical Physics
Nathan Fontes	UNCG	2/22/2018	Explicit Computations of Higher Weight Modular Forms
Sat Gupta	UNCG	3/1/2018	Practicing Statistics
Debbie White	UNCG	3/26/2018	Congruent Numbers and Elliptic Curves
Austin Lawson	UNCG	4/25/2018	Computational Topology and Its Application to Image Classifications
Joshua Safley	UNCG	4/25/2018	Computational Topology and Its Application to Image Classifications
Keri Spetzer	UNCG	4/25/2018	Positive Solutions for a Class of Nonlinear Boundary Value Problems
Sandamalee Seneviratne	UNCG	4/25/2018	Generalized-Monotone Finite Difference Methods with Third-Order Local Truncation Error for Stationary Hamilton-Jacobi Equations
Indika Gunawardana	UNCG	4/25/2018	A Finite Difference Method and Solver for the Elliptic Monge-Ampere Equation in Two Dimensions

11.7 Graduate Professional Development Speakers

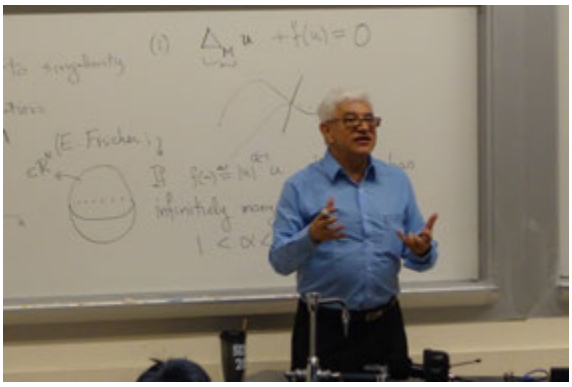
Julie Barnes	Western Carolina University	11/17/2017	Preparing for a career as a mathematician in a department that only awards bachelor's degrees
Sat Gupta	UNCG	2/23/2018	Publishing Journal Articles – An Editor’s Perspective

11.8 Research Visitors

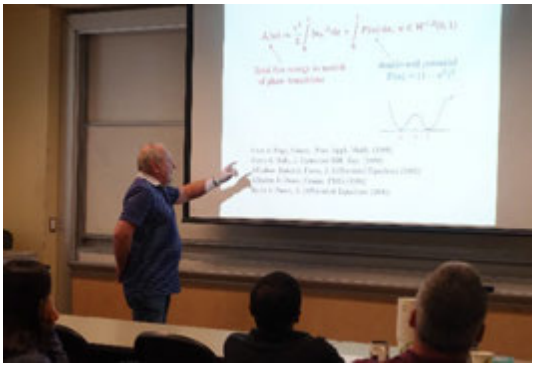
Research Visitor	Institution	Dates Visited	Host
Alfonso Castro	Harvey Mudd College	8/18-8/23/2017	Ratnasingham Shivaji

Pavel Drabek	University of West Bohemia, Czech Republic	10/21-10/31/2017	Ratnasingham Shivaji and Maya Chhetri
Marcello Lucia	City University of New York	11/16-11/21/2017	Ratnasingham Shivaji
Petr Girg	University of West Bohemia, Czech Republic	12/2-12/19/2017	Maya Chhetri
Quinn Morris	Swarthmore College	3/10-3/18/2018	Ratnasingham Shivaji
Byungjae Son	Wayne State University	3/10-3/18/2018	Ratnasingham Shivaji
Mark Broom	City University, London, UK	4/4/2018-5/4/2018	Igor Erovenko
Johann Bauer	City University, London, UK	4/4/2018-6/4/2018	Igor Erovenko
Tamás Varga	City University, London, UK	4/4/2018-6/4/2018	Igor Erovenko
Patricia Hersh	NC State University	4/6/2018	Cliff Smyth

Paul Bendich, Duke University



Alfonso Castro, Harvey Mudd College



Pavel Drabek, University of West Bohemia, Czech Republic

Mark Broom, City University, London

11.9 Carolina Topology Seminar

Jerry Vaughan, Organizer

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.

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 a Summer Topology Conference.

12. Service Profile

12.1 Math Help Center

Tracey Howell, Director of 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, 395 and STA 271, 290, 301, 352. This is a free and walk-in service open daily. 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 Fall 2017, weekly review sessions were held for MAT 112, 115, 120, 150, 151, and STA 108. In Spring 2018, weekly review sessions were held for MAT 112, 115, 120, 150, 151, 191, and STA 108.

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 2017

- 11 Graduate Teaching Assistants tutored in the Math Help Center and some of them conducted review sessions before mid-term exams.
- 1816 student visits were recorded in the MHC.
- 12 undergraduate students helped instructors with grading in their classes and with the Math Emporium lab.

Spring 2018

- 13 GTAs tutored in the Math Help Center and some of them conducted either weekly review sessions or before mid-term exams.
- 1592 student visits were recorded in the MHC.
- 15 undergraduate students helped instructors with grading in their classes and with the Math Emporium lab.

12.2 Math Emporium Lab

Tracey Howell, Director of 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 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

Scott Richter, Director of Statistical Consulting Center

2017-18 Highlights

- Faculty and student consultants assisted researchers from many disciplines across campus, including: Biology, Chemistry and Biochemistry, Communication Sciences and Disorders, Genetic Counseling, Human Development and Family Studies, Information Systems, Kinesiology, Nursing, Nutrition, Psychology, and Public Health Education.

- Faculty and student consultants assisted researchers affiliated with several off-campus entities, including Moses Cone Health System, Volvo, Randolph County Emergency Medical Services, and High Point University Pharmacy School.
- 12 students enrolled in STA 667 and worked with faculty consultants to complete graduate research projects.
- Several manuscripts appeared in 2017-18 stemming from SCC collaborations.

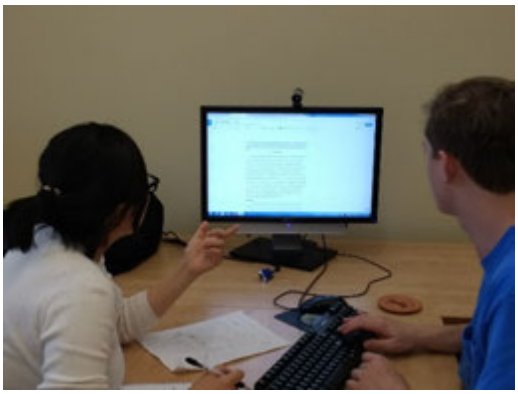
- Faculty consultants were involved as co-investigators in interdisciplinary grant submissions to the National Institutes of Health and US Department of Education Institute of Education Sciences (IES).

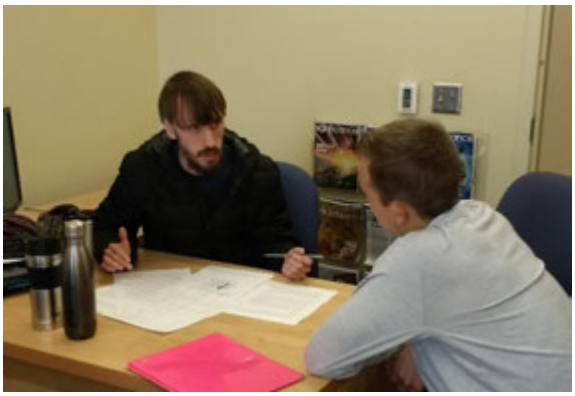
- The Quantitative Methodology Series (QMS), offered 6 workshops, including 3 new workshops presented in the 4th Annual Summer Workshop Series.
- The SCC organized a day for consultants from the SCC and the Schools of Education and HHS to provide assistance to students in the online Kinesiology PhD program.

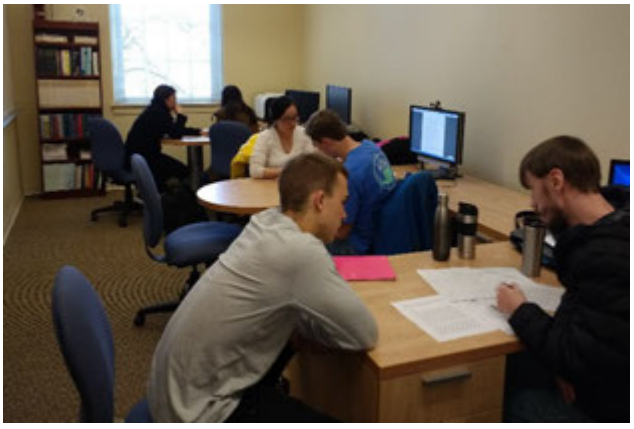
- The SCC began a collaboration with Guilford County Schools to provide statistical consulting on research projects for students completing the Advanced Placement Capstone program at Western Guilford High School.

Goals for 2018-19

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.







Graduate students assisting in the Statistical Consulting Center

4th Annual Summer Series on Quantitative Methodology: May 7 – 9, 2018

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

Monday, May 7, 2018
10:00 AM - 12:00 PM

Assessing Sensitive Topics in Surveys--Morning session
Researchers in social sciences often have to deal with sensitive topics. Randomized response techniques (RRT) can be used to reduce non-response and inaccurate responses.

We will cover the basic ideas of RRT methods for both binary and quantitative responses, and also discuss how RRT methods can be used to increase privacy.

Monday, May 7
1:30 PM - 3:30 PM

Assessing Sensitive Topics in Surveys--Afternoon session
We will discuss practical implementation of RRT methods, including how to execute such techniques using Qualtrics. Attendees will be able to gain hands-on experience with designing online surveys using RRT.

Prerequisites: Some experience using Qualtrics is helpful, but not required. A device capable of accessing Qualtrics will needed to experiment with implementing RRT methods.

Instructors: Dr. Sat Gupta is Professor in the Department of Mathematics and Statistics. He is one of the foremost experts in the area of randomized response techniques, having done extensive research in this area. Dr. Gupta has had a distinguished career, which includes recently being named a Fellow of the American Statistical Association. More information can be found at https://www.uncg.edu/mat/people/people.php?username=sngupta.

Matt Jester is a graduate student in the Department of Mathematics and Statistics. His Master's Project is concerned with implementation of RRT techniques, especially with online surveys using Qualtrics. More information can be found at https://www.uncg.edu/mat/people/people.php?username=mwjester

Tuesday, May 8
9:00 AM - 12:30 PM

Introduction to Data Analysis Using R
Hands-on introduction to using the R language for statistical analysis for those with little or no experience.

Topics will include
- R interfaces
- Installing packages
- Introduction to R syntax
- Reading data
- Data manipulation
- Creating summary statistics
- Simple plots
- Basic statistical analysis

Prerequisites: No previous experience using R is required. Participants must have a laptop with wireless internet access, able to install and run the R program.

Instructor: Dr. Scott Richter is Professor in the Department of Mathematics and Statistics and Director of the UNCG Statistical Consulting Center. He teaches undergraduate and graduate level courses in statistical methodology, and consults extensively with researchers across campus. More information can be found at http://www.uncg.edu/mat/people/people.php?username=sjricht2.

Tuesday, May 8
1:30 PM - 4:00 PM

Customizing Graphs Using R
We will explore customizing plots in R, first using the default installation functions, and then using the ggplot2 package. R functions will be used to customize several features of plots to conform to the requirements of a journal.

Prerequisites: Introduction to R for Data Analysis workshop, or equivalent previous experience using R. Participants must have a laptop with wireless internet access, able to install and run the R program.

Instructor: Dr. Scott Richter

Wednesday, May 9
1:30 PM – 5:00 PM

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

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

Instructor: Dr. Scott Richter

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

12.4 State Math Contest

Tracey Howell, Organizer

Some of the 2018 State Math Contest winners

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 3, 2018, the Department of Mathematics and Statistics hosted the Central Region State Mathematics Contest Finals. Fifty-seven students from middle schools and high schools participated in one of three levels. Eighteen students competed in Level 1, 18 students competed in Level 2, and 21 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 2018 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. Sat Gupta was the winner of the ARON Journal Writer's Contest Award in 2017 for a paper he co-authored with Cone Researchers. MA graduate Monika Goel presented a Cone Health study at the annual ARON Conference in Boston in April 2017. Master's student Ping Wang won the Best Poster Award at the 2017 Annual Cone Health/AHEC Research Symposium held at the Downtown Marriott on November 17, 2017.

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

MA graduate Monika Goel presenting a poster on this research at a nursing conference

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.

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.

14. Conferences

14.1 UNCG summer School in Computational Number Theory

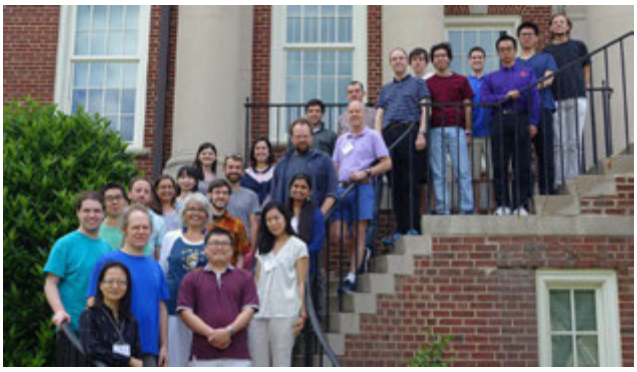
UNCG Summer School in Computational Number Theory 2017

From May 22 to May 26, 2017, the University of North Carolina at Greensboro hosted a summer school titled Modular Forms. There were 32 participants.

The summer school in computational number theory fills a gap in the education of many graduate students. Most graduate courses in number theory take a mainly theoretic approach with very little emphasis on the computational aspects of the subject. The goal of the UNCG Summer School in Computational Number Theory is to complement this with a constructive- algorithmic approach. Many of the algorithms used for number theoretic computations are non-trivial, which makes it difficult to cover them in a standard course. The subjects covered in 2017 included: classical modular forms and modular symbols, group cohomology and Galois representations, and lattice enumeration and isometry testing techniques to compute with spaces of modular forms for compact forms of classical groups.

The main lectures in the summer school were given by

- Matt Greenberg (University of Calgary)
- Paul Gunnells (UMass Amherst)
- Mark McConnell (Princeton University)
- David Roe (University of Pittsburgh)



Participants of 2017 Summer School in Computational Number Theory

The talks early in the week introduced the students to the subject. Talks later in the week covered related areas of current research and unsolved problems. The problems given to the students included exercises of theoretical nature as well as programming problems and computer experiments. All problems were aimed at increasing the students' understanding of the material by working with it.

This project is supported by UNCG, the NSA (H98230-16-1-0027) and the NSF (DMS- 1602025).
Additional information, including links, slides, and notes from some of the lectures, and problem sets can be found on the website:
www.uncg.edu/math/numbertheory/summerschool/2017.html

UNCG Summer School in Computational Number Theory 2018

From May 28 to June 1, 2018, the University of North Carolina at Greensboro will host the UNCG Summer School in Computational Number Theory: **Algorithms for Extensions of Large Degree**

Algorithms for extensions of global and local fields are the backbone of computational number theory. Improvements in computing power have made it feasible to conduct computations in larger and larger degree. As the complexity of algorithms for field extensions depends on the degree of the extensions, this has increased the interest in asymptotically fast algorithms. Among others we will consider algorithms for integral bases computation and ideal arithmetic.

Speakers

- Peter Bruin (Universiteit Leiden)
- Claus Fieker (Technische Universität Kaiserslautern)
- Jordi Guàrdia (Universitat Politècnica de Catalunya)

The summer school was attended by 15 students (11 external, 4 UNCG) and 10 faculty (4 speakers, 5 UNCG, 1 external). The summer school in computational number theory is supported by UNCG and the NSF (DMS-1602025).

Participants of 2018 Summer School in Computational Number Theory

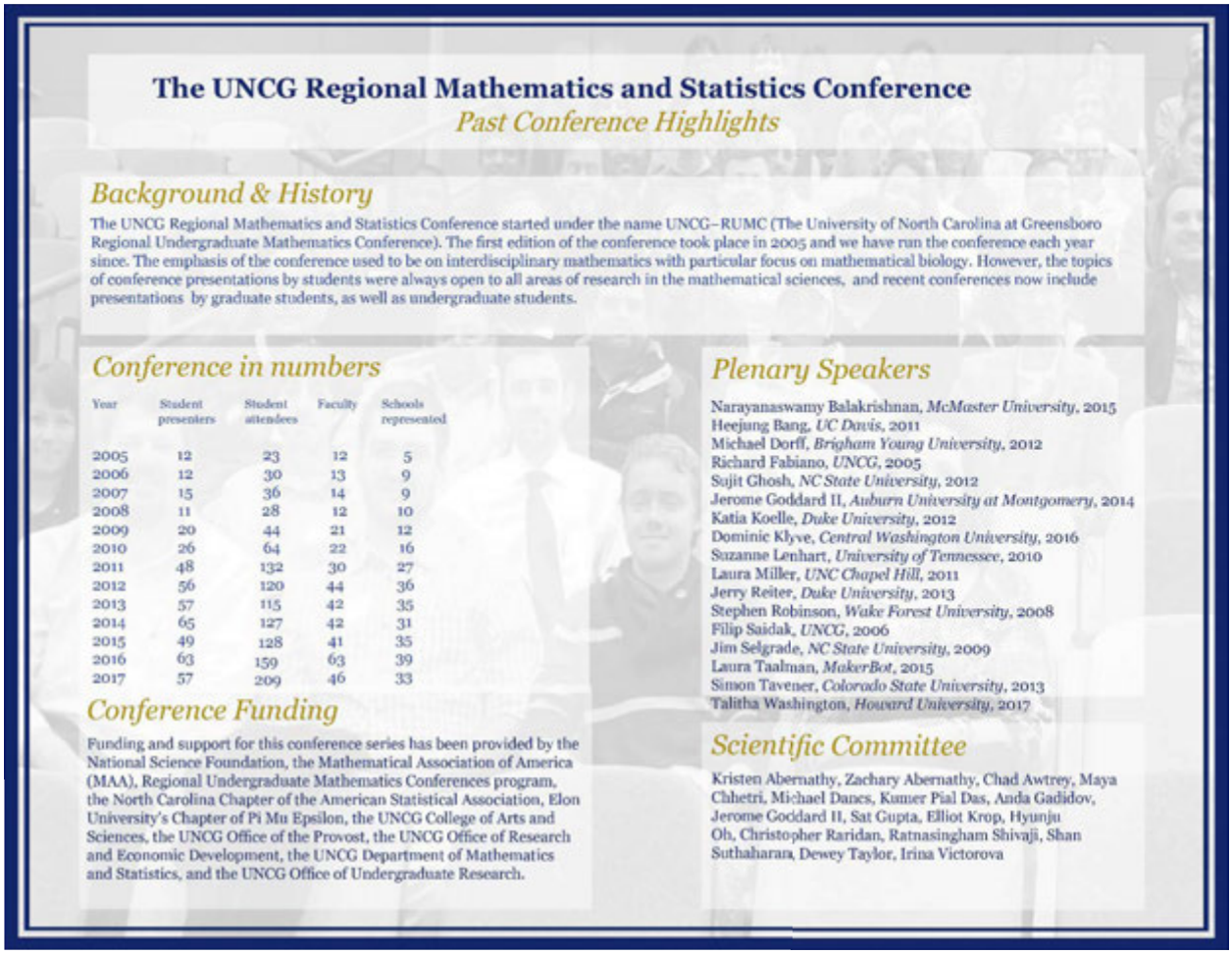
More information can be found at
http://www.uncg.edu/mat/numbertheory/2018.html.

14.2 UNCG Regional Mathematics and Statistics Conference (RMSC)

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

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



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
2017	57	209	46	33

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.

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
Talitha Washington, *Howard University*, 2017

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

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 13th Annual UNCG-RMSC 2017

Jan Rychtář, Conference Chair

UNCG-RMSC is an annual one-day conference promoting student research in mathematics, statistics, and their applications in various fields. The 2017 conference was held on Saturday, November 4, 2017. Jan Rychtář served as conference chair, Igor Erovenko was the main local organizer, Chad Awtrey from Elon University, Hyunju Oh from Bennett College, and Dewey Taylor from VCU were co-organizers and, Filip Saidak, and Jonathan Rowell from UNCG were local organizers. The conference featured one plenary presentation by an invited speaker.

Talitha Washington presenting at the 2017 UNCG-RMSC

The plenary lecture was delivered by **Dr. Talitha Washington**, NSF (and also Associate Professor of Howard University). As part of the conference, Drs. Kathryn Leonard and Chad Awtrey conducted the faculty development workshop on mentoring undergraduate research.

The conference also featured panels on:

- **Careers in mathematics**. The panelists were Luis Galiano (Syngenta Crop Protection, Inc.), Lee Hunt (Greensboro Police Department), Hristo Pavlov (Lincoln Financial Group), Scott Richter (UNCG), Chris Vanlangenberg (Apex Analytix)
- **Preparation for graduate school**. The panelists were Dr. Maya Chhetri (UNCG), Dr. Wei Feng (UNCW), Dr. Michael Schroeder (Marshall University)
- **Benefits of undergraduate research**. The panelists were Ivanti Galloway (Wake Forest University), Nicholas Hadgis (Elon University), Morgan Norge (Virginia Commonwealth University), Neil Pritchard (UNCG), Jay Saini (NCSU). All panelists are students that were involved in the undergraduate research in the past.

The conference was attended by a record number of 255 participants which included 209 students (46 middle and high school students, 132 undergraduate students, and 31 graduate students); and 46 faculty and industry representatives.

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 65% (135 out of 209) of the student participants were females. Almost 20%

(41 out of 209) of student participants were African American and almost 5% (10 out of 209) were Hispanic.

Participants at the plenary talk at RMSC 2017

34 different universities were represented at the conference, including universities from NC, SC, VA but also from Florida, New Hampshire, Maryland, California, Georgia, and Tennessee. The institutions with largest attendance were Winthrop University (28), UNCW (25), UNCG (25), Bennett College (14), Elon University (18), Lenoir Rhyne University (11), Marshal University (11), Salem College (10).

The students delivered a total of 58 presentations (29 talks by undergraduates, 12 posters by undergraduates, 15 talks by graduate students and 2 posters by graduate students). The following 9 students won the award for the **outstanding student presentation or poster**:

Graduate student category

- C. Matthew Farmer (Wake Forest University)
- Ivanti Galloway (Wake Forest University)
- Austin Lawson (UNC Greensboro)

Undergraduate student category

- Morgan Ferguson (Elon University)
- Katherine Kempfert (University of Florida)
- Dylan King (Wake Forest University

Poster category

- Alisha Beaudoin and Evan Shelby (UNC Wilmington)
- Jonathan Fabish (NC A&T)
- Natalie Kratts (Lenoir-Rhyne University)

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

Funding from the National Science Foundation provided travel support for 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.

15. Student Clubs and Organizations

15.1 π-STEM and the Student Chapter of the Association for Women in Math

Talia Fernós, Faculty Advisor

π-STEM is a graduate student group founded in collaboration between the Math and Stats department and the Chemistry department. It aims to build a community of STEM graduate students from underrepresented groups, in order to move toward proportional representations at all levels and areas of STEM. This is the 6th year of the AWM student chapter at UNCG, which has now been absorbed into the π-STEM group. This year, activities for both groups included several "meet and greets" where students met with the faculty advisor, Talia Fernós, to discuss a variety of issues such as advancement in STEM careers, and issues that affect this such as the notorious "Imposter Syndrome". Talia also gave a talk about gerrymandering as a joint AWM student chapter meeting and a Math Club meeting in the fall of 2017.

AWM meeting

π-STEM booth at Science Everywhere 2018

15.2 Math Club

Tom Lewis, Faculty Advisor

The 2017-18 academic year was the seventh year of the UNCG Math Club, whose goal is to create a community for math enthusiasts. The math club met regularly throughout the academic year, meeting on Tuesday evenings during Fall 2017 and Thursday evenings during Spring 2018. Meetings included presentations by UNCG faculty and students with Talia Fernós presenting on "The Mathematics of Gerrymandering" and Sat Gupta presenting on "Practicing Statistics". Meeting agendas also included a recruitment event with Lincoln Financial, learning about Pi Mu Epsilon and honors societies, puzzles, community building, watching TED talks, and community outreach. The club organized a table for Pi day (3/14) to celebrate with math/pie-themed games and prizes and hosted a table "Tangrams Puzzles for All" during the UNCG Science Everywhere (4/25) event. The math club also designed a t-shirt that the department purchased for the members of the club.

Pi Day contest on March 14, 2018

Talia Fernós presenting for a joint presentation for AWM and Math Club

Sat Gupta with the Math Club following a seminar

15.3 American Mathematical Society (AMS) Student Chapter

Yu-Min Chung, Faculty Advisor

The AMS Graduate Student Chapter at UNCG was founded at the beginning of the Fall 2019 semester. The first meeting was held on October 3rd, 2019. We are excited to be working with the AMS and UNCG Math/Stats department to promote the mathematics community.

AMS student chapter meeting

15.4 Pi Mu Epsilon

Rich Fabiano, Faculty Advisor

Each year the faculty carefully screen the academic records of mathematics majors and other students studying advanced mathematics. Those students who satisfy the rigorous induction requirements and receive the approval of the faculty are extended an invitation to join Pi Mu Epsilon. This year our North Carolina Pi Mu Epsilon chapter inducted four new members: Sara Feggeler, Bradley Froelich, Jonathan Machado, and Xuechen (Philip) Zhu.

We held an induction banquet to honor these students on May 2, 2018, at the Saigon Vietnamese Restaurant. The banquet was attended by new inductees and their guests, and several faculty members.

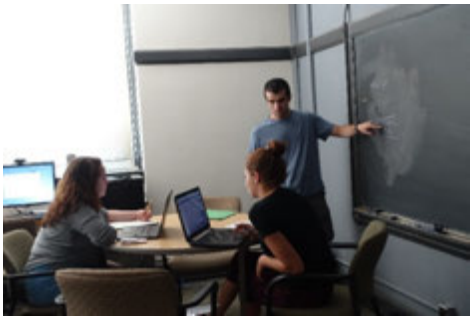
Faculty and students at the Pi Mu Epsilon Dinner

Inductees (from left to right) Jonathan Machado, Sara Feggeler, Bradley Froelich

16. Departmental Spaces

Jerry and Theresa Vaughan Conference Room in Petty 146.

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

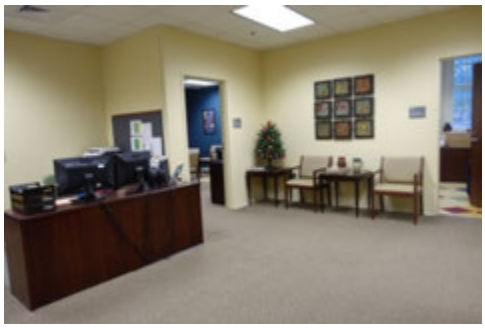


The **Math Help Center** is located in Curry 210.

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

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

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



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

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