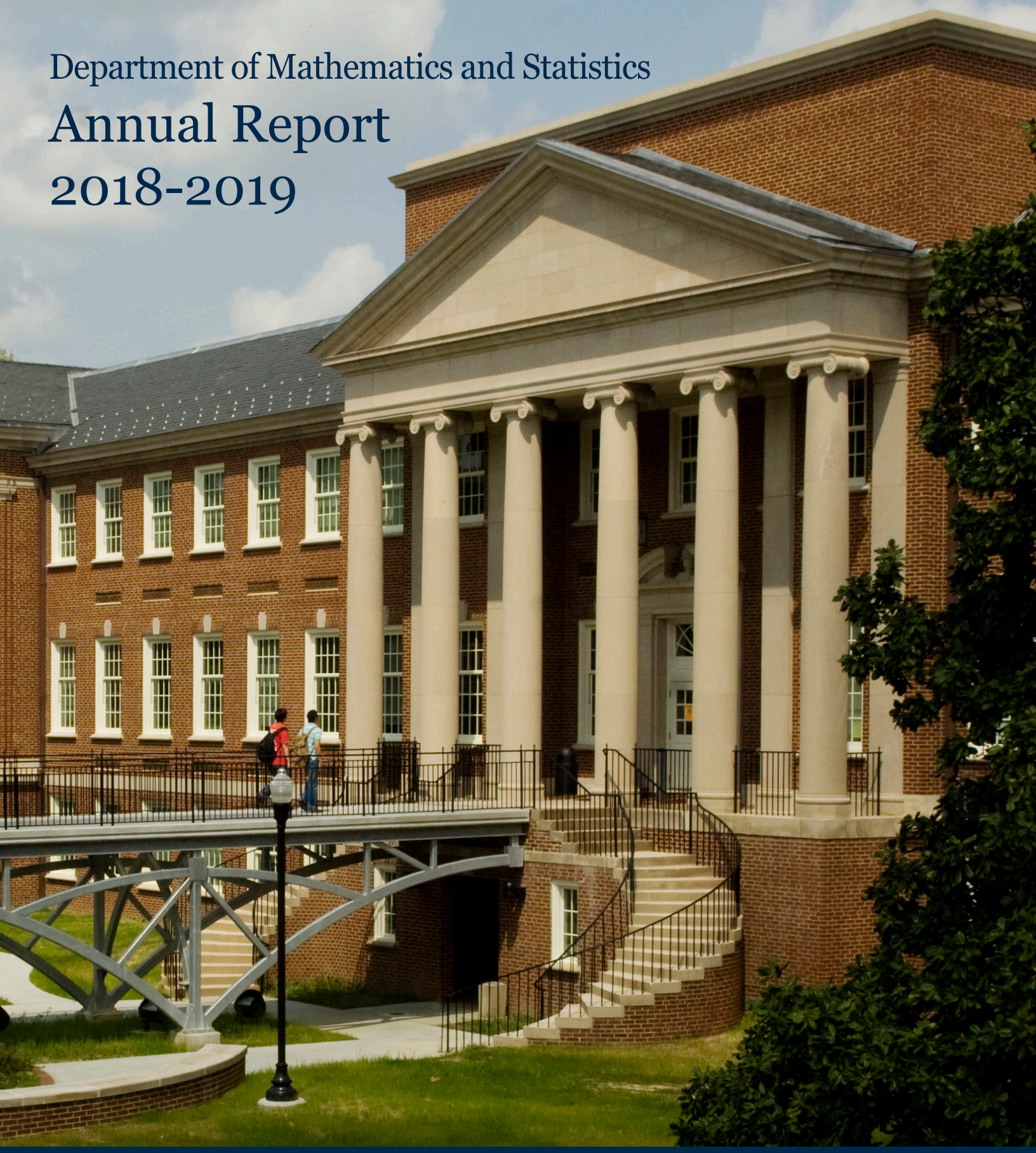
Department of Mathematics and Statistics

Annual Report 2018-2019



UNC GREENSBORO
Department *of*
Mathematics & Statistics

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1. Highlights

Sat Gupta, Head

1.1 Message from the Department Head

Dear Colleagues,

As I begin my tenure as Department Head, replacing Dr. Ratnasingham Shivaji who transitions to a full time faculty role after serving as Head with distinction for the previous 8 years, I would like to invite you to browse this annual report for the Department for the year 2018-19.

Many exciting things have happened over the past year. Several new faculty members were hired to begin their tenure effective August 1. The most prestigious addition is Dr. John Stufken, a Fellow of the American Statistical Association and a Fellow of the Institute of Mathematical Statistics. He served in 2011 as the Rothschild Distinguished Visiting Fellow at the Isaac Newton Institute for Mathematical Sciences, Cambridge, UK. Before moving to UNC Greensboro as the Bank of America Excellence Professor and the Founding Director of the UNCG Informatics and Analytics program, Dr. Stufken was the Charles Wexler Professor of Statistics in the School of Mathematical and Statistical Sciences at Arizona State University, where he also served as Coordinator for Statistics. Before that, from 2003-2014, he was Head of the Department of Statistics at the University of Georgia. He also worked in the Division of Mathematical Sciences at the National Science Foundation (2000-2003) and in the Department of Statistics at Iowa State University (1988-2000). His research has consistently been funded by the National Science Foundation. His papers have continuously appeared in top statistics journals, such as the *Annals of Statistics*, *Journal of the American Statistical Association*, and others. Dr. Stufken has been associate editor for multiple journals and currently serves in this role for the *Journal of the American Statistical Association* (the flagship journal of the ASA), *Statistica Sinica*, and the *Journal of Statistical Theory and Practice* (a Springer journal housed in our Department). He has also been the main editor for two journals, three years for each, namely the *Journal of Statistical Planning and Inference* and *The American Statistician* (which is a popular ASA journal).

Dr. Michael Hull was hired as a tenure track assistant professor of mathematics effective August 1. Before coming to UNCG, Michael was a Post Doc at University of Florida. He received a Ph.D. degree from Vanderbilt University in 2013. We also hired two new Visiting Assistant Professors, Donald Robertson (Ph.D. in Mathematics, Ohio State University, 2015) and Thomas McConville (Ph.D. in Mathematics, University of Minnesota, 2015). Among other exciting faculty news, Dr. Ratnasingham Shivaji became a Fellow of the American Mathematical Society. Also, Dr Jonathan

Rowell and Dr. Thomas Lewis were conferred permanent tenure with promotion to Associate Professor.

The Department continued the tradition of being recognized for teaching excellence with Dr. Haimeng Zhang winning the College of Arts and Sciences Senior Teaching Excellence Award and Dr. Tracey Howell winning the Teaching Excellence Award in the non-tenure track category. I may point out that in 2017, I won the Senior Teaching Excellence award and Dr. Thomas Lewis won the Junior Teaching Excellence award. Dr. Paul Duvall and Dr. Jan Rychtar are among the previous winners of the College teaching excellence awards.

The Department continued to produce high quality research with 62 papers by the faculty published or accepted for publication in 2018. The faculty made 74 research presentations, including 18 at international locations. The Department received new external funding from several prestigious funding agencies like the National Science Foundation, Institute of Mathematics and its Applications, and the American Statistical Association. We also held continuing external grants from the National Science Foundation, National Security Agency, and the Simons Foundation.

The faculty also held several prestigious external grants from agencies like the National Science Foundation, American Statistical Association, National Security Agency, and the Simons Foundation.

The graduate programs continued to get stronger with 8 new Ph.D. students and 5 new M.A. students joining the Department. We graduated ten (10) M.A. students and one Ph.D. student. Our graduate students published three journal articles and submitted seven more journal articles for publication. Additionally, our students made 11 research presentations in 2018-19.

The Department hosted two major conferences in 2018 – The UNCG Regional Mathematics and Statistics Conference (RMSC), and the biennial International Conference on Advances in Interdisciplinary Statistics and Combinatorics (AISC). We also hosted REU programs in Mathematical Biology and in Statistics, and the Summer School in Computational Number Theory. Our Colloquium series continued to get stronger featuring many nationally and internationally recognized distinguished speakers.

The Department continued to play a leadership role on campus in terms of undergraduate research by hosting two National Science Foundation funded REU programs in Mathematical Biology and Statistics. The 2019 Summer Mathematical Biology REU program included six (6) undergraduate students selected from over 175 applicants and involved students from the University of Illinois at Chicago, University of Illinois at Urbana-Champaign, Mount Holyoke

College, Elizabeth City State University, University of New Mexico, and University of Pudget Sound. The 2018 Summer Statistics REU program included four (4) nationally recruited students from over 55 applications. The selected students came from Purdue University, Winona State University, University of Wyoming, and Eastern Oregon University.

The major journals housed in our Department continued to flourish. The *Journal of Statistical Theory and Practice* (a Springer publication) published 45 journal articles covering 911 pages in 2018. *Topology and its Applications (*an Elsevier publication) published 17 volumes in 2018.

In 2018, the Department helped the UNCG Graduate School in a big way to launch an M.S. program in Informatics and Analytics (MSIA). I myself served as the Interim Director of the program and led the search that resulted in the hiring of John Stufken as the Founding Director of the program. The statistics faculty developed several core courses and a concentration in Advanced Data Analytics for MSIA. We look forward to partnering with the MSIA program and helping it grow.

Beginning in Spring 2018, the Department became actively engaged in the Math Pathways, a program where the University of North Carolina System partnered with the Charles A. Dana Center to improve the offering of lower level mathematics and statistics courses. One of the primary goals of the program is to establish effective pathways for the success of STEM majors.

As you browse this annual report you will find many more interesting pieces of information. With support from the administration, faculty, students, and our alumni donors, we expect the Department to maintain its robust growth trajectory.

Sat Gupta
Fellow of the American Statistical Association &
Head, Department of Mathematics and Statistics

1.2 Support for the Department

Mrs. Judy Adair	Mrs. Martha Gwyn	Mrs. Christine Posey
Mr. Matthew Adams	Mrs. Barbara Hagaman	Mrs. Laura Peake Prill
Ms. Janet Agnew	Ms. Becky Halsey	Mrs. Ann Speckman Przygocki
Ms. Peggy Aldridge	Mrs. Kathy Hamilton	Ms. Lisa Randall
Ms. Joan Allen	Ms. Mishele Hare	Ms. Denise Rangel
Ms. Joan Andersen	Mr. Bill and Mrs. Doris Hawthorne	Mrs. Jean Roosa
Mrs. Mary Jo Austell	Miss Victoria Hayes	Mr. Nathan P. Ross
Ms. Linda Bennetts	Ms. Janice Hite	Mrs. Grayson and Mr. Allen Sallez
Mrs. Maria Bernot	Mr. William and Mrs. Dorothy Howell	Mrs. Martha Schall
Ms. Lillian Boney	Mrs. Frankie Hubbard	Mrs. Susan Blanton Senn
Mrs. Marilou Bradley	Mrs. Roxanne Hunt	Mr. Pralad Shah
Mr. William Bradmon	Mrs. Mary Jackson	Mr. Jimmy and Mrs. Anelia Shelton
Dr. Jeremy and Ms. Lou Bray	Mr. Matt Jester	Mrs. Teresa Sink
Mrs. Shirley Brewer	Mr. John and Mrs. Gail Johnson	Mrs. Kim Smith and Mr. David Smith
Mr. Mervin Brown	Ms. Amy Kemp	Mr. Joseph Splawn
Ms. Wendy Louise Bullis	Mrs. Julie Lambert	Dr. Thomas Stafford, Jr. and Mrs. Judy Stafford
Mr. Michael and Mrs. Doris Burris	Mrs. Vicky Langley	Mrs. Brownie Stancil
Miss Christine Bottini	Mrs. Sue and Mr. Luther Lawson	Mrs. Carolina Stauers
Mrs. Eloise Bryan	Mr. Zach Leach	Ms. Penny Stelljes
Mrs. LaRue Burbank	Mrs. Jane and Mr. John Lomax	Mr. William and Mrs. Becky Tallon
Mr. Karl and Mrs. Judy Busick	Mrs. Phyllis Lupton	Ms. Nancy Taylor
Dr. Lisa Carnell	Mr. Tommy Maness	Mrs. Susanne Thatcher
Mr. Jason Cogley	Mr. Franco Mandina	Mr. Walter and Mrs. Krista Thomason
Ms. Kristin Cudequest	Mr. Benjamin Manifold	Mr. Danny Thompson
Mrs. Katherine Bland Davis	Mr. William and Mrs. Ashley McCarthy	Ms. Gloria Thornton
Mrs. Elaine Davidson	Mr. Lance McCluney	Mrs. Sharon and Mr. Howard Traywick
Mrs. Sandra Donaghy	Mrs. Sylvia McCollum	Mr. John and Mrs. Cynthia Triplett
Ms. Linda and Mr. Clifton Eason	Mrs. Lee Handy and Mr. Thomas McKee	Mrs. Nancy Tucker
Mr. Edwin and Mrs. Thelma Edmonson	Mrs. Valerie and Mr. Tyrone McMillian	Mrs. Nancy Turner
Ms. Kaye Edwards	Mrs. Margaret McQuain	Mr. Larry and Ms. Joyce Vest
Mr. Lance Everhart	Mr. Noel Melton	Mrs. Mary Weatherspoon
Mr. Xinyu Feng	Mr. Gregg Miller	Ms. Walker Weigel
Mr. Daniel Flores	Ms. Lynn Moore	Ms. Betsy Jordan Whitson
Ms. Shirley Fraley	Dr. Sharon Morgan	Mrs. Fran Williams
Mr. Malcom Garland	Dr. Thomas and Mrs. Mildred Mullikin	Ms. Linda Woodlief and Mr. Glenn Woodlief
Mrs. Nancy Geller	Mrs. Dawn and Mr. James Murchison	Mr. David Wright
Mrs. Monika Goel	Mr. Carl and Mrs. Jean Nilsson	Ms. Patricia Yegge
Mr. Yair Goldberg	Mr. Thomas Parrish	Ms. AbaGayle Younts
Ms. Aliesha Grady	Mrs. Linda Philips	Mr. Marwan Zamamiri
Mrs. Patti Grimm	Ms. Mary Pope	

If you are interested in donating to the Department, please go to mathstats.uncg.edu 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 Dean of the Graduate School

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

Maya Chhetri, Professor

Dr. Chhetri earned a Ph.D. from Mississippi State University in 1999 and joined the faculty in 1999. Her research focus is on nonlinear elliptic boundary value problems. Dr. Chhetri served as the Director of Graduate Studies from August 2017 to July 2019.

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. Dr. Erovenko was appointed to serve as Associate Head effective August 1, 2019

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. 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

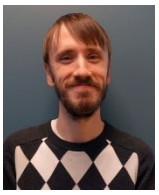
Fellow of the American Statistical Association

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. Dr. Gupta was appointed to serve a 4-year term as Department Head effective August 1, 2019.

Tracey Howell, Senior Academic Professional

Director of the Math Help Center, Coordinator of the Math Emporium Lab, & 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.



Matt Jester, Lecturer

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

Thomas Lewis, Associate 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

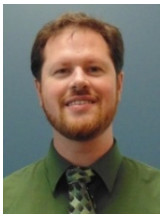
Director of Undergraduate Studies

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

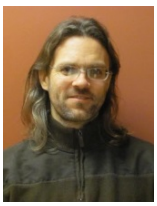
Director of the Statistical Consulting Center

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, Associate 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. Dr. Rowell was elected to serve as the Director of Undergraduate Studies effective August 1, 2019.



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.

Ratnasingham Shivaji, H. Barton Excellence Professor

W.L. Giles Distinguished Professor Emeritus of Mathematics (Mississippi State University), Fellow of the American Mathematical Society

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. Dr. Shivaji served as Department Head from July 2011 to July 2019.

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.

Jianping Sun, Assisstant Professor

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

Brett Tangedal, Associate Professor

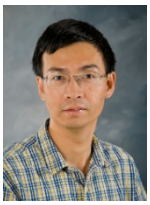
Dr. Tangedal earned a Ph.D. from the University of California at San Diego in 1994 and joined the faculty in 2007. His research focus is on algebraic number theory with a particular emphasis on explicit class field theory.

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. He retired in the Summer of 2019 after 46 years at UNCG.

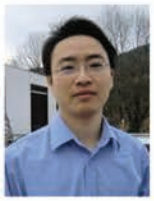
Dan Yasaki, Associate Professor

Dr. Yasaki earned a Ph.D. from Duke University in 2005 and joined the faculty in 2008. His research focus is on modular forms, particularly the connection between explicit reduction theory of quadratic forms and the computation of Hecke data for automorphic forms. Dr. Yasaki served as the Associate Head from August 2017 to July 2019.



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. Dr. Zhang was appointed to serve the next term as Director of Graduate Studies effective August 1, 2019.



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 (to start August 1, 2019)

John Stufken, Professor, *Bank of America Excellence Professor*

Fellow of the American Statistical Association, Fellow of the Institute of Mathematical Statistics, Elected Member of the International Statistical Institute

Dr. Stufken earned a Ph.D. from the University of Illinois at Chicago in 1986 and joined the university on July 1, 2019 as the founding Director of the MS program in Informatics and Analytics. His primary research interest is in theoretical, computational and applied aspects of design of experiments.

Michael Hull, Assistant Professor

Dr. Hull earned a Ph.D. from Vanderbilt in 2013 and joined the faculty at the beginning of the 2019-2020 school year. His main research interests are in geometric group theory and low-dimensional topology, especially focusing on the relationship between the algebra of groups and the geometry and topology of graphs, surfaces and 3-manifolds.

Elizabeth 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.

Thomas McConville, Visiting Assistant Professor

Dr McConville earned a Ph.D. from the University of Minnesota in 2015 and joined the faculty at the beginning of the 2019-2020 school year. His main research interests are in algebraic, geometric and topological combinatorics.

Donald Robertson, Visiting Assistant Professor

Dr. Robertson earned a Ph.D. from Ohio State University in 2015 and joined the faculty at the beginning of the 2019-2020 school year. His main research interests are ergodic theory and additive combinatorics.

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. Ms. Childers resigned in January 2019 to pursue employment as the Executive Assistant to the Vice Chancellor of Research and Engagement, Terri Shelton.

Carri Richter
University Program 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. Mrs. Richter took on the role of University Program Associate in February 2019.

Katelyn Young
Administrative Support Associate

Ms. Young earned a B.S. in Marketing and Business Management with a concentration in Entrepreneurship from Appalachian State University in 2013. She joined the Department in April 2019.

3. Tenure, Promotion, Awards & Honors

Tenure and Promotions

Dr. Thomas Lewis received tenure and promotion to Associate Professor, effective on August 1, 2019.

Dr. Jonathan Rowell received tenure and promotion to Associate Professor, effective on August 1, 2019.

New and Continuing Awards (July 1, 2018 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.

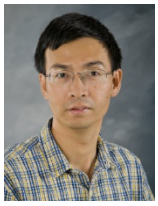
Dr. Xiaoli Gao has an ongoing Simons Foundation Grant for her Project titled, "Robust Estimation and Signal Approximation for High-dimensional Data." This award will run from 2015 to 2020.

Dr. Tracey Howell received the 2018-19 College of Arts and Sciences Non Tenure-Track Teaching Excellence Award.

Dr. Jan Rychtář was the PI on an NSF Research Experiences for Undergraduates grant from 2017 to 2020.

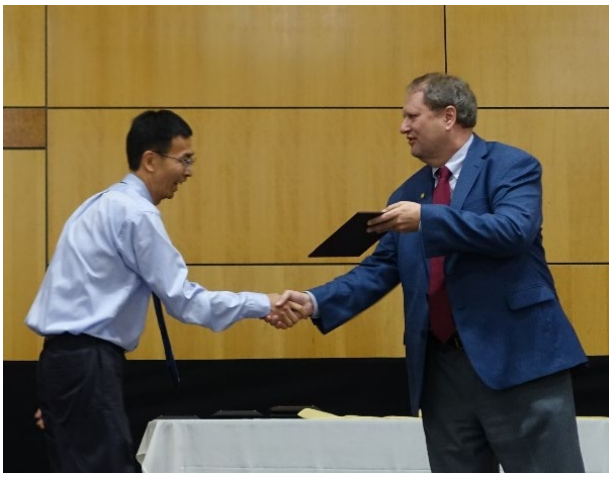
Dr. Ratnasingham Shivaji had an ongoing NSF research grant (2015-2019) and a new NSF grant (2019-2022) for his project titled, “Collaborative Research: Mathematical and Experimental Analysis of Ecological Models: Patches, Landscapes and Conditional Dispersal on the Boundary”. Shivaji was also selected to join the 2019 class of the Fellows 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. Haimeng Zhang received the 2018-19 College of Arts and Sciences Senior Teaching Excellence Award.

Dr. Sat Gupta (PI) and Dr. Xiaoli Gao (co-PI) were awarded an ASA/NSF Grant for Statistics REU that ran in the summer of 2018.



Haimeng Zhang receiving the 2018-19 College of Arts and Sciences Senior Teaching Excellence Award.

Tracey Howell receiving the 2018-19 College of Arts and Sciences (Non-Tenure Track) Teaching Excellence Award.

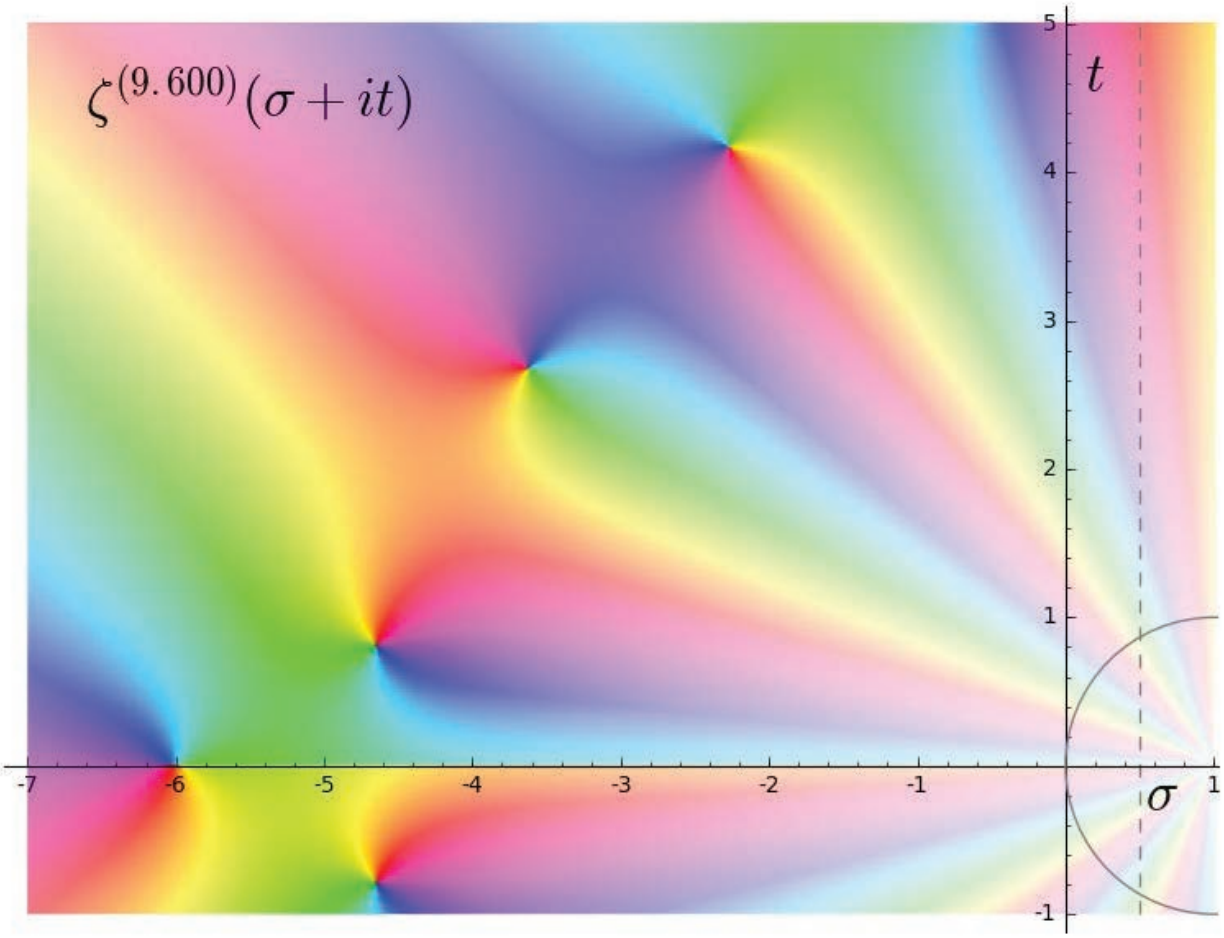
Shivaji was elected to the 2019 class of Fellows of the American Mathematical Society.

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 working in this area.

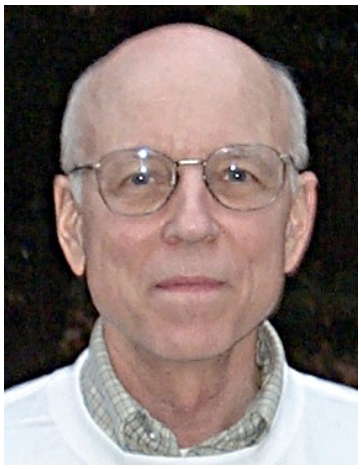
Sebastian Pauli with Ph.D. student Sandi Rudzinski

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. More information can be found at https://mathstats.uncg.edu/number-theory/.

2018 UNCG Summer School in Computational Number Theory

Combinatorics, Group Theory, and Topology



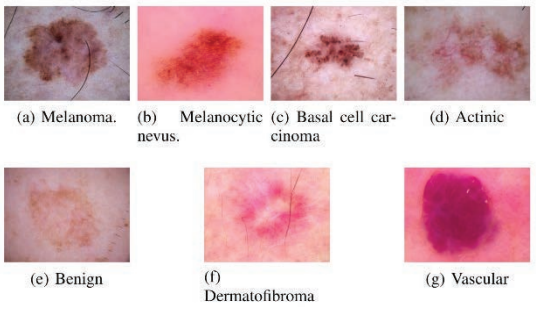
The members of the combinatorics, group theory, and topology group in 2018-19 were Greg Bell, Yu-Min Chung, Talia Fernós, Clifford Smyth, and Jerry Vaughan.

The UNCG Mathematics and Statistics Department bids a fond farewell to Jerry Vaughan this year and wish him all the best in his retirement.

Dr. Vaughan earned a Ph.D. in 1965 from Duke University and joined the UNCG faculty in 1973. His research studied general topology, set theory and logic, functional analysis, and set-theoretic topology. Dr. Vaughan retired with emeritus status at the end of the spring semester in 2019 after 46 years of service.

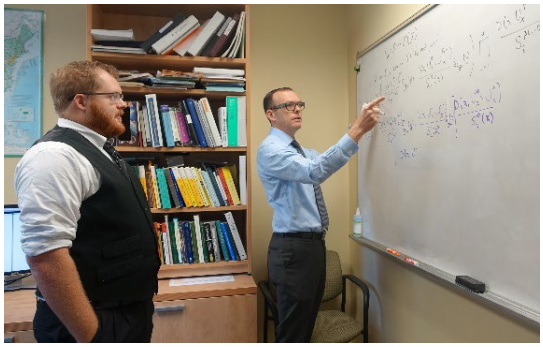
Jerry has left a lasting impression on his field with his 71 publications some of its most prestigious journals and with his work as co-editor of the The Handbook of Set-Theoretic Topology, editors K. Kunen and J.E. Vaughan, North-Holland Pub. Co., Amsterdam 1984, (1273 pages) and The Encyclopedia of General Topology, edited with J. Nagata and K. Hart, Elsevier BV 2005.

Yu-Min Chung was invited to give more than 10 research talks from regional to international, including the Interdisciplinary Distinguished Seminar Series at NCSU ECE Department, and the mini-symposium entitled “Topological Data Analysis and Applications in Dynamical Systems” in 2019 SIAM Conference on Applications of Dynamical Systems. He published two research articles in 2018-2019. One of them is a joint work with Clifford Smyth on classifying different types of skin lesions by tools in topology. With Chung’s collaborators, he also has submitted a grant proposal to the Army Research Office.



Different types of skin lesions. Develop automatic algorithms to classify them.

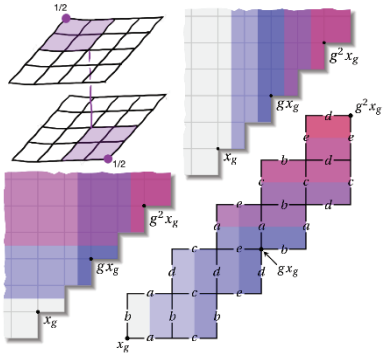
In 2018–19, Greg Bell delivered invited talks at a Geometric Topology Workshop at the University of Tennessee, Knoxville and an invited special session talk at an AMS sectional meeting. Current Ph.D.



Greg Bell with Ph.D. student Austin Lawson

Student Neil Pritchard also gave a talk at the workshop at UT. In May, Austin Lawson graduated with his Ph.D. under the direction of Greg Bell. Dr. Lawson currently serves as the Graduate School's Data Analyst and Program Coordinator for the MSIA program at UNCG. Greg made two trips to Warsaw, Poland to continue collaborations with Andrzej Nagórko in coarse geometry. He also worked on two projects with Lawson, Pritchard, and UNCG Professor Dan Yasaki. These projects combined geometric properties of Cayley graphs of groups with coarse geometry and computational number theory. His current projects involve an application of computational techniques to detect large-scale properties of infinite groups using local data and further extensions of asymptotic property C to the coarse category.

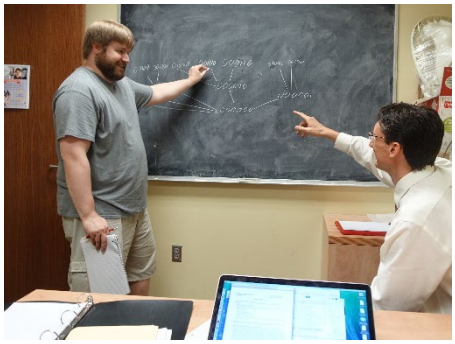
Talia Fernós investigates infinite groups through both analytic and geometric methods. CAT(0)cube complexes have interesting interconnections between geometry, analysis, and algebra, and so have fascinated her for some years now. Talia spent her summer traveling in Israel and France, attending and speaking 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.

Talia is currently working with her Ph.D. student Jenny Beck on the topic of linear groups.

Cliff Smyth's research area is combinatorics and he has been supported by his $35,000 Collaboration in Combinatorics from the Simons Foundation (2015-2020). He is currently working on combinatorial proofs of the non-negativity of the coefficients of implicitly defined generating functions with his Ph.D. student James Rudzinski and is mentoring his Ph.D. student Matt Farmer on a project on non-crossing bond posets. He worked on 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



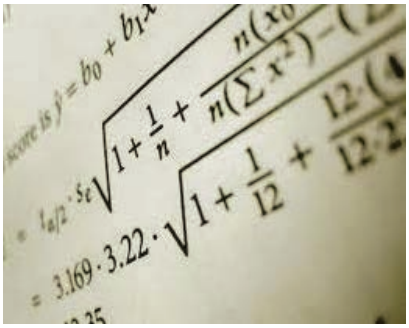
Clifford Smyth with Ph.D. student James Rudzinski

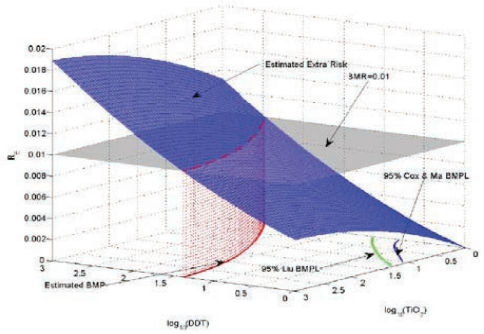
a UNCG Giant Steps grant with Gideon Wasserberg, Malcolm Schug, and Matina Kalcounis-Ruppell of the Biology Department to analyze the incursion of Lyme disease into North Carolina. He gave talks at the ACO Seminar, Carnegie Mellon University, Feb. 14, 2019, AMS Sectional Meeting, University of Michigan, Special Session, Oct. 21, 2018 UNCG International Conference on Advances in Interdisciplinary Statistics and Combinatorics, Oct. 6, 2018 and National Taiwan University, Algebra and Combinatorics Seminar, June 20, 2018.

He co-organized the 19th Triangle Lectures in Combinatorics that was held at Wake Forest University in Spring 2019. He published in one of the top journals in his field (Restricted Stirling and Lah number matrices and their inverses, Journal of Combinatorial Theory, Series A, 161 (2019) p. 271-298. with David Galvin and John Engbers) and also in a top conference proceedings (Topological approaches to skin disease image analysis [2018] IEEE International Conference on Big Data with Yu-Min Chung, Chuang-Shen Hu, and Austin Lawson.)

The current students in the group are Ph.D. students Jenny Beck, Matt Farmer, Neil Pritchard, and James Rudzinski. Recent past students include Austin Lawson (Ph.D. 2019) who is currently the UNCG Graduate School's Data Analyst and Program Coordinator for the MSIA program, 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



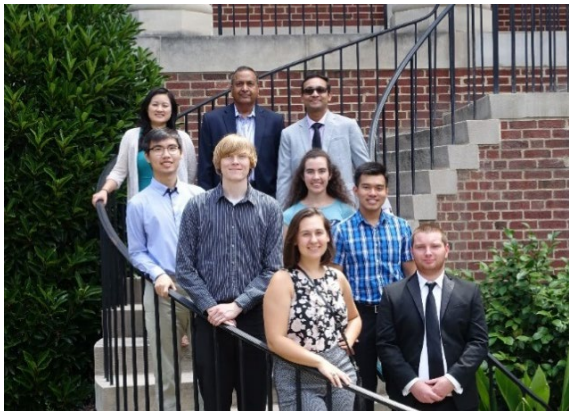


The statistics group in the Department consisted of five full-time faculty - Sat Gupta, Scott Richter, Haimeng Zhang, Xiaoli Gao, and Jianping Sun. The focus of Dr. Gupta's research is in the area of sample surveys, Dr. Richter specializes in nonparametric methods and multiple comparisons, Dr. Zhang specializes in survival analysis, spatial statistics, and applied probability, Dr. Gao specializes in high- dimensional data analysis and statistical genetics, and Dr. Sun specializes in statistical methodology and applied research in high-dimensional complex genomic data.

Xiaoli Gao with Ph.D. student Bin Luo

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 2018, the stats group had 7 published journal articles and 11 accepted journal articles.

In summer 2018, 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. The program ran from May 14 to July 20, 2018. Four nationally recruited students and two locally funded students participated in this summer REU. Students presented their work at the AISC 2018 international conference, and two students from the group won the best and the second-best presentation awards in the undergraduate student category.



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.

Wei Chen, a Ph.D. student specializing in computational statistics, graduated in 2018. Other Ph.D. students in 2018 were Badr Aloraini, Saragan Balasubramaniam, Charith Elson, Bin Luo, Romesh Thanuja, and Qi Zhang. The group also directed one master's thesis and three master's projects.

Led by Sat Gupta, the Department has been hosting biennial AISC conference since 2007. AISC 2018 was held at the EUC from October 5-7, 2018. Dean Kiss inaugurated the conference. The conference featured a total of 32 sessions and 122 talks including 8 plenary talks and more than 25 talks by students.

In 2017, Sat Gupta received the College of Arts and Sciences Senior Teaching Excellence Award. In addition, Ph.D. student Bin Luo (Mentor Xiaoli Gao) received the second place in the best presentation competition for graduate students in the AISC 2018 conference. Ph.D. student Austin Lawson won the third-place award for his research on Topological Data Analysis.

Sat Gupta and Provost Dana Dunn present Bin Luo with an award for his presentation.

Applied Mathematics

Flickr Material Database. Quantifying and discovering the intrinsic characteristics about different materials are both important and challenging.

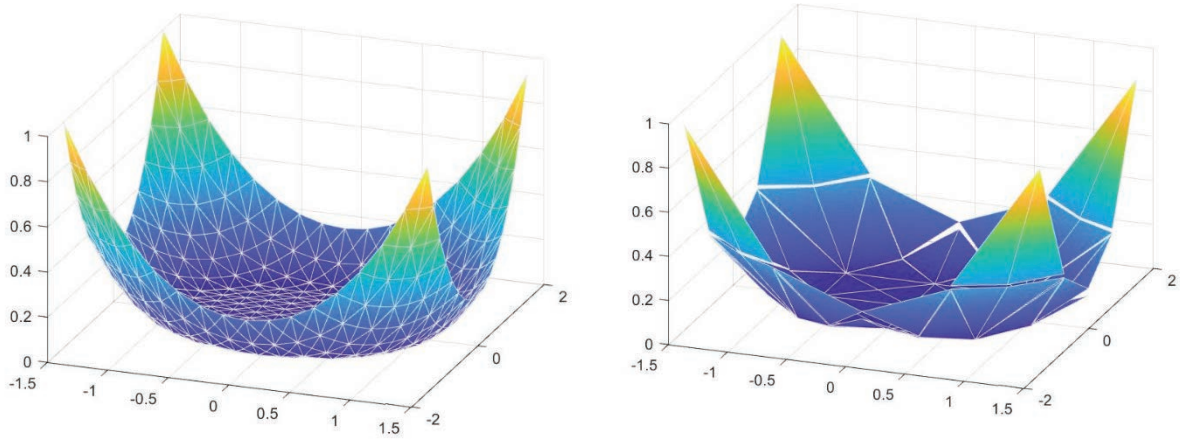
A triangulation of UNCG used to generate a computational mesh.

Applied mathematics is a discipline that develops mathematical techniques and concepts that can be used 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 focuses 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

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.

An example of h-refinement for the DWDG method approximation of an obstacle problem.



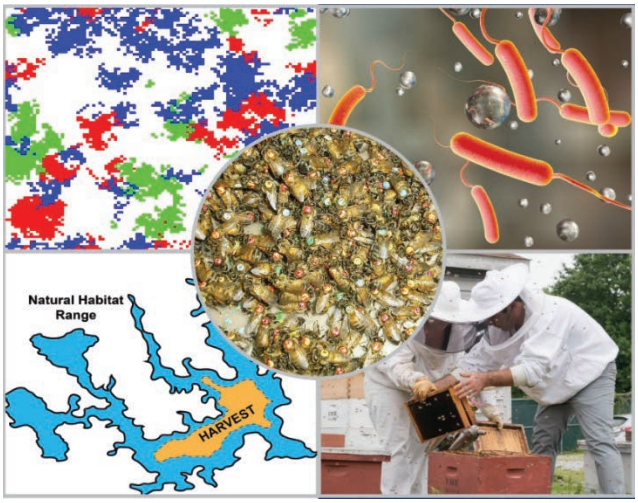
Chung, Igor Erovenko, Richard Fabiano, Thomas Lewis, Jonathan Rowell, Jan Rychtář, Ratnasingham Shivaji, and Yi Zhang. Recent Ph.D. graduates who worked in these areas are Quinn Morris (now an Assistant Professor at Appalachian State University), Catherine Payne (now an Assistant Professor at Winston-Salem State University), and Byungjae Son (now an Assistant Professor at the University of Maine). Recent M.A. 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, Ram Dhungana, Nalin Fonseka, Elliott Hollifield, Amila Muthunayake, and Aaron Rapp. Sara Feggeler, Jackson Leonard, Jonathan Machado Bilbraudt, Sandy Phan, and Juan Quirea are recent undergraduate research students in this area.

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

Maya Chhetri with Ph.D. student Elliott Hollifield

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

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, behavioral 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 Ananta Acharya, Nalin Fonseka, Elliott Hollifield, Amila Muthunayake and Joshua Safley.

Igor Erovenko received a Center for Undergraduate Research in Mathematics (CURM) mini-grant to support a 2018–2019 academic-year undergraduate research project. This grant required submission from institution pairs, and the partner institution was Bennett College. Igor Erovenko supervised research of two UNCG undergraduate students, and Ajanta Roy (from Bennett College) supervised research of two Bennett College undergraduate students. The UNCG students, Kristen Scheckelhoff and Ayesha Ejaz, completed two research projects during the 2018–2019 academic year: (1) A game-theoretic model of optimal clean equipment usage to prevent hepatitis C among injecting drug users; and (2) Optimal vaccination strategies to prevent hepatitis B in China. The outcomes of the student work include one paper submitted for publication in a peer-reviewed journal, one paper being prepared for publication, and four student conference presentations. Ayesha Ejaz graduated from UNCG in 2019, and she is currently a Ph.D. student at the University of Chicago. Kristen Scheckelhoff is planning to graduate in 2021 through the accelerated degree program with B.S. and M.A. in mathematics.

Cliff Smyth was co-PI on a $25,000 Giant Steps Research Development Grant, Characterization of Lyme disease spread from Virginia into North Carolina: the role of topographic corridors and anthropogenic forest fragmentation, January 8, 2018 – June 30, 2019. Other personnel were PI Gideon Wasserberg and co-PIs Malcolm Schug and Matina Kalcounis-Ruppell, all from the UNCG Biology Department. Outcomes of the project include: (1) an application for a thorough surveillance of tick and Lyme disease distribution in northwestern NC submitted to the NC Department of Health and Human Services on 04/17/2019; and (2) a tentatively approved contract for $20,000 for the year of 2019–20.

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 four Ph. D. students, Ananta Acharya, Nalin Fonseka, Elliott Holifield, and Amila Muthunyake undergraduate student Jackson Leonard working on this project. Quinn Morris (Ph.D. 2017), Byungjae Son (Ph.D. 2017), Catherine Payne (Ph.D. 2017), Keri Spetzer (M.A. 2018), Jessica Nash (B.S. 2017), Jonathan Machado Bilbraut (B.A. 2019), and Sara Feggler (B.S. 2019) are recent alumni who worked on this project.

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

4.2 Journal Articles in 2018

Sahana Balasubramanya
Accepted in 2018, but not published:
Abbott, C., **Balasubramanya, S. H**., and Osin, D., Hyperbolic structures on groups, *Algebraic & Geometric Topology.*

Greg Bell
Published in 2018:
Bell, G., Nagórko, A., On stability of asymptotic property C for products and some group extensions, *Algebr. Geom. Topol,* 18 (1): 221-245.

Accepted in 2018, but not published:
Bell, G., Lawson, A., Coarse direct products and property C, *Topology Proc.*

Bell, G., Lawson, A., Martin, J., Rudzinski, J., and Smyth, C., Weighted persistent homology, *Involve.*

Maya Chhetri
Published in 2018:
Chhetri, M., Sankar, L., Shivaji, R., and Son, B., An existence result for superlinear semipositone *p*-Laplacian systems on the exterior of a ball, *Differential and Integral Equations*, 31 (7/8): 643-656.

Chhetri, M. and Girg, P., Superlinear elliptic systems with reaction terms involving product of powers, *Appl. Math. Lett.,* 75, 121–127.

Accepted in 2018, but not published:
Chhetri, M., Drabek, P., and Shivaji, R., S-shaped bifurcation diagrams in exterior domains, *Differential and Integral Equations*.

Yu-Min Chung
Published in 2018:
Chung, Y-M. and Day, S., Topological Fidelity and Image Thresholding: A Persistent Homology Approach, *Journal of Mathematical Imaging and Vision,* 60.7: 1167-1179.

Igor Erovenko
Published in 2018:
Hurlbut, E., Ortega, E., **Erovenko, I.,** and Rowell, J., Game theoretical model of cancer dynamics with four cell phenotypes, *Games*, 9 (3): 61.

Kobe, J., Pritchard, N., Short, Z., **Erovenko, I.**, Rychtar, J., and Rowell, J., A game-theoretic model of cholera with optimal personal protection strategies, *Bulletin of Mathematical Biology,* 80 (10): 2580-2599.

Brettin, A., Rossi-Goldthorpe, R., Weishaar, K., and **Erovenko, I.**, Ebola could be eradicated through voluntary vaccination, *Royal Society Open Science,* 5 (1): 171-591.

Street, G., **Erovenko, I**., and Rowell, J., Dynamical facilitation of the ideal free distribution in nonideal populations, *Ecology and Evolution*, 8 (5): 2471-2481.

Accepted in 2018, but not published:
Erovenko, I., The evolution of cooperation in one-dimensional mobile populations with deterministic dispersal, *Games.*

Richard Fabiano
Published in 2018:
Fabiano, R. and Payne, C., Spline approximation for systems of linear neutral delay-differential equations, *Applied Mathematics and Computation*, 338: 789-808.

Fabiano, R. and Payne, C., Stability of the solution semigroup for neutral delay differential equations, *Journal of Differential and Integral Equations*, 31 (1-2): 133-156.

Talia Fernós
Accepted in 2018, but not published:
Fernos, T., Forester, M., and Tao, J., Effective quasimorphisms on right-angled Artin groups, *ANNALES DEL'INSTITUT FOURIER*.

Xiaoli Gao
Published in 2018:
Tang, Y., He, J., **Gao, X**., Yang, T., Zeng, X., Continuous amperometric hydrogen gas sensing in ionic liquids, *Analyst,* 143: 4136-4146.

Gao, X. and Feng, Y., Penalized weighted least absolute deviation regression, *Statistics and Its Interface*, 11 (1): 79-89.

Bunch, R., Murray, C., **Gao, X.,** and Hunt, E., Geographic analysis of domestic violence incident locations and neighborhood level influences, *International Journal of Applied Geospatial Research*, 9 (2): 14-32.

Sat Gupta
Published in 2018:
Yadav, S., **Gupta, S.,** and Misra, S., Population mean estimation when median of the study variable is known, *Statistics and Applications*, 16 (1): 339–350.

Suarez, D. and **Gupta, S.**, Variations of the Greenberg unrelated question binary model, *Involve - a Journal of Mathematics*, 11 (1): 119–126.

Khalil, S., **Gupta, S.**, and Hanif, M., A generalized estimator for finite population mean in the presence of measurement errors in stratified random sampling, *Journal of Statistical Theory and Practice*, 12 (2): 311–324.

Gupta, S., Mehta, S., and Shabbir, J., A unified measure of respondent privacy and model efficiency in quantitative RRT models, *Journal of Statistical Theory and Practice*, *12* (3): 505–511.

Gupta, S., Khan, Z., and Shabbir, J., Modified systematic sampling with multiple random starts, *REVSTAT*, 16 (2): 187-212.

Accepted in 2018, but not published:
Zhang, Q., **Gupta, S**., Kalucha, G., and Khalil, S., Ratio estimation of the mean under RRT Models, *Journal of Statistics and Management Systems.*

Shabbir, J., **Gupta, S**., and Ahmed, S., A generalized class of estimators under two-phase stratified sampling for non-response, *Communications in Statistics - Theory and Methods*.

Khan, H., **Gupta, S.**, and Farhat, H., A ratio - cum - regression estimator of population mean in unequal probability sampling design, *Communications in Statistics - Simulation and Computation*.

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

Khalil, S., **Gupta, S.**, and Hanif, M., Estimation of finite population mean in stratified sampling using scrambled responses in the presence of measurement errors, *Communications in Statistics - Theory and Methods*.

Suarez, D., **Gupta, S.,** Johnson, E., and Manthena, P., Variations of the Greenberg unrelated question model - a field test, *Journal of Interdisciplinary Mathematics*.

Thomas Lewis
Published in 2018:
Lewis, T., Feng, X., Nonstandard local discontinuous Galerkin methods for fully nonlinear second order elliptic and parabolic equations in high dimensions, *Journal of Scientific Computing, 77* (3): 1534-1565.

Sebastian Pauli
Published in 2018:
Farr. R., **Pauli, S.,** and Saidak, F., On fractional Stieltjes constants, *Indagationes Mathematicae,* 29 (5).

Jonathan Rowell

Published in 2018:

Lawhorn, C., Schomaker, R., **Rowell, J.,** Rueppell, O., Simple comparative analyses of differentially expressed gene lists may overestimate gene overlap, *Journal of Computational Biology,*25 (6): 606-612.

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

Kobe, J., Pritchard, N., Short, Z., Erovenko, I., Rychtar, J., **Rowell, J.**, A game-theoretic model of cholera with optimal personal protection strategies, *Bulletin of Mathematical Biology,* 80 (10): 2580–2599.

Street, G., Erovenko, I., and **Rowell, J.,** Dynamical facilitation of the ideal free distribution in non-ideal populations, *Ecology and Evolution*, 8, 10.1002/ece3/3811.

Jan Rychtář

Published in 2018:

Kobe, J., Pritchard, N., Short, Z., Erovenko, I., **Rychtar, J**., Rowell, J., A game-theoretic model of cholera with optimal personal protection strategies, *Bulletin of Mathematical Biology,* 80 (10): 2580-2599.

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

Pattni, K., Broom, M., **Rychtar, J**., Evolving multiplayer networks: Modelling the evolution of cooperation in a mobile population, *MAT Discrete and Continuous Dynamical Systems - Series B*, 23 (5): 1975-2004.

Barton, K., Smith, C., **Rychtar, J.,** Sendova, T., Modeling of breast cancer through evolutionary game theory, *Involve,* 11 (4): 541-548.

Hadjichrysanthou, C., Broom, M., **Rychtar, J.**, Models of kleptoparasitism on networks: the effect of population structure on food stealing behavior, *Journal of Mathematical Biology,* 76: 1465-1488.

Broom, M., Johanis, M., and **Rychtar, J.**, The effect of fight cost structure on fighting behaviour involving simultaneous decisions and variable investment levels, *Journal of Mathematical Biology,* 76 (1), 457-482.

Broom, M. and **Rychtar, J.,** Evolutionary games with sequential decisions and dollar auctions, *Dynamic Games, 8*(2), 211-231.

Broom, M. and **Rychtar, J.,** Ideal cost-free distributions in structured populations for general payoff functions, *Dynamic Games, 8* (1): 79-92.

Accepted in 2018, but not published:
Broom, M., Pattni, K., **Rychtar, J.**, Generalised social dilemmas: the evolution of cooperation in populations with variable group size, *Bulletin of Mathematical Biology*.

Filip Saidak:
Published in 2018:
Farr. R., Pauli, S., and **Saidak, F.**, On fractional Stieltjes constants*, Indagationes Mathematicae.*

Ratnasingham Shivaji
Published in 2018:
Chhetri, M., Sankar, L., **Shivaji, R.**, and Son, B., An existence result for superlinear semipositone *p*-Laplacian systems on the exterior of a ball, *Differential and Integral Equations*, 31 (7/8): 643-656.

Goddard, J., Morris, Q., **Shivaji, R.,** and Son, B., Bifurcation curves for singular and nonsingular problems with nonlinear boundary conditions, *Electron. J. Differential Equations*, (26): 1-12.

Morris, Q., **Shivaji, R.,** and Sim, I., Existence of positive radial solutions for a superlinear semipositone *p*-Laplacian problem on the exterior of a ball, *Proc. Royal Soc. Edin: Section A Mathematics*, 148 (2): 409-428.

Mallick, M., **Shivaji, R**., Son, B., and Sundar, S., Bifurcation and multiplicity results for a class of *n x n p*-Laplacian system, *Communications on Pure and Applied Analysis*, 17 (3): 1295-1304.

Chu, K.D, Hai, D. D., **Shivaji, R.,** Positive solutions for a class of non-cooperative *pq*-Laplacian systems with singularities, *Appl. Math. Lett.,* 85: 103-109.

Mallick, M., Sankar, L., **Shivaji, R**., and Sundar, S., Infinite semipositione problems with a falling zero and nonlinear boundary conditions, *Electronic J. Differential Equations*, (193): 1-13.

Goddard, J., Morris, Q., Robinson, S., and **Shivaji, R.**, An exact bifurcation diagram for a steady state reaction diffusion equation arising in population dynamics, *Bound. Value Probl.*, 170.

Accepted in 2018, but not published:
Perera, K., **Shivaji, R.**, and Sim, I., A class of semipositone *p*-Laplacian problems with a critical growth reaction term, *Advances in Nonlinear Analysis*.

Goddard, J., Morris, Q., Payne, C., and **Shivaji, R.**, A diffusive logistic equation with U-shaped density dependent dispersal on the boundary, *Topological Methods in Nonlinear Analysis*.

Chu K.D., Hai, D.D., **Shivaji, R.**, Uniqueness of positive radial solutions for infinite semipositone *p*-Laplacian problems in exterior domains, *J. Math Anal. Appl*.

Lee, E., **Shivaji, R.**, Sim, I., and Son, B., Analysis of positive radial solutions for a class of semipositone *p*-Laplacian problems with nonlinear boundary conditions, *Commun. Pure Appl. Anal*.

Hai D.D. and **Shivaji, R.**, Existence and multiplicity of positive radial solutions for singular superlinear elliptic systems in the exterior of a ball, *J. Differential Equations*.

Dhanya, R., **Shivaji, R.**, and Son, B., A three solution theorem for a nonlinear elliptic boundary value problem in the exterior of a ball, *Topological Methods in Nonlinear Analysis*.

Chhetri, M., Drabek, P., **Shivaji, R.,** S-shaped bifurcation diagrams in exterior domains, *Differential and Integral Equations*.

Clifford Smyth
Published in 2018:
Smyth, C., A probabilistic characterization of the dominance order on partitions, *Order* 35 (2), 393-402.

Accepted in 2018, but not published:
Smyth, C., Galvin, D., Engbers, J., Restricted Stirling and Lah number matrices and their inverses, *Journal of Combinatorial Theory, Series A*.

Bell, G., Lawson, A., Martin, J., Rudzinski, J., **Smyth, C.,** Weighted persistent homology, *Involve*.

Jianping Sun
Published in 2018:
Sun, J., Oualkacha, K., Forgetta, V., Zheng, H.-F., Richards, B., Evans, D., Orwoll, E., Greenwood, C., Exome-wide rare variant analyses of two bone mineral density phenotypes: the challenges of analyzing rare genetic variation, *Scientific Reports, 8*, *Article number: 220*.

Accepted in 2018, but not published:
Sun, J., Oualkacha, K., Greenwood, C., Lakhal-Chaieb, L., Multivariate association test for rare variants controlling for cryptic and family relatedness, *Canadian Journal of Statistics*.

Brett Tangedal
Published in 2018:
Tangedal, B.A., A two-variable generalization of the Kummer-Malmsten formula for the logarithm of the double gamma and double sine functions, *Journal of Number Theory*, 194: 251-277.

Dan Yasaki:
Accepted in 2018, but not published:
Dutour Sikiric, M., Gangl, H., Gunnells, P., Hanke, J., Schürmann, A., **Yasaki, D.,** On the topological computation of K_4 of the Gaussian and Eisenstein integers, *Journal of Homotopy and Related Structures*.

Ash, A., Gunnells, P., McConnell, M., **Yasaki, D.,** On the growth of torsion in the cohomology of arithmetic groups, *Journal of the Institute of Mathematics of Jussieu*.

Haimeng Zhang:
Accepted in 2018, but not published:
Huang, C., **Zhang, H**., Robeson, S., Shields, J., Intrinsic Random Functions on the Sphere, *Statistics and Probability Letters*.

Yi Zhang:
Accepted in 2018, but not published:
Brenner, S., Sung, L-Y, and **Zhang, Y**, C^0 interior penalty methods for an elliptic state-constrained optimal control problem with Neumann boundary condition, *J. Comput. Appl. Math*.

4.3 Refereed Conference Proceedings Papers Published in 2018

Yu-Min Chung and Clifford Smyth
Chung, Y-M., Chuan-S., Lawson, A., and Smyth, C., Topological approaches to skin disease image analysis, *2018 IEEE International Conference on Big Data* (Seattle, WA).

4.4 Research Presentations in 2018

Greg Bell
Decomposition theorems for property C and A, 33rd Summer Conference on Topology and its Applications, Western Kentucky University, Bowling Green, KY.

Decomposition theorem for property C and A, 52nd Spring Topology and Dynamical Systems Conference, Auburn University, Auburn, AL.

Asymptotic dimension of groups, UNCG REU in Mathematical Biology, University of North Carolina Greensboro, Greensboro, NC.

Maya Chhetri
Positive solutions of nonlinear boundary value problems, Seminar in Differential Equations,NTIS - New Technologies for the Information Society, Velehrad, Velehrad, Czech Republic.

Some bifurcation results for fractional Laplacian problems, Southeastern-Atlantic Regional Conference on Differential Equations, Gainesville, GA.

Positive solutions for a class of singular problem on an exterior domain, AMS Sectional Meeting, Boston, MA.

Yu-Min Chung
Computational topology with applications in the natural sciences, Mathematical Data Science Seminar, University of Tennessee Knoxville, Knoxville, TN.

Computational topology with applications in the imaging sciences, National Central University Mathematics Colloquium, National Central University, Taiwan.

Computational topology with applications in the imaging sciences, National Taiwan University Mathematics Seminar, National Taiwan University, Taiwan.

Theoretical foundation of data science with Application, National Center for Theoretical Sciences (NCTS), Taipei, Taiwan.

Computational topology and its application to image classifications, Topology Seminar, University of North Carolina Greensboro, Greensboro, NC.

Topological approaches to skin disease image analysis, 2018 IEEE International Conference on Big Data, Seattle, WA.

Computational topology on sea ice data, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, , University of North Carolina Greensboro, Greensboro, NC.

Persistence curves: a new vectorization of persistence diagrams, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, , University of North Carolina Greensboro, Greensboro, NC.

Topological fidelity in image thresholding, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, University of North Carolina Greensboro, Greensboro, NC.

Center manifold computations and application to fluid flows in cylindrical domains, Special Session of Theoretical and Numerical Advances in Classical and Geophysical Fluid Dynamics in 12th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Taipei, Taiwan.

Topological data analysis, roughness, and human red blood cells, Algebraic Topology: Methods, Computation and Science, Institute of Science and Technology Austria, Austria.

Frontiers in forecasting, Institute for Mathematics and its Applications, Minneapolis, MN.

Session of modeling and data analysis in atmospheric and oceanic science, 42nd SIAM Southeastern Atlantic Sectional Conference, UNC Chapel Hill, Chapel Hill, NC.

Textures analysis by topological methods, 42nd SIAM Southeastern Atlantic Sectional Conference, UNC Chapel Hill, Chapel Hill, NC.

Igor Erovenko
The evolution of cooperation in mobile populations on multiplayer stochastic networks, Conflict, Competition, Cooperation and Complexity: Using Evolutionary Game Theory to Model Realistic Populations, University of Turin, Turin, Italy.

Public goods game in mobile populations on stochastic multiplayer networks, AMS Eastern Sectional Meeting, University of Delaware, Newark, DE.

Richard Fabiano
Stability and approximation for linear systems, Department seminar (Get to know your colleagues), Department of Mathematics and Statistics, University of North Carolina Greensboro, Greensboro, NC.

Talia Fernós
Boundaries, boundaries, boundaries, Nonpositively Curved Groups on the Mediterranean, Center for the Mathematical Sciences, Israel.

Boundaries, boundaries, boundaries, Workshop on Largescale Geometry and Applications, Fields Institute, Toronto, Canada.

Boundaries, boundaries, boundaries, JMM Special Session on Boundaries of Groups, San Diego, CA.

Groups and CAT(0) cube complexes, University of Virginia, Charlottesville, VA.

Groups and CAT(0) cube complexes, Spring Eastern AMS Sectional Meeting, Northeastern University, Boston, MA.

Group actions on CAT(0) cube complexes, Spring Central AMS Sectional Meeting Ohio State University, Columbus, OH.

The wild world of infinite groups, Geometry, Algebra, Number Theory, and Combinatorics Seminar*,* University of North Carolina Greensboro, Greensboro, NC.

Xiaoli Gao
Statistical framework for semantic similarity searching on biological data, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, University of North Carolina Greensboro, Greensboro, NC.

Penalized redescending M estimation, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, University of North Carolina Greensboro, Greensboro, NC.

Robust online learning using weighted stochastic gradient decent, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, University of North Carolina Greensboro, Greensboro, NC.

Robust trend filtering and outlier detection, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, University of North Carolina Greensboro, Greensboro, NC.

Weighted adaptive hard threshold signal approximation for robust change point detection, The 2nd International Conference on Econometrics and Statistics (EcoSta 2018), Hong Kong, China.

Sat Gupta

Evaluating performance of mean estimators of sensitive variables under measurement errors with respect to efficiency and respondent privacy, International Conference on Emerging Innovations in Statistics and Operations Research, MDU Rohtak, India.

Various shades of statistical consulting, IIM Indore, India.

Respondent privacy, data security, and estimation quality in sample surveys, VNRVJIET, Hyderabad, Hyderabad, India.

Evaluating performance of mean estimators of sensitive variables under measurement errors with respect to efficiency and respondent privacy, IIT Bombay, Mumbai, India.

Evaluating performance of mean estimators of sensitive variables under measurement errors with respect to efficiency and respondent privacy, MNIT, Jaipur, India.

Statistical consulting, S V College, University of Delhi, Delhi, India.

Variations of the Greenberg unrelated question binary model, Lamar University, Beaumont, TX.

Variations of the Greenberg unrelated question binary model, University of North Carolina Greensboro, Greensboro, NC.

Practicing statistics, Math Club, University of North Carolina Greensboro, Greensboro, NC.

Publishing journal articles –an editor's perspective, Professional Development, University of North Carolina Greensboro, Greensboro, NC.

Tom Lewis
An introduction to the mathematics of numerical methods, Math-Bio REU, University of North Carolina Greensboro, Greensboro, NC.

Finite difference methods for approximating fully nonlinear partial differential equations, Applied Math Seminar University of North Carolina Charlotte, Charlotte, NC.

Approximating positone boundary value problems with multiple solutions, AMS Fall Central Section Meeting -- Special Session on New Trends in Numerical Methods for PDEs: Theory and Applications, Ann Arbor, MI.

Distributional derivatives and the penalization of DG methods, The Finite Element Circus, University of Tennessee, Knoxville, TN.

Convergent finite difference methods with second order local truncation error for Hamilton-Jacobi equations, Joint Math Meetings – AMS Special Session on Recent Trends in Analysis of Numerical Methods of Partial Differential Equations, San Diego, CA.

Sebastian Pauli
(Fractional) derivatives of zeta functions - a picture show, Geometry, Algebra, Number Theory, and Combinatorics Seminar, University of North Carolina Greensboro, Greensboro, NC.

Scott Richter
Simultaneous confidence intervals for scale parameters using deviances, 2018 Joint Statistical Meetings, Vancouver, BC.

Simultaneous confidence intervals for comparing scale parameters using deviances, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, University of North Carolina Greensboro, Greensboro, NC.

Jonathan Rowell
Apply what you know (and learn what you don't), UNCG Mathematics & Statistics Departmental Colloquium, University of North Carolina Greensboro, Greensboro, NC.

Understanding Scientific Literature: Finding, Reading, and Eventually Writing, National Research Experience for Undergraduates Program, University of North Carolina Greensboro, Greensboro, NC.

Jan Rychtář
Game-theoretical models in biology, VCU colloquium, Virginia Commonwealth University, Richmond, VA.

Ratnasingham Shivaji
Infinite semipositone problems, 38th Annual Southeastern- Atlantic Regional Conference on Differential Equations, University of North Georgia, Gainesville, GA.
S-shaped bifurcation curves, Special Session Paper, AMS Annual Meeting, San Diego, CA.

A positivity challenge in steady state reaction diffusion problems, Wake Forest University, Winston-Salem, NC.

An exact bifurcation diagram for a model in population dynamics, Applied Mathematics Seminars, University of North Carolina Greensboro, Greensboro, NC.

A positivity challenge in steady state reaction diffusion problems, Applied Mathematics Seminars, University of North Carolina Greensboro, Greensboro, NC.

Clifford Smyth
Restricted Stirling and Lah numbers matrices and their inverses, AMS Sectional Meeting, Special Session, University of Michigan, Ann Arbor, MI.

Restricted Stirling and Lah numbers matrices and their inverses, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, Greensboro, NC.

Estricted Stirling and Lah numbers matrices and their inverses, National Taiwan University, National Taiwan University, Taiper, Taiwan.

Jianping Sun
Multivariate association test for rare variants controlling for cryptic and family relatedness, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, Greensboro, NC.

Brett Tangedal
The analytic class number formula and abelian fields, Geometry, Algebra, Number Theory, and Combinatorics Seminar, University of North Carolina Greensboro, Greensboro, NC.

Dan Yasaki
On the growth of torsion in the cohomology of arithmetic groups, Palmetto Number Theory Series XXXI, University of South Carolina, Columbia, SC.

On the cohomology of congruence subgroups of GL_3 over the Eisenstein integers, Five College Number Theory Seminar, Amherst College, Amherst, MA.

On the cohomology of congruence subgroups of GL_3 over the Eisenstein integers, Southeast Meeting on Numbers 2018, East Tennessee State University, Johnson City, TN.

Haimeng Zhang
Intrinsic random functions on the sphere, International Conference on Advances in Interdisciplinary Statistics and Combinatorics, University of North Carolina Greensboro, Greensboro, NC.

Yi Zhang
Numerical approximations for PDE-constrained optimization problems, Applied Mathematics Seminar, University of North Carolina Greensboro, Greensboro, NC.

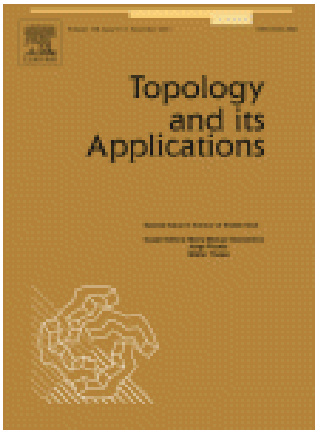
Numerical methods for variational inequalities, Get to Know Your Department Colloquium, University of North Carolina Greensboro, Greensboro, NC.

Numerical approximations for a singular elliptic variational inequality, Computational Mathematics Seminar Series, Louisiana State University, Baton Rouge, LA.

An a posteriori analysis of C0 interior penalty methods for a fourth order variational inequality, AMS Spring Central Sectional Meeting, Ohio State University, Columbus, OH.

4.5 Department Journals

Topology and its Applications



https://www.journals.elsevier.com/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

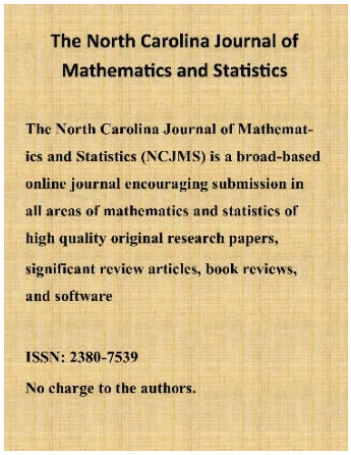
https://www.springer.com/statistics/journal/42519

Sat Gupta, Editor-in-Chief

The Journal of Statistical Theory and Practice was started in 2007 by Professor Sat Gupta, who continues to serve as its Editor-in-Chief. The journal was published by Taylor and Francis until mid-2018 and is being published now by Springer. 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), Dan Zelterman (Yale University), Sastry Pantula (ASA President 2010, California State University- San Bernardino), Pranab Sen (Cary C. Boshamer Professor, UNC Chapel Hill), and John Stufken (Bank of America Excellence Professor, UNC Greensboro).

The journal published a total of 45 papers in 2018 accounting for a total of 911 pages. The journal is indexed by Scopus and is also included in the Thompson Reuter's Emerging Sources Citation Index.

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 UNC 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).

5. Grants

5.1 External Grants

New Awards Administered by Mathematics and Statistics Department:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
19-0067	**Shivaji, Ratnasingham**		Collaborative Research: Mathematical and Experimental Analysis of Ecological Models: Patches, Landscapes and Conditional Dispersal on the Boundary	08/01/19	07/31/22	NSF	$238,982
18-0116	**Tangedal, Brett**	**Fernós, Talia; Pauli, Sebastian; Saidak, Filip; Yasaki, Dan**	UNCG Summer School in Computational Number Theory	09/15/18	08/31/20	NSF	$9,000
	Gupta, Sat	**Shivaji, Ratnasingham; Zhang, Haimeng**	International Conference on Advances in Interdisciplinary Statistics and Combinatorics	8/1/18	7/31/19	Institute of Mathematics and its Applications	$5,000

Continuing Awards Administered by Mathematics and Statistics:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	Award End Date	Sponsor	Award Amount
18-0418	**Gupta, Sat**	**Gao, Xiaoli;** Mohanty, Somya	UNCG REU: 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
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
16-0053	**Pauli, Sebastian**	**Tangedal, Brett; Yasaki, Dan**	UNCG Summer School in Computational Number Theory	4/1/16	6/30/19	NSF	$53,973
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

5.2 Internal Grants

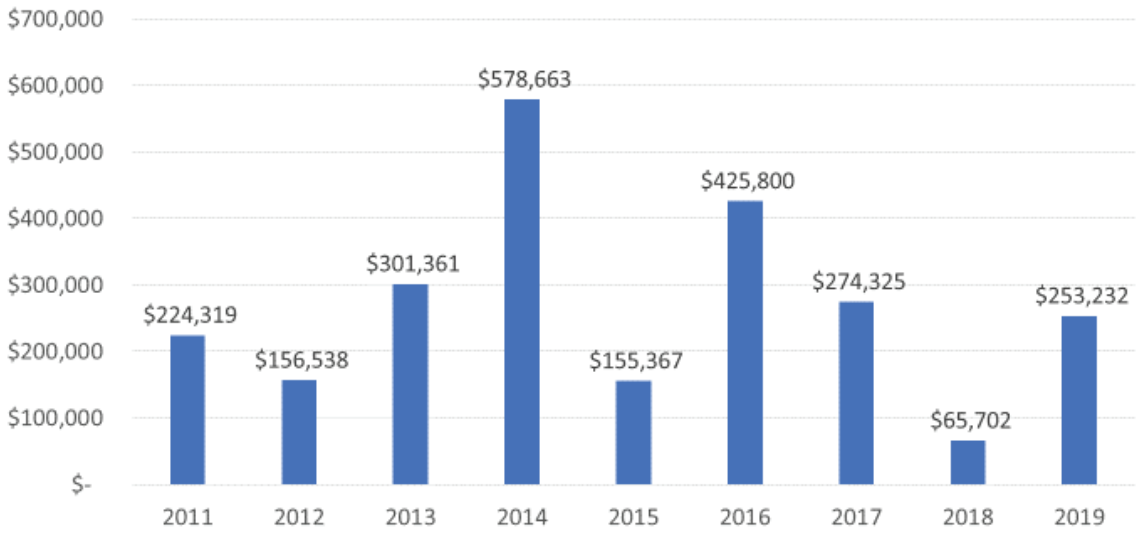
Continuing Awards Administered by Mathematics and Statistics:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
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
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	1/1/18	12/31/18	UNCG Giant Steps grant	$25,000

New Awards Administered by Mathematics and Statistics:

PROP #	Lead PI	Other Personnel	Award Title	Start Award Date	End Award Date	Sponsor	Award Amount
NA	**Gupta, Sat**		P-3: NSF proposal	8/1/18	5/31/19	UNCG – College of Arts and Sciences	$2,000
NA	**Erovenko, Igor**		Research student stipends	8/1/18	5/31/19	UNCG – College of Arts and Sciences	$1,500
NA	**Sun, Jianping**		New Faculty Grant	1/1/19	6/30/20	Office of Research and Engagement	$5,000
NA	**Gao, Xiaoli**	Deng, Jing	Regular Faculty Grant	1/1/19	6/30/20	Office of Research and Engagement	$10,000
NA	**Yasaki, Dan**	**Howell, Tracey**	Moving the Metrics: Calculus Corequisite Pilot	1/1/19	7/31/20	Provost Office and College of Arts & Sciences	$28,490

Grant Awards by Fiscal Year 2011-2019

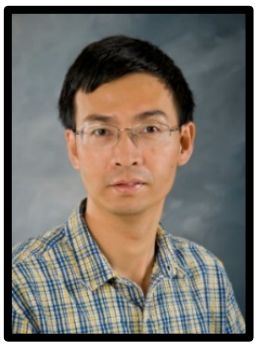


Total grant dollars since 2011 is $2,435,307.

5.3 External Award Recipients

NSF Grants

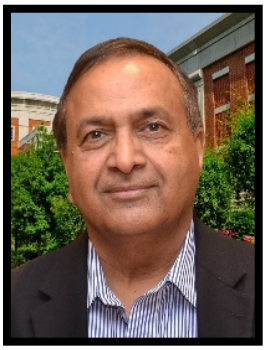
Fernós



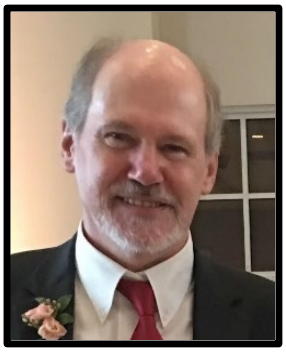
Zhang

Shivaji

Tangedal

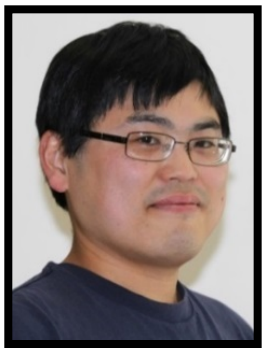


Gupta



Stufken

NSA Grants



Yasaki

Smyth

Simons Foundation Grants

Rychtář

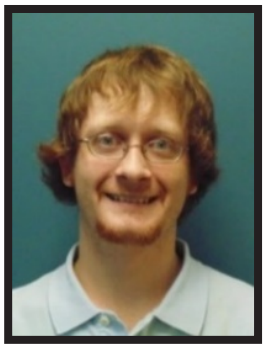
Gao

Smyth

Shivaji

Fernós

MAA NExT Fellow



Fellow of ASA

Fellow of the AMS

6. Undergraduate Program

6.1 Programs

Sebastian Pauli, Director of Undergraduate Studies

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, NSA 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.

Pathways

The UNC System has engaged with the Charles A. Dana Center to mobilize mathematics faculty in North Carolina to improve student success. Our Department has started implementing recommendations from this Mathematics Pathways initiative.

With the goal of increasing success in MAT 191 Calculus I the support course MAT 181 Foundations of Calculus I was created. It is targeted towards students who have had exposure to pre-calculus material but either do not have the formal prerequisites for Calculus I or feel that they need additional support. The combination MAT 191 with the co-requisite support course MAT 181 can be taken without having taken the prerequisite course for MAT 191.

Data clearly show that underprepared students can succeed in college-level math courses at higher rates and in less time as compared to students in traditional developmental sequences in both the one-year and one-semester models; however, the greatest improvement comes from one semester co-requisites (Bailey et al., 2010; California Acceleration Project, 2015; Complete College America, 2016; Logue, 2018; Rutschow & Diamond, 2015; Sowers & Yamada, 2015).

Graduates

2019 Mathematics and Statistics Graduates

During the 2018-19 academic year, 24 students earned a Bachelor's degree in mathematics, namely: Carly Baker, Rayeanne Gates, Brian Guerrero, Caitlin Hampton, Brandon Johnson, Jonathan Machado Bilbraut, Elizabeth Marett, Ngoc Nguyen, Jiaxi Ning, Michael Oppong, Andre Pierce, Fatima Williams, Emily Boerckel, Torre Caparatta, Daniel Donovan, Sara Feggeler, Michael Hobbins, Robert Izydore, Michael Jarina, Joyce Mayaka, Kayla McReynolds, Eric Sanchez, Shijie Wang, and Xuechen Zhu.

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.

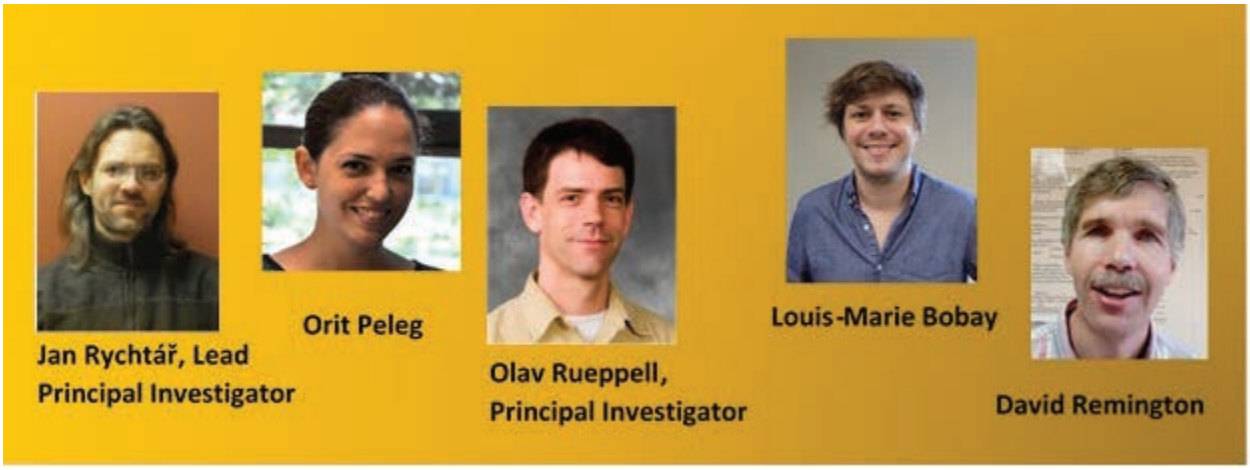
7. Undergraduate Research Program

Background and history

The major push for undergraduate research in the Department started in 2005 with the establishment of a mathematical biology research group by Dr. Rychtář, Dr. Chhetri, and Dr. Gupta from the Department of Mathematics and Statistics, Dr. Rueppell and Dr. 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 been continuously funded (2014-2017: 1359187, and 2017-2019: 1659646) and involved 17 faculty and over 50 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.

A diverse group of REU students

7.1 2019 National Science Foundation Funded Research Experiences for Undergraduates (REU) Program



This year's REU program was funded by the NSF grant to Jan Rychtář and Olav Rueppell and mentored primarily by Drs Rueppell and Bobay (UNCG, Biology) with Drs. Remington (UNCG, Biology) and Peleg (University of Colorado) as secondary faculty mentors. The program was further supported by a NSF grant to Louis-Marie Bobay that allowed four graduate student peer-mentors to work with the undergraduates.

Six undergraduate students were carefully selected from over 175 applicants and the two teams involved students from the University of Illinois at Chicago, University of Illinois at Urbana-Champaign, Mount Holyoke College, Elizabeth City State University, University of New Mexico, and University of Pudget Sound. Two of the six students were female and from two STEM underrepresented groups and this cohort varied in degree and ranged from sophomore to senior status. Two graduate students were selected from the Departments of Mathematics and Statistics and Biology, respectively.

The ten-week program (mid-May to mid-July) started with an introductory week that familiarized students with the basic underlying biology, mathematics, and computational tools with a mix of lectures and exercises. Some time was also devoted to developing other professional skills, such as oral communication, responsible conduct of research, and conflict resolution. Faculty and graduate student mentors, aided by some guest speakers, made for a well-rounded and varied program.

After this initial phase, the student cohort split into their respective working teams of three students each to work on their research projects. The first group focused on the propler estimation of recombination rates in bacteria, a large and complex problem that required the

generation of mock data sets, application of different estimation methods, and evaluating various programs. Significant progress was made to contribute to group leader Dr. Bobay's efforts of solving this medically relevant and theoretically interesting problem. The second group combined theoretical and experimental approaches to address the problem of optimal behavior in the face of pathogen pressure in complex societies of honeybees. Bees were inoculated with viruses to study transmission probabilities in response to food sharing, and the experiments were complemented by a theoretical analysis demonstrating that the optimal degree of food sharing in a social group depends on the virus transmission probability.

During the entire program, students had to present their research progress weekly and several trips to visit neighboring universities and other social activities were scheduled. The REU program culminated with final student project presentations in a formal mini symposium open to the public.

Summer 2018 Participants

- Rutgers University
- Georgia Southern University
- Truman State University
- St. Mary's College of Maryland
- Western Carolina University
- Xavier University
- University of California

Summer 2019 Participants

- Mount Holyoke College
- Elizabeth City State University
- University of Illinois at Urbana-Champaign
- University of Puget Sound
- University of New Mexico- Main Campus

Research projects

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

Mentors: Olav Rueppell, Orit Peleg, Prashant Waiker, Joshua Safley
Participants: Maya Brody, Matthew Hill, Spencer Moore

Honey bees (Apis mellifera L) are of significant ecological and economic importance and present excellent experimental study systems. Usually, one reproductive queen lives with thousands of female workers in a cohesive colony, coordinated by a complex communication and division of labor system. The bee colony represents in many regards a functional unit that can be compared to a superorganism. Thus, the colony is a dense, integrated network of individuals, which makes it susceptible to diseases. Recently, honey bee health has declining dramatically, threatening the pollination services that the apicultural industry provides. Social network structure is known to be affected by disease but many critical parameters have not been empirically and theoretically evaluated. Building on previous work, we investigated IAPV transmission dynamics in small groups of honey bees to better understand the dynamic of a IAPV outbreaks and individual infection risk. This work combined experimental virus-inoculation of worker bees with individual agent-based simulation models to contribute to our understanding of host - virus interactions in social groups and to improving honey bee health.

Estimating bacterial recombination rates

Bacteria are non-sexual organisms that reproduce by clonal division. However, these organisms have the ability to exchange small fragments of DNA through recombination, and this process frequently confers microbes the ability to adapt rapidly to changing environments and medical treatments. Recombination is largely responsible for the spread of antibiotic resistance genes and pathogenicity factors across bacteria, but despite its central role in bacterial adaptation, the recombination process remains poorly understood. The frequency and patterns of recombination vary drastically across species and methods to accurately quantify the rates of DNA transfers are needed. This project aimed to estimate recombination rate by using empirical estimates of Linkage Disequilibrium (LD) across a set of 153 species of bacteria. LD measures the association between alleles along genomes, and this approach is frequently used to estimate recombination rates in sexual organisms, but little work had been done to apply this approach to bacteria. Building on previous works from the lab and other research groups, the students working on this project developed a mathematical model to infer recombination rates from LD data in bacteria. The results will help understand how recombination rates vary across bacterial species and along their genomes.

Student Authored Articles and Presentations Articles

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

S. Sun, M. Leshowitz, and 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, and J. T. Rowell; A Game-theoretic model of cholera with optimal personal protection strategies, Bulletin of Mathematical Biology, 80(10):2580-2599, 2018.

Presentations

2019 HILL M., BRODY M., MOORE S., PELEG O., RUEPPELL O., "Quantification of Israeli Acute Paralysis Virus transmission via food-sharing and modeling of infectious networks in *Apis mellifera* (European honey bee)", 2019 Annual Biomedical Research Conference for Minority Students, Anaheim, CA.

2018 BARRS K., EVERSMAN K., ANI M.O., RUEPPELL O., "Hygienic Behavior and Subtask Specialization in *Apis mellifera* through Agent-Based Simulation in MATLAB", 7th Annual Kennesaw Mountain Undergraduate Mathematics Conference, Kennesaw, GA.

2018 EVERSMAN K., BARRS K., ANI M.O., ROWELL J., RUEPPELL O., "Division of Labor in Hygienic Behavior of *Apis mellifera*: Experimental Investigation to Simulation", NIMBioS Undergraduate Research Conference at the Interface of Biology and Mathematics, Knoxville, TN.

2018 ANI M.O., EVERSMAN K., BARRS K., ROWELL J., RUEPPELL O., "Division of Labor Among Nurse Bees Increases Honey Bee Health: Experimental And Modeling Evidence", Council on Undergraduate Research's REU Symposium, Alexandria, VA.

2018 ANI M.O., BARRS K., EVERSMAN K., ROWELL J., RUEPPELL O., "Does Division of Labor Increase the Efficiency of Hygienic Behavior in *Apis mellifera*?", UNCG REU Symposium, Greensboro, NC.

2018 WEISHAAR K. "Ebola Could Be Eradicated Through Voluntary Vaccinations", 15th Annual Pikes Peak Regional Undergraduate Mathematics Conference.

7.2 American Statistical Association/ National Science Foundation (ASA/NSF) Funded REU

In 2018, 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 ASA/NSF funded students, we included 2 locally funded UNCG Mathematics and Statistics 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 high-dimensional data consisting of patient demography, laboratory, and survey results. All three teams presented at the Advances in Interdisciplinary Statistics and Combinatorics (AISC 2018) conference held at UNCG in October 5-7 and won the top two awards in the Undergraduate Student presentation category.

Sat Gupta addressing the Statistics REU participants on the first day

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

2018 Summer ASA/NSF-REU participants and faculty mentors

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 teamwork.

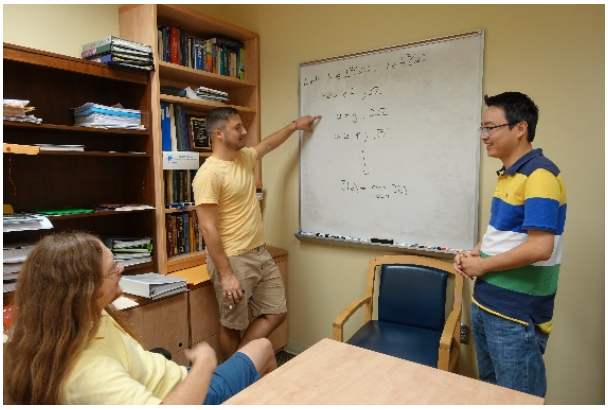
8. Graduate Program

8.1 2018 – 2019: Year in Review

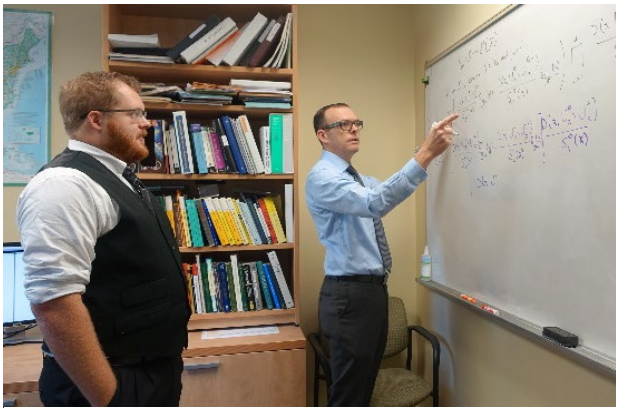
Maya Chhetri, Director of Graduate Studies

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

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 eight 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 seven published articles and further submitted nine journal articles. Our graduate students presented total thirteen talks during 2018-19. 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.



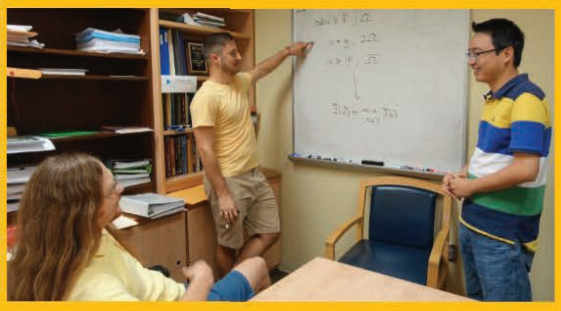
Pd.D. student, Aaron Rapp, working with his advisor Tom Lewis and Yi Zhang



Pd.D. student, Austin Lawson, working with his advisor Greg Bell

8.2 Programs & Certificates

UNC GREENSBORO
Department *of* Mathematics & Statistics



UNCG offers a PhD Program in Computational Mathematics

Mathematics Track:	Statistics Track:
• Combinatorics	• Design of Experiments
• Control Theory	• High Dimensional Data Analysis
• Differential Equations	• Nonparametric and Robust Methods
• Geometric Group Theory	• Sampling
• Mathematical Biology	• Spatial Statistics
• Number Theory	• Statistical Genetics
• Numerical Analysis	
• Topology	

Graduate Assistantship:
$18,000 + tuition waivers
Summer Support & Scholarships are often available.

Application and Assistantship Deadline: March 15th

For more information, contact Dr. Haimeng Zhang at h_zhang5@uncg.edu or go to mathstats.uncg.edu

UNC GREENSBORO
Department *of* Mathematics & Statistics

UNCG offers an MA in Mathematics with concentrations in

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

For more information, contact Dr. Haimeng Zhang at h_zhang5@uncg.edu or go to **mathstats.uncg.edu**

Graduate Assistantship:
$10,800 + tuition waivers
Summer Support & Scholarships are often available.

Application Deadlines:
Spring: November 15th · Fall: July 1st
Assistantship: March 15th

MATHEMATICIAN IS #2
STATISTICIAN IS #5
THE 2018 CAREERCAST JOBS RATINGS
ACTUARY IS #10
DATA SCIENTIST IS #7

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.mathstats.uncg.edu/graduate/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

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

MATHEMATICIAN IS #2

STATISTICIAN IS #5

THE 2018 CAREERCAST JOBS RATINGS

ACTUARY IS #10

DATA SCIENTIST IS #7

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

For more information, go to

www.mathstats.uncg.edu/graduate/actuarial

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 600 level or above STA courses

For more information, go to
www.mathstats.uncg.edu/graduate/post-baccalaureate-certificate-in-statistics/

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

UNC GREENSBORO
Department *of* Mathematics & Statistics

8.3 Degrees Awarded in Academic Year 2018-19

In 2018 – 2019, the following students were conferred a M.A. degree.

- Jenny Beck, May 2019, Mathematics
- Christine Bottini, May 2019, Applied Statistics
- Charith Elson, August 2019, Applied Statistics
- Xiangpan Li, May 2019, Data Analytics
- Yang Peng, May 2019, Data Analytics
- Bety Rostandy, May 2019, Data Analytics
- Na Wang, December 2018, Actuarial Mathematics
- Alex Smith, May 2019, Actuarial Mathematics
- Helen Guo, May 2019, Applied Statistics
- Nada Alzahrani, May 2019, Applied Statistics

Spring 2019 M.A. Graduate Ceremony

During this year, Austin Lawson graduated with Ph.D. in Computational Mathematics. This brings the total of our Ph.D. graduates to thirteen (13) since 2014 when the first batch of students started graduating. Those students who have graduated are - Abraham Abebe, Wei (Vivian) Chen, Ricky Farr, Jonathan Milstead, Danielle Moran, Quinn Morris, Catherine Payne, Jeong Sep Sihm, Brian Sinclair, Byungjae Son, Christopher Vanlangenberg, and Tanja Zatezalo.

Ph.D. Graduate Austin Lawson with Advisor Greg Bell

May 2019 graduate, Austin Lawson worked under the supervision of Greg Bell. His dissertation was titled "*On the preservation of coarse properties over products and on persistence curves*". Austin is currently employed at UNCG as a Data Analyst for the Graduate School.

8.4 Professional Mentoring

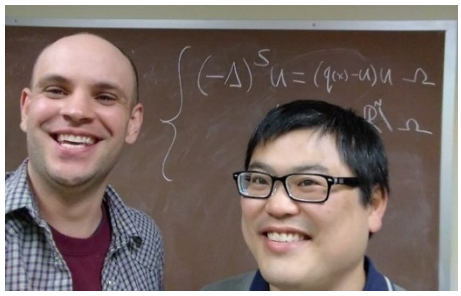
Igor Erovenko mentoring graduate student Sandi Rudzinski

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 2018-19, 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 one event. Igor Erovenko (UNCG) presented "The art and science of great presentations" during the fall 2018 semester.

Sat Gupta presenting at our Professional Development Seminar on publishing journal articles

Igor Erovenko 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

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

2017 graduate 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 2018-19, we had an enrollment of 25 Ph.D. students and 13 M.A. students.

Recruitment Efforts

Specific efforts were made to recruit students to our graduate programs and to advertise our new M.A. concentrations throughout the year. We continued our participation in recruitment fairs at both national and regional conferences such as the 2019 Joint Mathematics Meetings and the Tenth Undergraduate Research Conference at the Interface of Biology and Mathematics held by the National Institute for Mathematical and Biological Synthesis (NIMBioS) in the University of Tennessee at Knoxville, TN. The Joint Mathematics Meetings were attended by Maya Chhetri, Igor Erovenko, and Ratnasingham Shivaji in January 2019. 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 North Carolina A&T State University and Wake Forest University 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,

Igor Erovenko at the AMS 2019 recruitment event

Maya Chhetri at the AMS 2019 recruitment event

Shivaji at the AMS 2018 recruitment event

Jonathan Rowell at the NIMBioS 2017 graduate booth

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.

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. 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.

Under the leadership of Shivaji, the Department has been working to build a collaborative relationship from institutions in China. In particular, with the help of Haimeng Zhang, the Department reached agreements with Xiamen University of Technology (XMUT) in China to attract qualified students to come to UNCG to study for M.A. in our Department. With the help of Xiaoli Gao, the collaborative agreements with Nanjing Institute of Science and Technology (NUIST) from China are currently on the final stage.

8.7 Scholarships/Fellowships and Internships

Many of our continuing students were awarded competitive departmental *Helen Barton Scholarship* for 2019-2020 - Ananta Acharya, Romesh Arachchige, Shalmali Bandyopadhyay, Nalin Fonseka, Elliott Hollifield, Bin Luo, Amila Muthunayake, Aaron Rapp, and Kalani Thalagoda. Additionally, Philip Zhu received the *Dr. Theresa Phillips Vaughan Math Scholarship.*

During 2018 – 2019, we had thirteen Ph.D. students received the *Summer Research Scholarship* to advance their research program during Summer 2019. They were Aaron Rapp, Romesh Thanuja, Bin Luo, Nalin Fonseka, Qi Zhang, Eliott Hollifield, Badr Aloraini, Sandi Rudzinksi, Ananta Acharya, Sarangan Balasubramaniam, Kalani Thalagoda, Shalmali Bandyopadhyay, and Amila Muthunayake. They were expected to give talks about their summer research in Fall 2019.

In addition, several incoming students for Fall 2019 were awarded with the Graduate School fellowships or scholarship. In particular, Wenhao Shou and Jenny Beck received the Minerva Scholarship for one year.

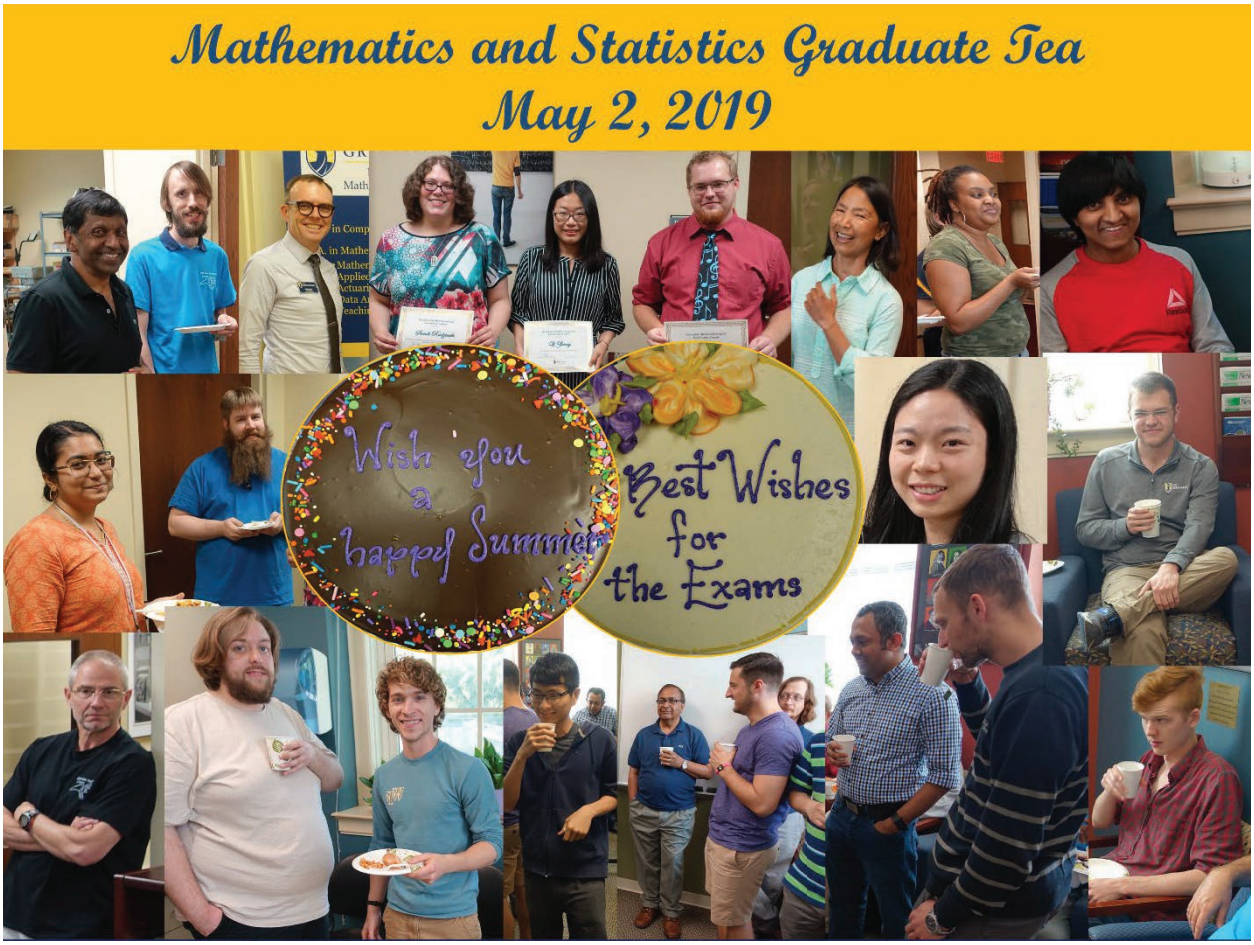
Bin Luo had been offered a Summer Internship at Volvo and Qi Zhang secured a summer Internship with ConvaTec, a global medical products and technologies company during Summer 2019.

Two of our Ph.D. students finished among the top three in the best presentation competition for graduate students in the AISC 2018 conference that was held in October 2018: Bin Luo (Mentor Xiaoli Gao) finished second and Austin Lawson (Mentor Greg Bell & Yu-Min Chung) finished third.

Finally, we also celebrated the outstanding achievements of our graduate students; Qi Zhang and Austin Lawson received the Outstanding Research Award, and Sandi Rudzinski received the Outstanding Teaching Award for the academic year 2018 - 2019.

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.



8.9 Graduate Student Handbook

With the hard work from Dan Yasaki, the Graduate Student Handbook is now available to all graduate students in the Department. The Handbook details the expectations and policies, as well as provides samples of various department forms and documents.

9. Funding Opportunities for Students

Departmental Scholarships

Thanks to our many generous donors, we are able to distribute thousands of dollars in math scholarships each year. Over $73,000 was disbursed in 2018-19. For more information, go to https://mathstats.uncg.edu/scholarships/.

- 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 2018-19 scholarship recipients are listed below.

Helen Barton Scholarship: Ananta Acharya, Romesh Arachchige, Shalmali Bandyopadhyay, Nalin Fonseka, Elliott Hollifield, Jackson Leonard, Bin Luo, Amila Muthunayake, Ryan Parks, Juan Quiroa, Aaron Rapp, Kristen Scheckelhoff, Kalani Thalagoda
Vicky Langley Math Scholarship: Quentin Merritt
Ione Holt Grogan Scholarship: Anna Hawkins-Ross, Kristen Scheckelhoff, Sarah Travis
Judith J. Mendenhall Scholarship: Shiyong Tian
Mary D. Murray Scholarship In Mathematics: Heather Parlaman
Eldon E. And Christine J. Posey Mathematics Scholarship: Kristen Scheckelhoff
Cornelia Strong Scholarship: Kristen Scheckelhoff
Dr. Theresa Phillips Vaughan Math Scholarship: Xuechen Zhu
Bertha Barnwell Vielhauer Endowed Scholarship: Heather Parlaman, Juan Quiroa, Samip Thapa, Shiyong Tian

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.

TA Elliott Hollifield lecturing

Graduate Assistantship levels:

• $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 2018–19 academic year, twenty full-time Ph.D. students and seven full-time M.A. students were funded through Graduate Assistantships.

Math Emporium

TA Aaron Rapp lecturing

Funded Ph.D. Students		Funded M.A. Students	
Ananta Acharya	Amila Muthunayake	Jenny Beck	Bety Rostandy
Sarangan Balasubramaniam	Neil Pritchard	Sravani Krosuri	Stephen Steward
Shalmali Bandyopadhyay	Aaron Rapp	Cole Love	Philip Zhu (Spring)
Ram Dhungana	James Rudzinski	Yang Peng	
Charith Elson	Sandi Rudzinski		
Matt Farmer	Joshua Safley		
Nalin Fonseka	Pujita Sapra		
Ivanti Galloway	Kalani Thalagoda		
Elliot Hollifield	Romesh Thanuja		
Bin Luo	Qi Zhang		

9.4 Other Scholarships

- The STAMPS (Science, Technology and Math Preparation Scholarships) Program at UNCG is supported by the National Science Foundation and it offers scholarships of up to $4,000 per year for academically talented undergraduate students in the sciences. The primary goal of the STAMPS program at UNCG is to provide financial and community support for undergraduate students who are majoring in Biology, Chemistry, Computer Science, Geography, Mathematical Sciences, and Physics and Astronomy. Students are awarded scholarships based on a demonstration of both a significant promise for success in science/math and a measurable financial need. In addition to financial support, STAMPS incorporates a variety of community-building measures including peer mentors, a science colloquium series, tutoring, and field trips to research facilities.
- 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 the 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 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.

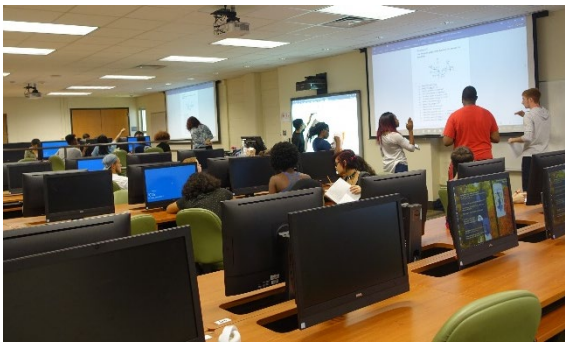
The program will accept a maximum of 5 students in any semester. The students in the program will be considered for a small scholarship from the Department of Mathematics and Statistics if the research work leads to a peer-reviewed journal article, or a conference presentation (oral or poster).

Program Coordinator:
Sat Gupta, Professor of Statistics, Department of Mathematics and Statistics, UNCG. The form and more details can be found at mathstats.uncg.edu/undergraduate/student-life/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 with the Emporium Model courses, bringing her expertise in student-centered pedagogy and technology-mediated learning to the Precalculus series. Students enrolled in Emporium 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 students spend each week Math Emporium Lab, the student's complete online mathematics assignments. The Math Emporium Lab is facilitated by teaching assistants specifically trained to assist students enrolled in these hybrid 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 the program. 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). 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.

Math Pathways Initiative

Tracey Howell

Dan Yasaki

Beth Lewis

Beginning in Spring 2018, The University of North Carolina System partnered 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, Tracey Howell (co-chair) and Dan Yasaki. The Task Force has created formal recommendations on the implementation of mathematics pathways in North Carolina and released them in August 2019. Those recommendations align 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.

In Fall 2018 and Spring 2019, the Department has worked hard to begin implementing the Math Pathways Task Force Recommendations. Most notably, we began offering a Foundations of Calculus course (Mat 181) in Spring 2019 under the direction of Beth Lewis.

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.

Sarah Day, College of William and Mary

Jianfeng Lu, Duke University

Lawrence Washington, University of Maryland

Peter X. K. Song, University of Michigan

Bruce Sagan, Michigan State University

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 Fall 2018 was held in October 2018.

11.3 Helen Barton Lecture Series Speakers

Sarah Day	William & Mary	9/28/18	Computational Topology and the Life Sciences: Finding structure in models and data
Alexander Dranishnikov	University of Florida	10/10/18-10/12/18	Topology and Robot Motion Planning
Jianfeng Lu	Duke University	10/26/19	Algorithms for Electronic Structure Models
Lawrence Washington	University of Maryland	02/8/19	Elliptic Curves: From simple questions to complicated answers
Peter X.K. Song	University of Michigan	3/22/19	Stochastic Differential Equation Approach to Infant Growth Trajectory Analysis with In Utero Exposure to Environmental Toxicants
Bruce Sagan	Michigan State University	4/26/19	The protean chromatic polynomial

11.4 Colloquia Speakers

Henry Segerman	Oklahoma State University	11/2/18	Design of 3D printed mathematical art
Paul Young	College of Charleston	11/9/18	Global series for zeta functions
Thomas McConville	Mathematical Science Research Institute	2/4/19	Canonical bijections among combinatorial lattices
Michael Hull	University of Florida	2/13/19	Equations and hyperbolicity in groups
Jean-Francois Biasse	University of South Florida	2/22/19	On the computation of the ideal class group of a large degree number field
Tim Kelley	NC State University	4/5/19	Anderson Acceleration: Convergence Theory and Numerical Experience
Jürgen Klüners	Paderborn University	4/12/19	Constructive Galois theory

Johann Bauer	City, University of London	4/22/19	The Stabilisation of Equilibria in Evolutionary Game Dynamics through Mutation

11.5 External Seminar Speakers

Christopher Davis	Tennessee Tech University	10/1/18	Additive Schwarz Domain Decomposition Preconditioners for Fourth Order Problems Using a Flat-Top Partition of Unity Method
Sayed A. Mostafa	NC A&T University	10/31/18	Kernel Density Estimation from Complex Surveys in the Presence of Complete Auxiliary Information
Nicole Dalzell	Wake Forest University	11/7/18	Teaching Students to "Knit": RMarkdown in the Statistics and Mathematics Classroom
Tao Pang and Jeffrey High	NC State University	11/12/18	Financial Math Program
Lutz Warnke	Georgia Institute of Technology	11/15/18	A dynamic view on the probabilistic method: random graph processes
Alen Alexanderian	NC State University	11/19/18	Efficient methods for optimal design of PDE-based inverse problems under uncertainty
Qing Shi	Cytel, Inc.	2/6/19	Career in Biostatistics for Clinical Trials
Larry Washington	University of Maryland	2/8/19	Elliptic Curves: From simple questions to complicated answers

Peter X.K. Song	University of Michigan	3/22/19	Stochastic Differential Equation Approach to Infant Growth Trajectory Analysis with In Utero Exposure to Environmental Toxicants
Joshua Hallam	Loyola Marymount University	3/28/19	The Noncrossing Bond Poset of a Graph
Chris Vanlangenberg	Apex Analytix	4/3/19	How data science can help find answers?
Becky Sanft	University of North Carolina at Asheville	4/8/19	The Mathematics and Mechanics of Biological Growth
Jacob Russell-Madonia	City, University of New York	5/1/19	The geometry of subgroup combination theorems
Lukas Kotrla	University of West Bohemia, Czech Republic	5/13/19	Fluid flow through porous medium-models involving the p-Laplace operator
Suzanne Lenhart	University of Tennessee	6/19/19	Investigating two data-driven models with mosquito-borne diseases

11.6 UNCG Seminar Speakers

Ratnasingham Shivaji	UNCG	8/15/18	An exact bifurcation diagram for a model in population dynamics
Ratnasingham Shivaji	UNCG	8/20/18	A positivity challenge in steady state reaction problems
Talia Fernós	UNCG	8/22/18	The Wild World of Infinite Groups
Greg Bell, Yi Zhang, and Yu-Min Chung	UNCG	8/24/18	Get to Know your Department
Kalani Thalagoda	UNCG	8/29/18	Continued Fractions with Irrational Numerators
Dan Yasaki	UNCG	9/5/18	What is a modular form?
Xiaoli Gao, Rich Fabiano, Jonathan Rowell	UNCG	9/7/18	Get to Know your Department

Yi Zhang	UNCG	9/10/18	Numerical Approximations for PDE-Constrained Optimization Problems
Igor Erovenko	UNCG	10/15/18	The art and science of great presentations
Sahana Hassan Balasubramanya	UNCG	10/17/18	Hyperbolic structures on wreath products
Sebastian Pauli	UNCG	10/24/18	(Fractional) Derivatives of Zeta Functions- A Picture Show
Cole Love	UNCG	10/31/18	Knapsack Cryptosystem
Qi Zhang	UNCG	11/15/18	Mean Estimation of Sensitive Variable Under Measurement Errors and Non-response
Brett Tangedal	UNCG	11/29/18	The Analytic Class Number Formula and Abelian Fields
Filip Saidak	UNCG	2/6/19	The Riemann Zeta Function developments until Reimann
Talia Fernós	UNCG	2/27/19	An introduction to trees and their automorphism group
Sebastian Pauli	UNCG	3/25/19	Intro to p-adics
Talia Fernós	UNCG	3/27/19, 4/3/19 & 4/17/19	Building for PSL $(2,Q_p)$
Bin Luo	UNCG	4/17/19	Robust group M-estimation for high-dimensional data

11.7 Research Visitors

Research Visitor	Institution	Dates Visited	Host
Byungjae Son	Wayne State University	8/1/18-8/15/18	Research with Shivaji
Muhammad Nouman Nazar Qureshi	University of Minnesota Twin Cities	8/24/18-8/28/18	Research with Sat Gupta

Sarah Day	William & Mary	9/27/18-9/29/18	Mathematics & Statistics Colloquium
Christopher Davis	Tennessee Tech University	9/29/18 -10/1/18	Applied Mathematics Seminar
Pavel Drabek	University of West Bohemia, Czech Republic	10/1/18 -11/1/18	Research with Shivaji and Maya Chhetri
David Galvin	University of Notre Dame	10/5/18-10/7/18	Research with Cliff Smyth
John Engbers	Marquette University	10/5/18-10/7/18	Research with Cliff Smyth
Alexander Dranishnikov	University of Florida	10/9/18-10/13/18	Helen Barton Lecture Series in Mathematical Sciences
Henry Segerman	Oklahoma State University	11/1/18 -11/3/18	Mathematics and Statistics Colloquium
Paul Young	College of Charleston	11/9/18-11/11/18	Mathematics and Statistics Colloquium
Byungjae Son	Wayne State University	11/21/18-11/26/18	Research with Shivaji
Petr Girg	University of West Bohemia	12/1/18-12/18/18	Research with Maya Chhetri
Johann Bauer	City, University of London	4/7/19-5/26/19	Research with Igor Erovenko
Mark Broom	City, University of London	4/7/19- 5/3/19	Research with Igor Erovenko
Tamas Vargas	Bolyai Institute, University of Szeged	4/7/19-5/2/19	Research with Igor Erovenko
Sadia Kahlil	Lahore College for Women University	6/23/19- 8/9/19	Research with Sat Gupta

11.8 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).

Seminar meeting June 2019. Newest members, Lori Alvin (center) and Lynne Yengulalp (second from right).

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. The Math Help Center also offers virtual tutoring for students enrolled in online MAT and STA courses. In addition to these tutoring services, MHC arranges Review Sessions for 100-level courses upon the request of course coordinators. In Fall 2018 and Spring 2019, 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 2018

- 11 Graduate Teaching Assistants tutored in the Math Help Center and some of them conducted the weekly review sessions.
- 1355 student visits were recorded in the MHC.
- 14 undergraduate students helped instructors with grading in their classes and with the Math Emporium lab.

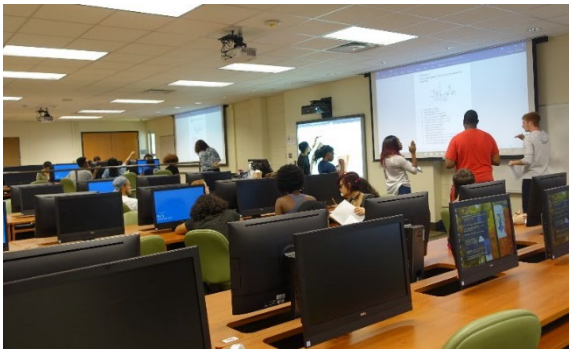
Spring 2019

- 18 GTAs tutored in the Math Help Center and some of them conducted either weekly review sessions or before mid-term exams.
- 1367 student visits were recorded in the MHC.
- 11 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

Emporium courses are enhanced versions of online courses. Students enrolled in these hybrid 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 their 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 these courses.



Math Emporium

12.3 Statistical Consulting Center

Scott Richter, Director of Statistical Consulting Center

2018-19 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.

- 17 students enrolled in STA 667 and worked with faculty consultants to complete graduate research projects. New online sections were introduced to assist students in online graduate degrees.
- Several manuscripts appeared in 2018-19 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 Ph.D. program.
- The SCC continued its 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 2019

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.

Dr. Haimeng Zhang, Statistics Professor, assisting in the Math Help Center.

5th Annual Summer Series on Quantitative Methodology (2019): May 21, June 4, June 11

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

Tuesday, May 21st
9:00 AM – 1:00 PM
Introduction to SAS for Data Analysis

Hands-on introduction to using the SAS System for statistical analysis for those with little or no experience. Topics will include

- SAS environments
- Introduction to SAS syntax
- Reading data
- Data manipulation
- Creating summary statistics
- Simple plots
- Basic statistical analysis

Prerequisites: No previous experience using SAS is required.

Instructor: Dr. Scott Richter,
UNCG Department of Mathematics and Statistics

Tuesday, June 4
9:00 AM - 1:00 PM
Introduction to Item Response Theory

The purpose of this workshop is to provide a gentle introduction to unidimensional item response theory (IRT). Specifically, we will discuss

- IRT models that can be used to fit responses from dichotomous items
- The use of the software package flexMIRT to estimate model parameters and how these results can be interpreted
- Application of IRT in educational testing

Prerequisites: Individuals attending this workshop should have familiarity with basic inferential statistics and regression.

Materials: Participants are encouraged to bring a laptop with the trial version of flexMIRT software, which is available here:
https://www.vpgcentral.com/software/irt-software/purchase/

Instructor: Dr. Kyung Yong Kim,
Assistant Professor in the Department of Educational Research Methodology

Tuesday, June 11
9:00 AM – 1:00 PM
Introduction to R for Data Analysis

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,
Department of Mathematics and Statistics and UNCG Statistical Consulting Center

Instructor Information:

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.

Dr. Kyung Yong Kim is Assistant Professor in the Department of Educational Research Methodology. His research interests include item response theory models and their applications. More information can be found at https://soe.uncg.edu/directory/faculty-and-staff/bio-kyungyongkim/.

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

12.4 State Math Contest

Tracey Howell, Organizer

The State Mathematics Contest is a problem-solving competition through which students interested in mathematics can become familiar with more sophisticated and advanced mathematical concepts and ideas that are not covered in traditional school curricula. The contest has been in existence for over 40 years in the state of North Carolina. During that time, over 100,000 students have taken part in the qualifying rounds and over 2,500 students have advanced to the state finals. Each year, the culmination of the contest is a final test that determines statewide winners. Currently, North Carolina is divided into three regions (Eastern, Central, and Western) and the final test is administered simultaneously at one site in each region.

Some of the 2019 State Math Contest winners

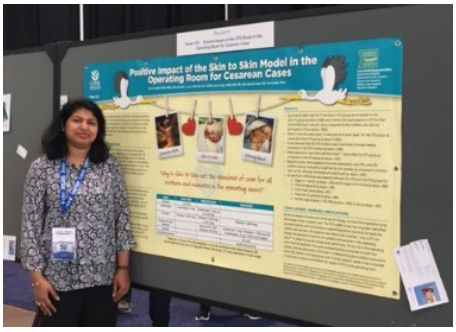
On Thursday, May 2, 2019, the Department of Mathematics and Statistics hosted the Central Region State Mathematics Contest Finals. Fifty-four students from middle schools and high schools participated in one of three levels. Fourteen students competed in Level 1, 14 students competed in Level 2, and 26 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 2019 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. M.A. 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.



M.A. graduate Monika Goel presenting a poster at a nursing conference.

In 2018, Ph.D. student Qi Zhang worked with physicians Promod Sethi and Jindong Xu of Cone Health Stroke Center under the supervision of Dr. Sat Gupta on a survival analysis project.

The Department, through the Statistical Consulting Center, has formed a collaboration with Guilford County Schools' AP Capstone Program, an advanced academic program culminating in a year long research project. The SCC provides statistical consulting services to the high school students working on these projects, providing valuable input on their projects, while also providing statistical consulting experience for our graduate students.

Moses Cone MedCenter

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.

14. Conferences

14.1 UNCG Summer School in Computational Number Theory and Algebra

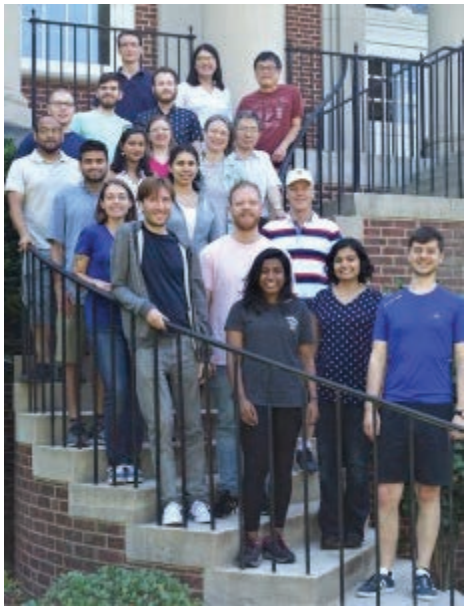
The summer school in computational number theory fills a gap in the education of many graduate students. Most graduate courses in number theory take a mainly theoretic approach with very little emphasis on the computational aspects of the subject. The goal of the UNCG Summer School in Computational Number 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.

On a typical day, external and local experts give talks in the morning, and in the afternoon, students solve problems related to this material. The talks early in the week introduce the students to the subject. Talks later in the week cover related areas of current research and unsolved problems. The problems given to the students might be of a theoretical nature but could also involve programming problems and computer experiments. All problems are aimed at increasing the students' understanding of the material by working with it.

Summer School 2019: Computational Aspects of Buildings

From June 24 to 28, 2019, the University of North Carolina Greensboro hosted the UNCG Summer School in Computational Number Theory and Algebra: **Computational Aspects of Buildings**.

Buildings provide a rich class of simplicial complexes with very nice local structure. They play key roles in several areas of mathematics, including number theory, geometry, algebra, and combinatorics. In this workshop, we studied the basic combinatorial and geometric structure of buildings and explored applications and open questions related to their large scale geometry, structure of their automorphism groups, existence of buildings with cocompact lattices and prescribed vertex link, and their role in algebraic combinatorics and the study of symmetric functions.



The summer school was attended by fifteen students and five faculty. The invited speakers were:

- Thibaut Dumont (University of Jyväskylä, Finland)
- Yusra Naqvi (University of Sydney, Australia)
- Xiangdong Xie (Bowling Green State University)

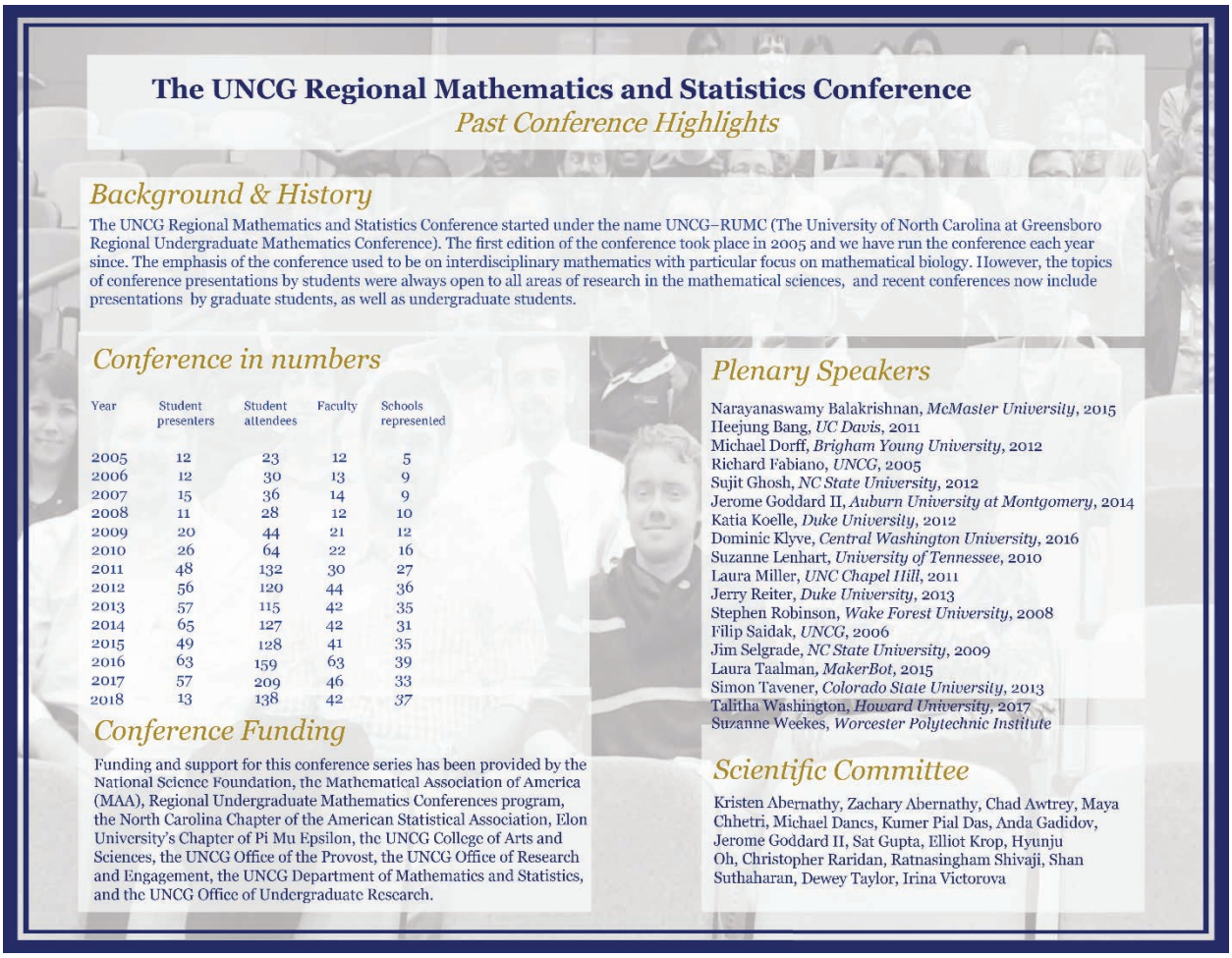
More information can be found at
https://mathstats.uncg.edu/numbertheory/summer_school/2019.

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



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.

In 2018, the conference was held on November 3, 2018 and was attended by 180 participants including:

- 138 students: 2 high school students, 106 undergraduate students, and 30 graduate students
- 42 faculty and industry representatives
- 13 UNCG undergraduate and graduate students presented talks at this conference. Two of our Math Ph.D. students Elliott Hollifield (Mentor Maya Chhetri) and Aaron Rapp (Mentor Tom Lewis) finished among the top three in the best presentation competition for graduate students.

The conference was very diverse as UNCG helps lead national efforts to increase opportunities for female and minority students in the science, technology, engineering and mathematics (STEM) fields. Almost 60% (80 out of 138) of the student participants were females.

The plenary lecture was delivered by Dr. Suzanne Weekes (Worcester Polytechnic Institute).

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

Please join me in congratulating and thanking Jan Rychtar (the lead organizer), Chad Awtrey (Elon University), Dewey Taylor (VCU) and the local organizing committee for hosting this successful conference. A big thank you also to Haley Childers and Carri Richter for handling all of the administrative work for the conference.

There were 27 different universities.

14.3 International Conference on Advances in Interdisciplinary Statistics and Combinatorics

The Mathematics and Statistics Department at UNCG has been hosting this important biennial event since 2007. AISC 2018 was held at the Elliott University Center on October 5-7, 2018. Dean Kiss inaugurated the conference. The conference featured a total of 32 sessions and 122 talks including 8 plenary talks and more than 25 talks by students. Barry Nussbaum, ASA President 2017, was the keynote speaker.
Other plenary speakers were:

David Dickey, William Neal Reynolds Distinguished Professor, Department of Statistics, North Carolina State University

Sujit Ghosh, Department of Statistics, North Carolina State University

Maria Ivette Gomes, University of Lisbon

Chris Nachtsheim , University of Minnesota

Barry Nussbaum, ASA President 2017, Former Chief Statistician, Environmental Protection Agency

Javier Rojo, Korvis Professor of Statistics, Oregon State University

Mahlet Tadesse, Department of Mathematics and Statistics, Georgetown University

Maura Stokes, Senior R&D Director, SAS Institute

Mathematics and Statistics faculty Sat Gupta, Scott Richter, Haimeng Zhang, Xiaoli Gao, Jianping Sun, Clifford Smyth, and Yu-Min Chung gave talks. Mathematics and Statistics Ph.D. students Romesh Thanuja, Bin Luo, Qi Zhang, Austin Lawson, James Rudzinski, and Matt Farmer also gave talks.

Two of our Mathematics and Statistics Ph.D. students finished among the top three in the best presentation competition for graduate students. Bin Luo (Mentor Xiaoli Gao) finished second and Austin Lawson (Mentor Greg Bell & Yu-Min Chung) finished third. Two undergraduate students who were part of UNCG Statistics REU won the top two awards in the undergraduate student category. They were Austin Miller (University of Wyoming, Mentor Xiaoli Gao) won the top prize, and Amber Young (Purdue University, Mentor Sat Gupta) finished second. Provost Dunn gave

away prizes to the student winners and the five senior NC statisticians at the conference banquet. Our own Sahana Balasubramanya gave a Bhartnatyam performance at the banquet.

The conference received sponsorship from IMA, SAS, ASA, NC-ASA, NISS, RHO, Springer, and Pearson.

Sat Gupta was the lead organizer for the conference with Haimeng Zhang serving as co-organizer. Other members of the local organizing committee were Scott Richter, Xiaoli Gao, Igor Erovenko and Somya Mohanty (Computer Science). Haley and Carri handled all of the administrative work for the conference. Monika Goel,with a large team of student volunteers, played a major role in running the conference flawlessly.

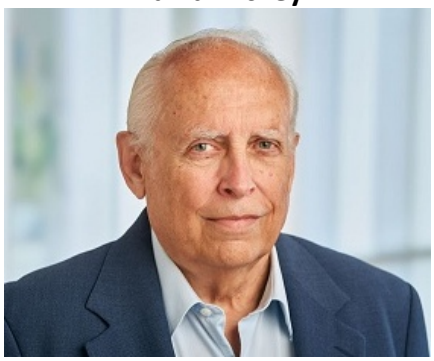
2018 NC ASA Senior Statistician Awards at AISC

The following senior NC statisticians were honored for their outstanding contributions to the theory and practice of statistics, particularly for their roles in the development of the subject in North Carolina.

David Banks

Duke University

David Dickey



North Carolina State University

Maura Stokes

SAS

Breda Munoz (RTI) and Sujit Ghosh (North Carolina State University) were honored for their service to the NC_ASA Chapter.

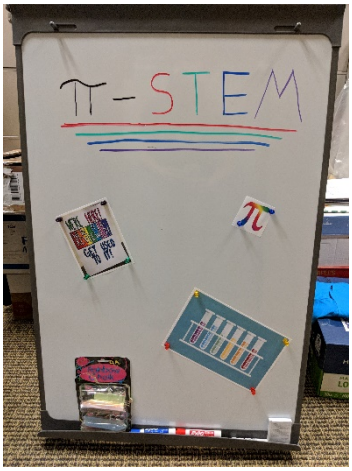
15. Student Clubs and Organizations

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

Talia Fernós, Faculty Advisor

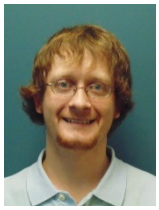
π-STEM is a graduate student group founded in collaboration between the Mathematics and Statistics Department and the Chemistry Department. It aims to build a community of STEM graduate students from underrepresented groups, in order to move toward proportional representations at all levels and areas of STEM. This is the 7th year of the AWM student chapter at UNCG. 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, as well as community building both at the department level and the college level. The AWM student chapter and the math students from π-STEM attended the AWM Conference at Wake Forest and several of the students presented their research there. The AWM student chapter is now in the process of organizing the second consecutive year of the AWM Conference in the Triad that will be hosted at UNCG.

AWM meeting



π-STEM booth at Science Everywhere 2018

15.2 Math Club



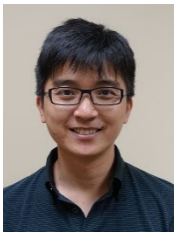
Tom Lewis, Faculty Advisor

The 2018-19 academic year was the eighth 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 on Thursday evenings. Meetings included a recruitment event with Lincoln Financial, a presentation about the Masters of Financial Mathematics program at NCSU, puzzles, community building, watching TED talks, a special meeting to learn about chaos theory, a joint meeting with AWM, and community outreach. The club organized a table for Pi day (3/14) to celebrate with math/pie-themed games and prizes and hosted an activity during the UNCG Science Everywhere event.

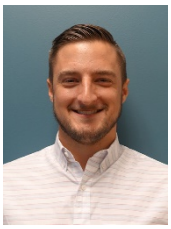
Pi Day contest

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

15.3 American Mathematical Society (AMS) Student Chapter



Yu-Min Chung, Faculty Advisor



Aaron Rapp, President, AMS Graduate Student Chapter at UNCG for AY 18-19

The AMS Graduate Student Chapter at the University of North Carolina at Greensboro (UNCG) was founded at the beginning of the Fall 2018 semester. The organization is open to all faculty, graduate-level students, and undergraduates who are considered juniors or higher by UNCG, if they are engaged or interested in mathematics and its application. The AMS Graduate student chapter's goal is to advocate for the mathematical community. The chapter hopes to accomplish this goal by participating in community outreach, attend conferences, and be engaged in research. In March the chapter participated in UNCG's Science Everywhere.

AMS student chapter meeting

15.4 Pi Mu Epsilon

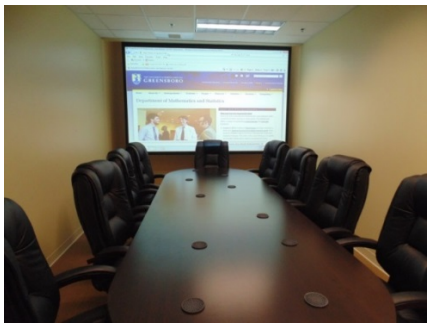
Rich Fabiano, Faculty Advisor

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: Robert Izydore, Michael Jarina, Ryan Parks, Juan Quiroa, Eric Sanchez, Kristen Scheckelhoff, Samip Thapa, Victor Vigoya, Luke Vilaseca.

We held an induction banquet to honor these students on April 30, 2019, 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

16. Departmental Spaces



Jerry and Theresa Vaughan Conference Room in Petty 149.

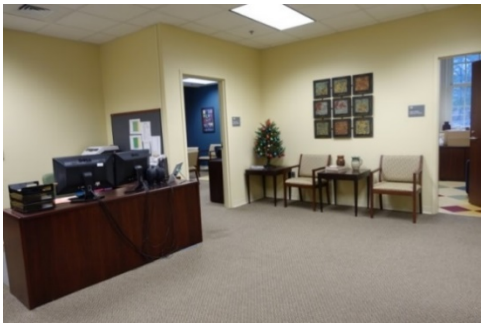
The **Math Emporium** is located in Graham 313.

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.

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