* Dr. Franke and his wife Debbie

Meet Dr. John Franke

Dr. John Franke was born in a small farming town west of Minneapolis and was raised in several small towns in Iowa. Growing up in a Lutheran parsonage, it was natural for him to attend Luther College in Decorah, Iowa where he earned a BA in mathematics and physics. After graduation, he taught mathematics and physics in high school for a year. Dr. Franke attended Northwestern University where he received his Ph.D in mathematics, which by the way he completed in four years. The final year of graduate school was spent outside of Paris at the Institut des Hautes Études Scientifiques, IHES, where Dr. Bob Williams, his adviser, was spending his sabbatical. After defending his dissertation, he and his wife toured Europe riding mopeds and camping. Wow, what a way to celebrate!

It was tricky to apply for an academic position from a foreign country, but NCSU offered him a one year teaching position. This one year position turned into a lifetime career where he worked up through the ranks to full professor. His research interests have been in the field of dynamical systems. His initial research was in the theoretical aspects including structural stability and classifications of maps. He worked with Dr. Jim Selgrade establishing some of the initial work on shadowing in differential equations. His more recent work has been on dynamical systems modeling biological systems in which he has found chaotic behavior.

Students at all levels have pursued research topics under his direction. Undergraduates have looked at fractals as well as some biological systems. Dr. Aziz Yakubu, former Ph.D. student, is now the chairman at Howard University and Dr. David Chan, former Ph.D. student, is at Virginia Commonwealth University. Differential equations, analysis, dynamical systems, chaos, and fractals are some of the classes Dr. Franke has taught.

Besides teaching and research he has served in several administrative capacities. He became director of summer school, for the Math Department starting in 2011. Dr. Franke has also served as the director of graduate studies, chairman of the Todd Fuller High School Mathematics Competition and Associate Head.

One of the highlights of his college days was meeting his wife Debbie who has been a wonderful partner for many years. She also double majored in mathematics and physics at Luther College and went with him to Northwestern where she earned an MS in physics. After coming to Raleigh, she earned an MS in electrical engineering at NCSU. Most people know Debbie for her marvelous cookies; just try to get one when he brings them to the department before Christmas. Dr. Franke has two daughters and nine grandchildren with whom he enjoys spending time with especially since most of them live in the Raleigh area.

Flying small airplanes is his passion. This summer he and Debbie took their most exciting trip to the west coast. It took an entire month and included stops in Texas and California on the way out and Montana and Iowa on the way back. If you get Dr. Franke started talking about airplanes, you will have a hard time pulling yourself away from his stories.

Course Highlights

MA 493-Differential Inequalities Research
Prerequisite: MA 425 or its equivalent is a prerequisite (MA 426 would also be a help)
This course is designed to introduce undergraduate students to the basic ideas and techniques in differential inequalities. We will then show how these methods can be applied to the study of systems of ordinary differential equations and also to optimization problems. Students will be expected to do presentations and there will also be a short project to be written up and turned in. At the end of the course the student should be in a position to work on a research paper (over the summer or during the next academic year). Also, any master's students are welcome to use this course as a beginning for their master's project.

MA/BIO 493: Mathematical Modeling Techniques for Biological Systems
Prerequisite: One year of calculus (MA 341 desirable)
This course seeks to provide students with a fundamental understanding of how mathematics and statistics are applied to problems in life sciences. Our approach will be through several ``case studies'' problems, which arise, in biological applications. For each case study we will discuss why a model is needed and what goals are to be sought. We will examine the mathematical models both analytically and computationally in order to compare their behavior with that exhibited by the modeled phenomena. Such a comparison can be achieved quantitatively through model verification and validation, which are central to the process of model development and evaluation for all complex systems. In particular, verification concerns with building the model right. It is utilized in the comparison of the mathematical model to its computer implementation. On the other hand, validation concerns with building the right model. It is utilized to determine that a model is an accurate representation of the real biological system. The emphasis of the course will be on the application and what mathematics and statistics can tell us about it. The course should serve both to give the student an appreciation of the use of mathematics and statistics and also to spark student interest for deeper study of some of the mathematical and statistical topics involved.

MA 512-Advanced Calculus
Prerequisite: MA 341
This class will be offered this spring and is open to both undergraduate and graduate students. This is a multi-variable calculus course, which seeks to reinforce and to move beyond the ideas explored in MA 242. There will be a careful treatment of continuity, partial derivatives, total derivatives as linear maps, the implicit and inverse function theorems, double integrals, triple integrals, and the change of variables theorem for such integrals. There will be a very basic formal introduction to differential forms in dimensions two and three. Line integrals and surface integrals will be defined utilizing both traditional vector methods and differential forms. There will be some emphasis on applications of the Stokes and Divergence theorems to electromagnetism, fluids, conservation laws in mechanics, etc. It should be understood that these applications will focus on those concepts accessible to students without prior knowledge of the applications being discussed.

MA 537 Nonlinear Dynamics and Chaos
Prerequisite: MA341 and MA405
The course topics include discrete and continuous dynamical systems, fixed points, periodic points and general orbits. Bifurcations and transition to chaos, Lyapunov exponents, strange attractors, and fractals

MA 591-Discrete Mathematical Biology
Prerequisites: At least 2 of 405, 407, 425 or consent of instructor.
This course will focus on the mathematical study of biological sequences (i.e. DNA, RNA, proteins). The mathematical tools for studying these objects come from discrete mathematics including graph theory, combinatorial optimization, and polyhedral geometry. We will learn to employ these tools to study traditional problems of computational biology with a view towards the interesting mathematics that arise. Topics we might cover include: sequence alignment, tree reconstruction, phylogenetic models, RNA secondary structure, and protein folding. No special knowledge of discrete math or biology will be assumed, all concepts will be explained in the course.

BMA / MA / ST 772-Biomathematics II: Stochastic Modeling in Biology
Stochastic models provide a useful and rigorous framework for analyzing natural phenomena subject to randomness. In this class, we study several stochastic models and emphasize their application to various realms of biology. Mathematical content includes both discrete- and continuous-time Markov processes, branching processes, counting processes, and diffusion processes. Areas of biological application include disease modeling, genetic drift, molecular evolution, and population dynamics. Special attention is paid to implementing computer simulations of Markov processes and to engaging the current scientific literature. **Prerequisite:** Although nominally a graduate course, the course is open to advanced undergraduates with a solid background in probability (ie, MA 421 or an equivalent). Note: It is not necessary to have taken BMA 771.

Advanced Mathematics Courses

The following classes may be used as advanced math Electives in the Spring 2012:

MA 325 Introduction to Applied Mathematics
MA 401 Applied Differential Equations II
MA 408 Foundations of Euclidean Geometry
MA 410 Theory of Numbers
MA 412 Long-Term Actuarial Models
MA 416 Introduction to Combinatorics
MA 421 Introduction to Probability
MA 426 Mathematical Analysis II
MA 428 Intro. To Numerical Analysis II
MA 432 Mathematical Models in the life &
　　　　　Social Sciences

MA 437 Applications of Algebra
MA 493 Differential Inequalities Research
MA/BIO 493 Mathematical Modeling Techniques for
　　　　　　Biological systems
MA 512 Advanced Calculus II
MA 513 Introduction to Complex Variables
MA 537 Nonlinear Dynamics and Chaos
MA 591 Discrete Mathematical Biology
BMA/MA/ST 772 Biomathematics II: Stochastic
　　　　　　Modeling in Biology

Honors Program

News from the Math Honors Program

We have several new students in the Math Honors Program: Joey Arthur, Alex Chin, Jordan Gower, Ethan Lockhart, Mark Schillaci, Alan Sheridan, Karen Stabile, William Vaughn, Tim Wessler and Michael Wright. Four students graduated last May: Zach Clawson, Mark Jayne, Rebecca Maust and Mike Schuster. Zach is in grad school in math at Cornell and also won an NSF Graduate Fellowship Mark is doing graduate work in math at NC State Becky is in grad school in math at Georgia Tech and Mike is in grad school at UNC in math. Thirty-nine students are currently participating in the Math Honors Program and invitations to join the program will be extended sometime during pre-registration. Every year approximately 20-25% of math graduates complete the Math Honors Program and about 80% of those students go on to graduate school. Schools they have attended include Berkeley, Princeton, Stanford, MIT, Cornell, NYU and UCLA. Math honors students have received 13 NSF Fellowships and four DoD Fellowships for graduate school as well as six Goldwater Scholarships and two Gates

Fellowships. Besides taking more challenging courses to complete their math degrees, Math Honors Program students also do research either at NC State or in a summer REU Program (Research Experience for Undergraduates). More than 30 students have completed a study abroad program focusing on mathematics, either at the Budapest Semesters in Mathematics or the Math in Moscow Program. Chris Thunes and Jeff Fowler did the Budapest Semesters in Mathematics last year and Sean Plummer is currently participating in BSM.

Participation in REUs, BSM and similar programs has played a major role in the success of our students in getting accepted into excellent graduate schools. Dr. Paur is happy to talk to any student interested in participating in the Math Honors Program –stop by her office in SAS 3144 or email her at sopaur@math.ncsu.edu for an appointment. More information about the program can be found on the Math Honors website at http://www.math.ncsu.edu/honors.

Undergraduate News

Undergraduate Research Opportunities

Dr. Molly Fenn

Mathematics students who are interested in participating in undergraduate research have several options. By seeking out a faculty mentor, students can begin working on research during the academic year. If you are interested in doing this, talk with your professors, attend talks in the department that sound interesting, check out the research interests of faculty using the department website, and talk to your peers. These are great ways to find faculty members who might have a project that interests you. Once you've found a research mentor and project, you can choose to earn academic credit for your research or apply for funding to support it. If you want to receive academic credit, you can enroll in an independent research course, MA 499 (or MA 491 for Math Honors students). Talk with your research mentor and academic adviser about this option.

The University's Office of Undergraduate Research offers funding of up to $1000 for undergraduate research projects. These grants can be used for supplies, books, software, travel to conferences, or other expenses related to your project. The next deadline for applying for these grants is October 24th. To find more information and the application details, go to www.ncsu.edu/undergrad-research.

Another exciting opportunity to participate in undergraduate research is through a summer Research Experience for Undergraduates (REU) program. These programs occur at universities around the country. They usually involve working on a project with a small group of other undergraduates under the direction of faculty mentors. These programs pay students a stipend for the summer and often include housing costs and some help with travel and meal expenses. Deadlines to apply for REU programs are usually in February. You can find lists of some math REU programs at the following websites: http://www.nsf.gov/crssprgm/reu/

Once you've worked on a research project, you may want to consider presenting your results. There are numerous opportunities to do this, from NC State's UG Research Symposia that take place every semester, to local or national conferences, to presentations within the department. For more information about finding these opportunities, contact Dr. Molly Fenn at mafenn2@ncsu.edu. Dr. Fenn is also the person to contact with questions about getting involved in undergraduate research.

SUM Series -Math and pizza!

The SUM Series features informal talks on mathematical topics. The talks are held Wednesdays from 4:00 to 4:50, in 2102 SAS Hall. You will have a few minutes to help yourself to pizza before the talk. For upcoming topics, check out the SUM Series website: http://go.ncsu.edu/sumseries. There is a low-volume (weekly) email list dedicated to announcements of upcoming SUM Series talks. Instructions for joining the list are on the website.

Need Access to the Undergraduate Lounge???

If you are a new or continuing Math Major who has not already requested access to the Undergraduate Lounge, you need to see Di Bucklad in SAS Hall 2108.

Undergraduate News

University of Surrey

Consider spending a semester (or more!) at another institution. Many schools, like Surrey, teach in English, but you are still immersed in a different culture. The Study Abroad Office (studyabroad.ncsu.edu) has more information on schools that partner with NCSU.

Integrated Undergraduate Training in Mathematics and Life Sciences at North Carolina State University

The overriding goal of the Integrated Undergraduate Training in Mathematics and Life Sciences at North Carolina State University, which is funded by the National Science Foundation, is to attract and train undergraduates in mathematics and life sciences for academic and nonacademic careers at the interface between mathematics, computational science, and life sciences. In particular, the program employs a multi-faceted approach to prepare the next generation of mathematicians and scientists who will meet the holistic, multi-disciplinary research problems of the 21st century. The program engages in cutting edge, significant, cross-disciplinary research; successful, well established curricular and support programs; as well as exciting, novel, new

initiatives. We aim to provide a comprehensive, challenging, yet supportive academic environment for students in mathematical and life sciences designed to ensure their success.

Starting in the 2012 Spring Semester, the program will train a cohort of eight undergraduates per year, divided into two groups, with joint mentoring of each 4-student group (two mathematics majors and two life sciences majors) by a pair of faculty members from mathematics and life science disciplines at NCSU as well as with our collaborators who are external to NCSU. To initiate students into the research projects, second semester junior students will take the MA/BIO 493 special topics course on "Mathematical Modeling Techniques for Biological Systems" and other course work to satisfy degree requirement. In the summer between junior and senior year, each cohort of a 4-student team will begin research on a carefully structured, closely mentored project.

The first semester of senior year will be spent tightening up research results, writing up the projects for journal submissions, preparing and giving presentations, while taking a full load of course work. Each student in the program will receive a stipend of $4,000 during the summer.

Math Riddle

I'm a four-digit number! My 2nd digit is twice greater than my 3rd. The sum of all my digits is thrice greater than my last digit! The product of my 3rd and 4th digits is 12 times greater than the ratio of my 2nd to 3rd. What am I?

Congratulations

Awards

- Zach Clawson (class of 2011) was awarded a National Science Foundation Graduate Research Fellowship which he will use to study applied mathematics at Cornell University. Clawson, a Caldwell Fellow from Manteo, North Carolina did an undergraduate research project with Professor Robert Martin and participated in an REU program at Cornell.

- Mathematics Department graduate Ashley Walls has won Arts NC State's 2010-2011 Creative Award for Dance. Walls, who will begin graduate study in the Mathematics Department this fall, won the award for her modern dance, "That One Should Always." Four earlier works by Walls have been presented in NC State Dance Company performances and other venues.

- Math Student Adam Keith was nominated for the 2011-2012 Astronaut Scholarship Foundation.

- The American Mathematical Society (AMS) has named NC State's Mathematics Department one of two winners of its 2011 "Mathematics Programs that Make a Difference" award. The award recognizes NC State's "extraordinary record in serving students who have traditionally been underrepresented in mathematics".

Undergraduate Program

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