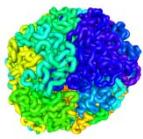


The Quaternion

Volume 27: Number 1; Fall, 2012
The Newsletter of the Department of Mathematics and Statistics



IN THIS ISSUE



The AMS Comes to Visit: the Section Meeting at USF	2
How the Human Genome Folds: the Nagle Lecture	4
Faculty News	5
STEM Education Center	6
Student News	7
Pi Mu Epsilon and Math Club News	8



The Quaternion is an annual publication of the USF Department of Mathematics and Statistics, which can be visited on the web at <<http://www.math.usf.edu/>>. Our snail-mail address is Department of Mathematics and Statistics, University of South Florida, 4202 E. Fowler Ave., CMC342, Tampa, FL 33620. Our phone number is (813) 974-2643, and our fax number is (813) 974-2700.

The AMS Comes to Visit

The American Mathematical Society (AMS) held its 1,079th meeting at the University of South Florida in Tampa over the March 10-11 weekend. 454 people registered, making it the fifth largest sectional meeting of the AMS ever.



Lunch in the BSN Atrium. The meeting was held in the Business Administration Building and Cooper Hall.

Founded in 1888, the AMS is the largest organization devoted to mathematics research and scholarship with over 30,000 individual and over 570 institutional members. The AMS holds meetings for mathematicians, mathematical scientists, and students to facilitate and encourage research and collaboration.

In a typical sectional meeting, the AMS will host a few invited speakers and solicit proposals for “special sessions”; a special session is devoted to a particular topic, and consists of ten to twenty invited talks. In addition, there may be sessions devoted to contributed talks.

In March, four invited speakers discussed DNA programming, the map color theorem, applying geometry to digital data sets, and Lie



Jamie Sprecher, Maja Milosovic, Corissa Kons, and Kristina Hilton work the registration desk

algebras. There were twenty-five special sessions, including ten organized or co-organized by USF faculty.

The AMS holds one or two international meetings annually, a Joint Meeting with the Mathematical Association of America and the Society for Industrial and Applied Mathematics each January, and slightly more than ten “sectional” meetings annually around the country.

continued ↗



Sherwin Kouchejian proposed the meeting and was the local organizer



Sandra Justice was the administrative liaison

The AMS Comes to Visit

continued from page 2



Lecturers spoke in the CPR and BSN classrooms



Participants could go outside to chat

This was the third time that the AMS came to USF Tampa. Two hundred and ten people registered at the 638th meeting in 1966, which featured three invited speakers and seven special sessions. Two hundred forty-nine people registered at the 895th meeting in 1991, which featured four invited speakers and twelve special sessions.



Twarock and two other visitors



Some speakers were students

One of the special sessions, the *Special Session on Discrete models in Molecular Biology* – organized by Alessandra Carbone of

the Université Pierre et Marie Curie, Nataša Jonoska of the University of South Florida, and Reidun Twarock of the University of York – segued into a three-day workshop on *Discrete and Topological Models in Molecular Biology*,



The workshop; Saito is in front right



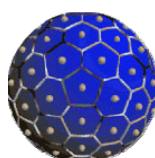
Jonoska (R) and three visitors

organized by Carbone, Jonoska, Katarzyna Rejniak of the Moffitt Cancer Center (an independent research hospital on USF grounds), and Masahico Saito of the University of South Florida.

There were 61 participants from Canada, France, Italy, Japan, the Netherlands, the United Kingdom, and the USA.



Newly published books, on research and teaching, were on display

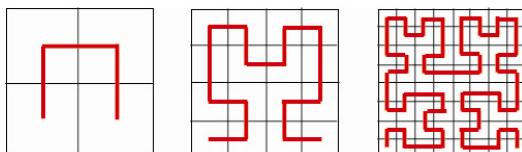


How the Human Genome Folds

The genome, said Erez Aiden, is “life’s little instruction book,” and its purpose is to enable cells, organs, and organisms to preserve the status quo while making copies of itself and thus taking over the world. The question is *how it is managed as a physical object*.

Erez Aiden delivered an R. Kent Nagle Memorial Lecture on April 18 on *How the Human Genome Folds*, for cells manage the genome by folding it up. It has to be folded up: it consists of two copies of a string of 3,000,000,000 codons (DNA base pairs), and each copy is two meters long, all of which has to fit into each cell nucleus.

Aiden described a model for how it is done: the “space-filling curves” of Giuseppe Peano and David Hilbert. The most popular of these is generated by repeatedly iterating the process below: the limit curve actually fills the square, even though, as a curve, it is the image of a line segment under a continuous function:

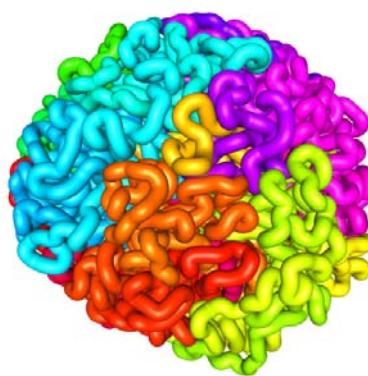


This is one of the classic fractal curves.

The important thing about this space filling curve is its hierarchical arrangement: a given subinterval of its domain is mapped onto a given subsquare of its range. It is not a spaghetti-like tangle. And that, claims Aiden, appears to be how the human genome is organized in the nucleus.

The equilibrium physics of polymers suggest that the genome should settle into a tangle. But it does not. Instead, it is wrapped in histone proteins to form spaghetti-like chromatin, which is then packed in a space-filling-curve-like

arrangement so that a substrand is all in one place, and could be pulled out if the cell wanted to make a transcription.



Different substrings are different colors, and a substring could be pulled out without unknotting anything.

This “fractal globule” is a model: Aiden said we lack tools to determine if this is how the genome is organized, although there is circumstantial evidence that it is.

Erez Lieberman Aiden is a Fellow of the Harvard Society. Two years after receiving his doctorate from Harvard and MIT, and three years after *Technology Review* listed him as one of 35 top innovators under the age of 35,



he has 37 patents or patents pending – including the iShoe, a device used to test the balance of elderly patients. His funded activities span classification neural cell types to cell phone recharging in rural Africa.

The Nagle Lecture Series was established in honor of the late R. Kent Nagle, a mathematician deeply interested in mathematics in itself, in education and in society. In this spirit, the NLS invites world renowned scholars to speak on such matters in lectures designed for the general public.

Faculty News

Arthur Danielyan

Arthur Danielyan joined the USF Department of Mathematics & Statistics as an instructor in 2003. He had received his doctorate from the Academy of Sciences of Armenia in 1987, and after teaching and researching at the Academy, at Moscow State University, and at the University of Oldenburg – among other places – he came to the United States in 1998, and worked at USF and the University of Central Florida.

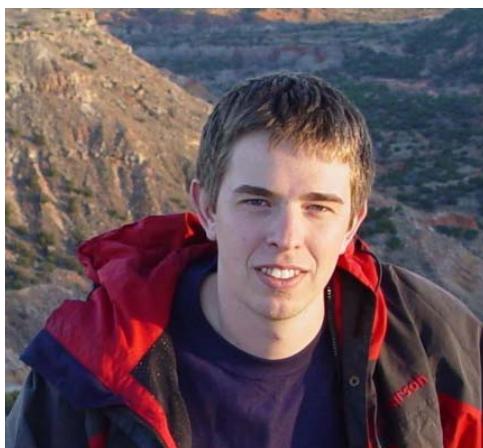


5

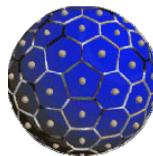
USF now has three types of instructor positions, and last spring **Dr. Danielyan was promoted from Instructor I to Instructor II**, a promotion analogous to the promotion from assistant professor to associate professor. In addition to his teaching, he is a prolific researcher concentrating in complex analysis and approximation theory.

Dmytro Savchuk

Dmytro Savchuk has just joined the USF Department of Mathematics & Statistics as an assistant professor. After matriculating at Kyiv Taras Shevchenko University, in the Ukraine, he came to Texas A & M University in 2003, where he earned a doctorate in 2009. He then served as Riley Assistant Professor at Binghamton University until this spring, where his service to students included advising the math club and the local Pi Mu Epsilon chapter.



Dr. Savchuk works in geometric and combinatorial group theory, with connections to automata theory. He has also worked on algorithms (including developing software) and low-dimensional topology.



STEM Education Center

Every summer, since 1979, the *Center for Mathematical Services* has offered a summer program for gifted high school students. This year, the renamed *STEM Education Center*, offered the program for the thirty-fourth year.

The six-week 2012 STEM Program, conducted from June 11 through July 20 for gifted high school students, consisted of two levels. Level I was for students entering grades 8, 9, and 10, while Level II was for students entering grades 11, 12, and for graduating seniors. The program was a success on several fronts, including:

1. Enrollment. This year we had the largest number of participating students ever: eighty-two students attended, a 67 % increase since last year. Students represented 41 high schools from the Tampa Bay area, plus one from Georgia and one from Jakarta.

2. Courses offered. Four courses were offered for college credit: *Engineering Calculus*, *Linear Algebra*, *Bridge to Abstract Mathematics*, and *Precalculus*. (And in these courses, many high school students outperformed USF students). In addition, students took courses in *Biophysics*, *Computer Animation*, *Architecture and the Environment*, *Explorations in Geology*, *Computer Modeling of an Epidemic*, and *The Heart of Mathematics*.

Eight students received scholarships through a grant from the Academy of Applied Science. These students, mentored by USF faculty members, were selected to work on research projects:

- *An inquiry into nanotechnology drug delivery methods to fight lung cancer*
- *The impact of a sustainability focused strategy on corporate structure*

- *Does anyone really know what time it is? An insight into the various aspects of time and their implications*
- *Fundamental sorting algorithms: Design, efficiency, and applications*
- *Re-design of a two degree-of-freedom powered prosthetic wrist*
- *The subset sum problem: Reducing time complexity of NP-completeness with quantum search*
- *Advantages and disadvantages of surgical mesh made of natural biomaterials*
- *Utilizing nanomachines/smart nanoparticles to enter the blood brain barrier to detect and treat brain cancer*

This year, more USF faculty taught in the program. Faculty included Dr. Donald Haynie (Physics), Dr. Thomas Bieske (Mathematics), Dr. Brendan Nagle (Mathematics), Dr. Jing Wang (Computer Engineering), Dr. Manoug Manouelian (Mathematics), Dr. Kingsley Reeves (Industrial and Management Systems Engineering), and Dr. Kathryn DeLaurentis (Mechanical and Aerospace Engineering), as well as graduate students Amber Bieske, Henry Custin and Ophelia George.

In addition to the grant received from the Academy of Applied Science, the program is grateful for assistance from the College of Arts and Sciences, the Department of Mathematics and Statistics, the University College, the Honors College, and the Jacarlene Foundation. Textbooks were provided by Brooks/Cole Publishers and Addison Wesley Publishers.

Student News

Seventy-seven students received seventy-nine degrees in mathematics and statistics during the 2011-2012 academic year.

August, 2011. B.A. in Mathematics:

Jonathan Brown; Pedro Gomez (magna cum laude); Kim Lucas; Mirela Ndrita; and Damon Page. **B.A. in Statistics:** Hongyi Chen (magna cum laude); Pedro Gomez (magna cum laude); Dhaval Mandaliya; and Jefte Ochaeta. **M.A. in Mathematics:** Kristen Childers, *Generalizing a Laplacian-type Equation in the Heisenberg Group and a class of Grushin-type Spaces*, under Thomas Bieske; Sherlene Enriquez-Sav; Matthew Fleeman; Seyed Zoalroshd. **M.A. in Statistics:** Xiaodan Zhang. **Ph.D. in Statistics:** Yong Xu, *Statistical models for environmental and health sciences*, under Chris P. Tsokos.

December, 2011. B.A. in Mathematics:

Mohammed Alim; Michael Chester; Donald Dahl (summa cum laude); Justin Doromal (cum laude, with honors); Darwin Dugar; Michael Foglia; Neli Gozo; Benimowei Jombai; Thu Nguyen; Chelsea Polka; and Maria Salas. **B.A. in Statistics:** Joseph Burchfield; Darwin Dugar; Julia Fernandez (magna cum laude); Omar Irizarry; Daniel Jackson; and Angela Lin. **M.A. in Mathematics:** Jennifer MacQuarrie, *Automorphism Groups of Quandles*, under Mohamed Elhamdadi; and Kari Sizemore. **M.A. in Statistics:** Yalan Tang. **Ph.D. in Statistics:** Keith Hackett, *Statistical analysis and mechanistic modeling of water quality: Hillsborough Bay, Florida*, under Chris P. Tsokos; Carlos Molinares, *Parametric and Bayesian Modeling of reliability and survival analysis*, under Chris P. Tsokos; Dimitrios

Vovoras, *Statistical analysis and modeling: cancer, clinical trials, environment and epidemiology*, under Chris P. Tsokos.

May, 2012. B.A. in Mathematics: Daniel

Ariew (with honors); Ryan Arredondo (cum laude); Shannon Barfield; Christeen Bisnath (cum laude, with honors); Christopher Cady; Graciela Carranza (cum laude); Nicole Dalzell (summa cum laude, with honors); Mark Diba; Joshua Donato; Alyssa Hambacher (cum laude, with honors); Ryan Hariprashad; Daria Karpenko (summa cum laude, with honors); Herman Lawrence; Matthew Maher; Michael Memole (summa cum laude); Nathaniel Moore (summa cum laude, with honors); Stacey Neff; Zachary Oreccchio (cum laude); Shaundra Pederson; James Ranceful; Virginia Rice; Kimika Rozier; Jacob Sedloff; Benjamin Stevens; John Theado (summa cum laude); Brian Tuesink; Alyssa Williams (cum laude, with honors); and Eric Young. **B.A. in Statistics:** Bridget Griffith; Michael Kotarinos (magna cum laude, with honors); Joshua Longcoy; and Cameron Lutz (magna cum laude). **M.A. in Mathematics:** Daria Karpenko, *Self-assembly of Self-similar Structures by Active Tiles*, under Nataša Jonoska; Emmanuel Appiah, *Pfaffian and Wronskian solutions to generalized integrable nonlinear partial differential equations*, under Wen-Xiu Ma; and Armando Signorini. **M.A. in Statistics:** Stephanie Branham; Maryam Habadi; Jean-Claude Pedjeu; Maral Saadati; and Taysseer Sharaf. **Ph.D. in Mathematics:** Magdy Asaad, *Pfaffian and Wronskian solutions to generalized integrable nonlinear partial differential equations*, under Wen Xiu Ma.

Math Organization News

PME News

The 2011-2012 President and Vice-President of our USF-based Florida Epsilon Chapter of Pi Mu Epsilon, the national math honor society, were Ryan Arredondo and Timothy Yeatman, respectively.

Thirteen new PME members were inducted in April of 2012: Rachel Coker, Kimberly Creech, Sarah Croome, Daniel Cruz, Zachary Forrest, Kyle Jutras, Daviel Leyva, Kira Mark, Maja Milosevic, Michael Mormino, Junyi Tu, Michael Uanino, and Brendan Weger. The Induction Ceremony invited speaker was Dr. Dave Snider, USF Emeritus Professor, with the presentation “Go Forth and Multiply”.



Daria Karpenko

The winner of the 2012 PME Outstanding Scholar Award was Daria Karpenko. She received a \$500.00 Nagle Memorial Scholarship, and a commemorative plaque at the PME Banquet in April. Daria was also invited to address the USF Math Club, and she

did so with the presentation *DNA Tiles and Self-Assembly*, based on research she conducted at USF with Professor Nataša Jonoska.

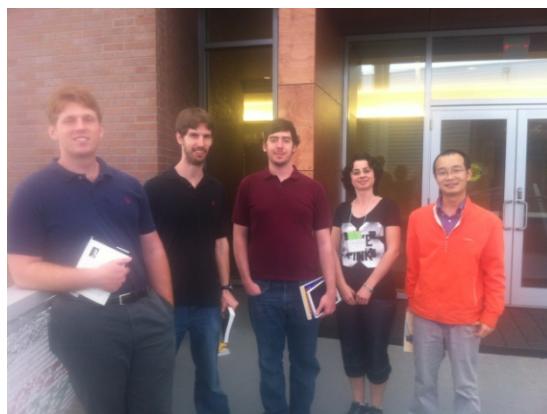
Math Club News

USF Math Club officers during the 2011-2012 academic year were Jamie Sprecher (President), Greg Churchill and Michael Kotarinos (Vice-Presidents for the fall semester, and spring semester, respectively), and Maja Milosevic (Treasurer).

Math Club activities included the following:

1. Many mathematics students, mostly undergraduates, attended the MAA Florida Suncoast Meeting at Florida Southern College in Lakeland and the Florida Regional MAA Meeting at the University of North Florida in Jacksonville. Student presentations by USF undergraduates at these MAA regional meetings included *Introduction to Knot Theory* by Tim Yeatman, and *Music Theory and Discrete Math* by Mariam Osman.

continued on page 9 ➞



Lucky Landrigan, Tim Yeatman, Ryan Arredondo, Canan Unlu, and Junyi Tu at the MAA meeting at UNF-Jacksonville

continued from page 8

2. Organizing and helping conduct math activities for K-12 Hillsborough County students during the 2012 USF Engineering Expo. Jamie Sprecher and Maja Milosevic held court at the math club table with activities concerning Babylonian math, performing calculations in the sexagesimal system and writing numbers using styluses and clay tablets, and having fun doing traditional paper-folding origami constructions.

3. Holding biweekly math club meetings throughout the academic year. One of the highlights of the meetings was the March 23 presentation on *Applications of Stochastic L-Systems to Leaf Mass and Branching Structures* by undergraduate students Ryan Arredondo, Tim Yeatman, and Michael Kotarinos. They presented their work submitted in February to the Mathematical Competition in Modeling (MCM), an annual 96-hour modeling competition challenging teams of students all over the world to clarify, analyze, and propose solutions to open-ended problems. Dr. Brian Curtin was faculty team advisor.

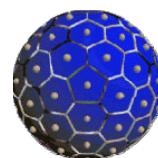
4. Sponsoring the popular monthly contest called “The Math Problem of the

9



Jing Lin

Month”. This competition is open to all USF undergraduate students, and features a monthly math problem carefully chosen by Dr. Milé Krajčevski to challenge the math abilities of our best math undergraduate students. At the end of the academic year the overall winner was (for the second year in a row) Jing Lin, a math and engineering student with a knack for finding elegant solutions to difficult problems. Jing was awarded a trophy and books at the PME Banquet in April.



We'd Like to Hear from YOU!

The Department of Mathematics & Statistics would like to hear from alumni, friends, collaborators, members of the community, and fellow explorers of and guides to the world of mathematics and statistics. Contact us at: 974-2643, or fax 974-2700. We have a web-page at <http://www.math.usf.edu/>. Snail-mail address is Department of Mathematics & Statistics, University of South Florida, 4202 E. Fowler Ave., CMC342, Tampa, FL 33620.

Appeal for funds

We are a growing department in a new university, and we strive to develop new programs to meet the needs and provide opportunities for our students and our community to fulfill their aspirations. With all due respect to Benjamin Franklin, many of the best things in education and scholarship cost money. We would appreciate any assistance we can get from alumni and the community. Feel free to contact our chair, Marcus McWaters, at the above address for details.