SCHOOL OF MATHEMATICS
PROOFREADER

FOR ALUMNI AND FRIENDS

Georgia Tech

MEET OUR MAJORS

LEARN ABOUT THE SCHOOL'S UNDERGRADUATE PROGRAM FROM THE STUDENTS THEMSELVES

JANUARY 5, 2021 | ATLANTA, GA

The nine majors offered by the College of Sciences provide undergraduate students with countless opportunities for learning, growth, and discovery. Check out our website to learn about the undergraduate programs directly from eight students, including this interview with graduating SoM all-star, Steven Creech.

Why did you choose to study your major at Georgia Tech?

I decided to major in mathematics as I saw that math was the language of the sciences.

What is the best part of your major?

Steven Creech - Mathematics Graduate from Cumming, Georgia

Whenever we prove a statement that statement is always true.

Use three words to describe your major.

Proofs, Beauty, Pure.

Tell us about your favorite class you've taken within your major.

My favorite class has been algebraic geometry as it provided a dictionary between the language of algebra and geometry.

Who is a professor that has inspired you?

My research advisor Matt Baker has been the professor who has inspired me the most .

What do you plan to do after graduation?

After graduation, I plan to go to graduate school at Brown University to study number theory and algebraic geometry (specifically arithmetic geometry).

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RESEARCH OPPORTUNITIES FOR UNDERGRADUATE STUDENTS

FEBRUARY 8, 2021 | ATLANTA, GA

On and off Georgia Tech's campus, there are countless opportunities for undergraduate students to gain practical skills, connections with industry leaders, and hands-on experience through research and internship opportunities.

The NSF REU (Research Experience for Undergraduates) program is designed to provide meaningful research experiences to undergraduates who may not otherwise have the opportunity, with an ultimate goal of increasing matriculation in STEM careers and graduate school.

Most NSF REU programs are designed to pair students attending smaller and undergraduate-only schools with faculty and lab groups at larger host institutions for mentorship and a meaningful research experience.

Students learn dynamical systems analysis for applied problems, working on original research in with novel results in both mathematical and applied contexts. They work in pairs, gaining teamwork experience. These skills and accomplishments will serve them well in any future career choice.

Importantly, as NSF notes, the inclusion of historically under-represented groups in STEM (minorities, low socio-economic status, first generation students, veterans and women) will serve to broaden the STEM talent pool.

As such, most REU programs in the College of Sciences at Georgia Tech host a diverse cohort of approximately ten non-Georgia Tech undergraduates, who have limited research opportunities at their current institution. Each unique program's focus and requirements vary, so check individual program links for application guidelines and deadlines.

The School of Mathematics at Georgia Tech has a rich tradition for undergraduate research. The projects have been mentored by many different faculty, on topics ranging from consumer fad formation, to random walks, tropical geometry, one bit sensing, extremal graph theory, and convex polyhedra. Our students have published many papers, have won a number of awards, and have been very successful in their graduate school applications.

Doron Lubinsky - Generalizations of Orthogonal Polynomials and Erdos-Szekeres Type Problems

Student: Cooper Billsborough (GaTech), Michael Freedman (U Florida), Samuel Hart (GaTech), Ari Pomeranz (U Maryland), Gidon Kowalsky (GaTech), Ana Sammel (Humbolt State U)

We studied the growth of Erdos-Szekeres polynomials on the unit circle. Erdos and Szekeres introduced these in the 1950's, motivated by questions in combinatorics. The topic has attracted the interest of many researchers, including Jean Bourgain. We obtained new lower bounds using Poisson integrals, and using Kellogg's extension of the Hausdorff-Young inequalities. The results will appear the paper "On Lower Bounds for Erdos-Szekeres Polynomials", that will appear in the Proceedings of the American Mathematical Society.

Cheng Mao - Statistical Ranking

Students: Zachary Sekaran (UPenn), Haoran Zhang (GaTech)

Our REU project "Statistical Ranking" studied the widely used Elo rating system both theoretically and numerically. In particular, the two students applied statistical modeling and optimization tools to rigorously analyze how fast the Elo ratings converge to the ground truth. Through the REU program, the students obtained research experience in mathematical statistics and learned several related topics at the graduate level, which prepares them for research in graduate schools. This project is the first of a series of undergraduate research projects at Georgia Tech that aims at connecting ranking systems used in practice and the statistical theory behind them.

Lutz Warnke - Random Graphs/Networks

Students: Tolson Bell (GaTech),
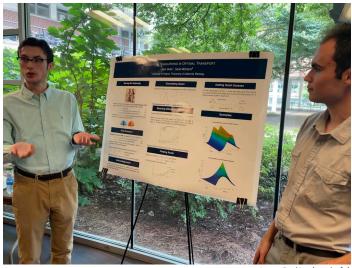*Suchakree "Petch" Chueluecha (Lehigh U)*

We worked on the well-known Sunflower Problem of Erdős and Rado from 1960. One goal was to understand the 2019 breakthrough by Alweiss, Lovett, Wu and Zhang on the topic, and during the virtual REU we managed to improve the best-known bound on the Sunflower Problem by a tiny bit (improving a logarithmic factor slightly). This result was disseminated by one journal publication as well as 6 talks and 2 poster presentations (including ``Honorable Mention'' at the 2021 JMM). This helped the students secure admission to PhD Programs at Carnegie Mellon University and University of Virginia (with Ken Ono); Tolson Bell was also awarded a prestigious NSF Graduate Research Fellowship.

Rachel Kuske and Larissa Serdukova - Dynamics and Noise in Energy Harvesting/Optimization Algorithms

Students: Sam Dulin (University of Virginia), Ariba Khan (Agnes Scott College), Kailee Lin (Harvey Mudd College), Yihua Xu (GaTech)

The students worked on nonlinear dynamical analysis and computational methods, in order to study complex nonlinear behavior in new types of vibro-impacting energy harvesting systems and dynamic dampers. With this expertise, they will explore the impact of variation in design parameters for the devices on their performance and energy output. They will also have the opportunity to compare how different types of input can benefit or disrupt the dynamics and the energy profile.

Students learn dynamical systems analysis for applied problems, working on original research in with novel results in both mathematical and applied contexts. They work in pairs, gaining teamwork experience. These skills and accomplishments will serve them well in any future career choice.

Sam Dulin (on left)

This work is part of an international collaborative group. The REU teams contribute novel results that are important in the settings for this funded research.

The School of Mathematics at Georgia Tech has a rich tradition for undergraduate research. The projects have been mentored by many different faculty, on topics ranging from fad formation, to random walks, tropical geometry, one bit sensing, extremal graph theory, and convex polyhedra.

This broader multidisciplinary project is an international collaboration between Georgia Tech, Georgia State University and Heriot-Watt University in the area of applied mathematics, nonlinear dynamics and energy harvesting with soft electroactive polymers. The project will address gaps and opportunities in mathematical developments and in practical applications for impact-based engineering devices and systems with non-smooth dynamics, critical for understanding the harvesting of vibrational energy.

Find more details on our website
https://math.gatech.edu/undergraduate-research

MOLEI TAO'S FIRST RESEARCH PAPER ON MACHINE LEARNING TAKES TOP HONORS AT AI CONFERENCE

SEPTEMBER 18, 2020 | ATLANTA, GA

School of Math associate professor gets top honor at international artificial intelligence conference.

A mathematician by trade, Molei Tao typically uses mathematics to design algorithms and solve physical science problems like how planets move. Recently, he became attracted to machine learning, an area that according to him, contains numerous interesting problems that are mathematically exciting and can benefit from modern mathematical tools.

This year, Tao, an associate professor in the School of Mathematics, published his first machine learning conference paper, and this work was awarded the best paper award at the 23rd International Conference on Artificial Intelligence and Statistics (AISTATS).

His paper, Variational Optimization on Lie Groups with Examples of Leading (Generalized) Eigenvalue Problems, details a natural way for adding momentum to the gradient descent optimization in non-flat spaces. In flat spaces, the approach of adding momentum for accelerating the training of machine learning models has already been tremendously successful, and this new progress expands the applicability of the popular and powerful idea.

Georgia Tech is full of leaders in machine learning with different areas of expertise. We are proud of how Molei continues to innovate and further connect machine learning to real-world problems, both physically and computationally.

Tao felt fortunate to win this recognition. He and his co-author, Tomoki Ohsawa of the University of Texas at Dallas, had read many classical works from previous proceedings of AISTATS. Impressed with the quality of work, the authors chose to submit their first draft to it.

Molei Tao

"We really did not think of winning the award at all. The completion of our work was around the AISTATS submission deadline, so we just submitted happily," said Tao. "This submission confirmed to me how vibrant the machine learning community is. They are open to new ideas and many people made real efforts to understand this theoretical work and ask good questions."

Tao was also encouraged by the collaborative and interdisciplinary environment provided by the Machine Learning Center at Georgia Tech (ML@GT) where Tao is also a faculty member.

"Georgia Tech is full of leaders in machine learning with different areas of expertise. We are proud of how Molei continues to innovate and further connect machine learning to real-world problems, both physically and computationally, and look forward to his future accomplishments" said Irfan Essa, ML@GT executive director.

Tao stated that winning this award encouraged him, and hopefully other mathematicians and scientists, to continue searching for fusion of ideas and creating new venues of applications.

Queensferry Crossing from Port Edgar Maria (Credit: Transport Scotland)

NEW 'VIBRANT PACK ENERGY HARVESTERS' TO HARNESS BIG BRIDGE VIBRATIONS

JULY 20, 2021 | ATLANTA, GA

Harnessing Vibrations Caused by Wind

Traffic and wind regularly cause low frequency vibrations to ripple through bridge building materials such as steel and concrete. This energy would normally travel away from its source before dissipating — but academics at Heriot-Watt University in Edinburgh alongside colleagues from Georgia State University and Georgia Tech in the US have recognized an opportunity. They intend to capture and recycle this untapped source by using the principles of physics.

They have received £340,000 (about $463,000) from the Engineering and Physical Sciences Research Council (EPSRC), part of UK Research and Innovation, and $443,000 from the National Science Foundation (NSF) to research

and develop a revolutionary vibro-impact energy harvesting device.

Daniil Yurchenko, Ph.D., from Heriot-Watt University, has created a prototype called a 'vibrant pack energy harvester' that can be fitted at multiple locations on a bridge.

A New Approach

These autonomous devices, measuring around 5 – 10cm in length, do not require wiring to an electrical power source and are relatively cheap to manufacture. They work by holding a small ball housed within a tube that rolls back and forth as the device absorbs low frequency vibrations. As the ball moves, it impacts on non-conductive materials, known as

dielectric membranes, located at either end of the tube. When the membrane is stretched, a brief electrical charge is applied but once it returns to its undeformed state, the generated excessive electrical charge can be harvested.

This electrical energy is stored in a battery and used to power a sensor capable of monitoring the structural integrity of a bridge. Engineers can then record multiple measurements, such as vibrations, traffic load, wind and temperature, all at the same time but without the need for specialist infrastructure to be installed at significant cost.

Yurchenko, from the School of Engineering and Physical Sciences at Heriot-Watt University, explains that while dielectric elastomer technology has been tried in wave energy, nothing has been done on this centimetre scale before.

"What we are doing is creating a more efficient and cost-effective solution by harvesting energy that would otherwise be lost," he said.

As the ball moves, it impacts on non-conductive materials, known as dielectric membranes, located at either end of the tube. When the membrane is stretched, a brief electrical charge is applied but once it returns to its undeformed state, the generated excessive electrical charge can be harvested.

"It's something that has never been done before in this way.

"It's a technology that can be used on any bridge anywhere in the world. There are plenty of places where these devices can be fitted to a bridge structure such as on cables, on the pillars, other side of the bridge deck, there really aren't any limits.

"The biggest problem in energy harvesting is that the absolute amount of energy produced by a typical device is very small due to the low available level of vibrations. In fact, for the past 100 years scientists have been fighting adverse vibrations to ensure that bridges are safe. So, through this work we will try to optimise the performance of our vibro impact energy harvesting device tuning it to the bridge application."

The team is working alongside Wenzel Consult, an independent company that specialises in bridge sensor technology in Austria and Turkey. As the project advances, the scientists say they intend to carry our real-life testing of their prototype on a 32-meter long highway bridge in northern Austria.

Rachel Kuske

The multidisciplinary project, entitled, Stochastic Nonsmooth Analysis For Energy Harvesting, is due to complete in 2024.

Rachel Kuske, professor and chair of the School of Mathematics at Georgia Tech, said: "While the device has nonlinear behaviour, which is beneficial in generating more energy than is used to power the device, the same nonlinearity can result in a range of complex responses to the vibrations.

"We will use dynamical analyses to predict the different types of responses, as well as to select design choices for responses that optimise energy output. As the bridge vibrations are also inherently noisy, the analysis will also identify how to leverage noise sources that are beneficial and mitigate effects from detrimental noise sources."

Professor Igor Belykh, co-investigator from Georgia State University, adds: "This project seeks to provide guidelines for designing power supplies that can harvest energy from bridge oscillations. These energy harvesters can be used in bridge damage sensors thereby minimising sensor maintenance/battery replacement and decreasing the associated risks to service personnel on high suspension bridges. Moreover, this project is synergistically connected to another project supported by NSF grant (2019-2022) 'Modern approaches to modelling and predicting bridge instabilities' that will inform the design of energy harvesters by offering a dynamical characterisation of bridge oscillations and external perturbations to be harvested."

The scientists say that in the future the same technology could be adapted and used to harvest energy from other vibrating man-made structures and machines.

This story by Craig McManamon first appeared in the Heriot-Watt University (Edinburgh, Scotland) newsroom and has been tailored for Georgia Tech audiences.

A collection of "BOBbots" in motion (Credit: Shengkai Li, Georgia Tech)

SIMPLE ROBOTS, SMART ALGORITHMS:

MEET THE BOBBOTS

APRIL 29, 2021 | ATLANTA, GA

Anyone with children knows that while controlling one child can be hard, controlling many at once can be nearly impossible. Getting swarms of robots to work collectively can be equally challenging, unless researchers carefully choreograph their interactions — like planes in formation — using increasingly sophisticated components and algorithms. But what can be reliably accomplished when the robots on hand are simple, inconsistent, and lack sophisticated programming for coordinated behavior?

A team of researchers led by **Georgia Tech ADVANCE Professor of Computing and Adjunct Professor of Mathematics Dana Randall**, and Daniel Goldman, Dunn

Family Professor of Physics, sought to show that even the simplest of robots can still accomplish tasks well beyond the capabilities of one, or even a few, of them. The goal of accomplishing these tasks with what the team dubbed "dumb robots" (essentially mobile granular particles) exceeded their expectations, and the researchers report being able to remove all sensors, communication, memory and computation — and instead accomplishing a set of tasks through leveraging the robots' physical characteristics, a trait that the team terms "task embodiment."

The team's simple BOBbots, or "behaving, organizing, buzzing bots" were named for granular physics pioneer Bob Behringer," explains Randall. "Their cylindrical chassis

have vibrating brushes underneath and loose magnets on their periphery, causing them to spend more time at locations with more neighbors." The experimental platform was supplemented by precise computer simulations led by Georgia Tech physics student Shengkai Li, as a way to study aspects of the system inconvenient to study in the lab.

(Credit: Shengkai Li, Georgia Tech)

When sensors, communication, memory and computation are removed from a group of simple robots, certain sets of complex tasks can still be accomplished by leveraging the robots' physical characteristics

Despite the simplicity of the BOBbots, the researchers discovered that, as the robots move and bump into each other, "compact aggregates form that are capable of collectively clearing debris that is too heavy for one alone to move," according to Goldman. "While most people build increasingly complex and expensive robots to guarantee coordination, we wanted to see what complex tasks could be accomplished with very simple robots."

Their work, as reported April 23, 2021 in the journal Science Advances, was inspired by a theoretical model of particles moving around on a chessboard. A theoretical abstraction known as a self-organizing particle system was developed to rigorously study a mathematical model of the BOBbots. Using ideas from probability theory, statistical physics and stochastic algorithms, the researchers were able to prove that the theoretical model undergoes a phase change as the magnetic interactions increase — abruptly changing from dispersed to aggregating in large, compact clusters, similar to phase changes we see in common everyday systems, like water and ice.

While most people build increasingly complex and expensive robots to guarantee coordination, we wanted to see what complex tasks could be accomplished with very simple robots.

"The rigorous analysis not only showed us how to build the BOBbots, but also revealed an inherent robustness of our algorithm that allowed some of the robots to be faulty or unpredictable," notes Randall, who also serves as a professor of computer science and adjunct professor of mathematics at Georgia Tech.

Sarah Cannon, Georgia Tech alumna and assistant professor in the Mathematics Department of Mathematical Sciences at Claremont McKenna College, with Dana Randall

The collaboration is based on experiments and simulations also designed by Bahnisikha Dutta, Ram Avinery and Enes Aydin from Georgia Tech, as well as on theoretical work by Andrea Richa and Joshua Daymude from Arizona State University, and Sarah Cannon from Claremont McKenna College, who is a recent Georgia Tech graduate.

This work is part of a Multidisciplinary University Research Initiative (MURI) funded by the Army Research Office (ARO) to study the foundations of emergent computation and collective intelligence.

This story was first published on EurekAlert! by Georgia Tech.

Bahnisikha Dutta, a graduate student at Georgia Tech, is part of an interdisciplinary research team that creates and studies magnetic robots (Credit: Allison Carter, Georgia Tech)

MAYYA ZHILOVA RECEIVES NSF CAREER AWARD

MARCH 8, 2021 | ATLANTA, GA

Mayya Zhilova

An assistant professor in the School of Mathematics is receiving a 2021 National Science Foundation Faculty Early Career Development Program (NSF CAREER) Award for research into promising aspects of statistical analysis, and for her outreach and mentorship plans for students and high schoolers from underrepresented communities.

Mayya Zhilova's NSF project, "New Challenges in High-Dimensional and Nonparametric Statistics," will "address challenging open questions in high-dimensional and nonparametric statistics motivated by practical applications in finance, engineering, and life sciences," as Zhilova writes in her abstract.

Contemporary problems concerned with analysis of complex and high-dimensional data sets require addressing numerous questions about fundamental concepts in statistics, data science, and related fields. This is particularly relevant for high-dimensional and nonparametric statistics. In high-dimensional statistics, one studies problems involving data sets of high complexity and dimensionality. Methods that are used in nonparametric statistics typically impose much weaker assumptions on a statistical model than the parametric statistics does. In general, this leads to a smaller modeling error and to a broader range of applications, or real-life problems, where these methods can be used.

Zhilova adds in her abstract: "The project is focused on development of new methods of statistical inference for complex data sets providing high accuracy and explicit theoretical guarantees. This includes *(i)* development of a novel framework for statistical inference that will considerably extend the range of applicability of some of the major statistical methods; *(ii)* studies of performance of resampling methods in a high-dimensional framework; and *(iii)* studies of intrinsic properties of high-dimensional models that ensure good performance of the statistical methods."

The educational aspect of Zhilova's NSF CAREER project includes mentorship of graduate and undergraduate students, summer camps in statistics and data science for STEM-oriented high school students, and a workshop/graduate school offering on high-dimensional statistics and learning theory for junior researchers. Zhilova notes that special attention will be given to supporting students and researchers from underrepresented minorities.

Award-winning plan will study challenging problems in contemporary statistics and data science, and includes mentorship and educational activities for junior researchers and high school students.

The NSF CAREER Program is one of the Foundation's most prestigious awards in support of early-career faculty who have the potential to serve as academic role models in research and education, and to lead advances in the mission of their department or organization. The NSF notes that activities pursued by early-career faculty recipients should build a firm foundation for a lifetime of leadership in integrating education and research.

Zhilova began work at the School of Mathematics at Georgia Tech in 2016, and is an affiliate faculty member of the Center for Machine Learning at Georgia Tech and the Transdisciplinary Research Institute for Advancing Data Science (TRIAD). Before coming to Atlanta, Zhilova was a researcher at the Weierstrass Institute for Applied Analysis and Stochastics, and at the School of Business and Economics at the Humboldt University of Berlin. She received her M.S. from the Lomonosov Moscow State University, and her Ph.D. from the Humboldt University of Berlin.

TWO SoM FACULTY INVITED TO SPEAK AT JMM

FEBRUARY 2, 2021 | ATLANTA, GA

The Joint Mathematics Meetings (JMM) is the largest meeting of the year, bringing together researchers from every corner of the country and from every disicpline. Two of the invited speakers were SoM faculty, and one was an SoM alumni.

ASL Invited Address - Anton Bernshteyn
Descriptive combinatorics and distributed algorithms

Descriptive combinatorics is the study of combinatorial problems (such as graph coloring) under additional topological or measure-theoretic regularity restrictions. It turns out that there is a close relationship between descriptive combinatorics and distributed computing, i.e., the area of computer science concerned with problems that can be solved efficiently by a decentralized network of processors. This talk outlined this relationship and presented a number of applications.

Current Events Bulletin Session - Jennifer Hom
Getting a handle on the Conway knot

When does a knot bound a disk? In three dimensions, the only knot that bounds a smoothly embedded disk is the unknot. However, if one considers disks in the four-ball, the answer becomes significantly more difficult.

A knot is called slice if it bounds a smooth disk in the four-ball. For 50 years, it was unknown whether a certain 11 crossing knot, called the Conway knot, was slice or not, and until recently, this was the only one of the thousands of knots with fewer than 13 crossings whose slice-status remained a mystery. This talk described Lisa Piccirillo's proof that the Conway knot is not slice.

AMS Invited Address - Ryan Hynd (MSc 2004)
The Hamilton-Jacobi equation, past and present

Nearly two centuries ago, William Rowan Hamilton observed that the equations of motion in classical mechanics can be derived by finding stationary points of a certain integral. In addition, he identified an equation satisfied by the integral itself, which is now known as the Hamilton-Jacobi equation. These ideas were later expanded upon by scientists who grappled with the challenges of understanding how to regulate machines, control spacecrafts, and optimize the production of goods. In recent years, mathematicians have made tremendous progress in developing a theory of control which prominently features a Hamilton-Jacobi equation. This talk discussed the highlights of this theory, some applications, and a few theoretical issues of recent interest.

Past NSF CAREER recipients:

» 1997 Dana Randall	» 2010 Dan Margalit	» 2016 Michael Damron
» 2002 Robert Ghrist	» 2010 Maria Westdickenberg	» 2017 Zaher Hani
» 2003 John Etnyre	» 2012 Anton Leykin	» 2018 Galyna Livshyts
» 2003 Mohammad Ghomi	» 2014 Greg Blekherman	» 2019 Yao Yao
» 2006 Chongchun Zeng	» 2015 Karim Lounici	» 2019 Molei Tao
» 2007 Hao-Min Zhou	» 2016 Esther Ezra	» 2019 Shahaf Nitzan
» 2008 Yuri Bakhtin	» 2016 Jen Hom	» 2020 Lutz Warnke
» 2010 Brett Wick	» 2016 Kirsten Wickelgren	

DAN MARGALIT AWARDED THE AMS CONANT PRIZE

NOVEMBER 6, 2020 | ATLANTA, GA

Congratulations go to Dan Margalit who has been awarded the AMS Conant Prize for his article "The Mathematics of Joan Birman."

This prize was established in 2000 in honor of Levi L. Conant to recognize the best expository paper published in either the Notices of the AMS or the Bulletin of the AMS in the preceding five years.

Margalit's portrait of Birman shows a visionary mathematician who was often ahead of her time, forged her own paths, and followed "her own vision, interests, and curiosity," while simultaneously building bridges across disciplines through highly productive collaborations. The author takes a long view, highlighting the significance of Birman's work in ways that are only possible in a major retrospective. He chooses to provide an overview of Birman's career that focuses exclusively and deservedly on her mathematics rather than on her nontraditional career trajectory. He tells a coherent and engaging mathematical story, offering a broad perspective on these topics, but also bringing a highly detailed knowledge of them to the front as needed. Readability and accessibility are never compromised, so that the article could also serve as an excellent introduction to a wide variety of topics in these areas of mathematics.

Dan Margalit

About the Prize

The Levi L. Conant Prize recognizes the best expository paper published in either the Notices of the AMS or the Bulletin of the AMS in the preceding five years. Prize winners are invited to present a public lecture at Worcester Polytechnic Institute—where Conant spent most of his career--as part of the institute's Levi L. Conant Lecture Series, which was established in 2006. The 2021 prize was recognized during the 2021 Virtual Joint Mathematics Meetings in January.

More details at:
https://www.ams.org/news?news_id=6447

Students by Tech Tower

EVENTS

paraDIGMS 2020 - IMSI
November 27, 2020 - November 30, 2020

Co-organized by Marissa Kawehi Loving (SoM) and Justin Lanier (SoM Alum), this online conference was the first event of the American Mathematical Society's paraDIGMS initiative to build a community of practice for graduate education in mathematics, with the goal of making the profession stronger and more equitable.

The goal of the conference was to highlight the work of individuals and organizations to build a diverse and equitable profession at the graduate level, while also challenging participants to see how far we still have to go. With the understanding that diversity is multidimensional and intersectional, this conference had a particular focus on diversity and inclusion with respect to race and ethnicity.

Speakers and panelists included:
  » Emily Butler, GlaxoSmithKline Pharmaceuticals
  » Carla Cotwright-Williams, National Association of Mathematicians
  » Jessica De Silva, CSU Stanislaus
  » Lorelle Espinosa, Sloan Found.
  » Rebecca Garcia, Sam Houston State University
  » David Goldberg, Purdue
  » Marcia Gumpertz, NC State U.
  » Susan Hermiller, U. of Nebraska
  » Raegen Higgins, Texas Tech
  » Theodore Hodapp, American Physical Society
  » Rick Laugesen, UIUC
  » Karen Marrongelle, NSF
  » Ebony McGee, Vanderbilt U.
  » Casey Miller, RIT
  » Lloyd Munjanja, UIUC
  » Julie Posselt, USC
  » Candice Price, Smith College
  » Sarah Salmon, CU Boulder
  » Simone Sisneros-Thiry, CSU E Bay
  » Belin Tsinnajinnie, Santa Fe Community College
  » William Y. Vélez, U. of Arizona
  » Corey Welch, Iowa State U.
  » Dwight Anderson Williams II, Iowa State U.
  » Joycelyn Wilson, Spelman College
  » Xiao Liu, GaTech Grad Student
  » Hyunki Min, GaTech Grad Student
  » Agniva Roy, GaTech Grad Student
  » Yian Yao, GaTech Grad Student

Southeast Center for Mathematics and Biology's 3rd Annual Symposium
December 7, 2020 - December 8, 2020

The 3rd SCMB Annual Symposium sought to elevate and amplify the ongoing dialogue at the interface of mathematics and biology. The symposium hosted a free online event with curated panels to highlight and dissect impactful interdisciplinary work from the math/bio community. Invited talks from all four National Science Foundation-Simons MathBioSys Research Centers shared compelling success stories of mathematical theory meeting biosystems data.

Topics of the Symposium

  » The impact of IE in shaping the careers of senior math-bio researchers
  » The value of developing IE from SCMB's junior researchers
  » The importance of IE in early career math/bio employment opportunities

The final day featured a plenary talk on algebraic systems biology by Heather Harrington, professor at the University of Oxford, and an interactive poster session with spatial conferencing.

About the SCMB

The Southeast Center for Mathematics and Biology at Georgia Tech was founded and is directed by SoM Professor Christine Heitch, and is one of four such centers in the U.S. examining the intersection of mathematics and biology. The National Science Foundation teamed up with the Simons Foundation in 2017 to award grants establishing the centers. The other Centers are at Harvard University, Northwestern University, and the University of California, Irvine.

The SCMB has six partner institutions across the Southeast, including Oak Ridge National Laboratory in Oak Ridge, TN; Tulane University in New Orleans, LA; the University of South Florida in Tampa, FL; the University of Florida in Gainesville, FL; Clemson University in Clemson, SC; and Duke University in Durham, NC.

COLLEGE OF SCIENCES ANNOUNCES INAUGURAL STAFF ADVISORY COUNCIL

SEPTEMBER 9, 2020 | ATLANTA, GA

The inaugural cohort of the College of Sciences Staff Advisory Council has been announced.

The Council represents and advocates for the diverse collective body of staff within the College and will interact directly with the Dean of the College of Sciences, to provide recommendations as well as to inform leadership members within each independent school regarding staff matters.

Lea Marzo
Assistant to the Chair, School of Mathematics

Background: I have been in higher education for over 13 years, six of those years at Georgia Tech. I have also been a graduate student for eight years and I believe that I can offer some insight from both a staff and a student perspective.

Why I'm joining the Council: I would like the opportunity to serve on the College of Sciences Staff Advisory Council because I will put the interests of the workers above my own. I believe that I am a team player and will work to the best of my abilities to ensure that the voices of the staff members are represented.

Chinneta Pettaway
Research Administrative Manager, School of Mathematics

Background: I have many years of experience prior to Georgia Tech working directly with chairs and executive management. I was able to form diverse leadership teams, which helped improve morale and retention within the department. My years at Georgia Tech working for the former Dean of the College of Sciences and the other leadership members allowed me the ability to understand the mission and vision of the College. I was able to utilize that knowledge with my transition to the School of Mathematics, to help with the development of the newly formed Southeast Center for Mathematics and Biology.

Why I'm joining the Council: I'm interested in serving on the College of Sciences Staff Advisory Council to help bring awareness and understanding to issues occurring on the school level. I'd like to advocate for the staff in the schools to help improve a safe and healthy work environment for everyone regardless of race, color, or creed. Importantly, we need to add to an effective communication avenue between management and staff. This will allow staff members to feel comfortable speaking about problems without fear of being reprimanded.

SoM FACULTY, STUDENTS, STAFF HONORED IN 2020 GEORGIA TECH FACES OF INCLUSIVE EXCELLENCE

SEPTEMBER 17, 2020 | ATLANTA, GA

Five SoM researchers, staffers, and students are among those named as 2020 Faces of Inclusive Excellence at Georgia Tech. The publication with the names of those honored was distributed during the Institute's 12th annual Diversity Symposium on September 9th.

The five are among 57 Georgia Tech faculty and staffers named in the annual Faces of Inclusive Excellence publication from Institute Diversity, Equity, and Inclusion. The publication recognizes "a diverse group of faculty, staff, and students who are committed to advancing a culture of inclusive excellence at Georgia Tech, and who have distinguished themselves in their research, teaching, and service."

The theme of this year's Diversity Symposium is "Understanding Accessibility as Inclusion: Georgia Tech's Pathway to Accessibility," which will highlight members of the Tech community who are paving the way for an accessible and inclusive campus.

> "When you dive deeper to explore the source of Georgia Tech's greatness, you discover this diverse group of faculty, staff, and students reveals the true faces of inclusive excellence," says Archie W. Ervin, Vice President of Georgia Tech Institute Diversity, Equity, and Inclusion.

Georgia Tech President Ángel Cabrera adds that scientific and entrepreneurial advances "only matter if they drive positive change that helps all of us live better lives. That's why accessibility and developing the technologies that fuel it are so vital. Indeed, accessibility's chief goal is to use technology to ensure no one is excluded from exercising their rights as humans and enjoying their freedoms as citizens — mobility, safety, communication, education, personal development, civic participation, and more."

The following are the names of the SoM members who were selected, along with their titles, and why they were selected:

Neha Gupta
Academic Professional and Director of Scheduling
School of Mathematics

Awarded the CIOS Student Recognition of Excellence in Teaching: Class of 1934 Award. As the coordinator of the Math 1551 course and an advisor for math majors, Gupta interacts with some of the most diverse groups of students on campus. She also aims to build community among math majors and reaches out to underrepresented students about opportunities that they may be unaware of.

Marissa Kawehi Loving
NSF Postdoctoral Fellow and Visiting Assistant Professor
School of Mathematics

Marissa Kawehi Loving co-authored an article published in the December 2019 issue of the Notices of the American Mathematical Society entitled "Broadening the Horizons of Teaching and Diversity in Math Departments." She co-founded SUBgroups, an online peer-support program for first year math graduate students that launched during the Fall 2019 semester.

Continued from the previous page.

"Accessibility's chief goal is to use technology to ensure no one is excluded from exercising their rights as humans and enjoying their freedoms as citizens." - Georgia Tech President Ángel Cabrera

Judith Taylor
Faculty Affairs Administrative Specialist
School of Mathematics

Taylor is a voting outreach organizer. She coordinated a math and English summer program in 2018–19 and has spent three years coordinating faculty affairs for the School of Mathematics. Taylor manages the visa application process, welcoming and onboarding newcomers, and supporting them throughout their experience.

Prasad Tetali
Regents Professor
School of Mathematics and School of Computer Science

Tetali was appointed director of Georgia Tech's interdisciplinary Ph.D. program in algorithms, combinatorics, and optimization, and is currently co-chair of the recently formed Equity, Diversity, and Inclusion Task Force in the School of Mathematics. He is also co-lead on a virtual research center at Georgia Tech on polynomials as an algorithmic paradigm.

Yao Yao
Assistant Professor
School of Mathematics

Yao is a recipient of the Sloan Research Fellowship and the National Science Foundation Early Career Development (CAREER) Award for her research in nonlinear partial differential equations.

STEPHANIE REIKES RECOGNIZED WITH GEORGIA TECH'S 2021 UNDERGRADUATE EDUCATOR AWARD
MARCH 23, 2021 | ATLANTA, GA

School of Mathematics Lecturer Stephanie Reikes has been recognized for her acheivements in undergraduate education with the bestowment of Georgia Tech's 2021 Undergraduate Educator Award.

This award, which was offered for the first time in 2009, recognizes outstanding contributions that non-tenure track faculty make to the education of students on campus.

Reikes has a unique role at Georgia Tech, with responsibilities in the School of Mathematics and the Tutoring & Academic Support unit at Georgia Tech, being responsible for teaching all of Tech's pre-calculus mathematics courses, including Math 0999 Support for College Algebra, Math 1111 College Algebra, and Math 1113 Pre-calculus.

In addition to leading improvements in this challenging area, she has strengthened the cooperation and collaboration between Tutoring & Academic Support and SoM, and introduced an innovative Learning Assistants program.

Reikes has a unique role at Georgia Tech, with responsibilities in the School of Mathematics and the Tutoring & Academic Support unit at Georgia Tech.

Stephanie Reikes

Along with the students who receive her constant efforts, we are very grateful for Reikes' continued work in undergraduate education and specifically her work in the School of Mathematics, and congratulate her on this distinguished honor.

DAN MARGALIT WINS THE GEOFFREY G. EICHHOLZ FACULTY TEACHING AWARD

MARCH 23, 2021 | ATLANTA, GA

Professor Dan Margalit has been awarded the institute Geoffrey G. Eichholz Faculty Teaching Award from CETL.

Margalit is recognized for his leadership on MATH 1553 Intro to Linear Algebra over the years, including coauthoring the online interactive textbook Interactive Linear Algebra.

The Eichholz Award, which includes a $3,000 prize, was established in 2005 through a gift from the School of Mechanical Engineering's Regents' Professor Emeritus Geoffrey Eichholz. It was created to reward senior faculty members who made a long-term contribution to introductory undergraduate education and were outstanding teachers for students taking freshman and sophomore core courses. It was recently broadened to recognize faculty at any point in their careers who excel in teaching core and general education courses, and who help students establish a solid foundation for their education at Georgia Tech.

In addition to his success as an effective and engaging instructor, Prof. Margalit is recognized for his leadership on MATH 1553 Intro to Linear Algebra over the years, including coauthoring the online interactive textbook Interactive Linear Algebra which is the course textbook for MATH 1553. Every semester, this course is taken by many GT students from almost every major, and thus plays an important role in their educational foundation.

Dan Margalit

Margalit's math research lies at the intersection of low-dimensional topology and geometric group theory. He focuses on mapping class groups of surfaces, also called the symmetries of surfaces. The author/editor of three books, Margalit hosts several workshops and discussion groups centering not just on topology and the advanced geometry he teaches, but mentorship and support for undergraduate and graduate students and faculty.

ERIC R. IMMEL MEMORIAL AWARD

SEPTEMBER 1, 2020 | ATLANTA, GA

Chris Jankowski has won the Eric R. Immel Memorial Award for Excellence in Teaching, in part for his role as the course coordinator for the foundational math course MATH 1553 Introductoin to Linear Algebra.

The award recognizes exemplary teaching by junior faculty members in foundational classes during the current or previous academic year. It is made possible by an endowment created through the generosity of College of Sciences alumnus Charles J. Crawford (B.S. in Applied Mathematics 1971) in recognition of the contributions

and accomplishments of the late Georgia Tech School of Mathematics Professor Eric. R. Immel.

Chris Jankowski is the School of Mathematics Director of Graduate Advising and Assessment, and the Assistant Director of Teaching Effectiveness.

Chris Jankowski

CLASS OF 1934 CIOS AWARDS, CTL HONOR ROLL

APRIL 19, 2021 | ATLANTA, GA

College of Sciences Awards

At the end of every semester at Georgia Tech — after weeks of faculty grading the work of students — the tables are flipped, and students get to evaluate their teachers and their class experiences using the Course Instructor Opinion Survey (CIOS).

Faculty members with exceptional scores and response rates are presented with the Center for Teaching and Learning's (CTL) Student Recognition of Excellence in Teaching: Class of 1934 CIOS Award. This year, 40 College of Sciences faculty and instructors are receiving awards and honors for their work from spring through fall 2020 semesters.

The challenges of teaching classes during Covid-19 necessitated a new recognition from the CTL: The Honor Roll, which includes 32 College of Sciences faculty on its inaugural list.

"Teaching during the pandemic has required everyone to pivot to new ways of teaching, and faculty appreciate hearing that students value their efforts," says Joyce Weinsheimer, CTL director. The criteria for Honor Roll selection are the same as for the Class of 1934 Award.

The following are the College of Sciences faculty named to both the Class of 1934 and Honor Roll Awards (groups broken up into small and large classes):

Class of 1934 Award

- » Hector Baños, Postdoctoral Researcher
- » Lutz Warnke, Associate Professor
- » Dan Margalit, Professor

Honor Roll

- » Alex Blumenthal, Assistant Professor
- » Klara Grodzinsky, Director of Teaching Assistants
- » Miriam Kuzbary, Postdoctoral Researcher
- » Michael Lavigne, Visiting Assistant Professor
- » Wenjing Liao, Assistant Professor
- » Marissa Kawehi Loving, Postdoctoral Researcher
- » Gregory Mayer, Director of Online Learning
- » Stephanie Reikes, Lecturer, Tutoring and Academic Support
- » Victor Vilaca Da Rocha, Postdoctoral Researcher
- » Zhiyu Wang, Postdoctoral Researcher

Class of 1934 Award Winners

Hector Baños

Lutz Warnke

Dan Margalit

TA AWARDS

MAY 10, 2021 | ATLANTA, GA

School of Mathematics Awards

Numbering 78 graduate TAs and 26 undergraduate TAs, the School of Mathematics has a robust and highly trained teaching assistant cohort. TAs are expected to not only teach the material well, but also engage the students in discussions, facilitate group learning, and hold office hours or Math Lab hours.

Led by the excellent Klara Grodzinsky, who is the Director of Teaching Assistants as well as the course coordinator for the Calculus II course, MATH 1552, and who is herself a highly awarded and sought after instructor, these undergraduate and graduate students strive every semester for excellence in the classroom.

CTL Intstitute-wide Recognition
There were five SoM TAs who were recognized by the Center for Teaching and Learning (CTL) for outstanding teaching this year.

» Outstanding Graduate Teaching Assistant
  Hassan Attarchi

» Outstanding Online Head Teaching Assistant
  Jun Tao Duan

» Outstanding Graduate Student Instructor
  Surena Hozoori

» Outstanding Undergraduate Student Instructor
  Anshul Tusnial

» Outstanding Online Teaching Assistant
  John "Jack" Olinde

SoM Undergraduate TA Awards
Three outstanding Undergraduate TA's were recognized for excellence in instruction.

» Jesse Jiang

» Morgan Knowlton

» Wade Kovalik

SoM Graduate Student Instructor Awards

» Kofi Amanfu

» Christina Giannitsi

» Mark Harkoenen

» David Harper

» Cvetelina Hill

» Xiao Liu

» Hyunki Min

» Agniva Roy

» Yian Yao

Hassan Attarchi

Jun Tao Duan

Surena Hozoori

Anshul Tusnial

Jack Olinde

SoM GRADUATE STUDENT AWARDS 2021

MAY 10, 2021 | ATLANTA, GA

School of Mathematics Awards

Several SoM graduate students were recognized for their achievements at the ceremony that was held online in BlueJeans on May 10th, 2021.

David L. Brown Fellowship
» Umar Ahmed
» James Anderson
» Harris Cobb
» Joshua Marsh
» Kevin Shu

Top Graduate Student Award
» Timothy Duff
» He Guo
» Shu Liu
» Hyunki Min
» Jaemin Park
» Jiaqi Yang
» Youngho Yoo

Herbert P. Haley Fellowship
This award is given by the College of Science for graduate students and is given only in the Spring 2021 semester.
» Jacob Ian Lewis

Sigma-Xi Best PhD Thesis Nominee
Since 1947, the Georgia Tech Chapter of Sigma Xi has annually honored Georgia Tech faculty and students for their research at the annual Spring Awards Banquet. The Georgia Tech Sigma Xi Research Awards are made possible by the gracious support of the Georgia Tech Research Corporation and the Ferst Foundation.
» Josiah Park

Outstanding Graduate TA
» Christina Giannitsi
» Marc Härkönen
» Xiao Liu
» Hyunki Min
» Agniva Roy
» Jiaqi Yang
» Weiwei Zhang

FESTA Fellowship
Funded by a gift from John R. Festa, this award recognizes graduate students who exhibit superior academic and leadership skills.
» Sally Collins

CTL/BP Outstanding Grad TA Nominee
» Hassan Attarchi
» Jack Olinde (Online TA of the Year nominee)
» Juntao Duan (Online Head TA of the Year nominee)

CTL/BP Outstanding Grad Instructor
» Surena Hozoori

Tech Tower Covered in Snow

Teaching Outside During the Coronavirus Pandemic

COLLEGE OF SCIENCES SPOTLIGHTS EXEMPLARY STUDENTS

MAY 7, 2021 | ATLANTA, GA

College of Science Awards

Two of the six College of Sciences students honored for end-of-school-year awards and scholarships this year are from the School of Mathematics. All six honorees offer a wide variety of accomplishments, and deserve special recognition for their accomplishments and research in a variety of disciplines.

2021 Robert A. Pierotti Memorial Scholarship
Presented to a top graduating senior in the College of Sciences. Endowment by a gift of the family and friends of former dean Robert Pierotti.

Kalen Patton

» Chattahoochee High School graduate.

» Received a Mathematics and Computer Science double major in Spring 2021.

» Researched with Lutz Warnke, School of Mathematics – "Prague dimension of random graphs".

» Published of research with Prasad Tetali, Professor in SoM and Computer Science – "Markov Chain-Based Sampling for Exploring RNA Secondary Structure", Math. Comput. Appl. 2020, 25, 67.

» Runner-up, Love Family Foundation Scholarship

2021 A. Joyce Nickelson and John C. Sutherland Undergraduate Research Award
Presented to a student studying physics and mathematics. Endowment gift of Jen Nickelson and John Sutherland.

Luojia Zhang

» Graduating Spring 2021 with a Physics and Mathematics double major.

» Researched with Zhigang Jiang and Carlos Sá de Melo, School of Physics.

» Published the paper "Landau quantization in tilted Weyl semimetals with broken symmetry," Journal of Applied Physics 129, 105107 (2021).

» Presented research at American Physical Society, March 2021.

Kalen Patton

Luojia Zhang

For information about creating an endowment, supporting our students, or dontaing to the School of Mathematics please email

comm@math.gatech.edu

RECENT PROMOTIONS IN SOM
APRIL 4, 2021 | ATLANTA, GA

Dr. Frederico Bonetto
Promoted to Full Professor

Before joining Georgia Tech as Assistant Professor in 2002, Dr. Federico Bonetto was a member of the Institute for Advanced Study in Princeton. He previously earned his Bachelor's degree from the University of Pisa in 1991 and his PhD in Mathematics from the University "La Sapienza" of Rome in 1997. Dr. Bonetto was promoted to Associate Professor in 2007. His research focuses on mathematical aspects of statistical mechanics with expertise in both dynamical systems and probability theory. His work covers both theoretical understanding of thermal or electric conduction and practical applications in economics dynamics, solid state physics, and novel materials.

Dr. Galyna Livshyts
Promoted to Associate Professor with Tenure

Dr. Galyna Livshyts joined Georgia Tech as Assistant Professor in SoM in 2015, after receiving her Bachelor's degree from Kharkiv State University (2009) and her PhD from Kent State University (2015). In Fall 2017, she held a postdoctoral position at MSRI's Geometric and Functional Analysis program. Her research focuses on asymptotic analysis, convex geometry and random matrix theory, presently supported through an NSF CAREER Award. Dr. Livshyts has co-founded the High-Dimensional Seminar and the Online Asymptotic Geometric Analysis seminar, co-organizes the Analysis seminar in SoM, and has organized several conferences.

Dr. Lutz Warnke
Promoted to Associate Professor with Tenure

Before Dr. Lutz Warnke joined GT in 2016, he received his undergraduate degree from ETH Zurich (2009) and his PhD from University of Oxford (2012), and was a Research Fellow at the University of Cambridge. Dr. Warnke's research accomplishments in probabilistic combinatorics and random graph theory have been recognized by the 2014 Richard Rado Prize, the 2016 Denes Konig Prize, a 2018 Alfred P. Sloan Fellowship, and a 2020 NSF CAREER award. His teaching efforts at GT have been recognized by a Class of 1969 Teaching Fellowship and a Class of 1940 Course Survey Teaching Effectiveness Award.

Dr. Yao Yao
Promoted to Associate Professor with Tenure

Dr. Yao started her tenure-track position at Georgia Tech in Fall 2015, after receiving her PhD in Mathematics from UCLA in 2012, and holding a Van Vleck Visiting Assistant Professor at the University of Wisconsin-Madison during 2012-2015. Her research is in the area of nonlinear partial differential equations, and has been supported by three NSF research grants, including an NSF CAREER Award. Dr. Yao also received a Sloan Fellowship in 2020. She advises and mentors PhD students in SoM and the GT-QBioS program, as well as a postdoc in SoM.

Federico Bonetto   Galyna Livshyts   Lutz Warnke   Yao Yao

AP PROMOTIONS

APRIL 18, 2021 | ATLANTA, GA

Christopher Jankowski
Promotion to Senior Academic Professional

Christopher Jankowski received his Ph.D. in Mathematics from the University of Pennsylvania in 2009 and joined Georgia Tech as an Academic Professional in 2016. He has taken on a range of administrative and teaching responsibilities at the undergraduate and graduate levels. Since the inception of formal math course coordination in the School, he has coordinated Introduction to Linear Algebra (Math 1553), and more recently Differential Calculus (Math 1551). As Director of Postdoctoral Teaching Effectiveness, he serves as a teaching mentor and an organizer of professional development events for postdoctoral faculty in mathematics. As the Director of Graduate Advising and Assessment, Dr. Jankowski is the central coursework advisor for MS Math and PhD Math students. For three years, he was the lead organizer or co-lead organizer of the High School Math Competition, SoM's largest outreach event.

Chris Jankowski

For three years, Chris was the lead or co-lead organizer of HSMC, the High School Math Competition, SoM's largest outreach event.

Klara Grodzinsky
Promotion to Senior Acadmic Professional

Klara Grodzinsky received her M.S. degree in Applied Mathematics from Georgia Tech in 1996. She has been employed at Georgia Tech since September 1997, serving as an instructor until she was promoted to Academic Professional in January 2017. In 2000, she co-created a training program for graduate and undergraduate teaching assistants, which earned the Board of Regents Teaching Excellence Award in 2006 and has been used as a model for other campus departments. Since 2008, she has served as the TA Coordinator for the School of Mathematics. She earned the Center for Teaching and Learning Undergraduate Educator Award in 2011 and won the institute-wide Class of 1934/1940 Course Survey Teaching Excellence Award *seven times*. In addition to directing the TA program, Ms. Grodzinsky has taken on key roles in course coordination, registration, permits, and the course scheduling team.

THEORY PLUS DATA, ACROSS DISCIPLINES:

WHAT'S NEW IN THE SOUTHEAST CENTER FOR MATHEMATICS AND BIOLOGY

JANUARY 5, 2021 | ATLANTA, GA

The Southeast Center for Mathematics and Biology (SCMB), which is headquartered at Georgia Tech, sits squarely at the critical intersection of two disciplines — and it has been collaborating and conducting research across mathematics and biosystems for the past two years.

> "Something we've all experienced over the past year is the importance of mathematical modeling," says SCMB Director Christine Heitsch, a professor in the School of Mathematics with courtesy appointments in the Schools of Biological Sciences, and Computational Science and Engineering. "The better the interaction between mathematics and biology, the better the quality of the data modeling and analysis."

Along with bringing mathematics and biosystems into sharp focus, the pandemic year of 2020 has also continuously evolved how we meet to share knowledge with one another.

SCMB hosted its 3rd Annual Symposium December 7-10, 2020 — marking the group's first virtual annual meeting. This year's virtual environment featured junior researchers showcasing their work at the frontiers of the math-bio interface via screenshare.

Created in 2018, SCMB is funded by the National Science Foundation and the Simons Foundation. It is headquartered at Georgia Tech, and has six partner institutions around the southeast --- ORNL, Clemson, Duke, Florida, South Florida, and Tulane. SCMB is one of four NSF-Simons Research Centers for Mathematics of Complex Biological Systems.

Seed projects at SCMB take advantage of a unique structure of pairing scientists in non-traditional, cross-disciplinary teams of principal investigators and junior researchers. The results promise a wider range of perspectives on scientific problems and potential solutions.

There are seven studies underway at SCMB, with the teams evenly split between mathematics and biosystems researchers — not just at the senior personnel (SP) level,

A poster session at an SCMB Symposium (Photo Jerry Grillo)

but also among the postdoctoral researchers and graduate students who are an integral part of the Center.

Current research projects include using math models to learn more about DNA and RNA interaction — and where breaks in that connection could lead to genetic disorders — as well as how biological agents exploit disorder and randomness to survive their treks through hosts. One SCMB research team is investigating RNA structural ensembles in evolution, while another is investigating how stem cells pattern within colonies due to specific cell to cell communication.

Q&A with the Southeast Center for Mathematics and Biology

How would you explain the "math-biology interface" to the layperson? What's the connection between mathematical areas of study like geometry and topology to, say, molecular biology or genetics?

Christine Heitsch:
We usually refer to it as the "math-bio interface." The reason is because the mathematical sciences are really broad, including optimization, statistics, parts of computer science, as well as the areas that we think of as more classic core mathematics.

"Bio" certainly includes biology and biomedical engineering but also physics, chemistry and chemical engineering, so we use the shortened form to indicate the breadth of studies here too.

Hang Lu:
Molecules, networks of genes, and images (of cells, tissues, organisms, and animal behavior) all have shapes, and interestingly shapes and changes in shapes can tell us a lot about function and dysfunction. Fields like geometry and topology are equipped with dealing with these things.

Christine Heitsch

Heitsch:
A fundamental premise for our center is "theory plus data." The idea is that the math side brings the theoretical expertise, and the bio side brings the experimental expertise. These two domains of expertise meet at the interface that is the modeling and analysis of the data.

In some sense, any researcher is fundamentally seeking to better understand the world. We differ in the range and types of tools used, and in the aspects of the problems that we find interesting.

Geometry is fundamentally the study of shapes as, in some sense, is molecular biology. But a molecular biologist traditionally has very different ways of thinking about shapes, experimenting with the shapes of interest, than a geometer does. Classically, a molecular biologist will use physical experiments, whereas a geometer will use thought experiments. Now, though, both of them are increasingly likely to use computational experiments, especially when collaborating with each other.

Is this a "big data" approach to math and biological sciences? Are you using computational models to search for patterns or connections in the biological sciences?

Heitsch:
We are always searching for patterns and connections. However, the phrase "big data" has a certain resonance in the common usage, which is not the best description of our approaches.

One of our senior personnel, Matthew Torres, an associate professor at the School of Biological Sciences, said at the very beginning of this initiative that his interest wasn't in having someone do a better analysis of his current data. Rather, he said, the greatest advantage to a biologist in participating in efforts like this is gaining a new way to ask questions that weren't known before. Matt put a huge effort into the planning and execution of this year's Symposium, so he's clearly invested in the center's success. He also shared how excited he was about the recent results from his SCMB collaboration, so stay tuned for further developments on that front.

Hang Lu

One SCMB research team is investigating RNA structural ensembles in evolution, while another is investigating how stem cells pattern within colonies due to specific cell to cell communication

The structure for your research teams is designed to make sure there's a math principal investigator and a bio principal investigator, along with a bio graduate research assistant and a math postdoctoral scholar, on every project. I know this is designed to share knowledge and train practitioners of one discipline in the foundations of the other discipline. How has that been working out since SCMB opened?

Heitsch:
Even better than we had hoped! That's one of the reasons

our Symposium this week focused on exactly this critical skill of interactional expertise in cross-disciplinary collaborations. It really does seem to be the secret sauce for success.

The way that I keep track of it in my head is by picturing a square. You always have the vertical/disciplinary sides, which are the standard senior mentor and junior trainee relationships. What SCMB is doing is bringing in those horizontal, cross-disciplinary connections — the bio grad students interacting with math postdocs, the senior personnel engaging with each other — as well as the diagonal connections being forged.

In that vein, one of the things that the center is always trying to communicate is that there's great value to studying more complimentary discipline. If you do, then you have some groundwork to interact with experts. You won't necessarily develop research expertise, but you'll have some fundamental vocabulary. A little bit of fluency in another discipline can go a very long way.

As an SCMB trainee, how do you like the interdisciplinary diversity within the center's research teams?

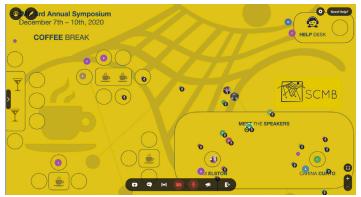Hector Banos, SCMB mathematics postdoctoral junior researcher:
I really enjoy it. I am trying to develop a micro-evolutionary model to describe allele variation in tRNA (transfer ribonucleic acid). Certainly, it's something new to me, but being able to get constant feedback from both the math and the bio sides really helps and keeps it interesting and relevant.

In our seed project, we have a nice collaborative system. I get to participate in the Bio PI lab's meetings, and I am treated as another [within the] cohort. They also are very welcoming and address any questions or 'inquietudes' I have regardless of the type of question. Sometimes it may be a little frustrating not being able to keep up with all the concepts and techniques, but I guess that is part of the learning curve for someone without formal bio training, and they help me with that. I also try to provide my perspective from the math side. All these interactions have led to great discussions.

How has this arrangement helped you with your research?

Massively. Being able to collaborate with biologists on a daily basis has changed my perspective on math and biology. I became more aware of the challenges, techniques, and topics

in the area. I have been able to communicate better with other biologists and bio-mathematicians. Also, being part of a center enhances the whole experience. We get to see different projects and talk to experts on math and biology. The center organizes activities that promote interactions within the fields. I am getting more comfortable in terms of biology and I think that is something someone who does math-biology needs to work on, so I am getting there.

Screen shot of a coffee break at the 3rd Annual SCMB Symposium, held virtually in December. Credit: Michael Lavigne

Can you give a status report on progress within the research teams?

Hang Lu:
In all projects, the bio researchers are now exposed to a whole new set of tools and ways of thinking. The multitudes of center activities certainly lowered the barriers for bio researchers to interact with mathematicians, particularly their partners. Most pairs have moved to defining better questions to ask and address together, which is exciting.

Heitsch:
We had our 2nd Annual Symposium in February 2020 which was coupled with the second Advisory Board meeting. All seven pairs of junior researchers got up in front of these senior experts and presented a unified picture of the progress made on each of their seed projects. The Advisory Board was definitely pleased with the center's progress overall. Internally we think things are going quite well, and we're delighted that that was validated by outside experts.

How hard has it been to get these seven research projects up and running since SCMB was founded?

Heitsch:
Initially, the research aspect was about as seamless as it could be.

By design the organization of the Center was intended to be very nimble, because we knew we would need to quickly ramp up on a number of research projects. It was great to see it working out as planned.

Recently, though, we've had to make some adjustments. A significant changes in plans was the postponement of our "postdocs in residence" program planned for May 2020. The four off-site postdocs (distributed around our partner institutions in the Southeast) were going to join the three GT ones in being embedded in the research labs of their seed project collaborators for almost a month. We're still hoping to reschedule so that the math PhDs really get an opportunity to experience the data side — this "theory plus data" balancing act.

On a more positive note, the bio grad students did have an opportunity to experience the theory side through a new "Math for Bio" graduate student course that was offered in spring 2020. A current SCMB postdoc, Daniel Cruz, and I taught that class, and the students have told us what a positive experience it was. They felt like they gained an understanding of some mathematics they had not previously been exposed to in a way that was accessible to them, and could be useful in the future.

Being able to collaborate with biologists on a daily basis has changed my perspective on math and biology. I became more aware of the challenges, techniques, and topics in the area. I have been able to communicate better with other biologists and bio-mathematicians.

What kinds of applications could result from this research in the next five to ten years? Where could math and biological sciences go from here?

Hang Lu:
The Center addresses questions from molecular scale all the way to organism behavior. In five to ten years, the Center will be looking at these questions from unconventional angles; that is, making predictions about biological functions and figuring out mechanisms of actions in proteins, RNA/DNA, designing molecular transport and cellular differentiation patterns, detecting subtle changes in organism aging process, and making better biomimetic robots.

Heitsch:
I'm not a good prognosticator. I will say that one thing we've seen over the past year is how important the modeling and analysis of biosystems can be. The level of interaction between math theory and bio data can have profound implications for our lives. It's really been a lesson in the importance of researchers who may not necessarily be experts in both sides but who can collaborate with experts from the other side.

For SCMB, this all circles back to our "theory plus data" approach. There are a lot of people who have expertise in math and a lot with expertise in bio, and if SCMB can facilitate their interacting with each other, then really great things can come of this. We're already seeing how these new collaborations --- as well as all the intra-center interactions --- are challenging us to think about our projects in new ways and helping to train the next generation of cross-disciplinary researchers.

When we went to New York (in February 2018) to make the pitch for the center, somebody asked, "How will you know it's been a success?"

It's similar to the question you're asking. By that point I was a little slap-happy, so I said, "when a biologist sitting in the audience thinks, 'Oh expletive, I need to find a mathematician to collaborate with.'"

We won't necessarily see the full impact directly, but what we're expecting to do is break new ground in our seed project areas. Throw down the gauntlet — this is the level of math-bio interaction needed to achieve these kinds of results.

EXTERNAL NEWS

ACO ALUMNS LUKE POSTLE (ACO PHD 2012) AND ADAM MARCUS (ACO PHD 2008) WINNING ACCOLADES FOR BREAKTHROUGH WORK

FEBRUARY 1, 2021 | ATLANTA, GA

Luke Postle Wins Coxeter-James Prize

Luke Postle (ACO PhD 2012; advisor: Regents' Prof. Robin Thomas) is being recognized for his groundbreaking work on graph theory with the 2021 Coxeter-James Prize from the Canadian Mathematical Society. Congratulations to Luke on this well-deserved recognition!

Dr. Luke Postle is an exceptional young researcher in structural graph theory, earning his Ph.D. in 2012 in the School of Mathematics working with Regents' Professor and former leader of the ACO program, Robin Thomas. Luke quickly earned a strong international reputation by using a broad and innovative range of tools to solve long standing and deep problems in combinatorics. He made several significant contributions to difficult, important, and long-standing open problems in graph colouring.

About the Coxeter-James Prize

The Coxeter-James Prize was inaugurated in 1978 to recognize young mathematicians who have made outstanding contributions to mathematical research. The award is named for two former CMS presidents, Donald Coxeter, who is recognized as one of the world's best geometers, and Ralph Duncan James, who was a great contributor to mathematical development in Canada.
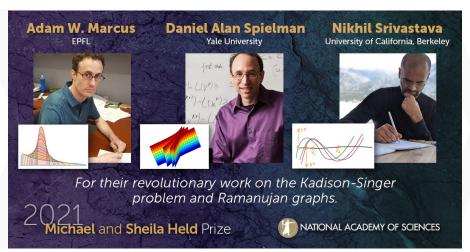
Adam Marcus Wins Michael and Sheila Held Prize

Adam W. Marcus (ACO PhD 2008) and his collaborators, Daniel Spielman and Nikhil Srivastava, have won the Michael and Sheila Held Prize from the National Academy of Sciences for their breakthrough work on the Kadison-Singer problem and on Ramanujan graphs, and the underlying theory that has lead to new connections between computer science, mathematics and physics.

The Michael and Sheila Held Prize is awarded to researchers demonstrating "outstanding, innovative, creative, and influential research in the areas of combinatorial and discrete optimization, or related parts of computer science."

About the Michael and Sheila Held Prize

The Michael and Sheila Held Prize is presented annually and carries with it a $100,000 prize. The prize honors outstanding, innovative, creative, and influential research in the areas of combinatorial and discrete optimization, or related parts of computer science, such as the design and analysis of algorithms and complexity theory. This $100,000 prize is intended to recognize recent

(Credit: National Academy of Sciences)

work (defined as published within the last eight years). The prize was established in 2017 by the bequest of Michael and Sheila Held.

About the ACO Program

Georgia Tech's Algorithms, Combinatorics and Optimization (ACO) program, jointly sponsored by the School of Mathematics, the College of Computing, and the H. Milton Stewart School of Industrial and Systems Engineering, boasts world-class faculty with research interests spanning a wide expanse of topics, from ones purely theoretical to others more applied. ACO alumni have been very successful and have won prestigious awards from a variety of research and professional societies. Graduates of the Program can be found in myriad settings in both academe and industry; some have even chosen careers in finance.

Coxeter-James Prize:
https://cms.math.ca/Prizes/info/cj.html

The Michael and Sheila Held Prize:
http://www.nasonline.org/programs/awards/michael-and-sheila-held-prize.html

EXTERNAL NEWS

SoM ALUMNI JIE MA (PHD 2011) AWARDED 2020 HALL MEDAL OF THE ICA
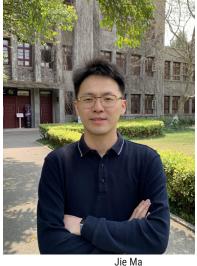
JUNE 14, 2021 | ATLANTA, GA

Hall Medals recognize extensive quality research with substantial international impact by Fellows of the ICA in mid-career.

An Impressive Career

Dr. Ma received the B.S. degree from the School of Mathematical Sciences, USTC, and subsequently obtained his Ph.D. degree in 2011 from the School of Mathematics, Georgia Institute of Technology, under the supervision of Prof. Xingxing Yu. He was a Hedrick Assistant Professor at the Department of Mathematics, UCLA, and a Postdoctoral Associate at the Department of Mathematical Sciences, Carnegie Mellon University. Dr. Ma is now a professor at the School of Mathematical Sciences, University of Science and Technology of China (USTC).

Jie Ma has made outstanding contributions in the fields of extremal and probabilistic combinatorics, and structural graph theory. He obtained several important results in the study of hypergraph Turan numbers, and proved several conjectures on the distribution of cycle lengths in graphs. He solved, or asymptotically solved, several open problems by Bollobas and Scott on judicial partitions of graphs and hypergraphs, which is a "very strong, impressive record". Using "sophisticated arguments and novel tools", he has made breakthroughs on several other difficult, longstanding problems of structural and extremal flavour.

Dr. Ma has published over thirty papers in the most prestigious combinatorial journals. He is a frequent speaker at national and international conferences, and a member of recognized editorial boards.

About the ICA

The Institute of Combinatorics and its Applications is an international scholarly society that was founded in 1990 by Ralph Stanton; the ICA was established for the purpose of promoting the development of combinatorics and encouraging publications and conferences in combinatorics and its applications.
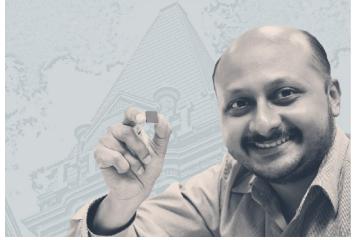
Jie Ma

ALUMNI NEWS

GEORGIA TECH ALUMNI 40 UNDER 40

JULY 21, 2021 | ATLANTA, GA

The Georgia Tech Alumni Association has released its annual list of young graduates working to change our world, with six College of Sciences alumni from three schools among those honored in the 2021 class of the Tech's 40 Under 40.

> "Georgia Tech's impact reaches every industry, every part of the globe, and every aspect of people's lives through the work of our esteemed alumni. These 40 individuals are changing the world for the better."
>   - Geogia Tech Alumni Association

Arindam Basu, MS Math 09, PhD ECE 10
Associate Professor | City U

Basu's work in implantable machine learning for brain-machine interfaces (BMI) offers hope to the nearly 5.4 million persons living with paralysis. While the technology is still nascent, Basu's research group at City University of Hong Kong and Nanyang Technological University in Singapore works on different aspects of neuromorphic circuits and systems that can be applied to brain-machine interfaces and Internet of Things (IoT). He helped pioneer the concept of integrating machine learning to BMI implants to reduce wireless data transmission rates, and thus, reduce the risk of infection that can be caused by needing to implant wires. Recently, his team has developed sensors that can mimic human pain receptors that can learn from harmful stimuli to trigger a pain withdrawal reflex even when the sensor is damaged.

Arindam Basu

Advice for new Yellow Jackets:

"Do not be afraid to explore new grounds—Tech is a melting pot of talented faculty and students, so you should try to maximize your learning experience in all possible ways. Most importantly, do not stick to the boundaries of your discipline—the most amazing discoveries and inventions await you the moment you can make connections between concepts across disciplines." – Basu

Check out our website for the full story.

DONATE TO SoM

Stay in Touch!
We look forward to future opportunities to stay in touch with you. We're very grateful for help in all forms, large and small, from our friends. Here are some ways you can stay involved with the School of Math, along with our Friends of the School of Math and our Alumni:

Give to the School of Math:
Your gift can have a large impact on the education and research efforts of the School of Mathematics. Below are some of the many ways this can happen.

Support the Bright Future of Mathematics
Undergraduate Scholarships: Everyone knows that college affordability is a serious issue for many families. Funds for undergraduate scholarships help support deserving students as they work toward a Math degree, a very valuable degree whose worth increases every day.

Graduate and Postdoctoral Fellowships
Our graduate students and postdoctoral researchers are the future of the discipline, integral to all of the efforts of the School—from teaching to research to outreach. Supporting them with fellowships, thesis/research prizes, travel-and professional-expense funds or other types of support has a large impact on their professional development, the School, and the discipline. The School's increased quality and quantity in postdoc and graduate recruitment illustrates how a named fellowship attracts and promotes top talent.

Connect with High Schools
The High School Mathematics Competition is an inspiring event where students gather with others interested in mathematics and compete for scholarships. It is run entirely by undergraduate and graduate student volunteers, with scholarships to bring these talented high school students to Georgia Tech. Contributions toward prize money or operating expenses ensures and expands the on-going inspiration and impact of this event (for registration and other details see http://hsmc.gatech.edu). The School also runs a large distance learning program for High School students, with potential for many areas of growth.

Recognize Teaching, Research, and Leadership in Mathematics
A central part of the mission of the School of Mathematics is teaching, with very talented and dedicated teaching faculty, as well as an extensive training program in teaching for our graduates and postdocs. Recognizing the best of them through awards for excellent teaching and mentoring underlines the importance of these efforts and encourages increased excellence. A named award would be a great way to remember an alumnus, former faculty member, or previous instructor who had a big impact on your life. Likewise, School members are leading research efforts, events, and training at Georgia Tech and around the world, so you may want to recognize their impact.

Create an Endowed Chair
Through an endowed professorship, a donor creates an enduring tribute that realizes their vision of mathematical excellence, provides exceptional opportunities for students and researchers at all levels, and promotes connections locally and globally.

Share your story
We ask all alumni, past visitors, and friends of the School to please update your contact information along with your news, with an email to comm@math.gatech.edu. More info on our [webpage](#). We hope to hear from you soon!

Visit us!
Or even better, deliver your story in person by visiting the School. We especially welcome opportunities for visits from alumni to stop by and connect with our students and School members.

CREATING THE NEXT®

Georgia Tech