2024 Prizes

Abigail Hickok

The Ivo and Renata Babuška Thesis Prize

Established in 2022 by Ivo Babuška, the Ivo and Renata Babuška Thesis Prize is awarded annually to the author of an outstanding PhD thesis in mathematics, interdisciplinary in nature, possibly with applications to other fields.

Ivo Babuška was a Czech-American mathematician whose honors include five doctorates *honoris causa*, the Czechoslovak State Prize for Mathematics, the Leroy P. Steele Prize, the Birkhoff Prize, the Humboldt Award of Federal Republic of Germany, the John von Neumann Medal, the Neuron Prize Czech Republic, the ICAM Congress Medal (Newton Gauss), the Bolzano Medal, and the Honorary *Medal De Scientia Et Humanitate Optime Meritis*. Asteroid 36060 Babuška was named in his honor by the International Astronomical Union.

Renata Babuška (nee Mikulášek) was Ivo's wife and partner for 63 years. Renata grew up in Prague, Czechoslovakia and graduated from Charles University in 1953 with a degree in Mathematical Statistical Engineering. After a career in Czechoslovakia as an educational administrator, Renata worked for different government agencies in Washington, D.C. as a data and computing management consultant. She liked to point out that behind every successful man is a strong woman and he often said that without Renata, he would not have accomplished all that he did.

Babuška's work spanned the fields of theoretical and applied mathematics with emphasis on numerical methods, finite element methods, and computational mechanics. His interest in fostering collaboration among mathematicians, engineers, and physicists led him to establish this prize to encourage and recognize interdisciplinary work with practical applications.

Citation: Abigail Hickok. The 2024 Ivo and Renata Babuška Thesis Prize is awarded to Abigail Hickok of UCLA in recognition of the outstanding contributions in her PhD thesis "Topics in Geometric and Topological Data Analysis."

The Babuška Thesis Prize is a new AMS prize, to be awarded annually. In view of Ivo Babuška's broad interests across applied and theoretical areas of mathematics, it is awarded to the author of "an outstanding PhD thesis in mathematics, interdisciplinary in nature, possibly with applications in other fields". One candidate thesis can be nominated each year by a university in the USA or an AMS institutional member university in other countries.

Dr. Hickok, whose PhD was granted in May 2023, works in the very active areas of Topological Data Analysis (TDA) and Geometric Data Analysis (GDA). These rapidly growing fields use ideas from algebraic topology, differential geometry, computational geometry, and statistics to analyze data, often in high dimensions. For example, one of the well-known ideas of TDA is persistent homology, which measures the connected components, holes, and higher-dimensional voids of a data set and tracks how these voids emerge and disappear at different scales. GDA adds the goal of extracting geometric information beyond topological invariants, such as curvature.

This thesis spans the theoretical and the applied. It begins with a beautifully written chapter introducing necessary concepts of topology and TDA and then introduces Hickok's new notion of Persistence-Diagram Bundles, which provide a new TDA approach to datasets that depend on more than one parameter. The next chapter then introduces an algorithm for computing PD Bundles.

This is followed by two chapters on applications to geospatial data, the first related to COVID-19 and the second to the distribution of resources such as polling stations. The final chapter addresses the GDA topic of computing curvature in data sets when all the information known is pairwise distances, not an embedding in Euclidean space.

It is a magnificent thesis, whose contributions will have fruitful consequences. As an appendix it also contains a further contribution, published in 2022 in the *SIAM Journal on Applied Dynamical Systems* with Hickok as lead author, on modelling opinion dynamics on hypergraphs.

Dr. Hickok was a mathematics undergraduate with pure inclinations in the Class of 2018 at Princeton, and as a graduate student at UCLA, she turned to more applied areas. This breadth of background has contributed to a thesis that is at once strongly founded theoretically, deeply involved in applications, and beautifully written. In Fall 2023 she took up an NSF Postdoctoral Fellowship with Andrew Blumberg at Columbia University.

Biographical Note. **Abigail Hickok** completed her PhD at UCLA (2023) under the supervision of Mason Porter, after receiving her undergraduate degree from Princeton University (2018). She is currently an NSF postdoctoral fellow at Columbia University, where she works with Andrew Blumberg.

Response from Abigail Hickok. I am very honored to receive the Ivo and Renata Babuška Thesis Prize. I would like to thank Ivo and Renata Babuška for their generosity in establishing this prize, as well as my graduate institution, UCLA, for nominating me. I am deeply grateful for the mentorship of my PhD advisor Mason Porter, who shaped my interest in using mathematics to study complex social systems and other interdisciplinary subjects. I'm also very thankful for the guidance of my postdoctoral mentor, Andrew Blumberg, for introducing me to geometric data analysis and its role in biology research. Additionally, I'd like to acknowledge my other wonderful collaborators—Benjamin Jarman, Michael Johnson, Jiajie Luo, Deanna Needell—whose contributions formed part of my dissertation. Finally, I wish to express my appreciation for the constant support of my parents, siblings, and partner.

Victor Ostrik

Chevalley Prize in Lie Theory

The Chevalley Prize was established in 2014 by George Lusztig to honor Claude Chevalley (1909–1984). It is awarded for notable work in Lie Theory published during the preceding six years; a recipient should be at most twenty-five years past the PhD. The prize is awarded in even-numbered years, without restriction on society membership, citizenship, or venue of publication.

Citation: Victor Ostrik. The 2024 Chevalley Prize in Lie Theory is awarded to Victor Ostrik for his fundamental contributions to the theory of tensor categories, which have already found deep applications in modular representation theory and Lie theory.

This award is based on three papers of Ostrik: "On symmetric fusion categories in positive characteristic," published in *Selecta Mathematica*, "Frobenius exact symmetric tensor categories" (joint with Kevin Coulembier and Pavel Etingof), published in *Annals of Mathematics*, and "New incompressible symmetric tensor categories in positive characteristic" (joint with Dave Benson and Pavel Etingof), published in *Duke Mathematical Journal*.

Fundamental to the representation theory of groups and Lie algebras is the ability to take tensor products of representations. For example, all simple representations occur inside tensor powers of any faithful representation. Abstracting the tensor product structure omnipresent in representation theory leads to the notion of a (symmetric) tensor category. For example, the category of finite-dimensional representations of a group over a field forms a symmetric tensor category. Another example is that of super-vector spaces, which formalize the sign rules that emerge when using differential forms. Super vector spaces lead naturally to superalgebras and supergeometry.

A remarkable theorem of Deligne from 2002 shows that when the coefficients underlying the tensor category are of characteristic zero, all symmetric tensor categories (of "moderate growth") arise as representations of groups or supergroups. In other words, any such category admits a tensor functor to super vector spaces.

In Lie theory, for every complex simple Lie algebra $\mathfrak{g}$ there is a symmetric tensor category of representations. According to Weyl, the simple objects in the category (irreducible representations) are indexed by a free abelian semigroup (the "dominant weights"). A variant of this theory emerged from physics. This is the Verlinde category $V(\mathfrak{g}, k)$ where the "level" k is a non-negative integer. As in the Weyl theory, these categories have simple objects indexed by a set of dominant weights, but now a finite set of weights (depending on k). The simple objects are not representations of $\mathfrak{g}$, but they have representation-theoretic interpretations, in the context of affine Lie algebras or quantum groups.

The Verlinde categories are remarkable for making connections between different representation theories. They are not symmetric but braided, a weaker condition, so they do not appear in Deligne's theorem. Apart from their importance in physics, the braiding of the Verlinde category was used by Witten and Reshetikhin-Turaev to define invariants of knots and 3-manifolds.

It was observed by S. Gelfand and Kazhdan, and by Georgiev and Mathieu that these Verlinde categories have analogs in characteristic p, and if the level k is chosen carefully, the characteristic p Verlinde category is symmetric (not 1 just braided!). In 2015, Ostrik made the bold proposal that one particular such symmetric Verlinde category, where $\mathfrak{g} = \mathfrak{sl}_2$ and $k = p - 2$ can serve as a "universal" Verlinde category needed to complete Deligne's theorem in characteristic p. This category is denoted Ver_p. As a proof of concept, he was able to prove this conjecture for symmetric fusion categories, i.e., semi-simple symmetric tensor categories admitting finitely many simple objects. His proof introduces a beautiful idea: he shows that functors resembling the Frobenius twist are internal to any tensor category in characteristic p. This observation proved crucial to further developments in the theory. These results were published in "On symmetric fusion categories in positive characteristic".

Ostrik's work, together with works of Etingof–Ostrik and Coulembier highlighted the importance of "Frobenius exact" tensor categories. Ostrik conjectured that such categories of moderate growth admit a tensor functor to the Verlinde category. This conjecture was proved in the paper "Frobenius exact symmetric tensor categories". An important example of such Frobenius exact categories are given by the semi-simplifications of representations of finite groups in characteristic p. When applied to this example, their theorem gives surprising applications to modular representation theory, namely precise information about the growth exponent of the number of indecomposable summands of dimension coprime to p in the n-th tensor power of a modular representation of a finite group (an area where any general results are very scarce).

What of Deligne's theorem in general in characteristic p? In "New incompressible symmetric tensor categories in positive characteristic," Benson, Etingof and Ostrik define "higher Verlinde categories" Ver_{p^n} and these objects are connected to yet another representation theory, namely the modular representations of Chevalley groups. This paper conjectures that every symmetric tensor category of moderate growth in characteristic p admits a fibre functor to a nested union of such categories. This conjecture, if true, would provide a complete analog of Deligne's theorem in characteristic p.

Ostrik's work breathed new life into the theory of tensor categories. He pursued these ideas for many years before making the breakthroughs sketched above. His earlier work includes a text (joint with P. Etingof, S. Gelaki and D. Nikshych) that has become indispensable for researchers in the field.

Biographical Note. **Victor Ostrik** was born in Mariupol, Ukraine, in 1973. He received an undergraduate degree from Moscow State University in 1995. In 1999 he received his PhD from Moscow State University, under the supervision of Alexei Ivanovich Kostrikin and Michael Finkelberg (from Independent University of Moscow). He was a postdoc at MIT before becoming a faculty member at the University of Oregon in 2003. He works in representation theory and in the theory of tensor categories. He was an invited speaker at the 2014 ICM.

Response from Victor Ostrik. It is a great honor to receive an award linked to the names of Sophus Lie, Claude Chevalley, and George Lusztig. I am very grateful to my advisors, Alexei Ivanovich Kostrikin and Michael Finkelberg, who introduced me to Lie theory and Ernest Borisovich Vinberg, whose lectures further deepened my fascination with it. I became interested in the theory of tensor categories when I studied George Lusztig's work on the asymptotic Hecke algebra and tried proving some of his conjectures. I am thankful to Roman Bezrukavnikov who showed me how the theory of tensor categories can help in such problems. The work that earned this prize was made possible due to the remarkable results of Pierre Deligne, Sergio Doplicher, and John E. Roberts. I also want to express my appreciation to my collaborators, David Benson, Kevin Coulembier, and Pavel Etingof. Their insight helped to overcome seemingly insurmountable obstacles and make our results more complete.

Jessica Fintzen

Frank Nelson Cole Prize in Algebra

This prize (and the Frank Nelson Cole Prize in Number Theory) was founded in honor of Professor Frank Nelson Cole on the occasion of his retirement as Secretary of the American Mathematical Society after twenty-five years of service and as Editor-in-Chief of the *Bulletin* for twenty-one years. The original endowment was established by the Cole family and Society members, was augmented in 2018 by an anonymous donor, and continues to receive support from the family. The prize is for a notable paper in algebra published during the preceding six years. The work must be published in a recognized, peer-reviewed venue.

Citation: Jessica Fintzen. The 2024 Frank Nelson Cole Prize in Algebra is awarded to Jessica Fintzen for her work transforming our understanding of representations of p-adic groups.

The prize is awarded in particular for the article, Jessica Fintzen, "Types for tame p-adic groups." *Ann. of Math.* (2) **193** (2021), no.1, 303–346.

It has long been understood that many questions about arithmetic can be studied by embedding the rational numbers in real or p-adic numbers, where methods of analysis are available. Because of this idea, the representation theory of groups defined over archimedean and p-adic fields has come to be a central tool in the study of automorphic forms.

Harish-Chandra in the 1960s used deep ideas about differential equations to describe in detail the representations of groups over archimedean fields. Within a few years, Robert Langlands found a formulation of Harish-Chandra's results that made sense also for p-adic fields, and conjectured that this gave a detailed description of the representations of groups over p-adic fields.

Proving such a description has been a central goal of p-adic representation theory for more than fifty years. The case of $GL(n)$ was completed, following work of Roger Howe and Allen Moy, by Colin Bushnell and Philip Kutzko in 1993, using the notion of a "type," which is a very particular kind of representation of a compact open subgroup.

Because classical reductive groups are centralizers of involutive automorphisms of $GL(n)$, Shaun Stevens in 2012 was able to use Bushnell and Kutzko's idea to construct some types for classical groups. These methods have a lot to say about what *ought to be true* for general reductive groups, but offer little in the way of *proofs*.

In 2001, Jiu-Kang Yu found a construction of representations that works when all of the relevant p-adic field extensions are tamely ramified. Yu's construction can be understood as a construction of Bushnell-Kutzko types for general reductive groups in this tamely ramified setting. But he did not extend the Bushnell-Kutzko exhaustion theorem: that every representation of $GL(n)$ contains a type.

Julee Kim in 2007 proved such an exhaustion theorem if the field has characteristic zero and the residual characteristic is (extremely) large.

What Fintzen accomplishes in "Types for tame p-adic groups" is to prove an exhaustion theorem for Yu's construction in all characteristics, and under the weakest possible hypotheses on the residual characteristic p: just those needed for Yu's construction to make sense. For example, in the case of the exceptional group E_8, this is all residual characteristics except for 2, 3, 5, and 7. Fintzen does this with a fundamental reworking of Yu's ideas, making them into the powerful tools that they have long promised to be.

Earlier work of Fintzen shed new light on p-adic representation theory at very small residual characteristic. Fintzen is leading the field toward a much deeper and sharper understanding of p-adic group representations.

Biographical Note. Jessica Fintzen received a bachelor's degree in mathematics and one in physics from the international Jacobs University Bremen before completing her PhD at Harvard University. After holding postdoctoral positions at the University of Michigan, the Institute for Advanced Study in Princeton and Trinity College in Cambridge, she became a lecturer (equivalent of assistant professor) and Royal Society University Research Fellow at the University of Cambridge and an assistant professor (later full professor) at Duke University. In 2022 she took up a professorship at the University of Bonn.

Response from Jessica Fintzen. Receiving the Frank Nelson Cole Prize in Algebra is a great honour and at the same time a big encouragement for me. I would like to thank those who nominated me for the prize and those who decided to award it to me. I would also like to thank those who supported me at various stages of my career, those who believed in my potential and offered me positions or opportunities, those who showed interest in the math I am doing and discussed mathematics with me, those who supported me when I faced obstacles, those with whom I could share my experiences and those who shared their experiences with me, and those who show by example how to be a responsible member of our math community. I am privileged that the list of people above that I am grateful for is longer than I can list here, but I would like to mention at least a few of them by name: I am particularly grateful to

Ana Caraiani, Samit Dasgupta, Stephen DeBacker, Tasho Kaletha, Lillian Pierce and Sug Woo Shin for their support in very different ways as well as their friendship.

Levi L. Conant Prize

Jennifer Hom

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. Levi L. Conant (1857–1916) was a mathematician who taught at Dakota School of Mines for three years and at Worcester Polytechnic Institute for twenty-five years. His will included a bequest to the AMS effective upon his wife's death, which occurred sixty years after his own demise.

Citation: Jennifer Hom. The 2024 Levi L. Conant Prize is awarded to Jennifer Hom for her article "Getting a handle on the Conway knot," which was published in the *Bulletin of the American Mathematical Society*, **59** (2021), 19–29. This article is a wonderful resource for the community on timely and important material.

The topic of Hom's article is a 2020 proof by Lisa Piccirillo that the Conway knot is not slice. When we view this knot K as sitting in the 3-sphere S^3, the boundary of the 4-ball B^4 saying that K is not slice means it cannot be the boundary of a smoothly embedded disk in B^4. (For comparison, every knot is the boundary of a topologically embedded disk.) The Conway knot was the simplest knot for which this question remained unresolved: the problem had been open for fifty years, and it resisted all known invariants and approaches. Piccirillo's solution attracted attention across the mathematical community, and many curious mathematicians wished for an accessible introduction.

Hom's paper gives a beautiful account of Piccirillo's work and its broader context. She starts at the beginning, with basic terminology and background, and then masterfully introduces increasing levels of detail and complexity as she tells the story. Her writing is vivid and engaging, always getting straight to the point with the immediacy of a spoken lecture, and it is full of illuminating diagrams, as well as motivation and commentary. Readers are left with new understanding and a sense of excitement for the future of this field.

Biographical Note. Jennifer Hom grew up in Massachusetts watching *Square One TV*. She earned a BS in Applied Physics from Columbia University, but decided to pursue graduate studies in mathematics after taking abstract algebra her junior year. She earned a PhD in mathematics from the University of Pennsylvania, under the supervision of Paul Melvin at Bryn Mawr College. She was a postdoc at Columbia and member of the IAS before joining the faculty of Georgia Tech, where she is currently a professor. Her research centers on low-dimensional topology, which she usually studies using Heegaard Floer homology. She has held a Sloan Fellowship, an NSF-CAREER award, and a Simons Fellowship. She is a Fellow of the AMS and spoke in the topology section of the 2022 ICM. She enjoys running and board games.

Response from Jennifer Hom. I am honored to receive the 2024 Levi L. Conant Prize. An extremely important, but often under-valued part of our job as mathematicians is communication, and I'm grateful to the AMS for valuing high-quality exposition in their publications.

I'd like to thank the organizers of the *Current Events Bulletin* session at the JMM for giving me the opportunity to speak and write about Lisa Piccirillo's beautiful result. I at times wondered whether any article about her work could live up to the remarkable clarity of her original paper; I'm grateful to Lisa for setting such a high standard, and for continually doing such interesting mathematics. I'd also like to thank my PhD advisor Paul Melvin for instilling in me the importance of clear exposition. Lastly, I am grateful to my friends, colleagues, and mentors in the low-dimensional topology community for the support and encouragement, and for helping to keep this whole mathematics thing a lot of fun.

Award for Distinguished Public Service

Angel Pineda

The Award for Distinguished Public Service was established by the AMS Council in response to a recommendation from their Committee on Science Policy. The award is presented every two years to a research mathematician who has made recent or sustained contributions through public service.

Citation: Angel Pineda. The 2024 AMS Award for Distinguished Public Service is presented to Angel Pineda, Professor of Mathematics at

Manhattan College, in recognition of his tireless work at the grassroots level supporting mathematicians living in challenged, resource-poor environments around the world and of the impact his example has had on national and international scientific organizations.

As a young researcher at Cal State Fullerton, he was one of the first mathematicians to answer the call issued by the AMS through its 2008 summer chairs letter for help in rebuilding the mathematics community in Cambodia, which had been destroyed in the late 1970s by the Khmer Rouge. He went to Phnom Penh in 2009, and again a year later, to teach an intensive one-month course in numerical analysis which led, eventually, to the creation of a Master's degree program at the Royal University of Phnom Penh, a major step in rebuilding the mathematics community in Cambodia.

With eventual financial support from the US National Committee on Mathematics and the AMS, a Volunteer Lecturer Program (VLP) was established that allowed others to follow Pineda's example. Subsequently, the VLP was incorporated into the portfolio of the Commission for Developing Countries (CDC) as established by the International Mathematical Union (IMU).

Professor Pineda has continued his participation in the VLP and has been involved with the work of the CDC ever since including contributing to a report on mathematics in Latin America for the IMU. Currently, he coordinates the IMU's program called Graduate Research Assistantships in Developing Countries. It grants financial support to deserving graduate students in mathematics in the developing world where graduate assistantships, teaching or otherwise, are essentially unheard of. In addition to the impact of his work as an individual, the model set by Prof. Pineda's leadership, steadfastness, and modesty has attracted others to the work, to the benefit of untold numbers of students of mathematics around the world.

Biographical Note. **Dr. Angel R. Pineda** is a professor of mathematics at Manhattan College. He was born in Honduras where his parents' work as medical doctors in a public hospital inspired his commitment to service and his research area. He received his BS in chemical engineering from Lafayette College, his PhD in applied mathematics from the University of Arizona and his postdoctoral fellowship from the Radiology Department at Stanford University. Before teaching at Manhattan College, he taught at California State University, Fullerton. His research studies human performance in detection tasks using MRI reconstructions generated by machine learning. He is currently the principal investigator (PI) of a research grant from NIH and was previously the PI of a mentoring grant for underrepresented students from NSF. In 2009 and 2010, he was a volunteer lecturer in Cambodia. He served in the Commission for Developing Countries (CDC) and currently serves on the Committee on Graduate Assistantships in Developing Countries (GRAID) of the IMU. He is a member of "Run For GRAID", a group of mathematicians who fundraise to support mathematics students in developing countries through running races.

Response from Angel Pineda. I feel deeply honored to receive the 2024 AMS Award for Distinguished Service. I accept the award on behalf of the many mathematicians who give their time and money to support mathematics in developing countries in general, and programs of the CDC in particular. In every project I have been involved in, I was just one member of a team who did the work. It is all of our work which is being recognized by this award.

I thank the selection committee for bringing attention to mathematics in developing countries. The ability to develop our mathematical talent depends heavily on the circumstances and countries in which we are born. Working to provide opportunities to those whose circumstances prevent them from developing their talent, both in the US and abroad, is rewarding and impactful. When I think of the Cambodian students with their deep appreciation of their teachers and hunger for knowledge or the African graduate students who can solely focus on their research instead of also having to work full time, I am reminded of the small and large ways in which we make a difference.

Finally, I take this opportunity to thank the members of the AMS who support mathematicians in developing countries through their donations to the IMU in the membership renewal form. Those donations add up to a consistent and meaningful source of funding for our programs. Thank you.

Award for an Exemplary Program or Achievement in a Mathematics Department

BYU ACME Program

The annual AMS Award for an Exemplary Program or Achievement in a Mathematics Department was established in 2004, first awarded in 2006, and fully funded by a gift to the AMS's permanent endowment by an anonymous donor in 2008. This award recognizes a department which has distinguished itself by undertaking an unusual or particularly effective program of value to the mathematics community, internally or in relation to the rest of society. Departments of mathematical sciences in North America that offer at least a bachelor's degree in mathematical sciences are eligible.

Citation: BYU ACME Program. The 2024 Award for an Exemplary Program or Achievement in a Mathematics Department is awarded to the Applied and Computational Mathematics Emphasis (ACME) program in the Mathematics Department at Brigham Young University. The ACME program has been highly successful in providing students with a rigorous foundation in mathematics as well as a broad interdisciplinary experience in applied mathematics.

During the first two years of the program, students take the traditional courses in mathematics. In their junior and senior year students join a tight-knit cohort in which traditional mathematics courses are supplemented with computing labs where students learn to convert sophisticated mathematical ideas into efficient working code. On top of this, they take courses in algorithms, optimization, dynamics, modeling with uncertainty, and other applied mathematics courses. Students also choose a concentration in a subject where they can apply the mathematics they have learned. The areas of concentration include biology, engineering, chemistry, data science, machine learning, economics, and many other important areas of science. This allows students to learn how to think about real-world problems, communicate across disciplines, and work on collaborative projects.

The evidence of success of ACME is apparent in many ways. The number of mathematics majors has increased from 276 in the Fall of 2013 to 415 in the Fall of 2021. The first graduating class of ACME had 15 students, and by 2021 the number rose to 52. In 2021 there were 250 declared ACME students. Students have had great success in getting internships and positions with major companies and also being accepted into top PhD programs in pure mathematics, applied mathematics, statistics, and other disciplines.

It should also be noted that the Mathematics Department has made efforts to broaden participation in the program and recruit more women and underrepresented minorities. These efforts include support groups to help students achieve success, recruiting students through summer programs and student clubs, and having current ACME women and underrepresented students reach out to first- and second-year students and encourage them to apply to the ACME program. The cohorts in the junior and senior year provide substantial social and academic support to students in the program and are especially valuable to students from underrepresented groups.

The ACME program is a valuable resource to the mathematics community. The mathematics faculty, in consultation with an advisory board whose members are from industry, has created curriculum materials that are available to other programs that wish to adopt similar applied mathematics courses.

Biographical Note. **BYU ACME Program** was the idea of Jeff Humpherys, who recognized many students loved math but were leaving the major because they didn't see rewarding jobs for math majors, and many math alumni had rewarding jobs using math, but weren't using the math taught in the traditional major. He proposed a new undergraduate program in applied and computational mathematics, modernizing the math major and better integrating it in the broader STEM community, with a curriculum written by Jeff Humpherys, Tyler Jarvis, Emily Evans, and Jared Whitehead, focused on mathematical analysis, algorithm design, mathematical modeling, and interdisciplinary study. The first cohort of 15 students began the program in 2013. Since then, the program has attracted many new students into mathematics, and now graduates about 60 students per year, who go on to rewarding jobs and graduate study in both pure and applied mathematics, as well as other STEM fields.

Response from BYU ACME Program. We are honored and delighted to receive the AMS Exemplary Program Prize for the BYU Applied and Computational Mathematics (ACME) Program. ACME has had a significant positive impact on students and our department. Students are attracted by the chance to use math to solve problems they care about, by rewarding career opportunities, by strong prospects for advanced study, and by the strong social support network of the ACME cohorts. This has led to a significant increase in the number of math majors in our department and a corresponding influx of resources.

ACME provides a rigorous education in the theory and practice of applied and computational mathematics. The main things that have made the ACME program successful are the following:

1. A challenging curriculum of rigorous mathematics integrated with applications, and a special focus on mathematical analysis, algorithms, and modeling. The challenging curriculum attracts strong students to the program, motivates students to collaborate, helps students become strong problem solvers, and opens rewarding career paths.

2. Required computing labs connected to every advanced mathematics course in ACME. These motivate theory with applications, improve students' mathematical understanding, teach students to convert sophisticated mathematical ideas into efficient working code, and enhance students' employability.

3. Interdisciplinary concentration in a student-chosen area of application. Students learn to communicate across disciplines and see how math is used. Many students are attracted to ACME because the concentration allows them to study both math and another subject they love instead of choosing between them.

4. Lockstep cohorts for the junior and senior years. After students complete the foundations of programming, calculus, linear algebra, and first-semester analysis, they join a lockstep cohort, taking advanced math and computing courses with the same classmates for two hours every day, five days a week. These cohorts provice significant social, emotional, and academic support for students, encourage teamwork, and build loyal alumni.

One alumna sums up her experience: "ACME is a great major. Its strongest suit is, of course, the combination of math, stats, and coding, but also the friendships and support one gets from other students and professors" —Erika Ibarra Campos '22.

We hope other programs will consider adopting some of the things that make ACME successful. We also hope the curriculum materials we have developed with support of the NSF will be useful to others, including textbooks published by SIAM and open-source lab manuals.

Ulf Grenander Prize in Stochastic Theory and Modeling

Tilmann Gneiting

The Grenander prize, established in 2017 by colleagues in honor of Ulf Grenander (1923–2016), recognizes exceptional theoretical and applied contributions in stochastic theory and modeling. It is awarded for seminal work, theoretical or applied, in the areas of probabilistic modeling, statistical inference, or related computational algorithms, especially for the analysis of complex or high-dimensional systems. Grenander was an influential scholar in stochastic processes, abstract inference, and pattern theory. He published landmark works throughout his career, notably his 1950 dissertation, *Stochastic Processes and Statistical Interference* at Stockholm University, *Abstract Inference*, his seminal *Pattern Theory: From representation to inference* and *General Pattern Theory*. A long-time faculty member of Brown University's Division of Applied Mathematics, Grenander was a fellow of the American Academy of Arts and Sciences, the National Academy of Sciences and was a member of the Royal Swedish Academy of Sciences.

Citation: Tilmann Gneiting. The Ulf Grenander Prize in Stochastic Theory and Modeling is awarded to Tilmann Gneiting for seminal work in environmental and stochastic modeling, with applications to computational weather forecasting, and for research in probability theory and mathematical statistics.

Gneiting is most widely known for foundational work on probabilistic forecasting. A simple example concerns the familiar weather forecast format "40% chance of rain tomorrow": it would be more informative to state a probability distribution over the amount of rain. To assess the relative accuracy of different such forecasts one needs a scoring rule. Gneiting authored two seminal and very highly cited 2007 papers, "Strictly proper scoring rules, prediction, and estimation" (with Adrian Raftery) and "Probabilistic forecasts, calibration and sharpness" (with Adrian Raftery and Fadoua Balabdaoui). These laid out the fundamental theory. As the latter paper argued, as well as calibration (that events forecast to have 80% probability should occur about 80% of the time) one seeks sharpness (individual forecasts should be as concentrated as possible). These theoretical developments have attracted immense attention in the real-world weather forecasting community. Gneiting has conducted extensive research in collaboration with the European Centre for Medium-Range Weather Forecasts (ECMWF), which is both a research institute and a real-time operational service. His foundational work on statistical post-processing for numerical weather forecasts provides the basis for current practice worldwide.

He had previously worked on spatial statistics and related covariance models. A major obstacle in the field was that researchers often were unable to determine whether many proposed models satisfied the hypotheses of a genuine covariance model. Gneiting turned to this area with zeal and published a lengthy series of papers (such as "Nonseparable, stationary covariance functions for space–time data," 2002) in which he provided necessary and sufficient conditions for a proposed model to be a genuine covariance model. Covariance models which had been used in the statistical analysis of spatio-temporal environmental data for wind-borne pollution were proved by Gneiting to be invalid. This work led to substantial literature amongst environmental researchers revising previous work modeling such data.

This early work relied on his deep understanding of the classical analysis concerning characteristic functions and positive definite functions. A sequence of papers, culminating in "Convolution roots of radial positive definite functions with compact support," 2004 (with Werner Ehm and Donald Richards), concerned topics such as positive definite functions with symmetry properties, convolution root properties, Pólya criteria and uncertainty relations for characteristic functions.

Biographical Note. **Tilmann Gneiting** is Scientific Director of the Heidelberg Institute for Theoretical Studies (HITS) and Professor of Computational Statistics at Karlsruhe Institute of Technology (KIT). Previously, he held faculty positions at the University of Washington in Seattle and at Heidelberg University. He received his PhD in mathematics in 1997 from Bayreuth University under the supervision of Peter Huber. His research uses probability and statistics across a range of applications: spatial and spatio-temporal models, theory and practice of forecasting in contexts of Atmospheric, Environmental and Earth Sciences, Epidemiology, Economics and Finance. He is a Fellow of the Institute of Mathematical Statistics (IMS) and a Fellow of the American Statistical Association (ASA) and received the (highest award) Distinguished Achievement Medal from the ASA section on Statistics and the Environment. He served as Editor-in-Chief of the *Annals of Applied Statistics*.

Response from Tilmann Gneiting. It is a great honor to receive the 2024 Ulf Grenander Prize in Stochastic Theory and Modeling, and I am deeply grateful to my coauthors, students, and colleagues in Heidelberg, Karlsruhe, Seattle, and elsewhere. Their support and their contributions to our joint work are immense and cannot be overstated.

A common thread of my research is a thorough theoretical treatment that is deeply rooted in analysis, probability theory, and mathematical statistics, yet driven by applications, particularly in the atmospheric, environmental, and earth sciences. While mathematical and statistical techniques are instrumental in solving a wealth of real world problems, inspiration goes both ways, and intense interaction with applied problems continues to prompt advances in our fields. In my case, insightful enquiries from meteorologists have prompted and facilitated theoretical and methodological advances in the generation and evaluation of probabilistic forecasts; more recently, collaborators from epidemiology and seismology have contributed fruitful challenges.

Undoubtedly, application oriented mathematical and statistical research will continue to thrive when theoretical foundations meet interdisciplinary fertilization.

AMS-MAA-SIAM Frank and Brennie Morgan Prize

The AMS-MAA-SIAM Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student is awarded annually to an undergraduate student (or students for joint work) for outstanding research in mathematics.

The prize recipient's research needn't be confined to a single paper. However, the paper (or papers) to be considered for the prize must be completed while the student is an undergraduate. Publication of research is not required.

The prize was established in 1995 and is entirely endowed by a gift from Mrs. Frank (Brennie) Morgan. The prize is made jointly by the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics.

Faye Jackson

Citation: Faye Jackson. The recipient of the 2024 AMS-MAA-SIAM Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student is Faye Jackson of the University of Michigan at Ann Arbor. Jackson worked on a wide range of topics in combinatorics and number theory. In particular, she discovered and theoretically explained several new and unexpected phenomena in analytic number theory. She has co-authored eight research papers, four of which have already been published or accepted, including in journals such as *Journal of Number Theory*, *Discrete and Computational Geometry*, and *The Fibonacci Quarterly*.

Jackson worked extensively on biases of distributions of parts in partitions. A partition $(m_1, \ldots, m_l)$ of a positive integer is a nonincreasing sequence of positive integers m_j whose sum is n. The individual integers m_j are called the parts of the partition. Recent work focused on understanding the distribution of parts modulo a given integer t. Beckwith and Mertens showed that the parts of arbitrary partitions are not equidistributed mod t and also provided asymptotics for large n. Craig generalized these results to the class of partitions with distinct parts. With fellow undergraduate Misheel Otgonbayar, Faye Jackson proved that k-regular partitions, where each part occurs less than k times, also exhibit biases in the distributions of their parts and provided detailed asymptotics for large n with improved error estimates.

Jackson then considered the case of partitions with parts that are not multiples of k. Given k and n, the number of such partitions coincides with the number of k-regular partitions, and Jackson was curious whether these two classes share the same distributions of their parts mod t. Unexpectedly, the answer is no: Jackson and Otgonbayar not only worked out heuristics for what these distributions should be for partitions with parts that are not multiples of k but also proved a beautiful general theorem that explains what these distributions are and how they converge to the distributions for k-regular partitions as k becomes large.

Jackson used an impressive range of techniques from analytic number theory, including modular forms, Euler-Maclaurin summation, L-functions, and the circle method, to establish these unexpected results.

At the University of Michigan, Jackson founded the Mathematics Undergraduate Student Advisory Council, served as the President of the Society of Undergraduate Mathematics Students, and was a member of the Mathematics Climate Committee. She also supported many outreach activities of the Ypsilanti Math Corps at Michigan as a mentor and instructor.

She received a Goldwater Scholarship in 2022 and the Alice T. Schafer Prize from the AWM in 2023. Jackson will continue her studies as a PhD student in the Department of Mathematics at the University of Chicago.

Biographical Note. **Faye Jackson** is a math PhD at the University of Chicago and a former undergraduate at the University of Michigan. She strives to become an educator for equity and to discover beautiful phenomena in mathematics. In Summer 2021 she participated in the SMALL REU at Williams College and played a major role in four different research projects. This work led to three published papers, two submitted preprints and two papers in preparation. Her mentor praises her creativity, generosity and the clarity of her exposition. In Summer 2022 she participated in the REU at the University of Virginia and co-authored one published paper and two submitted papers. Her mentor praised the beauty of her work and her impressive contributions to the life of the community.

Faye's instructors are similarly enthusiastic about her abilities and enthusiasm, and they describe her as a delight to have in class who helps spark important discussions. They are particularly excited about her contributions to outreach, and they describe her as a talented teacher for the Math Mondays in Ypsi, Super Saturday and Math Corps programs.

Response from Faye Jackson. Firstly I would like to thank the AMS for selecting me to win the Frank and Bennie Morgan Prize. I would also like to thank my incredible mentors such as Stephen DeBacker, Sarah Koch, Steven J. Miller, Ken Ono, and Jenny Wilson. They have introduced me to amazing mathematics, people, and opportunities. Sarah Koch and Stephen DeBacker especially have served as role models in outreach, which is such an important part of being a good mathematician. I also want to thank the mathematical community at the University of Michigan broadly. My classmates have provided me with friendships, shoulders to lean on, mathematical insights, and more laughter than I could have ever imagined. As I move to my PhD studies I will deeply miss all of them. I am also extremely thankful for my collaborators at both SMALL and the UVA REUs. Finally I would like to thank my mother and my partner for their continual support and encouragement. My mom is my personal superhero, and my partner has been my confidant and my rock for the past four years. Moving forward, I would like to continue to be a part of and to build communities that encourage kindness and greatness.

Rupert Li

Citation: Rupert Li. Rupert Li is recognized with an Honorable Mention for the 2024 Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student. Li is an undergraduate student of mathematics at the Massachusetts Institute of Technology. Li's work has focused on problems in combinatorics and has resulted in ten co-authored mathematical research papers.

Li's exceptional talent and dedication to research are evident through his three significant contributions to combinatorics, probability, dynamical systems, linear programming, and sphere packing. Impressively, his collaboration with Colin Defant, James Propp, and Benjamin Young on "Tilings of Benzels via the Abacus Bijection" settled two open problems regarding tilings. At the same time, his work on "Dual Linear Programming Bounds for Sphere Packing via Discrete Reductions" showcases his versatility in tackling mathematical challenges. His collaboration with James Propp on "A Greedy Chip-Firing Game" also introduces the "hunger game," enriching the fields of dynamical systems and probability. His impressive research achievements have earned recognition from reputable journals and experts.

Biographical Note. **Rupert Li** hails from Portland, Oregon. He was first introduced to math research in high school through the MIT PRIMES-USA program, and has loved researching ever since. His research interests lie in discrete geometry, probability, and combinatorics. Li is a senior double majoring at MIT, his primary major being mathematics and his secondary major being computer science, economics, and data science. In his free time, he enjoys hiking, watching movies, playing puzzle games, and alpine sliding.

Response from Rupert Li. I am incredibly honored to receive an Honorable Mention for the 2024 Morgan Prize. I wish to thank the Morgan family and the AMS, MAA, and SIAM for establishing this award.

I have been most fortunate to have amazing mentors supporting me on my mathematical journey. I extend my deepest gratitude towards Professor Joseph Gallian for his unwavering support. His unflagging effort and care for the Duluth REU and its students fosters a wonderful environment, both mathematically and socially. I am immeasurably grateful for Professor Henry Cohn and all his help and guidance. He has opened my eyes to incredible areas of math, and I have immensely enjoyed working with him ever since my first year at MIT. I extend my heartfelt thanks to Professor James Propp, who I have had the great pleasure of working with and learning from multiple times, enjoying every single project. I deeply thank Professor Nike Sun for her gracious mentorship and time, introducing me to new areas of math and fascinating problems. I am grateful to Dr. Colin Defant for being a wonderful mentor and collaborator. I also wish to thank my advisor, Professor Julee Kim, for her guidance and help throughout the years.

Daniel Zhu

Citation: Daniel Zhu. Receiving an Honorable Mention for the 2024 Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student is Daniel Zhu. Daniel was a recent undergraduate student of mathematics at the Massachusetts Institute of Technology and will now pursue a PhD in Mathematics at Princeton University. Introducing completely novel ideas and unexpected connections, Zhu and Moshkovitz addressed the conjecture that the notions of analytic rank and partition rank for higher-order tensors are equivalent up to a constant factor, proving nearly linear dependence (off by only polylog factors), a huge improvement over previous knowledge. In an accepted paper to *Combinatorial Theory*, he focused on estimating the number of numerical semigroups of a given genus. In a paper published in *Annals of Combinatorics*, Zhu made progress on the problem of list coloring bipartite graphs as well. Daniel's undergraduate work has resulted in two solo and two co-authored mathematical research papers, each of which represents a meaningful contribution to different areas of combinatorics. Zhu's letter writers have described him as "exceptional, careful and precise" and possessing "extraordinary drive," whose work would be considered strong "even for a professor."

Biographical Note. Daniel Zhu is a first-year graduate student at Princeton University studying combinatorics. A native of Rockville, Maryland, Daniel became interested in mathematics at an early age, and frequently participated in academic competitions throughout middle and high school, winning a gold medal at both the International Physics Olympiad in 2018 and International Math Olympiad in 2019. At MIT, Daniel received degrees in both math and physics and conducted research in several different areas within combinatorics at both the Duluth and Baruch College REUs. Outside of research, you can often find Daniel following national and local politics and going on walks around the Princeton area.

Response from Daniel Zhu. I am honored to receive an honorable mention for the 2024 Morgan Prize, and am grateful to the AMS, MAA, and SIAM for their continued recognition of undergraduate research. I would like to thank Guy Moshkovitz for being an outstanding collaborator and mentor, Alejandro Morales for introducing me to the research process and for his patience and encouragement, Joe Gallian and Adam Sheffer for organizing vibrant REU programs, and Yufei Zhao for providing invaluable advice and support throughout my time at MIT. More broadly, I would like to thank everyone who has supported my mathematical endeavors over the years, especially my parents, who have been there from the very beginning.

JPBM Communications Award

Natalie Dean

The Joint Policy Board for Mathematics (JPBM) Communication Award was established by the JPBM in 1988 and is given annually to reward and encourage communicators who, on a sustained basis, bring mathematical ideas and information to nonmathematical audiences. The JPBM is a collaborative effort of the American Mathematical Society, American Statistical Association, Mathematical Association of America, and Society for Industrial and Applied Mathematics.

Citation: Natalie Dean. The 2024 JPBM Communications Award is presented to Natalie Dean for a remarkable record of public engagement providing clear meaning and context to COVID models and predictions through traditional and social media.

Biographical Note. **Natalie Dean** is an Assistant Professor in the Department of Biostatistics and Bioinformatics at Emory's Rollins School of Public Health. She received her PhD in Biostatistics from Harvard University. She previously worked as a World Health Organization consultant and as faculty at University of Florida. Her primary research area is in methods for infectious disease epidemiology and vaccine study design, and she co-directs the Emory Alliance for Vaccine Epidemiology. She became active in communications at the start of the COVID-19 pandemic, via Twitter and engaging with the press. She authored op-eds in the *New York Times*, *Washington Post*, *Stat News*, and *Slate*. She appeared on TV and radio, including CNN, MSNBC, Good Morning America, and NPR's All Things Considered. She has over 300 press quotes across national and international outlets. She was previously honored as a member of the Committee of Presidents of Statistical Societies' Leadership Academy.

Response from Natalie Dean. What an absolute honor it is to receive the JPBM Communications Award. This recognition by the JPBM, including my home society the American Statistical Association, means the world to me. The magnitude of the COVID-19 pandemic has necessitated an enormous response that includes keeping policymakers and the public up-to-date. It has been my privilege to be able to contribute to this effort along with so many others.

I would like to thank my community of infectious disease researchers and biostatisticians—an incredibly hardworking community who leapt headfirst into the pandemic response, many in less visible but absolutely critical roles. Thank you to my family, friends, and colleagues who encouraged me with kind words of support, with a special shout-out to my pal Caitlin Rivers. Thank you to the incredible science reporters I have worked with and learned from along the way, and to the communications professionals at the University of Florida and Emory. I'd like to thank my sweet babies, Owen and Noelle, who keep me present and balanced. Most of all, I'd like to thank my husband Ethan, my biggest and best supporter.

Ronald Coifman

AMS-SIAM George David Birkhoff Prize in Applied Mathematics

The Birkhoff Prize is awarded for an outstanding contribution to applied mathematics in the highest and broadest sense. The prize was established in 1967 in honor of Professor George David Birkhoff, with an initial endowment contributed by the Birkhoff family and subsequent additions by others. The American Mathematical Society (AMS) and the Society for Industrial and Applied Mathematics (SIAM) award the Birkhoff Prize jointly. The prize is awarded every three years to a member of AMS or SIAM.

Citation: Ronald Coifman. The 2024 AMS-SIAM George David Birkhoff Prize in Applied Mathematics is awarded to Ronald Coifman for his profound impact on pure and applied harmonic analysis, and for the introduction of tools developed from these areas to address modern challenges of data science.

Coifman is one of the most influential mathematicians of our time. Coifman's research is foundational and has impacted many branches of modern analysis and applied mathematics. His work transformed the theory of Hardy spaces, singular integrals, the theory of homogeneous spaces, factorization theorems in complex analysis, the BMO theory, and the Coifman–Meyer theory of paraproducts. As Terence Tao put it, the theory of paraproducts "is a cornerstone of the para-differential calculus that has turned out to be an indispensable tool in the modern theory of nonlinear PDE".

Coifman is one of the pioneers in the realm of wavelets (a type of wavelet with vanishing moments is now known as Coiflet), and this marks the beginning of his profound impact on applied mathematics. More recently, he has developed powerful methods for dimensionality reduction of high-dimensional point sets, and in particular the Coifman–Lafon Diffusion Mapshave became a powerful standard tool in data science. Coifman has established one of the first theoretical results about what types of functions can be represented via neural networks used in deep learning. Coifman's influence on the scientific prominence of next generations of mathematicians is attested by the long list of his trainees who are today's leaders in their own right.

Coifman's distinguished research career has been recognized by a number of honors and awards, including being elected to the American Academy of Arts and Sciences in 1994 and to the National Academy of Sciences in 1998. He is a recipient of the 1996 DARPA Sustained Excellence Award, the 1996 Connecticut Science Medal, the 1999 Pioneer Award of the International Congresses on Industrial and Applied Mathematics. In 1999 Coifman was awarded the National Medal of Science, and in 2018 the Rolf Schock Prize for Mathematics.

Biographical Note. **Ronald Coifman** is Sterling professor of mathematics and professor of Electrical Engineering at Yale University. He obtained his PhD in Geneva in 1965 under the direction of J. Karamata , and was simultaneously mentored by Guido Weiss, and later by A. Calderon and A. Zygmund, while an instructor in Chicago. He joined Guido Weiss at Washington University in St Louis in 1968, until 1980 when he moved to Yale. Through the eighties he pursued an intensive collaboration with Yves Meyer and his team in Paris, later, followed by broad collaborations in Israel with Amir Averbuch and his group. Our current network joint with Y. Keverkidis is developing "mathematical empirical languages" to enable modeling empirical observations.

Response from Ronald Coifman. I would like to thank the AMS and the Society for Industrial and Applied Mathematics (SIAM) for the honor of being named the recipient of the 2024 George Birkhoff Prize in Applied Mathematics. And joining the previous recipients of the award who provided my mathematical inspiration. My view has always been that the boundary between pure and applied mathematics has never existed. Many people guided me throughout an exciting mathematical journey, starting with Zygmund who with Calderon and their students propagated the vision that a principal goal of a Harmonic analyst is to develop "methods" of analysis through a deep "understanding", replacing the miracles of complex analysis with "hard real variable methods or geometric book-keeping". I was mentored by Guido Weiss leading to a long and productive collaboration. Our program was to translate the ideas and tools of classical analysis to a general setting replacing the Fourier transform by adapted transformations that enabled us to go beyond linear convolutions and simple Euclidean structures. Throughout this journey collaborations with Yves Meyer opened the door to applications to nonlinear Fourier analysis and in signal processing. This is currently part of "computational Harmonic Analysis", and is a fundamental step for providing natural latent variables as "languages" essential for scientific models. This extended collaboration with Yannis. Kevrekidis, Yuval Kluger, Amir Averbuch, Vladimir Rokhlin, Jacques Peyriere and many, many, others has opened a world of merged visions.

Sybilla Beckmann

Award for Impact on the Teaching and Learning of Mathematics

The Award for Impact on the Teaching and Learning of Mathematics was established by the AMS Committee on Education (COE) in 2013. The endowment fund that supports the award was established in 2012 by a contribution from Kenneth I. and Mary Lou Gross in honor of their daughters Laura and Karen. The award is given annually to a mathematician (or group of mathematicians) who has made significant contributions of lasting value to mathematics education.

Citation: Sybilla Beckmann. Sybilla Beckmann, Josiah Meigs Distinguished Professor of Mathematics, Emeritus, at the University of Georgia, is nationally recognized for her seminal contributions to mathematics teacher education, combining experiences in mathematics, public school classrooms, textbook writing, national service, and research. Through her work in mathematics education policy, she has advocated for high-quality teacher education and rigorous mathematical curriculum, impacting students and teachers across the country.

Dr. Beckmann started her career in arithmetic geometry working on problems related to the Inverse Galois Problem, an open problem that asks whether every finite group occurs as a Galois group of a Galois extension of the rational numbers. She received her PhD from the University of Pennsylvania and taught at Yale University as a J. W. Gibbs Instructor of Mathematics before moving on to the University of Georgia.

When her children were in school, Dr. Beckmann became increasingly interested in K–12 mathematics education. To gain a deeper understanding of K–12 mathematics teaching, she taught one period of 6th grade mathematics in Clarke Middle School, a public school near the University of Georgia, for the entire 2004–2005 school year. Her direct experience in the classroom laid the foundation for her approach to teaching mathematics to future elementary and middle school teachers.

In particular, Dr. Beckmann's textbook, *Mathematics for Elementary Teachers with Activities*, first published in 2002 and now in its 6th edition, was groundbreaking in the space of mathematics teacher training. Dr. Beckmann's book focuses on arithmetic operations, giving a coherent understanding of K–12 mathematics, and it does so through activities, allowing students to experience the interactive, engaged teaching supported by research. This enables future teachers to develop deep insights into algebraic structures—making connections and drawing comparisons between different number systems. In addition, Dr. Beckmann incorporated best practices from mathematics curricula from Singapore and Japan in her textbook. Specifically, strip diagrams, which help students connect topics in arithmetic and algebra, feature prominently. Not only has Dr. Beckman influenced many future teachers who learned from her book, she truly changed the education of mathematics teachers with her innovative approach and perspective.

Dr. Beckmann has also been involved in writing many policy documents with the goal of improving the quality of mathematics education. She was on the Work Group for the Common Core State Standards for Mathematics, the closest thing the United States has to a rigorous set of standards shared across states. Dr. Beckmann was also one of the lead writers for The Mathematical Education of Teachers II, a document published jointly by the Mathematical Association of America and the American Mathematical Society that gives recommendations for high-quality mathematics teacher education. In addition, she helped to develop two Institute of Education Sciences Practice Guides, including *Improving Mathematical Problem Solving in Grades 4 through 8: A Practice Guide*. These nationally-recognized initiatives have had a broad impact on mathematics teachers and students.

In recognition of her commitment to excellence in math education and lasting impact on mathematics teacher education, the AMS awards Sybilla Beckmann the 2024 Award for Impact on the Teaching and Learning of Mathematics.

Biographical Note. **Sybilla Beckmann** is Josiah Meigs Distinguished Professor of Mathematics, Emeritus, at the University of Georgia. She earned a PhD in mathematics from the University of Pennsylvania and taught at Yale University as a J. W. Gibbs Instructor of Mathematics before teaching at the University of Georgia for 32 years.

Beckmann began her career doing research in Arithmetic Geometry, but she became interested in mathematics education as her children entered school. She developed courses for prospective elementary and middle-school teachers that were designed to go deeply into the ideas of elementary and middle-school mathematics. Her textbook for such courses is now in a sixth edition. Beckmann was a member of a number of national committees and writing teams to develop recommendations, guidelines, and standards for the mathematical education of students and teachers. She continues to do research in mathematics education.

Response from Sybilla Beckmann. Thank you so much to the AMS and the selection committee for this wonderful honor. When I began my career, I never imagined the path it would take. I followed my interests and took opportunities as they arose, and I developed a passion for mathematics education that sent my career in a non-standard direction. I am deeply grateful to the mathematics community as a whole, and to my colleagues and the heads of my department who valued and encouraged my work. I am so grateful to have been part of a culture in which the work I chose to do could thrive and flourish. It has been a joy and a privilege to think deeply about mathematics at many levels, from elementary school to the forefront of research, to work with so many dedicated and enthusiastic scholars, and to teach so many wonderful students. Huge thanks to my friends and colleagues in mathematics education who worked patiently with me and taught me so much, especially Andrew Izsák. And finally, thank you to my family, Will, Joey, and Arianna, for your love and inspiration, which made everything possible.

Mathematics Programs that Make a Difference Award

Three generations of MPM Organizers: (top row, left to right): Kim Klinger-Logan, McCleary Philbin, Esther Banaian, Sarah Brauner. (Bottom row, left to right): Patricia Commins, Marcella Manivel, Elise Catania, E Koenig. Not pictured: Alice Nadeau and Harini Chandramouli

In 2005, the American Mathematical Society, acting upon the recommendation of its Committee on the Profession, established the Mathematics Programs that Make a Difference Award. The award, provided by the Mark Green and Kathryn Kert Green Fund for Inclusion and Diversity, highlights programs that are succeeding and could serve as a model for others in addressing the issues of underrepresented groups in mathematics.

Citation: Mathematics Project at Minnesota. The AMS is proud to recognize the Mathematics Project at Minnesota (MPM) at the University of Minnesota (UMN) with the 2024 Mathematics Programs that Make a Difference Award.

Founded in 2018, the MPM is a week-long workshop that brings together undergraduate and graduate students and faculty at all levels to engage in activities and discussions aimed to build community, provide academic and professional development, and foster an environment committed to inclusivity and equity within the department. Through the efforts of graduate student leaders, the MPM has demonstrated success within the undergraduate program in recruiting, training, and retaining students who identify as underrepresented, women and gender minorities. With this recognition, the AMS envisions that the MPM at UMN can serve as a model and inspiration for similar workshops at peer institutions.

In the words of one of the graduate student organizers, "The workshop activities aim to deconstruct prior notions of what it means to be 'good' at math or to be a 'math person.' Often, students have internalized a rigid interpretation of who can be a mathematician and what types of skills this requires. Many of these assumptions are gendered and racialized. MPM engages students by (1) Asking them to critically think about the validity and origins of these assumptions; (2) Explaining that enjoying math is a sufficient reason to study it, as opposed to assessments of their own abilities (which they tend to underestimate); and (3) Fostering positive and collaborative mathematical experiences in a non-competitive environment... Community building underlies the entirety of the MPM workshop; in addition, several hours of each day of MPM are devoted to games, group meals and socializing. Throughout the workshop, small groups of participants are paired with advanced undergraduate students or graduate students who guide them through the various activities and sessions. Professors and post-docs who can serve as good mentors are invited to lead or attend sessions. The academic development sessions include group problem sessions and short individual presentations on a mathematics topic (with extensive help from graduate students along the way). Professional development workshops discuss career opportunities for a mathematics major, including a panel and dinner with local professionals. The equity and inclusivity discussions focus on imposter syndrome, growth mindset, implicit biases and privilege."

Each year, approximately ten graduate student volunteers organize and develop all workshop programming, recruit students and workshop volunteers, and obtain funding for the workshop (most recently, from the MAA Tensor Women and Mathematics Grant). To ensure that the program is sustainable, the MPM has thoughtfully created a tiered leadership structure, with advanced graduate students working together with early graduate students to convey experience and knowledge of running the workshop. Thus, graduate student volunteers gain experience in organizing workshops, building community, and seeking external funding. As an example of one of the many very positive statements from volunteers, "MPM has been a safe place for me and so many people, in which we have been able to explore and claim the identity of loving mathematics. MPM has given me a language to talk about struggles and growth in and around math and math communities, and tools to help me and others grow... I have made connections through MPM that have lasted years, and seen many people seek out opportunities they never would have known about."

The MPM builds community across academic levels: students early in their undergraduate careers are paired with their more advanced peers and graduate students. The workshop also builds connections among students, post-docs, faculty and local professionals in the mathematical sciences. The MPM mentoring relationships between paired undergraduate and graduate students continue long after the workshop. As noted in a voluntary comment from an undergraduate participant, "If I had not participated in MPM, I may not have stayed in the math department. The program gave me a community and the confidence to stay." And from another, "MPM helped me feel less alone on campus. As the only girl in my class, I often felt really lonely and scared in my pursuit in math and often questioned why I chose it as my major. MPM reminded me that I enjoy learning about math and there are many new careers I can do!"

In summary, the MPM is an invaluable and highly effective graduate student-led initiative developed with the goal of exposing and removing known barriers in retaining and advancing the careers of women, gender minorities and underrepresented groups in the mathematical sciences at the University of Minnesota. The workshop creates lasting mentoring relationships and provides academic and professional enrichment for participants at all levels through thoughtful activities, discussions, and local networking. This replicable program has the potential to have a profound and positive impact on students and faculty at similar graduate programs, as well as the power to make a significant difference to our greater mathematical community.

Biographical Note. Mathematics Project at Minnesota is a graduate student initiative that was founded in the fall of 2017 by Harini Chandramouli, Kim Klinger-Logan, and

Alice Nadeau. It was then organized by Esther Banaian, Sarah Brauner, and McCleary Philbin. The current organizers are Elise Catania, Patricia Commins, E Koenig, and Marcella Manivel. In addition to organizers, each year 5–10 graduate students help implement sessions and mentor participants.

The workshop is planned during the fall semester, and takes place the week before the University of Minnesota (UMN) spring semester starts. The program has grown substantially since 2017; the number of participants has gone from roughly 15 to 30, and the number of volunteers (MPM alumni, postdocs and faculty) has also nearly doubled. The workshop aims to recruit UMN undergraduates who come from underrepresented groups in mathematics and are early in their studies. Students are identified by department lists and instructor/teaching-assistant recommendations.

Response from Mathematics Project at Minnesota. The organizers of the Mathematics Project at Minnesota (MPM) are very honored to receive this award.

The MPM is a workshop held annually at the University of Minnesota (UMN). The goal of the program is to increase participation of undergraduate students from underrepresented groups in mathematics, and to encourage their success. The MPM is organized by graduate students at UMN, and typically has around 30 undergraduate participants. The week-long workshop contains approximately 20 sessions on various topics in mathematics, equity and diversity issues, professional development panels and information sessions, and social events.

The workshop has a strong focus on community building. Participants are paired with graduate student mentors who provide individualized advice and mathematical support throughout (and beyond the end of) the program. Postdocs and faculty members participate in various events, and several external speakers are invited to speak on professional development panels.

This sense of community is fundamental to the program; it encourages engagement, and reinforces strong positive messages that these students are welcome in the mathematical community. Participants are invited to return to the program in future years, and many are excited to return to take on supporting and mentoring roles. In anonymous surveys conducted after the program, an overwhelming majority of undergraduate participants indicated that they would recommend the program to other students and that they were more likely to participate in math research or pursue upper-level mathematics courses as a result of their experience at the MPM. Many workshop alumni have said that the workshop helped persuade them to stay in the mathematics major or go to graduate school.

We are indebted to the many graduate student volunteers who have worked tirelessly to help make the MPM a success and the mathematics major at UMN more inclusive. We also thank the MAA Tensor Grant for Women in Mathematics for providing funding for the workshop for the past three years, and to Paul Carter and Max Engelstein for serving as faculty liaisons.

We hope that this award helps MPM become a permanent, internally funded fixture of the mathematics department at UMN. We would also like to take this opportunity to invite members of the mathematics community to start similar programs at their institutions. We are happy to advise about logistics and to provide samples of all workshop materials we have used. Please visit our website for more information: `https://sites.google.com/view/mpm-umn`.

Bertrand Russell Prize of the AMS

Susan Landau

The Bertrand Russell Prize of the AMS was established in 2016 by Thomas Hales. The prize looks beyond the confines of the profession to research or service contributions of mathematicians or related professionals to promoting good in the world. It recognizes the various ways that mathematics furthers fundamental human values. Mathematical contributions that further world health, our understanding of climate change, digital privacy, or education in developing countries, are some examples of the type of work that might be considered for the prize. The prize is awarded every three years.

Citation: Susan Landau. The 2024 Bertrand Russell Prize of the AMS is awarded to Susan Landau. Landau is Bridge Professor in Cyber Security and Policy at The Fletcher School and the School of Engineering, Tufts University. She is a leading scholar in encryption policy and digital privacy, an area of great importance currently. Writing technical research papers and opeds, publishing public-facing work, briefing policymakers, and participating in national studies, Landau has effectively coupled the mathematics of digital privacy and encryption to policy-making. Her strengths and energy in communications, in testimony but especially in books, have helped to illuminate essential properties of the digital world that limit the range of policy and the degree of protection that digital methods can offer.

Biographical Note. **Susan Landau** is Bridge Professor in Cyber Security and Policy at The Fletcher School and the School of Engineering, Department of Computer Science, Tufts University. She works at the intersection of privacy, surveillance, national security law, and cybersecurity. Landau is the author of four books: *People Count: Contact-Tracing Apps and Public Health*, *Listening In: Cybersecurity in an Insecure Age*; *Surveillance or Security? Risks Posed by New Communications Technologies*; and co-author, with Whitfield Diffie, *Privacy on the Line: The Politics of Wiretapping and Encryption*. Landau has testified before Congress and briefed US and European policymakers on encryption, surveillance, and cybersecurity issues. She has served on various advisory boards, including the National Academies Computer Science and Telecommunications Board, NSF Computer and Information Science Advisory Board, and NIST's Information Security and Privacy Advisory Board. Landau has received multiple awards, including a Lifetime Achievement Award from USENIX in 2023. She received a BA from Princeton, an MS from Cornell, and a PhD from MIT.

Response from Susan Landau. I am deeply honored to receive the Bertrand Russell Award, which is quite meaningful to me in three ways.

The first is because of the momentous change in the mathematics community since I entered it in the early 1970s. At the time, reaching out to the wider world was deemed an unnecessary distraction from proving deep theorems. So the view embodied in the Bertrand Russell Award makes it particularly meaningful to me.

The second stems from the winds of change that blew across the AMS and math community in the late 1970s. In the early 1980s, the AMS *Notices* began publishing expository work. My first works on cryptography policy were for the *Notices*. Thus, those winds of change had a direct effect on my career.

The third reason the Bertrand Russell Award is so personally meaningful is that Russell and Joseph Rotblat founded the Pugwash Conferences on Science and World Affairs, an international organization of scientists working to eliminate weapons of mass destruction. Pugwash efforts lie behind the 1963 nuclear test ban treaty and multiple other international arms treaties. In 1981 I attended a Student Pugwash Conference; the meeting's indelible impression has guided my thinking and actions ever since. I feel greatly privileged to receive this award and thank the AMS and the Bertrand Russell Award Committee for this honor.

Elias M. Stein Prize for New Perspectives in Analysis

Marcel Filoche

Svitlana Mayboroda

This prize was endowed in 2022 by students, colleagues, and friends of Elias M. Stein to honor his remarkable legacy in the area of mathematical analysis. Stein is remembered for identifying many deep principles and methods which transcend their original context, and for opening entirely new areas of research which captivated the attention and imagination of generations of analysts. This prize seeks to recognize mathematicians at any career stage who, like Stein, have found exciting new avenues for mathematical exploration in subjects old or new or made deep insights which demonstrate promise to reshape thinking across areas.

Citation: Marcel Filoche and Svitlana Mayboroda. The 2024 Elias M. Stein Prize for New Perspectives in Analysis is awarded jointly to Marcel Filoche and Svitlana Mayboroda for their original, powerful, elegant and impactful theory of the "localization landscape," initially developed in *Proc. Natl. Acad. Sci.* USA, **109** (2012), no. 37 and *Contemp. Math.*, **601** (2013). The theory evolved in scope and impact through multiple subsequent collaborative works, including in *Adv. Math.* **390** (2021), Paper No. 107946, 34. In this theory, the localization of eigenfunctions to a Schrödinger type operator is controlled in various senses by a single, easily computed "landscape function." This discovery is supported by theoretical results, striking numerics, and physical experiment, and it provides a novel way to look at eigenfunctions that goes beyond existing methods such as semiclassical analysis or probabilistic approaches, greatly clarifying the phenomenon of wave localization.

Biographical Note. **Marcel Filoche** graduated from Ecole Polytechnique in 1985 and received his PhD from Université d'Orsay in 1991. He is currently CNRS Research Director at the Langevin Institute of the Ecole Supérieure de Physique et Chimie Industrielle (ESPCI), Paris.

Marcel Filoche is interested in transport and propagation phenomena in systems with complex geometries, both classical and quantum. Over the past ten years, he has developed together with Svitlana Mayboroda the mathematical theory of the localization landscape, unveiling the properties of eigenfunctions of wave operators in random potentials. Since 2018, he has been one of the leaders of the international Simons collaboration project on wave localization.

Biographical Note. **Svitlana Mayboroda** was born in Kharkiv, Ukraine. She received her PhD at the University of Missouri in 2005, and after that held postdoctoral positions at the Ohio State University, Australian National University and Brown University. She worked at Purdue University from 2008 to 2011 and moved to the University of Minnesota in 2011. Professor Mayboroda has been the McKnight Presidential Professor of Mathematics at the University of Minnesota since 2020. In 2023 she joined ETH Zurich.

Svitlana Mayboroda's awards include, in particular, the US Blavatnik National Award in 2023, the AWM Sadosky Prize in Analysis in 2014, the Alfred P. Sloan Research Fellowship in 2010. She has enjoyed continuous NSF support since 2008 and has been the Director of the Simons Collaboration on the Localization of Waves since 2018. She was an invited speaker at the ICM in 2018.

Response from Marcel Filoche. I am very honored and thrilled to receive the inaugural Elias Stein Prize. I would like to thank the American Mathematical Society for this prestigious award, and Svitlana Mayboroda who was my partner all along during the development of the localization landscape theory. It is truly a privilege to work with her. I would like to especially thank my professor who introduced me to the beauty of harmonic analysis, Yves Meyer, for his constant enthusiasm and care. I am also deeply grateful to Guy David, David Jerison, and Douglas Arnold for years of joyful and intense collaboration. I learned immensely working with them, and it is always a privilege. Finally, I am very thankful to my family for all the love and support.

Response from Svitlana Mayboroda. It is an immense honor to receive the inaugural Elias M. Stein Prize for New Perspectives in Analysis. Stein's legacy as a mathematician and educator has shaped my field, and I am incredibly grateful to my peers and to the selection committee for this remarkable recognition. This award has a special meaning to me. It not only endorses my individual contributions, but also pays homage to many years of the exciting collaboration that had such a deep impact on my mathematics, my life, and my career. I am deeply grateful to Marcel Filoche for challenging and inspiring me on this incredible journey, for sharing his vision and pushing us to fearlessly cross boundaries between mathematics and physics, and to Jill Pipher, Doug Arnold, and Guy David whose unwavering support has made this project possible.

Albert Leon Whiteman Memorial Prize

Leo Corry

This prize was established in 1998 using funds donated by Mrs. Sally Whiteman in memory of her husband, the late Albert Leon Whiteman. Mrs. Whiteman requested that the prize be established for notable exposition on the history of mathematics. Ideas expressed and new understandings embodied in the exposition awarded the Whiteman Prize will be expected to reflect exceptional mathematical scholarship. The prize is awarded every three years at the Joint Mathematics Meetings.

Citation: Leo Corry. The 2024 Albert Leon Whiteman Prize of the American Mathematical Society is awarded to Leo Corry of Tel Aviv University (currently President, the Open University of Israel) for his exceptional scholarship and exposition elucidating the roles of axioms and structures in the practice of modern mathematics and physics, as well as for his many contributions to the field of history of mathematics as an editor, mentor, and communicator.

Across an impressive array of publications, Leo Corry has insightfully examined pivotal developments in modern mathematical sciences with technical nuance, philosophical sophistication, and narrative flair. His first two books, *Modern Algebra and the Rise of Mathematical Structures* (Springer-Birkhäuser Verlag, 1996; 2nd ed. 2004) and *David Hilbert and the Axiomatization of Physics (1898-1918): From Grundlagen der Geometrie to Grundlagen der Physik* (Springer, 2004), treat what, at first glance, may seem like two largely distinct, if not actually contradictory, trends in twentieth-century mathematics: the development of modern algebra and the mathematical reorientation of physical theory. Corry's work in these books and numerous associated writings identifies the common background that informed the trends, clarifying their apparent tensions and demonstrating how structuralism and axiomatic foundationalism functioned at the dynamic interface between the philosophical characterization, and the actual practice, of mathematics. His analysis has illuminated the significance of the sometimes-paradoxical diversity of conceptions of structures, abstraction, and universalism, opening up a critical perspective on a rich and challenging era of major mathematical change that has inspired considerable further research by historians and others.

More recently, Corry has explored the interaction between theory building and intensive calculation in pure mathematics, especially number theory, both before and after the advent of the electronic computer. His work in this area has led to the widely-read and translated popular book, *A Brief History of Numbers* (Oxford, 2015), two books in collaboration with Raya Leviathan, *WEIZAC: An Israeli Pioneering Adventure in Electronic Computing* (1945–1963) and *Chaim L. Pekeris and the Art of Applying Mathematics with WEIZAC* (1955–1963) (Springer Verlag, 2019 and 2023, respectively), and a series of innovative and illuminating articles, notably "A Clash of the Mathematical Titans in Austin: Robert Lee Moore and Harry Schultz Vandiver (1924–1974)" (*The Mathematical Intelligencer*, 2007). Concurrently, Corry has studied the interrelation between arithmetic and geometry in the Euclidean tradition, focusing on the consolidation of algebraic methods in the early modern period and the rise of analytic geometry, on the one hand, and on the historical question of the interpretation of "geometrical algebra" in classical Greek geometry, on the other. In this vein, he has produced two, one-hundred-page monographs, *Distributivity-like Results in the Medieval Tradition of Euclid's Elements: Between Geometry and Arithmetic* and *British Versions of Book II of Euclid's Elements: Geometry, Arithmetic, Algebra (1551–1750)* (Springer Verlag, 2021 and 2022, respectively).

As a generous editor (notably of the leading journal, *Science in Context*, for most of the period of 1999–2013) and mentor, Corry has shaped the field of history of mathematics and its connections to allied fields in Israel and internationally. He has lectured around the world and shared his insights with many and varied audiences, most notably as an invited session speaker at the International Congress of Mathematicians in Madrid in 2006 and as a keynote lecturer in the Turing Centennial Conference of the Royal Flemish Academy of Belgium for Science and the Arts in 2012.

Taken collectively, Leo Corry's body of research has led to a new understanding of the very notion of "modern mathematics" as well as to insights in earlier traditions.

Biographical Note. **Leo Corry** is Professor Emeritus of History and Philosophy of Science at Tel Aviv University, currently serving as President of the Open University of Israel. He graduated in mathematics at Universidad Simón Bolívar (1977), in Caracas, and continued his studies at TAU, earning an MSc in mathematics (1982), and a PhD in history and philosophy of science (1990).

At TAU, Corry has been Director of the Institute for History and Philosophy of Science, Director of the Graduate School of Historical Studies, and Dean of Humanities. He has been visiting professor at the Max Planck Institute in Berlin, ETH Zurich and MIT.

Corry is co-author of twenty US patents in the field of electronic data storage. He has published scholarly work on Latin American literature, and has translated into Hebrew such writers as Borges, Vargas Llosa and Carpentier. He is an enthusiastic connoisseur of salsa and Venezuelan music, and a skilled *maraquero*.

Response from Leo Corry. I am thrilled and honored by being selected to receive this award. My work would not have been possible without the prolific community of historians of mathematics of my generation, whose work over the last few decades turned our discipline into a vibrant field of research. Because of its high quality and the range of topics and periods that it addresses, the ever-growing body of knowledge thus produced has received increased attention and recognition in the mathematical world at large. My sincere thanks go to all of my colleagues with whom I have had the privilege to interact professionally, and to learn from their work.

The remarkable mathematical education I received at Universidad Simón Bolívar, and was later complemented at TAU, provided the rock-solid basis of whatever I have done ever since. The all-encompassing intellectual ecosystem of the Cohn Institute of History and Philosophy of Science at TAU was for more than four decades a world-class academic home that shaped my career.

Leroy P. Steele Prize for Mathematical Exposition

Benson Farb

Dan Margalit

The Leroy P. Steele Prizes were established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein and are endowed under the terms of a bequest from Leroy P. Steele. Prizes are awarded in up to three categories.

The AMS Leroy P. Steele Prize for Mathematical Exposition is awarded annually for a book or substantial survey or expository research paper.

Citation: Benson Farb and Dan Margalit. The 2024 Steele Prize for Mathematical Exposition is awarded to Benson Farb and Dan Margalit for their Princeton Mathematical Series book *A Primer on Mapping Class Groups*. The authors are leading researchers in group theory as well as allied areas of topology and geometry. Their expertise shines through with masterful and clear expositions of the combinatorial, algebraic, geometric and analytic viewpoints that mapping class groups enjoy. Many of the classical theorems, for example the work of Dehn, are presented from a modern perspective and in particular through the work of Thurston, which was introduced and developed decisively in the short time since the primer was published.

The book has proved to be a valuable resource not only for the graduate students to whom it is addressed, but also for experts. It is already a classic and it sets the standard for accessible, clear and inviting writing. It stands as the very model of scholarship.

Biographical Note. **Benson Farb** is Professor of Mathematics at the University of Chicago. He was born and raised in Norristown, Pennsylvania, a suburb of Philadelphia. Farb graduated from Cornell University in 1989, obtained a PhD at Princeton University in 1994 under the direction of Bill Thurston, and then went to the University of Chicago as a postdoc and never left. Farb was a Sloan fellow, an NSF Career Award recipient, an inaugural Fellow of the AMS (2012), and an invited speaker at the 2014 ICM (Topology section). He was elected to the American Academy of Arts and Sciences in 2021. Farb has written papers on geometric group theory, low-dimensional topology, dynamical systems, differential geometry, Teichmuller theory, cohomology of arithmetic groups, representation stability, Hilbert's 13th problem, algebraic geometry, 4-manifold theory and the connections among all of these topics. He has supervised 52 PhD students and has been senior scientist for 15 NSF postdocs.

Biographical Note. **Dan Margalit** grew up in Flanders, NJ, the son of two Israeli immigrants. He received his ScB in Mathematics from Brown University in 1998 and his PhD in Mathematics from the University of Chicago in 2003 under the direction of Benson Farb. He was on the faculty at the University of Utah, Tufts University, and Georgia Institute of Technology before becoming Stevenson Chair and Chair of Mathematics at Vanderbilt University in 2023.

Margalit received a Sloan Research Fellowship in 2009 and an NSF CAREER Award in 2010. He received the Levi L. Conant Prize from the AMS in 2021. He was the Maryam Mirzakhani Lecturer at the 2022 JMM. Margalit was elected as Fellow of the AMS in 2019 "for contributions to low-dimensional topology and geometric group theory, exposition, and mentoring."

Margalit enjoys music, hiking, and juggling. He is married to Kathleen Margalit. They have two children, Lily and Simon.

Response from Benson Farb. I am grateful to the AMS for this honor. I am lucky to have learned so much about this topic from my advisor Bill Thurston (from whom I also learned how to encounter mathematics), from Curt McMullen (whose course in 1993 served as an inspiration for this book), and from Lee Mosher and Howard Masur. Thanks to Joan Birman for her support throughout the years. Joan was a pioneer in this area, and has served as a role model for so many of us. Finally, thanks to my family: Amie, Bea and Felix, for their love and support.

This project began with me teaching Dan Margalit this subject, and it ended with Dan teaching me much more. I am grateful to him for this, and for catching and explaining the many (alas) subtle points I'd missed.

Response from Dan Margalit. I am honored and grateful to be a co-recipient of the 2024 Leroy P. Steele Prize for Mathematical Exposition.

In Winter 2001, I was a third year graduate student. A struggling third year graduate student. Benson Farb, my advisor (and co-recipient), took a chance and asked me if I would take notes on his course, with the goal of writing a book. I thought this was a one-year project. Our book was published a decade later.

I am incredibly grateful to Benson for bringing me into this project. It gave me an avenue for deepening my feel for mathematical argumentation, for nurturing my intuition for groups and topology, and for developing my skills as a writer. Most of all, I benefitted from Benson's broad vision, impeccable taste, and joy for beautiful mathematics. We had many disagreements over the usage of commas, the ordering of sections, and the proofs of theorems (full disclosure: most of the time he was right). We often marvel (jokingly) at how we are still on speaking terms.

In working on the book, I relied heavily on conversations with Bob Bell, Mladen Bestvina, Joan Birman, Tara Brendle, Ken Bromberg, Chris Leininger, Andy Putman, Steven Spallone, and Kevin Wortman. I am grateful for their intellectual and emotional generosity. I would also like to thank Thomas Banchoff for drawing me into mathematics.

I am grateful to my wife, Kathleen, for giving me inspiration for this project and all my other endeavors. I am further grateful to her and our two children, Lily and Simon, for supporting my long hours of writing during weekends and winter vacations. My siblings, Ron and Thalia, are constant sources of love. Finally, I would like to thank my parents, Batya and Zamir, who sacrificed endlessly so their children could be successful and realize their dreams.

Leroy P. Steele Prize for Seminal Contribution to Research

József Balogh

Rob Morris

Wojciech Samotij

David Saxton

Andrew Thomason

The Leroy P. Steele Prizes were established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein and are endowed under the terms of a bequest from Leroy P. Steele. Prizes are awarded in up to three categories.

The Steele Prize for Seminal Contribution to Research is awarded for a paper, whether recent or not, that has proved to be of fundamental or lasting importance in its field, or a model of important research. The prize is awarded according to the following six-year rotation of subject areas: Open, Analysis/Probability, Algebra/Number Theory, Applied Mathematics, Geometry/Topology, and Discrete Mathematics/Logic.

Citation: József Balogh, Rob Morris, and Wojciech Samotij; David Saxton and Andrew Thomason. The 2024 Steele Prize for Seminal Contribution to Research is awarded jointly to József Balogh, Rob Morris, and Wojciech Samotij for their paper "Independent sets in hypergraphs," published in the *Journal of the American Mathematical Society*, **28** (2015), 669–709, and to David Saxton and Andrew Thomason for their paper "Hypergraph containers," published in *Inventiones Mathematicae*, **201** (2015), 925–992.

An independent set in a hypergraph is a subset of vertices containing no hyperedge. It is well understood that several important theorems and conjectures in combinatorics, such as Szemerédi's theorem on arithmetic progressions and the Erdös–Stone Theorem in extremal graph theory, can be cast as questions about families of independent sets in certain uniform hypergraphs. The above two papers, written independently of each other, distilled the property that many of these hypergraphs exhibit: a certain clustering phenomenon that explains why certain intriguing results hold.

A hypergraph container theorem claims the existence of a collection of subsets of vertices (containers) such that (a) every independent set is a subset of one of the container sets, (b) the number of containers is not large, and (c) every container set spans only few hyperedges. Each of the above papers proved such a container theorem, and gave numerous applications of it. Specifically: i) new proofs of random analogues of Turán and Szemerédi Theorems, ii) tight estimates for the number of H-free graphs and hypergraphs (for a fixed graph H), and a counting version of Szemerédi's theorem, and iii) a proof of the celebrated Kohayakawa–Łuczak–Rödl conjecture. Although these papers were published only eight years ago, their importance has been amply demonstrated by numerous deep results proved subsequently, in which a key step has been an application of the hypergraph container theorem or a variant of it.

Biographical Note. **József Balogh** grew up in a small thermal spa town, Mórahalom, in South Hungary. He attended the top mathematics secondary school at the time:

Ságvári, in Szeged. While in high school, Balogh won two silver medals at the International Mathematical Olympiad. He completed his undergraduate and master's studies at Szeged University and earned his PhD at the University of Memphis under the supervision of Béla Bollobás. Balogh held postdoctoral positions at AT&T Research, the Institute for Advanced Study at Princeton, and The Ohio State University; visiting positions at Szeged University, IPAM at UCLA, and the University of Cambridge; and a tenured position at UCSD. Currently, he is a professor at the University of Illinois in Urbana-Champaign, where he has advised 16 doctorate students. Balogh was a recipient of the George Pólya Prize in Combinatorics from SIAM (2016), an ICM speaker (2018), and a Simons Fellow (2013, 2020). Outside of mathematics, he enjoys racquet sports, chess, and soccer—both as a player and as a former coach.

Biographical Note. **Rob Morris** grew up in the north of England, but received his PhD from the University of Memphis, where he was a student of the famous Hungarian mathematician, Béla Bollobás. He fell in love with Rio de Janeiro during a visit to IMPA in 2004, and spent a year there as a postdoc in 2006–2007. After spending time in Cambridge, Tel Aviv and Tokyo, he returned to Rio (and to IMPA) in 2010, where he has been ever since. He has been awarded numerous prizes, including the MCA Prize, the Prêmio Reconocimiento de UMALCA, the Prêmio SBM, the Prêmio Elon Lages Lima, the Fulkerson Prize, the George Pólya Prize in Combinatorics, and the European Prize in Combinatorics. He was an invited speaker at the 2018 ICM, and in 2022 he was elected to the Brazilian Academy of Sciences. He lives in Rio de Janeiro, a few minutes walk from IMPA, with his wife and two daughters.

Biographical Note. **Wojciech Samotij** was born in Wrocław, Poland in 1983. After receiving MSc degrees in mathematics and in computer science from the University of Wrocław, he moved to the University of Illinois at Urbana- Champaign, where in 2010 he obtained his doctorate, advised by József Balogh. Samotij spent his postdoctoral years between Trinity College in Cambridge and Tel Aviv University, where he was appointed as a faculty member in 2014. He has worked at the School of Mathematical Sciences of Tel Aviv University ever since.

Biographical Note. **David Saxton** was born in Hampshire, England, and studied mathematics at Cambridge, where he did his PhD (2008–2012) in combinatorics under the supervision of Andrew Thomason. He continued combinatorics research in a postdoctoral position (2012–2014) at IMPA, Brazil, and is a recipient of the 2016 Pólya Prize. Since 2015 he has worked at DeepMind as a machine learning researcher, where his research interests and projects have included improving the reasoning abilities of neural networks, and applying generative modelling to protein design. Outside of professional life, David enjoys writing, meditation, and various sports, including climbing and cycling.

Biographical Note. **Andrew Thomason** was an undergraduate at Peterhouse, Cambridge, and received his PhD from Cambridge under the supervision of Béla Bollobás. Following a research fellowship at St John's College Cambridge, and tenured positions at Louisiana State University and at the University of Exeter, he returned to Cambridge as a faculty member and also a Fellow of Clare College. His research has been largely in the area of graph theory. He is now retired.

Response from József Balogh, Rob Morris, and Wojciech Samotij; David Saxton and Andrew Thomason. We are deeply honoured to receive the Leroy P. Steele Prize for Seminal Contribution to Research. We are extremely grateful to the colleagues who nominated us and to the wider combinatorial community for their unfaltering support over the years; in particular, we thank Béla Bollobás, the research supervisor of three of us.

We would like to stress that our work on hypergraph container theorems was only made possible by earlier works of many other mathematicians. The early foundations for the graph container method were laid already in the 1980s and 1990s by Daniel Kleitman and Kenneth Winston and, independently, by Alexander Sapozhenko, who was the first to use the term "container" in this context. Curiously, our journeys to a useful notion of hypergraph containers, and effective ways to implement it, were different. Two of us were pointed to the start of the trail by Sapozhenko, whilst the other three, following the spirit of Kleitman and Winston, were heavily influenced by the seminal work of Penny Haxell, Yoshi Kohayakawa, Tomek Łuczak, and Vojta Rödl in the 1990s, and by the wonderful papers of David Conlon and Tim Gowers and of Mathias Schacht, which independently developed two versions of the so-called "transference principle" in the context of extremal properties of random structures.

Further, a large portion of the credit that the five of us have received for the development of the "container method" should in fact extend to a much larger group of mathematicians who have found a great many, often very surprising, applications of our hypergraph container theorems. The container method is an achievement of the entire combinatorics community, and we would like to dedicate this prize to all of the mathematicians who contributed to its development over the years.

Response from József Balogh. I would like to express my deepest gratitude to my parents. My father, although equally talented in math during middle school, faced the unfortunate circumstance of not being able to attend high school due to financial constraints. The same was true for my mother. Despite their own limitations, they provided me with unwavering support for my education. I am profoundly grateful for their sacrifices and dedication to my future.

I extend my heartfelt appreciation to all the exceptional teachers who have played pivotal roles in my mathematical journey. In high school, Tamás Tarcsay, József Csúry, and Lajos Pintér ignited the flames of my passion for advanced mathematics. Later, as an undergraduate student, the influence of Péter Hajnal and András Pluhár sparked my interest with combinatorics, eventually leading me to join the research group of Béla Bollobás.

As a first-generation high schooler, the academic path was, and continues to be, far from smooth. Along this journey, solving mathematical problems often proved to be the easiest part of the journey.

One of the most valuable lessons I have learned from my teachers is that mathematics is fun; it's an exhilarating adventure. We should always focus on interesting problems and always enjoy the journey, not just the destination. I am dedicated to passing on this philosophy to the next generation of mathematicians.

On a more lighthearted note, my journey into the world of mathematics began when I participated in a Hungarian TV show—a math competition designed for 6th graders. You can catch a glimpse of my early mathematical enthusiasm in this video: see `https://www.youtube.com/watch?v=0E7GeTCTBtg`.

Haïm Brezis

Leroy P. Steele Prize for Lifetime Achievement

The Leroy P. Steele Prizes were established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein and are endowed under the terms of a bequest from Leroy P. Steele. Prizes are awarded in up to three categories.

Presented annually, the AMS Leroy P. Steele Prize for Lifetime Achievement is awarded for the cumulative influence of the total mathematical work of the recipient, high level of research over a period of time, particular influence on the development of a field, and influence on mathematics through PhD students.

Citation: Haïm Brezis. The 2024 Steele Prize for Lifetime Achievement is awarded to Haïm Brezis for his outstanding and seminal contributions in several fields of Nonlinear Functional Analysis and Partial Differential Equations, and for his remarkable influence in mathematics, in particular through his exceptional training of PhD students.

Brezis has greatly contributed to leading and shaping the fields of Nonlinear Analysis and Partial Differential Equations and how the main questions are posed. He has started and animated several different areas of analysis, for example maximal monotone operators, gradient flows and weak notions of degree. His papers contain gems with beautiful unexpected statements. His philosophy of action, which always starts with simple and easily understandable questions, has been adopted by many of his numerous students. Although a pure mathematician at heart, his mathematics has often been motivated by, or found its way back to, applications, for example to liquid crystals and to Ginzburg-Landau vortices in the theory of superconductivity.

Brezis is a fine lecturer and expositor. His beautiful book on Functional Analysis, *Sobolev Spaces and Partial Differential Equations*, first published in French in 1983 and then reprinted and expanded along the years and translated into eight different languages, has been used for forty years as a classical textbook in many universities worldwide.

The legacy of Haïm Brezis is measured not only by his work but also by that of his students and associates, many of whom have had, and continue to have, outstanding careers. He has supervised 58 PhD theses. In addition to his role as a teacher, leader and researcher, he has contributed greatly to the community through his many editorial roles and through influential posts such as Vice-President of the American Mathematical Society.

Biographical Note. **Haïm Brezis** was born in 1944 in Riom-es-Montagnes, a hamlet in the mountainous Auvergne region of France. His parents were Jewish refugees hiding under precarious conditions in the woods surrounding this hamlet. After WWII they settled in Paris, where Haïm received his entire education in various institutions of the celebrated Latin Quarter. He earned a Doctorate in 1971 from the Université de Paris, under the supervision of G. Choquet and J.L. Lions.

In 1972 he was appointed at the Université Paris VI (Associate Professor 1972–1976, Full Professor 1976–2007, Emeritus since 2008).

In 1987 he accepted an offer from Rutgers as Distinguished Visiting Professor for several months every year; he held it until 2022 when he became Emeritus. He was also a regular visitor at the Technion (2008–2022).

Brezis is a member of Académie des Sciences, Paris. He is a foreign member of the American Academy of Arts and Sciences, the National Academy of Sciences, USA, and several European national academies (Belgium, Italy, Romania, Spain).

He received Honorary degrees from various universities in Belgium, Greece, Israel, Italy, Netherlands, Romania, and Spain. He holds a Honorary Professorship from the Institute of Mathematics, Academia Sinica, Beijing, from Fudan University, and from Beijing Normal University.

Response from Haïm Brezis. I am delighted to have been awarded the 2024 Steele Prize for lifetime achievement and honored by the generous citation.

My encounter with Partial Differential Equations (PDEs) was accidental. During the 1960s French academia (perhaps still under the influence of Bourbaki) largely overlooked PDEs, with the notable exception of J.-L. Lions. Given my interest in Nonlinear Functional Analysis, my PhD advisor, Choquet, gave me papers by F. Browder to read. Some of them contained applications to PDEs that I did not yet understand, and so I taught myself basic PDEs. With Lions' support, I later deepened my understanding of the field under three leading experts who became my mentors and collaborators: Browder (Chicago), Nirenberg (NYU), and Stampacchia (Pisa).

Later, in the early 1970s, I witnessed in France a revolution: students were encouraged to learn PDEs because of their potential applications to many real-life problems. I received a position at the University of Paris where I taught PDEs to large groups of outstanding students (including from Ecole Normale Supérieure and Polytechnique). I had to generate open problems for my PhD students. Many of them and their descendants have become leaders in PDEs and adjacent fields. I was fortunate to work with brilliant collaborators to whom I am immensely grateful. Their list is much too long to be inserted in the limited space I have here.

Today, PDEs are thriving in France and worldwide; many new results and research directions have emerged, and some challenging open problems remain. Looking back, fifty years later, I am proud to have been part of this success story.

Credits

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