# Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics

In 1991, the Mathematical Association of America instituted the Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics in order to honor college or university teachers who have been widely recognized as extraordinarily successful and whose teaching effectiveness has been shown to have had influence beyond their own institutions. Deborah Tepper Haimo was President of the Association, 1991–1992.

## Citation

### Jacqueline Dewar

In her 32 years at Loyola Marymount University, Jackie Dewar's enthusiasm, extraordinary energy, and clarity of thought have left a deep imprint on students, colleagues, her campus, and a much larger mathematical community. A student testifies, "Dr. Dewar has engaged the curious nature and imaginations of students from all disciplines by continuously providing them with problems (and props!), whose solutions require steady devotion and creativity…." A colleague who worked closely with her on the Los Angeles Collaborative for Teacher Excellence (LACTE) describes her many "watch and learn" experiences with Jackie, and says, "I continue to hear Jackie's words, 'Is this your best work?'—both in the classroom and in all professional endeavors. ...[she] will always listen to my ideas, ask insightful and pertinent questions, and offer constructive and honest advice to improve my work." As a 2003–2004 CASTL (Carnegie Academy for the Scholarship of Teaching and Learning) scholar, Jackie has collaborated with other mathematicians in seeking to understand student learning in a problem-solving course.

On the LMU campus, Jackie has profoundly influenced the mathematics curriculum, as initial architect of the original biomathematics program, as a fashioner of the secondary education subject matter program in mathematics, as developer of several innovative courses (Mathematics Laboratory for Elementary Teachers, Women and Mathematics, and Workshop I and II for freshmen mathematics majors), and as a developer of individualized courses for the Master of Arts in Teaching students. The freshman-level Workshop course, most often taught by Jackie, is credited with improving retention of math majors; graduating seniors confirm that it was one of two classes they "absolutely could not have done without." Currently Jackie is working with colleagues on redesigning a core mathematics course through the NSF-funded project Science Education for New Civic Engagements and Responsibilities (SENCER).

Co-founder of the Math Science Interchange, an all-volunteer organization that sponsors annual Expanding Your Horizon Conferences for middle and high school girls, Jackie has played an important role in the recruiting and retention of women in mathematics. For 25 years, she organized these conferences on the LMU campus.

For her passionate devotion to the art of teaching, it is a great pleasure to present Jacqueline Dewar with the Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics.

### *Biographical Note*

Jacqueline M. Dewar is Professor and Chair of the Mathematics Department at Loyola Marymount University in Los Angeles. She has directed the Master of Arts in Teaching Mathematics program and coordinated the Mathematics Concentration for future elementary teachers. From 1995–2001, she worked with a team of faculty from ten institutions of higher education in the greater Los Angeles area to form the Los Angeles Collaborative for Teacher Excellence (LACTE), a five-year, $5,500,000 NSF-funded initiative with the goal of improving K–12 teacher preparation programs in science and mathematics. In 2003, she was selected as one of 26 national scholars by the Carnegie Academy for the Scholarship of Teaching and Learning. In 2005, she received Loyola Marymount University's Fritz B. Burns Distinguished Teaching Award.

### *Response from Jacqueline Dewar*

I am deeply honored to receive the Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics. In reflecting back over a 32-year career I see that the landscape of higher education and the special terrain of college mathematics teaching have incorporated many new figures into the scene. The list of "new" arrivals includes calculators, microcomputers, computer algebra systems, graphics and spreadsheet programs, calculus reform, cooperative group work, email, the Internet, cameras, mathematics awareness programs, competitions, affirmative action, diversity initiatives, service learning, integrative learning, civic engagement, and assessment. All have influenced college mathematics teaching, some more broadly than others. The scholarship of teaching and learning (SoTL) is a relatively recent arrival and, I believe, holds great promise for improving the quality of teaching and learning. SoTL invites faculty to frame and investigate questions about their teaching and their students' learning, and to share the results of those investigations with their colleagues in ways that can be built upon. Making the private work of teaching public and available for peer review can increase the value of teaching and provide ideas and motivation for continued improvements.

## Citation

### Keith Stroyan

Keith Stroyan's name is synonymous with innovation in the teaching of calculus. In more than 30 years of teaching at the University of Iowa, he has constantly sought ways in which to combine past knowledge with recent discoveries and technology, and to find the mental "hooks" with students' previous experiences, current interests, and future aspirations. His approach is away from an abstract, excessively formulaic and formalistic presentation, and toward a concrete, direct experiential approach. Computer projects that engage teams of students in investigating a realistic application of calculus, such as answering the question "Why did we eradicate polio by vaccination, but not measles?" are a prominent feature of his courses. Students choose from a large selection of topics; they not only carry out the investigations, but must write up their results in clear and cogent form.

An essential part of Stroyan's teaching is training graduate and undergraduate assistants for his courses—through summer workshops and through constant mentoring throughout the academic year. What is expected from a computer lab, how much to help without "giving it away," strategies to help students master the material, how the course is progressing, and how to evaluate student technical reports are all discussed. In lecture, students find Keith an energized teacher who talks (and listens) to students, and who responds to their comments by continually updating his courses. He gives prizes to students who find mistakes in his presentations.

Long before calculus reform was encouraged by NSF grants, Keith pioneered the idea of using computer programs to allow students to more easily develop computational examples of major calculus concepts. With two Iowa colleagues, he also ran summer workshops for high school teachers in which the teachers wrote software for projects in their classes. In the 1980s, when reform projects were begun at several institutions, Keith quickly became an important part of calculus renewal. With several NSF grants, he developed materials and collaborated with colleagues at Iowa and several other institutions in instituting calculus courses with computer-based investigations as an integral part. He continues to lecture widely on this approach to teaching calculus, and has written several undergraduate texts that support this approach.

For his innovation and continuing pursuit of ways to show that mathematics is the language of science, and that calculus does speak to students of today, we are happy to award Keith Stroyan the Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics.

### *Biographical Note*

Keith Stroyan grew up in rural Pennsylvania and developed an interest in mathematics and physics in high school, where a dedicated principal taught special classes.

Keith studied engineering at Drexel. In his co-op jobs, he designed an automotive tachometer and worked for a GE division that designed outhouses for spaceships. Not glamorous, but important! He graduated in physics.

Keith did graduate work in mathematics at Caltech in the late 1960s. His thesis used modern infinitesimals in functional analysis and complex variables and later he also did research using infinitesimals in economics and probability. He had a postdoctoral position at the University of Wisconsin, Madison, and went to the University of Iowa in 1973. But in all these schools, he was warned that he "spent too much time on his teaching."

Keith and his wife of 39 years live in rural Iowa where they raise Labrador retrievers.

### *Response from Professor Stroyan*

I am very grateful to be counted in the ranks of the great teachers who have received the Haimo Award. I am also grateful for the nomination by my colleagues in the Iowa MAA Section. Many of them are as passionate about their teaching as I, so the nomination alone is an honor.

Since I was an undergraduate, I have had an unusual interest in ways to present mathematics and skepticism about "the usual approach." I have used computing and variations of the fundamental theories to try to make various subjects clearer and more appealing to different groups of students. The most fun is when I help students explain a topic or solve a problem on their own terms—especially when they declare it better than my approach!

## Citation

## Judy Leavitt Walker

Judy Leavitt Walker is "an amazing teacher" who cares deeply about her students' intellectual growth and well-being. Her students testify that her courses are among the most demanding they ever had, yet consistently praise her ability to guide the direction of a class through questions. Superb at explaining mathematics and communicating the joy of discovery, she is readily available outside of class for special problem sessions, and is in demand as a doctoral thesis advisor. Since joining the faculty at the University of Nebraska-Lincoln (UNL) in 1996, Walker has had a profound impact on the department and the larger mathematical community.

One major innovation at UNL was her creation of a freshman honors seminar for non-majors, *The Joy of Numbers: Search for the Big Primes*, adapting materials developed at Georgetown University. Later she adapted much of the course to serve elementary and middle school teachers. In class, she guides students to discover and prove ideas about number theory and to present their results; after class, she documents their work with typed notes, including examples worked out by students, questions asked and answered, and theorems proved. At the end of the semester, students receive a copy of the book they have thus created. More than one freshman decided to switch to a mathematics major because of this challenging course that awakened a love of mathematics.

Colleagues testify that Walker's high expectations and successful methods have had a great impact on their own teaching, setting a new standard of excellence for the department. Her exceptional teaching was recognized in 2000 with two prestigious teaching awards from UNL.

In 1997, Walker and a colleague created ALL GIRLS/ALL MATH, a program to encourage high school girls to pursue mathematics; it has received grants from the MAA Tensor and the AMS Epsilon programs. She created for the camp a weeklong course in elementary number theory and cryptography in which students learn about the mathematics behind the secure transmission of data. In 1999, at the Mentoring Program for Women at the Institute for Advanced Study in Princeton, she gave a series of lectures (on her area of research) titled *Codes and Curves*; these lectures were later published as a book by the AMS. She also created the Nebraska Conference for Undergraduate Women in Mathematics, which has attracted 800 participants in its first seven years. Currently she is PI for an NSF grant to UNL for Mentoring (graduate students) through Critical Transition Points.

For her dynamic leadership and passionate commitment to teaching mathematics, we are delighted to award Judy Leavitt Walker the Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics.

### *Biographical Note*

Judy Leavitt Walker is an associate professor of mathematics at the University of Nebraska-Lincoln, where she has been on the faculty since 1996. Her research is in the area of algebraic coding theory; she has graduated one Ph.D. student and currently advises four others. She is a founding organizer of both the ALL GIRLS/ALL MATH summer camp for high school girls and the Nebraska Conference for Undergraduate Women in Mathematics, and she is the Project Director on the Nebraska Mentoring through Critical Transition Points project. She is on the editorial board of the *Rose Hulman Undergraduate Mathematics Journal* and an editor for the *Journal of Pure and Applied Algebra*.

### *Response from Judy Leavitt Walker*

I am deeply honored to have been chosen to receive a 2006 Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics from the Mathematical Association of America. I have been fortunate so far in my career to have had many wonderful and diverse teaching experiences, and I thank those who have given me these opportunities and those who have helped to make these experiences successful.

I especially thank my current and former department chairs, John Meakin and Jim Lewis, for creating a climate that nourishes excellence in both research and teaching.

# Chauvenet Prize

The Chauvenet Prize is awarded at the Annual Meeting of the Association to the author of an outstanding expository article on a mathematical topic by a member of the Association. First awarded in 1925, the Prize is named for William Chauvenet, a professor of mathematics at the United States Naval Academy. It was established through a gift in 1925 from J. L. Coolidge, then MAA President. Winners of the Chauvenet Prize are among the most distinguished of mathematical expositors.

## Citation

### Florian Pfender and Günter M. Ziegler

"Kissing Numbers, Sphere Packings, and Some Unexpected Proofs"
(*Notices of the American Mathematical Society*, September 2004, pp. 873–883)

In their lucid and beautifully illustrated paper, "Kissing Numbers, Sphere Packings, and Some Unexpected Proofs," Florian Pfender and Günter M. Ziegler report on the history and progress of three classical packing problems in various dimensions: the kissing number problem, the sphere packing problem, and the lattice packing problem. The immediate backdrop for this paper is Thomas Hales's controversial solution in 1998 to Kepler's Conjecture, which is the general sphere packing problem for dimension three. An important contribution of this paper is to clarify differences among the problems. While the latter two sound similar, the lattice packing problem is generally considerably simpler. All questions are easy in two dimensions, but already nontrivial in three dimensions. Since many problems remain open, this is not only a satisfying historical account, but also a stimulus to further work.

Another valuable contribution of this paper is that it sheds light on recent developments on the kissing number problem, "In $n$-dimensional space, what is the maximal number of blue spheres that can touch a red sphere of the same size?" The kissing number problem dates back at least to Isaac Newton and David Gregory who considered the problem in dimension three. Answers to the kissing number problem for dimensions one, two, and three have long been known. Answers for the special dimensions of eight and twenty-four were found in the late seventies, owing to Phillipe Delsarte's method that utilizes linear programming. In their paper, Florian Pfender and Günter M. Ziegler outline Delsarte's "elegant method." Next, they explain that Delsarte's method has recently been modified by Oleg Musin to solve the kissing number problem for dimension four. Last, they describe how Henry Cohn and Abhinav Kumar have also modified Delsarte's method to show that the sphere packing in dimension twenty-four given by the Leech lattice is an optimal lattice packing in dimension twenty-four, and an optimal sphere packing, up to an error of not more than $10^{-27}$ percent.

The authors succeed in making Delsarte's method and the modifications by Musin and Cohn and Kumar accessible. They strip away all but the essentials so that novices may appreciate the power and beauty of these new approaches to finding answers to the kissing number problem.

### *Biographical Note*

Günter M. Ziegler was born in München, Germany, in 1963. He studied mathematics and physics at Munich University, and got his Ph.D. in mathematics from M.I.T. with Anders Björner in 1987. He held postdoctoral positions at Augsburg University, the Mittag-Leffler Institute, and ZIB Berlin. He has been a professor of mathematics at Technische Universität (TU) Berlin since 1995, and is a member of the DFG Research Center Matheon "Mathematics for Key Technologies."

The focus of his work is on discrete geometry (polytopes!) and combinatorics, with special interest in algebraic and topological methods. He is the author of *Lectures on Polytopes* (Springer 1995) and of *Proofs from THE BOOK* (with Martin Aigner, Springer 1998). He edited the *Notices of the German Mathematical Society* (DMV Mitteilungen) 1997–2000.

His honors include a Gerhard Hess Prize of the German Science Foundation in 1994 and a Leibniz Prize in 2001. He just started a two-year term as the president of the German Mathematical Society.

### *Biographical Note*

Florian Pfender was born in Berlin, Germany, in 1973. He studied mathematics at Technische Universität (TU) Berlin, and got his Ph.D. from Emory University with Ron Gould in 2002. After holding a postdoctoral position at Emory University, he is currently a postdoctoral fellow at the DFG Research Center Matheon, at TU Berlin. His main research interests are in the areas of graph theory and discrete geometry. Outside of mathematics, he spends most of his time playing, coaching, and organizing ultimate frisbee.

### *Response from Günter M. Ziegler and Florian Pfender*

Our article was an attempt to share our excitement about beautiful ideas by Philippe Delsarte, Oleg Musin, Noam Elkies, Henry Cohn, Abhinav Kumar, and many others. Thus we hope that the Chauvenet Prize, which took us completely by surprise, helps to achieve just that. The article started from a press release that one of us (GMZ) had written for a workshop at MSRI, which under the guidance of Hugo Rossi grew into a little piece in the MSRI's *Emissary*. This in turn led to an invitation to write a feature in the *AMS Notices*. The paper grew under wonderfully helpful comments and criticism from Andy Magid, Allyn Jackson, and other *Notices*' editors. For any geometry piece, the illustrations are particularly important: Thanks to Michael Joswig and to the *Notices*' graphics editor, Bill Casselman, for their support and input. Thanks to everyone who helped to bring our article to life!

# Frank Nelson Cole Prize in Algebra

This prize was founded in honor of Frank Nelson Cole on the occasion of his retirement as Secretary of the AMS after 25 years of service and as editor-in-chief of the *Bulletin* for 21 years. The endowment was made by Cole, contributions from Society members, and his son, Charles A. Cole. This prize is for a notable paper in algebra published during the preceding six years.

## Citation

### János Kollár

The 2006 Cole Prize in Algebra is awarded to János Kollár of Princeton University for his outstanding achievements in the theory of rationally connected varieties and for his illuminating work on a conjecture of Nash.

The notion of a rational variety has long played an important role in algebraic geometry. An algebraic variety $X$ is rationally connected if there are enough rational curves to connect points in $X$. A pioneer of the notion of rationally connected varieties, Kollár extended the theory from the complex numbers to local fields. His papers (*Annals of Math.* 150 (1999), 357–367, and *Michigan Math. J.* 48 (2000), 359–368) and his joint work with Endre Szabó (*Duke Math. J.* 120 (2003), 251–267) are recognized as significant advancements in the theory of rationally connected varieties.

In 1952, after proving that a compact differentiable manifold $M$ is diffeomorphic to the zero set of real polynomials, John Nash conjectured that there exists a smooth real algebraic variety, birational to projective space, whose real points are diffeomorphic to $M$. Although known to be false in dimension two, evidence suggested a positive solution in higher dimensions until Kollár provided counterexamples by classifying the diffeomorphism types of smooth threefolds birational to projective space whose real points are orientable. This work is explained in a series of remarkable papers, notably his paper in *J. Amer. Math. Soc.* 12 (1999), 33–83.

### *Biographical Note*

János Kollár was born in Budapest, Hungary, in 1956. He did his undergraduate studies at Eötvös University in Budapest, and then his graduate studies at Brandeis University with Teruhisa Matsusaka. After his graduation in 1984 he was a Junior Fellow at Harvard University (1984–87) and then a faculty member at the University of Utah (1987–99). Since then he has been a Professor at Princeton University.

Kollár was elected to the Hungarian Academy of Sciences in 1995 and to the National Academy of Sciences in 2005. He gave the AMS Colloquium Lectures at the New Orleans Annual Meeting in 2001.

Kollár's main research area is the birational geometry of higher dimensional algebraic varieties and he also likes to explore the various applications of algebraic geometry to algebra, combinatorics, complex analysis, differential geometry, and number theory.

### *Response from Professor Kollár*

The most basic algebraic variety is affine $n$-space $\mathbb{C}^n$, and it has been a long-standing problem to understand which varieties behave like $\mathbb{C}^n$. For surfaces the problem was settled by Castelnuovo in the 1890s: these are the surfaces which are birational to $\mathbb{C}^2$. It took nearly a century to understand that the correct higher dimensional concept is not so global. Instead, we should focus on rational curves on varieties. There are plenty of rational curves in $\mathbb{C}^n$: lines, conics, etc. Roughly speaking, a variety is rationally connected if it contains rational curves in similar abundance.

It took some time to establish that rationally connected varieties are indeed the right class, but by now it is firmly settled that, at least in characteristic zero, we have the right definition.

I am very glad that the committee recognized the significance of this field and I feel deeply honored that they chose me to represent a whole area. This was truly a joint effort over the past 15 years. Much of the foundational work was done with Campana, Miyaoka, and Mori and the last piece of the basic theory was completed by Graber, Harris, de Jong, and Starr. Arithmetic questions over finite and $p$-adic fields were explored with Colliot-Thélène, Esnault, Kim, and Szabó, but the theory over global fields consists mostly of questions. Joint work with Bien, Borel, Corti, Schreyer, and Smith touched other aspects of rational connectedness.

The Nash conjecture on the topology of rationally connected varieties over $\mathbb{R}$ turned out to be beautiful algebraic geometry in dimension 3 and the higher dimensional versions by Eliashberg and Viterbo use techniques from symplectic geometry.

The theory of rationally connected varieties is rapidly growing, with recent major results by Hacon, Hassett, McKernan, Tschinkel, and Zhang. I hope that the recognition by the Cole prize will spur further activity.

Finally, I would like to thank three mathematicians who had a great influence on my work: my thesis advisor Teruhisa Matsusaka, who taught me to look for the big picture; my collaborator Shigefumi Mori, with whom many of these ideas were developed; and my former colleague Herb Clemens and the University of Utah for providing a wonderful environment to accomplish most of this research.

# Levi L. Conant Prize

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

## Citation

### Ronald M. Solomon

The Levi L. Conant Prize in 2006 is awarded to Ronald Solomon for his article "A Brief History of the Classification of the Finite Simple Groups," *Bulletin of the AMS* 38 (2001), no. 3, 315–352.

Solomon gives a remarkable overview of the work on the classification problem, from its inception in an 1893 paper by Otto Hölder to the recent two-volume proof of the final theorem by Michael Ashbacher and Stephen Smith. Solomon's article stresses key developments in a way that makes connections with other aspects of group theory so that the subject becomes more than just taxonomy. Thus, he provides a glimpse into a broad panorama of finite group theory.

The article gives an unusual insider's look at the process of mathematical research, with its false starts, insightful conjectures, and dogged determination. One sees different approaches go in and out of fashion and sometimes return with renewed vigor. Finally, he argues convincingly that even if the classification is complete, many avenues remain open for further investigation. The exposition is enhanced by descriptions of the personalities of the many contributors and their interactions.

Solomon has written a valuable survey, accessible to a broad spectrum of mathematicians, that is both engaging and enlightening.

### *Biographical Note*

Ron Solomon was turned on to mathematics by his high school geometry teacher, Blossom Backal. He fell in love with group theory as an undergraduate at Queens College, and had the great good fortune to study with the masters—Walter Feit, David Goldschmidt, Richard Lyons, and Leonard Scott—while earning a Ph.D. at Yale University in 1971. The NSF Summer Institute in 1970 was an unforgettable interlude. In the summer of 1972, he heard Danny Gorenstein propose his visionary 16-step program for the classification of the finite simple groups, and spent two years as a Dickson Instructor at the University of Chicago, learning with Jon Alperin and George Glauberman, and climbing one of Danny's steps. In 1974–1975, he made the first of several fruitful pilgrimages to Rutgers University, and then began 30 years (and counting) on the faculty of the Ohio State University. His sons, Ari and Michael, were born in 1980 and 1982, and have filled his life with love, joy, intellectual sparring, and periodic tsurus. In 1982, he began an ongoing collaboration with Gorenstein and Lyons to write a series of monographs presenting a substantial portion of the proof of the classification theorem. Since 2004, he has been blessed with the love of his wife, Rose.

### *Response from Professor Solomon*

It is a great honor to receive the Levi L. Conant Prize from the Society. I am saddened that neither my mother nor Walter Feit nor Danny Gorenstein are alive to share the joy of this occasion. My mother deserves double credit. I learned my writing skills from her, and my teenage rebellion against her authority drove me into mathematics. Walter and Sidnie Feit have always been most complimentary of my skills at group theory exposition, and of course I learned much at the knee of that master expositor, Danny Gorenstein.

A work of historical narrative can only be as good as its subject, and I had the advantage of a wonderful theme. The saga of the taming of the finite simple groups is a great one, shaped by titans of the imagination from Lagrange, Gauss and Galois to Thompson, Gorenstein and Aschbacher, with many other illustrious participants. It has been a rare privilege to be a friend and collaborator of the latter-day titans, and to tell a bit of their story. My thanks to you all for reading and enjoying the tale.

# George David Birkhoff Prize in Applied Mathematics

This prize was established in 1967 in honor of George David Birkhoff. It is awarded for an outstanding contribution to "applied mathematics in the highest and broadest sense." From 1968–1998, the prize was normally awarded every five years. Beginning in 2003, the prize will be awarded every three years. The award is made jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics.

## Citation
## Cathleen Synge Morawetz

The 2006 George David Birkhoff Prize in Applied Mathematics is awarded to Cathleen Synge Morawetz for her deep and influential work in partial differential equations, most notably in the study of shock waves, transonic flow, scattering theory, and conformally invariant estimates for the wave equation.

### *Biographical Note*

Cathleen Morawetz was born in Toronto, Canada, in 1923 where her father, Irish born and educated John L. Synge, was a professor of mathematics. The family returned to Ireland from 1925 to 1930. From 1930 to 1945 Morawetz received her education in the public schools of Toronto and later her B.A. at the University of Toronto. She started graduate school at MIT, receiving an M.S. in 1946. In October 1945 she married Herbert Morawetz, who became a professor of Polymer Chemistry at Brooklyn Poly. In 1946 Morawetz began working at NYU with Courant and Friedrichs, editing their book on compressible flow. In 1950 she completed a Ph.D. thesis on imploding shocks. From 1950 to 1951 she worked at MIT with C. C. Lin on fluid dynamic stability. In 1951 she returned to NYU on a part-time basis and worked with Friedrichs and Bers mainly on the problems of transonic flow and mixed equations. In the late fifties, at Courant's suggestion she began working under Harold Grad on the mathematical problems of plasma physics where she showed how a collisionless shock could exist without invoking turbulence. In 1957 she was appointed to the faculty of the Courant Institute. She continued to work in partial differential equations, mainly of mixed type but also on the wave equation. There she solved problems of decay by new conservation laws and later used the same type of estimates with Ludwig to justify geometrical optics in the lit region of a star shaped object. She continued to concentrate on these topics for the rest of her career. She retired in 1993 and became President of the AMS in 1995 (where she had served as trustee in the 1980s). Cathleen Synge Morawetz was awarded the National Medal of Science in 1998.

***Response from Professor Morawetz***

It is a totally unthought of and a wonderful surprise to receive the Birkhoff Prize. I am very, very grateful to the two societies, AMS and SIAM, for choosing me. There are many, many people whom I would have liked to thank for helping me over the years, but I would not have room for their names on this page. But one person stands out for supporting and encouraging me when I was between the crucial professional ages of 23 and 35. I worked part time on my Ph.D., part time as a postdoc, and I had four children. That person was Richard Courant, the creator of the Courant Institute at New York University where I have been a professor ever since.

# Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman

In 1990, the Executive Committee of the Association for Women in Mathematics (AWM) established the Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman. The prize is named for former AWM president and one of its founding members, Alice T. Schafer (Professor Emerita from Wellesley College), who has contributed a great deal to women in mathematics throughout her career. The criteria for selection include, but are not limited to, the quality of the nominees' performance in mathematics courses and special programs, an exhibition of real interest in mathematics, the ability to do independent work, and, if applicable, performance in mathematical competitions.

AWM is pleased to present the Sixteenth Annual Alice T. Schafer Prize to **Alexandra Ovetsky**, Princeton University.

Additionally, the accomplishments of two outstanding young women, both senior mathematics majors, were recognized on Thursday, January 12, 2006. AWM was pleased to honor **Allison Bishop**, Princeton University, as the **runner-up** and **Ellen Gasparovic**, College of the Holy Cross, as the **honorable mention** recipient in the Schafer Prize competition. Their citations are available from the AWM.

**Citation**
**Alexandra Ovetsky**

Alexandra Ovetsky is a senior at Princeton University. A Goldwater scholar, Ovetsky is also the recipient of the Princeton math department's Andrew H. Brown Prize for outstanding research in mathematics as a junior. Her coauthored paper "Surreal dimensions" has been published in *Advances in Applied Mathematics*.

In the summer of 2004, Ovetsky participated in the REU program at the University of Minnesota at Duluth. There she wrote a professional-level paper about well-covered graphs, turning the idea around and showing that the property of being not well-covered behaves well under Cartesian products. In the summer of 2005, Ovetsky participated in the Director's Summer Program at the National Security Agency. There she tackled three problems and made significant progress on all three. This work is being published internally at NSA.

For her junior paper at Princeton, Ovetsky proved a result in graph theory, generalizing a famous theorem of Claude Shannon from 1948. Ovetsky's theorem relates the chromatic number to the clique number for quasi-line graphs. One recommender reports, "She already has the research capabilities of an advanced graduate student or junior faculty member."

***Response from Alexandra Ovetsky***

I am greatly honored to be this year's recipient of the Alice T. Schafer Prize. I would like to thank the AWM for being such an encouragement to women in mathematics, in particular those at early stages of their careers.

I became passionate about mathematics at a very early age; however I only discovered the true beauty of this subject when I was introduced to mathematical research by Dr. Ted Chinburg of the University of Pennsylvania. I would like to thank him for his inspiration and patience in working with an enthusiastic but inexperienced high school student. I would also like to extend my gratitude to Joe Gallian for giving me the opportunity to interact with a group of the nation's top young mathematicians that he gathers at his REU at Duluth, Minnesota. Finally, I would like to thank Maria Chudnovsky, my thesis and junior independent work advisor at Princeton University, for encouraging me to continue working in the field of graph theory and for her excellent guidance of my research endeavors with her. The support of many other faculty members of the Princeton math department has also been invaluable.

# Louise Hay Award for Contributions to Mathematics Education

In 1990, the Executive Committee of the Association for Women in Mathematics (AWM) established the Louise Hay Award for Contributions to Mathematics Education. The purpose of this award is to recognize outstanding achievements in any area of mathematics education, to be interpreted in the broadest possible sense. While Louise Hay was widely recognized for her contributions to mathematical logic and for her strong leadership as Head of the Department of Mathematics, Statistics, and Computer Science at the University of Illinois at Chicago, her devotion to students and her lifelong commitment to nurturing the talent of young women and men secure her reputation as a consummate educator. The annual presentation of this award is intended to highlight the importance of mathematics education and to evoke the memory of all that Hay exemplified as a teacher, scholar, administrator, and human being.

**Citation**

**Patricia Clark Kenschaft**

In recognition of her long career of dedicated service to mathematics and mathematics education, the AWM is pleased to present the Sixteenth Annual Louise Hay Award to Patricia Clark Kenschaft of Montclair State University.

Trained as a functional analyst (Ph.D., University of Pennsylvania, 1973), Pat Kenschaft found her true calling in not only teaching university-level mathematics, but also in writing about, speaking about, and working for mathematics and mathematics education in the areas of K–12 education, the environment, affirmative action and equity, and public awareness of the importance of mathematics in society.

The wide scope of her interests and influence are evidenced by the titles of her published books and articles. Regarding equity, affirmative action, and the promotion of women and minorities in mathematics, she has written *Change is Possible: Stories of Women and Minorities in Mathematics* (AMS, 2005) and edited and/or contributed chapters to *Winning Women into Mathematic*s (MAA, 1991), *Complexities: Women in Mathematics* (Princeton University Press, 2005), and *Black Women in America: An Historical Encyclopedia* (Indiana University Press, 1994). With Catherine Wick, she wrote the chapter "Multicultural and Gender Equity in the Mathematics Classroom" (1997 NCTM Yearbook), detailing a series of "micro-inequity skits," based on real-life experiences, which point out in a good-natured way the sorts of small injustices that may occur daily to females in mathematics.

In the 1980s, Kenschaft surveyed black mathematicians in New Jersey and asked, “What can be done to bring more blacks into mathematics?” The most common answer was, “Teach mathematics better to all American children. The way it is now, if children don’t learn mathematics at home, they don’t learn it at all, so any ethnic group that is underrepresented in mathematics will remain so until children are taught mathematics better in elementary school.” These results led Kenschaft to found and direct PRIMES, the Project for Resourceful Instruction of Mathematics in the Elementary School, which was supported by 14 Eisenhower grants and served teachers in nine urban and suburban schools. As a result of her work on this project, Kenschaft developed the book *Math Power: How to Help Your Child Love Mathematics Even If You Don’t* (Addison-Wesley-Longman, 1997), and, in order to encourage other mathematicians to play a more active role in teacher education, she wrote the February 2005 *AMS Notices* article, “Racial Equity Requires Teaching Elementary Teachers More Mathematics.” Kenschaft has also promoted a broader understanding of the nature and importance of mathematics through her call-in radio show, Math Medley, which she hosted for six years and which was an innovative way of bringing experts on mathematics, mathematics education, and the environment in contact with the general public.

The final important set of contributions made by Kenschaft broadens our knowledge and understanding of the environment. Through her textbook *Mathematics for Human Survival* (Whittier Publications, 2002), her volume *Environmental Mathematics in the Classroom* (MAA, 2003, co-edited with Ben Fusaro), and her work for the MAA Special Interest Group on Environmental Mathematics, she has helped to raise understanding of the effects of human activity on the earth. Closer to home, she works to raise awareness of environmental issues and to promote local food, and she grows her family's vegetables without pesticides. A colleague wrote, “Her influence has been crucial to the emerging presence of environmental mathematics, that combination of the most critical challenge of our time and the most powerful technology of our time.”

One of Pat's insights is that problems—sexism, racism, environmental degradation, and poor teaching—are often caused by systems, rather than individuals, and that damaging individual behavior is often unconscious and may even be well-intentioned. While chair of the MAA Committee on the Participation of Women, she wrote, “I believe that in the late twentieth century we are all guilty of sexism, even those of us trying hardest to overcome the problem. The continual observations of my own teen-age son with the undimmed vision and precise tongue so characteristic of youth relieved me of any illusions that I might be an exception.”

As one of her colleagues wrote,

> She deserves to be recognized for her decades of dedication to mathematics and math education and for her innovative and unique contributions in these areas. In particular, her special attention to children and their parents, women, minorities, and the environ-

ment, all with respect to mathematics, have been and continue to be of benefit for the mathematical community and our society as a whole.

***Response from Pat Kenschaft***

I am, of course, delighted and deeply honored with this award. It is probably the award that means most to me. This citation makes me feel understood. I am especially glad that its author observed my dedication to changing systems, not people—although, like every good teacher, I do enjoy affecting individual people.

I myself have been especially fortunate in the systems in which I found myself—family, neighborhood, schools, and socio-economic systems. Yes, I have worked hard, but so has every other person who has earned a doctorate in mathematics. Yes, I have loved mathematics, but so have many others, and we are a fortunate group.

I was especially fortunate to have been born into a loving family that wanted me to experience as much of life as possible. Both my father and mother's father supported their women in reaching for the highest. Before I started kindergarten, my father explained the concept of $\pi$ to me. During a lunch in second grade, my mother showed me how using $x$ to represent "any number" could help me understand why a math puzzle "worked." When I asked her in fifth grade what "algebra" was, she suggested we find the encyclopedia, and we went through the entire description there while she did the ironing. My first grade teachers sat me in the back of the room with the two slowest students, thereby starting my love of teaching.

Belle Kearney, my ninth grade algebra teacher, was not angry that I already knew the subject when I came to her. She lent me her "college algebra" text and offered to meet with me once a week to go over my questions. A few years later, she won a fellowship to earn a doctorate, and then died of breast cancer.

She was my last female math teacher, but I can't remember any math teacher in high school, college, or graduate school who ever implied that I couldn't succeed because of my sex. I have continued to meet amazingly wonderful men and women in both my personal and professional lives. Lee Lorch mentored my equity writing. Lou Giglio, a high school math teacher, phoned the dean at Montclair State and asked for a collaborator to start a program supporting elementary school teachers mathematically, thereby beginning a great seven-year adventure. Ben Fusaro reached out to me with a variety of activities in environmental mathematics. Fred Chichester, my husband of thirty years, has shared my love of math and always supported my aspirations.

There is much still to do, but I have been repeatedly fortunate. Why not others? I wish that every person in my infant grandson's generation could be supported by a culture that is nurturing, equitable, and environmentally safe and sustainable. It might be possible if we all try. I am deeply grateful for this recognition that I have tried.

American Mathematical Society
Mathematical Association of America
Society for Industrial and Applied Mathematics

# Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student

The Frank and Brennie Morgan Prize stands to recognize and encourage outstanding mathematical research by undergraduate students. It was endowed by Mrs. Frank Morgan of Allentown, PA.

## Citation

### Jacob Fox

The winner of the 2005 Morgan Prize for Outstanding Research in Mathematics by an Undergraduate is Jacob Fox. Jacob Fox is now in his fourth year of undergraduate studies at M.I.T. The award is based on a most astounding collection of research papers by any undergraduate mathematician. Jacob Fox's research is in three areas: Ramsey-type problems, rainbow patterns in colorings of the integers or $Z/mZ$, and other problems in graph theory (namely on discrepancy, clique number, embedding, and diameter). Jacob Fox is an excellent problem solver, passionately interested in these subjects, driven by his love of mathematics, his talents and his originality. He communicates easily and frequently collaborates with a variety of distinguished researchers. He also frequently publishes alone. Jacob Fox's research exhibits a formidable ability to get to the heart of the issues in the problems at hand, and the ability to develop extremely ingenious and novel techniques. In addition to being able to solve problems posed by others, Fox has also excelled at finding topics all by himself, formulating novel conjectures and approaches to solutions. His accomplishments are shaping his areas of research, and are of extraordinary promise for the future.

### *Biographical Note*

Jacob Fox (previously Jacob Licht) is a senior majoring in theoretical mathematics at the Massachusetts Institute of Technology. Jacob first studied advanced mathematics as an epsilon at the Ross Program at Ohio State University. His love for mathematics was further developed through the Research Science Institute, which laid the foundation for work that earned him his first publication, second place in the Intel Science Talent Search, and fourth place in the Siemens Westinghouse. In college, Jacob's interest in combinatorics research was strengthened through undergraduate research supervised by Daniel J. Kleitman, Lucent summer internships at Bell Labs, and, most recently, Joe

Gallian's summer REU at the University of Minnesota, Duluth. In a paper in the *Journal of Combinatorial Theory Series A*, he and Kleitman proved the first nontrivial case of Richard Rado's 1933 Boundedness Conjecture. Extending earlier work of Erdos, Kakutani, Komjáth, and Rado, Jacob proved an infinite color analogue of Rado's theorem on partition regularity of systems of linear equations. At the Duluth program, he proved a bipartite analogue of Dilworth's theorem on partially ordered sets, which will appear in the journal *Order*. His research interests are in Hungarian-style combinatorics, particularly Ramsey theory, extremal graph theory, combinatorial number theory, and probabilistic methods in combinatorics.

### *Response from Jacob Fox*

I am honored to be the recipient of this prize. I would like to thank Mrs. Frank Morgan for endowing the prize and the AMS, MAA, and SIAM for sponsoring it. Daniel J. Kleitman and Rados Radoicic deserve special thanks for the many years they have mentored my research. I would also like to thank Yuliy Baryshnikov, Joe Gallian, Mohammad Mahdian, Janos Pach, Igor Pak, and numerous others for helping my development as a research mathematician. I thank my family for their love and support.

# Joint Policy Board for Mathematics Communications Award

The Joint Policy Board for Mathematics (JPBM) established its Communication Award in 1988 to reward and encourage journalists and mathematicians who, on a sustained basis, bring mathematical ideas and information to nonmathematical audiences. The award recognizes a significant contribution or accumulated contributions to the public understanding of mathematics, and it is meant to reward lifetime achievement. JPBM represents the American Mathematical Society, the American Statistical Association, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics.

## Citation

### Sir Roger Penrose

The Joint Policy Board for Mathematics presents its 2006 Communications Award to Sir Roger Penrose for the discovery of Penrose tilings, which have captured the public's imagination, and for an extraordinary series of books that brought the subject of consciousness to the public in mathematical terms.

Dr. Penrose has acquired a large public following for eight books he has written. A number of these explore ideas that relate fundamental physics, mathematical logic, and human consciousness. In *The Emperor's New Mind* (1989) and also in later volumes, he has argued that known laws of physics do not constitute a complete system and that human consciousness cannot be explained until a new physical theory of quantum gravity has been devised. These ideas have stimulated broad public debate. They have brought widespread attention to the scientific and philosophical implications of consciousness. The most recent book of Dr. Penrose, *The Road to Reality* (2005), is a bold and broadly conceived attempt to present the techniques of modern mathematics and physics before a general public audience. This year's JPBM Communication Award is a tribute to the way that Dr. Penrose has made the ideas behind high level mathematics accessible to large segments of the general public.

### *Biographical Note*

As a graduate student, Roger Penrose studied mathematics and physics at Cambridge University from the likes of Bondi, Dirac, Hodge, Steen, and Todd. He was awarded his Ph.D. there in Algebraic Geometry in 1958. After positions at various universities in both England and the United States, he was appointed the Rouse Ball Professor of Mathematics at the University of Oxford in 1973, a position he held until 1998, when he became Emeritus Rouse Ball Professor of Mathematics.

In his research career Dr. Penrose has made fundamental and remarkably diverse contributions to both mathematics and physics. Many of these concern the interplay between relativity, geometry, and topology, and are related to the attempt to unify relativity with quantum theory. In 1967, Dr. Penrose discovered twistor theory, a beautiful mathematical formalism that combines powerful techniques of algebra and geometry. In 1971, he introduced the theory of spin networks, which later became a part of the geometry of spacetime in loop quantum gravity. In 1974, he discovered what are now known as Penrose tilings, which are formed from two tiles that can only tile the plane aperiodically. Such patterns were later found, quite remarkably, to occur in the arrangement of atoms into quasicrystals.

Dr. Penrose has received many awards and honors. These include election to Fellowship in the Royal Society of London (1972), the Wolf Foundation Prize in Physics (with Stephen Hawking, 1988), election as a Foreign Associate of the National Academy of Sciences (1998), and the DeMorgan Medal of the London Mathematical Society in 2004. In 1994, he was knighted for his service to science.

### *Response from Sir Roger Penrose*

It is a deep and unexpected honour, and a great pleasure for me, to receive the JPBM Communications Award for 2006.

I certainly believe in the importance of conveying to the general public, as far as this is possible, something of the real nature of mathematics, not only for its increasing utility across so many areas of importance to modern society, but also for its beauty and for the inner satisfaction that it brings. Perhaps these latter qualities are even more important than the more utilitarian ones; for one cannot really properly understand mathematics without having some kind of appreciation of its aesthetic qualities. Moreover it is a belief (or a faith?) of mine that there are many more out there, among those who claim no appreciation or understanding of mathematics, who actually have within themselves some genuine but unrecognized abilities in this direction.

And it is certainly not just the general public who can stand to gain from clear expositions of mathematical topics. Science in general, and mathematics in particular, have grown to enormous proportions over the years, and over the centuries. Semi-popular expositions which give clear and intuitive accounts of one area of work can be an invaluable aid to others whose expertise may lie in some area of science or mathematics which is far from that being explained. In my own experience, such accounts can have enormous value.

If, as this award seems to imply, I have contributed, in some significant way, to the spreading of scientific or mathematical knowledge and understanding, then I am indeed well pleased. Thank you very much.

## Certificates of Meritorious Service

The Certificate of Meritorious Service is presented for service at the national level or for service to a Section of the Association. The first such awards were made in 1984. At each January meeting of the Association, honorees from several Sections are recognized.

### Citation

**Kay Somers, Eastern Pennsylvania-Delaware Section (EPADEL)**

For her years of service to the EPADEL Section and to the wider MAA community, it gives us great pleasure to nominate Kay Somers for the MAA Certificate of Meritorious Service. Kay has worked in both academia and industry, and this unique perspective on mathematics, together with her cheerful commitment to service, has made her a valued member of the mathematics community. Kay has taught mathematics at Moravian College since 1981, chairing her department from 1992 to 1998. For a thirteen-year period, she served in almost every office of the EPADEL Section, including Secretary/Treasurer, Vice President, President, and Governor. She has handled local arrangements for Section meetings held at Moravian College and for several years was responsible for the MAA book displays at all Section meetings. Nationally, she has served on MAA committees and boards, including the Committee on Undergraduate Student Activities and Chapters, the Membership Committee, the Classroom Resource Materials Editorial Board, and the Carl B. Allendoerfer Awards Committee. She is a regular contributor to regional and national MAA meetings, presenting talks and organizing sessions on applied mathematics, quantitative reasoning, undergraduate teaching, and experiences beyond the classroom for students. Professionally, Kay is one of a team of four colleagues who received two FIPSE grants to develop and disseminate materials for the integration of precalculus review with the first course in calculus. She is coauthor of the books *A Companion to Calculus*, now in its second edition, and *Quantitative Reasoning: Tools for Today's Informed Citizen*, currently in press. Kay Somers continues to be a champion of undergraduate mathematics in EPADEL and beyond.

***Response from Kay Somers***

I am very honored and delighted to receive the Certificate of Meritorious Service from the MAA. I have greatly enjoyed and benefited professionally and personally from associations with my MAA colleagues at the local, regional, and national levels. I have especially appreciated the opportunity to collaborate with faculty from Moravian College and other EPADEL institutions, to benefit from their experience, to learn things mathematical and non-mathematical from them, and to get to know them personally. Several years ago we celebrated the 75th anniversary of the EPADEL Section. As I read the history of the Section and looked at pictures taken at our anniversary meeting, I realized what rich traditions and wonderful "mathematics ancestors" we have in EPADEL. Thank you very much for this very special honor.

### Citation

### Calvin (Cal) Van Niewaal, Iowa Section

Calvin (Cal) Van Niewaal, Professor of Computer Science and John F. Yothers Professor of Mathematics at Coe College, has been an integral part of the Iowa Section for almost 25 years. Because of his service as Section Chair, newsletter editor, and liaison coordinator, he has been a member of/advisor to the executive committee of the Section for much of the last 25 years. In these and other capacities, Cal has provided strong leadership and invaluable institutional memory for the Section. As newsletter editor, he created the Section's website, moving the Section into the electronic age. For his many contributions to the Iowa Section over a quarter century, the Iowa Section of the Mathematical Association of America is pleased to nominate Cal Van Niewaal for this Certificate of Meritorious Service.

#### *Response from Calvin Van Niewaal*

Thank you for the honor of awarding me the Certificate of Meritorious Service. It is especially satisfying to become a fellow recipient with my friends and mentors from the Iowa Section who previously received the award: Basil Gillam, A. M. Fink, and Donald Meyer. Ever since Charles Lindsay, the senior professor of the mathematics department when I joined the Coe College faculty in 1981, encouraged me to become active in the MAA, I have enjoyed my service to the Iowa Section and I have never thought of it as "work." Rather it has given me interesting and challenging opportunities, and it has been a great pleasure to get to know my colleagues and learn from them over the past 25 years.

### Citation

### Alan Tucker, Metropolitan New York Section

Alan Tucker has been deeply involved with the MAA, both at the national and section level, since the early 1970s. He was Metropolitan New York Section Chair from 1994 to 1996, and he was the MAA First Vice-President from 1988 to 1990, during which time he also served on the Board of Governors. He has served on too many MAA committees to mention here, including CUPM and the Committee on Participation of Women in Mathematics, and has chaired the Coordinating Council on Education, the Publications Committee, the Panel on the General Mathematical Sciences Program, and the Upper-level Core Math Panel. He has been Associate Editor of the *Monthly*, has served on the Editorial Board of *FOCUS*, and was the founding chair of the Editorial Committee on *MAA Notes*. He continues to assist the MAA and the Metropolitan New York Section in numerous ways, and the Section feels strongly that the time has come to honor Alan for his many years of extraordinary service.

### *Response from Alan Tucker*

I am honored by the MAA for this award. I come from a family of MAAers, with both my father and grandfather having been MAA Presidents. I have served on MAA committees for over 30 years and learned quickly why my father and grandfather so enjoyed service with MAA. The work of the MAA committees makes a significant contribution to the mathematical community. The friendships made with fellow committee members mean that one gets much more out of service to the MAA than one puts into it.

### Citation

### Ivy Knoshaug, North Central Section

Ivy Knoshaug has been teaching mathematics to college and high school students since 1965. She has been a member of the faculty at Bemidji State University continuously, beginning in 1981. In addition to her current efforts as Director of the Honors Program, Ivy played a key role in the success of the Northern Minnesota Mathematics Contest, was a leader in Bemidji State's implementation of graphing calculator technology, and has served on departmental and college committees too numerous to mention. She has been a bulwark to her colleagues and an inspiration to many grateful students.

Ivy's contributions to the North Central Section are awe-inspiring. Whether organizing summer seminars or Section meetings, serving as Newsletter Editor, President, or member of the Executive Committee, she is someone we all count on. She is one of our stalwart core members and personifies our section at its best.

For dedicated service to her students and colleagues in the Department of Mathematics at Bemidji State University and for her unflagging devotion to the work of the North Central Section of the Mathematical Association of America, the North Central Section bestowed upon Ivy Knoshaug its eighth Certificate of Meritorious Service in April, 2001 and its twelfth Distinguished Teaching Award in April, 2005.

### *Response from Ivy Knoshaug*

I am deeply honored to receive this award and I thank the North Central Section for nominating me. It has been my privilege to work with many dedicated, talented, and creative people in the North Central Section. I thank them all for their leadership, support, and inspiration.

### Citation

### Marjorie Enneking, Pacific Northwest Section

It is a pleasure to nominate Marjorie Enneking for the MAA's Certificate of Meritorious Service. Marj Enneking has a long history of loyal and helpful service to the Pacific Northwest Section of the MAA. She was Vice Chair of Four-Year Colleges from 1980–1981, Section Chair from 1983–1985, and Section Governor from 2000–2003. She served the Section well in all of these important leadership roles. She is a very active participant at Section meetings and her presence at these annual events takes many forms. She has led panel discussions on topics from "Issues in K–12 Education" to "Family Issues" and spoken about the importance of universal participation in preparation of future teachers. After her time in Washington DC as an NSF program director, she shared with the Section much valuable information by leading a minicourse on writing grant proposals. We know from direct experience that Marj's advice, encouragement, and grant-writing wisdom has helped our Section in obtaining NSF funds for curriculum improvement. There are undoubtedly many in the Section who owe her a round of heartfelt applause.

She was also supportive of our Section NExT during its early years. As a consultant, she spent valuable time talking with our new NExT Fellows and encouraging them in their academic plans and her active participation at our meetings was always appreciated.

As her voluminous service record and accomplishments are of the highest order, the Pacific Northwest Section is proud to nominate Marjorie Enneking for the MAA's Certificate of Meritorious Service.

***Response from Marjorie Enneking***

I am grateful to the Pacific Northwest Section for selecting me for this honor. I have much affection for MAA and the greatest admiration for its many members who have shared so much of their time and energy through MAA to promote mathematics and the teaching of mathematics. Through its many programs and conferences, especially the National and Section NExT programs, MAA has created an amazing potential for the future. With the continued dedication of long-time MAA leaders and enthusiastic commitment of talented newer leaders, I am confident that MAA is in good hands. MAA has enriched my life. I salute you all and thank you.

**Citation**

**William Yslas Vélez, Southwestern Section**

The Southwestern Section of the Mathematical Association of America is pleased to nominate Professor William Yslas Vélez of the University of Arizona for the Mathematical Association of America Certificate of Meritorious Service.

Those who know Bill are well aware of his high quality service to the MAA and the mathematics profession in general, but even those who have served alongside Bill may be surprised by the extent of his work. His longstanding passion has been opening the doors to mathematics and the sciences for underrepresented groups and attracting students to the mathematics major, but he has also taken initiative to advance the discipline in other ways, and he has generously served elsewhere when asked.

Early in his academic career, Bill presented papers dealing with minority participation in mathematics and the sciences, evidence of his interest that was to blossom by the late 1980s in the form of grants, publications, and regular participation on national boards and committees. The 11 grant projects related to minority participation that Bill has either directed or co-directed have provided scholarships, funded REU programs, and supported minority recruiting and retention efforts. He has written a dozen articles discussing strategies for attracting students to the mathematics major and for increasing minority participation. His tireless efforts have resulted in several awards, including five advising and mentoring awards, the President's Award for Excellence in Science, Mathematics and Engineering Mentoring Program (Washington, DC, September 1997), and two NSF awards.

He is widely recognized as a leader in minority participation in mathematics and the sciences. He has served as President of the Society for the Advancement of Chicanos and Native Americans in Science, and as Governor-at-Large for Minority Interests on the MAA Board of Governors. This year, he presented the James R. C. Leitzel Lecture at MathFest 2005 in Albuquerque on "Increasing the Number of Mathematics Majors: Lessons Learned from Working with the Minority Community."

Bill's leadership is evident in other roles as well. He served a term as Program Director of the NSF Algebra and Number Theory Program and he has been a member of five MAA committees, four AMS committees, and 18 other national advisory boards or committees dealing with mathematics, diversity in the profession, and education.

Bill has organized three annual meetings of the Southwestern Section of the Mathematical Association of America, one of which included the Sociedad Matematica de Sonora, and another of which he organized together with a regional AMS meeting. He has also contributed to the organization of several national MAA and AMS meetings.

Bill Vélez's role in service can be characterized as unselfish, generous, passionate, high quality and inspiring. His presence and insights have been witnessed and appreciated by many. This is a fitting time to honor his outstanding contributions with the Mathematical Association of America Certificate of Meritorious Service.

***Response from William Yslas Vélez***

I am so pleased to have been recognized and nominated by the Southwestern Section of the MAA for the Certificate of Meritorious Service to our Section and to the MAA. I have been part of this Section since the early 1970s and the MAA has certainly been a valuable part of my professional life since I began graduate school. When I was a graduate student, the Southwestern Section provided me with the opportunity to give talks on my work. As a working professional I have benefited from the many wonderful books that are published by the MAA. Given that I have received so much from the MAA, I consider it fortunate that I also have had the opportunity to give back to this very important mathematical organization. I thank my peers of our Section for the recognition and the Board of Governors of the MAA for selecting me for this award.

## Beckenbach Book Prize

The Beckenbach Book Prize, established in 1986, is the successor to the MAA Book Prize which was established in 1982. It is named for the late Edwin Beckenbach, a long-time leader in the publications program of the Association and a well-known professor of mathematics at the University of California at Los Angeles. This prize is awarded to an author of a distinguished, innovative book published by the MAA. The award is not given on a regularly scheduled basis, but is given only when a book appears that is judged to be truly outstanding.

### Citation

### Arthur Benjamin and Jennifer Quinn

*Proofs that Really Count: The Art of Combinatorial Proof*

Few mathematicians are immune to the limpid charms of a clever counting argument; in Proofs That Really Count Arthur Benjamin and Jennifer Quinn will charm you over and over again. The authors claim that counting arguments make the most compelling, natural, and memorable proofs. It is hard to disagree with them after dipping into this lovely volume. Benjamin and Quinn begin by noting that the number of ways to tile a $1 \times n$ array of squares with tiles that are either $1 \times 1$ or $2 \times 1$ is exactly the $(n + 1)$th Fibonacci number. This elementary observation becomes the key to discovering and proving just about every Fibonacci identity you've ever heard of by simple counting of tilings.

There is something here for every fan of counting. For example, do you know how many odd numbers there are in the 76th row of Pascal's Triangle? Do you know what happens when you reverse the order of the terms in a finite continued fraction? *Proofs That Really Count* illustrates in a magical way the pervasiveness and power of counting techniques throughout mathematics. It is one of those rare books that will appeal to the mathematical professional and seduce the neophyte.

The Beckenbach Book Prize is awarded to "distinguished, innovative MAA books" that are "truly outstanding." The Prize Committee can think of no better adjectives to describe *Proofs That Really Count* except, possibly, charming.

### *Biographical Note*

Arthur Benjamin earned his B.S. in Applied Mathematics from Carnegie Mellon and his Ph.D. in Mathematical Sciences from Johns Hopkins. Since 1989, he has taught at Harvey Mudd College, where he is currently Professor of Mathematics and past Chair.

Along with Jennifer Quinn, Art Benjamin is co-Editor of *Math Horizons* magazine. Currently, he is Governor of the Southern California-Nevada Section of MAA, and has served as Editor of the *Spectrum Book Series* and on the editorial boards of *Mathematics Magazine* and *The UMAP Journal*. In 2000, he received the MAA's Haimo Award for Distinguished College Teaching. In addition to spending time with his wife and two daughters, he enjoys playing backgammon, watching live theatre, racing calculators, and performing magic.

### *Response from Arthur Benjamin*

It is an honor and a privilege to receive this award. Writing this book was a labor of love for Jenny and me, and I am pleased that so many people enjoy viewing the world through a combinatorial lens. There are "countless" people to thank, among them Francis Su, Ira Gessel, and *Dolciani* Editor Dan Velleman, whose input made this a better book than we had any right to expect. This book also benefited from the contributions of many former undergraduates, especially Chris Hanusa and Jeremy Rouse. Above all, I must thank my wife Deena, who proofreads everything I write (including this response)!

### *Biographical Note*

Jennifer Quinn is the recently appointed Executive Director of the Association for Women in Mathematics. She continues her work as co-Editor of *Math Horizons* and as a Visiting Research Scholar at the University of Puget Sound.

Jennifer Quinn earned her B.A., M.S., and Ph.D. from Williams College, the University of Illinois at Chicago, and the University of Wisconsin, respectively. For the past twelve years, she taught at Occidental College, rising to the rank of full professor and serving as department chair. In 2001, she was awarded the MAA Southern California Section Award for Distinguished Teaching and in 2005, Occidental College's Graham L. Sterling Award for Faculty Excellence. She has served on the boards of the *Spectrum Book Series*, *Mathematics Magazine*, and the Phi Beta Kappa Alumni Association of Southern California. She lives in Tacoma, Washington, with her husband Mark Martin, a microbial geneticist, and bookends Anson and Zachary.

### *Response from Jennifer Quinn*

Writing a book and having it published originally seemed unimaginable. But by working on the *Spectrum* editorial board and seeing how books get published through the MAA, it became remotely possible. A deep love of the material plus encouragement from colleagues, students, family, and friends made it a reality. To be awarded the Beckenbach Book Prize is a lifetime accomplishment beyond my wildest dreams. For me, Art's description of our book as a "labor of love" is more meaningful than he may have intended. We began writing while I was on maternity leave with my first son, Anson. Publication coincided with the birth of my second son, Zachary. They will forever be my bookends to this work.

# Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics

The Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics is the most prestigious award made by the Association. This award was first given in 1990. The Yueh-Gin Gung and Dr. Charles Y. Hu Award is the successor to the Award for Distinguished Service to Mathematics, awarded since 1962, and has been made possible by the late Dr. Hu and his wife, Yueh-Gin Gung. It is worth noting that Dr. Hu was not a mathematician. He was a retired professor of geology at the University of Maryland. He had such strong feelings about the basic nature of mathematics and its importance in all human endeavors that he felt impelled to contribute generously to our discipline.

## Citation

### Hyman Bass

Hyman Bass has invested vast energies over several decades to strengthen the mathematical community. In addition to his considerable contributions to the field of algebra, his service to the mathematics community is legendary. He is a member of the National Academy of Sciences and has served on many of the Academy's committees including the U. S. Committee on Mathematics Instruction and the Mathematical Sciences Education Board, which he chaired. He was a member of Bourbaki. The Mathematical Association of America's Hedrick Lectures and addresses at the International Congress of Mathematicians in Moscow and in Vancouver are among Dr. Bass's distinguished lectures. He is a past president of the American Mathematical Society and has served on numerous committees of the Society. Hyman Bass has been a member of several boards, including chairing the Board of Trustees of the Institute for Advanced Study, and the Mathematical Sciences Research Institute. He also served on the Board of the Science and Technology Center for Computation and Visualization of Geometric Structures. In addition, Dr. Bass has served as editor of eleven different journals and book series.

In recent years, Dr. Bass has expanded his area of interest to include school mathematics. He was a member of the Mathematics Learning Study Committee of the National Research Council that synthesized the research on pre-kindergarten through eighth grade mathematics learning. Later, he was a member of the RAND Mathematics Study Panel which produced a strategic research and development program in mathematics education. One of Dr. Bass's contributions to the panel was his concern for developing a research agenda to uncover how the teaching and learning of mathematical practices can be taught and learned at the school level. Such practices include the ability to represent mathematics in a variety of forms and to choose the most appropriate form of representation for a given problem, the ability to make hypotheses and justify them, and the ability to generalize from the particular. These practices, commonly used by mathematicians, are not often addressed in school mathematics, and many undergraduate majors come unprepared to use these practices in collegiate mathematics.

Dr. Bass continues to be immersed in research on the learning and teaching of mathematics at the school level, where he is analyzing the mathematical development among teachers and students in the classroom setting to determine the mathematics needed for teaching and how that mathematics should be taught at the university level. He is also studying how to improve and assess mathematics teaching in the schools.

Hyman Bass is playing a vital role in bringing the insights of a mathematician to mathematics educators and the insights of a mathematics educator to mathematicians. He is conducting carefully reasoned, incremental, foundational research in order that discussion of educational issues may one day be based on more rigorous scientific findings. His service to mathematics and its teaching and learning at all levels is truly remarkable. It is a great honor to present the Mathematical Association of America's Gung-Hu Award to Hyman Bass.

### *Biographical Note*

Hyman Bass is Roger Lyndon Collegiate Professor of Mathematics and Professor of Mathematics Education at the University of Michigan. A graduate of Princeton, Dr. Bass earned his Ph.D. from the University of Chicago under Irving Kaplansky. He has had visiting appointments at sixteen different universities in ten countries. The many honors and prizes that Dr. Bass has received include the Cole Prize in algebra. He is an elected member of the American Academy of Arts and Sciences and the National Academy of Sciences, and the Third World Academy of Sciences, and was elected Fellow of the American Association for the Advancement of Science. He has been both a Sloan and a Guggenheim Fellow. Dr. Bass has published eighty-six papers in mathematics and seventeen in mathematics education.

### *Response from Hyman Bass*

I am deeply honored to receive this award, and grateful to the MAA and its Gung-Hu Award Committee for their generosity. I note that Dr. Hu, a benefactor of this award, was a geologist, as was my older brother Manuel, who first inspired my interest in science and mathematics. For me the beauty of mathematics has always been closely associated with the elegance of its best exposition and teaching; I benefited greatly from such edifying teachers and mentors as Emil Artin, Irving Kaplansky, Sammy Eilenberg, John Milnor, and Jean-Pierre Serre. So my recent engagement with improvement of the teaching of school mathematics represents more spiritual continuity with my mathematical research career than might be apparent. At the same time this important work in K–12 education is very different, and challenging in new and interesting ways. Here again I have gained from inspired teacher/mentors, so I would add the name of Deborah Ball to the above list. Thank you very much for this recognition.

# Award for Distinguished Public Service

This award 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 a distinguished contribution to the mathematics profession during the preceding five years.

## Citation

### Roger Howe

The 2006 award for Distinguished Public Service is presented to Professor Roger Howe. Dr. Howe, a member of the National Academy of Sciences, is the William R. Kenan Jr. Professor of Mathematics at Yale University. This award recognizes Dr. Howe for his multifaceted contributions to mathematics and to mathematics education. Not only is Dr. Howe recognized for his mathematical research but he has also taken a leadership role in national initiatives focused on the teaching of mathematics and in the education of teachers. For several years he served as Chair of the American Mathematical Society's Committee on Education and he was a member of the National Research Council's Mathematical Sciences Education Board. He served as chair of the American Mathematical Society's Consultative Committee involved in a revision of national mathematics standards in 1998. For many years he was on the board of directors of the Connecticut Academy for Education in Mathematics, Science and Technology. Moreover, he has served on several national panels and study committees that have resulted in influential publications, including the National Research Council's Mathematics Learning Study Committee (Adding It Up), the RAND Mathematics Study Panel (Mathematical Proficiency for All Students: Toward a Strategic Research and Development Program in Mathematics Education), and the Conference Board of the Mathematical Sciences steering committee (The Mathematical Education of Teachers). Dr. Howe is currently chair of the Mathematics Standards Study Group, a group of mathematicians who are analyzing the mathematics standards in each state. Dr. Howe has worked diligently over the years to broaden and professionalize the involvement of a research mathematician in educational reform, to lead us towards the goal where involvement of mathematicians in education is viewed as a well-informed professional activity by mathematicians and educators alike.

### *Biographical Note*

Roger Howe earned his Ph.D. in 1969 from the University of California at Berkeley, under the direction of Calvin C. Moore. He spent 1969 to 1974 at SUNY Stony Brook, and has been at Yale since 1974. His research has been mainly in the representation theory of groups and harmonic analysis, and its applications to the theory of automorphic forms, invariant theory, geometry, ergodic theory, partial differential equations and mathematical physics. He is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, and the Connecticut Academy of Science and Engineering. He has served as the Editor of Research Announcements for the *Bulletin of the American Mathematical Society*, and as Chair and member of the Committee on Education. He has also served on many non-AMS committees devoted to issues of mathematics education. He currently is visiting the State University of New York at Stony Brook in hopes of initiating a long-term project for improvement of K–12 mathematics teaching and curriculum in the United States.

### *Response from Professor Howe*

I thank the Society for this distinction. I am grateful in many ways and for many reasons.

I have been working on issues in mathematics education for 10–15 years. As the citation says, I have been on lots of committees! Mathematics education is an area with few proofs and even fewer theorems. Therefore, it is immensely encouraging to have one's efforts applauded in this official and striking way. At the same time, I am mindful that awards like this can never recognize all who may merit them. I know several colleagues whose work in education deserves commendation as much or more than mine, but I have been the lucky one this time.

I have become convinced that it is vital for the health of U.S. mathematics education that in the future more mathematicians contribute their time, knowledge and insights to improve it. This cannot happen to the extent it needs to unless work on education no longer makes one a candidate for the Public Service Award! It must become a somewhat normal thing to do, and consistent with maintaining a research program. My current projects aim at making this possible.

With Alan Tucker, I am working to design a project intended to inspect critical issues and topics in the mathematics curriculum from a high level mathematical viewpoint. This project would involve mathematicians and mathematics educators working together to improve understanding of how these topics do and should play out in a productive curriculum. The results of this project would be a series of essays distilling our best current knowledge of these topics.

It took me several years of working on mathematics education before I began to feel I had a perspective which to some extent integrated educational and mathematical concerns in a sensible way. If all mathematicians who are to work in education require a comparable initiation period, the barriers to entry into educational work will always remain too high. I have been discussing how to construct a workshop which would enable interested mathematicians to learn, in a few weeks, much of which it took me and others of my generation of mathematicians-in-education years to absorb.

Finally, one of the most important publications in mathematics education in the last 10 years was the book *Knowing and Teaching Elementary Mathematics*, by Liping Ma. I wrote a review of this book for the *Notices* in 1999, and I have continued to think about it since. This book presents responses of Chinese teachers of elementary mathematics to several questions about teaching important mathematics topics. I have become convinced that the level of understanding of teaching and curriculum revealed by their answers is something that is very much needed, but very rare, in the United States. I am currently working with the Mathematics for America foundation and SUNY Stony Brook to initiate a project to develop and disseminate this kind of understanding. The thrust of the project would be to produce and work with teams of mathematics specialist teachers who know mathematics very well, and who teach all grades 1 to 6. I feel that there should be many projects of this sort, and each such project would need a dedicated research mathematician at its core.

# Leroy P. Steele Prize for Mathematical Exposition

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 following citation describes the award for Mathematical Exposition.

## Citation

### Lars V. Hörmander

The four volumes of Lars Hörmander's *The Analysis of Linear Partial Differential Operators* are a compendium of practically all of the exciting developments that occurred in the theory of linear partial differential equations and in the area of microlocal analysis in the period 1960–1985.

Microlocal analysis emerged as a well-defined part of modern analysis with the development of pseudodifferential operators in the early 1960s. This made possible a "microlocal" way of thinking about the basic objects in linear partial differential equation theory: the fundamental solutions of these equations and the classes of generalized functions to which the solutions of these equations belong. Thanks to microlocal techniques, one could analyze the singularities of these functions much more precisely, and implement much more explicitly than before, for many different varieties of differential equations, the "semi-classical limit" of quantum mechanics.

In these four volumes, Hörmander describes these developments in a treatment that is seamless and self-contained. Moreover, the effort to make this treatment self-contained has inspired him to recast, in much more simple and accessible form, the approach to much of this material as it originally appeared in the literature. An example is the theory of Fourier integral operators, which was invented by him in two seminal papers in the early 1970s. (These get a completely new and much more elegant reworking in volume four.) In brief, these four volumes are far more than a compendium of random results. They are a profound and masterful "rethinking" of the whole subject of microlocal analysis.

Hörmander's four volumes on partial differential operators have influenced a whole generation of mathematicians working in the broad area of microlocal analysis and its applications. In the history of mathematics one is hard-pressed to find any comparable "expository" work that covers so much material, and with such depth and understanding, of such a broad area of mathematics.

Another of Hörmander's masterpieces in exposition is his much shorter book, *An Introduction to Complex Analysis in Several Variables*, the first edition of which appeared in 1966. Like the four volumes cited above, it is remarkable in the scope of what it covers. For instance the first chapter, only 22 pages long, is one of the best treatments of functions of one complex variable available anywhere in the literature. Now, more than 30 years later, this excellent book remains the gold standard in teaching a graduate course in several complex variables at many universities in the U.S. and abroad. This short text of about 200 pages is a "must read" for anyone who works or uses the modern theory of analysis of several complex variables. In particular, it contains the best treatment available for weighted $L^2$ estimates for d-bar equations (originally invented by Hörmander), which continue to be used in other areas of mathematics.

In conclusion, Lars Hörmander's contribution to mathematical exposition is highly unusual and perhaps even unique in modern times.

### *Biographical Note*

Lars Hörmander was born on January 24, 1931 in southern Sweden. He was an undergraduate and a graduate student at the University of Lund, Sweden, first with Marcel Riesz and then, after Riesz retired, with Lars Gårding as advisor. After obtaining a Ph.D. in 1955 he spent a year in the U.S.—two quarters at the University of Chicago and a semester at what is now the Courant Institute in New York—before returning as full professor to the University of Stockholm in 1957. During the academic year 1960–1961 he was a member of the IAS in Princeton and a visitor at Stanford in the summers of 1960 and 1961 where he had a permanent appointment in 1963–1964 before leaving both Stockholm and Stanford to become a professor and permanent member at the IAS. He left Princeton in 1968 to return to Sweden as professor in Lund where he remained until retiring in 1996, apart from about two more years in the U.S., mainly at IAS, Stanford, Courant Institute and UC San Diego.

### *Response from Professor Hörmander*

I am very happy and grateful to receive this award for the activity which has dominated a great part of my professional life, and I wish to thank the members of the Selection Committee for their consideration.

My expository writing started in the 1950s with modest lecture notes just intended for the students in Stockholm I wanted to introduce to the theory of partial differential equations. I toyed with the idea of expanding them to a book but this seemed unrealistic until in 1960 I received a letter from one of the editors of the famous Springer "yellow series" inviting me to write a book for it. This was an enormous encouragement and as a result I devoted a great deal of the academic year 1960–1961 to this project, including research on topics which had to be better understood to make a systematic exposition possible. The manuscript of my first book *Linear Partial Differential Operators* was finished in 1962, and it appeared in 1963 in the yellow series. I was then working to understand better the applications of the theory of functions of several complex variables to the theory of partial differential equations with constant coefficients which I had not been able to cover in my book, and with the so-called $\bar{\partial}$-Neumann problem which through work of Morrey, Kohn and others had just made it possible to conversely base the theory of functions of several complex variables on the theory of partial differential equation. When I lectured on these topics at Stanford in 1964 I wrote detailed lecture notes. After some additions to round them off they were published by van Nostrand in 1966 as *An Introduction to Complex Analysis in Several Variables*, which is one of the books mentioned in the citation. Expanded editions were published by North Holland in 1973 and 1990.

The rapid development of microlocal analysis in the 1960s quickly made the book in the yellow series obsolete, but the pace was so fast that it seemed impossible to make it up to date. However, 15 years after it had been published I thought that it was worth trying and after the year 1977–1978 at IAS and Stanford devoted to preparations, I could make preliminary plans for a replacement in three volumes, again encouraged by Springer Verlag. When the manuscript was finished in 1984 the third volume had grown so much that it had to be divided in two, the last appeared in 1985. The title *The Analysis of Linear Partial Differential Operators* was chosen to indicate that the four volumes had developed from the 1963 book, which is why I have mentioned it here although it is not included in the citation. After two decades they are of course no longer up to date but they can still serve as an introduction to many of the basic techniques in the field. The first two volumes have been preserved in the Springer Classics in Mathematics series, and the last two should soon join them there.

In conclusion I would like to thank the many colleagues and students whose encouraging interest has stimulated my expository writing. Without such support and constructive criticism it would have been hard to persevere with that for so many years.

# Leroy P. Steele Prize for Seminal Contribution to Research

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 following citation describes the award for Seminal Contribution to Research.

## Citation

## Clifford S. Gardner, John M. Greene, Martin D. Kruskal, and Robert M. Miura

The Steele Prize for Seminal Contribution to Research is awarded for their joint paper "Korteweg-deVries equation and generalizations. VI. Methods for exact solution," *Comm. Pure Appl. Math.* 27 (1974), 97–133.

This is a fundamental paper in the theory of solitons, inverse scattering transforms, and nonlinear completely integrable systems. Before it, there was no general theory for the exact solution of any important class of nonlinear differential equations. Except for a few special cases, only approximations to solutions were possible. This paper, in the context of the Korteweg-deVries equation, introduced the use of scattering parameters of an associated linear problem to solve a nonlinear equation—effectively generalizing Fourier series and Fourier transforms to nonlinear equations. The idea was quickly extended to other nonlinear evolution equations, triggering important work in dynamical systems, inverse scattering, and symplectic geometry, to name a few. In applications of mathematics, solitons and their descendants (kinks, anti-kinks, instantons, and breathers) have entered and changed such diverse fields as nonlinear optics, plasma physics, and ocean, atmospheric, and planetary sciences. Nonlinearity has undergone a revolution: from a nuisance to be eliminated, to a new tool to be exploited.

## *Biographical Note*

### *Clifford S. Gardner*

Clifford S. Gardner was born in Fort Smith, Arkansas, in 1924. He graduated from Phillips Academy in 1940, and received his A.B. from Harvard College in 1944 and his Ph.D. from New York University in 1952. He worked in applied mathematics at various places including NACA Langley Field, U.C. Livermore Laboratory, Courant Institute, and the Plasma Physics Laboratory, Princeton. He was Professor of Mathematics at the University of Texas, Austin, from 1967 until his retirement in 1990.

***Biographical Note***

***John M. Greene***

John M. Greene received his B.S. degree in Physics from Caltech in 1950 and his Ph.D. in Theoretical Particle Physics from the University of Rochester in 1956. He worked at the Princeton Plasma Physics Laboratory (1956–1982) and at General Atomics from 1982 until his retirement in 1995. He has been a Fellow of the American Physical Society and a member of the American Geophysical Union.

In 1992 Prof. Greene was awarded the James Clerk Maxwell Prize from the Division of Plasma Physics of the American Physical Society. The citation reads: "For outstanding contributions to the theory of magnetohydrodynamic equilibria and ideal and resistive instabilities, for discovery of the inverse scattering transform leading to soliton solutions of many nonlinear partial differential equations, and for the invention of the residue method of determining the transition to global chaos."

***Response from Professor Greene***

This response is written by Alice Greene on behalf of John Greene:
John was always pleased with the work on the Korteweg-de Vries equations. I recall his triumphal announcement "It unfolded like a lily!" (After much intense work, I imagine.) He would be truly delighted with its recognition by the American Mathematical Society.

***Biographical Note***

***Martin D. Kruskal***

Martin D. Kruskal was born in New York City on September 28, 1925. He earned his B.S. from the University of Chicago in 1945 and his M.S. and Ph.D. from New York University in 1948 and 1952, respectively. He began his career as an instructor in the mathematics department at New York University (1946–1951) and then moved to Princeton University as a Research Scientist in the Plasma Physics Laboratory (formerly Project Matterhorn), becoming Senior Research Associate in 1959. While at Princeton, he was a Lecturer in Astronomy (1959–1961), Director of the Program in Applied [and Computational] Mathematics (1968–1986), Professor of Astrophysical Sciences (1961–1989), Professor of Mathematics (1979–1989), and is Professor Emeritus (1989– ). He is currently David Hilbert Professor of Mathematics at Rutgers University.

Prof. Kruskal has given innumerable invited lectures at conferences and institutions and has served on many advisory committees and editorial boards. He has traveled widely and has held various visiting and fellowship positions at the Max Planck Institut für Physik und Astrophysik (Munich), the University of Grenoble (France), the Lebedev Institute (Moscow), the Weizmann Institute of Science (Israel), Nagoya University (Japan), Bharathidasan University (India), Australian National University, the University of New South Wales (Australia), the University of Adelaide (Australia), Los Alamos National Laboratory, the University of California at Santa Barbara and the University of Chicago.

Prof. Kruskal has been the recipient of numerous honors and awards; including the President's National Medal of Science, the National Academy of Science Award in Applied Mathematics and Numerical Analysis, the Von Neumann Prize of SIAM, and the Pott's Gold Medal of the Franklin Institute (Philadelphia). He has received an Honorary Doctorate from Heriot-Watt University and is a member of the National Academy of Sciences and the American Academy of Arts and Sciences, a foreign member of the Royal Society of London and the Russian Academy of Natural Sciences, and an Honorary Fellow of the Royal Society of Edinburgh.

### *Response from Professor Kruskal*

It is usual for a prize recipient to thank the relevant society, the AMS in the present case, and the committee members who made the selection, for being selected—and I do certainly wish to express those sentiments. However, I also wish warmly to thank my co-recipients, who played such a major role in our joint research, and from whom I learned so much in the process.

Among the several functions that such prizes serve, a seldom mentioned one is to validate the decisions and efforts that the awardees invested in over, often, years of self-doubt and threatening discouragement. Research success may indeed be its own reward, but it helps nevertheless to receive the recognition of one's peers.

So, thanks to all of you!

### *Biographical Note*

### *Robert M. Miura*

Robert M. Miura was born on September 12, 1938, in Selma, California. He received his B.S. and M.S. degrees in Mechanical Engineering from the University of California at Berkeley in 1960 and 1962, respectively, and his M.A. and Ph.D. in Aerospace and Mechanical Sciences from Princeton University in 1964 and 1966, respectively. His doctoral research was in the area of the kinetic theory of gases. His first postdoctoral position in 1965–1967 was at the Princeton Plasma Physics Laboratory, part of Princeton University, where he started research on nonlinear wave propagation. There he worked closely with Martin Kruskal, Clifford Gardner, and John Greene on the Korteweg-de Vries equation, a nonlinear dispersive partial differential equation exhibiting soliton solutions and having numerous applications. This collaboration led to the inverse scattering method for exact solution of the KdV equation, and also to the proof of an infinite number of conservation laws. His postdoctoral position at the Courant Institute in 1967–1968 was in the Magneto-Fluid Dynamics Division headed by Harold Grad.

Prof. Miura has taught at New York University (1968–1971), Vanderbilt University (1971–1975), and the University of British Columbia (1975-–2001). In 1975, upon his arrival at the University of British Columbia, his research interests changed to mathematical neuroscience, specifically excitable cells, and mathematical physiology, more generally. Since 2001, he has been Professor of Mathematical Sciences and of Biomedical Engineering at the New Jersey Institute of Technology. He now is Acting Chair of the Department of Mathematical Sciences. He is a fellow of the John Simon Guggenheim Foundation (1980), the Royal Society of Canada (1995), and the American Association for the Advancement of Science (2005). He has authored many research papers and served on several editorial boards. Presently, he is co-editor-in-chief of *Analysis and Applications* and is on the editorial boards of the *Canadian Applied Mathematics Quarterly* and *Integrative Neuroscience*. He is a member of the American Mathematical Society, the Society for Industrial and Applied Mathematics, the Society for Mathematical Biology, the Canadian Mathematical Society, and the American Association for the Advancement of Science.

### *Response from Professor Miura*

I am particularly pleased, honored, and humbled to receive the 2006 Leroy P. Steele Prize along with my colleagues, Clifford Gardner, John Greene, and Martin Kruskal, and to be recognized for the work on the Korteweg-de Vries equation that we did 40 years ago. As a fresh postdoc, I was very fortunate to have had the opportunity to work with and to have been mentored by three generous and smart guys. The two years at the Princeton Plasma Physics Laboratory were the happiest and most exciting years in my research career. Every day came with the time to think deeply about new ideas and to produce results. The soliton solutions of the KdV equation, discovered by Kruskal and Zabusky, showed this equation is special. The initial-value problem for the KdV equation is fascinating, and there are many special properties of the equations, e.g., an infinity of conservation laws resulting in infinitely many conserved integrals of the motion. A major breakthrough was the development of a method for exact solution of the initial-value problem for the KdV equation on the infinite line, which we called the "inverse scattering method" since it utilized the scattering problem for the time-independent Schrodinger equation. At the time, we thought this method was very special and only could be applied to this equation. However, the Russians, Zakharov and Shabat, showed how to generalize the method to systems of equations, and the rest is history.

# 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. The following citation describes the award for Lifetime Achievement.

## Citation

### Frederick W. Gehring

For over fifty years F. W. Gehring has been a leading figure in the theory of quasiconformal mappings. The cornerstone of the two-dimensional theory is his theorem that the geometric definition of quasiconformality (infinitesimal discs are mapped to infinitesimal ellipses with eccentricity bounded) implies the more restrictive analytic definition. Gehring created the higher dimensional theory of quasiconformal maps, which is very different from the two-dimensional case. His work on convergence theorems, Hölder exponents, and the $L^p$ integrability of Jacobians forms the foundation of the higher dimensional theory.

Largely because of Gehring's work, the theory of quasiconformal mappings has influenced many other parts of mathematics, including complex dynamics, function theory, partial differential equations, and topology. Higher dimensional quasiconformality is an essential ingredient of the Mostow rigidity theorem and of recent work of Donaldson and Sullivan on gauge theory and four-manifolds, and quasiconformality has inspired much beautiful recent analysis on general metric spaces by Heinonen, Koskela, and others.

Gehring's mathematics is characterized by its elegance and simplicity and by its emphasis on deceptively elementary questions which later become surprisingly significant.

A person of incredible energy and enthusiasm, Fred Gehring has trained twenty-nine Ph.D. students, many of whom are now faculty members at research universities, and he has mentored more than forty postdoctoral fellows. The list of Gehring's former postdocs at the University of Michigan represents a large fraction of the present day leaders in complex analysis.

### *Biographical Note*

Born in Ann Arbor, Michigan, Fred Gehring's association with the University of Michigan goes back two generations to his grandfather, John Oren Reed, who was a member of the physics faculty and Dean of College of Literature, Science and the Arts. Gehring joined the U.S. Navy in 1943, and subsequently earned two degrees from Michigan—Bachelor of Science in math and electrical engineering in 1946, and Master of Science in math in 1949. He returned to teach mathematics at Michigan in 1955 after completing his Ph.D. at Cambridge, and spending three years as a Benjamin Peirce Instructor at Harvard. He became a professor in 1962, was named to a collegiate chair in 1984, and became the T. H. Hildebrandt Distinguished University Professor in 1987, one of the University's highest honors for faculty. His long and distinguished history of service at Michigan includes three terms as chair of the Department. Professor Gehring has received numerous awards, including the Distinguished Faculty Achievement Award, the Sokol Faculty Award, the Humbolt Award, Onsager Professorship, and he was the Henry Russel Lecturer for 1990. In 1989 he was elected to the National Academy of Sciences. He has also received honorary degrees from the University of Helsinki, the University of Jyväskylä, and the Norwegian University of Science and Technology.

Professor Gehring has also been of great service to the AMS. He has been a member of the Executive Committee (1973–1975, 1980–1982), a Member-at-Large of the Council (1980–1982), and on the Board of Trustees (1983–1992; chair 1986, 1991). He has served on numerous committees, including the Committee on Science Policy (1981–1983, 1985–1987), the Committee on Governance (1993; chair), the Editorial Committees for the *Bulletin*, *Mathematical Reviews*, *Proceedings*, and the *Electronic Journal on Conformal Geometry and Dynamics*, and on numerous selection and nominating committees.

Fulbright and Guggenheim Fellowships in 1958–1960 allowed Professor Gehring to study in Helsinki and Zürich, where he began to learn the theory of quasiconformal mappings, a subject that became the focus of his life's work. He was instrumental in developing the theory, often in collaboration with Finnish colleagues, and bringing it into the mainstream of mathematical analysis, making contact with potential theory, partial differential equations, geometric topology, Riemannian geometry, and complex dynamics, as well as classical function theory. In particular, he pioneered the important extension of the theory to $n$-dimensional space, emphasizing new tools such as extremal length, and has brought quasiconformal mappings into a broad study of discrete transformation groups. He has generously shared his passion for mathematics and research by mentoring over seventy Ph.D. students and Postdoctoral fellows during his career.

### *Response from Professor Gehring*

Some of the earliest memories I had as a child were music which my father played on a piano and orchestral pieces which he played on a large victrola. I was fascinated by what I heard and subsequently spent several years learning how to play the piano.

Later as I was finishing high school in 1943 I learned how to build radios and looked forward to a career in physics. But world events intervened. I joined the U.S. Navy V-12 program in June 1943 and spent the next thirty-two months as a student in the Department of Electrical Engineering at the University of Michigan.

This was a fascinating but somewhat frustrating experience since I would have preferred to see more rigorous proofs for the things I had learned. Hence after the war I changed my major and studied mathematics at Michigan and then at Cambridge University in England.

I never regretted that decision and I consider the ensuing years of teaching and research as the happiest possible. The opportunity to guide my Ph.D. students and the postdoctoral fellows with whom I have worked was educational, rewarding, and fulfilling.

Indeed I would feel quite remiss in accepting this award without acknowledging how much I owe to them. So now I thank you for this award which I accept in their names also.

## Citation

## Dennis P. Sullivan

Dennis Sullivan has made fundamental contributions to many branches of mathematics. Sullivan's theory of localization and Galois symmetry, propagated in his famous 1970 MIT notes, has been at the heart of many subsequent developments in homotopy theory. Sullivan used it to solve the Adams Conjecture and the Hauptvermutung for combinatorial manifolds. Later Sullivan developed and applied rational homotopy theory to problems about closed geodesics, the automorphism group of a finite complex, the topology of Kähler manifolds, and the classification of smooth manifolds. He has reinvented himself several times, playing major or dominant roles in dynamical systems, Kleinian groups, and low dimensional topology.

These brief remarks do not do justice to the scope of Sullivan's ideas and influence. Beyond the specific theories he has developed and the problems he has solved—and there are many significant ones not mentioned here—his uniform vision of mathematics permeates his work and has inspired those around him. For many years he was at the center of the mathematical conversation at IHES. Later he moved to New York where his weekly seminar remains an important feature of mathematical life in the City.

### *Biographical Note*

Dennis Sullivan was born February 12, 1941, in Port Huron, Michigan, but he grew up in Houston, Texas. He graduated from Rice in 1963 and came to Princeton; his Ph.D. thesis (1966) on geometric topology was written under the direction of William Browder. After graduation he held a NATO Fellowship at Warwick, where he continued work in the general area of his thesis (Hauptvermutung for manifolds, 1967), and a Miller Fellowship at Berkeley (work on the Adams conjecture, K-theory and étale homotopy). He spent 1969 to 1973 as the Sloan Fellow of Mathematics at MIT, studying localization in homotopy theory (in particular, Galois symmetry), étale theory, and the construction of minimal models for the rational homotopy type of manifolds, using differential forms.

He shared the AMS Veblen Prize with Rob Kirby in 1971. In 1973–1974, Sullivan visited the University of Paris-Orsay. He remained in France as Professeur permanent at the IHES, full-time until 1981, when he was named Einstein Professor at CUNY, and half-time after that until 1996, when he joined the Mathematics Department and the Institute for Mathematical Sciences at Stony Brook. During his years in France, his interests expanded first towards dynamical systems, including ergodic theory, foliations, Kleinian groups, and renormalization, and then, motivated originally by problems in conformal dynamics, towards Teichmüller theory (No Wandering Domains Theorem, 1982). He was awarded the Prix Élie Cartan by the Academie des Sciences in 1981, the King Faisal Prize in Science in 1994, the Ordem Scientifico Nacional (Brazilian Academy of Sciences) in 1998, and the United States National Medal of Science in 2005, and he was elected to the United States National Academy of Sciences in 1983 and to the Brazilian National Academy of Sciences in 1984. He was awarded honorary degrees by the University of Warwick in 1983 and the École Normale Supérieure de Lyon in 2001. His most recent work centers on quasiconformal analysis, holomorphic dynamics, and the relation between algebraic topology, quantum theory, and fluid dynamics. Dennis Sullivan has three daughters, three sons, and two grandchildren.

### *Response from Professor Sullivan*

I am very honored and pleased to receive the Steele Prize—with a small nuance that it is awarded for work done up to now. I am still trying to understand the correct algebraic structure of an algebraic model for manifold or spacetime. My thesis advisor's original emphasis on Poincaré duality is still the guide, but now expressed in new algebraic data related to the physicist's correlations, or multilinear functions on a space of states. I hope to apply this to write down finite dimensional computationally effective algorithms in nonlinear problems like fluid dynamics with applications to problems like helping out the 48 hour more precise advance prediction of the landfall of hurricanes like Katrina and Rita.

# Award for an Exemplary Program or Achievement in a Mathematics Department

This prize was established in 2004 to recognize 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. This prize was first awarded in 2006.

## Citation

The first Award for an Exemplary Program or Achievement in a Mathematics Department is presented to Harvey Mudd College in Claremont, California. The Mathematics Department at Harvey Mudd College excels in numerous dimensions. Its exciting programs have led to a doubling of the number of math majors over the last decade. Currently more than one out of every six graduating seniors at Harvey Mudd College majors in mathematics or in new joint majors of mathematics with computer science or mathematical biology. Furthermore, about 60% of these math majors continue their education at the graduate level.

The Harvey Mudd College Mathematics Clinic has served as a trailblazer and a model for other programs for more than thirty years. This innovative program connects teams of math majors with real-world problems, giving students a terrific research experience as well as a glimpse at possible future careers. Undergraduate research is a theme throughout the mathematics program at Harvey Mudd College, as exemplified by the over twenty papers published in the last three years by Harvey Mudd College mathematics faculty with student co-authors.

The Harvey Mudd College Mathematics Department promotes the pleasures of mathematics to nonmajors so well that many nonmajors participate in the weekly Putnam Seminar on problem solving, leading to an unusually large number of Harvey Mudd students taking the Putnam Exam each year. The Putnam Seminar's work has produced consistently outstanding performances in the Putnam Exam, with Harvey Mudd ranking in the top ten nationwide in 2001, 2002, and 2003 (and just missing in 2004 with an eleventh-place finish). Amazingly, Harvey Mudd mathematics students have won 19 NSF fellowships over the last six years.

The Harvey Mudd College Mathematics Department also devotes serious effort toward outreach to low-income and underrepresented minority communities. This work includes programs aimed at stimulating interest in mathematics and science in a local high school in a low-income area. The department also runs a workshop in Jamaica for Jamaican high school mathematics teachers, focusing on creative methods for teaching mathematics.

The mathematics community is fortunate to have Harvey Mudd College present such an outstanding example of an exemplary program in a mathematics department.

# Mathematics Programs That Make a Difference

The American Mathematical Society will highlight two programs each year that specifically:

(1) aim to bring more persons from underrepresented minority backgrounds into some portion of the pipeline beginning at the undergraduate level and leading to an advanced degree in mathematics, or retain them in the pipeline;
(2) have achieved documentable success in doing so; and
(3) are replicable models.

This recognition was first implemented in 2006.

## Citation

This year the AMS recognizes the Summer Institute in Mathematics for Undergraduates (SIMU) REU program conducted at the Universidad de Puerto Rico, Humacao, from 1998 to 2002, and the graduate program in the Department of Mathematics at the University of Iowa. Both of these programs have made significant, successful efforts to encourage underrepresented minorities to continue in the study of mathematics.

## Summer Institute in Mathematics for Undergraduates
## Universidad de Puerto Rico, Humacao

The goal of SIMU was to increase the number of Latinos/as and Native Americans earning graduate degrees and pursuing careers in the mathematical sciences. Junior and senior undergraduate students who were Hispanic/Latino/a and Native American U.S. citizens or permanent residents spent six weeks on the campus of the Universidad de Puerto Rico, Humacao. During the program, students were able to participate in a mathematics seminar and to attend a series of colloquium talks, complete an undergraduate research project, and learn about the skills and techniques needed for research careers. Later, students had opportunities to present their work at a SACNAS conference and the Joint Mathematics Meetings and to continue the mentoring relationships developed during the summer experience.

The program has been highly successful in meeting its goal. During five summers, 107 students participated in the program. Polls conducted after the program was over indicated that 92% of the students now wished to pursue a graduate degree in mathematics or science. Forty-four of these students have been accepted into mathematics Ph.D. programs; three have completed Ph.D.s in mathematics and one student has completed a Ph.D. in physics. Twenty-one participants have completed masters degrees in mathematics.

***The AMS commends the high level of commitment that the two program co-directors, Hebert A. Medina (Loyola Marymount University) and Ivelisse Rubio (Universidad de Puerto Rico, Humacao), have made to produce these remarkable results.***

### Graduate Program
### Department of Mathematics
### University of Iowa

In 1995, the Department of Mathematics at the University of Iowa made a long-term commitment to substantially increase the number of its U.S. graduate students from underrepresented minority groups (African American, Latino/a, and Native American U.S. citizens and permanent residents). Specific aspects of the ongoing program include a three-week intensive Summer Institute for incoming students, faculty mentoring for all students, peer mentoring at key points in the graduate career, and a new course, "Introduction to the graduate program." In addition, the department has built ties with several institutions, including a group of Historically Black Colleges and Universities, the Mathematics and Theoretical Biology Institute for undergraduates at Arizona State University, and a consortium of mathematics departments at 12 area colleges and universities.

The department's underrepresented minority graduate student population has grown from zero students in 1995 to twenty-four students currently. The department has done this while maintaining high average GRE scores and GPAs for entering students. Eight of the department's U.S. minority students have been awarded Ph.D.s since 1998; in 2004–2005, roughly 10% of the total number of doctoral degrees awarded to U.S. minority students nationally in mathematics have been at the University of Iowa. The department projects that, out of an average of 12 Ph.D.s awarded each year, three will be awarded to U.S. minority students for the foreseeable future. Creating a more supportive environment has helped other groups of students; for example, 41% of the graduate students in the department are now women. Retention rates have increased for all students since the program has been implemented.

***Such impressive results occur only when an entire department makes a strong commitment to a program. The AMS commends the Department of Mathematics at the University of Iowa for its successful efforts to improve the diversity of the profession of mathematics in the United States.***