January 2004 Prizes and Awards

4:25 P.M., Thursday, January 8, 2004

Program

Opening Remarks
Ronald L. Graham, President
Mathematical Association of America

Levi L. Conant Prize
American Mathematical Society

Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics
Mathematical Association of America

E. H. Moore Research Article Prize
American Mathematical Society

Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student
American Mathematical Society
Mathematical Association of America
Society for Industrial and Applied Mathematics

Louise Hay Award for Contributions to Mathematics Education
Association for Women in Mathematics

Leroy P. Steele Prize for Mathematical Exposition
American Mathematical Society

Leroy P. Steele Prize for Seminal Contribution to Research
American Mathematical Society

Leroy P. Steele Prize for Lifetime Achievement
American Mathematical Society

Certificates of Meritorious Service
Mathematical Association of America

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

Award for Distinguished Public Service
American Mathematical Society

Norbert Wiener Prize in Applied Mathematics
American Mathematical Society
Society for Industrial and Applied Mathematics

Oswald Veblen Prize in Geometry
American Mathematical Society

Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics
Mathematical Association of America

Closing Remarks
David Eisenbud, President
American Mathematical Society

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

Noam D. Elkies

The Levi L. Conant Prize in 2004 is granted to Noam D. Elkies for his enlightening two-part article "Lattices, Linear Codes, and Invariants," *Notices of the AMS*, 47, nos. 10–11 (2000); Part I, 1238–1245; Part II, 1382–1391.

Part I, which is of prize-winning quality by itself, begins with the problem of finding the densest packing of 24-dimensional marbles whose centers are placed at the points of a lattice. It carries the reader effortlessly along a journey through the space of lattices, through the subject of theta functions and modular forms, through classical number-theoretic identities, through sporadic finite simple groups, and finally to some hints of an exceptional 24-dimensional lattice known as the Leech lattice. Elkies keeps the reader's attention throughout, judging well which points to expand upon and which points to skip over. It is hard to put the article down as it takes unexpected turns and weaves together different areas of pure mathematics.

In Part II, Elkies avoids the temptation to expand this development further, in a way that might tire the reader, and instead he develops an ostensibly different topic, stressing a detailed analogy with the material in Part I. Here the topic is one in applied mathematics, specifically that of linear error-correcting codes. He introduces "Hamming space" as the space of ordered n-tuples from a finite alphabet, especially from the elements of a finite field. Error-correcting codes become the analog of sphere packings. Linear error-correcting codes become the analog of sphere packings with centers at the points of a lattice. "Weight enumerators" play the role of theta functions, and he pursues the topic through the same kinds of twists and turns as in Part I. Eventually he arrives again at the Leech lattice, and this time he constructs the lattice and examines some of its remarkable properties.

The article leaves the reader with a good feeling about the unity of mathematics, and its underlying beauty. It is a masterful exposition.

Biographical Note

Noam D. Elkies is a number theorist, whose work mostly concerns Diophantine geometry, computational number theory, and connections with other fields such as sphere packing and error-correcting codes. He also publishes occasionally in

enumerative combinatorics and combinatorial games. He twice represented the United States at the International Mathematical Olympiad, winning gold medals both times, and was a Putnam Fellow in each of the three years he took the Putnam examination. He has been at Harvard since coming there as a graduate student in 1985; after earning his Ph.D. there under Barry Mazur and Benedict Gross, he was a Junior Fellow, then Associate Professor, and was granted tenure in 1993 at age 26, the youngest in Harvard's history. His work has also been recognized by awards such as a Packard Fellowship and the Prix Peccot of the Collège de France.

Elkies' main interest outside mathematics is music, mainly classical piano and composition. Recently performed works include a full-length opera, *Yossele Solovey*; "Brandenburg Concerto #7", commissioned and performed by the Metamorphosen Chamber Orchestra; and several other orchestral compositions, one of which had Elkies playing the solo piano part in Boston's Symphony Hall. He still has some time for chess, where he specializes in composing and solving problems; he won the world championship for solving chess problems in 1996, and earned the Solving Grandmaster title in 2001.

Response from Professor Elkies

I am honored and grateful to receive the 2004 L. L. Conant Prize for my article "Lattices, Linear Codes, and Invariants" in the *AMS Notices*. I also thank Tony Knapp for soliciting the article, and for working with me on the mathematical writing. It was already gratifying to have the opportunity to introduce the *Notices* readership to a beautiful circle of mathematical ideas, whose continuing vitality is exemplified by such recent work as the unified treatment by Nebe, Rains and Sloane of various generalizations of the MacWilliams identity and Gleason's theorems, and the proof by Cohn and Kumar that the Leech lattice yields the densest lattice packing of spheres in dimension 24. I am delighted that my exposition was selected for the Conant Prize, and hope that this additional exposure will entice more mathematicians to learn about the invariants associated with lattices and codes.

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.

Citation

Thomas Garrity

When Thomas Garrity arrived at Williams in 1989, there were 11 senior math majors. This year, 52 sophomores signed on. Much of this success can be traced to Tom's overwhelming enthusiasm, love of everything mathematical, and ability to reach students at every level.

Tom Garrity is one of those teachers that students never forget, the kinds that will come up in discussions at their 50th reunion. He is completely uninhibited. There was the time he taught an entire class hopping on one foot. Another time, he decided to teach the rest of a class period without saying a word, entirely by writing on the board and hand signals. Approaching a key point, he has been known to raise his voice dramatically and say "and now I am raising my voice dramatically to create an artificial sense of excitement as we reach this point."

Why does he do these things? First and foremost, because he knows that students will remember the mathematics, not just the antics. And secondly, he is just being himself. Yet Tom's classes are notorious for being some of the most difficult on campus. Still, students flock to them. "Anyone who can make an 8:30 a.m. calculus class one of the best classes I've taken deserves large amounts of praise. His self-proclaimed 'cheap pedagogical tricks' to make material fun, funny, and attention-grabbing, are always successful. Garrity WILL make you crack up in class. He is a tough professor though. Expect to work a lot, and to work hard."

Tom's far-reaching mathematical interests make him an exceptional research advisor. He often has three thesis students working in three different areas, generally linked to his own research. He has been instrumental in the Williams "SMALL" summer REU which has produced more publications than any other in the country; he alone has advised 37 summer research students. Tom's book, *All the Mathematics You Missed (But Need to Know for Graduate School)*, has extended his impact well beyond Williams. It provides an inspirational overview of the important topics every incoming graduate student should know.

Tom is someone who can take math-talented or math-phobic students and turn them into mathematicians. He draws them into his world, where thinking about mathematics is as natural as breathing. In recognition of his extraordinary abilities, we are pleased to honor Thomas Garrity with the Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics.

Biographical Note

Thomas Garrity was an undergraduate at the University of Texas at Austin, graduating in 1981 with degrees in mathematics and philosophy. He then pursued graduate studies at Brown University, receiving his Ph.D. in 1986. He spent the next three years at Rice University as a G. C. Evans Instructor. In 1989, he arrived at Williams, where he has been ever since, save for sabbaticals spent at the University of Washington (1992–1993) and the University of Michigan at Ann Arbor (2000–2001).

Response from Professor Garrity

I am honored to be receiving one of this year's Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics, especially considering that there are so many mathematicians in the nation who are talented teachers. Of course, I am also very lucky, working at a college and in a department that supports, encourages, and inspires its faculty in both teaching and research.

Citation

Andrew Chiang-Fung Liu

Andrew Liu's popularity as a teacher reflects the enormous energy he expends on teaching, his ability to make mathematics fun, his uncanny sense for good problems, and his personal interest in his students. His outstanding reputation as consummate mathematics educator is documented by two teaching awards from his own University of Alberta, two Canadian national teaching awards, a 3M Teaching Fellowship, and the David Hilbert International award for promotion of mathematics learning from the World Federation of Mathematics Competitions.

At Alberta, he designed a unique course in discrete mathematics in which students must solve puzzles from D. Shasha's *The Puzzling Adventures of Dr. Ecco*, supplemented by Liu's own *Professor Scarlet's Notebook*. Once they understand a puzzle solution, the mathematics that underlies the solution is developed. This challenging course has grown from a single class of 20 to two sections topping 110 students. He maintains close ties with colleagues in the Faculty of Education (he holds a certificate in elementary teaching as well as a Ph.D. in mathematics), and designed their course required for all students majoring in elementary education.

Andy's desire to excite students about mathematics takes many forms. In Edmonton, he is a popular speaker in schools, has organized math fairs, and directed summer mathematics camps. For years he has drawn groups of enthusiastic junior high students to his free weekly Saturday Math Club. He lures them

with tantalizing problems (many original and unsolved) and encourages their own ingenuity in solving them. Locally, nationally, and internationally, he is a devoted supporter of mathematics competitions, serving as coach and leader for Putnam and IMO teams, chair of the Problem Selection committee of the IMO, and vice-president of the International Mathematics Tournament of the Towns.

Andy gladly shares his ideas on teaching, his problems, and interesting student solutions (which are frequently published in journals). He maintains informal mailing lists, has served as editor for two volumes of articles prepared for teachers of gifted high school students, and has collected 16 published articles by his young Saturday Math Club students in the *S.M.A.R.T. Analogy* to share with teachers.

For his remarkable teaching on so many fronts, it is a great pleasure to award Andy Liu the Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics.

Biographical Note

Andrew Liu was born during the Civil War in China. He attended McGill University in Montreal and the University of Alberta where he is now a full professor in Mathematical and Statistical Sciences. He also holds a Professional Diploma of Elementary Education. He is deeply interested in mathematics education and the popularization of mathematics, and is actively involved in mathematics competitions. He has authored and coauthored several sets of lecture notes as well as three books about mathematical olympiads. He maintains a research interest in combinatorics and geometry. His greatest accomplishment is working with children who are gifted in mathematics.

Response from Professor Liu

I am very honored to have been selected to receive one of the Tepper Haimo Awards. I am most grateful to the Teaching Committee of the University of Alberta for putting my name forth for the Distinguished Teaching Award of the MAA's Pacific Northwest Section, and for the Section for their recognition and then nominating me for the National Award. I will be proud to accept this award on behalf of my University and my Section.

Citation
Olympia Nicodemi

Mentoring students is a way of life for Olympia Nicodemi, writes one of her colleagues. Whether offering extra help to struggling students in calculus, encouraging students with budding ability, prodding students to take on a difficult challenge, or assisting students to obtain summer REU's and then providing a forum for them to present their work when they return to the campus of SUNY College at Geneseo, she is always finding ways to help students to aspire to a higher level.

In her twenty-two years at SUNY Geneseo, Olympia has provided a role model of excellent teaching and is undoubtedly responsible, in large part, for the unusual growth in mathematics majors (a current high of about 250), 65% of whom are female. She has been recognized by the SUNY Chancellor's Award for Excellence in Teaching and nationally by the Elena Lucrezia Cornaro Award for significant contributions to her profession and community. A popular but demanding teacher, she developed and wrote the text for an undergraduate course in Discrete Mathematics and developed a master's course in Classical Algebra, for which she is writing a text for publication. One student wrote, "According to Webster, the definition of a teacher is one who shows or helps someone to learn how to do something, or to provide someone with knowledge and insight. Based on this definition, Dr. Olympia Nicodemi is not your ordinary teacher. She goes above and beyond the call of duty…she tries to not only teach the material, but to instill a lifelong love of learning and math."

Beyond her classroom teaching, Olympia has directed undergraduate research projects and honors theses in a variety of subjects, and has been a guiding force in the "Research Weekend Experience" at Geneseo in which prominent mathematicians visit the campus for three days, culminating in a Saturday research seminar. As a Project NExT mentor, she has taken a leadership role in the formation of a regional Project NExT for the MAA Seaway section. She has been a frequent presenter on a wide variety of subjects at regional math gatherings for both students and faculty.

Olympia has served as faculty advisor to Geneseo's student MAA chapter for over 10 years, reaching out to student groups and nearby colleges. Her success led to her current appointment as Student Chapter Coordinator for the Seaway Section.

For her excellence in teaching and her extraordinary devotion to students, we are delighted to honor Olympia Nicodemi with the Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics.

Biographical Note

Olympia Nicodemi was born in Brooklyn, to an extraordinary mother and teacher, Anne Nicodemi. Nicodemi notes that her mother made learning—music and literature primarily—part of the happy fabric of life. Olympia found her way into mathematics as an undergraduate at New York University through Richard Courant's book at a time when he was still at the Institute. (She recognized him from the statue!) Olympia continued the mathematical quest at the University of Rochester where she learned to watch birds, attended concerts at the Eastman School, and worked on mathematics with David Prill, a mentor to whom she expresses many thanks. At the U of R, Olympia met Gary Towsley. Their wonderful sons are Adam and Jacob. Olympia has spent most of her teaching career at SUNY Geneseo, which she calls "a remarkable institution where the best scholars are the most dedicated and innovative teachers, and the students are the best teachers of all."

Response from Professor Nicodemi

Receiving the Tepper Haimo award is an overwhelming honor. My deepest thanks go to the MAA, my school, my department, and my family for their support of the joy of learning and teaching. But I must share the award with my students. It is mostly theirs; they learned more than I taught.

E. H. Moore Research Article Prize

This prize was established in 2002 in honor of E. H. Moore. Among other activities, Moore founded the Chicago branch of the American Mathematical Society, served as the Society's sixth President (1901–1902), delivered the Colloquium Lectures in 1906, and founded and nurtured the *Transactions of the AMS*. The prize will be awarded every three years beginning in 2004, for an outstanding research article to have appeared in one of the AMS primary research journals (namely, the *Journal of the AMS*, *Proceedings of the AMS*, *Transactions of the AMS*, *Memoirs of the AMS*, *Mathematics of Computation*, *Electronic Journal of Conformal Geometry and Dynamics*, and *Electronic Journal of Representation Theory*) during the six calendar years ending a full year before the meeting at which the prize is awarded.

Citation

Mark Haiman

"Hilbert schemes, polygraphs, and the Macdonald positivity conjecture", *Journal of the American Mathematical Society* **14** (2001), 941–1006.

Mark Haiman's groundbreaking paper proves both the $n!$ conjecture and Macdonald's positivity conjecture, both longstanding open problems in algebraic combinatorics, through the development of remarkable new notions in algebraic geometry and a tour-de-force derivation in commutative algebra.

The last step concerns the defining equations of the polygraph, an arrangement of linear subspaces connected with the geometry of the Hilbert scheme of n points in the plane. This is then shown to coincide with the Hilbert scheme of regular orbits of the symmetric group acting on labeled configurations of n points. The key result states that the isospectral Hilbert scheme is normal, Cohen-Macaulay, and Gorenstein.

Haiman's paper has within the last two years already led to numerous other new developments at the interface of combinatorics, algebraic geometry, and representation theory.

These include M. Haiman: "Vanishing theorems and character formulas for the Hilbert scheme of points in the plane", *Invent. Math.* **149**, no. 2 (2002), 371–407, I. Gordon: "On the quotient ring by diagonal invariants", *Invent. Math.* **153** (2003), 503–518, and J. Haglund: "A proof of the q,t-Schröder conjecture", *Internat. Math. Res. Notices* (2004).

Biographical Note

Mark Haiman received the Ph.D. in 1984 from the Massachusetts Institute of Technology, under the direction of Gian-Carlo Rota. He continued at M.I.T. as an applied mathematics instructor and then assistant professor until 1991, when he moved to the University of California, San Diego, becoming full professor in 1997.

Professor Haiman is presently professor of mathematics at the University of California, Berkeley, where he moved in 2001, following a semester there as a visiting Miller professor in fall 2000. He serves on the editorial board of *Algebra Universalis* and on the scientific advisory board of the Centre de Recherches Mathématiques in Montreal, Canada.

Professor Haiman's research interests encompass a mix of combinatorics, algebraic geometry and representation theory, with an additional occasional interest in lattice theory.

Response from Professor Haiman

It is an honor and a special pleasure to be chosen as the first recipient of the E. H. Moore Research Article Prize. The publication activity of the AMS is, I think, the most important of all its contributions to mathematical life. Since the *Journal of the AMS* was started in 1988, I have always thought first of submitting there on those occasions when I believed a paper I had just completed to be one of my best. It's a bit of good fortune that by doing so I became eligible for a prize which did not yet exist.

The cited work bears the name of a sole author, but it was not done alone. The conjectures that started it all came out of a long and rewarding collaboration with Adriano Garsia, which we began in 1991 and have never finished. Adriano taught me a lot of mathematics and even more about how to *do* mathematics. In 1992, Adriano introduced me to Claudio Procesi and we told him about our discoveries. The insight that the geometry of the Hilbert scheme should contain the solution to our problems was his. In those days, my knowledge of algebraic geometry was rudimentary, and I had never heard of Hilbert schemes. I have Claudio's impetus to thank for whatever more I might know about those subjects today.

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 recognizes and encourages outstanding mathematical research by undergraduate students. Undergraduates are working on problems of current research interest, proving theorems, writing up results for publication, and giving talks on their work. There is undergraduate research today at the highest standards of professional excellence. The prize was endowed by Mrs. Frank Morgan and also carries the name of her late husband.

Citation

Melanie Wood

The winner of the 2003 Morgan Prize for Outstanding Research by an Undergraduate is Melanie Wood. The award is based on research on two different topics: Belyi-extending maps and *P*-orderings.

The first topic is concerned with finite coverings of the projective line that are ramified only at three points of the projective line. The absolute Galois group of the field of rational numbers acts on these coverings and on diagrams (that Grothendieck named *dessins d'enfants*) associated with the coverings. Melanie Wood's research gives a way to generate genuinely new Galois invariants of *dessins* from old ones. Her work yields important insights into the actions of the Galois group on fundamental groups. This research has attracted the attention and admiration of the specialists working in this field. The paper has been submitted for publication.

In a separate project, Melanie Wood studies *P*-orderings in Dedekind rings. These *P*-orderings were introduced by Bhargava in 1995 to generalize the usual factorial function. It is well-known that a polynomial with rational coefficients takes integer values at the integers if and only if it is an integer linear combination of binomial coefficient polynomials ${}_xC_k$. One of her results in this area implies that in imaginary quadratic fields, the integer-valued polynomials cannot possess a basis of this same general form. Melanie began this work during the 2000 Duluth Summer Research Program (directed by Joseph Gallian), and her paper on *P*-orderings has recently appeared in the *Journal of Number Theory*. Richard Hain (with help from Makoto Matsumoto) mentored her work at Duke.

Melanie Wood's research has been described in glowing terms by her mentors and by other experts in her field. The work is deep and original. The committee commends her for the mature mathematical perspective in her writings. The AMS, the MAA, and SIAM are pleased to award the 2003 Frank and Brennie Morgan Prize to Melanie Wood.

Biographical Note

Melanie Wood graduated from Duke University in May 2003, with highest distinction in mathematics. Her math competition honors include top place finishes on the USA Mathematical Olympiad and the Asian Pacific Mathematical Olympiad and the designation of Putnam Fellow. She won both a Gates Cambridge Scholarship and a Fulbright to study at the University of Cambridge, where she is currently doing a one-year math program. This fall, she will enter the math Ph.D. program at Princeton on a National Science Foundation Graduate Fellowship. Her current research interests are in algebraic number theory and arithmetic algebraic geometry. Melanie also enjoys acting, especially classical acting and voice work, directing, dancing, and philosophy.

Response from Melanie Wood

I am extremely honored to be awarded this prize. My experiences doing math research have been tremendously rewarding and the critical factor in my decision to continue to graduate work in mathematics, and that I had these experiences at all is due to two institutions that enable and encourage undergraduate math research: Duke University and the REU at the University of Minnesota Duluth. At Duke, I wish to thank Richard Hain, who supervised my research on the absolute Galois group, and Robert Bryant, who was available for many helpful conversations. I wish to thank Makoto Matsumoto for quick and helpful responses to technical questions. I also wish to thank Joe Gallian, director of the Duluth REU, for his support of my research, and all those affiliated with the Duluth REU who gave me feedback on my *P*-orderings paper.

Honorable Mention

Citation

Karen Yeats

The Morgan Prize Committee is pleased to award honorable mention for the 2003 Morgan Prize for Undergraduate Research to Karen Yeats for a series of outstanding contributions on topics ranging from asymptotics and number theory to mathematical logic. A few examples indicate the broad versatility of her research.

One of Karen Yeats's research projects is motivated by a precise analogy between results in additive number theory and results in multiplicative number theory. Based on this analogy, Karen Yeats has proved a multiplicative version for Dirichlet series of a classical estimate of Schur on the size of the coefficients of a product of two power series.

In her second paper, Yeats determines bounds on the size of values of a character, expressed as a function of the degree of the character, for exceptional compact Lie groups. This research completes the work of other researchers, who had previously obtained results for classical compact Lie groups.

In a third paper, she makes a model-theoretic investigation of exotic identities of the positive integers. An exotic identity is one involving addition, multiplication, and exponentiation that is not a consequence of eleven basic arithmetic identities, articulated by Dedekind in 1888.

The committee was impressed by the quality of the papers, the enthusiastic letters from her mentors, and the speed and independence of her research. The committee is proud to honor Karen Yeats with this award.

Biographical Note

Karen Yeats was born and grew up in Halifax, NS, Canada. She began enjoying mathematics through contests, regional, national (Canadian), and foreign. She entered the University of Waterloo in September 1998 and graduated with an honors BMath in Pure Math and a Governor General's Silver Medal in 2003. During that time she had the opportunity to spend three summers as an NSERC (Natural Sciences and Engineering Research Council of Canada) undergraduate research assistant, and benefited greatly from the strong faculty and program in Pure Mathematics at Waterloo. She is now pursuing a Ph.D. in mathematics at Boston University. Karen is an accomplished recorder player, and also enjoys playing clarinet and singing in choirs, as well as the occasional foray into making teddy-animals and working on free software.

Response from Karen Yeats

I am truly honored to have been named honorable mention for this year's Morgan Prize. Great thanks to the creators and organizers to whom the Prize owes its existence. I also owe great thanks to NSERC, Kathryn Hare, Frank Zorzitto, and especially Stan Burris for my summer research terms, which have made all this possible. At the University of Waterloo I also want to thank everyone in Math and Pure Math for making it clear to me that I was in the right place from the very beginning, and in Halifax to everyone who encouraged me on the contests.

LOUISE HAY AWARD FOR CONTRIBUTIONS TO MATHEMATICS EDUCATION

In 1990, the Executive Committee of the Association for Women in Mathematics (AWM) established the annual 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

Bozenna Pasik-Duncan

In recognition of her wide range of outstanding work as a mathematician, the Association for Women in Mathematics (AWM) presents the Louise Hay Award to Bozenna Pasik-Duncan of the Department of Mathematics at the University of Kansas.

Educated in Poland, Bozenna Pasik-Duncan received her master's degree in numerical analysis from the Department of Mathematics at Warsaw University. In 1978, she received her Ph.D. in Stochastic Processes from the Department of Mathematics at the Warsaw School of Economics. As an assistant professor in mathematics there, she received a research fellowship in 1982 from the International Research Exchange Board to visit electrical engineering departments at the University of Maryland, University of California, Berkeley, Harvard, and the Massachusetts Institute of Technology (MIT), as well as the Mathematics Department at Kansas. In 1986, she received her Habilitation (a doctoral degree) in Mathematical Statistics and Stochastic Adaptive Control from the Mathematics Department of the Warsaw School of Economics.

Since joining the faculty of the Mathematics Department at Kansas in 1983, she has held visiting appointments in Poland, Hungary, the Czech Republic, France, Italy, Japan, and China. She has held offices and served on committees and as an editor at the Polish Mathematical Society, the Society of Applied Mathematics (SIAM), the Institute of Electrical and Electronics Engineers (IEEE) Control

Systems Society (CSS), and the International Federation of Automatic Control (IFAC). She has been Professor in the Mathematics Department at the University of Kansas since 1994.

Professor Pasik-Duncan's research has centered on stochastic processes and stochastic adaptive control of continuous-time linear and nonlinear systems; her current research interests are in stochastic processes and stochastic theory, the relation between statistics and control theory and applications of stochastic theory and control to biomedicine, biostatistics, telecommunication networks, and finance.

Her numerous awards and honors for her research culminated in an Institute of Electrical and Electronics Engineers Third Millennium Medal for outstanding achievements and contributions and a Distinguished Member Award from the IEEE Control Systems Society in 2000. In 2001, she became an IEEE Fellow for contributions to Identification and Stochastic Adaptive Control.

Bozenna Pasik-Duncan is a research mathematician with a deep commitment to education with the focus on integrating research, teaching, and learning in science, technology, engineering, and math. She has been recognized for her teaching from the time she was a Lecturer in Warsaw, when she received the National Teaching Award from the Ministry of Higher Education and Sciences in 1975. At Kansas, she has continued to receive teaching awards, including the Fellowship for Teaching Excellence and Advising in Public Outreach as well as one for distinguished teaching and the profound impact made on students' lives, and another Honor for Outstanding Progressive Educator (HOPE), the first HOPE award ever presented to a math professor by graduating seniors. She was the 45th recipient of this award.

Pasik-Duncan's work in education extends beyond her exceptional skill as a teacher. In nominating her, Professor Jack Porter, Chair of her department, said that her philosophy is that every student from high school senior to undergraduate to graduate will experience research that bridges mathematics with different fields (for example, biology, physics, chemistry, economics, and medicine). Pasik-Duncan has worked to make this vision come alive. Through the Research Experiences for Undergraduates Program of the National Science Foundation (NSF), Professor Pasik-Duncan has, since 1992, mentored students and nurtured them in their studies. Indeed, the NSF Control Workshops under her leadership enhance the connection among high school students, mathematics and science teachers, and research groups in Control Systems. As a co-investigator of projects supported by NSF and the Sprint Corporation, she involved her graduate students in industrial research. Her interests extend to mathematics education at the elementary level. She taught an algebra and probability class to fourth, fifth, and sixth graders in 1994–96, with her students winning regional and state mathematics contests, and for the past ten years, she has organized well-attended annual workshops for fifth graders. According to one of her former students, she would bring local elementary school children to the university and invite her undergraduate students to give presentations about mathematics and its applica-

tions. “It was seeing demonstrations like these as a kid that got me excited about science, and ultimately influenced my path to pursue a Ph.D. at M.I.T,” wrote this student from a small Kansas farming town, with a high school student body one-tenth the size of his freshman chemistry class at the university.

Among her many professional services, Pasik-Duncan had been Vice President for Membership Activities of CSS, Vice President of the Warsaw Branch of the Polish Mathematical Society, Program Director of SIAM’s Activity Group on Control and Systems Theory, chair of the IEEE CSS Standing Committees on Assistance of Engineers at Risk, International Affairs, Women in Control, and chair of the Technical Committee on Control Education as well as co-chair of the IFAC Control Education Committee. In 2000 she was the leader of the Control Systems Delegation to the People’s Republic of China under the People to People Ambassador Program. This past year, she has formed and will be the faculty advisor to an AWM Student Chapter at the University of Kansas. She consistently exhibits a firm and active commitment to support women in mathematics, engineering, and science.

By the Louise Hay Award, AWM is proud to honor Bozenna Pasik-Duncan for her broad and inspiring vision of mathematics as a discipline and as a profession, and for her remarkable skill and commitment in carrying out the role of a professional mathematician in a wide variety of communities and settings.

Response from Professor Pasik-Duncan

I am very honored and proud to have been selected by the Association for Women in Mathematics for its Fourteenth Annual Louise Hay Award for Contributions to Mathematics Education. Professor Louise Hay’s outstanding achievements as a teacher, scholar, administrator, and human being have inspired many of us.

It was over forty years ago when I became involved in real teaching as a teenager in a small village in Poland where we would spend lovely summer vacations. Every Sunday during those summers local kids walked to “my school” for math. It was during that time when I was also asked by a university math professor to tutor his daughter in math and science. One day when she was taking her oral exam in chemistry in the presence of the whole class she looked at me, “her teacher,” with desperation in her eyes: “help me, I cannot do it?” I answered with the utmost confidence, “Yes, you can,” and she did. From that moment on I knew that I could be a good math teacher who would take good care of all those students who need math and science. The long list includes my first students while I was in high school, my family, friends, neighbors, their children and grandchildren, etc. I have developed a reputation of being a math teacher who has time for everyone who needs help in math and science.

I have taught since 1984 at the University of Kansas after teaching in Poland for thirteen years, where I received excellent teaching experience. Balancing two cultures in teaching fascinates me the most. When my daughter, Dominique, was a fourth grader we took her to Poland and France and enrolled her in the local

schools. She was an outstanding student in Lawrence, but about two grade levels behind the French and Polish students in math. When we returned to Lawrence I said, "We need to work." I offered to share the tutoring with Dominique's class. It was the best teaching and learning experience. I used French, Polish, and American books so the students also learned some Polish and French. A year later Dominique was up to speed with her French and Polish classmates. My fourth-grade students scored the highest in the state at mathematical problem solving. I taught them for three more years, and this year they graduated from high school, with a few being National Merit Scholars. Dominique is a first-year math student at the University of Chicago with almost 100 credit hours from the University of Kansas.

It was over thirty-five years ago when I became involved in a real-world project for the Polish Central Planning Committee. Stochastic modeling and forecasting were my first major research areas. Shortly after that I became the director of the Applied Mathematics Center of the Polish Mathematical Society, with some fascinating work. I had taught for thirteen years at Warsaw School of Economics where I was lucky to have an outstanding mentor in teaching. I came to Kansas to work with Tyrone E. Duncan. His research in stochastic control, coupled with my own studies in stochastic processes and mathematical statistics, made the best partnership. We wrote over 100 papers together and solved some long-standing stochastic adaptive control problems. We built the program in stochastic theory and control that has put Kansas on the world map.

Most of my master's and Ph.D. students have gone on to work in industry. Some of them quickly took leadership positions: they work with the University of Kansas Medical Center on the analysis of epilepsy, for Sprint Corporation on the intricacies of telecommunication networks, for actuarial companies, for investment banks, for graphic design companies, and for various other industries. All of these former students are applying knowledge they acquired from research performed at KU. From freshmen to Ph.D. candidates, all of my students participate in research, and most of their research has been supported by the National Science Foundation. Several of my undergraduate students have received NSF fellowships for graduate study in the best programs in their fields of interest. Several undergraduate and graduate students are involved in research each summer. The NSF has also supported several national workshops for teachers and students on research and teaching, making a commitment to support K-12 school teachers who want to become involved in research.

I attended my high school's 35th year reunion and gave a talk entitled "From the Polish Space to the Land of Oz: Acceptance and Tolerance." I spoke about my students in Kansas, the people of Kansas, and about Kansas itself. I had never realized that I feel very much at home and can speak so enthusiastically and passionately about Kansas. I am grateful to all in Kansas for making me feel free from the stress of speaking with an accent. I can now joke, "You don't recognize my Kansas accent" when asked, "Where are you from?"

I would like to thank my entire control community that includes women in control for giving me so many opportunities to integrate research, teaching, and learning in science, engineering and math. I would like to thank many KU and Kansas people for beautiful acceptance and tolerance, for countless help and assistance, and for recognizing my love for math, music, science, engineering, and for people. I am proud of being a Kansan and an American, and this is the reason why I have enjoyed giving back to the Kansas community by being involved in outreach programs. Teaching Lawrence school students, bringing them to KU for math: these activities which make me so, so happy are most rewarding. I would also like to thank my students and all students for making me happy in Kansas and in this country. I would like to thank Professor Jack Porter, my chairman for nominating me for this award and Professor Judy Roitman, who is the 1996 recipient of this award and who has shared with me her success stories in mathematics education over many years. Last, but not least, I would like to thank my mother, my husband, and my daughter for their most beautiful support.

From the bottom of my heart I thank the selection committee and the AWM for making me feel the happiest person on the earth. I cannot find English words to express my feelings, but now I cannot even find Polish words to express my feelings. I will be even a better teacher now.

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

John W. Milnor

The Leroy P. Steele Prize for Mathematical Exposition is awarded to John W. Milnor in recognition of a lifetime of expository contributions ranging across a wide spectrum of disciplines including Topology, Symmetric Bilinear Forms, Characteristic Classes, Morse Theory, Game Theory, Algebraic K-theory, Iterated Rational Maps ... and the list goes on. The phrase "sublime elegance" is rarely associated with mathematical exposition, but it applies to all of Milnor's writings, whether they be research or expository. Reading his books, one is struck with the ease with which the subject is unfolding and it only becomes apparent after reflection that this ease is the mark of a master. Improvement of Milnor's treatments often seems impossible.

A portion of Kauffman's review of Symmetric Bilinear Forms by Milnor and Husemoller conveys the beauty evident in all of Milnor's expository work: "... Appendix 4, where this result is proved, is alone worth the price of the book. It contains Milnor's proof of a Gauss sum formula (due to R. J. Milgram) that uses elegant combinatorics and Fourier analysis to produce an argument whose corollaries include the divisibility theorem, the law of quadratic reciprocity and its equivalent in the language of forms over Z: the Weil reciprocity theorem. The proof is short, beautiful, and mysterious."

Milnor's many expository contributions to the mathematical literature have influenced more than one generation of mathematicians. Moreover, the examples that they provide have set a standard of clarity, elegance, and beauty for which every mathematician should strive.

Biographical Note

John Milnor was born in Orange, New Jersey in 1931. He spent his undergraduate and graduate student years at Princeton, working on knot theory under the supervision of Ralph Fox, and also dabbling in game theory with his fellow

students John Nash and Lloyd Shapley. However, like his mathematical grandfather, Solomon Lefschetz, he had great difficulty sticking to one subject. Under the inspiration of Norman Steenrod, and later John Moore, he branched out into algebraic and differential topology. This led to problems in pure algebra, including algebraic K-theory and the study of quadratic forms. More recently, conversations with William Thurston and Adrien Douady led to studies in real and complex dynamical systems which have occupied him for the last twenty years. But he is still restless: one current activity is an attempted exposition of problems of complexity in the life sciences.

After many years in Princeton, at the University and also at the Institute for Advanced Study, and after shorter stays at UCLA and MIT, Milnor moved to Stony Brook, where he has been the director of a small Institute for Mathematical Sciences since 1989.

Response from Professor Milnor

It is a great pleasure to receive this award, and I certainly want to thank the members of the Selection Committee for their consideration. It is of course also a tribute to my many coauthors: let me mention Dale Husemoller, Larry Siebenmann, Jonathan Sondow, Mike Spivak, Jim Stasheff, and Robert Wells.

I have always suspected that the key to the most interesting exposition is the choice of a subject that the author doesn't understand too well. I have the unfortunate difficulty that it is almost impossible for me to understand a complicated argument unless I try to write it down. Over the years I have run into a great many difficult bits of mathematics, and thus I keep finding myself writing things down. (And also rewriting, since I never get things right the first few times. Years ago, I was the despair of secretaries who would produce beautifully typed manuscripts, only to have them repeatedly cut, pasted, and scribbled over. Computers have eliminated this particular problem, but it still makes life difficult for coauthors.)

I am very happy to report that as mathematics keeps growing there are more and more subjects that I have to fight to understand.

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, limited this year to the field of geometry and topology.

Citation

Lawrence C. Evans and Nicolai V. Krylov

The Steele Prize for Seminal Research is awarded to Lawrence C. Evans and Nicolai V. Krylov for the "Evans–Krylov theorem" as first established in the papers:

Lawrence C. Evans, *Classical solutions of fully nonlinear convex, second order elliptic equations*, Communications in Pure and Applied Mathematics, 35 (1982), no. 3, 333–363

and

N. V. Krylov, *Boundedly inhomogeneous elliptic and parabolic equations*, Izvestiya Akad. Nauk SSSR, ser. mat. 46 (1982), no. 3, 487–523 and translated in Mathematics of the USSR, Izvestiya, 20 (1983), no. 3, 459–492.

Fully nonlinear elliptic equations are of interest in many subjects, including the theory of controlled diffusion processes and differential geometry. It is therefore of great interest to understand when these equations have classical solutions. The first results of any generality exhibiting classical solutions of the subclass of uniformly elliptic equations under suitable convexity conditions are due to the recipients in the cited works. These authors, independently and with different arguments, established the Hölder continuity of second derivatives in the interior, via a priori estimates, a result now known as the Evans–Krylov theorem. The Evans–Krylov theorem was both a capstone on fundamental contributions of the recipients and others and a harbinger of things to follow from the community.

While the Steele Prize for Seminal Research is explicitly awarded for the named works, it is noted that both recipients have made a variety of distinguished contributions to the theory of nonlinear partial differential equations.

Biographical Note

Lawrence C. Evans

Lawrence C. Evans was born November 1, 1949 in Atlanta, Georgia. He received his B. A. from Vanderbilt University in 1971 and his Ph.D. from UCLA in 1975; his advisor at UCLA was M. G. Crandall. Dr. Evans held positions at the University of Kentucky from 1975–1980, at the University of Maryland from 1980–1989, and is currently Professor of Mathematics at the University of California at Berkeley, a position he has held since 1989. He has been a visiting professor to Northwestern University (1977–1978) and the Institute for Advanced Study (1988). Noteworthy publications include *Weak Convergence Methods for Nonlinear Partial Differential Equations* (CBMS Issues in Mathematics Education, vol. 74, Providence: Amer. Math. Soc., 1990), *Measure Theory and Fine Properties of Functions*, co-authored with R. F. Gariepy (Studies in Advanced Mathematics, Boca Raton: CRC Press, 1992), and *Partial Differential Equations* (Graduate Studies in Mathematics, vol. 19, Providence: Amer. Math. Soc., 1998).

Response from Professor Evans

It is a wonderful honor to share with Nick Krylov this year's Steele Prize for a Seminal Contribution to Research.

When I was Mike Crandall's graduate student at UCLA and at Wisconsin over thirty years ago, I learned from him the then startling lesson that nonlinear analysis need not be solely based upon linearization, meaning small perturbation theory from linear approximations. Brezis, Browder, Crandall, J.-L. Lions and many others in the 1970s pioneered the analysis of various sorts of strongly nonlinear operators, theory in which linearity played little role at all. I think this was why I was not especially afraid to look at so-called "fully nonlinear" elliptic equations in the late 1970s and early 1980s.

These are important PDE, examples of which are the Monge–Ampere equation and Hamilton–Jacobi–Bellman equations in stochastic optimal control theory. And they are really, really nonlinear. But their solutions satisfy maximum principles, and this was a clue. It turns out that (i) when the nonlinearity is convex, we can get "one–sided" control on second derivatives, and that then (ii) the PDE itself provides a functional relationship among the various second derivatives, yielding thereby "two–sided" control. (Earlier Calabi had derived third derivative bounds for the Monge–Ampere equation, and Brezis and I had treated the very special case of the maximum of two linear elliptic operators.)

All success in mathematics turns largely upon persistence and luck; and while I can take some credit for the persistence, the luck was, well, luck. Chiefly in that, quite unknown to me, one N. V. Krylov in the Soviet Union had turned his attention to these same problems at about the same time. And Nick's contributions to the subject have been extraordinary, including not only the interior Hölder second derivative estimates, for which independent discovery we are being honored, but also his previous, and great, work with Mikhail Safonov on Hölder bounds and the Harnack inequality for nondivergence structure second--order

elliptic equations with discontinuous coefficients. We needed these to carry out step (i) mentioned above. Nick also later derived boundary second derivative estimates, something at which I completely failed.

So it is really an honor to share this prize with Nick, and to have seen over the past 20 years the magnificent work of Caffarelli, Guan, Li, P-L Lions, Nirenberg, Spruck, Trudinger, Urbas, Wang and many other researchers, vastly extending these ideas.

Biographical Note

Nicolai V. Krylov

Nicolai Vladimirovich Krylov was born in Soudogda, the region of Vladimir, Russia on June 5, 1941. He received his Ph.D. in 1966 and his Doctorate of Science in 1973 from Moscow State University; his scientific advisor was E. B. Dynkin. Krylov taught at Moscow State University from 1966–1990; he has taught at University of Minnesota since 1990, and currently holds the position of Samuel G. Ordway Professor of Mathematics. He has supervised the graduate degrees of 15 students.

Krylov has given invited addresses at the ICM in Helsinki (1978) and Berkeley (1986); he has given 58 invited lectures, has written nearly 200 research articles, and has published five monographs. A member of many journal editorial boards, Krylov was elected Fellow of the American Academy of Arts and Scientists in 1993, received a Humboldt Research Award for Senior U.S. Scientists in 2001, and has been a recipient of numerous National Science Foundation grants.

Response from Professor Krylov

It is a great honor to share with Craig Evans this year's Steele Prize for a Seminal Contribution to Research.

In the times when I was an undergraduate student in Moscow State University all kinds of control theory became popular. My scientific advisor, E. B. Dynkin, became interested in stochastic control theory and being a brilliant lecturer he easily attracted many people including me into it.

As it often happens in probability theory it was very easy to understand why certain probabilistic quantities should satisfy Bellman equations but discouragingly for quite a while there were no ideas how to prove this. Bellman equations are fully nonlinear possibly degenerate second order partial differential equations with convex nonlinearity, of which the Monge-Ampère equation is the most famous example. When in about 1963 I asked O. A. Oleinik what was known about such equations, the answer was very short: "Nothing". This boosted even further my desire to prove the solvability of Bellman equations by probabilistic means. However, it took seven years before I realized how to prove a basic estimate and after that the theory was completed in 1971–2.

It took even longer to develop an analytic approach. Working on some very natural questions from stochastic control theory, M. Safonov and I were lucky enough to obtain in 1978 Hölder norm estimates for solutions of linear equations

with possibly rough coefficients. These estimates prove, in particular, the continuity of harmonic functions corresponding to diffusion processes with measurable coefficients. An automatic consequence of this fact is the lower semicontinuity of superharmonics. On the other hand, it is trivial to see that the second order directional derivatives of solutions of Bellman equations are superharmonics for certain diffusions. Thus they should be upper semicontinuous. But the equation itself says that a certain function of these directional derivatives is continuous. In addition, the function is monotone and this yields the continuity of second-order derivatives.

Remarkably, Craig Evans obtained similar results at about the same time. Since then I became a great admirer of Craig's talent and I am very honored to share the prize with him.

Our results opened up the area to analytic treatment and since then very many mathematicians made amazing contributions. I want to mention only one directly related to our prize. A weak point in Craig's and mine argument is that we need to differentiate the equation twice which led to extra smoothness assumptions on the data. A major step forward in this respect was achieved by M. Safonov in 1984 when he showed that the estimate holds only under "natural" conditions.

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

Cathleen Synge Morawetz

Cathleen Morawetz has greatly influenced mathematics in the broad sense throughout her long and distinguished career. Her fundamental research has resulted in seminal contributions to a number of areas. These contributions include her early work on equations of mixed type, with its striking consequences for the theory of flow around airfoils, her work on local energy decay for waves in the complement of an obstacle, and her results concerning the existence of transonic flow with shocks. Throughout Professor Morawetz's work one finds the theme of deep, creative mathematics used in the treatment of problems selected because of their interest in applied areas. She has not only contributed greatly to mathematics, but also to the vitality of the interaction between mathematics and its applications.

Cathleen Morawetz's influence on mathematics extends well beyond her research contributions. In residence at the Courant Institute of Mathematical Sciences for almost all of her career, she provided guidance and inspiration to the stream of visitors and postdoctoral appointees, as well as to her own students. Her works include a number of influential contributions written in collaboration with younger mathematicians.

Beyond these mathematical contributions, commanding in themselves, Cathleen Morawetz has provided strong leadership for and representation of the mathematical community via her remarkable and generous service. The AMS has benefited from her membership on many committees, from her ten years of service as a Trustee of the Society, and her service as President of the Society. She dispatched her duties in these roles with excellence and did not merely serve; she provided leadership. The larger community benefited from her wisdom in positions such as that of a Trustee of Princeton University and a Trustee of the Sloan Foundation; mathematics also benefited from being represented by her in these roles. Among her pioneering "firsts", one notes that she was the first woman to direct an institute of mathematics in the US and she was the first woman to receive the National Medal of Science for work in mathematics.

Thank you, Cathleen, for all you have done.

Biographical Note

Cathleen Synge Morawetz was born in Toronto, Canada on May 5, 1923. She received a B.A. in applied mathematics from the University of Toronto in 1945, an M.Sc. from M.I.T. in 1946 and a Ph.D. from N.Y.U. in 1951. From 1950–51 she was a research associate at M.I.T. working on hydrodynamic stability with C. C. Lin. From 1951 on she worked with the group at N.Y.U. that became the Courant Institute, mainly at first with L. Bers, K. O. Friedrichs, and H. Grad.

Bers and Friedrichs introduced her to the fascinating problems of transonic flow; Harold Grad introduced her to problems in magneto hydrodynamics, especially the mathematical problem associated with very thin plasmas; and from Joe Keller she learned the open problems of wave propagation.

She became an assistant professor in the Institute in 1958. Always involved in some administration, she eventually served as Director of the Courant Institute from 1984 to 1988. She retired in 1993.

Cathleen Morawetz gave the Gibbs lecture in 1981. During much of her career she received support from the O.N.R.

She served the Society as a member of the Council from 1973 to 1975, as a member of the Executive Committee in 1975 and from 1994 to 1998, as a Trustee from 1975 to 1985, and was the second woman president of the society from 1995–97. She is still a member of two committees. She received the National Medal of Science for 1998.

Cathleen Morawetz was a trustee of Princeton University, a trustee of the Sloan Foundation, a member of the board of NCR, and a founding director of JSTOR (1995–1998). In addition, she served on the board of MSRI and chaired the board for theoretical physics of the Dublin Institute for Advanced Studies. She also received numerous honorary degrees.

She first studied the nonlinear wave propagation of shock wave theory as a student and later, at the suggestion of I. Segal, of semilinear equations. This resulted in fundamental work with Walter Strauss. Both her transonic theories and her work in wave propagation involved finding special identities and inequalities for the relevant equations.

Response from Professor Morawetz

Receiving the Steele Prize for lifetime achievement is not only a huge honor but a stunning surprise for which I am very grateful. But I can never be quite as grateful as I am to those people who mentored and encouraged me in a lifetime of mathematics which, somewhat to my surprise, still goes on. The person to whom I am most grateful is Richard Courant who steadfastly employed me in real research as I struggled to get a Ph.D. and to bear and raise four children between 1946 and 1958. He claimed it was Kurt Friedrichs who constantly recommended me to him but Courant was surely the only person with the authority to follow this nonstandard path. Before that time I wavered a great deal in my career ideas, working as a chronographer during World War II, seriously contem-

plating teaching in India (a chance meeting with Cecilia Krieger sent me off to graduate school instead), trying out and failing at electrical engineering at MIT. There was also a considerable amount of external social pressure to abandon my career but such ideas did not enter the minds of Courant and his colleagues—nor for that matter of my husband Herbert.

Among the many people at the Courant Institute who educated, mentored, and helped me in the vast literature of mathematics (I have a bad memory) were not only Friedrichs but Lipman Bers, Joe Keller, Harold Grad, Fritz John, Paul Garabedian, Peter Lax, and Louis Nirenberg. Let me add the names of my collaborators who taught me so much, Walter Strauss, Jim Ralston, and Ralph Phillips.

Lastly, and by no means least, I am forever indebted to my mother for instilling in me the idea of ambition (then very unladylike) and to my father for the idea of intellectual achievement (not to mention the introduction to Courant).

CERTIFICATES OF MERITORIOUS SERVICE

The Certificates of Meritorious Service are 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 roughly six Sections are recognized.

Citation

Underwood Dudley, Indiana Section

The Indiana Section of the MAA is delighted to nominate Underwood (Woody) Dudley for the MAA's Certificate of Meritorious Service. Woody is unsurpassed in his extraordinary contributions to the Section and outstanding efforts consistent with the stated purposes of the Mathematical Association of America and the Section, namely, assisting in promoting the interests of, and improving education in, the mathematical sciences in America, especially at the collegiate level.

Underwood Dudley has been a highly committed Section member since his arrival at DePauw University, where he has served his department as a superbly effective classroom teacher and as department chairperson. Woody regularly attends section meetings, frequently contributes presentations, and always is willing to offer his sly and appreciated advice, both informally and through service on standing committees of the Section. He served as Section chair two times—nearly twenty years apart, and he has also served the MAA at the national level.

Underwood Dudley is the author of many articles and books. Four of his books have been published by the MAA. His award-winning writing style has been recognized many times, including 1996 when he received the MAA's Trevor Evans Award. Who could ever forget Woody's talks? They invariably provide realistic glimpses of our profession, sprinkled with wry humor and always filled with a true sense of the joy of mathematics. It was no surprise to any of us who know Woody that he was named an MAA Pólya Lecturer for 1995 and that in 1996 was named as editor of *The College Mathematics Journal*.

Woody Dudley is an extraordinary example of an effective servant of the goals of the MAA at both local and national levels.

Response from Professor Dudley

I handed in my first set of grades in December 1958 (Calculus I) and my last set in May 2003 (Calculus II). Not much progress! I'm deeply grateful for this award, a wonderful way to end a career, that lets me feel that I have been of some use.

Citation

Stephen Ligh, Louisiana-Mississippi Section

Professor Stephen Ligh earned his Ph.D. at Texas A&M University in 1969. He has been a member of the MAA since 1964 and was a recipient of the Section's Distinguished Teaching Award in 1995. He has published 65 articles in a variety of areas including algebra, linear algebra, and number theory, and he showed in his research many interconnections between these areas.

Professor Ligh came to Louisiana in 1970 when he joined the faculty of University of Southwestern Louisiana (currently named University of Louisiana at Lafayette). While at USL, Dr. Ligh was very active in both research and teaching. He supervised several Ph.D. and Masters students in the areas of algebra, linear algebra, and number theory. In 1991, Professor Ligh moved to Southeastern Louisiana University to become Head of the Department of Mathematics. Dr. Ligh remained Department Head at SLU until his retirement in 1997.

While Professor Ligh has contributed to the MAA in a number of ways, the LA-MS Section is extremely indebted to his service for developing and implementing our Student Team Competition which has become a fixture of annual section meetings. Professor Ligh began this competition in 1988 and assumed all responsibilities for it until his retirement in 1997. This annual competition has served as a model for other sections and it continues to draw in excess of 30 teams with more than 100 students participating each year from the states of Louisiana and Mississippi.

Response from Professor Ligh

I am privileged and honored to have been selected as a recipient of the MAA Meritorious Service Award. The award is not just to me, but is shared by everyone who worked with me for many years on the Student Team Competition. Without their dedication, willingness to work with students and sacrifices to bring themselves and the students to the section meetings, this project would not have been successful.

I also want to extend my thanks and appreciation to all the students who have participated in the Competition. Seeing teams of students talking (sometimes laughing) and working together on mathematical problems has brought me much joy and satisfaction.

Thank you all very much.

Citation

Richard Barlow, Nebraska-Southeast South Dakota Section

The Nebraska-Southeast South Dakota Section is pleased to nominate Dr. Richard Barlow for the Mathematical Association of America Certificate of Meritorious Service as we recognize his many years of service to the section as an officer, chair, meeting host, and newsletter editor.

Dr. Barlow has been a member of the Mathematics Association of America since 1964 and has been a member of the mathematics/statistics faculty at the University of Nebraska at Kearney since 1966. He has attended a total of 19 Joint AMS/MAA Meetings and MathFests, including all six meetings while he was Section Governor from 1999–2002. He has made four presentations at the annual section meetings and one presentation at the Joint Meetings. In addition, he has participated in four MAA minicourses.

Dr. Barlow has provided our section with leadership in a number of ways. He has served as the Nebraska-South Dakota American High School Mathematics Contest Coordinator from 1980–1986. From 1996 to present he has been the Section newsletter editor, publishing three newsletters per year. In addition to being the newsletter editor, he has served as the Section Chair in the academic year 1995–1996 and has hosted the spring meeting at the University of Nebraska at Kearney in the spring of 1996. He was the Section Liaison with the MAA from 1997–2002 and has represented the Section as the Governor from 1999–2002. It goes without saying that Dr. Barlow attends all the Section meetings.

For his dedication to the MAA and to the Section, the Nebraska-Southeast South Dakota Section, with the approval of the Board of Governors, is proud to present the MAA Certificate of Meritorious Service to Dr. Richard Barlow.

Response from Professor Barlow

I would like to thank the Board of Governors and the Nebraska-SE South Dakota Section for this award. The MAA has been an important part of my life since I became a member at the beginning of my university teaching career in 1964. I have always enjoyed the many acquaintances and friendships resulting from my membership in the MAA and attending the national and section meetings. Serving in the various section offices and on the Board of Governors has been a highlight of my professional mathematics teaching career. There is no other professional organization I hold in more esteem than the MAA.

There are so many other members of our section who deserve this award more than I. Many work diligently for the success of our section. I feel greatly honored to have been selected as the section's nominee and humbly accept this meritorious service award for the small part I have played in the success of the section. I share this award with them.

Citation
Thomas Hern, Ohio Section

The Ohio Section of the Mathematical Association of America is pleased to recognize Thomas A. Hern of the Department of Mathematics and Statistics at Bowling Green State University as its 2004 recipient of the Certificate of Meritorious Service. Dr. Hern earned an A.B. in mathematics from the University of Cincinnati and a Ph.D. in probability theory from the Ohio State University. Tom has been a member of the MAA since 1970. Over the years he has compiled an impressive record of service to the organization.

From 1992–95 Dr. Hern served as President-Elect, then President and finally Past-President of the Ohio Section. He has also served as both a member and chair of the Section's Nominating, Teaching Award, and Program Committees. He handled local arrangements and planning at Bowling Green State University for Ohio Section meetings in May of 1975 and April of 1991 and Ohio Section Short Courses in June of 1976 and 1992. Tom founded and for many years maintained the Ohio Section web pages. He also served a five-year term as editor of the Ohio Section Newsletter and was the first to make it available on the web. Tom served as a member of the Ohio Section Committee on Cooperation Between College and Universities from 1975 to 1978 and the MAA Delegation to the People's Republic of China in 1983. He began a three-year term as Governor of the Ohio Section on July 1, 2003. Finally, Tom has done an exemplary job of mentoring numerous young faculty by encouraging and supporting their participation in the Ohio Section of the MAA.

Response from Professor Hern

It is a pleasure, and humbling, to receive such recognition from people you respect and enjoy working with.

Citation

John W. Kenelly, Southeastern Section

The MAA Southeastern Section is pleased to select John W. Kenelly, Alumni Distinguished Professor Emeritus of Clemson University, as the Southeastern Section recipient of the 2004 Certificate of Meritorious Service. Previously recognized by the section with the 1997 Southeastern Section Service Award, Professor Kenelly has been a leader in the MAA and in the Southeastern Section for many years. He is well known throughout the country for his visionary championing of the use of technology in the teaching of mathematics and has been instrumental in undergraduate mathematics reform. He is one of the most well-recognized mathematicians in the country today, and one of the central figures in the calculus reform movement. John's ideas and leadership have had and will continue to have a profound effect on our profession and our enterprise. As an example, John directed the NSF-funded $1 million cooperative project of the MAA and NCTM, "Teaching Mathematics with Calculators."

The list of offices that Professor Kenelly has held and committees on which he has served are too numerous to list. He has served the Southeastern Section as Section Chair, Governor, and Section Lecturer. A sampling of national MAA committees he has chaired include the Committee on Testing, the Committee on Placement Exams, the Building Committee, the Finance Committee Fund Drive, the Management Evaluation and Oversight Committee, the Compensation Committee, and the Program Committee for the 1988 Atlanta meeting. John has served on the CRAFTY subcommittee of CUPM, was editor of the MAA Placement Test Newsletter, and served on the committee for the American Junior

High School Mathematics Examination. In addition, John has served as the MAA Mu Alpha Theta representative and on the College Board-MAA Committee on Mutual Concerns.

Currently serving a five-year term as Treasurer of the MAA, John has specialized in finance committees of the MAA. In 1987, the MAA found itself needing an estimated $1.5 million for building repairs and having only $300,000 available. The MAA president turned to John. Under his direction, repairs were made for only $570,000 and money was raised from the membership to cover the cost. The result is the beautiful, restored building serving as MAA Headquarters in Washington, DC, which has allowed the MAA to continue to be situated where the action is. John's financial acumen has been applied to his memberships on the Finance Committee, Board of Governors, the Audit and Budget Committees, the Investment Committee, the Development Committee, and several committees concerning the MAA Headquarters renovations, including the recently announced Halmos project to develop the MAA Headquarters' historic carriage house into a Mathematical Sciences Conference Center.

Professor Kenelly is a tireless advocate for mathematics. He is currently completing an appointment as President and board member of the International Mathematical Olympiad 2001, USA. His nationally-recognized work with the Advanced Placement program, including service as the National Director, extends over five decades. He has worked on several nationally-funded projects and as consultant for many more. His accomplishments include service on more than a dozen boards involving mathematics, science, or mathematics education.

We commend him for his many accomplishments in service to mathematics and thank him for all he has done. We offer our congratulations on this well-deserved recognition for outstanding service.

Response from Professor Kenelly

It has been my pleasure to serve our profession in many ways, but the opportunities mentioned would not have happened without the support of my colleagues. I thank them all, identified or not, in accepting this award. In the beginning, Billy Bryant, John Neff, and Ivey Gentry showed me how much fun it is to be active in your section. Then Lida Barrett, who knew of my extracurricular activities in Banking and Real Estate, came to me for help with the "Building Problem." Within the bricks and mortar, there were always dollar questions, so Don Kreider and Jerry Porter got me deeply involved with the finances of the Association. After a brief reprieve, Shirley Frye and representatives of 23 mathematical science organizations asked me to use my "beggar" skills and help the nation host a spectacular International Mathematical Olympiad in Washington in 2001. But starting decades ago, Dick Anderson, Marcia Sward initially with Placement Tests issues, and Tina Straley with "down south" curricula problems have been constants that even today keep me saying to them and others " I would be glad to, thanks for asking."

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 annual 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 includes, but is 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 Fourteenth Annual Alice T. Schafer Prize to **Kimberly Spears**, University of California, Santa Barbara.

Additionally, four outstanding young women were recognized at the conclusion of the AWM Panel on Wednesday, January 7, 2004. AWM was pleased to recognize **Karola Meszaros**, a junior mathematics major at Massachusetts Institute of Technology, and **Jennifer Novak**, a senior mathematics major at Texas A&M University, who were selected as **runners-up** in the Schafer Prize competition. AWM was further pleased to recognize two outstanding women who received **honorable mention** in the Schafer Prize competition: **Elena Grigorescu**, a senior at Bard College with a double major in mathematics and computer science, and **Ariel E. Barton**, a senior mathematics major at Harvey Mudd College. Citations on the Runners-up and Honorable Mention recipients are available from the AWM.

Citation

Kimberly Spears

Kimberly Spears is a senior at the University of California, Santa Barbara. As a junior, her "dedication and passion" led her to excel in advanced sequences in abstract algebra and real analysis, courses populated mostly by incoming graduate students. During the following summer she did research with a mentor at UCLA, as a participant in the UCLEADS program (Leadership Excellence through Advanced Degrees). Her project resulted in a generalization of Gauss's Law of Quadratic Reciprocity to general (nonabelian) groups. Kimberly was "highly motivated and enthusiastic about learning" and "had to master a lot of new material on group representation theory to even understand the question." Kimberly's senior thesis addresses the question of classifying discriminants d with one class per genus. Her proof that assuming a conjecture about the Grand Unitary

Ensemble (GUE), no discriminant greater than d_{66} (the smallest with 66 prime factors) has one class per genus "would satisfy the minimum required for a Ph.D. thesis" at USCB. Kimberly's subsequent presentation in the UCSB Arithmetic and Geometry Seminar left the faculty audience "flabbergasted." "No undergrad had ever given a talk before, much less on original research," and "the breadth of material she has mastered astonished them." Papers on both of Kimberly's research projects will be submitted to journals this fall. Her recommenders also praise Kimberly's "remarkable ability to absorb the highlights and essential concepts of broad areas of mathematics quickly" and one writes that "Kimberly is without any doubt the best student I have ever seen in my 16-year career."

Response from Kimberly Spears

I am pleased to receive the 2004 Alice T. Schafer Prize. I would like to thank the Association for Women in Mathematics for encouraging me to continue doing what I love. Every day I have had to do research and learn more math is one that I have enjoyed.

I would like to thank my mentor Jeffrey Stopple who has been crucial to my development into a young mathematician. His dedication and support are indescribable. I would also like to thank William Duke for his mentoring and James McKernan. I would like to thank Sarah Dillingham and the UCLEADS program. Thank you to the mathematics department at UCSB for all their congratulations and support.

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

Richard Tapia

The award for Distinguished Public Service is given to Richard A. Tapia, for inspiring and teaching thousands of people (from elementary school students to senior citizens) to study and appreciate the mathematical sciences. His dedication to opening doors for underrepresented minorities and women is legendary, as is his determination to reach students who would otherwise be discouraged or overlooked. Educational and outreach programs that he has founded and leads, such as the Rice University Center for Excellence and Equity in Education, represent a continuing tribute to his energy and perseverance. More than half of Richard's Ph.D. students have been women, and more than a third have been underrepresented minorities. In addition, his life has been filled with many other forms of public service: he was a member of the National Science Board from 1996–2002; in 1996 he was one of the first recipients of a Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring; and he is a founding member of the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS).

Biographical Note

Richard Tapia is a mathematician and professor in the Department of Computational and Applied Mathematics at Rice University in Houston, Texas. He is internationally known for his research in the computational and mathematical sciences and is a national leader in education and outreach programs.

Tapia's current Rice positions are Noah Harding Professor of Computational and Applied Mathematics; Associate Director of Graduate Studies, Office of Research and Graduate Studies; and Director of the Center for Excellence and Equity in Education.

Tapia was born in Los Angeles to parents who, separately, immigrated from Mexico as young teenagers in search of educational opportunities for themselves and for future generations. Tapia was the first in his family to attend college. He received B.A., M.A., and Ph.D. degrees in mathematics from the University of

California-Los Angeles. In 1967 he joined the Department of Mathematics at UCLA and then spent two years on the faculty at the University of Wisconsin. In 1970 he moved to Rice University where he was promoted to associate professor in 1972 and full professor in 1976. He chaired the department from 1978–1983. He is currently an adjunct faculty member of Baylor College of Medicine and the University of Houston.

Tapia has authored or co-authored two books and over 80 mathematical research papers. He has delivered numerous invited addresses at national and international mathematical conferences and serves on several national advisory boards.

Due to Tapia's efforts, Rice has received national recognition for its educational outreach programs and the Rice Computational and Applied Mathematics Department has become a national leader in producing women and underrepresented minority Ph.D. recipients in the mathematical sciences. Thirty-five mathematics students have received, or are currently working on, the Ph.D. degree under his direction or co-direction. Of these 35 students, 15 have been women and 8 have been underrepresented minorities.

As Associate Director of Graduate Studies at Rice University, Tapia supervises a group of graduate students from all areas. He meets with the group regularly to monitor their progress, and many of these students are involved in community and educational outreach.

Under Tapia's direction, Rice's NSF-funded Alliances for Graduate Education and the Professoriate (AGEP) Program provides opportunities for undergraduate and graduate students in science, mathematics, and engineering to participate in university activities and work for the summer under the guidance of researchers at Rice. Over the years Tapia has impacted hundreds of teachers through two summer programs, the Mathematical and Computational Sciences Awareness workshop and GirlTECH.

Among his many honors:
The National Atomic Museum Foundation of Hispanics in Science and Engineering named Tapia Exhibit Honoree in Albuquerque, New Mexico in October 2003. In January 2002, Dr. Tapia was inducted into the Texas Science Hall of Fame. The Texas Science Hall of Fame is a tribute to the "giants" who shape the world through their innovative use of science. In October 2001, Dr. Tapia was honored with the Reginald H. Jones Distinguished Service Award by NACME, Inc. in Baltimore, Maryland. His work at improving the representation of underrepresented groups was celebrated with a symposium entitled "The Richard Tapia Celebration of Diversity in Computing". It is the first in a series of events designed to celebrate the technical contributions and career interests of diverse people in computing fields. The symposium, sponsored by the Association for Computing Machinery and IEEE-Computer Society, took place in Houston, Texas. The Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) honored Tapia with the 2000 SACNAS Distinguished Scientist Award at their annual national meeting in Atlanta, Georgia on October 14, 2000. Tapia was selected for his ongoing commitment to educational opportunities for women and

minority students and in honor of a lifetime of achievement in his field and of dedication to the future of young scientists. In September, Tapia received a 2000 Peace Award for Education from the Spiritual Assembly of the Baha'is of Houston. With unity of humanity as a guiding principle, the Baha'is of Houston present three awards—for education, for humanitarianism, and for peace—each year to individuals or organizations for their work in serving the community and breaking down barriers of culture, race, class, and creed. The awards are presented in association with the International Day of Peace, a day designated by the United Nations "to commemorating and strengthening the ideas of peace both within and among all nations and peoples." In May of the same year, Cornell University established a lecture series to honor Tapia and David Blackwell, professor at the University of California-Berkeley. The lecture series provides a forum for the research of African-American, Latino, and American Indian scientists working in the fields of mathematical and statistical sciences. In 1999, Dr. Tapia was awarded the Giants in Science Award by the Quality Education for Minorities (QEM) Network. He received the 1997 Lifetime Mentor Award from the American Association for the Advancement of Science. In 1997, he was inducted into the Hispanic Engineer National Achievement Awards Conference Hall of Fame. President Clinton appointed Dr. Tapia to the National Science Board (NSB), the governing body of the National Science Foundation in 1996. He also received the 1996 Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring. Later that year Tapia was named the Hispanic Engineer of the Year by *Hispanic Engineer* magazine, the first academician to receive this honor. He was awarded the inaugural A. Nico Habermann Award by the Computer Research Association in 1994 for outstanding contribution in aiding members of underrepresented groups within the computing research community. In the same year he was selected Professor of the Year by the Association of Hispanic School Administrators of the Houston Independent School District. In 1992, Dr. Tapia was elected to the National Academy of Engineering, the first native-born Hispanic to receive this honor. Students at Rice University voted him the 1991 winner of the George R. Brown Award for superior teaching. Dr. Tapia was given the College Level Educator of the Year Award by *Hispanic Engineer* magazine and named one of the 20 most influential leaders in minority math education by the National Research Council in 1990.

Tapia was asked to served as chair of the National Research Council's Board on Higher Education and Workforce, co-chair of all educational outreach and training activities for both the University of Illinois Supercomputer Center (NCSA) and the San Diego Supercomputer Center, and co-chair of the Research Board for Building Engineering and Science Talent (BEST).

Response from Professor Tapia

It is a great honor to be recognized by the American Mathematical Society. No recognition can be more cherished than recognition conferred by one's peers and colleagues. I thank the selection committee for choosing me for this prestigious award. Even more, I thank the AMS for establishing this award, which formally recognizes the importance of outreach and public service.

Throughout my formative years, my parents instilled in me the value of education, community, and outreach to others. As a result, in my professional life, I have valued not only academic scholarship, but also teaching and mentoring, public service and outreach to the general community. I never thought that these activities detracted from each other—I grew up thinking that they went hand in hand, each influencing and supporting the others. For example, credibility in scholarly research facilitates credibility in public service, while outreach activities broaden one's perspective, revealing that different people learn and understand mathematics in different ways.

This award is especially satisfying because formal recognition by prestigious organizations validates the importance of public service and outreach activities. In turn, this validation promotes public service within the mathematics community. I want young mathematicians to see that there are many dimensions to mathematical scholarship. In addition to scholarly research, the activities of teaching and mentoring, expository writing, increasing awareness and understanding of mathematics in a broader community, and other public service activities are both valuable and necessary for the scientific health of our nation.

My own development benefitted enormously from the guidance and support of others. My mother and my father came separately from Mexico to the United States as young teenagers in search of educational opportunities. Times were difficult when they arrived. My parents were not able to achieve their own educational goals, but their dreams were realized for their five children, each of whom graduated from college.

My siblings and I were born and raised in Los Angeles. I am a product of public education, from my primary education in the Los Angeles public schools through my doctoral degree from UCLA. I strongly believe that quality public education is essential to the educational health and scientific competitiveness of our nation.

As a graduate student at UCLA, I was greatly influenced by my professors. In particular, David Sanchez gave me direction at a time when I greatly needed guidance, while Mangus Hestenes shaped how I think about mathematics.

My first faculty position was at the Mathematics Research Center at the University of Wisconsin. My experiences at MRC, where I learned so much, in so many ways, from so many people, were crucial to my professional development. I particularly thank Michael Golomb, Barkley Rosser, I. J. Schoenberg, and Hans Weinberger for mentoring me, and for showing me that excellence and graciousness need not be mutually exclusive.

Rice University has been my home for more than three decades. The students I have taught and known, and from whom I have learned, have played an essential role in shaping my vision of what is important. The Rice administration, especially Ken Kennedy as Director of the Center on Parallel Computation and current Rice president Malcolm Gillis, have strongly supported that vision and allowed me to pursue it.

Recently, my six years on the National Science Board further expanded my horizons, allowing me to discern critical national needs in science and mathematics, including representation by all members of our society. I thank the National Science Foundation for this extraordinary opportunity to learn and to serve.

Finally, I thank my family. My wife, Jean, has been a wise advisor and an enthusiastic supporter of my activities. And I have learned so much from my children, my daughter Becky, my son Richard, and my late daughter Circee, to whose memory I dedicate this award.

The Norbert Wiener Prize in Applied Mathematics

This prize was established in 1967 in honor of Professor Norbert Wiener and was endowed by a fund from the Department of Mathematics of the Massachusetts Institute of Technology. The prize is awarded for an outstanding contribution to "applied mathematics in the highest and broadest sense." The award is made jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics. The recipient must be a member of one of these societies and a resident of the United States, Canada, or Mexico.

Citation

James Sethian

The Norbert Wiener Prize in Applied Mathematics is awarded to James A. Sethian of the University of California at Berkeley for his seminal work on the computer representation of the motion of curves, surfaces, interfaces, and wave fronts, and for his brilliant applications of mathematical and computational ideas to problems in science and engineering.

His earliest work included an analysis of the motion of flame fronts and of the singularities they develop; he found important new links between the motion of fronts and partial differential equations, and in particular found that the correct extension of front motion beyond a singularity follows from an entropy condition as in the theory of nonlinear hyperbolic equations. These connections made possible the development of advanced numerical methods to describe front propagation through the solution of regularized equations on fixed grids.

In a subsequent work (with S. Osher) Sethian extended this work through an implicit formulation. The resulting methodology has come to be known as the "level set method", because it represents a front propagating in n dimensions as a level set of an object in $(n+1)$ dimensions. Next, Sethian tamed the cost of working in higher dimensions by reducing the problem back down to its original dimensionality. This set of ideas makes possible the solution of practical problems of increasing importance and sophistication and constitutes a major mathematical development as well as an exceptionally useful computational tool with numerous applications.

Among the practical problems solved by Sethian are: the tracking of interfaces and drops in fluid mechanics with applications to inkjet design for high-speed printers; the analysis of crystal growth (with J. Strain); motion under mean curvature, construction of minimal surfaces and knot recognition in computational geometry; design of optimal structures under loads (with A. Wiegmann),

and the analysis of anisotropic front propagation and mixed discrete-continuous control. Each of these applications required extensions and modifications of the basic tools as well as new understanding of the problems under investigation.

Sethian's mathematical description of etching and deposition in the manufacture of computer chips has illuminated processes such as ion-milling, visibility, resputter, and material-dependent etch rates; the resulting algorithms are now an indispensable part of industrial semiconductor fabrication simulations throughout the world. His models of implicit surface motion together with fast Eikonal solvers are standard fare in medical and biomedical shape extraction and in fields such as shape-based image interpolation, shape-from-shading, stereoscopic vision, and texture segmentation; they are used in hospital electron beam scanners to quantify cardiac motion and efficiency. Recently, Sethian (with S. Fomel) developed efficient numerical methods for simulating multiple-arrival wavefront propagation by solving Liouville-type equations; this work has direct applications in seismic imaging and geophysical inverse problems and has already been put to use by the petroleum industry.

A particularly noteworthy aspect of Sethian's work is that he pursues his ideas from a first formulation of a mathematical model all the way to concrete applications in national laboratory and industrial settings; his algorithms are currently distributed in widely available packages. Sethian's work is a shining example of what applied mathematics can accomplish to benefit science as a whole.

Biographical Note

James A. Sethian was born on May 10, 1954 in Washington D.C. He received a B.A. in Mathematics from Princeton University in 1976 and a Ph.D. in Applied Mathematics from the University of California at Berkeley in 1982. After an NSF Postdoctoral Fellowship at the Courant Institute of Mathematical Sciences, he joined the faculty at UC Berkeley, where he is now Professor of Mathematics as well as Head of Mathematics Department at the Lawrence Berkeley National Laboratory. He has been a Plenary Speaker at the International Congress of Industrial and Applied Mathematicians, an Invited Speaker at the International Congress of Mathematicians, and has received SIAM's I. E. Block Community Lecture Prize.

He is an Associate Editor of *SIAM Review*, the *Journal of Mathematical Imaging and Vision*, and the *Journal on Interfaces and Free Boundaries*.

Response from Professor Sethian

In the course of a normal day, a letter from the AMS appears and jolts one out of a busy routine. I am grateful for this unexpected shock: It is a wonderful honor to be the recipient of the Norbert Wiener Prize.

My interest in front propagation began with the suggestions of Alexandre Chorin at Berkeley. Starting with his cell fraction-based Huyghens' propagation algorithm, he artfully led me toward unanswered questions about interface evolution, the Landau instability, and ill-posedness. The appeal of alternative approaches

stemmed from the sheer frustration of attempting to elevate existing numerical front propagation schemes beyond simple two-dimensional problems. I have a fond memory of buying building blocks in 1978 from a local toy store in an optimistic attempt to visualize the various cases involved in a three-dimensional version of the Volume-of-Fluid algorithm. The visual aids were not enough, and my thesis instead focussed on developing and analyzing a mathematical model of flame and front propagation.

A Danforth Fellowship at Berkeley, followed by an NSF Postdoctoral Fellowship at the Courant Institute, and then a Sloan Foundation Fellowship back at Berkeley, coupled to support from the US Dept. of Energy, generously allowed me time for subsequent work on entropy conditions for front propagation, as well as links between the regularizing effects of curvature on Hamilton-Jacobi equations for front propagation and viscosity in conservation laws, and opened up the strategy of applying shock schemes to interface problems.

Indeed, this work on casting front propagation in the language of differential geometry and partial differential equations benefitted from a collection of disparate ideas and tools that were bubbling together in the late 1970s and early 1980s. The work of M. Crandall and P.-L. Lions, and then L. C. Evans, on viscosity solutions for Hamilton-Jacobi equations, G. Barles' analysis of that Berkeley flame model, the maturation of numerical schemes for hyperbolic conservation laws, and fresh ideas about curve evolution by M. Gage and M. Grayson all formed part of the landscape in those early years.

These ideas have led to several algorithms based on a partial differential equations-view of evolving fronts. The first such algorithm, which relied on embedding the front as a particular level set of a higher dimensional function and employed high order schemes for the underlying Hamilton-Jacobi equation, became known as the "Level Set Method". The work is joint with Stanley Osher at UCLA, whose enthusiasm is a force unto itself, and I have warm memories of that collaboration.

As first laid out, that version of the Level Set Method was mathematically appealing, numerically robust, and unnecessarily slow. I was fortunate to have D. Chopp, now at Northwestern, as my first Ph.D. student, with whom the ideas of re-initialization and adaptivity were developed, pointing the way towards making these methods practical and efficient. The resulting Narrow Band Level Set Methods, were honed with an equally talented Ph.D. student, D. Adalsteinsson, now at UNC Chapel Hill, who helped put these methods on a competitive footing with other methods of the day.

In this short space, I cannot do justice to the large amount of work done on level set methods and the surprising areas to which they have been applied. Many efforts, including large-scale projects at the DOE National Laboratories, in particular at the Lawrence Berkeley National Laboratory, semester-long programs at IPAM at UCLA, and focussed teams such as those in the semiconductor industry, have all contributed to pushing these techniques forward.

I would like to make mention of a few of my most recent collaborators. R. Malladi developed groundbreaking work while at the University of Florida, applying these algorithmic ideas to image segmentation, and I was fortunate that he chose to take his NSF Computational Sciences Postdoctoral Fellowship at Berkeley. He continues to be a leader in applying PDE-based techniques for medical and biomedical applications, and I am grateful for the on-going collaboration. A. Vladimirsky, a former student now at Cornell, was instrumental in extending PDE-based front propagation techniques to produce extraordinarily fast methods for optimal control and anisotropic front propagation. S. Fomel, a former postdoc now at Texas, was pivotal in devising PDE front schemes for multiple "non-viscosity" arrivals with the same computational efficiency. And J. Wilkening, a former student now at Courant, tackled the difficult problem of front propagation and void motion in the context of electromigration.

It is a joy to work with such able talents.

Two other endeavors deserve mention, in part because of the extensive work done long after I left the scene. The work with A. Majda on zero Mach number combustion has been honed and melded into complex combustion calculations by J. Bell and P. Colella. And the work on mathematical botany, anisogamy and chemotaxis continues to be pioneered by P. Cox, Director of the National Tropical Botanical Garden.

I have been lucky to have had pivotal teachers that stood as "transformers" along the way, investing their own energy to raise the voltage and then graciously passing it on. At a public junior high school in Virginia, W. Taylor was the first to tell me to study mathematics. A high school teacher offered similar encouragement, adding that I was almost as good as the kid sitting next to me: I don't feel too bad, since that kid, Eric Schmidt, is now CEO of Google. W. K Allard, then at Princeton, brought me to PDEs. O. Hald at Berkeley introduced me to numerics. A. Chorin is a wise and skilled thesis advisor: I am fortunate to be in the large community of his former students.

Finally, I am grateful to the Dept. of Energy for its long-term support of these efforts, the National Science Foundation, and the on-going opportunity to interact with people at Berkeley and the Lawrence Berkeley National Laboratory of singular talent, warmth, and support, including G. I. Barenblatt, A. Grunbaum, O. Hald, and R. Malladi.

Oswald Veblen Prize in Geometry

This prize was established in 1961 in memory of Professor Oswald Veblen through a fund contributed by former students and colleagues. The fund was later doubled by the widow of Professor Veblen. The prize is awarded for research in geometry or topology that has appeared during the past six years in a recognized North American journal.

Citation

David Gabai

The 2004 Veblen Prize in Geometry is awarded to David Gabai of Princeton University in recognition of his work in geometric topology, in particular, the topology of 3-dimensional manifolds.

Since its beginnings in the early twentieth century, 3-dimensional topology has occupied a central role in geometric topology. It is tantalizingly close to what we can directly visualize, yet with its knotting phenomena it is an incredibly complex and difficult subject. For the last twenty years, Gabai has been one of the leading figures in this field. He has led many of the main avenues of development, developing tools in order to solve some of its most important problems himself, tools that have turned out to be central to the further development of the subject.

One aspect of 3-dimensional topology greatly influenced by Gabai is the study of surfaces inside a 3-manifold and the intersection patterns of two or more of these. His introduction of the notion of thin position, which he used to resolve the question known as "Property R" about when surgery on a knot in the 3-sphere can yield a 3-manifold homeomorphic to the product of the 2-sphere and a circle, has found application far beyond Gabai's original use, for example, in the proof that knots are determined by their complements. Gabai's study of surfaces is achieved in large part through the study of more general objects, codimension-one laminations, in a 3-manifold. In a sequence of papers beginning in 1980s and summarized in his talk at the 1990 International Congress of Mathematicians in Kyoto entitled "Foliations and 3-manifolds," Gabai developed the theory of these objects. In Gabai's hands, they have served to help unlock some of the topological mysteries of 3-dimensional topology. This theory of these laminations has now grown to the extent that it is a subdomain of 3-dimensional topology in its own right.

More recently, Gabai has investigated 3-dimensional hyperbolic manifolds. Hyperbolic 3-manifolds are a rich and much studied class. Conjecturally at least, they are by far the richest and most interesting class. One of the central problems in 3-manifold topology is how to tell when a 3-manifold is hyperbolic, i.e., has a

hyperbolic structure. By strikingly original arguments in a series of papers*, Gabai has answered this question in a special case, by showing that every irreducible 3-manifold with the homotopy type of a hyperbolic manifold has a hyperbolic structure. Further developments of his methods led to a proof by Gabai of the Smale Conjecture for hyperbolic 3-manifolds—describing the homotopy type of the space of selfdiffeomorphisms—and also to new estimates for the volumes of hyperbolic 3-manifolds.

(*)

"Homotopy hyperbolic 3-manifolds are virtually hyperbolic," J. Amer. Math. Soc. 7 (1994), no. 1, 193–198.

"On the geometric and topological rigidity of hyperbolic 3-manifolds," J. Amer. Math. Soc. 10 (1997), no. 1, 37–74.

(jointly with Robert Meyerhoff and Nathaniel Thurston) "Homotopy hyperbolic 3-manifolds are hyperbolic," Ann. of Math. (2) 157 (2003), no. 2, 335–431.

Biographical Note

David Gabai received his B. S. from MIT (1976), his M. A. from Princeton (1977), and his Ph. D. from Princeton (1980) under the direction of William Thurston. After positions at Harvard and the University of Pennsylvania he spent most of the years 1986–2001 at Caltech and has been at Princeton University since 2001. He held visiting positions at the Institute for Advanced Study, Princeton (1982–83, Fall 89), the Mathematical Sciences Research Institute, Berkeley (1984–85, 1996–97), and the Institute Des Hautes Etudes Scientific, Bures-sur-Yvette, France (1985–86). He has received NSF Postdoctoral, Sloan, and AMS Centennial fellowships. He gave a 45-minute invited talk at the 1990 Kyoto ICM and an hour invited talk at the 1995 AMS/SMM Guanajuato, Mexico meeting. He also gave the 1996 Porter Lectures (Rice), the 2001 Marston Morse memorial lectures (IAS) and the 2002 Unni Namboodiri memorial lectures (U. Chicago).

Response from Professor Gabai

I have been incredibly lucky all my life. As a graduate student at Princeton, Bill Thurston suggested an area of mathematics, foliations on 3-manifolds, which matched my talents. Being in a field, then considered by many experts to be either finished or peripheral, I could slowly and happily build my intuition and technical skills without the distraction of noise or the danger of being trampled. It turned out my constructions of foliations were useful and of contemporary interest, so I got a great job at Caltech. In 1991, I attempted to teach a topics course on the hyperbolic geometry that I should have learned as a graduate student. I started with Chapter 1 of Thurston's 1977–78 lecture notes but could not get past Chapter 5. There he discussed why Mostow's rigidity theorem implies that a manifold finitely covered by a hyperbolic 3-manifold is homotopy equivalent to a hyperbolic 3-manifold. I got stuck trying to prove the converse. Ultimately, the converse became the start of work cited here.

It is a great pleasure to thank Ulrich Oertel with whom I introduced essential laminations in 1986 and Rob Meyerhoff and Nathaniel Thurston who worked with me on the homotopy hyperbolic project. I also thank my long time collaborator Will Kazez and my collaborators Peter Milley, and Valentin Poenaru. Victor Guillemin's beautiful differential topology course during my last semester at MIT kept me from opting out of mathematics for medical school. Bill Thurston's influence has been immense. I am in debt to my teachers, and I count my students among them. I very much appreciate the many mathematicians who have encouraged me over the years. Finally, I thank my many hosts in China, England, France, Israel and Japan for providing quiet environments, during short visits, so that I could hide out and nurture my thoughts.

Much of what I know was done or inspired by former prize winners. It is humbling to be the recipient of the 2004 Veblen Prize.

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, first given in 1990, 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

T. Christine Stevens

Project NExT (New Experiences in Teaching) is widely accepted as being one of the most successful programs in the history of the MAA, and its success is one indelible mark that T. Christine Stevens has already left on the national mathematics community. However, it is not the only one, and before it is described in more detail, some of the others must be mentioned.

As an AMS/MAA/SIAM Congressional Science Fellow, Chris Stevens worked as a legislative assistant for a New York Congressman on issues involving defense, arms control, and education for the mathematical sciences, providing a reasoned mathematical voice in an environment in which it had an impact on national legislative policy. In addition, as an Associate Program Director for the Teacher Enhancement Program at the National Science Foundation, she directed the review, funding, post-award management, and evaluation of proposals that had direct consequences for the mathematical preparedness of large numbers of teachers and, consequently, their students. Chris has also lent her expertise to the larger mathematical community by serving on and chairing MAA and SIAM committees on science policy and education. In 1997, her effectiveness as a teacher and mentor was recognized by the MAA with the Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics.

But it is through her leadership of Project NExT that Chris has had by far her greatest influence on all levels of collegiate mathematics. Its success and impact may be measured in many ways: participants' testimonials; the effectiveness of those participants in their home departments; their success as teachers, scholars, and members of the academic community; and the influence the program has had on other academic societies and disciplines. Project NExT has served as the

gateway through which over 600 mathematicians have entered the academic profession, and its offshoots, the MAA Section NExTs, have similarly served over 400 more.

The impact of these participants on the profession has already been substantial. NExT Fellows have received two statewide teaching awards, a Section award for mentoring, two awards for outstanding articles in MAA publications, several research awards including a prestigious AAUW American Fellowship, and numerous NSF grants for curriculum development. One has served as a Visiting Mathematician at the MAA, many have served as officers in over two-thirds of the MAA's 29 sections, sixteen have served on MAA committees on education, and numerous others have served elsewhere throughout the MAA's committee structure. They have directed a project funded by the NSF to increase underrepresented minorities in science, mathematics, and education; directed an in-service project for middle school mathematics students in three states; co-organized a national research conference for undergraduate women in mathematics; and directed local mathematics programs for precollege students. The impact of this extensive array of activities on our profession has been and will continue to be truly remarkable.

Chris Stevens created Project NExT with the late Jim Leitzel in 1994, co-directed it with him until his death in 1998, and since then has been the director of the project. It is her active leadership, vision, attention to detail, and inextinguishable energy that have enabled the project not just to survive the passing of its co-founder, but to thrive. For her continuing service to mathematics through her direction of Project NExT and her long record of other service to the profession, the MAA is pleased to name T. Christine Stevens the winner of the 2004 Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics.

Biographical Note

T. Christine Stevens is Professor of Mathematics and Mathematical Computer Science at Saint Louis University. A graduate of Smith College, she earned her Ph.D. in mathematics at Harvard University. Her research interests are in topological groups, especially Lie groups, and in the history of mathematics. She has also published papers on issues in undergraduate mathematics education, and she is the director of the MAA's Project NExT (New Experiences in Teaching). Before coming to Saint Louis University in 1989, she taught at the University of Massachusetts, Lowell, at Mount Holyoke College, and at Arkansas State University. During leaves from these institutions, she spent a year doing research at the University of Cambridge and worked on Capitol Hill, at the National Science Foundation, and at the MAA.

Response from Professor Stevens

To receive the Gung and Hu Award is both an unexpected honor and a delightful surprise. The surprise is made doubly delightful by the fact that the service for which I am being honored has itself been a source of so much pleasure. The AMS/MAA/SIAM Congressional Science Fellowship provided me with a fascinating year on Capitol Hill, and my work at the National Science Foundation

taught me much about teaching. Through Project NExT, I have the joy of getting to know many of the wonderful people who are entering our profession, and I have been fortunate to share that experience with such marvelous colleagues as Jim Leitzel, Aparna Higgins, Joe Gallian, Judith Covington, and Gavin LaRose. I am grateful to the MAA for generously adding this award to the many benefits that I have already reaped from my service to mathematics, and I am greatly honored to join the list of its previous distinguished recipients, among whom is my dissertation director, Andrew Gleason, who launched me on this path a quarter century ago.

Summary of Awards

For AMS

Award for Distinguished Public Service: Richard Tapia

Levi L. Conant Prize: Noam D. Elkies

E. H. Moore Research Article Prize: Mark Haiman

Leroy P. Steele Prizes: Lawrence C. Evans, Nicolai V. Krylov, John W. Milnor, and Cathleen Synge Morawetz

Oswald Veblen Prize in Geometry: David Gabai

For AMS-SIAM

Norbert Wiener Prize in Applied Mathematics: James Sethian

For AMS-SIAM-MAA

Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student: Melanie Wood

For AWM

Louise Hay Award for Contributions to Mathematics Education: Bozenna Pasik-Duncan

Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman: Kimberly Spears

For MAA

Certificates of Meritorious Service: Richard Barlow, Underwood Dudley, Thomas Hern, John W. Kenelly, and Stephen Ligh

Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics: T. Christine Stevens

Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics: Thomas Garrity, Andrew Chiang-Fung Liu, and Olympia Nicodemi

Index of Award Recipients