MathFest 2009

PRIZES and AWARDS

THE MATHEMATICAL ASSOCIATION OF AMERICA

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Program

Opening and Closing Remarks
David Bressoud, President
Mathematical Association of America

Carl B. Allendoerfer Awards

The Carl B. Allendoerfer Awards, established in 1976, are made to authors of expository articles published in *Mathematics Magazine*. The Awards are named for Carl B. Allendoerfer, a distinguished mathematician at the University of Washington and President of the Mathematical Association of America, 1959-60.

Vesna Stojanoska and Orlin Stoytchev

"Touching the Z_2 in Three-Dimensional Rotations,"
Mathematics Magazine, vol. 81, no. 5, December 2008, pp. 345-357.

We think that we understand rotations in R^3 entirely, but in fact we don't. Some complete rotations, that is, rigid motions of a body that keep one point fixed and return the body to its original position, cannot be continuously deformed to the null motion. But if we compose two such nontrivial complete rotations, the resulting motion can always be so deformed. This paper gives a mathematical formulation of this non-obvious geometric property.

If we choose a basis in R^3, any rotation about a fixed axis can be expressed by means of a 3 by 3 orthogonal matrix with determinant 1. The set of all such matrices forms the special orthogonal group $SO(3)$, a fundamental mathematical object with various algebraic, topological, and analytic properties. A complete rotation can be viewed as a continuous path in $SO(3)$, so the statement about the deformability of complete rotations is just the assertion that the fundamental group $\pi_1(SO(3))$ is isomorphic to Z_2.

The authors provide an elegant visual proof by relating three dimensional rotations to braids. The argument is not easy, but it provides a good example of the interaction of algebraic and topological ideas and sheds light on an intriguing and deep physical property of the space in which we live. It offers a stimulating introduction to braids and topology and makes non-trivial mathematics accessible to undergraduates.

Biographical Notes

Vesna Stojanoska received her B.A. from the American University in Bulgaria and is now a Ph.D. student at Northwestern University. Her research is in algebraic topology: she is interested in using algebraic geometry and number theory to better understand various phenomena in stable homotopy theory.

Orlin Stoytchev is a professor at the American University in Bulgaria. He received his Ph.D. from Virginia Tech. His research interests can be summarized as "the different aspects of symmetries in mathematics and physics" and have led to works on Von Neumann algebras, representations of infinite-dimensional Lie groups and algebras, and recently on braid groups.

Response from Vesna Stojanoska and Orlin Stoytchev

One of the most gratifying feelings for a mathematician is when, after a long struggle with a problem, he or she suddenly starts seeing the solution. Everything fits in place and becomes embarrassingly simple. Even though for most of us these occasions are rare and we only see little steps further, the satisfaction is not diminished. Perhaps the only greater joy is sharing with others the beauty of this amazing human creation – mathematics. We are extremely honored to receive the Allendoerfer Award. We would like to express our gratitude to the MAA for providing a forum for popularizing mathematics and to the former editor of *Mathematics Magazine*, Professor Allen Schwenk, for his guidance and encouragement.

Jeff Suzuki

"A Brief History of Impossibility"
Mathematics Magazine, **vol. 81, no. 1, February 2008, pp. 27-38.**

When the trisection of the angle with only straightedge and compass is mentioned, we often see words to the effect, "In 1837 Wantzel showed that this is impossible." However, we are never told how Wantzel did it. In this paper Jeff Suzuki tells us, along with considerably more, in prose that is eminently clear and readable.

He starts at the beginning with Euclid, shows how Descartes made it possible to transform geometrical constructions into algebraic equations, mentions the work of Vandermonde and Lagrange on roots of polynomials, and gives a thorough outline of Gauss' proof that a regular 17-gon is constructible with straightedge and compass alone. He concludes with a proof of Wantzel's theorem that if a line segment of length r can be constructed with only straightedge and compass then r must be a zero of a polynomial of degree 2^n for some positive integer n.

The reader is drawn along, seemingly effortlessly, through results that are historically and mathematically important. The paper is reminiscent of the works of Euler. For expository writing there can be no higher praise.

Biographical Note

Jeff Suzuki, currently associate professor of mathematics at Brooklyn College, grew up in southern California with an inability to decide what he really wanted to do, so he earned a bachelor's in mathematics (with a physics concentration) and history from California State University, Fullerton. He went on to earn his M.A. and Ph.D. from Boston University, with a dissertation on the history of a topic in mathematical physics. Still unsure of what he really wants to do, he has spent some of the past year developing a course on cryptography, researching interdisciplinary topics in mathematics, and learning sign language. His wife Jacqui and children William X and Dorothy Z (yes, their middle names are X and Z) somehow manage to put up with his idiosyncrasies and have survived his culinary, literary, and musical efforts. His latest book, *Mathematics in Historical Context*, has just been published by the MAA (2009).

Response from Jeff Suzuki

I am very honored to have won the Allendoerfer Award for "A Brief History of Impossibility." I wrote the paper to answer a question that had been on my mind for many years; I was quite pleased to discover that *Mathematics Magazine* found it interesting enough to publish. I'd like to thank the editor, Allen Schwenk, and editorial assistant, Margo Chapman, for their work shepherding this manuscript through the publication process.

Trevor Evans Awards

The Trevor Evans Awards, established by the Board of Governors in 1992 and first awarded in 1996, are made to authors of expository articles that are accessible to undergraduates and are published in *Math Horizons*. The Awards are named for Trevor Evans, a distinguished mathematician, teacher, and writer at Emory University.

Richard A. Guyer

"Radiology Paging a Good Mathematician: Why Math Can Contribute More to Medicine Than You Might Think," ***Math Horizons*, April 2008, pp. 5–9.**

Whether in the hospital or watching popular television shows, mathematicians and the general public alike know the medical importance of magnetic resonance imaging (MRI). In this exceptional presentation of applied mathematics in practice, Richard A. Guyer explains how mathematics is used in various ways with MRI and provides descriptive images to help his audience better understand this diagnostic tool. This includes an explanation of the use of Fourier transforms and signal processing to convert a signal to an image, and how quantitative information about an organ can be derived from such images. The article also describes well-established characteristics about MRI based on mathematics such as the Flip Angle Effect and the Oxygen Interaction Effect. Readers also learn about other biomedical uses of mathematics and can access the online resources mentioned in the article for a more in-depth study of these topics.

Biographical Note

Richard Guyer is a 2006 graduate of Davidson College, where he studied mathematics and economics. After spending much of his time in college considering a career in academic economics or mathematics, he became interested in medicine. His time in the Mathematics Department at Davidson planted seeds of interest in applications of mathematics to medicine. Following graduation, he attended the post-baccalaureate Premedical Program at the University of Pennsylvania, where he was fortunate enough to work under outstanding researchers in the Department of Radiology. This work further sharpened his interest in the relationship between mathematics and medicine. Currently, he is a medical student at the University of Virginia planning for a career in academic medicine. Although he has not yet decided what field of medicine to specialize in, he is looking forward to applying his mathematical background in whatever specialty he ultimately chooses.

Response from Richard Guyer

My goal when writing this article was to encourage undergraduates studying mathematics to consider using their skills to attack medical problems. There are virtually countless ways that mathematics can be applied to medicine, only a few of which I discussed. I would strongly urge any mathematics student to consider a career in medicine and, conversely, I would strongly encourage any student who is planning a career in medicine to study mathematics!

Randy K. Schwartz
"The Birth of the Meter,"
***Math Horizons*, September 2008, pp. 14-17, 31.**

In this outstanding article, Randy K. Schwartz gives a historical perspective of the development of the meter as a precise form of measurement beginning his account in the wake of the French Revolution. The birth of this unit of measurement was not without its pains. Amidst the political turmoil of the 1790s, a heated debate ensued from the decision to replace over 250,000 different weights and measures with a system of measurement that would not be arbitrary. The author verses readers in the mathematical arguments as to how a meter should be defined – as a unit related to the swing of a pendulum or proportional to the size of the Earth. Readers see how each idea was implemented in its turn and learn the mathematical challenges inherent in each. The author explains the motion of a pendulum clock and why it does not lead to the desired universal measurement. Readers also learn about the French surveying project, the complications associated with it, and its ultimate success. In each step of the article, readers are exposed to wonderful descriptions of how mathematical tools, ranging from trigonometry to differential equations, were used to define the meter.

Biographical Note
Randy K. Schwartz holds degrees in mathematics from Dartmouth College and the University of Michigan. He is a professor of mathematics at Schoolcraft College, a community college in Livonia, Michigan where he has taught since 1984. At Schoolcraft, his teaching focuses on preparing students for careers in engineering, science, health care, and business. Professor Schwartz has also worked to bring the historical contributions of Arab and other cultures into the mathematics curriculum, and has participated in international conferences on the history of Arab mathematics. In 2000, he was awarded the Democracy in Higher Education Prize (National Education Association) for his essay, "Unity in

Multiplicity: Lessons from the Alhambra," an argument for a multicultural approach in mathematics education.

Response from Randy K. Schwartz

I am thrilled to receive a Trevor Evans Award and, considering its past recipients, I am honored and humbled to be in such company. I want to thank the Mathematical Association of America, the editors of *Math Horizons*, and the award selection committee.

Ostensibly, I investigated "the birth of the meter" to help answer a question put to me by colleagues in mathematics, American culture, and other disciplines. They wondered why the young United States, having broken away from imperial England, had retained the antiquated British system of units and never adopted the metric system devised in revolutionary France.

I confess, however, that my central motive was a more selfish one, for looking into this topic became another way for me to delight in the rich connections between mathematics and other spheres, especially history and technology. It was surprising how the historical attempts to define this seemingly arbitrary standard of measurement relied on many branches of mathematics.

When we feel excitement and passion in exploring a topic, that is our first reward. It is doubly gratifying to learn that this comes through to others when we write about it.

Lester R. Ford Awards

The Lester R. Ford Awards, established in 1964, are made to authors of expository articles published in *The American Mathematical Monthly*. The Awards are named for Lester R. Ford, Sr., a distinguished mathematician, editor of *The American Mathematical Monthly*, 1942-46, and President of the Mathematical Association of America, 1947-48.

Michel Balinski

"Fair Majority Voting (or How to Eliminate Gerrymandering)," *The American Mathematical Monthly*, vol. 115, no. 2, February 2008, pp. 97–113.

In this timely and interesting article, Professor Balinski argues that the gerrymandering of legislative districts can be eliminated by altering the method in which we choose the congressional delegation of each state. With clear and compelling examples combined with a touch of political and legal history, he shows how the problem of gerrymandering has developed over time and how it contributes to the political stasis that we observe in the United States House of Representatives.

The author gives compelling reasons to adopt fair majority voting and proceeds to prove the feasibility of the method via a nice linear programming argument. Professor Balinski mixes mathematics, politics and history to bring us a lovely illustration of using the power of mathematics to address the problems of the real world.

Biographical Note

Michel Balinski studied mathematics at Williams and Princeton, and economics at MIT. Having held positions at Princeton, University of Pennsylvania, Graduate Center of CUNY, Yale, and SUNY Stony Brook, he has been Directeur de recherche de classe exceptionnelle at the CNRS and the École Polytechnique (Paris) since 1982, where he is now *emeritus*. After working in optimization and founding the journal *Mathematical Programming*, his interests turned to electoral systems. With H. P. Young he developed a theory of apportionment in the prize-winning book, *Fair Representation: Meeting the Ideal of One-Man, One-Vote* (Yale University Press, 1982). A voting system he pioneered is used to elect the parliaments of the city and canton of Zürich. With Rida Laraki he has developed and tested a completely new model and theory of electing and ranking competitors of any kind – the "majority judgement" – forthcoming in the book, *One-Value, One-Vote: Measuring, Electing and Ranking* (MIT Press).

Response from Michel Balinski

It is a pleasure and a real honor to receive a Lester R. Ford Award for this paper.

Particularly so because it was at first rejected: "This is a really interesting article on a timely problem … but is not appropriate for the *Monthly*." There was, said the reviewer, not enough pages of mathematics in it. I countered: (1) In applying mathematics to politics the problem description and background cannot be as in applications to physics, mechanics or biology – replete with formulae and technical materials – but must necessarily deal with laws, Supreme Court decisions and history. (2) To be credible, the solution must admit of a simple description, understandable to voters. The argument was accepted.

I hope that readers of the *Monthly* will come to appreciate the importance of mathematics in designing and analyzing electoral systems, that some will devote time to it, and will offer courses about it (as has been done at Williams): the need is evident!

I salute Bruce Palka and Daniel Velleman for their superb editing of articles in the *Monthly*: Given papers containing decent ideas, their inputs turn them into prize winners!

Andrew Bashelor, Amy Ksir, and Will Traves

"Enumerative Algebraic Geometry of Conics," ***The American Mathematical Monthly,*** **vol. 115, no. 8, October 2008, pp. 701–728.**

Jacob Steiner asked this question in 1848: Given five conics in the plane, how many conics are tangent to all five? The authors of this article take this question and use it as a vehicle to take the readers on a tour of enumerative algebraic geometry. Beyond the answer to Steiner's problem (3,264), Bashelor, Ksir and Traves expose both the intuition and some of the complexities of the algebra involved.

Starting with drawing examples in the real plane, we are quickly taken on a tour of real and complex projective spaces, Bézout's Theorem, the Veronese surface, and beyond. Deftly mixing intuitive examples with the abstract approach that yields the needed results, the authors introduce their subject with a delicate touch that invites us into their exposition and leaves us with both a greater appreciation of the algebraic geometry and resources for further investigations.

Biographical Notes

Andrew Bashelor is a 2005 graduate of the United States Naval Academy from which he received his bachelor of science degree in mathematics (with Honors). During his senior year he participated with a select group of undergraduates in the Trident Scholar Program and his research over the course of the year served as the basis of this paper.

Immediately following graduation, he continued on to the Naval Postgraduate School where he earned his master of science in operations research in 2006. As a USNA alumnus he holds the rank of lieutenant, United States Navy. He has served as a division officer onboard the Aegis cruiser USS PORT ROYAL (CG 73), homeported in Pearl Harbor, HI, and currently is a staff officer for Destroyer Squadron 2 based out of Norfolk, VA. He and his wife live in Virginia Beach with their one year old son.

Amy Ksir grew up in Laramie, WY where she had the good fortune to learn geometry from Dr. Mary Jane Cowles Wolfe. She earned her B.A. at Rice University and her Ph.D. at the University of Pennsylvania. After a postdoctoral fellowship at Stony Brook, during which time she was a Project NExT Fellow (gold dot), she joined the faculty at the United States Naval Academy. She was honored to give a series of lectures based on this article at the Program for Women in Mathematics at the Institute for Advanced Study in 2007. She also enjoys playing the accordion.

Will Traves first learned about the enumerative geometry of conics from Frank Sottile, when Will was a doctoral student at the University of Toronto. He was later a Project NExT Fellow (brown dot) and now teaches at the United States Naval Academy. His interests outside of mathematics include playing games of chance and skill, reading good literature and cooking tasty food.

Response from Andrew Bashelor, Amy Ksir and Will Traves

We are grateful to the prize selection committee for their recognition of our work. This article grew out of Lt. Bashelor's Trident project, a full-year undergraduate research project at USNA. Over the course of the year, all three of us developed a much deeper understanding of the mathematics at work. Our goal for this article was to present the results in a way that would draw in a broad audience and introduce them to some of the strange but beautiful ideas in algebraic geometry. This took, for us, a huge amount of time and effort, but was also a tremendous amount of fun; we hope that our readers enjoy working through it as much as we enjoyed writing it!

We would like to take this opportunity to thank Dan Velleman, the editor of the *Monthly*, whose thoughtful guidance improved the paper substantially.

Andrew Granville

"Prime Number Patterns," ***The American Mathematical Monthly*, vol. 115, no. 4, April 2008, pp. 279–296.**

In 2005, Green and Tao combined ideas from many parts of mathematics to prove that for any positive integer k there are infinitely many distinct pairs of non-zero integers (a,d) such that $a+jd$ is prime for each integer j in $\{0, 1, \ldots, k-1\}$. In this engaging paper, Granville considers conjectures he formulated to probe beyond a horizon made more remote by Green and Tao. To his surprise many of his conjectures followed fairly directly from the work of Green and Tao.

This paper takes us on a clear and dazzling exploration of efforts to find the "smallest" example of several kinds of prime number patterns. One example: Among sets of n primes whose pairwise averages are all distinct primes, which has the smallest maximum element? Granville indicates why this smallest maximum element should grow like $O(n^{n/2})$. In his final section, Granville describes some classic and modern questions that do not succumb easily to the results of Green and Tao, but that are under newly optimistic consideration. This paper offers tempting conjectures and open questions to all mathematicians: whether deductive or experimental, expert or undergraduate.

Biographical Note

Andrew Granville is the Canadian Research Chair in number theory at the Université de Montréal.

His awards include the Presidential Faculty Fellowship in Mathematics (from President Clinton) in 1994, the 2008 Chauvenet Prize of the MAA, and the 2006 Jeffery-Williams Prize of the Canadian Mathematical Society. He was an invited speaker at the ICM in Zurich in 1994, and a plenary speaker at the Joint Mathematics Meetings of 1996 and 2002. He was recently elected a Fellow of the Royal Society of Canada.

He helped create the questions for MAA's Putnam Examination from 1999 to 2002. He has served on the scientific advisory panels of MSRI and of the Fields Institute, and on prize selection committees.

Thanks to two of Dr. Granville's mentors, Paulo Ribenboim and Carl Pomerance, who are both outstanding expositors and lecturers, he was long encouraged to view communication of ideas to traditional and non-traditional audiences, as one of his main roles as a research mathematician.

Response from Andrew Granville

I am happy to thank the selection committee for this kind recognition of my article, and to acknowledge the encouraging response to this article, from amateur and professional mathematicians alike.

Dan Kalman

"An Elementary Proof of Marden's Theorem," ***The American Mathematical Monthly,*** **vol. 115, no. 4, April 2008, pp. 330–338.**

Marden's Theorem deserves to be better known. That realization motivated Dan Kalman's lovely exposition of it. The theorem describes a thoroughly unexpected geometric connection between the roots of a cubic polynomial p with complex coefficients and the roots of the polynomial's derivative p'. To wit, if the roots of p are noncollinear points A, B, and C in the complex plane, the roots of p' are the foci of the unique ellipse inscribed in triangle ABC and tangent to the sides at their midpoints. Dan Kalman has provided an elementary, self-contained proof of Marden's Theorem. The extraordinary lucidity of Kalman's argument combines with his historical scholarship on the theorem's origins and the charm of this surprising result to make this article a model of mathematical exposition.

Biographical Note

Dan Kalman has been a member of the mathematics faculty at American University, Washington, DC since 1993. Prior to that he worked for eight years in the aerospace industry and taught at the University of Wisconsin, Green Bay. During the 1996-1997 academic year he served as an associate executive director of the MAA. Kalman has a B.S. from Harvey Mudd College and a Ph.D. from University of Wisconsin, Madison.

Kalman has been a frequent contributor to all of the MAA journals, and has served on the editorial boards of both MAA book series and journals. He is the author of two MAA books, *Elementary Mathematical Models* and *Uncommon Mathematical Excursions*.

Response from Dan Kalman

I am very grateful to receive the Lester R. Ford Award, and humbled to see my name added to the distinguished list of past winners. It is made all the more gratifying by my long affection for the topic of the paper. My first exposure to Marden's Theorem, as an undergraduate, filled me with wonder and surprise, reactions that are very little abated now more than thirty five years later. Even so, I doubt I'd have written about Marden's Theorem at all without the contributions of my late friend and colleague, James White.

Jim was a great proponent of dynamic computer environments for exploring mathematical ideas. The Mathwright software he developed was the ideal tool for creating such environments. Inspired by his philosophy and empowered by his software, I created an animated portrayal of Marden's Theorem. That awoke in me a renewed interest in the theorem, and ultimately led to the paper for which I am now receiving a Ford Award. Jim shared my enthusiasm for Marden's Theorem; I'd have liked to share my paper with him -- I am sure he would have enjoyed it.

I would also like to thank Dan Velleman, editor of the *Monthly*, for suggesting many ways to improve the exposition, and the prize committee for conferring this award. Finally, thanks to the MAA for publications and programs that so enrich our professional lives.

Mehrdad Khosravi and Michael D. Taylor

"The Wedge Product and Analytic Geometry," ***The American Mathematical Monthly*****, vol. 115, no. 7, August/September 2008, pp. 623–644.**

Exterior algebras are typically studied nowadays either by algebraists as a way to understand the universal properties of the determinant within multilinear algebra, or by analysts in the study of differential forms and their tensor calculus on high-dimensional manifolds. But these paths demand a fair amount of preliminary background and abstruse machinery to negotiate properly.

The authors of this paper have developed an eminently accessible approach to the development of the exterior algebra A^kR^n, one that could easily be read by anyone with a semester of linear algebra as background. The key is a construction of what they call a simple k-vector, the equivalence class of k-tuples of vectors in R^n that have the same orientation and that bound parallelepipeds of equal volume. They define the wedge product for such objects and, by a route that is informed along the way by the vector geometry of 2- and 3-space and basic linear algebra, they build up the concept of the exterior algebra quite directly. These tools are then used in a very satisfying way to produce higher-dimensional generalizations of a number of geometrical properties of R^2 and R^3, including the Law of Cosines, the Parallelogram Law, the Pythagorean Theorem, and the Cauchy-Binet Theorem.

Biographical Notes

Mehrdad Khosravi received his Ph.D. in mathematics from the University of Central Florida in the summer of 2008. Since then he has moved across the country to the San Francisco Bay area and teaches at De Anza College in Cupertino, California. His research interests are generalized functions and Boehmians. Currently he is working on publishing some of the results from his dissertation. In his free time he enjoys bicycling, gardening, and fixing up his house with his wife.

Michael D. Taylor received his Ph.D. in mathematics from Florida State University in 1969 and was a charter member of the University of Central Florida in Orlando when it opened in 1968. He became *emeritus* professor in 2003. When his children asked about the word *emeritus*, he explained that it meant "embalmed." His initial research interests were in topology of the embedding of 2-manifolds in 3-manifolds. The great majority of his work, however, has been in copulas and the types of dependence that can exist between random variables.

Response from Mehrdad Khosravi

It is a big honor and an amazing surprise to win the Lester R. Ford Award. Much of the credit, however, belongs to Michael Taylor, editors, and the referees. I took on the project as an undergraduate student because of my love for linear algebra and as an excuse to work with Dr. Taylor. After I finished my Honors in the Major project we decided the concept was just too pretty and we could enjoy it awhile longer. We were lucky to have great referees to guide us in the right direction and we are extremely thankful.

We don't practice mathematics for the awards, but getting such a prestigious one comes with some warm feelings.

Response from Michael D. Taylor

The Lester R. Ford Award came as a delightful surprise. Much of the credit must go to the guidance we got from editors and referees and the support of friends.

Our paper grew out of an honors thesis done by Mehrdad on the law of cosines for an n-simplex. This, in turn, was strongly influenced by trying earlier to teach differential forms from M. Spivak's small classic *Calculus on Manifolds* and by work done with my friend P. Mikusiński on a multivariable analysis text. The lesson that came from those experiences and the idea that guided us in the present work was this: the importance of finding intuition behind the abstraction.

George Pólya Awards

The George Pólya Awards, established in 1976, are made to authors of expository articles published in the *College Mathematics Journal*. The Awards are named for George Pólya, a distinguished mathematician, well-known author, and professor at Stanford University.

Lawrence Brenton

"Remainder Wheels and Group Theory," C*ollege Mathematics Journal*, vol. 39, no. 2, March 2008, pp. 129-135.

Why should mathematics education majors study higher mathematics that they (supposedly) won't have to teach? By revealing abstract mathematics lurking within the elementary school algorithm for the calculation of repeating decimals, Lawrence Brenton rolls out his own response to this question. After all, it is perfectly natural for a bright elementary school student to wonder "How can we know in advance how many digits will appear in the repeating part of the decimal?" or "Why do some digits appear together instead of with others?" It would help if her teacher had some idea how to answer those questions!

Following the pedagogical approach of others by placing the repeating digits on the face of a clock, Brenton proceeds to wind those questions (and clocks!) into a discussion of group theory, and considers remainders, cosets of Z_n*, and factor groups. As he chronicles this "bottom up" approach to teaching the subject of cosets, in which he goes so far as to construct cardboard copies of the cosets ("factor wheels") themselves, we can almost hear our own students' mental gears turning. Through this elementary introduction, his students manage to make peace with the idea of a factor group, investigating the group of units mod n in earnest and eventually proving a theorem of their own.

In the end, the students' experience with factor groups explains the behavior of repeating decimals, and in turn, their knowledge of repeating decimals improves their understanding of factor groups. Perhaps life really is a circle.

Biographical Note

Lawrence Brenton was educated at the University of Pennsylvania (B.A., 1968) and the University of Washington (Ph.D., 1974). After completing post-doctoral research work at the University of Bonn, he joined the faculty at Wayne State University, where he has served since 1975. Professor Brenton's field of research is algebraic geometry and several complex variables, with recent particular interest in singularities of projective varieties and applications to cosmology. At Wayne State, he has received excellence in teaching awards at both the college and university levels. He is an enthusiastic advocate for integrating mathematical research and mathematics education at the college level.

Response from Lawrence Brenton

I am deeply grateful to the MAA and to its prize selection committee for this singular honor. I am particularly delighted that the paper chosen for the award is squarely in the heart of my passion, building bridges between research mathematics and mathematical education.

In addition to the editor of the *College Mathematics Journal*, I must also thank the sixth grade students in the Wayne State University Math Corp Summer Camp, and the college student volunteers who taught them. By asking questions about fractions and decimals that I did not know the answers to, they launched me on a journey that did not end until I had revisited material of genuine mathematical substance. In my paper I hoped to show how even the simplest arithmetical algorithms that we teach to children are in fact infused with startling mathematical depth and subtlety.

Greg N. Frederickson

"Designing a Table Both Swinging and Stable," ***College Mathematics Journal,*** **vol. 39, no. 4, September 2008, pp. 258-266.**

"Some mathematical ideas are just so nifty that people can't resist finding a physical realization for them." This is the opening sentence of Frederickson's delightful article, which presents a whimsical application of plane geometry as a carpentry problem. Except that Frederickson has done the carpentry!

Frederickson begins with a history of hinged dissections of equilateral triangles that can be transformed into squares. Essentially these are a kind of equal-area puzzle, and a number of mathematicians have constructed tables to embody solutions to such a puzzle. The pieces are hinged so that if, say, four people are playing cards and one decides to go home, the host can just swing the parts around and have a triangular table. Frederickson studies two problems, the stability of such a table and its "hingeability."

Frederickson analyzes the positions of the legs so that the table remains stable in both configurations. His solution is to have one pedestal leg. By analyzing the areas of the various pieces and the centers of gravity of the table, he determines an "optimal" position for the pedestal. Unfortunately this position would result in too much stress on the hinges to be practical. So he cleverly alters the original dissection, and finds a position for the pedestal that results in a relatively stable table in both configurations without putting undue strain on the hinges.

Like any good applied mathematician, he then considers finer details: where to put the hooks and how to cut the wood in an attractive pattern in both configurations. Among the references given at the end of this article is the web address for a site where Frederickson provides animations of several of these dissections. You may want to go out and construct the table yourself!

Biographical Note

Greg Frederickson was born in Baltimore, MD. After graduating from Harvard University with an A.B. in economics, he taught mathematics in the Baltimore City public schools for three years before moving on to graduate school. He received a Ph.D. in computer science from the University of Maryland in 1977. He then joined the faculty in the computer science department at the Pennsylvania State University, from which he moved to Purdue University in 1982.

Professor Frederickson has conducted research in the area of the design and analysis of algorithms, with major contributions to approximation algorithms for NP-hard problems, graph and network algorithms, and data structures. He has published three books: *Dissections: Plane & Fancy*, *Hinged Dissections: Swinging & Twisting*, and *Piano-Hinged Dissections: Time to Fold!*

Response from Greg N. Frederickson

It is both an honor and a thrill to receive the Pólya Award from the Mathematical Association of America. Our most important activity is to create enthusiasm for mathematics. It has been a delight to take a mathematical construct, turn it on its head, and see what pops out: trying different ideas, improvising, innovating, tweaking, swinging! And then to reconstitute all that excitement for others: conveying the playfulness of Howard Eves, the lovely patterns of crossposed strips, the precision of the closed-form solutions, employing craftsmanship to position legs, place hooks, and align wood grain. What a blast!

The professionalism and dedication of MAA editors is wonderful. They have all provided me with an abundance of helpful suggestions for my three MAA publications so far. Finally, thanks to the Association for sponsoring these awards for expository excellence. How clever of you, after we authors have dreamt and proved and written so hard, to make it irresistible for us to try to squeeze that last ounce of pure enthusiasm out of our topics!

Merten M. Hasse Prize

In 1986 an anonymous donor gave the MAA funds sufficient to support a prize honoring inspiring and dedicated teachers. The prize was to be named after Merten M. Hasse, who was a former teacher of the donor, and who exemplified these qualities of a fine teacher. The prize is designed to be an encouragement to younger mathematicians to take up the challenge of exposition and communication. The Merten M. Hasse Prize is for a noteworthy expository paper appearing in an Association publication, at least one of whose authors is a younger mathematician.

Andrew Bashelor, Amy Ksir, and Will Traves

"Enumerative Algebraic Geometry of Conics," ***The American Mathematical Monthly*, vol. 115, no. 8, October 2008, pp. 701–728.**

Inspired by Mr. Bashelor's undergraduate project on Steiner's problem, the authors have written a wonderfully clear paper that concretely introduces deep concepts in algebraic geometry using conic enumeration problems. The paper gradually introduces ever deeper results and tools. The authors consider the general problem of how many conics pass through a given set of points, and are tangent to a given set of lines and conics, beginning with how many conics pass through 5 points and gradually building to Steiner's problem of how many conics are tangent to 5 given conics. They deftly use accessible examples to motivate the abstract structures, giving the reader intuition about otherwise abstruse mathematical structures such as moduli spaces (real and complex projective spaces), blowing-up, duality, and cohomology. Most won't be able to read the article in one sitting, but it does a remarkable job of making deep ideas accessible to an educated, but general, mathematical audience. The authors leave the reader with problems that suggest connections to other topics, such as string theory and kissing spheres. **(See pages 11-12 for biographies and responses.)**

Henry L. Alder Award for Distinguished Teaching by a Beginning College or University Mathematics Faculty Member

The award was established in January 2003 to honor beginning college or university faculty whose teaching has been extraordinarily successful and whose effectiveness in teaching undergraduate mathematics is shown to have influence beyond their own classrooms. An awardee must have taught full time in a mathematical science in the United States or Canada for at least two, but not more than seven, years since receiving the Ph.D. Henry Alder was MAA President in 1977 and 1978 and served as MAA Secretary from 1960 to 1974.

Scott Annin

Scott Annin of California State University at Fullerton (CSUF) is cited for his passion for teaching mathematics and his inspiration of students to major in mathematics. He has received four teaching awards at CSUF including the highest campus-wide recognition. The area outside his office is said to be a hive of activity where students gather at all hours of the day and night and on weekends to study mathematics. He has directed seven students in research projects with five already resulting in publications and conference presentations. He serves as a workshop leader and coach for students preparing for competitions such as the American Mathematics Competition and the Putnam Competition. He mentors new faculty on teaching strategies. He is co-author of a textbook on differential equations and linear algebra. The MAA is pleased to recognize Scott Annin with the Henry L. Alder Award.

Biographical Note

Scott Annin received B.S. degrees in mathematics and physics with highest distinction from the University of Nebraska in 1995. He then completed his Ph.D. at the University of California, Berkeley in 2002 in the area of noncommutative ring theory. He took a faculty position at CSUF in that year, and is now an associate professor in the Mathematics Department. He received three teaching awards as a graduate student at Berkeley, and four teaching awards at CSUF, including the campus' highest teaching honor, the Carol Barnes Excellence in Teaching Award, in 2008. Dr. Annin has co-authored *Differential Equations and Linear Algebra* and is preparing a new text in the area of problem-solving. He has mentored students preparing for the Putnam Competition and has supervised a number of undergraduate research projects in algebra as well. He has also been involved in the mathematics credential program for high school teachers at CSUF, providing individual supervision for several of the program's students over the past few years.

Response from Scott Annin

When I found out I received this award, I was overwhelmed with a sense of gratitude. I realize that my professional journey has not been charted in isolation, but with the support and encouragement of many. First, I am extremely grateful to my colleagues at CSUF especially Paul de Land, who have gone out of their way to encourage me to be the best teacher I can possibly be. Good teaching is sometimes hard to recognize, and it means a lot to me that my Fullerton colleagues have cared so much about this and taken the time to help me win this award. Second, my students are the most wonderful to work with in the world. It is because of them that I arise each day with excitement, enthusiasm, and passion for my career. I cannot imagine another line of work that would make me happier than being a college professor. It is easy to excel at something when your heart is fully engaged, and luckily for me, my students have inspired me through their dedication and hard work both in and out of the classroom. To them, I say `thank you ever so much.' Last, first, and always, I must thank my parents, Arthur and

Juliann Annin, for blessing me every day of my life. No matter where I go or what I accomplish in my life, I am always aware of the nurturing influence they have had on me, as well as their deep love. This award is very special to me, and I am thankful to the MAA for this wonderful honor and recognition.

Sommer Gentry

Sommer Gentry of the United States Naval Academy has been a major contributor to the Academy's restructured mathematics major. She helped design a new introductory applied mathematics course that includes an introduction to modeling and an introduction to programming. Students have been motivated to pursue research projects with her by hearing her discuss work she has done on graph-theoretic algorithms for matching kidney donors and recipients. Students are said to be "transformed" by her sharing of mathematical insights drawn from her passions for movement, medicine, and performance. She punctuates her teaching with concrete activities that connect mathematics with seemingly (to the student) non-mathematical experiences. She has inspired colleagues to do project-based teaching. She is sought out to give presentations at other institutions and has received public acclaim in the national media, including *Time* magazine. The MAA recognizes Sommer Gentry with the 2009 Henry L. Alder Award.

Biographical Note

Sommer Gentry is assistant professor of mathematics at the United States Naval Academy and is also affiliated with the Johns Hopkins University School of Medicine. She studied operations research at Stanford University and MIT. She was a Department of Energy Computational Science Graduate Fellow from 2001-2005, and won last year's CSGF contest for excellence in technical writing that conveys computational science to a lay audience. She designed optimization methods used for nationwide kidney paired donation registries in both the US and Canada. Her work has attracted the attention of major media outlets including *Time* magazine, *Reader's Digest*, *Science*, and the *Diane Rehm Show*.

Response from Sommer Gentry

I join many other passionate, innovative faculty members in thanking the Mathematical Association of America for keeping a spotlight on what is crucial to our future: how each of us goes about teaching mathematics. By joining my Section's Project NExT, I learned that the MAA community can help us develop our teaching skills and inspire us with a wellspring of ideas. I am grateful to my department for nominating me for this award, but more, for encouraging me to explore active learning and allowing me to design my courses with a free hand. I thank Els Withers for his generous and valuable mentorship through my four years at the Naval Academy. Dorry Segev, my husband and research collaborator, has given me his unfailing support and reassurance. Without him, my partner, I might never have reached this place.

Jennifer McLoud-Mann

Jennifer McLoud-Mann of the University of Texas at Tyler is cited for creating something special for mathematics students at a university in transition. She is known as a demanding teacher who gets high praise from students. Students know she cares about them personally. She serves as a role model for all students, but especially for female mathematics majors. She has mentored many undergraduates in research. They have presented their work at conferences, and four have published their work so far. She has served as a faculty sponsor for a "wildly successful" student chapter of the MAA that has standing room only at mathematical talks and offers many social events. Colleagues credit her with fostering a new culture in the department that represents a "dramatic change for the better." She has received two teaching awards, one of which is university-wide. The MAA recognizes Jennifer McLoud-Mann with the Henry L. Alder Award.

Biographical Note

Jennifer McLoud-Mann received her B.S. from East Central University in Ada, Oklahoma and her M.S. and Ph.D. from the University of Arkansas. Upon graduation in 2002, she accepted a tenure-track position at the University of Texas at Tyler. At UT Tyler, she has contributed to building an undergraduate research environment and served as co-advisor of what has become a very active math club. She was recognized by the Texas Section of the MAA with the 2008 Faculty Award for Outstanding Contributions to Students. Outside of work, she loves spending time with her husband, Casey, and her daughter, Nyx.

Response from Jennifer McLoud-Mann

I am honored to receive an Alder Award. It is wonderful to be recognized for something that you love doing! Of course, this is not just about me. This is about the amazing mathematical community at UT Tyler. I am so fortunate to work with an enthusiastic and dedicated group of students and colleagues. I would like to thank my students, colleagues, administration, family, and friends for all the support and encouragement they have given me. Special thanks go to my husband, Casey, for not only providing love and support but also for the countless conversations we have had about mathematics.

Index of Award Recipients