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FOCUS

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Haimo Award Winners to Speak at Joint Meetings

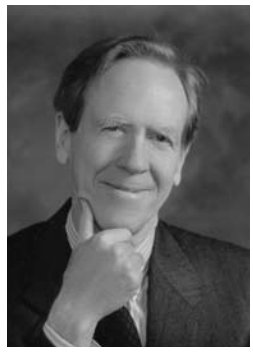
By Fernando Q. Gouvêa and the Haimo Award Committee

Four winners of the MAA's most prestigious teaching award will be speaking at the Joint Mathematics Meetings in San Diego on Tuesday, January 8, 2008 at 2:30 pm. The 2008 winners are Annalisa Crannell (Franklin & Marshall College), Kenneth I. Gross (University of Vermont), and James Allen Morrow (University of Washington). In addition, Gilbert Strang, who won the award in 2007 but was unable to speak last January, will be giving his Haimo talk.

Annalisa Crannell

Kenneth Gross

James Morrow



Gil Strang

Annalisa Crannell is known for her boundless energy and enthusiasm for all things mathematical. While still a graduate student at Brown, she was chosen to design and run the first-ever mathematics segment of Brown's "A Running Start," a summer program for gifted high school students. Arriving at Franklin & Marshall, she immediately began including writing assignments in her mathematics courses. Her goal was to teach students how to read, write, and speak mathematics. In 2004, she co-authored the MAA book, *Writing Projects for Mathematics Courses: Crushed Clowns, Cars, and Coffee to Go*, and has given talks around the country on this topic.

Crannell has also pursued the connections between mathematics and art, giving talks at a variety of levels, including high school students, MAA meetings and NASA's "Take Your Daughter to Work Day." She and her colleague Marc Frantz have developed materials and led workshops on the subject. Their book *Viewpoints: Mathematical Perspective and Fractal Geometry in Art* will be published by Princeton University Press in the near future.

Crannell's talk at the JMM is entitled "(Speaking in favor of) Redundancy, Inefficiency, Extravagance, and Waste." Her talk will give us "advice on how to spend time, how to add extraneous endeavors into our schedules, and how to follow our students and our colleagues into their numerous extra-mathematical pursuits."

Ken Gross's teaching and mentoring have had a dramatic impact on mathematics, education, and the lives of his students. As a well-known researcher in group representations and harmonic analysis, Gross has published over 1000 pages of research in refereed journals. For his expository writing, he received both the Lester R. Ford Award and the Chauvenet Prize from the MAA. His main focus now is the mathematical preparation of teachers.

In 1999, Gross founded the Vermont Mathematics Initiative (VMI), a master's degree granting program that trains elementary and middle school teachers to serve as mathematics leaders in their schools and districts. To date, over 200 teachers have participated in the program. Other programs modeled on VMI and utilizing VMI-designed materials have sprung up in Arkansas, Massachusetts, Nebraska, and New Mexico. Recently, the Intel Corporation tapped Gross to develop a program based on VMI, which Intel plans to scale up nationally.

Gross is currently Professor of Mathematics and Education at the University of Vermont, where he has received that institution's highest awards for both research and teaching. He will be speaking on "Elementary School Teachers as Mathematicians: The Vermont Model for Raising Student Mathematics Achievement."

Jim Morrow has had a fundamental impact at the University of Washington and throughout the Pacific Northwest. He has run a Research Experiences for Undergraduates site there since 1988, focusing on inverse problems in tomography. Eight of the students who participated in this REU have gone on to receive NSF graduate fellowships. Many of them have had substantial success in this and other fields of mathematics.

For the past six years, Morrow has also been preparing students for the Mathematical Contest in Modeling (MCM). His students have an enviable record of success, with seven teams that he has coached receiving the Outstanding Winner Award, and five of those seven winning additional awards from MAA, INFORMS, and SIAM. Since 1994, Morrow has organized a Mathday at UW, bringing 1200 high schoolers from the Northwest to the campus. It is an opportunity to showcase the relevance of mathematics to a variety of disciplines. In addition, he is the co-director of the Summer Institute for Mathematics at the University of Washington. This program brings 24 high schoolers from the US and Canada to campus for six weeks in the summer.

Morrow will speak on "Motivation in

Mathematics and Undergraduate Research." He will give a brief introduction to inverse problems for electrical networks, a topic that is "well-suited for introducing students to mathematical research and motivating them to study mathematics."

Gil Strang, who received one of the 2007 Haimo awards, will be giving his Haimo presentation this January because of other commitments last year. Strang, who teaches at MIT, is well-known for his books, his innovative use of video and the Internet, and as a great teacher in general. His talk is entitled "Everyone Can Teach Applications." Among other things, Strang will highlight the importance of second differences as replacements for the second derivative in both linear algebra and differential equations.

The MAA first instituted Awards for Distinguished College or University Teaching of Mathematics in 1991; in 1993, the MAA Board of Governors renamed the award to honor Deborah and Franklin Tepper Haimo. Each year up to three college or university teachers are honored with this national award. Typically all are recent recipients of MAA section teaching awards (see the August/September issue of FOCUS), but occasionally one of the winners may be selected from another source. The goal of the award is "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." For more information about the Haimo Awards, including insstructions on nomination and a list of past winners, visit http://www.maa.org/awards/haimo.html.

MAA's "Math in the News" Spans the Globe

By Harry Waldman

Since August 2006, the MAA's website has presented a one-of-a-kind feature, "Math in the News," that highlights the ubiquity of mathematics. "Math in the News" offers succinct, timely accounts of newsworthy people, research, discoveries, awards, policy matters, and amusements — with mathematics as a central element in each one. The ubiquity of these stories supports the hypothesis that mathematics is everywhere.

The news also serves as a springboard to wide-ranging material in a surprisingly rich world of information. Each "Math in the News" story contains links to sources and further information. The range of sources for the nearly 200 "Math in the News" items that have already appeared on maa.org is just as deep: universities on five continents, numerous newspapers, government agencies, radio and TV reports, books, science publications, scientific and technology organizations and groups, news releases and public relations notices, websites, and individuals. To see for yourself, check out each day's story on http://www.maa.org or browse the archive at http://www.maa.org/mathdl/minarchive.html.

Past "Math in the News" Columns

Mathematical Model Says Ideal Baseball Season Requires Additional 100 Games
—August 21, 2007

Explaining Plant Configurations Mathematically
—August 23, 2007

Detecting the Abrupt Formation of Ordered Patterns
—August 24, 2007

More U.S. High School Students Taking More Advanced Math Courses
—August 28, 2007

NSF's Science Board Announces Two-Part Plan for STEM Education
—August 29, 2007

Modeling a Nasty Bacterial Outbreak
—September 3, 2007

2007 SAT Math Scores Lowest Since the 1970s
—September 4, 2007

16-Year-Old Math Whiz Devises Encryption Method
—September 5, 2007

Nine-Year-Old Prodigy Finds College Math a Little Too Easy
—September 17, 2007

Conference on Mathematics' Role in Counterterrorism
—September 18, 2007

Innumeracy Is Costing Canada Billions
—September 24, 2007

Algorithm Can Trace Ancestry from a Single DNA Sample
—October 2, 2007

Math in the Art of Braided Hairstyles
—October 5, 2007

Giving a Cork a Mathematical Twist
—October 9, 2007

Hand-Held Calculator Reaches Age 40
—October 12, 2007

http://www.maa.org/mathdl/minarchive.html.

Mathematics Education in and for Work: An ICME Topic Study Group, Mexico 2008

By Susan Forman

The 11th International Congress of Mathematics Education, ICME 11, will be held in Monterrey, Mexico, on July 6–13, 2008. As always several "Topic Study Groups" will work in conjunction with the Congress. Topic Study Group 9 will discuss "Mathematics Education in and for Work." The study group will focus on two issues which, although intimately related, we will consider separately (to start with!). First, what mathematics exists in work? (Alternatively: How do people use mathematics and mathematical thinking in their work?) This question has many sub-questions including: What are the methodological difficulties of identifying mathematics in work? How can we characterize mathematics in work, when it typically looks so very different from the mathematics that is taught in schools and universities? How explicit are the requirements for mathematics for work, and how do they vary across work contexts? How do employers determine whether or not prospective employees have the mathematical skills required for a specific position? How does the mathematics required in work relate to the nature of the workplace, its demographics?

The second issue focuses on mathematics for work. That is, what mathematics should be taught in order to prepare individuals and communities for work? Again, numerous sub-questions arise, including: Who needs what kinds of mathematics in workplaces? Who is or should be responsible for teaching mathematics for work? What is the relation between current mathematical content, as taught in schools and colleges, and the mathematics required for work? What teaching/learning strategies should be incorporated into mathematics classes to prepare future workers for the ways in which they will be expected to function in the workplace (this might include group work and developing skills needed to find and use resources in workplace-related problem solving)?

We would like our sessions to be open, inclusive, and productive. In order to achieve this, we now call upon potential contributors to let us have an abstract of their proposal of no more than one page. This might be a potential paper, a "position statement," an outline of a current or completed research project or simply a provocative comment on one or both of the themes (or a related theme). The closing date for abstracts is December 1, 2007. Please send your proposal to Richard Noss (r.noss@ioe.ac.uk) and Susan Forman (sforman2@nyc.rr.com) using the format specified on the ICME-11 website at http://tsg.icme11.org/tsg/show/10#inner-27.

Distinguished Teaching Award Winners

Southwestern Section

Glenn Hurlbert
Arizona State University

Illinois Section

Dennis Schneider
Knox College

"On Being a Mathematical Citizen"—Addendum

In our October issue, we neglected to point out that Lynn A. Steen's article "On Being a Mathematical Citizen" was an excerpt from his Leitzel Lecture given at MathFest, which explains the placement of the article in the MathFest section of our October issue. The full text of the lecture, with extensive references and links, can be found online at http://www.stolaf.edu/people/steen/Papers/leitzel.html.

We apologize to Lynn and to our readers for the mistake.

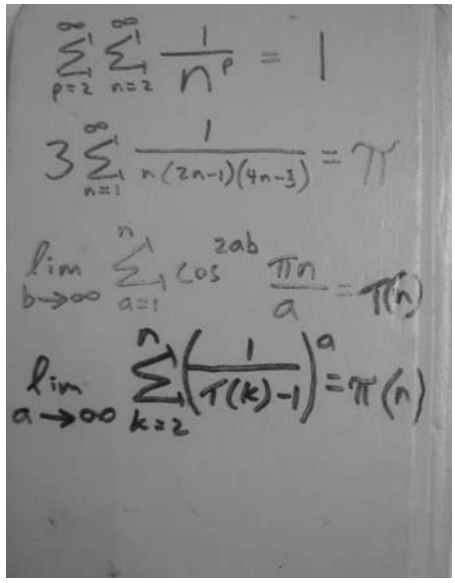
An Interview with Robert Schneider

By Colm Mulcahy

Robert Schneider is the main singer, guitarist and songwriter for the pop band The Apples in Stereo, which he founded fifteen years ago. He is also an extremely keen and enthusiastic amateur mathematician. In fact, he always travels with a highly treasured red notebook, on the cover of which he inscribes his favorite discoveries. Schneider attended MathFest in San Jose, and is expected at the Joint Math Meetings in San Diego, both at the invitation of the MAA. He hopes to do a student poster presentation of some of his mathematical findings in San Diego.

A well-thumbed copy of Bill Dunham's book on Euler rests on Schneider's guitar case.

Schneider performing at MathFest.



Treasured discoveries on the cover of the little red notebook.

Spelman College's Colm Mulcahy met Schneider in San Jose, and has been corresponding with him about mathematics (and music) ever since. He recently put some questions to the itinerant musician and fan of 18th-century mathematics.

You're a professional touring and recording musician, as well as a record producer, with an extensive catalogue of releases going back 15 years. What brings you to mathematics at this stage of your life?

I am attracted mostly to the potential for exploration in mathematics. There are an endless number of relationships that exist between such entities as whole numbers, for instance, or exponents, the properties of which are familiar even to children. Yet with these simple properties in hand, by asking interesting questions or making creative assumptions and seeing where they lead, you are almost certain to wind up in a neighborhood you have not seen before. I am mostly self-taught, which can be a slow process as you are constantly discovering things that are well-known to others — but you get to know those things very well, and have the feeling that they are your own. Reading in the histories of mathematics and physics comprises most of my education, so my mathematical skills and interests have evolved roughly along historical lines.

In the last few years, between tours and usually behind my manager's back (he would kill me if he knew how much time I spend studying mathematics, versus musical tasks), I have been taking calculus and physics classes at the university and also the community college in Lexington, Kentucky, where I live. I plan to take Calculus III next semester, after the touring for the new Apples album slows down, and I am slowly working toward a degree in mathematics.

Over the last year I have been meeting with a brilliant professor at the University of Kentucky, Dr. David Leep, who gives me occasional lessons and critiques my work on infinite series and number theory and other topics. He is very intense about mathematics, and has a keen eye for finding elegant proofs, and very quickly. He told me half-jokingly that his goal is to bring me from the eighteenth century, into the nineteenth — I am almost there. Thanks to Dr. Leep's guidance my math skills have improved by powers of two in the last year. I would say that in general, my work has a heuristic bent, and I get a lot of satisfaction from creative leaps when they produce solid results. But I am very concerned with considerations of rigor, and strive constantly to improve in this respect.

In addition to teaching me topics he thinks I need to know, or that I have questions about, Dr. Leep challenges me to produce proofs on the spot of things that seem obvious to me, and also of things that I have not worked through fully, which is intimidating but also extremely good for me, in terms of improving the rigor of my arguments.

Having a brilliant mathematician guiding me through a tangle of concepts which might otherwise seem impenetrable, is an amazing way to learn — especially as he usually has a feeling about which path to take, if not exactly where it will end up. It is a wonderful and very kind thing for Dr. Leep to do, to see my great need to learn even when I do not have the freedom to enroll in courses due to touring and traveling, and to teach me. It has made a greater impact on my life than I can say, and I reflect on this almost every time I open my notebook.

What mathematical resources do you tap into on a regular basis?

Mostly books. My favorite book, and most often-referenced, is the *Handbook of Mathematical, Scientific, and Engineering Formulas, Table, Functions, Graphs, and Transforms* by the Staff of the Research and Education Association, which my wife Marci gave me for Christmas some years ago. It is a gigantic red book the size of a dictionary, filled with tables of physical constants and prime numbers, and summations and integrals, and the properties of planets and different sorts of materials to use in construction of various structures, and just about anything you could possibly need to know that involves equations or measurements. It is the best book ever written, filled with the most beautiful drawings and formulae. If all of modern civilization somehow collapses, due to some natural catastrophe or robot-inflicted apocalypse, I hope that this book survives for future generations to discover. Plus maybe a solar-powered scientific calculator. Another amazing book is the *Table of Integrals, Series, and Products* by I.S. Gradshteyn and I.M. Ryzhik. The title sums its contents up pretty completely, which are pretty much my favorite things in the world.

Leon Harkleroad in action at his More Mathematics and Music minicourse.

You attended MathFest in San Jose in August. How did that come about?

I have been experimenting with a musical scale I invented, based on the natural logarithm function — I call it a non-Pythagorean scale. The MAA very kindly invited me to speak at MathFest this year, about the logarithmic musical scale. Dr. Joe Gallian essentially prompted me with questions about the logarithmic scale, and other mathematical and musical issues. I was on tour in Europe when the invitation came — it was very exciting for me, and I was super nervous in the weeks leading up to the conference.

Dr. Gallian is a huge music fan, and especially is an expert on the Beatles, who are my favorite band, just behind the Beach Boys. So we had a lot in common, as far as our musical interests go, and he is very hip and put me at ease. He also showed me an amazing proof about group theory, very very interesting, incorporating mapping and M.C. Escher, and culminating in the final piano chord of Sgt. Pepper's Lonely Hearts Club Band playing on his laptop — a creative juxtaposition of elements which fascinate me.

How was your experience at MathFest?

MathFest was such a great experience for me. Prior to going to San Jose, I had only met a couple of mathematicians in my life, including Dr. Leep. Seeing people all around writing in notebooks and quoting equations in casual conversation was really exciting. I went to lectures every hour of every day, and learned so many cool things, and met the most amazing people.

Euler is my mathematical hero, so it was very exciting that it is the 300th anniversary of his birth, and the conference was partially a celebration of this amazing man's work. I attended most of the Euler Society meetings, and read Euler in Latin, and I have to say the Euler contingent was an exotic group of geniuses, who made me feel very welcome. They were an extremely sociable and intensely brilliant bunch. I met my favorite author, Dr. Bill Dunham, and he autographed my extremely tattered copy of his book *Euler, Master of Us All* (published by the MAA), from which I learned almost all my mathematics, prior to my taking calculus.

The movie version of *Flatland* was great, and I obtained a DVD copy, which I have watched many times with my six-year-old son Max. He has memorized most of the lines and we often play out scenes involving Line-land or the Fourth Dimension. I benefited from a lot of one-on-one lessons, and Dr. Robert Vallin granted me many enlightening chats.

I attended a minicourse by Dr. Leon Harkleroad, who wrote another of my favorite books *The Math Behind the Music*, also published by the MAA — which I was very pleased to find out, when I walked into the course with his book in my hand, not even knowing he was the instructor! His course was fun, and I learned about group theory and constructed a stringed instrument, and found Dr. Harkleroad to be very interesting and creative, as well as an expert

in the field. I told my friends when I returned that it was like summer camp at Disneyland.

What are your specific interests in mathematics?

I am mostly interested in analysis and number theory. I love infinite series and prime numbers, and spend many hours a day contemplating these beautiful objects. I have summed dozens and dozens of series, and love taking seemingly unrelated series and combining them, to see what sums may result. There are few feelings that compare to the sense of wonder I get when after a convoluted sequence of manipulations, all the messy terms cancel out and the series boils down to something like $\pi/3$. I have written quite a few essays for Dr. Leep about the distribution of prime numbers among the integers, and the prime number theorem, and proving various summations and other things — which is a wonderful creative activity, and I am always very grateful for his critical comments.

Robert Schneider with his wife Marci at the MathFest Opening Banquet.

Lately I have been reading Gauss and Riemann, which feels like listening to jazz — I am not always sure what is going on, but I like it, and it gives me a lot of ideas. Also I am really into physics, especially mechanics, special relativity, and classical gravitation. I love Einstein, and learned a great deal of mathematics reading his books and papers. I love Descartes, and have been reading his writings on math and physics for the last year — he is an inspiring writer, and conceived in broad terms of surprisingly large portions of modern science and mathematics. He should be required reading for all young mathematicians — this idealistic man, dreaming of equations to represent everything.

Do you have plans for formal study in mathematics some day?

I am 36 now. My goal is to have completed my bachelor's degree in mathematics by the age of 40 (or sooner), which seems realistic with my work schedule. I have completed three years of university as a philosophy major, so I have a lot of math classes to take. I want to pursue a PhD in mathematics, and would love to spend my days in research, and talking and dreaming about nothing but mathematics.

What brought you to mathematics in the first place?

When I was young, in high school and university, I immersed myself in philosophy. I am especially enamored of ancient Chinese philosophy and poetry — I studied Chinese in college and started writing poems with my first vocabulary words. When I was 21, I used to tell my friends that I believed Chinese and mathematics were the two most poetic languages, best-suited to expressing universal truths, and that one day I would learn to write poetry in both languages. I still pretty much think this is true. Mathematics is a poetry that transcends language, and is true anywhere, in any cultural context or physical location, even if there is nobody to read it, at the bottom of the ocean or inside a black hole.

Colm Mulcahy (colm@spelman.edu) *has been in the department of mathematics at Spelman College since 1988. He writes a bi-monthly column on mathematical card tricks for MAA Online, called, appropriately enough,* Card Colm. *Along with colleague Jeff Ehme, he's giving an MAA minicourse on cryptography at the Joint Mathematics Meeting in San Diego.*

Mobilizing Minds at the Smithsonian

On October 4, 1957, fifty years ago this year, the Soviet Union launched Sputnik, the first artificial satellite to orbit the earth. This remarkable technical achievement, combined with a burgeoning school age population, catalyzed reform in mathematics and science teaching in the United States. The Smithsonian's National Museum of American History has prepared a new online exhibit, *Mobilizing Minds: Teaching Math and Science in the Age of Sputnik*. It presents a few objects from the time of Sputnik, as well as books and apparatus associated with contemporary reform in U.S. physics, astronomy, biology, chemistry, and mathematics teaching. Objects described range from flash cards and Cuisenaire rods for young children to programmed textbooks and overhead projectors. The exhibit can be found at http://americanhistory.si.edu/mobilizing. It was put together by Peggy Kidwell, Curator of Mathematics at the National Museum of American History. The electronic exhibit will be up indefinitely. There are also plans to have a small physical exhibit at the museum sometime in the fall 2008.

Sherry Gong's Striking Success

By Ryan Miller

Sherry Gong stands out in a number of ways. Of the six members of the U.S. International Mathematical Olympiad (IMO) team, she was the only female. And, among the 536 participants in this year's IMO, held in July in Hanoi, Vietnam, she finished in a tie for seventh place, earning a gold medal and the distinction of being one of the best young mathematicians in the world. Top that off with a tie for first place in the China Mathematical Olympiad for Girls, which took place in August, and you've got a young woman whose mathematical talent is creating quite a stir as she makes the transition from high school to college.

"I like math because it is beautiful," Gong says. "There are parts of it that are dainty and elegant, like a quick solution. There are also parts in which you create something incredibly powerful, and then you get to use it."

Gong's list of accomplishments in mathematics and physics competitions is enviable. Besides this year's gold medal, Gong earned a silver medal in the 2005 International Mathematical Olympiad in Mexico and in the 2006 International Physics Olympiad in Singapore. She has also excelled in geography bees, placing 12th nationally in 2002.

To Gong, these competitions seem a dream. "They are places where someone might be with peers who are a lot like themselves — peers who share his or her interests, fears, and hopes," Gong says. "When I was in eighth grade… a mathematical olympiad program changed my entire [perspective] on life. It opened my eyes to another way of life."

Born on Long Island, N.Y., Gong has lived in both Canada and Puerto Rico. She completed her high school education at Phillips Exeter Academy in New Hampshire and has now just started classes at Harvard University.

Between school and all her mathematical endeavors, Gong doesn't have a great deal of time to relax. "I mostly chat with friends, go out for a walk… or do math or physics," Gong says. Her mother, Liangqing Li, notes that her daughter is always willing to help her classmates with physics and math questions. And, like lots of other kids, she enjoys Harry Potter and The Lord of the Rings.

Sherry Gong at the USAMO Award Ceremonies. Photo by Robert Allen Strawn.

Some people say that it's Gong's desire to be always surrounded by mathematics that makes her so successful. "Sherry loves math and is constantly curious to learn more, and this is very important to her success," Melanie Matchett Wood says. A graduate student at Princeton University, Wood was one of Gong's coaches at this year's China Girls Math Olympiad. Steve Dunbar, MAA's Director of Competitions, has seen Gong in action at the IMO. "The word I would use is 'consistency,'" Dunbar says. "She was always consistent. Some of the other top students could have up days and down days, but I could always expect Sherry to perform at the top level consistently. That shows a lot of internal discipline."

Her mathematical influences include not only her parents, both accomplished mathematicians, but also some very familiar names. "Archimedes was way ahead of his time and provided foundations for many areas," Gong says. Her list also includes Leonhard Euler, "because he did great things in so many subjects," along with Carl Friedrich Gauss and Augustin-Louis Cauchy.

When it comes to being a successful woman in mathematical competitions, Gong will tell you that it isn't much of an issue. "One notices, of course, when one is the only girl, but gender isn't an issue that comes up too often, except for an argument, once in a while, over the proper way to phrase Hall's Marriage Lemma," Gong jokes. Gong does occasionally hear disparaging remarks, but that just drives her to work harder.

Before she became a coach, Wood was the first girl to earn a spot on a U.S. team to the IMO, so she knows what Gong is going through. "Being a woman doing math competitions does bring along extra pressure," Wood says, "but everyone handles that pressure in their own way."

"One problem is that there are so few women doing math competitions at a very high level that women as a whole are often judged based on a few examples, which can put a lot of pressure on those 'examples'," Wood adds. "Of course, representing the U.S. on an international level puts a lot of pressure on anyone, so sometimes the pressure from being a woman gets lost in the mix."

Annual Student Paper Contest in the History of Mathematics

The History of Mathematics Special Interest Group of the MAA (HOM SIGMAA) is pleased to announce its 2008 undergraduate writing contest. Information about this year's contest and results of the 2007 contest can be found at http://www.maa.org/sigmaa/hom For more information, please contact Amy Shell-Gellasch at shellgae@plu.edu.

At the China Girls Math Olympiad

By Alison Miller

The China Girls Math Olympiad (CGMO) is a competition for high school girls that was started in China in 2001 in the hope of encouraging more girls to excel in mathematics and compete on the International Math Olympiad team. It began as a regional competition, but after a few years the organizers decided to invite teams from other countries. For the first time this year, the United States was able to take the CGMO up on its invitation.

The team at the closing ceremony. Back row: Zuming Feng, Alison Miller, Marianna Mao, Sherry Gong, Colleen Lee, Melanie Matchett Wood. Front row: Wendy Hou, Jenny Iglesias, Wendy Mu, Sway Chen, Patricia Li.

We selected 8 talented high-school girls based on their performance on the previous USA Math Olympiad: Sway Chen, Sherry Gong, Wendy Hou, Jennifer Iglesias, Colleen Lee, Patricia Li, Marianna Mao, and Wendy Mu. They were accompanied by three coaches: Zuming Feng, Melanie Matchett Wood, and myself.

The girls attended the AwesomeMath summer program in Dallas, Texas to train for the Olympiad. AwesomeMath is structured so that each student gets an in-depth look at two areas of mathematics. Every morning and every afternoon, the students attended an hour-and-a-half lecture followed by an equally long session in which they work on related problems under the supervision of the mentors. The girls studied geometry and algebraic inequalities, the two topics that Zuming Feng considered to be most useful for the CGMO. I shared a furnished apartment with most of the girls, and helped them in the evening with their questions about the material. The girls also had a lot of fun: They got exercise running, swimming, and playing Dance Dance Revolution, relaxed by playing card games, reading Harry Potter, and singing, as well as going on AwesomeMath's organized field trips to Adventure Landing and Six Flags.

After arriving in Beijing we spent the next few days seeing the sights, eating a lot of good food, playing games and singing on the tour bus. Beijing wasn't like any U.S. city we'd seen. One pedestrian bridge was decorated with mathematical equations on its side! We climbed the Great Wall, went to Tiananmen Square and the Forbidden City. We then had a long day visiting the Summer Palace and the Temple of Heaven, after which we boarded a sleeping-car train for Wuhan, where the competition was held.

The opening ceremony was a parade of the teams. As one of the few international teams, our girls walked near the end of the procession, carrying a sign bearing the Chinese Characters for "United States." The speeches were all in Chinese, but were accompanied by a PowerPoint summary in English. In the afternoon, the girls attended the first of three aerobic dance sessions that were held in parallel with the competition. An aerobic dance instructor led all the students through the moves of a dance that they would have to perform in a dance competition two days later.

The next two days were the competition. Each day, the girls had four hours to work on four problems. The problems turned out to be harder than everyone had expected, and the organizing committee decided to grade generously. After each day, Melanie Matchett Wood and I would each look over the problems, make independent assessments of how much credit they were worth, and share our consensus with Zuming Feng, who would consult with the organizing committee when the partial credit was unclear.

Meanwhile, the girls participated in the final dance competition. Although they were somewhat intimidated by the polished performance of some of the other teams, which were more serious about practicing in areas without air conditioning, they still managed to win the second prize in the dance competition. The following day, while the organizers finished grading, all the students were taken to see the scenic parts of Wuhan. At one of the parks, there was a shack where you could pay to be put inside a giant inflatable bubble on the lake. (See the photo on the cover).

The girls would try to stand up inside the bubble, but it would not be long until they would lose their balance, and the bubble would roll over with a splash — much fun both for the girl floundering about in the bubble and the rest of us watching her!

When we got back, we found that the organizers didn't have final results yet. First they needed the Russian team leaders, who had also been on the expedition, to explain some of their team's combinatorics solutions that the Chinese organizers were unable to read, and

then they stayed up late into the night figuring out how to deal with a large tie near the medal cutoffs. The girls only found out how they did the morning of the awards ceremony.

At the closing ceremony Sherry Gong was given a gold medal (she tied for the top score at the competition), Wendy Hou received a silver medal, and Patricia Li, Marianna Mao, and Wendy Mu got bronze. We were all very proud and happy, but we had to leave directly from the closing ceremony to catch a flight to Xi'an, where we would be doing more sight-seeing.

We were all slightly weary of touring by then, but our time in Xi'an was both historic and exciting. We went to see the Garden of Stone Carvings, which featured engravings of classical Chinese texts, and the terracotta soldiers, but the most memorable parts of our tour were when a few brave girls among us decided to take the ride across the canyon suspended by metal cables, and our bike ride around the Xi'an city wall.

We returned to Beijing, where we were entertained by an acrobatics show that featured amazing feats of flexibility and balance, culminating in a finale where eleven acrobats balanced themselves on a single bicycle. Our last full day in China was a free day that we mostly spent shopping for souvenirs — some of the girls who spoke Chinese became quite practiced at haggling over items at the local market.

Although we were eager to return to the US after so long, the girls knew they would all miss each other. All in all, it was an amazing experience for everyone, and I believe it has encouraged the girls to pursue mathematics further.

The US Girls Math Olympiad team is sponsored by the MAA, the Mathematical Sciences Research Institute, IBM Almaden Research Center, the Akamai Foundation, the Shing-Shen Chern Foundation for Mathematical Research, and the Sunlin and Priscilla Chou Foundation. The team has a website, with the competition problems and a blog, at http://msri.org/specials/gmo.

Alison Miller was one of the coaches of the US team at the Girls Olympiad. Alison was the first U.S. woman to win a gold medal in the IMO. Now a student at Harvard, she has won the Elizabeth Putnam Prize in 2005 and 2006 (top 15 both times). She also finished third in the US National Spelling Bee.

EDGE: Enhancing Diversity in Graduate Education

In 1998, Bryn Mawr and Spelman College launched the EDGE program, with the goal of encouraging women to complete graduate degrees in the mathematical sciences, with particular attention to women from under-represented minority groups. The program is still going strong, and the 2008 EDGE Summer Program will be held at Pomona College in Claremont, CA, on June 5 to July 2, 2008. The program offers courses in analysis and algebra, a topical mini-course, guest lectures, and mentoring. Opportunities for networking and follow-up mentoring during the academic year are also available.

Applicants must be women who have applied to graduate programs in the mathematical sciences (to start in the Fall of 2008). All applicants should have completed standard undergraduate courses in analysis and abstract algebra and should plan to work towards a PhD. Participants are provided funding for travel, room and board, a stipend, and a small research fund. The deadline for applications is March 3, 2008. Visit http://www.edgeforwomen.org for more information on the application process.

The University of Northern Colorado Mathematics Contest: Learning – Growing – Bonding

By Richard Grassl

Each fall about 2000 eager 7th–12th grade students in Colorado gather at their respective schools in anticipation of matching mathematical wits with their peers. They hope to make the top 10%, and then the top 25 individually. For the past 15 years the School of Mathematical Sciences at the University of Northern Colorado has sponsored a mathematics competition designed to offer a unique opportunity to mathematically talented students by developing, deepening, and extending their experiences in mathematics. Inspired by similar competitions at Stanford, Santa Clara, and the University of New Mexico, this UNC competition can trace its philosophical roots back to the Hungarian Eötvös competitions held between 1894 and1905.

Nationally, there are many varied and successful competitions that address the needs of a wide variety of talented students, offering vehicles through which these students can continue to develop problem-solving skills and to explore new and challenging regions of mathematics. Equally important, at such competitions mathematically gifted students can find a friendly playing field on which to engage socially as well as competitively and where their special abilities can shine through these new bonded friendships. The UNC competition is dedicated to serving the needs of these students.

The Goals of the Contest

Consistent with its predecessors, the UNC contest has the following five goals: to offer a unique educational challenge to all secondary students; to recognize and reward talented students for their extraordinary achievements; to provide an opportunity for university faculty to cooperatively engage in an educational endeavor involving secondary school teachers, parents, and students; to draw attention to fundamental mathematical themes in the secondary curriculum; and to provide a meaningful student forum for discussing ideas about mathematics.

What makes this contest different? All students in grades 7–12 in the state of Colorado are eligible; there is no prescreening. All students take the same exam. The contest consists of a fall and a spring round, each with about 10 essay-type questions; calculators are allowed. The first round is graded jointly by secondary teachers and UNC faculty. The problems are paired — a theme is introduced in the first round and is then further developed in the final round. Finally, a solutions seminar for teachers and parents is conducted while the contest is underway.

The MAA-sponsored AMC has been successful for many decades in attracting a broad range of budding mathematicians to strive for the AIME level, and ultimately to USAMO and beyond. In contrast to the statewide UNC exam, the AMC is multiple choice (allowing for very efficient grading), is shorter in duration, is grade specific, involves little coaching, and encourages a special type of point strategy. These are, however, not competing but rather mutually supportive events. Many UNC winners are successful at MathCounts, advance to AIME and a few to USAMO. Each strives to provide winners with a good dose of recognition.

The Nature of the Competition

This contest is designed as an "extended" year-round learning experience. The first round consists of 10 or 11 open-ended questions designed to mildly challenge and to create intrigue. This round is mailed out to all secondary schools in the state. This serves one of our long term goals: to nurture a collaborative attitude with the secondary mathematics teachers. Solution sheets are returned to UNC, where a team of UNC faculty, secondary teachers, and graduate students conduct a grading session. One of the most valuable aspects of the contest occurs during this session. Discussions about various answers, solutions, and the questions themselves often lead to deeper understanding of the secondary curriculum, expectations, goals of certain high school programs, how to deal with the gifted, etc. A representative number of students from each of the grades 7 through 12 are invited to the final round. The top 25 winners are then invited along with parents and teachers to the awards banquet.

One intent of the first round is to encourage a very broad range of students to believe that they can be successful in their attempts at solving nonroutine problems. Problems are selected so that a talented 7th or 8th grade participant can readily compete on an equal basis with an 11th or 12th grader. Typically four or five of the first round problems foreshadow a tougher, more challenging version on the final round. Between the first and final rounds, students collaborate with one another and with their teachers, often sharing their thoughts on websites, in an effort to deepen their understanding of underlying topics that could be generalized or built upon later. This particular aspect rewards planning and aggressiveness.

The final round is conducted during a Saturday session on campus while a solutions seminar is conducted simultaneously at a nearby site. We observed many years ago that parents and teachers were often reluctant to discuss the problems with their child or student, fearing that they would expose their own inadequacies or inexperience with mathematics.

The solutions seminar partially solved this confidence issue. Together with the moderator, parents and teachers worked on the exam questions and derived (sometimes jointly) solutions that were presented to all. At the conclusion of this session, all were empowered to engage with the students as the competition concluded.

Be Tenacious and Creative

Many problems in mathematics have a variety of solutions. Through our solutions seminar and correspondence with teachers and students, we encourage the search for nice, creative solutions.

Consider the following question: How many positive integers have their digits in strictly increasing order? Of the many possible solutions, one of the winners zeroed in on the following very succinct and beautiful solution: Since any subset of {1,2,3,4,5,6,7,8,9} except the empty set will correspond to an "increasing" integer, the answer is $2^9 - 1$. Attacking problems like this with a calculator-like approach simply ruins the day. Our admonition to be creative echoes what Albert Einstein once implied. *We all have a brain. It's what we do with it that matters.*

Some Data

Participation in the contest has grown from 140 students in 1992 to about 2400 recently. The number of schools supporting participation has increased from the initial six to over 75. Of the top 25 winners each year, 18% were women. In 2007, for the first time in the 15-year history, a female participant achieved first place. Forty percent of those who placed in the top 10 were students from grades 8, 9, and 10. And, a somewhat surprising result, 38% of the time first place was achieved by a student in either the 8th, 9th, or 10th grade.

Winners have, with great consistency and few exceptions, gone on to distinguish themselves academically at the very highest levels. A recent query to parents, teachers, and the winners themselves produced the following information. Winners have matriculated at institutions such as Rice, UT Austin, Stanford, MIT, Cornell, U of Michigan, Harvard, Columbia, U of Wisconsin, and CU Boulder. Their majors and PhD programs include mathematics, mechanical, electrical, chemical, and aerospace engineering. Several have completed medical school or law school.

As one student reported, "The contest at UNC… had a profound effect on my academic career. Good contest problems involve looking beyond the surface appearance of patterns in order to find a deeper understanding. This outlook has helped me approach many problems in a variety of fields from a unique perspective."

Richard Grassl is Professor of Mathematics at the University of Northern Colorado. He can be reached at Richard.Grassl@unco.edu.

Sample Paired Problems from the UNC Competition

First round:

The odd number 7 can be expressed as $16 - 9 = 4^2 - 3^2$, a difference of two squares. Express each of 17 and 83 as the difference of two squares.

Final round:

(a) Demonstrate that every odd number $2n + 1$ can be expressed as a difference of two squares.

(b) Demonstrate which *even* numbers can be expressed as a difference of two squares.

First round:

The three sides of a triangle have integer lengths *a, b,* and *c* satisfying the inequality $a \le b \le c$. How many noncongruent triangles are there for $c = 10$?

Final round:

Determine a formula for the number of noncongruent triangles for general *c*, and explain your reasoning.

First round:

In the number spiral, give the next *three* numbers to the right of 11, 2, 1, 6, 19.

13	14	15	16	17
12	3	4	5	18
11	2	1	6	19 □ □ □
10	9	8	7	20
		⋯	22	21

Final round:

In the number spiral, give with proof a general formula for the numbers in the sequence, 1, 6, 19,… that appear as part of row three as shown.

The Harvard College Mathematics Review

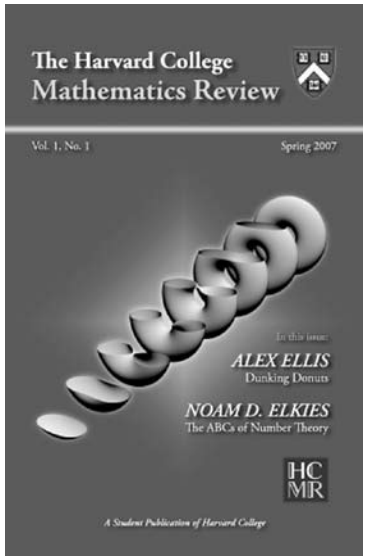
By Scott Kominers, Menyoung Lee, and Zachary Abel

An expository journal edited by undergraduates, *The Harvard College Mathematics Review* (hereafter, *The HCMR*) publishes articles presenting high-level mathematical concepts at the undergraduate level. *The HCMR's* primary purpose is to make mathematics accessible to a general undergraduate audience. Additionally, through the process of authoring and editing articles, students involved in *The HCMR* hone their skills in mathematical presentation.

The HCMR solicits submissions of student-written expository articles in all fields of theoretical and applied mathematics. Submissions from students at any domestic or international institutions, including secondary schools, are welcome. *The HCMR* also publishes short "feature" articles on topics of mathematical interest and original problems proposed by readers. In addition, *The HCMR* hopes to publish one expository "faculty feature article" each issue and seeks such articles from mathematics faculty worldwide. Submissions are reviewed entirely by students. This ensures that all *HCMR* content is readable at the undergraduate level.

The HCMR is widely distributed both in print and electronic form. In keeping with *The HCMR's* mission of reaching students, the online edition is freely available (at http://www.hcs.harvard.edu/hcmr) and subscriptions to the print edition are inexpensive, costing $10 for students, $15 for other individuals, and $30 for institutions.

The first issue contained five student-authored articles on a wide range of topics: a chocolate-covered introduction to Morse Theory; an exploration and proof of Dirichlet's Prime Number Theorem; examples from the theory of Quivers; a fitness-based network model; and a discussion of a polynomial root-approximation method. One article was co-authored by students at an international REU, and two of the articles gave expository accounts of student research projects.



Along with the student articles, the issue featured original proposed problems, as well as short, topical articles by students. In addition, Professor Noam D. Elkies (Harvard) contributed a faculty feature article, "The ABC's of Number Theory," addressing surprising relationships among the Pythagorean Theorem, the ABC Conjecture, and a particular problem from the William Lowell Putnam Mathematical Competition. Professor Dennis Gaitsgory (Harvard) brought the issue to a close with his account of an early, comical teaching experience.

Originally founded by Scott Kominers (Harvard '09), *The HCMR* is currently staffed by nineteen students, most of whom are Harvard undergraduates. Kominers himself serves as the Editor-in-Chief; the other authors of this article all hold editorial responsibilities, as well. In addition, Brett Harrison (Harvard '10) serves as Design Director, Charles Nathanson (Harvard '09) serves as Business Manager, and *The HCMR* is supervised by mathematician advisers Professor Benedict Gross (Harvard), Professor Peter Kronheimer (Harvard), Dr. Alon Amit (Google), and Professor Matthew Steven Carlos (Europäische Universität für Interdisziplinäre Studien).

Scott Kominers (Harvard '09) is a mathematics concentrator and ethnomusicology minor. Menyoung Lee (Harvard '10) is concentrating in mathematics and physics. Zachary Abel (Harvard '10) is concentrating in mathematics and computer science.

Authors may submit articles electronically, in .pdf, .ps, or .dvi format, to hcmr@hcs.harvard.edu, or in hard copy to:

The Harvard College Mathematics Review
Student Organization Center at Hilles
Box # 360
59 Shepard Street
Cambridge, MA 02138.

Problem proposers should submit problems to Problems Editor Zachary Abel, either at hcmr-problems@hcs.harvard.edu or at the address above. A complete solution or a detailed sketch of the solution should be included, if known. Solutions to previous problems should be sent to hcmr-solutions@hcs.harvard.edu or to the address above. Solutions should include the problem reference number. All correct solutions will be acknowledged in future issues and the most outstanding solutions received will be published.

The HCMR is available free online at http://www.hcs.harvard.edu/hcmr. Print subscriptions are available, at rates of $10 for students, $15 for other individuals, and $30 for institutions. Subscription inquiries should be directed to Distribution Manager Nike Sun at hcmr-subscribe@hcs.harvard.edu.

Teaching Time Savers: I Wholeheartedly Recommend Myself

By Anthony Tongen

I have found in my short career that the number of recommendation letters written is roughly proportional to the number of years at a school. So far, at least, I am hoping for more logarithmic behavior soon! While writing letters of recommendation for students is enjoyable, it can be an extremely time consuming aspect of our profession. In fact, the first in this series of teaching time savers was a helpful article by Michael Orrison on this very topic. ("A Recommendation for Recommendations," in the May 2006 issue of FOCUS) In his article, he minimized meeting time with students by making a website where students answer questions to give him insight into their goals, skills, and interests. My suggestion to you also cuts down on individual meeting time with the students, with a slight variation that makes for an interesting project.

Recollect the first letter of recommendation you wrote: How did you go about preparing it? Did you ask a colleague for a template? Did you look online or in books to find examples of recommendation letters? However you pursued your first letter, it was a learning experience in and of itself. Why not offer your students a similar learning experience while saving yourself time?

When a student asks me for a letter of recommendation, I usually respond, "Please write the rough draft of your letter of recommendation for me." My response is usually met with a furrowed brow, but I then proceed to explain that it is a great exercise to help the student analyze whether the position being applied for is a good match. I reassure the students that the actual letter of recommendation that I send will look almost nothing like their rough draft, which seems to put them at ease. The benefits of the recommendation exercise include evaluation of their research and writing ability, an idea of their self-perceived strengths, student accountability, and less of my time spent writing letters of recommendation.

The first advantage of the students' writing their own letters of recommendation is that the process gives me a glimpse into their research and writing skills. Most students do not know the first thing about writing a letter of recommendation. Therefore, this assignment makes them utilize resources for information on the topic and their letter is a mini-research assignment. I do not critique the students on their rough draft; however, if it is good, I will occasionally paste a few lines of their rough draft into my letter. Also, a writing sample from the student, which I may not have had in certain math courses, allows me to quickly evaluate the student's writing abilities.

Another positive aspect of students writing the rough draft of the recommendation is the ability to see what they view as their strengths. While students have numerous strengths, we may know only a small subset of these capabilities, due to limited interaction with them. Their letters will include their self-perceived strengths, thereby decreasing the time I spend evaluating the applicants' talents.

One of my favorite benefits of this assignment is the student accountability. For instance, if students tell me that they need me to write a letter and send it in the next two days, they also have to work quickly. If it is really close to the deadline, they may choose not to have me write the letter, thereby decreasing the length of my 'to-do yesterday' list. On the other hand, if the student writes a poor rough draft, it will impact my recommendation.

I have found this exercise to be extremely beneficial in teaching me a lot about my students, and at the same time, it saves me many hours per year. You may be wondering what I do with the rough drafts. I retain all of the applicants' letters and use them as a barometer for the students' writing and research abilities. I do not give the students any feedback on their rough drafts; I use it as an informative exercise. I would like to thank my postdoctoral advisor, Michael Tabor, who introduced me to this idea when I asked him to recommend me, although I was not as thankful at the time!

Time spent: 1 minute to ask the student for a rough draft.
Time saved: lower bound of 10 minutes per letter.

Anthony Tongen is an Assistant Professor in the Department of Mathematics and Statistics at James Madison University

Teaching Time Savers are articles designed to share easy-to-implement activities for streamlining the day-to-day tasks of faculty members everywhere. If you would like to share your favorite time savers with the readers of FOCUS, then send a separate email description of each activity to Michael Orrison at orrison@hmc.edu. Make sure to include a comment on "time spent" and "time saved" for each activity, and to include pictures and/or figures if at all possible.

Have You Moved?

The MAA makes it easy to change your address. Please inform the MAA Service Center about your change of address by using the electronic combined membership list at MAA Online http://www.maa.org) or call (800) 331-1622, fax (301) 206-9789, email: maaservice@maa.org, or mail to the MAA, PO Box 90973, Washington, DC 20090.

FOCUS on Students: The Job Talk

By Michael A. Jones and Karen Saxe

It's that time again — the academic job-market season. For those on the academic market for the first time, those reentering the market, and those serving on a college or university search committee, the job talk is crucial. It provides the best opportunity for a job candidate to showcase their mathematical knowledge and to demonstrate their teaching promise.

We have gained valuable experience interviewing for jobs, serving on search committees, and attending job talks. Because our institutions place high value on teaching, require regular research contributions, and expect faculty members to work with students outside of the classroom, the job talk is used to evaluate research potential and compatibility as well as teaching ability. As such, the job talk is more of a colloquium, in which one's own research is highlighted.

In this article, we give advice on how to give a job talk that features your research and also demonstrates your teaching skills. Not only can job candidates benefit from this advice, but members of search committees can too. Indeed, our advice may help search committee members to communicate their expectations for job talks to their candidates and to develop a rubric for evaluating talks. Some of our advice can be transferred to job talks at other types of institutions. If you find yourself on the job market or on a search committee again in the future, realize that these expectations evolve over time.

Basics

If nothing else, you should know the expected length of your talk, when during your visit it will be given, and the size of the room in which it will take place. You should also find out if that room has a whiteboard or blackboard, an overhead transparency projector, and a projector to use with your laptop. (Asking about this helps the search committee make sure the right equipment is available)

The golden rule is to make sure that you do not go over the time allocated for your talk. Try to leave a few minutes for questions. Further, have the appropriate number of slides for your talk. Skipping slides or rushing through slides to finish in a timely manner is almost as bad as not finishing on time. Remember to use fonts that are easy to read and big enough. Avoid using too many words on a slide. Practice your talk in front of peers, and solicit feedback, to ensure that these basic requirements are met. Once on campus, visit the room and make sure your laptop works with their projector or try out your overhead slides.

Audience and Content

At some schools, you will have a room with half a dozen faculty members and one or two of them may be in your subfield of mathematics. At other schools, you may be talking to thirty or forty eager undergraduates (plus the half dozen faculty members) whose only shared mathematics is linear algebra, or even calculus. In this latter scenario, the search committee may want a talk targeted at the students, or not. Find out! Think about how you might interact with your audience.

Because of the potentially diverse audience, presenting extensive details of proofs is not a productive use of time. It is better to stress the elegance and importance of the results and to sketch more complicated proofs. Remember to include examples and/or figures to motivate and to demonstrate your theoretical results. Feel free to spend the last few minutes of your talk on a more complicated aspect of your research. Of course, this should still be accessible to some faculty.

If you are hired at a predominantly teaching institution, you will have to teach a wide variety of courses. Use your job talk to demonstrate your range by touching on more than one area of mathematics (if possible) and pointing to a variety of results. If your research can be applied, then explain how. Because the job talk is used to gauge the potential for future research, indicate where the area or field is going and how you plan to contribute. If a portion of your future work lends itself to student involvement, then mention it because the search committee could be looking for your ideas about class projects and undergraduate research topics.

Media and Style

Although the current technology standard for delivering a job talk is computer-projected slides, including LaTeX's Beamer or Microsoft's PowerPoint, use media with which you are comfortable. If you use such slides, do not get too fancy — the amusing slide transition becomes old quickly. Bring a back-up copy of your slides and email a copy to yourself. Keep in mind that overly busy slides are difficult to decipher. Consider writing some content on a board to demonstrate your in-class teaching ability. Interacting in this way, as well as writing on overhead slides, engages the audience in your talk and provides a natural way to address questions and comments.

Finding your own talk style is delicate. Only by practicing and by giving many talks will you hone your style. Above all, it is best to be yourself. Since you are also trying to give an impression of what you will be like as a classroom

This is the third in a series of short articles for students. This article is a follow-up to the article that appeared in the October 2007 issue, which is also aimed at graduate students looking for jobs. The overall title for the series will be **FOCUS on Students**. Some of these articles will be for undergraduates, others for graduate students, and many for all students. These articles will also be posted in the Student section of the MAA web site.

teacher, give a realistic impression. Try to interact with the audience — especially with the students — before, during, and after your talk. Many speakers start with an anecdote about themselves or with a joke; a brief personal story or infusion of humor can be very effective but don't overdo it and only do it if you feel comfortable.

At the beginning of your talk, consider acknowledging a campus event as a way to connect to your audience. This can be done by studying the college or university's web pages, reading the school newspaper, or reading bulletin boards in the department. If possible, mention related contributions made by people at the institution. This demonstrates that you are aware of your potential colleagues' work. Plus, it is flattering!

In general, do not be self-absorbed — show the audience that you are interested in being one of their colleagues and that you care about the students. Interviewing for a job is also about determining if the institution is a good match for you. Doing your homework helps.

Other places to look

Regularly you will see articles published on how to give a job talk. We recommend that you read several, take in all of the advice, and decide what will work best for you. Remember that ideas about what makes a good talk, as well as the technology available to present your talk, change over time.

Professional organizations often have relevant information on their websites. In mathematics, the organizations to look at include the Mathematical Association of America, the American Mathematical Society, the Young Mathematician's Network, and the Society for Industrial and Applied Mathematics. You should also look at the *Chronicle for Higher Education* and do an Internet search since several mathematicians have posted advice on their personal web pages.

The job talk is the centerpiece of your campus visit. Think about the content, as well as how you deliver the content and how this reflects on you as a potential teacher and colleague. If you are unsure about the expectations for your talk, or any aspect of your visit, ask. Job-market season is an exciting and stressful time. We hope that our advice will help eliminate some of the stress associated with the job talk.

Michael A. Jones is an associate professor at Montclair State University. His mathematical interests often involve the interplay between discrete and continuous mathematics as they arise in combinatorics, game theory, and voting theory. He remembered the passage on mathematics talks from The Magic Numbers of the Professor *(see below) after reading it as a member of the Editorial Board for MAA's Spectrum Series. He is in training to be a soccer dad by chaufeuring his kids to daycare.*

Karen Saxe is professor and chair at Macalester College. Her mathematical interests include operator theory and functional analysis, game theory, and the mathematics of voting and elections. She is proud to be the recipient of the 2007 Teaching Award of the North Central Section MAA. She enjoys traveling, biking, skiing, is an enthusiastic soccer mom, and likes doing yoga even though she is really bad at it.

What Not to Do

By pulling strings, I arranged for Richard to be invited to give a talk to an undergraduate mathematics group in Dublin. Actually, I had to pull only one string, suggesting the possibility to someone that I knew. Societies that present talks are always grateful to have speakers, especially those that cost very little. I knew that I had succeeded when Richard called.

"Owen," he said, "My fame has spread at least as far as Dublin. I've been invited to speak there. You'll want to come and listen, won't you? It would be helpful if you could provide transportation. You won't mind if Michelle comes along, will you?"

"Of course not," I said. "What will you talk about?"

"Oh, this and that," he answered. "It's an undergraduate group, so it can't be anything very deep. Undergraduates have short attention spans, so they won't notice if the talk doesn't hang together. And they'll be so happy to have a decent speaker that I could talk about anything."

"You're sure that you'll be more decent than what they usually get?" I asked.

"Owen, you haven't gone to enough mathematics talks. All you have to do to stand out as a terrific speaker is to avoid obvious blunders. Not too long ago I was at a talk where the speaker never looked at the audience because he was looking at the projections of his transparencies. They were in type too small to be seen, so he was reading them to us, word for word, symbol by symbol. Since he wasn't using the microphone, he could hardly be heard, though his shadow could be seen when he stood in the way of the light from the projector. He also went ten minutes past his allotted time. Not only wasn't he hooted from the platform, when he finally finished he got an undeserved patter of applause. I will be splendid in comparison."

The lecture room was about two-thirds full when we arrived, with more empty seats towards the front than in the back. Richard had been prepared for this. Undergraduates, he told us on the way there, have a highly developed fear of fire and always want to be close to the exits, just in case.

From chapter 14 of *The Magic Numbers of the Professor*, by Owen O'Shea and Underwood Dudley (MAA, 2007).

Found Math

Let us sit on this log at the roadside," says I, "and forget the inhumanity and ribaldry of the poets. It is in the glorious columns of ascertained facts and legalized measures that beauty is to be found. In this very log we sit upon, Mrs. Sampson," says I, "is statistics more wonderful than any poem. The rings show it was sixty years old. At the depth of two thousand feet it would become coal in three thousand years. The deepest coal mine in the world is at Killingworth, near Newcastle. A box four feet long, three feet wide, and two feet eight inches deep will hold one ton of coal. If an artery is cut, compress it above the wound. A man's leg contains thirty bones. The Tower of London was burned in 1841."

"Go on, Mr. Pratt," says Mrs. Sampson. "Them ideas is so original and soothing. I think statistics are just as lovely as they can be."

(From *The Handbook of Hymen*, by O. Henry; thanks to J. Walter Lynch)

Remembering Vic Klee

By Branko Grünbaum, Robert R. Phelps, Peter L. Renz, Kenneth A. Ross

Mathematicians throughout the world were saddened to learn that Victor L. Klee, past President of the MAA, died on August 18, 2007 of complications following abdominal surgery.

Vic Klee was born in San Francisco in 1925. He earned his B.A. (with high honors) from Pomona College in 1945, majoring in both mathematics and chemistry. He wrote his thesis on Convex Sets in Linear Spaces under E. J. McShane, another past President of the MAA, and obtained his PhD in 1949 from the University of Virginia. More about his thesis will appear in the section on Klee's Mathematics.

After teaching for six years at the University of Virginia, Klee served on the faculty of the University of Washington from 1953 until his retirement in 1998. He had numerous visiting appointments and served as consultant for Boeing, Dupont, IBM, the National Security Agency, and the Rand Corporation, among others.

Klee and the MAA

Victor Klee was President of the MAA in 1971–1972. For many years, he was famous within the MAA for the "Klee Policy" forbidding deficits. When asked about this in 2006, he stated that "fiscal prudence has always seemed very important to me."

For his outstanding contributions to mathematics and mathematics education, the MAA gave Klee its Award for Distinguished Service to Mathematics in 1977. He also received three MAA awards for outstanding expository writing: the Lester R. Ford Award in 1972 for an article in the *American Mathematical Monthly*, and twice the Carl B. Allendoerfer Award, in 1980 and 1999, for articles in *Mathematics Magazine*.

When asked in 2006 what accomplishments as President he was most proud of, Klee responded as follows: "During the

Vietnam war, there seemed a very real danger that the MAA and AMS would be seriously weakened by resignations on the part of mathematicians who felt that the organizations were not dealing appropriately with their concerns. I particularly remember an MAA meeting at which, when entering the MAA business meeting, I was accosted by protestors with such rhetorical questions as 'Are you going in there with those pigs?' Before that business meeting, I had spent a lot of time studying parliamentary procedure, in the determination that everyone should not only have a fair hearing, but that they should realize that they had had a fair hearing. If my memory is correct, my best service to the MAA was in conducting that meeting, explaining the parliamentary rules and acting according to them. I was much pleased, after the meeting, when even some of the 'firebrands' complimented me on my handling of the meeting and said that, although not everything had been decided in the way that they had hoped, they did feel that they had been fairly treated rather than being denied their 'day in court'."

Klee helped to popularize mathematics. He wrote several general surveys, made a film, initiated and edited for several years an "Unsolved Problems" section in the *American Mathematical Monthly*, and was featured in an expository film on unsolved problems of geometry that won honorable mention at the National Education Film Festival.

Klee and Students

Klee was an excellent teacher. One of Klee's strengths was the care he devoted to his students. His doctoral students had weekly conferences with him, at which he most actively helped them formulate their thoughts in an effective way, provided them with suggestions, and tried to cheer them up when the problems seemed to be overwhelming. He continued to give all of them help throughout their careers. A complete list of his PhD students may be found at the Mathematical Genealogy web site, at http://genealogy.math.ndsu.nodak.edu/html/id.phtml?id=15079.

Klee was also a mentor to many young mathematicians who went to Seattle to work with him during the critical (early) postdoctoral stage of their careers.

Klee's Mathematics

Klee was one of the most distinguished members of the University of Washington faculty. He was a very productive researcher, whose nearly 250 published works range over convexity, optimization, the theory of algorithms, and various aspects of combinatorics and geometry.

As a teacher and researcher, Vic had a gift for directing attention to interesting and productive problems. He looked at particular problems such as the facial structure of polyhedra, polytopes and convex bodies in simpler and more concrete ways with the goal of seeing what might hold in general. In a 2006 interview, he described the ideal problem thus: "The problem should be of intrinsic interest in even a very special form, but should admit of interesting extensions. In my opinion, a good problem is sufficiently specific so that even

the specific form is of interest to someone, but of course it's best if a specific solution inspires further questions and generalizations. I deal with a specific case, if a meaningful (i.e., not obvious but not impossible) one can be found. Then 'brainstorm,' looking for natural generalizations and, if possible, applications."

When Vic was asked in 2006 how he came to convexity as the topic of his thesis, he responded, "…I found, upon inspection, that the Calculus of Variations [the topic recommended by his advisor, E. J. McShane] was too 'messy' for my taste, though the geometric simplicity of the notion of convexity was very appealing. This led to the thought that 'If only I can prove enough theorems having to do with convexity per se, I won't have to work in the Calculus of Variations.'"

Vic's interests and achievements spanned many fields. He made important contributions to the study of finite and infinite dimensional linear spaces and convex sets in such spaces, to graph theory, to combinatorics, to determining the computational complexity of geometrical constructions, and other topics. He presented new ideas and methods along with stimulating open problems. His most valuable mathematical achievement, however, is in the theory of convex polytopes. His path-breaking and seminal papers, published in the 1960s, helped launch this field, a field that flourishes at present. Klee must be considered one of the founding fathers of the entire field. He retained an interest in convex polytopes to the end, and had, over the years, many students exploring this topic.

Member of the Mathematical Community

In addition to his accomplishments within the MAA, Klee's numerous honors include a Research Fellowship from the Sloan Foundation, three honorary degrees, the Guggenheim Fellowship, a Fulbright Research Scholarship, and election as fellow of both the American Academy of Arts and Sciences and the American Association for the Advancement of Science. Over the years, Klee gave over 100 invited lectures throughout the world, including one at the International Congress of Mathematicians in 1974, in Vancouver.

Klee was a member of several American and international organizations and served on committees and as an officer of several of them. He was an Associate Secretary (1955–1958), and served on the Council and Executive Committee of the AMS. Klee served as chairman of Section A (Mathematics) of the American Association for the Advancement of Science, and he was on the Council of SIAM, the Society for Industrial and Applied Mathematics. He also served on the Council and Board of the Conference Board of the Mathematical Sciences.

Personal Observations of Friends

Robert Phelps: Victor Klee spent the 1955–56 academic year as a visitor at the UCLA mathematics department, where I was beginning my second year as a graduate student. Before he arrived, I overheard one of the faculty members refer to him as "the young hotshot from the University of Washington." I took his course on convexity and when I got stuck on a homework problem involving nearest points in convex sets, I started proving everything else about nearest points that came to mind.

Vic (still "Professor Klee" at that point) made some helpful suggestions and encouraged me to write up and submit my results to the *Proceedings of the AMS*. Having that paper appear during my third year of graduate school was a tremendous morale booster. By that time, of course, I had transferred to the University of Washington to continue working with Vic, finishing in 1958. While at UCLA, Vic, his then-wife Bitsy and another faculty couple had generously invited my wife Elaine and me to be their guests at a concert. Not having met him previously, Elaine had somewhat nervously visualized meeting a rather stuffy European with a graying beard. What she pleasantly found, of course, was another clean-shaven pun-loving Californian about our age.

Branko Grünbaum: The passing of Vic Klee should be an occasion to remember him, his character and his work, and the help of various kinds he has given to so many of us.

More than fifty years ago, while still a student in Jerusalem, I first came in contact with Vic. During the second round of letters he suggested shortening my addressing him from "Professor Klee" to "Klee", and in the next round, to replacing "Klee" by "Vic." This is just a small example of his friendly and open approach to people.

Vic was a very helpful colleague, always ready with references and other information about a variety of topics. He was also fair to a fault, happy to help out with classes if emergencies arose, and most thoughtful and meticulous in letters of recommendation he wrote. His lectures — whether in class, at the seminar, or in various meetings and colloquia — were always carefully thought out, and delivered in an inspiring and captivating manner.

One of Vic's lasting contributions to the UW department was the seminar he organized in the 1950s and led for many years. The seminar continues to this day. Over the decades, it went under various names — Convexity, Geometry, Geometry and Combinatorics, Combinatorics and Geometry, Combinatorics, reflecting the preferences and interests of its organizers — but the spirit did not change much. The regular participants formed a community with frequent contacts and exchanges. Often the attendance shot up during the Summer Quarter, as this was one of very few offerings that presented new ideas and recent results.

Peter Renz: I came to Washington in 1961, interested in analysis and topology and knowing no convexity. Klee captured me. Like a geologist, he surveyed new territory rich with interest. He showed how intersection properties of convex sets led to surprising results. How shifting from Euclidean spaces to Banach spaces or to linear topological spaces over fields could give new results and revealing examples.

For Klee, mathematics was inexhaustible, endless exploration. He welcomed progress by others along with his own. He was open to ideas of colleagues or students, equally. He was cautious and critical. As a student, when I brought him an idea or proof, he would lean back and say "Let me see, do I believe that?" Then I would sweat about whether I had checked carefully. If not, he would nail me. Vic taught us boldness and caution.

Klee's curiosity and broad interests led him to pose many appealing problems. He wove these through his classes. Students, including David Barnette and Kit Hanes and Joel Berman, earned early publications by solving such problems. Some were easy, others beyond reach, but all were intriguing.

In 1976, I was working for W. H. Freeman and Company and was delighted when Vic became our series editor. The fruits of his efforts included: Computers and Intractability by Micheal Garey and David Johnson (1979), Linear Programming By Vasek Chvatal (1983), *Tilings and Patterns* by Branko Grünbaum and G. C. Shephard (1987), and Problem Solving through Recreational Mathematics by Bonnie Averbach and Orin Chein, Dover reprint with additions in 1999. All are still in print and highly praised.

Klee was adventurous. In Hong Kong he and his wife, Jodey, tried a durian — the fruit so smelly that hotels won't let you take it to your room. He liked it. On returning to Seattle, he found some durian ice cream, which he offered me. I declined. When I do sample a durian, I will think of him.

Klee's openness to people and ideas, his wit and good humor, and his drive to excellence made him a wonderful human being.

Kenneth Ross: I took graduate topology from Klee in winter and spring 1957; this was my first year of graduate school. He thought highly of me (Bob Phelps told me so). In fact, since Klee was going to be away for 1957–1958, in the spring of 1957 he went to Edwin Hewitt (who barely knew me) and asked him if he had room on his grant for me. Hewitt asked whether I'd be a satisfactory note-taker for his real variables course. Klee evidently assured him, because I was on Hewitt's grant and was his note-taker. I ended up writing my thesis under Hewitt's guidance, and the rest is history.

Later, in 1969, I was asked by AMS Secretary Everett Pitcher whether I'd be interested in being Associate Secretary for what we now call the Far Western Section. I wasn't sure whether this was a good idea career-wise, so I called my mentor in Seattle — no, not Ed Hewitt, but Victor Klee. Klee started out by saying that he was the one who recommended me to Pitcher, so that turned out to be a short conversation, and I took the job. That job eventually led Len Gillman, then Treasurer of the MAA, to ask me about being MAA Secretary (without any previous MAA experience!), and again the rest is history.

One Friday in that topology course, Klee ended by stating an unsolved problem (from John Isbell). Something about fixed points of commuting maps. Then Klee told us that he would talk about XXX on Monday, unless of course one of us had solved the problem. Well, John Rowland and I independently solved the problem that weekend. We got together and merged our solutions into a short elegant solution. On Monday morning, Klee asked whether any of us had solved the problem. I said that John and I had. Klee was incredulous and dubious, but invited us (me) to give the solution. Each sentence was so clear, that Klee impatiently pushed me on. After about three sentences, I was done. Klee was stunned, clearly convinced, but puzzled. When he went back to Isbell, he discovered that he (Klee) had misstated the problem slightly. What we had solved was pretty simple. Still, I think Klee was impressed that John and I would tackle an alleged unsolved problem.

Branko Grünbaum is Professor Emeritus at the University of Washington, geometer and co-author with Victor Klee and Ludwig Danzer of an old (1963) but still often quoted survey, "Helly's theorem and its relatives."

Robert R. Phelps is Professor Emeritus at the University of Washington. His interests include convex functions, convex sets, and the geometry of Banach spaces.

Peter Renz taught at Reed, Wellesley and Bard, and was an editor at W. H. Freeman and Company, Birkhäuser Boston, and Academic Press. He also served as associate director of the MAA in Washington.

Kenneth A. Ross is Professor Emeritus at the University of Oregon, former Secretary and former President of the MAA. His interests include harmonic analysis and elementary probability.

Who Found the Math?

Our *Found Math* series features examples of mathematics, pseudo-mathematics, or other related things, all found in ordinary literature, advertising, newspapers, and so on. Texts and/or pictures can be used, and may or may not be accompanied by a short explanation or comment. Some *Found Math* pieces will be examples of good mathematics, but most, alas, are garbled or confused in one way or another. (We trust that most of you can tell the difference!) We hope our readers will enjoy them, and also that they will contribute their own examples.

Where Mathematics Meets Biology: Opportunities for Students

By Donna Beers

Last spring, four of my advisees, all seniors who were completing the mathematics major, eagerly sought capstone experiences where they could apply mathematics to solve compelling, real-world problems. Three sought internships in health care, while the fourth, who was also a biology major, wanted to do research in marine ecology. Happily, three placements were found where students got to work with real health data; since graduating, these students have continued to work in biostatistics. The biology student, whose passion is marine biology, used mathematics to model the population dynamics of Atlantic salmon. She presented her research at the 2006 Hudson River Undergraduate Mathematics Conference. She has just completed her first year in a Masters degree program in marine ecology.

My experience mirrors a more general situation confronting mathematics faculty today: the challenge of advising students, often double-majors, who aspire to apply mathematics to global problems such as infectious diseases or fisheries depletion. In hopes of serving students whose interests lie at the interface between mathematics and biology, I have assembled some resources which may be used as course enrichment materials or in advising.

Readings

An exciting new source of articles for undergraduates is a set of journals published by the Public Library of Science (PLoS): *PLoS Biology, PLoS Medicine, PLoS Computational Biology, PLoS Genetics, PLoS Pathogens, PLoS Neglected Tropical Diseases*, and *PLoS ONE* (formerly *PLoS Clinical Trials*). These are peer-reviewed open-access internet journals whose goal is to make the latest and best medical and scientific information on infectious diseases, clinical trials of new drugs, etc. available to a wide audience that includes doctors, patients, medical researchers, and students. They can be found online at http://www.plosjournals.org. *Science* magazine and *PLUS* internet magazine, at http://plus.maths.org/, also offer articles that are accessible and relevant for undergraduates. A particularly interesting example is the article "Mathematics is Biology's Next Microscope, Only Better; Biology is Mathematics' Next Physics, Only Better" (*PLoS Biology*, December 14, 2004). Searching these journals online is a good way to find articles for students to read.

Training and Internships

Summer Institute for Training in Biostatistics
http://www.nhlbi.nih.gov/funding/training/redbook/sibsweb.htm

Training opportunities at NIH Institutes and Centers
http://www.training.nih.gov/student/sip/catalog/

The NIH Summer Internship Program in Biomedical Research
http://www.training.nih.gov/student/sip/

NSF-funded Research Experiences for Undergraduates
Students should look both under "mathematical sciences" and under "biology"
http://www.nsf.gov/crssprgm/reu/reu_search.cfm

NIH Internships in Neuroscience
http://neuroscience.nih.gov/Training_Opportunities.asp

Undergraduate Internship Program in Biomedical Imaging and Bioengineering
http://www.nibib.nih.gov/Training/UndergradGrad

DOE Science Undergraduate Laboratory Internships at Oak Ridge National Laboratory
http://see.orau.org/ProgramDescription.aspx?Program=10055

Mathematical Biosciences Institute Programs
http://mbi.osu.edu/

Training Opportunities and Tutorials

The federal government is funding important tutorial and training opportunities for undergraduates. To meet the increased demand for biostatisticians, the National Heart and Lung Blood Institute has been offering six-week summer training courses for undergraduates, called Summer Institutes for Training in Biostatistics (SIBS), at Boston University, North Carolina State University, and the University of Wisconsin-Madison. The SIBS programs introduce students to biostatistical principles and techniques and show how they are applied to biomedical and clinical research. Two of my advisees have attended SIBS institutes. They are pursuing graduate degrees in epidemiology and biostatistics, respectively.

Internships and Research Experiences for Undergraduates

The National Science Foundation, the National Institutes of Health, and the National Institute of Biomedical Imaging and Biomedical Engineering offer a wide range of summer internships for students interested in fields where mathematics meets biology. There are also several REU programs in mathematical biology.

Career Opportunities

In 2004, *Nature* magazine published an attractive article, "Analyze This," which addressed the question 'What is biostatistics?' and surveyed careers in this field. *Science* magazine devoted a special issue (February 6, 2004) to Mathematics in Biology, and included several articles on careers in mathematical biology. Several of these can be found online in the Science Careers site, at http://sciencecareers.sciencemag.org/.We have called attention to one of these in the sidebar. Moreover, with a grant from the

Sloan Foundation, the MAA, AMS, and SIAM mathematics professional societies have collaborated in developing considerable resources on careers in mathematics, including a website, the Sloan Career Cornerstone Center.

Interdisciplinary Graduate Programs

The flood of data unleashed by advances in genome research has produced a great need for scientists who can make sense of this data, i.e., scientists with strong quantitative and biology backgrounds. Significant federal and private funding is being invested in interdisciplinary graduate education in order to meet this need. Quantitative ecology, statistical genetics, and computational biology are examples of the new interdisciplinary graduate programs available to students who want to apply the tools and concepts of mathematics and statistics to problems in biology. Sidebar 5 directs readers to some of these cutting-edge interdisciplinary programs.

Online Tutorials

A tutorial for undergraduates on data mining http://www.kdd.org/from the Association for Knowledge Discovery and Data Mining
http://www.kdnuggets.com/data_mining_course/

A primer on bioinformatic
http://www.ncbi.nlm.nih.gov/About/primer/bioinformatics.html

A primer on genomics and the Genome Project
http://www.ornl.gov/sci/techresources/Human_Genome/publicat/primer

Careers Where Mathematics Meets Biology

Analyse This
Nature, October 14, 2004

Emory University site on careers in biostatistics
http://www.sph.emory.edu/bios/careersinbios.php

The Mathematical Biology Job Market
ScienceCareers.org, February 27, 2004
http://sciencecareers.sciencemag.org/

Sloan Career Cornerstone Center
http://www.careercornerstone.org/

Biomedical Engineering Society
http://www.bmes.org/careers.asp

Top bioinformatics companies
http://www.bioplanet.com/bioinformatics_companies.htm

NIH profiles of careers in health and medical science
http://science.education.nih.gov/LifeWorks.nsf

Attracting and retaining students in mathematics is one part of improving the number of U.S. students pursuing majors and careers in science, technology, engineering, and mathematics. At a Microsoft conference held in Redmond, WA in July 2006, Dan Mote, President of the University of Maryland College Park, noted: "We have to realize that people don't find value in our field .... and it's not just students from poorly educated inner city high schools; you go to any spiffy high school and you survey the 14-year olds in that high school, and you'll not find them selecting science and technology and computer science as their subjects, because they do not see opportunity, they don't see the excitement.

Some solutions may be at hand. In computer science, in particular, Microsoft is engaging high school students in an annual world-wide competition called Imagine Cup, where students are challenged to find imaginative ways to use technology to solve global problems. The 2007 Imagine Cup challenged students to find ways to use technology to improve education around the world. The 2008 theme is: "Imagine a world where technology enables a sustainable environment." In addition, interviews of new students at Carnegie Mellon University disclose that college students "…choose computing not for the job opportunities, and not for love of programming, but rather because they have some compelling social vision of what they can do with their education."

Many mathematics majors also want to "make a difference." Some majors want to save the earth; others want to confront global infectious diseases. We hope that this article offers a window into opportunities which help students to make the transition from learning mathematics and statistics content for itself, to applying this knowledge in the service of personal and civic responsibilities.

Donna Beers teaches at Simmons College in Massachusetts. This article is partly based on work she did as a Visiting Mathematician at MAA.

Interdisciplinary Graduate Programs

Interdisciplinary graduate programs funded by the Howard Hughes Medical Institute: http://www.hhmi.org/news/112205.html.

The NSF's Integrative Graduate Education and Research Traineeship (IGERT) program: http://www.igert.org/.

State Requirements for Mathematics in College: Varied and Low Level

By Susan Forman and Bernard Madison

Over the past three years, the MAA Committee on Articulation and Placement (CAP) has surveyed each of the fifty states asking about mathematics requirements of state institutions of higher education for the baccalaureate degree. The questions in the survey are in the accompanying box. Basically, CAP asked if there was a statewide requirement, a system-wide requirement, or a flagship-wide requirement of mathematics for the baccalaureate degree.

The responses from the fifty states are of four types. (1) Half the states have no statewide or system-wide requirements, and the mathematics requirements for degrees vary by college and major. (2) Twelve states or major state systems require that graduates have specific quantitative reasoning competencies, which may be satisfied by credits in various mathematical sciences courses. (3) Seven states have designated sets of courses that contain some mathematics courses and are fully transferable between state institutions as part of the general education cores. These sets of courses are usually called articulation or transfer modules and they essentially make the courses (or substitutions) required by all the state institutions. (4) Six states have a requirement of one college-level mathematics course with some specifications such as "at or above the level of college algebra."

In many states the mathematics requirement for a degree can be satisfied by meeting set performance standards on examinations, such as SAT, ACT, or an institutional examination. Also, some requirements can be satisfied by mathematics courses taken in high school, regardless of whether or not the courses are designated "college level."

A typical situation for half the states where requirements vary by college and major comes from Kentucky. At the University of Louisville, for most programs in the humanities, many in the social sciences or music, and some degrees in the College of Education and Human Development, the mathematics requirement can be satisfied by Introduction to Contemporary Mathematics. The rest of the University requires either college algebra or calculus (or equivalent). At the University of Kentucky, the mathematics requirement for any baccalaureate degree is credit for college algebra or the equivalent or bypassing it through placement and either (a) credit for a calculus course or (b) both a basic statistics course and an introductory philosophy course.

The situation in Florida illustrates some of the features of the requirements in twelve states that have specific quantitative reasoning requirements. The Florida requirements for all associate and baccalaureate degrees are more rigorous than those reported by any other state and come from multiple sources, including the State University System of Florida, the Florida Community College System, and the Florida Administrative Code. These requirements include demonstrating competence in college-level academic skills, which, in mathematics is satisfied by successfully completing six semester hours of mathematics coursework at the level of college algebra or higher.

Courses in articulation or transfer modules are not per se requirements for baccalaureate degrees, but the courses in such modules are recognized as normally included in requirements for degrees. An example of the articulation or transfer module is found in Ohio where each state institution is required to establish a transfer module meeting certain requirements, including containing at least one mathematical sciences course upon demonstration of college entry level proficiency in mathematics. Possible courses include formal/symbolic logic, college algebra, statistics, mathematics in everyday life, pre-calculus, and calculus. All colleges in Ohio must accept the transfer module, but it does not mean that this meets the general education requirement for the transfer receiving institution.

The state of Arkansas has a transfer module, called the state minimum core

Summary of Results

1. Half the states have no statewide or system-wide requirements and the mathematics requirements for degrees vary by college and major.
2. Twelve states or major state systems require that graduates have specific quantitative reasoning competencies, and this may be satisfied by credits in various mathematical sciences courses.
3. Seven states have articulation or transfer modules that contain some mathematics courses, making the courses (or substitutions) required by all the state institutions.
4. Six states have a specific requirement of one mathematics course with some restrictions such as "at or above the level of college algebra."

of courses that is fully transferable between institutions. This minimum core includes a three-semester-hour course in mathematics that can be either college algebra or a "course as sophisticated as college algebra." There is the additional proviso that "institutions may require students majoring in mathematics, engineering, science, and business to take higher math as part of the State Minimum Core."

A less restrictive one-course requirement is found in Nevada where each baccalaureate degree program must contain a college level mathematics course.

As noted in the beginning, this survey has taken place over the past three years and some states may have changed requirements in that time. Further, judgments were made in sorting the fifty rather varied responses into the four categories outlined above. Eighteen of the responses were taken directly from the web sites of states' higher education agencies. Additional responses came from e-mails to the remaining 32 states, and the remainder of the information was obtained from MAA members in the states that did not respond.

Where courses are named or described, the generally low level is particularly striking. In 1954, when the College Board established the Advanced Placement calculus program, calculus was deemed to be the first year college mathematics course. As shown by the results of various recent surveys, including the one conducted every five years by the Conference Board for the Mathematical Sciences, most enrollments in collegiate mathematics are in courses that have been considered pre-calculus. The results of this survey by CAP show that state collegiate requirements in mathematics follow that pattern.

State Survey Questions

1. Does the state have a mathematics requirement for the baccalaureate degree from any state institution of higher education? If yes, what is the requirement or where can we find it?

2. If the answer to 1 is no, does any of the one or two major state systems of higher education (e.g. University of California System or SUNY System) have a uniform mathematics requirement for any baccalaureate degree? If yes, what is the requirement or where can we find it?

3. If the answers to 1 and 2 are no, does any of the one or two major state universities (e.g. Indiana/Purdue or Oklahoma/Oklahoma State) have a uniform mathematics requirement for any baccalaureate degree? If yes, what major universities?

Found Math

So if a man's wit be wandering, let him study the mathematics; for in demonstrations, if his wit be called away never so little, he must begin again.

– Francis Bacon, *Essays*, "Of Studies"

EMPLOYMENT OPPORTUNITIES

ALABAMA

University of Alabama in Huntsville
Department of Mathematical Sciences
Faculty Position
The Department of Mathematical Sciences at the University of Alabama in Huntsville invites applications for a tenure track position at the rank of Assistant Professor, beginning August 2008. A Ph.D. degree in mathematics or applied mathematics is required. Applicants must show evidence of excellent research potential in an area that matches the interests of the department. Applicants must also have a strong commitment to teaching and show evidence of excellent teaching ability. Preference will be given to applicants whose research area is partial differential equations, mathematical modeling, or mathematical biology.

Applicants should send a curriculum vita with the AMS standard cover sheet and three letters of recommendation (with at least one letter addressing teaching) to

Chairman chair@math.uah.edu
Department of Mathematical Sciences
University of Alabama in Huntsville
Huntsville, AL 35899.

For more information about the department, visit our web site at http://www.math.uah.edu.

Review of applicants will begin February 15, 2008, and will continue until the position is filled. Women and minorities are encouraged to apply. The University of Alabama in Huntsville is an Affirmative Action, Equal Opportunity Institution.

ALASKA

University of Alaska
Southeast (Juneau)
Assistant or Associate Professor of Mathematics at the University of Alaska Southeast (Juneau): This is a bipartite (teaching and service), tenure-track position beginning August 2008. The position will remain open until filled; however, first consideration will be given to applications received by January 11, 2008. Members of the search committee will participate in the Employment Center at the 2008 Joint Meeting. Go to www.uakjobs.com/applicants/Central?quickFind=60450 for position announcement and for information about the UAS Mathematics Program go to http://www.uas.alaska.edu/math/. UAS is an AA/EO Employer and Educational Institution.

CALIFORNIA

Harvey Mudd College
Assistant or Associate Professor
Harvey Mudd College invites applications for a tenure-track position; candidates from all areas of Mathematics and Applied Mathematics, including statistics, biostatistics, mathematical biology and mathematical finance, are encouraged to apply. The rank will be at the assistant or associate professor level. Excellence in teaching is essential, as is evidence of a strong and ongoing research program. Candidates must be willing to supervise undergraduate research, and work with others in departmental programs, such as the industrial projects-based Clinic program. Candidates with a demonstrated success in working with diverse student populations are particularly encouraged to apply.

Strong preference will be given to applications submitted through http://www.mathjobs.org/jobs/ (Position ID 216-HMCMATH). Further information about the college and department may be found at http://www.math.hmc.edu/. Preference will be given to applications completed by December 10, 2007.

University of California, Merced (UC Merced)
School of Natural Sciences: Lecturer with Potential Security of Employment
UC Merced is seeking a potentially permanent lecturer in the area of applied mathematics. This position closely parallels a tenure-track position, with a larger emphasis on undergraduate teaching. This is a unique opportunity to join the faculty in the new University of California campus. Qualifications include a Ph.D. in Applied Mathematics or a related scientific field and demonstrated excellence in teaching and university service. Special attention will be paid to applicants who have extensive teaching experience, have participated in curriculum development and have been involved in training and supporting teaching assistants. To apply: http://jobs.ucmerced.edu/n/academic/position.jsf?positionId=1234 AA/EOE

CANADA

McGill University
The Department of Mathematics and Statistics invites applications for a tenure-track position in discrete mathematics or continuous optimization. While the appointment is expected to be made at the level of an Assistant Professor, the Department would consider applicants for a senior position. The candidate must have a doctoral degree at the date of appointment. They are also expected to have demonstrated the capacity for independent research of excellent quality. Selection criteria include research accomplishments, as well as potential contributions to the educational programs of the Department at the graduate and undergraduate levels.

Applications with a curriculum vitae, a list of publications, a research outline, an account of teaching experience, a statement on teaching, and the names, phone numbers and e-mail addresses of at least four references (with one addressing the teaching record) should be sent to:

Professor Bruce Shepherd
Chair, Discrete Mathematics or Continuous Optimization Search Committee
Department of Mathematics and Statistics
McGill University
805 Sherbrooke Street West
Montreal QC H3A 2K6 Canada

Candidates must arrange to have the letters of recommendation sent directly to the above address. Candidates are encouraged to include copies of up to three selected reprints or preprints with their applications. To ensure full consideration, applications must be received by January 15, 2008.

To facilitate notification of the outcome of the search, candidates should send an email to the address DMCOSearch08@math.mcgill.ca at the time of application.

McGill University is committed to equity in employment and diversity. It welcomes applications from indigenous peoples, visible minorities, ethnic minorities, persons with disabilities, women, persons of minority sexual orientations and gender identities and others who may contribute to further diversification. All qualified applicants are encouraged to apply; however, in accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada.

GEORGIA

Georgia College & State University
The Mathematics Department at Georgia College & State University invites applications for a tenure track Assistant Professor of Mathematics. A PhD in mathematics, statistics, or closely related field is required. Employment will begin August 2008. A review of applications begins October 19, 2007. For full consideration, applications must be postmarked or electronically submitted at http://www.mathjobs.org/jobs by November 30, 2007. Please visit http://www.gcsu.edu/facultyjobs/ for a full position description.

Georgia is an Open Records state. The finalist will be required to submit to a background investigation. GCSU is an Equal Opportunity, Affirmative-Action Institution.

ILLINOIS

Southern Illinois University
Southern Illinois University Edwardsville, a comprehensive state university 20 miles from downtown St. Louis, Missouri, invites applications for a tenure-track assistant professor beginning August 2008. Applicants should have a PhD in math education, mathematics, or statistics. Review of applications will begin December 1, 2007. For more information visit www.siue.edu/MATH/.

MAINE

Colby College
Mathematics Department
The Department of Mathematics at Colby College invites applications for a one-year sabbatical replacement position in mathematics at the assistant professor or instructor level, beginning September 1, 2008. Ph.D. in mathematics preferred; A.B.D. considered. Five course teaching load. Evidence of exceptional teaching ability is required. The ability to teach a course in the history of mathematics is desirable but not required.

Send curriculum vitae, a statement on teaching and research, and three letters of recommendation (all in hard copy) to: Mathematics Search Chair, Department of Mathematics, Colby College, 5830 Mayflower Hill, Waterville, ME 04901. We cannot accept applications in electronic form. Review of applications will begin on January 15, 2008 and will continue until the position is filled.

Colby is a highly selective liberal arts college located in central Maine. The college is a three-hour drive north of Boston and has easy access to lakes, skiing, the ocean, and other recreational and cultural activities. For more information about the position and the department, visit our web site at www.colby.edu/math.

Colby is an Equal Opportunity/Affirmative Action employer, committed to excellence through diversity, and strongly encourages applications and nominations of persons of color, women, and members of other underrepresented groups. For more information about the College, please visit the Colby Web site at www.colby.edu.

MARYLAND

Goucher College
Assistant Professor
Mathematics/Computer Science
Goucher College is seeking an assistant professor of mathematics/computer science for Fall 2008. This is a one-year appointment, renewable for up to two additional years. Ph.D. in mathematics or computer science required, with the ability to teach in both fields desirable. Qualified applicants will possess a commitment to excellence in teaching; the ability to teach a wide variety of courses and conduct a research program; and a commitment to fostering research by undergraduates. Our course offerings range from introductory courses, major and non-major alike, through senior-level special topics courses for majors. Course assignments will accommodate the strengths of department faculty and the successful applicant. Deadline for applications is January 2, 2008. Interested applicants should submit vitae, transcripts of graduate work, three letters of recommendation (two of which must address teaching experience or potential), and a personal statement describing their interest in teaching at a small liberal arts college and also briefly describing their research to: Human Resources, Goucher College, 1021 Dulaney Valley Road, Baltimore, MD 21204. EOE.

MASSACHUSETTS

Williams College
Williams College Department of Mathematics and Statistics invites applications for a newly authorized visiting position in mathematics for the 2008-2009 year, at the rank of assistant professor. A Ph.D. is required. Send a vita and three letters of recommendation on teaching and research to: Visitor Hiring Committee, Department of Mathematics and Statistics, Williams College, Williamstown, MA 01267. Consideration of applications will begin on November 15th and continue until the position is filled. Williams College is dedicated to providing a welcoming intellectual environment for all of its faculty, staff and students; as an AA/EOE employer, Williams especially welcomes applications from women and minority candidates.

Williams College
The Williams College Department of Mathematics and Statistics invites applications for one tenure track position in mathematics, beginning fall 2008, at the rank of assistant professor (in an exceptional case, a more advanced appointment may be considered). We are seeking a highly qualified candidate who has demonstrated excellence in teaching and research, and who will have a Ph.D. by the time of appointment.

Williams College is a private, residential, highly selective liberal arts college with an undergraduate enrollment of approximately 2,000 students. The teaching load is two courses per 12-week semester and a winter term course every other January. In addition to excellence in teaching, an active and successful research program is expected.

To apply, please send a vita and have three letters of recommendation on teaching and research sent to the Hiring Committee, Department of Mathematics and Statistics, Williams College, Williamstown, MA 01267. Teaching and research statements are also welcome. Evaluation of applications will begin on or after November 15 and will continue until the position is filled. Williams College is dedicated to providing a welcoming intellectual environment for all of its faculty, staff and students; as an EEO/AA employer, Williams especially encourages applications from women and minorities. For more information on the Department of Mathematics and Statistics, visit http://www.williams.edu/Mathematics.

NEW HAMPSHIRE

Dartmouth College
John Wesley Young
Research Instructorship
The John Wesley Young Instructorship is a postdoctoral, two- to three-year appointment intended for promising Ph.D. graduates with strong interests in both research and teaching and whose research interests overlap a department member's. Current research areas include applied mathematics, combinatorics, geometry, logic, non-commutative geometry, number theory, operator algebras, probability, set theory and topology. Instructors teach four ten-week courses distributed over three terms, though one of these terms in residence may be free of teaching. The assignments normally include introductory, advanced undergraduate, and graduate courses. Instructors usually teach at least one course in their own specialty. This appointment is for 26 months with a monthly salary of $4667, and a possible 12 month renewal. Salary includes two-month research stipend for Instructors in residence during two of the three summer months. To be eligible for a 2008-2011 Instructorship, candidate must be able to complete all requirements for the Ph.D. degree before September, 2008. Applications may be obtained at http://www.math.dartmouth.edu/recruiting/ or http://www.mathjobs.org. Position ID: 237-JWY.
General inquiries can be directed to Annette Luce, Department of Mathematics, Dartmouth College, 6188 Kemeny Hall, Hanover, New Hampshire 03755-3551. At least one referee should comment on applicant's teaching ability; at least two referees should write about applicant s research ability. Applications received by January 5, 2008 receive first consideration; applications will be accepted until position is filled. Dartmouth College is committed to diversity and strongly encourages applications from women and minorities.

NEW YORK

Cornell University
The Cornell University Department of Mathematics seeks applications for the position of Senior Lecturer; full-time; 5-year renewable term appt.; 7/1/2008 - 6/30/2013. This individual would be Coordinator of the Mathematics Department Outreach and K-12 Education Program. We expect this individual to initiate and run activities that bring together mathematics department faculty, Cornell students, and the mathematics education and local K-12 education communities. The individual should have qualifications and expertise to supervise student teachers and to teach mathematics education and undergraduate mathematics courses.

To apply electronically, please go to http://www.mathjobs.org, or send three letters of reference and a curriculum vita to Dan Barbasch, Chair, Department of Mathematics, 320A Malott Hall, Cornell University, Ithaca, NY 14853-4201. For information about the Department see: http://www.math.cornell.edu/. Deadline January 31, 2008. We hope to make a decision in March. Cornell University is an Affirmative Action/Equal Opportunity Employer and Educator.

OHIO

The College of Mount St. Joseph
Chair, Department of Mathematics
The College of Mount St. Joseph is seeking a Mathematics Department Chair, to start in fall of 2008. The position offers the opportunity to grow the existing department, with administration commitment to additional faculty hires. The department works closely with strong cognate departments in a liberal arts setting committed to interdisciplinarity. The successful candidate will have a Ph.D. in mathematics, demonstrated leadership skills, and a desire to continue scholarly activity. Interested applicants should submit a letter of application, curriculum vitae, a statement of departmental vision, teaching philosophy, graduate transcripts and three letters of rec-

ommendation to: Department Chair Search Committee Chair, Department of Mathematics, College of Mount St. Joseph, 5701 Delhi Road, Cincinnati, OH 45233-1670. This position is a full-time, 10-monthcontract with a 75% teaching load. Salary and rank dependent uponqualifications and experience. Chairpersons are appointed for three year terms subject to review and renewal. A review of applications will begin immediately and continue until the position is filled. For general information about the college, please visit www.msj.edu. EOE

OKLAHOMA

The University of Oklahoma
Department of Mathematics
Applications are invited for one full-time, tenure-track position in mathematics beginning 16 August 2008. The position(s) is initially budgeted at the assistant professor level, but an appointment at the associate professor level may be possible for an exceptional candidate with qualifications and experience appropriate to that rank. Normal duties consist of teaching two courses per semester, conducting research, and rendering service to the Department, University, and profession at a level appropriate to the faculty member's experience. The position(s) requires an earned doctorate and research interests that are compatible with those of the existing faculty; preference will be given to applicants with potential or demonstrated excellence in research and prior successful undergraduate teaching experience. Salary and benefits are competitive. For full consideration, applicants should send a completed AMS cover sheet, curriculum vitae, a description of current and planned research, and have three letters of recommendation (at least one of which must address the applicant's teaching experience and proficiency) sent to:

Search Committee
Department of Mathematics
The University of Oklahoma
601 Elm, PHSC 423
Norman, OK 73019-0315

Phone: 405-325-6711
FAX: 405-325-7484
E-mail: search@math.ou.edu

*Applications may also be submitted online through http://mathjobs.org

Screening of applications will begin on December 15, 2007 and will continue until the position(s) is filled.

The University of Oklahoma is an Equal Opportunity/Affirmative Action Employer. Women and Minorities are Encouraged to Apply.

PENNSYLVANIA

Penn State Harrisburg
Assistant Professor of Mathematical Sciences
Penn State Harrisburg School of Science, Engineering and Technology, invites applications for a tenure-track Assistant Professor of Mathematical Sciences effective Fall Semester 2008. The position requires a Ph.D. in Statistics or Mathematics. Applicants with expertise in Statistics will be given special consideration but those with other areas of specialization will also be considered. Teaching will include a broad range of undergraduate mathematics courses, including service courses for a growing, and dynamic department. Additionally, the successful candidate will teach graduate students in Computer Science and Engineering with the opportunity to guide research projects in that discipline. Candidates must be multi-faceted team players with strengths in teaching undergraduate courses. Penn State tenure-track, faculty are expected to pursue and sustain scholarly research and publications; recruit and advise students; and contribute quality service to the University and the profession. Information about the College and the Department can be found at www.hbg.psu.edu and at http://math.hbg.psu.edu.

Applicants are invited to submit current curriculum vitae, research statement, teaching statement, and at least three letters of reference, including at least one that addresses teaching, to: Chair Mathematics Search Committee, c/o Mrs. Dorothy J. Guy, Director of Human Resources, Box: MAAFOC-26155, Penn State Harrisburg, 777 W. Harrisburg Pike, Middletown, PA 17057-4898.

Review of applications will begin immediately and continue until the position is filled. Penn State is committed to affirmative action, equal opportunity, and the diversity of its workforce.

Penn State Mont Alto
Penn State Mont Alto seeks a tenure track assistant professor to teach courses primarily in the first two years of college mathematics using traditional and hybrid delivery modes. Publish in refereed journals. Seek Ph.D. in mathematics and experience teaching introductory math courses. Prefer candidate with a record of successfully teaching students whose abilities range from weak to strong preparation for college-level mathematics. To learn more about the campus visit http://www.psu.edu/ur/cmpcoll.html. To learn more about the position and how to apply, visit http://www.psu.jobs/Opportunities/Opportunities.html and follow the "Faculty" link. AA/EOE.

SOUTH CAROLINA

Coker College
Assistant Professor of Mathematics
Coker College seeks a tenure-track Assistant Professor of Mathematics to begin August 2008. Ph.D. in mathematics is required with qualifications in applied mathematics and computer science a plus. The preferred candidate will demonstrate a commitment to teaching excellence, professional development, and a willingness to actively engage in faculty duties outside the classroom. Candidates should be prepared to teach a 12-hour load per semester, including both service and major courses. Some teaching in the college's evening program may be required. Coker is a highly ranked, private liberal arts college with an enrollment of approximately 1200 day and evening students. Women and minorities are encouraged to apply. Review of applications will begin in mid-November 2007. Send letter of application, CV, teaching statement, transcripts, and three letters of reference to: Professor Kaye Crook, Search Committee Chair, Department of Science and Mathematics, Coker College, 300 East College Avenue, Hartsville, SC 29550. EOE. http://www.coker.edu.

TEXAS

The University of Texas at Tyler
The University of Texas at Tyler invites applications for the position of Chair of the Department of Mathematics to begin fall 2008. The university seeks candidates who will energetically lead the department in continuing to build excellent undergraduate and graduate programs and will mentor faculty in teaching, research, and service.

The successful candidate will have a PhD in mathematics, an outstanding record of teaching and research commensurate with a tenured faculty appointment, effective leadership, administrative, and interpersonal skills, and the ability to lead the faculty in obtaining external funding.

Located 90 miles east of Dallas in the beautiful piney woods of East Texas, The University of Texas at Tyler has an enrollment of about 6000 students. The Department of Mathematics offers degrees at the under-

graduate and graduate levels. For general information about The University of Texas at Tyler, visit www.uttyler.edu. The Department of Mathematics has a web site at http://math.uttyler.edu

Please submit (electronically as attachments, if possible) a letter of application, curriculum vitae, unofficial transcripts, a brief description of research plans, statement of teaching philosophy, statement of leadership philosophy, and names and email addresses of at least four references to Dr. Don Killebrew, Chair, Department of Mathematics Chair Search Committee, dkille@mail.uttyl.edu. Paper submissions can be sent to Department of Mathematics, The University of Texas at Tyler, 3900 University Blvd., Tyler, Texas 75799.

Review of applications will begin immediately and continue until the position is filled. Applicants must be prepared to furnish the university with proof of eligibility to work in the United States. UT Tyler is an Equal Employment Opportunity/Affirmative Action Employer.

VIRGINIA

American Statistical Association
ASA Seeks Director of Science Policy
The American Statistical Association is seeking a director of science policy to begin in January 2008. The ideal candidate will be a member in good standing with the ASA and have an advanced degree in statistics with expertise in science policy and/or public policy. Major responsibilities of the director of science policy include executing plans designed to increase the participation and visibility of the statistical profession and the ASA in science policy discussions at the national and international levels; promoting the use and appreciation of sound statistical methods in the collection and analysis of the data on which decisions are based; and working with decision makers to help the statistical sciences receive an appropriate share of public funds devoted to scientific research and education. See our online ad for more details at www.amstat.org. The ASA is an Equal Opportunity Employer. Individuals interested in this opportunity should send a cover letter, résumé, salary history, and the names of at least three business references to Human Resources, Re: Science Policy, American Statistical Association, 732 North Washington Street, Alexandria, VA 22314-1943, or by email to lynn@amstat.org.

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