AWM
ASSOCIATION FOR WOMEN IN MATHEMATICS

Newsletter

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The purpose of the Association for Women in Mathematics is

- to encourage women and girls to study and to have active careers in the mathematical sciences, and
- to promote equal opportunity and the equal treatment of women and girls in the mathematical sciences.

IN THIS ISSUE

PRESIDENT'S REPORT

Collaboration. "The action of working with someone to produce something," from the Latin *collaborare*, "work together."

I want to take a moment to sing the praises of collaboration in mathematics: two or more people coming together to solve a problem. I'm thinking about this because I just got back from a fabulous week at MBI (Mathematical Biosciences Institute) in Columbus, Ohio, where 49 mathematicians gathered to work on seven different mathematical problems motivated by questions from biology. Coincidentally, my own group, led by the incomparable **Nina Fefferman**, studied how the dynamics of a disease in a population might be affected by the social structure, i.e., by the *connections* between individuals. In a meta-sense, all of us at MBI that week were part of an experiment: How does collaboration help the intellectual endeavor? How does collaboration combine with the mission of the AWM?

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Ectoparasite Modeling Group: left to right, front to back. Maryann Hohn, Heather Brooks, Nina Fefferman, Shelby Wilson; Suzanne Sindi, Ami Radunskaya, Nakeya Williams, Candice Price.

AWM

ASSOCIATION FOR
WOMEN IN MATHEMATICS

AWM was founded in 1971 at the Joint Meetings in Atlantic City.

The *Newsletter* is published bi-monthly. Articles, letters to the editor, and announcements are welcome.

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PRESIDENT'S REPORT *continued from page 1*

Years ago, during my first summer as an EDGE instructor in 1998, I was talking to students about barriers to women becoming mathematicians. One of the young women said: "But I don't want to become one of those lonely single women with lots of cats." While this statement may not be based on large amounts of data, the image of the solitary mathematician working away at a tough but captivating problem is deep-seated in our culture. I can now say, confidently, that being a mathematician need not be a lonely enterprise. In fact, there has been a gradual shift in the culture of mathematics publication that makes the "lonely mathematician" a fading old photo.

From the 1940s to the 1990s, collaboration in mathematics has increased, evidenced by a decrease in single-authored papers (from 90% in the '40s to fewer than half in the late '90s) and an increase in the number of papers with three or more authors (from < 1% to 16%) [1]. Using data from *Math Reviews*, Jerrold Grossman modeled collaboration in mathematics as a network, where nodes represent authors and edges between nodes signify joint papers. In this network representation, 25% of the authors were isolated nodes, there was one large connected component made up of approximately 42% of the authors, and the rest of the authors were in small components, most of them of size two (representing two people who only collaborate with each other). So, who is in the "in" group, the giant connected component of mathematicians? Fortunately, MathSciNet has a wonderful online tool that calculates the "collaboration distance" between two mathematicians, the minimum number of edges required to get from one node (author) to another. Figuring that someone who is "connected" (in the large component) should be connected to well-known mathematicians, I asked for the collaboration distance between myself and Kristin Lauter, our illustrious Past President. Result: we have a CD of 5; I'm connected! Since I actually know Kristin, I thought I should try a more stringent test, and put in Maryam Mirzakhani, the first female Fields Medalist: CD of 4, wow! Then I went crazy, and put in Albert Einstein: CD of 5, again!

This was exciting, but I did notice that most of the connecting nodes in my collaborative paths were not women. The zbMATH datbase has been used by other researchers to study the effect of gender on publication patterns [3]. While there don't seem to be any gender differences in the size of collaborative networks in mathematics, there does seem to be a difference in the number of co-authors in

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MR Collaboration Distance = 5

Ami E. Radunskaya	coauthored with	Lisette G. de Pillis	MR2226316
Lisette G. de Pillis	coauthored with	Michael Daub	MR2566932
Michael Daub	coauthored with	Victor Rotger	MR3356037
Victor Rotger	coauthored with	Andrew V. Sutherland	MR2982436
Andrew V. Sutherland	coauthored with	Kristin E. Lauter	MR2869057

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MR Collaboration Distance = 4

Ami E. Radunskaya	coauthored with	Roy Radner	MR3174848
Roy Radner	coauthored with	Benjamin Weiss	MR0716116
Benjamin Weiss	coauthored with	Elon Lindenstrauss	MR1749670
Elon Lindenstrauss	coauthored with	Maryam Mirzakhani	MR2424174

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MR Collaboration Distance = 5

Ami E. Radunskaya	coauthored with	Yang Kuang[2]	MR2525136
Yang Kuang[2]	coauthored with	Kenneth L. Cooke	MR1668036
Kenneth L. Cooke	coauthored with	Richard Ernest Bellman	MR0147745
Richard Ernest Bellman	coauthored with	Ernst Gabor Straus	MR0031095
Ernst Gabor Straus	coauthored with	Albert Einstein	MR0012947

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one's first paper: 33% of women's first papers are single-authored, while 43% of men are single authors on their first papers. It is not clear why this is: Are women more likely to co-author with their dissertation advisors? If so, why? Given that women are estimated to make up less than 15% of the published authors in the zbMATH database, we are led to speculate about the importance of developing collaborative networks for women. This might be particularly so for early career women, who are starting to branch out beyond their PhD work. Furthermore, there are differences across fields in mathematics: women have lower representation, for example, in dynamical systems and ergodic theory, algebraic geometry, and category theory. These fields are ripe for new research networks! The data suggest, also, that women tend to focus their mathematical efforts on fewer fields than their male counterparts. We need to welcome each other into our specific areas of research: a diversity of backgrounds will help us solve our problems faster.

Another symptom of the burgeoning popularity of collaboration is the idea of "massively open collaboration in math" proposed by Tim Gowers in a blog post in 2009. The polymath project was born, and since then thousands of collaborators have come together online to work on projects. After their first success, only six weeks after his initial blog post, Tim Gowers wrote: "Another thing I have found good about the project is that it has made it possible to work hard without having

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Ads: Feb. 1 for March–April, April 1 for May–June, June 1 for July–Aug., Aug. 1 for Sept.–Oct., Oct. 1 for Nov.–Dec., Dec. 1 for Jan.–Feb.

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the sensation of working hard" [3]. This highlights an important aspect of collaboration: it increases the Fun Quotient. We know that this is a good thing. In fact, when I was 10, I decided to favor the 'cello over the piano since that instrument facilitated collaborative music-making: nothing can compare to the real-time connection between 100 performers in a symphony orchestra.

So let's decrease loneliness and increase the visibility of women mathematicians by energizing our research networks. Help women publish early in their careers, introduce colleagues to our research areas, enlarge our connected component, and raise our Fun Quotient: here's to collaboration!

In AWM news this month, we are very pleased to announce that **Melanie Wood** has won the AWM-Microsoft Research Prize and **Lillian Pierce** is the recipient of the AWM-Sadosky Research Prize. You won't want to miss this year's AWM-MAA Falconer Lecture given by **Talithia Williams** at MathFest on July 28th in Chicago, titled "Not So Hidden Figures: Unveiling Mathematical Talent." Also appearing soon on our calendar July 10-11 in Pittsburgh: the AWM workshop at the 2017 SIAM Annual Meeting is on the topic of Numerical Analysis and Scientific Computing, led by **Susanne Brenner**, **Fengyan Li** and **Beatrice Riviere**.

The AWM Research Symposium held at UCLA was a big success; an article appears in this newsletter on pages 8–14. We are looking for hosts of the next AWM Research Symposium in 2019. If you are interested, send us a proposal.

References:

[1] Jerrold W. Grossman, "Patterns of Collaboration in Mathematical Research," *SIAM News*, 35(9), Nov. 2002.

[2] MathSciNet, *Mathematical Reviews* on the Web, 1940–present, American Mathematical Society, http://www.ams.org/mathscinet

[3] Helena Mihaljević-Brandt, Lucía Santamaría, and Marco Tullney, "The Effect of Gender in the Publication Patterns in Mathematics," *PLoS ONE*, 11(10), pp. 1–23 (2016)

[4] https://gowers.wordpress.com/2009/03/10/polymath1-and-open-collaborative-mathematics/

Ami

Ami Radunskaya
May 26, 2017
Claremont, CA

Ami Radunskaya

ASSOCIATION FOR WOMEN IN MATHEMATICS

AWM ONLINE

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Website: http://www.awm-math.org
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AWM DEADLINES

RCCW Proposals: July 1, 2017 and January 1, 2018
AWM Workshop at JMM: August 15, 2017
AWM-MAA Falconer Lecture: September 1, 2017
AWM Alice T. Schafer Prize: October 1, 2017
AWM Dissertation Prize: October 1, 2017
AWM Travel Grants: October 1, 2017 and February 1, 2018
AWM-AMS Noether Lecture: October 15, 2017
AWM-SIAM Sonia Kovalevsky Lecture: November 1, 2017
AWM Workshop at SIAM: November 1, 2017
Ruth I. Michler Memorial Prize: November 1, 2017

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Melanie Matchett Wood

Melanie Matchett Wood Wins AWM-Microsoft Research Prize

The Association for Women in Mathematics will present the third AWM-Microsoft Research Prize in Algebra and Number Theory to **Melanie Matchett Wood**, Professor of Mathematics, University of Wisconsin–Madison, at the Joint Mathematics Meetings in San Diego, CA in January 2018. Established in 2012, the AWM-Microsoft Research Prize recognizes exceptional research in algebra and number theory by a woman early in her career. The award is made possible by a generous contribution from Microsoft Research. The biennial presentation of this prize serves to highlight to the community outstanding contributions by women in the field of algebra and to advance the careers of the prize recipients.

The 2016 AWM-Microsoft Research Prize in Algebra and Number Theory is awarded to Melanie Matchett Wood in recognition of her exceptional research achievements in number theory and algebraic geometry. Wood received her doctorate in 2009 from Princeton University. She is currently a professor at the University of Wisconsin–Madison, after appointments at the American Institute of Mathematics, Stanford University, and the Mathematical Sciences Research Institute.

Wood has made deep and influential contributions to number theory and algebraic geometry. She excels at drawing connections between different areas of mathematics. Her work is a truly remarkable synthesis of number theory, algebraic geometry, topology, and probability. In arithmetic statistics, Wood, with her coauthors, gave the first heuristic account of the variation of the Mordell-Weil rank in families of elliptic curves, which predicts in particular that, contrary to widely held beliefs among the research community, elliptic curves over the rationals have absolutely bounded rank. Her joint work with Vakil suggests that the limiting behavior of many natural families of varieties should stabilize in a motivic sense. These results and conjectures have attracted considerable attention and spawned a substantial amount of follow-up research. More recently, she determined the behavior of the sandpile group of a random graph, thus proving an important conjecture in tropical geometry.

Wood has received many awards and recognitions, too numerous to list here. She was in the inaugural class of fellows of the American Mathematical Society and has been a Sloan Research Fellow and a Clay Mathematics Institute Liftoff Fellow. As a junior at Duke University she was the recipient of AWM's Alice T. Schafer Prize. Currently her research is supported by a Packard Fellowship, an NSF CAREER grant and the University of Wisconsin–Madison Vilas Early Career Investigator Award.

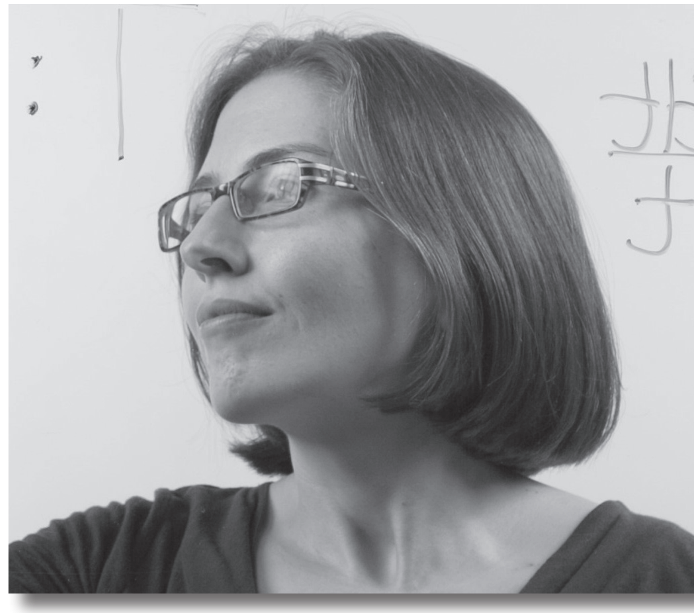
Beyond her outstanding scientific achievements, Wood has assumed many leadership roles in directing undergraduate research and promoting participation of women and girls in mathematics. She was one of the coaches of the first United States team to participate in the China Girls Math Olympiad, an international competition with a proof-based format. She is considered one of the most visible role models for a whole generation of American young women in mathematics.

The 2018 Joint Mathematics Meetings will be held January 10–13 in San Diego, CA. For further information on the AWM-Microsoft Research Prize, including the previous winners, please visit www.awm-math.org.

Visit www.awm-math.org for the latest news!

Lillian Pierce Wins AWM-Sadosky Research Prize

The Association for Women in Mathematics will present the third AWM-Sadosky Research Prize in Analysis to **Lillian Pierce**, Assistant Professor of Mathematics, Duke University, at the Joint Mathematics Meetings in San Diego, CA in January 2018. Established in 2012, the AWM-Sadosky Research Prize recognizes exceptional research in analysis by a woman early in her career. The award is named for Cora Sadosky, a former president of AWM, and is made possible by generous contributions from Cora's husband Daniel J. Goldstein, daughter Cora Sol Goldstein, and friends Judy and Paul S. Green and Concepción Ballester. The biennial presentation of this prize serves to highlight to the community outstanding contributions by women in the field of analysis, to advance the careers of the prize recipients, and to evoke the memory of all that Cora Sadosky exemplified as a mathematician, mentor and friend.



Lillian Pierce

The 2018 AWM Sadosky Research Prize in Analysis is awarded to Lillian Pierce in recognition of her outstanding contributions to harmonic analysis and analytic number theory. Pierce received her PhD degree in 2009 from Princeton University and has held appointments at the Institute for Advanced Study, Oxford University, and the Hausdorff Center for Mathematics before assuming her current position at Duke University.

Pierce is one of the most talented, original and visionary analysts of her generation. Her research spans and connects a broad spectrum of problems ranging from character sums in number theory to singular integral operators in Euclidean spaces. She has made far-reaching contributions to the study of discrete analogs of harmonic-analytic integral operators, taking inspiration in classical Fourier analysis, but drawing also on methods from analytic number theory such as the circle method and Diophantine approximation. In her recent work with Po Lam Yung, hailed as a remarkable breakthrough and a tour de force, she proved a polynomial Carleson theorem for manifolds, connecting two major directions of research in harmonic analysis and opening up entirely new research programs. Pierce's work on estimating short character sums, on her own and in collaboration with Roger Heath-Brown, has produced the first significant advance in several decades on this central and difficult problem in analytic number theory. Pierce is highly regarded for her broad vision, deep knowledge of several areas of mathematics, and outstanding technical skill. Her leadership and influence in the field are widely acknowledged.

Pierce is the recipient of a Marie Curie Fellowship, an NSF Mathematical Sciences Postdoctoral Research Fellowship, and an NSF CAREER award. She has a visible and active presence in the mathematical community. Her award of the AWM-Sadosky Research Prize is a worthy testament to her excellence.

The 2018 Joint Mathematics Meetings will be held January 10–13 in San Diego, CA. For further information on the AWM-Sadosky Research Prize, including the previous winners, please visit www.awm-math.org.

Talithia Williams Named Falconer Lecturer

Talithia Williams

The Association for Women in Mathematics and the Mathematical Association of America are pleased to announce that **Talithia Williams** will deliver the Etta Z. Falconer Lecture at MathFest 2017. Dr. Williams is an associate professor at Harvey Mudd College.

Williams received a BS in mathematics from Spelman College, followed by an MS in mathematics from Howard University and an MS and a PhD in statistics from Rice University. She was a visiting assistant professor at Rice University for one year before joining the faculty at Harvey Mudd College.

As illustrated in her popular TED talk “Own Your Body’s Data,” Williams demystifies the mathematics process, using statistics as a way of seeing the world in a new light. She develops statistical models that emphasize the spatial and temporal structure of data and has partnered with the World Health Organization in developing a model to predict the cataract surgical rate for countries in Africa.

Through her research and work in the community at large, she is helping change the collective mindset regarding STEM in general and math in particular—rebranding the field of mathematics as anything but dry, technical or male-dominated but instead as a logical, productive career path that is crucial to the future of the country. She has organized annual conferences on math and science for African American girls at Harvey Mudd College since 2011.

Williams is currently serving as the secretary and treasurer of the Sylvia Bozeman and Rhonda Hughes EDGE Foundation (Enhancing Diversity in Graduate Education). She was a local coordinator of two EDGE Summer Programs, one at Pomona College and one at Harvey Mudd College.

Williams is currently a member of the Mathematics Industry Internship Network Advisory Board and the MSRI (Mathematical Science Research Institute) Human Resources Advisory Committee. She recently served as Governor for Minority Interests on the MAA Board of Governors and on the Board of Directors of the Society for the Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS).

In 2015, Williams was selected by the American Council on Education as an ACE Fellow and served the 2015–2016 academic year shadowing the president of the University of Maryland, Baltimore County. She has also participated in the SACNAS Leadership Institute, Stanford University.

William’s lecture at MathFest is entitled “Not So Hidden Figures: Unveiling Mathematical Talent.” She is also an organizer of the AWM invited paper session “No Longer Hidden Figures: Women Mathematicians Share Their Path to the Profession.”

MathFest 2017 will be held July 26–29 in Chicago, IL. The Falconer lectures were established in memory of Etta Z. Falconer (1933–2002). Her many years of service in promoting mathematics at Spelman College and efforts to enhance the movement of minorities and women into scientific careers through many forums in the mathematics and science communities were extraordinary. Falconer lecturers are women who have made distinguished contributions to the mathematical sciences or mathematics education. Previous recipients of this honor include Izabella Laba, Erica Walker, Marie Vitulli, Pat Kenschaft, Karen King, Dawn Lott, Ami Radunskaya, Kate Okikiolu and Rebecca Goldin.

2017 AWM Research Symposium

Raegan Higgins, Kristin Lauter, Magnhild Lien, Ami Radunskaya, Luminita Vese, and Carol Woodward

Statistics Special Session

Introduction: The Association for Women in Mathematics held an AWM Research Symposium this year, April 8–9. The AWM launched its series of biennial research symposia in 2011 with the 40th anniversary conference held at Brown University. The second symposium was held in 2013 at Santa Clara University and the third in 2015 at the University of Maryland, College Park. This year, the symposium was held at the University of California, Los Angeles. These research symposia highlight the accomplishments of women in mathematics and showcase the research of women mathematicians at all stages of their careers. These symposia are designed to help support and nurture networks of women researchers in many areas of mathematics and to provide networking opportunities for junior and senior women to enhance career prospects and recognition. The 2017 AWM Research Symposium featured four high-level plenary talks given by distinguished women mathematicians, numerous special sessions on a broad range of research in pure and applied mathematics, and poster sessions for graduate students and recent PhDs. Eight special sessions were organized by the Research Networks supported by the AWM ADVANCE grant awarded by NSF. The UCLA Department of Mathematics and the Institute for Pure and Applied Mathematics (IPAM) hosted the symposium. Also, the symposium included a session titled "Wikipedia edit-a-thon" [more info follows this article], a jobs panel, a reception, a banquet, and a student chapter event. The second AWM Presidential Award was also presented during the banquet. The organizers were very pleased to see numerous young women mathematicians, early in their career, actively participating in the symposium as special session organizers, speakers, or attendees. Finally, details of all the events are given below.

Plenary talks: The line-up of Plenary Speakers consisted of former AWM President **Ruth Charney**, the first AWM Sadosky Prize Winner **Svitlana Mayboroda**, the 2016 Blackwell-Tapia Prize Winner **Mariel Vazquez**, and

Algebraic Combinatorixx (ACxx) Special Session the very first AWM-SIAM Sonia Kovalevsky Lecturer **Linda Petzold**. Ruth Charney opened the conference with a talk on "Searching for Hyperbolicity" explaining some recent work on finding and encoding hyperbolic behavior in infinite groups. Saturday afternoon, Svitlana Mayboroda talked about "The hidden landscape of localization of eigenfunctions" and applications to the construction of noise abatement walls, LEDs, and optical devices. Linda Petzold's talk on Sunday morning, "Inference of the Functional Network Controlling Circadian Rhythm," focused on the use of computing and mathematics to better understand circadian rhythm, the process by which living organisms manage to follow a 24-hour cycle. Finally, the conference ended with Mariel Vasquez's talk on "Understanding DNA Topology," where she discussed techniques from knot theory and low-dimensional topology, which she uses to study the topological state of the genome and the topology of DNA.

Special Sessions: In an effort to cover a broad range of subject areas we had nineteen special sessions, all of which were well attended. All but one special session met in two two-hour blocks, generally with four speakers in each block, with the exception being "The many facets of statistics—applied, pure and BIG." The Caucus for Women in Statistics (CWS) has been in existence as long as AWM, but surprisingly there has not been much collaboration between the two associations. In an effort to change that, the CWS was invited to organize a special session at the symposium, which resulted in "The many facets of statistics—applied, pure and BIG." Their session was spread over three two-hour blocks. Also new in the line-up of special sessions at the 2017 symposium were History of Mathematics, SMPosium: A celebration of the Summer Math Program for Women (at Carleton College), and Research in Collegiate Mathematics Education (which encouraged lively discussion and audience participation; see pp. 27–28). Eight of the nineteen special sessions were organized by Research Networks (https://awmadvance.org/research-networks/) supported by the AWM ADVANCE grant (https://awmadvance.org). The research networks, Women in Numbers (WIN), Women in Math Biology (WIMB), Women in Noncommutative Algebra and Representation Theory (WINART), etc., are groups of women with common research interests that are spawned from Research Collaboration Conferences for Women (RCCW; see https://awmadvance.org/rccws/). A list of all the special sessions is given on the next page. Abstracts can be found at the AWM website.

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CALL FOR NOMINATIONS

The 2018 Kovalevsky Lecture

AWM and SIAM established the annual Sonia Kovalevsky Lecture to highlight significant contributions of women to applied or computational mathematics. This lecture is given annually at the SIAM Annual Meeting. Sonia Kovalevsky, whose too-brief life spanned the second half of the nineteenth century, did path-breaking work in the then-emerging field of partial differential equations. She struggled against barriers to higher education for women, both in Russia and in Western Europe. In her lifetime, she won the Prix Bordin for her solution of a problem in mechanics, and her name is memorialized in the Cauchy-Kovalevsky theorem, which establishes existence in the analytic category for general nonlinear partial differential equations and develops the fundamental concept of characteristic surfaces.

The mathematicians who have given the prize lecture in the past are: Linda R. Petzold, Joyce R. McLaughlin, Ingrid Daubechies, Irene Fonseca, Lai-Sang Young, Dianne P. O'Leary, Andrea Bertozzi, Suzanne Lenhart, Susanne Brenner, Barbara Keyfitz, Margaret Cheney, Irene M. Gamba, and Linda J.S. Allen. Liliana Borcea will deliver the 2017 lecture at the SIAM Annual Meeting in Pittsburgh, PA in July 2017.

The lectureship may be awarded to anyone in the scientific or engineering community whose work highlights the achievements of women in applied or computational mathematics. The nomination must be accompanied by a written justification and a citation of about 100 words that may be read when introducing the speaker. Nominations are to be submitted as ONE PDF file via MathPrograms.Org. The submission link will be available 45 days prior to the deadline. Nominations must be received by **November 1, 2017** and will be kept active for two years.

The awardee will be chosen by a selection committee consisting of two members of AWM and two members of SIAM. Please consult the award web pages www.siam.org/prizes/sponsored/kovalevsky.php and www.awm-math.org/kovalevskylectures.html for more details.

- WIN Special Session: Work from Women In Numbers (Katherine Stange, Beth Malmskog)
- WinCompTop Special Session: Applications of Topology and Geometry (Radmila Sazdanovic, Shirley Yap, Emilie Purvine)
- WIMB Special Session: From cells to landscapes: modeling health and disease (Carrie Manore, Erica Graham)
- ACxx Special Session: Algebraic Combinatorics (Gizem Karaali, Hélène Barcelo)
- WINASC Special Session: Recent Research Development on Numerical Partial Differential Equations and Scientific Computing (Chiu-Yen Kao, Yekaterina Epshteyn)
- WINART Special Session: Representations of Algebras (Susan Montgomery, Maria Vega)
- WiSh Special Session: Shape Modeling and Applications (Kathryn Leonard, Asli Genctav)
- WIT Special Session: Topics in Homotopy Theory (Julie Bergner, Angélica Osorno)
- Women in Sage Math (Alyson Deines, Anna Haensch)
- Women in Government Labs (Cindy Phillips, Carol Woodward)
- EDGE-y Mathematics: A Tribute to Dr. Sylvia Bozeman and Dr. Rhonda Hughes (Alejandra Alvarado, Candice Price)
- SMPosium: A celebration of the Summer Mathematics Program for Women (Alissa S. Crans, Pamela A. Richardson)

Kristin Lauter at lunch meeting

Audience at lunch meeting

- The many facets of statistics—applied, pure and BIG (Monica Jackson, Jo Hardin)
- History of Mathematics (Janet Beery)
- Commutative Algebra (Emily Witt, Alexandra Seceleanu)
- Biological Oscillations Across Time Scales (Stephanie Taylor, Tanya Leise)
- Geometric Group Theory (Pallavi Dani, Tullia Dymarz, Talia Fernós)
- Recent Progress in Several Complex Variables (Purvi Gupta, Loredana Lanzani)
- Research in Collegiate Mathematics Education (Shandy Hauk, Pao-sheng Hsu).

Research Networks lunch meeting (sponsored by the AWM ADVANCE grant): As the title of the AWM ADVANCE grant "Career Advancement for Women through Research-Focused Networks" indicates, Research Networks are an integral component of the grant. Since eight of the symposium special sessions were organized by the research networks already supported by the grant, this was a perfect place to hold an informational meeting about the ADVANCE grant and the research networks in particular. Kristin Lauter, the PI on the grant and Magnhild Lien, co-Pi on the grant as well as AWM ADVANCE Project Director, were the leaders of the meeting held during the Saturday lunch break. Close to 40 people, with their take-out lunches from the UCLA food court, flocked into the meeting room eager to hear about establishing and maintaining research networks. They learned about the Research Networks Committee (RNC), which is charged with helping establish long lasting research networks from Research Collaboration Conferences for Women

(RCCW). The RNC offers support in establishing websites and listservs, oversees the common webpage on which the websites can be hosted, and gives advice on organizing steering committees and follow-up activities at AWM workshops or AWM Research Symposia. A fruitful discussion ensued, and by the time the meeting was over, connections were made by people who were ready for the first step in creating a research network in their area, i.e., planning proposals to organize an RCCW.

Poster Session: Thirty-six posters were presented by young mathematicians from 26 institutions. The venue at IPAM was ideal, because the posters could be viewed throughout the entire symposium, and the coffee breaks nearby were accompanied by the excited buzz of the exchange of ideas. Graduate students participated in a poster contest, coordinated by past president Sylvia Wiegand, and the Best Poster prize winners were: **Emily Olson** (Michigan State University), **Chong Wang** (George Washington University), **Emerald Stacy** (Oregon State University), **Fanhui Xu** (University of Southern California), and **Stefanie Wang** (Iowa State University). Congratulations to *all* of the poster presenters: we enjoyed each and every one of the presentations. Our gratitude also goes to all of the volunteer judges who made the poster contest a big success. Wolfram and Maple donated software as prizes for the best posters, which were presented at the Symposium Banquet on Saturday evening.

Jobs Panel: Saturday afternoon featured a panel session on non-academic jobs. Panelists **Carol Ammar** (independent entertainment industry consultant), **Alyson Deines** (Center for Communications Research), **Cynthia Phillips** (Sandia National Laboratories), and **Ashley Williams** (The Aerospace Corporation) provided engaging and stimulating discussions of their current job goals, educational backgrounds, and day-to-day aspects of their jobs. Panelists were encouraging about the many intellectually and scientifically engaging components of their positions. Both students and faculty in attendance for the full capacity session remarked that the panel helped fill in their knowledge of job experiences and opportunities outside academia.

Banquet: The Symposium Banquet took place at UCLA's Faculty Center. As we finished a delicious meal, past AWM President **Rhonda Hughes** introduced a video by **Angela Duckworth**, created for our symposium, on the subject of Grit: passion and perseverance towards a long-term goal. Professor Duckworth had excellent words of wisdom for us, especially that we should nurture our passions and remember to keep a growth mindset. The keynote address was given by **Maria Helena Noronha**, who described her own journey and her work mentoring undergraduates in Southern California. **Raegan Higgins** introduced the symposium song, which everyone sang together as a round, led by **Cymra Haskell** along with

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CALL FOR NOMINATIONS

The Association for Women in Mathematics Dissertation Prize

In January 2016 the Executive Committee of the Association for Women in Mathematics established the AWM Dissertation Prize, an annual award for up to three outstanding PhD dissertations presented by female mathematical scientists and defended during the 24 months preceding the deliberations for the award. The Prizes will be given for those dissertations deemed most outstanding by the award committee. The award is intended to be based entirely on the dissertation itself, not on other work of the individual.

To be eligible for the award a graduate student must have defended her dissertation within the last two years (October 1, 2015 to September 30, 2017). She must either be a US citizen or have a school address in the US. The Prizes will be presented at the AWM Reception and Awards Presentation at the Joint Mathematics Meetings in San Diego, CA, January 2018.

The nomination should include: 1) a one to three page letter of nomination highlighting the exceptional mathematical research presented in the dissertation; 2) a curriculum vitae of the candidate not to exceed three pages; 3) a copy of the dissertation and 4) two letters supporting the nomination. Nomination materials should be submitted online at MathPrograms.org. The submission link will be available 45 days prior to the nomination deadline. Nominations must be received by **October 1, 2017**. If you have questions, phone 703-934-0163, email awm@awm-math.org, or visit www.awm-math.org.

AWM President Ami Radunskaya and Past President Kristin Lauter.

Presidential Award: At the Banquet, the second AWM Presidential Award was presented to **Deanna Haunsperger**, MAA President, to honor her enduring contribution to advancing the mission of the AWM through her work to establish and run the Summer Math Program (SMP) at Carleton College. The symposium also served as a reunion for SMP alumnae who spoke in a special session, "SMPosium: A celebration of the Summer Mathematics Program for Women." Deanna's husband, **Stephen Kennedy**, accepted the award for Deanna, who appeared virtually via video.

Friday night Student Chapter event: The Institute for Pure and Applied Mathematics (IPAM) hosted a networking event on the eve of the Symposium, focused on student participants. The featured speaker was **Sarah Moshman**, film producer and director. Sarah discussed her experience producing the documentary *The Empowerment Project*, a film by five women filmmakers who set out to encourage, to empower and to inspire the next generation to fulfill their career ambitions. After a screening of the documentary, Sarah engaged the audience in a discussion about the challenges they faced, encouraging us to ponder: "What would you do if you knew you would succeed." IPAM Associate Director, **Christian Ratsch** led off the evening (and was the only man in the room).

Sponsors: The Symposium could not have happened without the support from our hosts, the UCLA mathematics department and IPAM. The AWM NSF ADVANCE grant provided funds to support special sessions as follow-ups to Research Collaboration Conferences for Women. Additional participant support for special sessions in other areas came through a $25,000 grant from the NSA and support from MSRI. Microsoft helped to sponsor the movie *The Empowerment Project* at the student event on Friday night and the banquet on Saturday night. Wolfram and Maple again sponsored prizes for the Best Poster contest. An exhibit hall included booths for our sponsors Springer, Oxford University Press, Basic Books, AMS, and IPAM. AMS encouraged attendees to visit their booth and find out about ways to get involved with *Mathematical Reviews*. IPAM encouraged Symposium attendees to apply to participate in IPAM programs—visit their website to see a list of upcoming programs. A *BIG* Thank you! to all of our sponsors and hosts!

Proceedings Volume: The proceedings volume for the Symposium will appear in Springer's AWM Series and all speakers and organizers were invited to submit. The editors of this volume are:

Candice Price, University of San Diego, Editor in Chief
Alyson Deines, Center for Communications Research
Daniela Ferrero, Texas State University
Erica Graham, Bryn Mawr College
Mee Seong Im, United States Military Academy
Carrie A Manore, Tulane University

Please send inquiries to: awm2017proceedings@gmail.com.

Poster Session Discussion

Volunteers: High school student volunteers, Joyce and Josephine Passananti (Kristin's daughters), sold T-shirts and the new AWM earrings (!) throughout the weekend and did most of the photography for the event! They also attended two of the plenary talks, those by Ruth Charney and Mariel Vazquez, and enjoyed them enormously. Great inspiration for the next generation of scientists! Joyce and Josephine also greatly enjoyed the student chapter event on Friday night and the movie featuring AWM President Ami Radunskaya. A shout out also to our AWM student members who helped with registration and at the reception: **Karen Wood**, **Bahar Acu** and all the others!

AWM symposium T-shirts are still available. Come visit our table at MathFest or SIAM this summer!

The Organizers:
Raegan Higgins, Texas Tech University
Kristin Lauter, Microsoft Research
Magnhild Lien, California State University Northridge
Ami Radunskaya, Pomona College
Tatiana Toro, University of Washington
Luminita Vese, University of California, Los Angeles
Carol Woodward, Lawrence Livermore National Laboratories

2017 AWM RESEARCH SYMPOSIUM

At the Symposium

Kristin Lauter with her favorite Springer volume

Banquet song

Student event group

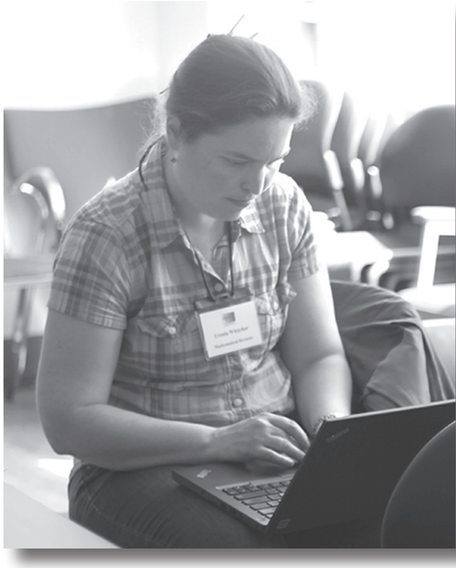
SMPers in front of projection of Deanna

Christian Ratsch introducing The Empowerment Project

Ami Radunskaya between Joyce and Josephine Passananti

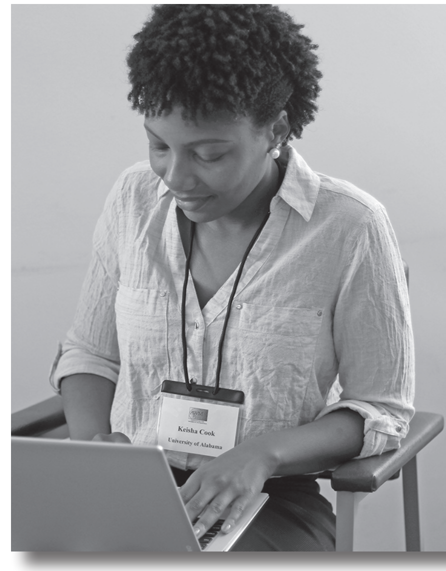
2017 AWM RESEARCH SYMPOSIUM

Ami Radunskaya with poster winners Emily Olson, Chong Wang, Emerald Stacy, and Fanhui Xu. Not pictured Stefanie Wang



Ursula Whitcher

Marie VItulli



Keisha Cook

Profiling Women in Math on Wikipedia

Ursula Whitcher

AWM members at the 2017 Research Symposium took over the UCLA math lounge to write Wikipedia entries on women in mathematics in a daylong "edit-a-thon." The hallway outside the lounge was lined with pictures of dead male mathematicians, but the conversation inside focused on living women. "It was so much fun learning how to edit Wikipedia!" said Keisha Cook, a graduate student at the University of Alabama and edit-a-thon participant. "There are so many women in math that need to be recognized. I was happy to be a part of that." Keisha's article on Talithia Williams (https://en.wikipedia.org/wiki/Talithia_Williams) was one of ten new Wikipedia entries created at the symposium.

Although Wikipedia is a crowd-sourced project where anyone can contribute, the vast majority of Wikipedia's volunteer "editors"—90%, according to one 2011 survey—are men. The AWM received a Rapid Grant from the Wikimedia Foundation in order to increase the diversity of Wikipedia's coverage and contributors by holding the edit-a-thon. "Mathematicians picked up wiki mark-up much faster than other groups of people I've encountered!" said Jami Mathewson, an experienced Wikipedian who attended the symposium. Other experts at the symposium included Marie Vitulli, a professor emerita at the University of Oregon and creator of the Women in Math Project (http://pages.uoregon.edu/wmnmath/), and Edward Dunne, Executive Editor of *Mathematical Reviews*, who shared strategies for using MathSciNet to document women's achievements. Sara Del Valle, a mathematician at Los Alamos National Laboratory and one of AWM's Wikipedia Visiting Scholars, gave tips to new Wikipedia users via Skype.

The AWM is planning a meetup for women in math on Wikipedia at the Joint Math Meetings. To learn more about the AWM on Wikipedia, check out the edit-a-thon Wikipedia page at https://en.wikipedia.org/wiki/Wikipedia:Meetup/AWM/AWM_Symposium_2017 or join the Google Group at https://groups.google.com/forum/#!forum/awm-wiki.

Photo credits: By Jami (Wiki Ed) – Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=57830400 for Whitcher; https://commons.wikimedia.org/w/index.php?curid=57831115 for Vitulli; https://commons.wikimedia.org/w/index.php?curid=57830398 for Cook

AWM WORKSHOP AT THE 2018 SIAM ANNUAL MEETING

Application deadline for graduate students: **November 1, 2017**

For many years, the Association for Women in Mathematics has held a series of workshops for women graduate students and recent PhDs in conjunction with major mathematics meetings. New in 2016 and going forward is that the workshop talks are supported by the AWM ADVANCE grant. The AWM Workshops serve as follow-up workshops to Research Collaboration Conferences for Women, featuring both junior and senior women speakers from one of the Research Networks supported by the ADVANCE grant. An AWM Workshop is scheduled to be held in conjunction with the 2018 SIAM Annual Meeting in Portland, Oregon, July 9–13, 2018.

FORMAT: The workshop will consist of two research minisymposia focused on Shape Analysis and Modeling organized by Cindy Grimm and Megan Owen, a Poster Session and an informational minisymposium directed at starting a career. Selected junior and senior women from the Research Collaboration Conference for Women (RCCW) WiSh 2 will be invited to give 20-minute talks in the two research minisymposia. The speakers will be supported by the National Science Foundation AWM ADVANCE grant: Career Advancement for Women Through Research Focused Networks. The Poster Session will be open to all areas of research; graduate students working in areas related to shape analysis and modeling are especially encouraged to apply. The graduate students will be selected through an application process to present posters at the Workshop Poster Session run in conjunction with the SIAM Poster Session. Pending funding, AWM will offer partial support for travel and hotel accommodations for the selected graduate students. The workshop will include a luncheon and mentoring session where workshop participants will have the opportunity to meet with other women mathematicians at all stages of their careers. In particular graduate students working in areas related to shape analysis and modeling will have the opportunity to connect with the Women in Shape (WiSh) Research Network.

All mathematicians (female and male) are invited to attend the talks, career panel and poster presentations. Departments are urged to help graduate students and junior faculty who are not selected for the workshop to obtain institutional support to attend the presentations.

MENTORS: We also seek volunteers to act as mentors for workshop participants, in particular the graduate students. If you are interested in volunteering, please contact the AWM office at awm@awm-math.org by **February 1, 2018**.

ELIGIBILITY: To be eligible for selection and funding, a graduate student must have made substantial progress towards her thesis. Women with grants or other sources of support are welcome to apply. All non-US citizens must have a current US address.

All applications should include:

- a title of the proposed poster
- an abstract (75 words or less) of the proposed poster
- a curriculum vitae
- a letter of recommendation from her thesis advisor.

Applications must be completed electronically by **November 1, 2017**. See http://www.awm-math.org/workshops.html.

BOOK REVIEW

Book Review Editor: Margaret Bayer, University of Kansas, Lawrence, KS 66045-7523, bayer@math.ku.edu

A Woman Ahead of Her Time: Mary Frances Winston Newson by Betsey Sellner Whitman. ISBN 978-1533291110. CreateSpace Independent Publishing Platform.

Reviewer: Marge Bayer

I had heard about Mary Frances Winston Newson, who lived in Lawrence, Kansas in the early 1900s, so I was excited to find a biography of her. We often read about women who overcame the odds to make important contributions in mathematical research. Mary (May) Winston Newson was not so lucky, in spite of her great talent. But she did lead an interesting and fulfilling life, infused with mathematics. Betsey Sellner Whitman has done us a service to document this life.

May Winston was born in 1869 in rural Illinois, where her father had a medical practice. Her mother, Carrie Winston, valued education highly, and, finding the education at the local school lacking, she mostly home-schooled her seven children. She prepared her children to go to college, teaching them Latin, Greek, geography, history and mathematics. At this she was most successful: all seven of her children earned advanced degrees.

May Winston enrolled at the University of Wisconsin at the age of 15; her 17-year-old brother started there at the same time. At the time, Wisconsin was one of a small number of universities that admitted women to a full range of studies. Unfortunately, while May did well in her first year, her family's financial situation prevented her from returning the next year. That year May prepared successfully for the teacher's exam and began teaching in April. She was, however, able to return to Wisconsin the following fall.

When May graduated from Wisconsin in 1890, 17% of the bachelor's and first professional degrees in the US went to women; 1% of the doctorates were awarded to women. [p. 59] After graduation, May got a mathematics teaching job at Downer College in Wisconsin. During her first year of teaching, she applied for a fellowship to study mathematics at Bryn Mawr. She did not receive it that year, but reapplied and won the fellowship the following year. Bryn Mawr had been founded six years previously, in 1885. Whitman describes Bryn Mawr as the first college in the US to award a PhD to a woman. However, Helen Magill White received a PhD in Greek at Boston University in 1877, and Winifred Edgerton Merrill received the PhD in mathematics at Columbia in 1886.

May's fellowship was for only one year; after that she moved to the brand new University of Chicago, where

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CALL FOR NOMINATIONS

The 2018 Etta Z. Falconer Lecture

The Association for Women in Mathematics and the Mathematical Association of America (MAA) annually present the Etta Z. Falconer Lecture to honor women who have made distinguished contributions to the mathematical sciences or mathematics education. These one-hour expository lectures are presented at the MAA MathFest each summer. While the lectures began with MathFest 1996, the title "Etta Z. Falconer Lecture" was established in 2004 in memory of Falconer's profound vision and accomplishments in enhancing the movement of minorities and women into scientific careers.

The mathematicians who have given the Falconer lectures in the past are: Karen E. Smith, Suzanne M. Lenhart, Margaret H. Wright, Chuu-Lian Terng, Audrey Terras, Pat Shure, Annie Selden, Katharine P. Layton, Bozenna Pasik-Duncan, Fern Hunt, Trachette Jackson, Katherine St. John, Rebecca Goldin, Kate Okikiolu, Ami Radunskaya, Dawn Lott, Karen King, Pat Kenschaft, Marie Vitulli, Erica Walker and Izabella Laba.

The letter of nomination should include an outline of the nominee's distinguished contributions to the mathematical sciences or mathematics education and address the nominee's capability of delivering an expository lecture. Nominations are to be submitted as ONE PDF file via MathPrograms.Org. The submission link will be available 45 days prior to the deadline. Nominations must be submitted by **September 1, 2017** and will be held active for two years. If you have questions, phone 703-934-0163 or email awm@awm-math.org.

she received a tuition fellowship (one of five fellowships in mathematics in that first year). By then, her parents had moved to Chicago, and she was able to live with them. (Her youngest brother was a freshman at U Chicago that year.)

Chicago was important, not just for the mathematics she learned, but for the connections she made. Two of the three mathematics professors had studied in Göttingen. They helped organize an International Congress of Mathematicians, held in Chicago in conjunction with the World's Columbian Exposition of 1893. (According to the IMU web page, this is sometimes known as the 0th ICM, with the "first" being in Zürich in 1897.) Felix Klein attended, and he stayed after the congress to give a series of twelve lectures on recent research. May was able to speak to him personally. She was on her way to Göttingen.

Christine Ladd Franklin, who had earned the PhD at John Hopkins in 1882, but was not to receive it until 1926 (!), offered May $500 for study in Göttingen. May started her PhD studies there in 1893 at the age of 24. At Göttingen May became friends with other women mathematicians: Grace Chisholm (later Young) from England (grandmother of mathematician Sylvia Wiegand) and an American postdoctoral scholar, Annie MacKinnon. MacKinnon got her bachelor's degree at the University of Kansas and taught high school in Lawrence. Then she attended Cornell, where she was the third woman to complete a mathematics PhD in the US. In 1885, "Grace Chisholm was the first woman to earn a degree from a German university as a regular student." [p. 72] (The "regular student" refers to the fact that Sofia Kovalevskaya was granted the PhD at the University of Göttingen after studying privately with Weierstrass at Berlin.)

May's third year of study at Göttingen was supported by a fellowship from the Association of Collegiate Alumnae. (The ACA joined with the Southern Association of College Women in 1921 to form the American Association of University Women, or AAUW.) In the summer of 1896, May completed the PhD with highest honors. The degree is dated 1897, however, because of difficulties printing the dissertation.

Finding an academic job in the US proved quite difficult. While waiting for the official awarding of the PhD, May taught high school German and mathematics in St. Joseph, Missouri. At a conference in Chicago, she saw Dr. Henry Newson, whom she had met earlier in Chicago, and who taught at the University of Kansas. He helped her get a job at Kansas State Agricultural College in Manhattan (now Kansas State University).

Three years later May resigned her position at Kansas State to marry Henry Newson and move to Lawrence. Henry wanted May to continue doing mathematics, but she did not have a position outside the household. Her most notable mathematical contribution in the early years of marriage

CALL FOR NOMINATIONS

Alice T. Schafer Mathematics Prize

The Executive Committee of the Association for Women in Mathematics calls for nominations for the Alice T. Schafer Mathematics Prize to be awarded to an undergraduate woman for excellence in mathematics. All members of the mathematical community are invited to submit nominations for the Prize. The nominee may be at any level in her undergraduate career, but must be an undergraduate as of October 1, 2017. She must either be a US citizen or have a school address in the US. The Prize will be awarded at the AWM Reception and Awards Presentation at the January 2018 Joint Mathematics Meetings in San Diego, CA.

The letter of nomination should include, but is not limited to, an evaluation of the nominee on the following criteria: quality of performance in advanced mathematics courses and special programs, demonstration of real interest in mathematics, ability for independent work in mathematics, and performance in mathematical competitions at the local or national level, if any.

With the letter of nomination, please include a copy of transcripts and indicate undergraduate level. Any additional supporting materials (e.g., reports from summer work using math, copies of talks, recommendation letters from professors, colleagues, etc.) should be enclosed with the nomination. All nomination material is to be submitted as ONE PDF file via MathPrograms.Org with a copy of transcripts included at the end of the file. The submission link will be available 45 days prior to the deadline. Nominations must be received by **October 1, 2017**. If you have questions, phone 703-934-0163, email awm@awm-math.org, or visit www.awm-math.org.

was her translation of Hilbert's famous "Mathematical Problems" lecture, given at the Second International Congress of Mathematicians in Paris in 1900. May's translation was published in the *Bulletin of the AMS* in 1902. May also taught at the University of Kansas one summer term.

May and Henry had three children, born in the years 1901 to 1909. May's parents moved to Lawrence in 1906. In 1910, Henry Newson died suddenly from a heart condition. May was 40 years old, with three children. She apparently expected to be hired at the University of Kansas to replace her husband, but that did not happen. In a strange twist, May was not eligible for a position at the University, because of an antinepotism rule: May's sister taught in the English department.

In the fall of 1913, May was hired at Washburn College in Topeka, then a church-affiliated college, but later supported by the city of Topeka. May taught at Washburn for eight years, but the later years were a time of turmoil at Washburn. A popular faculty member was fired after advocating for the formation of a Faculty Senate. May signed a petition to the College President asking for a hearing on the firing. The AAUP held an investigation. May's department chair was on the opposite side of the issue from May, and May felt increased tension. She apparently also resented the fact that she was paid less than her male colleagues.

So May took the opportunity to move to a job at Eureka College, in Illinois, with the condition that she receive an equitable salary. Eureka College was the third college in the US to educate women on an equal basis with men. May taught there for 21 years. In the years that May taught at Washburn and Eureka, her children sometimes lived with her and sometimes lived with relatives elsewhere. In her first year at Eureka, her eldest, Caroline, joined her as a sophomore at Eureka College, her second daughter, Josephine, was in high school in New York state, and her son, Henry, was in junior high school in Lawrence. One year later they were all together in Eureka. Ultimately, all her children graduated from college, Josephine from the University of Kansas in bacteriology, and the other two from the University of Illinois, Caroline in English and Henry in chemistry. Henry went on to get a PhD from the University of Chicago.

During her time at Eureka College, May was active in promoting the position of women. She was one of several women who founded a chapter of the AAUW. This chapter opposed the accreditation of the college by the North Central Association, because of the lack of women on the Board of Trustees. After two years, a woman was named to the Board of Trustees, and accreditation was awarded. For many years

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CALL FOR NOMINATIONS

The 2019 Noether Lecture

AWM established the Emmy Noether Lectures in 1980 to honor women who have made fundamental and sustained contributions to the mathematical sciences. In April 2013 the lecture was renamed the AWM-AMS Noether Lecture and since 2015 has been jointly sponsored by AWM and AMS. This one-hour expository lecture is presented at the Joint Mathematics Meetings each January. Emmy Noether was one of the great mathematicians of her time, someone who worked and struggled for what she loved and believed in. Her life and work remain a tremendous inspiration.

The mathematicians who have given the Noether lectures in the past are: Jessie MacWilliams, Olga Taussky Todd, Julia Robinson, Cathleen Morawetz, Mary Ellen Rudin, Jane Cronin Scanlon, Yvonne Choquet-Bruhat, Joan Birman, Karen Uhlenbeck, Mary Wheeler, Bhama Srinivasan, Alexandra Bellow, Nancy Kopell, Linda Keen, Lesley Sibner, Ol'ga Ladyzhenskaya, Judith Sally, Olga Oleinik, Linda Rothschild, Dusa McDuff, Krystyna Kuperberg, Margaret Wright, Sun-Yung Alice Chang, Lenore Blum, Jean Taylor, Svetlana Katok, Lai-Sang Young, Ingrid Daubechies, Karen Vogtmann, Audrey Terras, Fan Chung Graham, Carolyn Gordon, Susan Montgomery, Barbara Keyfitz, Raman Parimala, Georgia Benkart, Wen-Ching Winnie Li, Karen E. Smith and Lisa Jeffrey.

The letter of nomination should include a one-page outline of the nominee's contribution to mathematics, giving four of her most important papers and other relevant information. Nominations are to be submitted as ONE PDF file via MathPrograms.Org. The submission link will be available 45 days prior to the deadline. Nominations must be submitted by **October 15, 2017** and will be held active for three years. If you have questions, phone 703-934-0163 or email awm@awm-math.org.

BOOK REVIEW *continued from page 19*

May organized an AAUW discussion group on international relations.

In 1929 May attended the Fifth International Conference of the International Federation of University Women in Geneva. Her daughter Josephine accompanied her, and they traveled to Göttingen, May's first trip back since her degree. They visited Hilbert at his home. Also on that trip, they visited Grace Chisholm Young in Switzerland.

Helen Brewster Owens had studied with Henry Newson at the University of Kansas and had gone on to get her PhD at Cornell. In 1935 she got back in touch with May. Two years later May helped Helen organize a gathering at the summer math meetings for women who had earned early math PhDs. In 1940 Helen Owens attended the Women's Centennial Congress. There they announced the names of 100 women honored for working in professions not open to women 100 years before; May was one of them.

May retired as professor in 1942, when she was nearly 73 years old. An exception to the mandatory retirement age of 65 had been made for her. She lived to be 90 years old, spending as much time as possible with her siblings and children.

Whitman's biography is based in large part on conversations with May's daughter, Caroline Newson Beshers, and on family letters that Caroline Newson Beshers shared with Whitman and donated to the Sophia Smith Collection of Women's History (at Smith College). Whitman also references the 788-page history of my department (University of Kansas), written by our former chair, G. Baley Price.

AWM Slate Announced!

We are pleased to announce the slate for this fall's AWM election. **Ruth Haas** (University of Hawaii) has been nominated to serve as President-Elect. **Janet Beery** (University of Redlands) has been nominated to serve a second term as Clerk. **Carrie Eaton** (Unity College), **Talia Fernós** (University of North Carolina, Greensboro), **Pamela Harris** (Williams College), **Michelle Manes** (University of Hawaii), **Elizabeth Milicevic** (Haverford College), **Kavita Ramanan** (Brown University), **Shree Taylor** (Delta Decisions of DC), and **Farrah Jackson Ward** (Elizabeth City State University) have accepted nominations for Member-at-Large; four will be elected.

Nominations by petition signed by 15 members are due to our president by **September 1, 2017**.

Thanks to the Nominating Committee (Ruth Charney, chair, Sylvia Bozeman, Erika Camacho, Rebecca Golden, Rebecca Segal, Karen Uhlenbeck, and Erica Walker) for their efforts in producing this fine slate of candidates.

NSF-AWM Travel Grants for Women

Mathematics Travel Grants. The objective of the NSF-AWM Travel Grants is to enable women mathematicians to attend conferences in their fields, which provides them a valuable opportunity to advance their research activities and their visibility in the research community. Having more women attend such meetings also increases the size of the pool from which speakers at subsequent meetings may be drawn and thus addresses the persistent problem of the absence of women speakers at some research conferences. The Mathematics Travel Grants provide full or partial support for travel and subsistence for a meeting or conference in the applicant's field of specialization.

Selection Procedure. All awards will be determined on a competitive basis by a selection panel consisting of distinguished mathematicians appointed by the AWM. A maximum of $2300 for domestic travel and of $3500 for foreign travel will be funded. For foreign travel, US air carriers must be used (exceptions only per federal grants regulations; prior AWM approval required).

Eligibility and Applications. Please see the website (http://www.awm-math.org/travelgrants.html) for details on eligibility and do not hesitate to contact Jennifer Lewis at 703-934-0163, ext. 213 for guidance.

Deadlines. There are three award periods per year. Applications are due **February 1**, **May 1**, and **October 1**.

MEDIA COLUMN

In addition to longer reviews for the Media Column, we invite you to watch for and submit short snippets of instances of women in mathematics in the media (WIMM Watch). Please submit to the Media Column Editors: Sarah J. Greenwald, Appalachian State University, greenwaldsj@appstate.edu *and Alice Silverberg, University of California, Irvine,* asilverb@math.uci.edu.

Gifted

Sarah J. Greenwald

I went to see the movie *Gifted* with high hopes after reading producer Andy Cohen's words: "Normally, if you see movies about math and science it's with some mad genius, where they're brilliant, but troubled somehow.… We're trying to represent the fact that normal people can be really good at this—especially little girls and women—and hopefully that message gets out there and it doesn't become a big moment anymore. It just becomes normal" [1]. *Gifted* is centered around seven-year-old Mary's extraordinary mathematical talent and a custody battle over her. Mary's mother and grandmother are also portrayed with exceptional mathematical abilities. Mary's mother had worked on Navier-Stokes equations and Mary's grandmother wants to develop Mary's talent so that she could also contribute to such questions. What I liked best about the film was the thought provoking issues surrounding how to best raise a young genius.

Is the film likely to encourage girls and women as Cohen hopes? Unfortunately, much of the film portrayed mathematics as anything but normal, laden with stereotypes. Lack of social skills, mental illness, and obsession with mathematics? Check. Having to choose between mathematics and a family life? Check. The film also suggests that mathematical success is innate and an inherited trait [4]. I did enjoy the portrayal of the first-grade teacher and her efforts to work with Mary. Without providing any spoilers, the ending of *Gifted* is more hopeful in terms of the theme of being able to do mathematics while also having a life outside of research.

In terms of diversity issues, Mary is white and the mathematicians shown in the movie are white or Asian. A female student at MIT assists a male professor in one scene. In another, Srinivasa Ramanujan is briefly mentioned and a diverse classroom is seen fleetingly. Octavia Spencer, who played Dorothy Vaughan in *Hidden Figures*, plays the sassy black and loving neighbor here, but she is not shown as mathematical. There is an acknowledgment of gender and mathematics in a newspaper article about Mary's mother. While it wasn't on the screen long enough to read, I did notice a discussion about the underrepresentation of women in mathematics in what flashed by.

The mathematics included brief but prominent scenes of mental calculations, algebra and geometry problems, and board work involving integrals and differential equations. These are also shown in the movie trailer [5]. I liked the visual presentation of the Millennium Prize Problems, with an idealized sketch of Grigori Perelman above the title of the Poincaré conjecture and blank slates ready for those who might solve the others. Mary asks who is the "dude with the beard" pictured and hypothesizes that she might solve one of the problems in the future. There were four male mathematics consultants listed in the movie credits, including Jordan Ellenberg who appeared as a professor in the film itself, Terence Tao, Russel Caflisch, and Nicholas Broom, but no women.

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MEDIA COLUMN *continued from page 21*

Caitlin Gallagher, a writer for the women oriented website Bustle, suggests that this movie is a "huge deal for women in STEM" [3]. I thought that the movie was quite a nice representation of a single father figure, but overall the stereotypes ruined it for me. Several organizations partnered with the film including Girl Scouts and Kellogg's Family Rewards [2], which sends the message that the film is aimed at families. However, there was only one young girl in the audience at the screening I attended, with most of the audience members skewing toward retirement age. This was probably good, as I wouldn't recommend the movie as one that would inspire children to study mathematics unless they already identify themselves as "gifted."

Further Reading

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EDUCATION COLUMN

Education Column Editor: Jackie Dewar, Loyola Marymount University, jdewar@lmu.edu

Editor's Note: In addition to the regular column, we have a report from Shandy Hauk about talks in the Special Session on Research in Collegiate Mathematics Education at the 2017 AWM Research Symposium, and a short announcement.

Introducing Data Analytics in K–12

Anna Bargagliotti, Loyola Marymount University

As more complex data become available in our daily lives, we have to ask ourselves if the statistics content we are introducing to students in the K–12 curriculum will help them achieve statistical literacy in today's society. The implementation of the Common Core State Standards (CCSS) ushered in a large amount of statistics content in the middle and high school grades. Among other topics, the middle and high school curriculum include concepts such as exploratory data analysis, sampling variability and simulations, probability, and bivariate data analysis.

While the emphasis on statistics in the K–12 curriculum was much welcomed seven years ago when the CCSS was originally written and envisioned, the main focus of the topics covered in the CCSS was to prepare students for inference. Does the emphasis on inference meet our current needs in today's society? Inference is fundamental in statistics and the physical and social sciences and definitely should have a place in the curriculum; however, with the large amounts of data collected each day that do not fit the criteria for random sampling, we are often confronted with "unconventional" data that are rich and worthy of interesting analyses. The CCSS does not explicitly address the challenges of understanding the data students frequently encounter or generate in their daily lives. Given these developments, if we want students to be statistically literate when they graduate from high school, in addition to laying the foundation for inferential thinking, we need to incorporate curriculum that addresses how to manage and analyze the unconventional data that students will likely encounter in their lives.

Such unconventional data may include data produced by social networking (such as Twitter or Facebook), data produced by gaming devices and smartphones, data streamed from satellites used to understand climate change and data tracking online purchases, among many others. All these data fall under the general heading of "big data." The term big data originally referred to data sets of great size that had volume, variety, velocity, and veracity; however, over time, the term big data has relaxed to include data that have characteristics that can potentially lead to great size. Big data may include images, locations, and dates. Data of this type are rarely collected through random sampling and are typically familiar to all of us with much of it generated by individuals such as ourselves.

When we talk about data analytics in the K–12 curriculum, what we mean is using data sets that fall under the big data paradigm and the analyses that go along with them—utilizing unconventional data and asking students to answer provocative questions with such data. There are very few examples of this currently being done. However, one such example is the Mobilize project (http://www.mobilizingcs.org/), for which I am a faculty advisor. The Mobilize project was an NSF-funded project that designed several data-science oriented curricula, including a year-long data science curriculum titled "Mobilize Introduction to Data Science," for secondary school students to develop a blend of computational and statistical thinking skills applied to data from a variety of contexts and types, in particular, data collected in *participatory sensing* "campaigns." Participatory sensing (PS) is a data collection paradigm designed to create communities centered around both collecting and analyzing shared data (Burke et al., 2006). Mobilize uses the term "campaign" to refer to the entire process of collecting data via participatory sensing, including choosing a topic, crafting survey questions, collecting data, and then analyzing and interpreting the data. PS data have many characteristics associated with big data, and one goal of the curriculum is to prepare students to reason with data that do not easily fit into a random sampling paradigm. The Trash Campaign is an example of such a PS campaign.

The Trash Campaign

The Mobilize project's Trash Campaign begins by presenting students with a news article about "America's largest landfill site" (Gutierrez & Webster, 2012) (which is the primary landfill site for Los Angeles County) and a link to the website for the Los Angeles County Sanitation Department (www.lacsd.org). The assignment consists of writing a letter to the Los Angeles County Sanitation Department in which students are to suggest "two specific steps the public can take to reduce the use of landfills" and to support these recommendations with evidence.

Data collected from the Participatory Sensing Trash Campaign are made available to students to complete the activity. The Trash Campaign was carried out by Los Angeles area high school biology students and their teachers, who recorded data on their mobile devices every time they threw away a trash item over a five-day time period. Multiple classrooms were combined over a one-month time period. The students and teachers who collected the data signed waivers to allow for public use of the data, and the data were anonymized by removing names and perturbing the values.

The data from this campaign consists of approximately 2600 observations of 17 variables. The variables consist of a variety of types: categorical (which type of trash bin was the item placed in; what type of trash item was it; what activity generated the trash item; where the trash item was discarded), quantitative (the number of recycling bins visible from the location where the item was discarded; the number of trash bins visible; the number of compost bins visible), image (photos of the trash items), date, time, location (latitude and longitude), and text (an open-ended description of the trash item).

The set of variables provided and the data collection scheme do not match those of a well-designed, random sample-based study. Although the problem statement requires

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making conclusions about a universe beyond the sample at hand, the lack of a random sample means that generalizations to the larger population or claims about causality had to be based on types of reasoning other than inferential reasoning. In general, one would expect student reasoning and analysis to be guided by personal knowledge of recycling and landfills. For example, a student might reason that if more recyclable goods were put in recycling bins, the burden on the landfill would decrease. This might lead to exploring the data for the percentage of recyclable goods that are put into trash cans. Although the PS data would serve as a poor estimate of this percentage for all people in the county, it still serves as evidence of whether a problem does or does not exist.

Results

As part of the Mobilize project, professional development was delivered to teachers in order to prepare them to teach the Mobilize Introduction to Data Science curriculum to their secondary students. In one of the professional development sessions, teachers worked on the Trash Campaign assignment. A detailed account of the results from the study can be found in Gould, Bargagliotti, and Johnson (2017). Here are two observations made during that study that highlight potential approaches to infusing data analytics in the K–12 curriculum.

The first observation concerns how the data cycle model used for approaching a statistical investigation focused on inferential statistics (see Figure 1) can be applied to the analysis of big data. Called the "statistical investigative process" by the GAISE K–12 report (Franklin et al., 2007), the model includes four stages: Formulate Questions, Collect Data, Analyze Data, and Interpret Results. Wild and Pfannkuch (1999) also make reference to this cycle through their proposed PPDAC (Problem, Plan, Data Analysis, Conclusions) cycle for statistical investigations. And, the CCSS modeling cycle is similar to the statistical investigation process in which students Formulate, Compute, Interpret, and Validate results (California State Board of Education, 2013, pp. 131–132).

Figure 1. The statistical investigative process

This modeling cycle is widely accepted among statistics educators as a guide for statistical investigations focused on inference. Big data and accompanying data analytics should be no different. Teachers and students can utilize the data cycle as their solution pathway for working with unconventional data. While the data cycle has been applied to inferential statistics, it also can provide students with a structured pathway to deal with big data. Results from the professional development indicated that teachers who were successful in completing the Trash Campaign assignment, that is those who were able to complete the problem and provide data-supported suggestions for reducing the landfill, were moving in and out of the different states of the data cycle fluidly. In contrast, those teachers who were not successful in completing the Trash Campaign assignment spent more time in the analysis stage of the cycle without connecting to the other stages. Figures 2 and 3 code the transcripts of teacher dialogues while they were completing the activity according to the data cycle stage the teachers were in. In the figures, every box is equivalent to one second of time. In Figure 2, we see that the successful group of teachers, Group 1, began with questions and considering data. Group 2, the non-successful group, took longer to get into the investigation and began by considering the data and then asking questions. An important difference between the groups of teachers is that Group 1 spent considerably more time in interpretation (the darkest shading corresponds to time spent interpreting data), and this was primarily at the end of their investigation.

From the graphs, we can see that the successful group of teachers, Group 1, iterated between the different states more often than the unsuccessful teachers. The successful group has much more back and forth in the data cycle, it moves from questioning to analysis multiple times and then back to questioning. It also considers the data often as well. The successful teachers also spent approximately equal amounts of time in each state of the data cycle. Group 2 did something different. It had much less questioning, much less back and forth among the different states of the cycle, and it tried to interpret everywhere. These findings suggest that success with data analytics and big data could be modeled through the use of the data cycle. In other words, while the data cycle was originally envisioned for work using inferential statistics, it also applies to big data analysis.

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Figure 2
Graphical representation of Group 1's (the successful group's) sequential movement through the data cycle. Each square represents one second of the video, and the shading represents the coding applied during that time span. Each row represents a minute and each column a second within that minute. The "NA" was coded for a few trailing seconds of one of the researcher's instructions to the group.

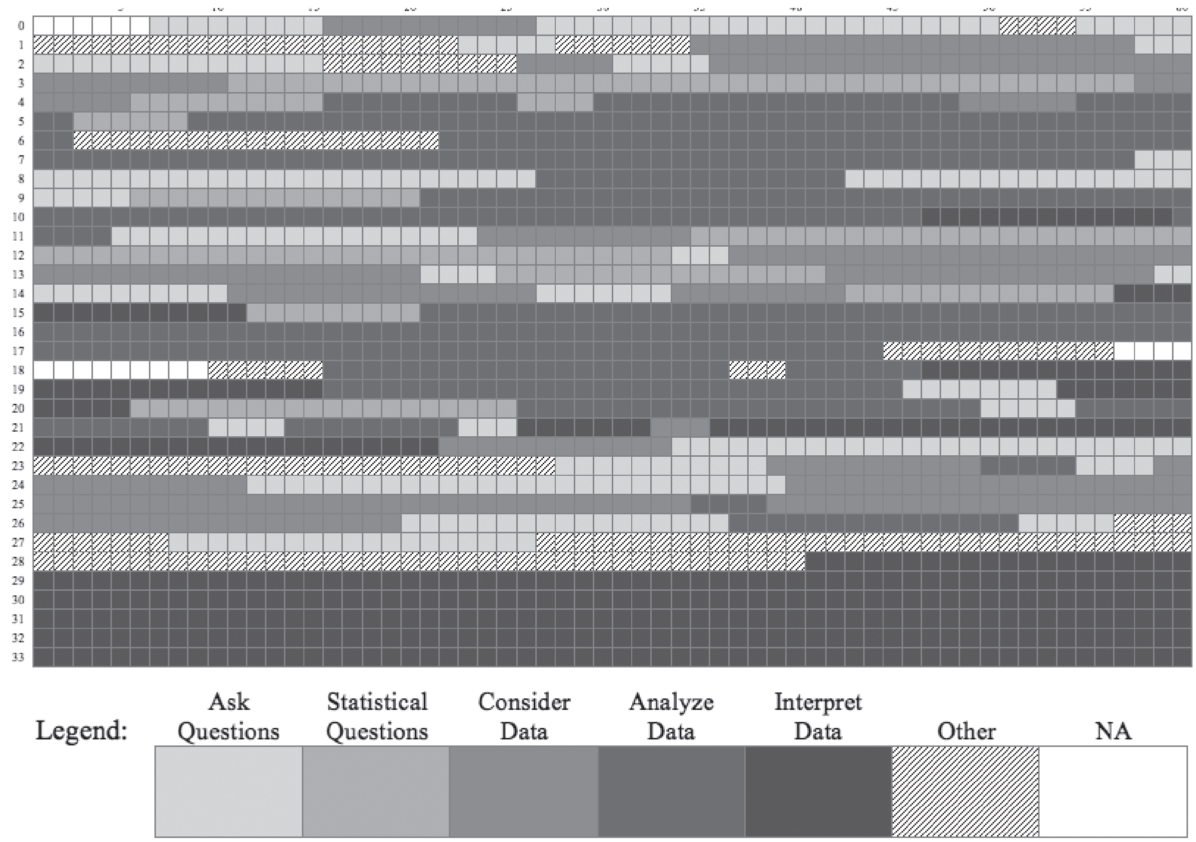
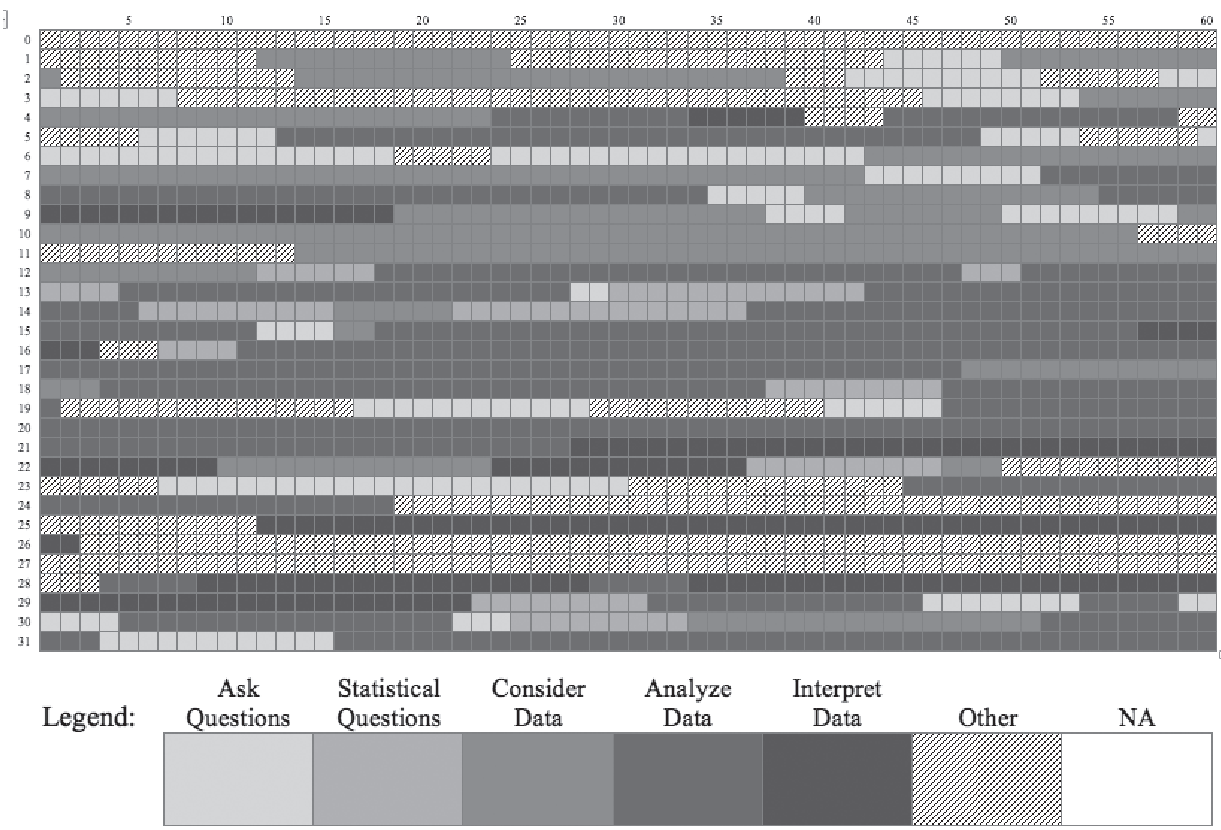


Figure 3
Graphical representation of Group 2's sequential movement through the data cycle



The second observation relates to the role of questioning in helping navigate a solution process. Questions can serve as guides for clarification and refinement in the data cycle. In the professional development, we observed that successful teachers posed questions to each other more frequently than their unsuccessful counterparts. Also, their questions were often refined through dialogue. For example, consider the following discussion between two teachers in the successful group.

Michelle (3'10''): So then do you want to do maybe, if there's more trash produced by where they are [when they dispose of the trash]. Like, by location? Do we want to?

Rosie: [Or] we could [consider if there's more trash produced by] activity level.

Rosie: Well it [the assignment] says to give two suggestions, right? But I think that there are things that we need to know. Like when is most trash produced?

Michelle: Like when, what time, or where? [Naming three other possible means by which the amount of trash might vary.]

Rosie: Like in what circumstances, so *where* [the name of a variable], and [doing] what activity?

Rosie: And then the availability of recycling bins and trash bins in relationship with *where*.

Rosie: So I'm interested in knowing how many recycle bins are around.

Michelle: So the typical number of recycle bins?

In this dialogue, Rosie suggests that they need to understand how the distribution of the number of items thrown away varies by any of several factors (location, activity, time). She eventually settles on a relatively simple question about the distribution of recycling bins, and Michelle understands how this can be analyzed. Next, they create a histogram of the distribution of the number of recycling bins, but rather than interpret this analysis, Rosie realizes this question is too simplistic, and so she modifies it:

Rosie: Do we need to compare [the distribution of recycling bins] to *where*?

Michelle is not immediately sure how to analyze this new question, and prods Rosie to think in terms of a graph. They oscillate between looking at the provided data and considering potential analyses, before Rosie states her final question:

Rosie: So I'm wondering how many recycle bins [there are] and where they are, I guess, is my first question.

The questions guided the teachers to cycle between consideration of the data (in particular, understanding which variables were provided that might help them answer their question) and an analysis.

While the data cycle has been noted as a model for a solution process when dealing with random samples and statistical inference, in Mobilize we found evidence that this same cycle can in fact inform a data analytic process while investigating big data. This makes it particularly appealing for introducing data analytics in the K–12 curriculum since no new model need be introduced. The role of questioning is also particularly important in data analytics because the data are typically not collected with a specific question in mind, instead the data are collected and questioning can serve as a way to sift through the data. In addition, the data can have many different variables compared to the two or three in most curricula. Because of this, students can become paralyzed by choice, and might resort to a "hunt and sort" method of analysis, in which they arbitrarily search for anything "significant." By emphasizing questioning, students can focus their investigation in a direction that is meaningful. In this sense, asking good questions about the data becomes pivotal to finding solutions in big data. Research on determining and classifying good statistical questions is becoming an important area of research in statistics education (see, for example, Arnold, 2013; Arnold & Franklin, 2017).

Reflection

Given the emphasis on data in society today and the widespread collection and availability of big data, it is important that we consider how data analytics can be brought into the K–12 classroom. Students need opportunities to work with big data in their classrooms in order to show the relevance of statistics in their daily lives. Therefore, teachers need to be comfortable using such data themselves in interesting activities and in turn bring such activities into the classroom.

In general, in order for students to be successful as statistical thinkers and working with big data, the curriculum presented in the CCSS is certainly necessary. It gives them statistics fundamentals. At this point in time, our job as educators is to figure out how data analytics can be incorporated and create overlapping curriculum standards that address both analytics and inference. Asking good statistical questions, for example, is one area that bridges both formal inferential statistics and data analytics. Other concepts such as knowing the limitations of a study design and knowing types of data and subsequently the appropriate ways to analyze it are concepts that cover a wide range of data types and analysis techniques both in analytics and inference.

Acknowledgments

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Research in Collegiate Mathematics Education Arrives at the AWM Symposium

Shandy Hauk, Science, Technology, Engineering, and Mathematics Program, WestEd

For the first time this year the AWM Symposium included a session on research in collegiate mathematics education. The six presentations in the session on Saturday, April 8, 2017 were based in various theoretical perspectives on the nature of human cognition and knowledge structures. Research methods ranged from individual interview and classroom observation to national survey and in-depth study of a particular instance or case. The span of topics covered calculus, combinatorics, linear algebra, foundations of proof, and the application of mathematics to teaching and the development of future teachers.

At the morning's first talk, the smell of Juicy Fruit gum filled the room as Nicole Infante distributed the manipulatives for an activity about Riemann sums to start her presentation, "Leveraging Our Bodies When We Learn." The narrow side of each stick of gum was delta x and the long side adjusted to be delta y as each of the 20 people in the room gestured their way through the foundational ideas of left and right sums in finding the area under a curve. A critical aspect of learning and understanding mathematical concepts is moving among different representations of an idea. From the perspective of embodied cognition, our understanding of concepts is shaped through bodily experiences, such as gesture. Nicole provided background from education research and some illustrative video examples from her current exploration of the use of gesture in college calculus teaching and learning. From instinctive to purposeful, gestures used by instructors (as well as those they encourage in their students) can clarify communication and support meaning-making.

Also in the calculus zone, but at a very different grain size, in the afternoon session Chris Rasmussen shared "Findings from a National Study of Calculus Programs." This project involved both a national survey and case studies of five institutions identified as having relatively successful calculus programs. The five sites included technical universities and medium to large public and private institutions. Chris shared results about the effects of particular departmental approaches through comparison of grades and perceptions of instruction among students who persist into Calculus II and those who switch out of the calculus sequence and leave

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the STEM pipeline. Project case studies used site visits and analysis of over 95 hours of interviews with faculty, administrators, and students. Findings revealed seven different programmatic and structural features common across the institutions, including substantive graduate teaching assistant training, coordination across sections, and the use of active learning approaches in instruction. Chris used community of practice and social-academic integrations perspectives to illuminate why and how the seven features contribute to successful calculus programs.

Axioms and definitions for foundational mathematics ideas are not as standard as some may think. In "Examining Students' Combinatorial Reasoning: The Case of the Multiplication Principle," Elise Lockwood presented a fascinating collection of textbook definitions and elaborations about the multiplication principle in probability. Combinatorics is a rich and accessible topic, but counting problems are difficult for students to learn and for teachers to teach. This principle is fundamental to combinatorics, underpinning many standard formulas and counting strategies. After offering a categorization of statement types found in analyses of many textbooks, Elise shared excerpts from a study where two mathematically skilled college students started with basic counting problems and then were asked to generate a definition for the multiplication principle. The two students then worked together on increasingly sophisticated problems, revising their definition each time to ensure it covered necessity and sufficiency conditions. The study shed light on student reasoning and revealed surprisingly subtle aspects of the multiplication principle. There are a number of mathematical and pedagogical implications of the research that bode well for improved understanding and flexibility with the principle and, more generally, student ability to create definitions.

An inquiry based approach is defined as incorporating (1) deep engagement in mathematics, (2) peer to peer interaction, and (3) instructor interest in and use of student thinking. As Michelle Zandieh shared in "An Example of Inquiry in Linear Algebra: The Roles of Symbolizing and Brokering," iterative cycles of research and development that focus on unpacking how people are thinking about ideas at various places in their learning can lead to powerful learning materials. Michelle's team is exploring the connections among representations in linear algebra and the growth of understanding of those connections as students and instructor interact in the classroom. The research and development by her team addresses practical questions such as: How do symbols appear and evolve in an inquiry-oriented classroom? How can an instructor connect students with traditional notation and vocabulary without undermining their sense of ownership of the material? She shared examples from linear algebra that highlight the ways an instructor is a broker of meaning and of what is mathematically valued, and the ways in which students might participate in the practice of symbolizing as they reinvent and develop a complex understanding of the diagonalization equation $A = PDP^{-1}$.

Research in collegiate mathematics education can inform us as mathematics instructors and as mathematical thinkers in several ways. In "Unearthing Students' Problematics through Proof Scripts," Stacy Brown presented findings from a study that explored students' reasoning about the "within argument contradictions" that arise from logically degenerate cases. The mechanism for getting at student reasoning was analysis of proof scripts. Scripts were created by students who were given a theorem and its purported proof (i.e., one generated by a student named Gamma). Students were asked to read the purported proof, identify problematic points in it, and then write a dialog between themselves and Gamma that went through the proof and addressed the problematics. Drawing on early findings, Stacy reported on a framework for proof problematics noticed by students. She also explored the viability of the proof script methodology for identifying difficulties experienced by students, but unseen by experts. Findings indicated students held conceptions of proof-by-cases that inhibited reasoning about the encountered contradictions and students had difficulties in correctly reasoning with logical conjunctions.

In the final presentation, "How and When Do High School Math Teachers Have the Opportunity to Learn Mathematics that Benefits their Teaching?" Yvonne Lai challenged us to think about mathematics for future teacher courses as being instantiations of applied mathematics: applying mathematics when the context is teaching. It is only in the last two decades that investigation has focused on mathematical knowledge that is specific to teaching. Research has demonstrated over and again that this knowledge may not be found in typical mathematics major coursework such as abstract algebra or real analysis. Yvonne offered interesting examples of what assessment of applied mathematical knowledge could look like for secondary pre-service teachers along with early results of a study validating such assessment items. Finally, she shared recent work that analyzed textbooks commonly used in mathematics courses for future teachers.

Books for future elementary school teachers contain many more opportunities than books for future secondary teachers for learners to get experience in applying mathematics to teaching-practice-based situations. She closed with some examples of current projects in the US that are developing instructional activities that do offer teaching-practice-based problems for applying mathematics to secondary school teaching.

Designed for people who have advanced degrees in the mathematical sciences, session activities touched on what research suggests about thinking and learning across the college curriculum. Speakers communicated some of the landscape of current research in undergraduate mathematics education and offered useful information for present and future faculty members. Presentations generated lively conversations about the foundations and implications of collegiate mathematics education research and offered networking opportunities for the audience of 15 to 25 graduate students, postdocs, and faculty who attended each presentation.

Conference Announcement

Alan Rogerson, alan@cdnalma.poznan.pl

The 13th International Conference of the Mathematics Education for the Future Project in Catania, Sicily, September 2015, was attended by 130 people from 22 countries. The next conference will be held at Hotel Annabella, Balatonfüred, Lake Balaton, Hungary from September 10–15, 2017. The conference, "Challenges in Mathematics Education for the Next Decade," continues our search for innovation in mathematics, science, computing, and statistics education. Our thirteen previous conferences since 1999 were renowned for their friendly and productive atmosphere and attracted many movers and shakers from around the world. So far 90+ people have registered from 20+ countries. For details, see the announcement at http://directorymathsed.net/montenegro/HungaryConferenceSecondAnnouncement.pdf or email alan@cdnalma.poznan.pl.

Six Women on Why Mathematics Is a Great Major

Rhonda Olson, Arizona State University

It's no secret that women are underrepresented in the sciences, especially in mathematics. Some researchers believe one factor that contributes is what they call the "brilliance effect"—the beliefs that natural brilliance or knack for a subject drives success, rather than hard work or persistence.

These six young women graduating with degrees in mathematics from the School of Mathematical and Statistical Sciences at Arizona State University (ASU) want to help change that perception. They agree that hard work and perseverance is needed to be successful at math, and at life. By putting in the effort and challenging themselves, they discovered a new way of thinking.

Their hard work is paying off. These top math graduates have earned great jobs right out of college, including working in a CalTech brain lab studying decision-making, becoming a life pricing analyst at USAA insurance, working as an analyst with health-care consulting firm Optumas, and teaching mathematics at McClintock High School. Several others will continue their education pursuing doctoral degrees in computer science at Stanford and working toward an advanced degree in pharmacy.

They hope to inspire the next generation of young girls to work hard as they pursue mathematics or whatever subjects they are interested in.

Grace Kennedy

Major: Actuarial Science (School of Mathematical and Statistical Sciences)

Awards and Scholarships earned: New American University Scholar – President's Award, Joaquin Bustoz Memorial Mathematics Scholarship, Blue Cross Blue Shield of Arizona Scholarship, Arizona Power Authority Scholarship, Goldwater Scholarship Honorable Mention

Hometown: Apache Junction, Arizona ("I love the Superstition Mountains. ASU always feels like home too especially because 'A' Mountain is a piece of volcanic rock from the mountain range of my hometown.")

Question: What was your "aha" moment, when you realized you wanted to study math?

Answer: I realized I wanted to "do something" with math in second grade. I viewed math as a means for empowerment, since anyone who was good at math in my elementary school was treated like they were amazing and awesome. I actually

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Grace Kennedy

didn't focus much on math until this "aha" moment. Luckily for me, that moment occurred early on. I put in a great deal of effort to improve myself because I wanted to be the best at math. When school would go out for summer I was the weird kid who said, "Mom, can we go to the bookstore? I need a math textbook on [insert next math class here]."

Five years later (yep, 12 years old), I found that something. I wanted to be an actuary. I guess I am not the typical kid, but I am passionate about my goals and apparently know how to get there.

Q: What's something you learned—in the classroom or otherwise—that surprised you, that changed your perspective?

A: Like I said in my "aha" moment, I wanted to be the best at math. I needed a change of perspective and I got it my first summer at ASU. I was in the Joaquin Bustoz Math Science Honors Program (JBMSHP) during high school. Basically the JBMSHP is math camp. It was the best thing I could possibly have done with my summers. I made so many friends and a lot of them were better at math than me, but that didn't mean I wasn't amazing and awesome—it meant I could learn from them. I later learned this is called "growth mentality."

Q: What's the best piece of advice you'd give to those still in school?

A: Find your passion, pursue it like a goal and tell the world. For instance, I was/am passionate about math, I made it a goal by focusing in on a career involving math (actuarial science), and I told everyone with my actions and my words. People helped me get where I am because I told them what I wanted. I honestly believe people want to help, but you need to help them help you, and that can be as simple as telling them what you need help with. I also am passionate about animal welfare: I made it a goal by learning to be a service and therapy dog trainer, and I make it a point to show people the importance of the cause.

It is important to also be willing to try other things because those experiences shape you. While I knew I wanted to be an actuary, I was also involved in the Naval Junior Reserve Officer Training Corp (NJROTC) at my high school. I was dedicated and became commanding officer. Even though I knew I wasn't the right fit for military life, I wanted to help the people that were going to be protecting us. That drive to help military personnel helped me to find work at USAA upon graduation as a life pricing actuary.

Q: Why is math a great major to pursue?

A: Math is a great major because math is awesome and amazing and so are the people who study it. Also, mathematics isn't like a lot of other majors. Math is a tool and can help any degree program by applying the knowledge gained to it. I am not just saying applied math is all math since pure math is where new thought processes develop.

Q: What are your plans after graduation?

A: I am going to move to San Antonio, Texas, with my fiancé to pursue a career at USAA as a life pricing analyst.

Q: If someone gave you $40 million to solve one problem on our planet, what would you tackle?

A: I have so many causes I would like to help, such as food and clean water insecurity for children, rainforest depletion, veteran affairs for PTSD patients, and math education. I would use the $40 million to raise awareness and recruit investors so I can raise money for all of these causes.... I guess I live by the "aim for the stars and you'll at least make it to the moon" mentality.

Alexandra Porter

Majors: BS Mathematics (School of Mathematical and Statistical Sciences), BS Computer Science (School of Computing, Informatics, and Decision Systems Engineering)

Minor: Music Performance (Percussion)

Awards: Charles Wexler Mathematics Prize, Computing Research Association Outstanding Undergraduate Researcher Finalist, National Science Foundation Graduate Research Fellowship

Hometown: Albuquerque, New Mexico

Q: What was your "aha" moment, when you realized you wanted to study math?

A: When I started research in theoretical computer science during sophomore year of college, I realized my interest in math was as strong as my interest in CS and I wanted it to be a bigger part of my education.

Q: What's something you learned—in the classroom or otherwise—that surprised you, that changed your perspective?

A: Taking Intro to Theoretical Computer Science made me realize that CS can be more than programming.

Q: What's the best piece of advice you'd give to those still in school?

A: Explore new topics in your major or otherwise; you may find something else you want to study that connects to your current interests.

Q: Why is math a great major to pursue?

A: As a major, math has something for every interest, whether in pure theory or applied subjects.

Q: What are your plans after graduation?

A: Attend Stanford for PhD in Computer Science.

Q: If someone gave you $40 million to solve one problem on our planet, what would you tackle?

A: I would tackle creating renewable energy.

Alexandra Porter

Koranis Sandy Tanwisuth

Koranis Sandy Tanwisuth

Majors: BS Mathematics with concentration in Statistics (School of Mathematical and Statistical Sciences), BS Psychology (Department of Psychology)

Certificate: Symbolic, Cognitive and Linguistic Systems

Awards and scholarships earned: André Levard Mackey Scholarship, Jerry Wistosky Memorial Scholarship

Hometown: Bangkok, Thailand

Q: What was your "aha" moment, when you realized you wanted to study math?

A: Since I started participating in several research laboratories, I knew that I need advanced mathematical knowledge to truly understand the decision-making process and that's why I chose to pursue a math degree.

Q: What's something you learned—in the classroom or otherwise—that surprised you, that changed your perspective?

A: Throughout my four years here at ASU, I've learned several things and the wisdoms I gained gradually changed my perspective on life. One of the most important changes I notice is that I became a hard worker and a believer in hard-working since it will eventually pay off.

Q: What's the best piece of advice you'd give to those still in school?

A: Work hard! It will pay off.

Q: Why is math a great major to pursue?

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A: Personally, the knowledge in mathematics enables me to understand previous literature in the fields and allows me to come up with an idea of a new cognitive model. Advanced knowledge in mathematics plays a very crucial role in understanding several phenomena.

Q: What are your plans after graduation?

A: Starting this summer, I will be working at O'Doherty's Lab, California Institute of Technology. During this year, I will apply to PhD programs related to Computational Neuroscience/Statistical Machine Learning and/or related fields to pursue a research career.

Q: If someone gave you $40 million to solve one problem on our planet, what would you tackle?

A: Probably education, since solving this problem will lead to solving several other problems.

Taylor Patten

Major: BS Mathematics (School of Mathematical and Statistical Sciences)

Awards and scholarships earned: New American Scholar, ASU Moeur Recipient

Hometown: Phoenix, Arizona

Q: What was your "aha" moment, when you realized you wanted to study math?

A: I realized I wanted to study math sometime in high school. It was the only class that I always enjoyed going to.

Taylor Patten

Q: What's something you learned—in the classroom or otherwise—that surprised you, that changed your perspective?

A: I've learned that I should have more confidence in myself academically. Just because you feel like you aren't very good at a certain subject doesn't mean you won't surprise yourself.

Q: What's the best piece of advice you'd give to those still in school?

A: My advice to anyone still in school is to continue to pursue your goals, no matter what problems or difficulties you encounter along the way. The right to pursue an education is truly a right to be valued and honored.

Q: Why is math a great major to pursue?

A: Math is a crucial element in so many areas that are vital to our society. For me, it has always been something that I have found challenging and enjoyable.

Q: What are your plans after graduation?

A: I'm continuing my education at ASU in order to complete the prerequisites necessary to pass the PCAT as well as satisfy the requirements necessary for entrance into a three-year accelerated program to become a Doctor of Pharmacy.

Q: If someone gave you $40 million to solve one problem on our planet, what would you tackle?

A: I would love to help find a cure for cancer or spread awareness about global warming.

Karla Gonzalez

Major: BS Mathematics with concentration in Secondary Education (School of Mathematical and Statistical Sciences)

Awards and scholarships earned: Ioana Elise Hociota !!! Memorial Mathematics Scholarship, Charles & Christine Michael Scholarship, and New American University Scholarship

Hometown: Tempe, Arizona

Q: What was your "aha" moment, when you realized you wanted to study math?

A: I decided I wanted to be a math major when I was in high school and stayed after school one of the days with my math teacher, and she showed me how to prove a mathematical concept and I was just in awe. I wanted to do these discoveries more and more.

Q: What's something you learned—in the classroom or otherwise—that surprised you, that changed your perspective?

A: I always thought math was about getting an "answer," but it is much more than that; it is a way of thinking and problem solving.

Karla Gonzales

Q: What's the best piece of advice you'd give to those still in school?

A: I would tell those still in school to stay focused and positive because even though things get overwhelming, life is about learning and growing and you will learn so much about yourself while in school.

Q: Why is math a great major to pursue?

A: Math is in everything. Math is a way of thinking. If you truly want to exercise your brain and be able to think in a new way, majoring in math is the way to go.

Q: What are your plans after graduation?

A: I have currently been hired to teach math at the high school level at McClintock High School in Tempe.

Q: If someone gave you $40 million to solve one problem on our planet, what would you tackle?

A: I would tackle starvation. No one deserves to die of hunger and malnutrition.

Julie Tang

Major: Actuarial Science (School of Mathematical and Statistical Sciences)

Awards and scholarships earned: National Merit Scholar, New American Scholar

Hometown: Chandler, Arizona

Q: What was your "aha" moment, when you realized you wanted to study math?

A: I was good at math, enjoyed math and finally understood by sophomore year that my greatest utilitarian value in society would be maximizing my efficiency and finding something in math.

Q: What's something you learned—in the classroom or otherwise—that surprised you, that changed your perspective?

A: The hardest thing to learn is the emotional labor it takes to make and maintain friendships.

Q: What's the best piece of advice you'd give to those still in school?

A: Finding (making, working for) a supportive system of friends might save your grades or your life!

Q: Why is math a great major to pursue?

A: With some reductionist reasoning, every STEM major is built on math. If you are a master of math, you can easily apply it to many fields.

Q: What are your plans after graduation?

A: I'm going to Sweden and Iceland for two weeks with my older sister! Then I am starting my job at Optumas, a small health-care consulting firm in Scottsdale.

Q: If someone gave you $40 million to solve one problem on our planet, what would you tackle?

A: The most frustrating issue I feel is the aggressive, willful ignorance or confirmation bias that plagues all of humanity. I feel there's not a single problem existing today that could not be solved by elevated rationality and consciousness of all humans. I honestly can't think of a single problem that plagues all of humanity that can be dented by just $40 million. I guess I'll give it to independent cancer research.

Julie Tang

AWM WORKSHOP AT THE 2018 JOINT MATHEMATICS MEETINGS

Application deadline for graduate students: **August 15, 2017**

For many years, the Association for Women in Mathematics has held a series of workshops for women graduate students and recent PhDs in conjunction with major mathematics meetings. New in 2016 and going forward is that the workshop talks are supported by the AWM ADVANCE grant. The AWM Workshops serve as follow-up workshops to Research Collaboration Conferences for Women, featuring both junior and senior women speakers from one of the Research Networks supported by the ADVANCE grant. An AWM Workshop is scheduled to be held in conjunction with the Joint Mathematics Meetings in San Diego, California, January 10–13, 2018.

FORMAT: The workshop will consist of a Special Session focused on Noncommutative Algebra and Representation Theory organized by Anne Shepler and Sarah Witherspoon, and a Poster Session for graduate students. Selected junior and senior women from the Research Collaboration Conferences for Women (RCCW) WINART, which was held at BIRS in April 2016, will be invited to give 20-minute talks in the Special Session on Noncommutative Algebra and Representation Theory. The speakers will be supported by the National Science Foundation AWM ADVANCE grant: Career Advancement for Women Through Research Focused Networks. The Poster Session will be open to all areas of research and graduate students working in areas related to Noncommutative Algebra and Representation Theory are especially encouraged to apply. The graduate students will be selected through an application process to present posters at the Workshop Reception & Poster Session. With funding from NSF, AWM will offer partial support for travel and hotel accommodations for the selected graduate students. The workshop will include a reception, a luncheon and a mentoring session where workshop participants will have the opportunity to meet with other women mathematicians at all stages of their careers. In particular, graduate students in Noncommutative Algebra and Representation Theory will have the opportunity to connect with the Women in Noncommutative Algebra and Representation Theory (WINART) Research Network.

All mathematicians (female and male) are invited to attend the talks and poster presentations. Departments are urged to help graduate students and junior faculty who are not selected for the workshop to obtain institutional support to attend the presentations.

MENTORS: We also seek volunteers to act as mentors for workshop participants, in particular the graduate students. If you are interested in volunteering, please contact the AWM office at awm@awm-math.org by **September 15, 2017**.

ELIGIBILITY: To be eligible for selection and funding, a graduate student must have made substantial progress towards her thesis. Women with grants or other sources of support are welcome to apply. All non-US citizens must have a current US address.

All applications should include:

- a title of the proposed poster
- an abstract in the form required for AMS Special Session submissions for the Joint Mathematics Meetings
- a curriculum vitae
- one letter of recommendation from her thesis advisor.

Applications (including abstract submission via the Joint Mathematics Meetings website) must be completed electronically by **August 15, 2017**. See https://sites.google.com/site/awmmath/programs/workshops for details.

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UNIVERSITY OF NEBRASKA—LINCOLN, Milton Mohr Professor of Mathematics—The Department of Mathematics at the University of Nebraska-Lincoln invites applications for the Milton Mohr Professor of Mathematics, at the Associate Professor or Full Professor level, to begin in August 2018. The ideal candidate will have a strong, internationally recognized research program in mathematics, a demonstrated ability to attract external funding, and a strong record of mentoring Ph.D. students and postdocs. To be considered for the position, applicants must complete the Faculty/Administrative application at http://employment.unl.edu, requisition # F_160191. In addition, applicants must also submit a cover letter, a curriculum vitae, and the names and contact information of three references. Materials may be submitted through mathjobs.org or via email to hiring@math.unl.edu. Review of applications will begin **October 1, 2017** and continue until the position is filled. For more information about this position, please go to: http://www.math.unl.edu/department/jobs/. The University of Nebraska-Lincoln is committed to a pluralistic campus community through affirmative action, equal opportunity, work-life balance, and dual careers. See http://www.unl.edu/equity/notice-nondiscrimination.

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