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.

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PRESIDENT'S REPORT

Warmest greetings to all as we enter this hinge-point into the New Year. This season tends to be one of looking backward and forward at the same time, a time of new beginnings, and a time of reflection. In this spirit, I re-read Lenore Blum's retrospective of the first 20 years of the AWM, written in 1991. In her Preface, Lenore describes her after-dinner talk at the 20th Anniversary Banquet of the AWM. She mentions many familiar names so that, even though I wasn't there, I feel part of that history. The article ends with an optimistic vision: "I predict that within five years there will be vast changes in the top departments reflecting (and benefitting from) changes already in place within the wider mathematics community. One might call this the 'trickle up' effect." While Lenore's predictions have, sadly, not come true, we *have* seen some dramatic changes. For example, Jill Pipher, one of the speakers at the 20th Anniversary AWM Symposium and AWM President in 2011–2013, has just been elected the next President of the AMS. Deanna Haunsperger, one of the graduate student speakers at the 20th Anniversary Symposium, is now President of the MAA. So, things definitely *are* looking up. In 1990, 18% of all PhDs in mathematics in the US were given to women; in 2015 that percentage had risen to 31%. So, I think that the needle *has* moved, and that this movement is the result of the efforts of the AWM and of programs that have supported women at various stages in their careers. Nevertheless, we do have a ways to go to realize Lenore's vision, to help these changes "trickle up." While 13% of professors at the top rank in doctoral-granting institutions are women, many of the most elite math departments have few or zero tenured women professors. As an organization and as a community, we need to continue to push for change at the hiring level: the pool of talented applicants *is* there.

And now I'd like to look at another needle. In her history of the AWM, Lenore writes that, in 1978, Pat Kenschaft organized a panel "Black Women in Mathematics," which included six of the twelve black women in the US then known to hold PhDs in mathematics. In 1991–1992, when the AWM celebrated its 20th, only 1% of math PhDs in the US went to women from underrepresented groups. This number has doubled in the past 25 years, hovering around 2% for much of the past decade. While both needles have moved, why are they so different? The answer is that we live in a complicated society that has historically disadvantaged certain groups. It makes sense that challenges faced by a gender in the minority are experienced differently, more acutely, by members who also belong to other underrepresented groups. Awareness of this intersectionality can help us develop more equitable programs that promote inclusion. Shifting our

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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.

Opinions expressed in AWM *Newsletter* articles are those of the authors and do not necessarily reflect opinions of the editors or policies of the Association for Women in Mathematics. Authors sign consent to publish forms.

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PRESIDENT'S REPORT *continued from page 1*

attention from diversity to inclusion means acknowledging the dynamics of difference in our jobs, labs and classrooms. In the past months, the AWM has renewed its commitment to creating a more inclusive community, and we continue to push for positive change. Sometimes I am frustrated by the slowness of change, and am reminded of Dr. King's words:

> We must come to see that human progress never rolls in on wheels of inevitability. It comes through ... tireless efforts and persistent work ..., and without this hard work time itself becomes an ally of the forces of social stagnation.

I welcome your advice and support as we engineer Lenore's "trickle up" effect, and I thank you all for your tireless efforts and persistent work.

AWM News. A lot has happened in the last few months. I welcome our new Executive Director, **Karoline Pershell**, who will be starting her duties on January 15, 2018. Karoline has been working with the AWM as a member of the Policy and Advocacy committee for several years. Along with **Michelle Snider**, Karoline organized a very successful Hill Visit in November (see the article on pages 16–19). With deep gratitude, I thank outgoing Executive Director **Magnhild Lien** for six years of leadership. We wish her well as she embarks on new activities, and are heartened that she will continue to work with the AWM as the project director of our ongoing ADVANCE grant.

We have announced our inaugural list of AWM Fellows: **Rodrigo Bañuelos**, **Georgia Benkart**, **Lenore Blum**, **Sylvia Bozeman**, **Bettye Anne Case**, **Ruth Charney**, **Carolyn Gordon**, **Mary Gray**, **Helen Grundman**, **Ruth Haas**, **Deanna Haunsperger**, **Rhonda Hughes**, **Trachette Jackson**, **Naomi Jochnowitz**, **Linda Keen**, **Cathy Kessel**, **Barbara Keyfitz**, **Genevieve Knight**, **Kristin Lauter**, **Suzanne Lenhart**, **Jill Mesirov**, **James Morrow**, **Jill Pipher**, **Judith Roitman**, **Linda Rothschild**, **Bhama Srinivasan**, **Jean Taylor**, **Chuu-Lian Terng**, **Mariel Vazquez**, **William Vélez**, **Sylvia Wiegand** and **Carol Wood**. Please join us as we celebrate them at the AWM Reception at the Joint Mathematics Meetings in San Diego on January 11th. This illustrious group seeds our new AWM Fellows Program; we are counting on you to nominate deserving individuals in the coming years.

The AWM has a full slate of events at the JMM: the AWM workshop, a panel on "Using Mathematics in Activism" organized by **Michelle Manes**, followed by the AWM Business Meeting. On Thursday, you'll want to attend the Noether Lecture presented by **Jill Pipher**, a panel organized by AWM Education Committee co-chairs **Jacqueline Dewar** and **Pao-sheng Hsu** and member **Harriet Pollatsek**, and the AWM special session on Women in Symplectic and Contact Geometry, organized by **Bahar Acu**, **Ziva Myer** and **Yu Pan**. At the Joint Prize Session we will present four prizes: the Louise Hay Award for Contributions to Mathematics Education will be presented to **Kristin Umland**, the Humphreys Award for Mentorship of Undergraduate Women will be given to **Erica Flapan**, the Sadosky Research Prize in Analysis will be awarded to **Lillian Pierce**, and **Melanie Matchett Wood** will receive the Microsoft Research Prize in Algebra and Number Theory. Don't miss any of the AWM activities at the JMM. For

a full list, see: https://sites.google.com/site/awmmath/awm-at-jmm, and be sure to stop by our booth to say hello.

It is exciting to see young, talented women pursuing mathematics. I want to congratulate our Schafer Prize winner, **Libby Taylor** (Georgia Tech), runner-up **Sameera Vemulapalli** (UC Berkeley), and honorable mentions **Hui Xu** (Amherst), **Sarah Fleming** (U Michigan) and **Shruthi Sridhar** (Cornell). We are also pleased to announce the AWM Dissertation Prize winners: **Jessica Fintzen** (University of Michigan), **Maja Tasković** (University of Pennsylvania) and **Xiaochuan Tian** (UT Austin). Kudos to all!

In other news: **Marie-Françoise Roy**, from the Committee for Women in Mathematics (CWM) has announced that the new International Mathematics Union (IMU) website has been launched, and CWM is part of it. Check it out here: https://www.mathunion.org/cwm/ Now all committees and commissions of IMU, including CWM, are fully integrated into one single website. We are encouraged to send them information about initiatives for women in mathematics in our country or scientific environment so that it can be disseminated on their website.

In this issue, we fondly remember **Cathleen Morawetz** and **Joyce McLaughlin**, both mathematicians of great stature who have made huge contributions to our community.

Finally, I want to personally thank all of you who have volunteered time and donated resources to the AWM this past year. We could do nothing without you. Here's wishing you all a joyous winter season.

References

Lenore Blum, "A Brief History of the Association for Women in Mathematics: The President's Perspectives," *AMS Notices*, Vol. 28, No. 7, pp. 738–774 (Sept 1991). This article, and another *Notices* article on the History of the AWM, are accessible on the AWM website: https://sites.google.com/site/awmmath/awm/history

The Annual Survey of the Mathematical Sciences, http://www.ams.org/profession/data/annual-survey/annual-survey

C. Puritty et al. "Without inclusion, diversity initiatives are not enough," *Science* Vol. 257, Issue 6356, pp. 1101–1102 (Sep 2017).

Martin Luther King, Jr. "Letter from Birmingham Jail" (1963), https://web.cn.edu/kwheeler/documents/Letter_Birmingham_Jail.pdf

Ami Radunskaya

Ami Radunskaya
November 30, 2017
Claremont, CA

Membership Dues
Membership runs from Oct. 1 to Sept. 30
Individual: $70 **Family, new member:** $35
Contributing: $160
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Newsletter Ads—AWM will accept ads for the *Newsletter* for positions available, programs in any of the mathematical sciences, professional activities and opportunities of interest to the AWM membership and other appropriate subjects. The Managing Director, in consultation with the President and the Newsletter Editor when necessary, will determine whether a proposed ad is acceptable under these guidelines. *All institutions and programs advertising in the* Newsletter *must be Affirmative Action/Equal Opportunity designated.* Institutional members receive discounts on ads; see the AWM website for details. For non-members, the rate is $116 for a basic four-line ad. Additional lines are $14 each. See the AWM website for *Newsletter* display ad rates.

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Editorial: 24th of January, March, May, July, September, November
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.

Addresses
Send all queries and all *Newsletter* material except ads and queries/material for columns to Anne Leggett, amcdona@luc.edu. Send all book review queries/material to Marge Bayer, bayer@math.ku.edu. Send all education column queries/material to Jackie Dewar, jdewar@lmu.edu. Send all media column queries/material to Sarah Greenwald, greenwaldsj@appstate.edu and Alice Silverberg, asilverb@math.uci.edu. Send all student chapter corner queries/material to Kavita Ramanan, kavita_ramanan@brown.edu. Send everything else, including ads and address changes, to AWM, fax: 703-359-7562, e-mail: awm@awm-math.org.

ASSOCIATION FOR WOMEN IN MATHEMATICS

AWM ONLINE

The *AWM Newsletter* is freely available online.

Online Ads Info: Classified and job link ads may be placed at the AWM website.

Website: http://www.awm-math.org
Updates: webmaster@awm-math.org

Media Coordinator
Joanna Wares; jwares@richmond.edu

AWM DEADLINES

RCCW Proposals: January 1 and July 1, 2018
AWM Essay Contest: January 31, 2018
AWM Mentoring Travel Grants: February 1, 2018
AWM Travel Grants: February 1, 2018 and May 1, 2018
AWM-Birman Research Prize: February 15, 2018
AWM Student Chapters Award: April 15, 2018
AWM Louise Hay Award: April 30, 2018
AWM M. Gweneth Humphreys Award: April 30, 2018

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Tribute to Magnhild Lien

Kristin Lauter, AWM Past President

After six years as Executive Director of the Association for Women in Mathematics, Magnhild Lien is retiring in January 2018. The Executive Director is a key leadership position for the organization, working closely with the President and Executive Committee to oversee all aspects of its programs and mission. As Executive Director (ED), Magnhild launched important new initiatives for AWM, such as the Annual Giving Campaign, the Finance Committee to manage investments, and the Fund Development Committee to raise money; structured the AWM Advisory Board; restructured our portfolios; updated our Handbook and Bylaws; and provided guidance to volunteers for successful leadership of committees. Also during her tenure, she helped implement the new AWM Research Prizes, Dissertation Awards, Student Chapter Awards, and AWM Fellows Program, the biennial AWM Research Symposia, the AWM Springer Series, the AWM Hill Visits Program, the AWM-MAA Liaison Program, and the AWM Scientific Advisory Committee, and helped obtain numerous grants to support our meetings, including the five-year NSF ADVANCE Grant for which she is the Project Director.

Former President Jill Pipher says, "Magnhild began her tenure as Executive Director when I was President of AWM. I was thrilled to have found such a superbly competent and dedicated partner. I was also struck by her extraordinary commitment to helping women at early stages of their careers. In general, the ED of AWM has critically important functions, many of which are 'behind the scenes'—the heroic efforts to make an organization run smoothly and professionally are not always visible. I know that Magnhild's outstanding (and sometimes invisible) work for AWM will be a lasting contribution to this organization and its members."

Born and raised in Norway, Lien earned her BA in mathematics at McGill University and her MS and PhD at the University of Iowa. At California State University Northridge, Lien rose through the ranks from assistant to full professor. She served as chair of the mathematics department and as the assistant director of Teachers for a New Era. Lien was actively involved with the AWM for many years before becoming ED, volunteering on numerous committees. Lien also served as Section Governor of the Southern California-Nevada Section of the Mathematical Association of America. Lien's research area is knot theory. Her other professional interests include mathematics education and women in mathematics. In the latter area, Lien has written two papers with her husband, sociologist Harvey Rich, on the influence of gender in science and mathematics.

Former President Ruth Charney writes, "AWM depends heavily on volunteers from the mathematics community and, to a large extent, the volunteers constitute the face of the organization. But as President, I came to feel that the most important individual in the organization, the one who keeps the lights on and the engines running, is the Executive Director. Magnhild Lien did a superb job as Executive Director. Her balance of vision and good sense, her organizational skills, and her unerring calm were invaluable to me as President, and to the organization as a whole. We owe her a tremendous thanks." Current AWM President Ami Radunskaya comments, "Magnhild brings extraordinary vision, passion

and an energetic attention to detail to the leadership team."

In her own words, Dr. Lien says,

> During my time as the AWM Executive Director I worked with four awesome AWM presidents, Jill Pipher, Ruth Charney, Kristin Lauter and Ami Radunskaya. Each president has put her own mark on the Association. I feel privileged to have been there to help facilitate new initiatives, of which there have been many, and to strengthen existing programs.

She continues,

> My view now as when I started in my position as the ED is that the AWM should: ensure that issues of concern to women mathematicians are in the forefront; promote and increase the visibility of women as research mathematicians; support and showcase women mathematicians at all career stages and career paths; support and encourage women to take on leadership roles both at the local and national level; spread the "I can do mathematics" message to young girls and serve as a liaison between its members and the other professional organizations in the mathematical sciences.
>
> Most of the work done by the AWM depends on the many volunteers that serve on committees and run programs. My job as the ED has been to work with the volunteer corps to make sure that "stuff" gets done. However, volunteers alone are not enough. Funding is needed to run our programs. Fundraising has been one of my priorities while serving as the ED. I take pride in my efforts to establish an annual giving campaign which during the last few years has been quite successful. I have been a PI or co-PI on several grants that are supporting our research symposia and AWM workshop.

Magnhild Lien

When I was president, she kept me going and on track every week. I just knew that if Magnhild wasn't there to stay on top of everything, the organization would not run! She has a great sense of humor, which made our weekly meetings fun, and my partnership with her was one of the most rewarding aspects of my service to AWM. I learned from her key management principles for steering a volunteer organization, and tried in vain to emulate her patience and tact. AWM is very fortunate to have benefited from the leadership of Magnhild Lien for six years! She will continue as ¼-time Project Director of the AWM NSF ADVANCE grant, and perhaps as a volunteer on some of our many committees!

MAA Instructional Practices Guide

The MAA Instructional Practices Guide is intended as a catalyst for community transformation toward improved mathematics learning experiences for our students. Our task as instructors is to partner with the learner to leverage their prior experience and current culture to create the best possible environment for success. The MAA has developed this guide to support our community in this endeavor. Released in December as a free download at https://www.maa.org/programs/faculty-and-departments/ip-guide, it will be a topic of discussion at the San Diego Joint Mathematics Meetings, most notably at the MAA Invited Paper Session on the topic.

Around the world, education researchers continually build upon the body of evidence about the effectiveness of instructional strategies that actively engage students in the learning process. Across the country, instructors at various institutions, sometimes in isolation, are successfully employing these techniques. The new MAA Instructional Practices Guide is a resource to assist all mathematics instructors in implementing such evidence-based instructional strategies, a resource to provide tangible connections to research evidence that compels instructors to use such strategies and facilitates the implementation.

Karoline Pershell Named AWM Executive Director

The Association for Women in Mathematics has named Dr. Karoline Pershell as its new Executive Director, effective January 15, 2018. Pershell is excited about this role and is "passionate about strengthening the voice of women across the spectrum of STEM fields and providing new ways for their voices to be heard." She is "honored to be able to extend Dr. Magnhild Lien's legacy, and look[s] forward to continuing the great work that AWM has been doing while creating new ways to grow our organization and strengthen the impact of our members on their respective professions." Karoline's work will include supporting the work of the AWM Executive Committee and strengthening and supporting the non-board volunteer corps for the AWM. She will represent the AWM at national meetings and will be involved with all AWM activities at the Joint Mathematics Meetings, the SIAM Annual Meeting, and MathFest.

Pershell comes to the AWM from her position as Director of Strategy and Evaluation at Service Robotics & Technologies (SRT), a robotics and IoT software company currently prototyping multi-robot control systems through an NSF SBIR grant. Her work with SRT includes data management and analytics, program evaluation, corporate strategy, grant writing and fundraising.

Karoline holds a BS in Mathematics from the University of Tennessee at Martin, where she was also a member of the UTM Rodeo Team as the first full-time female bull rider in the collegiate circuit. After finishing her undergraduate degree, she went on to receive an MS and a PhD in Mathematics from Rice University. Her research in 3-manifolds was completed under the direction of Dr. John Hempel. Following graduation, Pershell returned to UTM as an assistant professor of mathematics. She has also had the privilege of teaching overseas at Qingdao University in China and at the University of Hyderabad in India as a Fulbright Scholar. While in Hyderabad, in addition to teaching STEM Masters' degree students, she was able to interview Indian women on their perception of the gender barriers in math, and she presented her work on societal support structures for women in math at the International Conference on Gender Relations in Developing Societies.

In 2013, Karoline was awarded the AAAS Science & Technology Diplomacy Fellowship, through which she joined the Foreign Service Institute (FSI) where she was able to work on a broad range of issues. Her exceptional work at the FSI earned her two Department of State Franklin Awards. After her fellowship, Pershell chose to continue her career in industry, while still working to support women in the mathematical sciences. She is currently an active member of the AWM Policy & Advocacy Committee and of the EDGE community (Enhancing Diversity in Graduate Education). She is also involved in examining scientists' roles in policy and advocacy, strengthening communication between the scientific and non-scientific communities, and science outreach and integration at the community level. While serving the AWM as Executive Director, Pershell will continue in an advisory capacity with SRT. Karoline lives in Washington, DC with her husband, young son, and 1.75 dogs.

Karoline Pershell

Renew your membership or join at www.awm-math.org!

AWM Dissertation Prizes

In January 2016 the Executive Committee of the AWM established the AWM Dissertation Prize, an annual award for up to three outstanding PhD dissertations presented by female mathematical scientists and defended during the twenty-four months preceding the deliberations for the award. The award is intended to be based entirely on the dissertation itself, not on other work of the individual. Jessica Fintzen, Maja Tasković and Xiaochuan Tian will be presented with the second annual AWM Dissertation Prizes at the AWM Reception and Awards Presentation at the 2018 JMM in San Diego, CA.

Jessica Fintzen

Maja Tasković

Jessica Fintzen obtained her PhD from Harvard University in 2016 under the supervision of Benedict Gross. She is currently a member at the Institute for Advanced Studies and a Postdoctoral Assistant Professor in Mathematics at the University of Michigan (on leave). In 2016 she was also awarded a Junior Research Fellowship from Trinity College, Cambridge and has been invited to give many seminars on her research.

In the words of one of her letter writers, Jessica's thesis "solves a difficult and fundamental problem in the area of representation theory and harmonic analysis of p-adic reductive groups." Her work has important connections to number theory where p-adic reductive groups play a central role. They arise as the images of Galois representations and in the Langlands program where their irreducible complex representations form the local components of automorphic forms. Jessica's work concerns minimal positive depth supercuspidal representations, which were introduced as a tool to investigate number-theoretic aspects of the local Langlands correspondence. Reeder and Yu gave a criterion for the existence of these representations, but they only proved that the criterion was valid under certain conditions. Jessica showed that this criterion is valid for all p. (Some of this is joint with Beth Romano.) Her impressive work uses deformation theory and the theory of reductive groups over the integers and has opened up several new areas for research. In summary, Jessica's dissertation has introduced tools that have had significant impact.

Maja Tasković obtained her PhD in 2016 at The University of Texas at Austin under the direction of Irene Gamba and Nataša Pavlović. She is currently a Hans Rademacher Instructor of Mathematics at the University of Pennsylvania. Her work has been recognized through numerous awards, including the 2016 Frank Gerth III Dissertation Award from UT Austin.

Maja's research interests are in dispersive PDE and non-linear kinetic equations. Her dissertation provides endpoint Lebesgue space estimates for the high energy tail of solutions of the spatially homogeneous Boltzmann equations in the novel setting of non-cutoff assumption on the angular kernel. Maja's work has led to several

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publications, including the paper "On Mittag-Leffler moments for the Boltzmann equation for hard potential without cutoff" with R. J. Alonso, I. Gamba and N. Pavlović, to appear in the *SIAM Journal on Mathematical Analysis*, and a new preprint with I. Gamba and N. Pavlović. In these works Maja introduced tools (the Mittag Leffler function and Mittag Leffler moment) that are novel to this context and, in the words of one of her letter writers, turned out to be "the crucial idea and were a beautiful example of the 'outside of the box' thinking that Maja employs when faced with a subtle problem." In summary, Maja's dissertation has introduced tools that have had significant impact.

Xiaochuan Tian obtained her PhD in 2017 from Columbia University under the direction of Qiang Du. She is currently an R. H. Bing Instructor at The University of Texas at Austin. One of her papers, "Analysis and comparison of different approximations to nonlocal diffusion and linear peridynamic equations" (joint with her advisor), published in the *SIAM Journal on Numerical Analysis* in 2013, was awarded the SIAM Outstanding Paper Prize for 2016.

Xiaochuan's dissertation "Nonlocal models with a finite range of nonlocal interactions" yielded six highly cited papers in top journals that subsequently resulted in major advances in numerical analysis, computational methods, and applications in the general area of integro-partial differential equations. In another paper (joint with her advisor) that was published in 2014 in *SIAM Journal on Numerical Analysis*,

Xiaochuan Tian

Xiaochuan obtained criteria for a discrete nonlocal solution to converge to the solution of the local continuum model as the length scale and mesh spacing approach zero, criteria that are now known as asymptotically compatible discretizations. A letter writer states that "her results changed the way engineers in this community do numerical studies." Another letter writer states that this paper "represents a quantum leap in the numerical analysis of methods for nonlocal (e.g., integral) problems in diffusion and mechanics." In summary, Xiaochuan's dissertation has produced novel mathematical results that have had significant practical impact.

CALL FOR NOMINATIONS

The 2019 Louise Hay Award

The Executive Committee of the Association for Women in Mathematics has established the Louise Hay Award for Contributions to Mathematics Education, to be awarded annually to a woman at the Joint Prize Session at the Joint Mathematics Meetings in January. The purpose of this award is to recognize outstanding achievements in any area of mathematics education, to be interpreted in the broadest possible sense. The annual presentation of this award is intended to highlight the importance of mathematics education and to evoke the memory of all that Hay exemplified as a teacher, scholar, administrator, and human being.

The nomination documents should include: a one to three page letter of nomination highlighting the exceptional contributions of the candidate to be recognized, a curriculum vitae of the candidate not to exceed three pages, and three letters supporting the nomination. It is strongly recommended that the letters represent a range of constituents affected by the nominee's work. Nomination materials for the Hay Award shall be submitted online. See the AWM website at www.awm-math.org for nomination instructions. Nominations must be received by **April 30, 2018** and will be kept active for three years. For more information, phone (703) 934-0163, email awm@awm-math.org or visit www.awm-math.org.

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.

Bones: A Mathematical Retrospective

Sarah Greenwald

I just finished watching the last episode of *Bones*, a crime drama centered around forensic anthropologist Dr. Temperance "Bones" Brennan. The television show is very loosely based on the novels of real-life forensic anthropologist Kathy Reichs. Throughout the 12-year run of the FOX network series, mathematics has been portrayed as very applicable to a wide variety of real-life situations, and essential for a career as a scientist. Brennan has briefly discussed many mathematical topics over the years, for example, the definition of perfect numbers in "The Boneless Bride in the River" (season 2, episode 16). In "The Death of the Queen Bee" (season 5, episode 17) her high school yearbook entry listed "Interests: Chemistry, Math" and her participation in the math club. To Brennan, mathematical equations are "better than any speech, any photograph, absolutely, perfectly beautiful" (season 9, episode 11 "The Spark in the Park"). Overall, the mathematical discussions between Brennan and the other characters and the equations and geometric visualizations have highlighted their intelligence and scientific expertise, rather than engaging the audience with the mathematics. There hasn't been enough mathematical depth for that.

I was surprised to see some not so positive themes and stereotypes about science and mathematics emerge in the final episodes. We have the hyper-sexualized female scientist in "The Radioactive Panthers in the Party" (season 12, episode 10). The team is investigating a case related to a cheesy movie, and we view some movie footage of a lab with computations on boards, where a scientist is wearing a bikini that is clearly visible underneath an open lab coat. She has collected and analyzed data as a part of the silly plot: "By my calculations, we have seven hours until the panthers merge into one giant mega-panther." Next she takes off her glasses and further opens her lab coat, revealing a partially exposed breast.

There's always been a tension between Brennan, the logical empiricist, and FBI agent Seeley Booth, the intuitive humanist, but this scene from earlier in that same episode seemed quite mean spirited towards mathematics:

> Booth: "It's too early for math. Too early."
>
> Brennan: "It's never too early for math."
>
> Booth: "Anything before 12 is too early. Anything after 12 is too late."

During "The Flaw in the Saw" (season 12, episode 6), Brennan tells Booth how useful mathematics and physics are: "Everything's mathematics. Sports, architecture, comedy … Make sure you use the correct 'log-arithm'.… It's also simple 'geome-tree'." (Brennan is joking about lumberjacks here.) In the same episode, Brennan wants her daughter Christine to know that "trail equals wheel radius times cosine of head angle minus rake" before she learns to ride a bike, but Booth views this as taking the fun out of life. The show took this negative view of mathematics a step further when a female lumberjack was actually jeered and threatened by the fans during a competition when she took the time to perform geometry measurements and analysis: "Hit her in the face! Phyllis sucks!" Brennan herself was booed by lumberjack fans after she notes that "successful axemanship requires mathematical calculation. First we find the radius of the log divided by 1.25." On the contrary, Booth cuts this off with "Enough is enough" and gets cheered as he swings the axe based on his intuition. The theme of intuition versus rationality comes to a head when Booth and Brennan compete in a logrolling contest to decide who will teach Christine to ride her bike. Booth is again impatient with Brennan's careful analysis and measurements. The show goes to black as someone falls in, so we don't learn who won.

In "Back to the Lab: A *Bones* Retrospective," the actors and writers discuss the strong female characters, and producer Barry Josephson claims: "A lot of women have gone into science because of watching our show." Hart Hanson created the series aspiring for "young people to watch the show and say 'I want to do that for a living'," and I think it was relatively successful in that regard. That is why it seemed especially strange for the writers to denigrate the mathematical representations in the few episodes just preceding that ever so positive retrospective about the show and its intended impacts.

BOOK REVIEW

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

Equivalence: Elizabeth L. Scott at Berkeley by Amanda L. Golbeck, CRC Press, Taylor & Francis Group, 2017. ISBN 978-1-4822-4944-6

Reviewer: Marge Bayer

In the Preface of this large book (560 pages of text) Golbeck describes it as "a combined biography and microhistory." [p. xv] I would say the biography part is a fairly small part of the book, and it is not so easy to extract a chronology of Elizabeth (Betty) Scott's life from the book. (But I will try.) The title of the book is explained by the description of much of Betty Scott's work as "using statistics to advocate for equivalent status for women and men in academe." [p. 4]

Golbeck was able to access an enormous amount of information about Betty Scott's work, because of notes that Betty took and records that the university and other organizations kept. In addition, Golbeck knew her personally—Betty Scott was her graduate advisor. In reading the book one has the impression that the author could not bear to leave out any piece of information she had found. The book also suffers a bit from the author's apparent ambivalence as to whether to present her material thematically or chronologically.

Betty Scott certainly led a remarkable life, at least for her time. She was born in Oklahoma in 1917, but by the time she went to high school, the family had moved to Berkeley. She attended University High, the laboratory school of UC, where she excelled in mathematics and science. She went on to UC Berkeley, where she majored in astronomy and began serious work in astronomical observation and measurement. At the same time she took a lot of mathematics. Of particular importance for her eventual career were courses she took from a new statistics professor, Jerzy Neyman. After finishing her bachelor's degree, she went straight to graduate school in astronomy at Berkeley.

Betty had an academic role model in the family. Her aunt, Phoebe Waterman Haas, received her PhD in astronomy at Berkeley in 1913. (She and a classmate were the first women to earn PhDs in astronomy at Berkeley.) In her first two years of graduate school Betty spent a lot of time at two observatories, Lick Observatory and Mount Wilson Observatory. When the US entered World War II, Neyman got a subcontract with the National Defense Research Committee to do ballistics research and hired Betty as a research assistant. For the next three years, she was very busy, juggling the research assistantship with astronomy fellowships and teaching at the Navy Air Navigation School.

After the war, Betty resumed concentrated work on her astronomy PhD, but also continued to work with Neyman, who led the Berkeley Stat Lab, housed in the mathematics department. In fact, Neyman was able to get her funding in the Stat Lab and then, the last year before completing her PhD, she was a lecturer in the mathematics department. Following graduation, she became an instructor in mathematics and then, in 1951, an assistant professor in the mathematics department at Berkeley. In 1955, statistics became its own department, and Betty became an assistant professor in statistics. She was promoted to associate professor in 1958 and to full professor in 1963. She served as chair of the department from 1968 to 1973. To give an idea of how unusual this was, Margaret Rossiter names just five women scientists who held department chair or similar administrative positions at prestigious universities between 1940 and 1972.[1]

Moreover, Betty Scott's professional prominence was not confined to Berkeley. Over the years 1977 to 1985 she served successively as president of the Institute of Mathematical Statistics (IMS), vice president of the International Statistics Institute, and president of the Bernoulli Society for Mathematical Statistics and Probability. She was a Fellow of the IMS, the Royal Statistical Society, and the American Association for the Advancement of Science.

Betty Scott's research was in applied statistics. Not surprisingly, her original applications were in astronomy. She also had a long-term research interest in weather modification. In the 1950s and 1960s some hoped that cloud seeding would resolve problems ranging from drought to hail storms. From 1953 to 1985, Betty published 32 papers, reviews and reports on studies of the effectiveness of cloud seeding. Generally, these studies found that claims of success by cloud seeding companies were not supported by the facts, and that in some cases the effects of cloud seeding were opposite to the goal. Much of this research was done in collaboration with Jerzy Neyman, with whom she also shared a close personal relationship.

The largest part of the book, however, is devoted to Betty Scott's work on the status of women in science and women at UC Berkeley and nationally. Even before her major involvement in this issue, she had demonstrated her commitment to civil rights more broadly. She protested

(but signed) the loyalty oath the UC Regents started requiring in 1950. She joined a group of IMS members in petitioning for a by-law prohibiting racial segregation. (Three years later, renowned statistician David Blackwell—an African-American—became president of the IMS, as well as chair of the Berkeley statistics department.)

At Berkeley in 1970, in the whole university just 45 women held tenured or tenure-track positions, 3% of the faculty. At that time, unlike the statistics department, the Berkeley mathematics department had no female tenured or tenure-track faculty, while there were three female lecturers: Lenore Blum, Karen Uhlenbeck, and Julia Robinson. (Blum and Uhlenbeck were then recent PhDs, but Robinson, of course, was a distinguished mathematician at the time. We can suppose that the awarding of a full professorship to Julia Robinson several years later was in part due to Betty Scott's work for women at Berkeley and especially her fight against the nepotism policy.)

The Faculty Club at Berkeley was founded in 1902, with membership restricted to men. Women were first admitted 70 years later! In 1919 a Women's Faculty Club was created. Not until 1969 did the Faculty Club begin to address the issue of the exclusion of women. There followed several years of often rancorous discussions about merging the Faculty Club and the Women's Faculty Club, or of creating a Faculty Center that encompassed both. Betty Scott was at the center of these discussions, and they are detailed in the book. Neither the merger nor the Faculty Center happened, and today, in addition to the co-ed Faculty Club, the Women's Faculty Club still exists. (I am sure a number of AWM members have stayed there when visiting Berkeley or MSRI, as I have.)

The committees and campaigns Betty Scott led or was involved in form an alphabet soup: besides WFC (Women's Faculty Club), there were WFG (Women's Faculty Group), Policy (Senate) CSAW (Subcommittee on the Status of Academic Women), and LAW (League of Academic Women). The Policy CSAW was appointed in 1969 by the senate policy committee of the Berkeley division of the UC academic senate. Two years later, at the recommendation of the policy committee, it was replaced by the Senate CSAW, a standing committee of the academic senate. (Later it was broadened to the Committee on the Status of Women and Ethnic Minorities.) Soon after, two committees were formed at the Chancellor's level: the CSAW, Committee on the Status of Academic Women, and CSNAW, Committee on the Status of Nonacademic Women. The Chancellor's CSAW and Senate CSAW worked collaboratively. (The UC

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CALL FOR NOMINATIONS

The 2019 AWM–Joan & Joseph Birman Research Prize in Topology and Geometry

The Executive Committee of the Association for Women in Mathematics has established the AWM – Joan & Joseph Birman Research Prize in Topology and Geometry. First presented in 2015, the prize will be awarded every other year. The purpose of the award is to highlight exceptional research in topology/geometry by a woman early in her career. The field will be broadly interpreted to include topology, geometry, geometric group theory and related areas. Candidates should be women, based at US institutions who are within 10 years of receiving their PhD, or have not yet received tenure, at nomination deadline.

The AWM – Joan & Joseph Birman Research Prize in Topology and Geometry serves to highlight to the community outstanding contributions by women in the field and to advance the careers of the prize recipients. The award is made possible by a generous contribution from Joan Birman who works in low dimensional topology and her husband Joseph Birman who is a theoretical physicist.

The nomination should include: 1) a one to three page letter of nomination highlighting the exceptional contributions of the candidate; 2) a curriculum vitae of the candidate not to exceed three pages; and 3) three letters supporting the nomination (submitted independently). Nomination materials should be submitted online at MathPrograms.org. The submission link will be available 45 days prior to the nomination deadline. Review of candidates will begin in mid-February. For full consideration, nominations should be submitted by **February 15, 2018**. If you have any questions, phone 703-934-0613 or email awm@awm-math.org.

system also created a System CSW around the same time.) Nationally Betty Scott was on an AAAS ad hoc advisory committee on women and the Caucus for Women in Statistics. She authored reports on the status of women for the Carnegie Commission on Higher Education and the AAUP. In 1980 she collaborated with Mary Gray on a study commissioned by AAUP Committee W. [2]

In the years 1969–70, Betty Scott spearheaded a report by the Subcommittee on the Status of Academic Women on the Berkeley Campus. Under her influence, the report was grounded in data and statistical analysis. The recommendations in the final report show Betty's primary concerns of that time. These included the UC system's nepotism rule, the general lack of women in the academic ranks, the absence of a maternity leave policy, the dearth of women on major policy-making committees, low rates of admission of women graduate students, the rule that research associates could not apply for grants as principal investigators, and the exclusion of women from the Faculty Club. The report was disseminated widely, not only on the Berkeley campus, but to other UC campuses, the Women's Equity Action League, the National Center for Educational Statistics, the Carnegie Commission on Higher Education, and to universities around the country.

Betty thus became well known nationally as an advocate for women, and one whose arguments were based on solid evidence. She made major contributions to a 1973 Carnegie Commission Report, *Opportunities for Women in Higher Education: Their Current Participation, Prospects for the Future and Recommendations for Action*. From then on, much of her work was on gender inequality in salary at universities. For the AAUP she created the Higher Education Salary Evaluation Kit, a publication designed to assist university administrators and faculty groups to identify salary inequities and take steps to reverse the inequity. The Kit was sent to college presidents, to AAUP chapters, to editors of mainstream newspapers and magazines, and to various women's magazines and magazines targeting African-Americans.

In the 1960s and 1970s Betty Scott continued her distinguished career as a research statistician, while being a leader on the Berkeley campus and nationally in a number of campaigns to improve the status of women. She continued this work until her death in 1988. Decades later we can look back and see some significant advances, but unfortunately we see there is much still to be done on some of the issues she raised.

Endnotes

[1] Margaret W. Rossiter, Women Scientists in America: Before Affirmative Action, 1940–1972 (Volume 2), Johns Hopkins University Press, 1998, p. 144.

[2] M. W. Gray and E. L. Scott, A "statistical" remedy for statistically identified discrimination, Academe 66, no. 4 (1980), 174–181.

NSF-AWM Mentoring Travel Grants for Women

Mathematics Mentoring Grants. The objective of the NSF-AWM Mathematics Mentoring Travel Grants is to help junior women to develop a long-term working and mentoring relationship with a senior mathematician. This relationship should help the junior mathematician to establish her research program and eventually receive tenure. Each grant funds travel, accommodations, and other required expenses for an untenured woman mathematician to travel to an institute or a department to do research with a specified individual for one month. The applicant's and mentor's research must be in a field which is supported by the Division of Mathematical Sciences of the National Science Foundation.

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 $5000 per award will be funded.

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.

Deadline. There is one award period per year. Applications are due **February 1**.

EDUCATION COLUMN

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

Teaching Mathematics in Open-Door Institutions

Jackie Dewar, Professor Emerita of Mathematics, Loyola Marymount University

The Education Column discusses all sorts of topics related to mathematics education, either at the K–12 or postsecondary levels. As the following two statistics indicate, a tremendous amount of mathematics teaching in the first two years of college is done at community colleges. According to the *2010 CBMS Survey of Undergraduate Programs*[1] (latest available at this writing), there were 2,105,000 enrollments in mathematics and statistics courses in public two-year colleges in Fall 2010 (*2010 CBMS Survey*, Table TYE.2, p. 135). This includes 81,000 dual enrollments.[2] For comparison, at four-year schools there were 2,052,000 enrollments in precollege, introductory (includes precalculus), calculus, and elementary statistics courses (*2010 CBMS Survey*, Table E.2, p. 82). However, the Education Column has rarely focused specifically on mathematics teaching at two-year colleges.

Two-year colleges are "open-door," also called "open enrollment," meaning they accept anyone with a high school diploma or GED. In this way, two-year colleges are important entry points to postsecondary education for many people. The mathematics curriculum found within two-year colleges shares both content and characteristics with four-year colleges and universities, offering courses aimed at students in STEM majors (e.g., Calculus, Linear Algebra, and Differential Equations) and non-STEM majors (e.g., Liberal Arts Mathematics). Two-year colleges also provide applied mathematics curricula that dovetail with career and technical programs unique to non-tertiary, postsecondary education. Notably, the majority of mathematics taught within two-year colleges is introductory-level mathematics including developmental mathematics, college algebra, precalculus, and introductory statistics.

I recently had the pleasure of attending my first AMATYC (American Mathematical Association of Two Year Colleges)[3] conference, November 8–12, 2017. While there, I participated in a three-event Scholarship of Teaching and Learning (SoTL) Symposium that was supported by AMATYC and NSF-funded Project SLOPE[4] (more on the latter, later). In this column I will share some of what I learned and experienced.

Two-year college faculty are special in many ways! They work with the most diverse student populations found within higher education. They take on at least three disparate responsibilities: (1) to provide developmental education, (2) to serve the needs of career and technical programs, and (3) to prepare students for transfer for further study at baccalaureate schools. And, within the realm of higher education, they face unique challenges, some of which are deeply rooted in those three special responsibilities.

Before the conference, I asked my two-year college mathematics colleagues, some of whom I have known for many years, and others I have only recently met, to articulate some of the challenges they face. They found it all too easy to name a number of them. Here are four:

1. Dealing with continual changes by the state on policy and curricular issues that impact instruction.
2. Frequent changes by the baccalaureate institutions regarding their courses and requirements, usually done without consultation with the community colleges about how this impacts our students whom they want to transfer to their institutions.
3. Teaching at an open-door institution means we need to have responsive curricula that strike the right balance between access (to meet our students where they are at academically) and rigor (so as to provide the programs and pathways that serve the various academic and professional needs of our students).
4. More specifically in the area of mathematics, there is the challenge to adjust to the new co-requisite approach to developmental mathematics and make it "work" for all stakeholders.

During my talk "Exploring Teaching and Learning in the First Two Years of College Mathematics" which opened the SoTL Symposium, when I asked attendees to name some positive developments in the teaching and learning of mathematics in the last decade or so, they found that easy as well. Their lists included new technologies for teaching, a plethora of new pedagogical methods, ideas for motivating students, and more. Their enthusiasm for teaching and engaging their students was palpable, not unexpected given their positions at institutions with teaching-focused missions. Yet, they were attending the opening talk of a SoTL Symposium that would be followed by two workshops,

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one on developing SoTL questions to investigate and one on research design and evidence.

In my talk, I described two SoTL projects, one from College of San Mateo investigating the effect of incorporating data-based integrative writing assignments into precalculus and calculus and one from College of the Desert concerning the outcomes of teaching developmental mathematics students to outline their mathematics textbooks. These were clearly aligned with the teaching missions of those institutions because they enhanced the learning of the students in those courses, in subsequent courses taught by those instructors, and possibly in courses taught by others on the same campus or elsewhere. In addition, the instructors benefitted too, professionally and personally, by their involvement in SoTL work.

How do others see SoTL fitting with the two-year college mission to educate students and prepare them for careers or for further higher education? This is a very good question, for which I have several responses.

First, the two-year college mathematics professional organization AMATYC clearly sees a fit, because it designated classroom research (more or less a synonym for SoTL) as one of five priorities in its last strategic plan ending this year and includes it as one of six priorities in the strategic plan drafted to carry AMATYC forward for the next five years.[5]

Next, the two-year college mathematics community has an active Research in Mathematics Education for Two-Year Colleges (RMETYC) Committee.[6] Its purpose is to encourage quality research in mathematics education in two-year colleges. It provides organizational support and mentoring for faculty researchers and institutions conducting research in mathematics education and its application in promoting effective teaching strategies. RMETYC sponsored a session with ten research talks centered on the teaching and learning in the first two years of college mathematics at the conference.[7] RMETYC also hosted the SoTL Symposium at the conference.

Finally, the National Science Foundation is supporting this work at community colleges by funding AMATYC's Project SLOPE (NSF-IUSE:HER #1726891), where SLOPE stands for Scholarly Leaders Originating as Practicing Educators in two-year colleges. Project SLOPE is a research and professional development initiative for two-year college mathematics faculty. The goals of Project SLOPE are: to understand the opportunities and challenges of engaging in classroom-based research in two-year college mathematics, and to design and implement a pilot AMATYC Research Associate Program for two-year college mathematics faculty engaged in classroom-based research.

Project SLOPE is in its first phase of implementation researching the needs, barriers and potential opportunities for

CALL FOR NOMINATIONS

The Association for Women in Mathematics Student Chapter Awards

In September 2016, the Executive Committee of the Association for Women in Mathematics established the Student Chapter Awards, to be awarded annually at the MAA MathFest. The purpose of these awards is to recognize outstanding achievements in chapter activities among the AWM student chapters.

Awards will be given out in up to four categories: (1) scientific excellence, (2) outreach, (3) professional development, and (4) funding/sustainability. More details about each category can be found on the AWM website www.awm-math.org.

Eligibility: Any chapter may nominate itself for awards in at most two of the four categories.

The nomination should include: 1) A cover letter: The cover letter should summarize the chapter's qualifications for the award category to which it is nominating itself. If the chapter is applying in more than one category, it should ensure that all categories are clearly included in one cover letter. 2) An activities report: The activities report, 500–1000 words in length, should give a detailed description of the particular work for which it is seeking an award. If the chapter is applying in more than one category, a separate activities report is required for each. 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 **April 15, 2018**. If you have questions, phone 703-934-0163, email awm@awm-math.org, or visit www.awm-math.org.

two-year college faculty engaged in classroom research and the organizational systems that impact two-year college faculty classroom research. The second phase of Project SLOPE will center on the AMATYC Research Associate Program Pilot. The AMATYC Research Associate Program Pilot will consist of a group of two-year college faculty engaged in the Scholarship of Teaching and Learning (SoTL) projects. The program will provide participants with (1) professional development focused on SoTL; (2) supportive structures for navigating challenges specific to researching in two-year college mathematics classroom settings; and (3) a community of two-year college faculty SoTL researchers to foster collaboration, mentoring, and encouragement. Application information for the AMATYC Research Associate Program Pilot will be available in Fall 2018.

To learn more about Project SLOPE, please visit http://www.amatyc.org/?ProjectSlope. Project SLOPE personnel welcome your ideas. Please email Megan Breit-Goodwin, PI, at Megan.Breit-Goodwin@anokaramsey.edu to connect with Project SLOPE.

Endnotes

[1] http://www.ams.org/profession/data/cbms-survey/cbms2010-Report.pdf

[2] The *2010 CBMS Survey* defines dual enrollment as students enrolled in a course that earns credit in high school and a two-year college (p. 132).

[3] http://www.amatyc.org/

[4] http://www.amatyc.org/?ProjectSlope

[5] At this writing, the current draft of AMATYC IMPACT (*Improving Mathematical Prowess and College Teaching*) is available at https://c.ymcdn.com/sites/amatyc.site-ym.com/resource/resmgr/impact/AMATYC_IMPACT.pdf

[6] http://www.amatyc.org/?page=AMATYCCommittees#research

[7] See the November 7, 2017 entry in the RMETYC blog at http://rmetyc.blogspot.com/

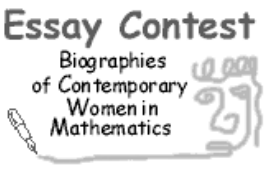
Column Editor's Note:

Regular readers of the column may have noticed that I have filled in for Jessica Hale in this January–February issue. The reason was that her baby decided to arrive just before the column was due. Join me in congratulating Jessica on the arrival of her son, James Loving Allen!

For 2018, we will have a few changes in the line-up of writers. In the past, the March–April column has typically been co-authored by Betsy Yanik and Suzanne Lenhart. Going forward, Betsy will be focusing on other endeavors, but Suzanne will continue to write for March–April. I thank Betsy very, very much for her contributions to the column, which go back to 2010!

For May–June, we have a new contributor to replace Ginger Warfield, who wrote her farewell column in 2017. I am very pleased to announce that Erica Walker, Professor of Mathematics and Education at Teachers College, Columbia University, has agreed to write the May–June Education Column. As many readers know, Erica was the 2015 AWM-MAA Falconer Lecturer. She is currently a member of the AWM Education Committee.

The rest of the column contributors will remain unchanged: Anna Bargagliotti (July–August), Pat Kenschaft (September–October), and myself (November–December).



To increase awareness of women's ongoing contributions to the mathematical sciences, the Association for Women in Mathematics holds an essay contest for biographies of contemporary women mathematicians and statisticians in academic, industrial, and government careers. AWM is pleased to announce that the 2018 contest is sponsored by Math for America, www.mathforamerica.org.

The essays will be based primarily on an interview with a woman currently working in a mathematical career. The AWM Essay Contest is open to students in the following categories: grades 6–8, grades 9–12, and undergraduate. At least one winning entry will be chosen from each category. Winners will receive a prize, and their essays will be published online at the AWM website. Additionally, a grand prize winner will have his or her entry published in the *AWM Newsletter*. For more information, contact Dr. Heather Lewis (the contest organizer) at hlewis5@naz.edu or see the contest web page: www.awm-math.org/biographies/contest.html. The deadline for electronic receipt of entries is **January 31, 2018**. (To volunteer as an interview subject, contact Dr. Joanna Bieri at joanna_bieri@redlands.edu.)

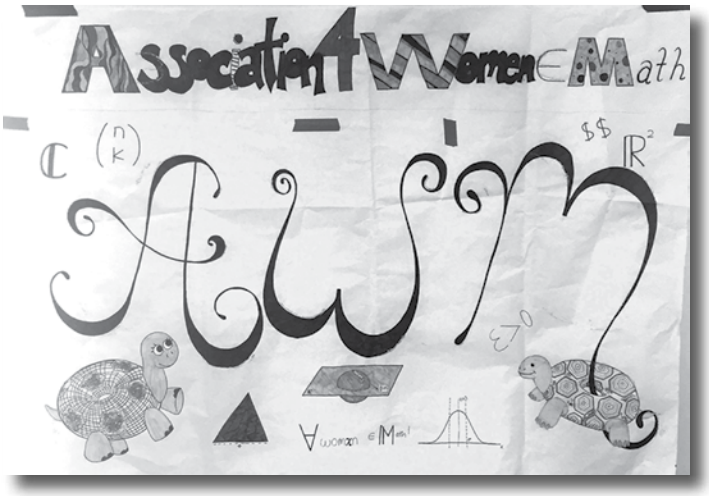
AWM
ASSOCIATION FOR WOMEN IN MATHEMATICS

MfA Math for America

STUDENT CHAPTER COLUMN

Coordinator: Kavita Ramanan, kavita.ramanan@brown.edu

University of Washington chapter, with faculty sponsor Sara Billey and AWM President Ami Radunskaya



Pomona chapter poster

Advocating for STEM: A Capitol Idea!

Michelle Snider

When thinking about getting involved in these politically charged times, it can be easy to feel swept up in the 24-hour news cycle, and overwhelming to figure out where to start. How about doing what you can with what you already have? By being a member of AWM, you know that too few women pursue or maintain careers in math. The so-called "leaky pipeline," in which the percentage of women drops with each increasing level of education, persists throughout our careers in both academia and industry, and across all STEM fields. Studies have repeatedly shown that systemic bias and stereotypes start as early as elementary school and are diverting talent away from STEM careers.

But don't despair! A number of bills exist at various stages of their legislative journey on topics ranging from expanding STEM educational opportunities and supporting research funding, to encouraging work/life balance, to creating a diverse and welcoming environment and increasing public recognition of women's achievements in all fields. However, our legislators are swimming in a sea of messages and priorities, so our ability to add context and value to the bills that are percolating can be invaluable.

> [To] people in the offices, it is just words on the paper ..., if we can convey how much passion and how useful it could be, maybe we could make a change....
> —*Cigole Thomas, graduate student at George Mason University*

On a cloudy Tuesday in November of this year, an intrepid group of 31 AWMers, assigned to seven groups, visited a total of 55 Congressional offices. We had 29 meetings in offices of the House and 26 in the Senate, representing districts from across the United States and on both sides of the political spectrum. This means that AWM visited over 10% of our country's 535 legislative offices, all in one day! Our group represented a broad spectrum of mathematicians and supporters: eleven undergraduate students and three graduate students from George Mason University (GMU) and Trinity Washington University (TWU), along with seven academics from different institutions and seven non-academic professional mathematicians.

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We start our day meeting in the lobby of the Hart Senate Building, where the contemporary ironwork Calder sculpture fills the seven-story atrium.

Rep. Karen Handel (R-GA) (center) along with: Dr. Sita Ramamurti and undergraduate students Sayra Lopez and Joicy Carvalho from TWU, and Dr. Evelyn Sander from GMU.

Rep. Seth Moulton (D-MA) with (left to right) Dr. Sarah Bryant, Dr. Adele Merritt, Neha Bora (Data Science Fellow), and Arsah Rahman (GMU).

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**.

> I'm excited to have politicians actually thinking about math, too, because … they don't hear about it a lot in their job…
> *—Shannon Connor, undergraduate at GMU*

Members of the AWM have been making spring and fall Capitol Hill visits since 2015. Congressional appointments are made based on the locality ties of the participants, as we are much more likely to get appointments if one of the group members is a constituent. We meet with legislative staffers who cover portfolios including women's issues, science and technology, and education. These staffers serve as gatekeepers for what information gets passed on to the actual elected officials, so they are key to getting our message across. On the rare occasions when a senator or representative is actually available during our visit, we can often get a photo.

We discuss behavioral and institutional change impacting all STEM fields, from early childhood learning to research support and small business incentives. This includes general support for systemic changes as well as addressing specific drops in the pipeline. We tailor our presentations to a specific Congressperson's priorities by focusing on math's role in such areas as technology, cybersecurity, big data, K–12 education, research, and international collaboration. The lack of diversity in STEM is not just a women's issue, it's a national issue. Diverse perspectives are necessary for scientific advances and technical innovations that benefit the country and community as a whole.

> … it [is] very interesting to see how Congressmembers … begin to think about math once we bring up the issues of having more women in STEM."
> *—Arsah Rahman, undergraduate student at GMU*

AWM can spark the most change by meeting with offices that don't appear to have these issues on their radar. Here, we hone in on the impact of a strong STEM workforce on entrepreneurship and job creation, manufacturing, national security, or healthcare; places where mathematical expertise and sophistication may not be obvious. Our nation cannot afford to leave such a large piece of the talent pool behind.

> The least fun meetings were probably the ones that made the most difference … our personal narratives may have shifted the opinion of the staffers just a small amount.
> *—Evelyn Sander, Professor at GMU*

Two groups coalesced to meet with Rep. Jerry McNerney (D-CA), whose PhD in differential geometry makes him one of two PhD scientists in the House of Representatives. Top row: Cigole Thomas (GMU), Dr. Magnhild Lien (Cal State Northridge), Dr. Evelyn Sander (GMU), Sayra Lopez (TWU), Dr. Sita Ramamurti (TWU), Dr. Ami Radunskaya (Pomona College and current AWM President); Bottom row: Angeles Garcia (TWU) and Joicy Carvalho (TWU).

Meeting with offices that already support these issues can be quite beneficial as well, both for providing contact info for AWM as a resource for issues concerning women in STEM and for encouraging the legislators to continue their good work, reinforcing that what they are doing matters to us. For the AWMers, it can be quite a recharge to connect with people who are dedicating their time to improving our lives, behind the critical scenes of funding, legislation, and policy.

> I felt like I made a difference. I know there are women in math I can look up to.
> *—Neha Bora, Data Science Fellow*

Join AWM on one of our upcoming Hill Visits! You can take a trip into a world of professional extroverts and get a glimpse of how decisions in our country are made, while advocating for underrepresented groups in technical fields. Have no fear though, we won't just throw you in the deep end. Each team has a mix of seasoned and new recruits, with a range of backgrounds and stories, giving you a chance to connect with a wider community of AWM members. We provide a script along with summary handouts for each office you visit, including talking points on the relevant issues. You add your own flair by talking about why you love math, what federal funding you have personally benefited from, how you had to take unpaid maternity leave, or perhaps

by describing a situation in which you felt unconscious bias limited your options. Wrap it up with how the staffer can help and why all of this matters to our nation as a whole.

> The moment I knew everything was going to be fine for the day was when the students started talking in that first meeting. They were confident, thoughtful, and poised. They were able to walk through the AWM information on the leaky pipeline and speak to the importance of support for STEM by sharing their own personal stories.
> —*Dr. Sarah Bryant*

We begin to change the culture by opening up the lines of communication with our legislators. The very fact that we show up in these offices and tell our stories can help to correct misconceptions about the role of mathematics and of women in STEM fields, as well as break down the stereotypes entrenched in our society. Our message counteracts the notion that math is confined to the proverbial ivory tower.

> I am inspired by math because it's a subject that trains you to think in the most abstract way possible, to understand the argument in the purest sense … good thinking skill works in all areas of life.
> —*Sayomi Stallings, graduate student at GMU*

We have been pleased by the following actions taken by some of the representatives we have visited:

- Representative James Langevin (D-RI) has signed on to the *STEM Opportunities Act of 2017, (H.R. 2653/S.1270)*, which both targets the drops in the pipeline and addresses how universities and labs can review and improve institutional support structures. Since academia benefits from a large amount of federal funding, change at this level can directly impact a large population as well as serve as a model for non-federally-funded institutions.
- Eleanor Holmes-Norton of the District of Columbia has signed on to all of the bills we highlighted on this visit, which support systemic change from kindergarten through college and beyond.
- Congresswoman Zoe Lofgren's office subsequently contacted AWM regarding a new bill that creates a national Science Laureate position, comparable to the Poet Laureate, as an honorary position and a platform from which to speak to the nation about science. The bill, also introduced in the Senate by Senator Mazie Hirono of Hawai'i, states:

> Congress recognizes that science contributes to the economic prosperity and general welfare of the United States, and that increasing the public's awareness about the sciences will increase such benefits. Congress also recognizes that scientists who are both accomplished in their fields and who foster the public's interest in science do a special service to the United States.
> Science Laureates Act (H.R. 3639)

The AWM has since endorsed this bill!

> … it was definitely out of my comfort zone but … to be outside of a non-academic environment talking about math made me feel like I was doing something bigger than myself.
> —*Joicy Carvalho, undergraduate at TWU*

Our mission is to put a human face on the issues facing STEM as a whole and underrepresented populations in particular, and to bring awareness to the policies that can make a difference, one office at at time. If you are interested in joining us for a future Hill Visit, either as an individual or as a Student Chapter, please contact us at hillvisit@awm-math.org.

"I Hate Math" Conference

An interesting article about a conference held in April 2017 at Southern New Hampshire University by STEM students appears at https://www.snhu.edu/about-us/news-and-events/2017/10/i-hate-math-conference. The conference provided "an opportunity to inspire and encourage girls in my community while simultaneously providing the opportunity for SNHU students to practice their presentation skills on a topic they are passionate about," according to conference director Elle Tibbits. According to Tori Berube, "we had a wide variety of workshop topics, such as accounting, ratios, math in fashion, science using genotypes, and motivation and growth mindset. These presentations were primarily done by undergraduate students at SNHU, but we had some participation from campus professors and public school teachers." Alycia Miner has an interesting story: "Outside of school, I am a professional tap dancer and dance teacher/choreographer. Thus, I work directly with students of this age range every day. I aspire to empower these young ladies through building confidence, self-esteem, and demonstrating to my students that anything is possible." SNHU plans to make this an annual event.

Undergraduate Survey

Amanda Glazer, Harvard '18

"You're a girl, you overthink the problem too much."

Introduction

The following is an abridged report, focusing on qualitative data, on a Spring 2016 survey that was conducted as an initiative of a Harvard student organization, Gender Inclusivity in Mathematics (GIIM). The purpose of GIIM is to make Harvard a leader in fostering an inclusive math community, and to encourage those with the desire to pursue math at any level regardless of their gender. I am the co-founder and former co-president of GIIM. I conducted this survey as an effort for GIIM as well as for a concurrent school project.

There were 2,668 total survey respondents. Due to limited resources I was able to evaluate only five schools. The targeted schools (Harvard, MIT, Princeton, Yale, and Brown) were a convenience sample based on contacts I had at particular Group I schools. Anyone could respond, so not all responses were from Group I schools. In order to understand the climate of mathematics departments and the makeup of mathematics students at Group I Private universities, I analyze the data from these five targeted schools.

Due to the low number of respondents, intersections such as race and non-binary gender identities could not be analyzed without compromising the confidentiality of respondents. Further research could include more schools and departments to ensure higher response rates, allowing further study of these intersections.

For the full report, see https://www.womendomath.org/wp-content/uploads/2017/02/NMS_Final.docx

Background

For several decades now, the gender gap in mathematics degree attainment has remained static while the gender gap in college degree conferment has disappeared. According to the National Center for Education Statistics women earned 57%, 60% and 52% of all bachelor's, master's and doctoral degrees respectively in the US in 2013–14. However, women earned only 43%, 41% and 29% of these degrees in mathematics and statistics in the US in the same year. Prestigious private universities are of particular interest, because the gender gap in mathematics appears to be worse at these universities.

Gender Breakdown, AY09–10 and AY14–15

	Number			Percentage		
	BA	PhD	SF	BA	PhD	SF
Harvard	245	58	25	20%	12%	4%
MIT	663	139	51	28%	20%	8%
Yale	176	31	17	26%	16%	6%
Princeton	209	85	41	15%	13%	7%
Brown	113	42	24	27%	21%	8%

Degree data comes from the Integrated Postsecondary Education Data System (IPEDS), a collection of annual surveys administered by the U.S. Department of Education's National Center for Education Statistics. Faculty data comes from each institution's mathematics department website as of November 2016. Senior faculty members (SF) include Full Professors, Professors Emeriti and anyone listed under Senior Faculty on the department website (at Harvard this also includes Professors of the Practice).

As the table shows, over a recent six-year period, none of the above elite mathematics schools reached the national average percentage of mathematics bachelor's degrees awarded to women (44% in 2013–14 for "mathematics, general"). Low proportions of women persist in the faculty (SF) at Group I Private universities; each of the five selected institutions has under 10% female senior faculty members.

One of the potential causes of the gender gap in mathematics is "stereotype threat," which occurs when individuals feel at risk of confirming negative stereotypes about their group. Stereotype threat has been linked to worse performance on mathematics tasks (Spencer, Steele and Quinn, 1999) and also to decreased interest and persistence in Science, Technology, Engineering and Mathematics (STEM) fields (Woodcock, 2012; Shapiro and Williams, 2012).

Furthermore, negative stereotypes may lead to unconscious bias in faculty members. Studies have found that faculty—both men and women—tend to favor men in STEM fields by, for example, being more likely to select them for research positions (Moss-Racusin, 2012). Science faculty have also been found to use different language to describe female versus male students in letters of recommendation, focusing more on ability and using more effective language for male than for female students (Schmader, Whitehead and Wysocki, 2007). A number of other manifestations of unconscious bias in academia have

been well documented, such as a tendency to hold women to higher standards and judge them more harshly for opportunities for advancement (Easterly and Ricard, 2011).

Although faculty of all genders can exhibit bias, professor gender can have an important offsetting effect. Female professors and role models in STEM fields can have a positive effect on female students' success (Carrell, Page, and West, 2010; Bettinger and Long, 2005). Furthermore, the success of peers, both close friends and classmates, often leads to more advanced course taking in adolescence. This influence is particularly evident amongst female students in regards to female peers (Riegle-Crumb, Farkas and Muller; 2006). This suggests the importance of female instructors, role models and successful female peers in order to provide an opposition to gender stereotypes. The current makeup of most mathematics departments in Group I Private schools, therefore, has the potential to exaggerate these stereotypes, as they are predominately composed of male faculty.

Although the gender gap in mathematics begins at a very young age, it persists and worsens throughout college (Griffith, 2010; Brainard and Carlin, 1997). Furthermore, there is evidence that the prestige of the school correlates with a larger gender gap in mathematics (Weeden, Thébaud and Gelbgiser, 2017; Espinosa, 2011). This indication serves as motivation to further study elite universities to understand the larger gender gap at these institutions.

This study focuses on mathematics undergraduate students at Group I Private mathematics universities. In order to investigate the climate in these departments, I conducted a survey of undergraduate mathematics students at the five elite universities identified in the table in Spring 2016. The primary goal of the survey was to assess the climate of various prominent mathematics departments.

Qualitative Data

The survey provided opportunities for respondents to give examples of comments that they had faced or elaborate on their experiences in mathematics. The relevant questions are: "In the environment(s) in which you practice mathematics (e.g. mathematics class, office hours, the mathematics lounge), has another student (or mathematics faculty

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CALL FOR NOMINATIONS

2019 M. Gweneth Humphreys Award

The Executive Committee of the Association for Women in Mathematics has established a prize in memory of M. Gweneth Humphreys to recognize outstanding mentorship activities. This prize will be awarded annually to a mathematics teacher (female or male) who has encouraged female undergraduate students to pursue mathematical careers and/or the study of mathematics at the graduate level. The recipient will receive a cash prize and honorary plaque and will be featured in an article in the AWM newsletter. The award is open to all regardless of nationality and citizenship. Nominees must be living at the time of their nomination.

The award is named for M. Gweneth Humphreys (1911–2006). Professor Humphreys graduated with honors in mathematics from the University of British Columbia in 1932, earning the prestigious Governor General's Gold Medal at graduation. After receiving her master's degree from Smith College in 1933, Humphreys earned her PhD at age 23 from the University of Chicago in 1935. She taught mathematics to women for her entire career, first at Mount St. Scholastica College, then for several years at Sophie Newcomb College, and finally for over thirty years at Randolph-Macon Woman's College. This award, funded by contributions from her former students and colleagues at Randolph-Macon Woman's College, recognizes her commitment to and her profound influence on undergraduate students of mathematics.

The nomination documents should include: a nomination cover sheet (available at www.awm-math.org/humphreysaward.html); a letter of nomination explaining why the nominee qualifies for the award; the nominee's vita; a list of female students mentored by the nominee during their undergraduate years, with a brief account of their post-baccalaureate mathematical careers and/or graduate study in the mathematical sciences; and supporting letters from colleagues and/or students. At least one letter from a current or former student of the candidate must be included.

Nomination materials for the Humphreys Award shall be submitted online. See the AWM website at www.awm-math.org for nomination instructions. Nominations must be received by **April 30, 2018** and will be kept active for three years at the request of the nominator. For more information, phone (703) 934-0163, email awm@awm-math.org or visit www.awm-math.org/humphreysaward.html.

member) ever made a comment concerning your gender in regards to your mathematics skills?"

Respondents were also asked to elaborate on the comments and rank how negatively or positively these affected them. In order to further preserve anonymity all school names have been eliminated.

Comments from Other Students

Amongst the five schools, 50% of female students (from all majors who have taken at least one college mathematics course) reported comments from other students in regards to their gender and mathematics ability of which 91% were reported to have had a neutral or negative effect. Respondents were asked to give examples or elaborate on the types of comments that they had received from other students in regards to their gender and mathematics ability. The following are some of the most frequent categories of comments with representative examples and explanations from surveyed female students for each category.

Gender Stereotypes

These comments reinforced negative stereotypes about women and women in mathematics.

- "You don't count as a girl because you're good at math."
- "You're the only girl I know who is good at math."
- " 'She does math AND is hot, it's crazy' perpetuates the stereotype that to do maths (as a girl) you can't take care of your appearance (otherwise you must be dumb)."
- "Assertions that women are not capable of the same brilliance as men."
- "You're a girl, you overthink the problem too much."
- "There has been a lot of surprise that I am good at math, and recently, someone even asked me if I had the right room for a class."
- "Girls shouldn't be able to do math."

Disrespect and Disregard for Intelligence

These comments illuminate a lack of respect for female intelligence in mathematics. Women's ideas and intelligence are often disregarded. If regarded, their success is attributed solely to their gender and not their intelligence.

- "Sometimes people don't want to work with me because I'm a girl—the most common experience I have is explaining something to a male classmate, only to have him ask another male classmate to validate what I've said. UGH."
- "Being a female in math is difficult. I will never be as respected as my male peers. Many an occasion occurs when collaborating where my ideas are completely disregarded as the only female in the room until they have exhausted all their ideas and then finally consider it (maybe)."
- "If you are a woman and you struggle with math, inevitably someone who thinks he's too clever to be sexist will say something about men's superior spatial reasoning or complain that professors and departments cut female students extra slack to improve their gender ratio.... It's bitter and annoying, but at this point in my education it makes me more determined than discouraged to hear that sort of thing."
- "It's not like girls will ever need to use math, the only STEM they can do is regurgitating biology."
- "You only got this opportunity because you're a girl."

"For a girl"

"For a girl" comments measure a mathematician's ability against their gender. Women are not deemed as being good at mathematics generally but rather out of the pool of other women.

- "You're good at math for a girl."
- "These comments, over time, have had a negative effect—because other people encouraged me to compete in the arena of 'women in math' and imply that it's good enough—I need not compare myself to 'people in math' because I'm 'good at math for a girl'."

Pressure to Represent

These elaborations discuss a pressure some female mathematics students feel to represent their gender well, since there are very few women in the mathematics program. They also touch on a sense of competition felt amongst female math students to do well.

- "A mathematics course professor was once discussing the exam results and was showing the results via demographics. The professor went out of his way to mention that "for some reason, women tended to [do] much worse than men." Although the data showed this was a true statement, stating it out loud for the 90% male and 10% female class to hear really put a weird shame and pressure on female students, who already struggle socially and stigmatically in the department."
- "I feel alone, increasing the pressure to do well to represent my gender."

- "If a female student asked a stupid question my friend used to say to me 'that's one less girl we have to compete with'."

Comments from Mathematics Faculty

Respondents were asked to give examples or elaborate on the types of comments that they had received from faculty in regards to their gender and mathematics ability. Among the five schools previously discussed, 15% of surveyed female students have received a comment from a mathematics faculty member in regards to their gender and mathematics ability, of which 63% of such comments were reported to have a neutral or negative effect. Examples and elaborations of such comments are as follows:

- "Grad student indicated that he felt that there was no need to be concerned about the number of women in math or to try to encourage more women to take math. He also stated that he would not mentor a female student in the same way he would mentor a male student because she might falsely charge him with sexual harassment. When I confided to a professor that I was having difficulty in his class because I didn't have a study group to work with in an almost exclusively male environment, his response was to tell me that if I wasn't able to keep up with the class, perhaps I should request a tutor or drop the course in favor of an easier one. Professor stated that women simply came in with less math preparation in high school, and that there was nothing the university could do to fix that. Professor insinuated that I might not be good enough at math to do a senior thesis, and that I should instead opt for a senior seminar. Interestingly, the only other people I have found who heard this from him seem to be women."
- "There are a couple professors who will actively encourage female undergraduates to try to fight the gender imbalance in the department, which tends to have slightly positive effect. Every once in a while other professors will slip and say something that's a little bit misogynistic, but this is mostly much older professors, so I tend to just ignore it."
- "A math faculty member with whom I'd been interacting for several months confusing me on several occasions for one of the only other women of my ethnicity in the department. On another occasion, hearing secondhand about a fellow student who was dissuaded from doing research by a male faculty member specifically on account of her gender."
- " 'I didn't finish that pset last week.' 'Of course, look who you were working with' (a group of girls)."
- "A visiting professor walked through at office hours for my math class and commented how much more attractive girls in math were now than in his day."

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AWM Conflict of Interest Policy

A conflict of interest may exist when the interest (financial or other) or concerns of any member of AWM, or the member's immediate family, or any group or organization to which the member has an allegiance or duty, may be seen as competing or conflicting with the interests or concerns of AWM.

When any such potential conflict of interest is relevant to a matter requiring participation by the member in any action by AWM or any of its committees to which the member belongs, the interested party shall call it to the attention of AWM or the committee and such person shall not vote on the matter. Moreover, the person having a conflict shall retire from the room in which the organization or its committee is meeting (or from a conference call) and shall not participate in the final deliberation or decision regarding the matter under consideration.

The foregoing requirements shall not be construed as preventing the member from briefly stating her position in the matter, nor from answering pertinent questions of other members, as her knowledge may be of great assistance.

The minutes of the meeting of the organization or committee shall reflect when the conflict of interest was disclosed and when the interested person did not vote. When there is a doubt as to whether a conflict of interest exists, and/or whether a member should refrain from voting, the matter shall be resolved by a vote of the organization (or its committee), excluding the person concerning whose situation the doubt has arisen.

A copy of this conflict of interest statement passed by the AWM Executive Committee, Vancouver, 8/16/1993, shall be published once a year in the *AWM Newsletter*, and any member serving as an officer or on a committee shall be advised of the policy upon undertaking her duties.

- "I've had a Math professor looking me up and down with surprise before talking to me and asking me if I'm sure I can handle maths research."
- "They said that they were glad to see a girl who was interested in math, which was reassuring in my math skills, yet made me concerned as to the assumption that most girls aren't interested."
- "Not explicitly referencing my gender as the rationale, but having me and another girl my age work with a younger and/or less experienced group of students."

Discussion

From the quantitative data, it is apparent that an extremely mathematically well-prepared group of students go on to concentrate in mathematics at Group I schools. Mathematics concentrators typically have strong backgrounds in regards to course work and parental support. More often than not, they have already completed a course in calculus and multivariable calculus and have at least one parent with a STEM degree. Female mathematics concentrators tend to come from even stronger family backgrounds (e.g., more parental STEM emphasis). At Harvard, mathematics concentrators typically begin with the most challenging courses. At first thought, this all seems very positive: top schools are attracting an extremely talented group of mathematics students. The flip side to this, however, is that there are very few people concentrating in mathematics who do not come from this particular background. This reinforces the stereotypes of what a mathematician looks like and potentially closes off the field to a wide group of people by making the barrier to entry too high. Female mathematics students came from equally strong and well-supported backgrounds, if not more so than males, indicating that the barrier to entry is even higher for women.

At the five surveyed Group I Private universities, there are substantial proportions of female mathematics undergraduates dissuaded from taking mathematics courses due to gender imbalance and comments made in regards to their gender and mathematics ability. The qualitative data further illustrates this problem. There are numerous examples of comments from both other students and faculty that reinforce mathematics stereotypes and insinuate that women are less capable at mathematics. One of the most frequently cited type of comment was the "for a girl" comment, where students or faculty expressed surprise at a female mathematics student's capability due to her gender or complimented the student not amongst all students but specifically amongst female students. This further highlights that many students and faculty members believe in the stereotype of who can be a mathematician (i.e., men).

While there is variation amongst surveyed universities, the basic trends remain the same. Universities attract well-prepared and supported mathematics students, but large proportions of female students face a negative mathematics climate. The national statistics on the proportion of women receiving degrees in mathematics is already an alarming indicator of the gender gap. This survey goes further in showing the negative consequences at elite universities. Female mathematics students feel dissuaded from taking mathematics courses, often feel more disrespected in mathematics environments and face subtly and overtly sexist comments. In order to create a diverse and inclusive environment that allows everyone the equal opportunity to thrive as a mathematician, serious changes must be made.

Recommendations

The natural question is: what can be done to improve the climate of university mathematics departments and work to eliminate the gender gap in mathematics? I conclude with a list of recommendations. These are concrete suggestions of actions that I believe mathematics departments can take to improve the gender gap and overall climate.

- **Hire more female faculty members**

This is the most important item as the faculty members are how the department presents itself. There is a clear lack of female faculty members at the surveyed universities. A number of studies (Carrell, Page, and West, 2010; Bettinger and Long, 2005) have found that female professors have a positive effect on the performance of female undergraduates. The extremely low proportion of female faculty members perpetuates the gender gap in mathematics. Female faculty members can serve as role models and mentor figures to women in mathematics. Mathematics departments should be extending several offers to female mathematicians and be actively working to recruit them. Enough offers should be extended to result in an increase in female mathematics faculty members.

The department should also think about this in terms of graduate students and postgraduate students, as, for example, the most recent class of mathematics graduate students at Harvard includes no women.

- **Mandatory unconscious bias training**

Require all faculty members and mathematics course assistants (CAs) to complete an unconscious bias training.

A variety of literature exists on unconscious bias and its harmful effects on women in STEM fields (Hill, Corbett and St. Rose, 2010; Easterly and Ricard, 2011). In order to mitigate its effects, require all faculty members and CAs to participate in unconscious bias training.

- **Invite female mathematicians to speak**

At least once a semester, invite prominent female mathematicians to speak. This highlights the accomplishments of female mathematicians and provides female role models to mathematics students. This also helps to negate the stereotypes surrounding who can be a mathematician by reinforcing that women can be and are successful at mathematics, not just "for a girl."

- **Mentorship program**

Create a mentorship program to provide undergraduates with a diverse set of mentors—perhaps pairing graduate students, postdocs or other faculty members with undergraduates. This will bring more concentrators in by providing more support and a more welcoming environment, as they will have someone to turn to for advice.

- **Encourage a collaborative environment**

Make sure the structure is in place for the mathematics department to be as inclusive and collaborative as possible. For example, at Harvard, a mathematics night was created once a week in a house dining hall. At mathematics night, students can meet other students in their classes, work together and get help from their teachers.

- **Restructure introductory courses**

If necessary, restructure introductory courses to be more welcoming of students from a diverse set of mathematical backgrounds. Make sure Calculus I counts for concentration/major credit so students coming in with less course background are not at a disadvantage in completing the concentration. Make sure there are tutors available for students in first year mathematics courses and that students know how to utilize the support resources available to them.

- **Provide funding to organizations working to create diversity in the department**

If a group of this sort does not exist, start one. Create an AWM student chapter in order to create a more inclusive community.

References

Bettinger, Eric P., and Bridget Terry Long. "Do faculty serve as role models? The impact of instructor gender on female students." *The American Economic Review* 95.2 (2005): 152–157.

Brainard, Suzanne G., and Linda Carlin. "A longitudinal study of undergraduate women in engineering and science." *Frontiers in Education Conference, 1997. 27th*

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Annual Conference. *Teaching and Learning in an Era of Change. Proceedings*. Vol. 1. IEEE, 1997.

Carrell, Scott E., Marianne E. Page, and James E. West. "Sex and science: How professor gender perpetuates the gender gap." *The Quarterly Journal of Economics* 125.3 (2010): 1101–1144.

Easterly, Debra M., and Cynthia S. Ricard. "Conscious Efforts to End Unconscious Bias: Why Women Leave Academic Research." *Journal of Research Administration* 42.1 (2011): 61–73.

Espinosa, Lorelle. "Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiences that contribute to persistence." *Harvard Educational Review* 81.2 (2011): 209–241.

Griffith, Amanda L. "Persistence of women and minorities in STEM field majors: Is it the school that matters?." *Economics of Education Review* 29.6 (2010): 911–922.

Hill, Catherine, Christianne Corbett, and Andresse St. Rose. *Why so few? Women in science, technology, engineering, and mathematics.* American Association of University Women. Washington, DC, 2010.

Moss-Racusin, Corinne A., et al. "Science faculty's subtle gender biases favor male students." *Proceedings of the National Academy of Sciences* 109.41 (2012): 16474–16479.

Riegle-Crumb, Catherine, George Farkas, and Chandra Muller. "The role of gender and friendship in advanced course taking." *Sociology of Education* 79.3 (2006): 206–228.

Schmader, Toni, Jessica Whitehead, and Vicki H. Wysocki. "A linguistic comparison of letters of recommendation for male and female chemistry and biochemistry job applicants." *Sex Roles* 57.7–8 (2007): 509–514.

Shapiro, Jenessa R., and Amy M. Williams. "The role of stereotype threats in undermining girls' and women's performance and interest in STEM fields." *Sex Roles* 66.3–4 (2012): 175–183.

Spencer, Steven J., Claude M. Steele, and Diane M. Quinn. "Stereotype threat and women's mathematics performance." *Journal of experimental social psychology* 35.1 (1999): 4–28.

U.S. Department of Education. Institute of Education Sciences, National Center for Education Statistics.

Weeden, Kim A., Sarah Thébaud, and Dafna Gelbgiser. "Degrees of Difference: Gender Segregation of US Doctorates by Field and Program Prestige." *Sociological Science 4* (2017): 123–150.

Woodcock, Anna, et al. "The consequences of chronic stereotype threat: domain disidentification and abandonment." *Journal of personality and social psychology* 103.4 (2012): 635.

CALL FOR PROPOSALS

Research Collaboration Conferences for Women

Supported by a National Science Foundation ADVANCE grant, the AWM is working to establish and support research networks for women in all areas of mathematics research. As part of the grant, the AWM will provide mentorship and support to new networks wishing to organize a research collaboration conference for women (RCCW), including: help finding a conference venue, help developing and submitting a conference proposal, and help soliciting travel funding for participants.

Mathematicians interested in organizing the first conference of a new RCCW are invited to submit a proposal to the AWM describing the conference topic, potential co-organizers and project leaders, and potential participants. Proposals should be no more than one page (PDF files only, please) and should be sent to awm.rccw@gmail.com. Deadlines for submission: **January 1** and **July 1** annually.

More information about the ADVANCE Grant, Research Collaboration Conferences for Women, existing RCCW networks, and related initiatives can be found at http://awmadvance.org/.

IN MEMORIAM

Cathleen Synge Morawetz, 1923–2017

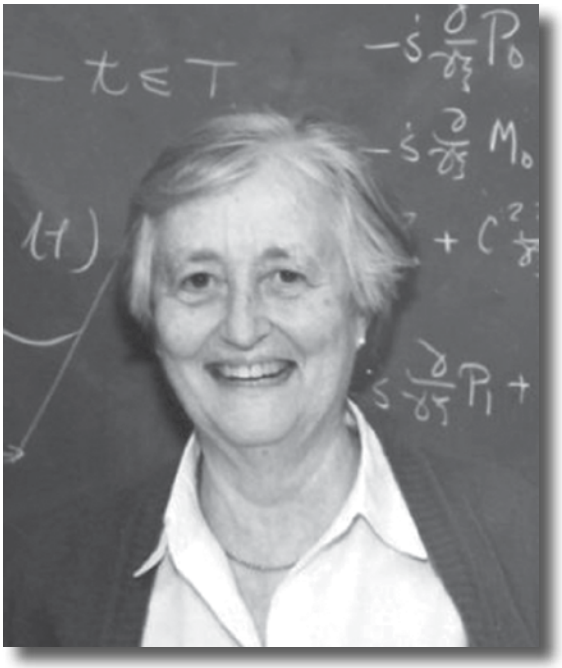
Reprinted by permission from "Professor Emerita Cathleen Synge Morawetz," https://cims.nyu.edu/webapps/content/more/cathleen-synge-morawetz-obituary

Cathleen Synge Morawetz died on August 8, 2017. She was 94 years old.

Cathleen was a leading mathematician who made fundamental and lasting contributions in the field of partial differential equations. She worked on a wide range of problems, making seminal contributions to transonic flow and scattering theory among other topics. In 1956 she solved what was then an engineering mystery, by showing that there is no airfoil design that robustly eliminates shocks at supersonic speeds. In the '60s and '70s she studied the scattering of waves by obstacles and nonlinear scattering theory. The techniques she introduced—now known as "Morawetz inequalities" and "Morawetz estimates"—are flexible and widely applicable; as a result, her work has strongly influenced many areas where wave propagation is important, including fluid dynamics and general relativity.

Cathleen was born in Toronto in 1923 to John L. Synge, a distinguished Irish physicist and mathematician, and Eleanor Allen. She graduated from the University of Toronto in 1945, received a master's degree in 1946 at the Massachusetts Institute of Technology, and a PhD in 1951 at New York University, under the supervision of Kurt O. Friedrichs. After spending a year at MIT, Cathleen joined NYU's Institute for Mathematics and Mechanics (the precursor of today's Courant Institute of Mathematical Sciences) in 1952 as a research sssociate, and after five years became an assistant professor. She remained at NYU throughout her career, and was Director of the Courant Institute from 1984 to 1988—the first and only woman director. She was proud to serve as a role model for generations of young mathematicians.

In addition to her academic positions, Cathleen served as President of the American Mathematical Society 1995–97; was a trustee for the American Mathematical Society, the Alfred P. Sloan Foundation, and Princeton University; and served on numerous advisory committees or boards of organizations including the JSTOR Consortium, the NYC Mayor's Commission on Science and Technology, the NCR Corporation, the National Research Council, and the Dublin Institute for Advanced Studies' School of Theoretical Physics.



Cathleen Synge Morawetz

Cathleen began her research on transonic flow while she was a research associate at NYU. In a series of three celebrated papers in the 1950s, she established that shock free flows about profiles are exceptional in the sense that perturbations of the profile shape or upstream velocity of a shockless flow will result in shock formation. This work also provided important tools for the study of mixed type PDE including ingenious energy estimates and maximum principles for auxiliary functions related to invariances in the equations. Cathleen also explored techniques for producing transonic flows with mild shocks, including artificial viscosity approaches combined with compensated compactness in the 1980s; this entailed finding appropriate entropy pairs and obtaining uniform estimates for small viscosity. In addition, Cathleen opened the door to constructing rich families of shockless 2-D flows by obtaining well posedness for weak solutions of the Dirichlet problem for Tricomi type equations, with a first breakthrough in 1970 and robust refinements some 30 years later.

During the '60s and '70s Cathleen became interested in scattering problems. One focus was the scattering of waves by obstacles, where she proved local energy decay for star-shaped obstacles. The proof was based upon ingenious energy identities, totally different from the usual energy identities of mathematical physics. These identities have

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been central to modern theories of hyperbolic and mixed-type partial differential equations. This work and subsequent research on nonlinear scattering theory led to a whole series of "Morawetz inequalities" and "Morawetz estimates," both of which refer to a general procedure for proving local energy decay of solutions to a large class of dispersive equations. The applicability of this procedure to a wide range of problems has made Cathleen's work very influential in the study of nonlinear waves, including general relativity.

Cathleen received many honors and awards, including honorary degrees from New York University (2007), the University of Toronto (1996), the University of Dublin (1996), the University of Waterloo (1993), Duke University (1988), New Jersey Institute of Technology (1988), Princeton University (1986), Brown University (1982), Smith College (1980), and Eastern Michigan University (1980). She was elected Fellow of the American Mathematical Society (2012), SIAM Fellow (2009), Fellow of the American Philosophical Society (1997), Fellow of the Royal Society of Canada (1996), Member of the National Academy of Sciences (1990), and Fellow of the American Academy of Arts and Sciences (1984); she held Guggenheim Fellowships twice, in 1966–67 and 1978–79.

In 1998 Cathleen received the National Medal of Science. Her other awards include the American Mathematical Society's Leroy P. Steele Prize for Lifetime Achievement (2004), and its George David Birkhoff Prize in Applied Mathematics (2006).

She is survived by her husband Herbert; her sister Isabel; her children John, Lida, Nancy, and Pegeen; ten grandchildren and step-grandchildren; and three great-grandchildren. The family has suggested that donations in remembrance of Professor Morawetz be made to the Cathleen Synge Morawetz Postdoctoral Fellowship Fund. See https://cims.nyu.edu/webapps/content/more/cathleen-synge-morawetz-memorial-gifts for further information.

Additional information about Cathleen, including video, is available at the Simons Foundation "Science Lives" website.

Compiled by your editor from many articles in the AWM Newsletter *archive.*

The obituary above does not discuss the keen interest Cathleen took in issues involving women and mathematics, so I wandered through the archives (aided by an Acrobat search) to find her in our archive. She is mentioned too many times to give them all here; I'll just hit a few highlights.

Fields Institute, September 19, 2008: Left to right, bottom row: Peter Lax, Louis Nirenberg, Cathleen S. Morawetz and Lia Bronsard. Second row: Daniela Lupo, Kevin Payne, and Gigliola Stafillani.

Also, I am sad to report that her beloved husband and widower Herbert died at the age of 102 on October 29, 2017.

Cathleen did not always agree with the approach of AWM. Lenore Blum gave a delightful talk "A Brief History of the Association for Women in Mathematics: The Presidents' Perspectives" at our 20th anniversary celebration in 1991. In it she said:

> Not all women mathematicians were enthusiastic about the AWM in the beginning. For example, as Cathleen Morawetz (in *Mathematical People*) puts it: "I did not want the Association for Women in Mathematics to speak for all women mathematicians. I joined them later, but at that time they were terrible attackers."

But Cathleen was always an ardent advocate for women in mathematics. She became chair of the AMS Committee on Women, which had been formed at her instigation, when it was first organized in 1971. She remained a member when the AMS-MAA Joint Committee on Women was established in 1974 and continued to serve for some years.

She gave the 54th Gibbs Lecture, the first to be delivered by a woman, in 1981 at the JMM. In 1982 at the summer JMM, she (originally from Toronto) was moderator of our panel on "Women Mathematicians in Canada." In 1983, she delivered the fourth Noether Lecture, "How do perturbations of the wave equation behave?" which ended

with a short film illustrating some of the phenomena she had discussed. In 1984, she became Director of the Courant Institute. We reprinted an article about this appointment from *SIAM News* (Vol. 17, no. 4, Jul 1984). She said: "I think my appointment is significant mainly because it highlights how few women there are in mathematics." Later in that article, in a section subtitled Pioneer Role, we read:

> Not only did Morawetz enter a field that at the time was dominated by men, she was determined, long before it was considered acceptable, to combine a career and a family. ("I have three daughters, one son—all professionals—and two grandchildren.")
>
> Although her father (applied mathematician John L. Synge) obviously played a role in developing her interest in the subject, there was a lack of supportive role models. "I knew one woman mathematician, Professor Cecilia Krieger, in Toronto, and she was certainly very encouraging," said Morawetz. "But she wasn't married and she had no children, and I didn't see that as an ideal life."
>
> "Later I met Mildred Cohn, now a very distinguished chemist and a very strong professional, who also had several children. I got some tips from her on how to manage."

Morawetz gave the Emmy Noether Lecture at ICM 1998 in Berlin. She had this to say at the beginning of her talk: "In my heart I know this honor for women would have been impossible forty years ago. And I hope that thirty years from now it won't be necessary." Her talk discussed conservation laws for the time dependent wave equation obtainable from some work Noether had done.

In 2008 the conference "Nonlinear Phenomena in Mathematical Physics: Dedicated to Cathleen Synge Morawetz on her 85th Birthday" was held at the Fields Institute in Toronto; it was jointly sponsored by AWM and the Fields Institute. Irene Gamba, one of Cathleen's doctoral students, had this to say in her article "Impressions of the Morawetz Conference":

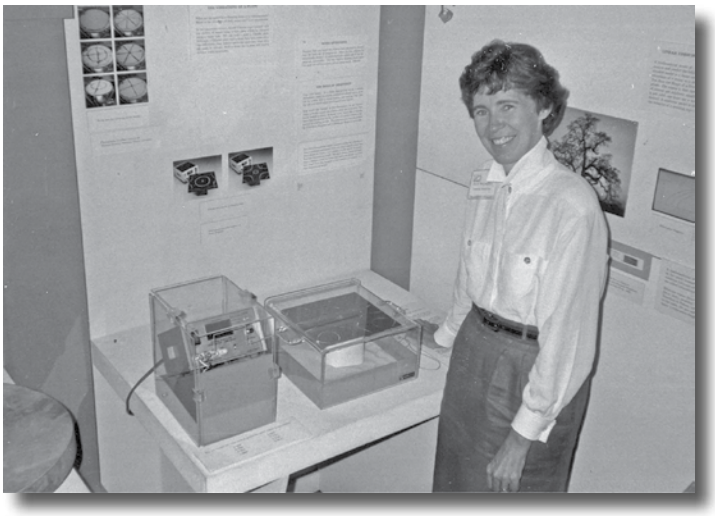
> It was a central event for the applied and computational analysis community focusing on Partial Differential Equations and it was remarkable in many aspects, with 20 distinguished speakers, 10 poster presentations, about 70 junior and senior participants and, of course, the participation of Cathleen Synge Morawetz.
>
> It was also a great happy occasion, not only to celebrate her paramount contributions to the theory of non-linear equations in gas dynamics and their impact in the current trends of nonlinear phenomena in mathematical physics, but also to serve as an awareness session of current women's contribution to mathematics. Of those twenty speakers, seven were women whose research has been inspired from or carried the legacy of Morawetz work.

Fields Institute, September 19, 2008: Left to right, bottom row: Peter Lax, Cathleen S. Morawetz and Louis Nirenberg. Top row, left to right: Christian Klingenberg, Irene M. Gamba, Barbara Keyfitz and Giu-Qiang Chen.

Joyce McLaughlin, 1939–2017

Compiled from information provided by Jackie Cortese and others at RPI.

Dr. Joyce R. McLaughlin died peacefully at the age of 78 on October 23, 2017. A memorial gathering was held November 13, 2017 at The Rensselaer Newman Foundation. She is survived by her husband, Harry McLaughlin, a professor of mathematical sciences at Rensselaer, and two children and their families, which include four grandchildren.



Joyce McLaughlin was a pioneer. When she started her career at Rennselaer Polytechnic Institute (RPI) in 1969, women were in a very small minority, whether as faculty or student. As Ford Foundation Professor in the Department of Mathematics, she became the first woman chaired professor at RPI in 1992; in 2003 she became the founding Director of the Inverse Problem Center at RPI (IPRPI). Through the years she was active on many RPI Committees.

Joyce served on many Boards (SIAM, AMS, NRC, IPAM, MSRI, AIM …). She was also active on many editorial and review boards (e.g., NSF, *Inverse Problems*, *SIAM Journal on Mathematical Analysis* and the *Encyclopedia of Computational and Applied Mathematics*). She was an appointed member of the inaugural class of SIAM Fellows in 2009 and was named an inaugural Fellow of the AMS in 2012. She was an invited speaker at many renowned international conferences and workshops; in particular, she gave an invited lecture on inverse problems in vibrating systems at the 1994 ICM. In 2004, she delivered the AWM-SIAM Kovalevsky Lecture.

McLaughlin was a wonderful mentor to many colleagues and students. She encouraged support and promotion of women in the world of science. Joyce was a longstanding member of AWM and participated in many AWM workshops held in conjunction with SIAM.

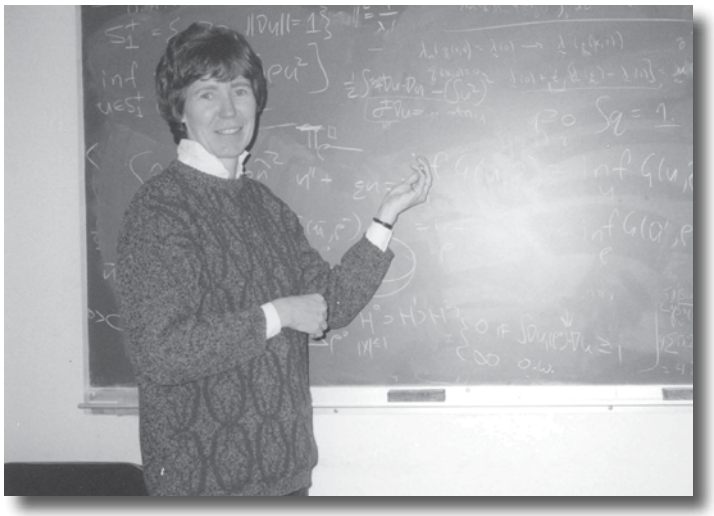
McLaughlin believed it important and possible to interweave family and career and encouraged others to do the same. She loved raising her family while pursuing her career, and also found enough time to learn to fly an airplane.

Joyce's determination, generosity and good humor at age 78 allowed her to meet with her PhD student, climb four flights of stairs to her office, continue to publish, and teach classes such as Optimization in Infinite Dimensional Spaces & Nonlinear Functional Analysis and Uncertainty Quantification.

Jackie Cortese, McLaughlin's assistant at IPRPI, has many fond memories of Joyce. She shared a few accomplishments that, although they may not appear on her CV, tell us a little more about Joyce McLaughlin.

Joyce traveled internationally to many conferences before travel became significantly safer and better geared for women, or any travelers for that matter. She instigated an increase in the number of ladies' rooms in her building (AWM members will well recognize the importance of this). She believed in "dressing for success" even before the phrase was coined in the '70s.

Joyce encouraged everyone, especially career-minded women, not to delay starting a family until their careers took off. She was devoted to her family as well as her research and students. Joyce loved investing her time in the pursuit of creating and finding solutions to new mathematical problems. She was highly invested in pushing the



boundaries of mathematical research and application and making it available to as many people as possible. Jackie commented that watching Joyce work with pencil in hand on her equations was like watching the flow of water downstream.

Joyce witnessed many changes in the world and in science, especially in communications, during her career: computers and the various storage possibilities (e.g.,. floppies, CD, thumb drives, …), the web (i.e., articles and information being available digitally) and so on. Importantly, she was very involved with the process of these communication conversions in organizations such as SIAM and AWM. She always strived to remain on the "cutting edge" and to apply these advantages to expand the capabilities and reach of mathematics and to promote better communication between people.

Next we give a description of Joyce McLaughlin's research. In preparation for this future work, she earned a bachelor's degree from Kansas State, a master's degree from the University of Maryland, and a doctoral degree in applied mathematics from the University of California, Riverside.

McLaughlin's work on the inverse problem of transient elastography and supersonic imaging and in magnetic resonance elastography had the goal of creating images of stiffness properties in biological tissue for use as medical diagnostic tools. She led a research team supported by NIH; its goal was to create images of the variations of shear wave speed in biological tissue. These images extend the doctor's palpation exam where the doctor presses against the skin to feel the presence of abnormal tissue, which is stiffer than normal tissue. Researchers are developing well-posedness results and fast algorithms for this wave speed recovery. Data measured in a waves and acoustics laboratory at the Ecole Supérieure de Physique et de Chimie Industrielles, Université Paris VII, at Mayo Clinic, at Charité Hospital in Berlin and at the University of Rochester—as well as synthetic data—are being tested in wave speed recovery algorithms.

A significant breakthrough was established with Dan Renzi and Jeong-Rock Yoon with the development of the arrival time algorithm. This algorithm uses the arrival time of a propagating wave front or the arrival time of a distinguishing feature of the wave as it propagates forward. Initial results with both synthetic and laboratory data are very promising. Newer algorithms with Kui Lin, Ning Zhang and Ashley Thomas are provably stable, and image the viscoelastic properties of tissue, over a range of frequencies, from time harmonic displacement data.

Joyce McLaughlin

McLaughlin's team has investigated inverse problems and wave propagation algorithms in waveguides. In this work, her group developed exact one-way algorithms for calculating the solution of the Helmholtz equation in a range and depth dependent ocean. For inverse problems, the researchers used their knowledge of waveguides to develop efficient methods for identification of objects and inhomogeneities in waveguides, as well as for time reversal problems where interfaces were identified.

The IPRPI Center geophysics project was the application of time reversal techniques to the identification of fault locations. There recorded seismic data from many minor earthquakes are collectively combined, time reversed and used, together with a rough wave speed background map, to sharpen estimates of fault locations.

Furthermore, she studied inverse spectral problems, where the data includes natural frequencies and eigenmode measurements. The inverse problem solution is material parameters such as density, sound speed, or elasticity coefficients. Mathematical models are second or fourth order partial and ordinary differential equations. Well-posedness results were obtained and algorithms were developed and tested. Solution techniques were aimed at maintaining the full nonlinearity of the inverse problem without employing linearization methods. Specific eigenmode measurements that surprisingly yield explicit formulas were the nodal sets of eigenfunctions.

Announcements

Mirzakhani Math Fellowship at Stanford

Engineers and entrepreneurs Rouzbeh Yassini-Fard and Anousheh Ansari have donated $800,000 to the School of Humanities and Sciences at Stanford University; matched by $400,000 from the William and Flora Hewlett Foundation, the $1.2 million endowment will be used to create the Maryam Mirzakhani Graduate Fellowship to support mathematics graduate students. Eleny Ionel, professor and chair of mathematics, said that the unpredictability in government funding in the natural sciences makes these fellowships more important than ever: "Graduate students are the future." (See "New Stanford graduate fellowship named for Maryam Mirzakhani," Natilie Jabbar, The Dish at Stanford News, https://news.stanford.edu/thedish/2017/12/06/new-stanford-graduate-fellowship-named-for-maryam-mirzakhani/).

Jill Pipher Elected as Next AMS President

AMS, December 2017

Jill C. Pipher, Vice President for Research at Brown University and Elisha Benjamin Andrews Professor of Mathematics at Brown, has been elected as the next AMS President, starting in 2019. Pipher is the third woman to be elected AMS President, following Julia Robinson (1983–1984) and Cathleen Synge Morawetz (1995–1996). She will succeed the current AMS President, Kenneth A. Ribet.

Pipher's professional honors include an NSF Postdoctoral Fellowship, an NSF Presidential Young Investigator Award, and an Alfred P. Sloan Foundation Fellowship. She is an inaugural Fellow of the AMS (2012), served as President of the Association for Women in Mathematics from 2011 to 2013, was an Invited Speaker at the International Congress of Mathematicians in Seoul in 2014, and was elected to the American Academy of Arts and Sciences in 2015.

Pipher's research areas include harmonic analysis, partial differential equations, and lattice-based cryptography. She has published more than 60 papers and co-authored an undergraduate cryptography textbook. Pipher jointly holds four patents related to the NTRU encryption algorithm. She was a co-founder of Ntru Cryptosystems, Inc., now part of Security Innovation, Inc.

Pipher received her PhD from UCLA in 1985 under the direction of John Garnett. She was a Dickson Instructor and later assistant professor at the University of Chicago before joining the faculty at Brown in 1989. She was the founding Director of the Institute for Computational and Experimental Research in Mathematics (ICERM), a National Science Foundation mathematics institute, from 2010 to 2016.

Pipher says that she "will work with energy on every aspect of the core mission of the AMS. I especially hope to help the AMS be an advocate for mathematical research in public, private, and government sectors and look forward to working with the dedicated staff and membership to advance these goals."

Current AMS President Kenneth A. Ribet (University of California, Berkeley), says: "I wish to thank the candidates who agreed to run for election and to congratulate all the winners. I especially wish to congratulate Jill Pipher, who will become President-elect on February 1, 2018. I look forward to working with Professor Pipher, first as AMS President and then in 2019 as Immediate Past President."

Additional 2017 AMS Election Results

http://www.ams.org/about-us/governance/election-results

As we read above, Jill C. Pipher has been elected as President of the AMS. A striking number of other women were also elected to office: Trustee, Judy L. Walker; Members at Large of the Council, Erika T. Camacho, Brooke Shipley, and Gigliola Staffilani; Nominating Committee, Tara S. Holm and Alice Silverberg; and Editorial Boards Committee, Amie Wilkinson. Congratulations to all!

AWM Thank-yous

AWM is very grateful to those whose donations support its mission of encouraging women and girls to study mathematics and have careers in the mathematical sciences. We extend a special thank you to AWM contributing members and donors. We also thank those who prefer to remain anonymous. (This list reflects activity from July 1, 2016 – June 30, 2017).

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The Full Preliminary Announcement and Call for Papers is now available at http://directorymathsed.net/public/Ireland/

Photo albums of our last three conferences, created by Jasia Morska (co-organiser), are at https://alantrogerson.imgur.com/

Dr. Alan Rogerson alan@cdnalma.poznan.pl

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