AWM
ASSOCIATION FOR WOMEN IN MATHEMATICS

Newsletter

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The purpose of the Association for Women in Mathematics is

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

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PRESIDENT'S REPORT

Dear AWM Friends,

How often do you find a story about the same topic in both *Quanta Magazine* and *Glamour*? We recently did when both these and all major news sources reported that Karen Uhlenbeck has won the Abel Prize. Indeed, it feels like it took a quantum leap for a woman to win the Abel Prize. But lo and behold it's glamorous when we get there. Uhlenbeck is recognized "for her pioneering achievements in geometric partial differential equations, gauge theory and integrable systems, and for the fundamental impact of her work on analysis, geometry and mathematical physics." And many of us recognize and thank her also, not only for being a pioneer at the highest levels of mathematics but also as a role model. Congratulations to Professor Uhlenbeck for defying the odds, blazing a path, and for a lot of incredible mathematics. This is a great moment for all women in math whether they prefer to read *Glamour*, *Quanta*, or the *Annals*.

Plans are underway to designate May 12th as an annual day Celebrating Women in Mathematics. The date was chosen to remember and honor another superheroine mathematician, Fields Medalist Maryam Mirzakhani whose birthday was May 12. The May 12th initiative is being supported by several organizations for women in mathematics around the world, including the AWM. The goal of the initiative is to inspire and celebrate women in math and encourage an open, welcoming and inclusive work environment for everyone. Please consider organizing an event to celebrate women in math this May. If you're late in planning this year, you can set your event to coincide with Uhlenbeck's award ceremony in Oslo on May 21. Information on the May 12th initiative including suggestions for local events can be found on the web page: may12.womeninmaths.org

As I write this the 1147th AMS sectional meeting is just wrapping up here in Hawaii. It was the largest sectional meeting ever with almost 1000 mathematicians attending. It was fun to hear many great talks and catch up with old and new mathematics friends from around the world. The program committee did a good job getting a gender balanced slate of invited speakers. I was struck though that the number of special sessions speakers was still overwhelmingly male. The AMS regularly collects and distributes demographic data. The most recent report in the October *Notices of the AMS* reported that at AMS meetings between 2013 and 2017, 72% of special session speakers were men, 21% women (with 7% with names not easily identified). This seemed to be the case at the 1147 meeting (though there were a few special sessions with almost 50% women). In contrast, the contributed

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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.

PRESIDENT'S REPORT *continued from page 1*

sessions were more balanced. My not very accurate count of contributed talks found about 46% men, 33% women (20% undetermined). I regularly attend midsized meetings in my research area where there are lots of women. Those conferences typically have a high percentage of contributed talks. The "CanaDAM"[1] conferences arrange contributed talks so they look just like special sessions (cohesive sessions, same talk lengths). This helps all speakers feel valued. As many women still tend to have to invite themselves, this is helpful. How do we do a better job of connecting the women who want to contribute to special session organizers? Major program committees are succeeding at choosing great women speakers. Can we have mechanisms that encourage all session organizers to look beyond the usual suspects?[2] How do we balance letting organizers follow their own vision, with providing access to all? These are not new questions, but continue to be important. How do we support and encourage women at all levels and make them feel valued?

I look forward to hearing your thoughts and working with our community.

Ruth Haas

Ruth Haas

March 29, 2019
Mānoa, HI

[1] The Canadian Discrete and Algorithmic Mathematics Conference.
[2] A recent article about the participation of women at the International Congress of Mathematicians (ICM) finds that the past 3 ICMs have had a whopping 14% women speakers.

ASSOCIATION FOR WOMEN IN MATHEMATICS

AWM Will Be *50* in 2021!

Can you believe that the AWM is closing in on its Golden Anniversary?! From its small but powerful beginning in 1971, to the expansive network in the mathematical sciences that it is today, AWM has a lot to celebrate in 2021! As we start the countdown, help us develop and plan the festivities. We are now accepting nominations to the 50th Anniversary Organizing Committee. If you are interested, reach out to Karoline Pershell at karoline@awm-math.org. Join us in looking forward to the amazing future of this timeless (and yet timely!) organization.

PRESIDENTS' REFLECTIONS

Column Editors: Janet Beery, University of Redlands; Francesca Bernardi, Florida State University; Kayla M. Bicol, University of Houston; Cathy Kessel, consultant

This is the third in a series of "Presidents' Reflections," articles by past presidents of the AWM that are intended to help us take stock of where we are and where we should be going, and to consider what we want the organization to be at its 50th anniversary. As always, the *AWM Newsletter* welcomes your suggestions and comments in letters to the editor.

Lenore Blum was the third president of AWM (1975–1978). For more about Blum, see her web page at Carnegie Mellon University (http://www.cs.cmu.edu/~lblum/), or her entries at MacTutor, Wikipedia, and the Agnes Scott College Biographies of Women Mathematicians.

Then and Now: The Numbers Speak Volumes

Lenore Blum

In January 2021, the Association for Women in Mathematics will celebrate its 50th Anniversary. Thirty years before that, in January 1991, AWM celebrated its 20th anniversary at the Joint Mathematics Meetings in San Francisco. It was hard to fathom then that 20 years had gone by, and even harder now to fathom that we are approaching 50.

At the 20th there was much to celebrate about progress we had made. I gave the banquet talk reflecting on the earliest days of AWM as well as the first 20 years from the AWM presidents' perspectives. An article based on that talk was published in the *Notices of the AMS*[1] and in two issues of the *AWM Newsletter*.[2] It was a joyous occasion, and I urge you to read that early history to get a sense of our excitement. I promise, you will be inspired.

But here I just want to focus on data, then and now. I began my talk by recalling data from the earliest days:

> [For] my journey back in time, I went to the library and checked out *Notices* [of the American Mathematical Society (AMS)] for 1971. The Joint Mathematics Meetings (JMM) that year were held in Atlantic City; the program in the January issue was quite revealing. Of the *more than 15 invited hour speakers*—AMS, MAA and ASL combined—*none was female* (i.e. 0%); of the *more than 300 AMS ten-minute talks*, about *15* were *given by women* (5%). I became curious and looked at the Personal Items section. This contains short descriptions of individuals' professional activities and achievements as well as job promotions and appointments. *Only five of the approximately 145 blurbs* seemed to mention women

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[1] *Notices of the AMS*, Sept. 1991, Vol. 38, No. 7, pp. 738–754, http://ams.org/journals/notices/199109/199109FullIssue.pdf.

[2] *AWM Newsletter* Archive, Vol. 21, No. 6, Nov–Dec, 1991, pp. 11–22, https://www.drivehq.com/folder/p8755087/1748757031.aspx and Vol. 22, No. 1, Jan–Feb 1992, pp. 12–25, https://www.drivehq.com/folder /p8755087/1748757891.aspx.

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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, appalachianawm@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, awm@awm-math.org.

> (less than 4%). Of the *31 promotions* listed, 3 were female (10%); at the instructorship level, women seemed to do relatively better, getting 3 of the 9 appointments (33%).... I used the well-known mathematical technique (which has served us so well over the years) of counting and dividing to calculate the telling percentages. And sure enough, as I went down the list—*as the positions became less prestigious—the percentage of women increased*. As if to confirm this trend even more dramatically, I noticed further on that, of the *4 deaths* reported in that issue, 2 were women (50%)! (emphasis added)

Anticipating much progress, *now almost 50 years later*, I checked recent issues of the *Notices*[3] for information about the January 2019 Joint Mathematics Meetings (JMM). I found that 3 out of the 5 Joint Invited Speakers were women (60%).[4] Fantastic! But then, only 2 of the 7 AMS Invited Speakers were women (29%). Together that's 5 out of 12. OK, not bad!

I then decided to check out employment data. Given that the percentage of women awarded PhDs in the mathematical sciences over the past 30 years or more has been around 30%, averaging over different subfields and types of PhD-granting departments, I had high expectations. From the most recent employment data I could find, the percentage of women in tenured positions in PhD-granting departments was in the *single digits*. Oh, dear! If we add tenure-eligible positions to the mix, the percentages increase to the *low double digits*.[5] Heartening it is that about 25% of new hires in top PhD-granting departments were female.[6]

How about awards? Now we go down the rabbit hole. *Only 3* of the 18 AMS prizes given at the 2019 JMM were awarded to women (including the Satter Prize, which is designated for women).[7] *None* of the awards given at the International Congress of Mathematicians last summer went to women.[8] Hmm?

On the brighter side, the March issue of the *Notices*[9] is chock full of stories about women, but then again, March is Women's History Month, so we wouldn't expect less.

Ever the optimist, I added a postscript to my 1991 article with the following upbeat message:

> Now [that] there is a near critical mass and an excellent pool of women mathematicians, 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.

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[3] *Notices of the AMS*, Vol. 65, No. 11, Dec. 2018, p. 1474.
[4] http://jointmathematicsmeetings.org/meetings/national/jmm2019/2217_invspeakers.
[5] *Notices of the AMS*, Vol. 65, No. 8, p. 952.
[6] *Notices of the AMS*, Vol. 65, No. 11, Dec. 2018, p. 1433.
[7] http://www.ams.org/profession/prizes-awards/prizes.
[8] *Notices of the AMS*, Vol. 65, No. 11, Dec. 2018, pp. 1438–1443.
[9] https://www.ams.org/journals/notices/201903/201903FullIssue.pdf.

ASSOCIATION FOR WOMEN IN MATHEMATICS

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The *AWM Newsletter* is freely available online.

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

Website: https://awm-math.org
Updates: webmaster@awm-math.org

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AWM DEADLINES

AWM Travel Grants:
May 1 and October 1, 2019
AWM Fellows: May 15, 2019
RCCW Proposals: July 1, 2019
AWM Workshop at JMM:
August 15, 2019
AWM-MAA Falconer Lecture:
September 1, 2019
AWM Alice T. Schafer Prize:
October 1, 2019
AWM Dissertation Prize: October 1, 2018
AWM-AMS Noether Lecture:
October 15, 2018
AWM-SIAM Sonia Kovalevsky Lecture:
November 1, 2018
AWM Workshop at SIAM:
November 1, 2019

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Obviously, I was wrong and much work still needs to be done. I leave the challenge in the good hands of current AWM President Ruth Haas and current AMS (and former AWM) President Jill Pipher and the wonderful members of the AWM. Ever the optimist, I expect (can't a girl hope?) that the "trickle up" effect will kick in by the 50th.

Postscript. The day after I finished this article I read in the *New York Times*[10] that "the Norwegian Academy of Science and Letters announced it has awarded this year's Abel Prize—an award modeled on the Nobel Prizes—to Karen Uhlenbeck, an emeritus professor at the University of Texas at Austin. The award cites 'the fundamental impact of her work on analysis, geometry and mathematical physics.'" Congratulations Karen! Perhaps now we are really on our way.

[10] https://www.nytimes.com/2019/03/19/science/karen-uhlenbeck-abel-prize.html.

Karen Uhlenbeck Wins 2019 Abel Prize

Our inboxes were full of messages from friends and colleagues giving us links to announcements about Uhlenbeck's well-deserved winning of the 2019 Abel Prize. The ceremony will be held May 21st in Oslo, followed by her prize lecture on the 22nd. Heartiest congratulations, Karen!

The sections below headed Citation, I'm Forever Blowing Bubbles, and About the Abel Prize appear in the press brochure "The Abel Prize Laureate 2019" available at http://www.abelprize.no/c73996/binfil/download.php?tid=74122. There is some overlap in content in the first two sections. The Biographical Info section has been compiled from sources that will be referenced in situ.

Citation

The Norwegian Academy of Science and Letters has decided to award the Abel Prize for 2019 to

Karen Keskulla Uhlenbeck
University of Texas at Austin

for her pioneering achievements in geometric partial differential equations, gauge theory and integrable systems, and for the fundamental impact of her work on analysis, geometry and mathematical physics.

Karen Uhlenbeck; Photo credit: Andrea Kane/Institute for Advanced Study

Karen Keskulla Uhlenbeck is a founder of modern Geometric Analysis. Her perspective has permeated the field and led to some of the most dramatic advances in mathematics in the last 40 years.

Geometric analysis is a field of mathematics where techniques of analysis and differential equations are interwoven with the study of geometrical and topological problems. Specifically, one studies objects such as curves, surfaces, connections and fields which are critical points of functionals representing geometric quantities such as energy and volume. For example, minimal surfaces are critical points of the area and harmonic maps are critical points of the Dirichlet energy. Uhlenbeck's major contributions include foundational results on minimal surfaces and harmonic maps, Yang-Mills theory, and integrable systems.

Minimal surfaces and bubbling analysis

An important tool in global analysis, preceding the work of Uhlenbeck, is the Palais-Smale compactness condition. This condition, inspired by earlier work of Morse,

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guarantees existence of minimizers of geometric functionals and is successful in the case of 1-dimensional domains, such as closed geodesics.

Uhlenbeck realized that the condition of Palais-Smale fails in the case of surfaces for topological reasons. The papers of Uhlenbeck, co-authored with Sacks, on the energy functional for maps of surfaces into a Riemannian manifold, have been extremely influential and describe in detail what happens when the Palais-Smale condition is violated. A minimizing sequence of mappings converges outside a finite set of singular points and by using rescaling arguments, they describe the behavior near the singularities as *bubbles* or *instantons*, which are the standard solutions of the minimizing map from the 2-sphere to the target manifold.

In higher dimensions, Uhlenbeck in collaboration with Schoen wrote two foundational papers on minimizing harmonic maps. They gave a profound understanding of singularities of solutions of non-linear elliptic partial differential equations. The singular set, which in the case of surfaces consists only of isolated points, is in higher dimensions replaced by a set of co-dimension 3.

The methods used in these revolutionary papers are now in the standard toolbox of every geometer and analyst. They have been applied with great success in many other partial differential equations and geometric contexts. In particular, the bubbling phenomenon appears in many works in partial differential equations, in the study of the Yamabe problem, in Gromov's work on pseudoholomorphic curves, and also in physical applications of instantons, especially in string theory.

Gauge theory and Yang-Mills equations

After hearing a talk by Atiyah in Chicago, Uhlenbeck became interested in gauge theory. She pioneered the study of Yang-Mills equations from a rigorous analytical point of view. Her work formed a base of all subsequent research in the area of gauge theory.

Gauge theory involves an auxiliary vector bundle over a Riemannian manifold. The basic objects of study are connections on this vector bundle. After a choice of a trivialization (gauge), a connection can be described by a matrix valued 1-form. Yang-Mills connections are critical points of gauge-invariant functionals. Uhlenbeck addressed and solved the fundamental question of expressing Yang-Mills equations as an elliptic system, using the so-called Coulomb gauge. This was the starting point for both Uhlenbeck's celebrated compactness theorem for connections with curvature bounded in L^p, and for her later results on removable singularities for Yang-Mills equations defined on punctured 4-dimensional balls. The removable singularity theory for Yang-Mills equations in higher dimensions was carried out much later by Gang Tian and Terence Tao. Uhlenbeck's compactness theorem was crucial in Non-Abelian Hodge Theory and, in particular, in the proof of the properness of Hitchin's map and Corlette's important result on the existence of equivariant harmonic mappings.

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 (https://awm-math.org/awards) for details on eligibility and do not hesitate to contact Steven Ferrucci at 401-455-4042 for guidance.

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

Another major result of Uhlenbeck is her joint work with Yau on the existence of Hermitian-Yang-Mills connections on stable holomorphic vector bundles over complex n-manifolds, generalizing an earlier result of Donaldson on complex surfaces. This result of Donaldson-Uhlenbeck-Yau links developments in differential geometry and algebraic geometry and is a foundational result for applications of heterotic strings to particle physics.

Uhlenbeck's ideas laid the analytic foundations for the application of gauge theory to geometry and topology, to the important work of Taubes on the gluing of self-dual 4-manifolds, to the groundbreaking work of Donaldson on gauge theory and 4-dimensional topology, and many other works in this area. The book written by Uhlenbeck and Dan Freed on *Instantons and 4-Manifold Topology* instructed and inspired a generation of differential geometers. She continued to work in this area, and in particular had an important result with Lesley Sibner and Robert Sibner on non-self-dual solutions to the Yang-Mills equations.

Integrable systems and harmonic mappings

The study of integrable systems has its roots in 19th century classical mechanics. Using the language of gauge theory, Uhlenbeck and Hitchin realised that harmonic mappings from surfaces to homogeneous spaces come in 1-dimensional parametrized families. Based on this observation, Uhlenbeck described algebraically harmonic mappings from spheres into Grassmannians relating them to an infinite dimensional integrable system and Virasoro actions. This seminal work led to a series of further foundational papers by Uhlenbeck and Chuu-Lian Terng on the subject and the creation of an active and fruitful school.

The impact of Uhlenbeck's pivotal work goes beyond geometric analysis. A highly influential early article was devoted to the study of regularity theory of a system of non-linear elliptic equations, relevant to the study of the critical map of higher order energy functionals between Riemannian manifolds. This work extends previous results by Nash, De Giorgi, and Moser on regularity of solutions of single nonlinear equations to solutions of systems.

Karen Uhlenbeck's pioneering results have had fundamental impact on contemporary analysis, geometry and mathematical physics, and her ideas and leadership have transformed the mathematical landscape as a whole.

A glimpse of the Laureate's work: "I'm Forever Blowing Bubbles"

Arne B. Sletsjøe, associate professor, Department of Mathematics, University of Oslo

Soap bubbles are beautiful objects, perfectly shaped and with a marvelous play of colors, due to interference of light reflecting off the front and back surfaces of the soap film. Soap bubbles are beautiful objects in a mathematical setting as well, as they constitute examples of minimal surfaces. When the enclosed volume of air inside the bubble is fixed, the soap film will minimize the wall tension, pulling the bubble into the shape of the least surface enclosing a fixed volume, known for centuries to be a perfect sphere.

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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/.

If instead of blowing the bubble, we dip a heavily deformed wire loop into a soap bubble solution, the soap film will form a disc with its boundary given by the wire loop and of minimal area. Unlike the sphere-shaped bubble, this film has equal pressure on each side, hence it is a surface with zero mean curvature, i.e., the average curvature along all directions is zero. Even if the soap film almost instantly is able to form a minimal surface, computing the shape of the surface analytically is a rather complicated task.

Among curves connecting two points in space, we can always find a shortest path. The analogous statement is not true for surfaces when considering their area. The problem is that in order to reduce the area of a surface, a consequence could be that the surface is shrunk to a curve, which of course does not count as a minimal surface. An example of this is the minimal tubular surface connecting two parallel circles. If the distance between the circles is small compared to their radius, the minimal surface looks like a slightly concave cylinder. When pulling the circles apart the cylinder will shrink in the region between the circles, forming a surface known as a catenoid. At a certain point, the middle part of the curved cylinder will collapse along the line connecting the centers of the two parallel circles. When pulling the circles further apart there is no tubular minimal surface connecting them.

Mapping spaces

In 1968 Karen Uhlenbeck received her PhD from Brandeis for her thesis "The Calculus of Variations and Global Analysis." Her supervisor was Richard Palais, who a few years earlier and together with Stephen Smale, had introduced the so-called *Palais-Smale Condition C*. This condition gives a criterion for the existence of minimizers for functionals on mapping spaces. The existence of minimizers for functionals on mapping spaces is a different condition than having a surface of least area, but Condition C can also be applied to the minimal surface problem, where it may fail. Motivated by the general non-existence of minimal surfaces, Uhlenbeck wanted to understand what happens when Condition C is violated. In a paper co-authored with Jonathan Sacks, they describe in detail the situation where you cannot rely on the conclusion of Condition C. They construct a sequence of mappings of a sphere into the target space which satisfies Condition C, but in such a way that their limit does not. Outside of a finite set of singular points everything works well, but near the singularities the so-called bubbling phenomenon appears. The area of the limit surface is strictly less than the limit of the areas of the surfaces in the sequence. The difference is concentrated in a finite set of isolated points, being the limit of "bubbles" in the sequence of surfaces. The idea and the methods of this revolutionary paper has since it was published become a successful mathematical tool. In particular, the bubbling phenomenon has had great influence as a method for solving problems in various parts of mathematics.

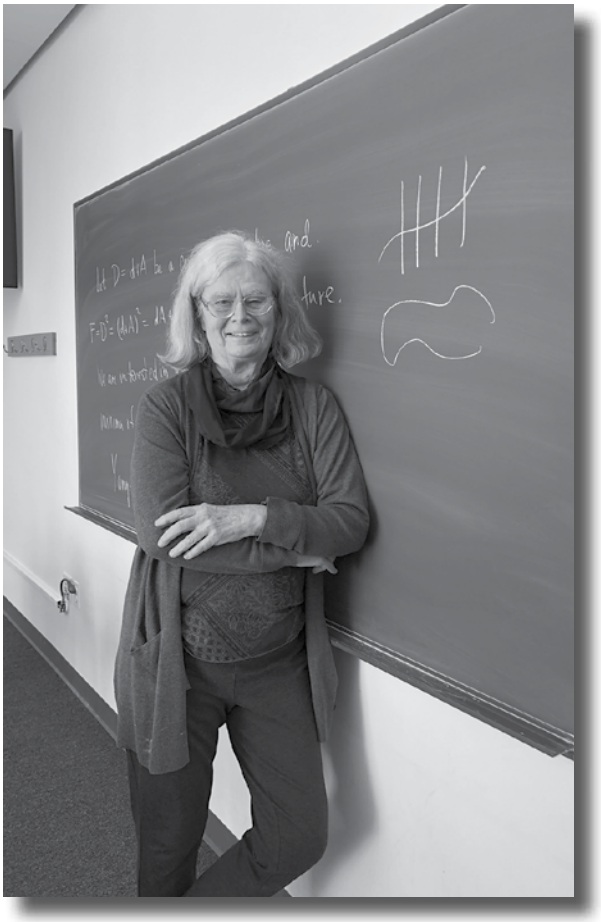
Footprints of gauge

Karen Uhlenbeck also left her footprints in the field called *gauge theory*. Gauge theory is a mathematical theory introduced by Hermann Weyl in 1918, which originated in theoretical physics and Einstein's theory of general relativity. A key idea in Einstein's work is that laws of physics should be the same in all frames of reference. This is also the general idea of a gauge theory, to find connections that compare measurements taken at different points in a space and look for quantities that do not change. The physical interpretation was brought further by Yang and Mills in the fifties, in what is now called the Yang-Mills equations. To reveal the secrets of theoretical physics you have to work in a (at least) four-dimensional space, three spatial coordinates and one time-coordinate. A physical law should be the same wherever you are located in space-time, i.e., independent of choice of frame of reference.

Minimal surfaces

Karen Uhlenbeck attacked this problem from the mathematical point of view. She pioneered the study of Yang-Mills equations in a rigorous analytical way. Her work formed the base of all subsequent research in the area of gauge theory. Her analysis of the Yang-Mills equations in four dimensions together with C. H. Taubes also laid the ground for the theories of Simon Donaldson, who later was awarded the Fields Medal in 1986 for his work on the topology of four-manifolds.

Minimal surfaces and gauge theory are two separate fields of mathematics which both originate from a wish to understand nature. When mathematicians get interested in such problems, the theory propagates into theoretical constructions far beyond the tangible objects of nature. But even if the mathematical theory seems to be soaring, scientists often benefit from the generalized theory. Karen Uhlenbeck's mathematical achievements constitute important examples of such processes.



Karen Uhlenbeck; Photo credit: Lee Sandberg/Institute for Advanced Study

About the Abel Prize

The Abel Prize is an international award for outstanding scientific work in the field of mathematics, including mathematical aspects of computer science, mathematical physics, probability, numerical analysis, scientific computing, statistics, and also applications of mathematics in the sciences.

The Abel Prize has been awarded since 2003 by the Norwegian Academy of Science and Letters. The choice of laureates is based on the recommendations from the Abel Committee. The prize carries a cash award of 6 million NOK (about 650,000 Euro or about 730,000 USD).

The prize is named after the exceptional Norwegian mathematician Niels Henrik Abel (1802–1829). According to the statutes of the Abel Prize the objective is both to award the annual Abel Prize, and to contribute towards raising the status of mathematics in society and stimulating the interest of children and young people in mathematics.

Among initiatives supported are the Abel Symposium, the International Mathematical Union's Commission for Developing Countries, and the Bernt Michael Holmboe Memorial Prize for excellence in teaching mathematics in Norway. In addition, national mathematical contests, and various other projects and activities are supported in order to stimulate interest in mathematics among children and youth.

At the Heidelberg Laureate Forum in Germany young mathematicians get the opportunity to meet winners of the Abel Prize.

Call for nominations 2020

The Norwegian Academy of Science and Letters hereby calls for nominations for the Abel Prize 2020, and invites you (or your society or institution) to nominate candidate(s). Nominations are confidential and a nomination should not be made known to the nominee.

Deadline for nominations for the Abel Prize 2020 is September 15, 2019.

Please consult www.abelprize.no for more information.

Biographical Info

From a press release, Institute for Advanced Study, https://www.ias.edu/news/press-releases/2019/abel

The Norwegian Academy of Science and Letters has awarded the 2019 Abel Prize to Karen Keskulla Uhlenbeck whose affiliation with the Institute for Advanced Study spans four decades, as a current Visitor in the School of Mathematics and a former Member and Visiting Professor in the School. Professor Emerita of Mathematics and Sid W. Richardson Regents Chair at the University of Texas at Austin, Uhlenbeck was cited by the Abel Committee "for her pioneering achievements in geometric partial differential equations, gauge theory and integrable systems, and for the fundamental impact of her work on analysis, geometry and mathematical physics."

"The Institute is thrilled that Karen Uhlenbeck has been recognized with the 2019 Abel Prize, for her transformative work across various mathematical disciplines, from minimal surfaces to gauge theory, and for her foundational contributions to the field of geometric analysis," said Robbert Dijkgraaf, IAS Director and Leon Levy Professor. "A leading mathematician of our time and a member of the IAS community since 1979, Karen has played a leading role

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in advancing mathematics research, championing diversity, and inspiring the next generation of women to become leaders in the field."

"Quite frankly: it is about time. Karen has had a tremendous impact on the development of modern geometric analysis, particularly the calculus of variations. Her contributions to minimal surface theory and Yang-Mills theory have changed the subjects and started some of the most exciting developments in mathematics," said Helmut Hofer, IAS Professor in the School of Mathematics. "Karen has had a long affiliation with IAS, and we are very happy that after retiring from the University of Texas at Austin she continues to contribute to the vibrancy of IAS as a Visitor. Besides her scientific impact, Karen has been an extraordinarily good citizen, making numerous contributions to the mathematical profession at large. She is a role model for all of us." …

Uhlenbeck, the first woman to receive the Abel Prize, initially came to the Institute as a Member in the School of Mathematics in 1979. She returned as a Member in 1995, served as a Visiting Professor in 1997–98 and 2012, and has been a Visitor since 2014. She is a founder of the Institute's Park City Mathematics Institute (PCMI), a summer program that brings together mathematicians and math teachers to study and exchange ideas, providing immersive educational and professional development opportunities. Uhlenbeck also cofounded the IAS Women and Mathematics program (WAM) with fellow IAS Member Chuu-Lian Terng in 1993 as part of PCMI, and then established the program on the Institute's campus in 1994.[1] The purpose of WAM is to address gender imbalance and success rates among women in the mathematics field. Both Uhlenbeck and Terng have mentored hundreds of young women mathematicians through the program they founded, resulting in a powerful network of nearly 1500 participants to date.

Uhlenbeck was born in Cleveland, Ohio, in 1942. Her father, Arnold Keskulla, was an engineer, and her mother, Carolyn Windeler Keskulla, an artist and school teacher. Having a curious mind, she developed a lifelong love of the outdoors, read incessantly, and dreamed of becoming a research scientist. Planning to major in physics, she enrolled at the University of Michigan, where she discovered the intellectual challenge of pure mathematics, guiding her future academic path. Graduating in 1964, she went on to study at Brandeis University, earning her Master's degree in 1966 and PhD in 1968.

In 1990, in Kyoto, Japan, Uhlenbeck became the second woman to give a Plenary Lecture at the International Congress of Mathematicians, the largest and most important gathering of mathematicians in the world. The first woman to deliver the lecture was Emmy Noether in 1932; the following year, Noether joined the Institute's School of Mathematics as a Visitor from 1933 to 1935. In 2016, a series of lectures at the Institute celebrated the life and work of Noether, during which Uhlenbeck explored Noether's fundamental insight into the conservation law in modern theoretical physics.

Uhlenbeck has held academic positions at the University of Texas at Austin; Institut des Hautes Études Scientifiques; the University of Chicago; Max-Planck-Institut für Mathematik; Harvard University; University of California, Berkeley; University of Illinois at Chicago; University of Illinois at Urbana-Champaign; and the Massachusetts Institute of Technology.

Uhlenbeck is a Fellow of the American Mathematical Society and a Member of the National Academy of Sciences, the American Academy of Arts and Sciences, the American Philosophical Society, the Mathematical Association of America, the National Association of Mathematicians, and the Association for Women in Mathematics. Her honors include the Steele Prize from the American Mathematical Society (2007), the National Medal of Science (2001), the Noether Lecture award from the Association for Women in Mathematics (1988), and a MacArthur Prize Fellowship (1983–88).

From a press release, University of Texas at Austin, https://news.utexas.edu/2019/03/19/mathematics-highest-prize-awarded-to-ut-austins-karen-uhlenbeck/

… "For more than three decades at The University of Texas, Karen Uhlenbeck conducted research that revolutionized geometric analysis and mathematics as a whole" said President Gregory L. Fenves. "She was an inspiring teacher and dedicated mentor to thousands of UT students, motivating them to reach great heights in their academic and professional lives. The Abel Prize is the highest honor in mathematics, and it is one that Professor Uhlenbeck richly deserves." …

[1] See the July–August 2018 issue of this newsletter, "WAM Turns 25!" by Kristin Lauter, pp. 20–22, https://drive.google.com/file/d/1oVk94BCbEXB4Kur8dwNuGcKP7Q8sVYzG/view. The article includes Uhlenbeck's banquet talk at the celebration.

"Uhlenbeck's research has led to revolutionary advances at the intersection of mathematics and physics," said Paul Goldbart, dean of the College of Natural Sciences and a professor of physics. "Her pioneering insights have applications across a range of fascinating subjects, from string theory, which may help explain the nature of reality, to the geometry of space-time." …

"She transformed the fabric of the department with her broad view of mathematics and beyond," said Thomas Chen, chair of the Department of Mathematics at UT Austin. "Her insatiable curiosity fuels both her deep vision in mathematics and wisdom in the human sphere, which is evident in her legendary generosity and attention to mentoring young mathematicians."

Outreach and mentoring have also been passions for Uhlenbeck, who says, "Seeing the success of students is its own reward." She co-founded programs at both Princeton University and UT Austin, including the Saturday Morning Math Group, the Distinguished Women in Mathematics Lecture Series, the Park City Mathematics Institute, and the Women and Mathematics program at the Institute for Advanced Study, designed to inspire and support young people in mathematics.

Further reading

www.genealogy.ams.org; search on Uhlenbeck to access a list of her 19 PhD students and their 26 doctoral descendants

https://web.ma.utexas.edu/users/uhlen/vita/bio.html

https://www.nytimes.com/2019/03/19/science/karen-uhlenbeck-abel-prize.html

https://www.princeton.edu/news/2019/03/19/uhlenbeck-receives-abel-prize-geometric-analysis

"Karen Uhlenbeck and the Calculus of Variations" by Simon Donaldson, Notices of the AMS, March 2019; https://www.ams.org/journals/notices/201903/rnoti-p303.pdf

"Lawrence H. Summers: One Year Later," an AWM panel; Uhlenbeck's remarks appear on pp. 20–21 of the May–June 2006 issue of this newsletter; https://www.drivehq.com/folder/p8755087/1751134459.aspx

https://awm-math.org/awards/noether-lectures/noether-lectures-1988/

CALL FOR NOMINATIONS

The 2019 Etta Zuber Falconer Lecture

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

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

The letter of nomination should include an outline of the nominee's distinguished contributions to the mathematical sciences or mathematics education and address the nominee's capability of delivering an expository lecture. Nominations are to be submitted as ONE PDF file via MathPrograms.Org. The submission link will be available 45 days prior to the deadline. Nominations must be submitted by **September 1, 2019** and will be held active for two years. If you have questions, phone 401-455-4042 or email awm@awm-math.org or visit https://awm-math.org/awards/falconer-lectures/ to learn more.

Anna Skripka Wins Ruth I. Michler Memorial Prize

The Association for Women in Mathematics (AWM) and Cornell University are pleased to announce that **Anna Skripka**, University of New Mexico, will receive the 2019–2021 Ruth I. Michler Memorial Prize.

The Michler Prize grants a mid-career woman in academia a residential fellowship in the Cornell University mathematics department without teaching obligations. This pioneering venture was established through a very generous donation from the Michler family and the efforts of many people at AWM and Cornell.

Anna Skripka was selected to receive the Michler Prize to pursue her proposed project to connect some of her recent work in noncommutative analysis with the research of Cornell faculty member Michael Nussbaum on statistical problems of estimation, regression, and asymptotic analysis.

Skripka earned her BS degrees from Kharkiv National University, Ukraine (2001) and her PhD (2007) from the University of Missouri under the direction of Konstantin A. Makarov. She has been at the University of New Mexico since 2012, where she is currently an Associate Professor in the Department of Mathematics. Prior to that, Skripka was an Assistant Professor at the University of Central Florida and a Visiting Assistant Professor at Texas A&M. She held invited positions at the University of California, Berkeley; Université de Franche-Comté, Besançon; and the University of New South Wales. She has been awarded four single-investigator NSF awards, including a CAREER award.

Skripka has been working primarily in the areas of noncommutative analysis and operator theory on problems that emerged from quantum theory. Her proposed research will expand to noncommutative aspects of probability and statistics and combine function analytic and probabilistic methods.

About her upcoming semester at Cornell, Skripka says:

> I look forward to this unique opportunity for participating in the dynamic research life at Cornell's mathematics department and interacting with Cornell experts in probability and analysis. I plan to collaborate with Michael Nussbaum on problems of quantum statistics and asymptotically efficient estimation.
>
> The existing partial results suggest that these problems should be approached by both analytic and statistical methods in their subtle combination, which we hope to find by joining our expertise. I also hope to advance on noncommutative approximation theory with help of consultations on combinatorial and multilinear harmonic analysis methods. I am eager to explore new techniques and directions in probability and analysis at the departmental seminars.

Anna Skripka

Ruth Michler's parents Gerhard and Waltraud Michler of Essen, Germany established the memorial prize with the Association for Women in Mathematics because Ruth was deeply committed to its mission of supporting women mathematicians. Cornell University was chosen as the host institution because of its distinctive research atmosphere and because Ithaca was Ruth's birthplace. At the time of her death, Ruth was in Boston as an NSF visiting scholar at Northeastern University. A recently promoted associate professor of mathematics at the University of North Texas, she was killed on November 1, 2000 at the age of 33 in a tragic accident, cutting short the career of an excellent mathematician.

Catherine Sulem Named Kovalevsky Lecturer

The Association for Women in Mathematics (AWM) and the Society for Industrial and Applied Mathematics (SIAM) have selected **Catherine Sulem** to deliver the Sonia Kovalevsky Lecture at the 2019 ICIAM Meeting in Valencia, Spain.

Sulem is a Professor of Mathematics at the University of Toronto. She obtained her PhD from l'Université Paris–Nord under the supervision of Claude Bardos and afterwards held positions with the CNRS, Ben Gurion University and the University of Toronto, where she is now a full professor.

Sulem is a world leader in the theory of nonlinear waves, which addresses propagation and collapse phenomena arising in nonlinear optics and plasmas physics, as well as in the analysis of ocean wave dynamics. She is well-known for her pioneering work on the nonlinear Schrödinger equation as well as for her influential contributions to the theory and modeling of nonlinear free surface water waves. She has an impressive body of work that includes a research monograph and more than 80 papers. Sulem's work with George Papanicolaou and Pierre-Louis Sulem on formation of singularities—how to predict their occurrence, their form, and hence the potential instability and collapse of a plasma state—is considered to be a major breakthrough in our understanding of the nonlinear Schrödinger equation. Her theoretical work on solitary wave interactions and the surface signature of internal waves in a stratified ocean, as well as her contributions to the numerical simulation of nonlinear water waves, with Walter Craig and Philippe Guyenne, are landmarks in a field of research that is important for physicists, engineers and mathematicians.

Catherine Sulem

The quality and impact of Sulem's research contributions have already been recognized through a number of prestigious awards, including the Krieger-Nelson Prize of the Canadian Mathematical Society, her election as a member of the inaugural class of Fellows of the American Mathematical Society, the Simons Fellowship in Mathematics and more recently her election as a Fellow of the Royal Society of Canada.

In addition to her scientific research, Sulem has made valuable contributions to mathematics in Canada through her mentorship of young mathematicians, her membership on the scientific advisory boards of the national mathematics institutes, and her organization of highly successful programs at the institutes. The quality and fairness of her scientific judgment and the high standards she exercises in her activities have made her one of the most respected members of the Canadian mathematical community.

The lecture takes places at the ICIAM conference in Valencia (Spain), July 15–19, 2019. The Kovalevsky Lecture honors Sonia Kovalevsky (1850–1891), the most widely known Russian mathematician of the late 19th century. In 1874, Kovalevsky received her Doctor of Philosophy degree from the University of Göttingen and was appointed lecturer at the University of Stockholm in 1883. She did her most important work in the theory of differential equations. Past Kovalevsky lecturers are Éva Tardos, Liliana Borcea, Lisa J. Fauci, Linda J.S. Allen, Irene M. Gamba, Margaret Cheney, Barbara Keyfitz, Susanne C. Brenner, Suzanne Lenhart, Andrea Bertozzi, Dianne P. O'Leary, Lai-Sang Young, Irene Fonseca, Ingrid Daubechies, Joyce R. McLaughlin, and Linda R. Petzold.

AWM Essay Contest

Congratulations to all the winners of the 2019 AWM Essay Contest: Biographies of Contemporary Women in Mathematics! Many thanks to Johanna Franklin, Hofstra University, contest organizer, and to the other members of the committee, along with the many volunteer judges. We are also grateful to Math for America for their sponsorship of this contest. The essay contest is intended to increase awareness of women's ongoing contributions to the mathematical sciences by inviting students from sixth-graders through college seniors to write biographies of contemporary women mathematicians and statisticians in academic, industrial, and government careers.

The 2019 Grand Prize essay appears after the list of this year's winners. To see the other prize-winning essays, visit https://awm-math.org/awards/student-essay-contest/2019-student-essay-contest-results/.

GRAND PRIZE WINNER

"How Bees Sting"
Dominique Alexander, Douglas High School, Minden, NV
(The essay is about Christine Ensign of Douglas High School.)

Undergraduate Winner

"Nothing Ventured, Nothing Gained"
Liyaan Maskati, Brown University, Providence, RI
(The essay is about Ellie Pavlick of Brown University.)

Undergraduate Honorable Mentions

"Dr. Hubbard's Impact Is Continuous"
Ankita Mohapatra, University of Michigan, Ann Arbor, MI
(The essay is about Diana Hubbard of Brooklyn College (CUNY), Brooklyn, NY.)

"Defying Standards and Stereotypes"
Mominah Subhan, UCLA, Los Angeles, CA
(The essay is about Sharmila Venugopal of UCLA.)

Grades 9–12 Winner

Same as Grand Prize Winner.

Grades 9–12 Honorable Mentions

"Related Rate"
Savannah Shoffner, Cienega High School, Vail, AZ
(The essay is about Gretchen Stickney, Cienega High School.)

"Grace in Mathematics"
Lara Zeng, Belmont High School, Belmont, MA
(The essay is about Grace Cook of Bloomfield College, Bloomfield, NJ.)

Grades 6–8 Winner

"My Teacher Makes the Irrational Perfectly Rational"
Farren Stainton, The Sharon Academy, Sharon, VT
(The essay is about Sandy Thorne of The Sharon Academy.)

Grades 6–8 Honorable Mention

"Inspired by a Problem: Mapping the Butterfly Effect"
Roxane Park, Crossroads Academy, Lyme, NH
(The essay is about Sarah Sellke of Purdue University.)

How Bees Sting

Dominique Alexander, Douglas High School, Minden, NV

A little girl and her father sit side by side on the beach, enjoying the breezy summer day after a sailing lesson when they hear a faint buzz. The source of this buzz becomes apparent when the father looks down at his wrist to find a bee perched there, about to sting him. The little girl notices this too. "Dad, swat it away! Get it off!" the girl pleads, panicked. But the father continues to observe the bee with calm, cool eyes. "Do you know how bees sting?" he asks his daughter. She shakes her head, still eyeing the bee apprehensively. "Okay, watch what it does. See how its stinger goes under my skin? The bee is injecting me with venom. And see how when it flies away, the stinger is left in my skin there?" The girl is listening intently now, her apprehension faded, her mind absorbing this information. After the bee leaves she asks her father, "Didn't that hurt you?" Her father responds with a small smile. "Only a little."

40 years later, Christine Ensign's eyes still light up while she reminisces on this memory about her father. Now working as a full-time AP Statistics teacher at Douglas High School in Minden, Nevada, and a part-time consulting statistician, Mrs. Ensign credits much of her love of

mathematical reasoning to her family. Her father's Spock-like supreme logic ensured that she was always thinking deeply, and her mother's propensity for numbers and her constant encouragement inspired Ensign to excel academically. However, Ensign's most influential role model in her childhood was her older brother.

"I idolized my brother," Ensign professes. "He was very good at math and a hurdler in track, and I became both of those things. I really looked up to him, and I think we naturally had similar interests."

Ensign, along with her family, grew up in the small town of East Canton, Ohio. This two-stoplight town inhabited primarily by cows and cornfields and lacking a single fast-food restaurant instilled a set life path for most of its citizens: Work in the factory and raise a family. Neither of Ensign's parents attended college and they both worked in factories their whole lives because it was the "responsible thing to do," but Ensign never felt constrained to this destiny.

"My mom told us from day one that we were very smart and very capable and expected us to do well in school. There was this expectation that we should think and learn things, and be successful in our learning. I never thought I wouldn't go to college, even if my parents didn't."

Ensign went on as a first-generation college student to earn a bachelor's degree at the University of Nevada, Las Vegas and worked on her master's degree at the University of Nevada, Reno, where she fell in love with the Sierra Nevada Mountains and never looked back. While studying at UNR, she also taught freshman-level mathematics courses, which began her 18-year teaching career. Despite her love affair with mathematics, her goals while teaching her students extend far beyond number-crunching.

"My goals have nothing to do with actual content. My overall goal is to help students think well and to think deeply, to foster a love for learning, to appreciate the power and beauty of mathematics, and to uncover and explain the underlying nature of things. I really hope to ignite curiosity, and I hope that my students leave my class with a really good foundation in mathematics because it contributes to

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CALL FOR NOMINATIONS

2020 Class of AWM Fellows

The Association of Women in Mathematics Fellows Program recognizes members who have demonstrated a sustained commitment to the support and advancement of women in the mathematical sciences, consistent with the AWM mission: "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."

The following criteria are required for nominees to be considered for Fellowship.

- Nominees must have demonstrated an outstanding, sustained commitment to the support and advancement of girls and women in the mathematical sciences.
- Nominees should be a member of AWM in 2019.

In the majority of cases a nominee should be at least fifteen years into her/his career; graduate study counts as part of the career. Nominations will close **May 15, 2019**, so please participate in this year's selection process by nominating someone who you think deserves this recognition. The primary nominator need not be a current member of AWM but he/she should have been one at some point in the past. Nomination packages consist of:

- a nomination letter from the primary nominator of at most two pages
- two supporting letters of at most two pages each, of which at least one is from another AWM member
- a CV of 3 pages or less
- a suggested citation (for use when the award is announced) of 50 words or less.

Further information will be posted at the AWM Fellows page, where a link to submit nominations will be open April 1. Questions? Phone 401-455-4042, email awm@awm-math.org or visit awm-math.org/awards/awm-fellows/.

skills that will help them learn any other concepts."

This philosophy is evident in her teaching style, which resembles a conversation more than it does a lecture. Her enthusiasm oozes, and she encourages her students to engage with the problems they work on. She emphasizes practical application, urges us to consider what question we are really trying to answer beyond the confines of the problem, whether the answer we reach is reasonable, and why the answer is meaningful. But most of all, she is authentic. She doesn't aim to be perfectly put-together at all times, and she has the courage to be vulnerable and open-minded in both her teaching and personal life.

The main component of Ensign's authentic and humble nature is her eagerness to learn new things, even regarding topics she is considered to be an expert in. Some of her favorite things to investigate in her free time are number theory, modular arithmetic, cryptography, and statistics in different lights. Jordan Ellenberg's "How Not to Be Wrong" and Hans Rosling's "Factfulness" are among her favorite reads, and every year she uncovers a new connection within the content that she teaches that she had never considered before.

"One of the powerful things that I hope students get that I also notice for myself is that you can learn so much from looking at simple things deeply. I also encourage students to read what other intelligent people have had to say and expand their horizons."

Learning simple things deeply is as valuable, if not more valuable, than learning complicated things shallowly. Ensign proves that students don't need to jump into quantum mechanics or differential calculus to expand their horizons; sometimes, it all starts with a bee sting.

CALL FOR NOMINATIONS

The 2021 Noether Lecture

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

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

The letter of nomination should include a one-page outline of the nominee's contribution to mathematics, giving four of her most important papers and other relevant information. Nominations are to be submitted as ONE PDF file via MathPrograms.Org. The submission link will be available 45 days prior to the deadline. Nominations must be submitted by **October 15, 2019** and will be held active for three years. If you have questions, phone 401-455-4042 or email awm@awm-math.org.

AWM Workshop at the 2020 SIAM Annual Meeting

Application deadline for graduate students: **November 1, 2019**

For many years, the Association for Women in Mathematics has held a series of workshops for women graduate students and recent PhDs in conjunction with major mathematics meetings. Since 2016, these workshop talks are supported by the AWM ADVANCE grant. The AWM Workshops serve as follow-up workshops to Research Collaboration Conferences for Women, featuring both junior and senior women speakers from one of the Research Networks supported by the ADVANCE grant. An AWM Workshop is scheduled to be held in conjunction with the 2020 SIAM Annual Meeting in Toronto, Ontario, Canada, July 6–10, 2020.

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

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

MENTORS: We also seek volunteers to act as mentors for workshop participants, in particular the graduate students. If you are interested in volunteering, please contact the AWM office at awm@awm-math.org by **February 1, 2020**.

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

All applications should include:

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

Applications must be completed electronically by **November 1, 2019**. See https://awm-math.org/workshops.html.

BOOK REVIEW

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

Reading About Ada: Adult Edition

Gizem Karaali, Pomona College

Augusta Ada Byron King Lovelace was born as Augusta Ada on December 10, 1815, in England. Her father was Lord Byron, one of the most famous poets of his time. Today Ada also happens to be the person celebrated as the first computer programmer in history.

Partly because of her lineage, and partly because of her contributions to computer science, Ada's life has captivated many people's interest and imagination. I am no exception. I have been reading obsessively on Ada and her various adventures for over a year now. My original motivation was to get to know this woman a bit once I saw how her simplified story impressed my young daughter. Therefore I have read as many children's books on Ada as I have read about all other mathematicians combined. I shared my thoughts on some of these in "Reading About Ada: Children's Edition," published in the Volume 41, Number 1 (January–February 2019) issue of this newsletter (pages 9–13). In that review I also offered a brief account of Ada's life story and some extremely brief sketches of some of the dramatis personae involved: I refer the reader there for the necessary introductions.

Even though I started with children's books, I did eventually graduate to books about Ada written for more mature audiences. In this review I share my thoughts on some recent books on Ada that fit into this description.

Ada's life is complex. Though she lived a bit less than thirty-seven years, she was able to fit in enough excitement to keep many authors in pursuit of her tale. And these authors all manage to tell exciting stories. Some of the excitement turned out to be a bit more adult-flavored than I had expected.

The first book for grownups I tried to read together with my then-nine-year-old was Sydney Padua's *The Thrilling Adventures of Lovelace and Babbage: The (Mostly) True Story of the First Computer* (Pantheon Books, 2015). This is a cartoon alternate history in which Charles[1] and Ada succeed in building the analytic engine. It is an extremely creative work and fun to read, but it was not as conducive to reading together. I kept getting distracted by the juicy notes at the ends of chapters; my daughter was visibly bored as I hungrily dug into them. So a great book for the adult, although not as exciting for the curious child in paired reading—she did enjoy it herself when she was given the book to read on her own. (A detailed review of this book by past AWM president Judith Roitman was published in the *Notices of the American Mathematical Society* (Volume 64 Number 5; see https://www.ams.org/publications/journals/notices/201705/rnoti-p504.pdf).

Then my daughter and I tried reading James Essinger's *Ada's Algorithm: How Lord Byron's Daughter Ada Lovelace Launched the Digital Age* (Melville House, 2014). Essinger is an experienced author, and he seems to know how to tell a captivating story. The setting, the personalities, the events are all introduced carefully and come to life with the many anecdotes he sprinkles in. The author even attempts a brief introduction to the algorithm that Ada wrote in her Note G (whose context and import were described in detail in my earlier review). Though I felt that he does a good job with some of the nuances here, I also felt that maybe there was a bit more of the author in this part of the book than elsewhere. This was not totally undesirable but felt a bit different in tone than the rest of the book.

In any case I enjoyed reading Essinger's book, but only after I decided to stop reading it with my daughter. You see, this was the book I referred to obliquely in my earlier review when I wrote "you just might find yourself, like I did, in some very awkward territory, where you need to either explain, or explain away, or simply skip through large portions of exposition, which go beyond PG-13. Yes, Ada's life is inspiring to children, but it also contains a lot of messy bits for the adults." And Essinger tells these messy bits with no hesitation (and with no warning!).

But there is more to Ada's story than even that.

As Ada's life was stormy and eventful, so, too, her afterlife has been. The first biography about Ada, *Ada, Countess of Lovelace: Byron's Legitimate Daughter* (Harper and Row, 1977) was written by Doris Langley Moore. She was not a mathematician, and she did not quite understand Ada's scientific inclinations. In any case it seems that her main contention was to prove that Ada's father was terribly misrepresented by his ex-wife, and all through the book, we more or less learn only that she, that is Ada's mother, was a terrible human being. But at least Langley Moore did not belittle Ada's scientific achievements. For that we needed the second biography!

This second biography about Ada Lovelace was written

[1] Charles here is Charles Babbage, the inventor of the analytical machine; I say more about him in the first review. In what follows, I use first names for all historical figures, just as I did in the first review. Everyone calls Ada by her first name, so it seems only fair.

by Dorothy Stein and published in 1985: *Ada: A Life and a Legacy* (MIT Press, 1985). It is pretty hard to read Stein's book. I have never read another author who disliked their central character this much. All through the book we are lectured on all the ills and vices of Ada, and apparently there are quite a few. Besides her terrible character, we also learn about Ada's mathematical skill level, which, according to Stein, is not much to look at. You will of course wonder how she makes this judgment. The answer, Stein tells us, is hidden in Ada's letters to Augustus De Morgan. Ada apparently asks rather silly questions in these letters, and makes quite stupid mistakes, and so it seems beyond doubt that "Ada's mathematical genius" just is not there.

Hold on a minute! Where did Augustus De Morgan come into this story? Let us explore this a bit now.

Augustus was already a well-established mathematician when Ada was a young girl. Today we know him best for his De Morgan's Laws in logic or equivalently in set theory, but at the time, he was a most respected and influential mathematician. Due to religious discrimination he could not get a post in either Oxford or Cambridge, so instead he ended up obtaining a mathematics chair at London University (now University College London). Augustus was a creative, energetic, and thoughtful scientist. But his role in our story is somewhat different.

Now to get the whole story, we need to go back to when Ada was twenty-seven and, having birthed three children, was itching to get back into mathematics. Ada's mother used her connections to convince Augustus to tutor Ada. These private lessons went on for about eighteen months via regular correspondence. And Stein looked at some of the simple questions Ada posed in these letters and decided: Ada is not at all brilliant; she is perhaps even a bit slow and stupid. She thinks very highly of herself but her head certainly does not work well for math!

Well, you might say, looking at her own writing, her own letters, her own stupid questions is a perfectly valid way to determine someone's mathematical strengths and weaknesses. Right? Right! And thus Stein's book has impressed upon the historians of mathematics and computation that perspective; over the next thirty years or so, no self-respecting historian of mathematics or computation would spare time for Ada. While those who want to introduce computers to children or to encourage young girls and women in the field continued to sing songs of glory about Ada, the topic remained a mildly embarrassing one for historians of science. If only she were really smart and creative, if only she were a visionary and a genius like the populists claim she is, we also would sure toot her horn. But unfortunately that is not the case! It is just impossible to claim that someone who lacked mathematical maturity to that extent could be the world's first computer programmer! It would be scientific malpractice!

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CALL FOR NOMINATIONS

The Association for Women in Mathematics Dissertation Prize

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

To be eligible for the award a graduate student must have defended her dissertation within the last two years (October 1, 2017 to September 30, 2019). She must either be a US citizen or have a school address in the US. The Prizes will be presented at the AWM Reception and Awards Presentation at the Joint Mathematics Meetings in Baltimore, MD, January 2020.

The nomination should include: 1) a one to three page letter of nomination highlighting the exceptional mathematical research presented in the dissertation, 2) a curriculum vitae of the candidate not to exceed three pages, 3) a copy of the dissertation and 4) two letters supporting the nomination. Nomination materials should be submitted online at MathPrograms.org. The submission link will be available 45 days prior to the nomination deadline. Nominations must be received by **October 1, 2019**. If you have questions, phone 401-455-4042, email awm@awm-math.org, or visit awm-math.org/awards/awm-dissertation-prize/ for more information.

Thankfully this is not where Ada's story ends.

There have been a few new developments in the last few years. Approximately five years ago, three English historians of mathematics, Christopher Hollings, Ursula Martin, and Adrian Rice, decided to dig deeper into the Ada-Augustus correspondence.[2] Through a thorough investigation, they put the sixty-three letters we still have from the pair into their rightful time order. Then they reexamined Ada's mathematical development and sophistication in its historical context. What do you imagine they concluded?

It turns out that the questions Ada posed in some of her earlier letters are really somewhat easy for a good high school student today. Indeed that was Stein's argument: Ada asks about simple things that all high school kids today know. How could she ever have contributed to mathematics if this is the case? Now of course we know today that Stein's reading of the letters was not in their correct time order, and this probably hindered her appreciation of Ada's evolving mathematical sophistication.

[2] The whole corpus of extant letters from this correspondence is available online; see http://www.claymath.org/publications/ada-lovelaces-mathematical-papers

But the real problem is that Stein was not a historian, and definitely not a historian of mathematics. Therefore she had no real understanding of the mathematical background Ada brought to the table at the beginning of her tutoring relationship with Augustus. While Ada was a young girl, she did learn all the math her peers were learning and she excelled at it. For instance she did have a good grasp of Euclidean geometry. However curves and functions were new concepts for her, as these were not typically a part of the mathematics curriculum for English aristocrats at the time. Their influence in English mathematics was expanding but had not yet managed to change what was still a pretty restricted regimen of study. Thus Ada did not know basic algebra or trigonometry, and she was just learning about all these through reading Augustus' own texts. And that was why she asked what to us might seem straightforward questions, on the meaning of a function, intersections of curves, and so on. But these are natural questions for the beginning student, and they pepper the earlier letters only. As Ada learns more and more, she displays her independence and versatility as a mathematician in her more sophisticated questions. In fact we can even see in some cases how she frustrates Augustus by some difficult questions challenging his own expertise.

In short Ada was a good student, a promising mathematician according to Augustus, who wrote at the

CALL FOR NOMINATIONS

Alice T. Schafer Mathematics Prize

The Executive Committee of the Association for Women in Mathematics calls for nominations for the Alice T. Schafer Mathematics Prize to be awarded to an undergraduate woman for excellence in mathematics. All members of the mathematical community are invited to submit nominations for the Prize. The nominee may be at any level in her undergraduate career, but must be an undergraduate as of October 1, 2019. She must either be a US citizen or have a school address in the US. The Prize will be awarded at the AWM Reception and Awards Presentation at the January 2020 Joint Mathematics Meetings in Denver, CO.

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

With the letter of nomination, please include a copy of transcripts and indicate undergraduate level. Any additional supporting materials (e.g., reports from summer work using math, copies of talks, recommendation letters from professors, colleagues, etc.) should be enclosed with the nomination. All nomination material is to be submitted as ONE PDF file via MathPrograms.Org with a copy of transcripts included at the end of the file. The submission link will be available 45 days prior to the deadline. Nominations must be received by **October 1, 2019**. If you have questions, phone 401-455-4042, email awm@awm-math.org, or visit awm-math.org.

time that Ada's mathematical skill could lead her to become "an original mathematical investigator, perhaps of first-rate eminence." Unfortunately shortly after this the lessons ended, and soon after Ada died of cancer. We will never know for sure if Ada had it in her to become the first-rate mathematician that Augustus assumed she could be.

Still we can imagine. And now we can actually equip ourselves with the more nuanced scholarship of Hollings, Martin, and Rice, who ended up writing a book to tell their version of Ada's story. In their *Ada Lovelace: The Making of a Computer Scientist* (Bodleian Library, 2018), there is nothing beyond PG-13, and if one is willing to dig in, there is much more excitement, of a mathematical flavor. I think this book would make a great follow-up read for any young person who finished all the children's books about Ada and wants to learn more. *Ada Lovelace: The Making of a Computer Scientist* has many illustrations and images in color, very few figure-less pages are followed by figure-less pages, and besides the usual portraits of the people involved, we are invited to peruse the handwritten letters of Ada, scribbles from Ada and Charles together, notes from Ada's mother, and other neat treats. And especially through her correspondence with Augustus, we witness Ada growing in front of our eyes from an impatient math enthusiast to a patient student of mathematics who knows that sometimes things take time, that speed is not everything. This might be inspiring for young people in particular but is always a good reminder, for anyone at any age.

I would like to mention two other books in this review. The first is *Lady Byron and Her Daughters* by Julia Markus (Norton, 2015). Reading Markus's book after anything else you might have read about Ada is, in the very least, unsettling. In most stories of Ada's life, except possibly in Stein's, the reader is led to sympathize with Ada in most situations, and in several of these her mother is not presented in the most complimentary light. Through my readings I have come to see Annabella Milbanke Byron as a selfish hypochondriac who did not really appreciate or support her daughter in anything but the latter's intellectual development. Of course I'd begrudgingly agree that at least that was to be commended, but overall, my impression of Annabella was quite negative.

Markus seems to have written her book to shake such convictions up. Through Markus's eyes, Annabella gets a second look. She is, as it turns out, herself an interesting character, intellectually sophisticated, compassionate and charity-oriented, even a revolutionary in terms of the schools she founded and political causes she supported. Reading her story, and her relationship with her friends and her grandchildren, we get a more complicated portrait of a woman, or as Markus puts it, "a celebration of a worthy but complex woman who led a big life that is still unsung."

Markus tells Annabella's story so convincingly that you might get confused. How can we ever know a person? This is a complicated question for anyone in our lives, but when it comes to people who have lived and died more than a century ago, in circumstances far different from what we might be able to conceive of today, its complexity seems to grow exponentially. I'm not sure if I like Annabella now, after having read Markus's book, but I sure am more confused about her. Not in a bad way, let me assure you. More in the sense of a "life is complicated" or a "people are hard to figure out" kind of way.

Finally let me say a few words about *Ada's Legacy: Cultures of Computing from the Victorian to the Digital Age* edited by Robin Hammerman and Andrew L. Russell (ACM, 2016). This is a collection of eleven eclectic essays on Ada and her legacy that were written to celebrate the centennial celebrations of Ada's birthday in 2015. The book contains essays on steampunk inspired by Ada's story, the Ada programming language, Charles and his analytical engine, Ada's own poetry and dreams of a "poetical science"; each is a gem in its own way. I have very much savored reading most of the essays, but I must admit my favorite was the final one written by Valerie Aurora: "Rebooting the Ada Lovelace Mythos."[3] Aurora in her essay (and in detail in her presentation linked to in the footnote below) categorizes the stories we tell about Ada into four groups:

1. First computer programmer
2. Icon for women in STEM
3. Delusional, arrogant, but had some insight
4. Mentally ill, morally repugnant, and ignorant too.

She then goes through these groupings one by one and shows how they are limited and limiting. She adds:

> Look at how limiting even the positive stories we tell are, and how they limit women in science and our society in general. I didn't even get into the part where, because Ada Lovelace was so multi-

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[3] Some notes and a video of Aurora's presentation with the same title may be accessed here: https://adainitiative.org/2013/11/26/rebooting-the-ada-lovelace-mythos-video-transcript-slides-and-summary-now-available/ and is worth watching unless you can read the article itself.

> dimensional and complex, it is likely that computing as founded by her would have been immediately connected with the arts and humanities in a way modern computing (which grew out of World War II) was not. Computing founded by Ada Lovelace would have been so much more interesting, and that's part of what I want to tell with these stories.

I am convinced. I agree that Ada's complexity should be celebrated. I will leave you with Aurora's final thoughts. Replace "computing" with "math" and "scientist" with "mathematician" if you will:

> Computing can be so much more and so much better connected with our society and ourselves. And, as a woman you can be a whole person and a scientist. You can have a family, you can sleep around, you can do drugs, and you can still do fantastic, amazing work. Men have been able to do this for a long, long time, it would be great if women could, too.

EDUCATION COLUMN

The Importance of a Good Mathematics Story

Erica Walker, Professor of Mathematics Education, Teachers College Columbia, ewalker@tc.edu

For this issue, I'd like to follow up on some thoughts based on my previous AWM newsletter column, "Hidden in Plain Sight: Lessons for Mathematics Education Seen Through a Storytelling Lens."[1] In that column, I wrote that "the power of storytelling as an invitational space for mathematics teaching and learning, I believe, is under-explored in mathematics education circles, and more broadly, storytelling could be a compelling means to improve the general public's understanding, interest and engagement in mathematics."[2] Further, I pointed out that "too many of our stories about mathematical excellence are not necessarily forgotten, or even unknown, but hidden from too many people."[3]

I'll begin by sharing some examples of how I use storytelling in my research and practice as a mathematics education professor, some findings from a few of these projects, and some implications of storytelling for mathematical practice in a variety of informal and formal settings.

How did I first come to use storytelling in my work? I often found myself telling stories to "break the ice" with K–12 students, teachers in professional development workshops, and graduate students at Teachers College who thought they were not "mathematics people"—in particular, preservice elementary education students who were taking my course as a required course for their degrees. One story I used was based very much on the truth, reflecting a typical big sister-little sister dynamic: several years ago my sister told me one time that I could just try all the combinations of 3-6-1-8 to reach her at her work office, because she couldn't remember her exact extension. Students of all ages got a kick out of hearing how their professor (or professional development workshop leader) was being bossed around by her big sister. Moreover this problem gives a nice way to get students thinking about the mathematics of counting efficiently and elegantly. It can be used with very young students, can be augmented for more challenging scenarios for older students, and can be used as an illustration of how people solve problems in multiple ways and can provide insight to teachers about student thinking.

When I embarked on a research project exploring how peers influence people's interest and success in mathematics, I heard very rich stories from both high school students and mathematicians. When I would share versions of these stories with my nephews and niece, they found them very engaging and were interested in the people and ideas behind the stories—so much so, that I began to wonder how other young people might respond to hearing these stories.

I continued this line of thinking via a class project I undertook with my students based on mathematicians' narratives from my book on the formative, educational, and professional experiences of Black mathematicians,

[1] *AWM Newsletter*, Vol. 48, No. 3, May/June, 2018, pp. 12–15.
[2] Ibid, 12.
[3] Ibid, 13.

Beyond Banneker: Black Mathematicians and the Paths to Excellence.[4] I asked some participants in the *Beyond Banneker* project, whose narratives were audio-recorded, to work with me to craft video vignettes of some of their most engaging stories. Then, students in my Research, Policy, and Evaluation in Mathematics Education course (along with one of my then research assistants, Dr. Nicole Fletcher) conducted pilot studies with K–12 students and teachers using those short vignettes (the longest was about 3.5 minutes long). Students in the course showed participants these video vignettes and asked a short series of questions. I was interested in learning what teachers might draw from these vignettes for their practice, and what students might learn from them. I was very pleasantly surprised by the breadth of learning exhibited by some of the youngest participants, who were in middle school. For example, one video is of Dr. Duane Cooper, chairperson of the Department of Mathematics at Morehouse College, sharing a story about a learning experience with his grandfather:

> [When I was about 6 or 7] we were on the front porch ... and my grandfather] asked: if he walked halfway to the end of the porch, and then halfway again, and then halfway again, halfway, how many steps would it take him to reach the end of the porch? And so, I may have guessed five or something, I don't know. So then he actually proceeded to do it, you know, [walking] halfway, and then halfway, and halfway, but the idea was that he was converging. He didn't use the term convergence of course. And he never actually reached the end of the porch, but he got closer and closer and closer, and of course he didn't say within epsilon, but anyway, I have fun when I'm teaching about convergence to really tap into it at this early level. First, just because I have fun telling the story, but also to give [my students] an idea of the sorts of things they can do with students. Because some of them may go on to become teachers, or just with their grandchildren one day, whatever the case may be, these are the sorts of things that can really bring high level things in very early, and just challenge the mind and make you think. I remember just loving that one.

After watching the video, two middle school boys interviewed stated:

> Well, if my family member would have done that, then maybe it would have changed my feelings about math. Because maybe that family member is trying to teach me something that I didn't know. He's not putting it in hard words—like formal math is—so maybe I would like to do math. The way that the family member did it, so it wasn't hard and I would get it easily after a couple of tries.

and:

> I think he [Dr. Cooper] passed on the story because maybe he knows that math isn't the best subject to love learning. But if he told the story to another kid, then it would inspire them to start liking math and maybe they would start inspiring somebody else and it would go on and on. And then it would make math a more popular subject to like, and then it would be easier for kids to keep going on in the future.

These quotations from middle schoolers are very revealing. I would argue that from Cooper's video they are learning something new about what it means to do math, and further, they have an understanding of how we are *socialized* into becoming math doers.

After seeing videos like this, K–12 students wanted to know more. They wanted to ask questions about mathematics and wanted to meet the mathematicians. This suggests to me that sharing stories could be a powerful mechanism to attract students to mathematics, certainly, but also has the added benefit of helping students (and teachers) understand that mathematics is a varied discipline with all sorts of problems and experiences. We are continuing to develop this project, to see what kinds of understandings and in what modalities (content, pedagogy, socialization, etc.) young people and teachers report.

A more recent project I've undertaken with colleagues and students at Teachers College involves documenting the history of the National Association of Mathematics (NAM), an organization founded in 1969 by a group of mathematicians, most of whom were African American. NAM was founded, in part, because these mathematicians were either barred or discouraged from joining and participating actively in other national professional organizations for mathematicians. NAM's mission continues to be to "promote

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[4] Walker, E. (2014). *Beyond Banneker: Black Mathematicians and the Paths to Excellence.* Albany: SUNY.

excellence in the mathematical sciences and to promote the mathematical development of all underrepresented minorities." Because NAM is celebrating its 50th anniversary this year, we saw an opportunity to begin to collect short narratives from mathematicians involved with NAM to learn more about NAM and to highlight its contributions to the profession.

A group of six Teachers College students and researchers and I went to the Joint Mathematics Meetings in Baltimore this past January to conduct short "(wo)man on the street" interviews about NAM and its impact. Each participant was invited to respond to one or more of three prompts: *Please share a favorite mathematical memory; Tell us about your work in mathematics and why it's important to you; Please share a story about NAM and its impact on mathematics and mathematicians.* We were able to conduct 31 interviews and expect this work to continue into the spring. The goal of this project is to eventually share a summary of the interviews via a podcast about NAM, and also to link these mathematicians' short stories to their profiles on existing websites. (You can read a brief summary on the project here: tinyurl.com/NAMstories). What is compelling about these interviews is that these mathematicians have great stories about their involvement with NAM and other mathematics organizations, but also vivid stories about the type of work they do in mathematics, when they first knew they loved mathematics, and ideas for recruiting and retaining more people into the field. In short, these stories have the potential to attract people of all ages to learn more about mathematics and, hopefully, to influence professors, policy makers, and administrators to develop effective programs and initiatives.

On reflecting on his life's work in mathematics, and his active engagement in NAM to ensure the participation of students and faculty in its mentoring and outreach programs, Dr. James Donaldson, retired dean and professor emeritus of mathematics from Howard University, said, "Mathematics belongs to everyone." Many of the stories that we tell about mathematics affirm this simple but powerful idea, but many do not. Organizations like NAM and AWM can play a significant role in facilitating access to mathematics, inducting young mathematicians into the profession, exposing people to new ideas about mathematics research and teaching, and, ideally, inviting more people to be engaged with mathematics at all age levels. In short, they play a tremendously educative role.

Using storytelling in my research and my own practice as a mathematics teacher, education researcher, and professor has often led to surprising and rewarding outcomes. It has been incredibly useful to engage with education researchers and mathematicians about how some of these ideas, so prominent in literature about literacy development, can be taken up in service of mathematics teaching and learning, engagement, and socialization. I hope you'll reflect on your own mathematics stories and experiences to consider and implement actions that broaden access to meaningful mathematics for all.

AWM's JMM Capitol Hill Visit

Michelle Snider

Policies on topics from NSF funding to Title IX protections affect mathematicians at all levels and in many careers. We all know the only-incrementally-changing statistics on women in STEM fields, and that more needs to be done. The only way we can enact systemic change is for people at all levels of power to get on board, from encouraging girls to see science as a fun and viable career option, to providing a network within the math community, to supporting policies that can change behavior and culture. We need support from institutions at all levels, and that is why the AWM hosts Capitol Hill Days. AWM as a 501(c)(3) non-profit organization may engage in some lobbying on legislation, as long as it is not "too much" and our efforts are kept below the "substantial" level.[1] In the words of our Executive Director Karoline Pershell, "AWM members represent the AWM community and get to participate in democracy at the nation's capital. We hope this memorable experience teaches all of us how we can use our collective voice for positive change."

That all sounds good in theory, but why would I, as a mathematician, go out of my way to intentionally talk to politicians? Even with a group of AWM members—we are a small organization, and we don't have much power. We certainly can't compete with polished and well-funded lobbyists, right? Besides, I'm an introvert.

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[1] Exactly what the terms in quotes mean in this context is somewhat murky, but see https://www.irs.gov/charities-non-profits/lobbying for further information.

AWM Workshop at the 2020 Joint Mathematics Meetings

Application deadline for graduate students: **August 15, 2019**

For many years, the Association for Women in Mathematics has held a series of workshops for women graduate students and recent PhDs in conjunction with major mathematics meetings. Beginning in 2016, the workshop talks are supported by the AWM ADVANCE grant. The AWM Workshops serve as follow-up workshops to Research Collaboration Conferences for Women, featuring both junior and senior women speakers from one of the Research Networks supported by the ADVANCE grant. An AWM Workshop is scheduled to be held in conjunction with the Joint Mathematics Meetings in Baltimore, MD, January 2019.

FORMAT: The workshop will consist of a Special Session focused on Several Complex Variables organized by Liz Vivas and Loredana Lanzani, and a Poster Session for graduate students. Selected junior and senior women from the Research Collaboration Conferences for Women (RCCW) WinSCV, which was held at AIM in April 2019, will be invited to give 20-minute talks in the Special Session on Women in Several Complex Variables. The speakers will be supported by the National Science Foundation AWM ADVANCE grant: Career Advancement for Women Through Research Focused Networks. The Poster Session will be open to all areas of research; graduate students working in areas related to Several Complex Variables are especially encouraged to apply. The graduate students will be selected through an application process to present posters at the Workshop Reception & Poster Session. With funding from NSF, AWM will offer partial support for travel and hotel accommodations for the selected graduate students. The workshop will include a reception, luncheon and a mentoring session where workshop participants will have the opportunity to meet with other women mathematicians at all stages of their careers. In particular, graduate students in complex analysis will have the opportunity to connect with the Women in Several Complex Variables (WinSCV) Research Network.

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

MENTORS: We also seek volunteers to act as mentors for graduate students as part of the workshop. If you are interested in volunteering, please contact the AWM office at awm@awm-math.org by **September 15, 2019**.

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

All applications should include:

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

Applications (including abstract submission via the Joint Mathematics Meetings website) must be completed electronically by **August 15, 2019**. See https://awm-math.org/meetings/awm-jmm/ for details.

The truth is, when we call Congressional offices and ask for an appointment, more often than not, we get one. There are people on the Hill who are fighting for us every day, to get us the resources we need to do our job—it is important that we connect with them, to thank them for what they are doing, and to provide ourselves as a resource for new legislation. There are people on the Hill who have never met a "real" mathematician—it is important that we reach out to them to show how what we do supports the country as a whole.

And so, in a chilly January, 50 people traveling from all over the country to Baltimore for the Joint Math Meetings, arrived a day early for a morning crash course in advocacy and an afternoon on Capitol Hill. The intrepid crew was pretty evenly distributed amongst undergraduate students, graduate students and postdocs, faculty, and BIG—business, industry, and government. Most had never done anything like this before.

At our Monday evening meet and greet, the head of the Government Relations Division for AMS Karen Saxe stopped by for a timely discussion of how the government shutdown, then in its fourth week, was affecting mathematicians and other academics in terms of ability to attend conferences and to plan for future grant funding from the National Science Foundation. We started Tuesday morning with a training session run by guest speakers from the American Association for the Advancement of Science (AAAS): Senior Program Manager Christine Rovner serves as a liaison between federal host agencies and AAAS Congressional Fellows, and Jennifer Pearl is the Director of the AAAS Science and Technology Policy Fellowship Program. They gave us an overview of the legislative process, including the role of advocates (like us!) in meeting with staffers, and a pep talk about getting out of our comfort zones. We capped off the formal training with a demo meeting by several brave volunteers, then the groups had time to start crafting their personal stories to fit within the AWM's mission. "Our group ranged from undergraduate to postdoc to working professionals in government and industry to an emerita professor, and everyone had stories of how government programs had affected their lives," said DePaul University Professor Emerita Susanna Epp.

After an hour-long bus ride to DC and a quick stop for a group photo by the unmissably large sculpture in the Hart Senate Office Building,[2] we were off to the proverbial races! Over the course of the afternoon, in 10 groups, we met with a total of 47 different offices: 22 Representative, 24 Senate, and 1 House Committee. These meetings were on both sides of the aisle (33 Democratic, 13 Republican, and 1 Independent). We can only get appointments for states and districts from which we have constituents, but thanks to the group being comprised of JMM-bound travelers, we were able to visit offices from 18 different states. We even met with the offices of all four women who had as of that day indicated their intentions to run for president in 2020.

Susannah Epp (DePaul University), Paulina Rodriguez (FDA), Annie Schenck (Mount Holyoke College), and Dong Dong (University of Maryland)

Annie Schenck, an undergraduate at Mount Holyoke College and a native of Illinois, "had a wonderful experience participating in the JMM Hill Visit this January. I got to work with an amazing group and loved hearing everyone's individual stories. Everyone was so involved with promoting change in the world of STEM, and I think we made a strong case as we met with staffers. We also had the opportunity to meet with two representatives from Illinois, Rodney Davis and Jan Schakowsky. It was great to hear their support and to share our stories directly with them."

As we met with staffers, we focused on the AWM's legislative priorities: to expand STEM educational opportunities, to support research funding, to help Americans achieve a healthier work/life balance, and to create a welcoming environment. We highlighted ways that they can help us ensure access for girls and minoritized populations to classes and programs on STEM subjects. "We were able to advocate

[2] See the group photo and a couple of others on page 22 of the March–April issue of this newsletter.

institutional changes to help women get access to higher level of education within mathematics. Raising the amount of NSF support is essential; it encourages women's interest to accomplish careers and achieve leadership positions. Funding facilitates the professional growth giving STEM women greater visibility in academic institutions," reports Sara Sami Jamous, a graduate student at Arizona State University.

Of course, we also meet with offices who might not be completely sold on the value of STEM. Most of the staffers are friendly regardless because they are after all in the politics game—they are professional extroverts. But sometimes they might actually listen and hear what we say and realize that it affects us—we just have to put math in terms that they care about, whether that's healthcare, big data, farming, or national security.

People in Congress hear professional arguments on all sides of issues all the time. What we have going for us is personal stories of constituents and student participation. These make all the difference. By regularly visiting the offices of elected officials, we establish a dialogue with those on the ground. If we do our job right, they will contact us when developing or signing on to new bills. Further, they may make useful suggestions to us on what we could do to help them make their case to their colleagues. Multiple offices have turned to members of AWM to help with wording on legislation. Already in this 116th Congress, the AWM has endorsed the Combating Sexual Harassment in Science 2019 House Bill (H.R.36) and the Hidden Figures Gold Medal Congressional Act (S.3321/H.R.1396).

Mela Hardin (Arizona State University), Emily Sergel (University of Pennsylvania), AWM Past-president Ami Radunskaya (Pomona College), and Emma Lennen (UC Santa Barbara), outside Senator Cory Booker (NJ)'s office.

Additionally, for the participants, Hill Day is a great way to spend a whole day with women mathematicians at all stages of the pipeline, and informal mentoring is natural. Susan Rogowski, a graduate student at Wake Forest University, said "Wow, what an incredible experience. I loved meeting the people from Congress and talking about issues that were important to me. But the best part was really meeting such incredible women AND men from around the country that shared similar views. It was such an amazing networking opportunity and I hope I will be able to get my AWM chapter to participate in the next one!"

When we tell our stories to those who have influence, we show them that we aren't just statistics. We are real people with real needs whom they have the power to help. When it comes down to it, every voice that is heard matters. Every meeting with a staffer matters. Fifty people were willing to take a day out of their busy lives of lesson planning, talk attendance, family time, etc., to travel to DC to do something that they don't normally do and that is probably outside their comfort zones. Because this matters. This is how systemic change happens: incrementally.

Professor Mark Branson from Stevenson University said "The experience was really transformative. I think a lot of us don't really think about the broader place of our actions in society—we're committed to what we can do to improve equity in our classrooms, in our departments, or even in our schools—but going beyond that is challenging. It's tough to envision how you can work for broader change in society as a whole. Visiting Congress with the AWM really made me think about what I can be doing on a broader basis to help improve opportunities for all students to succeed in mathematics."

To get involved, send an email to hillvisit@awm-math.org. If you are near or able to travel to DC, join us on future Hill Visits. If you would like to organize visits to your own local representatives' offices, we can help with that too!

News from the AMS

Jill Pipher Takes Office as AMS President

Jill Pipher, Vice President for Research and Elisha Benjamin Andrews Professor of Mathematics at Brown University, began her term as AMS President on February 1, 2019. "It is quite an honor to be starting my term as President of the American Mathematical Society," she says. "I've spent this past year as President-elect thinking hard about priorities for the next two years. I've been listening to the ideas and suggestions of many colleagues and learning in depth about the operations of AMS, from publications to meetings to long-range planning, and have formulated some priorities for this next two years."

Jill Pipher. Photo credit: Nick Dentamaro/Brown University

Among her priorities are advocacy and communication—in the public domain and in government for the importance of mathematics research and more generally for public awareness of mathematics in the world. "In a sense, advocacy has never been easier, because mathematics is ubiquitous in the things that touch our everyday lives: technology, climate modeling, medical advances, AI and more. We could do a better job of communicating the role of fundamental research in the future readiness of mathematical sciences to answer urgent societal questions. I look forward to working with the AMS Office of Government Relations in Washington, DC and with AMS policy committees to explore future directions in advocacy and communication."

The AMS programs for early-career mathematical scientists, such as the Mathematics Research Communities and travel grants, are made possible through partnerships with the National Science Foundation and the Simons Foundation respectively, as well as a new campaign to raise funds for endowments. "I am thrilled with the current focus of AMS on the 'next generation' of mathematicians. The AMS has a critical role to play in providing opportunities for students and in preparing graduates to find rewarding careers in the mathematical sciences."

Pipher intends to continue work started by past presidents in order to propel AMS into a leadership role in diversifying the profession and creating an inclusive community. "I plan to help identify processes that support, or hinder progress toward, this critical goal."

The AMS has partnerships with many organizations and mathematics institutes, and Pipher anticipates building on those partnerships and exploring with other leaders "where we can be stronger with one voice, and how we can work together for mutual benefit."

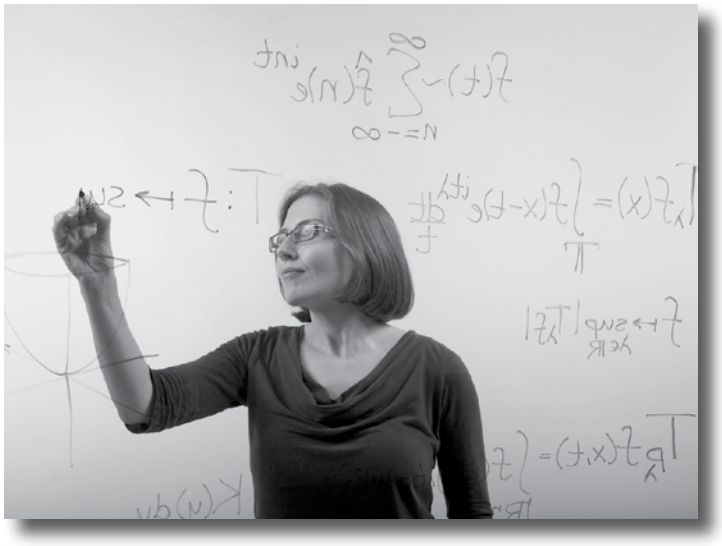
Pipher received her PhD from UCLA in 1985. She was a Dickson Instructor and later assistant professor at the University of Chicago before joining the faculty at Brown in 1989. She was the founding director of the Institute for Computational and Experimental Research in Mathematics (ICERM), a National Science Foundation mathematics institute, from 2010 to 2016. Pipher is the third woman to be elected AMS President, following Julia Robinson (1983–1984) and Cathleen Synge Morawetz (1995–1996).

Ed. Note: And we add: She was AWM President from 2011–2013. Congrats, Jill!

Lillian Pierce Awarded Birman Fellowship

Lillian Pierce of Duke University has been awarded the AMS Joan and Joseph Birman Fellowship for Women Scholars for the academic year 2019–2020. Pierce plans to use the fellowship funding to buy out teaching and to bring one or more collaborators to her home institution, thus reducing the effect of travel on her three young children. Pierce is particularly grateful to the Joan and Joseph Birman Fellowship for the purposeful flexibility of the funding it provides.

Pierce's research is in analytic number theory and harmonic analysis. Her work in number theory involves counting integral points on varieties and studying properties of class groups of number fields, for which problems she has developed new methods involving the circle method, sieves, and character sums. Her work in analysis focuses on oscillatory integral operators, Radon transforms, and Carleson operators, as well as their discrete analogues, which have deep ties to number theoretic questions.



Lillian Pierce. Photo courtesy of Duke Photography

About Lillian Pierce: Pierce grew up in a small town in California and was primarily home-schooled as a child. She began playing the violin at age four and was performing professionally by age eleven. She entered Princeton University as a mathematics major but also completed a pre-med curriculum. Under the mentorship of Elias Stein and others, her interest turned to pure mathematics. She was valedictorian of the 2002 class of Princeton and a Rhodes Scholar. After two years studying at Oxford University with Roger Heath-Brown, she returned to Princeton for her PhD, which she received in 2009 under the direction of Stein. She did postdoctoral work at Oxford, the Institute for Advanced Study, and the Hausdorff Center for Mathematics as a Bonn Junior Fellow. She joined the faculty at Duke in 2014, where she is currently the Nicholas J. and Theresa M. Leonardy Associate Professor of Mathematics.

Pierce has received a Marie Curie Fellowship, an NSF Mathematical Sciences Postdoctoral Research Fellowship, an NSF CAREER award, a von Neumann Fellowship at the Institute for Advanced Study, and a Sloan Research Fellowship. She was awarded the AWM Sadosky Research Prize in 2018 and gave an AMS Invited Address at the 2019 Joint Mathematics Meetings (JMM), a Bourbaki Seminar in 2017, and an MAA Invited Address at the 2017 JMM. In addition, this spring she'll present the lecture "Math, Music, History: 300 Years in 30 Minutes" at the 2019 National Math Festival on May 4 in Washington, DC.

Ed. Note: And we add: Her work with AWM includes her wonderful series of interviews "Mathematics + Motherhood" that appears in this newsletter. Congrats, Lillian!

AMS Committee on Human Rights Issues Statement of Concern About Turkish Mathematicians

The AMS Committee on Human Rights of Mathematicians (Dr. Arthur Ogus, University of California at Berkeley, Committee Chair), February 8, 2019

The AMS Committee on Human Rights of Mathematicians has issued the following statement expressing concern for Turkish mathematician Ayse Berkman and her colleagues:

> The Turkish government has charged the mathematician Professor Ayse Berkman with the crime of "making propaganda for a terrorist organization," based solely on her having signed a petition decrying military operations against civilians in Kurdish provinces. She appeared before the Heavy Penalty Court of Istanbul on January 10, 2019; see a translation of her defense statement (http://m.bianet.org/english/freedom-of-expression/204414-statement-of-academic-ayse-berkman) and the petition she signed (https://www.barisicina kademisyenler.net/node/63).
>
> Professor Berkman received her PhD at the University of Manchester Institute of Science and Technology in 1998. She has been teaching mathematics in Turkey since then, currently at Mimar Sinana University in Istanbul, and is a member of the American Mathematical Society.
>
> The Committee on Human Rights of Mathematicians of the American Mathematical Society deplores these political charges against Professor Berkman, which are a clear violation of human rights and academic freedom. These charges are part of a disturbing pattern: hundreds of academics in Turkey have been charged, and scores sentenced, for similar expressions of opinion. We decry these assaults on academic freedom and urge the Turkish government to respect the political and human rights of Professor Berkman and her colleagues.

Call for Nominations for the Ostrowski Prize, 2019

The aim of the Ostrowski Foundation is to promote the mathematical sciences.

Every second year it provides a prize for recent outstanding achievements in pure mathematics and in the foundations of numerical mathematics. The value of the prize for 2019 is 100.000 Swiss francs.

The prize has been awarded every two years since 1989. The most recent winners are Oded Schramm in 2007, Sorin Popa in 2009, Ib Madsen, David Preiss and Kannan Soundararajan in 2011, Yitang Zhang in 2013, Peter Scholze in 2015, and Akshay Venkatesh in 2017.

See https://www.ostrowski.ch/index_e.php for the complete list and further details.

The jury invites nominations for candidates for the 2019 Ostrowski Prize.

Nominations should include a CV of the candidate, a letter of nomination and 2-3 letters of reference.

The Chair of the jury for 2019 is Marcus Grote of the University of Basel, Switzerland.

Nominations should be sent to marcus.grote@unibas.ch by May 31, 2019.

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