

WOMEN AND THE MAA

Women's participation in the Mathematical Association of America has varied over time and, depending on one's point of view, has or has not changed at all over the organization's first century. Given that it is difficult for one person to write about the entire history, we present here three separate articles dealing with this issue. As the reader will note, it is difficult to deal solely with the question of women and the MAA, given that the organization is closely tied to the American Mathematical Society and to other mathematics organizations. One could therefore think of these articles as dealing with the participation of women in the American mathematical community as a whole.

The first article, "A Century of Women's Participation in the MAA and Other Organizations" by Frances Rosamond, was written in 1991 for the book *Winning Women Into Mathematics*, edited by Patricia Clark Kenschaft and Sandra Keith for the MAA's Committee on Participation of Women. The second article, "Women in MAA Leadership and in the American Mathematical Monthly" by Mary Gray and Lida Barrett, was written in 2011 at the request of the MAA Centennial History Subcommittee, while the final article, "Women in the MAA: A Personal Perspective" by Patricia Kenschaft, is a more personal memoir that was written in 2014 also at the request of the Subcommittee.

There are three minor errors in the Rosamond article. First, it notes that the first two African-American women to receive the Ph.D. in mathematics were Evelyn Boyd Granville and Marjorie Lee Browne, both in 1949. That was accepted knowledge in 1991, but recently it has become known that Euphemia Lofton Haynes earned a Ph.D. earlier, in 1943. Information on Haynes can be found at <http://www.math.buffalo.edu/mad/PEEPS/haynes.euphemia.lofton.html>. Second, Anne Leggett only began editing the *AWM Newsletter* in 1977, not 1975. And third, Bettye Anne Case began her term as Meetings Director of AWM in 1983, not 1973.

In addition to these three articles, we note that Sarah J. Greenwald, Anne M. Leggett and Jill E. Thomley have recently written an article about the Association for Women in Mathematics for *The Mathematical Intelligencer*, which puts the history of women in the MAA into a broader context. To read it, click [here](#).

A CENTURY OF WOMEN'S PARTICIPATION IN THE MAA AND OTHER ORGANIZATIONS

Frances A. Novak Rosamond*



Frances Rosamond

With over 30,000 members, almost a quarter of them women, the Mathematical Association of America (MAA) is one of the major mathematical organizations in the United States and, indeed, in the world. This brief history of women in the MAA traces how the climate for women in mathematics has changed since the 1890's, when the *American Mathematical Monthly*, the precursor to the MAA, was established [1].

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THE AMERICAN MATHEMATICAL MONTHLY

By the end of the 1890's, there were international, national and local mathematical as well as educational associations. Despite the fact that various mathematical organizations had regular publications, Benjamin Finkel, a teacher at Kidder Institute in Missouri, felt the need for another kind of journal.

¹ There are several excellent references that detail the contributions of women mathematicians in the United States prior to 1940, particularly the works of Green and LaDuke, and of Rossiter.

In 1894, Benjamin Finkel and Hannah Cokeley Finkel, his wife, began publishing *The American Mathematical Monthly*. We know very little about Hannah Cokeley Finkel, but she is given credit for actively supporting the *Monthly*. In the December 1912 (volume XIX) *Monthly*, Benjamin Finkel summarizes nineteen years of publishing: "To all these friends, and to Mrs. Finkel, who helped us in the proof-reading of nearly every page, ...we hereby extend our sincerest thanks...". Her support for the *Monthly* is mentioned again in the description of a celebration held for Benjamin Finkel after he had taught at Drury College for forty years.

In his introduction to the first issue of the *Monthly* Benjamin Finkel says that problem solving is an essential part of good teaching and the primary reason for undertaking the monumental task of publishing a new journal. "Most of our existing Journals deal almost exclusively with subjects beyond the reach of the average student or teacher of mathematics or at least with subjects with which they are not familiar, and little, if any, space is devoted to the solution of problems..."

Each issue of the *Monthly* had about two problems proposed in each of several categories such as arithmetic, geometry, calculus, mechanics, probability, or "Modern Higher Mathematics," and about three solutions to each previously posed problem. A few problems or solutions by women, often students, were published each year. For example, in volume 1 (1894), Grace H. Gridley, a student at the Kidder Institute, presented solutions to two geometry problems and Mrs. Mary E. Hogsett from Danville, Kentucky and Miss Lecta Miller, Professor of Natural Science and Art at Kidder Institute, each proposed problems. The journal also contained a biography and a portrait of a mathematician, two or three mathematical papers, book reviews, a column of queries and information, a column of notes, and an editorial.

Only five of the mathematical papers published in the first 12 years were written by women, although about 24 mathematical papers were published annually. In 1895, there was a mathematical paper by Emma C. Ackerman from Michigan State Normal School on "The Golden Section," and in 1896 she co-authored "On an Interesting System of Quadratic Equations" with Professor E. H. Moore of the University of Chicago. The next two mathematical papers written by women are found in 1903; one by Adelaid Denis, a graduate student from Colorado College, and the other by Ida May Schottenfels, which she had presented earlier to the American Mathematical Society. In 1905 Alice Church of New York City authored

"Tests of Divisibility by 7, 13, and 17." (By 1989, women still constituted less than 10% of the authors of each mathematical journal of the MAA.)

Another feature of the *Monthly* was the "News and Notes" section. Women are mentioned here, as in 1907: "Miss Hazel Anderson received her Master's of Mathematics at the University of Chicago and will be Instructor in Mathematics at Manual Training High School, Indianapolis, Indiana. Miss Mary E. Wells, Master's in Mathematics from the University of Chicago, returns to be Instructor in Mathematics at Mt. Holyoke college where she graduated in 1906." A Note in 1910 reads, "Emma M. Cowles, Milwaukee Downer College, is a Speaker for the Committee on the International Commission to the Teaching of Mathematics at the Mathematics conference at the University of Chicago."

A Note in the April 1912 *Monthly* shows an interest in the numbers of women in mathematics: "According to the latest Annual Register of the American Mathematical Society, about 50 of the 668 members are women. It is interesting to observe that the American Mathematical Society has a much larger percent of women members than the leading mathematical societies of Europe. According to the latest register of the German Mathematical Society...only 5 of its 759 members are women; and only one of these 5 members is a German woman, while three of them are Americans and the remaining one is a Russian [2]. The French Mathematical Society also has very few women members. The numbers of women members of the Circolo Matematico di Palermo and of the London Mathematical Society are considerably larger but they are much smaller than in our own society."



Charlotte Angas Scott

A highly visible role model in the United State was British Charlotte Angas Scott, department chair at Bryn Mawr from its opening in 1885 until 1931 [3]. To encourage mathematical research Scott helped found the American Mathematical Society [4] in the early 1890's. Scott was a highly respected leader in the mathematical community, and an inspiration to women. Seven women received their mathematics Ph.D.'s under her guidance.

2 We know who the German woman was; apparently Emmy Noether's isolation was more complete than that of her American peers.

3 Scott was born in England in 1858. In 1880, because she was a woman, she had to receive special permission to take informally the Tripos, the mathematics exam at Cambridge. She scored so high that the resulting publicity caused Cambridge to change its policies (Kenschaft, 1987).

MATHEMATICAL ASSOCIATION OF AMERICA: THE FOUNDING TO THE 1940'S

At the end of December, 1915, ten women and 96 men met at Ohio State University, where they agreed on the need for an organization that would address mathematical issues of interest to college teachers. The name, Mathematical Association of America, was chosen, and the *American Mathematical Monthly* was adopted as the official journal of the association. (It is most unusual for the official journal of an organization to precede the formation of the organization by twenty years.) The only woman in the organizational structure was Helen Abbott Merrill, one of the 16 associate editors appointed to the *Monthly*.

Helen Abbott Merrill (B.A. from Wellesley College in 1886, further study at the University of Chicago and Göttingen, Ph.D. from Yale in 1903) taught at Wellesley from 1893 and held an endowed chair of the Department of Mathematics (1916-1932). She was very active in the MAA. In addition to serving as Associate Editor of the *Monthly* from 1916 to 1919, she was a member of the Executive Council from 1917 to 1920, and vice-president in 1920 (Green and La Duke, 1988 and Siegel and Finley, 1985).

Almost ten years passed before the next women became associate editors of the *Monthly*: Elizabeth Carlson (from 1927 to 1931) and Helen Brewster Owens (from 1936 to 1938). Helen Brewster Owens, a mathematics teacher in Ithaca, New York (where her husband was a professor), left her job for a year to organize the successful "votes for women" campaign in Kansas in 1912, and again, though less successfully, in New York in 1915. (Another mathematician activist was Susan Cunningham, Professor Emerita of mathematics at Swarthmore College, where she had been one of the original faculty in 1863, who was reportedly an "ardent suffragist" until her death in 1921 [Rossiter, p. 116].)

The original organization of the MAA, as founded in 1915, consisted of a Nominating Committee of five, and the offices of President, Vice President, Secretary-Treasurer, and twelve additional members of the Executive council. The Standing Committee on Finance consisted of the President, the Secretary and the Managing Editor. All were men, as were all members of the various special committees.

4 The American Mathematical Society (AMS) preceded the MAA by more than two decades. The AMS was founded in the 1890's to encourage mathematical research; the emphasis of the MAA is on college mathematics. Members of the MAA have frequently been members of the AMS, and meetings of the two organizations often were, and are, held jointly. In 1990, however, there is only about one third overlap in membership.

The MAA Board of Governors supervises the scholarly and scientific activities of the Association. The board consists of the officers, the ex-presidents for six years after expiration of their presidential terms, the members of the Finance Committee, and additional elected members called "Governors." Each of the twenty-nine "Sections" of the MAA is entitled to elect a Governor to the board. Women's activities in the Sections are outlined below, and the names of women Governors are listed in Appendix II.

About twelve percent of the over 1000 charter members were women, and they represented a variety of institutions. The two largest contingents were seven women from Wellesley and six from Iowa State College of Agriculture. Two of these Wellesley women, Helen Abbott Merrill (mentioned above) and Clara Eliza Smith, eventually became Vice Presidents of the MAA (Green and LaDuke).

Clara Eliza Smith Served on the MAA Board of Governors from 1923 to 1926 and as a Vice President in 1927. Smith received her Ph.D. from Yale in 1904. She spent her career at Wellesley and co-authored textbooks with her colleague Merrill. The careers of Merrill and Smith were detailed by Green and LaDuke (1988).

Another early active member was Anna Johnson Pell Wheeler. After studies at the University of Iowa and Radcliffe College, Wheeler was awarded the distinguished Alice Freeman Palmer Fellowship by Wellesley College in 1906. A requirement of this fellowship was that she promise not to marry during the



Wellesley College Mathematics Department 1928. Back row l-r: Helen Abbott Merrill, Clara Eliza Smith, Jessie Esther Comegys, Mabel Minerva Young. Front row: Marion Elizabeth Stark, Mary Curtis Graustein, Lennie Phoebe Copeland.

award period. She used the award to pursue a Ph.D. at Göttingen [5], where her mentor, Hilbert, apparently rejected her thesis. She submitted it to the University of Chicago and was graduated magna cum laude in 1910.

She then discovered that women were unacceptable candidates for most college or university positions. Finally, in 1918, after nine years of heavy teaching loads at Mount Holyoke College that left little time for research, she began a 30-year career at Bryn Mawr College, succeeding Charlotte Scott as department chair in 1924 and gaining the high regard of professional mathematicians throughout the country. Wheeler encouraged her students to be active in research and to use professional organizations to further their careers. She published in functional analysis, served on the AMS Council (1924-26), and was the first woman to give an AMS invited address (1923) and also a Colloquium lecture (1927). (AMS invited lectures began in 1895).

In 1933, Wheeler and others managed, with the help of the Rockefeller foundation, to bring the famed German mathematician Emmy Noether to Bryn Mawr. Fellowships provided postdoctoral support for Grace Shover Quinn, Olga Taussky Todd, and Marie Weiss to work with Noether at Bryn Mawr. Marie Weiss became one of the associate editors of the *Monthly* in 1943 and was a National Research Council Fellow from 1928 to 1930. She worked actively in algebra and was a professor at Newcomb college, Tulane, until her death in 1952 (Green and LaDuke, 1988).

Olive Cleo Hazlet, a colleague of Wheeler's at Bryn Mawr in 1918, received her Ph.D. from Chicago in modular invariants and linear associative algebras under Dickson (1910), and spent a year as a post-doctoral fellow at Harvard. Her professors termed her "one of the two most noted women in America in the field of mathematics."

Hazlet took an associate professorship at reduced pay at the University of Illinois in 1925, where she expected to have more opportunity for research. However, she was required to teach large 'service courses' to nonmajors. In 1933, her salary was reduced from \$4,000 to \$3,500; unlike the rest of the members of her department, her salary was not raised again after the depression. One result was that she retired on a pitiable pension. She died in 1974 (Rossiter, 1982).

5 There has been significant European influence on mathematics in America. In the 1890's, in the 1930's, and after each world war, many European mathematicians came to live and teach in the United States. It was quite common for Americans to do at least some, if not all of their graduate work in Europe, particularly at Göttingen, where in the 1890's Felix Klein received permission to admit American women—as an experiment—prior to admitting German women.

One of the most active women in the MAA has been Mina Rees, who served on numerous committees and became vice president in 1963. In 1961, she was given the first MAA Award for Distinguished Service to Mathematics.



Mina Rees

Mina Rees faced the discouragement that many women experience during their education. Her family was relatively poor. She went to Hunter High School and graduated summa cum laude from Hunter College. She began to study at Columbia, but "When I had taken four of their six graduate courses in mathematics and was beginning to think about a thesis, the word was conveyed to me—no official ever told me this, but I learned—that the Columbia mathematics department [6] was really not interested in having women candidates for Ph.D.'s. This was a very unpleasant shock...I decided to switch to Teacher's College and take the remaining courses necessary for an M.A. there. A few years later, after I'd saved enough money, I went to Chicago [7]. That was the only episode that raised a question about the appropriateness of mathematics as a field for women before I had my Ph.D. It was really a traumatic affair for me. Of course, this is certainly not at all true of the mathematics department at Columbia now" (Albers and Alexanderson, 1985).

Until quite recently, few men would agree to be an advisor for a female graduate student and women had to adapt their research interests to those who would. Statistics by LaDuke and Green show that almost half of the Ph.D.'s in mathematics granted to women before 1940 in the U.S. were awarded in the 1930's, and 155 of them by only nine schools. Furthermore, only eight mathematicians served as advisors for more than one-third of the 229 degrees: Gilbert Ames Bliss at the University of Chicago, A.B. Coble at Johns Hopkins, L.E. Dickson at the University of Chicago, Aubrey Landry at Catholic University (a student of Morley's), Frank Morley at Johns Hopkins (a friend of Scott's), Anna Pell Wheeler and Charlotte Scott, both at Bryn Mawr, and Virgil Snyder at Cornell. (All except Anna Pell Wheeler, Charlotte Scott, and Aubrey Landry served at some time as president of the AMS, suggesting that they had the status to mentor students from a less welcome group [Archibald].) Ninety-one of the degrees were granted in the 1920's and twenty-seven in the 1930's.

When a woman did manage to obtain a Ph.D., she usually found employment restricted to a few high schools and women's colleges, with pay considerably lower than men's. Employment was almost nonexistent during the Great Depression of the 1930's (Niven, p 215-216). Because of nepotism laws, many women mathematicians (who tend to

marry mathematicians) were unable to secure paying jobs and taught on a volunteer basis.

One example is Sophia H. Levy, a member of the mathematics faculty at the University of California, Berkeley. Sophia Levy was a founding member of the Northern California Section, served as Secretary pro tem at the organizational meeting, and was elected vice-chair. In 1941, she organized a joint committee on education with the Southern California Section. Eventually she married John McDonald of the Berkeley mathematics faculty. "It was not until McDonald's retirement that she could marry him, due to the nepotism rules in effect at that time" (Alexanderson and Klosinski).

Until relatively recently, married women mathematicians usually could work only as research assistants or part-time faculty. Jean Pedersen, the first woman to teach in the Mathematics Department at Brigham Young University and subsequently the first woman to teach in the Mathematics Department at Santa Clara University, wrote that it helped her to hear Mary Ellen Rudin describe her "fractional appointment" rather than her "part-time position." By the 1980's, a few schools (including Wells College in New York and Smith College) hired a wife and husband jointly to fill one position, and it was possible to have a wife and husband both at the same university and even in the same department.



Mary Winston: One of the early American women mathematicians to study in Europe. Back row l-r: Charles Jaccottet, Paul Heegard, Gino Fano. Front row: Mary Winston, Grace Chisholm.

6 In 1886 Columbia University awarded a Ph.D. in Mathematics to Winifred Edgerton.

7 The professional status of women was high in the 1920's. Twenty-six women received Ph.D.'s in mathematics from the University of Chicago between 1920 and 1935, and many of the graduate students were women (Duren).

THE 1940'S TO THE 1960'S

World War II provided some women, most notably Grace Murray Hopper and Mina Rees, with unprecedented career opportunities. Grace Murray Hopper, Ph.D. from Yale in 1934, joined the U.S. Navy and became a pioneer in the development of higher level programming languages. Mina Rees served with the Office of Naval Research and is recognized as having been a guiding force behind government support of mathematical research. In 1953, the council of the AMS adopted a resolution citing her influence which reads, in part, "Under her guidance, basic research in general, and especially in mathematics, received the most intelligent and wholehearted support. No greater wisdom and foresight could have been displayed and the whole postwar development of mathematical research in the United States owes an immeasurable debt to the pioneer work of the Office of Naval Research and to the alert, vigorous and farsighted policy conducted by Miss Rees" [*Bulletin AMS* 60 (1954) p. 134].

During the war, women were allowed to take jobs, including mathematics teaching positions, on an "emergency basis," but many were dismissed afterward. After the war, many men used G.I. benefits to return to school. Many world-class European mathematicians had found refuge in the United States, and mathematical research developed as a result of war needs. Women did not participate in these mathematically exciting times to the extent that they did both before and afterward. Public opinion told them to return to their homes. The percentage of women receiving American mathematics Ph.D.'s dropped to an all-time low of 5% in the 1950's.

The McCarthy era hurt women as well as men. Pauline Sperry was the first woman Assistant Professor in the mathematics department at the University of California at Berkeley. In 1931, she compiled a bibliography of over 200 items on projective differential geometry. She was promoted to Associate Professor in 1932. Known as a great educator, she taught navigation to the Reserve Officers Training Corps in 1949, and helped organize the Women's Faculty Club. Pauline Sperry's career ended in 1949 when she refused to sign the California Regents' Oath, a non-communist oath that was a condition for employment. She, like many others, was fired from her job for this defense of academic freedom (Fasanelli in Grinstein and Campbell). The Committee on Tenure of the Academic Senate resigned because of the pressure by the University to have faculty sign loyalty oaths. Some tenured people were fired, and some resigned in disgust. The California Supreme court late declared the oath unconstitutional, and, in 1956, Sperry was reinstated emeritus and her back salary was paid [8].

8 The "Red-Hunt" is described by Chandler Davis and also by J. L. Kelley.

Students were not immune to the "Red-Hunt." Rebekka Struik, a graduate student at the University of Illinois in 1950, was asked to leave and her fellowship at Northwestern was withdrawn, presumably because her father, Dirk, a mathematician at MIT, was being investigated for "conspiracy to overthrow the Commonwealth of Massachusetts." The case was dismissed in 1955, and she is now Professor of Mathematics at the University of Colorado.

THE 1960'S AND THE 1970'S

In the 1960's, women continued to hold only "fractional" positions. Mary Ellen Rudin, who earned her Ph.D. in 1949, under R.L. Moore at the University of Texas, is the author of more than seventy research papers, primarily in set-theoretic topology. In 1971, she began a term on the Council of the AMS, the



Mary Ellen Rudin

first woman member in over forty years. She is active in both the MAA and the AMS and was vice president of the AMS in 1981-82. She describes the 1950's as the "housewives' generations" with women mathematicians being well-trained amateurs. "I didn't even think of mathematics as a career. The University of Rochester hadn't known I was coming with Walter, but they immediately gave me a calculus class to teach, so I taught. I had a private office. I didn't really have a position, but—oh well—I was a temporary part-time something. And that's the kind of job I have had almost all my life until 1971, when I became a full professor. I have had non-jobs wherever we happened to be" (Albers and Reid, 1988).

One of the few exceptions to this pattern was at the University of Rochester. In 1961 Leonard Gillman, then chair of its Department of Mathematics, hired both Dorothy Maharam Stone, and her husband, Arthur Stone, as Full Professors.

However, many graduate advisors were saying to women: "What makes you think you're worth educating? You're a woman, and you're already married." Simultaneously, *The Feminine Mystique* by Betty Friedan, was published and changed many lives. Louise Hay says, "When I read it, I questioned for the first time the rationale of giving first priority to being a wife and mother, and sacrificing a career for myself for the sake of my husband's" (Hay).

THE ASSOCIATION FOR WOMEN IN MATHEMATICS



Anne Leggett

As the women's movement resurfaced in the late 1960's, women mathematicians began openly expressing their concerns about the discrimination they faced. They discussed discrimination in groups on their campuses and at joint MAA and AMS meetings. In 1971, the Association for Women in Mathematics (AWM) was formed to encourage women to enter careers in

mathematics and related areas, and to promote equal opportunity and equal treatment of women in the mathematical community. Mary W. Gray of American University, a pioneering spokeswoman, was elected the first president of AWM (1971-73) and produced its first newsletters. Alice T. Schafer of Wellesley succeeded her in 1973-75 and established the AWM office at Wellesley college, where she was a professor.

AWM has grown to a membership of over 2700. It is independent, but holds joint national meetings with the MAA and AMS. At its January, 1980, meeting, AWM inaugurated the Emmy Noether Lecture Series, given annually at the MAA-AMS-AWM winter meeting by a distinguished woman mathematician.

The AWM has been a major force in uniting women mathematicians. Bettye Anne Case has been its dynamic Meetings Director since 1973. Its publication, the *AWM Newsletter*, has been edited by Anne M. Leggett since 1975, and is a source of abundant information about women's mathematical contributions and issues.



Bettye Anne Case
AWM Meetings Director

THE JOINT COMMITTEE ON WOMEN IN MATHEMATICS

Another force for change came in April, 1971, when the Council of the American Mathematical Society voted to appoint a Committee on Women in Mathematics with the following charge:

To identify and to recommend to the Council those actions which, in their opinion, the Society should take to alleviate some of the disadvantages that women mathematicians now experience and to document their recommendations and actions by presenting data.

The Committee compiled statistics which "reveal that many stereotyped beliefs about women in mathematics are not at all valid—such as, that they are a poor investment and abandon mathematics or, even worse, that they are not quite human." The Committee's opinion was that the main problem for women in mathematics "still lies in dealing with this stereotype view from their earliest years of learning through the period of deciding on a career, training for it, and, finally, facing employment situations both in hiring and in promotion."

The Committee recommended that the AMS "use its best efforts to encourage advisors and employers to avoid disparaging sex-oriented remarks...to encourage women to use their maiden names professionally, and to support the abolition of questions regarding marital or parental status on employment applications."

The Committee recommended that the AMS work actively for equal opportunities for women in recruitment, employment, advancement, tenure, admissions to graduate schools, fellowships and assistantships and in membership on advisory boards and panels; and that the AMS include more women on AMS programs, committees, governing boards and as invited speakers.

In 1972, the Committee submitted a questionnaire to about 650 women Ph.D.'s in mathematics and profiled a median picture of an American woman mathematician based on their findings:

She was born in the U.S.A. and received her Ph.D. before the age of thirty and within the last five years. She is married and has children. Her husband is also a mathematician and supports her professional efforts enthusiastically. Her job prospects are limited because she cannot move unless her husband gets a suitable job. However, she has roughly achieved what she set out for, feels perfectly competent and is reasonably content about her future. Her salary is considerably lower than her male

colleagues, in general, but she is satisfied to be an assistant professor at a four year college or university. There is a one in four chance that her husband would not be employed there, too, because of nepotism rules. The school is almost certainly not one of the prestigious schools. If her present occupation is not up to her expectations, she feels that this is not due to prejudice but to her lack of mobility and her family obligations. But she believes there is still prejudice and she would prefer prospective employers to avoid questions about her domestic, marital or parental life.

(Report of the Committee on Women in Mathematics, 1972)



Carole B. Lacampagne

While chaired by Carole Lacampagne (1984-87), the original AMS Committee on Women became a joint committee of the major mathematical societies and adopted its present role as collector of statistics about women in mathematics. Now called the Joint AMS-AWM-ASA-AMS-MAA-SIAM Committee on Women in the Mathematical Sciences, it was chaired by Betty Lichtenberg of the University of South Florida from 1987 to 1989 and now by Sue Geller of Texas A&M University. One of its goals in the 1990's is to determine why students of both sexes who are enrolled in graduate mathematics programs do or do not complete their degrees.

THE WOMEN AND MATHEMATICS PROGRAM (WAM)

By the mid-seventies, the women's movement had begun to raise public awareness of discrepancies between men's and women's job opportunities, salaries and advancements. Betty Vetter reported that the higher paying, higher prestige jobs were generally those that required some mathematics.

Researcher Lucy Sells found that mathematics served as a "critical filter" for women. Her work showed that 92% of the women (in contrast to only 43% of the men) in the 1972 freshman class at the University of California at Berkeley lacked the high school mathematics background that would make them eligible for the standard freshman calculus sequence. Therefore, unless these women undertook remedial work, they were limited in their choice of college major to five fields—humanities, music, social work, elementary education, or guidance and counseling (Ernest, p.9).

In an effort to encourage 9th and 10th graders to keep their options open by taking high school mathematics courses, the Women and Mathematics Secondary School Program was started by the MAA in 1975, funded primarily by IBM. The desire to have women mathematicians speak to secondary school students, parents, and guidance counselors came partially from the realization that there had been no women among the winners of the U.S.A. Mathematical Olympiad. This annual contest, begun in 1972, determines the U.S.A. team for the International Mathematical Olympiad.

The original grant proposal for WAM was written by Mary Gray with the support of Alfred Willcox, Executive Director of the MAA. The program began with director Eileen Poiani and three regional coordinators: Susan Devlin, New York/New Jersey/Connecticut; Mary L. Boas, Greater Chicago; and Jean J. Pedersen, San Francisco Bay Area. Carole B. Lacampagne was National Director from 1981 to 1988, when Alice J. Kelly assumed this leadership. WAM has now expanded to twenty regions around the country.



Mary Gray
Author of the original grant proposal for WAM.

Since its inception, representatives of Women and Mathematics have visited over 2,600 schools and thus reached over 201,000 students and more than 26,000 teachers, counselors, parents and other adults. WAM speakers often participate in the Expanding Your Horizons program for women. In addition, two women have been winners in the U.S.A. Mathematical Olympiad, most recently Elizabeth Wilmer of New York City, in 1987.

AFRICAN AMERICAN WOMEN IN MATHEMATICS

Until the end of the 1960's few blacks participated in the mathematical organizations because in the South, where most black mathematicians were concentrated, meetings were held in segregated facilities that excluded them. In December, 1951, Lee Lorch, who had joined the mathematics

faculty of Fisk University the previous year, wrote to the Board of Governors:

...the Association has the task of promoting the interests of collegiate mathematics, which includes bringing teachers of collegiate mathematics into active participation in the work of the Association.

Here it should be realized that nearly all Negroes teaching collegiate mathematics are employed in the segregated schools of the south. There are few exceptions...The Secretary of the southeastern region of the Association told me that no Negro had even attended an Association meeting in that region in the twenty years he has been Secretary until some Fisk faculty and graduate students went last spring (and were excluded from the banquet). I suspect that a similar report could be made in respect to the Society.

Negro mathematicians are naturally reluctant to attend meetings held at schools with which they have virtually no other contact. They feel concerned lest they be excluded, segregated, restricted in their activities, or otherwise humiliated. Those who teach in the state colleges for Negroes have the additional worry that their Boards of Trustees would take punitive action against them if they are involved in an "incident."

The southern meetings seem to have been organized around the assumption that no Negroes will attend...Precise by-laws are needed to extend to all members the full benefits restricted to some by present practices...Interracial arrangements committees for southern meetings would also help since they would anticipate (and could therefore eliminate) a number of problems that might otherwise prove bothersome (Lorch in Newell, et. al., p. 312-313).



Evelyn Boyd Granville

of the Association without discrimination as to race, creed or color..." (MacLane in Newell et. al. p. 316).

On February 1, 1952, MAA President Saunders MacLane wrote a memo to all the Section Officers in the country reporting a recent resolution of the board of Governors urging that the Association "promote the interests of Mathematics without discrimination as to race, creed or color." He added that he and the board had determined that it "is possible to...conduct the scientific, business and social affairs

At this time one of Lorch's colleagues in the Fisk University Mathematics Department was Evelyn Boyd (now Granville), who had become one of the first two African American women ever to earn a Ph.D. in mathematics, both in 1949. The other was Marjorie Lee Browne. both went north to earn their doctorates, Boyd to Yale University and Browne to the University of Michigan; there was no institution in the south where an Afro-American could earn a doctorate.



Marjorie Lee Browne

Although Lee Lorch spent only five years (1950-55) at Fisk University [9], four students who studied with him during that time are now apparently the only graduates of Fisk to hold a Ph.D. in mathematics. Three of these four were women: Etta Falconer, Vivienne Malone Mayes, and Gloria Conyers Hewitt. Another of His Fisk students, Joyce Venable Gould, holds a doctorate in mathematics education (Mayes, 1976).

Lorch's initiative in recommending Gloria Conyers Hewitt for doctoral programs netted her two offers without her even applying. (Her first two years at Fisk had coincided with Lorch's last two.) She accepted the offer of the University of Washington, where she was welcomed by her (all white male) colleagues and her thesis advisor. She thus became the third African American woman to earn a doctorate in mathematics in the United States in 1962. (In 1960, both Georgia



Gloria Conyers Hewitt

Caldwell Smith and Argelia Velez-Rodriguez had completed their requirements for a doctorate in mathematics from the University of Pittsburgh and the University of Havana, respectively. However, Smith died before the degree was conferred on her, and Velez-Rodriguez did not come to the United States until 1962.) Later Hewitt became active as a Visiting Lecturer for the MAA and was on the college board Advanced Placement Calculus Development Committee.

The experience of Vivienne Malone Mayes was more typical than Hewitt's. When Mayes was a graduate student in the 1950's at the University of Texas at Austin, she could not become a teaching assistant because she was black. One professor would not allow blacks to attend his classes. She could not discuss mathematics with her advisor and other classmates over coffee because they went to a segregated cafe. Only after standing on picket lines in a successful attempt to desegregate the cafe racially did she discover that women, whatever their race, felt unwelcome inside. She wrote, "I was the only black and the only woman. For nine weeks thirty or forty white men ignored me completely" (Mayes, 1975).



Vivienne Malone Mayes

Most accounts by Kenschaft of black women who earned doctorates in mathematics before 1980 indicate similar isolation and struggle. Kenschaft observed that every woman had not only great intelligence and diligence but also both a family member willing to sacrifice for her career and a secondary school teacher who had told her in effect, "You are excellent in mathematics. It would be worth your struggle to attain a career in mathematics" (Kenschaft, 1981).

Nevertheless, the proportion of women among African American mathematicians is greater than their proportion among white mathematicians, probably because the families of black girls expect them to earn money throughout their lives; the only question is how (Mayes, 1975). Thus a young black woman may feel less ambiguity than her white classmate about attaining as much education as her family can afford; the family believes she will "use" it as much as her brothers would. Several black women mathematicians have told Kenschaft that racism was a greater problem than sexism before earning their Bachelor's degree, after which sexism was the greater problem.



*Etta Falconer
First Director of BAM*

The lack of support for aspiring black mathematicians, evinced in the 14-year gap (1949-1963) between the second and third black women to receive a doctorate in mathematics is evinced in a statement by Walter Talbot, the fourth black man to do so. He wrote in 1973 that 35 years elapsed after his earning his doctorate in 1934 before "I had a chance to start existing in the national activities of the mathematical bodies." In April, 1969, a conference at Morgan State College, financed by the Ford Foundation, brought together 26 black mathematicians. "That conference was significant because it provided the first realistic opportunity for black Ph.D.'s in mathematics to meet each other, and in some cases to discover each other's existence." Richard Anderson and Creighton Buck attended the conference as consultants and helped bring the others into MAA and AMS activities.

Out of this conference was born the National Association of Mathematicians, as it is now known, officially at the Joint Mathematics Meetings in 1970. Harriet Walton of Morehouse college has been Treasurer since 1980 and Geraldine Darden served as treasurer for several years just preceding her. Etta Falconer received the award for outstanding service in January 1988. NAM holds annual dinners, programs and meetings and recently has been publishing proceedings after each Joint Meeting. It provides a network of active black mathematicians and outreach to prospective ones.

Meanwhile, in 1975 the MAA began a program, Blacks and Mathematics (BAM), similar to WAM with the goal of encouraging black students in mathematics. Etta Falconer was the first director of BAM, ably assisted



Gloria F. Gilmer

by Della Bell as area coordinator in Houston Texas. Gloria Gilmer was the second director. Both Falconer and Gilmer were among those who received awards for outstanding service to minorities at the May 1990 conference on Making Mathematics Work for Minorities (mentioned below). Several black women mathematicians were active in BAM, but the program faded. A task force was formed to study the problems of minorities in mathematics and potential structures to help. In 1989 it produced a report with 42 recommendations, including the establishment of a special office at MAA headquarters. SUMMA, Strengthening Underrepresented Minority Mathematics Achievement, already is open.

Another recommendation was for an MAA Standing Committee on Minority Participation in Mathematics. Major work lies ahead for this committee. Of the 200 Afro-American youngsters who obtained a mathematics SAT score over 550 in 1986, not a single one indicated an intention to pursue

mathematics in college; of the 10,000 who scored over 450, only 35 indicated a serious interest in mathematics (Kenschaft, *AWM Newsletter*, 18:5, 1988, 5-7). Chaired by two men, one black and one Hispanic, this committee is beginning a journey similar to that of the Committee on Participation of Women three years ago, and members of the two Committees keep in touch with each other for mutual support.

Gloria Gilmer became the first black female MAA Governor in 1978 as Governor-at-Large for Two-Year colleges. In 1981 the MAA created a position of Governor-at-Large for Minorities. Two women have held this position, Eleanor Green Jones and Sylvia Bozeman.

In 1989-90 the EXXON Education foundation funded a national project, "Making Mathematics Work for Minorities." It encompassed six regional workshops and a national convocation. The AAAS-AMS-MAA Committee on Opportunities in Mathematics for Underrepresented Minorities, chaired by Gloria Gilmer, proposed that the Mathematical Sciences Education Board (MSEB) undertake the project. Marcia Sward, then the Executive Director of MSEB and now of MAA, obtained the EXXON grant and had oversight responsibilities for the project. Many MAA members were involved; in particular, Beverly Anderson of the University of the District of Columbia, was Director.

OTHER MINORITY WOMEN IN MATHEMATICS

There are probably more Asian women mathematicians than African Americans but accurate data are not available about either the sex or ethnicity of MAA members. Furthermore, Asian mathematicians have not organized to draw visibility to their group.

There are fewer Hispanics in mathematics than African Americans. There are very few native American mathematicians, but Claudette Bradley, a native American woman from the University of the Arctic, is active in the AAAS-AMS-MAA Committee on Underrepresented Minorities.

PI MU EPSILON

Though not a part of the MAA, Pi Mu Epsilon, Inc. has been holding its national meeting in conjunction with the MAA summer meetings since 1952. At the turn of the century, many colleges had mathematics clubs for undergraduates, often organized by women students. In 1903, Mary B. Quinlan, a faculty member at Syracuse University, organized a mathematics club to encourage students in mathematics. She

became its secretary. In 1914, Helen Applebee, Purley J. Bentley and Olive E. Jones, three women students from Syracuse, obtained a charter to change the mathematics club to Pi Mu Epsilon Fraternity, Inc., a non-secret, mathematical honor society. They became the first officers of the society.

Helen Mary Barnard and Florence A. Lane were two of the first Councilors of Pi Mu Epsilon (1914-1922), but there were no more women for almost three decades. The next was Ruth Stokes in 1951-1957. Since then, a woman has been a councilor almost every year, with Gloria Hewitt being the first black officer in 1972-75. In 1987, Eileen Poiani of St. Peters College in New Jersey became the first woman president of the 258 chapters across the country. Poiani was instrumental in changing the name from Pi Mu Epsilon Fraternity, Inc., to Pi Mu Epsilon, Inc. in December, 1989.



Eileen Poiani

The Pi Mu Epsilon Journal was first published in 1949 with Ruth Stokes editing. All subsequent editors have been men. (Poiani, 1979).

THE SECTIONS AND LOCAL ACTIVITY

Immediately upon the founding of the MAA, various parts of the country raced to organize local sections: the Ohio and Kansas Sections organized in 1915, the Iowa Section in 1916, the Rocky Mountain Section in 1917. [Today, 15 of the 29 Sections have student chapters.] There were apparently no women Section chairs in those early years, but women were active at the grass-roots level. In 1939, Sophia H. Levy, mentioned earlier in this chapter, helped organize the Northern California Section. Women who have served as Section Governors are listed in Appendix II.

Paul Schaefer is writing a 50-year history of the Seaway Section (Upper New York State). He reports that he "was struck by the fact that the section has usually had women participating at all levels." Caroline A. Lester of SUNY at Albany was one of the five women signers of the organizing petition of that section in 1940.

Schaefer says, "Caroline Lester was a student of C.C. MacDuffee at the University of Wisconsin, and was one of the first woman Ph.D.'s in mathematics from Wisconsin. To give an indication of how things were in those days--1930's

to early 1950's—she told me then that she was not allowed to teach 'higher level courses' at Albany such as Calculus I until she received her Ph.D.!"

"Ellen Stokes had been a student of Bliss at Chicago, working in Calculus of Variations. She felt that her professional opportunities were so limited in the mathematics department of the 1940's, that she accepted the position of Dean of Women, leaving mathematics for good" (Schaefer, correspondence).

Other women Ph.D.'s maintained their connection with mathematics by becoming high school teachers. One of these is Katherine E. O'Brien, who received her A.M. in mathematics from Cornell University in 1924 and Ph.D. from Brown in 1939. In addition to serving as a referee and reviewer, O'Brien has contributed mathematical poetry to MAA publications for over forty years.

In an effort to obtain more information about the women in the Sections, this author sent a questionnaire to each section Governor in the spring of 1989. Often the male Governor passed the questionnaire on to a woman in the section for responses. For example, Linda Hill from the Intermountain Section wrote that she and Patricia Henry have held almost every office, except Governor. They have been on program committees, panel discussions, and local arrangement committees.

The questionnaire asked "How have the women in your section met challenges—

- of child-rearing responsibilities combined with a career
- reluctance or refusal of schools to hire women
- expectation that women academics serve on multiple committees, teach more, teach lower level courses, and are lower paid
- attitude toward women's ability to excel intellectually
- women's own tendency to consider their contributions and career to be of less importance than those of men."

One contributor responded, "All of us have had to face every one of these issues, and we have done so each alone with those terrible problems. We have apparently different solutions, but the struggle and the barriers, I believe, have been the same for all of us."

She added, "Now that I think of it, there are 'urban legends' about women here...shadowy figures. When I was first hired I was told that there had once been a woman in the department, although no one could tell me her name, or when, who was fired on the spot one day for having worn pants to the campus on a Saturday. Who knows? But that is the way I was

welcomed to this place I had come to work. I doubt that male mathematicians newly-hired here were welcomed the same way."

Another decried the lack of role models. "Women in mathematics at my school have such an indistinct history, you're not aware of any having been here. It gives you the feeling that either you are the first woman who has ever done this, either there have never been any others, or any woman who has ever tried failed. I would have liked to have some evidence that a woman could make it if she wanted to."

A response from Dr. Anne Henriques, Professor Emeritus of the college of Santa Fe, echoes the isolation for women. "I retired in 1971. I was usually the only full-time woman at the University of Utah (1937-1956). There were two of us at the University of New Mexico (1956-1962), and I was the only one at the College of Santa Fe (1961-1971). I attended most meetings, read only one paper. Once I was secretary of a division meeting. I spent a lot of energy running the Utah Council of Teachers of Mathematics and as Secretary Treasurer of Sigma Xi, too. There were no women's issues!" She added that during the Depression, "There were no jobs in 1932, so I stayed on for my Ph.D.—although I had no money." During the war, "I paid off a mortgage with the overtime at the University of Utah teaching in the Army program to train engineers."

J. Larry Marting, from Missouri Southern State College, wrote to tell about another woman pioneer, Martha McCormick. He says, "She began teaching at Joplin Jr. College when the college first opened in 1937 and taught mathematics full-time through 1971-72. She continued teaching part-time for several more years. Throughout those years she provided inspiration, encouragement and excellent instruction. She was the math department. she received the Alumni Merit Award from the University of Missouri-Rolla in 1978. She was not an alumnus of UMR but her reputation as a calculus teacher and as a pre-engineering advisor to countless students who transferred to Rolla earned her the award. She was selected as an Outstanding Educator of America in 1972." He added, "Martha earned an MA from the University of Chicago. I do recall her telling me that she did not feel welcome as a woman in mathematics at that time."

In 1945, Mary E. Haller, from the University of Washington, was one of eighteen petitioners to the MAA for the formation of the Pacific Northwest Section. The first women officers were Marjorie Enneking of Portland State University, who was elected chair-elect in 1980, and Sue Kaplan at Western Washington State University, who began a newsletter for the section in 1982 (Ross, 1987).



Photographed on the occasion of Governor Kean of New Jersey's presentation of Mathematics Awareness Week Proclamation, 1987. Shown here (L. to R.) are: Sister Stephanie Sloyan, Chair of the NJ MAA Section; Susan Marchand, MAA Governor; Agnes Azzolino, President of MATYC for NJ; with Ellen Brockman, President of the Association of Mathematics Teachers of NJ, in front.

Sister Stephanie Sloyan of Georgian Court College was one of the original members of the New Jersey Section in 1956 and has served as both its Chair and its Governor. Her article about women in the New Jersey Section appeared in the September, 1989, *FOCUS* and included a photograph taken by David Boliver, now a member of the Committee on Participation of Women. The photograph had previously been published in *Ms. Magazine* because all four of the leading mathematical officers in New Jersey at that time were women: Sister Stephanie was MAA Chair, Susan Marchand was MAA Governor, Agnes Azzolino was President of the Mathematical Association of Two-Year Colleges of New Jersey, and Ellen Brockman was President of the Association of Mathematics Teachers of New Jersey.

Sister Stephanie, who from 1968 to 1974 had been president of Georgian Court College, and Miriam Cooney (of the committee on Participation of Women) are studying religious women in mathematics and have located about 100 sisters who have earned Ph.D.'s in mathematics. Sister Lucille McKillop, president of Salve Regina College in Newport, RI, and Sister Brigid Driscoll, president of Marymount college in Tarrytown, NY, may be the only other women mathematicians who have served as presidents of colleges. Sister Felice Vaudreuil was secretary of the Wisconsin Section for many years. Green and LaDuke reported 17 women Ph.D.'s with religious vocations in the 1930's. For decades the MAA directories listed all sisters under "Sister" instead of their individual names, mute evidence of the non-communication between MAA leaders and one of its strongest women's contingents.

Domina Eberle Spencer (born in 1920) wrote to describe her mathematical history and that of her sister, Vivian Eberle (born 1907). She wrote that Vivian received her undergradu-

ate and masters degrees from Oberlin College, where Professor Cairns, head of the Mathematics Department and one of the founders of the MAA, introduced her to the Problem Section of the Monthly at an early age.

Deciding that she wanted to go to the Massachusetts Institute of Technology, Spencer recalls walking into Dean Pitre's office to ask about admissions. "There were no college boards, he merely began to talk scholarships. Actually the scholarship they gave me was only a token \$50 out of a tuition of \$500. They told me girls were bad investments."

Spencer describes the situation in the 1930's:

My sister wanted very much to teach. Penn said they would have been delighted to hire her if she were a man. Instead, Shohat found her a position in the Census of Mineral Industries in Washington. The pay was about twice what colleges were offering... Vivian had no interest in teaching at women's colleges and those seemed to be the only teaching possibilities... She turned out to be the top woman in the Bureau and the top statistician in the President's Materials Policy Commission. She did teach two statistics courses at American University in the evenings for many years, but the real reason she took the job was to pay for my education at M.I.T. The Depression had hit my father's business very hard and he could only contribute a small part. (By the way, Vivian never had a course in statistics!!)

So I blithely entered M.I.T. with no formal mathematics and no entrance test. The first fall I walked into the office of Professor H.B. Phillips and asked to take Professor Wiener's course in Fourier Series. Phillips leaned back in his chair and said he was teaching Advanced Calculus (a graduate course) that fall. He said if I could pass that he would give me credit for all my undergraduate mathematics. And that is how I managed to graduate from M.I.T. in 2 years with a bachelor's in physics.

Spencer then took a course with Dirk Struik. "It was the first course I had ever had in which the possibility of new research was even mentioned." She continued to take courses in physics and engineering, but earned her Ph.D. in mathematics with



Domina Eberle Spencer

Struik in 1942 at the age of 21. Since then, Spencer has written approximately 250 papers and nine books. At the age of 70, she is at work on more books and says she is thankful that mandatory retirement has been abolished as she hopes to have the fun of teaching for many more years.

THE 1980's



Dorothy Bernstein

The 1980's was a landmark decade. In 1980, Dorothy Bernstein became the first woman President of the Mathematical Association of America. In 1982, Julia Robinson became the first woman President of the American Mathematical society. Lida K. Barrett became the second woman President of the MAA in 1989, and in January, 1991, Deborah Tepper Haimo became the third woman President of the Mathematical Association of America.

Each November, with revised data reported in May, the AMS Notices provides statistics on graduates. The highlight of the 1988-1989 survey, was that 24% (98 out of 411) of the U.S. citizens receiving their mathematics doctorates are women. For the past six years, this number has been about 20% [10].

Statistics by Green and LaDuke show that women earned 14.3% of the mathematics Ph.D.'s granted to Americans prior to 1940, which is higher than the percentage of all Ph.D.'s granted to women in that period. This increased to about 16% after the 1920 Women's Suffrage Amendment to the Constitution was passed. The numbers then decreased to a low of about 5% in the 1950's due in part to the lack of jobs, the Great Depression, the war, the G.I. Bill (which gave an economic edge to males) and the post-war baby boom [11]. There was a gradual increase to 6% in the 60's, to 13% in 1976-1977 and to 20% in the mid-1980's. As mentioned in the previous paragraph, the percentage jumped to 24% in 1989.

Unfortunately, this impressive percentage increase is due to a drastic decrease in male Ph.D.'s, not a significant increase in females. In 1976-1977, there were 87 women and 602 men, but in 1986-1987 there were only 73 women and 289 men. Thus, although the percentage of women increased from 14% to 25% during this decade, their actual number dropped. The percentage of women graduate students in American mathematics departments did not change as dramatically as these numbers would indicate, however, because in 1989 54% of the mathematics Ph.D.'s awarded by American universities went to foreign students, where the percentage of males is greater than among Americans (NOTICES, November 1989). Thus the cohort of women providing peer support among American mathematics graduate students is not as strong as these numbers might suggest.

TABLE 6: U. S. Citizen Doctorates, Male and Female

	Doctorates who are			% Female
	U. S. Citizens	Male	Female	
1973-1974	677	618	59	9%
1974-1975	741	658	83	11%
1975-1976	722	636	86	12%
1976-1977	689	602	87	13%
1977-1978	634	545	89	14%
1978-1979	596	503	93	16%
1979-1980	578	491	87	15%
1980-1981	567	465	102	18%
1981-1982	519	431	88	17%
1982-1983	455	366	89	20%
1983-1984	433	346	87	20%
1984-1985	396	315	81	20%
1985-1986	386	304	82	21%
1986-1987	362	289	73	20%
1987-1988	363	287	76	21%
1988-1989	411	313	98	24%

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THE MAA COMMITTEE ON THE PARTICIPATION OF WOMEN

Seeking to encourage greater participation of women in the MAA, the MAA established the Committee on the Participation of Women in 1987. The activities of the Committee are described elsewhere in this booklet, but one of its major accomplishments has been to assist in getting women appointed to committees and nominating boards. The numbers of women who now serve may seem few, but they represent significant improvements.

In 1988, the chair of the Committee, Patricia Kenschaft, reported, "Women constitute about 23% of the MAA membership, and they are active and visible. Eight of the 38 members holding four or more national committee appointments are women, or 21%. However, only 16% of all committee members are women. If the seven committees that were formed because some groups are underrepresented in mathematics are discounted, only 11% of those serving on the remaining 123 national committees are women" (*FOCUS*, 8:4, 1988).

10 From 1960 to 1986, women M.D.'s increased from 5.5% to 30.8%; lawyers from 2.5% to 39%; engineers from 0.4% to 12.6%; and dentists from 0.8% to 22.6% (U.S. Bureau of the Census, 1989).

11 A brief description of how the status of women in mathematics has been changed in response to conditions in American society can be found in Duren, 1988.

AWARDS AND PRIZES

Outstanding mathematics achievement is recognized by awards and prizes. While about 23% of the MAA membership is female, less than 11% of Award Committee members are women. Of the four members of the Subcommittee on George Pólya Awards in 1989, Ann E. Watkins was an ex officio member. Deborah Tepper Haimo was one of five on the Committee on the Yueh-Gin Gung/Dr. Charles Y. Hu Award for Distinguished Service to Mathematics. (She is Chair of this Committee in 1990). Judith T. Sutcliffe was one of six on the Edyth May Sliffe Award committee. Lily E. Christ, as Chair of the Committee on the Merten Hasse Prize, was the only female chair. No women were on the committees for the coveted Chauvenet Prize, the Beckenbach Book Prize, the Lester R. Ford Awards, or the Putnam Prize Competition.

The numbers of women recipients of MAA sponsored awards and prizes is appallingly low. The Distinguished Service to Mathematics Award has been awarded 27 times since Mina Rees was its first recipient in 1961. Shirley Hill, who received the award in 1991, is the only other woman to be so honored.

No woman has ever won the Chauvenet Prize, awarded since 1925, for an outstanding expository article on a mathematical topic.

The Earle Raymond Hedrick Lectures began in 1952, and Mary Ellen Rudin has been the only female so honored.

The Lester R. Ford Awards for the outstanding article in the *Monthly* in the previous year began in 1965. Five out of the 114 recipients have been women. Margaret W. Maxfield won the Award in 1968, Olga Tausky Todd in 1971, Cathleen S. Morawetz in 1980, Judith Grabiner in 1984, and Joan Cleary in 1987.

Four out of the 24 winners of the Carl B. Allendoerfer Awards for outstanding articles in *Mathematics Magazine* have been women since the Award began in 1977: Doris J. Schattschneider in 1979, Marjorie Senechal in 1982, and Judith Grabiner in 1984 and 1989.

The George Pólya Award has been presented to women five times in the 26 years since it began in 1977. These winners were Anneli Lax, 1977; Freida Zames, 1978; Ruma Falk and Maya Bar-Hillel, 1984; Constance Reid, 1987; and Beverly L. Brechner (shared with John C. Mayer), 1989. Brechner is on the 1990 Pólya Award Committee.



Lily Christ

Of the thirty-three winners of the Certificate of Meritorious Service to Sections, the three women winners were Dorothy L. Bernstein, Maryland-DC-Virginia Section in 1985; Lily E. Christ, Metropolitan New York Section in 1986; and Aughtum S. Howard, Kentucky Section in 1988. Nura Turner, 1978, and Hope Daly, 1983, are winners of the Certificate of Merit Award, which has been made seven times.

Alice C. Beckenbach, who has attended almost every national MAA meeting since 1930, established the Beckenbach Book Prize in 1986 in memory of her husband, Edwin F. Beckenbach. This prize has been awarded three times. The Merten M. Hasse Prize was awarded twice. Neither of these prizes has gone to women.

A few prizes are named in honor of women. There is the Emmy Noether Research Instructorship, the ACM Grace Murray Hopper Award, and the Amelia Earhart Fellowship for aerospace studies.

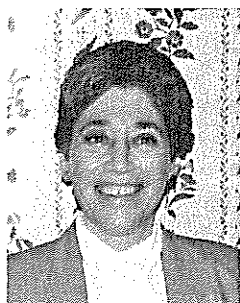
In 1988, the Edyth May Sliffe Award was established to honor outstanding high school teachers. In 1990, AWM established the Alice T. Schafer Award for excellence in mathematics by a woman undergraduate and the Louise Hay Award for Contributions to Mathematics Education.

PUBLICATIONS

In the decade following World War II, four women served as associate editors of the *Monthly*. Since 1972, at least one of the 13 associate editors of the *Monthly* has always been a woman. Since 1987, Louise Hay, Joan P. Hutchinson, Anita E. Solow, Judith V. Grabiner and Constance Reid have served as associate editors. Donna Beers succeeded Hay in January, 1990, after Hay's untimely death in October 1989. However, no woman has served as editor-in-chief since the *Monthly's* inception in 1894.

In addition to the *Monthly*, the MAA publishes *Mathematics Magazine*, *The College Mathematics Journal*, and its newsletter *FOCUS*. Women constitute less than 12% of the authors of each MAA journal. Only one major article of the *Monthly* in the years 1984-1988 was written by a woman (Kenschaft, *FOCUS*, May-June 1988). To help remedy this situation, the Committee on the Participation of Women sponsored a panel discussion and also a workshop at the 1989 national meeting on how to break into print in mathematics (Rosamond).

Mathematics Magazine was started in 1926, and the MAA began publishing it in 1960. In 1981, Doris Schattschneider became its first woman editor, thereby the first woman editor of any MAA journal. Martha Siegel became the second female editor of *Mathematics Magazine*, in January 1991.



Martha Siegel



Ann Watkins

Ann Watkins, co-editor with her husband William, is the first woman editor of the *College Mathematics Journal*, begun in 1970. In 1990, Katherine A. Franklin, Elizabeth J. Teles, and Kathie A. Yoder were three of the thirteen associate editors.

FOCUS, THE NEWSLETTER OF THE MATHEMATICAL ASSOCIATION OF AMERICA, was first published in March 1981 with Marcia Peterson Sward as its first editor. She remained editor as long as she was Associate Director of the MAA, through the January-February 1986 issue. Susan Forman of Bronx Community College became the first woman to chair the *FOCUS* Editorial Committee with the March-April 1989 issue.

Women have contributed financially to support the publications of the MAA. Alice C. Beckenbach's gift has been noted. The first MAA series, the Carus Mathematical Monographs, was made possible by a series of gifts from Mrs. Mary Hegeler Carus in 1921. None of the Carus Monographs has been written by a woman. In 1976, Carol R. Brink endowed the Raymond W. Brink Selected Mathematical Papers series in honor of her late husband, Raymond W. Brink, nineteenth President of the MAA. Miss Bessie Houck bequeathed her estate to the MAA and established the Jacob Houck Memorial Fund in honor of her father.

Mary P. Dolciani was an extremely successful author of high school texts, a long-time MAA member who served as a Visiting Secondary School Lecturer and a Member-at-Large of the Board of Governors. She was the first woman member of the United States Commission on Mathematical Instruction



Mary Dolciani
Photo Courtesy of Houghton Mifflin

and was a Governor of the New York Section. In 1974, she endowed the Dolciani Mathematical Expositions. The MAA headquarters, named in her honor after she donated a significant amount for its purchase, is known as the Dolciani Mathematical Center. In 1974, the board of Governors bestowed upon her an honorary Life Membership in recognition of her many services and contributions to the mathematical community, and to the MAA in particular (Rosenberg, 1974).

CONFERENCES

The MAA, AWM, and AMS hold joint meetings each January (about 4000 attended in 1990) and smaller summer meetings in August. Judith D. Sally, Northwestern University, presented one of the five MAA invited addresses at the 1990 national meeting. The four joint AMS-MAA invited addresses were all given by males, but Sun-Yung Alice Chang, University of California, Los Angeles, presented one of the six AMS invited addresses. The September, 1988, *AMS NOTICES* reported that women constitute 14% of the membership but are speakers for only 6% of the invited hour addresses or special sessions.

Activism by women can make a difference in the numbers of invited speakers at conferences. The International Congress of Mathematicians (ICM) in Helsinki in 1978 had no women speakers. A resolution was passed at a large international meeting at the congress organized by AWM urging that this situation be rectified at the 1982/3 ICM in Warsaw, and four women were invited to speak there.

However, the preliminary list for the 1986 ICM-Berkeley again revealed no women research mathematicians. Pressure was applied from various segments of the community, with the result that three women research mathematicians were on the final program. In 1989, the American Mathematical Society celebrated its Centennial with great fanfare. Karen K. Uhlenbeck, a member of the National Academy of Sciences, of the University of Texas at Austin was the only woman among the 21 invited speakers.

A minicourse on how to teach a course or seminar on women in mathematics was first offered at the Boulder meeting in 1989 and again in Louisville in 1990. The presenter, Miriam Cooney, of Saint Mary's of Notre Dame, Indiana, has pioneered this course at her own institution since 1982. She gives those attending the MAA minicourse a bibliography and expanded syllabus, as well as an experience of "process learning." Both minicourses were registered to capacity. A third of the participants said they plan to offer a similar course. The feminist literature is increasing in mathematics, but not as rapidly as in other fields.

The MAA sends representatives to other organizations. The Conference Board of the Mathematical Sciences did not have a female member of the Executive Committee in 1988-89, but since the Council consists of presidents of member societies, members in 1990 included MAA President Lida K. Barrett, AWM President Jill Mesirov, and Operations Research Society of America President, Judith S. Liebman. The MAA representative to the American Association for the Advancement of Science (AAAS) is Ruth A. Bari, and to the U.S. National Committee for Mathematics (NAS-NRC) is Sun-Yung Alice Chang.

Women and minorities was one of the three main issues discussed at the March/April 1989 workshop of the Conference board of the Mathematical Sciences (CBMS). AWM was an invited participant.

Three of the five U.S. Delegates to the International Congress of Mathematicians were women in 1990: Lenore Blum, Sun-Yung Alice Chang, and Linda Keen.

CONCLUSION

At the January, 1990, Joint MAA-AWM-AMS meeting, the MAA Committee on Participation of Women produced skits about microinequities (the scripts appear elsewhere in this booklet) that actually happened at the August, 1989 summer meeting. The fact that men and women were not afraid to act out these subtle discriminations, and that a large, enthusiastic audience recognized and was able to laugh at them, indicates increased awareness of our unconscious behavior.



Alice T. Schafer

In January 1989 *Everybody Counts—A Report to the Nation on the Future of Mathematics Education* was published by the Mathematical Sciences Education board, the board on Mathematical Sciences, and their joint committee on “The Mathematical Sciences in the Year 2000.” Alice T. Schafer, in her review of *Everybody Counts* for the *AWM Newsletter*, stated, “For the first time in my memory, in a report written by a group the majority of which is male, the following belief is expressed: ‘Gender differences in mathematics performance are predominantly due to the accumulated effects of sex-role stereotypes in family, school, and society.’ What is being said here is that women should now be encouraged to continue in the mathematical sciences! (Clearly, a student’s ability in mathematics should not be judged by sex, race, religion, etc., only by the individual’s capability.)”

There was a time when some women had no regular position, and thought it was natural. There was a time when some women felt that being in favor of women’s rights diluted their accomplishments. In addition to a change in attitude, there is solidarity among us now, and networking. It feels as if we are locked arm in arm, and if some women tire in the face of discrimination, the community will hold them up. We are all encouraging each other and celebrating each other’s successes. The more and louder we celebrate, the more we will attract other women into mathematics.

*Frances Rosamond is Chairperson of the Department of Mathematics at National University, a private university serving working adults with eleven learning centers in California, Southern Nevada and Costa Rica. She is active in the MAA, serving on four committees. Her research focuses on the connections between cognition, emotions, and belief structures. She earned her Ph.D. from Cornell University under David Henderson and Robert Gowin.

APPENDIX I

SOME IMPORTANT WOMEN IN MATHEMATICS OF THE 80’s & 90’s

Lida K. Barrett: Second woman President of the Mathematical Association of America (1989-1991). She serves on the Mathematical Sciences for the Year 2000 Project, on the Conference board of the Mathematical Sciences and on the Council of Scientific Society Presidents.

Dorothy Bernstein (1914-1988): First woman President of the Mathematical Association of America (1979-1981). Bernstein worked to have more women represented on MAA committees. She was on the Buildings Site committee in 1975, and was instrumental in locating a home for the MAA headquarters in Washington, D.C.

Lenore Blum: First woman editor of *International Journal of Algebra and Computation* (1989-1991); Co-founder and co-director of Math-Science Network Expand Your Horizons Program; an invited speaker and delegate to the International Mathematical congress 1990; Vice President, AMS (1990-91).



Lenore Blum

Iris Carl: President of NCTM (1990-1992). Frye and Carl are the first successive women President of the NCTM, and Carl is the first black woman president of NCTM. Iris Carl was the 1988 President of the National Council of Supervisors of Mathematics.



Iris Carl

Miriam Cooney: Taught the First MAA mini-courses about teaching courses on "Women and Mathematics," in August, 1989 and January, 1990.



Shirley Frye

Shirley Frye: President of the National Council of Teachers of Mathematics (1988-1990).

Gloria Gilmer: First Chair of the AAAS-AMS-MAA Committee on Opportunities in Mathematics for Underrepresented Minorities (1985-1992). She is also the first president of the International Study Group on Ethnomathematics (1985-).

Evelyn Boyd Granville: First black woman mathematician to receive an honorary doctorate (1989 from Smith College). In 1949 she and Marjorie Lee Browne were the first black women to earn doctorates in mathematics.

Deborah Tepper Haimo: President of the MAA in 1991. Thus, Barrett and Haimo are the first women presidents of the MAA elected successively. Haimo was first vice-president (1986-87) and chaired the committee that selected Marcia P. Sward as the MAA's new Executive Director.

Shirley Hill: first woman president of the NCTM (1978-1980). Also, first Chair of the Mathematical Sciences Education Board (1985-1990).



Shirley Hill

Grace Brewster Murray Hopper: First woman to be promoted to Commodore in the U.S. Navy (1985). She has since become an Admiral. The "Mother of COBOL."

Sandra Keith: Coordinator of the first National Conference on Women in Mathematics at St. Cloud State University, November 1989.

Patricia Clark Kenschaft: First Chair of the MAA Committee on Participation of Women (1987-1993).

Carol Lacampagne: First Chair of the Joint Mathematical Committee on Women (1984-1987). Second Director of WAM (1981-1988).



Joan Leitzel

Joan Leitzel: First woman Director of the Division for Materials Development, Research, and Informal Science Education of the National Science Foundation (1990).

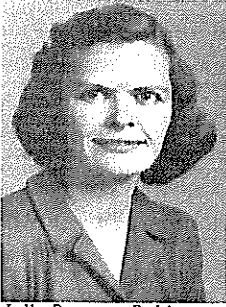
Cathleen Synge Morawetz: First woman to head a United States mathematics institute; she became Director of the Courant Institute of Mathematical Sciences in 1984. First woman Gibbs Lecturer (the 54th Gibbs lecturer) in 1981. Winner of the Lester R. Ford Award of the MAA (1980).



Cathleen Morawetz

Eileen L. Poiani: First woman President of Pi Mu Epsilon, Inc., the National Honorary Mathematics Society (1987). first national Director of WAM, the Lecturership Program of MAA. First woman representing the MAA selected to be the United States National Representative to the General Assembly and Head of the American Delegation to ICME-6 in 1988.

Mina Rees: First woman mathematician to have a library dedicated in her honor, the Mina Rees Library of the Graduate School and University Center of the City University of New York (dedicated 1985). First recipient of the MAA Award for Distinguished Service to Mathematics (1961).



Julia Bowman Robinson

Julia Bowman Robinson (1919-1985): First woman President of the American Mathematical Society (1982). First woman to be elected to the Mathematics Section of the National Academy of Sciences (1976). Second woman to be invited to deliver the Colloquium Lectures of the AMS (1980). First woman mathematician to receive a MacArthur Foundation Fellowship (1983).

Linda Rothschild, then President of AWM, and Julia Robinson, President of AMS, accepted a first: a citation by the MAA "in honor of those who have furthered the progress of mathematics by enhancing significantly the status of women in mathematics," at the joint annual meetings in 1984.

Mary Ellen Rudin: First woman U.S. member and also Chair of the official U.S. Delegation to the International Mathematical Union (IMU) in Berkeley, 1986. First Grace Chisholm Young Professor of Mathematics (1981) at the University of Wisconsin. Vice-President of the AMS (1980-81). Member of the National Research Council (since 1983). Member of the editorial board of *Topology and its Applications* (since 1976).

Alice T. Schafer: Planned the first tour of women mathematicians to the People's Republic of China for 1989. After violence in China caused the tour to be cancelled at the last minute, she led a tour of 18 women and 2 men (both members of AWM) in 1990.

Doris Schattschneider: First woman Editor of *Mathematics Magazine* (1981-1985). First woman to deliver Pi Mu Epsilon's J. Sutherland Frame Lecture (1988). (The second was Jane Cronin Scanlon in 1989.)



Doris Schattschneider

Judith S. Sunley: First woman Division Director of Mathematical Sciences of the NSF, 1987. Members of the advisory board for Mathematical Sciences include Susan Montgomery, Julia Knight, Mary Wheeler and Chuu-lian Terng. (Currently the Division of Astronomy also has a female Director, Dr. Laura Bautz.)



Judith Sunley

Photo courtesy of Joan Wexler

Marcia Sward: First woman Executive Director of the MAA (in 1989). She had been Associate Director from 1980-1985. First Executive Director of the Mathematical Sciences Education Board. Sward's Ph.D. is from the University of Illinois with a specialty in partial differential equations.



Marcia Sward

Karen Uhlenbeck: Second woman mathematician to be elected to the National Academy of Sciences. (There are only 57 female members.) Second woman mathematician to receive a MacArthur Foundation Fellowship. Third to be invited to deliver the AMS Colloquium Lectures (1985). The only woman to be invited to speak at the AMS Centennial in Providence. Named one of America's 100 Most Important Women on the Eve of the 1990's by the editors of *Ladies' Home Journal* (November 1988).

Ann Esther Watkins: First Woman Editor of the *College Mathematics Journal* (1988-1992).

APPENDIX II

WOMEN OFFICERS OF THE MAA 1916-1947

VICE PRESIDENTS

- 1920 Helen A. Merrill, Wellesley College
1927 Clara E. Smith, Wellesley College

ADDITIONAL MEMBERS OF THE BOARD

- 1917-19 Helen A. Merrill, Wellesley College
1918-20 Elizabeth B. Cowley
1923-25 Clara E. Smith, Wellesley College
1936-38 Mary Emily Sinclair
1945-47 Sophie Levy McDonald, U.C. Berkeley
- 1948 ASSOCIATE SECRETARY
1948-57 Edith R. Schneckenburger, University of Buffalo
- 1950 GOVERNOR AT LARGE
1950-52 Marie J. Weiss, Newcomb, Kentucky
Autumn School, Wesleyan College
- 1951 2ND VICE PRESIDENT
1951-52 Jewell H. Bushey, Hunter College
- 1957 SECTIONAL GOVERNOR
1957-60 Metropolitan N.Y., Jewell H. Bushey, Hunter College

- | | | | |
|------|--|------|--|
| 1961 | SECTIONAL GOVERNOR
1961-64 Upper N.Y. State, Harriet F. Montague, SUNY Buffalo
1961-64 Md.-DC.-VA., M. Gweneth Humphreys, Randolph-Macon Women's College | | GOVERNOR AT LARGE
1978-80 Katherine P. Layton, Beverly Hills H.S. |
| 1963 | 2ND VICE PRESIDENT
1963-64 Mina S. Rees, City Univ. of N.Y. | | 1979 PRESIDENT, MEMBER OF THE EXECUTIVE AND FINANCE COMMITTEE
1979-81 Dorothy L. Bernstein, Goucher College |
| 1965 | SECTIONAL GOVERNOR
1965-68 Md-DC-VA, Dorothy L. Bernstein, Goucher College | | 2ND VICE PRESIDENT
1979-80 Jacqueline C. Moss, Paducah Community College |
| 1967 | SECTIONAL GOVERNOR
1967-70 Northeastern, Grace E. Bates, Mt Holyoke College | | GOVERNOR AT LARGE
1979-81 Gloria F. Gilmer, Milwaukee Area Tech. College |
| 1968 | SECTIONAL GOVERNOR
1968-71 Louisiana-Miss., L. Virginia Carlton, Centenary College | | SECTIONAL GOVERNOR
1979-82 Kentucky, Jacqueline C. Moss, Paducah Commun. Coll. |
| 1969 | GOVERNOR AT LARGE
1969-71 Mary P. Dolciani, City Univ. of N.Y. | | 1979-82 Northeastern, Anne F. O'Neill, Weaton |
| 1972 | 1ST VICE PRESIDENT
1972-73 Dorothy L. Bernstein, Goucher College
GOVERNOR AT LARGE
1972-74 Shirley A. Hill, Univ. Missouri, Kansas City
SECTIONAL GOVERNOR
1972-75 Northern Calif., Mary V. Sunseri, Stanford Univ. | 1980 | PAST PRESIDENT, MEMBER OF THE EXECUTIVE AND FINANCE COMMITTEE
1979-82 Seaway, Mabel D. Montgomery, SUNY Buffalo
1981-86 Dorothy L. Bernstein, Brown Univ.
ASSOCIATE DIRECTOR
1980-85 Marcia Sward
GOVERNOR AT LARGE
1980-82 Susan J. Devlin, Bell Telephone Lab
SECTIONAL GOVERNOR
1980-83 Florida, Beverly L. Brechner, Univ. of Florida
1980-83 Michigan, Deila Koo, Eastern Michigan Univ. |
| 1973 | 2ND VICE PRESIDENT
1973-74 June P. Wood, South Texas College
GOVERNOR AT LARGE
1973-75 Mary E. Rudin, Univ. Wisconsin, Madison | 1981 | EDITOR OF MATHEMATICS MAGAZINE
1981-85 Doris J. Schattschneider, Moravian College
GOVERNOR AT LARGE
1981-83 Martha Zelinka, Weston H.S.
SECTIONAL GOVERNOR
1981-84 Kentucky, Martha F. Watson, Western Kentucky Univ.
1981-84 Northern Calif., Jean J. Pederson, Univ. of Santa Clara |
| 1974 | GOVERNOR AT LARGE
1974-76 Deborah T. Haimo, Univ. Missouri, St. Louis
SECTIONAL GOVERNOR
1974-77 Iowa, Elsie C. Muller, Morningside College | 1982 | GOVERNOR AT LARGE
1982-84 Marilyn J. Zweng, Univ. of Iowa
SECTIONAL GOVERNOR
1982-85 Kansas, Sister Jo Ann Fellin, Benedictine College
1982-85 Seaway, Violet H. Larney, SUNY at Albany
1982-85 Southwestern, Ivey C. Gentry, Wake Forest Univ. |
| 1975 | 2ND VICE PRESIDENT
1975-76 Betty J. Hinman, Downtown Coll. Univ. of Houston
GOVERNOR AT LARGE
1975-77 Mary B. Williams, Ohio State Univ.
SECTIONAL GOVERNOR
1975-78 Nebraska, Mildred L. Gross, Doan College | 1983 | GOVERNOR AT LARGE
1983-85 Eleanor Green Jones, Norfolk State Univ.
SECTIONAL GOVERNOR
1983-86 Louisiana-Miss., Carol B. Ottinger, Miss. Univ. for Women |
| 1976 | SECTIONAL GOVERNOR
1976-79 New Jersey, Eileen L. Poiani, St. Peter's College | 1984 | ELECTED MEMBER OF FINANCE COMMITTEE
1984-87 Lida K. Barrett, Mississippi State Univ. |
| 1977 | GOVERNOR AT LARGE
1977-79 Marjorie L. Stein, U.S. Postal Service
SECTIONAL GOVERNOR
1977-80 So. Calif., Alice A. Huffmon-King, Cal State Poly Univ. | | |
| 1978 | PRESIDENT ELECT, MEMBER OF THE EXECUTIVE AND FINANCE COMMITTEE
1978-79 Dorothy L. Bernstein, Goucher College | | |

- GOVERNOR AT LARGE
1984-86 Mary Harley Kruter, Fairfax County Schools
- 1985 SECTIONAL GOVERNOR
1985-88 Susan G. Marchand, Kean College of N.J.
- 1986 1ST VICE PRESIDENT
1986-87 Deborah Tepper Haimo, Univ. Missouri, St. Louis
2ND VICE PRESIDENT
1986-87 Ann Watkins, Los Angeles Pierce College
- SECTIONAL GOVERNOR
1986-89 East. Penn. & Del., Doris J. Schattschneider, Moravian C.
- 1987 GOVERNOR AT LARGE
1987-89 Judith E. Broadwin, Jericho H.S.
- 1988 PRESIDENT ELECT
1988-89 Lida K. Barrett, Mississippi State Univ.
GOVERNOR AT LARGE
1988-90 Marjorie L. Stein, U.S. Postal Service
- SECTIONAL GOVERNOR
1988-91 Allegheny Mt., Barbara T. Faires, Westminster College
1988-91 Missouri, Shirley M. Huffman, S.W. Missouri State U.
1988-91 New Jersey, Stephanie M. Sloyan, Ga. Court College
- 1989 PRESIDENT
1989-90 Lida K. Barrett, Mississippi State Univ.
GOVERNOR AT LARGE
1989-91 Sylvia T. Bozeman, Spellman College
- SECTIONAL GOVERNOR
1989-92 Illinois, Linda R. Sons, Northern Illinois Univ.
1989-92 Iowa, Anne K. Steiner, Iowa State Univ.
1989-92 So. California, Carol Adjemian, Pepperdine Univ.
- 1990 PRESIDENT ELECT
1990-91 Deborah Tepper Haimo, Univ. of Missouri, St. Louis
GOVERNOR AT LARGE
1990-92 Dorothy Wendt, Grissom H.S.
- 1991 PAST PRESIDENT
1991 Lida K. Barrett, Mississippi State Univ.
PRESIDENT
1991 Deborah Tepper Haimo, Univ. of Missouri, St. Louis

APPENDIX III

THE EMMY NOETHER LECTURES

Descriptions of the mathematicians and their lectures can be found in "The Emmy Noether Lecturers," prepared by Lori Kenschaft and published by AWM, 1988, Wellesley, MA.

- 1980 F. Jessie MacWilliams (1917-1990), "Survey of Coding Theory"
- 1981 Olga Taussky Todd, "Many Aspects of Pythagorean Triangles"
- 1982 Julia Robinson (1919-1985), "Functional Equations and Arithmetic"
- 1983 Cathleen Morawetz, "How do Perturbations of the Wave Work?"
- 1984 Mary Ellen Rudin, "Paracompactness"
- 1985 Jane Cronin Scanlon, "Model of a Cardiac Fiber Problem in a Singularly Perturbed System"
- 1986 Yvonne Choquet-Bruhat*, "On Partial Differential Equations of Gauge Theories and General Relativity"
- 1987 Joan S. Birman, "Studying Links via Braids"
- 1988 Karen K. Uhlenbeck, "Moment Maps in Stable Bundles: Where Analysis, Algebra and Topology Meet"
- 1989 Mary F. Wheeler, "Large Scale Modeling of Problems Arising in Flow in Porous Media"
- 1990 Bhama Srinivasan, "The Invasion of Geometry into Finite Group Theory"

*The first woman elected to the French Academy of Sciences in its 300-year history. Even Marie Curie had been rejected.

APPENDIX IV

PRESIDENTS ASSOCIATION FOR WOMEN IN MATHEMATICS

- 1971-73 Mary Gray
1973-75 Alice T. Schafer
1975-79 Lenore Blum
1979-81 Judy Roitman
1981-83 Bhama Srinivasan
1983-85 Linda Rothschild
1985-87 Linda Keen
1987-89 Rhonda Hughes
1989-91 Jill Mesirov

APPENDIX V

SALARIES

The lack of equity in employment and salaries has been and continues to be grim. The 1989 AMS Survey (*Notices*, May 1989) reports that women comprise 24% of the U.S. citizens receiving doctorates, but only 16% of those obtaining employment in doctorate-granting institutions; that is, 16% of the new doctoral hires in U.S. doctorate-granting departments were women. The percentage of women full-time faculty in institutions granting doctoral degrees is only about 6%.

Betty M. Vetter, in the May 1989 AAAS Observer, tells us that women scientists, "continue to be paid considerably less than men in the same field and at the same experience level." Salary differences begin with the first job and the gap widens with years of experience. Forty percent of Ph.D. women have ten or more years of experience. Vetter says that "salaries of full-time women doctoral scientists cease to rise after 25 years of experience, although male salaries continue upward for another decade." Unemployment is almost twice as high for women doctoral scientists and engineers as for men. Men are considerably more likely than women to be tenured or on tenure track. As graduate students, women tend to be self-supporting while men have research or teaching assistantships or grant support.

One of the most insidious myths is that most women are supported by their husbands. This is generally not true and women continue to struggle to support themselves and/or dependents. This lack of financial support may contribute to the attrition of women from graduate schools [12]. The May-June 1989 AMS NOTICES reports that 47% of the junior and senior mathematics majors are women, yet they are less than 20% of the Ph.D. holders. In 1980, President Carter signed the Women in Science and Technology Equal Opportunity Act that called for a 125 million dollar program under the National Science Foundation (NSF) to support women. President Reagan decreased the funding, but NSF still has programs that offer support to women: Standard Research Grants, Research Initiation Awards, Research Planning Grants, Career Advancement Awards, and the Visiting Professorships for Women. In addition there are the Minority Research Initiation Awards and the Facilitation Awards for Handicapped Scientists and Engineers.

The July-August, 1989, *AWM Newsletter* reported that twelve of the ninety-one Sloan fellows in sciences and economics are women. "Albert Rees, President of the Sloan Foundation, said, 'We are most pleased that there are twelve women among the new fellows, the largest number in more than

decade. We hope that this indicates a longer-run increase in the number of outstanding women attracted to academic careers in science.'" (could it be that providing support for women may attract them to these careers and enable them to participate?)

12 R.G.D. Richardson, writing in 1935, used a variety of measures to conclude that fellowships stimulate individual research.

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Women in MAA Leadership and in the American Mathematical Monthly

Lida K. Barrett and Mary W. Gray

Often we are asked why there are not more women in leadership positions in mathematics. It may seem to some that there are so few women in the field that it is a question of supply. However, both historically and currently, the issue is not that simple, if by history we confine ourselves to the life of the Mathematical Association of America, founded in 1915. In the 1920's it was less the case than now that to aspire to a leadership role one probably needed a Ph.D., but it was still an objective measure of the presence of women in the field and indicated that there were many women available. In 1921, 40% (6 of 15) of the Ph.D.s in mathematics went to women, a figure that has not yet been equaled. In the 1931-1935 period it was 15.7%. Then the figures declined even more, hitting a low of 4 to 5% in the late 50's and early 60's. The percentages began a slow incline upward after two events of 1972: Title VII of the Civil Rights Act of 1964 became applicable to college faculty and the Association for Women in Mathematics was founded. AWM worked tirelessly to increase the participation of women in mathematics and to improve the status of women in the field, and discrimination became illegal if not nonexistent. A figure of 34% of the Ph.D.'s in mathematics going to women was reached in 1998-1999 and since then the percentage generally has hovered in the high twenties. Thus there has been little question of supply at the inception of the MAA or in recent years.

It is often remarked that when a minority reaches the level of 15% there is a critical mass, a mass that makes less exclusionary attitudes likely and leads to even more substantial representation of the minority. Although this benchmark was reached (for the second time after a decline of several decades) more than twenty years ago, the subsequent pipeline effect has led only in isolated instances to substantial increases in the proportion of women in the leadership of top departments or professional organizations. It should be noted that the MAA has a better record (four women presidents in nearly 100 years) than the AMS (two presidents in 130 years), but not nearly as good as the ASA, where four of the last seven presidents have been women for a total of twelve out of just over 100. All ten of the American women who received Ph.D.'s in the nineteenth century were active in the AMS soon after its founding in 1888, but the continuation of participation or its spread to the MAA has been sporadic at best.

That the mathematical sciences have been particularly inimical to women is easy to believe. However, prominent mathematicians have promoted the inclusion of women going back to the end of the nineteenth century. Gösta Mittag Leffler was responsible for getting a professorship for Sonya Kovalevskaya at the University of Stockholm (it took 100 years for there to be another women professor of mathematics there), Arthur Cayley was noted for his advocacy on behalf of advanced education for women, G. H. Hardy reportedly found the implication of sexism in the questioning of Olga Taussky-Todd offensive¹, and David Hilbert is known (at least in legend) for declaring that Emmy

¹ At her job interview for a position at Girton College, a member of the committee asked her, with motivation we can imagine, "I see you have written several joint papers. Were you the senior or the junior

Noether should not be excluded from the Göttingen University Senate on the basis of sex as it was, after all, not a bathhouse. True, envious male mathematicians have asserted through the ages that there were only two women mathematicians, one of whom (Kovalevskaja, whose work was said to be due to Weierstrass) was not a mathematician and other one of whom (Noether, sometimes referred to as “Der Noether” or the “father of algebra” in not necessarily flattering ways) was not a woman. That the Christian mobs of Alexandria slaughtered Hypatia probably is not, however, primarily attributable to either her sex or her mathematics. Much more recently, however, a well-known mathematician, former president of both the AMS and the MAA, asserted that at his prominent institution they once hired a woman for the math faculty but she was not really very good so that they did not hire more women. He also had earlier remarked that the women Ph.D.’s trained at his department were not destined for the faculty of research universities. On the other hand, such mathematicians as I. N. Herstein, [Lipman Bers](#), and [Gail S. Young, Jr.](#) were well known for their encouragement of women.

However, we were charged with examining the role of women in the MAA. The part played by women in leadership in the MAA over the last fifty years can be discerned by a look at the offices held by women at the national level. The list of national officers and Section Governors appeared in the Monthly on a more or less regular basis until 1983. Going back to MAA’s tenth year in a special issue of the Monthly in November of 1924 there is a list of all the officers back until 1917; in each year there are one or two women listed as elected members of the Council. In the 1927 listing Clara E. Smith of Wellesley College is listed as a Vice President. There are five women listed as section officers. This pattern more or less can be seen to have continued in the lists that are available.

Using the list of officers, the Board of Governors, and committees that appeared in the Monthly from 1960, fifty-five years ago, to 1983, when the list of officers and committees no longer appeared in the Monthly, we can see the pattern over this time.

In 1960 there were no women national officers. In the 27 sections, Jewel Bushey as Governor of the Metropolitan New York section was the only woman Governor. There were 24 committees and women served on just two, those related to secondary schools-lecturers, and contests. In 1961, there were two female section governors. In 1963 the second vice president was [Mina Rees](#) who in 1964 received the first Distinguished Service Award.

Throughout the rest of the 1960’s there were one or more women serving as section Governors and three to five on committees. In 1972 Dorothy Bernstein served as First Vice President; there was one woman on the Board of Governors; and there were women serving on twelve of the twenty nine committees of the Association.

In 1973 June Wood was the Second Vice President and in 1975 Betty Hinman was Second Vice President. In 1975 women served on twelve committees; sometimes a

author?" G.H. Hardy, also on the committee, immediately interjected, "That is a most improper question. Do not answer it!"

woman served on more than one committee. In addition five women served on the Board of Governors.

In an email, David Roselle, who served as secretary beginning in 1975, said, “I do not think of myself as a good source of information about women and the MAA. The MAA became a better organization as a result of there being additional women in the profession. What I will say is that women were welcomed by the MAA and that I do not recall any reluctance to appoint women to committees, as Executive Director, invited speakers, authors, editors, etc. In brief, things related to women were as things related to women (and all others) should be.”

The pattern of women’s participation as one of the officers and on the Board of Governors continued. In 1982 there were 26 women as members of committees. [Marcia Sward](#) became Associate Director of MAA. By 1984, the last time the Officers and Committee Members were listed in the *Monthly* there were twelve women on the Board of Governors; there were 32 committees and, counting the women on subcommittees, thirty places were held by women.

The participation of women continued to grow as the size of MAA continued to grow. [Dorothy Bernstein](#) became President elect in 1978 and served 1979 and 1980. [Lida K. Barrett](#) was President in 1989 and 1990, followed by [Deborah Haimo](#) in 1991 and 1992. The secretary’s report in August 1999 reports the election of [Ann Watkins](#), who served as President in 2001 and 2002, with Barbara Osofsky serving as First Vice President and Tina Straley being appointed as the new Executive Director succeeding Marcia Sward, women in three key leadership roles.

The appendix is a chart, a record kept by the MAA office, which details the participation of women in MAA over the period from 1998 to 2009.

The history of the MAA is closely linked with that of the *American Mathematical Monthly*, so it seemed appropriate to look at the role of women in the *Monthly*. At the beginning, it was customary to list most given names with initials only, so it is difficult to know how many women can be numbered among the founders and early members. However, there seem to be exceptions to this custom, interestingly nearly all of which appear to be names which are generally identifiable as those of women. Thus it would probably be possible to put a lower limit of the number of women in the early membership lists, but not an upper limit. For what it is worth, we can note that the list of 104 at the founding meeting includes nine with names superficially identifiable as female [19]. What is more interesting it that virtually all of these women are high school teachers, graduate students, or faculty at small colleges, mostly colleges for women only. Of the four officers and twelve Council members chosen, none is identifiably a woman, but there was one woman selected for the twelve-member committee on publications. The absence of women in more prestigious positions cannot, of course, be blamed solely on the MAA itself. However, when the first president asserted in his “Tentative Platform of the Association” that “No man can speak with authority concerning the future of this Association,” it is unlikely that he intended that a woman should, as he later stated “The chief motive may well be said to be that of service to the whole body of teachers of

mathematics in American colleges. If I am right, the Association will not stop at anything which will serve this body of men.” However, it was said that 125 of the 500 “charter members” were women. Progress was slow; a 1953 list of sectional governors has no women.

What then of the *Monthly*? The language used by writers is instructive. Often there is an effort at inclusiveness as the recruitment of “men and women” to the study of mathematics or the activities of the Association is noted. On the other hand, any time the topic turns to research, the attempt at inclusiveness fails. In fact, in the early days of the organization it appears that the term “researcher” was unknown; instead we see repeated references to the “man of research.”

Bias in language also had a habit of showing up in problems as late as the one relegating women and dogs to the same status in 1962: In how many ways can a party of m men, w women, and d dogs be arranged in a row so that neither two women nor two dogs are together? Of course, perhaps that was a long-standing holdover from pre-MAA days of the *Monthly* (1902) when a typical problem had women going to market to sell their eggs. Eventually increased sensibilities led to an article entitled “Non-Sexist Solution of the Ménage Problem” [4]. We also hear in 1977 of a talk, “Choosing a Wife,” at an MAA meeting by Leonard Gillman, the declared reason for which was not only to present some interesting mathematical reasoning, but to make a mathematical contribution in support of equal status for women, obviously perceived to be necessary. The talk was based on earlier *Monthly* articles and was followed by one by David Gale and Marilda Sotomayor (described as his mathematical grandchild) demonstrating that “Machiavellian” behavior in a matchmaking game could benefit women [11]. Although through the years there have been relatively few articles by women, we do see women proposing solutions to problems and very rarely as speakers at meetings or as officers of regional groups early on in the MAA’s operation of the journal.

A 2001 *Monthly* article “Towering Figures in American Mathematics, 1890-1950” contains little about women, mentioning two students: Lucille Smith, noted as “later Mrs. G.T. Whyburn” and the distinguished mathematician Mary Ellen Rudin, who obtained her doctorate with R.L. Moore at the end of the period of review (at least not described as the wife of Walter Rudin) [39]. There is a reference to Mina Rees, certainly a major figure in American mathematics, if not “towering,” but she commands only a passing reference to her own *Monthly* paper [36]. The influx of émigrés is described as the most dramatic development of the 1930s but Emmy Noether doesn’t rate a mention.

The next year Mina Rees’s key role in funding mathematical sciences and in the development of computer science in universities deserved an article [38]. Amy Shell-Gellasch notes that Columbia did not welcome female doctoral students and Rees later obtained her Ph.D. at Chicago, a major producer of women Ph.D.’s in the pre-World War II period (largely Leonard Dickson’s influence), if not a place for women to obtain faculty positions. Rees, like most others, graced the faculty of a women’s college, Hunter, before taking up the position with the wartime Applied Mathematics Panel that led to her later enormous influence; interestingly she attributed her AMP appointment to

her acquaintance with Courant and his reliance on the “buddy” system. Rees’ assistance to young researchers included support of Mary Cartwright and Olga Tausky Todd. Rees was a long-time activist in the MAA and AMS, receiving MAA’s first Award for Distinguished Service to Mathematics. AMS and IMS also honored her. She was the first female president of the AAAS, but was never in a leadership role in the mathematics organizations.

Sophie Germain appears in the *Monthly* through a review by Joseph Dauben of *Sophie Germain: An Essay in the History of the Theory of Elasticity* by Bucciarelli and Dworsky [7]. The authors and the reviewer both consider Germain’s mathematics disappointing, but attribute this to her lack of a sound mathematical foundation on which to build her work, especially that in elasticity, and limited interaction with the active contemporary mathematical community. Brief mention is made by the reviewer of the work for which she is best known, partial results on Fermat’s Last Theorem.

There is a review [1] of Ann Hibner Koblitz’s biography in which the reviewer pays tribute to Kovalevskaia as “the author of influential papers [who] was respected by the mathematical community for mathematical abilities beyond those reflected in her research.” An earlier article [34] emphasizes later work by other mathematicians building on that of Kovalevskaia but rather cavalierly dismisses the contemporary criticism of her early work, particularly that leading to the Bordin Prize.

Lenore Blum’s review of Constance Reid’s *Julia: A Life in Mathematics* characterizes the 1970’s as a time of consciousness raising for women in mathematics after the naiveté, denial and lying low of the 1960’s, concluding that subsequently women mathematicians have proactively developed constructive programs to increase the participation of women in mathematics [5]. With that came honoring of the two women in the derogatory quotation, Emmy Noether and Sonya Kovalevskaia, in various commemorative ways. Also in 1996 the AWM held the Julia Robinson Celebration of Women in mathematics and subsequently the book, a compilation of four articles on Robinson’s life and work, in particular the evolution of the solution to Hilbert’s tenth problem, appeared.

Blum also relates the following quotation from *Julia* of Robinson’s election to the NAS:

“When the University press office received the news, someone there called the mathematics department to find out just who Julia Robinson was. ‘Why, that’s Professor Robinson’s wife.’ ‘Well,’ replied the caller, ‘Professor Robinson’s wife has just been elected to the National Academy of Sciences.’”

Robinson’s health would not accommodate a full time teaching load and the Berkeley department had never before seen fit to offer her a real part-time position. The same year as her election, the math department decided to give her a full professorship (with the duty of teaching one-fourth time. [Julia](#) was the first female president of the AMS (1983-1984) ([Cathleen Morawetz](#) being the second and last (1995-1996)).

But sometimes when women mathematicians write in the *Monthly*, there is little evidence of sisterly appreciation of others' work. Cathleen Morawetz, reported in "Giants," [32] on the progress and changes in applied mathematics from the founding of the MAA until 1990. Outside of a vague mention of a nameless daughter of George Boole and aunt of Geoffrey Ingram Taylor, a pioneer in the study of turbulence (Taylor is one of Morawetz's "giants"), we hear little of women.. The author's references to her own career do note her inability to lunch in Cambridge Commons or enroll in Caltech, but hint at the advantages of the paternalistic buddy system. One is tempted to ask: will subsequent women mathematicians name earlier women as their "giants." Indeed, for Blum, Robinson was a "giant."

In its earliest years, the *Monthly* addressed the issue of women's mathematical education head-on. In 1917 we find a discussion "Relating to Required Mathematics for Women Students," one of the rare articles written by women in those years [26]. The argument is made that "some college mathematics" is needed if a woman student "is to have an education that will send her out into life with the best general equipment." The college mathematics thought to be essential is college algebra and trigonometry, distinction being made between the routine of high school algebra and the logic and reasoning involved in college algebra courses, bolstered by the contention that mathematics—unlike economics or philosophy—furnishes the woman student with a subject in which the validity of the conclusions drawn from its laws can easily be tested, and in which "the personality of the instructor and the bias of the student can play no part." Apparently this is proposed as necessary because of the fact that "the woman is prone to look at everything from the personal side." The article continues to remark upon the trend towards requiring science courses of women and the fear that removal of a mathematics requirement will push them towards "non-mathematical sciences (if such sciences truly exist) ... These fields may be wide and they may be fertile, but by permitting this limitation women are denying to themselves the equality of opportunity with men that has been won for them at such a cost by the pioneers in the struggle for the right of women to share in the higher education." Whether mathematics should be required of everyone (man or woman) and what mathematics should it be continue to be the subject of discussion a century later in the MAA and elsewhere, but so also does what equality of opportunity should mean and how should it be assured.

A 2001 article [17] recounted the role of mathematics in World War I, including that of Elizabeth Webb Wilson, a "computer" before there were computers, who constructed a new range table for field artillery at the office of mathematical ballistics, where she worked with seven other women computers. In a bow to equal opportunity, the 1924 report on research fellowships in mathematics recently funded by the Rockefeller Foundation described one purpose as "the opportunity for more thorough training of young men and women in research." However, the fundamental requirements of an applicant were said to include "promise for the future backed by the opinions of men closely associated with him in scientific work" [27].

With U.S. entry into World War II only months off, “On Education for Service” made eloquent appeals for more extensive mathematical training for men and women, foreshadowing the significant role to be played by women, especially as “computers” by asserting “In particular, it would be desirable to have numerous women trained through the stage of elementary mathematical statistics, for the use of government, the professions, and industry.” Other recommendations include training for inductees into the armed services in eighth and ninth grade “modern” mathematics and the study by “each boy and girl of sufficient mathematical aptitude” of solid geometry and spherical trigonometry as a patriotic action. [18] However, in 1943 another article on mathematics in wartime mentioned that five institutions provided special courses involving mathematics for the training of women, but could cite only one success story, a woman who, “with an A.B. degree in mathematics (Phi Beta Kappa key!) obtained an attractive position in the Research Laboratory of the United Aircraft Corporation at East Hartford, Connecticut.” Apparently the *Monthly* editors failed to see how ridiculous this statement appeared. [33].

Some thirty years after the pleas of 1917, perhaps as a result of the call for patriotism cited above, the Women’s Bureau of the U.S. Department of Labor produced, as part of a series of opportunities for women, a booklet on the outlook for women in mathematics and statistics [28]. More than a prospective look, the booklet provided a study of what women had been doing during World War II. The *Monthly* review notes that the booklet might be a useful guide for all seeking to earn a living by following some mathematical profession, but did not foresee how the propaganda to keep women out of the paid work force would mean that few women might be among the successful job seekers in the coming years. Similar booklets were produced in 1956 and 1957 [13].

On the other hand, the 1946 “Rehabilitation of Graduate Work” [20] speaks of the need to continue the research done by men and proposes the creation of “as many as 6000 four-year scholarships to enable young men who show scientific promise to work for the bachelor’s degree.” The article concludes by calling on the MAA to meet the challenge of “widening the frontiers of mathematical truth,” but apparently not for women.

The famous Gardner report of 1956, “A National Weakness” [12] refers repeatedly to the need for better mathematics education for all youngsters but then opines “The national need for *men* [emphasis added] with scientific and mathematical competence exists at all levels. It is not just that we need more creative scientists at the Nobel Prize level. Behind the great creative minds in science moves an army of able and superbly trained *men* who test and confirm (or reject) new discoveries” When he reaches the level of well-trained and skillful laboratory technicians and assistants, the gender-specific language disappears.

The result of the change in societal norms immediately after World War II was reflected in an article the next time the question of women and mathematics appeared in the *Monthly*, at the half way point between the period of the discussion of 1917 and the present but after more than a decade of women retreating from the work force. Many reached the conclusion that women were needed back in the paid work force if the

education situation cited by Gardner was to improve. In a brief new item we learn of a program at Rutgers for the “Re-Training in Mathematics of College Graduate Women” [29]. Funded as a pilot program by the Ford Foundation, the “program was set up in recognition of the fact that college graduate women who wish to start or resume professional work after years of raising a family need guidance and re-training” and recognizing that relearning old or learning new mathematics is essential to the process. Several years later the *Monthly* reported [25] that 188 women and 2 men had successfully completed one or more semesters of the program. As the program was motivated by the shortage of qualified mathematics teachers, not surprisingly the majority of those completing an entire program were teaching. Nearly half a century later we still have this shortage although among the many programs designed to address the issue there may not be any exactly like that of Rutgers in the 60’s. Should there be? Is the situation so different now than it was then?

What has changed in the last forty years is the percentage of degrees in mathematics at each level going to women. In 1961 [22] it is reported that 28.9% of bachelor’s, 18.8 % of master’s and 5.3% of Ph.D.’s in mathematics and statistics were awarded to women, a result much worse than the figures for Ph.D.’s in either 1930 or 2009; as noted above, in 1921 the percentage of women among those getting Ph.D.’s was 40% (admittedly that amounted to only 6), but in the period 1931-1935, the percentage was 15.7% (63 women) [21]. W.L. Duren, in a article recounting his experience as a graduate student at Chicago in the 1920’s [9], says “Only years later did I learn that it was considered unladylike to study mathematics...I wonder if the current women’s liberation has even yet succeeded in pushing the professional status of women to the level already reached in the twenties.” Note that the wide presence of women with Ph.D.’s was not reflected on the faculty of research institutions either then or now.

The employment of women mathematicians is a phenomenon little commented upon in the *Monthly*. It is clear that the healthy production of women Ph.D.’s in the 20’s and 30’s did not result in very many women being hired on the faculties of major universities; those who were employed in higher education were generally at women’s colleges. However, gradually such colleges, for whatever reason, began to employ more men, eliminating jobs for women as faculty and as role models for women students, without a concomitant rise in the percentage of women on the faculties at men’s colleges or at integrated institutions. The conversion of many women’s colleges to co-ed institutions may well have contributed to fewer jobs for women and to fewer women inspired to go to graduate school in mathematics. Even today the production of women Ph.D.’s exceeds their intake on the faculties of top research institutions. Currently annually statistics are gathered under the auspices of MAA and other mathematical and statistical organizations but are generally published in detail only in the *Notices of the American Mathematical Society*.

In 1961, an article by the distinguished mathematician and administrator Mina Rees reported on the topic she knew so well, “Support of Higher Education by the Federal Government” [35]. In discussing where the personnel will be found for the mathematical tasks foreseen, she asks “What of women?” After admitting that

“historically, women have characteristically not been productive mathematicians... In teaching, however, and in many phases of applied mathematics that are now claiming large numbers of our trained youth, women have performed most effectively.” She continues with a rather negative assessment of the potential of women in mathematics, but doesn’t address the always interesting issue of whether women are more attracted to some fields than others. For example, the percentage of Ph.D’s in statistics going to women is close to 50%, far higher than in other sub-disciplines in the mathematical sciences.

Serious, more sustained attention to the issue of women in mathematics was kicked off with an article with that title (authored by one of the current authors) [15]. The subject of “Women in Mathematics” was primarily to report on a panel at the 1971 Summer MAA meeting. Topics included the contemporary paucity of women on mathematics faculties at research institutions, the existence of women mathematicians in the past, the effect of cultural conditioning, and finally proposed efforts to increase the participation of women in mathematics as well as their status within the profession. Remedies that would “level the playing field” were favored in general by the panelists. Gray described the founding of the Association for Women in Mathematics, which has grown over its nearly forty years to an organization of several thousand women and men. In a report in the *Monthly* on the same session, it was noted that the MAA could help improve the image of women—as-mathematicians by including women in their leadership, by featuring women in films, etc. [30]. Although it is true that the number of women who lead and serve on MAA committees has increased since 1971, no systematic study has been reported in the *Monthly* in the subsequent nearly forty years.

In the very next issue of the *Monthly* [14], Murray Gerstenhaber included his views on the role of women in his predictions concerning undergraduate mathematics education in 1984, including a gratuitous remark implying that women spend most of their time on the phone. His opinions were perceived by many as presenting “stereotyped, derogatory and negative views of women in the mathematical, academic and professional world” in a follow-up article the following year [2]. In particular, objections were raised to the implication that mathematics would need to be somehow watered down to accommodate an influx of women whose “principal expertise [would consist] in using a computer cleverly.”

The following year “Female Mathematicians, Where are you?”[21] focused on the large dropout rate for women from bachelor’s in mathematics to Ph.D.’s: (from 36% to 7% in the 1966-1970 period). The author raises the question of whether graduate schools are making a real effort to admit more women and award them assistantships, but also asks what causes women to lose interest—could it be sexism in society or, the Larry Summers question: “do females have less aptitude for doing mathematical research than do males?” But by this time the *Monthly* began to report future meetings of the Association for Women in Mathematics along with those of other mathematics organizations.

By 1976, more mathematicians had taken an interest in “Mathematics and Sex.” [10]. This *Monthly* article focused on sex differences in the education of males and females. One finding of interest in a small sample survey was that throughout K-12 there was little difference in the *liking* of mathematics between girls and boys; other more conventional results included that the influence of parents on what their children study is significant and that parents may be conveying to their children a feeling that mathematics is not an appropriate area of study for their daughters. Also important was the role of this article in publicizing a key report by Lucy Sells identifying the fourth year of high school mathematics as the “critical filter” reducing the participation of women in mathematics and science [37]. Attrition rates for men and women from the calculus sequence in college in surveys reported in the article differed substantially in favor of men; other sources of lack of encouragement of women in college courses were also documented. The problem of stereotyping of successful women mathematicians was also highlighted as a deterrent to women’s pursuit of the profession. Figures cited showed that the proportion of women on university faculties fell far below their percentage among those receiving Ph.D’s, a phenomenon that still exists although both percentages have risen substantially since the appearance of this article. The article itself as well as its extensive list of references certainly should have provided a wake-up call for the profession. Perhaps a specific follow-up might be a worthwhile task for the MAA, since little of a similar nature has appeared in the *Monthly* in the last thirty-three years.

The next year found another article, again by one of the present authors, focusing on “The Mathematical Education of Women” [16]. In part it was directed at the “critical filter” argument that the author believed was being used by some mathematics faculty as a means to absolve themselves of the responsibility for the scarcity of women at the graduate level in mathematics, the “filter” theory being that the damage was already done by the deficiencies in women’s high school backgrounds before they ever reached college. An argument was made for efforts at remedial programs, if required, plus positive encouragement along the way, including providing some role models. It was noted that even though the percentage of women among Ph.D. recipients was not as high as one might like, it was still much higher than the percentage of women among the mathematics faculty at prominent research institutions. Various techniques to improve the entry and advancement of women in mathematics were proposed.

In 1979 Luchins reported on “Sex Differences in Mathematics: How Not to Deal with Them” [23], including various survey results reporting evidence of discrimination of women in mathematics and examining attitudes of men and women regarding sex differences in mathematics. Particularly noteworthy was her refutation of the supposed prevalence of mathematical anxiety among women and the resulting harm done by the publicity centering on it.

The *Monthly* reported that at the 1979 Summer MAA meeting a talk by Luchins on “Women and Mathematics: Fact and Fiction,” attempted to separate fact from fiction based on survey data. However, no details of the conclusions were cited [31]. In 1981 an article based on this talk was published [24]. The author discussed a number of studies that have been made of possible sex differences in a number of abilities, such as verbal,

spatial, and physical strength, concluding that data are far from clear cut insofar as they relate to mathematical ability. She also cited the legendary connection between madness and mathematical genius as an extreme example of what may be fact or fiction.

More than thirty years later there has been almost nothing more in the *Monthly* on the issue of women in mathematics, although W. E. Kirwan's article "Mathematics Departments in the 21st Century: Role, Relevance, and Responsibility" (Jan. 2001, pp. 1-9) touches on the subject. Would that the problems had been solved. We have seen in that 30 year period a number of women in leadership roles in the MAA as president and as executive director and some projects designed to increase the participation of girls and women in mathematics. But perhaps it is time for the MAA to meet the 1946 challenge of widening the frontiers of mathematics for women as well. In particular, guidelines for increasing the participation of women in leadership roles might address what impediments women create for themselves as well as institutional obstacles.

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Appendix

Mathematical Association of America Data on Gender 1998-2009

	MAA Awards			
	Total Awards	Female Awardees	Male Awardees	Percentage of Females
1998	26	8	18	31%
1999	24	1	23	4%
2000	20	4	16	20%
2001	14	3	11	21%
2002	22	3	19	14%
2003	23	6	17	26%
2004	22	4	18	18%
2005	31	7	24	23%
2006	21	5	16	24%
2007	36	6	30	17%
2008	34	7	27	21%
2009	29	5	24	17%

	Board of Governors			
	Total Board Members	Female Board Members	Male Board Members	Percentage of Females
1998	51	16	34	31%
1999	50	10	40	20%
2000	51	10	41	20%
2001	50	13	37	26%
2002	51	17	34	33%
2003	50	16	34	32%
2004	51	13	38	25%
2005	50	14	36	28%
2006	51	14	37	27%
2007	50	17	33	34%
2008	50	16	34	32%
2009	50	11	39	22%

Nominees to the Board of Governors				
	Total	Female	Male	Percentage
	Nominees	Nominees	Nominees	of Females
1998	29	9	20	31%
1999	27	8	19	30%
2000	18	7	11	39%
2001	14	6	8	43%
2002	26	5	21	19%
2003	19	7	12	37%
2004	23	8	15	35%
2005	18	5	13	28%
2006	19	6	13	32%
2007	23	7	16	30%
2008	19	4	15	21%
2009	19	4	15	21%

Council, Committee, Subcommittee and Joint Committee Chairs

	Total	Female	Male	Percentage
	Chairs	Chairs	Chairs	of Females
1998	132	31	101	23%
1999	149	49	100	32%
2000	109	34	75	31%
2001	137	44	93	32%
2002*	96	31	65	32%
2003*	99	33	66	33%
2004*	91	33	58	36%
2005	91	33	58	36%
2006	96	30	66	31%
2007	131	45	86	34%
2008	114	36	78	32%
2009	101	25	76	25%

* In 2002, 2003, and 2004 there were 114 Committees, but not all had appointed Chairs.

Speakers at National Meetings*				
	Total	Female	Male	Percentage
	Speakers	Speakers	Speakers	of Females
1998	105	26	79	25%
1999	127	35	92	28%
2000	199	65	134	33%
2001	227	83	154	37%
2002	110	44	66	40%
2003	140	65	75	46%
2004	125	45	80	36%
2005	134	47	87	35%
2006	188	61	127	32%
2007	180	63	117	35%

2008	172	65	107	38%
2009	157	57	100	36%

**This list includes MAA Invited Addresses, Minicourse and Short Course Organizers, and Organizers of Contributed and Invited Paper Sessions. The total number of speakers were not counted consistently. They do not include the actual speakers at contributed and invited paper sessions and panels, only "organizers."*

	Membership		
	Female	Male	Unknown
2008	20%	65.50%	14.50%

Women in the MAA, A Personal Perspective
Pat Kenschaft
Emerita, Montclair State University

When a publisher offered to send me to the JMM in 1977, an older mathematician looked dubious. He said I would find it a very lonely experience. Having confidence in my social skills, I arranged to arrive during the opening cocktail hour. Surely I would find someone there to join for dinner! As a woman, I would immediately bond with other women. I would turn my charm on men, and they would respond appropriately.

Alas, I didn't find any other women at the cocktail party. Most of the men were standing alone, holding a drink. It was easy to stand in front of one and smile an engaging smile. Every one turned ninety degrees sideward, avoiding my eyes. I felt grateful for the warning that I would be lonely, and was extremely relieved to meet a friend from graduate school. He invited me to dinner with his (all male) colleagues. Whew!

The next day I was happy to find the AWM (Association for Women in Mathematics) desk among the displays. There was Mary Gray, founding president of AWM (1971-1973). She said, "Pat Kenschaft! I'm so glad to meet you at last!" I was amazed. "You know about ME?" "I know about all American women with a doctorate in mathematics. There are only about a thousand of us." That summer there was an actual AWM meeting. I became active in the national organization and started a New Jersey chapter.

MAA Committee on Participation of Women

Early in 1987, a decade after I attended my first national MAA meeting, [Ken Ross](#), Secretary of the MAA, telephoned me to ask if I would become the first chair of the Committee on Participation of Women (CPW). [Lynn Steen](#) had been MAA president since 1985 and was amenable to the request of Lida Barrett, who was on the Executive Committee, for the formation of such a committee. Reba Gillman, wife of then-president-elect of MAA [Leonard Gillman](#), emailed me that Alice Schafer (who had been AWM's second president) had also been persistent in insisting that such a committee be formed. The Board of Governors passed the needed resolution at the 1987 JMM.

The first committee consisted of three men and four women, very different from AWM (Pat Kenschaft, Paul Campbell, David Ballew, Donald Bushaw, Rhonda Hughes, Marjorie Stein, and Deborah Tepper Haimo). I was startled at first, but then I realized I cared about blacks, so why shouldn't men care about women? I quickly found that these men certainly did.

That summer, at the meeting in Salt Lake City, we hosted a panel, "What are the problems? What are the solutions?" All seven of us appeared on the panel. The committee met twice that summer and developed a series of recommendations, many of which were followed. We suggested allowing self-nominations for MAA national

committees since many people from small institutions could not get support for going to a national meeting until they were already on a committee and so would not be known nationally. We also suggested that committee meetings be posted in the general program, since having open meetings was ineffective unless people knew when and where the committee was meeting. We suggested the MAA disseminate a brochure on implementing non-sexist language, include a section on women in the next five-year report on the mathematical profession, and make a serious effort to include women and minority speakers in its 75th anniversary meeting in 1990. We recommended family activities and child care be provided at meetings and publicized ahead of time. At our recommendation, the MAA paid AWM to compile a list of women mathematicians in each Section, with the goal of increasing the number of women speakers at Section meetings. CPW member David Ballew, Chair of the Committee on Sections, included a question in the annual questionnaire to Sections about the number of women speakers in that Section that year.

In the January 1989 Joint Meeting in Phoenix, the CPW sponsored a panel on “Breaking Into Print in Mathematics,” followed by a workshop, “Meet the Editors.” We scheduled Gloria Gilmer, recent chair of the MAA-AMS-AAAS Committee on Opportunities in Mathematics for Underrepresented Minorities and a member of CPW, as our 1990 JMM speaker on “Unity in Diversity.”

The “Micro-Inequities” Skits

Despite these successes and others, the CPW meeting at the summer 1989 joint meeting, held at the University of Colorado in Boulder, included a spontaneous gripe session. Women told how ridiculously they had been treated that very day. We found ourselves both shaking our heads and laughing at the stories. “These would make great skits,” observed Gloria Gilmer. The group broke into uproarious laughter. “That’s a great idea,” I said, when the laughter died down. “You aren’t serious!” the group chimed almost in unison. But I had had enough experience with dramatics to persuade them that this was a way to attract an audience and reach people.

Sue Geller wrote up the stories in script form. The first skits in 1990 dramatized incidents that had actually happened during the summer 1989 meeting. We were too late to get into the 1990 JMM schedule, but they found us a room that was available after Gloria Gilmer’s talk where we could perform our skits, and we posted flyers around the convention area. About 200 people showed up; we felt successful. The following day I heard several exhibitors say that the skits were discussed all around the exhibit hall.

As narrator, I invited people to notice micro-inequities as they happened; Mary Hesselgrave had said that was the term for small inequities that individually are funny but collectively undermine self-confidence and a sense of inclusion. A man who later acted in the skits observed that these incidents wear away like drops of water on a rock. I suggested people say “micro-inequity” when they saw one. It became a friendly educational game. (People obviously felt they hit the jackpot when they caught Pat Kenschaft at one.) We invited people to report micro-inequities committed anywhere in

the math community to Sue Geller, who wrote them up for next year's program, calling herself the "skitwrite." The summer of 1990 we repeated the same skits as we had given at the JMM to a smaller but different audience. The 1991 JMM skits, now in the program, drew an audience of 400 and the 1992 JMM skits attracted 600.

People told us we should follow the micro-inequities skits with discussion groups. At a subsequent summer meeting we hired a professional discussion leader to train a gratifying number of us to lead such discussions. We decided to have a man and woman co-lead each group, and had enough volunteers. The following JMM we held six discussion groups after the skits, each involving about 15 participants, about half from each gender. The reports from all the groups were remarkably similar. All of the women had said, "That's my world!" and all the men said they hadn't noticed anything like those skits. But no woman said, "How can you be so blind?" and no man said, "You're making this up!" All cooperated to make the MAA more nearly the organization that we all want it to be. As I listen to my colleagues in other professions, I think mathematicians can be proud of our equity efforts.

The skits continued for five years, making their debut in January and being repeated at the summer meeting. Each year we had more reports of micro-inequities. The last year fifty new micro-inequities were reported to Sue Geller or me. That set of skits included five people acting out micro-inequities, four men and me. Having people laugh at your sins seemed like appropriate expiation. The skit scripts are available at www.math.tamu.edu/~geller (scroll down).

Meanwhile, [Lida Barrett](#), the second woman president of the MAA (1989-91), said at two consecutive Board of Governors meetings that the CPW should publish a book about women in mathematics. *Winning Women Into Mathematics* (MAA, 1991) was the result. The frontispiece of the book is a photograph of four MAA leaders, Lida Barrett, President, Deborah Tepper Haimo, President-elect, Marcia Sward, Executive Director, and Rhoda Goldstein, Associate Directors for Finance and Administration. There were chapters on statistics, what is being done organizationally, what individuals can do, why so few women are in mathematics, minority women, the CPW, and an eight-page bibliography.

The book includes a 21-page history of women in the MAA by Frances Rosamond (see above) with a page and a half of names of women who had already served as MAA officers before 1991 and photos of 45 women. One of the photos had previously been published both in *FOCUS* and *Ms. Magazine*. It is of four New Jersey women: the chair and governor of the NJ-MAA and the presidents of both MATYC of NJ and AMTNJ (two-year college and K-12 mathematics teachers, respectively). The first paragraph of the history reports that Hannah Cokeley Finkel, wife of *American Mathematical Monthly* founder Benjamin Finkel, is credited with proofreading every page of the *Monthly* for more than a decade at its beginning.

My perception is that people in the MAA, both men and women, have struggled hard to make it a hospitable organization for women. Our cultural habits provide

challenges and none of us are immune to committing micro-inequities. But I believe that individually and as an organization we are trying and making progress. People appear much happier at national meetings than they did in that first grim cocktail party I attended. Occasionally, I see a woman nursing a baby in a corner. More often I see a man pushing a stroller. One graduate student who first came to a national meeting two decades ago commented recently at how much more animated women's rooms are now at math conferences, in contrast to the quiet places they were when she first attended. The most convincing evidence of change was the list of invited speakers for MathFest 2013: six women and five men. One of each gender was African American. What a contrast to earlier days!