Association for Women in Mathematics

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HAPPY BIRTHDAY, AMS!

PRESIDENT'S REPORT

Good news from NSF! We expect to receive $60,000 for travel grants for women. Details will follow — stay tuned!

The American Mathematical Society is celebrating its Centennial in Providence in August, and we'll be there to join in the festivities. On behalf of AWM, I extend warm congratulations to the AMS for one hundred years of leadership in mathematics research. The history of women in the AMS is well-known to readers of this *Newsletter*. In 1984, Charlotte Angas Scott served on the first Council of the AMS and became its first woman Vice President in 1905. Although over seventy years passed before another woman, Mary Gray, held that position, today women are active at all levels of the Society. The AMS has had a woman President, Julia Robinson, and in the coming decades we will undoubtedly see more women hold that position.

AWM is grateful for the generous support of the AMS and its superb staff in providing facilities and advertising for our semi-annual meetings. Our gift to the AMS is in two parts. We have prepared a commemorative booklet in honor of the Centennial, featuring the nine women who have given the prestigious Emmy Noether Lectures. The booklet will be available in Providence.

In addition, we are making a contribution to the AMS Centennial Fellowship Fund, in a spirit of hope and optimism that the next hundred years of American mathematics will see women and other minority groups fully represented at all levels of mathematical endeavor. Happy Birthday and Best Wishes, AMS!

AWM has many activities planned for the Centennial Celebration. Our panel discussion "Centennial Reflections on Women in American Mathematics" will be held on Tuesday evening, August 9, 8:00-9:30 P.M., and will feature panelists Mabel S. Barnes (emeritus, Occidental College), Judy Green (Rutgers-Camden), Jeanne LaDuke (DePaul University), Vivienne Malone-Mayes (Baylor University), and Olga Taussky-Todd (emeritus, Cal Tech). This promises to be an exciting retrospective, and we hope you'll attend. Other events of interest:

AWM Business Meeting, 7:30-7:55 P.M., and
AWM Party, 9:30-11:00 P.M.,

both on Tuesday, August 9.

As always, the AWM Table will be in need of sitters, so please stop by and say hello.

Thanks to the generosity of the efficient AMS staff, the Parent-Child Lounge will be a regular feature at joint meetings. While it is difficult to have toys available, there will be a VCR equipped with cartoons. There should be many children at the Summer meeting, so please use this space, and send any suggestions for improvement to me.

See you in Providence!

Good-bye to Lori Kenschaft. Lori Kenschaft, who has served for a year as our Executive Director, is off to do graduate work at the Harvard Divinity School. Lori has worked on many projects for AWM and helped countless members and nonmembers with queries about women and mathematics. She has considerably increased our membership, encouraged women's studies departments to join AWM, helped with fundraising efforts, and is currently reorganizing the Speakers' Bureau and rewriting the directory. We are looking for her replacement, who will take over in August. Lori, we wish you well!

Sonia Kovalevsky High School Day. The third annual high school day was held at Simmons College in Boston on April 7th and is receiving rave reviews. Organized by Alice Schafer, Donna Beers, Margaret Menzin, Michael Brown and Richard Cormier, all from Simmons; Jo Ellen Hillyer from Newton North High School; and Eleanor Palais from Belmont High School, these events have attracted a loyal local following. Several AWM members have asked Lori Kenschaft for the information packet she has prepared on organizing a local high school day.

I would like to see AWM give even more guidance to these projects. We are seeking outside funding for ten high school days to be held around the country in conjunction with Mathematics Awareness Week, 1989. We have submitted a proposal to the Carnegie Corporation for partial funding. If you would like to take part in this project, please let me know.

Task Force on Women, Minorities, and the Handicapped in Science and Technology. On April 7th, Mary Beth Ruskai presented AWM's testimony to the Task Force hearing in Boston. Several hearings have been held around the country to determine appropriate ways in which government agencies can contribute to the retention of underrepresented groups in the sciences. Our testimony appears in this *Newsletter*.

News. * The Annual AMS Survey shows that whereas 17% of the doctorates in mathematics in 1987 were earned by women, only 12% of the new doctorates taking employment in doctorate-granting institutions are women. Given the importance of role models for students, particularly graduate students, and the steep climb up the academic ladder, this percentage is too low.

* On a final bright note, congratulations to Abigail Thompson (U. Cal., Berkeley) and Susan Landau (Wesleyan), who received NSF Postdoctoral Fellowships, and to Ruth J. Williams (U. Cal., San Diego), recipient of a Sloan Research Fellowship. It is most gratifying whenever these prestigious awards go to women.

* I would like to add to Anne Leggett's request that you send interesting mathematics to the *Newsletter*, along the lines of Karen Uhlenbeck's lively summary of her Noether Lecture.

Rhonda Hughes
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Women in Mathematics Delegation to the People's Republic of China: June 10-July 4, 1989. I am very pleased to announce that AWM has been invited by People to People International to send a delegation of women in mathematics to China. People to People has sponsored many delegations to China, among them two in mathematics, the second in 1987 (see this *Newsletter*, May-June 1988, "A Report on Women in China, 1987" by Susan Gordan Marchand *et al.*). John H. Lupert, Director of Science and Technology Projects for People to People, reports that the China Association for Science and Technology (CAST), the umbrella organization over the Chinese Mathematical Association (which issues the formal invitations), and the Chinese Women's Federation are very interested in having a delegation of women mathematicians visit China and would welcome one.

I am pleased that Alice Schafer, a member of the 1987 group, has agreed to be the leader of the AWM delegation. We feel that it would be appropriate for this delegation to focus on research in the mathematical sciences: pure or applied mathematics, computer science, statistics, operations research, etc. If you are interested in being a member of this delegation, write to Alice Schafer, 60 Spring Valley Road, Belmont, MA 02178 for further information. We think this is an exciting prospect for AWM and are looking forward to a successful visit and opportunity to discuss common mathematical interests with our Chinese colleagues.

- Rhonda Hughes

I. N. HERSTEIN: IN MEMORIAM

by Martha Smith, University of Texas at Austin

I. N. Herstein of the University of Chicago died on February 9 at age 64 after battling cancer for several years.

Herstein was born in Poland and emigrated to Canada with his family as a small child. His given name of Yitzhak was mistranslated as Israel, but he always used the original nickname, Yitz. He received his B.S. from the University of Manitoba, his master's from Toronto, and his Ph.D. (with Max Zorn) from Indiana. After temporary positions at Chicago, Pennsylvania, Kansas, Ohio State, and Cornell (not necessarily in that order), he returned in 1962 to Chicago, which remained his home base (he traveled almost addictively) for over twenty-five years.

Yitz loved life. He had an amazing capacity to be both an adventurer and a nurturer. The adventurer surfaced in his research, his travels, and his non-mathematical pursuits. In his research, Yitz was not so much a builder of theories as a tackler of problems. He reveled in, and excelled at, the kind of problem that requires a *tour de force*, a tortuous (and sometimes torturous to almost anyone else) path pursued by means of cleverly conceived and delicately arranged calculations. Irving Kaplansky aptly described a series of Yitz's papers as a "display of virtuosity." His propensity to toss out conjectures showed this same adventurous streak. (His ability to generate conjectures awed me as a graduate student. I soon realized part of his secret: he covered all bases. Half of his conjectures were apt to be inconsistent with the other half.) His non-mathematical interests ranged from pool playing, to the stockmarket, to painting (both as appreciator and artist), to punning. He was great fun just to sit around and talk with.

The nurturer appeared in his teaching and expository writing. He didn't fuss (except in urging people to eat); he gave what I feel is more valuable: a belief in people. He assumed his students would do well, then showed his delight when they lived up to his expectations. He had over thirty Ph.D. students. I suspect we all did a little better than we might have with a different advisor. We worked in a variety of areas, yet there is a sense of the "family" of Herstein students. Yitz was also a very influential undergraduate teacher. Many of his undergraduate students became research mathematicians. One of them, Barbara Osofsky, describes her experience as follows:

> In the Preface to his book *Topics in Algebra*, Yitz mentions that the book is an outgrowth of a class he taught at Cornell in 1959-1960. I took a very similar course from Yitz at Cornell a year earlier. It was a very inspiring experience. There were a group of about six very bright undergraduates in that class, all of whom later went on to get Ph.D.'s in mathematics. I remember distinctly the excitement Yitz transmitted to us about the beauty of mathematics. Wielandt's elegant proof of the first Sylow theorem had just come out and was presented to the class in a way making clear just how lovely Yitz felt it was. When John Thompson's thesis was announced, Yitz got the students to go to Thompson's talks on it at Cornell. The previous year the problem had been slipped into our class as an unrequired exercise. Had both Yitz and I stayed at Cornell, I have no doubt that I would have gotten my Ph.D. under him. That did not happen, but I still consider that Yitz was one of the most significant shapers of my mathematical career.

Herstein's nurturing abilities also involved a perceptiveness to individual needs and the willingness and adaptability to act effectively in response to them. I experienced this myself when he insisted that I watch him shoot pool rather than go over my notes for the n^{th} time before giving my first lecture. A colleague who taught at Tuskegee when Yitz briefly visited there reports being impressed at how a research mathematician from a high-powered university could interact with the Tuskegee undergraduates in just the right way. And the starred problems in *Topics in Algebra* have for a couple of decades provided just the right material to nourish the talent of bright mathematics undergraduates. (They have also furnished a useful means of identifying the best students; when I served on the panel to select NSF graduate fellows, the phrase "did most of the starred problems in Herstein" in a letter of recommendation said much more than a high score on the Graduate Record Exams.)

Yitz wasn't afraid to state his opinions, but wasn't afraid to change them when presented with new information. His attitude toward women in mathematics exemplified this. He became very impressed by Barbara Osofsky's mathematical talents when she was his student at Cornell. For many years, he had no other undergraduate student he considered of comparable quality. But her marrying "that engineer" after undergraduate school, instead of going directly on to graduate school, embittered him on the subject of women students. However, when Lynne Barnes Small visited Chicago in 1964-65 as a graduate student of Jacobson from Yale, Yitz informally assumed much of the role of thesis advisor. About two years later, Susan Montgomery became his student; I followed suit the next year.

Inspired by the burgeoning women's movement and the strength of numbers (two was a large number of women then — as it still sometimes is today), we occasionally spoke out about women's issues. One day he said to me, "Do you know what I did the other night? I was having dinner with Jake [Nathan Jacobson], and I found myself arguing in favor of women's rights! See what you two have done to me!" He subsequently had other women Ph.D. students (including his last student, Gail Letzter, who received her degree last year), served on the AMS Committee on Women, and was a supporter of AWM. (He also married a mathematician, Barbara Cortzen of DePaul University.) Alice Schafer remembers his role on the AMS committee as follows:

> Three months after the founding of AWM, the AMS appointed a Committee on Women in Mathematics (Cathleen Morawetz, chair). To no one's surprise, Yitz was appointed a member of the Committee, the first such committee of any of the mathematical organizations. He served well and faithfully on the Committee for the next six years, always coming to meetings and telephoning with ideas for increasing the number of women mathematicians and for increasing their number on mathematics faculties at research universities. I shall mention just two. He suggested that each member of the Committee contact friends in mathematics departments at research universities to urge them and their colleagues to appoint qualified women to positions in their departments. (There were qualified women then and still are, and Yitz's idea is still a good one!) In its first years the Committee published a *Directory of Women Mathematicians*, which it hoped employers, committees seeking speakers, and officers seeking members for committees would use. Yitz suggested that a natural follow-up to the *Directory* was a survey on the graduate school origins of female Ph.D.'s. He felt that such a survey could prove useful as a guide to prospective women graduate students, particularly those who might want a congenial atmosphere in which to begin their graduate work — some men also like a congenial atmosphere in which to begin their graduate work. As was typical of Yitz, he set about and did all the work for the survey himself (except for a minimal checking by myself, by then chair of the Committee, and by a secretary at Wellesley College). The results of the survey, "Graduate Schools of Origin of Female Ph.D.'s," appeared in the *Notices of the AMS* in 1976. Yitz will be missed by so many.

In March 1987, less than a year before his death, the University of Chicago held a conference in honor of Herstein's spending twenty-five years there. (The original August date was moved up in response to his failing health.) Most of his Ph.D. students who were in the U.S. (and a couple who were not), several former undergraduate students, and numerous colleagues participated. The presence of his thesis advisor, Max Zorn, especially pleased Yitz. Various non-mathematical friends also attended the banquet. I happened to sit at the table with his editors, who related how he invariably called them from the hospital two or three days after each of his many operations to discuss progress on his latest book. (He wrote three after learning he had cancer. The last, *A Primer on Linear Algebra*, appeared shortly before his death.)

In his after-dinner remarks at the conference last year, and again at the memorial for Yitz this year, Kaplansky said, "What's really special is that he cares." With all due respect to Kap, that doesn't say it well enough for me. The word "care" is used so much these days, and means so many different things to so many different people, that I want to be more specific. When Yitz sent me a copy of his book *Rings with Involution*, he inscribed it, "with esteem and affection." That typifies the kind of care he showed toward people in general: he didn't just like them; he respected them as well.

(Memorial contributions may be sent to:
The University of Chicago Cancer Research Foundation
Culver Hall 405
1025 East 57th Street
Chicago, IL 60637.)

A REMEMBRANCE OF I. N. HERSTEIN

by Murray Gerstenhaber, University of Pennsylvania

I first met Yitz in September, 1953, when we arrived at Penn to replace Dick Schafer who was leaving for M.I.T. It was sobering to learn that the chairman thought he needed the two of us to fill Dick's shoes. When Dick gave us the low-down on what was then a stuffy institution with serious problems, we realized that if we were not to drown it would have to be "us against them." I have a deep gratitude for Yitz's lousy jokes and wonderful sense of humor. We tried to organize a departmental strike for higher pay; it failed, I still say, because one member of the department was bought off. Some of the worst shaggy dog stories I ever heard Yitz tell pulled us out of our resulting depression. They were needed again when our two-man consulting company, formed in desperation, got no business whatever.

There was no money for anything in those days, and in particular none to invite speakers. This time, one of Yitz's wacky schemes worked. There was a local radio quiz show in which college teams of three competed. The winners shared $25 and returned the next week. With Jesse Price, we won often enough to bankroll a few visitors.

In the dark academic year 1953-54, a ray of hope appeared. The N.S.F. sent Leon Cohen around the country to explain to mathematicians how to apply for grants. Leon was probably happy to be away from the A.M.S. that year; we had shared the shock, a year before, when a physicist paranoid over the rejection of a paper shot two secretaries dead in the Physical Society offices. When Leon came to Penn, a small group of us listened politely, but the only proposal that emerged was a joint one of Yitz and myself. It was for a three-year project and threw the Penn administration into a tizzy. It covered our second, third, and fourth years at Penn. We had been hired for three-year terms. Did approving the proposal commit the school to keep us a fourth year? The question went all the way to the new president, himself a physicist, who decided that the university was not bound. So Yitz and I got the first N.S.F. grant awarded to Penn. Ironically, we got two years.

Yitz took leave from Penn for an algebra year at Yale arranged by my former Chicago thesis advisor, A. A. Albert. He never returned. Albert brought Yitz to Chicago, and I remained forever at Penn. In retrospect, the year that Yitz and I arrived at Penn was the school's worst. The same year, the new physicist prexy, Harnwell, replaced politician Harold Stassen. Aided in a minor way by a few kicks from Yitz and myself, the rusty academic gears started to turn. Sputnik, in the fall of 1957, speeded the flow of academic money. So although Yitz and I separated, subsidized travel brought us together again in many places. But over the years, while Yitz still had his grin and good humor, I was pained to see his face become more lined with cares.

I grieve now that I will not see Yitz again. He was a comrade-in-arms. But there is a joy in remembering. We shared not only some bad old days but some good ones too. He was the only smiling usher at my wedding, wearing a dead serious morning coat and an impish grin that suggested that he was the only there who knew exactly what was happening. Perhaps he was.

So long, Yitz. You were a mensch. I'll miss the wisdom you earned by your cares, as well as your lousy jokes. You have taken a little of all of us with you, but you've left a lot of warmth and love behind.

AWARDS AND HONORS

Congratulations to Anne C. Dinning and Tamar Schlick, graduate students at the Courant Institute of Mathematical Sciences. Dinning, in the Computer Science Department, has received the Harold Grad Prize for outstanding accomplishment and scientific promise during the first three years of graduate study. Schlick has been awarded the Kurt O. Friedrichs Prize for an outstanding thesis in mathematics. Her dissertation is entitled "Modeling and Minimalization Techniques for Predicting Three-Dimensional Structures of Large Biological Molecules;" the prize consists of a citation plus $1,000. Also, she has won the Jay Krakauer Award from the Graduate School of Arts and Science Office of Alumni Relations for the outstanding 1988 dissertation in the sciences. Says Schlick, "It was a great pleasure to receive my award last week here at Courant, where in the words of Cathleen Morawetz, 'there has been a long tradition of women in mathematics.' "

Olga Taussky-Todd, professor emeritus of mathematics at the California Institute of Technology, received the honorary degree "Doctor of Science *honoris causa*" at the University of Southern California's 105th spring commencement ceremony, May 6, 1988.

Dr. Taussky-Todd, a member of the Austrian Academy of Sciences, is one of the world's leading researchers in algebra, number theory and matrix theory, though as a child she envisioned becoming a poet and composer.

Taussky-Todd's father, an industrial chemist and journalist, recognized her acumen for numbers and assigned her mathematically related chores designed to hone her skills. One such chore involved the mixing of vinegar and water.

According to Austro-Hungarian law, vinegar had to conform to a particular level of acidity. The workmen in her father's factory had a feel for the proportions of vinegar and water they needed to mix to achieve the desired results, but Taussky-Todd's father asked her to determine them exactly. She did so by devising a diophantine equation solved with positive integers, and the little table she produced with colored pencils was hung in the factory. Eventually she set aside poetry for mathematics.

Taussky-Todd, born in Olmutz in the Austro-Hungarian Empire in 1906, studied at the University of Vienna under number theoretician Philip Furtwangler. She assisted in the editing of a mathematical journal published out of the German town and university of Göttingen. Later, she received fellowships at Bryn Mawr College in Pennsylvania and Girton College in Cambridge, England.

While she was at Girton, Taussky-Todd met and married mathematical analyst John Todd. They moved to Todd's native Belfast, where they both lectured at Queen's University. At Queen's, Taussky-Todd focused on the two areas of matrix theory — generalizations of matrix commutativity and integral matrices — that absorbed her throughout her career.

Taussky-Todd and her husband came to the United States in 1947. She worked for the National Bureau of Standards' field station at UCLA, taught at Princeton University and, in 1957, joined the California Institute of Technology faculty. She is the author of more than 200 papers.

The following is the commendation of Taussky-Todd which was printed in the commencement program:

> Olga Taussky-Todd, professor emeritus at the California Institute of Technology, is recognized by her peers as one of the foremost mathematicians of her generation. Her research in algebra, number theory, and matrix theory has influenced scholars throughout her long and distinguished career. For more than 30 years, she has been the moving force in the development of matrix theory, and her influence on both pure and applied mathematics has been profound. Born in present-day Czechoslovakia, she was raised in Austria and received her doctorate in class field theory from the University of Vienna. From there she went to the leading mathematical center in the world at Göttingen, where she worked with David Hilbert and edited the two volumes of his studies in number theory. During World War II, she applied her mathematical skills working for the British Ministry of Aircraft Production. For a period of 10 years following the war, she was associated with the Applied Mathematics Division of the United States Bureau of Standards. During that time she also spent a year at the prestigious Institute for Advanced Study in Princeton, New Jersey. She joined the faculty of the California Institute of Technology in 1957. Hailed by students and colleagues alike as one of Caltech's most gifted teachers and stimulating intellects, Taussky-Todd's 30-year tenure there has established her as one of the world's leading mathematical theorists. As editor of many of the leading mathematical journals, she has had a profound impact on the direction of scholarly research. Selected by the *Los Angeles Times* as Woman of the Year in 1963, her work has been recognized in professional circles with a Ford Prize for Mathematical Exposition, given by the Mathematical Association of America; the Gold Cross of Honor, First Class, for Arts and Sciences, given by the Austrian government; and the Gold Doctor Diploma, given by the University of Vienna. A fellow of the American Association for the Advancement of Science, Taussky-Todd is a corresponding member of both the Austrian and Bavarian Academies of Science. She is a member of the Council of the London Mathematical Society and a three-time member of the Council of the American Mathematical Society. Now it is with great pleasure and profound respect that the University of Southern California confers its highest honor on Olga Taussky-Todd.

LETTERS TO THE EDITOR

To the editor:

I was invited to visit the Departamentode Matemáticas at the Universidad de Zaragoza by Professor Maria Teresa (informally Maité) Lozano, a Spanish topologist whom I have known for some years through our mutual interests in knots and braids. While I had also known of one other woman topologist who received her Ph.D. several years ago in this same department, I was nevertheless very pleasantly surprised to find that a career in research mathematics seems to be quite as normal for women in Spain as for men! We had a very stimulating and busy week, and I learned a lot of mathematics. I gave several seminars which were well-attended by men and women, but the highlight was yesterday, when the very lively audience for a talk by Professor Hugh Morton (a visitor from

England) on "Knot Polynomials" consisted of six women: Professors Maité Lozano and Elena Martin of the University of Zaragoza, Professor Carmen Safont from the University of Barcelona, myself, and two graduate students at Zaragoza, Milagros Izquierdo and Carmen Elvira. (Hugh said he thought he now understood how things seem to *us* under the reverse situation.)

Sincerely, Joan Birman, Columbia University

To AWM:

I am writing this letter as a member of AWM; my views do not necessarily represent the views of the MAA.

In reading your article "Age and achievement in mathematics: a case-study in the sociology of science" [March-April 1988, pp. 12-20], I am reminded of an incident on this campus a few years ago. I was sent a questionnaire from a campus social scientist, but the questions were meaningless in my case. When the scientist persisted that he wanted my responses, I explained that all I could give were random responses. He explained, "That's okay; they'll still have statistical significance."

It seems to me that the article mentioned represents bad science. The author has given no evidence that citation counts reflect the quality of the researcher. I can think of lots of reasons why older mathematicians will be cited more often, even if the quality of research has in fact declined. For one thing, they are likely to have authored books. If these have been excluded from the counts, the author should so indicate. In any case, older mathematicians often write expository or semi-expository articles. These are often extremely valuable and merit citations, but do not reflect high levels of research. Rather, they reflect accumulated wisdom. Even some of their research articles might be half-baked, but (consciously or subconsciously) the authors realize that they will be furthering the subject by publicizing the questions and their partial answers.

It is not even clear from the article whether the author took into account that citations for a younger mathematician necessarily cover a shorter period of research than those for older mathematicians.

Finally, I don't follow the logic of statements like: "Only 10.9% of mathematicians under age 35 were cited more than the mean number of times, ... that is, 11 of 101 mathematicians under 35 were responsible for approximately half the citations of that age group." This doesn't follow no matter what "the mean number of times" refers to.

Sincerely, Kenneth A. Ross, Department of Mathematics, University of Oregon

AMS REFERENDUM

All five motions in the AMS referendum passed. President G. D. Mostow made the following statement:

> The first resolution, which was passed by 57% of those members who voted, reflects widespread skepticism in the mathematical community about the ability of the SDI program to achieve its stated objectives. It also reflects concern about SDI's incalculable cost and the waste incurred by premature deployment.
>
> The second resolution, passed by 74% of those who voted, addresses the desirable norms for funding mathematical research. It is important to note that resolution II does not disapprove of grants from defense agencies. Rather it emphasizes that the aims of non-mission oriented agencies such as NSF are more closely matched to the aims of basic research than those of agencies with more narrowly-focussed objectives.
>
> The intent of the Society can clearly be read from the overwhelming approval of resolutions III, IV, and V, which call for the support of diversity in mathematics through individuals and small groups, for the support of basic research by all agencies that use mathematics, and for reviews of scientific merit by expert scientists.

The Boston *Globe*, April 4, 1988, contained a short article "Mathematicians say No to Star Wars" under the heading Science Briefs. From the article:

The society is the first major professional organization to take an official stance against the Strategic Defense Initiative (SDI) and funding for military research. It is made up of about 20,000 mathematicians, 7,000 of whom voted in the referendum. ...

The referendum was initiated in the fall of 1986 by a group that included [William P.] Thurston and others. In an article in the society's Notices of the AMS in January last year, Thurston wrote: "Academia should be separated from the military. Military funding of research in Universities, and of mathematics in particular, is bad for our society, bad for the universities, and bad for mathematics.

"The military pattern of funding has a large negative impact, since it attaches strong strings from the military to academia. Even in normal times, this channels the short supply of mathematics into an intellectually limited range of topics, and distorts the debates on societal issues. In troubled times, the strings can be exercised to disastrous effect."

TESTIMONY TO THE TASK FORCE ON WOMEN, MINORITIES AND THE HANDICAPPED IN SCIENCE AND TECHNOLOGY

FROM THE ASSOCIATION FOR WOMEN IN MATHEMATICS, APRIL 7, 1988
presented by Mary Beth Ruskai, University of Lowell

There are many issues related to women in mathematics that deserve careful attention. This statement concentrates on the participation of women in the more visible aspects of professional mathematical activity, namely research, conferences, and symposia. We have chosen to focus on this issue because we believe it is one that can be readily addressed by funding agencies.

Recent surveys by the American Mathematical Society (AMS) show that almost 10% of mathematicians with doctorates teaching at four-year colleges and universities are women,[1] over 20% of the doctorates in mathematics granted to U.S. citizens each year since 1983 were earned by women, and 13% of the members of the AMS are women.[2] However, the more public image projected by the profession does not reflect either this increased participation by women or the substantial achievements of many women research mathematicians. On the contrary, in recent years we have witnessed repeated disregard for these achievements.

We are particularly concerned by the failure to include women as invited speakers at public symposia on mathematics. Recently, several major conferences have been organized in the United States with no women speakers, including the Symposium honoring Hermann Weyl (May 1987), the Symposium honoring John von Neumann (June 1988),[3] and the Symposium on American Mathematics Entering its Second Century at the recent AAAS meeting (February 1988). The Centennial meeting of the American Mathematical Society (August 1988) will have only a single woman invited speaker, Karen Uhlenbeck.[4]

The gains that women have made, as measured both by their research contributions and by the increasing percentage of doctoral degrees that they receive, will not have as much impact as they should if these women continue to be ignored by the scientific establishment. The absence of women from public programs does little to encourage other women, particularly graduate students, to pursue research careers seriously. In the case of the AAAS meeting and the AMS Centennial celebration, both very public events designed to draw the attention of the media and the public to the importance of mathematics and its viability as a career for young people, the absence of women is particularly damaging. The continued portrayal of mathematics as a white-male dominated field does little to increase the likelihood that the projected shortage of mathematicians will be addressed by increasing the involvement of women and minorities.

There is some evidence that specific efforts to include women in research activities can be effective. For several years, the AMS has had a policy of placing women on its Program Committees to select speakers for its national meetings; the result has been the appearance of women in most of the national programs.[5] By contrast, those meetings mentioned above had no women on their organizing committees. Most relevant to these hearings is the role that government agencies sponsoring many of these conferences can play. Most of the cases in point were partially funded by the NSF or other government agencies. There should be a mechanism (stronger than existing ones, which clearly have been ineffective) to ensure that efforts have been made to identify qualified women and minorities, that these groups play a role in the organization of major conferences, and that their participation in such conferences is encouraged.

Recently the Association for Women in Mathematics has applied to the NSF for funds to support travel grants for women to attend research conferences in their fields. While these grants are intended to improve the rate of participation of women in research conferences, they do not directly address the participation of women as speakers. By increasing the number of women attending conferences, however, we increase the visibility of women researchers in the pool from which speakers at subsequent meetings are drawn. By developing more effective guidelines, funding agencies can play an important role in increasing the number of women who participate in mathematical conferences and symposia as invited speakers and as members of organizing committees.

There are certainly other issues of equal importance to women in mathematics. One of the most encouraging of recent statistics is that 46% of undergraduate mathematics majors in 1986 were women.[6] The widespread and successful participation of women in undergraduate mathematics must be better understood in order to counteract the attrition that occurs at other stages of the educational process, most notably in adolescence and in the graduate years. Programs publicizing the participation of women in mathematics and science should be encouraged at all levels, from elementary school through graduate school. The AWM Speakers' Bureau and Women and Mathematics (WAM, a program of the Mathematical Association of America) send women speakers to high schools and colleges in order to achieve precisely this goal. It should be noted that both efforts are currently very much in need of funding despite impressive past records of success.

In short, there are several areas in which federal agencies can intervene in an effective manner. We are eager to continue the dialogue begun by these hearings and welcome future opportunities to work with the Task Force toward our common goals.

Notes

1. AMS *Notices* 34(7): 1073.
2. AMS *Notices* 34(4): 700-701.
3. Marina von Neumann Whitman will be a panelist, but will not give a mathematical lecture.
4. Photocopies of these programs as printed in the AMS *Notices* and the poster announcing the Symposium honoring John von Neumann [were] attached as appendices.
5. AMS *Notices* 34(4): 700.
6. *Women and Minorities in Science and Technology*, National Science Foundation, January 1988.

December 5, 1987; testimony published anonymously

Women, minorities, and the handicapped are underrepresented in the sciences. These groups need role models at every level, grade school through college. The role models demonstrate that you can like science and be successful in it, even if you are not a WASP man. Furthermore, a scientist from the targeted group can perhaps offer a special sensitivity and compassion for the underprivileged.

The following table shows data on women mathematicians. I computed the percentages from data in the November, 1986, *Notices* of the American Mathematical Society.

MATHEMATICIANS WHO ARE U.S. CITIZENS, WITH DOCTORATE, AT FOUR-YEAR COLLEGES AND UNIVERSITIES

Rank	%Women
Instructor or Lecturer	21
Assistant professor	17
Associate professor	8
Professor	5

Notice that the higher the rank, the smaller the percentage of women. The statistics suggest job discrimination.

I want you to know about my last academic appointment.

I have a Ph.D. in mathematics. In national competition, I won fellowships from the National Science Foundation for four years of graduate study. I have research publications, articles on teaching, and a text published by a well-known firm. I believe that I have the aptitude, training, and dedication to teach college mathematics.

In May, 1985, I accepted a position as associate professor of mathematics at a private four-year college. Dean #1, who hired me, told me that he checked references with my former employers, and he got glowing recommendations from everybody. He gave me a copy of the faculty handbook. He emphasized a statement in it mandating an annual evaluation conference with the dean for each untenured member of the faculty.

In August, 1985, I started work at the college. Dean #1 left the college and Dean #2 took over as acting dean. All the other science faculty were men. The mathematics department consisted of two men and me; each of them had a master's degree but no doctoral degree.

I never got an evaluation conference at the college, in the sense of a meeting where both parties discussed strengths and weaknesses. Neither Dean #2 nor the department chair watched me lecture, inquired about my work, or expressed an opinion about it until my termination notice February 28, 1986. This came about as follows:

Throughout my career at the college, I noticed widespread attempts at cheating among my students. On February 26, 1986, I Xeroxed the test of a student before returning it to him. He claimed that I had graded him incorrectly. But the paper he showed me was different from the paper I copied. He had changed his answers to raise his score.

I called Dean #2 to tell him about this student. The secretary asked me to come in. After the dean and I agreed that the student would get an "F" for the test, the dean told me that I would get a terminal contract for the academic year 1986-1987 because of student comments. I asked what the students said. He quoted one as saying, "I am not paying this kind of money for that kind of teaching."

I think that most likely this remark came from a student disappointed by a low grade or by a foiled attempt at cheating. The dean refused to give me information about the disgruntled students.

In July, 1986, Dean #3 took over. I proposed reconsideration of the decision to terminate my services. I suggested a review group consisting of the dean, the department chair, and a mathematician from outside the college. Dean #3 agreed to review the decision, but declined to include an outsider. He said, "An outsider could only evaluate your technical competence. He couldn't judge how well you *fit in.*"

...

In December, 1986, Dean #3 told me that the decision to terminate was unchanged. He said, "You won't believe this, but the decision is not for professional reasons." I responded that I did not want to be treated like a leper, and I would resign, effective January 1, 1987. He replied, "We would be glad to have you work here next semester." But I stuck to my decision.

Since I left the college, I have worked as a statistician, reviewer, and tutor. In February I will teach at a community college. I am proud of my work, and I intend to continue it. I am willing to take a high school job, but this may require a year of education courses to get a teaching certificate.

I propose the following to the task force.

1. Laws against discrimination must be vigorously enforced. The EEOC needs more funding and backing. Numerical goals are necessary — without them, the administrators can claim that they have no prejudice, there are just no qualified workers except able-bodied white men. Everybody else has one glaring defect or another.

2. If a college has federal funding, then its administrators should get training in affirmative action. Administrators should learn that they must have written procedures for personnel actions, and they must, in general, follow their procedures. Something is wrong when the first time an employee learns of dissatisfaction is the day she is fired.

...

Students tend to evaluate women faculty more negatively than men (this *Newsletter*, May, 1987, page 17). If you want to get more women, minorities, and handicapped people into the sciences, then the dominant men must learn to deal with their own prejudices.

3. Encourage scientists to teach in high school by allowing subject expertise to substitute for education courses. In California if you have a master's degree in mathematics, you can get a teacher's certificate without extensive education courses. I would like to teach high school, but it is hard for me to devote a year to coursework.

NEWS FROM AWM MEMBERS

J. Silk reports on subtle discrimination at the Epcot Center in Florida. Male characters (Mickey, Goofy, etc.) were fussing over the boys and ignoring the girls. Minnie and the other female characters were nowhere to be seen. Also, only Mickey and Goofy appear in Exxon's comic book about the Universe of Energy.

Katye O. Sowell says: I thought you folks might "enjoy" this. Gastonia is as far as we got after a day's driving on ice from Atlanta after the AMS-MAA meeting! I enjoyed meeting so many AWM folks there. We've got a lot of *educating* to do!

from the Gastonia, NC newspaper, January 8, 1988:

> Snow Macho: Why is it that snow brings out the macho in men? Some of us seem to think that making it to work when it snows is some kind of mark of manhood.
> Well, we noticed that at least as many women got to the office Thursday. That's why we're offering this winter tribute to females:
>
> **Frostelle The Snowwoman**
> Frostelle the snowwoman
> Was more mature than Peter Pan.
> And the children said she worked math in her head
> Quite as well as any man.
>
> Frostelle the snowwoman
> Was a pinstripe-and-blue-serger,
> She could change the oil and lance a boil
> While she forced a hostile merger.
>
> There must have been some magic in those pearls they found one day,
> Cause when they placed them 'round her neck, she got an MBA.
>
> Frostelle the snowwoman
> Wouldn't ever melt like you, man
> Getting warm, she knew, would never do;
> Someone might think she was human.

And *Newsweek* can't print an article about girls and math without quoting Camilla Benbow.

Jill Mesirov, our President-Elect, sends in a full page on Women's History Month from the *Bell Lab News*, March 21, 1988. In "Women Look at Their Work, Their Heritage," five women's careers with AT&T and their involvement with women's issues are profiled. "In Celebration of Women's Contributions" is a collection of photos showing the diversity of events in the Labs' celebrations of National Women's History Month.
It's nice to see that things can be done right.

John Ed Allen, Chairman of the Department of Mathematics at North Texas State University, Denton, Texas says: We are pleased to report that seven of our last nine Ph.D. degrees in mathematics were (will be) granted to women!

1986-87 Denise Race, who is employed by E-Systems; Alexandra Kurepa, who is on the faculty of the University of Zagreb in Yugoslavia. (Scott Chapman is on the faculty at Trinity University in San Antonio.)

1987-88 Catherine Abbott, who will join the faculty at Francis Marion in South Carolina; Karen Gragg, who will join the faculty at Western Kentucky; Karen Brucks, who will join the faculty at Michigan State University; Sumalee Unsurangsie, who is from Thailand and plans to return there; Somporn Sutinuntopas, who is also from Thailand, but who may stay here in the States. (Terry McCabe will join the faculty at Southwest Texas State University.)

The *Tallahassee Democrat* of January 20, 1988 had a nice article about Chandra Fleming on the first page of the Local/State section. ("FAMU student figures she'll get a graduate degree after trip to see mathematicians" by Dorothy Clifford.) She is one of seven black female math majors from FAMU who traveled to the annual meetings in Atlanta with faculty member Don Hill. The following excerpt is from the article:

> Fleming said she observed only 100 blacks among the distinguished mathematicians at the Atlanta meeting.
>
> "We [FAMU students] were nervous at first," she said, "but the professors were so wonderful, we felt like the center of attraction. A few even walked up and said they had money — or would find money — if we needed it to continue going to school."
>
> As far as Hill is concerned, that's what the two-day trip was all about.
>
> "There's more to math than just learning stuff in books," Hill said. "The students need to know experts and see them networking with friends. When they need to know something they can't find in the library, they need to know an expert to call."

BOOK REVIEW COLUMN

Correction. The price listed for *Math for Girls* in the March-April column was out of date. The correct price is $10.00 plus $2.00 for shipping. Thanks to Catherine Kessel for pointing this out.

How to Encourage Girls in Math & Science: Strategies for Parents and Educators, by Joan Skolnick, Carol Langbort, and Lucille Day. 1982. Dale Seymour Publications, P.O. Box 10888, Palo Alto, CA. ($9.95, paperback, no postage & handling if prepaid by check, Mastercard, or Visa.) Originally published by Prentice-Hall.
Reviewed by Lori Kenschaft, Executive Director, AWM.

One of my moments of greatest delight recently was when I discovered that *How to Encourage Girls in Math & Science* had been reprinted by a different publisher — such books are so badly needed!

The first part of the book is a concise but detailed, non-dogmatic, and very readable explanation of how early experiences affect the skills and attitudes with which girls and boys first approach mathematics as a discipline. This section has converted at least one person from the "girls just aren't as good at math" point of view: she has now announced her determination to equalize the achievement of the girls and boys in her care.

The authors identify four teaching strategies that are critical to girls' successful learning: building confidence, using manipulative materials, providing advantageous social arrangements, and developing students' sex-role awareness. The last 120 pages of the book describe specific activities to strengthen the mathematical skills that girls are more likely to find difficult. These activities can be used by teachers and parents with children from preschool to grade eight.

This book is thought-provoking for anyone interested in early mathematical development and math education, and most useful for those who want to help young people learn math.

Women and Minorities in Science and Engineering, available on request from the Scientific and Technical Personnel Characteristics Study Group, Division of Science Resources Studies, National Science Foundation, 1800 G St. NW, Room L611, Washington, DC 20550.
Reviewed by Lori Kenschaft, Executive Director, AWM.

If you ever want statistics about women's educational and professional status in science, you should know about the NSF's *Women and Minorities in Science and Engineering*. The 1988 edition of this biennial report contains 170 pages of statistical tables covering everything from the average number of science courses taken by high school students, to sources of graduate support, to professional advancement as indicated by tenure, academic rank, or years of experience. All information is broken down by both sex and race, as well as field ("mathematical scientists" are classified as one group but are separated from "computer specialists"). The statistical tables are backed up by a clearly written 60-page introduction and overview.

Women of Mathematics: A Biobibliographic Sourcebook, edited by Louise S. Grinstein and Paul J. Campbell. Greenwood Press, New York, 1987. 312 pp., $45.00. ISBN 0-313-24849-4.
Reviewed by Barbara A. Jur, Assistant Professor, The University of Tennessee at Chattanooga.

Women of Mathematics is a fascinating collection of essays about 43 women mathematicians covering the span of time from Hypatia to the present. Nine of the women included are still living, and only seven of the representatives lived out their lives before the twentieth century began. The editors decided which women mathematicians to include based on a) the obtaining of advanced degrees despite opposition, b) innovative mathematical research, c) influence based on teaching and advising, d) leadership in professional societies, e) publications, f) participation on editorial boards, g) geographic spectrum. Thus Olga Taussky-Todd is included along with Alicia Boole Stott (in fact Taussky-Todd immediately follows Stott because of the alphabetical listing of the entries). This indicates the book's range from professional to amateur.

The individual essays are divided into biography, work, and bibliography, giving insight not only into the woman's personal history but also into the mathematical questions she dealt with. Most often the work section is a report of research, which while accessible to almost everyone with some mathematical sophistication is nevertheless generally an elegant capsulization. For those whose career was important from other standpoints, the work description highlights that importance. For example, Mina Rees' essayist emphasized the importance of her work with ONR.

Although the essays are arranged alphabetically, the historical patterns in education and opportunity which influenced the career decisions and difficulties each woman encountered can clearly be seen. The influence of marriage and children, mentors, and family are brought out. It was fascinating to learn through several biographies that the women who had to overcome the greatest educational impediments for the longest time were those in England (Cambridge did not grant degrees to women until 1948). Even the German universities were more open. In the U.S. there were enough excellent alternatives so that degrees from a particular university were not critical to developing excellence in mathematics.

While it is clear from the life stories that most of the women encountered prejudice against women studying mathematics, and many encountered obstacles to their study of mathematics (from Scott sitting behind screens at Cambridge to Germain being consigned to the dark), their careers could be rich and varied, depending on their personal talents and what might be termed catalyst connections. Of the latter, Grace Chisholm Young was the epitome of a woman working in a highly productive collaborative relationship. Those who were not as productive as their contemporaries as often chose other career paths or were affected by political upheavals as much as by being thwarted by prejudice against women mathematicians. Alice Schafer in her Foreword sees the work as the chronicle of the struggle for equality between the sexes among mathematicians. It can also be seen as an inspiration; not that the road to success in mathematics was not and is not difficult for women, but that success is really possible and that there are a variety of choices in combining life roles and developing mathematical talent.

A recurring theme shared by many of the essayists is the importance of mathematical research and publication. For example: "Claribel Kendall was not a leading research mathematician, but she was a dedicated teacher who had an active life..." [p. 93] and "Fenchel did not have the opportunity to become a very productive mathematician..." [p.31] and "Newson indicated ... that [she] neglected [research] work" [p. 163]. What is the work of a productive mathematician? This question is as valid for men as for women. Is the answer only mathematical research? If so, then Mina Rees' career would not be outstanding. The essays show that some of the women — Mary Somerville, Kovalevskaia, Gabrielle-Emilie Le Tonnelier de Breteuil — did very well at mathematics socially; they were at the center of a ferment of creative ideas. Others were renowned teachers or administrators, researchers or some combination. Without their mathematical background these women could not achieve recognition as people of talent in their roles as mathematicians. Yet, what is of real value? Is the researcher who is an adjunct more laudable than an applied mathematician who solves problems in industry but does not publish or a teacher who inspires creative students? *Women of Mathematics* has no answers, but includes representatives of all such mathematical activities.

Biographical sketches of the contributors were also included as an interesting sidelight.

This book is truly inspiring. Without exception the essays are well written and engage the reader both literarily and mathematically. It is a must for any student of the history of mathematics and good reading for everyone else.

Call for Reviewers. Thanks to the more than a dozen people who have already volunteered to write reviews. More would be helpful. Please contact me if you are willing to be on my regular reviewer list (specify areas of interest or disinterest, if you wish), or if you wish to review a book you have recently read that would be of interest to AWM members.

Martha Smith
Department of Mathematics
University of Texas
Austin, TX 78712

THE COMMITTEE ON PARTICIPATION OF WOMEN, MATHEMATICAL ASSOCIATION OF AMERICA

by Pat Kenschaft, Montclair State College

The Committee on Participation of Women of the MAA was established by the Board of Governors at its meeting in January, 1987. Last spring I accepted the chair, and the following people accepted invitations to serve on the committee: David Ballew, Donald Bushaw, Paul Campbell, Deborah Haimo, Rhonda Hughes, Peter Renz, and Marjorie Stein. We had our first meetings in August, 1987, at the Salt Lake City Meetings. On January 5, 1988, in Atlanta I presented the first report of the Committee to the Board of Governors. The text of my presentation follows.

The Committee on Participation of Women had its first meetings in August, 1987. Our first goal was to study the current participation of women in the MAA and solicit suggestions. A panel of our own members in Salt Lake City reported on women in various facets of MAA activities. We also held two animated meetings during which we passed thirty resolutions. Among these was the decision to invite to Atlanta Donna Shavlik, Director of the Office of Women in Higher Education at the American Council on Education.

Recent surveys of the CML indicate that women constitute about 23% of the MAA. Last year about 20% of Americans who received a Ph.D. in mathematics and about 46% of those receiving bachelor's degrees were women. In mathematics departments that confer only bachelor's or master's degrees, women are 24% of the assistant professors and 9% of the full professors. In those granting the doctorate, they are 15% of the assistant professors and 3% of the full professors.

Over the past three years women presented about 17% of the 753 papers at the MAA Section meetings and 25% of the student papers. In the most recent issue of *Crossroads* David Ballew, a member of our committee and chair of the Committee on Sections, appealed for each section to appoint an "Encourager," to "encourage the new faculty, women, and all minorities to participate in all of the Section's activities. Appoint them to committees, invite them to help with the newsletter, as Public Information Representatives, with the program, and to give presentations. Help all of our members jump the fence that separates the inside group from the outside group."

In the national MAA women are active and visible at the highest levels. Eight of the 38 members, or 21%, holding four or more national committee appointments are women. However, only 16% of the individuals on all committees are women. Worse, if we omit the seven committees that were formed because some groups are underrepresented in mathematics, only 11% of those serving on the remaining 123 national committees are women. Introducing new blood to national committees is a problem in general. As Ken Ross wrote, "The 'problem' ... is that we have too many dedicated and competent people working for the MAA and too many more people who would like to help out."

The publication statistics are the most grim. For the past four years, the best report is that 8% of the reviews in the *Monthly* were written by women. However, only one major article in the past four years was written solely by a woman. Eleven more co-authored articles with men, so about 6% of the 176 authors were women. From the beginning of 1984 until this past May about 6% of the articles in the *Mathematics Magazine* were written by women and about 7% of those in the *College Mathematics Journal*.

It is the committee's conviction that there are very few mathematicians in the late 1980's who consciously want to exclude women from the math community — although some do exist. We have had consistent and friendly cooperation from all the Association's leaders, although our inquiries have clearly caused some inconvenience. We want to thank many *individuals* who are helping us.

At the same time we are distressed with the Association's statistics. We seek ways to change our structures, our habits, our expectations, and our subconscious acts that result in women being so underrepresented in the MAA activities compared to their percentage of the membership. We invite you to make suggestions, to come to Donna Shavlik's presentation this Friday, and to consider both tiny and significant steps that you personally can take to promote the participation of women in mathematics.

After Donna Shavlik's talk (delivered via FAX and Pat Kenschaft because the Atlanta airport was closed due to snow), there was a lively discussion among women in the audience as to why women are so underrepresented in mathematics journals compared to their proportion in the math community. Questions were asked about acceptance rates of men and women. The evidence is not yet conclusive, but it seems that women's submissions are accepted at a rate noticeably higher than that of men. This is true for journals where the data are available. Other journals are just beginning to collect data, but it is already clear that women don't submit articles at anything close to the rate men do. The question then arises as to why not.

In general, acceptance rates are low. One woman observed that women are less inclined to resubmit repeatedly than are men. "They are so easily discouraged!" she exclaimed. We should not expect publication to be easy, or always to succeed at it. The rejection of articles is very common, and an inevitable part of the publication process. Only by accepting the normality of rejections and continuing to submit will we get our share of acceptances.

It was noticed that women's relative lack of confidence means they are less likely to take risks in general, making it especially hard for them to attempt a low success-rate activity such as submitting for publication. "We *must* teach our daughters to take risks!" said another. Yet another reported research indicating that men are more likely than women to apply for and accept jobs which require learning how to do the job on the job.

Women's tendency to place a higher standard on themselves and to polish their articles repeatedly before submitting them means they postpone submitting articles until they are better written than necessary. Perfectionism is encouraged and expected in highly achieving girls, the group from which women mathematicians are drawn. One woman said she and another woman have a favorite three-word phrase for encouraging each other: "Go for it!"

At its meeting the following day the Committee decided to respect the AMS's wish that the MAA not sponsor panels this August. Instead it will use that time for quiet meetings to discuss how to increase the number of articles written and co-authored by women for MAA publications. We actively solicit suggestions from all. Meanwhile, the committee requested that the following article be published in the AWM *Newsletter*.

JOURNAL REFEREES NEEDED

by Pat Kenschaft, Montclair State College

At the first meetings of the new MAA Committee on Participation of Women there was much discussion of how the Committee could foster a larger percentage of women authors in mathematics journals. One promising suggestion was that women should be encouraged to volunteer to serve as referees.

There are many advantages to being a referee. One sees not only the best of the journal's submissions (thereby learning some mathematics before it is published), but also those that need more work, and those that are clearly unacceptable. Seeing the latter group can be quite an education for the referee; hopefully, it will increase her self-confidence (and there is considerable evidence that women, as a group, need more self-confidence as they contemplate journal submissions).

Reading articles that need more work gives the referee practice in weighing what is essential for an article to be publishable. Thus she may hone her own publication skills without risking the loss of self-confidence that may follow rejections of her own articles. By being a judge, she develops strategies on how to survive being judged.

There is evidence, although inconclusive, that a greater proportion of articles submitted by women are accepted than that of men (it is true of the journals where data is available). Nevertheless, the proportion of articles published by women is far less than their representation in the mathematical community. It seems plausible, therefore, that women may have higher standards than men for the quality of papers they are willing to submit. This speculation is corroborated by numerous studies indicating that girls tend to be perfectionists. Such tendencies may have helped us meet the higher standards that were set for us compared to our brothers as we were growing up, but they are counterproductive in the competition to be published. Refereeing helps us see when we must continue to perfect our work, and when we can slack off.

In general, refereeing is an excellent way to become a part of the publishing world without putting one's own mathematics on the line. Although some young people are under the impression that only the experts in a field can referee, this is not the case.

Virtually every journal actively seeks referees. Any journal is likely to welcome an offer to referee articles from someone who reads that journal regularly. Of course, matching a willing referee to a suitable article usually takes some time. However, once an article is sent for review, the referee must immediately return the card saying whether or not she is willing to referee the article and when. Also, the refereeing should be done promptly. Otherwise, the editor, who is always busy and facing deadlines, will probably decide not to use this referee again.

The Committee is seeking ways to promote an increase in the number of papers published by women mathematicians. We are aware that lack of time is one factor contributing to women's underrepresentation in math journals, but there seems to be little we can do to remedy unequal expectations in home responsibilities, committee service, and role modeling, except to point out that these distractions take time from research and writing. There may be other problems, however, that we *can* address. Suggestions are welcome. Send yours to me, Pat Kenschaft, at the Department of Mathematics and Computer Science, Montclair State College, Upper Montclair, NJ 07043. What can our committee do to help aspiring mathematical authors?

Meanwhile, if you are one, consider offering your services as a referee. It is worth your time.

EMMY NOETHER: ON HER 100th BIRTHDAY

by K.H. Schlote
a lecture delivered at the 6th meeting of the Special Section on History, Philosophy, and the Foundations of Mathematics of the Mathematical Society of the GDR, Greifswald, October 1982
reprinted from the *Communications of the Mathematical Society of the German Democratic Republic*, 1983, no. 1, pp. 49-60; translated from the German
thanks to Lee Lorch for bringing this to our attention

"Within the past few days a distinguished mathematician, Professor Emmy Noether, formerly connected with the University of Göttingen and for the past two years at Bryn Mawr College, died in her fifty-third year. In the judgment of the most competent living mathematicians, Fraeulein Noether was the most significant creative mathematical genius thus far produced since the higher education of women began. In the realm of algebra, in which the most gifted mathematicians have been busy for centuries, she discovered methods which have proved of enormous importance in the development of the present-day younger generation of mathematicians."

– Albert Einstein, Princeton University, May 1, 1935[1]

These appreciative words come from a longer commentary that Einstein sent to the *New York Times* on the death of Emmy Noether and which was published therein on May 5, 1935. Even today we can agree completely with these words.

In Emmy Noether we meet a mathematician who decisively influenced the development of her field. The decades around the turn of the century were, as everyone knows, characterized by the beginning of a radical upheaval in the overall concepts of knowledge and in the subject matter of mathematics. The algebra of that time was undergoing radical change as well. On the one hand, classical algebra found a conclusion of a sort in the work of H. Weber (1842-1913) and D. Hilbert (1862-1943); on the other hand, the direction of future development was already becoming clear.

Emmy Noether was born during this nascent revolutionary phase of algebra. Indeed, it is in a sense symbolic that the birth of this algebraist who was subsequently so important coincided almost exactly with the instant when the abstract group concept first saw the light of day or, more exactly, made its appearance before the mathematical public.

Amalie Emmy Noether, the first of four children of Max Noether (1844-1921) and Ida Amalia Noether (née Kaufmann) (1852-1915), was born in Erlangen on March 23, 1882. Both her parents were of Jewish descent; Max Noether's grandfather had first adopted the name Noether in 1809 pursuant to a Baden tolerance edict.

Emmy Noether's development was not extraordinary to begin with. From 1889-1897 she attended a girls' higher school, and in 1900 after further language studies she took an examination in Ansbach for French and English language teachers. Now her interest in university studies was aroused.

Higher education for women was scarcely developed at this time; in most of the German lands, there was no legal basis for women's education. In particular, female students generally had no right to take the examinations necessary to obtain some kind of degree after their study. So Emmy Noether was one of the great exceptions when she attended lectures at Erlangen University in the winter semester of 1900-01. Her main interest was not yet directed toward mathematics. This was first the case in Göttingen where she attended lectures by H. Minkowski (1864-1909), F. Klein (1849-1925), D. Hilbert, etc., after successfully matriculating by examination in the winter of 1903-04. In 1904, she returned to Erlangen and could now take up mathematical studies by virtue of legal regulations altered during the intervening years. Under Gordan's (1837-1912) influence, she obtained her doctoral degree four years later with a thesis in invariant theory.[2] Hence she was still working in an area of classical algebra which was very popular in the second half of the nineteenth century. During the following years she worked without an official position in the mathematical institute of the university. On the one hand, she helped her father and, on the other, worked on her own research problems.

There were two events that were probably essential to Emmy Noether's development in the direction of abstract algebra: the influence of E. Fischer (1875-1954) as well as the invitation to and later settlement in Göttingen. Fischer, who succeeded Gordan in 1911, was Emmy's advisor and patron. He introduced her in particular to Hilbert's abstract way of thinking as exhibited, for instance, in his writings on invariant theory. Very quickly Emmy Noether earned a reputation as a specialist in invariant theory; as such, she was invited by Hilbert and Klein to Göttingen in 1915. Together with these two great men of mathematics, she investigated problems of invariant theory which were closely related to questions in the theory of relativity. At the same time she pursued her own studies. Hilbert and Klein expressed their appreciation for this collaboration. Their attempt to make it possible for Emmy Noether to obtain the "Habilitation" (the formal qualification for a lectureship) and to tie her more closely to Göttingen through a permanent position, failed. Even Hilbert's personal efforts with various government departments were to no avail. Only in 1919, when legal barriers were removed, was E. Noether able to get the "Habilitation" and obtain permission to lecture. Even then, another four years were to pass before she actually received a lectureship and, with it, a small stable income for the first time. The appointment as "extraordinary professor" occurred in 1922, explicitly without change in her legal status. It is striking that, in later life as well, Emmy Noether was awarded only slight official honors, in contrast to the high reputation she enjoyed among her colleagues in her specialty. In particular, neither was she appointed as an ordinary professor, nor did a German academy elect her to membership, so strongly did the prejudice against women in science work.

Let us now turn to Emmy Noether's scholarly works.

In her first creative period (1907-1919), Emmy Noether had already completed the transition to abstract thinking and to axiomatic methods in her work, which was mainly in invariant theory. This tendency now became fully apparent. It was an essential feature of Emmy's development into an eminent researcher who would influence the development of mathematics so enduringly. H. Weyl (1885-1955) noted on that score: "This method was applied by Emmy Noether with masterly skill; it suited her nature and she made algebra the Eldorado of axiomatics."[3] Of decisive importance therefore was the formulation of precise general concepts, to which Emmy Noether and her students paid great attention. For them it was essentially a matter of discovering abstract concepts which were common to various algebraic theories.

In a 1920 publication with W. Schmeidler (1890-1969), Emmy Noether for the first time expressed very clearly the abstract style of algebraic thinking.[4] At the same time, she began an entire series of works on ideal theory which appeared mainly between 1920 and 1926. The central problem was to investigate the decomposition of ideals in a ring R, considering the ideals as R-modules. The application and elaboration of R. Dedekind's (1831-1916) ideas on modules and ideal theory decisively influenced Emmy Noether's work. Already in this first paper we find such basic concepts as representations as direct sums and intersections, residue class modules and isomorphisms of modules. Although the actual subject of this work is differential expressions, the representation is distinguished because of its great generality.

As an example, I would like to refer to the definition of isomorphism of residue class systems and to that of one-sided modules. The latter reads:

> In our domain J (J = integral domain of polynomials) one can distinguish between the following kinds of modules because of the non-commutativity of multiplication:
> 1. the right-sided module which contains, given M, also FM for an arbitrary polynomial F, and, given M_1 and M_2, also $M_1 + M_2$;
> 2. the left-sided module which contains, given M, also MF, and, given M_1 and M_2, also $M_1 + M_2$.[5]

In both cases, the definition does not change when one considers arbitrary elements rather than polynomials. Also, the general concept of an A-module (A an arbitrary ring) was presented in the paper, namely in the proof that the totality of all residue classes mod M (M a given module) form a module, more precisely a J-module. Looking at the multiplicative action of a polynomial on a residue class, it becomes quite obvious that the two components are chosen out of different domains, and that the result of the composition is again an element of the module. Emmy Noether then carried out the corresponding steps of abstraction in her pioneering 1921 work "Ideal Theory in Ring Domains," where she gives an abstract definition of a T-module M, with an "abstractly defined non-commutative ring" T as the domain of multipliers.[6] To this end, she combined an Abelian group S with the ring T via an associative and distributive multiplication to create a double domain (S, T) and then characterized a module by two conditions which clearly exhibited the analogy with the definition of an ideal. ($M \subseteq S$, and 1. M contains, given α, also $c\alpha$, where c is an arbitrary element of T. 2. M contains, given α and β, also their difference $\alpha - \beta$.) (For S = T this is the definition of a right ideal!)

It should be noted in passing that these considerations were at the same time valuable stimuli to the concept, initiated by W. Krull in 1925, of a group with operator domain. Based on the module concept,[7] it was shown that the representation of a module (of an ideal) as the least common multiple of relatively prime modules (ideals) also exists in the non-commutative case and is, under certain conditions (for completely reducible modules, that is, the least common multiples of prime modules of representable modules), also unique. These investigations into the decomposability of ideals, or rather modules, were continued in the above-mentioned work of 1921. E. Noether proved generally that, with abstract definitions of the notions ring and ideal, for an arbitrary ring the validity of the Hilbert Basis Theorem is equivalent to Dedekind's divisor chain condition. The assertion that every ideal (module) in the ring R has a finite basis is therefore equivalent to the condition that in R no O-chain of ideals (modules) with infinitely many links exists; here an O-chain is a sequence of ideals (modules) $\{A_i\}$ where A_{i+1} is a proper superset of A_i.

E. Noether's merit lies not only in the abstract formulation of both conditions and the proof of their equivalence, but in the fact that she perceived and comprehensively demonstrated the significance of this phenomenon (already in 1919, according to W. Krull). The best known result, discovered by E. Lasker (1868-1941), was the generalization from polynomial domains to arbitrary rings with divisor chain conditions, of the decomposability of ideals into the intersection of primary ideals. The abstract proof required no deep penetration into ideal theory and into the specific properties of the polynomial domain. Not even the decomposability of a polynomial into a unique product of finitely many irreducible polynomials was needed; the proof was based solely on the divisor chain condition. This is one of Emmy Noether's greatest achievements. In this connection, the notions of primary ideal (A is called primary if when $ab \in A$ and $a \notin A$, then $b^n \in A$ for some finite n necessarily follows; this is a generalization of Dedekind's unique ideal and the abstract framing of the corresponding Lasker concept) and of irreducible ideal (that is, the ideal cannot be represented as a common multiple of two proper divisors) were introduced. Altogether, four different decompositions of ideals were given, each of which can be derived from any other. From the proof that the hypotheses for these decompositions are fulfilled for modules, it then followed easily that the theorems are also valid in the more general case. The above-mentioned equivalence between the basis theorem and the divisor chain condition is significant; on the one hand, the divisor chain condition is very well-suited for abstract proofs, but on the other hand, the validity of the basis condition can often be more easily checked. (If, for example, the basis theorem holds for a ring R, then it holds also for every polynomial ring over R.)

In the following years, E. Noether continued her ideal-theoretical studies. In the editing of K. Eintzelt's "On the Theory of Polynomial Ideals," she strove to emphasize clearly the principal methods, in particular the reduction to problems of module theory. Then, in 1923, she integrated this elimination theory into her general ideal theory and substantiated abstractly the "Nullstellen" theory. The final version was due to B. van der Waerden (born 1903), who found important results independently of her and to whom she generously ceded publication. In these works, the dominant feature was to show the fruitfulness of the general mode of approach in individual special cases, and, by means of abstract methods, to make conceptually simpler and to extend further the theory of specific rings.

General questions stood once again at the center of her second great fundamental work on ideal theory, "Abstract Theory of Ideals in Algebraic Number and Function Fields," which was published in 1926 in the *Mathematische Annalen*. More strongly than in earlier publications, the chief attention was given to an axiomatic characterization of all those rings which allow a unique representation of non-zero ideals as a product of powers of prime ideals (ZPI-ring). Emmy Noether solved this problem completely for commutative rings. She gave the following axioms:

(1) the validity of the divisor chain condition: Every chain of ideals in which every ideal is a proper divisor of the preceding is finite;
(2) the validity of the multiple chain condition modulo every non-zero ideal: Every chain of ideals in which every ideal is a proper multiple of the preceding and in which all ideals are divisors of one fixed non-zero ideal is finite;
(3) the existence of a unit element for multiplication;
(4) the non-existence of zero divisors;
(5) the ring is closed, i.e., all elements belonging to the quotient field which satisfy an equation $x^n + a_1x^{n-1} + \ldots + a_n = 0$ for some ring elements a_i, belong to the ring themselves.

The axioms (1), (2), and (5) are the important ones. (3) and (4) ensure virtually only that the ring under consideration is actually an integral domain. The representation of every ideal as an intersection as well as a product of finitely many primary ideals belonging to various prime ideals follows from axioms (1) and (2). The prime ideal P belonging to a primary ideal Q is then formed as the totality of those ring elements of which a power belongs to the primary ideal under consideration. In order to obtain the decomposition of an ideal into a product of prime ideal powers, it is still necessary that every primary ideal be a prime ideal power, exactly as guaranteed by axiom (5). Emmy Noether succeeded in filtering out the properties on which the validity of the decomposition theorem in number fields is based. As salient features of Noetherian work, the significance of the three most important axioms (1), (2) and (5) is clearly illustrated. As a corollary of axiom (1), the representability of an ideal as the least common multiple of finitely many irreducible ideals is proved again and the proof, in comparison to her earlier work, simplified.[8] Also, the Noetherian effort to formulate all statements as generally as possible becomes apparent: in section 2, axioms (1) and (2) are formulated for modules and conclusions are drawn from them. The important result that the stated system of axioms holds in number- and function-fields was shown by Emmy Noether. In that way, the relationship to classical ideal theory was established, and this theory was incorporated into general ideal theory. In her work, the abundance of concrete individual results crystallized into the algebraic substratum. The foundation for further fruitful research was created. This then became mainly the work of her students, while Emmy Noether turned to new questions.

The new questions fell under this heading: non-commutativity. As we saw, Emmy Noether had in her earlier work already embedded her ideal-theoretical research into the consideration of modules, and she always came back to this general starting point. This yielded not only an elaboration of the tendency of linearization in algebra as demonstrated by Dedekind and Steinitz (1871-1928), but also led in a natural way to the consideration of non-commutativity and to investigations of hypercomplex systems (algebras) and the representation of these systems as well as groups. By proving that to every representation of a ring or other system (e.g., an algebra) corresponds the so-called representation module, E. Noether was able to subsume the representation theory of groups and hypercomplex systems under module theory. Many concepts such as reducible, irreducible, and completely reducible which she had introduced earlier, mainly in commutative ideal theory, now became important in the investigation of non-commutative structures. General consideration of isomorphisms (including the two isomorphism theorems) for groups with operators shifted more forcefully to the center; the notion of an automorphism now supervened and was used in manifold ways. With her great work "Hypercomplex Quantities and Representation Theory" she put the theory of algebras on a new foundation. Non-commutative algebras (hypercomplex systems) and their representations were treated by her in a unified, abstract and purely conceptual form which, up to that time, included all known deep results, due to such mathematicians as Molin (1861-1941), Frobenius (1849-1917), Dickson (1874-1954) and Wedderburn (1882-1948). The connection between the concept of Abelian groups with operators and that of the linear representation of groups discovered by Krull (1899-1971) in 1926, was masterfully generalized by E. Noether to algebras. This work deserves "to be valued as one of the pillars of modern linear algebra, because of the importance of new ideas and the clarity of its structure..., just like Steinitz' dissertation on commutative fields."[9] Although the work appeared in 1929, E. Noether's research on this subject dates back to about 1924. She added to the work itself a note: "The following stems from B. L. van der Waerden's extended notes taken during my lectures in the winter of 1927-28. We undertook together the editorial work before giving it to the printer. I owe thanks to B. L. van der Waerden also for a series of critical remarks."[10]

After introducing fundamental concepts such as group with operators, double module (= two-sided module), automorphism ring, operator homomorphism and isomorphism, and hypercomplex system (which, in case a unit exists, is also characterized as a ring of finite degree with respect to a field lying in the center ($k \in K \rightarrow kc \in M$)), Emmy Noether developed, among other things, non-commutative ideal theory. Again, divisor chains and the multiple chain theorems or their equivalent formulation as maximal and minimal conditions play an essential role. The two most important results of this period are the following theorems: rings without radicals (i.e., no non-zero nilpotent ideal exists) with minimal condition for right ideals are exactly the rings with identity which are completely reducible with respect to right ideals, and conversely. From the right-sided complete reducibility and the existence of an identity follows the two-sided complete reducibility and that direct summands are two-sided simple.

Every completely reducible two-sided simple ring R with identity is isomorphic to the ring of matrices of degree n over a field K which is isomorphic to the automorphism field of right ideals of R. The two chapters on "Module and Representation Theory" and on "Representations of Groups and Hypercomplex Systems" contain the definition of the representation of the ring R in the field K, as a homomorphism of R into the ring of matrices of degree n over K, and of the representation module of R with respect to K which is a left R-module and a right K-module, as well as the relationship between representations and representation modules. To every representation class of a ring belongs a unique representation module. Reducibility and complete reducibility of the representation are equivalent to the reducibility and complete reducibility, respectively, of the representation module. Of the other results we mention here only the following: for every hypercomplex system with minimal condition for right ideals, the residue class ring with respect to the radical is completely reducible.

In 1933, Emmy Noether continued, in a second fundamental work, "Non-commutative Algebra," to establish the uniform, abstract structure of the representation theory of algebra, in particular with a structure theory for simple and semi-simple hypercomplex systems. From some general theorems on automorphisms and modules she derived a generalized Galois theory for simple hypercomplex systems: the simple subalgebras B of a simple normal algebra A (over the coefficient field P) correspond one-to-one to the closed subgroups H of the Galois group G of A. Here H is the full group of all automorphisms of A which leave the elements of B fixed and, conversely, B is the ring of all elements of A which remain fixed under all automorphisms of A which belong to H. Moreover, E. Noether was able by means of module theory to solve the problem of splitting fields, those fields in which a representation splits into absolutely irreducible ones (these are representations which are also irreducible in an algebraically closed extension of the coefficient field), and to characterize the splitting fields for some algebras.

At this point, I would like to refer once again to the unifying effect of Noether's research in the theory of algebras. Already Wedderburn in his famous work united the abstract American trend with the results of European mathematicians on some specific algebras. But at this point in time, representation theory was completely separated from studies of hypercomplex systems. It was Emmy Noether who gave the first unification of these two powerful streams into one direction of research.

But Emmy Noether was concerned not only with the abstract theory of modules and algebras; she at all times tried to give applications as comprehensive and varied as possible of her ideas and concepts. With respect to this, one must mention in particular the application of hypercomplex methods in number theory, something she pursued herself. Together with R. Brauer (1901-1977) and

H. Hasse (1898-1979), she gave on this basis a new formulation for some parts of number theory and proved a fundamental theorem for algebras over number fields: every division algebra over an algebraic number field is cyclic, i.e., of Dickson type.[11] The significance of Hasse's results on cyclic algebras was made clear by this theorem, and these results came to achieve the status of a structure theory for simple algebras. In this connection, one must also mention the "bounded products" (factor systems) E. Noether introduced which played an important role in several structure theories, especially for cyclic algebras. Emmy Noether never published her theory of bounded products; this was done by H. Hasse[12] and M. Deuring (born 1907)[13] after many mathematicians had already used and investigated this concept in specific cases. Nonetheless, she made repeated use of the theory in her research work, particularly in examples for her principle of applying non-commutative theory to the commutative case. She formulated this principle in her impressive survey talk at the 1932 International Congress of Mathematicians in Zurich in which she proved again that important conclusions on commutative structures can be drawn from the study of the non-commutative case: "With the theory of algebras, one tries to derive invariant and simple formulations for known facts on quadratic forms or cyclic fields, i.e., those formulations which depend only on the structural properties of algebras. Once the invariant formulation has been proved...then a transfer of the facts to arbitrary Galois fields follows by itself."[14]

Unfortunately, Emmy Noether was denied the chance to pursue to the end this route of investigation into non-commutative structures and into the manifold applications of the results obtained which she herself used, in particular in number theory. Death brought all her ideas and efforts to an untimely end. Emmy Noether died unexpectedly on April 14, 1935, as the result of a tumor operation in a Bryn Mawr hospital.

Unfortunately, in this short paper, I could give a detailed appreciation only of some aspects of Emmy Noether's scientific work, but many other important things would need to be described more thoroughly if we wanted to do even approximate justice to the personality of this great algebraist. Among those are, for example, the "Noether School" and the influence to build up modern algebra; Emmy's warm, selfless and supportive relationship to her students; her interest in political events; and her exile caused by the fascists and her immigration to the USA. However, I hope I have transmitted at least some impression of this extraordinary mathematician. With justice, she is counted among the architects of modern algebra or, as P. S. Alexandrov expressed it in a speech to the Moscow Mathematical Society: "If today the development of mathematics moves under the sign of algebraization, if the penetration of algebraic ideas and methods into different mathematical theories goes forward, then this became possible only through the work of Emmy Noether. She was the one who taught us to think in simple and general algebraic concepts... ."[15]

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EUREKA! SUMMER PROGRAM IN MATH AND SPORTS FOR TEENAGE GIRLS

Alice Miller, Director of the Women's Center, Brooklyn College, CUNY, prepared the following report for the AWM Education Committee.

Eureka! is a career and leadership development program designed to encourage 13- and 14- year-old girls, primarily from economically disadvantaged families, to pursue high achievement in mathematics and science and to consider mathematics-related careers. Administered by the Brooklyn College Women's Center in cooperation with the Departments of Mathematics and Physical Education and the School of Education, this four-week summer program, with seven follow-up sessions on Saturdays during the school year, addresses the underrepresentation of women in occupations such as engineering, science, finance, economics, and business management.

Eureka intervenes at the critical stage in female development when girls begin to avoid the more difficult math courses, as well as computers, science, and competitive sports. In a nurturing single-sex environment, girls enjoy mathematics and try out assertive behavior in the math and computer classroom and on the playing field, while being challenged to plan for their futures as career women in a high technology society. Recognizing that social forces often discourage teenage girls from entertaining unconventional aspirations, Eureka elevates competition, cooperation, and risk-taking, with the goal of nurturing self-confidence and sturdy egos.

At its inception in the summer of 1987, Eureka was funded mostly by Morgan Guaranty Trust, and also by Chase Manhattan Bank and the Brooklyn College Foundation. This summer, Eureka doubled in size due to increased funding, with substantial amounts for this summer and next from the New York Community Trust and the Aaron Diamond Foundation.

The four-week tuition-free program gives equal emphasis to mathematics instruction and physical education, on the assumption that these two fields of study are truly mutually reinforcing. The typical daily schedule is as follows: mathematics applications, computer activities (Logo), lunch and free time (with computer and sports facilities available), individual sport (track and field, gymnastics, or fencing), team sport (softball, volleyball, or field hockey), swimming, and career awareness workshop.

The mathematics component focuses on projects and exercises that develop spatial visualization and problem-solving skills, which, according to research, are two areas of weakness among adolescent girls. The program uses manipulatives, hands-on projects, and testing, and emphasizes the notion that there are many right answers and many approaches to solutions. Female guest speakers who are successful professionals in math-related careers meet regularly with the girls. And, by means of trips, the girls see women at work in non-traditional fields.

The sports component (like the math component) incorporates activities (fencing and field hockey) that are new to participants, in addition to those with which they have some limited acquaintance (swimming, softball, and basketball). Most of the girls have very little experience in playing team sports and have received little, if any, individualized instruction. They are encouraged to overcome their fears such as fear of water and of diving. Self-consciousness about body image is also addressed.

The concluding hour, led by a trained counselor, emphasizes self-awareness, career education, clarification of values, and leadership training. Participants spend an hour at the college Office of Career Services working with computer software (Discover) designed to assist them in answering questions about themselves such as, "Am I a data person? a people person?" Videotapes portray female role models who have chosen math- and science- related careers. Each girl receives a packet of literature about math and science careers, and Junior membership in the New York Academy of Sciences. On Parents' Evening, fathers and mothers receive a taste of the Eureka experience; they sample career awareness exercises and math problems and screen a video about girls in sports.

Most applicants are recruited through the NYC Board of Education network of guidance supervisors. Brooklyn junior high school guidance counselors circulate the brochures among girls who would benefit from participation in the program. The first summer, Eureka admitted 30 girls from 100 applicants. Most were black; there were several Asians, two Caucasians, two Hispanics, and two of interracial background.

Eureka worked well. An outside evaluator with extensive experience with equity programs, Dr. Patricia Campbell (Campbell-Kibler Associates), administered pre- and post- questionnaires which surveyed: math and science course plans; attitudes towards math, computers and sports; career and education plans; and attitudes toward Eureka. She also administered the Fennema and Sherman Math Attitudes Test to measure math anxiety, confidence in doing math, and perceived usefulness of math.

Dr. Campbell's report indicated that Eureka had a dramatic impact on girls' course-taking plans, attitudes toward sports, and career aspirations. Girls were planning, by the end of the program, to take more math than they were at the beginning: more girls were planning to take third-year math (an increase of 10% to 36%), fourth-year math (an increase of 14% to 69%), and calculus (an increase of 21% to 46%).

Although medicine was the most frequently mentioned career goal at the beginning and end of the program, Eureka made participants aware of the field of engineering. At the beginning, no participant had mentioned engineering as a career choice, but by the end, 42% listed engineering as one of three jobs they might want to do in ten years.

While the evaluation of Eureka at the end of the first summer was positive, the final evaluation after the seven-session spring follow-up program was sobering. Although the girls' course-taking plans in math remained ambitious, their scores on the math confidence/anxiety scales dropped to the level where they had been before they entered the summer program. The intervening school math classroom experience seemed to erode the math confidence that Eureka had nurtured. We believe that changes need to occur in school math and science classrooms in order to achieve long-lasting results and to conserve the benefits brought about by intervention programs such as Eureka.

READER SURVEY: (a) Do you have information about other new programs designed to encourage women in mathematics? The AWM Education committee would appreciate your help in obtaining such information, as well as updates on older programs.

(b) Do you have suggestions about changes in the school math classroom that would increase girls' confidence in math?

Please send responses to AWM Education Committee, c/o Sally Lipsey, 70 East 10th Street, #3A, New York, NY 10003. Thank you.

"WOMEN DO MATH" AT S.F.U.

by Tasoula Berggren, Conference Organizer, Laboratory Instructor, Simon Fraser University

The Department of Mathematics and Statistics at Simon Fraser University held its first annual "Women Do Math" conference on November 27, 1987. I had felt for some time that we needed to do something to encourage girls in the 9th and 10th grades to remain in mathematics as a step towards opening doors to careers that would otherwise be closed to them. This conference was designed to help achieve that goal, and its success reflected the joint efforts of faculty, staff and students at SFU as well as the support of teachers, counsellors and parents.

The response to the invitations, which were sent to all the schools in the lower mainland, was terrific. We had planned for a conference of about 150, including teachers, and we ended up having to turn away applicants when we reached an enrollment of 370 — not counting the teachers and parents who came! Girls were chosen by teachers and counsellors. However, the word got out in the press, and so many mothers called asking if their girls could take part that it was necessary to make the conference a large one.

The conference featured a series of talks, workshops and discussion groups. One of the talks was given by Lily Yen, a mathematics honours student at SFU, who talked about mathematics from the perspective of a woman who is still learning the subject. Other talks were given by Jean Cook (Statistician at Forintek), Radmilla Ionides (Electrical Engineer at B.C. Hydro) and Louise Routledge (Math Instructor at BCIT). These women told how their study of mathematics opened up good careers for them and some things about the work they were now doing.

After these speakers, in the afternoon the students were greeted by Dr. John Webster, Acting Dean of the Faculty of Science at SFU, who introduced Dr. Geraldine Kenney-Wallace, Chairman of the Science Council of Canada and Professor of Chemistry and Physics at the University of Toronto. Dr. Wallace gave a strong plea to the girls to stay in mathematics courses in order to open up opportunities for their lives.

The 12 workshops featured topics like probability, symmetry, computer graphing and the mathematics of medical imaging. They had anywhere from 25 to 50 girls each, depending on the size of audience suitable for the topic of the workshop. Each workshop had a leader and most had several helpers, so that there was ample supervision and help available when it was needed. Many of the workshop leaders reported that the girls really got involved in doing things, and all filled the forty minutes available with lots of activities.

Another feature of the conference were the 37 discussion groups, called "circles." Each had a woman as leader, all volunteers from students, faculty and staff at SFU and all professionals, or on their way to becoming such, in the areas of science and technology. The object was to get the girls to talk to each other about their feelings about mathematics, higher education and their goals for themselves.

Most of the day was taken up by the above activities, but there were opportunities for the girls to talk to each other and to the people from SFU informally during the lunch hour, as well as to compare notes at a reception held at the end of the day. A feature of the lunch hour was (optional) participation in juggling lessons, conducted by faculty and students from the mathematics department. Besides giving the girls some physical activity during the day, it also carried the message that something could be fun to do but still involve considerable concentration, practice and frustration in learning it. It seems like a good message for mathematics education!

The logistics of getting about 450 visitors registered and conducted around a campus most of them had not seen before were ably handled by a host of volunteers. The many events went off smoothly and both girls and accompanying persons enjoyed the conference very much, virtually ensuring that SFU will repeat it next year.

KOVALEVSKAIA FUND

Pat Kenschaft, moved by Ann Hibner Koblitz's statement in Arlene Ash's report of the conference in Vietnam [see this *Newsletter*, November-December 1987] that she and Neal had chosen to "have" the Kovalevskaia Fund instead of children, decided that even though she had had the pleasure of children, she could still make a significant (if minor by comparison) contribution to the participation of women in mathematics in underdeveloped countries. She wrote to Ann and Neal asking if they could arrange for her to send a woman from Nicaragua to the Sixth International Congress of Mathematics Education in Hungary this summer. Arrangements have been made for Consuelo Flores of the Nicaraguan National Autonomous University in Leon to attend the conference, and both she and Pat are excited about the plans. [You may recall that Professor Flores was a member of the AWM panel at the ICM.]

Ann adds: We are extremely pleased about Pat's initiative, and invite the suggestion of specific projects by other interested individuals. (Remember, all donations to the Kovalevskaia Fund are tax-deductible.)

Also, could I ask any AWM members attending ICME-6: If you know participants from Spanish-speaking countries or are Spanish-speaking yourself, you might look up Consuelo Flores while you are in Budapest. I'm sure she would be happy to meet you. Thanks!

Bilingual Managua Proceedings available: The *Proceedings of the First Central American Conference on Women in Science, Technology and Medicine* are now available for $5 (free to contributors). Some talks are given in full in both Spanish and English; others are published in the language of presentation with a resumé in the other language. Write to Dr. Ann Hibner Koblitz, Director, Kovalevskaia Fund, 6547 17th Ave. N.E., Seattle, WA 98115.

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JOB ADS

Institutional members of AWM receive two free ads per year. All other ads are $10 each and must be prepaid. Vacancies are listed in alphabetical order by state. All institutions are Affirmative Action/Equal Opportunity employers.

Pitzer College, Dept of Math, 1050 N Mills Ave, Claremont, CA 91711-6100. Tenure track, preferably Asst Prof position to begin 9/89 (possibly earlier). Ptizer is a liberal arts college with a social science emphasis. Duties: teaching at level of calculus & pre-calculus and curriculum development. Opportunity to teach 1 course for Claremont Graduate School and to participate in Claremont mathematical community. Required: PhD, excellence in teaching, experience with courses for non-majors, research potential and performance, breadth of mathematical vision. Preference to applications before 12/1/88. Send vita and 3 letters of reference to Alfred Bloom, Dean of Faculty.

University of Nebraska - Lincoln, Computer Science and Engineering Dept, Ferguson Hall, University of Nebraska, Lincoln, NE 68588-0115. Applications and nominations for Chairperson of dept with 13 PhD faculty that offers BS, MS, and PhD. Dept has strong research programs in algorithms, theoretical CS, communications theory and networks, information retrieval, fault tolerant computing, and human factors. University has a wide variety of computing resources linked by a sophisticated campus-wide network. UNL is the lead institution in the NSF-funded regional network, MIDnet, and a node on the NSFnet backbone. The state has recently appropriated funds to enhance CS research, which the Chair will play a fundamental role in administering. Required: PhD in CS or related field, strong leadership for research & academic programs, credentials appropriate for full professor. Administrative experience desirable. Position starting date open. Closing date 9/1/88, or when position is filled. Salary commensurate with qualifications. Send resumes and names of 3 references to Spyros S. Magliveras, Chair, Search Comm. E-mail: spyros@fergvax.unl.edu.

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