AWM
ASSOCIATION FOR WOMEN IN MATHEMATICS

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PRESIDENT'S REPORT

It's been four months now since Jill handed me the AWM bowl, and I haven't been this busy since I had two toddler daughters! Certainly the AWM work presents challenges more pleasant and interesting than my other duties. I do hope that all that I'm learning will be digested in time to be put to good use for AWM. (Taped on my wall for years is a "Peanuts" cartoon in which Snoopy is writing his memoirs: "Things I Learned After It Was Too Late"!) If not, the Nominating Committee has come up with a great list of women who will be able to do what I cannot; the slate appears on page 7. It looks as if Jenny Baglivo will be paroled soon from her life sentence as Treasurer. Thanks, Jenny!

One thing I have learned is that the President of AWM goes to Washington often. The CBMS Workshop on Graduate Education took place there May 4-6, 1991, with keynote speakers Luther Williams (from NSF's Education and Human Resources) and Calvin Moore (Chair of MSEB's Committee on Collegiate and University Relations). The focus of the discussions was on how doctoral, masters, and non-degree graduate programs in the mathematical sciences could better serve national needs. Much concern was expressed about the failure of the profession to renew itself adequately, and also for the need for improved interaction between the educational and research communities. None of the leaders pretends now that the profession can continue in good health drawing solely on its traditional pool of white male students: it's not only *fair* to include women and minorities; it's *necessary*. Watch for the report from the CBMS workshop which is being prepared by the CBMS Chair, Ivar Stakgold. Meanwhile the MS2000 report, *Moving Beyond Myths: Revitalizing Undergraduate Mathematics*, has been published by the National Academy. The bulk of it will appear in the July-August *Notices*; you may want to have a look at it.

Part of AWM's role is to identify ways in which the mathematical community can become more attractive and hospitable to women at all stages of their education. This is far from easy, I find, perhaps especially since most of us survived the old system. Please write me

IN THIS ISSUE

AWM
ASSOCIATION
FOR WOMEN IN
MATHEMATICS

The Association was founded in 1971 in Boston, MA. The purpose of the association is to encourage women to study and to have active careers in the mathematical sciences. Equal opportunity and the equal treatment of women in the mathematical sciences are promoted.
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The Editor welcomes articles, letters, and announcements.
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your ideas and suggestions, and I promise not to reward you with work, unless you also state your willingness!

In this context, Alice Schafer and I represented AWM on May 6th, together with NAM, at the National Academy of Sciences, discussing issues of recruitment of women and minorities with Larry Cox and Nathaniel Knox of the Board on Mathematical Sciences. This was the second such meeting, and the next step may involve a planning group to produce a handbook on "pipeline" issues, including resource information and outreach suggestions. I would love to see the old-girls-network broadened for this, and I welcome names of people, including yourselves, to involve in these activities. I would also like to find a better word than "pipeline".

I have just returned from a special panel June 3-4 at NSF on women in science and engineering, formed to discuss funding recommendations for women, precollege through professional. AWM's own Sue Geller was also there and presented information and recommendations for graduates and undergraduates. Especially exciting for me was the ease with which the panelists moved back and forth between suggestions specific to women and ideas that would improve the scientific climate for everyone.

Washington in July

The NSF-ONR Workshop preceding the ICIAM '91 meeting in Washington, DC is all set for July 7, with a great response from graduate students and postdocs. The next issue of the *Newsletter* will contain a report on the events there. Don't miss it, all you applied mathematicians!

Orono in August

Come to Orono and be the first on the block to have a copy of our booklet *Careers That Count: Opportunities in the Mathematical Sciences*. On August 8th at the Summer Meetings, we will showcase our career booklet at a panel with the same title, cosponsored by the MAA. Jenny Baglivo will chair the panel, which includes Allyn Jackson and several women featured in our booklet as participants. The panel takes place at 3 P.M., followed immediately by our business meeting, at which the second Alice T. Schafer Prize awards will be presented. The winner and runner-up will be there, and we're hoping that the eight honorable mention recipients will also be able to attend. Congratulations to all ten women (keep reading for the news story), and thanks for the hard work done by the prize committee: Bhama Srinivasan (Chair), Alice T. Schafer (herself!), and Jill Mesirov.

Baltimore in January

The Noether Lecture Committee has selected Nancy Kopell of Boston University as our Noether Lecturer for 1992, and I am delighted to report that she has accepted our invitation. Thanks to the committee: Susan Montgomery, Karen Vogtmann, and

especially Chuu-Lian Terng, who served as chair and now leaves the committee. Also, welcome to the newest member of the Noether Committee, Sun-Yung Alice Chang of UCLA.

Enormous Thanks

Thanks to Ethel Ward-McLemore for a repeat instance of generosity to AWM, in the form of a large check sent to Alice Schafer for AWM's use. Ethel is currently involved in research involving geoscience literature on China, and her support of mathematics and its role in science is most heartening and welcome.

To Keep Us (and Them) from Getting Complacent

Here is the list I promised last time — a short but by no means complete list of departments of mathematics which currently include NO TENURED WOMAN. Additions accepted. I will update and apologize in this column if any department is wrongly named. I will not however apologize for omissions, nor do I suggest that schools not on the list have enough tenured women. But that's another list. Here goes:

M.I.T., Stanford, University of Chicago, and — last but never least, and never a tenured woman, the HYP three — Harvard, Yale, and Princeton.

As I include such lists, I also predict that they will soon become as outdated as have those attitudes which made it possible for six such departments to exist.

Carol

Carol Wood
Middletown,
June 6, 1991

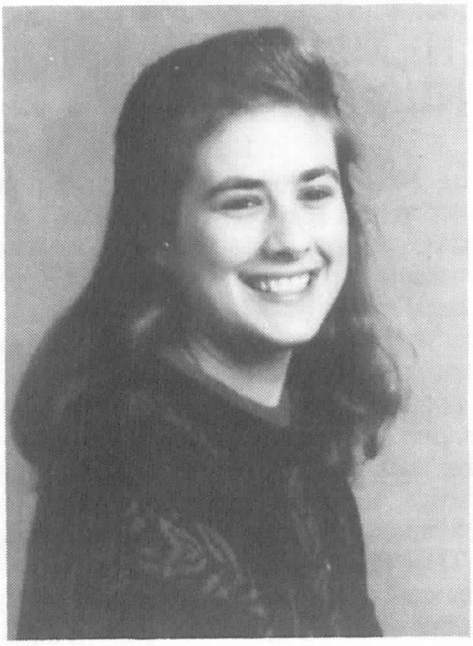
ALICE T. SCHAFER MATHEMATICS PRIZE WINNERS!

Jèanne Neilsen, a senior at Duke University, was awarded the second annual Alice T. Schafer Mathematics Prize sponsored by the Association for Women in Mathematics (AWM). The Prize carries a stipend of $1000. The Prize is given to an undergraduate woman in recognition of excellence in mathematics. The criteria for selection include, but are not limited to, the quality of the nominees' performance in mathematics courses and special programs, an exhibition of real interest in mathematics, the ability to do independent work, and performance in mathematical competitions, if any. The Prize is named for AWM former president and one of its founding members, Alice T. Schafer, who has done so much for women in mathematics throughout her career.

The task of choosing a winner was a difficult one for the Prize Committee which consisted of Bhama Srinivasan (Chair), University of Illinois at Chicago; Alice T. Schafer, Marymount University; and Jill P. Mesirov, Thinking Machines Corporation. Zvezdelina Stankova, a junior at Bryn Mawr College, was declared Runner-Up and will receive a $100 check. In addition to Neilsen and Stankova, the committee recommended that eight other exceptionally talented undergraduate women receive Honorable Mention. A sophomore and a first-year student were singled out for outstanding performances so early in their mathematical careers.

This year the number of nominations received doubled to ninety. It is a tribute to all of the undergraduate women who were nominated that they were recognized by their faculty for such an honor. The Committee took special note of the large number of nominations from community colleges and also of the significant number of older women with families who had been nominated for the prize. The outstanding work and accomplishments of the latter group were especially impressive, given the additional demands on their time and energy.

Jèanne Neilsen was described as a "highly original, enthusiastic, and talented young mathematician" and one of the best undergraduate



Jèanne Neilsen

mathematics majors her nominators had seen anywhere. Neilsen began to show promise as a research mathematician the summer after her sophomore year when she obtained results in finite group theory which have been submitted for publication. More recently, her interest in algebraic and differential geometry has yielded some impressive research results there. Professor Robert Bryant, in his letter nominating her for the prize, said, "Her mathematical maturity and insight are astonishing." Neilsen received an Honorable Mention in this year's Putnam exam, a national mathematics competition for undergraduates, finishing 30th out of 2347 contestants.

Zvezdelina Stankova is on a full scholarship at Bryn Mawr College, having won a competition in Bulgaria to identify gifted students to study in the United States. As a high school student she participated in the International Mathematics Olympiad on the Bulgarian team; she won silver medals in 1987 and 1988. Stankova finished 101st in the 1991 Putnam Competition. Next year, her senior year at Bryn Mawr, she will be taking graduate courses at the University of Pennsylvania and hopes to graduate with both a bachelor's and a master's degree in mathematics. "One of the brightest young people I have ever known, Zvezde is truly a star, as her name suggests," said Professor Rhonda Hughes in her nomination letter.

AWM is also pleased to recognize the eight outstanding women who were nominated for the Schafer Prize and given Honorable Mention in the competition.

Sarah Marie Belcastro is a senior at Haverford College. She has written a senior thesis in algebraic combinatorics and a paper with Gary Sherman based on her participation in a Research Experience for Undergraduates (REU) program at Rose-Hulman Institute of Technology.

Debra Boutin is a senior at Smith College. In joint work with Michael Albertson of the Smith faculty, she has written a research paper in graph theory. She is also thirty-something and a single parent.

Cheryl Grood is a junior at the University of Michigan who has successfully completed some very demanding courses in the Department. She participated in an REU program at Rose-Hulman in 1990, and this resulted in a paper in computational group theory.

Karen King is a senior at Spelman College and will begin graduate work at the University of Maryland in the fall. She has been engaged in research projects on coding theory at NASA and at Spelman. She gave talks at the Conference on Undergraduate Research at Caltech and at a meeting of the Mathematical Association of America in the spring.

Speranta Marcu is a senior at Santa Clara University. Her results in a summer research project were presented at the Conference on Undergraduate Research at Caltech in March.

Edith Mooers is a senior at the University of Washington who, to quote her nominating faculty member, "performed at a stellar level" in an advanced Lie theory course. She has participated in an REU program at the University of Washington, as a result of which she has written a research paper with the conference organizers.

Jessica Polito is a junior at Harvard University who has taken Harvard's accelerated program with great success and is at the level of some of the first year graduate students. She was one of the top 200 in the 1991 Putnam Competition.

Diana Thomas is a senior at the University of Montana. She is writing a senior thesis on fluid flows and turbulences. Her work resulting from an REU program at the University of Colorado (Boulder) was presented at the Conference on Undergraduate Research at Caltech in March.

Zvezdelina Stankova

In addition, two nominees were given special recognition by the Prize Committee for their outstanding achievements in mathematics so early in their careers.

Yick Chan is a sophomore at Barnard College who won the annual mathematics prize competition at Barnard/Columbia: her answer to one of the problems is described as "more enlightening than the answer designed by the creators of the exam." She is described by a Barnard faculty member as "the most talented undergraduate we have seen at Barnard in my 17 years here."

Millie Niss is a first-year student at Columbia University. She wrote a research paper in combinatorics in her very first semester. She is described by a faculty member as the "strongest undergraduate student I have ever worked with, irrespective of year, sex, or any other arbitrary category."

Continuing last year's tradition, AWM is planning a special award ceremony at the AWM Business Meeting on August 8, 1991 at 4:00 P.M. during the Joint Mathematics Meeting in Orono, Maine. Please join us in honoring all of these fine young women.

The Prize is funded by an endowment with initial contributions coming from the AWM, the American Mathematical Society, and the Mathematical Association of America, as well as individual contributors. **Additional contributions will help to ensure the long-term viability of the Prize. Checks made payable to "ATS Math Prize" may be sent to the Association for Women in Mathematics, Box 178, Wellesley College, Wellesley, MA 02181.**

AWARDS AND HONORS

Congratulations to all the women listed below for their meritorious achievements.

Rhonda J. Hughes, former AWM president and current chair of the Department of Mathematics at Bryn Mawr College, received the Sears-Roebuck Foundation Teaching Excellence and Campus Leadership Award on May 19th, 1991, at Bryn Mawr's commencement. The Award was given "in recognition of outstanding contributions to undergraduate education, student learning, and campus life."

Marcia Linn, director of UC Berkeley's Instructional Technology Program, has earned the 1991 Willystine Goodsell Award from the American Educational Research Association. She was cited for her research accomplishments in the area of gender, mathematics, and science. The Award is given for service to AERA "through scholarship, activism and community building on behalf of women and education."

Doris J. Schattschneider, Moravian College, has received a 1990 Meritorious Service Award for her work in the Eastern Pennsylvania and Delaware Section of the MAA. She has served the MAA at both the regional and national levels, including serving as Governor of the section and as Editor of *Mathematics Magazine*. Her work with tesselations of the plane and her exposition of M.C. Escher's art are internationally known.

The 1990 Meritorious Service Award for the Southern California Section has been given to **Alice King**, California State Polytechnic University. Along with her many service activities, including serving the section as Secretary and being the Regional Examination Coordinator for Southern California of the American High School Mathematics Examination, she has somehow found time to earn a law degree from UCLA recently.

Four women received NSF Mathematical Sciences Postdoctoral Research Fellowships. They are (name, field, Ph.D. institution, year of Ph.D., current institution, host institution): **Janet Becker**, nonlinear waves and hydrodynamic stability, University of California, San Diego, 1989, University of New South Wales, University of Washington; **Andrea Bertozzi**, hydrodynamics, Princeton University, 1991, Princeton University, University of Chicago; **Antonia Bluher**, number theory, Princeton University, 1988, University of California, Los Angeles, University of California, Los Angeles; and **Gail Letzter**, rings and algebras, University of Chicago, 1987, Wayne State University, Massachusetts Institute of Technology.

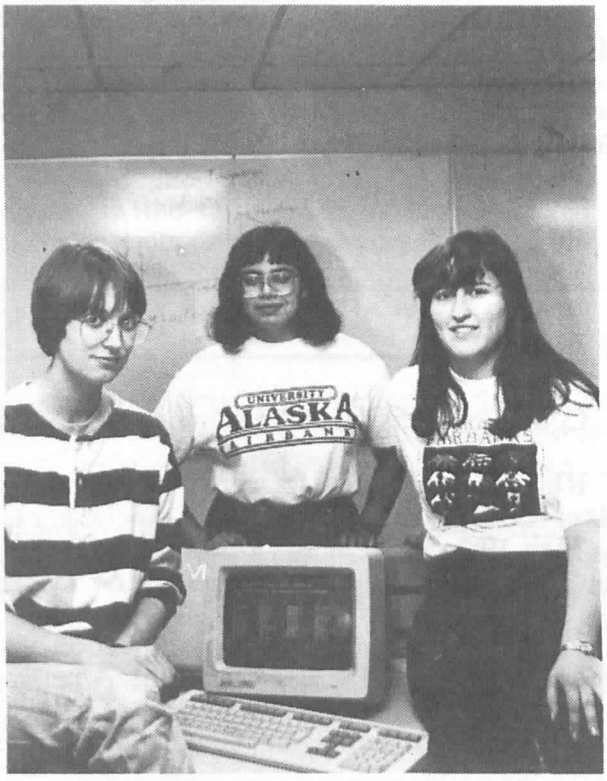
Janis Hardwick, Department of Statistics, University of Michigan, will be supported by the Division of Mathematical Sciences of NSF as a Presidential Young Investigator in Biostatistics.

In addition, the Division will be helping to support **Tamar Schlick**, Courant Institute, New York University, whose primary support as Presidential Young Investigator is coming from the biological sciences area of NSF. Her field is Computational Science.

Several women were on student teams which received awards in the most recent Mathematical Contest in Modeling, which is sponsored by the Consortium for Mathematics and Its Applications (COMAP). In fact, one team was composed entirely of women! The two problems this time concerned a city water tank and minimal spanning trees for a communications network.

Monica Menzies, Beloit College, Wisconsin and **Mary M. Wood**, Mount St. Mary's College, Maryland were each on one of the three teams judged Outstanding on the Steiner trees problem. This problem involved finding a minimum cost spanning tree for a nine-node communications network, given the rectangular coordinates for the stations and using only rectilinear lines, and generalizing the solution.

Anna T. Baumgartner, **Anupama M. N. Rao** and **Eiluned A. Roberts** of University of Alaska, Fairbanks, formed one of the three teams judged Outstanding on the water tank problem. The problem required estimating from limited data the daily water use and flow from a tank located in a small town. The students used methods including numerical differentiation using Newton-Gregory polynomials, interpolation with cubic splines, and numerical integration, according to their coach, assistant professor of statistics at UAF, Dr. Robert Hollister. The UAF team was also recognized as having the winning paper by the Society for Industrial and Applied Mathematics (SIAM). SIAM will pay the team's expenses to attend ICIAM '91 this summer to present their paper.



Eiluned Roberts, Anu Rao and Anna Baumgartner

AWM ELECTION

On behalf of the Nominating Committee (Rhonda Hughes and Linda Keen, co-chairs; Ruth Charney), I am pleased to announce the candidates who have agreed to run in the next AWM election.

President: Cora Sadosky, Howard University
Member-at-Large: Sylvia Bozeman, Spelman College; Mei-Chi Shaw, Notre Dame
Treasurer: Donna Beers, Simmons College

For the Committee, Rhonda Hughes

Note: Nominations by petition are due by **September 1, 1991.** Twenty signatures of current AWM members should be sent to President Carol Wood.

AWM WORKSHOPS

AWM Workshop at the Joint Mathematics Meetings, Baltimore , Maryland, January 8-11, 1992

AWM will sponsor an AWM Workshop (day to be announced) in conjunction with the Joint Mathematics Meetings in Baltimore, Maryland, in January 1992. This workshop is made possible through grants from the National Science Foundation and the Office of Naval Research. Two other workshops were included in the Workshop Grant: the AWM 20th Anniversary Symposium and Graduate Student Workshop, and the AWM Workshop at ICIAM '91.

Funding is available for ten women graduate students and ten women postdocs (within approximately five years of their Ph.D. degree) to attend the Baltimore Meeting and the AWM Workshop. The workshop will provide opportunities for women to discuss their research and participate in a number of other activities during the day-long program. Details on the program will be published in the next newsletter, and announcements will be sent to all mathematics departments in the U.S and Canada.

Each applicant must submit a short description of her research and a letter indicating her interest in attending the Baltimore meeting. In addition, both groups must submit a curriculum vita. Each graduate student must also have submitted a letter from her thesis advisor. Thesis advisors are encouraged to write thoughtful, informative letters of recommendation describing the student's work and including as much detail as possible to assist the selection committee in making their decisions.

Applications must be postmarked by **October 15, 1991.** Direct any questions regarding the workshop or funding to Tricia Cross at the AWM office.

AWM Workshop, ICIAM '91

We are pleased to announce the recipients of NSF/ONR funding for the AWM Workshop at ICIAM '91, Washington, DC, July 7, 1991.

The graduate students will have a poster session. Their names and affiliations are:

Karin Bennett, University of Kentucky

Suncica Canic, SUNY, Stonybrook

Danielle Carr, Duke University

Doris Hinnestorza, University of Cincinnati

Ying Sue Huang, Brown University

Rachel Kuske, Northwestern University

Martha Nesbitt, University of Colorado, Boulder

Frieda Porter-Locklear, Duke University

Catherine Samuelson, Rice University

Mei Zhu, University of Washington.

The post-docs will deliver twenty-minute talks. Their names and affiliations are:

Martha Abell, Georgia Southern University

Helene Barcelo, University of Michigan

Mary Brewster, University of Colorado, Boulder

Marie Dahleh, National Center for Atmospheric Research

Tylene Garrett, Transylvania University

Smadar Karni, University of Michigan

Wen Masters, Jet Propulsion Laboratory, CalTech

Naomi Decker Naik, Vassar College

Norma Rueda, St. Lawrence University

Mary Lou Zeeman, Massachusetts Institute of Technology.

AWM MUG: Donate $25.00 or more to AWM to support our activities and programs, and we will send you the official AWM mug. Here Bettye Anne Case shows one off.

CALL FOR NOMINATIONS: THE LOUISE HAY AWARD

The Executive Committee of the Association for Women in Mathematics has established the Louise Hay Award for Contributions to Mathematics Education, to be given annually to a woman at the January Business Meeting. Shirley M. Frye received the first such award at our 20th anniversary celebration in January 1991. The purpose of this award is to recognize outstanding achievements in any area of mathematics education, to be interpreted in the broadest possible sense. The awardee will be selected by a committee appointed by the President and will receive a citation at the AWM Business Meeting.

While Louise Hay was widely recognized for her contributions to mathematical logic and for her strong leadership as Head of the Department of Mathematics, Statistics, and Computer Science at the University of Illinois at Chicago, her devotion to students and her lifelong commitment to nurturing the talent of young women and men secure her reputation as a consummate educator. The annual presentation of this award is intended to highlight the importance of mathematics education and to evoke the memory of all that Hay exemplified as a teacher, scholar, administrator, and human being.

Nominations for the award should be sent by **October 7, 1991** to: The Hay Award Committee, c/o Patricia N. Cross, Association for Women in Mathematics, Wellesley College, Box 178, Wellesley, MA 02181. (617) 237-7517.

NSF-AWM TRAVEL GRANTS FOR WOMEN

The objective of the NSF-AWM Travel Grants is to enable women to attend research conferences in their field, thereby providing a valuable opportunity to advance women's research activities, as well as to increase the awareness that women are actively involved in research. If more women attend meetings, we increase the size of the pool from which speakers at subsequent meetings are drawn and thus address the problem of the absence of women speakers at many research conferences.

The Travel Grants. The grants will support travel and subsistence to a meeting or conference in the applicant's field of specialization. A maximum of $1000 for domestic travel and of $2000 for foreign travel will be applied.

Eligibility. Applicants must be women holding a doctorate in a field of research supported by the Division of Mathematical Sciences of the NSF (or have equivalent experience). A woman may not be awarded more than one grant in any two-year period and should not have available other sources of funding (except possibly partial institutional support).

Target Dates. The next due date for applications is August 1.

Applicants should send a description of their current research and of how the proposed travel would benefit their program, a curriculum vita and a budget to Association for Women in Mathematics, Box 178, Wellesley College, Wellesley, MA 02181.

IN MEMORIAM: A TRIBUTE TO WILHELM MAGNUS

On October 15, 1990, Wilhelm Magnus died, after a long illness. He was my thesis advisor, and Rebekka Struik's too, and since we knew he had been thesis advisor to many other women mathematicians, we agreed that a tribute in this *Newsletter* might be appropriate. Of course, we knew that we could only speak of our own experiences, so we asked other Magnus students if they would help. This article is made up of the responses we solicited and collected.

Wilhelm Magnus began a career in US academia at the age of 43, when he emigrated to the United States from Germany after World War II. He went on to advise an astonishing total of 62 Ph.D. students, among whom were 14 women! He took enormous pride in his successes as a teacher and believed with all sincerity that each of his students could become a creative mathematician. The list of his students, which is appended, includes many of our well-known colleagues and stands as an impressive tribute to Wilhelm's broad interests, to his extraordinary ability to judge where new research was waiting to be done, and to his generosity in sharing his time and his ideas with his students.

I would like to share with you one of my own experiences from the time when, as a graduate student, I arrived at the point where I had to select a thesis advisor. I knew Magnus and liked him, and I also knew of his reputation as an accessible and helpful advisor, yet I hesitated. The area which interested me the most was topology, but that was not in the then-existing menu of possibilities at Courant. The Magnus students I knew were all working on various aspects of combinatorial group theory, which did not have enormous appeal to me. Therefore I made the rounds and spoke to other faculty members to find out what they might suggest before I went in to see Magnus about a possible thesis topic. I was in for a surprise. To my astonishment, Magnus had not only anticipated that I might wish to work with him, even more he had also paid sharp attention to the small hints I had dropped about my tastes in mathematics. He had a problem all ready for me and was clearly impatient to tell me about it and to get to work. That day he told me about Artin's braid groups and about his own work on the mapping class group of the n-times punctured sphere and the twice-punctured torus, done in 1932, shortly after his thesis. He suggested that there were hints of a deeper relationship between braid groups and mapping class groups, which (an illustration of his old-world courtesy) might be accessible to someone who, unlike himself, did not "walk with blinders before his eyes." I was hooked, and all doubts vanished. Braids seemed very beautiful to me that day, and my love affair with them has continued to this day, shaping all my research.

On a different day I arrived for our weekly appointment with vague and half-formulated ideas, which I was initially hesitant to communicate. He quickly reassured me, telling me I was to regard him as "family" and his office as "home" — by which he meant a place for experimentation, for trying out new ideas, where one could feel free to make mistakes without shame. At the same time he also let me know that there was much inspiration to be found in belonging to a family whose roots reached back to Magnus' own mathematical mentor, Max Dehn.

I think it would have pleased Wilhelm to read the tributes from his students which appear on the pages that follow.

Professor Joan S. Birman
Columbia University
New York, NY

from Professor Benjamin Fine:

I was Magnus' next to last Ph.D. student at Courant — Esther Freilich was the last. I have been asked on numerous occasions what I consider to be Magnus' greatest contributions. This is a difficult question since so many of Magnus' contributions were hidden. Certainly Magnus made fundamental and seminal contributions in many areas of combinatorial group theory, including the proof of the Freiheitssatz and the ideas behind it leading to the whole development of HNN extensions as well as the ideas surrounding the Magnus representation. However, a look at his own work does not even begin to reflect his impact on the discipline. I will let others comment more fully on his mathematics. Let me

say that in my own case the problems and insights which he directed me towards in my thesis led directly to ten years of solid work and indirectly to almost everything else I've worked on.

Magnus was totally unselfish with his ideas, and his insights were tremendous. Through his many students, his presence and impact is felt in almost all currently "hot" areas of infinite group theory — automorphism groups, braid and knot groups, one-relator groups, geometric methods, hyberbolic groups (through his work on discrete groups) and low dimensional topology among others. Perhaps his greatest contribution was his ability to spread his ideas so widely through his students and then not take any credit for it. Here is just a simple relatively recent illustration. Magnus became interested in the so-called Neumann subgroups of modular groups. Parts of his ideas developed into a thesis topic for Esther Freilich. An extension of this became a thesis for Carol Tretkoff, which in turn was generalized and extended in a series of papers by Roger Lyndon and A.L. Brenner. Through all this, Magnus' impact and ideas were present, yet he himself stayed in the background — complimenting the others on what beautiful work they were doing.

Magnus' generosity was legendary. Roger Lyndon, who was of course himself one of the most influential people in the field, often spoke highly of how helpful Magnus had been to him as a young group theorist. Lyndon then dedicated his own book *Combinatorial Group Theory* (with P. Schupp) to Magnus. I should mention that Magnus' book with Karrass and Solitar was also a tremendous contribution. A whole generation of combinatorial group theorists grew up on this book. In my opinion, even though the discipline has taken a more geometric turn, it is impossible to truly work in the field without being familiar with Magnus, Karrass, and Solitar.

Magnus was also entirely without self-aggrandizement. As an illustration, consider his own treatment of his book *Discrete Groups*. This is still one of the finest expositions in print of the subject. Joe Lehner, in his book on automorphic functions which for many years was the definitive treatment of the area, mentions how influential Magnus' *Discrete Groups* notes were to him. Yet Magnus chose to leave this book as an almost hidden set of Courant notes rather than publish and promote it. He felt it was available as it was to those who needed it.

Why Magnus had so many women students and students in general, was a function of this unselfishness and basic humanity. He was willing to work with anyone who wanted to work in the field and was not intimidating about it. Magnus made his students feel that they knew more than they really knew. The reputation at Courant was that every Magnus student eventually finished — how much Magnus gave depended on the strength of the student. This had a downside — often it was difficult early in their careers to know how to evaluate Magnus students. There was always the question of how much was Magnus and how much was the student. Yet this basic helpfulness and unselfishness with ideas coupled with tremendous mathematical insight was what led students to come to him. In the department at Courant, where most of the professors were accessible, Magnus was the most accessible.

Fairfield University
Fairfield, CT

from Professor Abe Shenitzer:

I first met Wilhelm Magnus in 1950 when I was admitted to NYU as a graduate student. We quickly became friends.

I was Wilhelm's first doctoral student in the U.S. Since I was reasonably intelligent and a good student, Wilhelm assumed that I was a potentially good researcher and gave me a very difficult problem to work on. My progress was glacial. One day Wilhelm told me that he had just read a paper bearing on the problem I was to solve and concluded that he, Wilhelm, did not understand the problem. The obvious conclusion was that I should work on another problem.

The second problem was essentially computational, and I was able to get results quickly. Then Wilhelm went to a conference in Baltimore and came back crushed. It turned out that in Baltimore he had been approached by a doctoral student who had all of my results and many more. Wilhelm was so upset that all I could think about was the need to comfort him. Finally he said that if I had the energy, then he would suggest a third problem for me to work on. His suggestion took the form of

what he thought was a true theorem. A few months later I had a proof. One year later (in 1954) my main findings were published in the *Proceedings* of the AMS. "Now I congratulate you," said Wilhelm.

My story was the first installment of a "caring teacher" series that was to involve Wilhelm Magnus and 61 other doctoral students.

Wilhelm Magnus passed away on October 15, 1990. At the funeral he was eulogized by his philosopher friend Hans Jonas who called him one of the "Lamed Vav" — a Hebrew term for the thirty-six just who make possible the world's continued existence. Never was this epithet bestowed with greater justice.

York University
Toronto, Canada

from Professor Ruth Rebekka Struik:

From 1953-1955, I was a graduate student at NYU; Wilhelm Magnus was my thesis advisor. Since it is over thirty years ago, I am not certain how accurate my memories are, but here they are.

When I first came to NYU in January of 1953, I had already completed several years of graduate study (M.A. from University of Illinois, and a year of graduate work at the University of Chicago). I registered for a course on automorphic functions; the prerequisites (according to the catalog) were a standard course in complex variables, which I had already had. The text was *Automorphic Functions* by Lester Ford. To my horror, once I started attending lectures (given by Professor Magnus), I discovered it was assumed that one had attended the course on discrete groups given by Professor Magnus the preceding semester. There was no text for that course; a student was in the process of writing up the notes for it, but they would not be available for months, maybe years. At one point I found out that the first few chapters of the text by Ford were what had been covered the previous semester; all I needed to do was study them. What a relief!

Later I worked on a thesis under Professor Magnus. Every week we had an appointment. I enjoyed these meetings and working on the problems he suggested. A few months after we had really been working, he said, "you have enough for a thesis." I was sad about no longer going to talk to him each week; it would have been nice to continue, but that was his decision. Now that I know that he eventually had 60 students, if he had several by then, he probably needed to devote more time to them.

After receiving my Ph.D. from Professor Magnus, I saw little of him. From 1957-61, I was in British Columbia; then I came to Colorado. In a letter dated 1963 he agreed to write a letter to support my request for aid from Sigma Xi. When I wanted a letter from him in support of my promotion to full professor, he wrote immediately.

Over the years we exchanged greetings at Christmas time. In one such greeting he wrote "I am allergic to mass meetings," referring to national math meetings. When I was beaten up riding my bike home at midnight in December of 1968, he wrote a note.

We saw each other at a group theory conference in the early seventies and had a long chat. I regret not having a better recollection of what we said. Now that he is no longer here, I regret not having tried to contact him when I visited the New York area.

University of Colorado
Boulder, CO

from Dr. Edna Kalka Grossman:

I was one of the last students at the Courant Institute to have Wilhelm Magnus as a thesis supervisor. I began working with him in the spring of 1971 and received my doctorate in the fall of 1972. There was much outside of mathematical research to keep us busy during this time. For Professor Magnus, this time marked the end of his career at N.Y.U. and the preparation for beginning anew at New York Polytechnic, while for me this was the first year of marriage. Distraction may have been a problem for me, but at each of our meetings, I was surprised at how undistracted Professor Magnus was. He seemed to need no reminding of where things had stood when we'd last met and followed anything new I had done at a detailed level.

For my thesis work, Professor Magnus suggested that I study integral matrix representations of the automorphism groups of free groups. This was a subject about which little was known, Professor Magnus himself being one of the few

people to have done anything significant in the field. My first inclination was to begin by doing an exhaustive literature search, hoping to find some helpful tools. I was gently steered off this course by Professor Magnus. He did it, not by reminding me that he was an expert in the subject who would surely be directing me to any useful past work (much of it his own), but by telling me that he hoped I would bring a fresh point of view to the problem and that cluttering my mind with other people's work would only bias me toward looking at it in the same old way. This was a piece of advice which served me well many times in life, in mathematical as well as non-mathematical situations. The way in which it was given typifies for me Professor Magnus' modesty and his disinclination to take credit for himself or to give criticism to others.

Professor Magnus was very much an old-world gentleman, always bowing slightly when I entered his office. In all his dealings with people he was especially careful not to offend others by addressing them in an "incorrect" manner. At that time, professors with female students were sensitive to a woman's desire to maintain her own name after marriage and to her having a preference among Ms., Miss, Mrs., Professor, or Dr. But Professor Magnus was unusual in that he extended this sensitivity to the husbands of his female students. Reaching my husband once when he phoned my home shortly after I had received my Ph.D., he asked: "Professor Grossman, may I please speak to Mrs. Grossman?" I picked up the receiver, and his first words were, "How are you Dr. Kalka?" I was glad that not too long after that our relationship switched to a first-name basis.

Brilliance, humility, and sensitivity are seldom found together in one person as they were in Wilhelm Magnus. It was a great privilege for me to have had him as a teacher and advisor.

IBM
White Plains, NY

from Professor Harry Hochstadt:

In a recent letter, Joan, you asked why I thought Wilhelm Magnus had so many women students. I should like to broaden the question by asking why he had so many students, and the answer to why he had so many women students is implicit in my answer to that question. There are two aspects to the answer, namely his mathematical breadth and his personality.

Wilhelm had two major areas of research — analysis and algebra. In algebra he had students in both finite group theory as well as infinite group theory, which in itself is an unusual combination. In analysis his major area was special functions and their applications to problems of wave propagation. Some students worked on projects dealing primarily with special functions, and others worked on problems of wave propagation which could be solved using special functions. I don't have to emphasize how rare it is to find a mathematician with Wilhelm's talents who also had such widespread interests. He also had an uncanny knack of finding problems, and he was able to match problems to the talents of individual students.

What made Wilhelm such a fine teacher was his deep concern for students and his great courtesy. He performed extremely well in the classroom, and that in itself drew students to him. He would never put a student down or hint that anyone was deficient in any way. Other advisors gave students little leeway in assigning problems and offered little help. Wilhelm was always available. If the student found the problem to be hard, Wilhelm would offer another problem. I believe these qualities helped to attract many students. Women who started graduate work in mathematics had probably encountered more obstacles in their earlier studies then men and therefore appreciated these qualities even more than men.

Polytechnic University
Brooklyn, NY

from Professor Carol Tretkoff:

My thesis advisor Wilhelm Magnus was a dedicated mathematician and teacher. I knew him during his last years at the Courant Institute and his years at the Polytechnic University in Brooklyn. The one course I took from Magnus was the Introductory Graduate Number Theory course at Courant; it was one of the best courses I have ever taken. He transmitted his love of mathematics and appreciation of fine proofs to the class; and he gave for homework very interesting and nontrivial problems, some of which he himself had gotten as

a student from Carl Ludwig Siegel. I especially enjoyed working on these problems and finding my way to the clever point behind them.

My debt to Magnus lies mainly in the thesis topic that he gave me. It was a conjecture that came from some early work of B.H. Neumann; it served not only as a fruitful topic, but as an introduction to interesting mathematics and other mathematicians, including the Neumanns and Roger Lyndon.

I will never forget how after my thesis defense he welcomed me to the club of mathematicians, saying "Carol, you can call me Wilhelm now."

Brooklyn College
Brooklyn, NY

from Professor Donald Solitar and Professor Abe Karrass:

As far as the relatively large number of women who worked with Wilhelm goes, we think it was in part due to Magnus' unthreatening manner and his generosity in aiding students' and colleagues' research. Wilhelm also had a strong sense of family, and there was a "group theory family" that regularly attended the Group Theory Seminar, which alternated between lectures by visiting researchers and "tutorial sessions." Some part was also played by the location of the Courant Institute in New York and by the helpful attitude there, which allowed students to be more financially independent.

He was courageous and risked his life to save Nazi victims. Although his social manner suggested diffidence, he was in fact quite confident in mathematical and personal beliefs. His research shows originality, which was regarded uneasily by colleagues at the time.

Moreover, he not only produced results, but also pioneering methods for the solution of problems in each of the areas in which he was involved. His great imagination and intuition allowed umpteen problems to be given to students and umpteen transformations from unsolvable dead ends to clear pathways.

We treasure many memories of Wilhelm, which reveal his kindness and genuine concern for people, especially people with difficulties.

We were invited to Wilhelm's house after knowing him for about four months, while helping with his group theory text. He said that instead of Professor Magnus, we should call him "Wilhelm," or if that was too difficult (because of the "v" sound) then just plain "Bill."

A famous mathematician was visiting Wilhelm, who greeted him with "And how's your family?" whereupon the visitor said, "Never mind my family, what do you think of my latest result?"

When Wilhelm was starting out his career, he accompanied a famous mathematician to a famous institute, with the lady friend of the visitor. In those days the institute practiced a pretty severe form of propriety so that the lady friend could not be housed at the institute. His "assistant," Wilhelm, therefore enquired of secretaries for a suitable place in town where the lady friend might be housed. Immediately rumors flew to the effect that Wilhelm was marrying the lady.

When asking Wilhelm for the best method for refereeing a paper, he immediately replied, "Don't bother at first with long proofs, but go to those places where the author says, 'It is obvious that, or clearly.' Almost 95% of errors occur precisely there."

York University
Ontario, Canada

from Professor George Bachman:

When I started research work on my doctoral thesis, I thought I knew a lot, and that it would be fairly easy. In reality, I had much to learn, but had the good fortune of working under the guidance of Wilhelm Magnus.

Wilhelm had enormous knowledge and suggested my thesis topic to me; he took me through all the rough spots; he constructed examples for me when I was badly stuck — helping me to see what was really going on. In addition, Wilhelm Magnus was incredibly encouraging and concerned at all stages of the research. His office door was always open for a quick or not so quick consultation when things were not working out — or even when, at times, they went smoothly.

In essence, he helped make research significant and enjoyable to a beginner and imbued in me an abiding love of doing research.

Since those days, I have had a number of thesis students of my own. I have tried to approach

Wilhelm's way of guiding doctoral students, and if I have had any success it is due in large measure to his inspiring example.

Polytechnic University
Brooklyn, N.Y.

The Ph.D. students of Wilhelm Magnus

George Bachman
Seymour Bachmuth
Joan S. Birman
Leslie Blumenson
James Briggs
Robert Brigham
Bruce Chandler
Orin Chein
David Cohen
Anastasia Czerniakewicz-Kerzman
Albert Drillick
Dennis Enright
David Epstein
Irving Epstein
Robert Feuer
Benjamin Fine
Emanuel Fischer
Diane Forrastiero
David Fox
Karen Frederick
Esther Freilich
Betty Jane Gassner
Karin Ginsberg
Philip Gold
Martin Greendlinger
Edna Kalka Grossman
Morton Hellman
Harry Hochstadt
Robert Horowitz
David L. Jagerman
Robert Katz
Leon Kotin
Kathryn Kuiken
John Ledlie
Bernard Levinger
Henry Levinson
Seymour Lipschutz
John Mariani
Nathan Newman
Ada Peluso
Eugene Pflumm
Samuel Poss
Richard Rosenthal
Martin Schechter
Martin Segal
Abe Shenitzer
Patrick Socci
Bernard Sohmer
Donald Solitar
Dennis Spellman
Peter Stebe
Arthur Steinberg
John Stevenson
Daniel Stork
Elvira Rapaport Strasser
Ruth Rebekka Struik
Charles Traina
Carol Tretkoff
Charles Weinbaum
Franz Wever
Stanley Winkler
Nancy Zumoff

THERE THEY GO AGAIN!

Doris Appleby and Maryam Hastings, professors of mathematics at Marymount College, Tarrytown, NY, recently had a letter to the editor published in their local Gannett newspaper. They wrote to complain about a week of "Luann" comic strips in which girls are stereotyped as math-haters. From their letter:

> The first strip reminded readers that Gunther ... is the nerd who likes Luann. ... In the third strip, we found that not only is Luann no good at math, but she also has no idea why it might be useful. ... In the final episode Luann got a couple of problems right, for which she credited the ever-faithful Gunther, not herself.

In the second strip, after Gunther explains an equality to her, Luann says "Oh, you mean like, 'Doing these problems *equals* feeling stupid, frustrated and sick to my stomach?' "

Hastings and Appleby point out how this "humor" undermines our attempts to "make our female students realize that they are just as good as men in subjects requiring mathematical reasoning."

BOOK REVIEW

Winning Women into Mathematics, edited by Patricia Kenschaft, Mathematical Association of America, 96 pp., 1991, paperbound, $11.00, ISBN 0-88385-453-8.

Consider the following:

A well-known math department hires (with tenure) a well-known woman mathematician. She leaves after one semester.

In another math department, women students start dropping out before the end of their first semester of graduate school.

After a year at a research institute with her advisor, a graduate student has not gotten to know any other mathematicians.

The MAA Committee on the Participation of Women has produced *Winning Women into Mathematics* to produce an understanding of problems like these and to provide examples of successful solutions.

A main focus is micro-inequities, "small injustices which happen every day," which I'd characterize as a mixture of plain bad manners and our society's beliefs about women. Some, dramatized by Sue Geller, were presented as skits at the January 1990 AMS meeting.

Here are some examples:

An eminent male mathematician sits next to a female mathematician on a bus. When she interjects a relevant comment into the discussion of common finals which the male mathematician is having with surrounding male mathematicians, he turns and glares at her, and continues, ignoring her comment.

Dr. X, a male mathematician, and his wife meet Dr. Y, a female mathematician, and her husband. Dr. Y introduces Mr. Y as a lawyer. The form of the ensuing conversation is an iteration of the following (*i* runs from 1 to 4):

> Dr. X: Mr. Y, do you do mathematical activity Z_i?
>
> Mr. Y: I'm a lawyer, my wife is a mathematician.

Micro-inequities are petty, but together form "a serious obstacle to sanity, success, and feelings of well-being; they lead to a sense of alienation."

Some of the beliefs and customs that fuel micro-inequities are described in Kenschaft's article "Fifty-five cultural reasons why too few women win at mathematics." This is a collection of short accurate summaries, many of research and longer articles. They are categorized as societal, familial, specific to educational practice, specific to mathematical practice, and resulting behaviors of individuals. The categories and their ordering give a sense of the interconnectedness of these beliefs and customs, and their cumulative effect on girls and women moving through the mathematical pipeline.

Kenschaft gives, of course, a synopsis of the Benbow-Stanley study purporting to show a biological basis for differences in mathematical ability, but also summarizes the less well-known related study of Eccles and Jacobs. The latter showed the damage done by media accounts of the Benbow-Stanley study by comparing daughters of mothers who'd heard of the study with those who hadn't. Daughters of mothers unacquainted with the Benbow-Stanley study tended to take more math courses.

Here's a sample of the fifty-four remaining reasons:

> Teachers at all levels pay more attention to male students.
>
> The isolation of women in mathematics classes can cause them to feel alienated and/or result in a lack of study companions.
>
> It is a rare woman that possesses the combined requirements that she both enjoys men as close companions and has an unusually strong belief in women's capabilities. Without the former she won't develop the collaborators and coauthors so often needed for success in mathematics, and without the latter she may collapse under her own self-doubt.

Without knowing some history, it is easy to conclude that few women wanted to become mathematicians in the first part of this century. Frances Rosamond's chapter "A century of women's participation in the MAA and other organizations" contains some surprising facts. In 1912 about 50 of the 668 AMS members were women and "[a]bout twelve percent of the charter members [of the MAA, founded in 1915] were women." Early barriers to women's participation in mathematics were graduate schools which didn't

admit women, or did admit them and wouldn't grant them Ph.D.'s, colleges and universities which didn't hire women, or did hire them, but at salaries less than those of men. Later barriers: "Until quite recently few men would agree to be an advisor for a female graduate student," and "married women mathematicians usually could [work only] as research assistants or part-time faculty." African-American women faced extra obstacles: they could not earn Ph.D.'s at any southern institution, and, sometimes, as in the case of Vivienne Malone Mayes in the 1950's, they could not become teaching assistants, attend some professors' classes, or discuss mathematics in a café.

Sandra Keith's chapter "Winning women into math: what is being done" briefly describes some of the many programs to recruit and retain girls and women in math and science which were presented at the National Conference on Women in Mathematics and the Sciences (organized by Keith). Programs for girls range from one-day conferences like Expanding Your Horizons (national), Futurescape (Georgia), MathConn (Pennsylvania) to summer institutes such as SummerMath (Massachusetts), Eureka! (New York), and Summerscape (Georgia) to mentoring programs which follow students from high school to college. College and university programs include the Douglass Program at Rutgers which combines (among other things) peer study groups, an intern group, and a residence hall for women in science; NSF Research Experiences for Undergraduates at Case Western Reserve; innovative courses; and networking programs linking women science and engineering faculty with those at other schools, with women in business and industry, and with pre-college girls.

And there's more: Donald Bushaw has contributed an extensive annotated bibliography of educational, historical, and career information about and for women in mathematics. Sandra Keith does a statistical overview of 1989 American women doctorates. David Ballew presents statistics on women's participation at MAA section meetings. A minority woman's viewpoint is given by Eleanor Dawley Jones. Patricia Kenschaft discusses what you can do to promote women's participation in mathematics. There are anecdotes, cartoons, and photographs (I especially like that of the seven-woman Wellesley College math department of 1928).

Winning Women into Mathematics is easy to read and packed with information. Perhaps micro-inequity theater will be coming to a math department near you. And perhaps math departments will become kinder and gentler worlds for all.

reviewed by Cathy Kessel

Book Review Editor
2523 Piedmont Avenue
Berkeley, CA 94704

WAM: NOT JUST A PERMUTATION OF LETTERS

Those of us who work in the Women and Mathematics Program (WAM) find ourselves responding to questions about AWM or to remarks such as "but it's the same, isn't it?" referring to the two organizations AWM and WAM. It is disappointing to respond to these comments with what we think are clear explanations of the differences, only to have the same comments or questions repeated the next day, or week, or month. This is particularly frustrating since there are such obvious differences between the two organizations, AWM being much larger with many more activities and very different in scope. Just what is the difference or, more to the point, just what is WAM? Everyone knows what AWM is.

I will try to answer this question, although sometimes I am not sure just what we are as we seem to be always changing or, I hope, evolving. The Women and Mathematics Program started as a speakers bureau in 1975 funded by IBM and sponsored by the MAA. The concept came about during an IBM-hosted reception for high achievers in the U.S.A. Mathematics Olympiad, where it was noted that there were no women among the winners. Mary Gray wrote the original proposal, and Eileen Poiani was the first director. We started with three geographical regions, New York/New Jersey/Connecticut, Chicago and the San Francisco Bay Area.

We have since expanded into sixteen regions throughout the United States. We still visit schools

upon request, as well as math clubs and parent-teacher meetings. Some of our other activities include taking part in career days, organizing and staffing career conferences, mentoring individual female students, and conducting tours through technical laboratories. In general you could describe our activity as anything that will further the goal of encouraging young women to study mathematics in grade school and high school, to feel good about their mathematical ability and their enthusiasm for mathematics, and to recognize that they need mathematics to take a full and complete part in the world of the future.

Thus WAM is not an association or club; we have no formal membership or dues; and the only way anyone can join is to be female and be willing to answer requests to go where we are needed, usually schools (elementary, middle, junior high, high schools and colleges) to speak to students, then follow any paths that open up from the school visits that will connect with and encourage female students to develop their math ability. Our initial visits with the schools and classes are with all the students. We do not segregate the females from the males. The males need encouragement too and need to realize that women can and do participate fully and successfully in scientific and technical fields. All WAM volunteers are female as we are providing an image, a role model of the successful, competent scientist-technologist woman of today.

We have WAM volunteers from all parts of the scientific community. But we don't stop there. Any woman who is interested in encouraging young women and who holds a job that requires four years of high school mathematics can be a WAM volunteer. There are no degree requirements or college mathematics requirements. In short, we are not trying to create mathematicians. We want to free young women of the "women can't/don't do mathematics" stereotype.

Each year WAM makes contact with over 25,000 students, 2500 teachers and 1500 other adults. We have about 500 volunteers making approximately 500 formal presentations. And all this is done on a budget of about $40,000, over 30% of which is in goods and services contributed by the volunteers themselves. We are a dedicated group of women. We also depend upon grants from IBM and other foundations for funding.

If you have any questions about the Women and Mathematics program, would like to receive our brochure or annual reports, or would like to become a volunteer or regional coordinator, please contact me at the Department of Mathematics, Santa Clara University, Santa Clara, CA 95053 (email AKELLY@SCU.BITNET).

Alice J. Kelly, National Director of WAM

LETTER TO THE EDITOR

I am pleased to have been an AWM member for twenty years! The organization and its members have made great strides in changing the perception of the role of women in mathematics. However, I wish to make a special plea to the members of AWM. Since January 1990 when I became Editor-Elect of *Mathematics Magazine*, I have been receiving and processing manuscripts for the journal. I expect to be Editor until January of 1996. I am surprised by the small number of papers submitted by women. As many of you know, *Mathematics Magazine* is a refereed publication of the MAA. It is not a research journal, rather it emphasizes expository writing on mathematics. Our approximately 16,000 subscribers are college professors, high school teachers, undergraduates, beginning graduate students, and non-academics who enjoy the lively articles about mathematics, its relationship to other disciplines, and its history. I urge the members of AWM to consider writing for this journal. I am particularly interested in articles that explain current mathematical research for the non-specialist. The editorial policy statement appears in the February 1991 issue (v. 64, n. 1).

If you are not ready to contribute your own paper, why not volunteer to be a referee? Just send me a note indicating your mathematical interests, and we will be happy to give you work.

I hope to be hearing from many of you soon.

Sincerely,

Martha J. Siegel
Towson State University
Towson, MD 21204

EDUCATION COMMITTEE

Beth Porter (Collin County Community College, Texas) is one of our "state reporters." To obtain information, she designed a questionnaire and cover letter to send to a variety of institutions in her state. After compiling the responses, she wrote the following "Report from Texas."

A Symposium on Supporting and Encouraging Women in Mathematics and Natural Sciences

On November 3, 1990, a Symposium on Supporting and Encouraging Women in Mathematics and in the Natural Sciences was held at The University of Texas at Austin. The 300 in attendance focused on obstacles that women face pursuing a career in the sciences and how to remove them. Lectures covered such topics as "The Role of Institutions that Teach Teachers," "Classroom Teaching," and "Minority Women in Mathematics and Sciences: Success Stories."

By the close of the symposium, close to 60 recommendations for action were generated by the participating institutions, parents, businesses, teachers, and civic organizations. These recommendations ranged from considering "single-sex learning environments" for those classes in which women might be intimidated by men to reconfirming the need for accessible inservice and teacher education programs. To ensure that these recommendations were put into action, an implementation group was established.

The symposium was co-chaired by Drs. Robert S. Boyer (Computer Sciences) and Martha Smith (Mathematics). Co-sponsoring institutions from the Austin area were Austin Community College, Concordia Lutheran College, Huston-Tillotson College, St. Edwards University, Southwest Texas State University and Southwestern University. Those financially supporting the symposium were the College of Natural Sciences Foundation Advisory Council, IBM Corporation, Lone Star Girl Scout Council, Mobil Research and Development Corporation, Radian Corporation, RGK Foundation, Texas Instruments, 3M Austin Center, and Women's Foundation of Texas.

Texans Addressing the 1990 International Congress on Mathematics

Dr. Karen Uhlenbeck was the second woman to have the honor (the first being Emmy Noether in 1932) to present one of the plenary addresses at the 1990 International Congress of Mathematics in Kyoto, Japan. Uhlenbeck is the holder of the Sid Richardson Chair in Mathematics and teaches at The University of Texas at Austin.

Dr. Saber Elayd of Trinity University also gave a plenary address at the International Symposium on Functional Differential Equations and Related Topics in Kyoto, Japan.

MathCounts

In February 1990 the MathCounts trial contest got underway at The University of Texas at Dallas for seventh- and eighth-graders of surrounding counties. The contest is sponsored by the National Society of Professional Engineers and focuses on wiping out mathematics illiteracy in the United States. The competition consisted of three written tests followed by an oral countdown round for high scorers of the written tests. The winners received various prizes and an expense paid trip to Austin for the state competition held in March. The national competition was held May 2-5 in Washington, DC.

To prepare for the competition, teachers and parents coached the students for months in basic arithmetic, algebra, and more advanced math, such as statistics and probability. The coaching starts with three to four hours a month, then progresses to daily sessions the month before the competition. By that time, according to Elizabeth Metting (local contest chairwoman), many students "will be performing at least a year ahead in some math skill areas."

Taking Charge

At Tarrant County Junior College (T.C.J.C.) on April 21, 1990, an Expanding Your Horizons conference was held for 200 sixth- to eighth-graders from Tarrant County Schools. Organizing this event were Jane Moore (Texas Wesleyan College) and Lou Ann Mahaney (T.C.J.C.).

Dr. Daniel Freed and Dr. Karen Uhlenbeck of The University of Texas at Austin are organizing the first summer's research program entitled "Geometry and Topology of Manifolds and Quantum Field Theory" for the Geometry Initiative funded by the National Science Foundation. The initiative involves universities from Texas (including Rice University), Utah, Illinois, Michigan and

Washington. The main focus of the program is to integrate studies in geometry at all levels. The chief organizer of the Geometry Initiative is Dr. Herb Clemens of Utah.

Dr. Elaine Kant organized Austin's first Expanding Your Horizons conference for young women that was held on February 23, 1991. Dr. Kant is a computer scientist at Schlumberger Corporation.

San Jacinto College Central hosted a Conference on Technology in June 1990 in Houston, Texas. The conference focused on incorporating graphing calculators into the mathematics curriculum from the middle school level to the college level. The next conference will be held June 21-22, 1991, at the Marriott Astrodome in Houston, Texas.

Awards

Kathy Childs and Dr. Vanessa Huse of Lon Morris College were awarded the Eisenhower Grant for Math and Science Development. The Grant provided funds for a summer inservice training session for county-wide elementary schools.

Dr. Woody Bledsoe of The University of Texas at Austin was awarded the 1990 Milestone Prize by the American Mathematical Society in honor of his work in Automatic Theorem Proving.

Minerva Cordero-Vourtsanis and Marianna A. Shubov of Texas Tech University were awarded travel grants by AWM/NSF toward expenses to attend conferences. Minerva attended Combinatorics '90 in Gaeta, Italy, in May 1990; Marianna presented an invited talk at the Conference in Oberwolfach in May 1990.

Chair: Sally I. Lipsey
70 E. 10th Street, #3A, New York, NY 10003

Education Committee Call for More State Reporters

The Education Committee would like to make sure that each state is represented in our column. Would you like to become a member of our committee as a "state reporter"? The charge would be to take responsibility for an annual report (1-2 pages or longer) on mathematical education news from your state, particularly, but not only, covering projects involving women. Such information might be based on material from a state department of education, state or local educational institutions, or other sources. If you would care to take on this responsibility, please let us know when during the year it would be convenient for you to submit your report. We will send you the forms developed by Beth Porter which you might like to use. Please respond to AWM Education Committee, c/o Sally I. Lipsey at the address above. Thank you.

1991 MATHEMATICAL SCIENCES DEPARTMENT CHAIRS COLLOQUIUM

The 1991 Mathematical Sciences Department Chairs Colloquium sponsored by the Board on Mathematical Sciences, National Research Council, will be held on October 18-19, 1991, in Arlington, VA. The theme of the 1991 colloquium is "Encouraging Talent into the Mathematical Sciences Pipeline." The program is designed to provide information and materials chairs may use in the design of recruiting and nurturing programs for their departments.

Conferees will be provided with information about the mathematical sciences pipeline. On Friday, October 18, a panel presentation and floor discussion on these issues will be held. The next morning, workshops (divided according to whether primary institutional emphasis is teaching or research) based on the preceding day's material will be held.

The conference will include other panel discussions, a session for new department chairs, and other sessions. The keynote speaker for the colloquium is Mary Good, Chair of the National Science Board.

The registration fee is $160.00 and includes all colloquium sessions, materials, and related meals and social activities. For further information, write or phone: Board on Mathematical Sciences, National Research Council, 2101 Constitution Avenue, NW, Room NAS 312, Washington, DC 20418; (202) 334-2421.

GENDER DIFFERENCES IN MATHEMATICS PERFORMANCE: A META-ANALYSIS: Part 2 of 2

Discussion

Averaged over all studies, the mean magnitude of the gender difference in mathematics performance was 0.20. When SAT data were excluded, *d* was 0.15. The positive value indicates better performance by males on the average, but the magnitude of the effect size is small. Figure 1 shows two normal distributions that are 0.15 standard deviation apart. If one looks only at samples of the general population (excluding selective samples), *d* was -0.05, indicating a female superiority in performance, but one of negligible magnitude. We can place considerable confidence in these results because they are based on testing literally millions of subjects, on more than 200 effect sizes, and on many well-sampled, large studies such as the state assessments.

These findings are in contrast to the results of Hyde's (1981) earlier meta-analysis, in which she reported a *d* of 0.43 for quantitative ability. The discrepancy may be accounted for in two ways. First, her computation was based on a small sample of studies taken from the Maccoby and Jacklin (1974) review; sufficient information was available for the computation of only seven values of *d*. In addition, to test Maccoby and Jacklin's hypothesis that gender differences in mathematics performance emerge around the age of 12 or 13, only studies with subjects 12 years or older were included. Using only that set of studies probably produced a larger gender difference than if studies with younger subjects had also been included. Second, the present meta-analysis provides evidence that the magnitude of gender differences has declined over the past three decades. We found that *d* was 0.31 for studies published in 1973 or earlier and 0.14 for studies published in 1974 or later. Thus, there probably has been a decline in the gender difference since 1973. These findings are consistent with those of Feingold (1988), who documented a decline in the magnitude of gender differences in abilities as measured by several standardized tests.

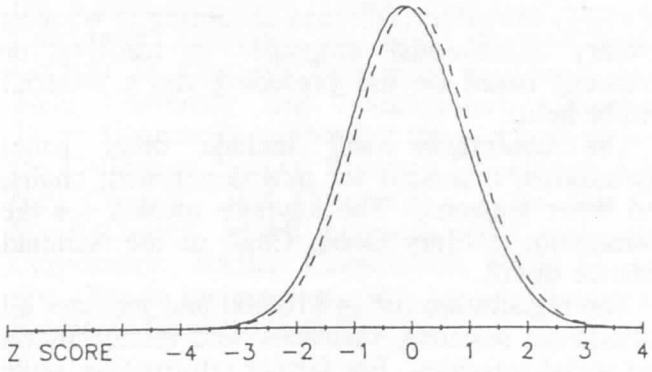


Figure 1: Two normal distributions that are 0.15 standard deviations apart (i.e., $d = 0.15$. This is the approximate magnitude of the gender difference in mathematics performance, averaging over all samples).

It is important to recognize that the set of effect sizes is not homogeneous. It is therefore essential to consider variations in the magnitude of the gender difference as a function of the three variables that were significant predictors in the multiple regression analyses: age, selectivity of the sample, and cognitive level of the test.

Age Trends and Cognitive Level

Age trends in the magnitude of the gender difference in mathematics performance are important. Averaging over all studies, there was a slight female superiority in performance in the elementary and middle school years. A moderate male superiority emerged in the high school years ($d = 0.29$) and continued in the college years ($d = 0.41$), as well as in adulthood ($d = 0.59$).

However, the age trends were a function of the cognitive level tapped by the test. Females were superior in computation in elementary and middle school, and the difference was essentially zero in the high school years. The gender difference was essentially zero for understanding of mathematical concepts at all ages for which data were available. It was in problem solving that dramatic age trends emerged. The gender difference in problem solving favored females slightly (effect size essentially zero) in the elementary and middle school years, but in the high school and college years there was a moderate effect size favoring males. These are precisely the years when students are permitted to select their own courses, and

females elect somewhat fewer mathematics courses than do males (Meece *et al.*, 1982). Differences in course selection appear to account for some but not all of the gender difference in performance on standardized tests in the high school and college years (Kimball, 1989).

We are puzzled by the fact that tests with mixed or unreported cognitive levels had a slightly larger gender difference (0.19) than tests of problem solving (0.08). One possible explanation is that there may be some feature of the format or administration of these tests, about which we lacked information, that produced a male advantage on the tests. For example, the content of problem-solving items on those tests may have heavy representation of masculine-stereotyped content, which has been shown to produce better performance by males in some studies, although results on the issue are mixed (e.g., Donlon, 1973; Selkow, 1984).

Sample Selectivity

Sample selectivity was one of the three most powerful predictors of effect size in the multiple regression analysis. When all effect sizes (excluding the SAT) were averaged, *d* was 0.15. Yet when only those 184 effect sizes based on general, unselected populations were averaged, *d* was -0.05. That is, there was a shift to a slight female advantage, although the difference was essentially zero. The magnitude of the gender difference favoring males grew larger as the sample was more highly selected: *d* was 0.33 for moderately selected samples (such as college students), 0.54 for highly selected samples (such as students at highly selective colleges, or graduate students), and 0.41 for samples selected for exceptional mathematical precocity.

These findings are very helpful in interpreting the results of Benbow and Stanley's (1980, 1983) study of mathematically precocious youth. Their research has found large gender differences favoring males in mathematical performance, and the results have been widely publicized. Often the secondary reports fail to acknowledge the specialized sampling in the study, implying that the large gender differences are true of the general population. The results of the present meta-analysis demonstrate empirically exactly what would be expected from a consideration of normal distributions (Hyde, 1981): Large gender differences can be found at the extreme tails of distributions even though the gender difference for the entire population is small. Certainly it is important to study gifted populations, but it is essential to remember that studies like Benbow and Stanley's do not generalize to the rest of the population.

We must raise one caveat about studies that were coded as unselected samples of the general population. In high school, males have a higher dropout rate than females (Ekstrom, Goertz, Pollack & Rock, 1986). Dropouts tend to be low scorers, and they are not included in data based on the testing of high school students. Thus, male advantages in performance in high school and later may in part result from the selective loss of low-scoring males from the samples.

The SAT-Math

A recent meta-analysis of gender differences in verbal ability (Hyde & Linn, 1988) indicated that the SAT-Verbal produced idiosyncratic results. The average of all effect sizes yielded a *d* of 0.11, indicating a slight female superiority in performance, although the authors concluded that the gender difference had essentially become zero. Yet the SAT-Verbal produced a *d* of -0.11 (the negative sign reflecting superior male performance in that meta-analysis). That is, the SAT yielded superior male performance when the pattern over all other tests was a slight female superiority in performance.

The SAT-Math also yielded discrepant results in the present analysis. The overall effect size, excluding the SAT, was 0.15. Yet, according to the data from the 1985 administration of the SAT (Ramist & Arbeiter, 1986), for males the mean was 499 (*SD* = 121), and for females the mean was 452 (*SD* = 112), resulting in a *d* of 0.40. That is, the SAT produced a considerably larger gender difference than our overall meta-analysis found. The larger gender difference favoring males on the SAT may be due to several factors:

1. The SAT data are based on a moderately selected sample, those who are college-bound. As we indicated earlier, sample selectivity increases the magnitude of the gender difference. For moderately selected samples excluding the SAT, *d* was 0.33.

2. As Hyde and Linn (1988) pointed out, a larger number of females take the SAT, and the males appear to be a somewhat more advantaged sample in terms of parental income, father's education, and attendance at private schools (Ramist & Arbeiter, 1988). In short, the male SAT sample may be more highly selected than the female sample.

3. There may be features of the content of the test itself or of its administration that enlarge the difference between males and females. For example, the present meta-analysis indicates that gender differences are larger in the high school year for measures of problem solving but not for computation. Although the SAT includes many items that tap problem solving, there also are some purely computational items.[3] The SAT was coded as "mixed" in our cognitive-level analysis. The mixture of problem solving and computational items should produce a gender difference favoring males, but it should be smaller than 0.40.

How Large Are the Gender Differences in Mathematics Performance?

The interpretation of the magnitude of effect sizes has been debated. Cohen (1969) considered a *d* of 0.20 small, a *d* of 0.50 medium, and a *d* of 0.80 large. On the other hand, Rosenthal and Rubin (1982b) have introduced the binomial effect size display as a means of translating effect sizes into practical significance. For example, an effect size reported for success in curing cancer, reported as a correlation of 0.20, translates into increasing the cure rate from 40% to 60%, surely an important practical effect. Our overall value for samples of the general population, a *d* of -0.05, translates into a correlation of -0.025, which yields only a 3% increase in success rate (from 48.5% to 51.5%). Applied to the analysis of gender differences, it means that approximately 51.5% of females score above the mean for the general population, whereas 48.5% of males score above the mean. Thus, the overall effect size is so small that even the binomial effect size display indicates little practical significance.

The effect size of 0.29 for problem solving in high school-aged students translates into 43% of females and 57% of males falling above the mean of the overall distribution, using the binomial effect size display.

Some idea of the magnitude of the overall effect size of -0.05 for general populations or the effect size of 0.29 for problem solving in high school students can also be gained by comparing them with effect sizes found in other meta-analyses. For example, a meta-analysis of gender differences in verbal ability found *d* to be 0.11, and the authors concluded that the value was so small as to indicate no difference (Hyde & Linn, 1988). A meta-analysis of gender differences in spatial ability indicated that the magnitude of the gender difference depended considerably on the type of spatial ability tested (Linn & Petersen, 1985). For measures of spatial perception (e.g., the rod-and-frame test), *d* was 0.44. For measures of spatial visualization (e.g., Hidden Figures Test), *d* was 0.13. For measures of mental rotation (e.g., PMA Space or the Vandenberg), *d* was 0.73. In all cases the differences favored males. Linn and Petersen concluded that the only substantial gender difference was in measures of mental rotation.

Meta-analyses in the realm of social behavior have indicated that *d* was 0.50 for gender differences in aggression, including studies with subjects of all ages (Hyde, 1984). For social-psychological studies of aggression by adult subjects, *d* was 0.40 (Eagly & Steffen, 1986). For gender differences in helping behavior, *d* was 0.13, although the effect sizes were extremely heterogeneous and *d* varied, for example, from -0.18 for studies conducted in the laboratory to 0.50 for studies conducted off campus (Eagly & Crowley, 1986).

One can also compare the magnitude of the gender difference with effects that have been obtained outside the realm of gender differences. For example, the average effect of psychotherapy, comparing treated with control groups, is 0.68 (Smith & Glass, 1977).

Thus, the overall effect size of 0.15 (or -0.05 for samples of only the general population) for gender differences in mathematics performance can surely be called small. The largest effect sizes we obtained were 0.29 and 0.32 for problem solving in the high school and college years, respectively. These are moderate differences that are comparable, for example, to the gender difference in aggressive behavior, yet they are smaller than the effects of psychotherapy.

Implications

This meta-analysis provided little support for the global conclusions that "boys excel in mathematical ability" (Maccoby & Jacklin, 1974, p. 352) or "the finding that males outperform females in tests of quantitative or mathematical ability is robust" (Halpern, 1986, p. 57). The overall gender difference is small at most ($d = 0.15$ for all samples or -0.05 for general samples). Furthermore, a general statement about gender differences is misleading because it masks the complexity of the pattern. For example, females are superior in computation, there are no gender differences in understanding of mathematical concepts, and gender differences favoring males in problem solving do not emerge until the high school years.

However, where gender differences do exist, they are in critical areas. It is important for us to know that females begin in high school to perform less well than males on mathematical problem-solving tasks. Problem solving is critical for success in many mathematics-related fields, such as engineering and physics. In this sense, mathematical skills may continue to be a critical filter. The curriculum in mathematics, beginning well before high school, should emphasize problem solving for all students (National Council of Teachers of Mathematics, 1988). Currently, it emphasizes computation, and girls seem to learn that very well. The schools must take more responsibility in the teaching of problem solving, both because it is an important area of mathematics and because it is an issue of gender equity.

Boys may have more access to problem-solving experiences outside the mathematics classroom than do girls, creating boys' pattern of better performance (Kimball, 1989). For example, data from California high schools from 1983 to 1987 indicate that girls made up only about 38% of physics students, 34% of advanced physics students, and 42% of chemistry students (Linn & Hyde, in press). These science courses are likely to provide extensive experience with problem solving, and fewer girls than boys gain that experience.

The gender difference that was found on the SAT-Math also has significant implications. Scores on the SAT are used as criteria for college admission and for selection of scholarship recipients. Thus, lower SAT-Math scores may influence these critical decisions about female students. The format and items of the SAT-Math should continue to be inspected for two purposes: (a) to determine whether some items are gender-biased and should be eliminated from the test, and (b) to determine whether certain items tap important problem-solving skills that are not taught adequately in the mathematics curriculum of the schools. Then schools will be able to take positive steps to improve the teaching of the mathematics required to solve such problems.

One frustration that occurred in the process of conducting this meta-analysis was the difficulty of analyzing the results according to the mathematics content of the test. Few authors specified the content clearly, probably because the content was mixed. We must know if there are large gender gaps for certain types of content. That can be determined only when researchers construct tests and report results that assess the various kinds of mathematics content separately.

Nonetheless, the gender differences in mathematics performance, even among college students or college-bound students, are at most moderate. Thus, in explaining the lesser presence of women in college-level mathematics courses and in mathematics-related occupations, we must look to other factors, such as internalized belief systems about mathematics, external factors such as sex discrimination in education and in employment (Kimball, 1989), and the mathematics curriculum at the precollege level.

Note

3. An example of a computational item from the SAT is the following: The test taker is asked to tell which of the following quantities is greater or whether the two are equal: (1/3 - 1/5) and 2/15 (College Entrance Examination Board, 1986).

Lists of 40 references and 97 studies used in the meta-analysis are not included due to space limitations.

by Janet Shibley Hyde, Elizabeth Fennema, and Susan J. Lamon, University of Wisconsin - Madison

Thanks to Julia Abrahams for bringing this paper to our attention.

ARTICLES OF INTEREST

The second report of the 1990 Annual AMS-MAA Survey appears in the May-June *Notices*.

> In the final count there were 90 women (22%) among the 410 U.S. citizen new doctorates. Among non-U.S. citizens, women represent 15% of the new doctorates. These percentages are substantially lower than the ones for earlier stages of the mathematics education pipeline. Among all U.S. citizen graduate students in U.S. mathematical science departments, women constitute 36% of the total. At the undergraduate level, 43% of junior/senior mathematical science majors are women.

The section on faculty characteristics contains much interesting information. The table on percentage of women among all full-time faculty, Fall 1990, shows in striking fashion the decline in percentage as department quality rises from bachelor's level to Group I research departments (24.6% to 6.6%). Also, women form a much higher proportion of non tenure-eligible faculty: this is as high as 50% at Group II research departments and 55.7% in master's-granting departments.

Here is a quote from Johnetta Cole, President of Spelman College, from an article in *AAUW Outlook*, April-May 1991:

> Thirty-seven percent of our students major in math and science despite the fact that everyone knows black folk don't like science and girls can't do math. The point is, you put a student in an atmosphere where there's high teacher expectation and you get extraordinary results. You take her away from threats of racial and sexual harassment and she's free to think about thermodynamics.

Jenny Harrison's tenure case is in the news again. She maintains that she was denied tenure at UC Berkeley in 1986 due to sex discrimination. After being denied at the departmental level by a split decision, she appealed the decision through the university grievance procedure; the university-wide committee upheld the decision of the department. She filed a civil suit in September 1989. In February, a Superior Court judge ruled that Berkeley must provide Harrison with the records of the mathematicians who were given tenure at about the time she was denied tenure; Berkeley has complied with the order. Her case will go to court in October 1991.

Point and counter-point:

from *The Daily Californian*, Wednesday, February 20, 1991, "Professor gains access to files" by Sandy Louey, p.2
[Corrections in brackets were provided by Harrison.]

> The math department told Harrison in 1987 that she had not published enough articles to qualify for tenure.
>
> ... Harrison has ... said she has published [as many major works as some of the men who were promoted around the time she was at Berkeley].
>
> "I believe and assert that the files will contain the evidence that my work is on par with [some of] the males that were tenured during my time," Harrison said yesterday.

from the *San Francisco Examiner*, April 25, 1991, "Women multiply in field of math" by Keay Davidson, p. A-1

> During her mathematical career, "my strongest opponents have been men that I've threatened mathematically," says Harrison, 42. "I work in their area and prove things which they've tried but failed to prove."
>
> University counsel Christopher Patti replies: "The record showed [Harrison] was given more opportunities than her male colleagues to show that she was deserving of tenure, and her research record didn't show she was deserving of tenure."

In addition to the two articles cited above, an article very sympathetic to Harrison's case has appeared in the *East Bay Express*. "The Gender Factor" by Brady Kahn appears in the March 8, 1991 issue (Vol. 13, No. 22). The article is quite lengthy (my xerox copy runs twelve pages). It includes some of Harrison's biography, her analysis of her mathematics, a description of the tenure process (the reporter seems to take a fairly dim view of our procedures), a chronology of Harrison's tenure battle, interviews with her lawyers and supporters and a defender of the math department (due to the impending court case, her opponents would not comment on Harrison, but one did speak more generally on women and math), and commentary on the alleged discrimination of the University in general.

> "Being denied tenure is hard on anybody," [Harrison said]. "The university's hierarchical

structure makes you feel nurtured and gives you a false sense of belonging. When the rug is taken out from under you, it's really, really bad. When you couple that with the belief that there has been discrimination involved, the emotions can easily turn into anger or depression. And they do. I've seen people who are permanently damaged by it. They become bitter. And that doesn't go away.

"In my case, I went through four years of anger, depression, and sleeplessness. Now, I try to avoid that by trying not to take things personally — it's not against me. Also I try to keep a sense of humor."

"The other thing I can do is my mathematics," she added. "I make myself do it very day. It helps to diffuse the obsession with the tenure problems. Like, what are you going to think about in the shower? I don't want to think about the tenure dispute all the time. So if I sit and think in my chair about mathematics, it's very much like meditating. You have to clear your mind, and focus on some simple picture or image — and when you get in the right state of mind, the mathematical thoughts begin to flow and that takes you away from those destructive feelings. You can't think about your worries.

"The other thing about math is, when you get good ideas, it reaffirms your ability and rebuilds your confidence. It's perfect." She laughed.

"Mathematics on the Rocks" is a speech given on the occasion of the Academic Awards Ceremony at Tufts University, April 12, 1991, by Lenore Feigenbaum of Tufts University. Her moving talk was motivated by the coincidence of the United States bombing of Iraq beginning just as her history of mathematics class began to study Babylonian mathematics.

> Normally the real world does not come *that* close to my classroom. Nor had I ever anticipated that in the mornings I would be discussing the mathematics found on 4000-year-old clay tablets while in the evenings I would be glued to the television set, hoping that the precious archaeological sites from whence they came had not been damaged or destroyed.

She then gives an account of Babylonian mathematics, which was discovered to be quite rich and well-developed from evidence found on the clay tablets mentioned above. She then gives her analysis of the political situation, which might well be summarized by this quote from her speech: "We chose war, which I felt was the wrong choice, just as I see us making so many other unwise choices that only harm us."

"Splits and chasms on affirmative action" by Cedric Herring appeared in the May 1991 issue of *Illinois Issues*. A statewide random telephone survey of Illinois adults examined levels of support for affirmative action polices. Not surprisingly, African-Americans (74%) and Hispanics (60%) favored affirmative action programs much more strongly than whites (32%). Women (43%) were only somewhat more supportive of affirmative action than men (38%). City dwellers (54%) are considerably stronger supporters than suburbanites (35%) and non-urbanites (36%). Again not surprisingly, Democrats (52%) are much stronger supporters of the idea than Republicans (26%). Level of support drops as income rises. The level of support for those with a high school diploma or less or with at least some graduate school education is about the same (46%), but among those with at least some college but no graduate school education, it falls to 35%.

"Little Girls Lose Their Self-Esteem On Way to Adolescence, Study Finds" by Suzanne Daley appears in *The New York Times*, Wednesday, January 9, 1991. It reports on results of a survey commissioned by the American Association of University Women.

> Girls emerge from adolescence with a poor self-image, relatively low expectations from life and much less confidence in themselves and their abilities than boys, a study to be made public today has concluded.
>
> Confirming smaller studies that were smaller and more anecdotal, this survey of 3,000 children found that at the age of 9 a majority of girls were confident, assertive and felt positive about themselves. But by the time they reached high school fewer than a third felt that way.
>
> The survey ... found that boys, too, lost some sense of self-worth, but they ended up far ahead of the girls.
>
> For example, when elementary school boys were asked how often they felt "happy the way I am," 67 percent answered "always." By high school,

46 percent still felt that way. But with girls, the figures dropped from 60 percent to 29 percent.

Another interesting result was that "[f]ar more black girls surveyed were still self-confident in high school compared to white and Hispanic girls, and white girls lost their self-assurance earlier than Hispanic girls." Because of these apparent racial differences in girls' loss of self-esteem, it seems clear that cultural factors play a major role here.

"Shortchanging Girls, Shortchanging America" is an American Association of University Women paper on the survey referred to in the article above. The following text is the conclusion of that paper.

Adolescence, the period of transition from childhood to adulthood, is a critical time for the development of self-identity. It is a time in a person's life when the differences of gender are particularly formative for the adult lives of women and men in our society.

Equity for Women and Girls

Gender inequity in our schools diminishes girls' self-esteem, stifles their dreams and undermines their confidence in their own abilities. Gender fair classrooms can encourage girls to strive towards higher goals and help prevent the tragic loss of girls' potential.

Despite popular beliefs that peer groups and peer pressure dominate the actions, values and goals of teenagers, the survey shows that adult institutions including family and school have a greater impact on adolescents' development.

Teachers and other adults have a great ability to instill confidence and shape interests and aspirations in children. In particular, family and schools have a great potential for altering patterns of declining self-esteem among girls.

We cannot afford to let low self-esteem and aspirations track another generation of girls into a cycle of poverty — teen-age pregnancy, single motherhood and children growing up without hope. Now, before it's too late, America must provide opportunity for the next generation of children by educating their mothers.

Workforce 2000: Meeting the Needs of American Competitiveness

By the year 2000, 2 out of 3 new entrants to the workforce will be women, and our national economy will require 500,000 additional scientists and engineers. We must prepare our girls to meet these workforce needs.

The American workplace of the 21st century will require women to meet its workforce needs and to improve American competitiveness in the world economy. Girls will need math and science to fill these jobs.

There is a clear link between academic interests in math and science, career aspirations and self-esteem in girls and boys. Equitable treatment in the classroom is needed to prevent a downward spiral among girls in all these areas and to prepare today's students to meet the needs of tomorrow's workforce.

Declining self-esteem among girls as they grow up is reflected in their declining interest in math and science.

As long as we deny our girls the education and encouragement they need, America will be competing with only half its team on the field.

Current national debate and support for education reform provides a window of opportunity to improve education for our girls. America simply cannot afford to ignore half its young people — half its future. It's a matter of simple justice. And it's a matter of survival. Because when we shortchange girls, we shortchange America.

The results of this survey related to math and science are particularly interesting.

A large majority of both girls and boys like math and science, but their interest declines as they get older. The most precipitous losses are among girls. Both girls and boys grow to dislike math because they get bad grades. However, they justify their problems with math differently. Girls perceive bad grades as a personal failure, while boys come to believe that math is not useful.

An overwhelming number of girls and boys like math and science. Most also have confidence in their abilities in math — particularly in the early grades. 81% of girls and 84% of boys in elementary school like math. 75% of girls and 82% of boys in elementary school like science.

All students' enthusiasm for math declines as they get older, but the loss of interest among girls is significantly larger. Girls who like math drop 20 points to 61% by high school. Boys drop 12 points to 72%. The gap between girls and boys who like math increases from 3 points to 11 points.

> Boys and girls treat their problems with math differently. Girls "internalize" their problems with math as personal failures. Boys "externalize" their problems with math as unimportant. Large percentages of girls and boys who dislike math do so because they get bad grades or consider it too hard. As girls get older, the percentage who dislike math because it is "too hard" drop, and the percentage who dislike math because they get "bad grades" increases. As the boys get older, they come to believe that they do not like math because the subject is "not useful."
>
> Interest in math and science is high among minority children as well as white children. 73% of black girls and 85% of black boys say they like math. 70% of Hispanic girls and 68% of Hispanic boys say they like math.
>
> There is a circular relationship between liking math and science, self-esteem levels and career aspirations. Girls and boys who like math and science have higher self-esteem, greater career aspirations and are more likely to hold onto their dreams.
>
> Girls and boys who like math and science have higher levels of self-esteem. Girls and boys with higher levels of self-esteem like math and science. Girls and boys who like math and science are more likely to prefer careers in occupations which make use of these subjects. [They] are more likely to aspire to careers as professionals. This relationship is stronger for girls than for boys.
>
> Girls who like math are more confident about their appearance and worry less about others' liking them. Girls and boys who like math and science hold onto their career dreams more stubbornly. They are less likely to believe that they will be something different from what they want to be.

The *New York Times* for April 30, 1991, has an article "More Math Well Taught, Is Her Goal" in the Careers column written by Elizabeth M. Fowler. The article concerns her work as New Jersey director of PRIMES, the Project for Resourceful Instruction of Mathematics in Elementary School.

> Patricia Clark Kenschaft, a mathematics professor at Montclair State College, would like to see two things happen in the nation's schools. She would like to seem more students, especially women, major in mathematics and she would like to see better-trained math teachers in the elementary grades to give pupils a grounding at an early age.

Also, she gives a good commercial about the good career opportunities available to the mathematically trained.

[Ed. note: I know that "Ms." is an improvement for the *Times*, but why is Pat referred to six times as "Ms." and only once as "Dr."?]

"Ada, an Analyst and a Metaphysician" by Betty Alexandra Toole appeared in *Ada Letters*, March/April 1991. It is an interesting article about the life and work of Augusta Ada Byron, Lady Lovelace, for whom the computer language Ada was named. Much of the article is a defense of the accomplishments of Lady Lovelace in her work with Charles Babbage; there has been considerable debate on the level of her true expertise in mathematics. The following story shows early evidence of her imaginative and technological skills.

> When Ada was twelve years old, this future "Lady Fairy", as Charles Babbage affectionately called her, decided that she wanted to fly. Ada had an object in mind, a flying machine, and proceeded to go about designing it, methodically, thoughtfully, with imagination and passion. Her first step in February 1928 was to construct wings. She investigated different materials and sizes. She considered various materials for the wings: paper, oilsilk, wires and feathers. She examined the anatomy of birds to determine the right proportion between the wings and the body. She decided to write a book called *Flyology* illustrating, with plates, some of her findings. She decided what equipment she would need, for example, a compass, to "cut across the country by the most direct road," so that she could surmount mountains, rivers and valleys. Her final step was to integrate steam with the "art of flying."
>
> Steam proved to be Ada's most difficult problem to overcome. She developed a design, and she thought that if she was successful her flying machine would be even more "wonderful than steam packets or steam carriages." Her design was to make a "thing in the form of a horse with a steam engine in the inside so ... as to move an immense pair of wings" and in such a manner "as

to carry it up into the air while a person sits on its back." [Lovelace-Byron papers]

Ada's ideas predate Henson's design for an Aerial Steam Carriage in 1842. Lady Byron humored Ada's project, but when she learned that Ada was not attending to her studies she was reprimanded. Ada thanked her mother for her "kind advice" and dropped the flying project, but the idea of the potentiality of technology did not escape her imagination.

"Barriers to Equality: The Power of Subtle Discrimination to Maintain Unequal Opportunity" by Mary P. Rowe, Special Assistant to the President and Adjunct Professor, Sloan School of Management, MIT, was a talk delivered to the American Psychological Association, Boston, August 1990. The abstract:

This paper argues that subtle discrimination is now the principal scaffolding for segregation in the United States. The author suggests this scaffolding is built of "micro-inequities": apparently small events which are often ephemeral and hard-to-prove, events which are covert, often unintentional, frequently unrecognized by the perpetrator. Micro-inequities occur wherever people are perceived to be "different": Caucasians in a Japanese-owned company, African-Americans in a white firm, women in a traditionally male environment, Jews and Moslems in a traditionally Protestant environment. These mechanisms of prejudice against persons of difference are usually small in nature, but not trivial in effect. They are especially powerful taken together. (As one drop of water has little effect, though continuous drops may be destructive, one racist slight may be insignificant but many such slights cause serious damage.) Micro-inequities work both by excluding the person of difference and by making that person less self-confident and less productive. An employer may prevent such damage by developing programs on diversity, like "valuing differences" and team-building. The author does not believe micro-inequities should be made the subject of anti-discrimination legislation.

"The Power of Menstruation" by Dena Taylor appeared in the Health column of *Mothering*, Winter 1991.

The cyclical nature of menstruation has played a major role in the development of counting, mathematics, and the measuring of time. ... Lunar markings found on prehistoric bone fragments show how early women marked their cycles and thus began to mark time. Women were possibly "the first observers of the basic periodicity of nature, the periodicity upon which all later scientific observations were made."

BRIEF NOTES

The 12th Annual Conference of NCSEE, the National Coalition for Sex Equity in Education, will be held July 15-19, 1991 in San Antonio, Texas. NCSEE was founded in 1979. Its purpose is "to provide leadership in the identification and infusion of sex equity in all educational programs and processes and within parallel equity concerns, including but not limited to race, national origin, disability, and age." For more information, write Teddy Martin, 1 Spruce Road, Clinton, NJ 08809.

Richard Brislin, *The Art of Getting Things Done: A Practical Guide to the Use of Power*, Praeger Publishers, 1991.

Leone Burton, editor, *Gender and Mathematics*, Cassell, 1991. Order from: Publishers Distribution Center, P.O. Box C831, Rutherford, NJ 07070.

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In 1992-93 MSRI will feature three programs: Algebraic Geometry for the entire year, Symbolic Dynamics for the first half, and Transcendence and Diophantine Problems in the second half. Please consult the general MSRI announcement for 1992-93 elsewhere in this issue of the Notices. Research Professorships are directed to applicants in all fields of the mathematical sciences. There are also Senior Memberships, which normally offer smaller awards. An applicant can apply for both (but only one award will be made per applicant). Women and minority candidates are especially encouraged to apply.

MSRI does not use formal application forms. An application should include a vita, a bibliography, a plan of research, and a statement concerning financial requirements. Two letters of reference are required. Candidates are asked to make sure that their application materials and the two letters arrive by October 1, 1991. Late applications cannot be assured a complete consideration. Awards will be announced in early December, 1991.

Send applications to the **Mathematical Sciences Research Institute,** 1000 Centennial Drive, Berkeley CA 94720.

The Institute is committed to the principles of Equal Opportunity and Affirmative Action.

WELLESLEY COLLEGE. Two or three tenure-track positions at the Asst. Professor level beginning Fall 1992. The teaching load is currently four courses per year. Requirements include a PhD in mathematics (completed or expected by June 1992), excellence in and commitment to both undergraduate teaching and mathematical research in a liberal-arts environment. Candidates with research interests in any area of mathematics will be considered. Applicants should send a curr. vitae and arrange for at least three letters of recommendation that address both teaching and research. Applications and recommendations should be sent to arrive by December 6, 1991, to ensure full consideration. Reply to: Search Committee, Dept. of Math., Wellesley College, Wellesley, MA 02181. Wellesley College is an EO/AA Employer and particularly encourages applications from women and minority candidates.

ALLEGHENY COLLEGE seeks an experienced mathematics (or science) educator to play a major role in its redesigned certification program in elementary and secondary education that brings a special math and science emphasis to each. The ideal candidate will have teaching experience in the schools, and college-level experience. A terminal degree and certification in elementary or secondary are highly desirable. This is a senior level position that is available now. Please send inquiries along with an updated curr. vitae to: Provost Andrew T. Ford, Box 18, Allegheny College, Meadville, PA 16335.

GLENVILLE STATE COLLEGE has an open position for the teaching of mathematics and is inviting applications for the position of Professor (Assoc., Assist., Instr.) of Mathematics beginning in August 1991. This is a tenure track appointment with salary and rank to be determined by the qualifications of the successful applicant. The person in this position will be primarily responsible for math courses and will be assigned other courses which he/she may be able to instruct. The usual teaching load is three to four courses per semester with lectures and labs. The PhD in mathematics is preferred but persons with the Masters Degree will be considered and are encouraged to apply. Anyone with a degree in mathematics, physics, or physical science, and a desire to teach at the college level will be considered for this position. The salary is competitive and will be based on qualifications and experience; compensation will meet the state approved pay schedule and will include the regular West Virginia retirement (State and/or TIAA/Cref) and insurance benefits. Send resume to: John A. Chisler, Chairman, Division of Science and Mathematics, Glenville State College, Glenville, WV 26351. Applications will be accepted until the position is filled.

UNIVERSITY OF SOUTH CAROLINA AT AIKEN. Temporary non-tenure track, one-year, full-time appointment beginning August 16, 1991, contingent upon funding. Renewable for second year, contingent upon funding. Qualifications: At least a Masters in math or computer science. All applicants should have a strong background in math. Duties include departmental service and 12 hours of undergraduate teaching in a Math/Computer Science B.S. degree program. Salary and rank are competitive and are dependent upon qualifications. Send resume, graduate transcripts, and arrange to have three letters of recommendation sent directly to Dr. Stephen King at USCA, 171 University Parkway, Aiken, SC 29801. Applications received by June 15, 1991 will be assured of consideration.

Association for Women in Mathematics

Institutional Membership
Date.....19.....

Please fill out this application and return it as soon as possible. Your institution will be updated on our membership list upon receipt of the completed application and payment of member dues or receipt of postal order. See below to determine which membership category you wish to choose. Subscription to the AWM **Newsletter** is included as part of the membership. Institutional members receive two free advertisements per year. All institutions advertising in the **AWM Newsletter** are Affirmative Action/Equal Opportunity Employers.

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Association for Women in Mathematics
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Wellesley, MA 02181
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AWM
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