AWM
ASSOCIATION FOR WOMEN IN MATHEMATICS

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IN THIS ISSUE

PRESIDENT'S REPORT

I am happy to report that ONR has renewed funding for the AWM workshops for women postdocs and graduate students and that NSF has done the same for AWM travel grants for women mathematicians. Both programs are funded for three years. These together with the Kovalevsky High School Days are three of our most important programs. Many women mathematicians volunteer their ideas, labor, and time to make these programs possible, and I would like to thank them all.

The Kovalevsky High School Day Program started in 1985, which makes it one of our oldest programs. When I read the AWM file on this program, I found that the written feedback from past participants and organizers was very helpful. The Travel Grants Program started in 1989 and the Workshop Program, in 1990. Although we believe that these two programs are successful and important for women mathematicians, we do not have much written documentation to support this belief. So I would like to request all past participants in workshops and all awardees of travel grants to send to the AWM office a current vita (with email address, current position and publication list), comments on the effect the AWM grant has had on them, and suggestions for improvements. Please also inform any such person you know who might not read our *Newsletter* about this request. Your help is very important for our programs and is much appreciated.

The AWM office had a very busy February and March. I would like to thank the AWM office staff of Joanna Schot, Dawn Wheeler and Angie Beach for their dedication and hard work. They are responsible for the smooth running of all our programs and for answering the increasing numbers of inquiries from schools and individuals across the country.

Thanks to Cathy Kessel for her excellent job as Book Review Editor for our *Newsletter* during the past five and a half years and to Marge Murray, who has agreed to take over from her.

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.
The *Newsletter* is published bi-monthly.
The Editor welcomes articles, letters, and announcements.
Circulation: 4,000.

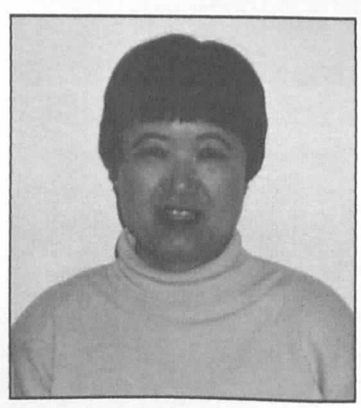
Our past Presidents Cora Sadosky and Rhonda Hughes organized a session at the 1995 AAAS annual meeting in Atlanta, Georgia (February 16–21) on "What Works: Successful Programs for Women in Mathematical Sciences"; Cora's report appears on page 21. Linda Skidmore, director of the Committee on Women in Science and Engineering at the National Research Council, also organized a meeting at the AAAS conference; her report is on page 25. From February 23 to 25, NSF held a conference on "Joining Forces: Spreading Successful Strategies." Our former President Carol Wood represented AWM at this conference; more information will appear next issue.

The Mentoring Program for Women Mathematicians of IAS/Park City Mathematics Summer Institute will be held May 15–25 at The Institute for Advanced Study in Princeton, New Jersey. This program, organized by Karen Uhlenbeck and me, is designed to bring women students in contact with postdocs and more advanced research mathematicians in the field of speciality of the Summer Institute. The topic for this year is nonlinear wave phenomena. The program will consist of two mini-courses, seminars, working problem groups, mentoring and networking sessions. Joyce McLaughlin will give one mini-course, and Susan Friedlander and Barbara Keyfitz will jointly give another. AWM will have a panel discussion and a reception organized by Nancy Hingston.

Recently, women graduate students in the MIT mathematics department formed "The Noetherian Ring at MIT," which is modeled after the one at Berkeley. This group meets every other week with a half-hour mathematical lecture followed by a half hour of social activities. Women students from science departments in Brandeis University also formed "The Women in Science Club" to support and encourage female science majors. Many senior women mathematicians feel that the support and networking generated from such groups play an important role in helping women scientists succeed. I hope many more such groups will be formed in mathematics departments across the country.

Because recently there has been a lot of debate on affirmative action, I would like to end my report by calling for articles on "What is affirmative action, and what should it be?"

Chuu-Lian Terng
Boston, MA
March 26, 1995



TREASURER'S REPORT

1/1/94 through 12/31/94

Category Description	AWM Operating Fund	Schafer Prize Fund	Grant Funds	TOTAL
BALANCE – 12/31/93	50725	53763	27913	132401
INCOME/EXPENSE				
INCOME				
Contributions	286	285	0	571
Dividends/Interest Earned	1178	1521	0	2699
Dues	92118	1610	0	93728
Grants	0	0	104262	104262
Miscellaneous Income	960	0	0	960
Publication Income	14126	0	0	14126
TOTAL INCOME	108669	3416	104262	216347
EXPENSES				
Advertising	2650	150	2500	0
Dues & Fees	1132	0	0	1132
Equipment	203	0	1374	1577
Fund Transfers	1728	-1728	0	0
Grant Overhead	-10319	0	10319	0
Honoraria	0	1450	1200	2650
Interest/Finance Charge	268	0	0	268
Meeting Expense	4745	0	2517	7262
Miscellaneous	1594	226	201	2021
Office Expenses	16250	622	2575	19446
Participant Support	0	0	65805	65805
Payroll Transactions	44282	1472	27332	73087
Professional Services	2815	0	0	2815
Publication Expenses	55677	0	21197	76874
Travel (Non-Participants)	1327	0	4204	5530
TOTAL EXPENSES	117051	2192	139224	258467
TOTAL INCOME/EXPENSE	-8383	-1224	-34962	-42120
BALANCE – 12/31/94	42342	54987	-7049	90281

Respectfully submitted, Judy Green, Treasurer, Marymount University

MEMBERSHIP AND NEWSLETTER INFORMATION

Membership dues

Individual: $40
Family (no newsletter): $30
Retired, part-time: $20
Student, unemployed: $10
Contributing: $100
All foreign memberships: $10 additional for postage
Institutional:
Level 1 (two free basic job ads and up to ten student memberships): $120 ($200 foreign)
additional student memberships: $10 ($18 foreign) for next 15; $6 ($14 foreign) for remainder
Level 2 (two free basic job ads and up to three student memberships): $80 ($105 foreign)
Affiliate: $250
Corporate: $150

Subscriptions and back orders

All members except family members receive a subscription to the newsletter as a privilege of membership. Libraries, women's studies centers, non-mathematics departments, etc., may purchase a subscription for $40/year ($48 foreign). Back orders are $6/issue plus shipping/handling ($5 minimum per order).

Payment

Payment is by check (drawn on a check with a U.S. branch), U.S. money order, or international postal order. Cash payment will be accepted if necessary, but only in U.S. currency.

Ad information

AWM will accept advertisements for the *Newsletter* for positions available, programs in any of the mathematical sciences, professional activities and opportunities of interest to the AWM membership and other appropriate subjects. The Association Administrator, in consultation with the President and the Newsletter Editor when necessary, will determine whether a proposed ad is acceptable under these guidelines. *All institutions and programs advertising in the newsletter must be Affirmative Action/Equal Opportunity designated.* Institutional members receive two free basic ads as a privilege of membership. For non-members, the rate is $60 for a basic ad (eight lines of type). Additional lines are $6 each.

Deadlines

Editorial: 24th of January, March, May, July, September, November
Ad: 1st of February, April, June, August, October, December

Addresses

Send all **Newsletter** material **except ads and book review material** to Anne Leggett, Department of Mathematical Sciences, Loyola University, 6525 N. Sheridan Road, Chicago, IL 60626; phone: (312) 508-3554; fax: (312) 508-3514; email: leggett@math.luc.edu. Send all material regarding **book reviews** to Marge Murray, Department of Mathematics, 460 McBryde Hall, Virginia Tech, Blacksburg, VA 24016; email: murray@math.vt.edu. Send everything else, **including ads and address changes**, to Dawn V. Wheeler, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461; phone: (301) 405-7892; email: awm@math.umd.edu.

WOMEN IN PROBABILITY WORKSHOP

The workshop "Women in Probability" organized by Molly Hahn and Ruth Williams at the invitation of Rick Durrett was held at Cornell University on October 16–18, 1994. The meeting was sponsored by the Mathematical Sciences Institute (MSI) and the American Mathematical Society. The sixty attendees, including participants from four other countries, found the interactions unusually rewarding and are extremely grateful to MSI for the financial and organizational support.

The strength in numbers and quality of a new generation of female probabilists was clearly indicated in the eleven invited lectures and twenty-six contributed lectures which formed the core of the workshop. Some lectures focused on questions of intrinsic interest in probability. However, others demonstrated the diversity and interdisciplinary nature of the subject of probability by considering problems motivated by applications in biology, finance, operations research, physics, and statistics or problems exhibiting connections with areas in analysis such as (stochastic) partial differential equations and differential geometry.

Two panels and luncheon round-table discussions positively addressed many issues related to the overall health of probability as well as issues of specific interest to women probabilists.

The first panel addressed "Opportunities in Probability" with short presentations followed by a period of questions on the following topics: (a) Research Institutes and Societies: David Brillinger (IMS President), Joyce McLaughlin (SIAM), Cathleen Morawetz (Courant Institute and AMS President-Elect), Cora Sadosky (AWM President); (b) Non-academic Career Opportunities: Leslie Gruis (NSA), Marge Hogan (Bear Stearns and Company), Pat Wirth (AT&T Bell Labs); (c): Funding Agencies: Keith Crank and Steve Samuels (NSF).

At the two luncheon breaks, participants were divided into groups with each group being assigned a topic for discussion. The results were used as input for the second panel. The panelists were Jennifer Chayes (UCLA), Cindy Greenwood (University of British Columbia), Marjorie Hahn (Tufts University), Deborah Nolan (UC Berkeley), Magda

Ruth Williams, University of California, San Diego

The Workshop

Peligrad (University of Cincinnati), and Ruth Williams (UCSD). Among the topics discussed by this panel and the roundtables were: (a) The curriculum and experience in probability from undergraduate through postdoc; (b) Interconnections between probability and other areas — what are they, how can they be stimulated? (c) Ideas and problems surrounding the attraction and retention of women in probability or mathematics; (d) Identification of other needs of women in probability and ideas for how they can be met (e.g., funding, networking, etc.).

A few points generated by the panels and roundtables may be of interest to a broader audience. One of the significant points made to the many new researchers at the meeting was the importance of becoming known. Advice included the advantages of attending meetings, refereeing papers, networking with others in the field, joining relevant societies, volunteering to organize sessions at meetings, submitting abstracts to the organizers of special sessions related to one's area of interest, and finding a mentor. With the growth of electronic networks, various mechanisms for keeping in touch between meetings were mentioned, including the following which have regular e-mailings (contact email addresses follow these items): Stochastic Analysis Digest (submissions: send an email message to rcarmona@uci.edu or rtd1@cornell.edu with "submit to sad" as subject; subscriptions: send a one line email message to listserv@uci.edu with body "subscribe sad 'your name' "), Probability Abstract Service (prob@math.washington.edu), Association for Women in Mathematics electronic newsletter (awm-net-request@cs.umd.edu), Young Mathematicians Network (cyeomans@ms.uky.edu), New Researchers in Probability and Statistics (chow@edc.mast.queensu.ca). An issue that needs work is that of providing readily available quality child care at reasonable cost. This is needed not only at home institutions, but also at institutions where one may visit; in particular, the research institutes might consider taking the lead here.

One particular highlight of the workshop was a wonderful after-dinner talk by Alexandra Bellow on "The Ironies of Life."

A "Women in Probability" email list has been established for future networking and distribution purposes. Anyone desiring to be added to the list should send their name, address, and email address to womprob@math.ucsd.edu.

The following is a list of the invited and contributed lectures. Within each of these two groups, the order is that of presentation, except that some of the contributed talks were in parallel sessions.

Invited Lectures

"The stepping stone model with extinction and recolonizations," Claudia Neuhauser (University of Wisconsin, Madison); "Mixed queueing networks and hybrid production systems," Vien Nguyen (MIT); "A general estimation method based on spacings," Marjorie Hahn (Tufts University); "A probabilistic approach to some semilinear heat equations," Alison Etheridge (University of Edinburgh); "Approximation and support theorems for stochastic partial differential equations," Marta Sanz-Sole (University of Barcelona); "Random fields and infinite particle systems," Raya Feldman (University of California at Santa Barbara); "Improved use of the Gibbs sampler," Priscilla Greenwood (University of British Columbia); "Percolation methods in the analysis of the Potts model," Jennifer Chayes (University of California at Los Angeles); "Limit theorems for weak dependent random variables," Magda Peligrad (University of Cincinnati); "From the Dobrushin phenomenon to the IBM," Antonia Foldes (College of Staten Island, CUNY); "Brownian models of multiclass queueing networks," Ruth Williams (University of California at San Diego).

Contributed Lectures

"Self-organization in cellular automata," Kellie Evans (University of Wisconsin); "Cellular games," Lenore Levine (University of Illinois, Urbana); "Time minimizing paths in first-passage percolation," Cristina Licea (Courant Institute of Mathematical Sciences); "Gaps in a one-dimensional annihilation-creation model," Dorothee Eberz (University of Washington); "Stochastic process models for genetic mapping," Eleanor Feingold (Emory University); "A stochastic model for the movement of a white blood cell," Silvia Heubach (California State University, Los Angeles); "Change-point problem for multinomial observations," Monika Serbinowska (University of Utah); "Existence and strong consistency of maximum likelihood estimates for one-dimensional exponential families," Weiwen Miao (Tufts University); "Maximum likelihood estimation for parameters in stochastic partial differential equations," Marianne Huebner (Michigan State University); "Some asymptotics of wavelet fits in the stationary error case," David R. Brillinger (University of California, Berkeley); "Perturbed empirical distribution functions and quantiles under strong mixing," Shan Sun (Texas Tech University); "A compound move-to-front scheme," Eliane Rodrigues (Universidade de Brasília); "A probabilistic analysis of random tournaments," Jinghua Qian (Tufts University); "Intersection probabilities for random walks on lattices," Emily Puckette (Duke University); "Large deviation of multi-type branching random walks in some sets of R^d," Jinhua Tao (Central Missouri State University); "Escape rates for transient reflected Brownian motion in wedges and cones," Ellen Toby (Texas A&M University); "Weak schemes for oblique reflected diffusion processes," Yingjie Liu (Tufts University); "Variational problems for Brownian exit times," Kimberley Kinateder (Ohio State University); "Smoothness properties of a class of Wiener-measure-preserving transformations on path spaces of compact manifolds," Carolyn Cross (University of California, San Diego); "Some problems related to spatial Markov point processes," Elisabeti Kira (University of North Carolina and Universidade de São Paulo); "Generalized stable models for asset returns," Anna Panorska (University of Tennessee, Chattanooga); "Evolution systems associated with M(t)/M(t)/1 queues," Barbara Margolius (Case Western Reserve University); "Convergence of sums of Wick powers," Norma Terrin (Carnegie Mellon University); "Heat equations in white noise analysis," Jung-Soon Kim Lee (Southern University, Baton Rouge); "Wiener distributions and the Stratonovich integral," Mylan Redfern (University of Southern Mississippi); "Hypergroups and Walsh Fourier series," Lorna Hayes (Western New England College).

Abstracts of the lectures presented at the workshop are available by sending a message with your return email address to womprob@math.ucsd.edu.

JCW ANNUAL REPORT

The Joint Committee on Women in Mathematics (JCW) is a joint committee of AMS-ASA-AWM-IMS-MAA-NCTM-SIAM; its charge is to identify and recommend actions which those societies should take to alleviate some of the disadvantages that women mathematicians now experience and to document its recommendations and actions by presenting data. On 17–18 September 1994, the JCW held its first annual intensive weekend meeting at O'Hare airport in Chicago. Specific actions and recommendations are summarized below.

All those attending the September meeting found it extremely productive and agreed that the work accomplished was well worth the modest cost to the participating societies. There was an unequivocal consensus that further meetings of this type should take place annually.

1. Sexual Harassment: In February, 1994, the JCW formally recommended that all of the mathematics societies endorse the AAUP statement on sexual harassment. The MAA had already done so previously, and AWM had endorsed a statement of its own. At its April meeting the AMS Council endorsed the AAUP statement and subsequently voted by mail ballot to "speak in the name of the Society" on this matter; in August, the ASA Council endorsed the statement. However, the SIAM Council did not act on this matter and the IMS reported that its Executive Committee, despite "without exception ... support[ing] the AAUP general statement of policy" took no action because of concerns about procedures (which were not part of the JCW recommendation). We are awaiting notification of NCTM action.

At the request of the MAA science policy committee, the JCW considered the question of whether or not sexual harassment in a research environment should be included in the definition of scientific misconduct. Because this issue was tied to other complex questions, including concerns about the questionable NSF practice of categorizing it under "serious deviation from scientific practice," the JCW never reached a consensus leading to a formal resolution on this matter. JCW did learn that current NSF grant management policy does not even include rules implementing the statutory provisions of Title IX, although a review is underway. In February, the JCW chair met with both NSF legal counsel and Linda Skidmore, Director of the NRC Committee on Women in Science and Engineering (CWSE). Subsequently, Jewel Plummer Cobb, CWSE chair, wrote to COSEPUP asking that the NAS/NAE/IOM Councils address this issue and suggesting that grant management guidelines include a workplace free from sexual harassment as well as "drug use." Since this was consistent with JCW concerns, and the issue may be better addressed by the NRC CWSE than by JCW, no further action has been taken.

2. Washington and Science Policy: JCW has continued to cooperate with JPBM on a variety of issues, including endorsement of Congresswoman Morella's efforts to establish a Congressional Commission on the Advancement of Women in the Science and Engineering Work Forces.

In April, JCW and JPBM learned that Congresswoman Eshoo was pressing Clinton to name more women to the National Science Board (NSB), but that her (AWIS-generated) list of potential nominees included only one mathematician. Using JCW's earlier list of potential nominees to the proposed congressional commission as a starting point, JPBM forwarded a list of mathematicians to President Clinton's science advisor, John Gibbons. In August, Clinton named six new members, but no mathematicians, to the NSB, leaving mathematicians (of both sexes) seriously under-represented.

In May, the Subcommittee on Energy of the House Committee on Science, Space and Technology held a hearing on Careers for Women in Science and Technology. Although some of the testimony was excellent, none of the eight women

M. Beth Ruskai, JCW chair, University of Massachusetts at Lowell. Two attachments to this report (Incentive funding for women speakers and Recommendations to AMS regarding women speakers) are available from Beth via email at bruskai@cs.uml.edu.

scientists who spoke were mathematicians. JCW remains concerned about the need for a more effective voice in Washington and views this as part of a larger problem of effective representation of mathematicians.

Much of the January, 1994 JCW meeting in Cincinnati was devoted to an informal discussion with Fred Wan and Richard Herman regarding NSF policy, programs affecting women, and gender aspects of an MPS division program of data collection and analysis. JCW would like to thank DMS for its willingness to communicate and respond to their concerns.

3. Women Speakers at Mathematics Meetings: The ICM program in Zürich had an unprecedented ten women speakers, including two plenary speakers. Nevertheless, there are still far too many conferences with few or no women speakers, and this issue remains one of JCW's major concerns. During the past year, the JCW made a number of specific recommendations to the AMS [copies of these recommendations are available from Beth Ruskai, bruskai@cs.uml.edu].

It should be emphasized that JCW actions have concentrated on AMS, not because the Society is particularly derelict — on the contrary, the AMS record for invited hour speakers at national and section meetings is excellent — but because the Society's laudable policy of making an annual report of statistics on women (see November/December *Notices*, p. 1213) inevitably draws attention to areas where greater participation of women is called for. Last February, JCW recommended that all represented organizations make similar reports to their members. Thus far, JCW has received such a report only from ASA, which has an extremely healthy record of participation of women members at all levels. In collaboration with the MAA's Committee on Participation of Women (CPWM), the MAA representatives to JCW have been preparing a set of recommendations for future MAA reporting. However, none of the other organizations appear to have acted on this important issue.

Finally, the JCW was dismayed by the letter from Larry Shepp published in the October AMS *Notices* which seriously misrepresents AMS policy and is inconsistent with the recommendations of the JCW on such matters. The JCW is preparing a response.

4. Ethics and Editorial Policy: At its September meeting, the JCW discussed a number of issues related to equity in the editorial process of research journals. Rather than recommend a specific strategy, such as blind refereeing, the JCW passed (by subsequent email ballot) the following resolution: "Because equity for women is based upon fair treatment, rather than differential standards, the JCW supports the principles espoused in the proposed AMS ethical guidelines." Despite reference to a specific statement (the wording of which has since been revised), the JCW endorsement of "the principles" is intended to encourage fair and ethical treatment throughout the mathematical community, and not just the AMS.

5. Evaluation of Teaching: After learning that, as a follow-up to the JPBM report on Professional Recognition and Rewards, AMATYC, AMS, MAA and SIAM plan a joint study on the evaluation of teaching, JCW made the following recommendation. "We understand that such a study will go well beyond the use of student evaluations. Nevertheless, we wish to call to your attention two recent articles [S. Basow, "Student Ratings of Professors Are Not Gender Blind," September–October 1994 AWM *Newsletter*, pp. 20–21; N. Koblitz, "Are Student Ratings Unfair to Women," AWM *Newsletter*, September–October 1990, pp. 17–20] on student evaluations which indicate the prevalence of subtle, but significant, gender bias which may affect some women faculty. It is particularly noteworthy that such bias may not be apparent in superficial studies using aggregate data, but only emerges upon more careful analysis. Because any underlying student bias could affect other forms of evaluation as well, we hope that the proposed study of teaching evaluation will examine such issues in detail and take them into account in any recommendations the participating organizations may make."

6. Other Matters: Concerns were raised as to whether programs to assist mathematicians in Russia and other countries of the Former Soviet Union were reaching many of the substantial number of women in those countries. The JCW is continuing to examine this issue and anticipates making some recommendations soon.

In October, 1994, the JCW again sponsored a panel at the annual BMS national math chairs meeting. This year's topic was "The Chair's Role in Faculty Advancement." Margaret Cozzens, Nancy Flournoy and John Garnett spoke on the panel which was chaired by M. Beth Ruskai (JCW chair).

At the final session of the BMS meeting, the chair of the AMS-IMS-MAA data committee reported the latest employment statistics for 1994 doctorates. Because of concern that overemphasis on an apparent gender difference in unemployment rates might have unfortunate repercussions, the JCW chair circulated a short email message pointing out some of the confounding factors [see pages 12–15, January–February 1995 *Newsletter*]. The data chair responded very positively to this analysis and continued the previous policy of inviting JCW to send a representative to the data committee's meeting in San Francisco.

AWM: WHY DO WE NEED IT NOW?

It would be difficult to measure the impact of AWM since it was established in 1971 if we tried. During that period the percentage of women among the U.S. citizens who earned doctorates in mathematics has doubled; there is greater visibility of women on national programs and in professional leadership positions; and more visible attempts have been made to interest young women in mathematics. AWM has addressed each of these areas through its programs. But as long as women are underrepresented in any aspect of the mathematics community, and as long as the reasons for that underrepresentation are not adequately addressed by the larger mathematics community, we will continue to need AWM.

Several of the concerns of minority women in the mathematics community are due to the appalling statistics on degree attainment and employment of these groups in the mathematical sciences. According to information from national databases there are small numbers of minority women completing mathematics degrees at the bachelor's, master's, and doctoral levels, large drop-off rates from one educational level to the next, and a severe shortage of minority women among doctoral recipients.

In order to address these concerns in the hope of improving existing statistics, we must develop techniques for attracting more minority women into the study of mathematics and provide support for them to persist through graduate school and into a productive mathematical career. One model for addressing this concern is to create an environment where women of different cultures learn to support each other in their mathematical development. At the undergraduate level such a model is implemented in the Spelman-Bryn Mawr Summer Mathematics Program. The program establishes an environment where students support each other through research teams, where networking in diverse populations is seen as an important habit to form and skill to acquire, where women build confidence in their mathematical ability (countering the message from society at large) through research and presentations, and where understanding contributes to an appreciation of diversity. In this way the program seeks to address early a serious impediment to the research and career advancement of women, particularly minority women: mathematical isolation.

At the graduate level there is concern about the climate in which minority students study for advanced degrees and the factors which influence their persistence. A recent survey of African-American women mathematicians, which I conducted, isolated several factors believed to influence the number of African-American women who earn or pursue doctorates in the mathematical sciences. Although the undergraduate mathematics faculty and the curriculum exert the greatest influences, persistence among these women is strongly influenced positively by the support system provided to beginning graduate students in general, and particularly to African-American students, and influenced negatively by the isolation resulting from their often solitary status in the graduate mathematics department. Minority women are concerned with finding ways to control these factors and any others which might impede the success of graduate students.

AWM is needed now to be proactive in addressing the special concerns of *all* graduate women as they are identified. AWM and all other professional mathematics organizations can work toward increased sensitivity to the issues faced by graduate women and minority students in mathematics.

At the professional level AWM can be proactive in being inclusive. As a young and developing organization, it has an opportunity to establish a pattern of involving women from all groups in articulating and addressing issues of common concern. If AWM does not, who will?

Sylvia T. Bozeman, Ph.D., Spelman College,
summary of a presentation on the AWM Panel in San Francisco, January 4, 1995

WHY I BECAME A SCIENTIST

I have been given by the organizing committee the task of trying to answer the question "Why I became a scientist" in a way which will help us focus our discussion for the next several days. Although I begin from my own experience, I have tried to incorporate experiences of many others, including my contemporaries in science, my students and fellows as well as the thoughtful answers that many of you provided to the questionnaire you were sent. The goal for this meeting is to leave with a practical agenda for improving the likelihood that women will choose science, mathematics or engineering as a career, and once chosen, will stay in the profession. When I began thinking about this talk, I had hopes that each reason I could provide for why I became a scientist would suggest a remedy, a recipe for achieving our goal, a plan of action that I could try to incorporate in my own institution. This has not proved to be so easy.

The first reason why I am a scientist suggests the nature of the problem. It has long been my conviction that one of the primary reasons I am a scientist is that I had parents who believed I could do anything. Of all the positive aspects mentioned in your questionnaires, this was the most common one: the importance of having a supportive family that placed no boundaries on your ambition. This is not the first time I have noted a strong correlation between highly expectant and non-judgmental families and success of women in science. It is sobering, though, because while the knowledge can make us better parents, as educators a significant amount of water has flowed under the bridge by the time we first meet our students. Can strong effective teaching in primary schools or secondary schools replace this important ingredient? Frankly I don't know, but the frequency with which it is credited by women for their success suggests to me that it is a central issue.

The second reason I became a scientist was that I loved the doing of it. Joan Girgus tells our freshman women at Princeton every year that it is important to find something to do with your life that you can imagine doing every day. It's wonderful advice. What hooked me on chemistry in high school was puzzle-solving. I loved the order I could bring to balancing chemical equations, the challenge of taking one molecule and making from it an entirely new molecule through a series of intermediate steps, using well-defined rules. God, I even loved the periodic table! In the laboratory, I liked the physical and visual aspects, the phenolphthalein changing color, the crystals coming out of solution, the challenge of working out an NMR spectrum where each peak had an identity. In quite a visceral sense, I loved the doing of it.

However, I can honestly attribute none of this excitement to a brilliant teacher or an inspired mentor during the critical years of high school. Quite the contrary. I can only describe my formal instruction in chemistry as somewhere between abysmal and counterproductive. I spent the first half of my senior year in chemistry class reading 19th century novels and the second half cooling my heels in the Vice Principal's office, having been permanently kicked out of the class. I did manage to get through the collected works of Jane Austen, the Brontë sisters, and George Eliot, which I adore to this day. So where did my enthusiasm for chemistry come from? You got me. I don't have a clue. So now you begin to see my problem.

As a geneticist I could ask whether the love of science is an innate trait or whether it can be acquired from that brilliant teacher or inspired mentor. Obviously this is an impossible question to answer, but of one thing I am certain: a deep love of science is a critical ingredient for success in science. I call it "fire in the belly," and in my experience there is a direct correlation between those who have it and those who succeed. Where does it spring from?

Certainly many of you in your questionnaires attest to the importance of a critical teacher or mentor in initiating the spark; there is clearly a profound role for educators in communicating the beauty of science and why it is exciting. How we do that, and whether we can do it in a manner which is more accessible to women than the current practices, will, I am sure, be the subject of debate this weekend at Mills.

I profess no expertise in this regard, but offer one anecdote. I trace my real birth as a scientist to a moment in the late 1960's in college when I was leafing through *Nature*. I came across the Messelson-Stahl experiment, which provided the first

Shirley Tilghman, Howard A. Prior Professor of the Life Sciences, Lewis Lab, Molecular Biology Department, Princeton University. Talk given at The Women in Science Summit at Mills College, October 30, 1994.

evidence for the semi-conservative replication of DNA. It is now, of course, a classic of molecular biology, but what struck me about it were two things: first that the question being asked was a profound one and that the experimental design was breathtakingly elegant. At that moment I knew that I had to practice this new science of molecular biology. If I had been told that same week that DNA replicates semi-conservatively, without the attendant explanation of how we know that fact, I am not sure that I would have been so moved. I suspect that the way to teach science is by posing a series of questions and developing the solutions, where the question How? not What? drives the discussion. Science is a process, and there is as much beauty in the path to the solution as there is to the final solution. Given that the life of a scientist is spent almost entirely on one path or another and only rarely at the solution at the summit, one must love the chase to be a scientist. And the place to learn the love of the chase is the laboratory.

Which brings me to the third reason that I am a scientist, which is that I was allowed to experience the laboratory early in my career as an undergraduate. I went to a fine Canadian university and benefitted from the Canadian system which allows for intense concentration as an undergraduate. I was doing original research as part of the honors curriculum from my second year on and had first-hand experience of research. Of all my educational experiences, this was the most important in deciding my future. I believe my experience is generalizable. One strategy for bringing women into experimental science is to bring them into the laboratory as early as possible. Aside from the most important benefit, which is to experience the joy of asking original questions and obtaining original answers, it has two additional benefits. First it dispels once and for all the common misperception that science is for loners. One cannot spend a day in a typical molecular biology laboratory and leave it still thinking that science is an activity which does not involve people. (I wish I had a dollar for every undergrad who has solemnly told me that she has chosen medicine over biology because she likes to work with people.) Second, it is the best mechanism I know for providing intense one-on-one instruction. Both of these benefits are especially important for women. I don't know whether there is an equivalent strategy appropriate for women in math and theoretical science, but it is worth thinking about this weekend.

The fourth reason I am a scientist is that I was always a very good student. This seems to be a universal experience, in that every one of you emphasized the fact that you were excellent students. It is possible that we might find the same correlation if we were a group of successful lawyers or real estate agents. But I wonder if science is particularly unforgiving of the false start, the late bloomer. Our acquisition of knowledge is so hierarchical that it is difficult to misstep and then make it up later. I think it is possible to change fields, and I suspect many of us, including myself, did just that. But the typical profile is one of a student strong in math and science, whatever its form, from an early stage. It may be worth some time to think about whether we have such a narrow and unforgiving path to scientific academic excellence that we lose many highly promising prospects along the way. On the other hand, I don't think we should kid ourselves that the pool for remedial education is a large one. Science is a hard profession, where one survives entirely on one's wits. You have to have some degree of native intelligence that even enormously hard work won't compensate for.

The degree to which the young see the profession in this way was recently brought home to me by a curious exchange I had with a group of M.D.-Ph.D. students at Johns Hopkins. These are the best students in the country, and we were discussing the problem of juggling careers and families. They challenged me by saying that the experience of my generation was not useful for them in their own decision making, because times were so much easier for us. Needless to say, this took me by surprise, as I had rested secure with the assumption that things were getting better for women. They pointed out that the issue wasn't one of women versus men anymore, it was scientist against the system. They saw their prospects for finding a good position and acquiring funding as bleak at best. Once I got over my surprise, I understood their point. It is quite a brave thing to decide to be a scientist in this funding climate, and it is not for the weak at heart.

Inspired mentoring only influenced my career decisions once I was a graduate student. Both as a graduate student and as a postdoctoral fellow I had wonderful mentors. As it happens, both were men. Both expressed to me an absolute conviction that I had the ability to succeed in science and backed that conviction up with tangible support such as recommending me for positions, nominating me for awards, getting me on powerful committees. In this respect I was extraordinarily lucky, and I attribute a great deal of my success to this luck. I was spared the overt and covert discrimination that many women have experienced with mentors in a position to do great harm. Good mentoring is essential at every step of the ladder, from the girl in primary school feeling strange about liking science to the senior faculty member looking for mechanisms to break through a glass ceiling. Probably more than any other single thing, this is the path to an improvement in the system.

Let me close by making one last and possibly controversial observation: one reason I survived as a scientist (as opposed to deciding to become one) is that I don't mind a good fight and have been accused of being almost pathologically independent in spirit. I raise this point with some trepidation because it is an aspect of science which I do not savor and would very much like to see changed. The culture of the modern laboratory is a highly competitive and aggressive one. There are those who believe that this is essential to the enterprise and that without it, the engine that drives scientific enquiry would stall out. This is utter bosh, in my opinion. The aggression, which can border on pathology in some instances we could all name, certainly inhibits many women from joining the fray. One needn't have two children of opposite sex, as I do, to know that there are very strong behavior differences between boys and girls that inexorably lead men to feel more comfortable in the rough and tumble of normal scientific discourse. We can only teach by example in our own laboratories that it is possible to practice science in a humane, ethical and respectful environment, but we would be remiss if we didn't alert our students to the other side of the coin.

I think many women respond by adopting the last characteristic that was mentioned by many of you as contributing positively to your becoming a scientist: persistence and stubbornness. Many of you said that your normal response to adversity was to work harder than before, to dig in your heels. I suspect that this is a critical characteristic for a woman scientist. The other two characteristics that seem to help most, which were identified for me a symposium of women scientists at Princeton several years ago, are a sense of humor and a failure to recognize reality. I hope that this weekend we can begin to design an agenda for eliminating that last need: to make reality something to embrace instead of overcome.

CALL FOR PAPERS

The *Journal of Women and Minorities in Science and Engineering* (Carol J. Burger, Ph.D., Editor-in-Chief) is pleased to report a successful first year of publication. We now call for submissions for our second year. We would also like to identify those interested in reviewing papers. The purpose of the *Journal* is to publish original, peer-reviewed papers that report innovative ideas and programs, scientific studies, and formulation of concepts related to the education, recruitment, and retention of underrepresented groups in science and engineering.

Subjects for papers submitted can include: empirical studies of current qualitative or quantitative research; historical investigations of how minority status impacts science and engineering; original theoretical or conceptual analyses of feminist science and Afrocentric science; reviews of literature to help develop new ideas and directions for future research; explorations of feminist teaching methods, black student/white teacher interactions; cultural phenomena that affect the classroom climate.

To receive guidelines for manuscript preparation or to submit a curriculum vita as a prospective reviewer contact: Kathy Wager, Editorial Assistant, *Journal of Women and Minorities in Science and Engineering*, Women's Research Institute, Virginia Polytechnic Institute and State University, 10 Sandy Hall, Room 10, Blacksburg, VA 24061-0338; email: jrlwmse@vt.edu; phone: 703-231-6296; fax: 703-231-7669.

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EDITORIAL DEADLINES:
Please submit *Newsletter* material by May 17 and July 17 for the next two issues if possible. Our production schedules are tight due to vacations and meetings.

INTERNATIONAL OPPORTUNITIES

Fulbright Scholar Awards

Fulbright Scholar Awards for U.S. Faculty and Professionals provide lecturing and research opportunities in nearly 140 countries. Awards range from two months to a full academic year. Virtually all disciplines and professional fields participate.

The basic eligibility requirements are U.S. citizenship and the Ph.D. or comparable professional qualifications. For lecturing awards, university or college teaching experience is expected. Language skills are needed for some countries, but most lecturing assignments are in English.

The deadline for lecturing or research grants for 1996–97 is August 1, 1995; for Fulbright seminars and academic administrator awards, the deadline is November 1.

Funding for the Fulbright Program is provided by the United States Information Agency, on behalf of the U.S. government, and cooperating governments and host institutions abroad.

For further information and application materials, contact the Council for International Exchange of Scholars, 3007 Tilden Street, NW, Suite 5M, Box GNEWS, Washington, DC 20008-3009; phone: 202-686-7877; email (application requests only): cies1@ciesnet.cies.org.

U.S.-CEE Joint Scientific Initiatives 1995–96

The Office for Central Europe and Eurasia of the National Research Council, the operating arm of the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, offers grants to individual American specialists who wish to collaborate with their colleagues from Central/Eastern Europe (CEE) and the Newly Independent States (NIS).

Applications from American specialists (U.S. citizens and permanent residents) who possess or will possess Ph.D. degrees or equivalent research experience at least six months prior to the requested beginning dates of their programs will be considered. Visiting specialists must possess CEE or NIS citizenship and the same academic credentials. Although visiting scientists may spend part of their visits at U.S. government facilities, the program does not generally support the travel of U.S. government employees. As the program is primarily designed to support new collaborative efforts, no more than two grants will be awarded per applicant in a four-year period. Applicants who have received their doctoral degrees within the past six years will receive special consideration, as will applicants wishing to work with colleagues in less frequently represented countries and regions.

Short term project development grants ($2200–$2500; two-week visits to prepare collaborative research proposals for submission to the NSF) and long-term grants ($3000–$15,000; one to six months; significant joint publications expected) are available. Deadlines are July 7 for long-term grants and August 11 and December 29 for project development grants.

For more information and application materials, contact: Office for Central Europe and Eurasia, National Research Council, 2101 Constitution Avenue NW, Washington, DC 20418; phone: 202-334-3680; fax: 202-334-2614; email: ocee@nas.edu.

Beijing Conference

Conference Associates (1776 Lincoln Street #620, Denver, CO 80203; phone: 303-863-9506; fax: 303-863-9507) has several packages available for the United Nations Fourth World Conference on Women: Action for Equality, Development and Peace. Discounts are available to AWM members.

Conferees will attend the NGO (non-governmental organizations) forum scheduled for August 30 to September 8. Planned and organized by sixty-three international organizations and the All-China Women's Federation, the conference is open to all interested women and men. This conference will present a fascinating viewpoint on the past and future of the status of women around the globe.

A pre-trip professional exchange in Guangdong Province and a post-trip Yangtze River Cruise are available. The dates are: professional exchange and conference, August 23 to September 10; conference only, August 27 to September 10; Yangtze river cruise, September 9–16.

LATE–BREAKING NEWS: People-to-People International is interested in sponsoring a group to attend this conference. For further information, contact Alice Schafer at 2725 N. Pollard Street, Arlington, VA 22222 or ats@gwuvm.gwu.edu.

AAAS MEETING

AWM AT THE AAAS 1995 ANNUAL MEETING IN ATLANTA

February 16–22, the AAAS held its huge annual meeting in Atlanta. This year there was a significant increase in the usually small number of sessions devoted to mathematics, among them a very well-attended symposium on image processing and one on mathematics-based intervention programs. Among twenty-five Topical Lectures, two were on mathematics, one by Peter Hilton, who gave a delightful recollection on working with Alan Turing, and the other by Robert Moses, from the Algebra Project, on creating models for developing minority mathematicians. Furthermore, one of the main prizes, an AAAS Mentor Award for Lifetime Achievement, was presented to Mary Gray (American University, AWM founding President) "for devoting her career to increasing the number of women and minorities in mathematics in addition to contributing her talents and energies to advocating the rights of women and minorities in academia."

AWM presented a symposium entitled "What Works: Successful Programs for Women in the Mathematical Sciences," co-organized by Rhonda Hughes (Bryn Mawr, former AWM president) and myself. The goal of the session was to give some insight into what is really working for training women towards careers in the mathematical sciences. In the past decade, there has been substantial growth in the percentage of women majoring in the mathematical sciences at the baccalaureate level. With women now representing about 45% of mathematics majors, the mathematics community has made considerable progress in encouraging young women to start studying mathematics at the undergraduate level. However, the progress at the Ph.D. level and beyond has been less impressive. The percentage of women entering graduate programs is way below that of math majors, and attrition rates in math Ph.D.'s programs are high, particularly for women. The percentage of women Ph.D.'s in mathematics remains around 20%, with only modest growth in the past several years (more in relative than in absolute numbers). Representation of women among tenured faculty remains far below the level of Ph.D. production, particularly at the prestigious research institutions. In the past several years, various model programs have emerged to address the issue of the underrepresentation of women at the graduate level and beyond. We wanted to highlight them and accent their results. Funded by federal agencies, corporations, and academic institutions, these programs work in a variety of ways to increase the commitment of women to careers in the mathematical sciences: they introduce women to research problems early on; they provide mentoring relationships; they establish networks; and they provide women with opportunities to appreciate the breadth of career options in the mathematical sciences.

The five speakers at the symposium presented programs addressing constituencies at different stages, from beginning undergraduates to postdoctoral mathematicians. They were Sylvia Bozeman, Spelman College, who spoke on "The Spelman-Bryn Mawr Summer Mathematics Program" for freshman and sophomore women; Steven Givant, Mills College, on "The Mills Summer Mathematics Institute" for women undergraduates, especially juniors and seniors; Joseph O'Rourke, Smith College, on "The Computer Science Distributed Mentor Project," an innovative program pairing individual women students with women researchers for a summer; Mary Gray, American University, on "The American University Ph.D. Program in Mathematics Education" that has been particularly successful in graduating African American women; and I, who spoke on "The AWM Workshops for Graduate Students and Postdoctoral Female Mathematicians."

After the talks there was one hour of questions and comments by the audience on a variety of issues ranging from single-gender education to affirmative action. The session was well-attended and well-received. The audience included scientists from outside of mathematics and a considerable proportion of young people. It was a good experience for us all.

Cora Sadosky, Howard University

THE MILLS SUMMER MATHEMATICS INSTITUTE

In the late 1970's Mills College gained a national reputation for its innovative *access* programs that give women quick access to collegiate-level mathematics courses — calculus and beyond — and that prepare them to enter careers for which

Steven Givant, Mills College

such courses are a prerequisite. The Mills Summer Mathematics Institute (SMI) has its roots in those early efforts, but it is not an access program. It is an intensive six-week summer mathematics institute for twenty-four talented undergraduate women math majors selected nationwide. Thus, it is directed at women who are very well-prepared mathematically, and its aim is to help them reach the top of the mathematical ladder, to help them obtain advanced degrees in the mathematical sciences.

How did the Mills Summer Math Institute start?

Mills had been a women's college for 138 years when the Trustees voted, in 1990, to make the College coeducational. Immediately after the announcement, a student strike began. During this period there were many discussions about the benefits of being educated at a women's college and the difficulties that women often face, especially in science classes, at coeducational institutions.

The well-known logician and mathematics educator, Leon Henkin, was teaching at Mills College as a visiting professor that semester, and we often talked about the pros and cons of women's colleges. Towards the end of the strike, Leon mentioned to me a new program that he and Uri Treisman had started at Berkeley the preceding year, a Summer Mathematics Institute for minority math majors. I said, "You know, what would really be great is a summer math institute like that for women!" I told him about many of the things I had learned about teaching math to women at Mills, things I had learned while working with a colleague of mine, Lenore Blum, one of the original eloquent voices in struggle to make people aware of the problems women face at all levels in mathematics. Without batting an eye, Leon said "Let's do it!" I remember my heart sinking a bit at his words: I saw the little free time still left in my life sailing away in the distance. We met with Lenore and Diane McEntyre (a professor of computer science at Mills), and the four of us designed the program. With the encouragement of Debbie Lockhart, the head of Special Projects at NSF at that time, we submitted a one-year proposal to the NSF. We were on our way.

Why do so few women go on in math?

According to 1992 statistics, women make up about 45% of the mathematics majors nationally, but only about 25% of the graduate students. At institutions with very strong mathematics programs, the picture seems to be bleaker. For example, at the University of California at Berkeley about 30% of the undergraduate mathematics majors are women. Only 14% of the M.A.'s and 9% of the Ph.D.'s in math are awarded to women.

Why do so few women (relatively to men) pursue advanced degrees in mathematics? Often, talented women who are drawn to mathematics find it difficult to believe that they can have effective careers in the field. There is a sense of isolation that they experience in mathematics classes. Few of their math professors are women. Male students tend to dominate the classes and get more attention from the instructor. There is a common view that mathematics is a male subject and that women who pursue it are "masculine" or "strange." There is a lack of awareness about women mathematicians. Women studying mathematics often have to deal not only with the difficulties inherent in the subject, but with the psychological and emotional problems caused by studying in such an environment.

While not all women students may be affected, many are. For example, the women who have participated in the Mills SMI are among the strongest undergraduate mathematics majors in the country, yet many of them report that, before entering the Mills program, they had doubts about their abilities to succeed in a graduate program. It is a tragedy that some of our brightest young women are being lost to mathematics because of such factors.

Why a women's program?

It was our hope that, in a program aimed exclusively at women, it would be possible to break some of the stereotypes. We thought that the students would be excited by the idea of doing mathematics with other women, that they would serve as role models for each other. Thus, one goal was to bring together a critical mass of talented women math majors.

We also decided right from the start that, if possible, we wanted to hire only women instructors and teaching assistants. It wasn't that we felt men could not be effective teachers of women. But we wanted faculty who could also serve as role models for the students. We thought that the idea of role models would add an important dimension to the whole experience for the students and perhaps even for the teachers. In particular, women instructors and teaching assistants might themselves be excited by the idea of teaching a class of gifted women and might come to feel an almost missionary sense of enthusiasm.

We hoped that a spirit of camaraderie would spring up among the students and between the students and instructors. We wanted to provide them with an experience that they could carry back to their home institutions, an experience that would prepare them mathematically and emotionally for graduate school. We wanted to communicate to them that women can, should be, and are doing mathematics, that they would be entering a growing network of professional women mathematicians.

We weren't disappointed in these dreams. Here is a quote that is typical of the student responses we have received.

> I think that the most valuable aspect of the program for me was meeting and getting to know such remarkable women math majors. It is nice to know that I'm not alone as a woman who likes math. My experience with the Mills program was perhaps the best mathematical experience of my life. Beforehand, I viewed math as one of several subjects I might pursue. Now I can hardly imagine *not* being a math major.

How is the Mills SMI organized?

The heart of the program consists of four seminars, two in classical areas of mathematics and two in more specialized areas. Students select two seminars, one from each pair. To give some examples of seminar topics, last summer they were Algebraic Number Theory, Topology, Dynamical Systems and Graph Algorithms.

The character of the seminar work is very different from that encountered in typical undergraduate mathematics courses. Students establish by themselves many of the results. They are given challenging problems to solve, and they are assigned individual and group projects for which they read journal articles, do independent research, and report on their findings to the class.

In addition to the seminars, which are the foci of the students' work, there are mathematics colloquia that are held twice weekly. In these talks, well-known mathematicians introduce the students to a panorama of topics. There are also four panel discussions: applying to graduate school and getting graduate fellowships; the challenges women face as graduate students and as professionals in mathematics; the variety of graduate programs available in the mathematical sciences; and the spectrum of careers in mathematics.

A final component of the program involves sending students to the joint annual winter meeting of the mathematical societies (the AMS, AWM, MAA, and NAM). There they meet representatives of different graduate programs, participate in workshops of the AWM and sometimes give presentations of their own, have the opportunity to listen to professional talks in the field, and get the chance to meet former SMI participants.

What problems have we encountered?

The mix of students. We wanted to accept a broad mix of students, not just students who were headed for graduate school on their own. The students we admitted fell into three groups: 1) those who were studying at small, sometimes isolated institutions; 2) those at regional state universities; 3) those from well-known institutions with strong mathematics programs, some of whom were already planning to enter graduate school. We also admitted students who were at widely different stages of pre-graduate studies, from gifted high school seniors to graduating college seniors.

We included students from mathematically strong, well-known institutions for several reasons. First of all, even very bright and well-prepared women often decide not to attend graduate school, or else drop out of graduate school after a year or two. Secondly, we felt that such strong students would make an important contribution to the success of the other participants by acting as role models for the less motivated or less well prepared.

Initially, the variation in backgrounds, motivation, and preparation created difficulties. Some students felt intimidated: they had always been the best math majors at their home institutions, and now they were working with students who seemed to know more than they. The instructors had to work very hard to handle this diversity. By the end of the first summer, many of the students felt that this variety of backgrounds was a strength of the program. Younger or less experienced students definitely began to see some of the older or stronger students as role models, and the stronger students viewed others as sisters that they wanted to help along.

Still, diversity of background and level of preparation remains a difficult problem to handle, one that concerns students and faculty alike. In our admission process we now ask students to submit two faculty recommendations instead of one and to give us a list of all collegiate math courses they have taken, including the name of the text they used. But we simply can't get enough information to be able to select a uniform group of students. Maybe such a grouping is really impossible to achieve, and perhaps it is not even desirable.

The seminar atmosphere and the intensity of the program. When the students come to a program like the Summer Mathematics Institute, they expect something different from what they are used to back home. I remember the very first year, during the first two weeks of the program, students complained that attending seminars was too much like going to class. They complained that the program was not intense enough. When instructors began to give them more work and more responsibility, they complained that there was too much work and not enough time to do it. The whole problem of achieving a proper balance and of creating an intense, exciting atmosphere is a challenging one and crucial to making a program a success.

The presence of men. In a program aimed exclusively at women, the presence of men can sometimes be a problem. For example, for two years I was the sole director of the Mills SMI. Even though the program was going quite well, the fact that the director was a man bothered some of the students. And I felt a bit like "odd-man-out." Fortunately, two women — Ani Adhikari at Stanford and Deborah Nolan at the University of California, Berkeley — now co-direct the program with me and have taken over much of the actual summer administration.

Some of our faculty have successfully involved their husbands in their teaching efforts. But I think that the problem of having men in positions of authority in a program for women, and the students' perception of that, remains a sticky issue.

Cost effectiveness and the problem of funding. Our program is about twice as expensive as REU's (research experiences for undergraduates). What factors contribute to this? First of all, the faculty of REU's are usually local and receive most of their summer compensation from their own research grants, not from the REU. The Mills SMI faculty are almost never local. It simply is not feasible to hire each year four suitable faculty members from the pool of Bay Area mathematicians. In fact, the number of women mathematicians in the nation who are active researchers, fine teachers, and available to work in summer is quite limited.

Secondly, we bring the students to the Bay Area and pay them a stipend. Were it not for these stipends, many students could not participate — they need to make money to help pay for their education.

In view of the cost of the program, perhaps it is not surprising that the biggest ongoing problem is funding. In each of the years 1993 and 1994 our funding was cut successively by about 20%. The point of view of the NSF is that they want to provide seed money for programs with new ideas; established programs should seek funding from other sources. We did receive a generous donation two years in a row from Genentech, and we were able to get supplementary grants from both the NSA and finally even from the NSF. Perhaps there are untapped sources of funding out there for worthwhile programs such as our own. But it takes time, skill, and expertise to find such sources. Each of us has demanding teaching and research obligations, and little expertise in the matter of fund raising. So funding remains a long-term problem.

What happens to students after they leave the program?

When they return to their home institutions, many of the students become much more active in the mathematical life of their campuses. Some join mathematics clubs or mathematics honor societies, and give talks about the work they have done at Mills. Others participate in math outreach programs to lower division and high school students. Many later attend other summer mathematics programs or participate in intensive mathematics/study-abroad programs.

Some of this activity may be due to the fact that the students in the program are mathematically motivated. But a number of them have said that they would never have become so involved in these activities, or gotten so much out of them, were it not for the Mills program.

Of the 49 students who were involved in the program during its first two years, 35 are already in graduate school in a mathematical science. These students report that the SMI gave them a real boost in starting their graduate studies. Perhaps the following quote will give an indication of how they feel.

> The Mills program heavily influenced me to go on to graduate school. Specifically, it was listening to the other participants talk about their plans to get advanced degrees that convinced me to do the

same. As I realized last summer and as I continue to realize today, choosing to participate in the Mills program was probably one of the best decisions I ever made. And I sincerely believe that, had I not gone to Mills, I would probably not be going on to graduate school.

What lies ahead?

As the Mills SMI developed over the last few years, and in particular as we had to narrow the range of students that we admitted to the program, many ideas occurred to us or were suggested to us about other possible programs that could be developed to encourage women to go on in mathematics: a program for lower division students to prepare them for proof-oriented upper division courses; undergraduate research experiences aimed at women and perhaps tied to an institution like the Mathematical Sciences Research Institute; a bridge program to work with women who were about to enter graduate school; a program for women who were already in graduate school. And we realized that there were many ideas for effective programs that we hadn't thought or heard of.

Last summer Mills organized an NSF-sponsored conference, "Programs for Women in Mathematics: Scaling the Heights." At that conference, representatives from seven campus (Carleton and St. Olaf, George Washington, Mills, Mount Holyoke, SUNY Stony Brook, the University of Chicago, and the University of Michigan) drafted a proposal for a consortium of programs for women in mathematics that would directly involve more than 100 women students each year. We felt that the united effort of a consortium would have a greater impact and create greater public awareness than any individual program working in isolation. It would give a centralized approach to task of bringing women into mathematics. The response to the proposal was overwhelmingly positive, and it was submitted to the NSF.

Unfortunately, we recently learned that only a part of the consortium will be funded this year (the Carleton-St. Olaf program for freshmen and sophomores and Mills and George Washington programs for juniors and seniors), and even the existence of this part of the consortium depends on supplemental funding from the NSA. Still we are hopeful that other programs like those we proposed will eventually spring into being. Through our combined efforts, the trickle of women entering careers in mathematics will become a stream.

NATIONAL COALITION ON WOMEN IN SCIENCE AND ENGINEERING

Yolanda George, AAAS, and Linda Skidmore, NRC, organized an informal session during the AAAS annual meeting to discuss the possibility of creating a National Coalition on Women in Science and Engineering. About twenty women held a lively discussion on Monday, February 20. Below is a summary of the main points of the session.

Participants decided that a formal coalition would be impractical, specifically because most of us have more meetings to attend than we can now handle. However, we would like a formal gathering of representatives from related groups (at the AAAS annual meeting) as well as an informal mechanism to facilitate communication between us (an electronic network).

Participants agreed to write to the AAAS Program Committee; Rita Colwell, AAAS president; and Richard Nicholson, AAAS executive director, making the following points in time for their consideration/incorporation for the 1996 meeting:

1. AAAS should re-establish its women's caucus or establish a special interest group, "Women in Science, Engineering, and Technology." In addition, AAAS should fund a pre-annual meeting session of caucus leaders, who would develop a program for the annual meeting (see #3 below).

2. AAAS should provide a resource room for use by underrepresented groups — namely, women and racial/ethnic minorities — throughout its annual meeting. That room could not only house materials related to the participation of these groups within science education and employment in order to facilitate the informal exchange of information, but also serve as a gathering place (i.e., tables and chairs would be necessary; coffee/tea would be appreciated) for members of these groups to interact with educators and researchers interested in increasing the numbers of women and minorities studying and practicing science.

3. AAAS should provide a room in which members of the women's caucus and interested individuals could hold a one-day meeting, preferably on Saturday, during the AAAS annual meeting. It is

Linda Skidmore, Director, Committee on Women in Science and Engineering, National Research Council, lskidmor@nas.edu

expected that this meeting would have at least three parts: an address by an invited policymaker whose attention we need to get about the significance of women in the scientific enterprise; sharing of information by participants about current and proposed research on issues affecting women in science; and a business meeting held in conjunction with a AAAS-sponsored luncheon.

4. AAAS should re-instate within the annual program a track of sessions dealing with underrepresented groups. This year, not only were such sessions scattered among several tracks, but also parallel sessions were placed in two different tracks (specifically, the sessions dealing with women in mathematics and minorities in mathematics were designed by session organizers to complement each other but were, in reality, placed in different tracks and held on different meeting days).

5. AAAScope should be used to highlight caucus/SIG activities.

6. Current AAAS structure (perhaps its Committee on Opportunities in Science or the Office of Education and Human Resources) should be utilized to implement these recommendations.

There is great interest in improving communication between the various groups striving to increase the participation of women in science. In addition to the actions noted above, the following steps are being taken to reach this goal:

1. Linda Skidmore will pursue the feasibility of establishing a listserv capable of being accessed by professional science and engineering societies and others interested in women in science. Since there are costs associated not only with establishing the listserv but also for paying staff to create and maintain the database, external funding will be sought. Electronic communication will enable us to publicize meetings, provide information about research, etc.

2. April 1, 1995 is the deadline for proposing sessions to be conducted during the 1996 AAAS annual meeting, to be held in Baltimore. Several of us have discussed possible session topics but have not written them yet. We hope to collaborate on sessions for AMSIE*96.

3. Representatives of four organizations based in Washington, D.C., will meet this month to assess "next steps": Catherine Didion, Association for Women in Science; Yolanda George, AAAS; Sue Rosser, National Science Foundation; and Linda Skidmore, National Research Council.

Participants expressed concern on a related matter. Individuals have been unable to learn the status of appointment of members to the U.S. delegation to the U.N. Fourth World Conference on Women. We want to ensure that a number of the delegation members are women and scientists. Shirley Malcom's assistant will arrange a meeting of Shirley and others of us who are interested and available with Tim Wirth, U.S. State Department, in March or April. (We subsequently learned that Shirley has been requested to send a written request for this meeting to Mr. Wirth; we do not yet have a meeting date/time.)

SUMMER ODYSSEY

The Brandeis Summer Odyssey is a four-week science-oriented program for high school students from across the country; typically, 100–150 students participate. Student applications are due May 15, 1995. Proposals for core courses and elective courses for 1996 are sought; innovative and interdisciplinary proposals are particularly encouraged. Preference will be given to proposals with an active, hands-on approach to learning. The deadline for course proposals is September 15, 1995. For more information, contact: Daniel Terris, Assistant Provost, Rabb School of Summer, Special and Continuing Studies, Brandeis University, P.O. Box 9110, Waltham, MA 02254; phone: 617-736-2111; fax: 617-736-3420.

IDEAAAS: A SOURCEBOOK

IDEAAAS: Sourcebook for Science, Mathematics, and Technology Education is a 256-page listing of more than 1000 organizations and the 10,000 resources and programs they offer. Published by the AAAS and The Learning Team, it is available for $24.95 plus $4.00 s/h from The Learning Team, Inc., 10 Long Pond Road, Armonk, NY 10504; phone: 914-273-2226; fax: 914-273-2227.

BOOK REVIEW

GENDER FICTIONS (Part two of two)

The two remaining chapters

Two papers are left out of the above discussion of Burton's book because they do not really fit my "truth" categories. Prudence Purser and Helen Wily, who ask "Where have the mathematicians gone in New Zealand?" look at the decreasing numbers not only of mathematics graduates but also of those going on to higher degrees in their country. Their study covers the period from the 1972/73 academic year to 85/86 with an update on the last page of the paper for 86/87 and 88/89. Although the overall number of mathematics graduates (at all levels) was found to be decreasing, the decrease was greater for men than for women. A decrease was also found in the number of graduates continuing to study for more advanced degrees. What is notable here is the low ratio of women to men continuing to take advanced degrees, and this "has been consistent over the 14-year period." Shifts in occupational groups of mathematics graduates indicate that fewer are entering teaching and more going into computers and statistics. The decline in mathematics graduates entering teaching is considered "alarming."

The last chapter in the book, "Women and mathematical research in Italy during the period 1887–1946," by Fenaroli, Garibaldi and Somaglia, is intended as a historical response to the question of "women's inferiority in mathematics," a first response to the need for a detailed and impartial analysis of women's scientific production in mathematics in Italy from 1887 to 1946, "the period of taking up of awareness."

Apart from a few anecdotes from the six papers published on the subject of women and mathematics during this period, we are given mainly a statistical account of women's presence. We learn, for instance, that the Loria collection of 14,500 published articles contained 175 papers by (66) women. In the Italian journals reviewed, 6.2% of the articles were written by women, and in congress proceedings between 5 and 6% of communications were given by women. Of the six papers on the subject of women and mathematics in the Loria collection, five were written by men. Opinion as to the place of women in mathematics seemed to be equally divided between those who saw a "glorious" future for women in mathematics and promoted coeducation, and those who felt that women had no hope of achieving anything in the field of mathematics research and were opposed to coeducation.

After what appears to have been such an ambitious review of the Italian scientific literature, it is disappointing to read only a few statistics on the relative absence of women in the field of mathematics research. There are several hints that the authors did indeed get into some analysis of the actual work of some of the women listed, but it is not shared with the reader. Nor is there any analysis or commentary on the statistics that are presented, except for a few brief asides such as a comment on the fact that "8.5% of women and 33.4% of men wrote 5 papers or more" in the Italian journals — the authors "conclude that more women than men limited their engagement in research." In the next sentence they infer that this was due to marriage and responsibility for childcare. They then go on to say that "of course both men and women stop scientific production because of difficulties with university career advancement and the links to the supervision of research." This is followed by two examples of women ceasing their academic publications because of the deaths of their male masters.

This is an appropriately ambiguous and confused ending for *Gender and mathematics*. The reader is left puzzled as to the aims and conclusions of the research and what exactly the authors intended to contribute to the gender and mathematics debate. There are no hints as to the position of the authors in that debate, not even a hint as to the sex of the authors.

In her brief conclusion to *Gender and mathematics*, Leone Burton seems herself to set aside gender considerations when she sums up the book as a plea "to respect the learner in *her* or *his* attempts to make sense of the new in the context of the old and to respect the discipline of mathematics education...." [Italics mine.] The very last lines of the "Conclusion" are worth quoting for their non-committed, cautious nebulousness, properties that characterize the entire collection:

> Ensuring that societies can be enriched by the mathematical contributions of their citizens and

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> that individuals can feel positive about themselves in relation to the learning and use of mathematics is very obviously neither a straightforward nor a simple task. The challenge is there. [p. 157]

They provide as well a wonderful jumping-off board for a leap into *Schoolgirl fictions* where Walkerdine sets about turning the fictions of femininity inside out and in the course of this passionate rampage tackles head-on the "truths about girls" that were so cautiously addressed and replicated in *Gender and mathematics*.

Walkerdine's contributions in *Schoolgirl fictions*: the "truths" about girls and women

Walkerdine questions "the veridicality of claims to truth about girls" and the " 'will to proof' which seems to lurk behind them." Truths about girls in relation to mathematics are part and parcel of an elaborate social construction concerning what it is to be a woman, to be feminine. Walkerdine views femininity as an immense and very powerful fiction and indeed refers to "the fantasy of woman" that permeates "current pedagogical practice." If we are to address the five truths on girls and mathematics from Walkerdine's perspective, it is crucial to first understand her position on the "fictioning of femininity" and on how this fictioning is sustained and becomes fact in the mathematics classroom.[3]

Walkerdine views the gendering process, or "the fictioning of femininity," in the wider context of the process of differentiation in general, or as she calls it, the creation of the "Other," whether that Other happens to be girls, God, Mother, the Man of Reason, or even "the old pedagogy." Her view of the results of the process of differentiation is more nuanced than Cockburn's (see note 3) in that there is a less clear division of people into the camps of oppressor and oppressed. She does not, for example, find the "unitary feminist position of women as oppressed, powerless, etc." particularly helpful. For Walkerdine, women and girls "are not unitary subjects uniquely positioned, but are produced as a nexus of subjectivities, in relations of power which are constantly shifting, rendering them at one moment powerful and at another powerless." The particular positionings of women as teachers and girls as students are the main preoccupations for Walkerdine in part 1 of *Schoolgirl fictions*. Schooling, for Walkerdine, is one of the "powerful practices" in which the fantasy of femininity becomes fact.

To fully understand what happens to girls in mathematics and how the "truths" are constantly created and sustained in the mathematics classroom it is necessary to look at reason itself.[4] Walkerdine refers to reason or "the Cogito" as a philosophical doctrine which was transformed "into the object of a science in which reason became a capacity invested within the body, and later the mind, of the man, from which the female was, by definition, excluded." "The rational self was in this sense a profoundly masculine one from which the woman was excluded, her powers not only inferior but also subservient. The 'thinking subject' was male; the female provided the biological prop both to procreation and to servicing the possibility of 'man.' " In "proving" the inferiority of girls and women as rational beings we legitimize their exclusion not only from mathematical but all scientific endeavor. In a reflection on "Reason and gender" in Chapter 6, Walkerdine briefly reviews the history of the legitimation of this exclusion from the 19th century scientific view of woman, "whose failure to reason was produced through incapacity rather than oppression," to the view that it was physiologically "dangerous for women to reason" (not to mention the danger for the "future of the species"), and finally to the modern discovery of "the female intellect" which is seen as more suited to nurturing rationality through the caring professions. Although Walkerdine fails to mention the continuing attempts by the scientific community to produce "incapacity" theories which legitimize the exclusion of women from scientific endeavor by situating the problem in women's bodies (from craniometry through genetic and the present hormonal theories of female inferiority), her historical review does remind us of the central role of science in continuing to define reason as profoundly masculine.

It is this "will to proof," this necessity to constantly retell "the stories," to produce the truths "afresh," that leads Walkerdine to wonder what "fears and desires construct such fantasies and fictions, and read them back as fact," in this case facts or truths about the mathematical inferiority of girls. She considers "Man" as an elaborate fiction invested with a "fantasy of total control."

> Female equivalence, or an absence of difference, therefore presents a constant threat to sexual difference and to the existence of "man" as supreme and omnipotent mathematician, the architect of "reason's dream," created in the image of God, "the divine mathematician." [p. 62]

Mathematical reason is viewed as

> an elaborate construction, a discourse itself constructed out of fear, a power built on the terror of powerlessness. If "woman" is subservient in this fantasy, then any failure to find difference threatens the very possibility or existence of that power. The stories have to be constantly retold, the truths produced afresh. [p. 62]

Thus, according to Walkerdine, the whole enterprise of "truths about girls in mathematics" serves the status quo, the position of power to those who participate in it. The fiction of girls and mathematics has to be maintained in order to keep at bay man's fears of powerlessness. Girls have been fictioned as the Other of mathematics.

It is therefore not with any intention of proving or disproving "the truths" about girls in mathematics, their Otherness, that Walkerdine tackles some of the same areas as the authors of *Gender and mathematics*. In fact, she feels that women's attempt at disproving such truths constitute a futile defensive battle which can never be won: "If we, as women, enter that game, we are continually caught in the circuit of claim and counterclaim." Walkerdine's contribution is to undermine "the very claims upon which the 'truth' about women is founded." She attempts to "turn the tables on this proof" and to examine "the elaborate fears and desires" that have led to the construction of such "facts," "such fantasies and fictions." For Walkerdine, the question is not "are the arguments true?" but rather "how is this truth constituted, how is it possible, and what effects does it have?" With this in mind, let us examine Walkerdine's contribution to the five "truths" that emerged in considering *Gender and mathematics*.

Girls are given less attention than boys in mathematics class

Walkerdine delves much more deeply into the differential treatment of boys and girls in the classroom and provides a portrait which situates the question-directing behavior of teachers, as described by Leder, in a much wider context than simply the teacher's belief that it is more important for boys to compete in mathematics. She also tries to give us some idea of the profound effects of this male-centered classroom dynamic on both women teachers and girls.

Walkerdine sees the silencing of girls as just one of the effects of the contradictory positioning of girls in the classroom. Silencing is the subject of a long chapter in *Schoolgirl fictions*: "On the regulation of speaking and silence: subjectivity, class and gender in contemporary schooling." Since the "truth" we are dealing with here has to do with verbal attention, it is worth briefly reviewing some of Walkerdine's understanding of speaking and silence as it is manifested in the classroom. In her first chapter, "Sex, power and pedagogy," Walkerdine suggests that the reason girls are relatively successful in early education is because in early schooling the material and institutional position of women as mothers and teachers is more powerful. "The very power of women in this transitory situation, between the domestic and the academic, is precisely what permits the early success of girls." Boys must struggle "to redefine the situation as one in which the women and girls are powerless subjects of other discourses." Boys often resist this "quasi-domestic power" by silence. Is the silence of girls in later schooling a manifestation of a similar resistance to a power that has escaped them?

Walkerdine warns us that "the issue of silence and speaking is not a simple matter of presence or absence, a suppression versus an enabling." She traces the development of the role of language in the "new pedagogy of experience and natural development." Once talk had become "dissociated from the passive regurgitation" of the old pedagogy, it could take its place as "an aspect of freedom, of the facilitation of language" and another "natural" aspect of the natural child. Silence was pathologized as the "absence of language," and mothers were the chief targets of blame. Language was to have a central role in the new pedagogy, which was itself a manifestation of the shift, begun in the nineteenth century, from overt to covert regulation of the population. Emotion was to be personalized, and overt conflict was to be transformed into rational argument, passion into "feelings," and the irrational into the rational under the loving guidance of the mother and teacher. "Like natural reason, natural language was allowed, permitted, desperately facilitated."

A classroom where girls are given less attention than boys, where girls are asked fewer and less challenging mathematics questions is, in Walkerdine's view, one in which both girls and their female teachers are placed in psychologically painful and damaging positions. It is a classroom where girls are officially sex- and class-neutral children, treated "like boys" in the fiction of progressive education and where, at the same time, they are excluded from that fiction by another equally powerful fiction, that of femininity. They are covertly or overtly praised by teachers and approved of by peers for their helpful, industrious and considerate behavior and at the same time pathologized as "drudges" and as the failures of progressive mathematics education for the same behavior. Walkerdine does not deny that greater attention is given to boys in mathematics class. Her contribution to this truth is to situate it in the wider context of the classroom dynamic where it becomes one minor, understandable, and unpardonable element.

Girls flourish in a mathematical environment which is loving, noncompetitive and supportive. Girls do better with female teachers, female role models and content that is more humanistic.[5]

Walkerdine, a former primary school teacher herself, reflects on a very specific classroom setting, that of a modern British primary school with mixed-sex classes and a female teacher, with "child-centered practices," i.e., with children learning at their own pace in an active environment (through "play," not "work"). In this setting, the Other, the undesirable, becomes the old authoritarian, passive, hard-working, role-learning pedagogy. This "progressive," motherly, non-competitive and humanistic setting appears to be the ideal one where girls will "flourish" mathematically. It is hard to imagine how in such a "natural," happy, playful, constructive setting there could be so many painful experiences for girls and the women who teach them.

And yet this is the setting where the "fictioning of femininity" in girls becomes fact. As children, girls are expected to behave like boys, to conform to the portrait of the "natural child" (active, open, exploring and, one might add, messy, noisy, inconsiderate, and often rude). For girls, another list of expectations and behavior is reinforced, which Walkerdine sums up as "nice, kind, and helpful." Good behavior, hard work, helpfulness, and so on, are sometimes covertly and sometimes openly encouraged in girls by the teachers. Girls are enlisted as "sub-teachers," "guardians of the moral order, keepers of the rules" (though they are both needed and despised in these roles). The result of these contradictory expectations is that girls are put in a losing position whatever behavior they opt for. If they behave as boys they are considered unfeminine and not liked by their peers; if they become "sub-teachers," demonstrate hard work and good behavior, they are considered incapable of brilliance, of conceptual understanding — future teachers, at best. Their success is tarnished by the Other of hard work, and even when they outperform the boys on tests and exams their achievement is not valued. For many girls, and particularly for those who do well, the psychological effect is one which Walkerdine describes as "splitting," which although it is a defense mechanism, an attempt to remain "sane" while "being positioned like a boy and a girl," brings with it tremendous suffering. The effects, which Walkerdine found persisted into the lives of the female academics she studied, are "silence, lack of confidence, the suppression of anger and hostility" and "apparent docility."

The positioning of female teachers in the school system is riddled with painful contradictions as well. In the new pedagogy teachers are clearly defined as the nurturers of reason. Not themselves the possessors of conceptual understanding and rationality, they are nevertheless to nurture it in children. They are to work very hard so that the children may play, to be passive loving servants to each child in their care. With the introduction of "progressive education," "women teachers became caught, trapped inside a concept of nurturance which held them responsible for the freeing of each little individual, and therefore for the management of an idealist dream, an impossible fiction." Caught in a net of unreal expectations, an unrealizable mandate, teachers also have to develop survival strategies. Those that stay in teaching often pay lip service to the new pedagogy while maintaining the old. They actively recruit girls as sub-teachers and insist on order and discipline while praising the boys for non-conformity and their "ability to break set."

Boys outperform girls in mathematics. Even when their overall performance is comparable, boys do better at higher-level tasks and girls at repetitive, rule-following, lower-level tasks.

In Chapter 6 of *Schoolgirl fictions* Walkerdine recounts her reaction to an analysis by Hilary Shuard of the results of a British study in which, according to Walkerdine, Shuard concluded that girls, in spite of being conscientious and hard-working, "perform better on those aspects of mathematics which are taken to require low-level rule-following." Hard work and rule-following are offered as reasons for girls' "failure" in mathematics.

Walkerdine's response could as well be aimed at any of the authors who touch on this theme in *Gender in mathematics*, the studies and interpretations being so similar to Shuard's. Her first question is: "How does it come about that the attributes which on one level might be considered good qualities — industriousness and diligence — are understood as causal of girls' apparent failure in mathematics, and how are such accounts presented as scientific evidence?" Walkerdine accepts the data that girls are hard-working and well-behaved, and so on. Nor does she contest the marks on the test that Shuard analyzes: girls performed better on 11 out of 91 items (which the researchers deemed "easier") and boys performed better on 14 items. She does point out that this means there was no significant sex difference on 66 of the items, a "fact" that does not seem to have elicited any attention elsewhere. And she notes the slippage from the opinion that the questions on which the girls did better were considered "easier" to the statement that "girls are good only at those aspects of mathematics which are low-level" and the girls "low-level skills" "are produced by rule-following, rote-learning, and improper conceptualization." Walkerdine does not raise the question how certain questions were identified as "easier," though it is possible that the fact that girls did significantly better on certain questions ensured that they would be classified in this way. (Nor does she critique the statistical enterprise in general and the biases in its development.[6])

Walkerdine takes issue instead with the way in which certain observations about girls are presented as "hard evidence," "hard fact," or truths. In her brief review of the historical production of such facts, she traces the roots in cognitive psychology of the notion of "real understanding," which has replaced the old theory and practice based on "rule-following" and "rote memorization," the Other of mathematics education. Yet "those explanations that allow girls' success at all say that it is based on rule-following and rote-learning, not on proper understanding." In fact, the non-rule-following behavior of boys is produced as evidence of ability to "break set" and an indicator of a propensity for conceptual or "real" understanding.

Real understanding involves correct reasoning, and here Walkerdine's whole thesis, developed in *The mastery of reason*, comes into play. We are reminded of the investment of reason in the male body, leaving women in the role of procreators and servants incapable of rational thought. In their role as servants of reason, women were at first excluded from educational institutions, and then when their struggles meant they could no longer be excluded, they were admitted to the extent they could "prove themselves equal to men." Walkerdine believes that "the terms of the debate" have not changed today. "It is still up to women to prove themselves equal to men" while at the same time all the attention is focused on their "failure," a failure which is guaranteed by the very definition of reason and monitored by science.

In an article which appeared in Volume 10, Number 3, of *For the learning of mathematics*, Walkerdine refers to the vicious circle of "pathologization of difference." When girls' very success can be read as a failure in "real understanding" and boys' behavior problems and poor performance read as a potentiality for conceptual understanding, then one senses that "some fiction is being created to account for what it is necessary to prove time and time again: the inferiority of the Other."

Different worlds

While the authors of *Gender and mathematics* are enthusiastically engaged in the business of "claim and counterclaim" and exploring the widely accepted "truths" about girls and mathematics, Walkerdine is pulling the conceptual rug out from under their feet. She is not particularly concerned with the arguments for or against such truths but asks: how did these truths come to be, whose interests are served by their maintenance, and how do they affect the lives of women and girls?

Yet it is not simply in relation to these "truths" that these books stand out in such stark opposition. From the dedications and introductions the reader is aware that the two books emerge from very different visions of the world and the issues of gender. Before concluding, it is worth returning to the first few pages of the two books and reading them with our attention sharpened by the preceding analysis.

Dedications

Book dedications are rarely taken as seriously as they ought to be. How often does a reviewer deal with or even mention them? And how many of us skip over them as we do most of the blank or semi-blank pages that open a book, rushed as we are to get into the meat of Chapter One? Yet some insights can be gained by noting the author's choice of people at whose feet she lays her entire work.

Gender and mathematics is "dedicated to future generations of women in all parts of the world in the hope that they will be able to benefit from conditions of equality of opportunity that will render redundant further considerations of gender bias." *Schoolgirl fictions* is "For Helen, Jo, Pam, Jo and Joan and the many working class women who have struggled to obtain an education." The first is aimed at future generations of women, the second at actual women living and struggling now — not women in general all over the world but specific working-class women. But more important, the first situates the problem in "gender bias" and the solution in "equality of opportunity."

Walkerdine is critical of equal opportunity solutions to a problem she perceives as extremely deep rooted and powerful. "If girls' and women's power is a site of struggle, constantly threatening the tenuous grasp of male academic superiority, then any engagement with these issues in practice cannot rest upon a rationalistic base of choice or equal opportunities."[7]

Walkerdine's dedication raises the issue of class, which is absent not only from the dedication but from the entire *Gender and mathematics* collection. Gender and class are fundamental themes in Walkerdine's analysis of the school experience of girls, though she admits that while "gender and race have become common currency, it has become almost impossible to speak about class." Although *Gender and mathematics* is very explicitly concerned with gender, it is surprising that among the more than twenty contributing authors, none found it necessary or even useful to consider class (and only one chapter even mentions the word) in their analysis of classroom practice, curriculum and achievement.[8]

Walkerdine's "Preface," Burton's "Introduction"

Walkerdine chose to write a short preface to her work. In the very first sentence she situates herself as a woman. "For many years, like many other women, I was a schoolgirl." There are twelve 'I's in the first paragraph. It is a personally revealing piece where she describes her own sense of powerlessness as a woman in such terms as "struggling," "infantilized" and "terrorized." Her situation is linked to that of other women: "What words will take *us* from the position of schoolgirls," "*We* can tell other stories." [Italics are mine.] It is a preface of intimacy and solidarity with other women, and yet it immediately challenges traditional feminist analyses of the situation. She questions a "roles and stereotypes" analysis and the theory of an "existential feminist voice that has been silenced." She raises the hope that women can blow apart the fictions that have formed and subjugated us by exploring the existing stories and uncovering the "other stories," those that tell how our "socialization does not work."

Whereas Walkerdine situates herself immediately as a woman and adopts a personal stance, Burton avoids the personal or any mention of herself as a woman. She does allow herself the occasional use of 'I' in comments such as "I too found that women ... " and the last paragraph "I recall ... " in which she recounts an experience at a seminar in China. As the editor of a collection of articles, Burton had a very different task to undertake in her "Introduction." IOWME, the group that organized the sessions from which the book emerged, is composed of both women and men. It is made up of individuals and groups who "share a commitment to equity in education" and who are "interested" in gender and mathematics issues. It aims to provide "a forum" and "current information" and "to encourage and disseminate information" related to women and the mathematical sciences. There is no feminist analysis or any overt ideological stance. "Interest" and not commitment to change is the basis of adherence. In its stated aims the group is not even necessarily interested in increasing the participation of women in mathematics. It only claims to "encourage and disseminate research related to" strategies and programs with this in mind. While Walkerdine's preface closes with the hope that her book will contribute to blowing apart the fictions that position women, Burton expresses the hope that hers will be a start in "identifying trends" and "drawing attention to the complexity of the issues pertinent to providing equal opportunities in mathematics education."

Conclusion

In most of this review I have presented the two books as "confrontational" — not only when I looked at the dedications, preface, introduction and so on, but also to some extent in examining the five "truths." Safely poised in their academic garb of neutrality, the contributors to *Gender and mathematics* end up reinforcing, subtly and not so subtly, the "truths about girls."

Is there something the two books have in common? In my opinion they are linked chiefly by their, albeit very different, denials of gender. *Gender and mathematics* ends up gently drowning the issue. Boys-have-problems-too and what's-good-for-girls-is-good-for-boys and the-times-are-changing. Oppression (gender and class) is denied both personally in the lives of the female authors as well as collectively. Walkerdine denies gender in the sense that she views it as a fiction, a cruel fiction that has become fact.

This review has not done justice to the richness of Walkerdine's work. I have, in fact, extracted those portions of *Schoolgirl fictions* which throw Walkerdine into the very debate she feels women should avoid, a debate which might qualify as one which helps "the fictions" to flourish and oppression to be denied. Indeed, on this latter theme of oppression, Walkerdine has a great deal to say which is of importance for mathematics educators. She is of the opinion that our omnipresent developmental model of "stagewise progressions" can only "engage with oppression" as "individual pathology." What is needed, in Walkerdine's view, is "an understanding of development as specific to social and historical circumstances."

There is a particularly poignant poem in *Schoolgirl fictions* which sums up Valerie Walkerdine and her work. It begins with

> *You kill me with your gentle oppression*

and ends with the lines

> *You will no longer take away*
> *my past*
> *for today I take my life into these two hands*
> *I am a time-bomb*
> *and I have started ticking.*

Several of the contributors to *Gender and mathematics* hint that much more research needs to be done on gender issues in mathematics.[9] Hanna, Kündiger and Larouche conclude their paper by pointing out the complexity of the issue:

> The study highlights the fact that the issue of gender differences in mathematics is very complex and should be explored from many different perspectives. [p. 96]

Schoolgirl fictions provides a very "different perspective" to those academics in IOWME who wish to continue their work on gender issues and, hopefully, the injection of energy which may start them "ticking" anew.

Notes

1. It is a common experience that in public settings men frequently do most of the talking even when they are in a minority. (See Deborah Tannen, *You just don't understand.*) My own experience with running sessions in a union setting on the subject of "la condition feminine" was that a single male participant was able to monopolize the discussion even when the subject was the experience of women as wives, mothers, and workers. It is one thing to acknowledge that boys are socialized to perform verbally in the public setting of the classroom and to try to redress the balance by calling on girls more. It is quite another to reinforce the situation by actually calling on boys more and then to excuse it as simply a classroom reflection of the "expectations and gender beliefs" of society at large.

2. The paper is quite shocking on several fronts. Firstly, there is no questioning or critical approach to either the literature or the test instrument itself. We are given two statements about girls' under-achievement: "Many studies to date have show that by age 13, boys are significantly superior to girls in both their mathematical performance and their attitude" and "that the male advantage is especially pronounced among high-scoring exceptionally gifted students with boys outnumbering girls 13 to 1." Then a list of research which attempts to explain male advantage through biological (hormones, genes, brain organization), environmental, and psychosocial factors is given, once again with absolutely no criticism or mention of any counter-research. One is left with the impression that all research is equally credible, and without any orientation as to the state of the debate today. As was mentioned above, the authors also seem to accept the test instrument as a pure unbiased test that can actually measure "achievement" (whatever that means) in 15 different countries.

Yet it is in the statistical analysis, or "discussion," where the authors "attempt to account for these findings" that one is left totally dismayed. The hypotheses are not clear, the statistics slippery, and the results confusing. For example, in the "explanation" (discussed under "3rd truth") about the proportion of female mathematics teachers, it is not clear what the hypothesis is. The first paragraph mentions that girls' achievement might be negatively affected by a perception of mathematics as a male domain and by a fear of success (boys won't like them), and that it is positively affected by involvement of older girls in the role of tutors and counsellors. The second paragraph begins: "In this light, it would seem reasonable to suggest that the ratio of female to male math teachers may be an important factor in *explaining* sex differences in mathematics achievement, since it most likely affects the degree to which girls subscribe to the notion that math is the preserve of men." [Italics are mine.] The argument goes on to say that "according to this reasoning, countries with negligible sex differences in achievement would be expected to have higher proportions of female math teachers."

Here we are referred to a brief table of data with entries for six countries under "Female math teachers (%)" and told "our data do not support [this notion]." What exactly is the "notion" that is not supported? Are we to conclude there is no support for the hypothesis that girls' underachievement might be due to a perception of mathematics as a male domain? Or is the unsupported hypothesis that girls do better with a higher ratio of female to male mathematics teachers in their country? And what about the effects of "older girls" as tutors and the fear of success? Each of the sections in the discussion is equally fuzzy so that when I got to the "Conclusions" and read that "the analyses indicated that differences in achievement could not be attributed to these (contextual) variables," I was left wondering what those variables were and what exactly had been demonstrated.

3. Cockburn gives, I think, a very clear description of how the fiction of femininity or the fiction of woman/girl is sustained. "Gender, it is by now widely accepted, is not the same thing as biological sex. People are born more or less one physical sex or another, and on this basis they are ascribed a gender. They are then 'brought up' socially to live that gender: masculine or feminine." This gendering process begins at birth, is reinforced by the schools, and continues in the work place. Not only does all behavior become gendered, objects and even thought itself are gendered in our society. "Gender is part of our tools for thinking, for ordering and understanding the world," according to Cockburn, who refers to Genevieve Lloyd's work on the "genderization of ideas." [1984] Although different societies vary in what they consider to be feminine, Cockburn finds one constant: "inequality between men and women" to the benefit of men. "We have no choice but to suppose that the social process of gender construction, formulations of gender difference, are important mechanisms in sustaining male dominance." Cockburn situates gender differentiation within the wider context of social differentiation. "The social processes of differentiation and separation serve power, whether that of a class, a race or a sex. They are universal devices of oppression."

4. Cockburn refers to reason as "the philosophical concept that underlies modern science, technology and industry." Reason and rationality are gendered in that the " 'Man of Reason' was conceived of as precisely 'transcending the feminine,' " with the consequence that women are excluded from rationality, and this exclusion "is a constitution of femininity itself."

5. I have grouped the second and third truths together here since they combine to provide an almost perfect description of the classroom setting that Walkerdine is reflecting on. The fourth and fifth truths are dealt with as a piece for similar reasons.

6. For a critical discussion of the development of statistics, see, for example, *The mismeasure of man* by Stephen Jay Gould.

7. Cockburn, in *Machinery of dominance*, refers to the "good-natured concept" and the "notionally open door" of equal opportunity. From her research on women and technical know-how, she concludes that changing the situation "requires a more radical perspective on change" than that offered by equal opportunity schemes which essentially are concerned with "a pushing open of doors." In her view, it is not a case of simply clearing up the myths and making women want to enter non-traditional fields, though she agrees that this work also needs to be done. The fact that there is "no queue at the door" is not a simple problem of "gender bias." There are historical processes of tremendous power and longevity sustaining division of labor in society and at work."

8. Cockburn also finds it impossible to untangle gender from class in her attempt to analyze the position of women *vis-à-vis* technology. She describes how class relations and sexual domination have been encoded in the new electronic technology.

9. Indeed if the papers in *Gender and mathematics* are indicative of the state of research internationally, it would appear that only negligible amounts of research time and money are going into the gender question in mathematics. Nearly all of the papers are either reflections on research that was not primarily concerned with gender issues, or tales of small studies or teaching experiments undertaken by the authors with little or no financing. Nor does one get the impression that there is a research agenda on gender issues in the mathematics education community.

References

Burton, Leone (ed.) [1990] *Gender and mathematics*. London: Cassell

Cockburn, Cynthia [1985] *Machinery of dominance*. London: Pluto Press

Gould, Stephen Jay [1981] *The mismeasure of man*. New York: W.W. Norton

Lloyd, Genevieve [1984] *The man of reason: "male" and "female" in Western philosophy*. London: Methuen

Tannen, Deborah [1990] *You just don't understand: women and men in conversation*. New York: Morrow

Walkerdine, Valerie [1990] *Schoolgirl fictions*. London/New York: Verso

Again, many thanks to Cathy Kessel for serving as book review editor since 1990. This is the last column under her watch. Marge Murray, Virginia Tech, will take over next issue.

CENTENNIAL FELLOWSHIP

At its March meeting, the AMS Council authorized the redirection of the Centennial Fellowship to young (in the sense of years from Ph.D.) mathematicians, beginning with the fall, 1995 application process. In recent years, the fellowship has gone to well-established mathematicians who received their Ph.D.'s 7–12 years earlier. Details of the new program are still being worked out and will be announced in the AMS *Notices*. However, AWM members should be aware that contributions made with their 1995 AMS dues payment will be applied to the new program.

Proponents of the new plan hope that contributions will increase significantly.

M. Beth Ruskai, University of Massachusetts, Lowell

CHILDCARE AT THE JOINT MEETINGS: A SURVEY

Daycare is an important issue for many young mathematicians. In San Francisco several people raised their concerns about the lack of adequate childcare arrangements. For those of you who are parents, potential parents, or just interested in this issue, we would like to solicit your answers to the following:

1. Would you be more likely to attend the joint meeting — next year it's in Orlando, Florida — if childcare were available at the meeting?

2. Will lack of childcare prevent you from attending the meeting?

3. If daycare were provided at the conference center, perhaps at a moderate fee, would you be certain, likely, or unlikely to use it?

4. How much would you be willing to pay for daycare at the joint meeting? (in dollars per child per hour)

5. For what age children would you be requiring daycare?

6. If you do not have children now, but may in the future, do you think you would use childcare services if they were available at the joint meetings?

7. Do you have any suggestions for how this situation can be improved?

This survey was prepared by the Young Mathematicians Network. It can also be found in the YMN archives via anonymous ftp to ftp.ms.uky.edu in the directory pub3/mailing.lists/ymn-list under the file name childcare.survey. Please send your responses to dobrow@cam.nist.gov.

SUMMER MATH 1995

SummerMath is a program at Mount Holyoke College for young women in eighth through twelfth grades who value intellectual achievement and personal growth through free exchange of ideas. The 1995 program runs from June 25 through August 5.

Participants from many backgrounds and all levels of experience will strengthen mathematical thinking and communication skills, develop powerful strategies for solving problems, program the computer, see how math applies to everyday life, and grow more self-confident. The curriculum is individually configured according to mathematical preparation and competence level. Each student takes three classes: fundamental mathematical concepts, mathematical workshops, and either computer programming or technology labs depending on grade level. Parents are invited to an open house on the last day of the program, so that they may see what their daughters have accomplished.

The application deadline is May 1 for financial aid candidates and June 1 for other candidates. For further information and application materials, please contact Dr. Charlene Morrow or Dr. James Morrow, SummerMath Directors, at SummerMath, Mount Holyoke College, South Hadley, MA 01075; phone: 413-538-2608; fax: 413-537-2002.

CONFERENCES

Conference on Fermat's Last Theorem

A conference on Fermat's Last Theorem will be held at Boston University, August 9–18, 1995; the organizers are Glenn Stevens, Gary Cornell, and Joseph Silverman. Expected speakers include John Coates, Stephen Gelbart, Nick Katz, Barry Mazur, Ken Ribet, David Rohrlich, Karl Rubin, Alice Silverberg, and Andrew Wiles.

The conference is intended to be as accessible as possible to a general mathematical audience. However, some expertise in number theory and arithmetic geometry will be required. The level of the conference will be aimed at advanced graduate students and recent Ph.D. recipients. The conference will also be valuable to experienced mathematicians seeking to master the tools used in the proof.

The conference will focus on two major topics: Andrew Wiles' recent proof of the Taniyama-Shimura-Weil conjecture for semistable elliptic curves, and the earlier work of Frey, Serre and Ribet showing that Wiles' theorem would complete the proof of Fermat's Last Theorem. In keeping with its instructional mission, the conference will begin with introductory lectures on elliptic curves, modular curves, modular forms, and Galois representations. Wiles' work also draws from a significant number of more advanced topics, including the deformation theory of Galois representations, refined structure of Hecke algebras, complete intersection rings, and generalized Selmer groups. Each topic will be introduced by an expository lecture describing some of its history and explaining in general terms how it fits into the proof of Wiles' theorem. The ensuing lectures will cover the finer aspects of the proof in detail.

In recognition of the historical significance of Fermat's Last Theorem, some lectures will also reflect on the history of the problem while others will speculate on the future and describe some of the connections of Wiles' work with other parts of mathematics.

August 13 is reserved for twenty-minute talks; their number may be limited by time constraints. Participants who wish to speak in this forum are invited to submit abstracts to the address below.

A proposal for funding from the NSF is pending. We hope to be able to offer financial support to those who need it. Top priority will be given to graduate students and recent Ph.D. recipients.

For more information, write: Fermat Conference, Department of Mathematics, Boston University, Boston, MA 02215; fermat@math.bu.edu.

Lorch Conference

Help Lee Lorch celebrate his 80th birthday! The conference "Special Functions and Related Topics in Analysis" will be held June 9–10 at York University. The speakers will include Richard Askey (University of Wisconsin), Chandler Davis (University of Toronto), James A. Donaldson (Howard University), Mary Gray (American University), Jean-Pierre Kahane (Université de Paris, Orsay), Donald J. Newman (Temple University), and Cora Sadosky (Howard University).

The conference will be devoted to those topics in analysis to which Lee Lorch has made particular contributions. It will also honor his lifelong dedication to the struggle for civil rights and for equal educational opportunities for women and minority groups.

For more information, contact Martin Muldoon, Department of Mathematics and Statistics, York University, North York, Ontario M3J 1P3, Canada; email: muldoon@mathstat.yorku.ca; phone: 416-736-5250; fax: 416-736-5757; or use the World Wide Web, http://www.math.yorku.ca/Conferences/LL80/menu.html.

Channels for Change

This year's Women in Technology Conference will be held June 27–29 at the Santa Clara Convention Center. For more information, contact: WITI, 4641 Burnet Avenue, Sherman Oaks, CA 91403; phone: 818-990-1987; fax: 818-906-3299; email: witi@crl.com.

Asian Technology Conference in Mathematics

The first Asian Technology Conference in Mathematics will be held in Singapore, December 18–21, 1995. Its theme is "Innovative Use of Technology for Teaching and Research in Mathematics."

Technology has great potential to aid us in our quest for improvement in teaching mathematics at all levels. Enthusiasts have looked into new approaches for teaching and research. The Conference will provide mathematics educators, computer specialists, researchers, policy makers and teachers with the opportunity to share and discuss the latest developments in their areas of specialization and to engage in collaborative research.

Papers are invited for presentation at the Conference from those who are involved in the use of technology in teaching and research in higher institutions and schools. Abstracts of not more than 200 words should be mailed to (email acceptable): Dr. Fong Ho Kheong, Chair, ATCM 95 Organizing Committee, Nanyang Technological University, National Institute of Education, 469 Bukit Timah Road, Singapore 1025, phone: 65-460-5310, fax: 65-469-8952, email: fonghk@nievax.nie.ac.sg; Dr. Wei-Chi Yang, Chair, IPC, ATCM 95, Department of Mathematics and Statistics, Radford University, Radford, VA 24142, phone 703-831-5232, email: wyang@mathstat.ms.runet.edu, fax: 703-831-6452.

Women, Gender and Science

A conference on Women, Gender and Science will be held at the St. Paul campus of the University of Minnesota, May 12–14, 1995. This conference will offer a series of conversations among those who study women and science and those who engage in research on gender and science. The 90 presenters are historians, philosophers, scientists, sociologists, educators, administrators, and others for whom such research has important intellectual, social and personal implications. The conference is organized to explore a number of questions about how the cultures of the sciences gender their practice and content, how women's underrepresentation affects the goals, methods, and outcomes of science as well as the lives of individual women, and how these phenomena have functioned in different times and places. Some sessions will examine women's contributions to the advancement of science as well as factors that empowered or inhibited them. Other sessions will focus on scientific theorizing and the relationship between gender and conceptions of knowledge. Still others will explore science education, considering pedagogical practice and outcomes for women at every educations level.

A number of roundtables and informal discussions events will encourage attendees to present their own ideas and engage in discussion with scholars from around the world.

The registration fee is $55.00. For further information, contact: Susan M. Burke, Program Associate, University of Minnesota, 204 Nolte Center, 315 Pillsbury, Drive, S.E., Minneapolis, MN 55455-0139, (612) 625-3530; sburke@mail.cee.umn.edu.

Call for Papers, National Technical Association

The National Technical Association will hold its 67th Annual Conference, "Global Information: Emphasizing Space and Education," at the Westin Galleria Hotel, Houston, Texas, July 19–22, 1995, hosted by the Houston Area Chapter of the NTA.

All professionals, educators, and college or high school students, whether or not affiliated with NTA, are invited to submit abstracts for conference presentations. Topics directly related to the conference theme are strongly encouraged, but all technical or educational subjects are welcome. Full manuscripts are also welcome. All completed manuscripts will be published in a special conference proceeding.

There will be three days of technical presentation sessions. We ask that presentations be limited to 10 minutes with 5 minutes for questions or discussion.

Abstract submissions must contain the following: Author(s) full name, mailing/email address, daytime phone/fax numbers; Academic or occupational position, including company/institution name; NTA affiliation (professional/student member and chapter, nonmember); Title of presentation in 15 words or less; Abstract of presentation, approximately 150–300 words in length.

One copy of the abstract should be submitted to each of: Lee G. Willis, NASA Johnson Space Center, Mail Code: EC5, Houston, TX 77058-3696, (713) 483-9153; Robert B. Lee, NASA Langley Research Center, Mail Stop 420, Hampton, VA 23681-0001, (804) 864-5679; and George R. Carruthers, Naval Research Laboratory, Code 7609, Washington, DC 20375-5320, (202) 767-2764.

EDUCATION COMMITTEE

Family and Child Characteristics, but Not Schools, Influence Math Achievement

"The 1992 eighth-grade mathematics test of the National Assessment of Educational Progress [NAEP] reveals a low average level of achievement, wide variation across states, and a large differences in average scores of white and black students," Victor Fuchs and Diane Reklis report in a new NBER study. Their careful analysis then shows that "the characteristics of children (such as readiness to learn in kindergarten) and of the households in which they live (such as mother's education) have much larger effects on NAEP test scores than do variables (such as the student/teacher ratio) that measure school characteristics." Further, black-white differences in the characteristics of children and their households explain much of the racial differences in NAEP test scores, they find.

In *Mathematical Achievement in Eighth Grade: Interstate and Racial Differences* (NBER Working Paper No. 4784), Fuchs and Reklis explain that, beyond average NAEP scores being low, there is nearly a 40 point gap (about 15 percent) between the lowest and highest state's score. Further, the highest average state score for blacks is below the lowest average state score for whites.

The most important determinant of NAEP scores, the authors find, is "readiness to learn in kindergarten." A measure of that characteristic comes from a new series developed by the Carnegie Foundation for the Advancement of Teaching, based on kindergarten teachers' responses in 1990 to questions about students' "physical well-being, social confidence, emotional maturity, language richness, general knowledge, and moral awareness."

Readiness to learn in kindergarten, in turn, is influenced positively by the level of the mother's education and negatively by living in a single-adult household. In households with two adults, if both work at least 20 hours per week, there is a slightly negative effect on a child's readiness to learn; if one adult works less than 20 hours and the other more, there's a slight positive effect on readiness to learn. There is also a large racial difference in readiness to learn in kindergarten, attributable primarily to the percentage of black children living with only one adult, and to the higher education levels of white mothers.

In sum, Fuchs and Reklis find, the most consistent predictors of interstate differences in mathematical achievement are the percent of children who enter kindergarten ready to learn and the percent of mothers who dropped out of high school. If both parents work in paid jobs, there is a positive effect on math achievement. Most of the racial differences in achievement also can be explained by readiness to learn in kindergarten, mother's education, and poverty. In fact, the only school-related variable of significance, Fuchs and Reklis find, is the share of school revenues supplied by the state, which has a small negative effect on achievement.

Fuchs and Reklis also examine a number of factors that turn out not to affect math test scores: percent of children moving within the past year, living in a large city, or living with two unmarried adults; percent of children whose mothers received prenatal care; the median household income per person; the percent of poor children in Head Start; school expenditures per student; the percent of children aged nine to thirteen in private school; and the percent of children aged three to four in preschool.

reprinted from the NBER Digest, *the National Bureau of Economic Research, Inc., Cambridge, MA, September 1994, p.2.*

Any comments? Write to: AWM Education Committee, c/o Sally I. Lipsey, Chair, 70 E. 10th Street, #3A, New York, NY 10003-5106

BUDAPEST SEMESTER

Hungary is a country with a long tradition of excellence in mathematical research and education. Spend a semester of your junior or senior year experiencing this tradition in the Budapest Semesters in Mathematics program. American undergraduates in this program study under eminent Hungarian scholar-teachers, most of whom have previously taught at American institutions. The deadline for applications for the spring semester, which begins in February, is October 15. Early applications are encouraged and will be processed promptly. For further information and application forms, write the North American Director, Professor Paul D. Humke, Department of Mathematics, Saint Olaf College, Northfield, MN 55057; 507-645-6440.

WORKSHOP FOR WOMEN GRADUATE STUDENTS AND POSTDOCTORAL MATHEMATICIANS

The Association for Women in Mathematics, with funding from the Office of Naval Research, will continue to hold a series of workshops for women graduate students and postdoctoral mathematicians in conjunction with major mathematics meetings.

The next workshops in the series will be held in conjunction with the Society for Industrial and Applied Mathematics (SIAM) Annual Meeting in Charlotte, NC, October 22–26, 1995 and in conjunction with the annual AMS-MAA Joint Mathematics Meetings in Orlando, FL, January 9–13, 1996. The workshops will be held sometime during the given time periods; exact dates for these workshops will be announced later.

We invite graduate students to present posters on their thesis problems and postdocs to present talks on their research. AWM will offer funding for travel and subsistence for up to ten women graduate students and ten women postdocs to participate in each workshop. Participants will have the opportunity to present and discuss their research and to meet with other women mathematicians at all stages of their careers. Each workshop will also include a panel discussion on issues of career development, a luncheon, and a dinner banquet.

All mathematicians (female and male) are invited to attend the entire program whether or not they are funded. Departments are urged to help graduate students and postdocs obtain some institutional support to attend the workshop and the associated meetings.

To be eligible for funding, graduate students must have begun work on a thesis problem; postdocs must have received their Ph.D. within approximately the last five years. All non-U.S. citizens must have a current U.S. address. All applications should include a curriculum vitae and a concise description of research; graduate students should include a letter of recommendation from their thesis advisor. Nominations by other mathematicians (accompanied by the information described above) are also welcome.

Please send **five** copies of the application materials to: Workshop Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461 (applications via email or fax will not be accepted). Applications must be received by **June 1, 1995** for the Charlotte workshop and by **October 1, 1995** for the Orlando workshop. For more information contact the AWM office at (301) 405-7892 or awm@math.umd.edu.

Three presidents in San Francisco: Cora Sadosky, AWM Past President; Ron Graham, AMS Past President; Chuu-Lian Terng, AWM President

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BUCKNELL UNIVERSITY - DEPARTMENT OF MATHEMATICS - Bucknell University invites applications for a one-year, entry-level, sabbatical replacement position in mathematics for 1995-96, with the possibility of renewal for an additional year. Bucknell is a private, primarily undergraduate university of about 3,500 students; its broad curriculum in the liberal arts and sciences is complemented by strong professional programs in engineering, education, and management. Several departments, including mathematics and nearly all science and engineering departments, offer master's degrees. Qualifications include a Ph.D. and evidence of high potential for teaching and research. Send curriculum vitae, three letters of recommendation, and other supporting materials to: **Allen Schweinsberg, Chair, Department of Mathematics, Bucknell University, Lewisburg, PA 17837**. Letters of recommendation should among them discuss both teaching and research. Applications will be screened beginning May 15, 1995 and will continue until the position is filled. Bucknell University encourages applications from women and members of minority groups (EEO/AA).

CASE WESTERN RESERVE UNIVERSITY - DEPARTMENT OF MATHEMATICS - Visiting Position in Mathematics - The Department of Mathematics anticipates visiting appointments in Mathematics beginning August 21, 1995. Preferred areas: numerical analysis, probability and stochastic processes, global analysis and geometry, algebra, dynamical systems, control theory, mathematical aspects of computer science, functional analysis and partial differential equations. Send vita and arrange for three letters of recommendation to be sent to: **Appointments Committee, Department of Mathematics, Case Western Reserve University, Cleveland, OH 44106-7058**, (or e-mail to drr@po.cwru.edu or fax to 216-368-5163). Applications will be reviewed as they are received, and continue until the position is filled. If you applied earlier this year, you don't need to reapply, but an e-mail message indicating your availability or lack thereof would be appreciated. CWRU is an Affirmative Action/Equal Opportunity Employer.

SOUTHERN ILLINOIS UNIVERSITY AT CARBONDALE - DEPARTMENT OF MATHEMATICS - Temporary Positions - 1995-96 - Temporary positions are anticipated starting on August 16, 1995, as Lecturer. Master's degree in mathematics or admission to candidcay required; Ph.D. preferred. Applicants must provide evidence of excellence in teaching and evidence of ability to teach research interests compatible with those of the faculty. The duties will consist of 12 hours of undergraduate mathematics instructions each semester. Closing date May 15, 1995, or until positions are filled. Send applications (including transcripts) to: **Temporary Positions, c/o Ronald Kirk, Chair, Department of Mathematics, Southern Illinois University at Carbondale, Carbondale, IL 62901.** SIU-C is an Equal Opportunity/Affirmative Action Employer.

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY - DEPARTMENT OF MATHEMATICS - Applications are solicited for a postdoctorate position in dynamical systems. Pending yearly budget approval, the length of the position is three years, and there is a strong possibility for a conversion to a tenure-track position at the assistant professor level. Candidates must have a Ph.D. in mathematics or a related field, and strong research accomplishments and teaching skills. Preference will be given to applicants whose interests overlap with existing faculty groups in applied partial differential equations, fluid and continuum mechanics, numerical analysis, and control theory. Send letter of application, curriculum vitae, summary of research plans, and three letters of recommendation, one of which should address teaching, to: **Dynamical Systems Search Committee, Department of Mathematics, Virginia Tech, Blacksburg, VA 24061-0123**. Review of applications will begin on April 15, 1995 and continue until the position is filled. Virginia Tech has a strong commitment to the principle of diversity and, in that spirit, seeks a broad spectrum of candidates including women, minorities, and people with disabilities. Individuals with disabilities desiring accommodations in the application process should notify Michael Renardy, Department of Mathematics, 703-231-6536 (TDD/PC 1-800-828-1120 - Voice 1-800-828-1140).

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY - DEPARTMENT OF MATHEMATICS - Visiting Faculty Position in Technology - Enhanced Teaching - The Mathematics Department at Virginia Tech is seeking candidates, preferably up to the level of associate professor, to fill an anticipated one-year visiting faculty position for 1995-96. In addition to teaching one course per semester, the visitor will lead and assist our efforts in several technology related directions (with emphasis depending on the candidate's expertise): **1)** Using technology in mathematics courses at all levels; **2)** Planning the effective use of self-paced learning modules and distance learning systems; **3)** Evaluating interactive software and developing educational modules aimed at communicating and teaching mathematics to K-12 and undergraduate students; **4)** Developing undergraduate computer labs. **Essential Qualifications:** Masters Degree in mathematics, math education, computer science, or a related discipline; Experience in using and programing mathematical software; Teaching calculus to college level students; Organizational and communication skills. **Preferred Qualifications:** Ph.D degree; Experience in using instructional technology and software; Experience with K-12 students; Experience with Unix and graphics workstations. Virginia Tech is a land-grant university with an enrollment of about 26,000. The Mathematics Department has a large service responsibility in teaching calculus for engineering majors and for students of biology, business and other disciplines. A locally funded Instructional Development Initiative has provided faculty training and computer equipment for laboratories and classrooms, leading to a rapid increase in the use of computer algebra systems in classes at all levels, consequent rethinking of content and methods, and a growing interest in the possibilities of interactive and distance learning. Applicants should submit a brief letter describing their ideas relative to the directions listed above, as well as a resume and three letters of reference, to: **Kenneth B. Hannsgen, Chair, Visiting Faculty Search Committee, Mathematics Department, Virginia Tech, Blacksburg, VA 24061-0123.** Applications will be reviewed beginning April 10, 1995. Virginia Tech has a strong commitment to the principle of diversity and, in that spirit, seeks a broad spectrum of candidates including women, minorities, and people with disabilities. Individuals with disabilities desiring accommodations in the application process should notify Kenneth B. Hannsgen, Dept. of Mathematics, 703-231-6536 (TDD/PC 1-800-828-1120 - Voice 1-800-828-1140).

Directory of Women Mathematicians

With support from the National Security Agency (NSA), the **Association for Women in Mathematics** plans to publish a ***Directory of Women Mathematicians.*** Women mathematicians (both members and non-members) will be receiving shortly a mailing inquiring about their interest in being listed in this *Directory*. All female members of AWM who have answered "yes" to the directory question on their renewal forms will be included with no further authorization.

ADDRESS & INFORMATION CHANGES*:** Please inform us of any changes, so we can update our database for this directory. Let us know if you have a new mailing or email address, a new job, changed phone numbers, etc. If you want to make sure we have the most up-to-date information, just **FILL OUT THE FORM** on ***page 35 and return it by ***June 1st***.

Any woman mathematician can be included in this ***Directory*** whether she is a member of AWM or not. Therefore, we would appreciate you passing this information onto any woman mathematician who might be interested in being included in this *Directory*.

To be included in the ***Directory of Women Mathematicians***, **FILL OUT THE FORM** on **page 35** and return by ***June 1st*** to:

***Directory of Women Mathematicians*, c/o AWM, 4114 CSS Bldg., Univ. of Maryland, College Park, MD 20742-2461.**

Any questions, contact Dawn V. Wheeler at the AWM Office, TELEHONE: 301-405-7892; E-MAIL: awm@math.umd.edu

(In 1996, AWM once again plans to publish a Membership Directory.)

ASSOCIATION FOR WOMEN IN MATHEMATICS

LAST NAME _______ FIRST NAME _______ M.I.

ADDRESS_______________________________

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AWM's membership year is from Oct. 1, 1995 to Sept. 30, 1996. Please fill-in this information and return it along with your DUES to:

Association for Women in Mathematics
4114 Computer & Space Sciences Building
University of Maryland
College Park, MD 20742-2461

The AWM Newsletter is published six times a year and is part of your membership. Questions? (301) 405-7892, or awm@math.umd.edu

Work Phone: **E-mail:**

Interests (list 2 from below) _____ _____

PROFESSIONAL INFORMATION:

If student, GRADUATE or UNDERGRADUATE (circle one)

Position:
Institution/Company:
City, State, Zip:

- ☐ I am currently a member of AWM and wish to be included in the *Directory of Women Mathematicians* to be published.
- ☐ I would like to join AWM and be included in the *Directory of Women Mathematicians* published. (Dues enclosed.)
- ☐ I do not wish to join AWM at this time but would like to be included in the *Directory of Women Mathematicians* published.

INDIVIDUAL DUES SCHEDULE

Please check the appropriate membership category below. Make checks or money order payable to: **Association for Women in Mathematics.**
NOTE: All checks must be drawn on U.S. Banks and be in U.S. Funds. AWM Membership year is **October 1st to September 30th.**

REGULAR INDIVIDUAL MEMBERSHIP	$ 40	________
2ND FAMILY MEMBERSHIP (NO newsletter) Please indicate regular family member: ________	$ 30	________
CONTRIBUTING MEMBERSHIP Indicate if you wish for this contribution to remain anonymous: ________	$100	________
RETIRED or PART-TIME FACULTY MEMBERSHIP (circle one)	$ 20	________
STUDENT or UNEMPLOYED MEMBERSHIP (circle one)	$ 10	________
ALL FOREIGN MEMBERSHIPS (INCLUDING CANADA & MEXICO)....**FOR ADDITIONAL POSTAGE ADD**	$ 8	________

All payments must be in U.S. Funds using cash, U.S. Postal orders, or checks drawn on U.S. Banks.

TOTAL DUES ENCLOSED $ ________

Fields of Interest

00 General
01 History and biography
03 Mathematical logic and Foundations
04 Set Theory
05 Combinatorics
06 Order, lattices, ordered algebraic structures
08 General algebraic systems
11 Number Theory
12 Field Theory and Polynomials
13 Commutative rings and algebras
14 Algebraic Geometry
15 Linear and multilinear algebra: matrix theory
16 Associative rings and algebras
17 Nonassociative rings and algebras
18 Category Theory, homological algebra
19 K-theory
20 Group theory
22 Topological groups, Lie groups
26 Real Functions
28 Measures and Integration
30 Functions of a complex variable
31 Potential theory
32 Several complex variables and analytical spaces
33 Special functions
34 Ordinary differential equations
35 Partial differential equations
39 Finite differences and functional equations
40 Sequences, series, summability
41 Approximations and expansions
42 Fourier analysis
43 Abstract harmonic analysis
44 Integral transforms, operational calculus
45 Integral equations
46 Functional analysis
47 Operator Theory
49 Calculus of variations and optimal control
51 Geometry
52 Convex and discrete geometry
53 Differential geometry
54 General topology
55 Algebraic topology
57 Manifolds and cell complexes
58 Global analysis, analysis on manifolds
60 Probability theory and stochastic processes
62 Statistics
65 Numerical analysis
68 Computer Science
70 Mechanics of particles and systems
73 Mechanics of solids
76 Fluid mechanics
78 Optics, electomagnetic theory
80 Classic thermodynamics, heat transfer
81 Quantum Theory
82 Statistical mechanics, structure of matter
83 Relativity and gravitational theory
85 Astronomy and Astrophysics
86 Geophysics
90 Economics, operations research, programming, games
92 Biology and behavioral science
93 Systems theory, control information and communication, circuits
94 Information and communication, circuits
001 Education: K-8
002 Education: 9-12
003 Education: Undergraduate
004 Education: Graduate
005 Gender Issues
006 Affirmative Action
007 History of Women in Mathematical Sciences
008 Other (please specify): ________

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M/J 95

ADDRESS CORRECTION FORM

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