

File

# Association for Women in Mathematics

Volume 11, Number 4

NEWSLETTER

July-August, 1981

\*\*\*\*\*

## PRESIDENT'S REPORT

Pittsburgh. As usual there will be several AWM events at the Joint Mathematics Meetings at Pittsburgh this summer. All our activities are on Wednesday, August 19, 1981. We are having a panel discussion on "Women Mathematicians in the Eighties" at 3:15 p.m. The panelists are Jeanne Ferrante (IBM), Rhonda Hughes (Bryn Mawr) and Judith Prewitt (NIH), representing industry, academia and the health-related professions. Each panelist will talk about her perceptions of the opportunities and problems for women in her profession. Thus, in a sense, we will continue the dialogue that we started at the panel in San Francisco and look at the coming decade.

The panel will be followed by the Business Meeting from 4:15 to 5 p.m. It would be helpful if those of you who have items for discussion would send them to me by August 10, if possible. We are also having a party at around 8:30 p.m.; the exact time and place will be posted at the AWM table.

Other items of interest are an MAA Invited Address by Mary Gray, our first President, on Wednesday August 19 at 2:20 p.m. and an AMS Invited Address by Linda Rothschild, a long-standing member of AWM and a member of our Journals Committee, on Thursday August 20 at 2:10 p.m.

As always, there will be an AWM table. I hope and look forward to seeing many of you at the meeting.

Elections. Perhaps some of you received the May-June Newsletter too late to send in nominations for candidates for the elections by the deadline; our apologies for the delay. I hope that some of you sent in nominations anyway. You can also send nominations by petition, with 20 signatures, to me before August 19. The positions to be filled are President-elect and three Members-at-Large of the Executive Committee; there will be a ballot in the fall. The report of the Nominating Committee appears below. We also propose some changes in the by-laws and will ask for your approval. The main effect of the changes would be to have elections every other year instead of every year, by increasing the term of office of the Treasurer and Members-at-Large from two years to four years.

Women in Science. The NSF Science Authorization Act, incorporating the Women in Science Bill, was passed by Congress at the end of 1980. Our past presidents Mary Gray and Alice Schafer worked long and hard to get this Bill passed. The Reagan Administration proposes to cut the funds for NSF Science Education in general and for the Women in Science Programs in particular. AWM has written to Senators Hatch and Kennedy, NSF Director Slaughter and President Reagan about the short-sightedness of cutting back on these programs even before they got going. I hope many of you wrote to your Representatives as suggested last issue. The text of my letter to Hatch appears below.

Committees. We have set up the following AWM Committees:

- NSF Committee: Pamela Ferguson
- Archives Committee: Judy Green, Jeanne LaDuke
- Maternity Leave Policies Committee: Rhonda Hughes

If you are interested in knowing more about these committees, or would like to serve on these or other committees, please let me know. For example, would you be interested in being on a Mathematical Education Committee, which, among other things, would look into ways of attracting more high school girls to mathematics?

Some reflections. Exactly ten years ago, in 1971, there was a panel on "Women in Mathematics" at the Summer Meeting of the MAA at Penn State University. A description of the panel discussion appears in the Amer. Math. Monthly 78 (1971), p. 1049, and an article by Mary Gray with the same title giving her impressions of the panel appears in the Amer. Math. Monthly 79 (1972), pp. 475-479. It would be interesting to hear the views of our panelists at Pittsburgh, in 1981.

In a lighter vein, an AWM member proposed in 1973 that the name of AWM be changed to the Emmy Noether Society. The idea was dropped after many members responded negatively to the suggestion.

Bhama Srinivasan  
Math. Dept.  
University of Illinois at  
Chicago Circle  
Chicago, IL 60680

#### LETTER TO HATCH

Senator Orrin Hatch is Chairman of the Labor and Human Resources Committee.

Dear Senator Hatch:

After three years of effort by a coalition of women scientists, among whom were members of the Association for Women in Mathematics and the Joint Committee on Women in Mathematics, the NSF Authorization and Equal Opportunities in Science and Technology Act was passed by Congress in the fall of 1980 and signed by the President on December 12, 1980. This act, incorporating the Women in Science Bill, set aside funds for increasing the participation of women in various scientific fields. It is therefore with great concern that we find that even before the NSF has started to implement the provisions of this act, there is before Congress a proposal to rescind the funds for 1981 and to cut the funds for 1982.

We recognize the need for economic initiatives on the part of the federal government that include deep budget cuts, and the need for all citizens to make sacrifices in the larger interests of society. However, we feel that if, at this critical stage in the development of science education for girls and of larger opportunities for women scientists, the much-needed funds are cut, the gains made by women in the last decade will be badly eroded, our nation will not benefit from the scientific education of more women, and those groups of society which have traditionally made the greater sacrifices will again be called upon to sacrifice their interests.

We also share the concern of other organizations like the Mathematical Association of America and the American Association of University Professors towards a move to cut funds for Science Education generally at NSF. This proposal threatens the quality of scientific education for future generations at a time when we face a critical need to produce highly trained, quantitatively oriented people. It specially affects the education of girls, who have only recently had the opportunities to pursue scientific studies in representative numbers.

We urge the Congress to restore funding for NSF support of Science Education and of the Women in Science programs.

Sincerely yours, Bhama Srinivasan  
President, Association for Women in Mathematics

## REPORT OF THE NOMINATING COMMITTEE

by Judy Roitman, University of Kansas

This fall we will be electing a president-elect and three members-at-large to the executive committee. The nominee for president-elect is Linda Rothschild, University of Wisconsin. Nominees for members-at-large are: Gloria Hewitt, University of Montana; Joan Hutchinson (incumbent), Smith College; Jeanne LaDuke, De Paul University; Judith Longyear, Wayne State University, and Vera Pless, University of Illinois at Chicago Circle. Both Louise Hay and Rhonda Hughes will be leaving the executive committee when their terms are up this January, having chosen not to run again. The nominating committee, on behalf of AWM, thanks them for their past service.

Members are reminded that additional candidates may be nominated by petition. If you are interested in nomination by petition, contact Margaret Munroe at the AWM office.

A ballot and statements for the candidates will appear in the November-December Newsletter.

## REPORTS ON AWM MEETINGS

Illinois Section of the MAA by Joan Wyzkoski, Bradley University

On Saturday, May 2, 1981, an AWM luncheon meeting was held immediately following the annual meeting of the Illinois Section of the MAA at Illinois State University in Normal. Linn Sennott, a member from ISU, supplied a flier, which announced the luncheon and was distributed during registration. The gathering was very informal. With a small group of six people, the conversation was lively and friendly, with topics ranging from computers and calculus to remedial math and, of course, the infamous Johns Hopkins study.

The time of the meeting was inconvenient for several members, so alternate times were discussed. Most felt that for next year's meeting, the time on Friday between the business meeting and the banquet should be tried. Suggestions are welcome.

Ohio Section of the MAA by Jessie Ann Engle, Ohio State University, Marion

A small group of current and potential AWM members and guests met at Miami University, Oxford, Ohio, on Friday evening, April 10, 1981, during the MAA Ohio Section spring meeting. We noted that some of our members were in New York, attending a meeting on the teaching of remedial mathematics.

The WAM project in central Ohio is getting started under the leadership of Suzanne Damarin of The Ohio State University. Suzanne has compiled a preliminary list of speakers and topics, and is now adding to that list, as well as getting the names of schools where the WAM project might be welcomed. Those present were encouraged to volunteer for the program, and to send Suzanne names of appropriate schools.

We discussed the problem of the conspicuously small number of women on lists of contest winners, in concurrent-registration programs, in summer math institutes, and also in math major and graduate programs, without coming to any conclusions as to reasons or remedies.

Kansas Section of the MAA by Sister Jo Ann Fellin, Benedictine College

AWM materials were displayed at the joint meeting of the MAA Kansas Section and the Kansas Association of Teachers of Mathematics held at Benedictine College on April 10-11, 1981.

A display on women in mathematics, prepared by the library staff, was located near the meeting registration desk. It included the following books: Math Equals by Perl, Women in Mathematics by Osen, Emmy Noether by Dick, Hilbert and Courant by Reid, and A Russian Childhood--Kovalevsky.

The film "Sandra, Zella, Dee, and Claire: Four Women in Science" was one of the films available for viewing at the meeting.

### Boston Area

An informal AWM meeting/brunch was held on April 5, 1981 at Martha Jaffe's home in Newton Center, Mass. One of the main actions was formation of a committee to plan a career conference for junior and senior high school girls interested in careers in mathematics-related disciplines. We felt strongly the need to reach down to the junior high level because it is there that the "tracking" in mathematics courses begins and so it is also there that the student's education must not be narrowed so as to exclude careers which require a strong mathematics background. We hope to have speakers from a wide range of disciplines such as the physical sciences and business areas who can address the role of mathematics in their own professions and the necessity for a sound education in it in order first to complete a program of studies in such fields and then to be competitive in the job market.

Interest in such a conference was high among all who were present at the meeting. Represented were many area colleges and high schools including MIT, Boston State College, Wellesley College, Simmons College, Bentley College, Boston University, Fitchburg State College, Brandeis University, The Cambridge School of Weston and Concord-Carlisle High School. With interest from so many, we will be successful in starting such a conference for the Boston area. We are, however, in only the beginning stage of planning, namely looking for funding. If anyone in AWM has participated in planning for a similar conference we'd like to hear from you. Please contact: Carroll McMahon, Department of Quantitative Analysis, Bentley College, Waltham, MA 02254. Phone: (617) 891-2986.

### AN INTERVIEW WITH MARGUERITE LEHR

by Pat Kenschaft, Montclair State College

Marguerite Lehr retired as professor emeritus from Bryn Mawr College in 1967. She was the oldest of five children of a Baltimore grocer, the only one of the five to go to college. After graduating from Goucher College in 1919, she became Charlotte Scott's graduate reader the following fall, answering questions in class and holding office hours for Scott, who was by then completely deaf. She won a fellowship for study abroad and studied algebraic geometry at the University of Rome. In 1925 she received her Ph.D. from Bryn Mawr College, the last of Scott's students, and after that she taught there continuously except for several leaves.

She has had three research papers published and several articles about mathematics. For eight years she was an examiner for the Woodrow Wilson fellowship applicants and she spent five weeks as a visiting MAA lecturer. She pioneered using commercial TV as a medium for teaching mathematics.

It was my privilege to visit in her living room on March 31, 1981, and record three hours of tapes for the Bryn Mawr archives. The depth of her thinking, the breadth of her knowledge, her passion, and her choice of words is too inspiring to leave to the archives, so I have chosen some of the high points to edit and share. Lehr speaks poetically with many gestures and voice inflections, so the following reflects not just her exuberant personality but also my efforts to adapt her expressions to the printed page.

-- Someone asked me if I was ever sorry I had chosen mathematics. I said, "I didn't choose! Mathematics is an addiction with me!"

-- Mathematics and poetry are head-tail of the same coin. Both are an attempt to discern pattern--because you refuse the idea of a chaotic universe--and to develop

Language which has to be metaphoric, or you'll drown in jargon.

-- The one thing I'm sure of is that pronouncement comes out of ignorance. The one thing we have to know is that knowledge is tentative.

-- Even before Plato there was "high Magic" and "Low Magic." High magic is discerning pattern.

Low magic is the attempt to use accepted patterns to get an answer. In our generation we call these "pure mathematics" and "applied mathematics."

Too often people search for answers before they have framed a meaningful question. That is where you must start!

-- To experience reality is to discern patterns.

If you have any accepted patterns (don't call them "true"), you put them to the test; that is the "low magic" stage. Maybe you get nice sentences. But maybe it blows right in your face; that's when you must admit you can't use the word "true".

-- When I was still young, President Park of Bryn Mawr chose me to represent the faculty of our college at a meeting of the seven women's colleges. We met at Vassar. Vassar's president

said that the young men on his faculty seemed to publish more than the women did. He added that perhaps it was because they felt the responsibility of the family. And I said innocently--I wasn't being nasty--"What do you think of the quality of the work under that motivation?"

-- I went to as many of the International Congresses as I could get to. But I didn't notice if a woman were there. I went for the person I knew had done something... I thought only about the fact that I was hooked on one kind of work.

-- During my first leave I attended Zariski's lectures and I thought I could generalize what he was talking about. I worked very hard, but what I got was a mess. So when the editor of the American Journal of Mathematics came to me and said, "Zariski says you have some work I should publish," I responded, "It's a mess; it's a bad lead. Zariski asked to see what I had done, and of course I had to give it to him. Then he said, "You didn't get what you went in after. But you proved some things. Now back off, and



**Miss Lehr, caught in a characteristically -pirited mood at Manset, Maine, which is, she confesses, next to Mathematics, her greatest obsession.**

from BM Alumni Bulletin, 1954

state what you proved. You have to publish what you have to keep other people from going down your dead end. But we don't know; maybe someone will see a fork in the road." That is very hard; if you have a feel for style, you think things should be elegant too.

Kenschaft: Did you find it painful at the time to expose those disappointing results?  
Lehr: Horrible. Horrible. I hated it. But I don't say I didn't learn from just the effort to get it written.

-- Once when I was walking down a corridor, I heard a colleague say to his class, "You'll never do mathematics if you can't see pictures." So I waited in the hall until the class was over and said, "What is this heresy I hear?! Never do mathematics...?!!" For two weeks he would try to catch me by asking questions he thought would force me to visualize something. Finally he said, "Okay." People use what they have... I have more or less six senses.

-- I am strongly auditory. I am strongly kinesthetic. I wrap space in knots and I live in a left-helical world. (Gesturing with her arms a left helix) It is very hard for me to do that other one. (Vainly attempting a right helix) ...I live in a curved space.

-- I walk up and down and talk, and when I write, the work is finished--if I pick up my reluctant pen... I came along too early... If there had been easy tape-recording and Bryn Mawr had had any money... I do think we underestimate the power of the spoken word... Mathematicians should be using TV more...

Kenschaft: But you did do a series for TV.

Lehr: Yes, fourteen weeks. And it did get response. But there hasn't been enough. We should have taped Artin...

-- When Emil Artin, Emmy Noether, and John von Neumann walked and talked, work went on better for young and vigorous minds. Life isn't just writing. The new view imagines the universe as a seamless web, not those little boxes of space and time... a great cosmic dance...

-- Once a woman asked me, "Are you a mathematician?" The big words, I think, belong to the big things. So I said, "No, but I spend most of my waking hours thinking about mathematics, and sometimes sleeping hours too." I didn't know Paul Levy was at my shoulder. He said in his nice French, "But you know very well what mathematics is... You do the dance called 'thinking' in front of them. And they learn. They don't all learn the same thing, but that doesn't matter." He looked puzzled, and then he exclaimed, "Ah, the little articles! All those little articles!" I had been considering leaving teaching and getting a job with a publisher, but I was so excited, I returned to Bryn Mawr.

-- The first and only thing I ever failed in school was the first quarter of algebra. And I know why, now... But I could be docile and learn rules, so I passed the second quarter with a 95.

-- I knew German from the time I was four; I grew up in a German church. German wasn't talked at home because my father didn't want that.

-- Later I had to know French, German, and Italian, all three. You couldn't work without them. You can't wait for the translations, and you can't trust them.

-- Frank Morley once presented what seemed like a very simple theorem to a group of seniors. One of the girls asked him if it had originally seemed intuitive or if that simplicity came after beating. He was absolutely delighted. And he said, "Look, child, I have eyes to see where I would like to go. I have feet to try to take me there. That is intuition and proof in mathematics, and no more. And no less! And no less!" wagging his finger at her.

-- The richest experience of my life was the eight years I spent interviewing candidates for the Woodrow Wilson graduate fellowships.

-- In 1967, my last year of teaching, I decided to give myself the pleasure of presenting projective spaces again. This time I did in three weeks what it used to take a semester to do!

Kenschaft: Could the students follow you?

Lehr: They followed better! They didn't have to pick their way through all those extra

messes that are going to get trimmed away. You get it down to clean, clean bone. Right down...

-- That same year, I was very disappointed once about how a class had gone and I must have made a noise as I walked away. A chemistry graduate student asked me if I were all right. I said, "Did I get in the way of it that time!" She said, "Maybe they don't feel that way about it." I said, "That's no excuse! How can they know the water is deep unless I take them in deep?" She was really nice and perceptive. "Now look. By the meaning of your 'best', it isn't something you can do every day." She walked to the bookstore with me so I could blow.

-- Two years ago I.M. Singer was at Haverford for a few days. He announced his topic as "Applications of the Eta-invariant." It has something to do with elliptic spaces. When Singer talked, it was superb, and for 48 hours I almost think I got in there. Someone teased him as he came in, "So you jumped on the applications train too." As I left, I told him, "I have a better title for you. What you were doing was not 'applications'. It was 'apparitions'."

-- I like to put good sayings on the opposite side of one file card. Here is one. Confucius says, "The wind of anger blows out the flame of intelligence." The other side to that is, "Anger is a prerequisite to action. It steps up the adrenalin."

-- I object to acting as if you can quantify creative ability... I don't care whether it is in mathematics, poetry, or whatever. Anyone who says "the greatest" this and that... it makes me chuck my lunch. It says something about the person writing, and it doesn't say anything I have to admire. ...But I do have to try to hold my tongue. You'd be surprised at some things that get called "work!"

--Kenschaft: Are there any guidelines for this world?

Lehr: Not guidelines, no. But there are the moments when you say "yes" before you know what you are saying yes to. Then you sweat, and that sweat makes it fun.

...There are no simple solutions... only intelligent choices. Answers! We've come far if we've framed a good question... and maybe even that will explode on you.

...I never use the word "true." Too many people act as if things were either-or, and it is almost only trivial questions that are either-or.

...For me work and worship are head-tail of a coin. They have served each other like that. The work saves me from jargon, and the worship gives me a heritage down the centuries... I think it is presumptuous when people use humankind language about God. A woman said God is "sophisticated!" People talk to you like that! It makes me want to get under a bench... In this rich dance (of reality) watch the words you give yourself. I said to a woman, "You use the word 'God,' but you puzzle me. You talk as if He needed Man's little boxes of space and time to keep track of his doings." To hear some speak you would think God began in zero A.D.! (Much laughter)

The question of what vocabulary you permit yourself is partly due to severe training in pure mathematics. Last week I heard a lecture on rather high-powered stuff, compactification and so on. It starts with something they call "one dimensional." They used the word "curve." They stretched the word, "curve." Then in the next stage when they used two of them, they called it a "surface." That's excellent use of what I call stretching a word.

...I think it's a shame to impoverish human relationships... fortunately, you don't have to... only once in a while you're plunged into... and you have to pull yourself... a dark night (she laughs)... there are enough plusses... the dark's small lamps... to light those times when you're not sure you have either the courage or desire... for life...

-- (reading from a passage she wrote in the 1950's when she was paralyzed, not knowing if she would get out of bed again) I don't need a class. For me dissecting thought is fun. A class is an audience, is occasion for dissection of thought... If I have a minimum of wit, then they gain also, and, perhaps, we both gain in high degree. But this possibility would risk being invalidated by the intention that they gain. It exists only when the obstinate and persistent practice is kept up by me.

-- (extemporaneously into the tape at the age of 82) True mathematicians don't need an audience. Working out the music is enough. An audience is an occasion for making music, and on that occasion it may also be an experience of delight.

## CONGRATULATIONS

Professor Mary Ellen Rudin of the University of Wisconsin has just been awarded a named professorship. She has chosen to be called the Grace Chisholm Young Professor of Mathematics.

NSF Mathematical Sciences Postdoctoral Research Fellowships are awarded to permit recipients to choose research environments that will have maximal benefit to their scientific development. The stipend is \$20,000 per year for full-time research. Next year Deborah Allinger, currently at Indiana University, will work at Massachusetts Institute of Technology; Dale Marie Clarke, currently at Courant Institute, will work at California Institute of Technology.

Graciela Chichilinsky, an Argentine of Russian background who earned two doctorates (in mathematics and economics) won a Rockefeller Fellowship. The grants average \$55,000 each for advanced academic studies in international affairs.

## STATUS OF WOMEN IN THE PHYSICAL SCIENCES, MATHEMATICS, AND ENGINEERING

by Rhonda Hughes, Bryn Mawr, Bunting Institute Faculty Fellow 1977-79  
reprinted from Choices for Science, Proceedings of Symposium  
sponsored by The Mary Ingraham Bunting Institute of Radcliffe College  
by permission of Marion Kilson, Director

Although affirmative action and equal opportunity employment practices as mandated by Title IX have been in effect since 1972, the numbers of women holding academic positions in scientific fields remains discouragingly low. Because mathematics is a critical prerequisite for any career in the sciences, and because I am a mathematician, I have chosen to seek possible causes for the current situation by examining those factors which I feel contribute to the high attrition rate for women from mathematics at every level of their intellectual development.

Already in early childhood girls are subject to the stifling influence of toys which promote passivity and conformity to traditional stereotypes. A walk down the aisle of any toy store is a grim lesson in the different expectations our society holds for girls and boys, and hence for women and men. As soon as we pass the toys of infancy, we encounter the dolls, dishes, pots, pans and irons which must dampen the scientific curiosity of their unsuspecting recipients. By contrast, the toys traditionally reserved for boys' use seem fascinating even to an adult. Although there is no conclusive evidence for differences in mathematical ability between boys and girls before adolescence<sup>1</sup>, I am convinced that many of the attributes which are so valuable to the scientist in later life are already being programmed out of girls in infancy and early childhood.

In elementary school the conforming, nonaggressive behavior for which girls are frequently rewarded is incompatible with the demands of their innate intellectual curiosity. They may submerge their natural creativity in a trade-off for the approval of their teachers; moreover, these teachers often expect boys to do better in mathematics<sup>2</sup> and may themselves feel they have an inadequate grasp of the material. It is not altogether surprising that this climate produces girls whose participation in academically challenging courses in mathematics and science decreases sharply in high school when these courses become optional.

Other factors which may contribute to the disparity between the interest and achievement of girls and boys which appears at this level are societal expectations and peer pressure. The sexual stereotype of the woman scientist as a rather formidable individual is as persistent as it is inaccurate; because of this stereotype, young women fear they must forego their "femininity" in order to become scientists. In his eulogy of the eminent woman mathematician Emmy Noether, Hermann Weyl said, "No one could

contend that the Graces had stood by her cradle;... if we... often chaffingly referred to her as 'der Noether,' it was also done with a respectful recognition of her power as a creative thinker who seemed to have broken through the barrier of sex... ."3 I have no doubt of Weyl's respect for Noether and her work, but it is hard to imagine that were she a man, he would have said, "the Graces had not stood by his cradle... ." Today, we regard his remarks about Noether's "femininity" or lack thereof as irrelevant; by increasing the awareness in girls of the diversity of people who actually are mathematicians, such stereotypes can be dispelled.

Moreover, the current popularization of math anxiety may lead girls to believe they suffer from an inevitable female disorder and may ironically reinforce existing stereotypes of women as being inept at math and sciences. Another factor is the misleading impression young women have about the degree of mathematical facility needed for their particular career aspirations. Even the traditionally female fields in the social sciences, humanities and education may now require more mathematics than was previously assumed. Lucy Sells has referred to mathematics as a "critical filter in the job market," because women are effectively barred from a wide variety of careers due to inadequate preparation in mathematics.

As young women are beginning to avoid mathematics and science, the participation of their male peers is increasing. The aggressive behavior which was often a problem for boys in the primary grades in high school becomes an acceptable approach to problem solving. Young men who now demand challenging work are viewed by their teachers as "finally settling down."<sup>4</sup> Moreover, since society views the acquisition of mathematical and scientific knowledge as an appropriate activity for men, there are no stereotypes to be fought at the expense of valuable intellectual and emotional energy.

Patricia Casserly, a research scientist at Educational Testing Service, recently found three characteristics common to math teachers in schools with strong programs for both women and men:

- (1) the teachers use older girls to counsel and tutor younger girls;
- (2) the teachers have access to their students' families; and
- (3) the teachers seem to thrive on teaching students who may be brighter than they are themselves.

This last characteristic is crucial to the young women they teach for, as a rule, gifted young women are not the delight to their teachers that young men are.

Also, girls need more realistic counselling and challenging experiences in the schools. "Math can become a natural pursuit long before girls wonder whether it's a proper subject or before sexual self-consciousness and sexual stereotyping become problems."<sup>5</sup>

The young woman whose enthusiasm has survived until college faces a new set of obstacles. Encountering for the first time the predominantly male scientific establishment, she may find that the shortage of women faculty members creates a less than supportive atmosphere. For example, women students often feel more comfortable seeking help from their women teachers, whom they claim are more sympathetic to their needs; the additional responsibility this implies for the woman faculty member seeking tenure is a significant issue in view of the current demands of academe. Also, research has shown that both women and men faculty are more supportive of students of the same sex;<sup>6</sup> hence, the scarcity of role models begins to take its toll. The relatively large proportion of women faculty at women's colleges has been suggested as the possible reason for their impressive record for producing women who are subsequently cited for career achievement.<sup>7</sup>

Another aspect of the women's colleges which may contribute to their success is the absence of male students in the classroom. A young woman majoring in mathematics may be the sole representative of her sex in the classroom. If she is not "one of the boys," she may miss out on the intellectual exchange among students which is so important at all levels of scientific development. The situation is exacerbated by the greater confidence men display in their abilities; as noted in the compilation of research on sex differences by Maccoby and Jacklin, men overestimate their position in the dominance hierarchy, and their sense of self-worth is enhanced by positive feedback.<sup>8</sup> Such self-assuredness, even in the absence of any particular intellectual

superiority, is, in my opinion, a manifestation of the sense of potency one derives from a supportive environment. Whereas male mathematicians may favor the more demonstrative "male style" in which they themselves were primed since childhood, a woman who performs in the more methodical, disciplined fashion reminiscent of the behavior for which she was rewarded in the elementary school setting may find herself criticized for being "a good student, but not creative."

The woman who chooses to do graduate work in mathematics may be affected to an even greater extent by the paucity of role models. Women who have power in their departments and need not fear for their jobs not only provide encouragement and support to women students, but may enlighten male colleagues and graduate students as well. Given the current employment situation, an unfortunate woman graduate student may never encounter a prominent woman in her field. For example, in 1978-79, the percentage of Ph.D. women on the faculties of the 27 most prestigious mathematics departments was 4.5, with 2.7 tenured.<sup>9</sup> In my own case, the presence of tenured women was a significant aspect of my graduate school experience, the fact that I was not at one of the 27 most prestigious schools was more than offset by the more relaxed and egalitarian atmosphere which produced many women Ph.D.'s. It should be pointed out that even when suitable candidates are available, women are frequently overlooked for positions which may increase their visibility. For example, in a recent survey conducted by the Association for Women in Mathematics, of 467 journal editors, only 8 were women. When questioned about the situation, one editor replied that only "leaders in the field" were appointed to the editorial board. After a tactful reminder that one of the editors was by no means in this category, a woman was appointed to the editorial board.<sup>10</sup>

Although the percentage of Ph.D.'s in mathematics has been growing for several years, to 13.3 in 1979, women do not seem to be securing academic positions at the same rate as doctorates. For example, the percentage of women on the tenured faculty of four-year colleges and universities remained fixed at 4.4 over the two-year period 1977-79.<sup>11</sup>

Once appointed to tenure-track positions, women faculty members in general climb the academic ladder more slowly than men, and they are less likely than men to achieve tenured status.<sup>12</sup> Among the possible causes contributing to this situation is that women in general have higher teaching loads: NCES data show that 35 percent of female university faculty, compared to 53 percent of male university faculty, teach eight hours or less per week.<sup>13</sup> There is also concern that women's research may be evaluated unfairly; there is evidence that even when the publication rates of women and men are identical, men are promoted more rapidly.<sup>14</sup> Examples of discrimination and underemployment of qualified women are well documented, but in the mathematical community the case of Julia Robinson, the first woman in mathematics to be elected to the National Academy of Sciences, is the most striking. Robinson was for many years a lecturer in the mathematics department at Berkeley. Unemployed at the time of her election to the National Academy, Berkeley promptly offered her a full professorship. Efforts to eliminate alleged biases have been for the most part unsuccessful; blind refereeing has been a hotly contested issue in the American Mathematical Society for several years, and was recently abandoned due to considerable opposition.

As mentioned earlier, the woman faculty member may face additional demands on her time due to the small number of women in her department. In sciences where graduate students and research grants are indispensable, the aspiring young woman often feels she lacks the professional connections which are important in the establishment of a reputation, and hence in the accrual of grants and students. One difficulty in establishing connections is that women often report feeling isolated from their male colleagues, socially and professionally, and that their colleagues may feel uncomfortable or restrained in their presence. Indeed, Edith Luchins has documented these attitudes among women mathematicians.<sup>15</sup>

Although I have said little about other areas of science, similar situations prevail. In a recent article, Vera Kistiakowsky demonstrates that the status of women in physics has changed little since 1971 or, for that matter, since the beginning of this century. With the exception of assistant professors, the increase in the percentage of women

professors in doctorate-granting physics departments since 1971 is insignificant. For example, in 1971-72, 1.5 percent of all professors in such departments were women, whereas in 1978-79, 1.7 percent were women.<sup>16</sup> It remains to be seen whether the increase from 2.0 to 4.5 percent for assistant professors, as well as the increasing percentage of Ph.D.'s awarded to women, will affect the status of women physicists.

For women in chemistry, there are few models in prominent positions. As of 1977, less than 3 percent of the faculty in the 35 most prestigious chemistry departments were women; in fact, of 188 doctoral-granting departments, 114 had no women in tenure-track positions. More encouraging statistics are that in 1977 12 percent of new Ph.D.'s were women, and that some graduate schools boast female enrollments as high as 35 percent.<sup>17</sup>

The prognosis for the status of women in engineering is, perhaps, the most promising, for the number of women freshmen in engineering has risen 623 percent from 1969 to 1976. Although the effects of this increase are not yet fully reflected in bachelor's degrees, the number of women receiving degrees in engineering has increased 509 percent in this same period.<sup>18</sup>

Lest the future seem too gloomy, let me close by saying that there are several positive steps being taken to analyze and remedy the situation. On the West Coast, there are currently several programs underway to encourage women to study math and science. Led by Lenore Blum and others, there is a "Women in Science" program at Mills College designed to prepare students with inadequate backgrounds for calculus. The "Math for Girls" program at Lawrence Hall of Science was designed to provide an opportunity for 6-14 year olds to explore mathematical concepts in a non-threatening environment. The Math/Science Network, which grew out of these projects, has conducted several conferences designed to increase young women's interest in and awareness of careers in math and science. Recently funded by the Carnegie Corporation, the Network will disseminate its resources to provide models for such activities throughout the country.<sup>19</sup> Also, the Association for Women in Mathematics has made great strides in increasing the visibility of and communication between women mathematicians. Each year, as more women receive Ph.D.'s in the sciences and slowly climb the academic ladder, the number of role models for aspiring young women will increase, for the ultimate benefit of society.

#### Notes

1. Lilli Hornig, Climbing the Academic Ladder: Doctoral Women Scientists in Academe (Washington, D.C.: National Academy of Sciences, 1979), pp. 11-12
2. John Ernest, "Mathematics and Sex," American Mathematical Monthly 83 (1976), p. 599
3. Lynn M. Osen, Women in Mathematics (Cambridge, Mass.: The MIT Press, 1974), p. 152
4. "Factors Related to Young Women's Math Achievement," Caucus for Women in Statistics Newsletter, 9:1 (February 1979)
5. ibid.
6. Hornig, p. 15
7. ibid., p. 14
8. ibid., p. 13
9. Judy Green, "Fifth Annual Report of Employment of Women in Mathematics Departments," this Newsletter 9:1 (January-February 1979)
10. Bhama Srinivasan, "First Report on a Project Involving Journal Editorships," this Newsletter 9:5 (September-October 1979)
11. Green
12. Hornig, p. 82
13. Ruth B. Ekstrom, "Women Faculty: Development, Promotion, and Pay," Findings, ETS 5:2 (1979), p. 2
14. ibid., p. 3
15. Edith Luchins, "Women in Mathematics: Problems of Orientation and Reorientation," Final Report on NSF Grant, Jan. 1976 (preprint)
16. Vera Kistiakowsky, "Women in Physics: Unnecessary, Injurious and Out of Place?" Physics Today, Feb. 1980, pp. 32-40

17. Rebecca L. Rawls and Jeffrey L. Fox, "Women in Academic Chemistry Find Rise to Full Status Difficult," Chemistry and Engineering News, Sept. 11
18. Betty M. Vetter, "Data on Women in Scientific Research," this Newsletter 9:3 (May-June 1979)
19. "Activities of Bay Area Math/Science Network," this Newsletter 9:2 (March-April 1979)

#### COMMENTARY ON WOMEN IN MATH

Are boys better at math than girls? Findings recently reported by Johns Hopkins researchers (Benbow and Stanley) would seem to indicate that this traditional view is, indeed, correct. However, the author of the following article cautions us in accepting this conclusion by pointing out some difficulties with the experimental design and assumptions inherent in the research. Reprinted with the permission of the author, Elizabeth K. Stage of University of California at Berkeley.

Reprinted here from *On Campus with Women*, published by the Project on the Status and Education of Women, Association of American Colleges, 1818 R St., N.W., Washington, DC 20009.

The recent report in Science magazine on sex differences in mathematical ability (1) and the associated news story (2) have received much attention in the popular media (3) and have caused considerable concern among mathematicians and educators. The article reports on a study which has taken place over the past eight years at Johns Hopkins University which has been conducting talent searches by administering the College Board Scholastic Aptitude Test (SAT) to seventh and eighth graders. A large difference was observed in each of the six talent searches between the performance of the males and the females on the mathematical portion of the SAT (SAT-M) while no such difference was observed between males and females on the verbal portion (SAT-V). Since "boys and girls have presumably had essentially the same amount of formal training in mathematics," through the seventh grade, the researchers concluded that, "It is therefore obvious that differential course-taking in mathematics cannot alone explain the sex differences [they] observed in mathematical reasoning ability, although other environmental explanations have not been ruled out." (1, p. 1263)

There are two problems with this inference, one in the assumption of equivalent instruction and the other in the portrayal of the differential course-taking argument which they purport to test. The difficulty with the assumption that there has been no essential difference in the formal training in mathematics is that it ignores a wealth of evidence on the differential treatment of boys and girls in elementary school, including the findings that girls receive less praise for correct answers than boys do (4), praise received by girls occurs randomly while boys are praised for participation in academic activities (5) and teachers sex-stereotype academic fields, making more academic contacts with girls in reading and with boys in math (6). From these findings, one would expect males to be participating at a higher level in school, particularly in mathematics.

The limitation of Benbow and Stanley's portrayal of the differential course-taking argument is that Fennema and Sherman, whose work is cited as an example of that argument, have never contended that differential course taking alone explained the performance differences between males and females in mathematics. The cited article, in which only students with the same math backgrounds are compared says, "The only high school with two significant sex-related differences in cognitive factors also showed the highest number of sex-related differences in affective factors, six out of eight. The very fact of variation from school to school in the occurrence of sex-related differences on cognitive factors makes it less likely that the difference observed can be attributed to sex per se." (7, p. 66) These researchers concluded their subsequent article, in

which they examined students in middle schools as well, with the following statement: "The strong conclusion reached by the authors after two years of intensive study of sex-related difference in mathematics achievement of students in grades 6-12 is that when relevant factors are controlled, sex-related differences in favor of males do not appear often, and when they do, they are not large. When relevant variables were controlled, sex-related mathematics and other cognitive differences were few and of slight extent." (8, p. 201)

Benbow and Stanley admit that a possible criticism of their results is "that only selected mathematically able, highly motivated students were tested. Are the SMPY results indicative of the general population?" (1, p. 1264) They explain that lowering of the criteria of eligibility for the searches did not change the number of high scoring individuals. That fact does not, by itself, make the results representative of the general population. As they point out in the following paragraph, the question remains, "To what extent do girls with high mathematical ability opt out of the SMPY talent searches?" Unless and until they survey the pool of potential participants to find out who among them decides to participate and who declines, they cannot rule out the possibility that the most able females are deliberately choosing not to participate because they realize that the social consequences of such an activity will be negative (9).

A further shortcoming of the paper is highlighted in this sentence, "Our results suggest that these environmental influences are more significant for achievement in mathematics than for mathematical aptitude." (1, p. 1264) While the College Board encourages a distinction between achievement and aptitude in its testing program and the SAT is intended to test aptitude rather than achievement, it is not clear that the SAT is the most appropriate measure of aptitude or that seventh graders taking a test intended for high school students is the most appropriate sample. Further, text experts are questioning the distinction between aptitude and achievement tests, estimating as much as 60-75% overlap between the two constructs (10, p. 285) In fact, achievement and aptitude tests sometimes correlate as highly as their reliabilities, which set a maximum on the possible correlation (11, p. 401).

Finally, Benbow and Stanley favor the hypothesis that "sex differences in achievement and attitude toward mathematics result from superior mathematical ability, which may in turn be related to greater male ability in spatial tasks." They did not measure spatial ability themselves, but relied upon two sources. One of these (12) relies on studies now twenty or more years old, the other has been superseded by work that clearly voices objections to the "male superiority" hypothesis (13). Without a measure of spatial ability and with such questionable references, it is hard to see the basis for the spatial ability claim.

There are several reasons, then, for being cautious in interpreting the recent Science article. The authors make an unwarranted assumption of equivalent treatment of males and females in elementary school; they imply that disagreement with them is equivalent to agreement with a socialization-only hypothesis; they generalize from an unusual sample; they use an unusual aptitude measure for a seventh grade sample; they draw conclusions about spatial ability without having tested it. The data presented are limited to the observation that, on the average, males who responded to a talent search outscored females who responded to a talent search on the mathematical section of a test designed to predict high school students' college performance. Even if the result could be generalized, the observation obscures the substantial overlap of the distributions of scores on the test. Furthermore, few students, male or female, reach their potential in mathematical achievement. Research efforts should be directed at discovering ways to enhance the development of all students' mathematical reasoning ability and achievement.

#### References

1. Benbow, C. P. and Stanley, J. C. Sex differences in mathematical ability: Fact or artifact? Science 210:1262-1264, 1980.
2. Kolata, G. B. Math and sex: Are girls born with less ability? Science 210:1234-1235, 1980.

3. The gender factor in math. Time, 116(24):57, 1980; Williams, D.A. and King, P. Do males have a math gene? Newsweek 46(24):73, 1980.
4. Brophy, J.E. and Good, T.L. Teachers' communication of differential expectations for children's classroom performance: Some behavioral data. Journal of Educational Psychology 61(5):365-374, 1970.
5. Delefos, P. and Jackson, B. Teacher-pupil interaction as a function of location in the classroom. Psychology in the Schools 9(2):119-123, 1972.
6. Leinhardt, B., Seewald, A.M., and Engel, M. Learning what's taught: Sex differences in instruction. Journal of Educational Psychology 71(4):432-439, 1979.
7. Fennema, E. and Sherman, J. Sex-related differences in mathematics achievement, spatial visualization, and affective factors. American Educational Research Journal 14:51-71, 1977.
8. Fennema, E. and Sherman, J. Sex-related differences in mathematics achievement and related factors: A further study. Journal for Research in Mathematics Education 9(3): 188-203, 1978.
9. Lockheed, M.E. Female motive to avoid success: A psychological barrier or a response to deviancy? Sex Roles 1:41-50, 1975.
10. Cronbach, L.J. Essentials of Psychological Testing (Third Edition). NY:Harper and Row, 1970.
11. Ahastasi, A. Psychological Testing (Fourth Edition). NY:Macmillan 1976.
12. Smith, I.M. Spatial Ability. London:University of London Press, 1964.
13. Sherman, J. Sex Related Cognitive Differences. Springfield, Illinois:1978.

#### INTERNATIONAL CONGRESS OF MATHEMATICIANS

The Organizing Committee is pleased to announce that the next International Congress of Mathematicians will be held in Warsaw, from Wednesday, August 11 to Thursday, August 19, 1982. The work of the Congress will be divided into nineteen sections. A reception, concerts and open-air entertainment will be arranged during the Congress. Short tours will be organized to various places in Poland. For a copy of the Second Announcement, write: ICM-82, Śniadeckich 8, P.O. Box 137, 00-950 Warsaw, Poland. (They'd like your name and address printed three times.)

#### OF POSSIBLE INTEREST

Women's Studies, Temple University Press, Broad & Oxford Streets, Philadelphia, PA 19122.

Women: An International Perspective, UNIPUB, 345 Park Avenue South, NY, NY 10010.

For a year beginning in October 1981, Mary Clare Powell and Anne Cheatham will be traveling the US looking for women creating the new. Anne will be collecting material for a book called The Future Is Female, and Mary Clare will be looking for feminist artists who are not widely known. Both will be creating support networks. They are collecting names and addresses of women to contact. Write 8002 Iliff Drive, Dunn Loring, VA 22027 by Sept. 1st.

REENTRY is a newsletter published both for women returning to academic and professional life and the program directors who serve them. It is published quarterly and distributed free of charge by the Women's Reentry Consortium. The Consortium is a national association of three universities funded to provide organizational expertise to institutions running--or considering running--reentry programs. They focus on every aspect of the process encountered by women who reenter academic and professional situations after a period of absence: their personal, academic and professional needs.

DEADLINES: July 24 for Sept.-Oct., Sept. 24 for Nov.-Dec., Nov. 23 for Jan.-Feb., 1982.

ADDRESSES: Send all newsletter material except ads to Anne Leggett, Math. Dept., Western Illinois University, Macomb, IL 61455. Send everything else, including ads, to AWM, Women's Research Center, Room 204, Wellesley College, 828 Washington St., Wellesley, MA 02181.

#### JOB ADS

Institutional members of AWM receive two free ads per year. All other ads are \$10.00 apiece and must be prepaid. The vacancies listed below appear in alphabetical order by state. All institutions advertising below are Affirmative Action/Equal Opportunity employers.

Purdue University. Dept. of Mathematics. Professor/Assoc. Professor with tenure in Applied Mathematics. Salary competitive and negotiable. Required: Excellent research credentials. Position (s) available for academic year 1982-83. Purdue has strong graduate programs in applied mathematics, algebra, logic and analysis. Please apply to M. S. Baouendi, Head, Dept. of Mathematics, Purdue University, West Lafayette, IN 47907.

Kansas State University. Dept. of Mathematics. Head of Dept. of Mathematics at rank of assoc. or full professor. Required: Ph.D. and proven record of high achievement in teaching and research. Commitment to research and teaching at all levels. Salary negotiable. Send vita and 3 names of reference to Prof. L. E. Fuller, Chmn., Math Search Committee, c/o Dean of Arts and Sciences, Eisenhower Hall, KSU, Manhattan, KS 66506 by 9/30/81.

Boston State College. Full time faculty position in Computer Science effective fall, 1981. Specialization in comp. sci. and applications, including Programming Languages, Systems Analysis, Data Structures, Operating Systems and Data Base Systems. Requirements: Master's Degree; Doctorate preferred. Rank and salary commensurate with education and experience. By 7/15/81 send resumes to Director of Personnel, Boston State College, P. O. Box 8128-2, 625 Huntington Ave., Boston, MA 02115.

Cornell University. N. Y. State College of Agriculture & Life Sciences. Asst. or Assoc. Professorship effective 9/1/81 or later. Duties: teaching, research & statistical consulting in an academic unit; possibly some administrative leadership duties, up to 1/4 time. Required: Ph.D. in stat. or biometry and, for the rank of Assoc., several years of appropriate experience. By 8/31/81 send resume of education, experience, transcripts of college records and 3 letters of reference to Professor Walter T. Federer, Biometrics Unit, 337 Warren Hall, Cornell University, Ithaca, N.Y. 14853.

ASSOCIATION FOR WOMEN IN MATHEMATICS  
MEMBERSHIP APPLICATION

The AWM membership year is October 1 to  
October 1.

Name and  
Address \_\_\_\_\_

New \_\_\_\_\_ Renewal \_\_\_\_\_

Individual \$15.00 \_\_\_\_\_

Family \$20.00 \_\_\_\_\_

Retired, Student, Unemployed \$5.00 \_\_\_\_\_

New Member Rate: Individual,  
for each of first 2 years \$10.00 \_\_\_\_\_

Institutional affiliation, if any \_\_\_\_\_

Institutional \$25.00 (Two free advertisements  
in the Newsletter) \_\_\_\_\_

Contributing Member \$20.00+ \_\_\_\_\_

Make checks

payable to: ASSOCIATION FOR WOMEN IN MATHEMATICS

and mail to:

Association for Women in Mathematics  
Women's Research Center, Wellesley College  
828 Washington Street  
Wellesley, Massachusetts 02181

Association for Women in Mathematics  
Women's Research Center, Wellesley College  
828 Washington Street  
Wellesley, Massachusetts 02181

July-August, 1981

NON-PROFIT ORG.  
U. S. POSTAGE  
PAID  
BOSTON, MASS.  
PERMIT NO. 12548