Association for Women in Mathematics

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PRESIDENT'S REPORT

Our grant from the NSF is now official. Over the next three years, AWM will be able to award travel grants to women to attend conferences. Please consider applying, and spread the word to nonmembers as well. We hope to award every penny of this grant to worthy applicants. Details appear on page two.

Emmy Noether Lecturer – Phoenix '89. I am delighted to announce that applied mathematician Mary Wheeler of the University of Houston has accepted our invitation to deliver the 10*th* Emmy Noether Lecture in Phoenix. The Selection Committee was comprised of Linda Rothschild (Chair), Jane Gilman, and Audrey Terras.

AWM Office. We are fortunate to have Tracy O'Brien, a recent graduate of Wellesley College with a degree in anthropology and sociology, staffing the office this summer. We are in the process of hiring Lori Kenschaft's replacement, who will be announced in the next *Newsletter*.

AMS 50-Year Members. I found it interesting to note that of the 325 AMS 50-year members listed in the July/August *Notices*, the names of 44 (over 13%) were identifiable as women. When compared with the 1987 figure of 13%, we seem to have come less far than we might have hoped. As Pat Kenschaft points out in her article "Women Mathematicians around 1900" in *Signs*, Vol. 7, No. 4, pp. 906-909, we have in recent decades merely regained lost ground.

Stats from NASA. Thanks to Carol Collins for supplying information on the status of women in NASA's work force: as of the end of FY 1987, women represented 10.8% (1,265) of the scientists and engineers, compared with 2.6% (310) in 1974. The average grade for women in 1974 was 6.1; by 1987, it had increased to 8.4. The percentage of women in high-level positions remains low (around 4%), but has nevertheless increased considerably.

More News from Members, Please. I enjoyed reading news from AWM members in the July-August issue of the *Newsletter*. Let's continue our praise and acclamation of deserving parties. Some news sent to me:

Robert M. Hamer of the Department of Biostatistics of the Medical College of Virginia sent an e-mail message to say that in the past few years, his department has had more women graduate students than men. This increase is coincident with a toughening of their requirements and an increase in rigor. Two out of six members of the faculty are women. He feels his department is egalitarian in orientation and tries to recruit all good students.

Evelyn Hart, a graduate student at the University of Wisconsin, praises her undergraduate college, Middlebury College in Middlebury, VT, as an excellent place for a woman to start out in mathematics.

NSF Awards. Congratulations to the many women awarded grants and fellowships from the National Science Foundation:

Sherry Elisabeth Marcus (Cornell) (Minority Graduate Fellowship)

Sharon Pedersen (U. of Pennsylvania) and Jennifer Widom (Cornell)
(NSF-NATO Postdoctoral Fellowships)

Marsha Berger (NYU) and Gail Kaiser (Columbia) (Presidential Young Investigators)

Laura Marie Anderson (Cal Tech), Ann Louise Askew (Brown), Jean Carol Carletta (Colgate), Dawn Myfanwy Cohen (Columbia-Barnard), Jill Renee Gaulding (MIT), Rachel Ann Kuske (U. of Wisconsin-Green Bay), Nancy Lee Kim (Berkeley), Sheralyn Listgarten (U. of Pennsylvania), Mary Sara McPeek (Harvard), Susan Tolman (U. of Chicago), Judith Lynne Underwood (Oberlin), Kathryn Louise Van Stone (Harvey Mudd), and Julia Sue Yang (MIT) (Graduate Fellowships)

Judith Sally (Northwestern) (Visiting Professorship for Women)

It is interesting to note that no women were listed as recipients of REU (Research Experiences for Undergraduates) awards in the May/June *Notices*. We all know of many women who are dedicated, innovative and talented undergraduate teachers. If you know one, encourage her to apply.

Other NSF programs for women have their deadlines soon: the ROW (Research Opportunities for Women), CAA (Career Advancement Awards), and RIA's (Research Initiative Awards), and the VPW's (Visiting Professorships for Women).

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NSF-AWM TRAVEL GRANTS FOR WOMEN

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

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

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

Target Dates. There will be four award periods per year, with applications due

November 1, 1988
February 1, 1989
May 1, 1989
August 1, 1989.

Applicants should send a discussion of how the proposed travel would benefit their research program and a curriculum vita to

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AMS ELECTIONS

The following is an excerpt from the letter sent to all AMS candidates for contested office who were announced in the May/June *Notices*:

> Every year the September-October issue of the AWM *Newsletter* contains statements from candidates for contested positions in the AMS elections. Topics discussed in the past which you might wish to consider have included the following: women in math, minorities in math, the role of the AMS Council, promotion and tenure practices, and the David report and its implications.
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> A topic of special concern this year is the recent failure to include women as invited speakers at public symposia on mathematics. No women researchers were included in the programs at the Weyl Symposium, the von Neumann Symposium, and the AAAS Symposium on American Mathematics Entering its Second Century. Only one woman has been invited to speak at the AMS Centennial Meeting. What are your reactions to this? What can be done to prevent its recurrence?

Vice President

One vice-president will be elected. The Council has nominated one candidate for the position, Sun-Yung Alice Chang. A further candidate will be named later.

Sun-Yung Alice Chang, Professor, UCLA

The following is the statement which I have put in the AMS *Notices*:

> I think the primary function of the AMS is to promote mathematical research. We need to ensure adequate funding from government and other sources to support research. Another urgent need is to encourage talented young men and women to enter and remain in the profession.

As a woman mathematician myself, I am very aware and sensitive about various problems concerning the status of women mathematicians. Although the percentage of new women Ph.D.'s in mathematics has been consistently 20% in the past few years, I feel that they confront greater difficulty than men in developing into successful career mathematicians. We need to call attention to this problem, support each other, and encourage more women students to get into the profession.

Council Members-at-Large

Five members-at-large will be elected. The Council has nominated Jonathan L. Alperin, Fan R. K. Chung, Lawrence J. Corwin, Hugo Rossi, George R. Sell, William Yslas Velez, and Robert J. Zimmer. At least three more candidates will be named.

Fan R. K. Chung, Division Manager, Bellcore

We are today in the midst of a technological revolution. Mathematics will play a vital role both in laying the foundation for this process and in making crucial contributions throughout the whole spectrum of this development. The AMS, as the major organization for fostering mathematics research, has a special responsibility to maximize the impact of mathematicians and to attract the best talent, including, in particular, women and minorities.

Lawrence J. Corwin, Professor, Rutgers

I asked some colleagues their reaction to the AWM's question about the lack of women speaking at major conferences. The men tended to say, "It's true that there's a problem, but there aren't that many women with established reputations." The women tended to say, "It's true that not that many women have established reputations, but there is a problem." Much of the problem, it seems to me, lies in that difference in emphasis. There *are* far fewer women that men with established reputations, and some of the causes for this (the lack of women who got math Ph.D.'s 15-20 years ago) are beyond the power of the AMS to change immediately. But that's not the whole answer. Part of establishing a reputation is getting invited to speak, and conference organizers still often pick men in preference to women. (One colleague [female] said that her collaborator [male] was almost always the one invited to present their joint work.)

I don't have any brilliant ideas about how to alleviate the situation. What we need, in large part, is awareness that in issues like choosing speakers, we are not making purely objective choices on the basis of quality, and sensitivity to the effect of our choices on various groups. And while special events like the AMS Centennial Meeting get the most attention, it is at least as important that we make sure that women get invited to speak at more specialized conferences — especially early in their careers, so that they can get all the recognition they deserve.

Nominating Committee

Four members will be elected to the Nominating Committee. The President has nominated John B. Garnett, Victor Klee, Ray A. Kunze, Andy Roy Magid, James D. Stasheff, and Alan D. Weinstein. At least two more candidates will be named.

Victor Klee, Professor, University of Washington

The position of a member of a nominating committee is, in my opinion, quite different from that of an officer of a society. While it is probably appropriate for certain officers — particularly members of the AMS Council — to have special "axes to grind" (indeed, they may be elected because of this), that would not be appropriate for a member of a nominating committee. Hence I choose not to respond to specific questions that you raised (women in math, minorities in math, etc.), and will simply repeat the statement that I gave to the AMS. It is contained in the following paragraph.

Like any member of a nominating committee, I would try to choose the best possible officers for the Society. I would interpret "best" in terms of the officially stated goals of the Society, and thus would judge primarily in terms of research accomplishments and knowledge, administrative ability and experience, and expected interest in the task at hand.

Andy R. Magid, Professor, The University of Oklahoma

The Society needs talented and committed mathematicians to serve as its officers. The Nominating Committee needs to make special efforts to not only identify qualified candidates but to induce them to serve the Society. It is especially important that the Committee makes efforts to seek out qualified candidates from institutions which have not traditionally supplied the Society with its Council Members, Editors, and Officers.

Women and minorities are under-represented in our profession. Affirmative efforts by the Nominating Committee to place women and minorities in leadership positions in the Society, can, among other things, provide role models which may help alleviate under-representation.

Alan D. Weinstein, Professor, Berkeley

I believe that the representation of women and minorities on AMS committees and as speakers at meetings is an issue which should not be ignored by the Nominating Committee. In forming the committees such as the ones which select speakers for AMS meetings, it is important to include members who will be sensitive to this issue.

NEWS FROM AWM MEMBERS

Chandler Davis sends us a couple of clippings from the *Times of India* from May 19 and 28, 1988. The articles are "Girls outshine boys again" and "Girls again on scoring spree." Chandler says, "Noteworthy but not particularly surprising that the girls are doing well on Class XII exams. Rather surprising that the paper highlights their success. ([It] is quite an establishment paper.)" Two short quotes:

> In science 8,536 girls appeared and 94.4 per cent passed whereas out of a total number of 18,051 boys who appeared in this group only 89.7 per cent cleared the exams. [All India Senior School Certificate Exam.]
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> In science 91.4 per cent of a total number of 2,143 girls passed as against 81.8 per cent of a total number of 5,320 boys. [Delhi Senior School Certificate Examination]

AWARDS AND HONORS

For the first time in the 75-year history of Pi Mu Epsilon, national mathematical honor society, a woman has delivered the J. Sutherland Frame Lecture. Congratulations to Doris Schattschneider, who presented a talk entitled "You Too, Can Tile the Conway Way" on August 10, 1988, at the Providence meeting.

Doris Schattschneider received an M.A. and Ph.D. in mathematics from Yale University and is currently Professor of Mathematics at Moravian College in Bethlehem, Pennsylvania. Her dual interest in geometry and art led naturally to the study of tiling problems. Active as a teacher and lecturer, she has also been Editor-in-chief of *Mathematics Magazine*, 1981-1985. She has authored many scholarly articles on plane tiling and has acted as "Boswell" to reveal to the professional world the mathematical investigations of housewife Marjorie Rice and Dutch artist M. C. Escher. Two recent articles appear as chapters in the works *Symmetry: Unifying Human Understanding*, edited by Istvan Hargittai, Pergamon 1986 and *M. C. Escher: Art and Science*, North Holland 1986. She has spent time in research at the Gemeentemuseum in the Hague, Holland to study and photograph materials from their collection of Escher's private notes and drawings. Funded by an NEH grant from the Interpretive Research/Humanities, Science and Technology Program during her 1988-89 sabbatical, she is preparing a book on the pioneering mathematical investigations of M. C. Escher in the field of color symmetry. She is co-author of a book and collection of geometry models: *M. C. Escher Kaleidocycles*, Pomegranate Artbooks, Corte Madera, California 1987.

Abstract of talk: Any triangle or any quadrilateral will tile the plane with copies of itself; in fact this can be done using just a sequence of half turns carrying each tile to an adjacent neighbor. John Horton Conway discovered a criterion for the shape of a tile which guarantees the tile can pave the plane using a sequence of half turns. Intricately shaped tiles can be created using Conway's criterion — many examples will be shown from decorative art, polyominoes, and Escher's symmetry drawings, as well as mathematicians' originals. Direct participation of the audience will be requested, as they are guided in fashioning their own unique Conway tiles.

Congratulations to Elizabeth Wilmer, member of the team from Harvard University that was the first winner of the new SIAM award for exceptional performance in the Mathematical Contest in Modeling. This year 204 teams participated in the MCM, a 37% increase over the number participating in 1987. Each year, the teams choose between a "discrete" and a "continuous" problem. The Harvard team chose to solve the discrete Railroad Car problem: how to load a flatcar with minimal wasted floor space under a number of constraints.

BLACK WOMEN IN MATHEMATICS

by Patricia Clark Kenschaft
Excerpts (adapted) from a talk at the AAAS National Conference in Chicago on February 16, 1987. Most of the facts omitted from the talk can be found in Pat's paper "Black Women in Mathematics in the United States," in the October, 1981, *American Mathematical Monthly*.

Until 1949 no black woman had earned a doctorate in mathematics, although the first doctorate granted in the United States was in 1866 (and was in mathematics), the first doctorate conferred on a black American was only ten years later in 1876 (in physics), and the first doctorate granted to a woman in the United States was only ten years later still in 1886 (also in mathematics). The effect of the Jim Crow laws that were imposed in the late nineteenth century helps explain the fact that almost forty more years passed until, in 1925, Elbert Cox became the first black person to receive a Ph.D. in mathematics. It was another quarter century before David Blackwell became in 1954 the first black to give an invited address at the International Congress of Mathematicians.

In our contemplations of why over 200 white women received doctorates in mathematics before the first Afro-American woman, it is instructive to look at the life of Susie Johnson McAfee. Her story was told to me by her son, Dr. Walter McAfee, who concluded his career as Chief Scientific Advisor to the Electronic R&D Command at Fort Monmouth. Much earlier he had earned a Ph.D. in theoretical physics from Cornell University after writing a highly mathematical thesis.

Susie Johnson McAfee, his mother, was born in 1889, the daughter of a successful farmer who was an ex-slave. (Mr. Johnson later told his grandchildren about the horrors of slavery and impressed them with the privilege of being free.) She attended normal school at Wylie College and took the teachers' examination for Texas certification. There was no problem with any subject but one. Her spelling paper had been lost. Later her father was told it could be found if he paid fifty dollars. He was outraged, and said so. That was the end of his daughter's career.

But Susie Johnson McAfee did not completely give up. She married a farmer and had nine children. Although she couldn't teach in a classroom, Dr. McAfee told me, "She taught *us*!" All nine of her children became students at Wylie College, and eight of them graduated from it. Five of these eight degrees were in mathematics! Two were in chemistry. One other son completed two years of a mathematics major and then decided to use his bent for mathematics to become a successful electrician. That made eight with math-based careers. The youngest obtained his bachelor's degree in physical education, but in middle age he took certification courses and became a mathematics teacher.

Surely Susie Johnson McAfee made a contribution to mathematics in the United States, but it is provocative to consider what she might have achieved if her education and career had not been artificially curtailed. It is sobering to wonder how many others with similar talent succumbed to even worse fortune.

Although three black women were graduated from Oberlin College in 1884 — the daughters of hard-working and clever ex-slaves — they did not choose to specialize in mathematics. I do know of black women born in the nineteenth century who eventually taught high school mathematics. Most of these women retired early enough to escape the unhappy fate of some black women born in the early twentieth century with similar achievements who were forced to retire when the school system in which they taught became integrated. Southern society was forced to accept black classmates for their children, but there was no protection for many black teachers in the formerly segregated schools after all classes contained some white students.

Apparently, the earliest born Afro-American woman who eventually earned a research doctorate in mathematics was born in 1909. She was Georgia Caldwell Smith. She earned her doctorate in 1960, the third black woman to do so, but died before the ceremony at which the degree was to be conferred, shortly after passing her thesis defense. Thus the earliest born black woman actually to receive a doctorate in mathematics was Marjorie Lee Browne, who was born in 1914. She received her degree in 1949 and lived for thirty more years.

My research indicates that at least thirty-six American black women have earned doctorates in pure or applied mathematics. There have been at least four more in Cuba and at least one in Africa. It sometimes seems like more, because these women are dynamic, visible people, as are numerous black women with doctorates in mathematics education. Among the latter are Genevieve Knight and Iris Carl, who have recently served on the Board of the National Council of Teachers of Mathematics, and Gloria Gilmer, who was one of the twenty-five American mathematicians to be sent to the International Congress of Mathematics Education in Australia at public expense in 1984.

Most of the thirty-six received their pre-college training in the segregated black schools of the American South. Some began kindergarten after 1954, the year of the Supreme Court desegregation decision, and yet never had a white classmate until they entered college. The majority attended college at traditionally black institutions and were still mathematically underprepared when they entered graduate school. The others made the difficult transition into white society as undergraduates.

It is remarkable how few went through school with whites. Of the first twenty-four Afro-American women to earn a doctorate in pure or applied mathematics, my research indicates that only one received her pre-college education in integrated classrooms. She was supported by her mother who was a waitress. She was never permitted to be a baton twirler — and certainly not an angel in the Christmas play. Nevertheless, she was first in her high school class. That was the only year that there was no valedictory speech at graduation. She expressed great pleasure that each of her two daughters won the *national* championship for baton twirling!

I have asked several of these women why they believe that so many of the top achievers in mathematics grew up in segregated school systems where the mathematical education was, by all accounts, inferior. Why have those educated in integrated schools not succeeded as well? They suspect that there are at least three reasons — the presence of role models in the black schools, the assumption that the top students would do well, and the encouragement of black students that apparently does not exist in integrated school systems. My own independent observations indicate that in the North there is an incredibly rigid belief among *both* whites and blacks that blacks "cannot" do mathematics, and that this conviction is wreaking havoc with black youngsters' self-confidence, the

one ingredient that is crucial to anyone who will someday excel at math. Susie McAfee's children were not exposed to such brainwashing.

One reason that the black women who have achieved in mathematics have been able to overcome their relatively poor pre-college schooling is their family support. There was never any question as they were growing up as to whether they would have a job outside the home. They always expected to earn money; the only question was how. The black women in mathematics that I have known seem to have more family support for their careers than many, probably most, of the white women mathematicians I know, although this may merely indicate that without this support black women are doomed to early termination of their education. Every black woman with a doctorate in mathematics that I have interviewed had a family member, usually a parent, who earned money and sacrificed for her education.

All of these women also remember a secondary school teacher who said in effect, "You are gifted in mathematics. It would be worth the struggle for you to try to go far with it." Many others with doctorates in mathematics have similar memories, but there are white males who do not.

There are also many black women in mathematics who have not earned doctorates. Over the past two years I have located almost two hundred black people in New Jersey who have at least one degree in mathematics. Of these almost half are women. About two-thirds of both the men and the women are teachers. Of the remaining third, the majority combine their mathematical training with some aspect of computer work — usually programming, customer service, or design of technical applications. Some of these and most of those who neither teach nor work in computers are in management. One woman is an army mathematician.

The women's job distribution does not seem to be significantly different from that of their black male counterparts, but the number with doctorates is. Only two of the women have doctorates, although nine of the men do. Even this is far above what their background would predict. Of the seventy-five who responded to my survey, only four had two parents who are college graduates. The majority did *not* grow up in a home where both parents were high school graduates. For almost a third, neither parent *entered* high school. Yet all had successful professional careers. Mathematics, contrary to the public myth, seems to be a relatively good field for a first-generation black professional.

Black women have consistently told me that before college, racism is a more serious problem than sexism, and afterward sexism is worse than racism. In my survey of the 75 black mathematicians of New Jersey, I included a question about racism in their *careers*, as opposed to their education. Although I did not inquire about sexism, several of the women volunteered that it seemed to be a greater problem in their career than racism.

Further evidence of this is my investigation of the effects of a 1962 summer workshop. Dr. Clarence Stephens, one of the first blacks to earn a doctorate in mathematics, was teaching at Morgan State College in Baltimore when the post-Sputnik money became available. No Morgan State graduate had yet earned a doctorate in mathematics, so he applied for and received a grant for a summer program to encourage Morgan State undergraduates to consider and prepare for a doctoral program. He accepted four men and four women into the program. All four of the men have doctorates in a math-related field, and two are highly productive research mathematicians. None of the women have doctorates. Two of them earned a master's degree in operations research and have thriving careers in this mathematical field, but the other two have left math altogether.

What might be the future of black women in mathematics? My crystal ball is not optimistic. Of the 2000 American black youngsters in 1986 who obtained a mathematics SAT score over 550, not a single one indicated an intention to pursue mathematics in college. Of the 10,000 American black students who earned over 450 on the mathematics SAT's, only thirty-five indicated a serious interest in mathematics. This does not bode well for the future of blacks in mathematical circles.

Indeed the present situation is reminiscent of the position of women earlier in this century. By 1940 about two hundred American women had earned doctorates in mathematics, roughly the same number as blacks now. Before 1940 women constituted fourteen percent of the Americans who held doctorates in mathematics. However, there was then a sudden change. During the 1950's women constituted only five percent of the American doctorate recipients, and during the 60's they were only six percent. If serious attempts are not made soon to recruit and retain blacks in mathematics, I fear that the encouraging and wholesome gains of the past quarter century may wither. This would obviously have serious cultural and economic consequences for the black community. Since blacks are becoming a constantly larger proportion of the American population, and since the economic health of any modern country is becoming increasingly dependent on widespread knowledge of mathematics, such a regression would also have a serious — and sad — effect on the entire United States population.

REPORT ON THE SONIA KOVALEVSKY HIGH SCHOOL MATHEMATICS DAY

by Margaret S. Menzin, Simmons College

The Third Annual Sonia Kovalevsky High School Mathematics Day was a resounding success. The event was held on April 7, 1988 at Simmons College in Boston, Massachusetts and was sponsored jointly by the Association for Women in Mathematics and Simmons College.

Because this event has been over-enrolled in the past, we asked each high school teacher to bring no more than six students, and so were able to accommodate most of the schools that wished to participate. One hundred ninety-five students and fifty teachers registered for the event by mail, and almost all were able to come. The Day's program ran from 7:45 A.M. to 1:30 P.M., the school day in many schools, and was scheduled by some schools as a "field trip."

Teachers and students attended separate activities in the morning. Students chose two of four workshops (each offered three times): "Why Were There No Women on the Jury of Dr. Spock's Draft Trial?" (on random selection of jurors), "The Thought-You-Saiders and the Telephone Game: What Did the First Person Really Say?" (on error-correcting codes), "Collecting Cereal Freebies and Other Waiting Games" (on probability), and "What Hidden Secrets Did the Chinese Uncover in Pascal's Triangle?" (on combinatorics). Students also participated in a problem-solving contest, which was organized and run by Professor Ethan Bolker of the University of Massachusetts in Boston. Students were offered the option of working individually or in teams of two.

Meanwhile, the teachers attended three workshops: "Map Coloring: Old Mathematics/New Applications" (on graph coloring), "Math Class Micro" (on using BASIC and computer graphics in the classroom), and "The Ideas That Work Come From Teachers," led by three local high school teachers (Jo Ellen Hillyer, Lynn Nadeau, and Eleanor Palais), in which all the participants swapped ideas.

At the end of the morning sessions, students and teachers rejoined each other. After a formal welcome from Anne E. Coghlan, Dean of Sciences of Simmons College, they had lunch and heard a talk by Professor Mary W. Gray of American University, Washington, D.C., on "Statistics and the Law." Professor Gray is a statistician and a lawyer and has served as an expert witness in many interesting cases.

Following Professor Gray's talk, Professor Bolker led a lively session in which he described the answers to the problem-solving contest, and both individual and team prizes were awarded. The individual prizes were won by Sarah Morse of Newton North High School and Catherine O'Neil of Lexington High School, the team prizes were won by Eun Jin Lee and Ayla Lari of Framingham North High School, and the prize for the most interesting "favorite number" was won by Paula Veres of Lynn Classical High School.

Finally, a resource with interesting material from COMAP/HIMAP, films, posters, and AWM material — including the "Careers in Mathematics" booklet written by Margaret S. Menzin and Robert N. Goldman — was available to teachers for the entire day. Donna L. Beers was in charge of the resource room and had done a marvelous job of collecting materials. Alice T. Schafer was chair of the Organizing Committee, which was composed of faculty members at Simmons, Jo Ellen Hillyer from Newton North High School, and Eleanor G. Palais from Belmont High School.

Hillyer and Palais had prepared an evaluation form which each teacher was asked to fill out. The evaluations were very enthusiastic. The teachers very much enjoyed their morning workshops, the opportunity to swap ideas with each other, and the talk by Mary Gray. They also indicated that their students were enthusiastic about the day. The students' workshops were kept at a maximum of 33 each, which allowed them to be very "hands on," and the students enjoyed that. The students also had fun in the problem-solving contest, especially enjoying the opportunity to work in pairs or individually.

Plans are to continue to hold an Annual Sonia Kovalevsky High School Mathematics Day in the Boston area each spring. It is valuable for high school women interested in mathematics and the sciences to meet each other, share ideas, and to be encouraged to continue their study of mathematics and the sciences.

NOTE: Lori Kenschaft has written an information packet that describes how to plan and organize a high school day in your own area. This model program is based on the three Sonia Kovalevsky High School Days that have taken place in the Boston area, all three of which have been very successful. If you might be interested in organizing such a program, please contact the AWM office.

MATHEMATICS IN ART/ART IN MATHEMATICS

The following is a report on a collaborative project between the Consortium for Educational Equity at Rutgers, the State University of New Jersey, in New Brunswick, and the Montclair Art Museum. It is adapted (by Sally Lipsey, AWM Education Committee) from a paper presented by Arlene S. Chasek at the Annual Invitational Meeting of the Joseph Priestly Association, Museum of Natural History, in New York City in November, 1987. Arlene S. Chasek was the winner, in 1986, of an AERA award from Women Educators (SIG) for her work on FUTURES UNLIMITED, a program of print and video materials for the encouragement of women in math and science.

MATHEMATICS IN ART/ART IN MATHEMATICS is both a math enrichment program and an art enrichment program as well as a teacher training program. The project consists of a notebook of curriculum enrichment materials; a series of five full-day workshops, based upon and enhancing the notebook; and a model for collaboration among a museum, a corporation, local schools, and a postsecondary institution focusing on equity for females and minorities. It was funded by the New Jersey Department of Higher Education and Hoffmann-La Roche, the pharmaceutical company.

The inspiration for the project came from a series of mathematics-in-art workshops at the Montclair Art Museum developed by educational curator Janet Cooke and partially funded by Hoffmann-La Roche, and from the Futures Unlimited project, also partially funded by Roche. Vivian Beetle from Roche envisioned the collaboration of the Consortium and the Museum. Arlene Chasek saw an opportunity to strengthen student proficiency in mathematics (especially visual-spatial skills, so much needed by females and minorities) while deepening their appreciation of fine art.

To develop the materials, Chasek and Cooke studied the results of standardized high school tests and college placement tests to determine areas of math weakness on which to focus; they looked at museum slides for appropriate examples of art, leading to discussions of ratio, proportion, shape, and symmetry. They discovered Pascal's triangle in African textiles and recognized an intuitive sense of geometry in the patterns of African and Native American weavings and artifacts. They discovered the ubiquitous Fibonacci sequence in pine cones, daisies, nautilus shells, and the Great Pyramid and went on to Mandelbrot's fractals in connection with topographical mapping.

The resulting MATHEMATICS IN ART/ART IN MATHEMATICS notebook contains units of enrichment materials, each one developed around a particular area relevant to high school mathematics, i.e., the golden rectangle, grids, ratio, proportion, area, perimeter, set theory, patterns, symmetry, transformations, two dimensions, three dimensions, etc. From an equity point of view, the materials, not usually found in traditional high school math texts, provide a new way to interest the math anxious-math avoider who is often the underachieving female or minority student.

In order to train teachers, workshops were conducted at the Montclair Museum. At first, the teachers were self-conscious — the art teachers spoke of their feelings of math anxiety, and the math teachers confessed to art anxiety. But soon their anxiety was replaced by delight in sharing experiences and gaining new perspectives, and by pride in the projects produced by their students. The workshops provided the opportunity to explore and exchange ideas on math and art: they consisted of lecture-discussions, slides, movies, hands-on activities, guest presentations, and, of course, observation of fine art. Throughout each workshop, the leaders wove in the experience of problem-solving — from the perspective of the artist as well as from that of the mathematician.

This project has aimed to generate a new awareness of the many connections between mathematics and art (and the subtle power of the visual image) and of the complexity inherent in all works of art. The materials may be used to help students to increase their ability to visualize and solve mathematical problems in creative and untraditional ways.

READER SURVEY

1. Have you had any experiences integrating math education with art?
2. The AWM Education Committee would be grateful for your help in identifying other new projects or updating information about older projects which aim to alleviate the problem of women and mathematics.

We would appreciate hearing from you. If you have information, please send it to AWM Education Committee, c/o Sally I. Lipsey, 70 East 10th Street, #3A, New York, NY 10003. Thank you.

BOOK REVIEW COLUMN

The EQUALS Handbook, by Alice Kaseberg, Nancy Kreinberg, and Diane Downie, Math/Science Network, Lawrence Hall of Science, University of California, Berkeley, 1986.
Reviewed by Catherine Kessel, College of Charleston

Anthony Ralston wrote in the *Mathematical Intelligencer* recently (Vol. 9, No. 3, 1987) "all college and university mathematicians should be interested in precollege mathematics education." I hope the reason they should be interested is obvious. Similarly all feminists should be interested in girls' mathematical education. Some reasons appear in *The EQUALS Handbook*.

The purpose of the Math/Science Network is to "promote the participation of women in mathematics and to encourage their entry into nontraditional occupations." The part of the Network focusing on elementary and secondary education is the EQUALS program.

The EQUALS Handbook gives a very detailed and helpful description of an EQUALS workshop for educators to "increase awareness of sex differences in young people's education and subsequent career choices" and an extensive list of sources for more information on these issues.

The first section of the workshop is carefully designed to involve the participants and to make them aware of sex differences in their schools and their students' career expectations. The second involves the participants in problem solving. The book provides examples of different kinds of problems which require thought but little prior knowledge (some are riddles) and gives problem solving strategies and detailed suggestions for leading the EQUALS workshop participants in solving the problems. (These would be useful in courses for elementary teachers.)

The last phase of the workshop promotes awareness of different career options and the idea of math as a critical filter. One of my colleagues liked an activity that begins by posting filters (coffee, vacuum cleaner, etc.) on a board to stimulate discussion.

The authors carefully discuss possible reactions to the workshop and its results, organizing the workshop (even mentioning the advantages and disadvantages of various times of the week and school year) and using the ideas from the workshop in and out of the classroom.

The remaining half of the book is mainly a collection of annotated listings of resources — handout sources; federal funds for educational improvement; a section on problem solving with a bibliography and some strategy games, spatial activities, and logic problems; professional journals for teachers of mathematics; bibliographies on: sex-fair counseling; history of women in mathematics and science; careers in math, science and engineering; calculator books and periodicals; women's studies — and a game, "Odds on You," in which each player rolls dice to determine his or her sex, education and job. The game is designed to reflect career and educational statistics so that players who take little math in the game tend to be excluded from many jobs and college majors in later moves of the game. It also reflects a statistic well-known to AWM members — that women take fewer math courses than men.

Femmes et Mathématique, Louise Lafortune, ed. Les Editions du remue-ménage, Montréal, 1986, 206 pp., $15.00 paperback. ISBN 2 89091 065 2.
Reviewed by Erica Flapan, The Claremont Colleges

This book contains an interesting and varied collection of papers presented at a conference organized by MOIFEM (Mouvement international pour les femmes et l'enseignement de la mathématique) in Montreal, June 6-7, 1986. Most of the papers deal in some way with mathematics education and its impact on women or girls. However, the range of topics is broad and also includes: a historical paper about the difficulties experienced by Mary Fairfax-Somerville, Sofya Kovalevskaya, and Emmy Noether; a paper suggesting ways that mathematics can be demystified for adult women who are returning to college; a psychoanalytic discussion of the problems that some girls have with mathematics; and finally summaries of two workshops on feminist perspectives on mathematics and mathematics education.

I particularly recommend the paper by Leone Burton entitled "Femmes et mathématique: y a-t-il une intersection?" [Ed. note: an English version of this article will appear soon in this *Newsletter*]. Burton compares two different visions of mathematics and their effects on the way children learn mathematics. The first vision emphasizes mathematical knowledge and formalism, whereas the second vision emphasizes intuition, conjecture, and the process of exploration. According to Burton, the way we teach mathematics is dominated by the first vision, while mathematics research is more concerned with the second vision. In particular, we teach mathematics as a precise discipline in which

there is one correct approach to a problem and one correct solution. The role of the student is limited to the assimilation and reproduction of what is in the text and the lecture. While this type of pedagogy has an impact on all students, Burton asserts that it has a particularly negative impact on girls, since girls tend to feel more comfortable in disciplines which seem more intuitive, verbal and interactive. Hence a mathematical pedagogy based on the second vision of mathematics might make mathematics more attractive to girls than one based on the first vision of mathematics. She proposes such an alternative mathematical pedagogy in which the teacher guides the students as they work together in groups to develop their own methods and approaches to problems. Such a learning environment would be more creative as well as less competitive and individualistic than the average mathematics classroom today. She concludes that this would not only make mathematics more appealing to girls, it would increase their self-confidence and ultimately their success in the field.

Reading this book raised important questions for me about how we teach mathematics in general, and whether I could teach my classes in a way which would be more comfortable for my women students. In addition, some of the essays go even beyond the question of mathematics education to consider mathematics itself from a feminist point of view. For example, one of the workshops addressed the issue of whether mathematics as a discipline reflects the fact that it was developed almost exclusively by and for men. In doing so, the participants questioned the definition of mathematics; and then on the affective level, they talked about the joys and anxieties they had individually experienced in doing mathematics. I enjoyed reading the account of this workshop, in spite of the fact that it left me with more questions than answers. While I found some of the papers in this collection more interesting than others, on the whole I would recommend it if you want to read some thought-provoking essays on an important topic (and you can read French).

Book Review Editor:

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GRANTS-AT-A-GLANCE

Grants-At-A-Glance is an 88-page publication of the Association for Women in Science (AWIS). It details grants, fellowships, and awards available to women in life, physical and social sciences and engineering. To order send $8.00 ($6.00 for members) to:

AWIS
2401 Virginia Ave., NW, Suite 303
Washington, DC 20037.

WINSTON PAPERS

The Sophia Smith Collection, the women's history archive at Smith College, has recently acquired and processed the papers of Mary Frances Winston (1869-1959). Winston graduated from the University of Wisconsin in 1889 with a major in mathematics and held fellowships at Bryn Mawr and the University of Chicago between 1891 and 1893. She traveled to Germany in 1893 to study at the University of Göttingen, receiving her Ph.D. in 1897, the first American woman to receive a Ph.D. in mathematics from a German university. She taught math at Kansas State Agricultural College, Washburn College, and Eureka College between 1897 and 1942. The papers consist of correspondence from Winston to her family from 1889 to 1895, the most significant being those from Göttingen describing student life there between 1893 and 1895. In addition there are typed transcripts of these letters, a 13-page description of her student days in Germany, and several photographs. The papers are the gift of her daughter Caroline N. Beshers. For more information contact Susan Boone, Curator, Sophia Smith Collection, Smith College, Northampton, MA 01063.

♥ ♥ ♥ CONGRATULATIONS to our President-Elect Jill Mesirov on the birth of her second son, Samuel Mesirov Gross. Samuel's father is Benedict Gross of Harvard, and his four-year-old brother is Isaac Leon Mesirov Gross. ♥ ♥ ♥ ♥

THE TWO-PERSON CAREER

by Eric Zencey, Professor of History and Social Inquiry, Goddard College, Plainfield, VT
reprinted by permission from *The Chronicle of Higher Education*, April 1, 1987, pp. 104-105

Thanks to Jane Day for bringing this article to our attention.

Ten years ago I was a graduate teaching assistant in political science and shared an office with seven other T.A.'s in a big room on the top floor of a house the university owned on a back street. One day the conversation centered on some good news that one of our number had received. George (as I shall call him) had just won a Fulbright to study in Asia for a year.

George was an ambitious fellow, determined to make a name for himself. With a Fulbright, his career was off to a good start. We congratulated him as he rushed off to his discussion group. His footsteps were still echoing on the stairs when Martin, the most cynical among us, said, "You know why he's going, don't you? To get himself a wife. Somebody to do his laundry and bring up his kids while he writes articles."

And, in truth George returned a year later, no doubt with copious notes — and also with a wife. From what we could see, Martin had been right. George's wife spoke little English, had no interest in the feminist ideas that were circulating on campus, and gave every indication that the promotion of George's comfort was her sole purpose in life. George seemed to have found himself a partner for that almost extinct enterprise, the two-person career.

There was a time when all careers were two-person careers. The assumption was that there was a woman behind every working man, not just the successful ones. Even if that woman did not push her man, seeking vicariously the successes that society denied her, the economic system still knew she was there. She took care of the chores and responsibilities that come with being a member of our species. Her role allowed her partner the dubious luxury of focusing entirely on business, which, before the unions established the 40-hour week as the norm, meant for most men working six 12-hour days out of seven. Women worked outside the home as well, of course, but no matter how many did so, they were viewed as exceptions.

It's been some time since workers were routinely expected to devote 72 hours a week to their jobs, but only recently have we begun to regard the one-wage-earner household as old-fashioned. More women are pursuing careers; fewer are satisfied to serve as uncompensated drudges whose goal is to make life easier for a man. Advertisements offer us a romanticized image of two-career couples — we see them taking a moment from their fascinating jobs to enjoy an expensive Scotch or to exchange Rolexes on Valentine's Day. The reality, of course, is different. Two-career couples are not all "up-scale." And unless they are, and can hire a wife — a combination maid, cook, nanny, and personal secretary — one or both of them are going to be exhausted.

A profession — and this includes academe — is not something you can walk away from at 5 o'clock. Part of the pleasure of being a professional is increased responsibility. A professional is responsible for completing tasks, not putting in hours, and often the tasks to be completed in a given week take much more than 40 hours. The hours that remain are barely sufficient for rest and a minimum of family or social life, let alone for the performance of the routine functions that maintaining a household entails. Most professions — ours included — are structured on the assumption that behind every professional there is a support person, a wife.

This is in spite of the advances made by feminism in the past 15 years, because the standards of professional achievement in academe are still those set by people — men, mostly — with two-person careers. The standards need not be written down, though one may find them on occasion in retention and renewal clauses in contracts, or in the guidelines for granting tenure. They operate informally, coming into play when candidates for jobs or advancement are compared. Did this one publish more

often than that one? Which received more commendation for committee work? Who was the more dedicated teacher?

How these questions are answered depends in part on how individuals have answered questions like these: Will I re-read this student's essay before commenting on it, or will I vacuum the living-room rug? Will I read this stack of memoranda to prepare for my committee meeting, or will I take my daughter to the dentist? Will I take an hour to go over my notes for class tomorrow, or will I read my son a story? If I choose the professional responsibility over the domestic one, no doubt my performance evaluations will be better than they otherwise would be — but only because I impose an unfair burden on my partner. And that burden isn't just the time involved in doing domestic chores; it is also having to devote one's mind to planning, worrying, noticing, caring. Having help with the execution of tasks is better than being left alone with them, but it doesn't relieve the burden of responsibility.

Among union members, workers whose ambition drives them to produce more than the norm are called rate busters. They are despised, because they lead employers to have expectations that others, for various reasons, cannot match. My old colleague George, liberated from responsibility for the day-to-day affairs of his own life, is an academic rate buster. The institutions that employ us have always assumed that a professor's job description describes a two-person career, and as long as even a minority of professors continue to enjoy the fruits of the oppression of women, our employers will continue to assume so.

George, and people like him, also make it tough for members of the profession who are looking for jobs, because they are measured against him and found wanting. George's choice puts pressure on young academics to put aside all thought of trying to be equal partners in marriage and to devote their energies to "succeeding," to meeting a standard set by two people sharing one career.

George also suffers from his choice. By making it, he has denied himself the pleasure and challenge of living with a person who is "other," different, but nonetheless equal. His teaching will be the worse for his not having to face that challenge. He may well find it difficult to accept the views, opinions, and beliefs of students as valid, on the ground that they are different from him and therefore not his equal.

This choice is damaging in other ways, as well. It is immoral at worst and immature at best for a person to expect someone else to be responsible for the drudge work that their life creates. It is immoral to rely on — exploit is the harsher term — another to perform those tasks; it denies that person the opportunity to choose more fulfilling work. It is immature for one adult to expect another to mother him, to pick up after him, to make his life easier by insulating him from the realities of the world.

The educational enterprise as a whole suffers from having a professorial class insulated in that way. The folklore of our culture offers the charming portrait of the absent-minded professor, totally absorbed in the life of the intellect, totally oblivious to the life of the world. Such a professor (always a man) is seen as harmless, even likable. But there is real harm in the image, for it presents an unacceptable role model for students to emulate. The person who exists solely on the plane of ideas and intellect is unbalanced, deformed, even grotesque. Even in the rare cases where liberation from the mundane details of life is not predicated on the oppression of another person, the fruits of the intellectual absorption that such freedom permits are likely to be sterile, arrogant, perhaps even dangerous, because they are not grounded in the wisdom that comes from full participation in the human experience.

Our business is to cultivate and exercise true intellect, which can only be accomplished in the real world, where people are responsible for themselves as physical, social, and emotional, as well as intellectual, beings. Products of the intellect that are not rooted in the depth and breadth of human existence are like the modern, mechanically harvestable tomato: wonderfully firm and colorful, but tasteless and lacking in nutrition.

It is time for academic institutions to recognize that they can no longer expect professors to have drudges at home to take care of the machinery of life, and to take the lead in reducing their employees' work loads to a level consistent with today's reality. I don't delude myself that such change will come about easily. It's a rare institution that would be swayed by arguments about justice, especially when the benefits to education are so intangible compared to the very tangible costs of change. It is more likely that the impetus for change will come, as it usually does, from those who have the most to gain: the women who serve as uncompensated drudges, the women who struggle to meet both professional and domestic responsibilities, and also the men for whom rejection of a sort of perpetual childhood is the clearest path to growth.

In the meantime, I fantasize about the perfect hiring committee. Members sit around a seminar table, waiting quietly as the candidate is ushered in. "Mr. Smith," the chairwoman begins, "you indicate here on your vita that you have two children, ages 2 and 5. And you've also published two books in the past three years." Mr. Smith smiles broadly, pleased that his diligence and dedication have been noticed. "How," asks the chairwoman, "do you explain that?"

TITLE IX IS BACK

Project on the Status and Education of Women (PSEW), Association of American Colleges,
1818 R St., NW, Washington, DC 20009

On March 22, 1988, Congress overrode President Reagan's veto of the Civil Rights Restoration Act, so that once again Title IX of the Education Amendments of 1972 prohibits sex discrimination in *all* programs of institutions which receive federal funds.

In 1984 the Supreme Court, in *Grove City College v. Bell*, limited the protection of Title IX by ruling that Title IX applied only to the particular program receiving federal dollars within an institution. Prior to this decision, Title IX and other civil rights laws prohibiting discrimination on the basis of race, color, national origin, disability, and age had been interpreted as covering an entire institution when the institution received any federal dollars. As a result of the 1984 decision, the majority of students were not covered by federal antidiscrimination laws throughout most of their college experience.

The 1988 Civil Rights Restoration Act essentially overturns the *Grove City* decision by restoring the earlier interpretation of a broad scope of coverage with one exception, a compromise amendment concerning abortion. Under the new law, institutions are not required to provide abortion benefits or services, nor are they prohibited from providing them. Additionally, institutions cannot penalize someone who has had an abortion or is planning to have one.

Because Title IX now covers the *entire* institution regardless of where federal funding is used, students are once again protected from sex discrimination throughout the institution. Areas such as athletics, counseling, and course offerings and issues such as sexual harassment and marital and parental status are all affected by Title IX.

Under the requirements of Title IX, institutions receiving any federal funds must designate at least one employee to coordinate efforts to comply with Title IX and to investigate any Title IX complaint that is communicated to them. Institutions are also required to take specific and continuing steps to notify groups such as applicants for admission and employment, students, and employees that the institution does not discriminate on the basis of sex as prohibited by Title IX. The notification, which should appear in announcements, bulletins, catalogues, and on application forms used to recruit students and employees, should also state that inquiries about Title IX can be referred to the designated Title IX compliance person *or* to the Assistant Secretary for Civil Rights at the Department of Education, Washington, DC 20202.

PSEW is planning to publish a comprehensive packet of materials explaining Title IX more fully.

DIRECTORY OF MATHEMATICIANS FROM DEVELOPING COUNTRIES

UNESCO (United Nations Educational, Scientific and Cultural Organization) is sponsoring a directory of mathematicians from developing countries. To be included, please supply the following information (typed or in block capitals): surname, name; year of birth; nationality; present address, permanent address; academic qualification, obtained at: institute, city and country, in 19--; research interests (in brief): (1), (2), (3); recent publications. Send the information to the International Centre for Theoretical Physics, P.O.B. 586, Miramare, Strada Costiera 11, 34100 Trieste (Italy).

CONFERENCE REPORT: WOMEN IN SCIENCE AND ENGINEERING

by Barbara A. Wilson, AT&T Bell Laboratories, Murray Hill, NJ
reprinted with permission from *CSWP Gazette: A Newsletter of the Committee on the Status of Women in Physics of the American Physical Society*, Nov. 1987, Vol. 7, Issue 3, pp. 1-6
Thanks to Beth Ruskai for bringing this article to our attention.

Women in Science and Engineering (WISE): Changing Vision to Reality
University of Michigan–Ann Arbor, 29-31 July 1987

Representing CSWP, I recently participated in this very stimulating conference which was organized by Marsha Lakes Matyas and Shirley M. Malcom of the American Association for the Advancement of Science, and sponsored by the AAAS Office of Opportunities in Science. About 200 people attended the 2-1/2 day conference, the majority of whom were involved in science education and/or intervention programs to increase the participation of girls and women in science. In this report I shall attempt to summarize the contents of the conference. While the emphasis will be on those aspects which I perceived to be most relevant to women in physics, there will be an additional bias toward the particular presentations which I personally found the most interesting.

The WISE conference began at lunchtime on 29 July with an "International Panel Debate: Gender and Science Issues," held in conjunction with the Fourth International Conference on Girls and Science and Technology (GASAT). GASAT, which had been held in the same location just preceding the national WISE conference, was attended by 131 participants representing 24 nations.

Leslie Parker of the Secondary Education Authority of Western Australia started the joint session with a synopsis of recent advances in feminist analysis of the institutional patterns of science, as it is currently practiced, which inhibit the participation of girls and women. This is an approach which has not been pursued extensively in this country, but which appears to be the underlying theme of the international community. They tend to focus on the question "What's wrong with science that makes girls not like it?", rather than "What's wrong with girls that they don't like science?" In other words, the approach in the U.S. has more frequently been to help women fit into the existing structure of science, rather than an attempt to change the structure of science so that it meshes better with women's interests and lifestyles.

Some of the examples given by Leslie Parker of the ways in which the structure of science may be seen to reflect the historical restriction of science to people socialized along masculine tracks (i.e., men) are:

- Science is usually taught, and often practiced, as if social context and social impact do not exist.
- Scientific models are often dualistic, considering only two possible choices, and acknowledging only "right" or "wrong" answers, rather than allowing for a diversity of answers and approaches.
- Similarly, scientific models are usually hierarchical, not allowing for diversity on an equal footing.
- Scientific principles are presented as isolated abstractions that focus on control and domination of nature, rather than as an aid to understanding the role of one piece as part of an interactive whole.
- Scientists often confuse the cognitive tools used to model a system with the system itself. For example, just because we choose to analyze a system in a dualistic (or hierarchical) framework, that does not mean that the system itself has an inherently dualistic (or hierarchical) nature.
- Science as taught in schools tends to isolate subject matter by disciplines, stressing what is different about each area, rather than focusing on the commonality and interrelatedness of all areas of science.

A second talk on a similar topic was presented by Jan Harding of Chelsea College, U.K. She pointed out that science (especially physics) is presented in terms of attributes and interests in tune with the socialization of boys, but not with that of girls. Girls are trained to value interactive, socially relevant and socially constructive activities and tend to choose fields which have a reputation of being people oriented, socially relevant, and helpful. The presentation of science has unnecessarily played down these aspects and has stressed instead the isolation of effects, a total autonomy from social issues, and an object rather than people related orientation. Likewise, scientists have traditionally been characterized in Western cultures as people who exhibit strong abilities in the areas of objective, abstract and analytical thinking, attributes historically associated with males. In fact, to do good

science, one must have abilities that span the whole range of human attributes, including creativity, intuition, and good interpersonal skills, to name a few characteristics commonly associated with females in Western societies.

Jan Harding also stressed that the very way in which a problem is stated can affect the relative level of interest on the part of girls and boys. For example, are you looking for a technical "fix" to an abstract problem, dissociated from its origin and social context, or are you trying to find solutions to a problem with social significance, whose outcome will affect real people?

The final talk of the lunch session was presented by Lili S. Hornig of Higher Education Resource Services and Wellesley College Center for Research on Women. She suggested that some interesting tests of these ideas might be possible by making comparisons with other professional fields which women have entered in large numbers, e.g., law and medicine, etc. She also brought up the issue of inherent gender differences in cognitive style, pointing out that if such differences exist, then the structure of science must also reflect a one-sided approach in this area.

The first afternoon session, entitled "Defining the Problem," included presentations by Shirley Malcom of AAAS, Betty M. Vetter of the Commission on Professionals in Science and Technology, and John H. Moore of NSF. Some of the major points made by these speakers included:

- The U.S. is rapidly losing its ability to compete technically with the rest of the world. This is due to an overall drop in the level of scientific literacy of our population and to a declining number of highly trained people graduating in scientific fields.
- These problems can only be expected to intensify if ignored. The baby boom has peaked, so the total university age population is dropping. Fewer white males, historically the source of most scientists in our country, are choosing to study science, and they also represent an ever diminishing fraction of the population. Finally, the teaching resources of our country, in terms of the number of trained science teachers and the level of instrumentation available to schools, have been allowed to deteriorate to a deplorable degree.
- Meanwhile women and minority groups remain highly underrepresented in science and engineering, especially in the physical sciences, and thus are an important untapped resource. All three speakers stressed that efforts to increase the participation of women and minorities in science can no longer be viewed solely as an issue of equity and fairness; the success of these efforts has become a matter of national survival.
- The differences in field selected by men and women cannot be considered merely a manifestation of free will. Strong social and institutional barriers remain which inhibit full participation of women in science. Science has evolved in a manner consistent with the lifestyles of white males in our society, without regard for the biological and social agenda of women.
- Finally, it is important to remember that we are not discussing *equity versus excellence, but excellence through equity*!

The second session of the afternoon was focused on "Policy Responses to the Challenge" and included talks by individuals representing the U.S. Congress Office of Technology Assessment, a state board of regents, two state university systems, and a county public school system. Daryl E. Chubin of OTA discussed a recent assessment of the education and employment of scientists in the U.S. which examined differences by race, gender, field, and institution. The two speakers from state university systems talked about recent task forces which had studied various aspects of the crisis in science education. However, none of these speakers was able to give a very optimistic report on any actions taken to increase the participation of women in science as a result of these studies. Part of the problem is that task forces and assessment studies do not, in general, have the power to bring about the implementation of their recommendations. In contrast, Michael Hickey, School Superintendent of the Howard County Public School System, reported on a wide variety of intervention programs at the primary and secondary school levels which had been successfully implemented following an evaluation of the school system that examined the science curriculum, teacher training, and participation by female and minority students. These projects include programs aimed at teacher training and equity sensitization, changes in the curriculum to include more hands-on experiences and a greater emphasis on the contributions of outstanding female and minority scientists, and workshops to encourage the participation of female and minority students.

A dinner panel, "International Perspectives — Parallels and Differences," provided additional perspectives on educational systems and intervention strategies in other countries. One of the main

differences in the international arena is an emphasis on programs that will impact *all* students, not just the scientifically gifted ones. Efforts in the U.S. have often emphasized the importance of helping outstanding women to pursue careers in science. In contrast, the international community has focused more on the need to increase the participation of women in science and technology at all levels. Another area more frequently examined outside the U.S. than within is that of reentry and retraining. (Joan Kowalski is currently organizing a CSWP symposium on this topic to be held at the 1988 APS March Meeting.) Later that evening conference participants gathered for informal discussions at a reception. Various written resources brought by participants were made available at this time. Some references to this literature, along with instructions for obtaining copies, are provided at the end of this report.

For the second day of the conference, three parallel sessions were held which focused on precollege, undergraduate, and graduate/professional issues, respectively. I attended the latter sessions, in which graduate issues were discussed in the morning and professional issues in the afternoon. For both parts of the day, the program started with formal presentations on these issues, followed by discussion periods in which we were further split into small groups numbering about 15 people. Our charge during the small group discussions was to generate a list of recommendations for action in terms of (a) future research, (b) intervention programs, and (c) policy changes. I acted as a moderator for one of the afternoon groups. The recommendations generated by the discussion groups in the three parallel sessions were summarized for all participants during the closing session of the conference.

During the morning's formal session we heard three talks on Graduate Issues. (There was to have been a fourth talk on "Minority Women Graduate Students," but the speaker was, unfortunately, taken ill.) First Lili Hornig gave a talk on "Enrollment and Retention." She noted that there is still little effort made to recruit female graduate students. For example, many of the brochures make no reference to women students or faculty. Significant qualitative differences also still exist between the letters of reference written for female and male applicants. The former often stress appearance and personality, with little attention given to scientific ability and potential. Possibly many professors still have difficulty considering female students as future professional colleagues. Female candidates' grade point averages are significantly higher on the average, but their Graduate Record Exam scores are slightly lower. Thus acceptance rates for male and female applicants to graduate school depend on how these various assessments are weighed at any particular institution. The recipient to applicant rate for NSF Fellowships remains lower for women than for men. The retention rate for female graduate students in the physical sciences is 0.75-0.77.

The second talk, by Susan Coyle of the National Research Council on "Sex and Race Differences in Financial Aid Patterns," provided some interesting information on recent changes in funding patterns for men and women graduate students. There are three main sources of graduate support: funds administered by the institution (primarily through research and teaching assistantships), direct Federal funding to the student (for example, NSF Fellowships), and self-support (mainly savings, assistance from relatives, and concurrent outside employment.) A larger fraction of the men receive university-administered funding than is true for women, and this gap is growing. Women are more likely than men to be self-supporting and/or to receive direct Federal funding, although the latter gap is shrinking. Thus the current decline in direct Federal funding programs is having a disproportionate impact on women. There is also cause for concern as a larger fraction of the available funds are administered at the discretion of individual professors, predominantly male, who are selecting students to work with them. Given the inherently personal and subjective nature of these selections, the inequitable effects of subjective biases may increase concomitantly, thus perpetuating the skewed proportions of men and women professionals in science.

An interesting correlation between the rate at which students receive university-administered funds and their marital status has been noted. The rates decrease in the order: single men, married men, single women, married women. The rates for self-support are in exactly the reverse order. At the time the Ph.D. is granted, 45% of the women and 60% of the men are married.

A strong correlation has been found between the type of graduate support and the length of time to the Ph.D. Students receiving university-administered funds take the shortest time, followed by those receiving direct Federal funding. This discrepancy may reflect an increased personal interest on the part of the professor toward students supported on his/her own grant monies. After all, the success of the next grant application depends directly on the progress of the projects these students have been hired to work on. When a student on fellowship joins the group, the professor can afford to be more laid back about the rate of progress. Self-supporting students take the longest; on the average 2-4 more

years are required. Women supporting themselves through outside employment take longer than the equivalent group of men. Perhaps the lower salaries earned by women require them to work more hours for the same level of income.

Carolyn M. Jackson of Purdue University described a fascinating demographic study of men and women engineers. The study showed that discrepancies in salary, job satisfaction, and promotion to management positions become exaggerated after six years of professional experience and that these discrepancies cannot be attributed to differences in education, self-confidence levels, or career breaks. A disturbing note: More than half of the surveyed male engineers, in *each* age bracket, did not agree with the statement "Women with small children can be as good on the job."

During lunch (I think they scheduled almost every minute of this 2-1/2 day conference), Gertrude Scharff-Goldhaber of Brookhaven National Laboratory presented a lecture entitled "Eminent Women Scientists of the Last Two Centuries: What Can We Learn from Their Lives and Achievements?" This uplifting talk by Dr. Scharff-Goldhaber, herself an eminent physicist, described the remarkable contributions made by some of these exceptional women. In describing the perverse conditions under which they worked, she also reminded us implicitly of how far we have come toward full equity of opportunity for women.

The afternoon's formal session of the graduate/professional section focused on professional issues. Marie Cassidy of George Washington University Medical School started the session with a discussion of "Academic Career Patterns." She characterized the main barriers to a successful academic career as first, gaining access (earning a Ph.D. and getting a job); second, attaining tenure; and third, achieving a powerful position within the institution. While women have had a difficult time surmounting each of these barriers in significant numbers, she noted that the structure of academic science appears to be changing, with more value placed on good interpersonal skills, for example. Next, Howard P. Tuckerman of Memphis State University spoke on some studies he has carried out on patterns of part-time faculty careers. Part-time employment by both men and women has been expanding, but not always because it is the desired work status. Currently about 40% of the women and 70% of the men in part-time work are seeking full-time employment. He ended his presentation with a strong statement that part-timers continue to experience discrimination in benefits received and more often than not find their jobs to be a dead-end road, offering little opportunity for professional advancement.

The third talk, by Lois Peters, Rensselaer Polytechnic Institute, focused on "Women Scientists in Industry." There is little data on this subject, even though about 73% of all R&D takes place in industry. In the industrial sector, women constitute approximately 25% of all scientists and engineers and 11% of all physical scientists. Nevertheless, only 6 out of the 609 members of the Industrial Research Institute — consisting of the top technical people of major corporations — are women. Polling women themselves, she found that those who have recently entered industry are generally happy with their work situations and do not perceive any barriers to their career plans. Women at the middle management levels, on the other hand, are frequently angry with the inequitable treatment they have received to date, but are still not discouraged about prospects for their future in the company.

Some statistics on women in academe were provided by Gretchen Klein of NSF. She noted that women still lag men considerably in tenure attainment. While 63% of the men on U.S. Science and Engineering faculty have tenure, only 37% of the women do. On the other side of the coin, 31% of women are in non-tenure track positions, while only 14% of the men are. Even when these figures are corrected for field, quality of the Ph.D. institution, and years of professional employment since the Ph.D., inequalities still remain. Women are also less likely than men to be principal investigators on NSF grants.

Gretchen Klein also presented a summary of existing NSF programs for women. The revised Research Opportunities for Women (ROW) Program contains three parts: Research Initiation Grants (equivalent to the original ROW Program, these are research grants for women who have not previously been principal investigators), Research Planning Grants (for support while a grant proposal is being drafted), and Career Advancement Awards (for support while making a career change to an adjacent field). The ratio of awards to proposals last year was 160/711, with a total of $7.2 million being awarded. The Visiting Professorships for Women (VPW) Grants are also still available from NSF. I noted from a breakdown of the fields that only 1 of the 24 VPW awards granted this year was in physics. Apparently we need more strong applicants for this program.

The final talk in this session, by Mary Frank Fox of the University of Michigan, provided some data on publication records of male and female scientists as a measure of professional productivity. She noted that while women publish at only about one-half the rate of men, this discrepancy is not due

to differences in IQ, institution of degree, or marriage/parenthood patterns. In fact, married women publish more than single women, and the presence of children does not affect publication records. The strongest correlation is found to be with the prestige of the institution where the person is employed. In addition, there is some indication that the causal direction of this effect is that publication records conform to the local environment, rather than that frequent publishers tend to be offered employment at these prestigious institutions.

The final morning of the conference started with a plenary session in which Heidi I. Hartmann of the National Research Council discussed a recent NRC study on the effects of computer technology on women's employment. The results showed that while the advancement of computer technology enhances the level of many jobs by taking over drudgery and mindless activities, it also dehumanizes others. In general it is the higher-level, more powerful positions which are enhanced and the lower-level and clerical positions which become less interesting and more removed from human interactions. Since women tend to be in less powerful positions, they are more frequently adversely affected by these technological advances than men are. In addition, women are less likely to be involved in the design of the new technologies, the stage at which some of these deleterious effects could be taken into account and avoided. Minority women in clerical jobs, who are less likely than white women to be assigned work involving human interactions, are especially vulnerable to the dehumanizing effects.

The recommendations generated during the previous day's small group discussions were reported back to the full conference during the final session. In the area of research programs and information dissemination, the following proposals were made:

- Studies of women students' self-confidence.
- The impact on women students of the increase in foreign nationals as graduate students and faculty members.
- A determination of the reasons some schools are more successful than others in producing women graduates in science.
- The establishment of a centralized data base covering previous research and intervention programs. (To some extent, CASET, the Center for the Advancement of Science, Engineering, and Technology of Hutson-Tillotson College, offers this capability.)
- More follow-up studies on the effectiveness of intervention programs.

Many intervention programs were suggested, along with a plea to place a stronger focus on the evaluation and dissemination of program results and to continue those programs with proven effectiveness. Suggestions for precollege programs included:

- More career awareness through college orientation programs, teachers, and parents.
- Outreach programs at meetings of professional organizations.
- Out of school science programs.
- Undergraduate science majors acting as role models for grade school and high school students.
- Intervention programs for *all* students, not just for the particularly bright ones, to increase the general interest in science, and thus the level of science literacy in our country.
- Better science training as part of the teacher education curriculum, and more in-service programs to increase science knowledge of practicing teachers.
- Evaluation of teachers to include their sensitivity to equity issues.
- In-service programs for teachers to increase their sensitivity to equity issues and to a diversity of learning styles.
- Text book evaluation vis-à-vis equity issues.

The following suggestions were made for intervention programs at the undergraduate level:

- More career literature.
- Programs to sensitize male faculty to the importance of mentoring female students.
- Offer single-sex classes.

- Replications of effective programs at more schools. (For example, the highly successful Purdue University program for engineering students could be adopted by other schools.)

Finally, the following recommendations were made for programs at the graduate and professional levels:

- Intra- and inter- institution support groups for isolated female graduate students, researchers, and faculty.
- Assertiveness training.
- Encourage mentoring of non-tenured female faculty by tenured faculty, male and female.
- More outreach programs by corporations.
- Make university deans more aware of the severe national impact of decreasing science enrollments.
- Make department chairs more answerable for the ratio of male to female faculty.
- Encourage dialogues on sexism between students and faculty.
- Workshops on sexual harassment.
- Reward faculty mentoring activities more highly.
- Workshops for graduate students and young professionals on how the "system" works — how to get through school with a degree, how to get a job, how to get promoted, how to negotiate the industrial and academic environments, etc.

Sue Kemnitzer summarized the recommendations related to policy and funding changes. One of the repeated suggestions was for longer funding cycles for intervention programs and the continued funding of existing programs with proven effectiveness. (At the current time funds are much more readily available to experiment with "new" programs and ideas than to repeat "old" programs with a new group of people.) It was also noted that the Commission on Professionals in Science and Technology is suffering a severe funding shortage. Since this organization is the sole source of many of the statistics on women and minorities in science and engineering, there was a strong consensus that it should be funded on a more consistent basis, rather than having to rely on short-term grants. Other specific suggestions generated by the small groups in the area of policy issues included:

- Stronger efforts to enforce existing EEO laws and policies.
- More funding for undergraduate research.
- Enhanced access to capital for female and minority entrepreneurs.
- Requirement of specific plans to utilize underrepresented groups as part of proposals for (and evaluation of) research grants, government-supported centers, etc.
- More support for summer science programs for underrepresented groups.
- Funding for programs to assist women and minorities in preparing research grant proposals, and to write papers in preparation for tenure evaluation.
- National policies to support day care and parental leave, and national goals for equity in science and engineering.

Finally, using the example of the Federal Task Force on Women, Minorities, and the Handicapped in Science and Technology, of which she is the chair, Sue Kemnitzer stressed how important it is to include as part of any panel those people who have the power to *implement* recommendations that are generated.

A full proceedings of the conference will be available from AAAS. Contact Marsha Lakes Matyas, AAAS Office of Opportunities in Science, 1333H Street, NW, Washington, DC 20005.

Related Literature

The following publications were among those brought to the attention of conference participants:

Science, Technology and Women: A World Perspective. (1985) AAAS Publication 85-14

Partial List of Precollege Mathematics and Science Programs for Minority and/or Female Students by State. (1987) Compiled by the AAAS Office of Opportunities in Science.

Equity and Excellence: Compatible Goals. (1984) AAAS Publication 84-14.

Problems and Solutions in the Education, Employment and Personal Choices of Minority Women in Science by Paula Quick Hall. (1981) Available from AAAS Office of Opportunities in Science.

Associations and Committees of or for Women in Science, Engineering, Mathematics and Medicine. (1986) Available from AAAS Office of Opportunities in Science. (1987 edition currently in preparation.)

Other publications associated with material presented at the conference:

Engineering Careers: Women in a Male-Dominated Field, Carolyn M. Jagacinski, Psych. of Women Quarterly, 11, 97 (1987).

Comparison of Women and Men in the Engineering Work Force, Carolyn M. Jagacinski and William K. LeBold, IEEE Trans. in Ed., E-28, 204 (1985).

Computer Chips and Paper Clips, Editors: Heidi I. Hartmann, Robert E. Kraut and Louise A. Tilly, 1986, National Academic Press, Washington. (NRC study on the impact of computer technology on women's employment.)

Women in Pure and Applied Science, a Bibliography, compiled in 1987 by Sheila Bertram, Faculty of Library Science, Univ. of Alberta, Edmonton, Alberta, Canada.

THE ETHICS OF WAR AND PEACE IN THE NUCLEAR AGE: WHAT WOMEN ARE SAYING

Marymount College in Tarrytown, NY is sponsoring a series of lectures on "The Ethics of War and Peace in the Nuclear Age: What Women Are Saying." The lectures will be funded by a GTE grant. The program follows:

October 3, 1988: "The Nature of Modern Weapons Technology: A Scientific Overview" by Dr. Thomas Marshall, Department of Applied Physics, Columbia University

November 7, 1988: "The Formation of Modern Weapons Technology and the Rise of the Feminist Moral Voice" by Dr. Blanch Wiesen Cook, Professor of History at the John Jay College of Criminal Justice, City University of New York

February 6, 1989: "Pacifism and Nuclear Pacifism: The Feminist Contribution" by a speaker to be announced

March 6, 1989: "Feminist Perspectives on the Question of Science and the Military" by a speaker to be announced.

From the grant proposal:

It is clear that the scientific research community would not be able to continue in its present direction without the implied consent of the general public. Social and political critics, and more recently feminist critics, have argued strongly for a change in the priorities of scientific and technological development. The majority of the scientific community has been unresponsive to feminist critics, arguing their ignorance of the complexities, and even of the basic principles, of nuclear weapons technology. Both as laypersons and as women, these critics are asked to prove their credibility. The aim of this lecture series is to provide women and men, both Marymount students and the general public, with some of the basic information necessary to understand the issues and with several thoughtful and provocative critiques to inform their own responses.

Lecture I: Since President Reagan proposed development of the Strategic Defense Initiative (SDI, also known as "Star Wars") in March 1983, there has been considerable public controversy and political debate about the feasibility and desirability of creating a space-based network of directed energy weapons. Proponents argue that SDI will provide the best defense for the United States, strengthen our bargaining position with the Soviet Union, possibly obviate the necessity of further development of nuclear weapons, and stimulate basic research on lasers and particle beams which will have peaceful uses as well. Opponents assert that SDI is unworkable and would not in fact shift the balance from offensive to defensive weapons. Others also believe that nuclear weapons pose an unbearable threat and that U.S. policy ought to be directed towards reduction of all nuclear arsenals.

The general public is ill-equipped to participate in these debates [and may] have exceptional difficulty understanding the jargon which surrounds SDI discussions. Therefore, the first lecture in the series must outline the salient facts of nuclear weapons technology to provide a common base of information for subsequent ethical and political judgments. This lecture will provide basic facts, an assessment of the scientific feasibility of the technology needed for successful SDI deployment, and comment on the ethical considerations faced by those who work in the field.

Lecture II: While modern social revolutions from the Napoleonic period brought mass armies into existence, it was the industrial revolution that equipped these armies and made them far deadlier than before. By the onset of the American Civil War, the impact of new weapons technology, railroads, and communications was evident to all — now war would be enormously costly in terms of human lives. Leo Tolstoy, Mohandas K. Gandhi, and others were clear in stating that modern technology has made pacifism an imperative rather than merely one option among others. This pacifist response to the new technology of war and its implications has been a powerful strain in moral discourse that has only become more vocal with the advent of the nuclear age.

Though traditionally women had little opportunity to comment on the ethics of peace and war, the technology of modern conflict elicited a new pacifist voice. From Emma Goldman to Dorothy Day in America, and from Bertha von Suttner (*Down with Arms*, 1894) to Rosa Luxemburg in Europe, to mention only a few, leadership in the formation of a women's peace movement emerged. Increasingly, women have expressed their concern with the technological expansion of war by articulating new moral responses. During the 1920's some American feminist leaders vigorously advocated disarmament through both American and international organizations. The Vietnam War again engendered a strong feminist response.

This lecture will discuss the development of the distinctive female moral voice which has throughout the 20th century responded to technology in general and modern weapons technology in particular.

Lecture III: In addition to understanding the relation of weapons technology to the general history of women's peace movements, it is important to focus on the moral position of a contemporary thinker in systematic detail. A widespread movement of women is convinced that their motives for rejecting the modern technology of war are unique and irreducible to the framework of either traditional pacifism or "nuclear pacifism," which tolerates non-nuclear conflict in accord with just-war criteria (just cause, proportionality, non-combatant immunity, etc.).

In particular, this lecture will explore what women are saying about maternal experience and the military technology that contradicts it. The argument is being made that women, due to this experience of giving life, are potentially a powerful peacekeeping force in public life. Many want to see this force brought to full consciousness among women and then developed as a response to the technological imperative. In sum, just because the technology can be developed and used does not mean that it should be. Women have a special obligation, given the maternal vocation, to limit the autonomy of weapons technology.

Lecture IV: During the past twenty years, scholars have brought feminist critiques to virtually every area of knowledge, including all the sciences. However, the natural sciences initially proved more amenable to these inquiries and, for example, yielded major revisions in primatology and theories of evolution. Mathematics and the physical sciences have been more recalcitrant for a number of reasons. Most notably, these disciplines maintain the strongest claims to being objective, value-free, sex-neutral and fully subject to rational debate. In addition, there have been relatively few women with sufficient training to write about the sciences, and within the feminist community ignorance of science is all too common.

Notwithstanding, a number of feminist scientists have been developing increasingly sophisticated critiques of androcentric science. Some writers argue for recognition of the value of a woman's point of view. Following Carol Gilligan, they postulate connected reasoning and relational thinking which looks at the limitations of a solution and describes the unresolved conflicts. Others, however, warn of the dangers of such an approach, arguing that it tends to confirm familiar stereotypes of women and leans toward a reductionist subjectivity. Sandra Harding and Evelyn Fox Keller in particular have been especially critical of any "feminization" of science. Instead, they advocate a scientific method which acknowledges the inevitable interaction of knower and known, but which does not exalt either the feminine or masculine viewpoint. A central element of such a method is self-reflection.

Because science and technology affect all aspects of our lives, no one can afford to remain uninformed. Because the present trend of scientific research is still formulated in the masculine terms of contest, power, mastery, and domination, the feminist critique is imperative to undermine these metaphors and methodologies.

OF POSSIBLE INTEREST

Women's Studies in the United States by Catharine R. Stimpson with Nina Kressner Cobb. The dramatic growth in women's studies in the last fifteen years is traced in this report to the Ford Foundation. Ford Foundation, P.O. Box 559, Naugatuck, CT 06770.

Women's Studies. The University of Michigan Press, P.O. Box 1104, Ann Arbor, MI 48106.

Women's Studies. Routledge, An Imprint of Routledge, Chapman and Hall, Inc., Formerly Methuen, Inc., 29 West 35th St., NY, NY 10001.

Women's Studies. Harvard University Press, 79 Garden St., Cambridge, MA 02138.

DEADLINES: Sept. 24 for Nov.-Dec., Nov. 24 for Jan.-Feb., Jan. 24 for Mar.-Apr.
AD DEADLINES: Oct. 5 for Nov.-Dec., Dec. 5 for Jan.-Feb., Feb. 5 for Mar.-Apr.
ADDRESSES: Send all Newsletter material except ads and book review material to Anne Leggett, Dept. of Math. Sci., Loyola Univ., 6525 N. Sheridan Rd., Chicago, IL 60626; BITNET: LMA24@LUCCPUA; USENET: gargoyle!cantor!borel!alm; COMPUSERVE: 73240,2051.
Send all material regarding book reviews to Martha Smith, Dept. of Math., University of Texas, Austin, TX 78712.
Send everything else, including ads, to AWM, Box 178, Wellesley College, 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 zip code order. All institutions advertising below are Affirmative Action/Equal Opportunity employers.

Williams College. Dept. of Math, Williamstown, MA 01267. Three openings Asst Prof, for one position there is a preference for statistics or operations research. Required: Strong commitment to both teaching and scholarship. Teaching load is five 1-semester courses /yr plus a "Winter Study" in alternate Januaries, beginning in the second year. Send vita and 3 letters of recommendation on teaching and research to Frank Morgan, Chair. Review of applications begins 11/15/88 until position is filled.

University of N.C., Chapel Hill. Dept of Math, Box 3250, Phillips Hall, Chapel Hill, N.C. 27599. Seek applicants for senior level tenured appointment in applied and computational mathematics for Fall 1989. Rank and salary commensurate with qualifications. Required: Ph.d and demonstrated excellence in research and teaching. Applications will be reviewed starting 01/15/89, until position is filled. Send vita, 4 letters of recommendation, and abstracts of current research to Pat Levin.

University of Florida, Gainesville. Dept of Math, 201 Walker Hall, Gainesville, FL 32611. David Drake, Chair. Seek mathematicians of exceptional caliber for several tenure-track positions for Fall 1989. All academic ranks, (including junior candidates) are welcome; one of the positions is reserved for a senior candidate in partial differential equations. Other areas of interest include, but are not limited to, arithmetic geometry, number theory and dynamical systems. Send resume, including a list of publications and at least 3 letters of recommendation to the Chair by 12/31/88.

University of Tennessee, Knoxville. 124 Ayres Hall, Knoxville, TN 37996-1300. Several tenure track positions available. Specific areas of interest are: numerical differential equations, numerical linear algebra, optimization. Required: Outstanding record (potential for junior candidates) in research and teaching. Application review to begin 11/15/88 and will continue until positions filled. Write Dr. Steve Serbin.

Ohio State University. Dept of Math, 231 W. 18th Ave. Columbus, OH 43210. Seeking applicants for research instructor in mathematics for the academic year 1989-90. Required: Ph.d in math and strong research promise. Send credentials and letters of recommendation to Prof Joseph Ferrar.

Ohio State University. Dept of Math, 231 W. 18th Ave, Columbus, OH 43210. Seeking applicants for several positions, both visiting and permanent, for Fall 1988. Candidates in all areas of pure and applied math are invited to apply. Required: Significant research accomplishments or exceptional research promise, and evidence of good teaching ability. Send credentials and letters of recommendation to Prof Joseph Ferrar for immediate review.

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September-October 1988

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