AWM

ASSOCIATION FOR WOMEN IN MATHEMATICS

Volume 21, Number 3 NEWSLETTER May-June 1991

PRESIDENT'S REPORT

After six pages in the previous issue, I promise to take it easy on the trees this time. Things are busy in the AWM office with resource materials, Schafer prize nominations, travel grants, and the usual chaos. Jill Mesirov and I visited the office February 27th to see Tricia in her home away from home at Waban House, also meeting Tricia's right hand woman Katherine Moore. I came away with an AWM mug (see page 12 to learn how one can be yours as well).

We get requests for information about summer programs for mathematics students, especially high school students, such as the PROMYS program described in the last issue. Jill has suggested that we might serve as a clearing house for such programs, perhaps listing them in the newsletter. As a first step, please send me and/or Patricia Cross any information you have about existing listings on such programs, including their requirements and the contact person if possible. Our guess is that even if such a list is incomplete, it could prove helpful.

An article in the February 8, 1991 issue of *Science* contains a great report of interviews with Jill Mesirov, Lenore Blum, and Mary Beth Ruskai at our 20th Anniversary Celebration in San Francisco. In the spirit of Jill's remarks there, I promise in my next letter a partial listing of mathematics departments with no tenured women, starting with the Group I institutions.

News Items

JOAN HUTCHINSON of Macalester College has agreed to serve on the AMS-ASA-AWM-IMS-MAA-NCTM-SIAM Committee on Women in the Mathematical Sciences. She joins EVELYN SILVIA of UC-Davis, who is the other AWM representative. Joan replaces PAT KENSCHAFT, who served as our representative even when we didn't have official status on the committee. Thanks to Pat for looking out for us all these years!

Welcome to IMS, AWM's newest Affiliate Member.

IN THIS ISSUE

Applied Mathematicians! See Page 35 for an important announcement.

AWM

ASSOCIATION FOR WOMEN IN MATHEMATICS

The Association was founded in 1971 in Boston, MA. The purpose of the association is to encourage women to study and to have active careers in the mathematical sciences. Equal opportunity and the equal treatment of women in the mathematical sciences are promoted.
The *Newsletter* is published bi-monthly.
The Editor welcomes articles, letters, and announcements.
Circulation: 4,000.

LAURA VAN ZOEST of Illinois State University is organizing an AWM breakfast on April 27, 1991, at the Illinois Sectional MAA meeting.

A summer conference on General Topology and Applications in honor of MARY ELLEN RUDIN and her work is scheduled for June 26-29, 1991 in Madison.

ASHLEY REITER of Charlotte, N.C., won first place in the 50th annual Westinghouse Science Talent Search this year for her project in fractal geometry. Ashley is a senior at the North Carolina School of Science and Mathematics.

SIMMONS COLLEGE hosts its 6th annual Sonya Kovalevsky High School Day on April 4, 1991. Our Past President JILL MESIROV will be a panelist. AWM supports this program, and we thank the folks at Simmons for keeping up the fine work.

AWM's ICIAM WORKSHOP, sponsored by NSF and ONR, is Sunday, July 7, 1991 at the Washington Sheraton Hotel. If you plan to attend, please consider arriving Saturday night in order to participate in our workshop.

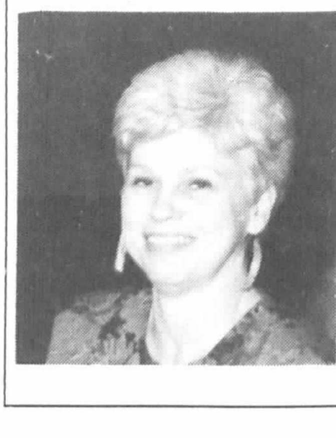
SUMMER MATH MEETINGS in ORONO have a new format with a shortened time of three days and many co-sponsored events. AWM will sponsor or co-sponsor a panel (details later) and will host a post-clam-bake party. As special enticement you can see our new career materials there, which will be available soon, thanks to Jenny Baglivo, her Resource Committee, and the incomparable Allyn Jackson.

CBMS meets May 4-6 in Washington, D.C., with focus on graduate education in the mathematical sciences.

As I write, it is the season of Passover and Easter and Ramadan (and SPRING!), and the campus is warm and full of music and students in short sleeves. I am even more optimistic than usual, and I wish a happy and productive spring to all of our members.

Carol

Carol Wood



NSF-AWM TRAVEL GRANTS FOR WOMEN

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

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

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

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

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

MORE TWENTIETH ANNIVERSARY CELEBRATION NEWS

AWM Symposium: The Future of Women in Mathematics

The Symposium was held Wednesday, January 16, 1991, at the Joint Meetings in San Francisco, California.

Judy Sunley, NSF, introduced Carolyn Dean, University of Michigan, "Monomorphisms of the Weyl Algebra" and Bernadette Perrin-Riou, University of Paris, "P-adic representations and L functions."

Nancy K. Stanton, University of Notre Dame, introduced Mei-Chi Shaw, University of Notre Dame, "Solvability and regularity for tangential Cauchy-Reimann operators" and Jiang-Hua Lu, MIT, "A symplectic proof of a classical convexity result on complex matrices."

Linda Rothschild, University of California, San Diego, introduced Ruth J. Williams, University of California, San Diego, "Reflecting Brownian motions in polyhedral domains" and Laurette Tuckerman, University of Texas at Austin, "Bifurcations and symmetry-breaking in computational fluid dynamics."

Fan Chung, Princeton University, introduced Lynne M. Butler, Princeton University, "Combinatorics and topology of subgroup complexes" and Joan Feigenbaum, AT&T Bell Labs, "A modern view of self-reducibility."

Alice Chang, UCLA, introduced Elise Cawley, SUNY at Stony Brook, "Gibbs measures and deformations of total diffeomorphisms" and Jill Pipher, Brown University, "Higher order elliptic partial differential operators on non-smooth domains."

It was a pleasure to hear so many talks delivered with such enthusiasm by so many distinguished women mathematicians.

Graduate Student Workshop

The AWM Graduate Student Workshop, funded by the National Science Foundation and the Office of Naval Research, was held on January 17, 1991. Over 70 women applied for travel funds and 10 were chosen to participate. The workshop was chaired by Lenore Blum, International Computer Science Institute. Participants, their affiliations, and their subjects were: Andrea Bertozzi, Princeton University, Vortex Patches; Jill Dietz, Northwestern University, Algebraic Topology; Ellen Gethner, Ohio State University, Modular Forms; Milja-Riitta Hakosalo, MIT, Algebraic Number Theory; Deanna Haunsperger, Northwestern University, Statistics; Kitty Holland, University of Illinois at Chicago, Geometries of Strongly Minimal Sets; Diana Major, University of Southwestern Louisiana, Mathematical Approaches to the Classical Inverse Problem of Electroencephalography; Susan Schwartz, Montana State University, Topological Dynamics; Melanie Stein, Cornell University, Geometric Methods in Group Theory; and Julia Yang, MIT, Enumerative Combinatorics.

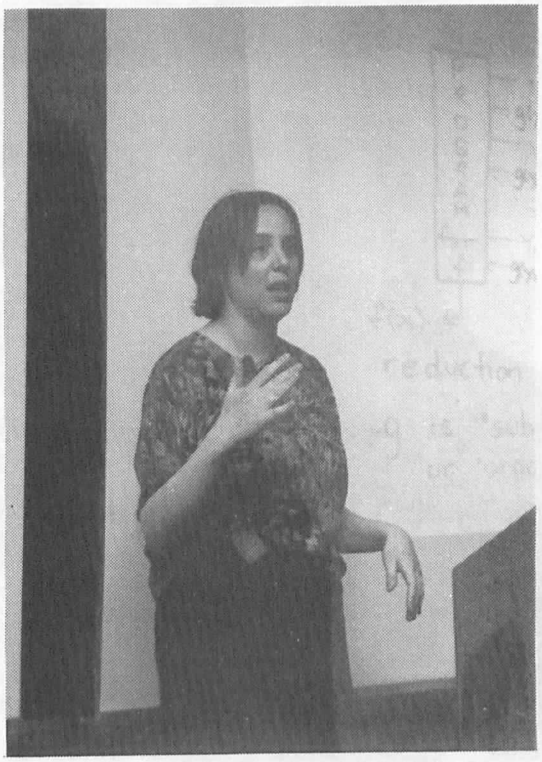
Jill Mesirov

Carolyn Dean

Mei-Chi Shaw

Bernadette Perrin-Riou

Laurette Tuckerman



Joan Feigenbaum

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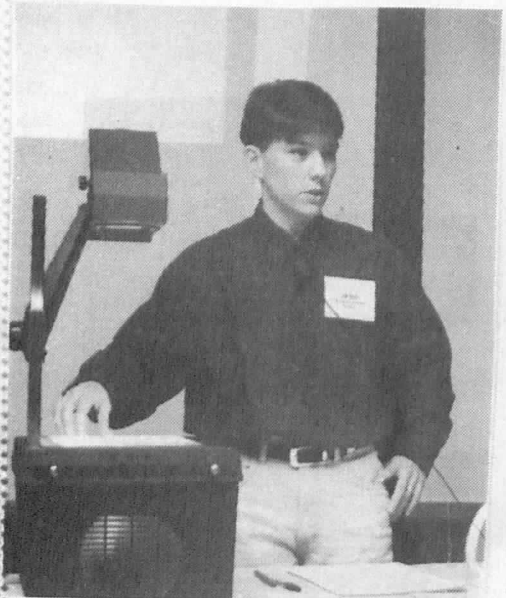
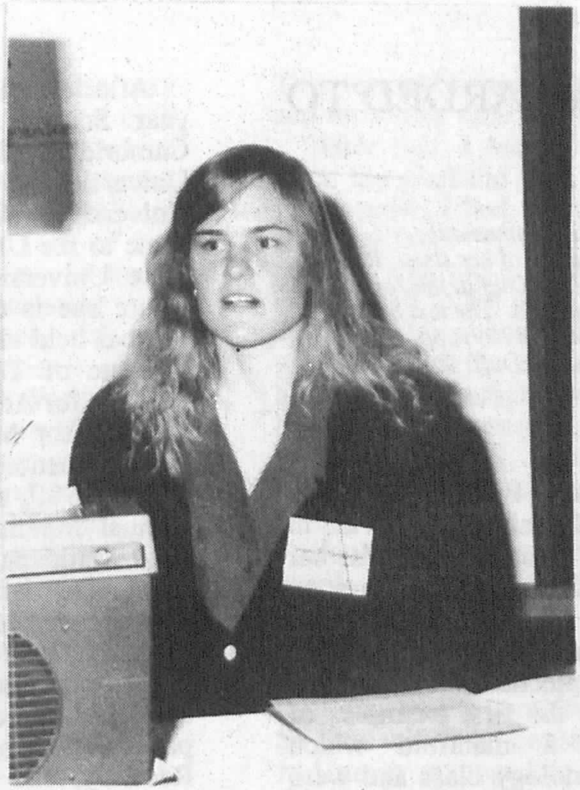


Jill Dietz

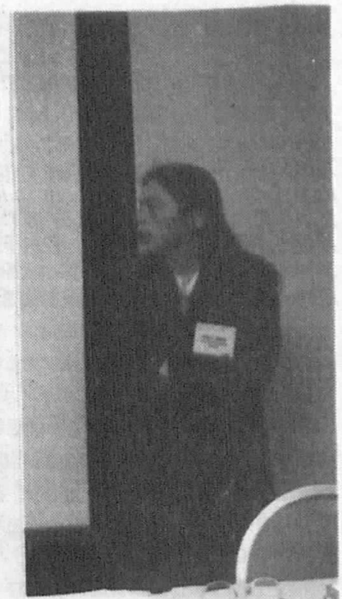
Ellen Gethner

Julia Yang

Melanie Stein



Deanna Haumsperger



Kitty Holland

Milja-Riita Hakosalo

Susan Schwartz

Diana Major

SATTER PRIZE AWARDED TO DUSA MCDUFF

The 1991 Ruth Lyttle Satter Prize in Mathematics, established by Joan Birman in memory of her sister, Ruth Lyttle Satter, was awarded to Dusa McDuff at the Joint Mathematics Meetings in San Francisco. The text below is reprinted from the AMS Notices, *March 1991, pp. 185-187, by permission of the AMS and Dusa McDuff.*

Citation

The Committee for the Satter Prize unanimously recommends that the first Biennial Satter Prize in Mathematics be awarded to Dusa McDuff, for her outstanding work during the past five years on symplectic geometry.

A pervasive theme in that work has been the relationship between symplectic and complex geometry. She constructed the first examples of symplectic structures on a manifold which belonged to the same cohomology class and were homotopic as symplectic structures, but were not isotopic. These examples were sharp, because if the cohomology class had remained fixed during the homotopy, the forms would have to be equivalent. She went on to give other examples which put a limit to the analogy between symplectic manifolds with contact boundaries and complex manifolds with pseudo-convex boundaries. Among her outstanding work during the past two years has been a complete classification of compact symplectic manifolds which contain a symplectically embedded two-sphere with non-negative self-intersection number. Most recently, she established a beautiful and simple criterion for a symplectic four-manifold to be the blow-up of a rational or ruled complex surface and proved a surprising unicity theorem.

Biographical Sketch

Dusa McDuff (née Margaret Dusa Waddington) was born on October 18, 1945 in London, England. She received her bachelor's degree from the University of Edinburgh in 1967 and her Ph.D. from the University of Cambridge in 1971. During her graduate school years she traveled to Moscow, where she was greatly influenced by I. M. Gel'fand.

After finishing her doctorate, she held a two-year Science Research Council Fellowship at Cambridge. She was then appointed lecturer at the University of York (1973-1976) and then at the University of Warwick (1976-1978). In 1978, she came to the United States to take a position at the State University of New York at Stony Brook, where she is currently professor of mathematics. She has held visiting positions at the Massachusetts Institute of Technology (1974-1975) and at the Institute for Advanced Study (1976-1977).

Professor McDuff gave an Invited Address at the International Congress of Mathematicians in Kyoto, 1990, and an Invited Address at the AMS Annual Meeting in Atlanta (1988). During the Joint Mathematics Meetings in Boulder in August 1989, she delivered the first AMS Progress in Mathematics lecture. For a long time McDuff's research centered on the relation between classifying spaces of groups of diffeomorphisms and the theory of foliations, concentrating particularly on the volume-preserving case. Recently, she has worked in global symplectic geometry.

Response

I am very honored to be the first recipient of this prize and want to thank Joan Birman on behalf of the whole mathematical community for instituting it. I am particularly happy to get this prize because it is for my research. I grew up in a house in which creativity was very much valued but, despite the achievements of the women in the family, males were seen to be more truly creative than females, and it has taken me a long time to find my own creative voice. My life as a young mathematician was much harder than it needed to be because I was so isolated. I had no role models, and my first attempts at inventing a life style were not very successful. One important way of combating such isolation is to make both the achievements of woman mathematicians and the different ways in which we live more visible. I hope that this will be one of the effects of the Satter prize. I'll try to do my part by telling you something of my life.

I grew up in Edinburgh, Scotland, though my family was English. My father was a Professor of Genetics who travelled all over the world and wrote books on philosophy and art as well as on developmental biology and the uses of technology.

My mother was an architect, who was also very talented, but who had to make do with a civil service job since that was the best position which she could find in Edinburgh. Her having a career was very unusual: none of the other families I knew had mothers with professional jobs of any kind. There were other women on my mother's side of the family who led interesting and productive lives. I identified most with my maternal grandmother since I had her name: Dusa was a nickname given to her by H.G. Wells. She was most notable for creating a great scandal in the London of her time by running away with H.G. (this was before she married my grandfather), but she later wrote books, on Confucianism for example, and was active in left-wing politics. Her mother (my great grandmother) was also distinguished: in 1911 she wrote a book about the working class poor in London which I was pleased to find being used in Stony Brook as a textbook. In discussing the women in my family I should also mention my sister, who was the first Western anthropologist allowed to go on a field trip to Soviet Central Asia, and is now a Fellow of Kings College, Cambridge, with a lectureship at the university.

I went to a girls' school and, although it was inferior to the corresponding boys' school, it fortunately had a wonderful maths teacher. I always wanted to be a mathematician (apart from a time when I was eleven when I wanted to be a farmer's wife) and assumed that I would have a career, but I had no idea how to go about it: I didn't realise that the choices which one made about education were important, and I had no idea that I might experience real difficulties and conflicts in reconciling the demands of a career with life as a woman.

When, as a teenager, I became more aware of my femininity, I rebelled *into* domesticity. I gladly started cooking for my boy-friend; I stayed in Edinburgh as an undergraduate to be with him instead of taking up my scholarship to Cambridge; and when I married I took his name. (My mother had kept her maiden name for professional purposes.) I did eventually go to Cambridge as a graduate student, this time followed by my husband. There I studied functional analysis with G.A. Reid and managed to solve a well-known problem about von Neumann algebras, constructing infinitely many different II_1 factors. This was published in the *Annals of Mathematics* and for a long time was my best work.

After this, I went to Moscow for six months since my husband had to visit the archives there. In Moscow, I had the great fortune to study with I.M. Gel'fand. This was not planned: it happened that his was the only name which came to mind when I had to fill out a form in the Inotdel office. The first thing that Gel'fand told me was that he was much more interested in the fact that my husband was studying the Russian Symbolist poet Innokenty Annensky than that I had found infinitely many II_1-factors, but then he proceeded to open my eyes to the world of mathematics. It was a wonderful education, in which reading Pushkin's "Mozart and Salieri" played as important a role as learning about Lie groups or reading Cartan and Eilenberg. Gel'fand amazed me by talking of mathematics as though it were poetry. He once said about a long paper bristling with formulas that it contained the vague beginnings of an idea which he could only hint at and which he had never managed to bring out more clearly. I had always thought of mathematics as being much more straightforward: a formula is a formula, and an algebra is an algebra, but Gel'fand found hedgehogs lurking in the rows of his spectral sequences!

When I came back to Cambridge, I went to Frank Adams's topology lectures, read the classics of algebraic topology, and had a baby. At the time, almost all the colleges in Cambridge were for men only, and there was no provision at all for married students. I was very isolated, with no-one to talk to, and found that after so much reading I had no idea how to begin to do research again. After my post-doc, I got a job at York University. I was the family breadwinner and housekeeper and diaper changer (my husband said that diapers were too geometric for him to manage). At about this time I started working with Graeme Segal, and essentially wrote a second Ph.D. with him. As this was nearing completion, I received an invitation to spend a year at M.I.T. to fill a visiting slot which they had reserved for a woman. This was a turning point. While there I realised how far away I was from being the mathematician I felt that I could be, but also realised that I could do something about it. For the first time, I met some other women whom I could relate to and who also were trying to become mathematicians. I became much less passive: I applied to the Institute for Advanced Study and got in and even had a mathematical idea again, which grew into a joint paper with Segal on the group-completion theorem. When back home, I separated from my husband and, a little later, obtained a lectureship at Warwick. After two years at Warwick, I took an (untenured) assistant professorship at Stony Brook, so that I could live closer to Jack Milnor in Princeton. I went to Stony Brook sight unseen. I knew no-one there, and have always thought myself extremely lucky to have landed in such a fine department, although very foolhardy to have given up a tenured job for an untenured one.

After that, I had to do the work that everyone has to do to become an independent mathematician, building up on what one knows and following one's ideas. I spent a long time working on the relation between groups of diffeomorphisms and the classifying space for foliations: this grew out of my study of Gel'fand-Fuchs cohomology in Moscow and my work with Segal on classifying spaces of categories. I still worked very much in isolation and there are only a few people who are interested in what I did, but it was a necessary apprenticeship. I had some ideas and gained confidence in my technical abilities. Of course, I was influenced by the clarity of Jack Milnor's ideas and approach to mathematics, and was helped by his encouragement. I kept my job in Stony Brook, even though it meant a long commute to Princeton and a weekend relationship, since it was very important to me not to compromise on my job as my mother had done. After several years, I married Jack and had a second child.

For the past eight years or so, I have worked in symplectic topology. Here again I have been very lucky. Just after I started getting interested in the subject, it was revitalised with new ideas from several sources. Most important to me was Gromov's work on elliptic methods. I took advantage of a sabbatical to spend the spring of 1985 at I.H.E.S. in Paris so that I could learn about Gromov's techniques, and the work I did then has been the foundation of all my recent research. At the time, our child was a few months old. So I worked rather short days, but found it easy to cope since we had enough money to pay for good day care. Eventually he brought the family together. We didn't want to make him commute, and Jack did not like being left with him for the best part of each week. So Jack took a job at Stony Brook, where we are now enjoying life in one house.

In conclusion, I think that there is quite an element of luck in the fact that I have survived as a mathematician. I also got real help from the feminist movement, both emotionally and practically. I think things are somewhat easier now: there is at least a little more institutional support of the needs of women and families, and there are more women in mathematics so that one need not be so isolated. But I don't think that all the problems are solved.

TRAVEL GRANTS AWARDED

The following women have been awarded travel grants through the AWM/NSF Travel Grant Program:

Fernanda Botelho, Memphis State University
Southeast Dynamical Systems Conference, Georgia, March 1991

Daniela Calvetti, Stevens Institute of Technology
SIAM Conference on Parallel Processing for Scientific Computing, Texas, March 1991

Aimee S.A. Johnson, Tufts University
Conference on Ergodic Theory, France, May, 1991

Cheryl Chute Miller, SUNY Potsdam
Finite and Infinite Combinatorics in Sets and Logic Conference, Canada, April 1991

Eirini Poimenidou, Bryn Mawr College
1991 Symposium in Algebra, England, June 1991

Anne Schwartz, Dartmouth College
5th Annual Workshop on Automorphic Forms and Related Topics, California, March 1991

Sally S. L. Shao, University of Southern California
Conference on Theory and Applications of Differential Equations, Texas, May 1991

Phyllis E. Singer, University of Missouri - Rolla
Summer Research Institute, Pennsylvania, July 1991

AWARDS AND HONORS

CONGRATULATIONS to all below on their meritorious achievements!

Constance van Eeden, Adjunct Professor at the University of British Columbia, Vancouver and chercheure associée at the Université du Québec à Montréal, has been awarded the 1990 Gold Medal of the Statistical Society of Canada for "her achievements in statistics, particularly in the area of non-parametric methods; for her leadership in the development of graduate programs in statistics and for her countless contributions to statistical activities."

Jessica M. Utts was elected a Fellow of the American Statistical Association in August 1990. Lynne Billard received, with her co-authors G.F. Medley, David Cox and R.M. Anderson, an award for Outstanding Statistical Applications from the same Association.

Fan R.K. Chung received, jointly with her co-authors, a 1990 Carl B. Allendoerfer Award from the Mathematical Association of America for their paper "Steiner trees on a checkerboard."

Dr. Evelyn Boyd Granville, one of the first two African-American women Ph.D.'s in mathematics and recent recipient of an honorary doctorate from Smith College, came out of retirement in the fall. She is teaching half time at the University of Texas at Tyler, where she holds the Sam A. Lindsey Chair.

June M. Donato has been selected as the winner of the 1991 Householder Fellowship in Scientific Computing at the Oak Ridge National Laboratory (ORNL). Ms. Donato is currently finishing her doctorate degree in Applied Mathematics at UCLA working with Professor Tony Chan. Her research interests are in the numerical solution of partial differential equations via iterative techniques and parallel computing.

Ms. Donato will be collaborating with the researchers in ORNL's Mathematical Sciences Section and with applied computational scientists in various divisions at ORNL on scientific problems involving high performance computing. Her primary interest will be on parallel iterative algorithms for solving large sparse systems resulting from the discretization of scalar and coupled systems of partial differential equations in three dimensions. Her fellowship appointment will begin this summer.

The Householder Fellowship Program is supported by the Applied Mathematical Sciences Subprogram of the U.S. Department of Energy.

Pat Rogers of the Mathematics Department, York University, has received a 3M Teaching Fellowship that recognizes exceptional teaching at Canadian universities.

the following items are from the AMS Notices, *October 1990, November 1990, January 1991, February 1991, March 1991*

The Council of the American Mathematical Society, meeting in Columbus, Ohio, on August 7, 1990, passed the following resolution:

> The Council of the American Mathematical Society notes with pleasure the action by the City University of New York recognizing the achievements and distinction of its former faculty member, Lee Lorch, by its award to him of an honorary degree. By this action, the University has acknowledged the injustice of its treatment of Lorch in firing him for political reasons in 1949.
>
> The council suggests to The University of Michigan that it acknowledge the injustice of its treatment of Chandler Davis and his dismissal in 1954.
>
> The damage done to Professors Davis and Lorch and others like them cannot be undone, but formal recognition of these past injustices will help to strengthen freedom of inquiry in our academic institutions.

The Educational Foundation of the American Association of University Women (AAUW) has awarded fellowships and grants amounting to more than $2 million to 101 women scholars. Among the awardees are three mathematicians.

Tamar Schlick of New York University will receive a Postdoctoral Fellowship for her theoretical investigations into the structure, energetics and dynamics of supercoiled DNA. Maria Brooks, a statistician at the University of North Carolina at Chapel Hill, will receive a Dissertation Fellowship for her research in bandwidth selection methods for kernel estimators of the intensity function of a non-homogeneous Poisson process. Also receiving a Dissertation Fellowship is Tamara Olson of New York University, whose research focuses on homogenization methods for coupled fields in composite materials.

Among this year's American Fulbright scholars in the mathematical sciences (along with their home institutions and the countries in which they are lecturing or conducting research) are: Virginia B. Flack, University of California at Los Angeles, Guatemala and Linda M. Lesniak, Drew University, Hungary.

Carole Lacampagne, associate professor of mathematical sciences at Northern Illinois University, has taken a position as a rotator in the Division of Teacher Preparation and Enhancement at the National Science Foundation (NSF). As a program director, she is responsible for managing the review procedure for and making recommendations on grant proposals which seek to improve the quality of mathematics instruction in the schools through programs that enhance teacher effectiveness while serving as prototypes for other inservice projects.

Ann Hibner Koblitz has received the History of Women in Science Award from the History of Science Society. The $500 award, presented at the Society's annual meeting in Seattle in October 1990, honors original research that explores the issues faced by women in science, the ways that science has dealt with gender, and the ways that science has dealt with women.

Koblitz, who currently teaches Russian history at Hartwick College in Oneonta, New York, received the award for her article, "Science, Women and the Russian Intelligentsia" (*Isis*, 1988, 79:208-226). The article focuses on the political, social, and individual contexts of a group of female members of the intelligentsia in Russia in the 1860s and 1870s.

Koblitz is perhaps best known for her writings on the mathematician Sofia Kovalevskaia, and particularly for her book *A Convergence of Lives. Sofia Kovalevskaia: Scientist, Writer, Revolutionary.*

The Mathematical Association of America (MAA) awarded a number of prizes during the Joint Mathematics Meetings in San Francisco in January 1991.

The Yueh-Gin Gung & Dr. Charles Y. Hu Award for Distinguished Service to Mathematics went to Shirley A. Hill, Curator's Professor of Education and Mathematics at the University of Missouri, Kansas City. Hill has been president of the National Council of Teachers of Mathematics and chair of the Mathematical Sciences Education Board. She was instrumental in the development of the Board and the publication of its major 1989 report, *Everybody Counts*. The award consists of $4000 and a gold cup.

AWM MUGS

Donate $25.00 or more to AWM to support our activities and programs, and we will send you the official AWM mug. The first mugs were a real hit at the twentieth anniversary celebration in San Francisco. (Public television, move over!)

TENURE TRACK, MOMMY TRACK

My husband and I married while I was a graduate student in computer science at M.I.T. "Don't have children until you finish," cautioned a friend, the wife of a history professor. I nodded easily. I was then twenty-five. At twenty-eight I completed my doctoral thesis. "Don't have children until you get tenure," warned a member of the faculty. I was leaving to become an assistant professor at Wesleyan University. This time the nod didn't come so easily. Tenure is typically a seven year process, and my husband and I wanted a family. I didn't want to wait until I was thirty-five to begin one.

Choosing which came first was not hard for me. The security of tenure was important, but children were more so. If I had tenure at thirty-five, but was then unable to have children, the pain would have been unbearable. I knew I could handle the opposite situation. I had my first child at thirty-one, my second at thirty-three. At thirty-four I have my family even if I don't have academic permanence.

All along I felt that the choices were more mine than my husband's. We both raise the children. I'm the one who's pregnant. I have the fuzzy brain for nine months; I'm the one who can't go off to conferences during the late months of pregnancy and the early months of nursing. My work suffers, my energy flags, my batteries fade. I've lost about two years of research in the first five years after my Ph.D. (What I've gained is immeasurable — but not the subject of this essay.) So I get 51% of the vote. As it turns out, we both voted for children first, tenure second, so it was no contest. But there's a price I may yet pay in my career.

In the new professional world of recent years, many women face the hard choice between career and family. That decision is particularly sharply etched in academia: the average Ph.D. degree requires five to seven years of study after a B.A., and a tenure decision generally comes seven years after that. The years between the degree and tenure are the years one proves oneself: as a scholar, a professional colleague, a teacher. They are not the years for distractions, the languor of pregnancy, the time-consuming demands of infants and young children.

"Are you a serious scholar?," says the academe, "Publish (or perish). Lecture. Go to conferences. Are you a concerned professor? Advise students. Serve on university committees. Establish yourself as a teacher and a researcher."

Tenure is a seal of approval, the university's vote of confidence in a professor's abilities and direction. Having tenure, a scholar can take the long view and tackle problems that may take years to come to fruition. Those first years after the Ph.D. are crucial for developing momentum and establishing one's professional reputation. It's also the time many of us want to have children.

I chose to — and was lucky. I didn't know I'd be in a state of torpor for nine months of pregnancy, but I also didn't expect the burst of creative energy that followed the birth of each child. That energy more than made up for those lost nine months. Every academic mother has a different experience, but all of us face the ticking of those simultaneous clocks of tenure and the childbearing years.

Academia doesn't help. Few universities have maternity leave. Those that do ignore what happens next. For example, my university has an excellent maternity policy (one semester's leave at two-thirds salary), but no day care facilities, despite over a decade's lobbying by male and female faculty. Thus my kids are at a center forty-five minutes away. I can't attend late afternoon colloquia or faculty meetings. Last year my husband and I were both invited to spend our sabbaticals at a university where we would have great research opportunities. Lack of day care there meant we couldn't go.

Of course American business and industry aren't much different. In general, maternity leaves are inadequate and on site day care is rare.

Fifteen years of affirmative action haven't substantially improved things. To talk about women in academia is to talk about tenths: nationally one tenth of all full professors are women, less than one tenth of the tenured faculty at the most prestigious institutions — the Ivies, M.I.T., Stanford — are women, only one tenth of the current Ph.D. recipients in science are women. It is hard to hire women — there are so few qualified — but then the universities do little to keep us.

The lack of women sends a discouraging message to our brightest students, male and female. Few women go on to pursue graduate degrees, fewer still to teach. This percolation effect extends down the line, and at less prestigious institutions, there is a similar lack of women. By example — or lack thereof — universities and colleges are telling their students that women do not succeed as scholars. We are effectively eliminating half the research talent this nation has to offer.

I didn't meet a female mathematician until I was twenty-five. Despite the smoke signals, I was convinced women could be mathematicians. (I can thank a sixth grade math teacher — male — for that.) When I decided to become a professor, it was because I loved mathematics. I wasn't married, wasn't thinking of children or timing, or any of the issues that are now so crucial. Had I been, my decision might have been different.

There's a touch of the priesthood in the academic world, a sense that a scholar should not be distracted by the mundane tasks of day-to-day living. I used to have great stretches of time to work. Now I have research thoughts while making peanut butter and jelly sandwiches. Sure it's impossible to write down ideas while reading *Curious George* to a two-year-old. On the other hand, as my husband was leaving graduate school for his first job, his thesis advisor told him, "You may wonder how a professor gets any research done when one has to teach, advise students, serve on committees, referee papers, write letters of recommendation, interview prospective faculty. Well, I take long showers."

The tenure process was established in an era when men had professions and women had babies. Women now have professions as well as babies, but the academic world hasn't changed. Yet universities can afford to be farsighted.

My two maternity leaves in two years seemed like a lot to several of my colleagues. ("You shouldn't vote on this," complained one, "You're never here.") I see it as two maternity leaves over a lifetime. Even if a faculty member chooses to work half-time for ten years, that still leaves thirty years for full-time scholarship and teaching.

Small changes can make a great deal of difference. Universities have flexibility. They can use it without sacrificing standards. A few have adopted a "stop-the-clock" policy: if a woman takes time out — a semester, a year — for maternity leave, the tenure clock is set back that semester or year. Others allow a temporarily reduced teaching load — at a reduced salary. This allows faculty members to concentrate on research and babies at a crucial time. Some fellowships exist which free women from teaching duties.

These solutions are not without problems. A delay on tenure creates pressure because it extends the probationary period. Colleagues who are sympathetic to lowered teaching loads because of professional commitments often look askance at those who request it for personal reasons. Many untenured women cannot afford to risk the option. Fellowships are few and far between. But these changes are a start.

They helped me. My university's generous maternity policy gave me time after childbirth to catch up on the research that I had been unable to do while pregnant. A government fellowship has just given me more time during the years when my children are young.

I am one of the lucky ones. Many women are not, and they leave — or don't enter — academe. Solutions cost money. So does the lack of solutions, but this doesn't show up on the universities' balance sheets. Instead, we, as a nation, are paying with a growing shortage of scholars and researchers.

There are any number of complex reasons why women have not reached the top echelons in a variety of sectors. This is a simple, avoidable one. Fellowships, maternity leaves, on site day care can make a huge difference. Universities should be leading society on this one. As long as they make it difficult for us to be professors and mothers, they are engaging in a policy which effectively keeps a significant segment of women off the faculty.

by Susan Landau, who is currently at the University of Massachusetts. The article was written in 1988; at the time the author was a faculty member at Wesleyan University.

SAMPLE MATERNITY LEAVE POLICY

Several years ago, Rhonda Hughes created an AWM Task Force on Maternity Leave to examine what was happening to women in academe when they decided to have children. The first thing that we did was to collect both official policies and personal stories. What we discovered was that most schools had no policy, and women were largely relying on luck, good timing, and the generosity of their colleagues. One large problem was that, for many women, the only recourse they had was to beg their co-workers to cover their classes. This led to a great deal of pressure for women to return to the classroom shortly after the birth. The Task Force was charged with writing a sample maternity leave policy. This policy could then be endorsed by AWM and used by members as a place to start when dealing with their individual institutions.

What follows is our suggested sample policy. We are open to suggestions and comments and will rewrite the policy with them in mind.

Please send your comments to me at Grinnell College, Grinnell, IA 50112, or e-mail: solow@grin1.bitnet

One of the key features of this policy is flexibility. Some people desire to stop teaching during this time. Others wish to remain professionally active, although possibly with a reduced load. We therefore felt that the policy should offer these, and other, possibilities. The most convenient time frame to work with in academe is the semester or term. Therefore, most of the recommendations are written with this in mind.

Benefit: A faculty member shall receive a fully paid maternity leave. The length of time should be at least 6 weeks and up to a semester (or term). An additional unpaid leave for up to one year shall be available, if desired.

Process: A faculty member should meet with the appropriate administrator (dean or provost) as soon as possible after the determination of pregnancy or notification of adoption to request maternity leave. Neither the administration nor the department will press the faculty member to teach during the term semester. The department may expect additional staff to cover the faculty member's courses during this semester. The arrangements for this staff will be made by the administration and the department.

Eligibility: Maternity leave is available to all faculty holding positions other than one-year or one-semester term positions, after one year of service. This benefit is available to the parent having primary responsibility for child care.

Notes:

1. This policy is based on a healthy pregnancy and delivery. Special arrangements will be made in the event of medical complications.
2. The form that the maternity leave may take has several possibilities. Not all faculty desire to take six weeks or a semester away from their employment. Another option, in addition to six weeks to one semester paid leave, is to consider alternative duties during the academic year of the leave. These could take the form of a reduced teaching load during one or both of the semesters.
3. A separate issue is whether to allow the faculty member a one-semester or one-year delay in the evaluation for promotion and tenure. There are arguments on both sides of this issue. From experience, I know how difficult it is to maintain a decent publication record during this time. On the other hand, I do not want to see women opt for this delay and find themselves at a lower rank longer than necessary. For more comments, see the statements by Mary Gray in *Academe*, November-December 1988.

AWM Task Force on Maternity Leave Policy
Anita Solow, Chair

Comments from Mary Gray, AWM General Counsel:

The proposed maternity leave policy raises some legal questions. Although there are no cases that I know of, I believe that it is illegal to exclude fathers. A possible solution would be to grant the leave to the parent having primary responsibility for the care of the child. Employers may not discriminate in fringe benefits between low-paid and high-paid employees; some faculty who might want to take advantage of the leave policy could be classified as high-paid so the leave benefit would have to be made available to all employees. For that reason, it would be better to speak of assignment to alternative duties rather than a total leave or a reduced teaching load. The AAUP has a useful policy called "Anticipated Medical Leaves of Absence."

AMS ASSOCIATE TREASURER

The American Mathematical Society is seeking applications and nominations for candidates for the position of Associate Treasurer of the Society. While the term of office is two years, it is expected that the person filling this office will be reappointed biennially for a number of terms, to insure continuity. If you or someone you know would be a good candidate for this position, see the ad in the AMS *Notices* for more details.

NEWS FROM MSRI: AN AFTERNOON WITH HIGH SCHOOL STUDENTS

Arlene Baxter, Manager, Business and Finance at MSRI, had the fabulous idea of inviting a group of young women and their mathematics teachers for tea, a small panel discussion and a tour of MSRI, the Mathematical Sciences Research Institute. Some juniors and seniors from Berkeley High School came to visit on February 27, 1991.

Some students have already applied to various colleges, and all of them have expressed an interest in science. What makes Arlene's idea so special, in my opinion, is the opportunity for them to be in an environment that promotes specialized research. Director Kaplansky gave a warm welcome; Arlene addressed the Institute's almost ten year history, the problems behind the curtain, and the rhythm of daily life at the Institute. Three panelists then spoke on various issues particular to women scientists.

The first speaker, Corinne Manogue, went through the stages of her own career, which turned out to be full of inspiring enterprise, from her college days at Mount Holyoke to her postdoc in India. She made a sensation when she pointed out that her institution, Oregon State University, states in the job ads that a special effort will be made in the case of married applicants to hire both husband and wife; she had us in stitches when she explained how she'd have to hide in her walk-in closet to check her own physicist's intuition by a brute-force calculation and protect it from her mathematician husband's two-line disproof (she was right in the end!).

Then it was my turn. I was simply bubbling over with good news. After some grim statistics on women in math from the past (for contrast), I rattled off a list of career opportunities *reserved* for women (I had made up a reference sheet, thereby missing the tea and devil's food cake). The last issue of *Focus* alone (January-February, 1991) provided plenty of examples, such as Lisa Thompson's report on Congress's "The Excellence in Mathematics, Science and Engineering Act." (National Science Scholarships, funded by DOE and NSF, are to be awarded each year to two high-school seniors, *at least one of whom is female*, from each congressional district). I told the teachers to get their institutions to become members of AWM and MAA (then a number of students can have free memberships) and the students to get something going for "Math Awareness Week" (April 21-27). I pointed out what a surge of interest and enthusiasm (and funds!) there is toward undergraduate research opportunities and how much innovation is going into the teaching of college math. I mentioned my colleagues Paul Blanchard and Bob Devaney of Boston University, who have integrated computers into their courses and thereby given the students an instrument for personal experimentation and discovery. I just feel that these days mathematics is a fantastic place to be, and women should move in and shape it.

Lenore Blum, AWM President 1975-78, currently of International Computer Science Institute, Berkeley, concluded the presentation. She thoughtfully commented on things that Corinne and I had said (especially, she replied to my misgivings about "women-only" programs by quoting the tremendous response and respect for women mathematicians that she witnessed as a member of various committees). Then she contributed fun and little-known historical episodes for perspective. She brought along a draft of her talk, given at the AMS meeting in San Francisco (January 1991) on the occasion of AWM's 20th anniversary. The talk was a fascinating and affecting journey through the struggle for recognition of women in mathematics and particularly within AWM.

Afterwards we went to the library where the MSRI Librarian Jo Butterworth had put together a display of books and articles on women in mathematics. She distributed bibliographies from the U.C. Berkeley catalog and *Math. Reviews*: the Institute has quite a number of items that make good browsing.

The girls (all of them belonging to racial minorities, in case you were wondering) were attentive, asked questions and became involved when we sneaked mathematical references into an anecdote. Rather than being intimidated by the place, they walked out galvanized for action. One of them asked me for the Boston University address because she was interested in the PROMYS program (a summer course for talented high-schoolers), which I had unashamedly extolled; another said she would never have imagined that there were so many organized groups to support women scientists. The teachers invited me to attend some of their experimental classes for the renewal and enlivenment of math.

Arlene wants to work on making these meetings a regular feature at the Institute. Brava!

by Emma Previato, Boston University; currently at MSRI

PROGRESS IN EQUITY AWARD WINNER

The Douglass College Project for Rutgers Women in Math and Science (New Brunswick, NJ) has received the AAUW Legal Advocacy Fund's 1990 Progress in Equity Award. The Douglass Project, which began in January 1986 with a three-year grant from the New Jersey Department of Higher Education, is designed to promote equity for women and minorities and serves students at Rutgers, the State University of New Jersey, and New Jersey high school students.

Douglass Project activities for women math and science majors include career options sessions, "Big Sister/Little Sister" pairings, visits to university and corporate research labs, talks by women scientists, and peer study groups in chemistry, computer science, math, biology, and physics. Douglass math and science students are eligible for specially designated academic year scholarships and for summer science research fellowships. Students may choose a semester-long internship with companies in New Jersey/New York that offer employment to math and science majors, and they may also choose two-week career exploration externships through the Associate Alumnae of Douglass College.

Club Curie, the Douglass Math and Science House, began in 1987 as a community for 15 first- and second-year undergraduate women with an interest in math and science. Since then, Club Curie has grown into the Bunting-Cobb Math and Science Residence Hall. Bunting-Cobb Hall, which was dedicated in October 1989, fosters mentoring and peer support within a community residence. It houses 110 women: 100 undergraduates and ten graduate fellows as their mentors.

The Douglass Science Institute for High School Women serves 46 young women each year during a two-week residential program at Douglass. Incoming eleventh-graders take short courses in word processing and graphing techniques for lab reports, in microbial ecology, in lightwave communication, in math, and in molecular approaches to studying genes. They talk with women working in math and science careers. Activities also include field trips to corporate and natural sites, a science/math fair, and a group project, such as a newsletter. During the following year, participants return to Douglass with their parents and teachers, so that the Project supports a network of high school girls throughout New Jersey.

BOOK REVIEW

Educated in Romance: Women, Achievement, and College Culture, Dorothy Holland and Margaret Eisenhart, University of Chicago Press, 1990.

This is the account of an ethnographic study of twenty-three women with "strong academic records and career aspirations," which began in 1979 when each woman entered one of two Southern universities (one historically black, one white), and ended in 1987, with over two-thirds of them poorly prepared for careers. The study originated as an investigation of the reasons why so few women became scientists or mathematicians, but ended by revealing "young women's paths into traditional positions in society in general."

The women's views of the value of college work and its relation to their future careers were illuminating (and provide some explanation for students' widely varying responses to the same academic work). But the authors discovered to their dismay (both were and are university professors) that the "ethnographic work clearly told" them schoolwork was "relatively unimportant in students' lives, black and white."

What was important was the "sexually charged, peer-dominated world of gender relations," the world of romance, in which women are constantly judged on the basis of their sexual attractiveness to men, not on their intellectual abilities. Some women limited their involvement in this world by having absentee boyfriends or postponing wedding dates as long as possible; one participated in "man-hunting activities" but showed no interest in a romantic relationship during interviews.

> These women, most of whom were successful in school, were managing to control their involvement in heterosexual relationships, but as some of them found out, they could not remove themselves from the sexual auction block. They could not prevent themselves from being evaluated for their sexual attractiveness and treated primarily from the frame of sexualized gender relations. Several especially resented being treated by professors according to their sexual attractiveness. A number seemed to believe that sexual relations would become the frame of interaction between themselves and male professors or bosses at work, if and only if they wanted them to. Others ... were beginning to realize consciously that they as women were *always* vulnerable to being treated from the perspective of sexualized gender relations.

The few women who explicitly opposed aspects of this world acted as individuals; they sought and received no group support for their actions.

This phenomenon isn't limited to Southern universities. Holland and Eisenhart describe other studies of young women in Britain, Australia, and the U.S. which show a similar culture of romance, and similar outcomes.

The chapters on the study itself are well written and a pleasure to read. The chapter on the theoretical framework which the authors use to interpret their data is also well written, but not easy reading for those unfamiliar with social theories (the authors say it can be read after the account of the study, and I agree). However, I think it's worth taking the time to understand the social theory as well as the study presented in this book if one is interested in the problems of education.

by Cathy Kessel
Book Review Editor
2803 Parker, Apt. 2
Berkeley, CA 94704

EDUCATION COMMITTEE

The call has gone out to the mathematical education community from the National Council of Teachers of Mathematics, the Mathematical Association of America, and the Mathematical Sciences Education Board to reform the teaching of mathematics — to bring the real world into the math classroom more than ever before. The business and industrial community is supporting this movement with money and personnel. Corporations are investing funds and staff time to participate in innovative educational projects both in academic institutions and in their own facilities.

For instance, according to a very helpful survey by *Fortune Magazine* [see articles by Joel Dreyfuss, Susan Kuhn, and Andrew Kupfer in "Education, 1990," Spring issue] corporations such as Lincoln National in Indiana, Allied Signal in New Jersey, and Upjohn in Michigan, make their own professionals available to students and teachers for lectures, study and internships. Upjohn has also been instrumental in creating a magnet school for math and science, and Mobil has "adopted" fifteen schools in New York. Many others provide funds (often specifically targeted to women and minorities) for summer programs, scholarships, computers, and development of new materials.

To amplify the existing information on corporate investment in mathematical education, especially as it affects women, we would like to hear from AWM members who are involved in or have knowledge of such projects.

AWM Education Committee Survey

1. If you have information about a non-academic organization which is investing money and/or personnel in mathematical education for women at any level, please tell us some details.

2. If you are not a teacher, please tell us what kind of work you do.

3. If you are a teacher, please tell us your reaction to curriculum reform whose goal is the teaching of math substantially through applications.

Please mail your responses to AWM Education Committee, c/o Sally I. Lipsey, chair, 70 E. 10th St., #3A, New York, NY 10003-5102. Thank you.

by Sally I. Lipsey

NSF NEWS

NSF Proposal Format Changes

Early last fall some pending changes in the format of NSF proposals were announced. Originally scheduled to become effective on October 1, 1989, these changes raised many questions in the scientific community, and they were not implemented as planned. After reconsideration and revision, these provisions have been fully implemented on January 1, 1991.

There are two distinct components to the changes: 1) all renewal proposals, as part of the summary of progress under prior awards, must contain a statement about the impact on education and human resource development of the NSF-supported project for which renewal is being requested; all progress reports on continuing awards must contain a similar statement; 2) for all proposals, the format for the biographical sketch that accompanies the proposal has been revised.

Processing of proposals and continuing increments will be significantly delayed if items are missing or in an inappropriate format for review.

Here are some questions that should be addressed in impact statements: 1) To what extent were the (faculty) participants in this research directly involved in activities related to maintaining and broadening the pool of mathematically trained individuals at the precollege, undergraduate, graduate and postdoctoral levels?; 2) What was the impact of the award on that activity? Did it enable or inhibit it?; 3) Did students or postdoctoral researchers participate in the research program? How did this contribute to their training?; 4) Was there active participation of women, minorities, or disabled individuals in the project?; 5) What impact might the research outcomes themselves have on the educational process? For example, might the results of the research be useful in an undergraduate or graduate course or seminar? Might there be some implications for cross-disciplinary training?

The changes in the structure of the biographical sketch are being made to emphasize the role of quality of prior research and research training over quantity. Investigators are asked to delineate for reviewers what in their past work provides the clearest indication of the quality of their research as related to the specific proposal and more generally.

Molecular Evolution Workshop

A Molecular Evolution Workshop will be held August 18-30, 1991, at the Marine Biological Laboratory. It will consist of a series of lectures and discussions exploring multiple approaches to molecular evolution and a computer laboratory for phylogenetic and sequence analysis. This two week program is designed for established investigators, postdoctoral fellows, and advanced graduate students. Scientists with a strong interest in molecular evolution including organismic biologists, molecular biologists, and ecologists are encouraged to apply. In addition, mathematicians, statisticians and computer scientists with some background in molecular biology and with an interest in molecular evolution are encouraged to apply.

Topics to be covered include 1) the theoretical basis for comparative sequence analysis of proteins and nucleic acids, 2) the analysis of genomic sequence data and identification of homologous sequences, 3) the applicability of macromolecular sequences to phylogenetic analyses and contemporary approaches to molecular systematics, 4) the impact of molecular phylogeny data on understanding the ecology and evolutionary history of liming systems, 5) the use of model systems for the study of micro-evolution, 6) the evolution of chromosomes and genomes, and 7) current views on the evolution of mutation rates, introns, transposable elements, repeated DNA sequences, and multi-gene families.

Director: Mitchell L. Sogin, Marine Biological Laboratory

Tuition: $550, includes room and board. Limited financial aid is available to qualified applicants.

Application Deadline: June 1, 1991

For further information and application forms, contact: Florence Dwane, Admissions Coordinator, Marine Biological Laboratory, Woods Hole, MA 02543; (508) 548-3705, ext. 216.

GENDER DIFFERENCES IN MATHEMATICS PERFORMANCE: A META-ANALYSIS: Part 1 of 2

Reviewers have consistently concluded that males perform better on mathematics tests than females do. To make a refined assessment of the magnitude of gender differences in mathematics performance, we performed a meta-analysis of 100 studies. They yielded 254 independent effect sizes, representing the testing of 3,175,188 Ss. Averaged over all effect sizes based on samples of the general population, *d* was -0.05, indicating that females outperformed males by only a negligible amount. For computation, *d* was -0.14 (the negative value indicating superior performance by females). For understanding of mathematical concepts, *d* was -0.03; for complex problem solving, *d* was 0.08. An examination of age trends indicated that girls showed a slight superiority in computation in elementary school and middle school. There were no gender differences in problem solving in elementary or middle school; differences favoring men emerged in high school (d = 0.29) and in college (d = 0.32). Gender differences were smallest and actually favored females in samples of the general population, grew larger with increasingly selective samples, and were largest for highly selected samples and samples of highly precocious persons. The magnitude of the gender difference has declined over the years; for studies published in 1973 or earlier *d* was 0.31, whereas it was 0.14 for studies published in 1974 or later. We conclude that gender differences in mathematics performance are small. Nonetheless, the lower performance of women in problem solving that is evident in high school requires attention.

During the past 15 years, there has been much concern about women and mathematics. Since Lucy Sells (1973) identified mathematics as the "critical filter" that prevented many women from having access to higher paying, prestigious occupations, there has been much rhetoric and many investigations focused on gender differences in mathematics performance.

Particularly within the fields of psychology and education, gender differences in mathematics performance have been studied intensively, and there has been some consensus on the pattern of differences. Anastasi (1958), in her classic differential psychology test, stated that although differences in numerical aptitude favored boys, these differences did not appear until well into the elementary school years. Furthermore, she stated that if gender di erences in computation did appear, they favored females, whereas males excelled on tests of numerical reasoning. Concurring with this, Maccoby and Jacklin (1974) concluded that one of four sex differences that "were fairly well established" was that "boys excel in mathematical ability" (p. 352). They also noted that there were few sex differences until about ages 12-13. when boys' "mathematical skills increase faster than girls' " (p. 352).

Most recently, Halpern (1986) concluded that "the finding that males outperform females in tests of quantitative or mathematical ability is robust" (p. 57). She stated that the differences emerge reliably between 13-16 years of age.

The literature in education has reported conclusions that are basically in agreement with the psychological literature. In 1974, Fennema reviewed published studies and concluded that

> No significant differences between boys' and girls' mathematics achievement were found before boys and girls entered elementary school or during early elementary years. In upper elementary and early high school years significant differences were not always apparent. However, when significant differences did appear they were more apt to be in the boys' favor when higher-level cognitive tasks were being measured and in the girls' favor when lower-level cognitive tasks were being measured. (Fennema, 1914, pp. 136-137)

In the Fennema review, no conclusions were made about high school learners because of the scarcity of studies of subjects of that age. However, a few years later, Fennema and Carpenter (1981) reported that the National Assessment of Educational Progress showed that there were gender differences in high school, with males outperforming females, particularly in high cognitive-level tasks. This conclusion has been reported by each succeeding National Assessment (Meyer, in press).

Stage, Kreinberg, Eccles and Becker (1985), in a thorough review of the major studies that had been reported up to 1985, concluded that

> The following results are fairly consistent across studies using a variety of achievement tests: 1) high school boys perform a little better than high school girls on tests of mathematical reasoning (primarily solving word problems); 2) boys and girls perform similarly on tests of algebra and basic mathematical knowledge; and 3) girls

> occasionally outperform boys on tests of computational skills. ... Among normal populations, achievement differences favoring boys do not emerge with any consistency prior to the 10th grade, are typically not very large, and are not universally found, even in advanced high school populations. There is some evidence, however, that the general pattern of sex differences may emerge somewhat earlier among gifted and talented students. (p. 240)

Thus, although there are some variations, there is a consensus that, overall, gender differences in mathematics performance have existed in the past and are still present. Global conclusions tend to assert simply that males outperform females on mathematics tests. More refined discussions generally conclude that the overall differences in mathematics performance are not apparent in early childhood; they appear in adolescence and usually favor boys in tasks involving high cognitive complexity (problem solving) and favor girls in tasks of less complexity (computation).

Theoretical Models of Gender and Mathematics Performance

Theoretical models concerning gender and mathematics performance generally begin with the assumption that males outperform females in mathematics. The models are designed to explain the causes of that phenomenon. For example, Eccles and her colleagues (e.g., Eccles, 1987; Meece, [Eccles] Parsons, Kaczala, Goff, & Futterman, 1982) have built an Expectation × Value model to explain differential selection of mathematics courses in high school. Fennema and Peterson (1985) proposed an autonomous learning behavior model that suggested that failure to participate in independent learning in mathematics contributes to the development of gender differences in mathematics performance. Others have proposed biological theories focusing, for example, on brain lateralization (reviewed by Halpern, 1986).

This model building may be premature because the basic phenomenon that the models seek to explain — the gender difference in mathematics performance — is in need of reassessment, using the modern tools of meta-analysis.

Meta-Analysis and Psychological Gender Differences

The reviews cited previously have all used the method of *narrative review*. That is, the reviewers located studies of gender differences, organized them in some fashion, and reported their conclusions in narrative form. The narrative review, however, has been criticized on several grounds: It is nonquantitative, unsystematic, and subjective, and the task of reviewing 100 or more studies simply exceeds the human mind's information processing capacity (Hunter, Schmidt, & Jackson, 1982).

Meta-analysis has been defined as the application of "quantitative methods to combining evidence from different studies" (Hedges & Olkin, 1985, p. 13). In the 1980s, meta-analysis began to make important contributions to the literature on psychological gender differences (e.g., Hyde & Linn, 1986). Hyde (1981) performed a meta-analysis on the 16 studies of quantitative ability of subjects aged 12 or older that were included in Maccoby and Jacklin's (1974) review (12 being the age at which Maccoby and Jacklin concluded that the sexes began to diverge in mathematics performance). Hyde found a median effect size of .43 and noted that this difference was not as large as one might have expected given the widely held view that the difference is well established.

The Hyde (1981) meta-analysis included only studies reported through 1973, and thus there is a need to update it with recent research. Furthermore, the median value of d was computed on the basis of only seven values. In addition, statistical methods have advanced considerably since the time of the Hyde review. Hedges and his colleagues have developed homogeneity statistics that allow one to determine whether a group of studies is uniform in its outcomes (Hedges & Olkin, 1985; Rosenthal & Rubin, 1982a). Applied to the topic of gender differences in mathematics performance, these statistical techniques allow one to determine whether the magnitude of the gender difference varies according to the cognitive level of the task, the age group, and so on. Thus, modern techniques of meta-analysis can answer considerably more sophisticated questions than could the earlier meta-analyses and certainly more than could earlier narrative reviews.

Current Study

We performed a meta-analysis of studies of gender differences in mathematics performance. Our goal was to provide answers to the following questions:

1. What is the magnitude of gender differences in mathematics performance, using the *d* metric? We were chiefly interested in answering this question for the general population. However, we also provide analyses for selective samples.
2. Does the magnitude or direction of the gender difference vary as a function of the cognitive level of the task?
3. Does the magnitude or direction of the gender difference vary as a function of the mathematics content of the test (arithmetic, geometry, algebra, and so on)?
4. Developmentally, at what ages do gender differences appear or disappear, and for what cognitive levels?
5. Are there variations across ethnic groups in the magnitude or direction of the gender difference?
6. Does the magnitude of the gender difference vary depending on the selectivity of the sample, whether the sample is of the general population or of a population that is selected for high performance?
7. Has the magnitude of gender differences in mathematics performance increased or declined over the years?

Method

Sample of Studies

The sample of studies came from seven sources: (a) a computerized data base search of PsycINFO for the years 1967-1987, using the key terms *human-sex-differences* crossed with (*mathematics* or *mathematics-concepts* or *mathematics-achievement* or *standardized tests*), which yielded 198 citations; (b) a computerized data base search of ERIC, using the key terms *sex-differences* crossed with (*mathematics* or *mathematics achievement* or *mathematics-tests*), which yielded 435 citations; (c) inspection of all articles in *Journal for Research in Mathematics Education* and *Educational Studies in Mathematics*; (d) the bibliography of Maccoby and Jacklin (1974); (e) the bibliography c Fennema (1974); (f) norming data from widely used standardized tests; and (g) state assessments of mathematics performance.

In the case of the computerized literature searches, abstracts were printed for each citation. The abstracts were inspected, and citations that did not promise to yield relevant data (e.g., review articles or nonempirical articles) were excluded. All relevant articles were photocopied. Doctoral dissertations were obtained through interlibrary loan and were then inspected for the data necessary to compute effect sizes.

Only studies reporting psychometrically developed mathematics tests were included. Specifically, we excluded studies using Piagetian measures (e.g., the concept of conservation of number) because they assess a much different construct than do standardized tests. Grades, too, were excluded because they may measure a different construct, and because they are assigned more subjectively and may therefore be more subject to bias than are standardized tests. (See Kimball, 1989, for a review of gender differences in classroom grades; girls consistently outperform boys in mathematics grades.)

If an article appeared to have relevant data but the data were not presented in a form that permitted computation of an effect size, a letter was sent to the author at the address specified for reprints or at a more recent address found in the American Psychological Association *Membership Register* or the American Educational Research Association *Directory*.

Large-sample, normative data were obtained for the following widely used tests: American College Testing Program test (ACT), Graduate Management Admissions Test (GMAT), Scholastic Aptitude Test (SATQ), SAT Mathematics Level I and Level 2, Differential Aptitude Test (DAT), Graduate Record Examination (GRE-Q), GRE-Mathematics, California Achievement Test, and the Iowa Test of Basic Skills (ITBS).[1] Data from the National Assessment of Educational Progress (NAEP; Dossey, Mullis, Lindquist, & Chambers, 1988) were also included.

To obtain data from additional large-scale assessments, a letter was sent to one official of each state department of education and of the departments of education of the District of Columbia and the Canadian provinces of Manitoba, Nova Scotia, Ontario, and Saskatchewan (based on the 1987-1988 membership list of the

Association of State Supervisors of Mathematics), for a total of 55 letters. There were 29 responses, and nine states provided usable data: Alabama, Connecticut, Michigan, North Carolina, Oregon, Pennsylvania, South Carolina, Texas, and Wisconsin.

It is possible to obtain several independent effect sizes from a single article if, for example, data from several age groups (in a cross-sectional design) or several ethnic groups are reported. These groups can essentially be regarded as separate samples (Hedges, 1987, personal communication).

The result was 100 usable sources, yielding 259 independent effect sizes. This represents the testing of 3,985,682 subjects (1,968,846 males and 2,016,836 females). When data from the SATs were excluded (for reasons discussed later), there were 254 effect sizes, representing the testing of 3,175,188 subjects (1,585,712 males and 1,589,476 females).

Coding the Studies

For each study, the following information was recorded: (a) all statistics on gender differences in mathematics performance measure(s), including means and standard deviations or *t*, *F*, and *df*; (b) the number of female and male subjects; (c) the cognitive level of the measure (computation,[2] concepts, problem-solving, and general-mixed); (d) the mathematics content of the test (arithmetic, algebra, geometry, calculus, and mixed-unreported); (e) the age(s) of the subjects (if the article reported no age but reported "undergraduates" or students in an introductory college course, the age was set equal to 19; if a grade level was reported, 5 years was added to that level to yield the age: e.g., third graders were recorded as 8-year-olds); (f) the ethnicity of the sample (Black, Hispanic, Asian American, American Indian, White, Australian, Canadian, or mixed-unreported); (g) the selectivity of the sample (general samples, such as national samples or classrooms; moderately selected samples, such as college students or college-bound students; highly selected samples, such as students at highly selective colleges; samples selected for extreme precocity, such as the Study of Mathematically Precocious Youth; samples selected for poor performance, such as Headstart samples, low socioeconomic status samples, or remedial college samples; and adult nonstudent samples); and (h) the year of publication.

Interrater Reliability

Interrater agreement was computed for ratings of ethnicity, sample selectivity, cognitive level of the test, and mathematics content of the test. The formula used was Scott's (1955) pi coefficient, as recommended by Zwick (1988).

Pi was 1.00 for ethnicity, .90 for sample selectivity, .88 for cognitive level, and 1.00 for mathematics content. Thus, these categories were coded with high reliability.

Statistical Analysis

The effect size computed was *d*, defined as the mean for males minus the mean for females, divided by the mean within-sexes standard deviation. Thus, positive values of *d* represent superior male performance and negative values represent superior female performance. Depending on the statistics available for a given study, formulas provided by Hedges and Becker (1986) were used for the computation of *d* and the homogeneity statistics. All effect sizes were computed independently by two researchers, Janet Shibley Hyde and an advanced graduate student. There were discrepancies in fewer than 4% of the *d* values; these were resolved. All values of *d* were corrected for bias in estimation of the population effect size, using the formula provided by Hedges (1981). The complete listing of all studies, with effect sizes, is provided in Table 1 [ed. note: this table is too long to include in the *Newsletter*].

Results

Magnitude of Gender Differences in Mathematics Performance

Averaged over 259 values, the weighted mean effect size was 0.20. When data from the SATs (Ramist & Arbeiter, 1986) were excluded, the remaining 254 effect sizes yielded a weighted mean *d* of 0.15. In both cases, this small positive value indicates that, overall, males outperformed females by a small amount. When one looks just at samples of the general population, *d* was -0.05, reflecting a superiority in female performance, but of negligible magnitude.

We excluded the SAT data from the remainder of the meta-analysis for the following reason. The number of subjects in this group was so enormous (810,494) that they accounted for 20% of all subjects and, in a weighted means analysis, they exerted a disproportionate effect. We reserve a separate section of the discussion for the SAT data.

Overall, 131 (51%) of the 259 effect sizes were positive, reflecting superior male performance; 17 (6%) were exactly zero; and 111 (43%) were negative, reflecting superior female performance.

Homogeneity analyses using procedures specified by Hedges and Becker (1986) indicated that the set of 254 effect sizes was significantly nonhomogeneous, $H = 49{,}001.09$, compared with a critical value of $\chi^2(253) = 300$ (approximation), $p < .0001$. Therefore, we concluded that the set of effect sizes is heterogeneous and we sought to partition the set of studies into more homogeneous subgroups, using factors that we hypothesized would predict effect size. These factors are ones that have previously been shown to be important moderators of gender differences in mathematics performance (e.g., Fennema, 1974; Stage et al., 1985). Subsequently, we performed regression analyses to determine which variables are the best predictors of variations in *d*.

Cognitive Level

The results of the analysis of effect sizes, arranged according to the cognitive level of the test, are shown in Table 2. As in the overall analysis, the effect sizes are small. There is a slight female superiority in computation, no gender difference in understanding of concept, and a slight male superiority in problem solving. Oddly, the gender difference for tests with a mixture of cognitive levels (or no report of cognitive level) is largest, although still less than 0.25 standard deviation.

Homogeneity analyses indicate that there are significant differences between the four effect sizes shown in Table 1; the between-groups homogeneity statistic (H_B) was 7,479 compared with a critical $\chi^2(3) = 7.81$. However, it should be noted that the number of subjects and the number of effect sizes in this analysis is so great that small differences can be significant. In the succeeding analyses, H_Bs can be compared to see which between-groups effects are strongest. The cognitive-level effect is a large one compared with the others.

Mathematics Content of the Tests

The analysis according to the mathematics content of the tests was less successful because so many studies failed to report the mathematics content or used tests with a mixture of content. The results of the analysis are shown in Table 3. They indicate that there was no gender difference in arithmetic or algebra performance. The male superiority in geometry was small (0.13), and the tests with mixed content showed the largest gender difference.

Homogeneity analyses indicated that there was a significant difference between the effect sizes for

Table 2
Magnitude of Gender Differences as a Function of the Cognitive Level of the Test

Cognitive level	*k*	*d*	95% confidence interval for *d*	*H*
Computation	45	-0.14	-0.14 to -0.13	1,144*
Concepts	41	-0.03	-0.04 to -0.02	118*
Problem solving	48	0.08	0.07 to 0.10	703*
Mixed or unreported	120	0.19	0.18 to 0.19	39,557*

Note: *k* represents the number of effect sizes, *H* is the within-groups homogeneity statistic (Hedges & Becker, 1986).
* Significant nonhomogeneity at $p < .05$, according to chi-square test.

Table 3
Magnitude of Gender Differences as a Function of the Mathematics Content of the Test

Mathematics content	*k*	*d*	95% confidence interval for *d*	*H*
Arithmetic	35	0.00	-0.02 to 0.01	368*
Algebra	9	0.02	-0.08 to 0.11	8
Geometry	19	0.13	0.09 to 0.16	47*
Calculus	2	0.20	0.18 to 0.22	0.17
Mixed or unreported	190	0.15	0.15 to 0.15	48.064*

Note: Same as for Table 2.
* Significant nonhomogeneity at $p < .05$, according to chi-square test. All other categories are homogeneous.

the different types of math content, $H_B = 548$ compared against a critical $\chi^2(4) = 9.49$. This between-groups difference was smaller than most of the others.

Age Differences

The ages were divided into five subgroups: (a) 5-to 10-year-olds, (b) 11-to 14-year-olds, (c) 15- to 18-year-olds, (d) 19- to 25-year-olds, and (e) those 26 and older. These age groupings were chosen for two reasons. First, they correspond roughly to elementary school, middle or junior high school, high school, college, and adulthood. Second, some reviewers have asserted that there is no gender difference in mathematics performance until the age of 12, when it begins to emerge (e.g., Maccoby & Jacklin, 1974). Other reviewers believe that the difference does not emerge until the last 2 or 3 years of high school (e.g., Meece et al., 1982; Stage et al., 1985). Thus, it was important to have age categories reflecting these two hypotheses.

The results of the analysis for age categories are shown in Table 4. Overall, there was a small female superiority in the elementary and middle school years. There was a more substantial male superiority in the high school years, the college years, and beyond, although this last finding is based on relatively few effect sizes, most of them from the GRE.

Homogeneity analyses indicate that there are significant differences in the magnitude of the gender difference as a function of age group, $H_B = 37{,}669$ compared with a critical $\chi^2(4) = 9.49$. The age effect is strong.

The results of the analysis of Age × Cognitive Level of the Test interaction are also shown in Table 4. Females were superior in computation in elementary school and middle school, although all differences were small. There was essentially no gender difference at any age level in understanding of mathematical concepts. Problem solving, on the other hand, presents a different picture. There was a slight female superiority or no gender difference in the elementary and middle school groups; however, a moderate gender difference favoring males was found in the high school and college groups.

Ethnicity

The results for the analysis of gender differences as a function of ethnicity are shown in Table 5. Data for the SAT are provided by ethnic group and were coded in that manner for the present meta-analysis. Two effect sizes are

Table 4
Magnitude of Gender Differences as a Function of Age and Cognitive Level of the Test

Age group	All studies	Cognitive level: Computation	Concepts	Problem solving
5-10	-0.06 (67)	-0.20 (30)	-0.02 (33)	0.00 (11)
11-14	-0.07 (93)	-0.22 (38)	-0.06 (28)	-0.02 (21)
15-18	0.29* (53)	0.00 (12)	0.07 (9)	0.29 (10)
19-25	0.41 (31)	NA	NA	0.32 (15)
26 and older	0.59 (9)	NA	NA	NA

Note: NA = not available; there were two or fewer effect sizes, so a mean could not be computed. k is shown in parentheses, where k = number of effect sizes on which the computation of the mean was based.
* Data for the Scholastic Aptitude Test were excluded in the computation of this effect size.

Table 5
Magnitude of Gender Differences as a Function of Ethnicity

Ethnic group	d_1	d_2	H
Black	0.23 (22)	-0.02 (21)	219*
Hispanic	0.30 (21)	0.00 (20)	157*
Asian American	0.29 (5)	-0.09 (4)	15*
White	0.41 (14)	0.13 (13)	152*
Australian	0.11 (7)	0.11 (7)	31*
Canadian	0.09 (5)	0.09 (5)	21*
American Indian	0.44 (1)	NA	
Mixed or unreported	0.15 (184)	0.15 (184)	48,114*

Note. NA = Not available; no effect size was available in this category. d_1 = the mean for all effect sizes, d_2 = the mean effect size excluding Scholastic Aptitude Test (SAT) data, H = homogeneity statistic based on data excluding the SAT. All samples are from the United States unless otherwise indicated. k, the number of effect sizes on which each mean is based, is shown in parentheses.
* Significant nonhomogeneity at $p < .05$, according to chi-square test.

provided: d_1 is the mean of all effect sizes including the SAT, and d_2 is the mean of effect sizes excluding the SAT.

When the SAT data were excluded, there was essentially no gender difference in mathematics performance for Blacks, Hispanics, and Asian Americans. Indeed, the 95% confidence interval for d covers 0 for both Blacks and Hispanics. The slight difference for Asian Americans favored females. Only for White Americans was there evidence of superior male performance, and the difference was still small. The mean effect size for American Indians should not be taken too seriously because it is based on a single value.

Homogeneity analyses, using the data set excluding the SAT, indicated that there were significant differences between ethnic groups in the magnitude of the gender difference, $H_B = 293$ compared with a critical $\chi^2(6) = 12.59$. Ethnicity was not one of the stronger effects.

Selectivity of the Sample

The analysis for the magnitude of the gender difference as a function of the selectivity of the sample is shown in Table 6. Notice that the gender difference was close to zero (favoring females slightly) for general samples; a larger gender difference favoring males was found for each successive level of selection for higher ability. The gender difference was moderate to large for highly selected samples ($d = 0.54$) and for samples selected for extreme precocity ($d = 0.41$). Also note that the great majority of samples (184) in this meta-analysis were general and unselected. Not surprisingly, the greatest heterogeneity of effect sizes was for the general samples.

Table 6
Magnitude of the Gender Difference as a Function of the Selectivity of the Sample

Sample	k	d	95% confidence interval for d	H
General	184	-0.05	-0.06 to -0.05	5,461*
Moderately selective	24	0.33	0.33 to 0.34	290*
Highly selective	18	0.54	0.53 to 0.54	1,674*
Precocious	15	0.41	0.39 to 0.43	211*
Selected for low performance	12	0.11	0.04 to 0.18	24*

Note: k represents the number of effect sizes, H is the within-groups homogeneity statistic (Hedges & Becker, 1986).
* Significant nonhomogeneity at $p < .05$, according to chi-square test. All other categories are homogeneous.

Homogeneity analyses indicated that there were significant differences in effect size depending on how selective the sample was, $H_B = 41{,}341$ compared with a critical $\chi^2(4) = 9.49$. Sample selectivity was one of the large effects.

When the interaction of sample selectivity and cognitive level was examined, it was apparent that the effects of sample selectivity were found most strongly for problem solving. For such measures, the magnitude of the gender difference varied from 0.02 for general samples to 0.43 for highly selected samples.

Year of Publication

Studies were divided into two subgroups depending on the year of publication: those published in 1973 or earlier and those published after 1973. We chose 1973 as a divider between older studies and more recent ones because it marked the last year that was included in the Maccoby and Jacklin (1974) and Fennema (1974) reviews.

For studies published in 1973 and earlier, d was 0.31, based on 37 effect sizes. For studies published in 1974 or later, d was 0.14, based on 217 effect sizes. Thus, the data show both the increase in research on gender and mathematics and a substantial trend for smaller gender differences in more recent studies.

Regression Analysis

In view of the fact that the first homogeneity analysis indicated that, overall, the set of effect sizes was nonhomogeneous, multiple regression analysis was used to construct a model of the sources of variation in effect sizes (Hedges & Becker, 1986). The effect size was the criterion variable. On the basis of the results of the categorical analyses reported previously, we performed an initial regression analysis using the following predictors: age of subjects, year of publication, ethnicity of sample, selectivity of sample, cognitive level of the test, mathematics content of the test, and the Age × Cognitive Level interaction. The regression analyses were conducted by using the GLM procedure in the SAS statistics program. Repeated regression analyses indicated that the SAT data were having a disproportionate effect on the results, particularly in terms of the strength of the ethnicity variable, because of the large sample size. Thus, the SAT data were deleted in the final multiple regression analysis. In addition, those few studies in which the sample had been selected for poor performance were also deleted, because they did not fit conceptually with the ratings of samples for increasingly greater selectivity for high performance. For the final regression analysis, predictors that were nonsignificant in previous analyses were deleted.

The result was a simple, well-defined equation in which 87% of the variance in d was predicted by three variables: subjects' age, selectivity of the sample, and cognitive level of the test. All three were significant predictors; age was the strongest predictor, $F(1,232) = 1{,}174.04$, $p < .0001$, followed by sample selectivity, $F(3,232) = 113.22$, $p < .0001$, which was followed by cognitive level, $F(3,232) = 7.88$, $p < .0001$. (Sample selectivity and cognitive level were coded as class variables.)

Notes:

1. Although we tried to sample broadly over the major standardized tests, the number of these tests is great and it was not feasible to report data for all. In some cases, the test publisher was not able to provide the needed data. In other cases, we did not wish to include too many tests by the same publisher with the same format, thereby weighting those tests too greatly. For example, we include the GMAT but not the Law School Admission Test (LSAT) or the Medical College Admission Test (MCAT). All are published by Educational Testing Service and are similar in the quantitative portion, in content and format. Furthermore, all include selective samples, although it is difficult to assess the degree of selection for mathematics performance. Therefore, we included the GMAT but not the LSAT or MCAT. Because our major interest was in assessing the magnitude of gender differences in mathematics performance in the general population, inclusion of data from tests (e.g., the MCAT) based on very selective samples was counterproductive.
2. The definitions of the cognitive levels were as follows: *Computation* refers to a test that requires the use of only algorithmic procedures to find a single numerical answer. *Conceptual* refers to a test that involves analysis or comprehension of mathematical ideas. *Problem solving* refers to a test that involves extending knowledge or applying it to new situations. *Mixed tests* include a combination of items from these categories.

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

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

NAME A FEATURE OF VENUS FOR A MATHEMATICIAN

The public has been invited to propose names of notable women for the many impact craters and large volcanic vents being discovered on Venus by the Magellan spacecraft's imaging radar.

Names for Venusian features will not be considered until the International Astronomical Union meets in 1994. Names proposed this year, if accepted as provisional by the Working Group for Planetary System Nomenclature, may be used on published maps and articles, pending IAU approval.

Many features on Venus, by international agreement, are named for goddesses of ancient religions and cultures. But craters and volcanic calderas or vents are named for actual women.

There are stipulations, however. Women must have been deceased for at least three years and must have been in some way notable or worthy of honor.

Names of military or political figures of the 19th and 20th centuries are forbidden under IAU rules, as are the names of persons prominent in the six main living religions. Names of a specific national significance also are not allowed.

When a name is submitted, her birth and death years and a one or two sentence written rationale for the honor should be given, along with a reference book citation, if available.

So here is our chance to write the names of some women mathematicians on the map of Venus. Submissions should be sent to: Venus Names, Magellan Project, Mail Stop 230-201, CalTech JPL, 4800 Oak Grove Drive, Pasadena, CA 91109.

Reprinted from JPL Universe, *March 15, 1991. Thanks to Carol Collins for bringing it to our attention.*

BRIEF NOTES

Two universities have recently adopted "tenure clock" policies. Information is available from Claire Wagner, Miami University, Oxford, OH 45056 and from Paul Sugrue, Vice-Provost, Office for the Executive Vice-President and Provost, University of Miami, 240 Ashe Building, Coral Gables, FL 33124.

Gender in the Classroom: Power and Pedagogy, ed. by Susan L. Gabriel and Isaiah Smithson, University of Illinois Press.

Senta Troemel-Ploetz, "Mileva Einstein-Maric: The woman who did Einstein's mathematics," *Women's Studies International Forum*, vol. 13, no. 5, 1990.

Developments in School Mathematics Education Around the World, Volume 2, edited by Izaak Wirszup and Robert Streit, NCTM, 1991. Available from: NCTM, 1906 Association Drive, Reston, VA 22091.

Transcending Boundaries: Multidisciplinary Approaches to the Study of Gender, edited by Pamela Frese and John Coggeshall, Bergin and Garvey, 1991. Available from: Greenwood Publishing Group, Inc., 88 Post Road West, Box 5007, Westport, CT 06881.

Gender and Mathematics, edited by Leone Burton, Cassell, 1991. Available from: Publishers Distribution Center, P.O. Box C831, Rutherford, NJ 07070.

The following are available from the National Women's History Project:

Charlene Billings, *Grace Hopper: Navy Admiral and Computer Pioneer*, grades 5-12

Valjean McLenighan, *Women and Science*, grades 4-8

Barbara Shiels, *Winners: Women and the Nobel Prize*, grades 7-12

Virginia Slachman, Susan Edeen, and John Edeen, *Portraits for Classroom Bulletin Boards: Women Mathematicians.*

The Equity Institute, *American Women in Science Biographies*, grades 1-4.

The Equity Institute, *You Can Be a Scientist, Too!*, video for grades 1-6.

The catalogue of the National Women's History Project can be obtained for $1.00 from National Women's History Project, 7738 Bell Road, Windsor, CA 95492-8518.

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MEREDITH COLLEGE. Full time tenure track faculty position in Computer Science beginning August 1991. To teach undergraduate computer science courses and take a leadership role in the development of the computer science and information systems curricula. PhD preferred. Salary and rank based on qualifications and experiences. Send letter of application, resume, and three letter of reference to: Dr. Virginia Knight, Head, Department of Mathematics and Computer Science, 3800 Hillsborough Street, Raleigh, NC 27607-5298.

OAKLAND UNIVERSITY. Prof./Assoc. Prof in appl. stat. Duties include research, teaching, consulting and coordination of graduate programs and industrial contracts. B.S. and M.S. degrees in applied statistics are active and a PhD program is planned. Contracts with the auto industry for teaching, consulting and student interns are funded. Demonstrated leadership experience and significant scholarly record in a relevant applied statistics area is required. Areas of research preferred are reliability, warranty forecasting, time series, robust procedures, experimental design, or statistical process control. Send resume and names, addresses, and telephone of 4 references to Dr. Darrell Schmidt, Acting Chair, Oakland University, Dept. of Math. Sciences, Rochester, MI 48309-4401. Applications reviewed until position is filled.

OREGON STATE UNIVERSITY. A Postdoctoral position is available for new or recent PhDs in atmospheric or related physical sciences to conduct research on the analysis of global air-sea interaction using satellite data. The position will be funded from interdisciplinary grants to researchers in the OSU College of Oceanography and the Department of Atmospheric Sciences. The position is initially limited to one year, but may be renewable through numerous ongoing research projects in the area of satellite remote sensing. The salary will be set at a level which takes into account the individual's experience. Priority will be given to applications received by May 15, 1991, and the appointment may begin as early as June 1991. Those wishing to be considered should send a resume, a statement of research goals and the names of three individuals who would be willing to write letters of reference to: Professor S.K. Esbensen, Department of Atmospheric Sciences, Oregon State University, Strand Agriculture Hall, Room 326, Corvallis, OR 97331-2209. (503)-737-5687.

SOUTHERN ILLINOIS UNIVERSITY AT CARBONDALE. Department of Mathematics anticipates temporary positions starting on August 16, 1991 as Lecturer. Masters degree in mathematics or admission to candidacy required; PhD preferred. Applicants should provide evidence of excellence in teaching and foreign applicants must provide evidence of ability to teach in English effectively. Preference given to applicants with research interests compatible with those of the faculty. The duties will consist of 12 hours of undergraduate mathematics instruction each semester. Closing date May 15, 1991 or until positions are filled. Send applications (including transcripts) to: Temporary Positions, c/o Ronald Kirk, Chair, Department of Mathematics, Southern Illinois University at Carbondale. Carbondale, Illinois 62901.

UNITED STATE MILITARY ACADEMY. The Dept. of Math. Sciences of the United States Military Academy invites applications for the position of Visiting Professor. The Visiting Professorship is a one-year position designed to bring educators with a variety of educational backgrounds into the Department. We continually seek individuals with strong interests in teaching, a desire to become involved in curriculum development, and research interests which complement those in the Department of Mathematics for this ongoing annual position. The position requires education to the PhD level as well as experience as an educator. Transportation cost to and from West Point are paid. Family quarters are available for rent on Post. Send Curr. Vitae to: Dept. of Mathematical Sciences, Thayer Hall, United States Military Academy, West Point, New York 10996-1786.

WAYNE STATE UNIVERSITY. Dept. of Computer Science invites apps. and nominations for the pos. of Computer Science Dept. Chair. Candidates must exhibit a distinguished research record as well as a commitment to teaching and strong administrative skills. A Ph.D. in Computer Science or a related field is expected. Letters of application including names of three professional references should be sent to: Dr. L.D. Favro c/o Maureen Schore, Wayne State University, Dept. of Computer Science, 431 State Hall, Detroit, MI 48202.

TRINITY COLLEGE - CLARE BOOTHE LUCE PROFESSOR OF MATHEMATICS

Trinity College is pleased to announce a search for a Clare Boothe Luce Professor of Mathematics. Under the guidelines of the Selection Committee of the Henry Luce Foundation, the Luce Professor must be a scientist or mathematician early in her career, and the appointment is to the tenure track at the assistant or associate level as appropriate. The designation as a Luce Professor has a term of five years, after which the appointee continues as a regular tenure track member of the faculty contract. Final appointment of the Luce Professor of Mathematics at Trinity is subject to approval of the candidate by the Selection Committee of the Henry Luce Foundation. Trinity seeks a mathematician with expertise in analysis or algebra. An earned doctorate in mathematics is required, and some teaching experience is preferred. Letters of application, resumes, and the names of at least three references should be submitted to: Clare Boothe Luce Professor Search Committee, Trinity College, Box 1000, Washington, D.C. 20017

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Association for Women in Mathematics

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Association for Women in Mathematics

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The **AWM Directory of Women in Mathematical Sciences** will be updated and published bi-annually beginning in 1991. Please indicate below if you would like your name, address and areas of interest included in the 1991 Anniversary Edition.

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47 Operator theory
49 Calculus of variations and optimal control; optimization
51 Geometry
52 Convex sets and related geometry topics
53 Differential geometry
54 General topology
55 Algebraic topology
57 Manifolds and cell complexes
58 Global analysis, analysis on manifolds
60 Probability theory and stochastic processes
62 Statistics
65 Numerical analysis
68 Computer science
70 Mechanics of particles and systems
73 Mechanics of solids
76 Fluid mechanics
78 Optics, electromagnetic theory
80 Classical thermodynamics heat transfer
81 Quantum mechanics
82 Statistical physics, structure of matter
83 Relativity
85 Astronomy and astrophysics
86 Geophysics
90 Economics, operations research, programming, games
92 Biology and behavioral sci.
93 Systems theory; control
94 Information and communication
001 Education: K-8
002 Education: 9-12
003 Education: Undergraduate
004 Education: Graduate
005 Gender issues
006 Affirmative action
007 History of women in math sciences
008 Other (please specify): ____________

Association for Women in Mathematics
Box 178 Wellesley College
Wellesley, MA 02181
(617) 237-7517

Women Graduate Students and Postdocs* in Applied Mathematics

The Association for Women in Mathematics is pleased to announce an AWM Workshop on Sunday, July 7, 1991 at the Washington Sheraton Hotel, Washington, DC immediately preceding the 2nd International Conference on Industrial and Applied Mathematics. ICIAM 91 will be held from July 8 - 12, 1991 at the same location.

The National Science Foundation and the Office of Naval Research are providing funds for travel and subsistence and registration fees for 10 women graduate students and 10 women postdocs [received their PhD within approximately the last five years] to attend the AWM Workshop and ICIAM 91. [Call the AWM office to see if all the funds have been awarded.] The Workshop will provide opportunities for women to discuss their research and to participate in a number of other events during the day. There will be a panel to discuss research funding, the graduate school environment, and pipeline issues, a luncheon, and a special program and dinner where participants will have the opportunity to meet women in the SIAM leadership.

All mathematicians (female and male) are invited to attend the entire program (and we hope you will!) even though only 20 women will be funded. Departments are urged to help graduate students and postdocs obtain some institutional support to attend the workshop and the ICIAM meeting that follows.

The Workshop Registration will take place Saturday evening 7-9 p.m. and Sunday morning from 8-9 a.m. at the Washington Sheraton Hotel. There is no charge for the Workshop. Lunch will be provided. There will be a charge for the dinner Sunday evening.

Direct any questions regarding funding or the AWM Workshop program to Patricia N. Cross at the AWM office 617-237-7517.

AWM Workshop, July 7, 1991

Second International Conference on
Industrial and Applied Mathematics
July 8-12, 1991
Sheraton Washington Hotel
Washington, DC, USA

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AWM
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