File

Association for Women in Mathematics

Volume 10, Number 3 NEWSLETTER May-June 1980

* *

LETTER FROM THE EDITOR

There's no president's report this issue, so I'm grabbing the front page to make a couple of requests. I'm no investigative reporter, so I'm pretty much dependent on what passes across my desk or under my nose when I put the Newsletter together. Thanks to all of you who have been sending me material. If there is an article you'd like to write, or if you know someone you think might write a good one, let me know about it. Also, if you see something in another publication that you think might be worth reprinting, send it to me. I'm especially interested in receiving articles about our mathematical heritage as women, for instance the articles that appear in this issue about Lise Meitner and about black women Ph.D.'s.

Lenore Blum and others have suggested that the Newsletter could become a forum on AMS issues that affect AWM. It would help AMS Council members and committee members if they know what most concerns us. I'm not exactly sure what the best format for this project would be. Perhaps a good start would be a letter column for the exchange of ideas. Sympathetic AMS officers could then give their reactions and/or report on AMS actions.

Anyway, folks, this is your newsletter, and I can use all the help I can get.

The Frontiers of Knowledge, edited by Judith Stiehm, University of Southern California Press, September 1976

The Frontiers of Knowledge is a collection of autobiographical essays based on a series of lectures sponsored by USC's Mortar Board and delivered by Antonia Brico, Cynthia Fuchs Epstein, Mildred Dresselhaus, Celeste Ulrich, Laura Nader, and Florence Howe, each of whom discussed how she came to her profession, how her work is conducted, and where the current boundaries lie in her field. I've had my copy for a while, but at the time I received it, it could be ordered by writing to Women's Studies, University of Southern California YWCA, University Park, Los Angeles, CA 90007.

I recommend this book wholeheartedly. The essays are all well-written. The women's fields are musical conducting, sociology, solid-state physics, physical education, anthropology, and education. It is interesting to see, despite the disparity of fields, the similarity of the struggles of these women against cultural and social norms. It is clear that they believe that increased participation by women in intellectual life will expand the frontiers of knowledge.

Brico's essay is the most anecdotal and flamboyant. If you have seen Judy Collins's movie Antonia, Portrait of the Woman, you will have a good idea of its tone. Her main message is never to be deflected from what you want to do. "If you want to do something you can't just say, 'I want to do it.' You have to be prepared. You have to study. As a woman you even have to know five times as much as a man. You have to believe in what you're doing. You don't say, 'Do I have talent?' You say, 'I want to do it. I'm going to leave no stone unturned to better myself. I want to do it, and I will do it.' Let that be my final word to you. 'Prepare, and then do it.'"

A Russian Childhood by Sofya Kovalevskaya, translated, edited and introduced by Beatrice Stillman, with an analysis of Kovalevskaya's mathematics by P. Y. Kochina, USSR Academy of Sciences, Springer-Verlag, 1978

I can't help but like Sofya Kovalevskaya. It turns out that one of her earliest childhood memories is of an atrocious pun; I think about that "sand"wich at Jones Beach when I was three and feel myself a kindred spirit. If you are looking for a full-scale biography of Kovalevskaya, you won't find it here. But the book is a fun-to-read account of the childhood of a fascinating woman, accompanied by some biographical data and some mathematics. Most of the book is the delightful childhood memoir; her interest in mathematics is mentioned only in one chapter about one of her uncles. (It is not clear how much effect the fact that her nursery was papered with a calculus text when she was eleven had on her mathematical development. "I would stand by the walls for hours on end, reading and rereading what was written there. I have to admit that I could make no sense of any of it at all then, and yet something seemed to lure me on toward this occupation.") An Autobiographical Sketch, written about a year before she died, is a fairly short account of her mathematical career. She does not, however, go into much detail about the many difficulties she faced. Stillman gives an account of some of these in her introduction. Polubarinova-Kochina sketches some of Kovalevskaya's work on the problem of the motion of a heavy rigid body near a fixed point and some of her other work in partial differential equations.

The I Hate Mathematics! Book by Marilyn Burns, illustrated by Martha Hairston, Yolla Bolly Press, 1975

I stumbled onto this book while bookstore-browsing one day (it was right next to T.A. for Tots). I know at least two other mathematicians who have heard of it, but I'd like to let the rest of you in on it. It starts out, "Some of the nicest people hate mathematics. Especially kids who think mathematics = arithmetic." It goes on from there to "several hundred mathematical events, gags, magic tricks, and experiments." It's a fun book with some real math in it. If you know a kid who hates math, or maybe even a kid who loves it, or an adult who can be told "I know it's a kid's book, but...", this book is well worth $4.95. (Actually, I bought it for myself, and it was still worth $4.95.)

Anne Leggett
Math. Dept.
Western Illinois Univ.
Macomb, IL 61455

AAAS NEWS RELEASE

Under a contract from the Department of Health, Education and Welfare, the AAAS Office of Opportunities in Science has recently begun a project to facilitate the inclusion of women, minority and handicapped scientists and other professionals on the advisory and review panels within HEW. This technical assistance project will involve four major components: 1) the solicitation of resumés from minority, women and handicapped scientists for inclusion in the NIH computerized registry; 2) workshop sessions for agency personnel having responsibility for identifying and recruiting individuals for committees on how to locate minority, women and handicapped scientists; 3) direct assistance in identifying persons for consideration for specific panels where vacancies occur during the project; and 4) the development of a guide for future use on how to identify and recruit minority, women and handicapped scientists. If you have received a request directly from NIH for reviewer information, we would encourage you to respond to them. Otherwise please send all information, resumés, and requests to us c/o Karen Ehrlich, Technical Assistance Project, AAAS Office of Opportunities in Science, 1776 Massachusetts Avenue, N.W., Washington DC 20036 (202/467-5438).

NEWS FROM THE MEMBERSHIP

Ann Arbor Summer Meeting

The highlight of AWM activities will be a Symposium on the life and work of Anna Johnson Pell Wheeler. (There is biographical and bibliographical information compiled by L. Grinstein and P. Campbell in this Newsletter, September and November, 1978.) She is the only woman to have presented the AMS Colloquium Lectures prior to those scheduled by Julia Robinson for this summer. We are especially delighted that Wheeler's great-niece, Nancy J. Owens, and Ruth S. McKee (a Noether thesis student at Bryn Mawr) will join the biographers in talking. Some of Professor Wheeler's former students and colleagues will share reminiscences; we invite responses from or about such people (address below).

There will be a general membership meeting, and we hope that people will enjoy visiting as they staff the table, as usual. There is a need for someone to help with the early table staffing and party arrangements. Please let me know if you will be at the meeting the first day and/or live in that area and can help some.

Bettye Anne Case
2405 Idyllic Terrace
Tallahassee, FL 32303

AWM at Florida Section MAA Meeting March 7-8

Elizabeth Magarian, Stetson University, arranged a panel discussion (Elinor V. Bowman, a consulting actuary; Bettye Anne Case, from a community college; Jean Larson, from a university; Betty Lichtenberg, from mathematics education) which was followed by a spirited question session. MAA President Dorothy Bernstein attended, and commented on the MAA (IBM-supported) Women and Mathematics lectures in high schools. M. Repsher, K. Timmer, M. Jones, B. Mather, and Magarian agreed to set up a session at the 1981 meeting, possibly with a mathematical talk.

Report of local AWM meeting by Susan Montgomery, USC, Los Angeles

The AWM of Southern California held a meeting on March 8, 1980 at California State University, Northridge, in conjunction with the spring meeting of the MAA, Southern California Section.

The meeting was on "Non-academic Employment for Mathematicians", and consisted of informal discussion with women mathematicians employed in industry. Representing Aerospace Corporation, Inc., were Sherry Green, Elizabeth Ralston, and Marie Smith; from Hughes, Barbara Gregoire; from JPL (Jet Propulsion Lab), Diane Schwartz; and from Pacesetters, Inc., Sue Bienkowski. Each person discussed how she got her job and what her work was like, and overall it was quite informative and interesting. Two points made repeatedly: (1) women with only bachelor's degrees in math are appreciated in many areas, such as computer sales, for their technical background, and (2) mathematicians in industry usually function as problem-solvers for others such as engineers.

Report on a Chicago Area AWM Meeting by Bhama Srinivasan, Univ. of Ill., Chicago Circle

A meeting of AWM was held at the University of Illinois, Chicago Circle on Saturday, January 19, 1980. About 30 women were present at the meeting and some came from as far as Urbana and Notre Dame. Louise Hay inaugurated the meeting. She said that one of the achievements of AWM in the last decade has been to make more women visible in the mathematical community as members of AMS committees, hour-speakers at AMS meetings, etc., and that our next efforts should be towards increasing the sheer numbers of women doing mathematics, in academia or elsewhere. I gave a brief report on the San Antonio meeting, touching mainly on the lectures of Jessie MacWilliams and Dana Angluin. Jeanne Kerr of the University of Chicago gave a talk about her work; she gave an example of a Goldie ring such that the 2x2 matrix ring over that ring is a non-Goldie ring. This had been an unsolved problem for about 20 years. Then Judith Baxter, Jeanne Kerr and Nancy Johnson took part in a panel discussion on "Combining a mathematical career with a family", with Jeanne LaDuke acting as moderator. There were several lively comments from the audience. We ended the meeting with an enjoyable lunch at a nearby restaurant.

Phyllis Chinn, Associate Professor, Humboldt State University, Arcata, CA would like help putting pressure on John Wiley & Sons, Inc., Publishers, 605 Third Avenue, New York, NY 10016. Her recent letter to them reads: Thank you for the poster "The Faces of Calculus". I am very disappointed to see no female faces on the poster. Perhaps Emilie du Chatelet who translated Newton and advocated his ideas in France is worthy of inclusion, or Sophie Germain. I would be delighted to see a revision correcting this omission.

Women in Science by Alice Fins (VGM Career Horizons, 8259 Niles Center Road, Skokie, IL 60077, 154 pp., $5.75 paper, $7.25 cloth) combines general career information with ten biographical chapters about women working in biology, chemistry, geology, astronomy, physics, mathematics, and computer science. The woman representing mathematics is Joan Rosenblatt of the National Bureau of Standards.

The book is addressed primarily to high school students, perhaps also to their parents and teachers. In the chapter on "getting a good job," re-entering the work force is briefly discussed. There is a list of associations and committees that can provide additional information, including the AWM, the MAA Committee on Women in Mathematics, and the Bay Area Math/Science Resource Network.

LETTER TO THE EDITOR

I am writing to (i) convey some news, (ii) express thanks, and (iii) request some suggestions.

(i) News. (a). The first item is very sad. Dr. Marjorie Lee Browne, Professor at North Carolina Central University, died October 15. I hope that AWM will be among the organizations to persuade someone to write an appropriate obituary. [Ed. note: Pat Kenschaft is already planning on doing this.] Dr. Browne deserves to be better known in the general mathematical community. Born in Memphis, graduated from Howard University, she earned the Ph.D. at the University of Michigan in 1949. That same year, Dr. Evelyn Boyd (now Granville) earned hers at Yale University. These two colleagues thus became simultaneously the first Black women ever to receive Ph.D.'s in mathematics in the U.S.

(b). Academician P. Polubarinova-Kochina (this is a combination she often uses of her maiden and married names) celebrated her 80th birthday May 13, 1979. On this occasion, a leading Soviet journal, Uspekhi Mathematiceskii Nauk., published a commemorative article (v. 34, 1979, pp. 217-220). This will soon be available in English, since this journal is translated under the title Russian Mathematical Surveys. In addition to the achievements in applied mathematics and mechanics which led to her election to the Academy of Sciences of the USSR (and to the accompanying life-time stipend of 500 rubles per month), she is well-known also for her brief biography of Sofya Kovalevskaya, an English translation of which was published in 1957. A few years ago she published a volume of personal reminiscences, illustrated by her own sketches, including a description of the development of her interest in Kovalevskaya and the preparation of various published materials about her. More recently, she contributed as an appendix an appreciation of Kovalevskaya's research to the new translation of Kovalevskaya's Reminiscences of a Russian Childhood. [Ed. note: see letter from the editor.]

(c). Professor Beatrice Lumpkin of Malcolm X College (a component of the Chicago city system of public higher education) has published an article on "History of Mathematics in the Age of Imperialism" in Science & Society, 1978, a journal not widely known in mathematical circles and perhaps not even processed by Mathematical Reviews. Professor Lumpkin provides information, in this and other publications, useful to those interested in knowing and teaching the extensive historical mathematical developments in Africa and Asia.

(d). A mathematician, Professor Yvonne Choquet-Bruhat, has just become the first woman ever elected to the French Academy of Sciences in its 300 years of existence. Among her specialties is the mathematics of general relativity. Even Mme. Curie, twice winner of the Nobel Prize, was refused election. This recognition of Professor Choquet-Bruhat brings to mind the failure of the Consultative (=scientific program) Committee of the International Congress of Mathematicians (Helsinki 1978) to include any women on its roster of invited speakers. This failure was criticized in a formal (but little publicized) resolution adopted by the large audience which attended an unofficial panel on Women in Mathematics held during the Helsinki Congress.

(ii). Thanks. To AWM as an organization and to my co-members go my thanks for the support which resulted in my recent election to the Council of the American Mathematical Society for a three-year term which began January 1, 1980.

(iii). A request. In this connection, I wish to ask both the organization and any individual AWM member, please to send me suggestions and comments concerning issues either before the AMS, or which ought to be raised at Council (which meets January, April, August) in furtherance of the AWM program. [Ed. note: see letter from the editor for related request.] Supporting documentation, preferably quotable, would be appreciated. Please remember that agenda items must normally be submitted to the Council at least one month before the meeting at which they are to be discussed.

I look forward to your help and repeat my thanks for your confidence and support.

Cordially, Lee Lorch, York University, Downsview, Ontario, Canada

BLACK WOMEN IN MATHEMATICS

We publish here the concluding two talks of the AWM panel "Black Women in Mathematics" held at the joint annual meetings in Atlanta on January 7, 1978. The first three speakers were Eleanor Jones of Norfolk State College in Virginia, Geraldine Darden of Hampton Institute, and Evelyn Roane of Northern Virginia Community College. Their talks were published in the September, 1978, issue of this Newsletter.

Pat Kenschaft of Montclair State College in New Jersey was the organizer, moderator, and editor. In her introductory remarks she mentioned that when the topic of "Black Women in Mathematics" was first suggested someone responded, "the null set?". Pat now knows of 17 American Black women holding a Ph.D. in pure mathematics. In the 1970 decennial census over 1100 Black women reported they were "mathematicians."

The fourth speaker was Dr. Elayne Idowu from the University of Pittsburgh. She received her doctorate in finite groups from the University of Cincinnati.

We panelists are all present on this stage as black women mathematicians, yet I recently heard someone state that Blacks just don't make good mathematicians. Even more recently, I heard someone say that he had never met a good woman mathematician. These two statements caused me to reflect on the two most prevalent forms of discrimination in our society -- racial and sexual -- and on the fact that as black women most of us have had to take a double dose. I perceive that the real question here tonight is what bearing that double dose of discrimination has had on our ambitions and abilities to become practicing, contributing mathematicians.

I can only tell you of my personal experiences. I was born and raised in the North, near Pittsburgh, Pennsylvania, and I always attended integrated schools -- in general, about 80% white and 20% black. Those of us who were black knew that we could never be cheerleaders or majorettes, and especially not angels in the school Christmas play. Racial discrimination was there and we had to accept it. I even had to accept it when there was no valedictorian the year that I graduated first in the class. But all in all, I don't think I felt any lasting bad effects from my school days because, in general, the teachers seemed to encourage everyone to do her best academically.

When I graduated from high school, I went to the University of Pittsburgh School of Engineering. About that time I received a lot of letters and a big dose of sexual discrimination. I first received a letter telling me that I had been awarded an Honor Scholarship by the University. I later received a letter informing me that I had been chosen by the University as the recipient of the Mesta Machine Company Scholarship which provided more benefits than the Honor Scholarship, which would be rescinded. The choice had been made on the basis of high school grades and college board scores. Several days later I received yet another letter. I was to be given back the Honor Scholarship because Mesta Machine Company refused to give their scholarship to a female. Mesta had hoped that the recipient of their scholarship would spend many years of employment with them as an engineer and a female just wasn't a suitable candidate.

This experience had several adverse effects that I feel might be illustrative of what discrimination can do. First of all, I felt resentful -- I resented the white male who received "my scholarship", as I thought of it. I had classes with him and often heard him boast about the great scholarship that he had "won". Secondly, I felt compelled to prove that I could do anything that the male students could do (often collectively). They were not friendly and I didn't ask them any questions, lest they think that I was not capable of doing my own work. In effect, I was isolated, and it was me against all of them. In thinking back, I suppose that the worst effect of my undergraduate experiences was the lack of intellectual exchange with my peer group. Finally, when I graduated, I couldn't find out my class rank because girls were not rated in the School of Engineering.

I worked for more than seven years as an aerospace engineer without any particularly illuminating experiences. One of my last bad experiences came after I had been admitted as a doctoral student in mathematics.

Several of my instructors advised me early in my first term to take the preliminary examinations which were to be offered soon. I decided to confer first with the professor whom I anticipated would be my thesis advisor. He warned me that the failure rate on the examinations was about 50% in general and about 98% among "housewives like you". I had never thought of myself as a "housewife" since I was an engineer and did the same things as the men in my office. My would-be advisor suggested that I spend at least a year taking courses from those who would likely prepare the examinations to enhance my probability of passing. I followed this advice (much to the consternation of my husband, who said it was the first time he had seen me show a lack of confidence) and wasted a year with the suggested study. This professor soon left the University and I was fortunate in choosing a thesis advisor who was most supportive.

From my personal experiences I have concluded that those who are inclined to state that Blacks or women cannot make good mathematicians tend to make a self-fulfilling prophecy. For one placed in isolation with little or no intellectual exchange and her confidence constantly undermined has little chance of succeeding. And these are the conditions that such people tend to create.

I know that with the enlightened attitudes which are prevailing the set of black women in mathematics -- which I am told someone once believed to be the null set -- could well become a dense set.

The final panelist was Dr. Dolores Spikes of Southern University. She received her Ph.D. in mathematics from Louisiana State University, and her specialty is commutative ring theory.

I can sympathize with all of the former speakers' problems because they all sound alike to me. They remind me of a non-Black male accountant who thought that women ought not to be mathematicians and Blacks ought not to be mathematicians. I didn't know what his religious convictions were, but I wasn't about to tell him about my Vatican connections!

However, I don't want to talk to you right now about my own personal experiences because I think you have heard them all. I would like to speak about two things. One is the problems that an existing Black woman mathematician faces and the other is suggestions for how we can have more Black women studying mathematics at the graduate level.

One problem of Black women mathematicians is lack of a Ph.D. degree or delayed Ph.D. training, creating a void in the participation of these women in professional activities such as that we see in the organizations that have met here this week. Were it not for the fact that there are five Black women on this panel, I doubt that we would see so many Black faces in this audience. I am delighted to have been asked to serve on this panel, because I would not have been here otherwise. I came to one of these meetings about 15 years ago and I guess I wondered why I had not been back until I came today. But I am glad that I am back.

Another problem is that Black women mathematicians generally work in institutions with high teaching loads, thus limiting their ability to create mathematics, and to become what in the minds of many of you are "real mathematicians." Somehow some people don't regard persons who have had training in mathematics but who somehow can't get around to doing research as "real mathematicians."

Another problem is that because of race and other societal influences Black women mathematicians usually must engage themselves in activities outside mathematics that take up much of their time so they have a limited amount of time to devote to mathematics and mathematical professional organizations.

Another problem is the lack of role models. When I finished my Bachelors degree at Southern University in 1957, I journeyed to the University of Illinois where I studied for the Master of Science degree in mathematics. That was to be the end of my training because I had never known a Black Ph.D. in mathematics. I did a few years later, but not at that time. Certainly I had known no Black women mathematicians.

I tell you this with the knowledge that Southern University, located in Baton Rouge, is the largest predominantly Black university in the country, and that it sits in a city with another institution of higher education that does offer a Ph.D. degree. But through the years that institution has failed to respond to the needs of Black mathematicians. In 1971 when I received a doctorate in mathematics from that institution, I was the first Black to do so and even the first graduate of Southern University to do so.

I am not proud of that fact. I regard it as a shame -- a blight on the state of Louisiana and on education in general. I say to you that many of the men that we honor as outstanding mathematicians in these organizations that have met here this week could not pass a test in human rights.

Another problem in the recruitment of Black women mathematicians is often job offers. About 80 or 90% of our students are on financial aid. That means they come to us with the expectation that in a few years they will be able to earn a little money and indeed live a little more decently than they have in the past. So when the lure of a job comes to them upon receipt of their B.S. degree, they are sometimes hesitant even to think about going to graduate school.

Well, what can be done about these problems? I think that there is an excellent opportunity for training in the mathematical areas of new emphasis -- for example, in applied mathematics -- in institutions that hire predominantly Black faculty members or with student bodies of the Black race. I say that there is an opportunity for training because you will find that in these institutions the percentage of Ph.D.'s in mathematics, particularly among women, is very low. So that gives us an excellent opportunity now to suggest that they become trained in areas in which we need more mathematicians.

What's needed? Well, we need money. But we need more, too. Many of these Black women are in their mid-thirties or forties or more and would love to have more training, but they aren't just going to track off and leave their families and go to school. I think we have to be more innovative in our approach to the problems they are having.

Maybe we can go to them. Maybe we could send visiting specialists, have on-site programs, prepare materials for self-study, and run seminars for these students. I think that this is the way the professional organizations such as the AMS, the MAA, and the AWM can help these institutions.

I believe that the mathematical societies should also encourage a direction of more funds from funding agencies such as the NSF to the kinds of projects that I have just enumerated. Another thing I think that these organizations can do very well is to provide more information to these scholars and to college administrators. Part of our

problem is that we are at a standstill in these colleges because college administrators don't really know what the plight of Black women mathematicians is. We can tell them, but I think that the news coming from a professional organization would hit them much more solidly and I think that they would be more likely to receive it and perhaps act on it.

I think that the organizations could consider a voluntary accreditation program. My reason for suggesting this is that I think this would be particularly beneficial to Black institutions. In states that still have predominantly Black schools they will always come out on the short end of the funding, but I have noticed that in those subject areas that have accredited agencies, even with volunteers, they come out a bit better in the distribution of money. I think we should all give some serious consideration to a voluntary program of that nature.

Lastly, I would suggest that the mathematical community initiate a massive public media campaign. I think that we ought to let the media know what our problems are and what the possible solutions are. We need to translate our problems into something the public can understand.

I want to thank you for having us here. It's been fun, and I hope to be back again.

GRANT INFORMATION

The Bunting Institute at Radcliffe College has received a grant from the Office of Naval Research for postdoctoral fellowships for women scientists. They are two-year fellowships in the physical sciences and natural sciences. The stipend is $16,000 per year plus some funds for travel. The applicants must have held the Ph.D. no longer than five years. Apply to: Postdoctoral Program for Women Scientists
Dr. Marion Kilson, Director
Bunting Institute, Radcliffe College
3 James St.
Cambridge, MA 02138.

LISE MEITNER (1878-1967) - THE EARLY YEARS PART I

by Pat Rife
Pat is currently a doctoral student in the Union Graduate School. Her field is Social Thought, and she is writing a biography of Lise Meitner, analyzing the cultural influences of her development as a woman scientist. Pat plans to take classes at Harvard and the Univ. of Pennsylvania in the History and Sociology of Science and Mathematics.

> Science usually advances by a succession of small steps, through a fog in which even the most keen-sighted explorer can seldom see more than a few paces ahead. Occasionally the fog lifts, an eminence is gained, and a wider stretch of territory can be surveyed--sometimes with startling results. A whole science may then seem to undergo a kaleidoscopic rearrangement, fragments of knowledge being found to fit together in a hitherto unsuspected manner. Sometimes the shock of re-adjustment may spread to other sciences; sometimes it may divert the whole current of human thought.
>
> Sir James Jeans
> Physics and Philosophy

The physicist Arnold Sommerfeld was once quoted as saying: if you want to be a physicist, you must do three things -- first, study mathematics, second, study more

mathematics, and third, do the same.[1] Within the late 19th century in Austria and Germany, such advice was well heeded by young (male) scientists. With major discoveries appearing on the horizon in the realm of physics and mathematics, a generation of students who wished to be well-versed in the laws and symbols of our universe applied themselves to the study of mathematics with a rigor and sense of enthusiasm well justified. And in Vienna, a shy, dark woman was applying herself with equal stamina to her studies and university preparation.

Lise Meitner, born on November 7, 1878 (one year earlier than the famed Einstein and von Laue), was the third of eight children baptized in the Meitner family. Her father, a lawyer of Jewish background, wished Lise to prepare for the state examination in French so that she could support herself as a language teacher if the need should arise. Early in her life, however, she became fascinated by mathematics and physics. But it was only after she acquired her degree for teaching that she was allowed to prepare herself for the so-called "Matura", the exam which would qualify her for the university. She completed that training in two years of very intensive work -- which normally took a student eight years in the Austrian high school. Her brothers and sisters used to tease her, saying "Lise, you are going to flunk, you have just walked through the room without studying."[2] Out of the fourteen girls who took the test, she was one of only four who "got through". In her remembrances of the experimental physics professor who taught her and the other women students at the time, Lise Meitner recollects:

> "...for the most part all one was given were figures and diagrams of apparatus, and I must confess that I did not always gain from these a correct idea of the shape of the apparatus in question. Today it amuses me to think of the astonishment with which I saw any certain apparatus for the first time."[3]

But, due to the "ideas which were then generally held with regard to women's education"[4] it was not surprising that this student with a "marked bent for mathematics and physics" was surprised to see an "actual laboratory" of equipment even though she had been studying experimental problems.

Meitner began her studies at the University of Vienna in 1901, studying and attending lectures in mathematics, physics and philosophy (still a compulsory subject). She began studying theoretical physics under the famous Ludwig Boltzmann, and heard his lectures from 1902 until his death in 1906 - lectures which ranged from topics in thermodynamics and statistics to his advocacy of the atomic theory of matter. After Boltzmann's death, Max Planck came to Vienna to look over the Institute for Theoretical Physics. This raised Meitner's desire to spend several semesters in Berlin, in order to gain a "real understanding of physics." But this came about only after she had been prompted to do her first individual work in Boltzmann's Institute in the field of heat conduction in non-homogeneous materials, a subject set by her professor, for which she received her doctoral degree in 1906.[5]

Female candidates for a doctoral degree were quite out of the ordinary at this time in Vienna. The first woman postgraduate had been Gabriele Baronin Passander (medicine, 1897); Adele Grafin Wartensleben (classics) had been a pioneer in the faculty of philosophy; and Olga Steindler was the first woman to gain a doctorate in physics in 1903. Lise Meitner and Selma Freud followed in 1906.[6] In the year between the award of her degree and the meeting of Planck, Meitner worked intensively on methods of measuring radioactive matter in the absorption of x- and B- radiation. When she sought to go to Berlin, her parents complied with a small allowance, and what was to be a two-term visit turned into a 31-year stay! Meitner states:

> "When I registered with Planck at the University in Berlin, so as to attend his lectures, he received me very kindly and soon afterwards invited me to his home. The first time I visited him there, he said to me: 'But you are a Doctor already! What more do you want?' When I replied that I would like to gain some real understanding of physics, he just said a few friendly words and I did not pursue the matter any further. Naturally I concluded that he could have no very high opinion of women students, and possibly that was true enough at the time."[7]

Yet Planck, discoverer of the quantum constant (h) of action and the founder of the quantum revolution in physics, was to be a main influence on Meitner in the following years, and she and many of the advanced students learned to see beyond Planck's staid "reserve" to his true character. She relates: "He enjoyed cheerful company, and his house was the center of good companionship. In the summer we ran races in the garden and Planck joined in with an almost childlike eagerness and pleasure..."[8]

In 1908, Meitner took her first collaborative step, when the young chemist Otto Hahn (1879-1968), fresh from advanced work with the jovial New Zealander, Rutherford, at Cambridge, England, expressed interest (through her professor Rubens) in working with her in the field of radioactivity. The only difficulty, Meitner recalls, was that:

> "...in the course of conversation, Hahn, (who had been given a place at the chemical institute directed by Emil Fischer) told me that Emil Fischer did not allow any women students into his lectures or institute. So Hahn had to ask Fischer whether he would agree to our starting work together. Afterwards ...I went to Fischer to hear his decision and he told me that this reluctance to accept women students stemmed from an unfortunate experience he had had with a Russian student, because he always worried lest her rather exotic hairstyle would result in her hair catching alight on the Bunsen burner."[9]

But Fischer finally agreed to Meitner's working with Hahn if she promised not to go into the Chemistry Department "where male students worked and where Hahn conducted his chemical experiments." "Our work," she recalled, "was to be confined to the so-called carpenter's shop."

This basement workshop, fitted out as a room for measurements on radiation, was where Meitner worked until 1909. When women's education at the university level was officially sanctioned in the Prussian city of Berlin in late 1908/09, Fischer lifted his restriction, but Meitner and Hahn continued their work in the small carpenter's shop up until 1912.

Yet even under such segregated working conditions, Meitner states that she did not feel isolated due to the group of mathematicians and physicists which met weekly in self-organized colloquia, viewed by Meitner as a "quite exceptional intellectual center." It was not unusual during these weekly gatherings in bustling Berlin to hear the physicist James Franck lecture on ionized energy, to see von Laue demonstrate X-ray inferences, hear the famous Nerst debate with Planck, sitting intently in the front of the circle, and later to hear the young Einstein discourse on and argue his favorite theories.

All the while, Lise Meitner and Otto Hahn continued their research, first on B(beta) rays (which, according to theory, should have been absorbed by a substance in accordance with exponential law), and later, on the so-called line spectra of beta radiation. In 1912, at the age of 34, Meitner became Planck's assistant at the new Kaiser Wilhelm Institute of Chemistry, part of the University of Berlin. That same year, Hahn was given a small section to supervise in radiochemistry, and was made an academic member (later chief) of its staff.[10]

When war broke out in 1913, Meitner attended special X-ray courses in Berlin, and volunteered as an X-ray nurse until 1917 in Austrian hospitals at the front; Hahn was assigned to a group working on offensive and defensive measures in gas warfare. Hahn had married in 1913, and later he and his wife had two fine sons. But even under wartime conditions, Hahn and Meitner continued to meet to work in Berlin when possible, searching for the "mother" substance of actinium, an alpha-emitting substance. Hahn observed in his later autobiography that Meitner always had been a quite shy individual, and that their working relationship was just that--to the extreme that in their early years of workshop collaboration, when they would work every night until 8:00 p.m., that one of them would quickly run to the local grocery for meats and cheese before the stores closed, and that afterwards "Lise Meitner would go to her house, and I would go home to mine."[11] But their working relationship persisted; the theoretical physicist Meitner making mathematical sense out of the chemical experiments and results found by her and Hahn; each in turn utilizing experimental and theoretical calculations in their inquiry into atomic structure. Before the end of WWI, they could point conclusively to the radioactive source of actinium, which was dubbed "protactinium", the longest-lived isotope of the element 91.

In 1918, Meitner was appointed head of the Physics Department of the Kaiser Wilhelm Institute. Her pedagogical talents found focus when she was awarded in 1922 the venia legendi, the German universities' certificate which permitted a young "Doktor" to lecture (without pay). Meitner's little-known contributions during this period include her lectures on radiation, ionization processes, questions in atomic physics, and radioactivity, as well as her collaboration with Szilard, London, and Kallman in the early 1930's. Meitner was awarded the Liebniz Medal of the Berlin Academy of Science in 1924, the Leiber Prize of the Austrian Academy of Science in 1925, and earned the title of Professor Extraordinare at the University of Berlin in 1926.

During these years, Otto Hahn had been appointed Director of the Kaiser Wilhelm Institute for Chemistry, and it was not until 1934 that Hahn and Meitner again became a research team. Yet Meitner saw the years up to 1934 as extremely stimulating. Her Physics Department needed and developed complicated apparatus after the war for experimental work. A strong solidarity built on mutual trust grew up between students and faculty, although Meitner observed that the staff was "not entirely united in its political views" during those years.[12] Many exciting developments in mathematics and physics were emerging in the late 1920's and early 30's: David Hilbert was working in Gottingen, and the gentle Dane, Niels Bohr, whose work with the electron and atomic nucleus led to an explanation of atomic structure through Planck's quantum theory (and also gave a solid base to the periodic table of the elements) was beginning to gather a school of young physicists and mathematicians around him in Copenhagen. Wolfgang Pauli, Werner Heisenberg, Gamow, Placzek and Frisch were some of the "students" who later became noted authorities themselves. The world of mathematics, theoretical and experimental physics saw new surprises with each conference and publication.

In 1933, the Seventh Council of Physics met at the famed Solvay International Conference. In attendance were such notables as Madame Curie and her daughter and son-in-law, Irene and Pierre Joliet-Curie, who were tracing many of the same problems in radiochemistry as were Hahn and Meitner; Bohr and his school; the honorable Lord Rutherford; the genius de Broglie; Schrodinger; Chadwick; and Dirac: only Einstein was conspicuously absent. During the Sixth Solvay Council, a virtual summit meeting in 1930, Niels Bohr had "thrown down the gauntlet"[13] with an account of the epistemological problems leading from the latest developments in quantum physics. As the heated discussions over the three-day period drew out the subtle philosophical issues involved in high-energy physics and quantum calculations, Einstein repeatedly affirmed that "God does not play dice with the Universe." His discomfort with the riddles of indeterminancy and uncertainty principles carried through to the Seventh Solvay Conference, and Einstein waged a long campaign in this respect to the end of his years. In a speech given three years after Einstein's death, the physicist Max Born states:

> "A man of Einstein's greatness, who has achieved so much by thinking, has the right to go to the limit of the a priori method. Current physics has not followed him; it has continued to accumulate empirical facts, and to interpret them in a way which Einstein thoroughly disliked. For him a potential or a field component was a real natural object which changed according to definite deterministic laws. Modern physics operates with wave functions which, in their mathematical behavior, are very similar to classic potentials, but do not represent real objects. They serve for determining the probability of finding real objects, whether these are particles, or electromagnetic potentials, or other physical quantities."[14]

Meitner, of course, was witness to and participant in these debates with her friends of long standing, all of whom had so much invested in unlocking the time-honored secrets of the constitution of matter itself. Although her belief in the ultimate simplicity of nature had led her astray in regard to the distribution of energy of primary electrons,[15] she was correct in her theory that electron lines were generated from the outer electron shell. She measured the electron lines of actinium to demonstrate that they were produced from the shells of the newly formed--rather than decaying--nucleus. Meitner thus showed that gamma rays follow upon radioactive transformation, rather than acting as the "triggering mechanism" for it, as others had suggested.[16] She further observed and

correctly interpreted those radiation-less transitions in which an electron, on dropping into a vacancy in an inner shell, ejects another electron from the atom, a phenomenon usually named for Auger, who independently described it in a totally different context about two years after Meitner's discovery. In 1933, after she had encouraged her students to use the neglected Wilson's cloud chamber (overlooked since 1911), in her own investigations Meitner was the first to observe and report on positrons formed from gamma rays.

Nuclear physics and its mathematical counterparts advanced dramatically in the 1930's: the neutron was discovered in 1932, the positron in 1933, and artificial radioactivity in 1934. Meitner and her colleagues published "a number of short papers in light of these rapid developments."[17] In 1934 Meitner resumed her work with Hahn to follow up results obtained by the Italian physicist Enrico Fermi. Fermi had been subjecting elements to bombardment by neutrons instead of by beta and gamma rays. When he bombarded uranium with neutrons, he had found several radioactive products which he thought might be due to a "transuranic" element, since neutron bombardment had invariably led to "the formation of a heavier, usually beta-radioactive, isotope of the bombarded element."[18]

In his investigation of this phenomenon, Hahn discovered several decay products for uranium, some of which were presumed to be "transuranic", all with atomic numbers greater than 92. He and Meitner set out to isolate such elements by precipitating an irradiated and acidified uranium salt solution with hydrogen sulfide in order to eliminate all elements between polonium (84) and uranium (92);[19] they assumed that the remaining precipitate must contain only "transuranic" elements. But a surprising piece of news came to them in the late months of 1938 from the French team of Irene and Pierre Joliet-Curie, news on irradiating uranium with penetrating beta rays--news of a substance with a half-life of three and a half hours, a substance similar to lanthanum, almost half-way down the periodic table of the elements.[20] However, Hahn and Meitner's work was interrupted. The storm clouds raised by Hitler and the enactment of the nazi racial laws began to draw near. Although raised as a Protestant, Meitner had never concealed her Jewish origin. (Her Austrian citizenship gave her some leeway for freedom.)

The years of collaboration in the 1930's demonstrated Meitner's authority in her field and with her research team. In 1935, a young physical chemist named Fritz Strassman was called on to join the team and was employed as an assistant; he had refused a lucrative industrial position due to the prerequisite of joining a nazi organization. Skilled in chemical analysis, he formed the connecting link between the fields of his older team members. Contrary to Otto Hahn's statements of later years, Lise Meitner, in the eyes of Strassman, was the intellectual leader of the team. Their signatures under announcements and directions on the bulletin board were regularly falsified to read "Otto Hahn, 'read' Meitner." Most of the papers signed "Hahn and Strassman" were written by Hahn without being shown to Fritz Strassman. Meitner's frequent saying: "Hahnchen, leave that to me, you have not the faintest notion about physics!" became almost proverbial among the staff.[21] It was Lise Meitner who instigated the joint studies on the "transuranics". Up to her departure from Germany in July, 1938, the puzzle of the uranium nucleus had still not been solved.

Next issue: Meitner's escape from nazi Germany; the discovery of nuclear fission.

Bibliography

1. Sommerfeld's advice was cited in an interview by Daniel Kelves with Paul H. Kirkpatrick. Kelves, D., The Physicists: The History of a Scientific Community in Modern America, Vintage Press, 1979
2. Frisch, Otto, What Little I Remember, Cambridge Univ. Press, 1979 - recollections by Meitner's famous nephew
3. Meitner, Lise, "Looking Back", Bulletin of Atomic Scientists, November, 1964, p. 2
4. Meitner, Lise, "Lise Meitner Looks Back", the International Atomic Energy Agency Bulletin, Vol. 6, No. 1, January, 1964, p. 4

5. Krafft, Fritz, "Lise Meitner: Her Life and Times--On the Centenary of the Great Scientist's Birth", Angewandte Chemie, International Ed. in English, Vol. 17, No. 11, 1978, pp. 826-842.
6. ibid.
7. & 8. "Lise Meitner Looks Back", p. 5
9. "Looking Back", p. 5
10. Krafft, op. cit.
11. Hahn, Otto, Scientific Autobiography; Dietrich Hahn, Otto Hahn: Begründer des Atomzeitalters, List Verlag, München, 1979
12. "Looking Back", p. 6
13. Clark, Ronald, Einstein: The Life and Times, Avon, 1971, pp. 416-419
14. ibid.
15. Frisch, O., "Meitner", Dictionary of Scientific Biography, ed. by C.C. Gillispie, Vol. IX, pp. 260-263
16. ibid., p. 261
17. ibid., p. 262
18. ibid., p. 262
19. ibid. (This search for "transuranics" makes interesting reading in this period - little documented today in this age of "corrected" history.)
20. ibid., p. 262; Robert Reid, Madame Curie, Signet, 1974
21. ed. note: missing from typescript; see next issue.

CLIMBING THE ACADEMIC LADDER: DOCTORAL WOMEN SCIENTISTS IN ACADEME: part three

a report to the Office of Science and Technology Policy from the Committee on the Education and Employment of Women in Science and Engineering Commission on Human Resources, National Research Council, National Academy of Sciences, Washington, DC, 1979
Tables too numerous to duplicate have been omitted.

THE SUPPLY OF WOMEN DOCTORATES (Chapter 2)

An assessment of the supply of women doctorates in the various fields of science is essential to an understanding of the career paths of women scientists and an analysis of their relative opportunities. It has long been evident that women constitute small fractions of those earning science doctorates though their numbers vary greatly by field. Some of the factors associated with this have been indicated in Chapter 1.

The proportion of women doctorates in science compared with the baccalaureate pool is actually much lower than has been recognized so far. The fact that the percentages of science doctorates granted to women have approached or exceeded the levels of the 1920's in the last few years has been widely regarded as a sign of considerable progress; indeed it is much better than the dismal record just after World War II. However, the levels of the 1920-1929 decade must be compared with the relative supply of baccalaureates then and now; during the earlier period only about half as many women as men completed college, while today their numbers are about equal. The ratio of women doctorates to women baccalaureates is still dramatically smaller than it used to be. Examination of the ratios for men and women in recent years shows that the proportion of women B.A.'s who complete Ph.D.'s is still less than half the proportion of men. Nevertheless, while the ratios have steadily declined for both sexes over the last five years, the ratio for men has declined at a much faster rate.

The very low rate of participation in graduate study by women following World War II is largely a result of well-documented overt sex discrimination practiced for many years in some graduate science departments (see, for example, the essays by Evelyn Fox Keller and Naomi Weisstein in Working it Out). Conversely, the high growth rate since the late

1960's of women doctorates in science can be ascribed in large measure to the exposure and consequent easing of overt bias even before 1972, as well as to general changes in the social climate.

A 1972 study found the ratio of graduate school acceptances to applications to be slightly greater for women than for men (Solmon, 1976, p. 43). It has been pointed out, however, that in some cases, basing admissions on the number of applications of each sex still produced acceptance of poorer male students while better women candidates were rejected (Cross, 1973, p. 41). Since the women applicants must therefore have been a better pool, this result suggests that they may have different perceptions of the standards for viable candidacy. At present we lack the data to tell us how such self-selection operates--the degree to which it is a relatively independent decision of the potential applicant, though reflecting earlier educational experience, and the extent to which it is mediated through advisers and others.

A question of particular interest is whether significant changes took place in the graduate admissions patterns and practices of the distinguished universities whose undergraduate bodies were either exclusively or predominantly male before 1968. Similarly, the graduate education patterns of the new alumnae from these institutions should be followed closely; it is possible that they differ significantly from those of the past, when women had no general access to these undergraduate training opportunities. If that proved to be so, it would suggest accelerating the currently slow movement toward equal access to these universities.

Another issue of importance in graduate training is equality of access to financial support. Aid in the form of fellowships appears to be comparable in amount for men and women but somewhat different in kind, with more men more likely to receive research assistantships and women teaching fellowships (Survey of Earned Doctorates, 1977). Such a difference may have far-reaching effects in establishing patterns of interest and actual quality of graduate training, and requires further investigation. Student loans were less accessible to women until the advent of recent state and Federal legislation prohibiting sex discrimination in credit. The relationship of the recent availability of loans to women to rates of initiation and completion of graduate studies requires further study.

The relative low proportion of women graduate students in the two decades before 1970 is currently reflected in their small representation on faculties (see Chapter 4) which may in turn create a less favorable learning environment for women students (Chapter 1). The need for maintenance of an adequately trained scientific work force, in view of declining enrollments, suggests that more attention be devoted to the recruitment and retention of women graduate students.

Recruitment of women science students must also deal with the competition of professional training in law and medicine, which is attracting many of the ablest students, both women and men, but particularly women. The more limited job opportunities in the 1970's in the sciences have led to increased competition and lower confidence in scientific career prospects. A greater likelihood of being able to combine career and family responsibilities successfully in an independent profession may also contribute substantially to women's heightened interest in these fields. Unless better career prospects in science can be made evident to outstanding women students, they will have little incentive to pursue graduate training. The possibility that job openings in science may not expand and the near certainty that academic opportunities will contract make it more important to seek all of the best possible talent, not less.

In this chapter we look at the contenders at the start of their professional careers --young women and men just emerging from doctoral training--to see how evenly matched they are and whether they can fairly expect equal opportunities.

1. Comparative Quality of Women and Men at the Doctorate

No standard has yet been devised by which to measure the scientific promise of young researchers. Failing that, we use certain commonly measured characteristics such as grades and test scores, rank of institution or department granting the Ph.D., length of time taken to complete the degree (or its close relative, age), and stated future

aspirations. All of these characteristics are open to a variety of interpretations: high grades may connote intellectual brilliance or mere diligence, average ones an average mind or an exceptional but unchallenged one; rapid completion of a thesis may be the result of luck as much as high motivation or inspired solutions. Nonetheless, the combination of intellectual ability, short time lapse to the Ph.D. (more commonly thought of as youth), and training at an outstanding department is generally thought of as a promising one.

A. Academic Ability

To the extent that grades and test scores are indicators of academic ability, women doctorates are a more promising group than men. Harmon found that for those in every field the high school grades, class rank, and standardized test scores of doctorate women far outranked those of comparable men (1965, pp. 28-32).

In the period covered by his work, careers in science were considered especially inappropriate for married women; the fact that married women appear at the top of the ability rankings of doctorate recipients at the same time that scientific careers were considered inappropriate for them supports the hypothesis that they were determined to succeed in the face of major obstacles.

The differences in mean ability between men and women doctorates that are illustrated here must be viewed in the context of the very different sizes of the two groups. The distinctions are indeed less sharp among the social scientists, with larger ratios of women Ph.D.'s than among biological scientists. As the number of all Ph.D.'s and the proportion of women Ph.D.'s has increased since the 1959-1962 period, a new study would indicate whether differences in ability patterns have narrowed.

A large-scale national study, the 1969 Carnegie Survey of Higher Education, found similar sex differences in the undergraduate grades of the graduate students in the study. It was found that 52 percent of the women graduate students, but only 37 percent of the men, had undergraduate grade point averages of B^+ or better (Feldman, 1974, p. 18). These findings are consistent with the greater degree of selectivity in women's admissions mentioned previously.

B. Length of Study, and Age at Ph.D.

Elapsed time from baccalaureate to doctoral degree is very similar for male and female scientists and the differences have changed direction over the last ten years. In several fields, women now take less time than men. Only in the medical sciences do women take substantially longer. In social sciences, psychology, and mathematics, women in the 1977 cohort showed less elapsed time than those of the 1967 cohort in completing their degrees. The trend is reversed for women in physics/astronomy. Men, however, increased the time from the earlier to the later cohort in nearly every field. The only field in which men reduced their B.A.-to Ph.D. time lapse was the medical sciences, and this reduction accounts for most of the present difference between the sexes.

A similar pattern with respect to field differences and changes since the earlier period characterizes the median age of 1977 men and women doctorates. In most fields, the differences in median age are small and favor women. The exceptions are psychology, in which the median age of women is slightly higher, and the medical sciences in which it is substantially higher.

C. Institutional Origins of Doctorates

Male and female doctorates in each field are similarly distributed according to the institutions or departments in which they were trained. The percentages of degrees granted to all doctorates and to women by all universities and by AAU universities are compared in two recent three-year periods, by broad fields. During the period from 1970 to 1972, in the life sciences, and more noticeably in the social sciences, a higher proportion of women than of all doctorates received degrees from AAU universities. There was no difference in the field of engineering while in the physical sciences, a smaller percentage of women than of all doctorates received degrees from AAU universities. For the later period, the picture had changed. In every field, a larger proportion of women Ph.D.'s than of all Ph.D.'s received their degrees at AAU universities. The difference was particularly marked in the field of engineering despite the small numbers of women involved.

A more detailed comparison of degrees granted in selected individual fields by departments rated highly by Roose-Andersen is given. In the six fields examined, the highest-rated departments produce major fractions of women Ph.D.'s, ranging from about one-third to one-half of the total. The table illustrates some interesting differences among disciplines, which we shall see reflected later in employment figures (Chapters 3 and 4), as well as trends over time.

Before these differences and changes are described, it should be noted that with some variation, the percentages of both sexes trained by these highly rated departments dropped over the ten-year period, most notably in the case of psychology where graduate enrollments increased sharply in the decade. In mathematics, larger proportions of men than of women have been trained in highly rated departments and the difference has become slightly bigger as more women have gone into the field and pressures for equal access have mounted. With the exception of the initial period, highly rated physics departments have also trained larger percentages of male degree recipients. In contrast, prestigious microbiology and psychology departments have produced higher proportions of women than of men doctorates throughout the period, with the differences decreasing in recent years. High-ranking chemistry and sociology departments have fluctuated with both producing higher percentages of women than men Ph.D.'s for most of the ten-year period.

In the aggregate, given the relative numbers of degree recipients in the different fields, more women than men among recent science Ph.D.'s have received degrees at prestigious institutions. A much more detailed analysis, well beyond the scope of this report, is needed to identify reasons for the divergent sex ratios in some fields among highly rated departments including, especially, evaluations of applications in relation to admissions, and analysis of retention patterns of graduate students. Such a study would be of general interest in establishing whether practices in certain fields are systematically sex-biased.

2. Plans for Postdoctoral Study

Planning postdoctoral study has traditionally been a measure of high aspirations but may now also reflect realistic assessments of a tight job market. The fact that men and women plan to embark on postdoctoral training in comparable proportions, field by field, is therefore an indication of general similarity in their professional aspirations although they may pursue this training for different reasons. A more detailed analysis of this topic follows in Chapter 3.

3. Labor Force Participation and Unemployment

We mentioned earlier that women account for 10.4 percent of all science and engineering doctorates awarded since 1920. How similar is their presence in the work force, the work force being the effective supply of women doctorates?

In 1977, 9.7 percent of the doctoral work force were women. Their participation varies greatly by field, from nearly one fourth in psychology to less than one percent in engineering.

While women comprised 10 percent of the doctoral work force in 1975, they accounted for nearly 30 percent of the Ph.D.'s who were unemployed involuntarily or who took part-time positions because full-time jobs were not available. Women were three times more likely than men to be unemployed and seeking employment. The sex differences in unemployment rates were greatest among physicists. In all fields, the proportions of women who were unemployed and seeking work, or part-time employed and seeking full-time employment exceeded those for men (Maxfield, Ahern, and Spisak, 1976, p. 8).

4. Marital Status

Certain factors which have no bearing on quality of doctorates and no intrinsic relationship to prospects for general professional success may nonetheless legitimately affect relative employment prospects.

One of the factors most frequently cited to affect the education, employment status, and professional achievement of women is marital status. Marriage-career incompatibility for women has been given as the explanation for the much smaller percentage of women than men doctorates who are married.

It is apparent that in most fields, more men than women Ph.D.'s are married at the time they receive the degree. The field of physics and astronomy is the exception with a higher proportion of married women, and the percentages of married men and women are almost identical in mathematics and engineering. The biggest sex differences are found in the medical and agricultural sciences which have high proportions of married men and low proportions of married women.

It should be pointed out that answers to a question on marital status may not accurately describe informal arrangements that are now quite common in the graduate student population. It is known that the proportion of married men has been steadily dropping among U.S.-born doctorates in recent years, but not among new women Ph.D.'s (Gilford and Snyder, 1977, p. 36), but we do not know whether traditional marriages are being supplanted by such informal arrangements. Nor do we know how these commitments may affect the educational and career choices of Ph.D.'s of either sex.

The data likewise do not reveal past marital ties of those receiving the doctorate. All studies have shown high rates of separation and divorce among women graduate students (e.g., Feldman, 1974, p. 19) and women doctorates (e.g., Centra, 1974, p. 103) so that many who report themselves as single when they receive the degree may have been married earlier. Data on 1973-1976 women Ph.D.'s showed nearly 30 percent to have at least one dependent when they obtained the Ph.D. (Gilford and Snyder, 1977, p. 38). This requires consideration in the award of stipends for the postdoctoral training of women Ph.D.'s.

Marital status has been identified as a crucial factor operating to reduce the retention of women in college (Astin, 1969, p. 18), the likelihood that they will attend graduate school (Cross, 1973, pp. 46-47), the time they spend on professional activity (Centra, 1974, p. 43), and their productivity as measured by number of publications (Centra, 1974, p. 77).

Marriage is also assumed to act as a barrier to the geographical mobility required for professional advancement. There is some evidence to support this assumption. In the Centra comparison of men and women Ph.D.'s of different cohorts, 49 percent of the women reported that the spouse's job had been a major deterrent to their consideration of a job that would require a move to another community, in comparison with 4 percent of the men. Among the women who reported having experienced periods of unemployment, 57 percent of the reasons they gave concerned marital status and family responsibilities, but none of the men who had been without work at some time after receipt of the degree gave such reasons. A 1976 survey of 1971-1975 Ph.D.'s in the biomedical and behavioral sciences found that married women in both fields were somewhat more likely than single men or women, or married men, to have spent time unemployed following the degree and to be seeking employment at the time of the survey (NRC, 1977, Vol. 2, pp. 133-134). Their higher unemployment rate might suggest that married women could afford to be more selective about the jobs they accepted, but other results of the study show that this is not the case. In the same study, married women were much more likely than the other groups to state that their degrees were irrelevant to their current employment (p. 139).

In any event, many of the reported differences between married and single women with respect to professional employment and achievement are not large. In a number of studies, married women show some differences when compared with the members of the other categories but they are not at the present time very different from single men and women Ph.D.'s. The same may be said of the differences reported in Chapter 3 for their post-doctoral status, and for their tenure standing and salaries (Chapter 4). In fact, the group that displays major differences in these respects consists of married men. They are the ones least likely to plan or to hold postdoctoral appointments and the group most likely to achieve tenure or to be in tenure-track positions early in their careers. In the Centra study, married men published at nearly double the rate of single men or women or married women (p. 77).

It is probable that economic responsibilities of married men account for somewhat distinctive educational and employment patterns. For example, in the Carnegie survey, married male graduate students were more likely than single males, or single or married

females, to list increased earning power as a motive for attending graduate school (Feldman, 1974, p. 129). If postdoctoral study has traditionally been a measure of high aspiration or the road for men to professional advancement (Reskin, 1976), it appears to be a luxury that many married men cannot afford. Family responsibilities may also help to explain the greater proportion of men than women doctorates who are employed in industry where salaries are higher than in other work sectors (Chapter 4).

We also know from Astin's study of women doctorates (1969, p. 28) and Centra's comparison of men and women Ph.D.'s that 63 percent of the husbands of married women Ph.D.'s had doctorates or professional degrees in comparison with 8.3 percent of the wives of the men doctorates. In the same survey, 90 percent of the husbands of the married women Ph.D.'s had been employed full time or almost full time since the marriage, as compared with 12 percent of the wives of the men Ph.D.'s. This would again indicate a greater burden of family support on the men Ph.D.'s.

Several possible explanations for the greater "success rate" of married men suggest themselves. One is simply that they are better than other individuals, a deduction which finds little support in studies of ability patterns. Another is that the need to provide for a family provides added motivation; conversely, educational and career structures may also respond to this need. Finally, the supporting labor of a wife may free a man of other responsibilities and leave him more freedom to pursue work-related interests.

Conclusions

Men and women scientists at receipt of the doctorate are similar in average quality although women have an edge in academic ability as measured by college grades and high school test scores. In engineering and in most science fields, they receive their Ph.D. at the same age as or younger than men, and have completed their training as fast as or faster than men. Generally, similar proportions of both sexes are trained at highly-rated institutions. Based on the evidence presented here, one would expect the prospective opportunities for career development of young men and women doctorates to be essentially equal.

Recommendations

Three more detailed studies are recommended to assess the sex distribution in admissions to highly-rated graduate departments, differences in graduate training patterns depending on B.A. origins, and influence of marital status on employment prospects:

1. A detailed analysis of graduate admissions patterns, by field and sex, in prestigious departments; this should analyze trends over the last decade and establish a design for annual monitoring in the next few years.
2. A study of the graduate training patterns of women who earned baccalaureates from formerly all-male (or predominantly male) colleges and universities to determine whether these patterns differ significantly from those of alumnae of other institutions.
3. A study of the relationship between marital status, geographic mobility, and postdoctoral employment status of women, using data from the Doctorate Records File. Analysis of the effect of marital status on professional employment during later career periods will require the addition of a question on marital status to the Survey of Doctorate Recipients.

References

1. Astin, Helen S., The Woman Doctorate in America, Russell Sage Foundation, New York, 1969
2. Centra, John A., Women, Men, and the Doctorate, Educational Testing Service, Princeton, New Jersey, September 1974
3. Cross, K. Patricia, "The Woman Student," in W. Furniss and P. Graham, Eds., Women in Higher Education, American Council on Education, Washington, D.C., 1973, pp. 29-49
4. Feldman, Saul D., Escape from the Doll's House, Carnegie Commission on Higher Education, McGraw-Hill, New York, 1974

5. Gilford, Dorothy M., and Joan Snyder, Women and Minority Ph.D.'s in the 1970's: A Data Book, National Academy of Sciences, 1977
6. Harmon, Lindsey R., High School Ability Patterns - A Backward Look from the Doctorate, Scientific Manpower Report No. 6, National Academy of Sciences, Washington, D.C., August 1965
7. Keller, Evelyn Fox, "The Anomaly of a Woman in Physics," in Working It Out, Sara Ruddick and Pamela Daniels, Eds., Pantheon Books, New York, 1977
8. Maxfield, Betty D., Nancy C. Ahern, and Andrew W. Spisak, Employment Status of Ph.D. Scientists and Engineers, 1973 and 1975, National Academy of Sciences, Washington, D.C., 1976
9. National Research Council, Commission on Human Resources, Personnel Needs and Training for Biomedical and Behavioral Research - 1977 Report (Volume 1 and Volume 2, appendices), National Academy of Sciences, Washington, D.C., 1977
10. Reskin, Barbara F., "Sex Differences in Status Attainment in Science: The Case of the Postdoctoral Fellowship," American Sociological Review, Vol. 41, August 1976, pp. 597-612.
11. Solmon, Lewis C., Male and Female Graduate Students, Chapter 2, Praeger Publishers, New York, 1976, p. 47
12. Weisstein, Naomi, "How Can a Little Girl Like You Teach a Great Big Class of Men?", in Working It Out, Sara Ruddick and Pamela Daniels, Eds., Pantheon Books, New York, 1977

A MISLEADING TEXTBOOK EXAMPLE

by Caroline Eastman, Dept. of Math., The Florida State University, Tallahassee

Textbooks in the computer science field often reflect and reinforce sexist attitudes. A book recently published by Computer Science Press, PASCAL: An Introduction to Methodical Programming, by W. Findlay and D.A. Watt (Computing Science Dept., University of Glasgow), contains a sample program which is likely to reinforce a common misconception.

This program, a PASCAL procedure called MARRY, updates a civil registry to reflect a marriage (see p. 174). It checks that the man and woman are both unmarried. If they are, it changes their marital status to married and changes the wife's surname to that of the husband.

In almost all states in the United States marriage does not automatically change the wife's surname. She is allowed to continue using the name she used before marriage. However, many people are still not aware of this and continue to create problems for women who choose not to adopt their husband's surname.

Last year I wrote a letter to Computer Science Press objecting to this example. The second edition is to contain the same example with a disclaimer: "The following is intended for illustration only. Marriage laws vary considerably from state to state. The following is based on the current law of Scotland." This disclaimer is insufficient since it does not indicate in what way the laws might vary. The example should be removed or the disclaimer should be made more specific.

Sexist examples and assumptions in textbooks are unlikely to be changed unless we let the publishers and authors know that we are offended by them. The address of the president of Computer Science Press is: Barbara B. Friedman, President, Computer Science Press, Inc., 9125 Fall River Lane, Potomac, MD 20854.

Reply from the authors

When we received Professor Eastman's original complaint about this example we were quite happy, not being sexists, to amend it accordingly. The disclaimer she quotes was incorporated in the very next printing of the book, now on sale (not in the second edition, which is planned for 1981).

We consider Professor Eastman's latest complaint to be unreasonable. To render the example acceptable to her it would seem necessary to make specific remarks about a specific marriage custom. This we were very reluctant to do, not because we supported the custom, but because of the precedent it would establish.

We have deliberately illustrated our textook with examples drawn from the "real world". Inevitably, some of those examples will impinge on topics which are distasteful to one group or another. Marriage law is only one example: others might be interest calculations, tax calculations and even the unstated assumption that text is read from left to right. Taking Professor Eastman's arguments to their logical conclusion, we must deduce that every such example should either be excluded, or be accompanied by a legal/political/moral/cultural discussion. Would this be reasonable in an elementary textbook on computer programming?

We leave it to your readers to judge whether the example really is sexist, and whether hypersensitivity of this kind is more likely to help or to hinder the women's movement.

That said, we must add a confession and an apology. The algorithm we give is simply wrong. Scottish law does not require a woman to change her name in marriage. It is in fact completely liberal: either the husband or the wife or both or neither may choose to change their name. We will correct the example accordingly at the first opportunity, retaining the present disclaimer.

OF POSSIBLE INTEREST

The Harvard Educational Review (Longfellow Hall, 13 Appian Way, Cambridge, MA 02138) is publishing two special issues on "Women and Education." Despite the diversity of content, approach, and style among the articles and reviews in these issues, two themes emerge. The first is that we must integrate women's lives, experiences, and perspectives into all descriptions and analyses of human behavior. The publication of work on and by women is central to the development of a truly human scholarship. Second, women need a sense of their collective past, present, and future. The intellectual and emotional isolation of women has been a catalyst for and a symptom of other forms of sexism.

A Canadian Journal for Feminist Scholarship: RFR/DRF (Resources for Feminist Research, Dept. of Sociology, O.I.S.E., 252 Bloor Street West, Toronto, Ontario M5S 1V6, Canada) links researchers and teachers in all fields with the most exciting and informative scholarship on women. They have been meeting the demand for international information on women's studies through a network of ties with feminist researchers and centres throughout the Commonwealth and Europe, as well as Canada; recent years have also seen the emergence of an exciting new feminist scholarship in underdeveloped and developing nations. (To avoid duplication of effort, most American materials are excluded.)

The Making of a Feminist: Early Journals and Letters of M. Carey Thomas is Thomas's own account of her childhood and youth, drawn from the journals she kept from the time she could first write and the letters she sent to family and friends from boarding school, Cornell, and her years of study in Europe. As first dean and then long-time president of Bryn Mawr College, she established standards of rigor and achievement that transformed higher education for women in the twentieth century. The Kent State University Press, Kent, Ohio 44242.

Bryn Mawr College and HERS Mid-Atlantic announce the fifth annual Summer Institute for Women in Higher Education Administration to be held July 6 through July 30, 1980 on the campus of Bryn Mawr College. The program will focus on institutional governance and planning, in finance and budgeting, management and leadership skills, and administrative computing applications. Attention will be given to professional development with emphasis on career planning, mentor relations and other support networks. For further information write to: Bryn Mawr College/HERS Mid-Atlantic Summer Institute, Bryn Mawr College, Bryn Mawr, Pennsylvania 19010.

The Economic Development Administration is undertaking a comprehensive outreach program to insure that women and minorities are made aware of employment opportunities expected to be available this spring in Washington, D.C., and at the agency's regional offices under an expanded program pending before Congress. Jobs are to be available for accountants and accounting technicians, administrative officers, civil engineers, community planners, economists, financial and management analysts and for specialists in the fields of computer programming, environmental protection, equal employment opportunities, business loans, personnel management, public information and the public works and technical assistance programs. Further information of available jobs may be obtained by writing to the Economic Development Administration, Personnel Management Division, Room 7087, Main Commerce Building, 14th Street and Constitution Avenue, Northwest, Washington, D.C. 20230 or by telephone at (202) 377-2617.

Far West Laboratory is holding Women's Educational Equity Grant Writing Workshops at various locations. The program has already begun and will continue through August, 1980. Also, three volumes of materials have been developed to assist people in developing grants related to issues in women's educational equity. For further information, write to Far West Laboratory, 1855 Folsom St., San Francisco, CA 94103.

DEADLINES: May 23 for July-Aug., July 24 for Sept.-Oct., Sept. 24 for Nov.-Dec.

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

JOB ADS

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

California State University, Fullerton. Dept. of Mathematics. Tenure track position for Fall, 1980 for applied mathematician. Ph.D. required. Prefer applicants with outstanding teaching qualifications, computation experience, and backgrounds in modeling, combinatorics, numerical analysis, applied statistics or optimizaiton. Rank & salary determined by experience & qualifications. Send vita to: Chair, Selection Committee, Dept. of Mathematics, CA State University, Fullerton, CA 92634.

Pomona College. Dept. of Mathematics. Asst. or Assoc. Professorship, tenure track, beginning 9/1980. Teaching load, 9 hours per semester. Ph.D. & demonstrated excellence in teaching & research required. Prefer candidate with strong backgrounds in computing. Contact Prof. Harry Millikin, Chmn., Mathematics Dept., Pomona College, Claremont, CA 91711.

Mount Vernon College. Dept. of Mathematics. Tenure track Asst. Professor of Mathematics starting Fall, 1980. Salary $15,400 - $16,800 depending on experience. Requirements: Ph.D., background to teach lower levels of college math and either basic statistics for the social sciences or introductory computer programming. Candidates may send resumes & references to Office of Academic Affairs, Mt. Vernon College, 2100 Foxhall Rd., N.W., Wash., D.C. 20007. (202/331-3414)

University of Iowa. Dept. of Mathematics. Opening for visiting faculty member. Selection criteria will include the potential of productive research interaction with regular faculty, teaching credentials, etc. To apply send vita and have 3 letters of reference sent to Robert H. Oehmke, Dept. of Mathematics, Univ. of Iowa, Iowa City, Iowa 52242.

Clark University. Dept. of Mathematics. One year visiting position anticipated. Teaching responsibilities include an introductory computer programming course. Research interests include functional analysis, approximation theory, group theory and category theory. Two tenure track positions are anticipated for the fall of 1981. Send resume, bibliography and at least 3 references to E. Cline, Dept. of Mathematics, Clark University, Worcester, MA 01610.

Smith College. Dept. of Mathematics. Asst. Professorship in 9/1980. One year with possibility of second year. Minimum salary $16,200. Teaching duties are 3 undergraduate courses per semester, one of them at upper level. Superior scholarship & teaching required. Send resume & 3 letters of recommendation to James Callahan, Chair, Math Dept., Smith College, Northampton, MA 01063.

Michigan Technological University. Dept. of Mathematical & Computer Sciences. Head of Department starting Fall, 1980. Appropriate Ph.D. and established reputation in research & scholarship required. 40 faculty members; B.S. & M.S. programs. Send nominations, applications to MACS Search Committee, Office of the Dean, Sciences & Arts, Michigan Technological University, Houghton, MI 49931.

College of St. Thomas. Quantitative Methods & Computer Science Dept. Tenure track Asst. Professor, Fall, 1980. Teaching in undergraduate Quantitative Methods Dept. and in graduate Master in Business Administration program. Primary areas of responsibility would be statistics, computer programming, data processing & 1 more area depending on applicant's expertise. Teaching load: 9-12 hours/week. Required: Ph.D.; experience with record of excellence in teaching; expertise in one of following: (1)Comp. Sci. including data structures, compilers, operating systems & programming languages. (2) Management Inf. Systems including systems analysis, computers in management, computer center management, COBOL, & hardware evaluation. (3) Statistics & operations research. Send resume & vitae to Dr. Thomas P. Sturm, Dept. Head, Quantitative Methods & Comp. Sci. Dept., College of St. Thomas, St. Paul, Minn. 55105.

C. W. Post Center, Long Island University. Dept. of Mathematics. Asst. Professorship available Sept., 1980. Required: Ph.D. in Mathematics, evidence of strong potential for teaching and research, and ability to teach statistics and/or computer science. Salary commensurate with experience. Please send 2 copies of resume & 3 letters of recommendation to Dr. Elliott Bird, Chmn., Dept. of Mathematics, C. W. Post Center, Long Island Univ., Greenvale, N.Y. 11548.

Russell Sage College, Women's Division. Dept. of Mathematics/Physical Science. Asst. Professorship beginning 9/1/80. Ph.D. in Computer Science preferred. Experience and/or background in business desirable. Duties: teaching 9-12 hours/week in such courses as computer languages, Assembler Language Programming, Data Structures, Numerical Analysis; curriculum development; consultant to other departments; institutional planning in computer science. Excellent teaching ability expected. By 4/15/80 (or until position is filled) send vita & applications to Dr. Rita Murray, Math Dept., Chairwoman, Russell Sage College, Troy, N. Y. 12180.

College of Charleston. Dept. of Mathematics. Tenure track position available 8/1980. Duties: teaching 12 hours/week in undergraduate math and comp. sci. program. Required: Ph.D. & sincere commitment to teaching & research. Desirable: strong background in applications of math., stat., numerical analysis or computer science. Minority & female applicants are encouraged to apply. Minimum salary $15,700. Send 3 letters of recommendation and resume to W. Hugh Haynsworth, Dept. Chairman, Math Dept., College of Charleston, Charleston, S. C. 29401.

Mathematical Association of America. Opening for Associate Executive Director at its headquarters in Washington, D.C., beginning July 1, 1980 or soon thereafter. Applicants should have interest and ability in administration and should be willing to exercise independent initiative. A Ph.D. in mathematics or a mathematical science is desirable. Salary commensurate with experience and training. Send curriculum vitae & have 3 letters of recommendation sent to: Prof. Dorothy L. Bernstein, President, Mathematical Assoc. of America, Div. of Applied Mathematics, Brown University, Providence, R. I. 02912.

ASSOCIATION FOR WOMEN IN MATHEMATICS
MEMBERSHIP APPLICATION

The AWM membership year is October 1 to October 1.

Name and
Address _____

_____

_____

_____

Institutional affiliation, if any _____

_____

New _____ Renewal _____

Individual $10.00 _____

Family $15.00 _____

Retired, Student, Unemployed $5.00 _____

Institutional $25.00 (Two free advertisements in the Newsletter) _____

Contributing Member $20.00+ _____

Make checks
payable to: ASSOCIATION FOR WOMEN IN MATHEMATICS

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

Association for Women in Mathematics
Women's Research Center, Wellesley College
828 Washington Street
Wellesley, Massachusetts 02181
May-June, 1980