NATIONAL SCIENCE FOUNDATION ACTIVITIES FOR WOMEN AND GIRLS

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In response to the persistent barriers to women's participation in science, engineering and mathematics careers, studies and reports have called for a renewed focus upon the issues involved. However, since the 1983 publication of the U.S. Department of Education's, *A Nation at Risk*, 1/ relatively few of the task forces and commissions addressing the issue of educational reform have focused on gender issues.

When we look at the numbers of women in science and engineering, both at the professional level, and as students, we recognize that women are keenly underrepresented. Many things are blamed, including the "chilly" departmental climates, the isolation, the lack of a "level playing field." Statistics tell us that not only are undergraduate students opting out of SEM majors, but many bright pre-college students are limiting their options by not taking the essential gate-keeping mathematics courses. This particularly true for girls. Research tells us that instructional strategies and materials in mathematics and science tend not to complement the learning styles of females (Clewell, 1992). 2/

The problem is partly socio-cultural. The popular conception of a scientist or engineer, particularly as portrayed in the media, is a white male in a lab coat who is a little "nerdy." We have developed myths and pressures about the inability of girls and women to succeed in math, science and engineering. Our young girls are given Barbie dolls that say, "Math is hard," while our little boys are given chemistry or Lego sets to challenge their creativity and provide hands-on experiences. Studies, such as the one published by AAUW in 1991, 3/ tell us that the perception of math incompetence among young teen girls correlates with their loss of self-esteem, while positive evidence of their success in science and math--such as good grades--tend to be considered irrelevant. Our historic cultural role of women appears to impact societal expectations. Many school counselors are remiss in not directing girls toward careers in science, math, and engineering, while some parents do not perceive of these fields as appropriate for women.

Substantial "hands on" experience, particularly with instruments appropriate to the field, is critical for training in the technical disciplines, but when boys and girls work together in laboratory activities, girls frequently defer to boys for the actual experimentation. They then become the note takers and designated "experiment writers." Boys generally have hands-on experience in constructing or fixing things, but women often are "disadvantaged" when they enroll in engineering or the sciences because they frequently lack the experience of working on their car engines, with motor sets, doing construction,

lack the experience of working on their car engines, with motor sets, doing construction, or just taking objects apart and putting them back together. This deficiency contributes to girls' underestimating their abilities, with a consequent lack of self-esteem.

The focus of many undergraduate introductory science, math, and engineering courses is another problem, not just for women, but for many students. The perception of these courses as "gate-keepers," with the role of "weeding-out" the timid or underprepared, quickly sends many students to humanities, business, and other majors. Thus, the problem is not just recruitment, but also retention. Women seem to thrive best in a nurturing, cooperative environment, but the "chilly" atmosphere of some departments is male-dominated cut-throat competition.

Mentoring and role modeling have a very positive impact upon the pursuit of SEM careers, but females role models are sparce in the physical sciences, math, and engineering, particularly the latter. NSF data 4/ tells us that of the Ph.D. faculty members in our nation's bachelor and graduate degree-granting institutions, only 679 (2.7%) are women in engineering--not a lot of role models, especially since female role models seem to make a real difference in graduate school attendance, especially for women pursuing careers in nontraditional fields.

The problem of isolation for women, and the need for "critical mass," is beginning to be recognized. The lone girl in the advanced placement high school math class, the two female graduate students in a "male world," who are eliminated from departmental socializing, or the token woman faculty member, all share the problem of isolation, compounded by the fact that women, as a gender, often prefer to work cooperatively as part of a group, as opposed to competitively as individuals, as do many males.

If our nation is to be competitive in the year 2000 and beyond, with its economic and political status increasingly based upon a technological society, all segments of our population, including traditionally underrepresented areas, must be part of the technical work force. Addressing the problems we have just discussed, will not only positively impact underrepresented individuals, but have a positive effect on the entire SEM population. NSF recognizes this, and is addressing it in several ways. These include a selection of programs targeted for special population groups, namely, women, ethnic minorities underrepresented in SEM, and persons with disabilities.

Administrative steps have been taken in some disciplinary areas to encourage the participation of women scientists. Two NSF directorates have implemented a policy of not providing funding for scientific meetings unless women are adequately represented on the program. Also, some special programs for women and girls are being funded in the research directorates. Engineering has provided funding for additional NSF graduate Fellowships for women, travel support for a national workshop of Expanding Your Horizons coordinators, as well as money for start-up of an electronic network, regional meetings, and other activities of your own organization, WEPAN. The Computer and Information Sciences Directorate has funded a number of special efforts to enhance the participation of girls and women, including some special conferences with pre-college

and undergraduate girls as participants, and a mentoring workshop. The Chemistry Division's projects included a graduate retention effort for women, as well as Research Experiences for Undergraduates Site projects for young women only. The Division of Mathematical Sciences has funded a summer math intervention-type program for undergraduate women, and several special workshops, including one for recent Ph.D.s to enhance their research activity. It also has funded the development of a career information booklet targeted for girls/women.

It is important to note that, until this year, formal NSF efforts targeted especially for women have supported essentially research and research-related activity, namely:

o **Visiting Professorships for Women**, the oldest of these programs, dates back to the early eighties. A woman researcher from government or other non-profit organization, industry, or academe goes to another institution (academic) for a visit, usually a year, but the duration is flexible. In addition to her research, she spends one-quarter to one-third of her time engaged in special activities to enhance her visibility as a role model/mentor on campus, interacting with students and faculty. The "interactive activity" includes teaching, formal and informal seminars, conferences, and other special events for women.

o The **Research Planning Grants**, developed in the mid-eighties, for women without prior independent research funding, provide support for up to 18 months to enable the investigator to develop a more competitive research proposal for NSF. At the conclusion of the planning grant, the investigator is required to submit a disciplinary research proposal to the Foundation.

o A **Career Advancement Award**, designed for the investigator who previously has been a principal investigator, enables the women to spend up to a year engaged in activity that will enhance her research career. She may have had a career break and need to update her skills, or she may wish to learn new ones to expand her research in a different direction.

o **Faculty Awards for Women** are ongoing for outstanding investigators/teachers recommended by their respective institutions. Although continuing support is being provided, no new competition is planned at this time.

The Directorate for Education and Human Resources developed, this year, a new initiative for women and girls in science, engineering, and mathematics (SEM). It is a Directorate-wide effort to support projects that have the potential to effect both short- and long-term changes in the representation of women in SEM careers, and the overall science and mathematic education of women. The publication of *EHR Activities for Women and Girls in Science, Engineering, and Mathematics* 5/ formalized an EHR Directorate philosophy that the issue of full participation is related to the educational system as a whole. Thus, proposals submitted to any of EHR's programs may be specifically targeted toward women and girls, for example, or they might be for all students but with clear sensitivity to one aspect such as gender issues. Such proposals

must fall within the context of the recipient program. They are reviewed in the usual manner and funded in the cognizant EHR division. Prior to developing such a proposal, prospective investigators must read the relevant program announcement and consult with the cognizant program officer. Some examples of such funding in Elementary, Secondary, Informal Education include: a K-6 curriculum project modeling new teaching strategies and content for elementary school instruction, with an understanding of gender implications; Young Scholars projects in several disciplines targeted expressly for middle and high school girls; and a "hands-on" science activity project for Girls, Inc., a community-based organization. The Undergraduate Division funded a project for developing an undergraduate "girl-friendly" participatory type of chemistry course. The Research Evaluation and Dissemination Division has funded several projects targeting women/girls, particularly relative to career access and retention.

The Women's Program in the Division of Human Resource Development has developed three components to help increase the representation of women and girls and to address some of the problems previously described. Eligible institutions include colleges and universities; non-profit, nonacademic institutions (museums, professional associations, youth centered and/or community-based organizations); and state and local governments (including school districts). Projects which help to build or strengthen alliances among educational institutions and with other organizations are encouraged. As described in the *EHR Activities for Women and Girls*, these efforts are:

Model Projects for Women and Girls: which (a) encourage the design and implementation of innovative short-term, highly focused strategies, activities, and/or materials that will improve educational achievement and/or career access; (b) prepare existing strategies/projects for wide dissemination through evaluation and revision; and/or (c) widely disseminate intervention models, or possibly implement existing models at new institutions, locations, or with a different population. There was an April deadline for 1993, but there will be a January 15 deadline henceforth. An advisory panel was convened May 16-18 to evaluate the proposals submitted for this competition. We are in the process of making the award decisions.

Experimental Projects for Women and Girls support comprehensive approaches for improving K-12, undergraduate, and graduate SEM education and/or encourage women to enter and be retained in such studies/careers. These proposals are to involve multiple "players" (cooperating organizations/institutions) and multiple categories of participants, and must be focused on creating permanent changes in the SEM climate for students, or developing program models to fill the "gaps" in current programmatic efforts for women and girls. The projects should build upon current understanding of the social, learning, and teaching factors which facilitate the interest, motivation, and achievement of girls and women in SEM. Preliminary informal letter proposals are due July 1. Proposers will be notified whether they are encouraged to submit a formal proposal for the October 1 deadline. Beginning in 1994, the deadline for preliminaries will be May 15, while the formal proposal deadline will be September 1.

Information Dissemination Activities provide limited support for conferences,

workshops, and symposia addressing issues, projects, policies, and research related to the focus area. Since people working on issues related to education and careers for women and girls in SEM come from a variety of fields, NSF wishes to encourage opportunities for them to interact and share both results and methodologies. Proposals are limited to one per year per institution. These projects must meet needs in the educational and/or academic community, catalyze future action by participants, and may be national, regional, or systemic in scope.

There have been many isolated successful intervention programs for women and girls, but little attention has been paid to their commonality. There are a number of factors which might be addressed in proposals to components of the Women's Program, but among them are ones which should be part of any education/training proposal:

- o Clearly focused objectives/goals, with delineation of the most effective mechanisms for greatest participant impact, perhaps including:
  - Hands-on, inquiry approach
  - Cooperative group work
  - Strong academic component
  - Substantial student/staff contact (possibly residential campus experience, bridge programs, etc.)
  - Outreach with follow-up
  - Role models/mentoring
  - Parental involvement (as appropriate);

- o Clear delineation of the participant population and its eligibility criteria;

- o Carefully planned recruitment, selection, and follow-up of participants;

- o Provision for critical components: instruction, enrichment, mentoring, career counseling, etc.;

- o Participant involvement in meaningful learning activities, particularly hands-on research, and cooperative group experiences;

- o Faculty/staff ongoing involvement

- o Demonstrated institutional commitment, with plans for institutionalization/ mainstreaming, and development of a stable funding base (possibly external);

- o Carefully developed, effective management and assessment plans, with the latter being an integral part of the project;

- o Fully developed plans for dissemination of project information.

Our Women's program wishes to fund projects which: involve collaborating

organizations; have broad potential impact; demonstrate understanding of the issues/research; and, which build up upon existing efforts. We are looking for projects which have the potential for improving access, retention, or " climate" of SEM education and careers. Assessment must be an integral part of the projects, as well as appropriately designed dissemination efforts. We are looking at the realistic possibility for long turn impact, including institutionalization of the efforts.

NSF has an array of funding opportunities. One needs to look for program opportunities with the best "match," not only for the proposed activity, but for the institution and its resources, as well as for the target population. And, by all means, talk with the cognizant program officer before submitting a proposal. The result may be a more focused proposal, or you may find that a particular program is not where your project fits.

The Foundation has become increasingly committed to addressing the underrepresentation of women in SEM. Working in cooperation with many organizations, including professional groups such as yours, we anticipate real change in the climate for women and girls, and look forward to the day when their representation in SEM will equate their representation in the population. We hope that through "creative carrots" we can encourage cooperation and commitment of institutions and organizations to provide a catalyst for change within and by the system itself.

CITATIONS

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4/ National Science Foundation, *Women and Minorities in Science and Engineering: An Update*. Washington, DC: National Science Foundation, 1992. (NSF 92-303)

5/ National Science Foundation, *EHR Activities for Women and Girls in Science, Engineering, and Mathematics*. Washington, DC: National Science Foundation, 1993. (NSF 93-6)