6-23-1992

Report of the Women in Science and Engineering Initiatives Committee

Women in Science and Engineering Committee, University of Maine

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Women in Science and Engineering Initiatives Committee

June 23, 1992

University of Maine
Orono, Maine

June 19, 1992

Fred Hutchinson, President and Acting Vice President for Academic Affairs
Alumni Hall
University of Maine
Orono, Maine

Dear President Hutchinson:

The Women in Science and Engineering (WISE) Committee was charged with identifying resources at the University of Maine that encourage the participation of women in science and engineering, both as students and as faculty; identifying ways to increase the recruitment and retention of women in these areas and recommending ways that the University can support this effort.

Our work has convinced us that this initiative would benefit individual women as well as contributing to the good of the University and society as a whole. We have found that although some departments and programs are more successful than others in addressing issues facing women students and faculty in science and engineering, there are no institutionalized organizations, guidelines, or goals directed toward these issues. We believe that significant progress and long-term change will result if there is campus-wide commitment. To that end, the WISE Committee recommends that:

1. Recruiting and retaining women in fields of science and engineering at the University of Maine, both as students and as faculty, be made a high priority of the Affirmative Action Plan of the University.

2. The Women in Science and Engineering Committee of the University of Maine (WISE) be institutionalized as a standing committee, appointed by the President, and charged with developing an annual plan recommending a full spectrum of activities directed towards women in science and engineering. Furthermore, we recommend that approximately $20,000 be made available for FY 93 to be earmarked for the WISE Committee (pending approval of a plan and attached budget) to initiate several high-profile, relatively low-cost programs to create institutional momentum for change.

3. Commitment to and accountability for these goals be assured at all levels of the University (i.e., department chairs and faculty, deans and directors, vice presidents, and the president) through allocation of resources and evaluation of programs.

The following report offers suggested strategies and supporting documents that we suggest be distributed to the University community to serve as a resource for further action.

Respectfully submitted,
WISE Committee

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ORGANIZATION OF THE REPORT:

The image of a pipeline has frequently been used to describe education and employment in science and engineering. The pipeline starts in elementary school and flows through middle/junior high school and high school. There are side branches for vocational high schools and technical colleges, but the main branch is the undergraduate college or university ending with multiple branches into academic science and engineering, industry, and pre-college science teaching. Looking for narrowing or leaks in this pipeline is a useful way to identify the problems faced by women in science and engineering and to formulate solutions. At each step the WISE Committee identified ways the University of Maine can play a constructive role in increasing the progress of girls and women through the pipeline.

The following report outlines statements of the problems both nationally and at the University of Maine and recommends strategies for each stage of the pipeline, emphasizing those areas over which the University of Maine has the most influence, i.e., faculty development, undergraduate and graduate instruction in science and engineering, and pre-service and in-service education for science and mathematics teachers.

Appendix 1 contains a list of the members of the WISE Committee. Also included are the original charge to the current WISE Committee (Appendix 2) as well as suggested guidelines for the future WISE Committee (Appendix 3), and a description of the process employed by the WISE Committee (Appendix 4).

The original charge to the WISE Committee included identification of the present situation regarding the presence of women in science, mathematics and engineering at the University of Maine. Appendix 5 lists the resources in place at UM which were identified by the Committee. The WISE Committee's charge also included identification of resources to support any recommendations, strategies or new endeavors. The Committee consequently surveyed external funding sources which are targeted to this arena (Appendix 6). As part of the survey of resources available, the Committee also collected an extensive library of material on the subject which is now housed in the UM Women's Resource Center. A list of this material is given in Appendix 7.

The terminology varies throughout this report. Sometimes we use "science," sometimes "science and engineering," "math, science and engineering," or "science and technology." In the headings, we have abbreviated "science, mathematics, and engineering" as "SME;" that includes the technical areas in the four colleges central to our work, the Colleges of Applied Sciences and Agriculture, Engineering, Forest Resources, and Sciences. These labels represent various perspectives of both committee members and also research materials that we used. For the purposes of this report, the phrases are used interchangeably.

The strategies are numbered for identification purposes only and do not reflect priorities of the WISE Committee.

FACULTY IN SCIENCES, MATHEMATICS, AND ENGINEERING (SME)

Nationally the number of women graduating with Ph.D.'s in science and engineering has increased in recent years (women receive approximately 27% of the Ph.D.'s each year). Women generally are found in the lower ranks of academe, as assistant professors or instructors, in a disproportionate percentage to their availability in the doctoral pool. In 1989, 66% of women on Science and Engineering faculties were untenured or in positions where tenure was not applicable. Junior male scientists are more likely to be promoted than their female counterparts. In comparison studies, when there is control for years of experience and rank, women scientists earn less than their male colleagues. These trends are evident across all fields of science and engineering but are more pronounced in computer science, chemistry, physics, and engineering and less in the biological sciences.

Table 1 (page 13) compares the number and percentage of UM women faculty in the sciences, mathematics, and engineering (SME) with national data at comparable universities from the AAAS report "Investing in Human Potential."

Some progress has been made in the past few academic years in increasing the number of women on the UM faculty. Figure 1A (page 13) compares the numbers and percentages and Figure 1B (page 14) the salaries of UM women for 1987 and 1991 at each rank. The fraction of UM faculty who are women has increased at all ranks in the four-year period even though the absolute numbers are still small. Although average salaries at all ranks have increased for women faculty from 1987 to 1991, the average salaries for women at all ranks are still about 85% of male salaries. Women's salaries for instructors and full professors at UM have slipped even further behind in the four-year period.

Utilization Analysis and Goals

Since the UM Report of the Task Force on the Status of Women in 1988, very little has changed with respect to numbers of tenured/tenure-eligible women in three of the four colleges we are studying. In the College of Sciences the net gain is three women; in the College of Applied Sciences and Agriculture the net gain is 0.5 women; and there are net gains of one position each in Forest Resources and in Engineering. While there have been some women added in fixed-length appointments (not included in these statistics), these do not take the place of tenure-track appointments. Table 2 (page 15) shows the number of positions in which men would have to be replaced by women in order for the departmental percentage to equal the national availability. Thus, Table 2 shows the number of positions by which women are underrepresented in SME units at UM. Tables 3, 4, 5, and 6 (pages 15-18) detail the representation of women on the faculties of the four UM technical colleges. Women students in two of the four colleges will, in all likelihood, never have a women as a professor, mentor, or advisor. In the other two colleges, their chances are 1 in 10 and 1 in 6 (excluding Human Development).

To a certain extent, the lower percentages of women faculty reflect the lower percentages in national availability. This does not mean we do not have to improve, but that we will have to act more affirmatively to recruit, retain and promote women faculty. However, in some departments the percentage of women is significantly below the national availability.

Suggested Strategies at the University of Maine for Faculty:

1. Establish a fund for Opportunity Hires of (a) distinguished women scholars at associate or full professor rank, (b) promising women scholars at junior ranks in disciplines in which the national availability of women is severely limited; offer similar incentives for partners of women hired.

2. Continue to require heads of all units conducting searches to obtain from the Equal Opportunity Office the most current equal opportunity / affirmative action search information, including the utilization status of their unit. Evaluate unit heads and deans partly on the basis of the improvement in representation of women in their units.

3. Continue to require search committees in units in which women are underrepresented to meet with a representative of the Equal Opportunity Office and a college level representative (preferably the dean) to discuss equitable search processes and to agree upon the committee's strategies for meeting affirmative action goals.

4. Enlarge the potential applicant pool of qualified women for faculty positions by initiating exchange programs to bring visiting women scholars to the University, helping departments to keep in touch with women students who go on to graduate study elsewhere, and supporting intensive efforts to identify and recruit promising women candidates from other institutions.

5. Develop formal methods for mentoring and advising tenure-track faculty to replace informal methods which disproportionately disadvantage women.

6. Equalize and attend to the "start-up packages" offered to male and female faculty, especially in science and engineering.

7. Institute a support group for women faculty.

8. Miscommunication of expectations is more common for women faculty than for men. Therefore, re-examine the tenure process University-wide. Institute a system of specifically designed two to four year contracts for each faculty member to identify where that person should focus for the time period. Negotiate the appropriate proportion of time distribution to match. Evaluations to be made on the basis of the terms of the contract.

9. Recognize the value of teaching, mentoring, and advising as well as research and public service. Incorporate into the department tenure and promotion documents for the four SME colleges criteria specific to improving the participation of women in the sciences.

10. Renegotiate the AFUM contract to extend tenure-eligible positions to part-time faculty; offer a tenure clock "slow down" option for part-time and full-time faculty taking leave for family reasons. Identify this option as part of the initial negotiation for employment.

11. Develop innovative ways for faculty to combine family responsibilities and work life.

12. Present programs and workshops to assist in socializing male faculty in working more equitably with female colleagues.

13. Design forums for studying and discussing gender differences in approaches to doing science and teaching science, emphasizing the advantages of a diversity of approaches.

14. Since women generally prefer to work more cooperatively than competitively, provide workshops and programs on pedagogical techniques for graduate students and faculty to make classrooms more hospitable to women; include cooperative learning, emphasis on socially productive uses of the material, decreased emphasis on competition, decreased emphasis on grades.

15. Develop methods for helping faculty incorporate information on women's roles in science and engineering into all their courses. (e.g. Bruces' information on women in chemistry. See bibliography.)

16. Encourage faculty to attend workshops on teaching at their professional meetings and to share knowledge with colleagues when they return.

17. Institute a program of speakers on women in science and engineering including special meetings with faculty.

18. Include material on gender issues in content and pedagogy in new faculty orientation programs within the colleges.

19. Publicize the resources that the Women in the Curriculum Program, the Women's Resource Center, and the Council on Women have to offer faculty.

20. Improve faculty knowledge of the diversity of careers open to their student majors so that faculty can improve the recruitment and retention of women majors who may appreciate non-traditional job opportunities.

21. Sponsor an annual conference on Women and Science/Technology.

22. Include gender issues on agendas for faculty meetings.

23. Provide information to faculty on evaluating their own classes for gender equity.

GRADUATE STUDENTS

Women are less likely than their male peers to continue with graduate study in science and engineering. However, a majority of women enrolled in graduate programs are in the life sciences and in industrial engineering. The graduate experiences of men and women are very different: men are more likely to hold research teaching assistantships or fellowships, while women generally support their graduate study by teaching assistantships. In 1988, women received 12 percent of the masters degrees in engineering and 7 percent of the doctoral degrees. Computer science and engineering are the fields in which the percentage of women earning graduate degrees is growing the fastest. Although the number of women earning degrees in science and engineering has increased, the percentage of those degrees awarded to female American citizens has declined. (National Science Foundation, January, 1990, Women and Minorities in Science and Engineering, (NSF #90-301), Washington, D.C.).

Similar to national trends, the majority of women science graduate students at UM is enrolled in the life sciences. Tables 7, 8, and 9 (pages 18-19) give the number and percentages of female graduate students majoring in the Colleges of Sciences, Engineering and Forest Resources, respectively, for Fall 1991. Similar data were not tabulated for agriculture. Sixty percent of the female graduate students in the College of Sciences are in the life sciences; in the Departments of Plant Biology and Pathology, Biochemistry, Microbiology and Molecular Biology, and Zoology. Although data are available on the numbers of degrees awarded at the master's and doctoral levels, the data are not tabulated by gender except by CID category (see section on undergraduate education.)

Suggested Strategies at the University of Maine Concerning Graduate Students:

1. Include a statement in the Graduate Catalog reflecting an institutional commitment to the participation of women in science and engineering.

2. Set ambitious recruitment and graduation goals, i.e., any particular department or program should strive to maintain at least twice the percentage of women graduate students as reflected in that field, at that degree level. For example, if 5% of the Ph.D.'s in Physics in the United States are women, then the goal of the Ph.D. program in the Department of Physics and Astronomy should be at least 10% women Ph.D. degree recipients.

3. Provide special scholarships and assistantships for women graduate students in Science/Mathematics/Engineering.

4. Allocate funds for outreach directed toward recruiting women graduate students from the best regional undergraduate programs.

5. Increase the graduate student teaching assistant stipend to become competitive for the best students; index the teaching assistantship stipends to reflect cost of living increases, collective bargaining increases, etc. Have a printed contract or policy stating the pay period and what is expected over a designated period of time.

6. Provide teaching methods workshops (including gender issues) for teaching assistants as well as faculty.

7. Establish an organization for graduate students in science, mathematics, and engineering and link it with a mentoring program for undergraduates.

8. Monitor attrition from graduate programs by sex.

9. Optimize institutional commitments, especially to women graduate students, which are of primary importance often to women, e.g. living environment options offered by the University, library hours, day

care, part-time employment opportunities for the nonstudent spouse and the general level of campus functions and services over undergraduate vacation periods.

10. Substantially increase support for visiting women speakers, visiting women professors, and student travel, especially for women, to expand advising, mentoring, and connections for women graduate students who have fewer role models on the UM faculty.

11. Develop programs for women graduate students to work with women undergraduates.

12. Graduate program reviews should require that gender and equity issues be part of the assessment.

13. Program self-study reports should address gender issues and site visit teams should be gender balanced.

14. Encourage flexibility in the amount of time taken to complete a graduate program so parenthood can co-exist with graduate education.

UNDERGRADUATE INSTRUCTION IN SCIENCE AND ENGINEERING

In recent years, there has been an increase in the number of women enrolling in undergraduate science and engineering programs; however, women are still less than 50% in all areas of science and engineering. Many universities have established recruitment and retention programs in order to increase the number of female students, but a majority of the successful programs focus only on engineering. Also many of these programs are funded on "soft-money," rely heavily on volunteer efforts of faculty and students, charge participant fees, and ignore minority women, especially American Indians. (Matyas, M. & Malcolm, S. (1992). Investing in Human Potential: Science and Engineering at the Crossroads, American Association for the Advancement of Science, Washington, D.C.).

As expected, the number of science degrees awarded to women at UM over the last decade is proportionately small. The University does not tabulate the distribution by sex for individual degrees awarded. Table 10 (page 20) and Figure 2 (page 20) show the number of College of Sciences degrees conferred at the University of Maine during the past decade. Sciences graduates came from the following areas in what is presently the College of Sciences: biochemistry, biology (BA and BS), botany, chemistry (BA and BS), computer science, engineering physics, geological science, mathematics, medical technology, microbiology, molecular-cellular biology, physics and astronomy (BA), and zoology. During this time, the number of Bachelor's degrees awarded declined from 201 to 115. However, the number of Masters degrees remained fairly constant and the number of doctoral degrees increased from 4 in 1980 to 13 in 1990. Similar data are not available for the Colleges of Applied Science and Agriculture, Engineering, or Forest Resources.

Table 11 (page 21) shows the percentage of degrees awarded in all technical CID categories at UM from 1987-1990. Less than one third of the bachelors' degrees awarded at the university were in the sciences. Females were awarded less than one quarter of the bachelor's degrees in science, yet they received approximately 45% of all the bachelor's degrees awarded at UM. Women students are not equally represented in the undergraduate science programs. At the present time these figures are not available for engineering.

Table 12 (page 21) and Figure 3 (page 22) show UM and national data on women baccalaureate recipients by CID technical categories. The percentage of women majoring in science degree programs at UM compares favorably with the national figures, although UM awards below the national percentage in computer sciences and the physical sciences. While UM compares more favorably in the agricultural sciences, engineering, life sciences and mathematics, the number of women students in these programs is small.

Migration and Attrition of Undergraduate Students in the College of Sciences

Students enrolled in the College of Sciences in Fall, 1985, were tracked forward through to Fall, 1990 by the UM Office of Institutional Studies. "Migration" occurs when a student declares a major in a particular area and then at some stage in her/his undergraduate career changes to another major. If a student left the College of Sciences and enrolled in another college, this was called "out-migration." Alternatively, if a student had declared her/his intent to major in another College and later moved into the College of Sciences, this was defined as "in-migration." Attrition occurs when students "drop-out" of the university without degree completion.

Table 13 (page 23) shows the attrition, out-migration, and persistence of students, by sex, who enrolled in the College of Sciences in the Fall, 1985. First-year students who did not declare a major were not included in the study. Males were more likely than females to drop-out of the College. The College graduated less than 50% of the students who had declared a major in science by 1990. This figure is similar to the national average.

None of the females enrolled in the chemistry, geology or physics departments dropped-out. (However, they may have changed their major.) Females enrolled in computer science were more likely to drop-out than females in the other departments. However, it should be noted that computer science had the third highest number of female students enrolled after biology and zoology. And in general, all students enrolled in computer science were more likely to drop-out. Females enrolled in biology (45.4%) and chemistry (38.5%) were most likely to change their major, although as noted above, none of the females who declared majors in chemistry, geology, or physics dropped-out of the university. One area that bears further investigation is biology. Seventy-two percent of the females who declared biology as their major either dropped-out or changed their major. In the future, perhaps special advising may be needed for these students.

Figure 4A (page 24) shows the attrition, out-migration to another major, and graduation rates of the 1985 student cohort who had declared science as their major in their first year at the University of Maine. Figures 4B, 4C, and 4D (pages 24-25) show the differences by sex for attrition, out-migration to another major, and graduation, respectively, of the same 1985 student cohort.

All baccalaureate students who were enrolled in the College of Sciences in the Fall semester, 1990 were tracked backwards through the Fall, 1985, to determine if they had "always" been identified with that specific College of Sciences' major or if they had migrated from another major (from the College of Sciences or another college). Students enrolled as "undeclared" within the College of Sciences were excluded from this study. (See Table 14, page 26)

Women majors were most likely to have moved into the Departments of Geology (75.0%), Mathematics (64.3%), Chemistry (60.0%), and Computer Science (58.8%). It should be noted that women accounted for less than 20% of the students who migrated into these departments. Women were least likely to transfer in to the physics (22.2%) or the biology major (36.7%).

In a separate study by Professor Ann Schonberger, students entering baccalaureate programs in engineering or physical science (physics or chemistry) in the Fall of 1984 or 1985 were followed until January 1990. The dropout rates for the four groups (M/F, 1984/1985) were similar, ranging from 34.0% to 38.7%. The persistence rates for the two years were quite different, however. In the Fall 1984 groups 47.1% of the men and 31.4% of the women were still in engineering or physical science in Spring 1989; 39.8% of the men and 28.6% of the women had graduated in these fields by January 1990. In the Fall 1985 group, 39.5% of the men and 40.5% of the women persisted until 1989; the graduation rates by January 1990 were 19.1% for men and 21.6% for women. The Fall 1984 women transferred into other sciences as well as into nonscience majors in somewhat greater numbers than the Fall 1985 women or the men from either group. Although a 22% increase in the number of students in the Fall 1985 group (presumably less academically capable) might have led to the lower persistence of 1985 males, it would not explain the <u>higher</u> persistence of the 1985 females. Whether the 1984 or 1985 group's persistence pattern is more typical is hard to say. However, in another study of students entering the college of Engineering in Fall 1982 the graduation rate for women was lower than that for men.

Table 15 (page 27) and Figure 5 (page 27) show the number and percentage of female undergraduate students enrolled in the College of Engineering during the fall semester of 1991. Table 16 (page 28) and Figure 6 (page 28) show similar information for the College of Forest Resources during the same fall semester of 1991. Similar data for the College of Sciences and Applied Sciences and Agriculture were not tabulated. These data reflect national enrollment patterns (NSF, 1990). A majority of the female students in Engineering were enrolled in the Departments of Chemical and Civil Engineering. The Department of Wildlife Management and Recreation accounted for fifty percent of the female enrollment in the College of Forest Resources.

Suggested Strategies at the University of Maine for Undergraduate Instruction:

1. Increase the number of women faculty teaching science and engineering courses.

2. Provide meaningful internships and work study or work merit jobs for women to make them more competitive in their search for employment or their acceptance for advanced academic work. Specially target non-traditional students for these programs.

3. Encourage programs that emphasize the development of leadership skills for women.

4. Since women generally seek to make their work applicable to solving people's problems, offer programs emphasizing socially productive uses of science and engineering such as the development of environmentally friendly living spaces, the creation of roads and bridges, the ecological solutions to society's problems, and the improvement of health and welfare.

5. Restructure first- and second-year science and mathematics courses to broaden the focus and change the reputation they have as "Weeder" courses.

6. Invite guest lecturers, women and men, to talk about science and engineering as a career.

7. Organize recitation and tutoring in integrated groups as well as study groups for women only.
   a. Payment through workstudy for organizers or teachers.
   b. Conducted by honor societies and/or professional organizations.

8. Support the new Science Residence Hall program.

9. Survey women students to determine how they feel about science and engineering and whether courses made them like science more or less and why.

10. Provide programming and training opportunities to address male students' negative attitudes about women in science and engineering.

11. Develop protocols for advising science majors that go beyond scientific work, e.g. career planning, mentoring.

12. Enhance placement services for women SME degree recipients.

13. Emphasize programs to encourage networking and mentoring among women in science, with emphasis on peer cooperation and support.

14. Undergraduate program reviews should require that gender and equity issues be part of both the self-study reports and the external assessment.

15. Involve undergraduate women students in the Expanding Your Horizons Conference and other mentoring programs for high school science students. Encourage sustained involvement in such programs with work study or work merit money.

16. The enrollment management plan of the University which targets high quality, underenrolled degree programs for special out-of-state recruitment activities should include special efforts to recruit women students into the technical degree programs offered by the University.

17. Develop courses on the history and philosophy of women in science.

TEACHER EDUCATION

A national survey of elementary teachers (97% of whom were female) indicated that 27% of elementary school teachers feel that they are "very well qualified" to teach life science but only 15% had the same perception of their competence to teach the physical sciences and/or earth/space science. In this national sample, over 80% of elementary teachers have had a college biology course, 30% a college chemistry course, and less than 20% a physics course. About 5% have no college science, 15% have had only one course and about 40% have had two college science courses. We need to improve the quality of the science education preservice teachers receive in order to change this status quo. At present, approximately 85% of the students enrolled in UM's elementary education program are female (Weiss, I.R. (1987). (Report of the 1985-86 National Survey of Science and Mathematics Education, Report RTI/2938/00-FR, Research Triangle Park, North Carolina)

The average age of science teachers in Maine (especially in chemistry and physics) is steadily increasing. Many of these teachers may not have been introduced to the research that documents specific teaching strategies and practices that encourage all students, but especially girls, to continue with science. UM could provide opportunities for workshops and institutes for inservice teachers to develop their content and pedagogical content knowledge in science, mathematics and technology, and to train teachers in equitable teaching strategies.

As teachers are a primary influence on students' career choices, it is crucial that math and science teachers at the middle and high school level are aware of the special needs of girls. AAUW's report "How Schools Shortchange Girls" shows that girls' self-esteem begins to decline when they enter middle school and continues to decline into their high school years. This transition time is difficult for girls; if they choose to study science they must reconcile its masculine image with their identity and femininity. (AAUW (American Association of University Women) (1992). How Schools Shortchange Girls. Association of University Women, Washington, D.C.).

Suggested Strategies at the University of Maine:

1. Require a course on Gender Issues in education degree programs. Make sure that math and science equity is emphasized.

2. Require that elementary education majors complete 12 credit hours of science, including assessment of basic science process skills.

3. Develop "break-out" sections of introductory biology, astronomy, chemistry, and physics for elementary education majors with an emphasis on science content and pedagogical content knowledge.

4. Develop a two-semester "General Physical Science for Non-Science Majors" (INT) course.

5. Require that at least 30 percent of the candidate's science course work be based on direct experience in investigating phenomena using scientific equipment.

6. Provide opportunities throughout education degree programs to teach science to children in schools.

7. Offer significant contact with the kinds of facilities, equipment, and instructional and library materials that are typical of outstanding science teaching and learning programs.

8. Evaluate student teachers on "equitable teaching strategies," especially math and science teaching.

9. Provide understanding of the societal implications of science and technology.

10. Prepare teachers to use such processes of science as observing, classifying, measuring, interpreting data, predicting, and experimenting.

11. Require at least 3 semester hours of study devoted exclusively to science methods, such work ideally undertaken just prior to student teaching.

12. Increase opportunities for research experiences within the science education curriculum.

13. Encourage the Maine Department of Education to adopt standards for science education that reflect national standards.

14. Support the SSI grant preservice component.

15. Provide opportunities for workshops and institutes at night and in the summer for inservice elementary, middle school, and secondary teachers to develop content and pedagogical knowledge in science, mathematics, and technology, and to improve their scientific knowledge. Make sure that gender issues are included.

16. Establish research projects in science so that elementary and secondary teachers can learn to "do" science.

17. Provide release time to UM faculty to improve communication (networking) between scientists, science educators, and practitioners in the field.

18. Install an 800 number electronic bulletin board service and an on-line CD-ROM curriculum database to permit teachers throughout Maine to have rapid access to resources, information, and developments in science and science education.

19. Bring students to campus to encourage them into math and science. Make sure that programs designed for all students are attractive to girls as well as boys.

20. Provide ongoing institutional support and funding for "Expanding Your Horizons Conference." Continue to involve UM women graduate and undergraduate students as well as faculty.

21. Continue to offer and support programs such as, "National Engineers Week School Visits Program."

22. Collect information on math and science programs for girls in the Northeast and provide it to area middle / junior high schools.

23. Continue to offer and support programs such as "Tour of Tomorrow," "Young Scholars Program," "Pulp and Paper Foundation Juniors Program," and "Engineering Open House," with additional emphasis on participation of girls.

24. Offer summer programs on campus; involve women undergraduate and graduate students in the programs as mentors.

25. Ensure that admissions literature reflects affirmative action goals and philosophy.

26. Design an outreach program through the admissions office in which female students majoring in science, math or engineering speak to high school groups throughout the state. Train the students and pay them through work study, work merit, or corporate donations.

TABLES AND FIGURES

Table 1
The Number and Percentage of Women in the Science & Engineering Faculties at the University of Maine Compared with National Data, 1991.

	Number of UM Female Faculty	Total Number of UM Faculty	% Female	% Female National
Faculty	141	542	38.3	
Professor	13	171	7.6	
Associate Professor	50	197	25.3	
Assistant Professor	63	149	42.3	
Instructor	15	25	60.0	
Faculty* Science/Engineering	27	295	9.1	
Professor	6**	131	4.6	5.8
Associate Professor	11	102	10.8	16.9
Assistant Professor	11**	61	18.0	26.8
Instructor	1	1	100.0	

Note:. *University of Maine data include the Colleges of Applied Sciences and Agriculture, Engineering, Forest Resources, and Sciences.
**One shared position.
Data Sources: Office of Equal Opportunity, University of Maine.

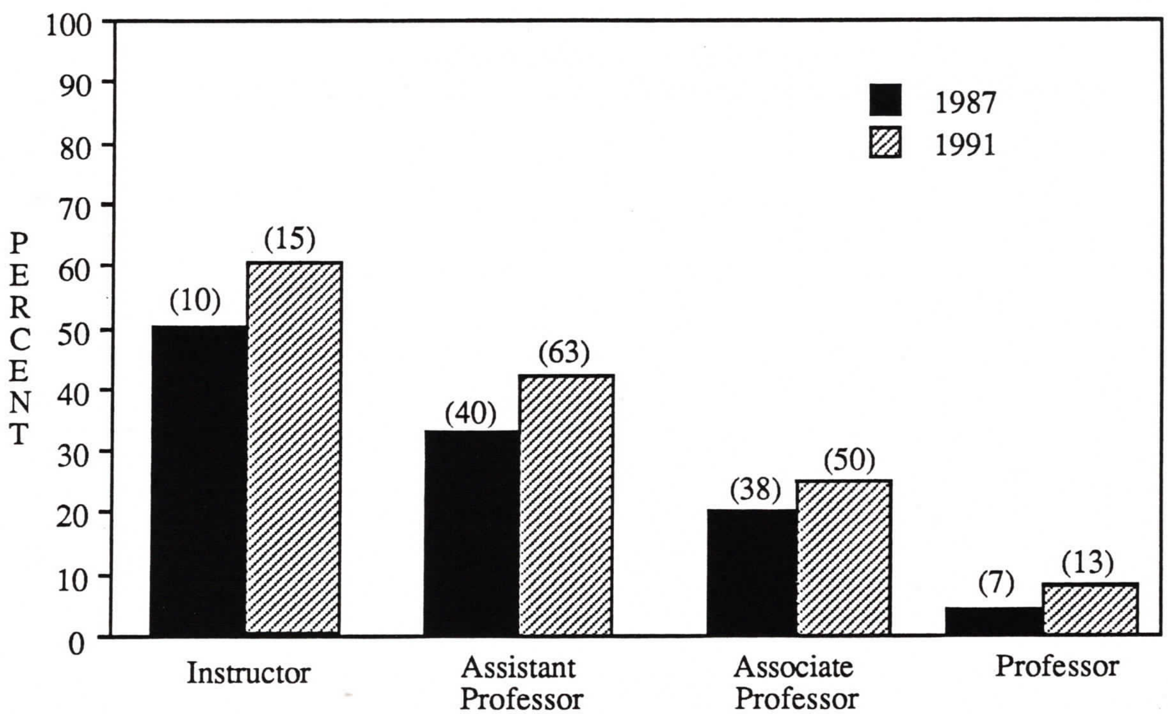

Figure 1A
The Number and Percentage of Women on the Faculty at the University of Maine in 1987 and 1991 as a Percentage of Their Male Counterparts.

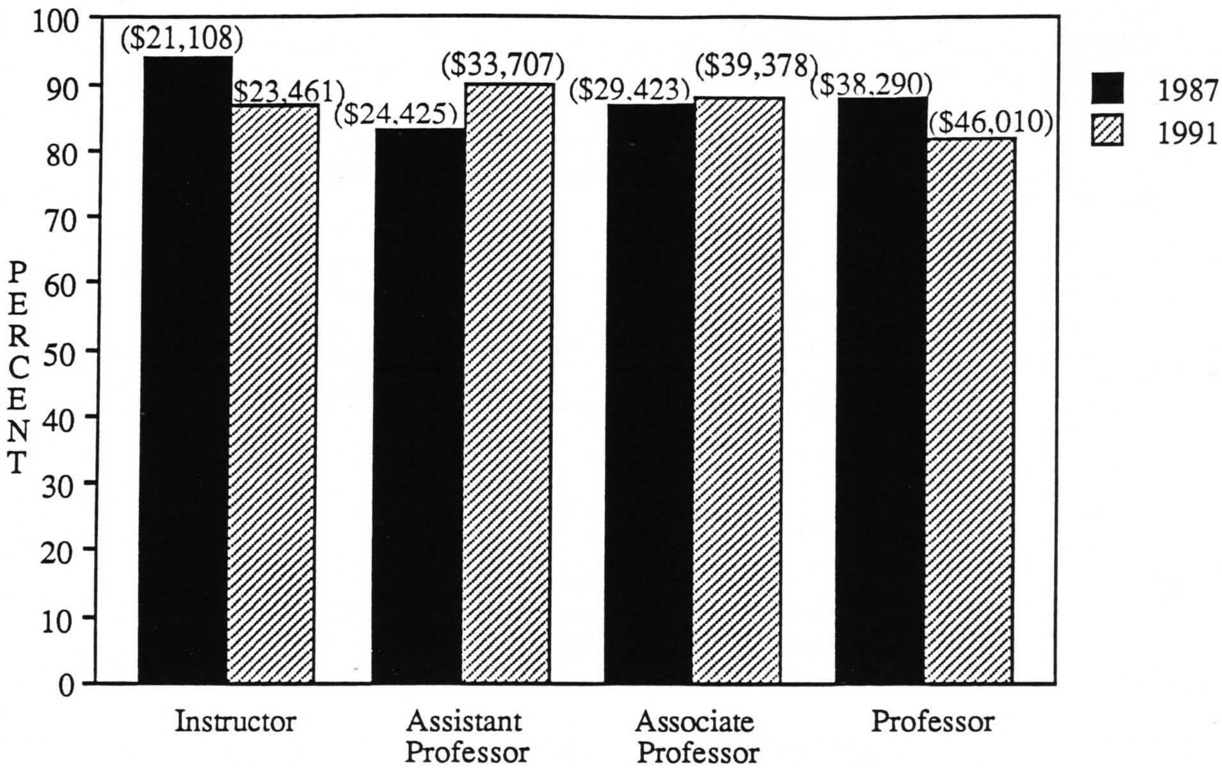

Figure 1B
The Salaries of Women on the Faculty at
the University of Maine 1987 and 1991 as a Percentage of Their Male Counterparts.

Table 2
The Number of Positions by which Women in the Science and Engineering Faculties are Underrepresented at the University of Maine Compared with National data, 1991.

Department	Positions
Geological Sciences	1-2
Mathematics	2-3
Plant Biology & Pathology	2
Computer Science	1
Biochemistry, Microbiology & Molecular Biology	1

Table 3
The Number and Percentage of Women Faculty in the College of Sciences at the University of Maine Compared with National Data, 1991.
Note: Net gain of three positions.

	1987-1988		1991-1992		
Department	Female/All Ratio	%	Female/All Ratio	%	% National Availability
Biochemistry, Microbiology, & Molecular Biology	2/14	14	2/12	17	25
Chemistry	1.5/14	11	1.5/12	13	14
Computer Science	0/6.5	0	0/7	0	12
Geological Sciences	0/14	0	1/14	7	18
Mathematics	1/25	4	1/25	4	13
Oceanography	did not exist		0/8	0	NA
Physics & Astronomy	1/17	6	1/17	6	5
Plant Biology & Pathology	0.5/15	3	1.5/15*	10	26
Zoology	2/18	11	3/15	20	22
TOTAL	8/123.5	6	11/125	9	

* plus 0.65 quasi tenure track

College of Engineering

Table 4
The Number and Percentage of Women Faculty in the College of Engineering at the University of Maine, 1987-1988 and 1991-1992 Compared with National Data, 1991.
Note: Net gain of one position.

	1987-1988		1991-1992		
Department	Female/All Ratio	%	Female/All Ratio	%	% National Availability
Chemical	0/15	0	0/13	0	4
Civil	1/18	6	1/11	9	3
Electrical	0/10	0	0/10	0	3
Mechanical	0/13	0	0/11	0	3
Surveying			1/5	20	NA
Engineering Technology	0/14	0	0/14	0	3
TOTAL	1/70	1	2/64	3	

College of Forest Resources

Table 5
The Number and Percentage of Women Faculty in the College of Forest Resources at the University of Maine, 1987-1988 and 1991-1992 Compared with National Data, 1991.
Note: Net gain of one position.

	1987-1988		1991-1992		
Department	Female/All Ratio	%	Female/All Ratio	%	% National Availability
Forest Biology	1/5	20	1/5	20	6
Forest Management	0/14	0	1/12	8	6
Wildlife	0/5	0	0/5	0	
TOTAL	1/24	4	2/22	9	

Table 6
The Number and Percentage of Women Faculty in the College of Applied Science and Agriculture at the University of Maine, 1987-1988 and 1991-1992 Compared with National Data, 1991. Note: Net gain of 0.5 position.

	1987-1988		1991-1992		
Department	Female/All Ratio	%	Female/All Ratio	%	% National Availability
Agricultural & Resource Economics	1/11	9	1/11	9	6
Animal & Veterinary Sciences	2/13	15	1/9	11	16
Bioresources Engineering (Formerly Agricultural Engineering)	0/8	0	0/6	0	
Entomology	1/7	14	2/6	33	11
Food Science	0/3	0	1/4	25	27
Plant, Soil, & Environment	2/13	15	1.5/13	12	14
School of Human Development	6/12	50	7/11	64	58
TOTAL	12/67	18	13.5/60	23	
TOTAL (without Human Development)	6/55	11	6.5/49	13	

Table 7
Number and Percentage of Women Graduate Students in the College of Sciences at the University of Maine, Fall, 1991.

	Number of females	Total	% Female
Biochemistry	1	4	25.0
Biological Sciences	7	17	41.2
Botany & Plant Pathology	6	11	54.5
Chemistry	7	21	33.3
Computer Sciences	1	16	6.2
Geological Sciences	5	19	26.3
Mathematics	7	13	53.8
Medical Technology	1	2	50.0
Microbiology	7	13	53.8
Oceanography	3	14	21.4
Physics	6	32	18.8
Plant Sciences	3	6	50.0
Zoology	14	29	48.3
Total	68	197	34.5

Table 8
Number and Percentage of Women Graduate Students in the College of Engineering, the University of Maine, Fall, 1991

	Number of females	Total	% Female
Chemical	5	23	21.7
Civil	13	41	31.7
Computer	1	16	6.3
Electrical	6	30	20.0
Mechanical	2	12	16.7
Surveying	5	32	15.6
Total	32	154	20.8

Table 9
Number and Percentage of Graduate Women Students in the College of Forestry at the University of Maine, 1991

	Number of females	Total	% Female
Forest Resources	0	17	0.0
Forestry	4	18	22.2
Master in Forestry	0	3	0.0
Resource Utilization-Forestry	0	3	0.0
Wildlife Conservation	0	2	0.0
Wildlife	2	10	20.0
Wildlife Management	8	18	44.4
Total	14	71	19.7

Table 10
Numbers of College of Sciences Degrees Conferred from 1980 to 1990
at the University of Maine

Academic Year*	Bachelor	Masters	Doctorate
1980	201	39	4
1981	189	24	8
1982	229	34	11
1983	197	39	2
1984	193	31	4
1985	185	28	7
1986	224	39	8
1987	199	27	9
1988	134	32	9
1989	121	40	13
1990	115	34	13

* Academic Year includes December of previous year, May and August. Data by sex not available.

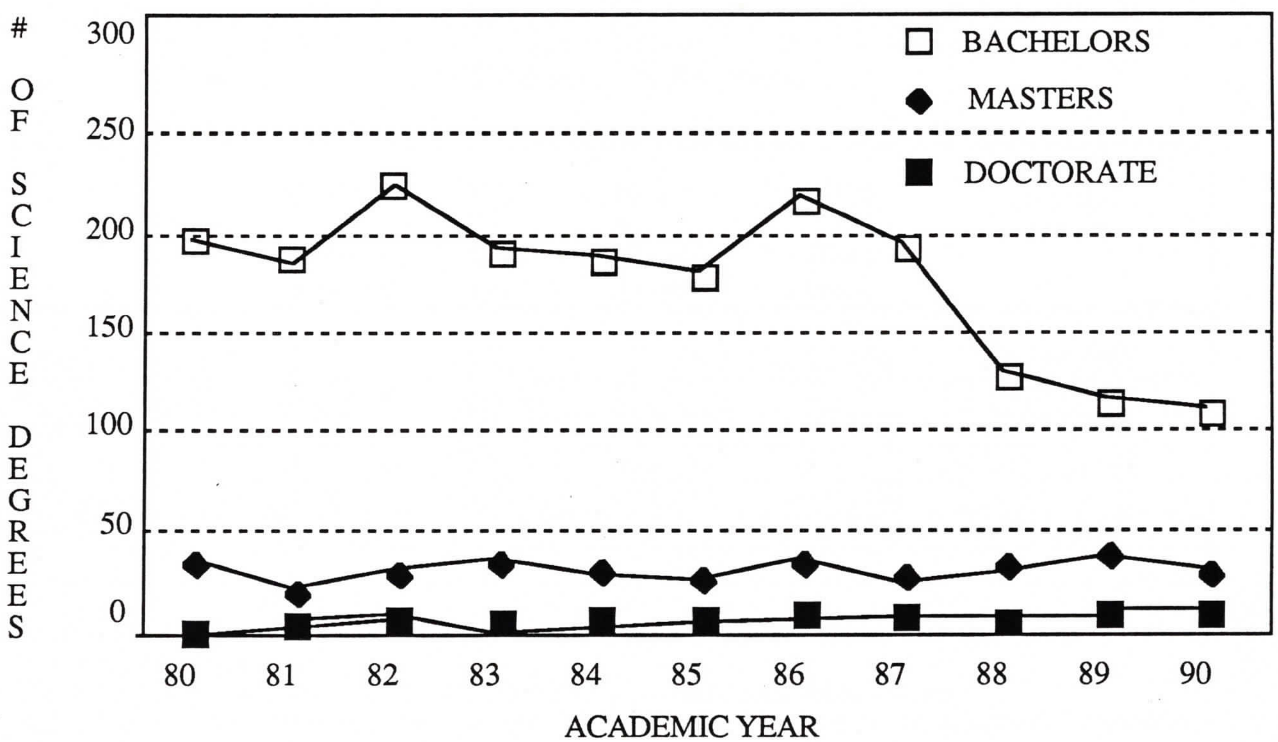

Figure 2
Number of Bachelors', Masters', and Doctoral Degrees in Science
Awarded at the University of Maine, 1980-1990. Note: Academic year includes December of previous year, May and August. Data from University of Maine-Office of the Registrar

Table 11
Percentage of Science Bachelors Degrees Awarded by Sex

Academic Year	% Degrees awarded in science	% Science degrees awarded to women *(number)*	% Degrees awarded to women *(number)*
1987	33.1	28.2 *(100)*	47.0 *(645)*
1988	35.3	17.7 *(87)*	48.2 *(671)*
1989	25.7	19.6 *(70)*	46.0 *(644)*
1990	29.0	23.6 *(99)*	47.7 *(699)*

Table 12
Women as a Percentage of Students Majoring in Baccalaureate Degree Programs in the Sciences at the University of Maine 1987-1990, Compared with National Data on 1988 Baccalaureate Recipients.

	1987 % *(Total number)*	1988 % *(Total number)*	1989 % *(Total number)*	1990 % *(Total number)*	National[1] (1988)
Agricultural Sciences[2]	65.0 *(20)*	70.5 *(17)*	71.4 *(14)*	64.7 *(16)*	32.6 *(14,740)*
Computer Science	13.8 *(29)*	18.8 *(32)*	15.0 *(20)*	28.5 *(21)*	29.9 *(39,805)*
Engineering	11.0 *(217)*	10.2 *(205)*	9.2 *(273)*	14.0 *(143)*	11.6 *(77,262)*
Life Sciences	42.6 *(54)*	52.3 *(42)*	39.5 *(43)*	59.1 *(49)*	41.4 *(56,414)*
Mathematics	52.9 *(17)*	60.0 *(15)*	29.0 *(31)*	60.0 *(10)*	35.2 *(16,378)*
Physical Sciences	45.5 *(11)*	22.2 *(9)*	57.0 *(7)*	18.8 *(16)*	25.0 *(15,811)*

1.National Science Foundation. (1990, January.). Women and minorities in science and engineering. (NSF #90-301). Washington, D.C.
2. The School of Human Development is NOT included in the data for agricultural sciences.
Notes: (a) University of Maine data taken from IPEDS Reports. (b) Note areas are for selected CIP categories.

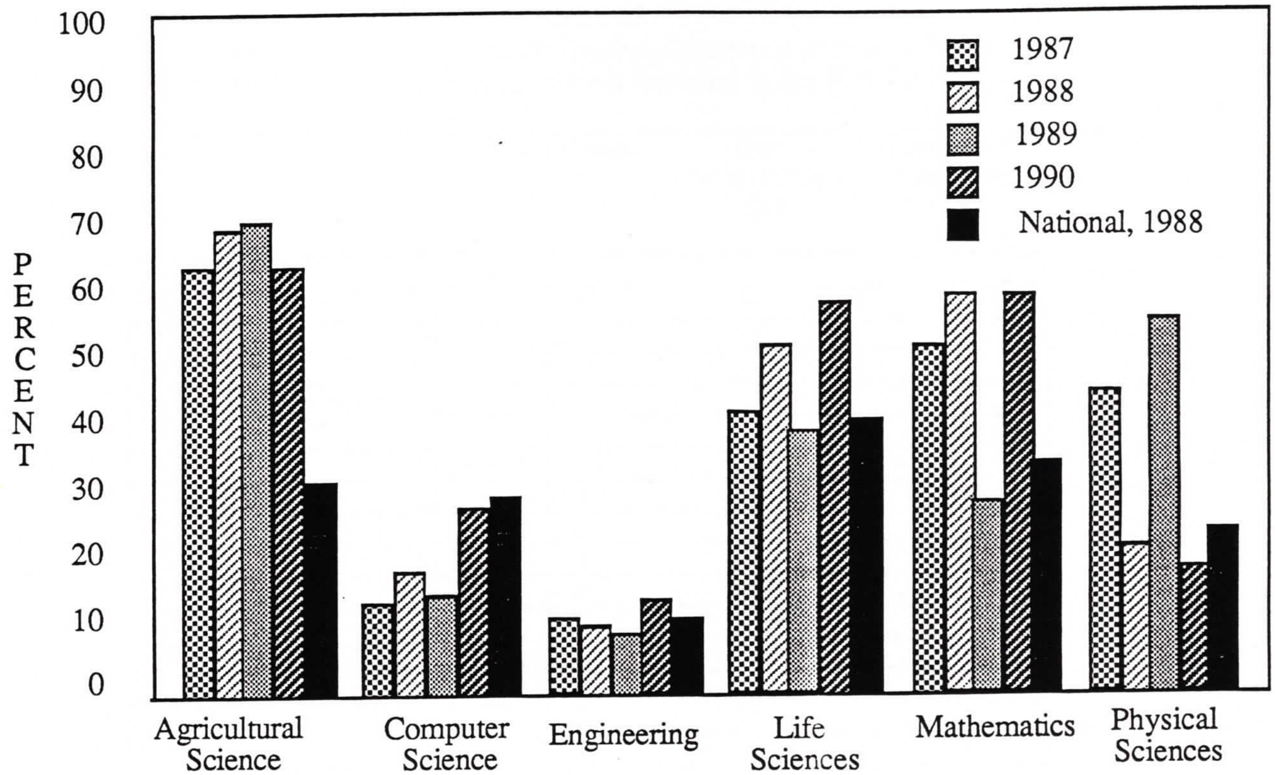

Figure 3
Percentage of Women Enrolled in Science and Engineering Programs at the University of Maine Compared with National Data.

Table 13
Assessment of Baccalaureate Student Outcomes after Five Years for College of Sciences' Majors Enrolled in the Fall, 1985.

Major[1]	N	Attrition (%)	Out-migration (%)	Graduated/ Persisted (%)
Biology				
Total	188	31.9	36.7	31.4
Males	91	36.3	27.5	36.3
Females	97	27.8	45.4	26.8
Biochemistry/Microbiology				
Total	94	12.8	16.0	71.3
Males	49	14.3	20.4	65.3
Females	45	11.1	11.1	77.8
Chemistry				
Total	37	13.5	40.5	45.9
Males	24	20.8	41.7	37.5
Females	13	0.0	38.5	61.5
Computer Science				
Total	344	28.5	29.7	41.9
Males	259	27.0	29.3	43.6
Females	85	32.9	30.6	36.5
Geology				
Total	39	12.8	15.4	71.8
Males	36	13.9	13.9	72.2
Females	3	0.0	33.3	66.7
Mathematics				
Total	94	25.5	24.5	50.0
Males	57	31.6	19.3	49.1
Females	37	16.2	32.4	51.4
Plant Biology				
Total	15	20.0	26.7	53.5
Males	10	20.0	30.0	50.0
Females	5	20.0	20.0	60.0
Physics[2]				
Total	86	14.0	23.3	62.8
Males	77	15.6	24.7	59.7
Females	9	0.0	11.1	88.9
Zoology				
Total	165	27.9	18.8	53.3
Males	76	32.9	17.1	50.0
Females	89	23.6	20.2	56.2
College Totals				
Total	1062	25.9	26.8	48.2
Males	679	26.1	25.3	48.6
Females	383	23.0	29.5	47.5

Notes: (1) includes Arts & Science majors whose selected major was an appropriate College of Sciences major.
(2) includes Engineering Physics majors. Data for Table 13 from OIS 92-17a, December, 1991.

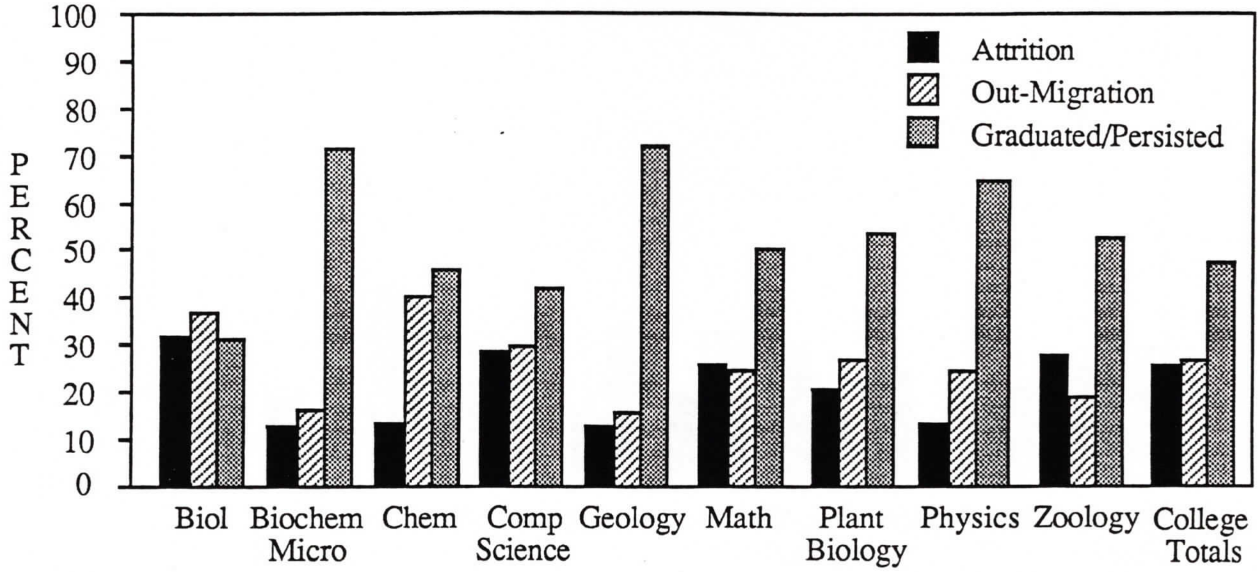

Figure 4A
Assessment of Baccalaureate Student Outcomes after Five Years
for the College of Sciences' Majors Enrolled in the Fall, 1985.

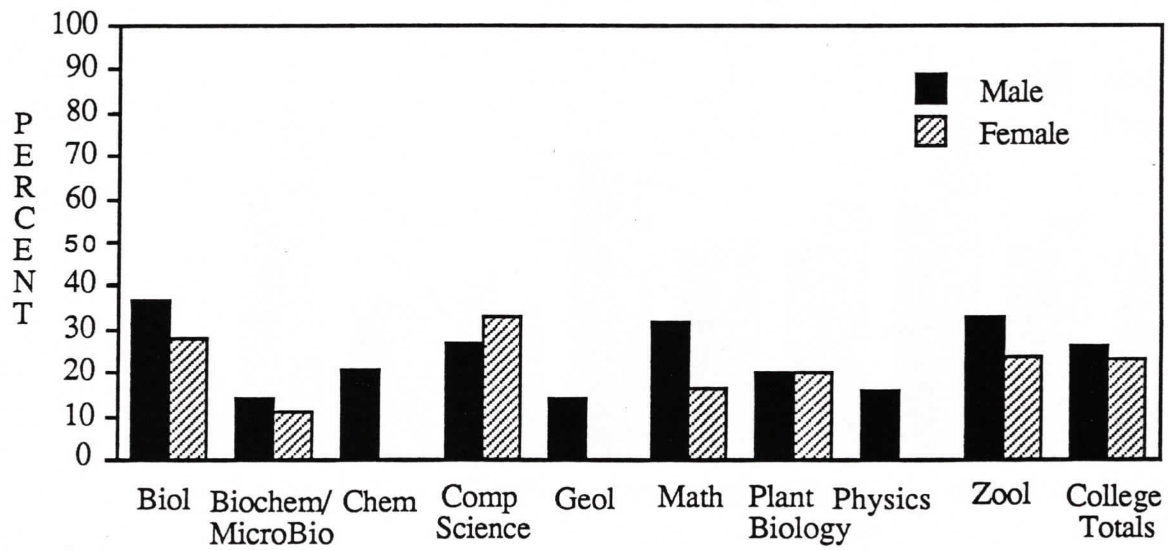

Figure 4B
Attrition Outcomes of Baccalaureate Students after Five Years
of College of Sciences' Majors Enrolled in the Fall, 1985 by Sex.

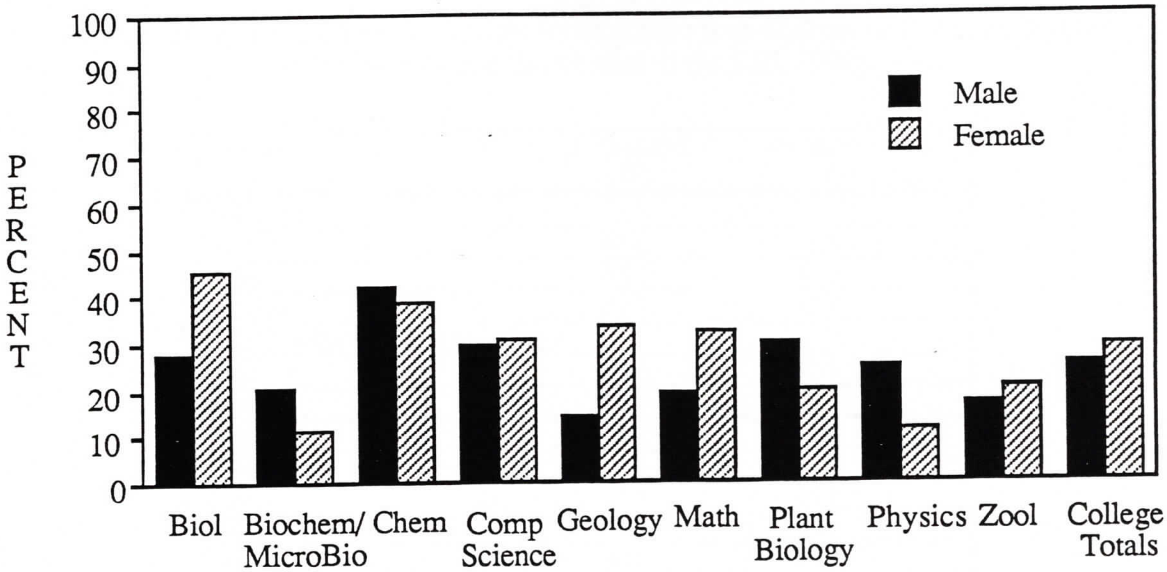

Figure 4C
Out-Migration Outcomes of Baccalaureate Students after Five Years of College of Sciences' Majors Enrolled in the Fall, 1985 by Sex

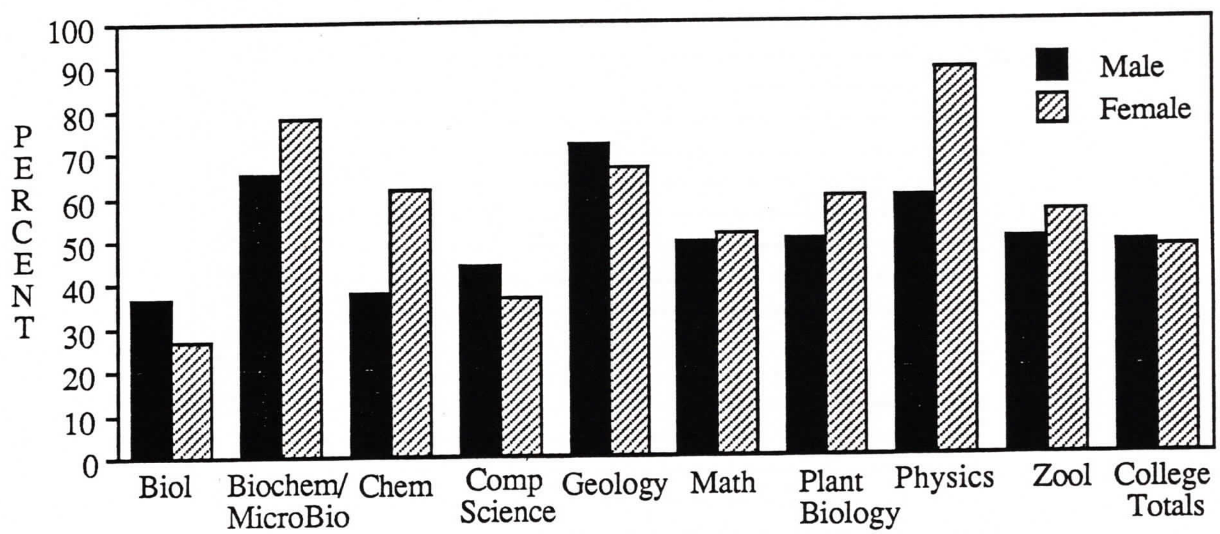

Figure 4D
Graduation/Persistence Outcomes of Baccalaureate Student after Five Years for College of Sciences' Majors Enrolled in the Fall, 1985 by Sex.

Table 15
Number and Percentage of Undergraduate Women Students in the College of Engineering at the University of Maine, Fall, 1991.

	Number of females	Total	% Female
Chemical	45	160	28.1
Civil	45	216	20.8
Computer	2	32	6.3
Electrical	13	177	7.3
Engineering Physics	4	37	10.8
General Engineering	2	37	5.4
Mechanical	19	192	9.8
Pulp & Paper Technology	1	8	12.5
Surveying	5	42	11.9
Undeclared	5	45	11.1
Total	**141**	**807**	**17.4**

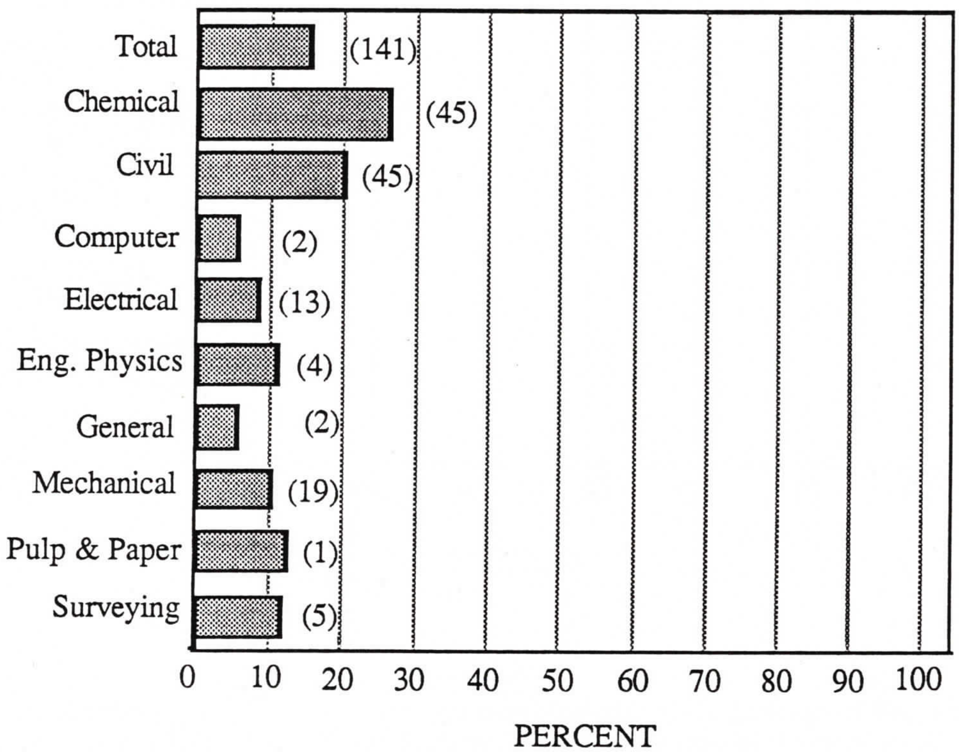

Figure 5
Number and Percentage of Women Undergraduate Students in the College of Engineering at the University of Maine, Fall, 1991. Note: Figures in brackets represent the number of women undergraduate students enrolled in the major.

Table 16
Number and Percentage of Women Undergraduate Students in the College of Forestry at the University of Maine, Fall, 1991.

	Number of females	Total	% Female
Forest Engineering	6	30	20.0
Forest Management	1	23	4.3
Forestry	12	132	9.1
Recreation Park	12	59	20.3
Wildlife Management	36	120	30.0
Wood Technology	0	1	0.0
Total	**70**	**383**	**18.3**

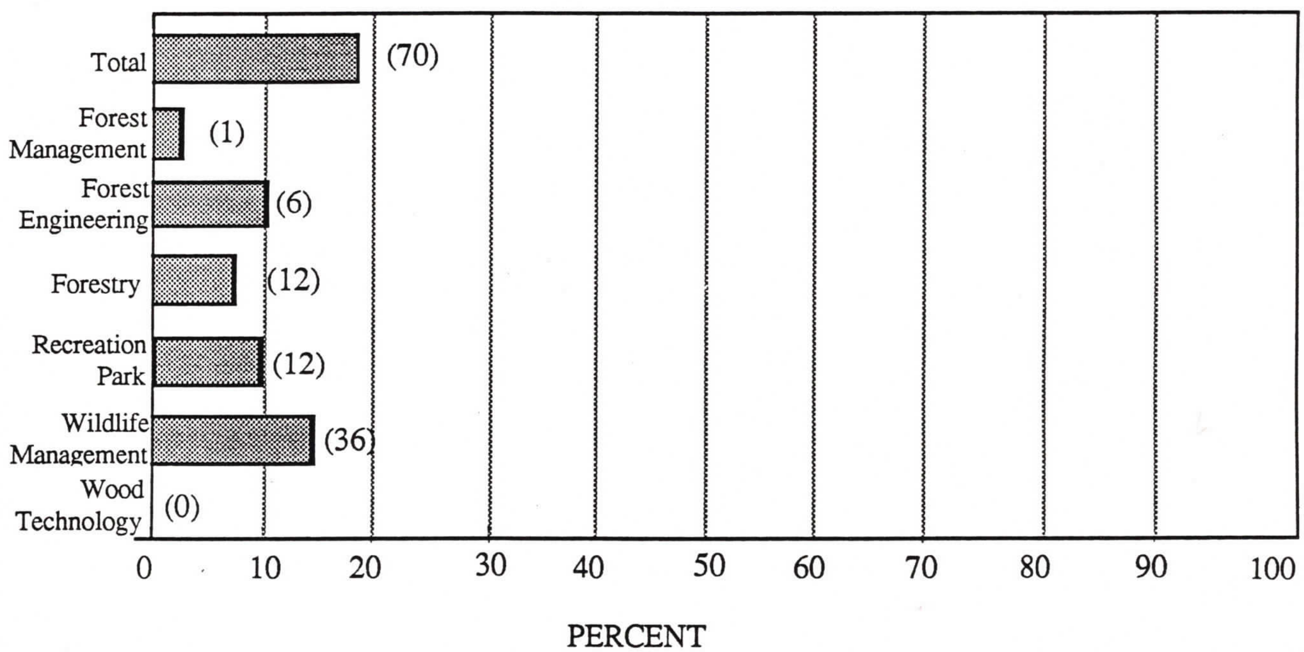

Figure 6
Number and Percentage of Women Undergraduate Students in the College of Forestry at the University of Maine, Fall, 1991. Note: Figures in brackets represent the number of women undergraduate students enrolled in the major.

APPENDIX 1

COMMITTEE LIST

UNIVERSITY OF MAINE
TASK FORCE ON WOMEN IN SCIENCE & ENGINEERING (WISE)

COMMITTEE LIST

John Alexander, Professor, Civil Engineering, 103 Boardman Hall

Sharon Barker, Director, Women's Resource Center, 101 Fernald Hall

Alice Bruce, Assistant Professor, Department of Chemistry, 288 Aubert Hall

Mitchell Bruce, Assistant Professor, Department of Chemistry, 288 Aubert Hall

Tom Byther, Chair, Department of Computer Science, 237a Neville Hall

Dagmar Cronn (WISE Committee Chair), Dean, College of Sciences, 263 Aubert Hall

Morgan Eash, Undergraduate Student, Department of Civil Engineering, 105 Boardman Hall

Cathy Elliott, Wildlife and Fisheries Specialist, Cooperative Extension, 234 Nutting Hall

Sally Jacobs, Instructor, Department of Biochemistry, Microbiology & Molecular Biology, 227 Hitchner Hall

Kate Scantlebury, Assistant Professor of Science Education, Department of Education, 206 Shibles Hall

Ann Schonberger, Professor and Director, Developmental Studies & Women in the Curriculum, 101 Fernald Hall

Charles Slavin, Associate Professor, Department of Mathematics, 322 Neville Hall

Charles Smith, Chair, Department of Physics & Astronomy, 117 Bennett Hall

Norman Smith, Dean, College of Engineering, 101 Barrows Hall

Don Stimpson, Associate Dean, College of Applied Sciences and Agriculture, Winslow Hall

Connie Stubbs, Graduate Student, Department of Plant Biology & Pathology, 202 Deering Hall

Katherine Weber, Assistant Dean, College of Forest Resources, 208 Nutting Hall

Bonnie Wood, Chair, Department of Zoology, 221 Murray Hall

APPENDIX 2

CHARGE TO WISE COMMITTEE

TASK FORCE ON WOMEN IN SCIENCE & ENGINEERING
(WISE)

CHARGE

In response to discussions with a variety of individuals (faculty, deans, professional staff, students, and alumnae/i), an Initiatives Committee on Women in Science and Engineering has been created at the University of Maine. It is charged to

1. Identify and describe the current programming and other resources for recruiting* and retaining** women in fields of science and engineering at the University of Maine.

2. Identify and describe the needs in the areas of recruiting* and retaining** women in fields of science and engineering at the University of Maine. Develop a vision statement that would guide the University in responding to these needs.

3. Recommend long-term goals (using a three- to five-year framework) and short-term objectives that support the University of Maine's vision statement concerning women in fields of science and engineering.

4. Identify funding and other resources for implementation of the goals and objectives.

5. Report findings and recommendations to the Vice President for Academic Affairs no later than December 31, 1991.

Upon receipt and acceptance of this report, the Vice President for Academic Affairs will recharge this Initiatives Committee with the implementation of the accepted recommendations.

* *Recruiting should be conceptualized as dealing with issues of aspirations as well as more traditional issues.*

** *Retention should be conceptualized as dealing with curriculum development as well as more traditional issues.*

APPENDIX 3

SUGGESTED GUIDELINES FOR FUTURE WISE COMMITTEE RESPONSIBILITIES

SUGGESTED GUIDELINES FOR FUTURE WISE COMMITTEE RESPONSIBILITIES

1. Monitor the Council on Women's Annual Report of progress related to women in science and engineering.

2. Work with Office of Institutional Studies to develop a system to keep computerized institutional data by sex, e.g. degrees granted by discipline.

3. Ensure that fund raising activities in the Development Office and the Office of Sponsored Programs includes projects that enhance the status of women in science and engineering at the University of Maine.

4. Monitor the number of women on committees related to science and engineering.

5. Establish priorities for each year to enhance the status of women in science and engineering.

6. Establish mechanisms for liaison with the private sector: develop campus programs about gender for representatives of industry; and encourage faculty to assess the climate for women in industries when determining appropriate internships.

7. Coordinate development of on-campus initiatives such as "Video in Science Week," Women in Science bulletin boards, and monthly science newsletters to public school teachers.

8. Provide training for University recruiters about women and science.

9. Require a category in the annual reports of science and engineering departments and colleges that addresses gender issues.

10. Publish an annual report in the Maine Perspective; deliver an annual report to the Faculty Senate and the Deans' Council.

11. Negotiate with AFUM to allow part-time tenure-track positions.

12. Acquire permanent institution of monetary resources for continuation of projects and programs for women in science and engineering.

Suggestions for immediate action:

1. Institute a program of speakers on women in science and engineering including special meetings with faculty.

2. Include material on gender issues in content and pedagogy in new faculty orientation programs within the colleges.

3. Publicize the resources that the Women in the Curriculum Program, the Women's Resource Center, and the Council on Women have to offer faculty.

4. Sponsor an annual conference on Women and Science/Technology.

APPENDIX 4

DESCRIPTION OF WISE COMMITTEE PROCESS

DESCRIPTION OF WISE COMMITTEE PROCESS

- An ad hoc group of individuals who had expressed interest in recruiting and retaining women in the fields of science and engineering was convened in May of 1991.

- The Women in Science and Engineering (WISE) Committee was established by the Office of Academic Affairs with Dagmar Cronn, Dean of the College of Sciences, designated as chair.

- The Committee decided to focus its efforts on the four colleges with the highest proportion of science and engineering programs, i.e., the Colleges of Applied Sciences and Agriculture, Engineering, Forest Resources, and Sciences. The Committee recognizes there are science programs in other areas of the University including University College and the College of Social and Behavioral Sciences that should be included in future initiatives.

- The Committee identified current programming and other resources for recruiting and retaining women in science and engineering at the University of Maine. (See Appendix 5.)

- The Committee collected statistical data reflecting the situation at the University of Maine. (See tables and figures.)

- Committee members collected articles, brochures, and other bibliographical information that was compiled and catalogued in the Women in the Curriculum library at the Women's Resource Center. (See Appendix 7.)

- Committee members familiarized themselves with the subject by reading <u>Stalking the Second Tier</u> by Sheila Tobias, <u>Factors Contributing to High Attrition Rates Among Science, Mathematics, and Engineering Undergraduate Majors</u> by Nancy Hewitt and Elaine Seymour, and other appropriate articles.

- The WISE Committee held two public forums to elicit input from the campus community.

- Input was solicited through a survey that asked primarily for suggestions for improvement in the work climate for women in science and engineering. These surveys were conducted by telephone or in person. The groups surveyed were deans, department chairs, women faculty in the sciences, student groups (including honors students and women's studies students), and other individuals in enrollment management.

- The Committee developed sets of strategies in pertinent categories.

APPENDIX 5

RESOURCES AT THE UNIVERSITY OF MAINE TO ENCOURAGE THE PARTICIPATION OF WOMEN IN SCIENCE, MATH, AND ENGINEERING

RESOURCES AT THE UNIVERSITY OF MAINE TO ENCOURAGE THE PARTICIPATION OF WOMEN IN SCIENCE, MATH, AND ENGINEERING

FACULTY PROGRAMS

- RESEARCH PROJECTS

    Research by Ann Schonberger about retention of women students in physical sciences and engineering at the University of Maine

    Research by Kate Scantlebury about Science Education and gender

- CURRICULUM DEVELOPMENT

    Alice and Mitchell Bruce's biographical sketches entitled "Women in Chemistry" for use in chemistry lectures

- FACULTY DEVELOPMENT

    Women in the Curriculum Program
    WIC lunch series features research about women being conducted by faculty

    WIC grants for curriculum development and research
    "Women in Physics: A Program to Combat Isolation and Improve Retention" A project designed by Dr. Susan McKay, Assistant Professor, Department of Physics and Astronomy

    NSF Postdoctoral Research Fellowships in Environmental Biology

    NSF Research Planning Grants and Career Advancement Awards

- RECRUITMENT / RETENTION INITIATIVES

    Special efforts to hire women faculty by the Civil Engineering Dept. and the College of Sciences

    Dean's luncheon for women in the College of Sciences

    Inclusion of gender issues / awareness on the agenda for faculty meetings in the Civil Engineering Department

    Women in the Sciences - A networking group of faculty and students initiated by the Zoology Department

PROGRAMS TO BENEFIT GRADUATE AND UNDERGRADUATE STUDENTS

- Women in the Curriculum Program
  WIC lunch series features research about women being conducted by faculty

- Onward Mathematics - provides students with poor precollege mathematics background remediation of math deficits in a supportive atmosphere

- Young Scholars Program

- McNair Scholars Program

- Paid hands on research participation

- Association of Graduate Students (and undergraduates) research and travel grants

- Math labs

- Exploring Science Professions Program (Residential Program providing support for men and women in science)

- SCS 100 Academic Advising (Support for men and women majoring in science)

- Efforts by the Civil Engineering Faculty to promote a more supportive environment for women including: 1) Successful proposal to the U.S. Department of Education to provide fellowships for women and minorities to pursue PhD's in science and engineering. (Seven of the ten fellowships have been awarded to women.) 2) Cooperation between the Civil Engineering Department and Residential Life in room assignment for engineering students. 3) Annual survey of women students as to climate issues in the department; follow up meetings are scheduled and meetings with the Chair of the Department are offered to women students to air concerns and discuss ideas. 4) Fundraising attempts to establish and endowment for scholarships for entering women students. 5) Efforts to establish a big sister program for incoming women students.

- The Math Department is an institutional member of the Association for Women in Math, i.e., the institution pays the membership fee for women math students, which includes newsletters

- "Women in Physics: A Program to Combat Isolation and Improve Retention," a series of four colloquia, panel discussions, receptions and luncheons to provide opportunities for women physicists, designed by Dr. Susan McKay and funded by the WIC program.

- The Chair of the Electrical Engineering Department is advisor to all incoming students in the department.

UNIVERSITY OF MAINE / PUBLIC SCHOOL SYSTEMS

- Planetarium.

- Involvement of University faculty (Alice Bruce, Vivian Holmes, and Maryann Jerkofsky) in Science-by-Mail program.

- Expanding Your Horizons Conference.

- Environmental Awareness Committee in Wildlife Department uses volunteer students to present environmental programs in public schools.

- Availability of successful women scientists as role models, including presentations by women science faculty in the public schools and to Girl Scouts of America Organization.

- Brochure produced by Applied Sciences and Agriculture entitled, "Careers for Women in the Applied Sciences: Opportunities for the 21st Century."

- Outreach to high school girls with SAT scores over 1100 to inform them of scholarship programs available in Civil Engineering (half of the available scholarship money has been awarded to women in the first three years of the scholarship program).

- Annual statewide conference for high school physics teachers.

- "Tour of Tomorrow," alternate years, broad invitation to schools within 120 miles of campus, publicized through Bangor Daily News supplement and radio commercials. Brings 2000-2500 students to campus for a one-day tour of science and engineering activities. Not targeted to either males or females, but idea of women in Engineering careers is pushed.

- "Young Scholars Program" - NSF sponsored two-week summer residence program for high school juniors. Student gender mix aimed at 50:50. Very competitive annual programs run by Electrical Engineering, about 25 students per year.

- "Pulp and Paper Foundation Juniors Program." Two 1-week resident programs for high school juniors sponsored by the Pulp and Paper Foundation. Thirty students in each session, which is a general introduction to engineering and campus academics -- 50% plus are females.

- "Engineering Open House." One day campus visit for 400-600 students following a series of programs in selected schools and a visit to a paper mill. Each engineering department is open for student visits. Approximately 40% females.

- "National Engineers Week School Visits Program." Visits to approximately 150-200 middle and high schools in late February each year. Video, college-produced, introduces engineering, pushes math and science as important classes and features women engineers and students equally with males. Visits made by volunteer practicing engineers. Reaches approximately 6000-7000 students each year.

APPENDIX 6

WOMEN IN SCIENCE AND TECHNOLOGY FUNDING SOURCES
NATIONAL SCIENCE FOUNDATION

WOMEN IN SCIENCE AND TECHNOLOGY FUNDING SOURCES

NATIONAL SCIENCE FOUNDATION

UNDERGRADUATE SCIENCE, ENGINEERING AND MATHEMATICS EDUCATION

1. Career access opportunities in science and technology for women, minorities, and persons with disabilities.

   a. Prototype and model projects for women, minorities, and persons with disabilities

      - Encourage institutions to create special outreach programs for these target audiences

      Program Announcement: NSF 88-126

2. Research Experiences for Undergraduates

   - Summer stipends for work as apprentices doing research
   - Designated for advanced students
   - Frequently sought after funding

   Deadline: October 10 annually

   Program Announcement: NSF 88-28

3. Undergraduate Course and Curriculum Development Program

   Proposals invited for:
   1) Introductory-level courses
   2) Curricula
   3) Laboratories

   - Emphasis on large enrollment courses
   - Emphasis on projects that target specific populations, eg. science education teachers
   - Some opportunities to establish a link between science and humanities
   - Curricula proposals concerned with design, development, and planning
   - Multidisciplinary and interdisciplinary proposals encouraged

   Projects may request support for up to five years

   Materials to prepare grant material:

   1. NSF brochure: Grants for Research and Education in Science and Engineering (GRESE) (NSF 90-77, rev. 8/90)

   Deadlines: June 15, 1992

RESEARCH CAREER DEVELOPMENT

1. Young Scholars Program

   - Provides support for programs run by colleges targeted to high school and junior high students
   - Disciplinary focus
   - Programs that encourage young people to make choices re: high school electives that will lead to science careers
   - These programs cannot be targeted towards one sex, except for math and physics programs for 6th and 7th graders; these can be targeted for girls only
   - Does include some research possibilities for students
   - University of Maine does have a young scholars program in the Electrical Engineering Department; this is a residential, summer program that runs for three weeks

   Awards funded for one year with second year funding contingent on review of activities of first year and availability of funds.

   Deadline will be announced in the NSF Bulletin

   Program Announcement: NSF 90-29

RESEARCH INITIATION AND IMPROVEMENT

1. Visiting Professorships for Women

   - A grant to invite distinguished women for a year to do research, teaching, but especially to inform and encourage women students
   - Departments without women faculty are targeted
   - The visiting professors can be researchers, or in the corporate or government sectors (do not necessarily have to be academics)
   - This can also be used by our women faculty to go elsewhere as a visiting professor to see what other colleges and universities are doing
   - The grant reimburses the host institution

   Deadline: November 15 of each year

   Program Announcement: NSF 90-42

APPENDIX 7

BIBLIOGRAPHY

BIBLIOGRAPHY

A Celebration of Women in Sciences. Discover. December, 1991.

Adapting to the Future: Report of the BBS (Biological, Behavioral, and Social Sciences) Task Force. November 2, 1991.

Adelman, Clifford. U.S. Department of Education. Women at Thirtysomething: Paradoxes of Attainment. June 1991.

Association of American Colleges. Evaluating Courses for Inclusion of New Scholarships on Women. May 1988.

Association of American Colleges. Looking For More Than A Few Good Women In Traditionally Male Fields. January 1987.

Association of American Colleges. On Campus With Women (Newsletter), Volume 20, Number 1, Summer 1990.

Association for Women in Science. Not Getting the Award, Grant, or Job? Check Those References! Volume 21, Number 1. January/February 1992.

Begley, S., Springen, K., Hager, M., Barrett, T., Joseph, N. Rx for Learning; There's no secret about how to teach science. Newsweek, pgs. 55-63, April 9, 1990.

Bernstein, Danielle R. Comfort and Experience with Computing: Are They the Same for Women and Men? SIGCSE Bulletin, Volume 23, Number 3, pgs. 57-64, September 1991.

Blum, Debra. Environment Still Hostile to Women in Academe, New Evidence Indicates. The Chronicle of Higher Education, pgs. A1, A20, October 9, 1991.

Bordieri, Corinne A. Workforce Report: Professionals in Chemistry. A Male Profession: Women in Chemistry. May 1991.

Borman, Stu. College Science Studies: Women, Minority Recruitment Lags. C&EN, pgs. 6-7, November 4, 1991.

Breaking Barriers: Women and Minorities in the Sciences. On The Issues, pgs. 7-9, 33, Summer 1990.

Bruce, Alice E. and Bruce, Mitchell R.M. Women's Contribution in Chemistry: A Report on the Process of Searching and Identifying Women in Chemistry. Summer/Fall 1988.

Brush, Stephen G. Women in Science and Engineering. American Scientist, Volume 79, pgs. 404-419, September-October 1991.

Brush, Stephen G. Women in Science and Engineering: Women are still seriously underrepresented in the sciences, and they have made comparatively little progress in the past five years. Why? American Scientist, pgs. 404-419, Volume 79.

Committee on Participation of Women of the Mathematical Association of America. Winning Women Into Mathematics, 1991.

Committee on Women in Science and Engineering, Office of Scientific and Engineering Personnel, National Research Council. Women in Science and Engineering: Increasing Their Numbers in the 1990s. 1991.

Cornell University. Sigma Delta Epsilon Graduate Women In Science Bulletin, Volume 50, Number 2, Summer 1986.

Cowley, G., Springen, K., Barrett, T., Hager, M. Not Just for Nerds. Newsweek, pgs. 52-54, April 9, 1990.

Dresselhaus, Millie. The Committee on the Status of Women In Physics (CSWP) Report to APS Council, April 21, 1991.

Frenkel, Karen A. Women & Computing. Communications of the ACM, Volume 33, Number 11, pgs. 34-46, November 1990.

Hewitt, Nancy M. and Seymour, Elaine. Factors Contributing to High Attrition Rates Among Science, Mathematics, and Engineering Undergraduate Majors. Report to the Alfred P. Sloan Foundation. 1991.

Hileman, Bette and Rawls, Rebecca L. 1992 Employment Outlook. C&EN, pgs. 30-35, October 21, 1991.

Hinckley, Patti. Engineering Women into the Workplace, Civil Engineering, pgs. 66-67, November 1991.

Howard Hughes Medical Institute. Support For Science Education and Research By Foundations and Voluntary Health Associations, 1990.

In the National Interest: The Federal Government in the Reform of K-12 Math and Science Education. September 1991.

Jackson, Allyn. Careers That Count: Opportunities in the Mathematical Sciences. 1991.

Kahn, Susan. University Science Teaching Must Reach Out to Women and Minorities. The Journal of NIH Research, Volume 4, January 1992.

Keith, Sandra Z. and Keith, Philip. Proceedings of The National Conference on Women in Mathematics and the Sciences. November 11-12, 1989.

Kenschaft, Patricia Clark. Winning Women into Mathematics. Mathematical Association of America, 1992.

Klawe, Maria. CRA Committee on Status of Women Has Many Activities Planned for Future. Computing Research News.

Kramer, Pamela A. and Lehman, Sheila. Mismeasuring Women: A Critique of Research on Computer Ability and Avoidance. Signs, pgs. 158-172, Autumn 1990.

Kumagai, Jean. St. Louis Program Pitches Science to Girls and Minorities. Physics Today, pgs. 54-55, May 1991.

LaFollette, Marcel C. Daring Steps Are Needed to Increase Women's Role in Science. The Chronicle of Higher Education, pg. A56, October 3,1990.

Listening for All Voices: Gender Balancing the School Curriculum, 1988. Proceedings of a conference held at Oak Knoll School, Summit, New Jersey, June 20-23, 1988.

Mappen, Ellen F., Dr. Bringing More Women into Science: What College Administrators Can Do. Rutgers: The State University of New Jersey. January 1992.

Martin, Dianne. In Search of Gender-Free Paradigms for Computer Science Education. Computing Research News, pgs. 5-7, October 1990.

Matyas, Marsha Lakes and Malcolm, Shirley M. Investing in Human Potential: Science and Engineering at the Crossroads. 1991.

Matyas, Marsha Lakes and Malcolm, Shirley M. Investing in Human Potential: Science and Engineering at the Crossroads. Executive Summary. 1991.

McMillen, Liz. Women in Academe Say They Bear the Brunt of Staffing Cutbacks. The Chronicle of Higher Education, 1991.

Meshkov, N. K. Graduate School and Beyond: A Panel Discussion from the Conference Science Careers in Search of Women. 1990.

Moche, Dinah. Physics in Your Future. The American Physical Society, 1989.

National Science Foundation. Guide to Programs, 1991.

National Science Foundation. NSF Visiting Professorships for Women: Program Announcement and Guidelines, Deadline: November 15, 1991.

National Science Foundation. Undergraduate Course and Curriculum Development Program; Announcement and Guidelines. Federal Register, Volume 56, Number 91, May 10, 1991.

National Science Foundation. Undergraduate Science, Engineering, and Mathematics Education, 1992.

National Science Foundation. Young Scholars Program FY 1992, Guidelines for Proposal Submission. Federal Register, Volume 56, Number 72, April 15, 1991.

Office of Institutional Studies. College of Sciences Out-Migration and In-Migration. December, 1991. University of Maine.

Office of Institutional Studies. An Assessment of In-Migration of Enrolled Mathematics and Phyical Science Majors. July 31, 1991. University of Maine.

Office of Institutional Studies. An Assessment of Out-Migration of Mathematics and Phyical Science Majors. July 31, 1991. University of Maine.

Ogozalek, Virginia A. A Comparison of Male and Female Computer Science Students' Attitudes Toward Computers. SIGCSE Bulletin, Volume 21, Number 2, pgs. 8-14, June 1989.

Pearl, A., Pollack, M. E., Riskin, E., Thomas, B., Wolf, E., and Wu, A. Becoming a Computer Scientist; A Report by the ACM Committee on The Status of Women in Computing Science. Women & Computing, Volume 33, Number 11, pgs. 47-57, November 1990.

Pool, Robert. Who Will Do Science in the 1990's? News & Comment, pgs. 433-435, April 27, 1990.

Prinzing, Debra. Women in Engineering, consulting fields breaking new ground, increasing their numbers and impact. Women Inc. Magazine, pgs. 8-13, January 23, 1989.

Raymond, Chris. Continuing Shortage of Women in Science Decried; Many Drop Out. The Chronicle of Higher Education, pgs. A31-A32, December 11, 1991.

"Recycling Existing Data." The Power of Archival Data for Longitudinal Research. Sponsored by the Murray Research Center with Support from the John D. and Catherine T. MacArthur Foundation and the National Institute of Mental Health. May 8-10, 1992.

Roberts, Leslie. Climate Extravaganza Bombs. News & Comment, pg. 436, April 27, 1990.

Roitman, Judith. What Still Needs to Change (for the Good of Women in Mathematics, and for the Good of Mathematics). Forum, pgs. 774-777, September 1991.

Rosser, Sue. Feminism Within the Science & Health Care Professions: Overcoming Resistance. Pergamon Press.

Rosser, Sue. Female-Friendly Science. 1990. Pergamon Press.

Schonberger, Ann K. College Women's Persistence in Engineering and Physical Science. Proceedings of the National Conference on Women in Mathematics and the Sciences. (Sandra Keith and Philip Keith, Eds.) November 11-12, 1989, St. Cloud State University, St. Cloud, MN.

Shell, Ellen Ruppel. "Flesh & Bone - A Celebration of Women in Science. "Discover: The World of Science. December 1991.

Sloat, Barbara Furin. Perspectives on Women and the Sciences: Bibliography. LSA Magazine, pgs. 1-2, Spring 1990.

Spertus, Ellen. Why Are There So Few Computer Scientists? MIT Artificial Intelligence Laboratory. December 1991.

Stebbins, Lisa. Perspectives on the 1991 College Women Students Leadership Conference. National Association for Women in Education, 1992.

Tapia, Richard. Rice Program Encourages Minorities to Pursue Science, pg. 9.

THREADS, Office for Women's Research Newsletter, Spring 1991.

Tobias, Sheila. They're Not Dumb, They're Different: Stalking the Second Tier. 1990.

University of Maine. Careers for Women in the Applied Sciences: Profiles of Women Making a Difference.

U.S. Department of Energy Notice of Program Solicitation No. 71. Guide for the Preparation of Proposals for the Pre-Freshman Enrichment Program PREP-1992, August 1991.

Watkins, Beverly T. An Outsider Pierces Veil of 'Math Anxiety' and 'Science Avoidance.' The Chronicle of Higher Education, pg. A3, April 17, 1991.

Wilson, Robin. Colleges Start Programs to Encourage Women Who Are Interested in Engineering Careers. The Chronicle of Higher Education, pgs. A27-A29.

Women in Math and Science. Murray Research Center News, 1992.

Women in Science Program, University of Michigan. Resource List of National Organizations of and for Women in Science.