The Science Glass Ceiling: Breaking Down Gender Barriers
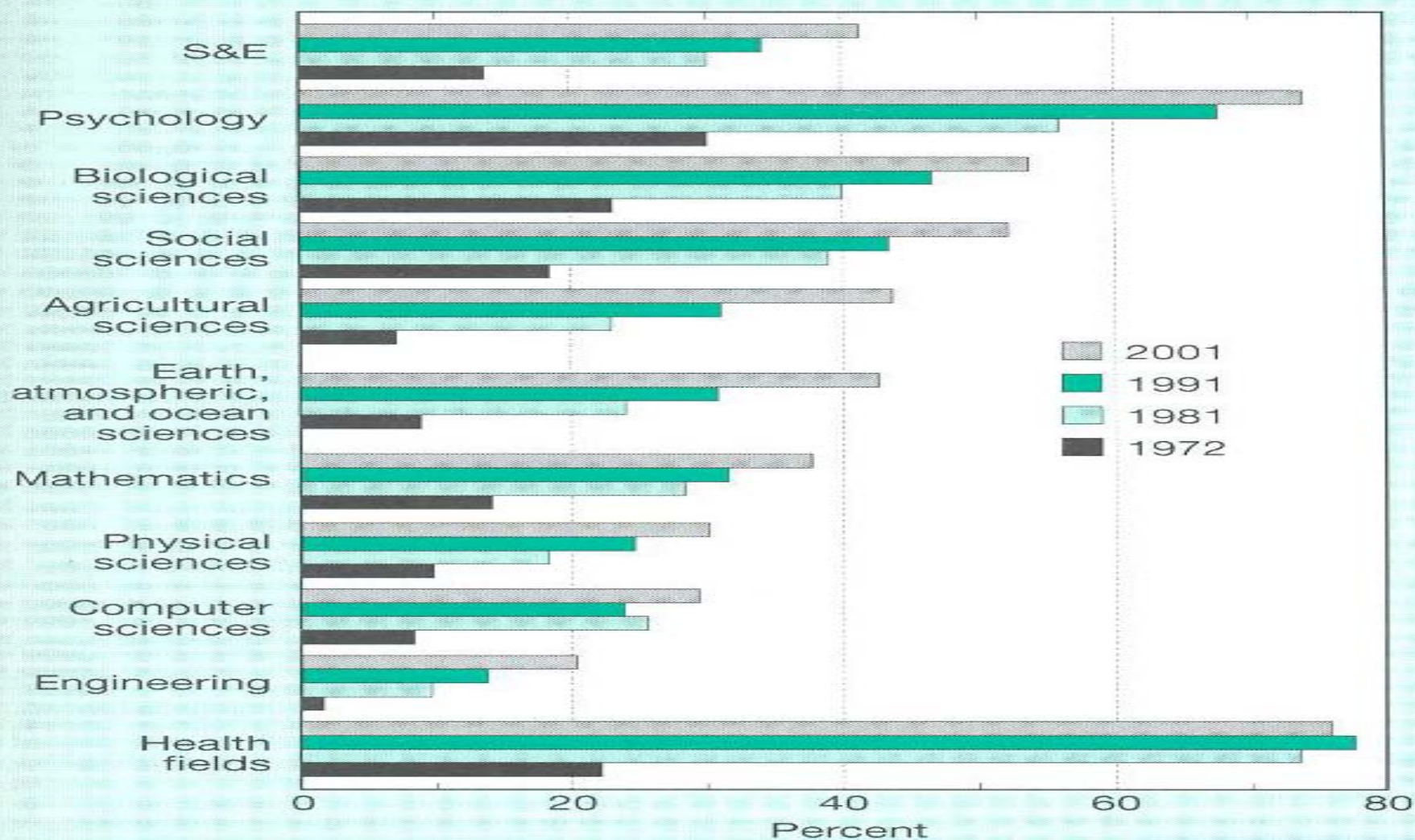
Femtec. International Conference

Berlin, Germany

October 21, 2005

Dr. Sue V. Rosser
Dean, Ivan Allen College

Georgia Institute of Technology

Figure 2-7
Female U.S. graduate S&E enrollment, by field: Selected years, 1972–2001
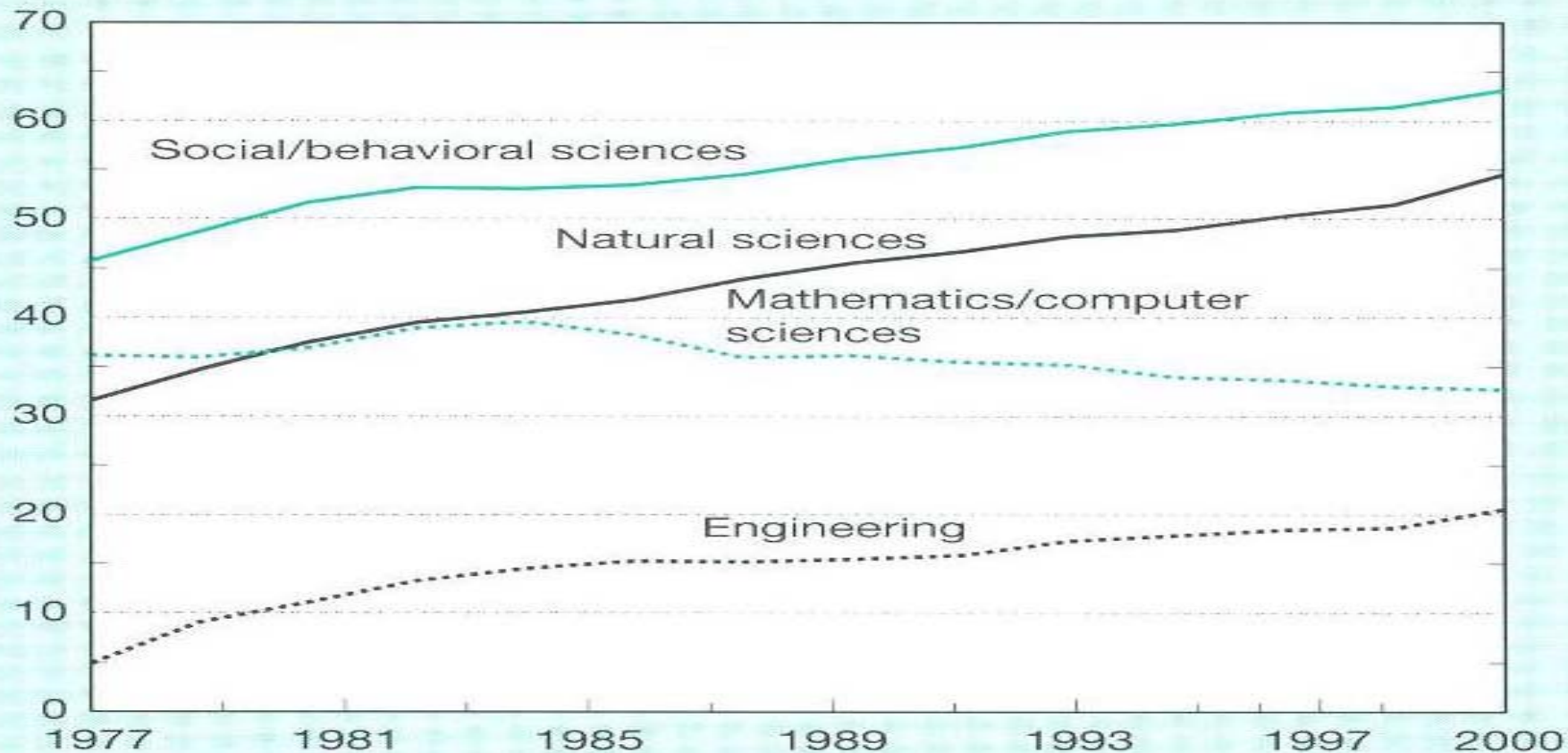

NOTE: Health fields not included in S&E total.

SOURCE: National Science Foundation, Division of Science Resources Statistics, WebCASPAR database system, http://caspar.nsf.gov. See appendix table 2-13.

Science & Engineering Indicators – 2004

Figure 2-12
Female share of S&E bachelor's degrees, by selected fields: Selected years, 1977–2000

NOTES: Data for 1983 are estimated. Natural sciences include physical, biological, earth, atmospheric, and ocean sciences.

SOURCES: U.S. Department of Education, Completions Survey; and National Science Foundation, Division of Science Resources Statistics, WebCASPAR database system, http://caspar.nsf.gov. See appendix table 2-22.

Science & Engineering Indicators – 2004

Number of degrees

Social/
behavioral sciences

Natural sciences

Engineering

Mathematics/
computer sciences
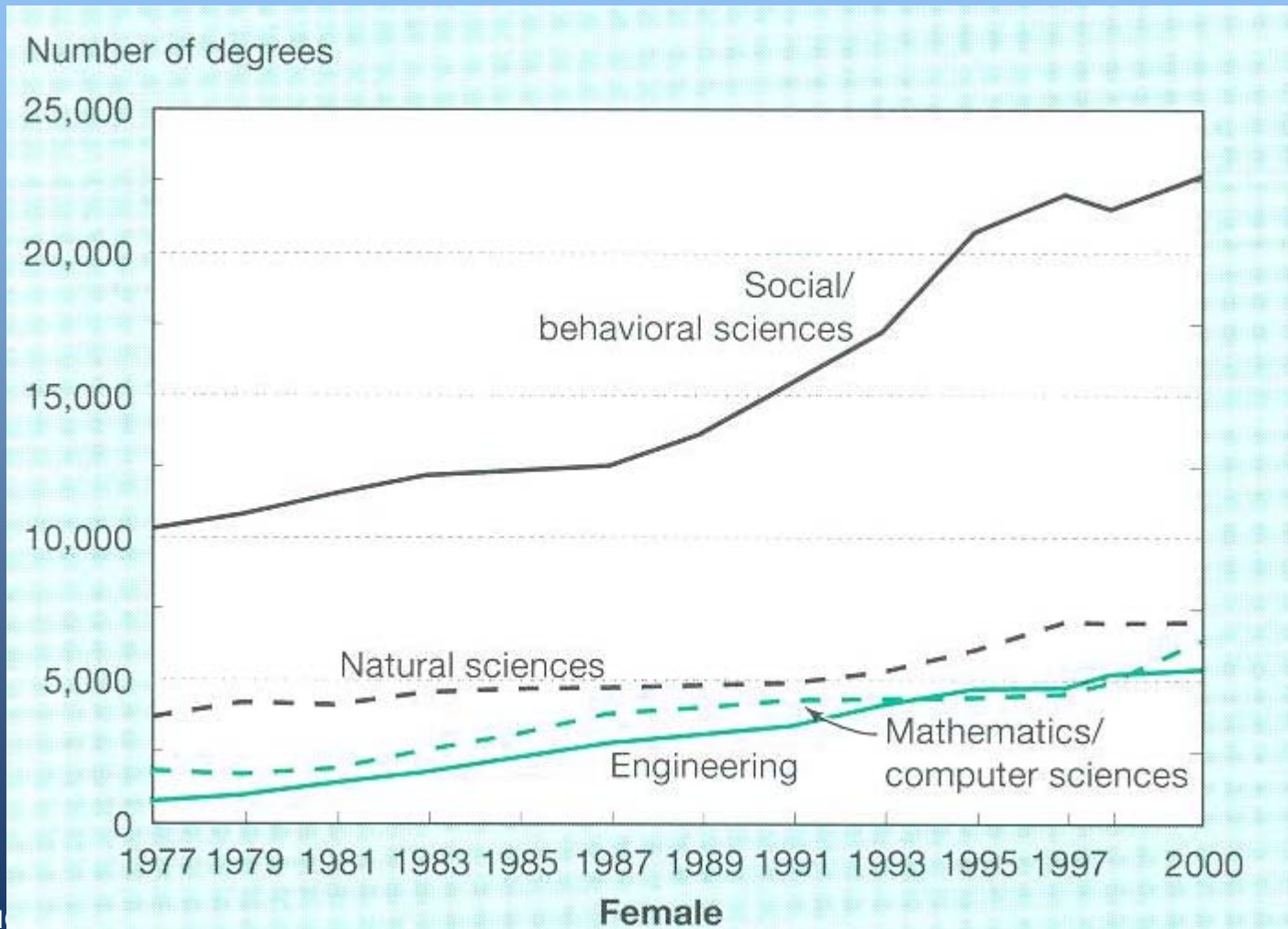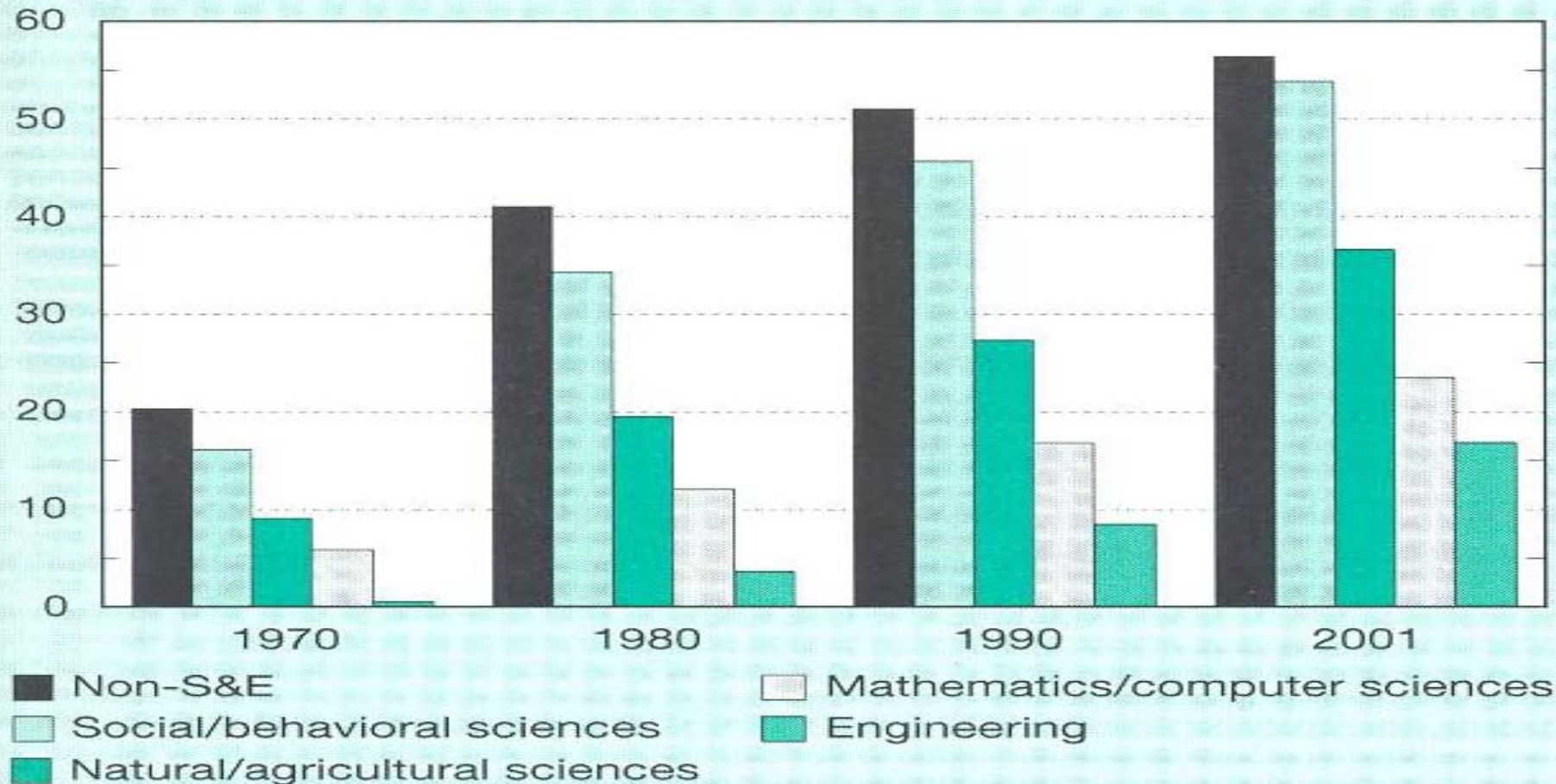
1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 2000

Female

Figure 2-20
Doctoral degrees earned by women in U.S. institutions, by field: Selected years, 1970–2001

Percent

Legend:
- Non-S&E
- Social/behavioral sciences
- Natural/agricultural sciences
- Mathematics/computer sciences
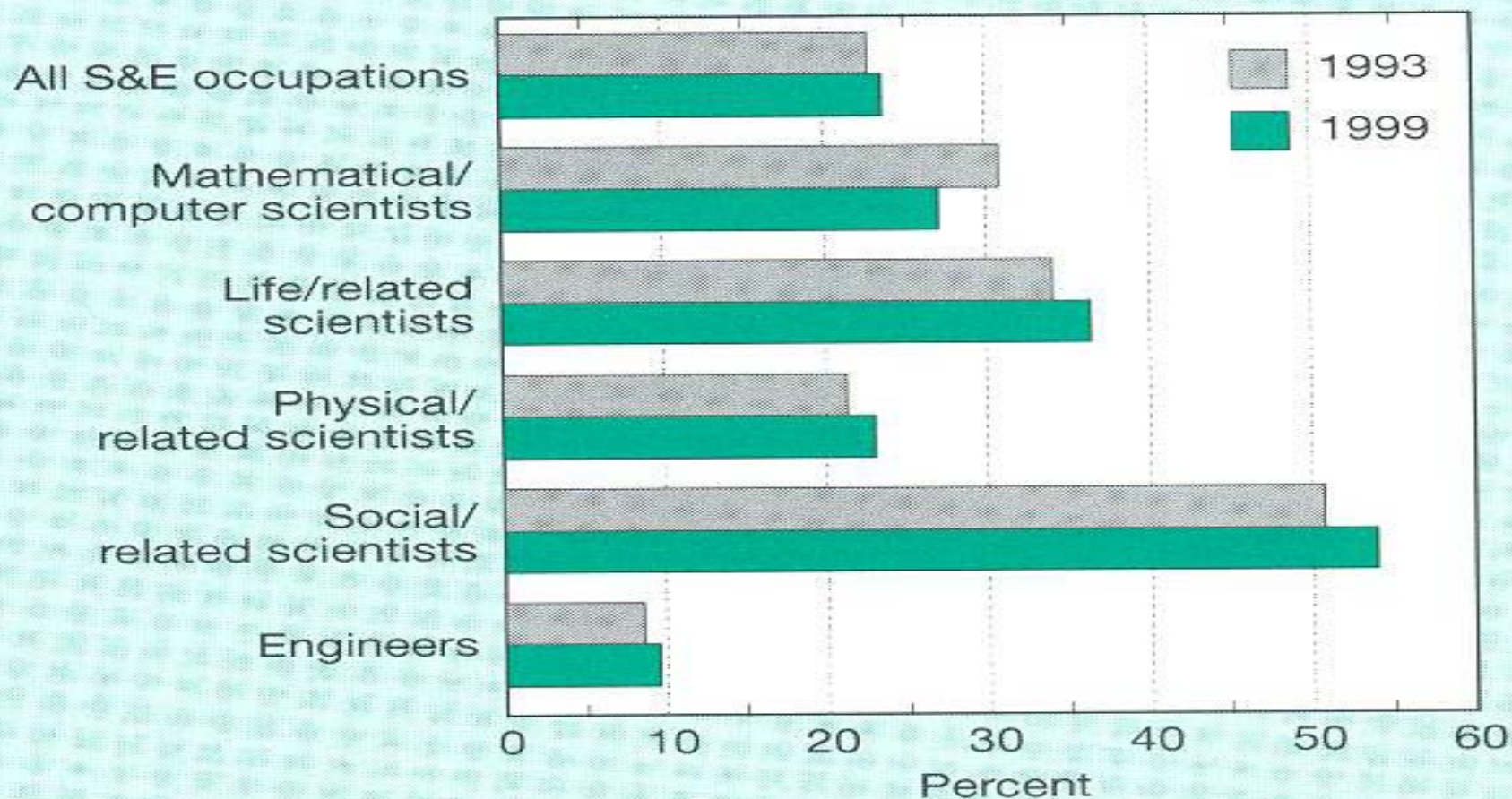- Engineering

NOTE: Natural sciences include physical, biological, earth, atmospheric, and ocean sciences.

SOURCE: National Science Foundation, Division of Science Resources Statistics, WebCASPAR database system, http://caspar.nsf.gov. See appendix table 2-26.

Figure 3-20
Female employment in S&E occupations, by broad occupation: 1993 and 1999

SOURCE: National Science Foundation, Division of Science Resources Statistics, Scientists and Engineers Statistical Data System (SESTAT), 1993 and 1999. See appendix table 3-13.

Science & Engineering Indicators – 2004

INFORMATION TECHNOLOGY

Student Interest in Computer Science Plummets

Technology companies struggle to fill vacant positions

BY ANDREA L. FOSTER

STUDENTS ONCE SAW computer-science classes as their ticket to wealth. Now, as more technology jobs are outsourced to other countries, such classes are seen as a path to unemployment.

New data show students' interest in the discipline is in a free fall. The number of newly declared computer-science majors declined 32 percent from the fall of 2000 to the fall of 2004, according to a report released this month by the Computing Research Association, which represents computer scientists in industry and academe. Another survey, from the Higher Education Research Institute at the University of California at Los Angeles, shows that the number of incoming freshmen who expressed an interest in majoring in computer science has plummeted by 59 percent in the last four years.

Students' waning enthusiasm for the field worries technology companies that must work harder to fill vacant positions, as well as researchers who need a steady supply of intellectual talent to fuel scientific breakthroughs. Computer scientists are already struggling to maintain basic research despite sharply reduced financial support from government agencies.

Computer scientists say their ranks need to grow for them to tackle such challenges as protecting the country's financial, utility, telecommunications, transportation, and defense systems from terrorist attacks.

In response, the National Science Foundation and some colleges are stepping up efforts to promote computer science—especially to women and some minority groups, whose representation in the field is minuscule.
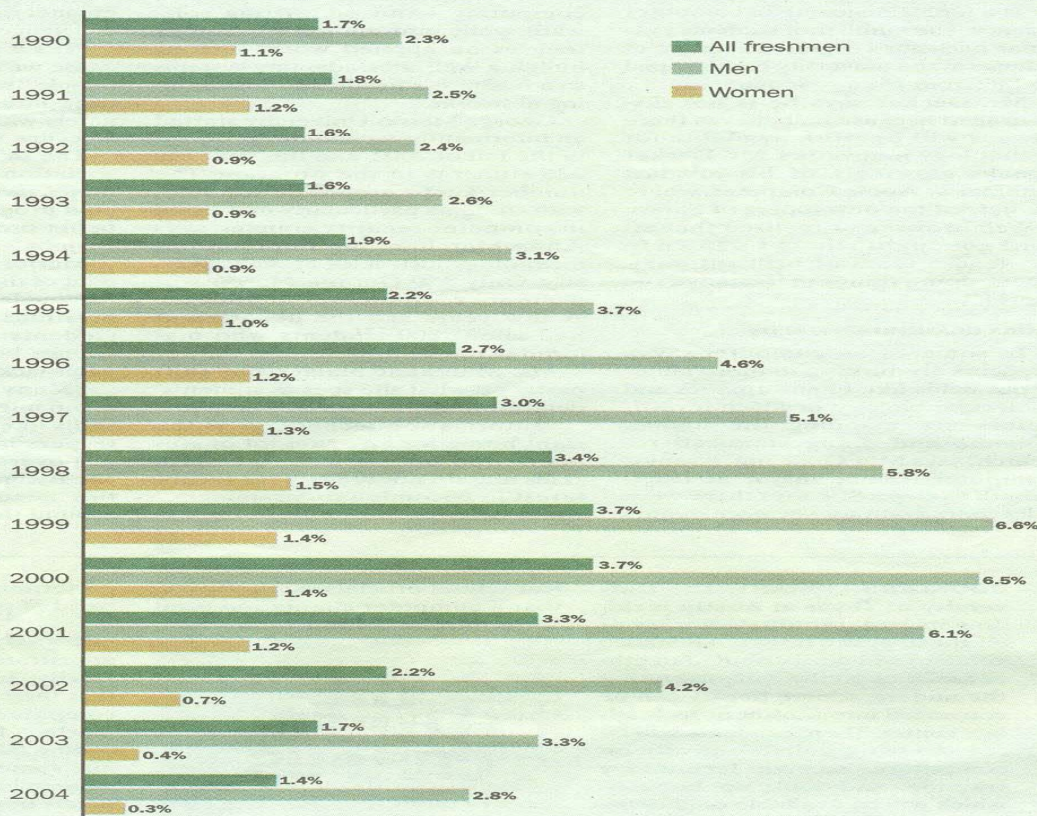
"We may have to do a little bit of recruiting," says Stuart H. Zweben, author of the Computing Research Association report and a professor and chairman of the computer-science and engineering department at Ohio State University at Columbus, where the number of computer-science majors dropped 28 percent from the fall of 2001 to the fall of 2004.

WHY THE DRAIN?

Computer scientists and undergraduates blame the field's anemia mostly on news-media reports of technology jobs moving to developing countries, and on the bursting of

The Rise and Fall of Computer Science

While student interest rose to record highs during the dot-com boom, in recent years the percentage of freshmen at four-year colleges expecting to major in computer science has fallen sharply.

Year	All freshmen	Men	Women
1990	1.7%	2.3%	1.1%
1991	1.8%	2.5%	1.2%
1992	1.6%	2.4%	0.9%
1993	1.6%	2.6%	0.9%
1994	1.9%	3.1%	0.9%
1995	2.2%	3.7%	1.0%
1996	2.7%	4.6%	1.2%
1997	3.0%	5.1%	1.3%
1998	3.4%	5.8%	1.5%
1999	3.7%	6.6%	1.4%
2000	3.7%	6.5%	1.4%
2001	3.3%	6.1%	1.2%
2002	2.2%	4.2%	0.7%
2003	1.7%	3.3%	0.4%
2004	1.4%	2.8%	0.3%

THE CHRONICLE
of Higher Education.

December 3, 1999 • $3.25
Volume XLVI, Number 15

The M.I.T. professors who studied the treatment of female faculty members included (from left): Sylvia Ceyer, Paola Rizzoli, Penny Chisholm, Nancy Hopkins, Leigh Royden, JoAnne Stubbe, and Mary-Lou Pardue.

Women at MIT Create
a Movement for Female Academics

Their report changes their careers and prompts
other universities to look anew at gender bias: A16

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Dean, Ivan Allen College

Georgia Institute of Technology

Statement by Leaders at MIT Meeting on 1/29/01

"Institutions of higher education have an obligation, both for themselves and for the nation, to fully develop and utilize all the creative talent available," the leaders said in a unanimous statement. "We recognize that barriers still exist" for women faculty.

They agreed to:

- Analyze the salaries and proportion of other university resources provided to women faculty
- Work toward a faculty that reflects the diversity of the student body
- Reconvene in about a year "to share the specific initiatives we have undertaken to achieve these objectives"
- "Recognize that this challenge will require significant review of, and potentially significant change in, the procedures within each university, and within the scientific and engineering establishments as a whole."

(Campbell, 2001, p.1)

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Research Informs Project Goals
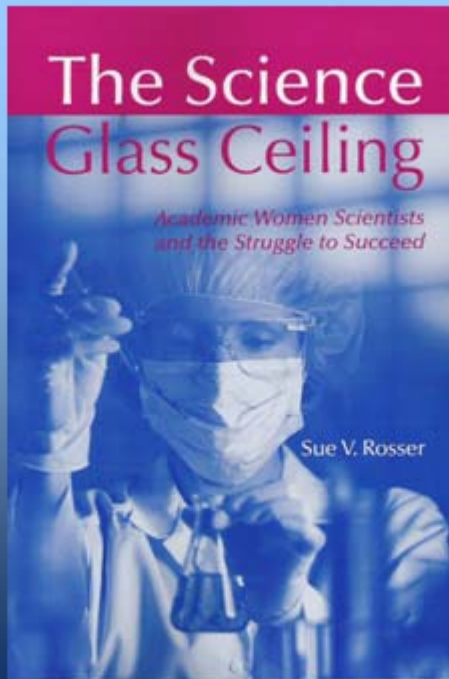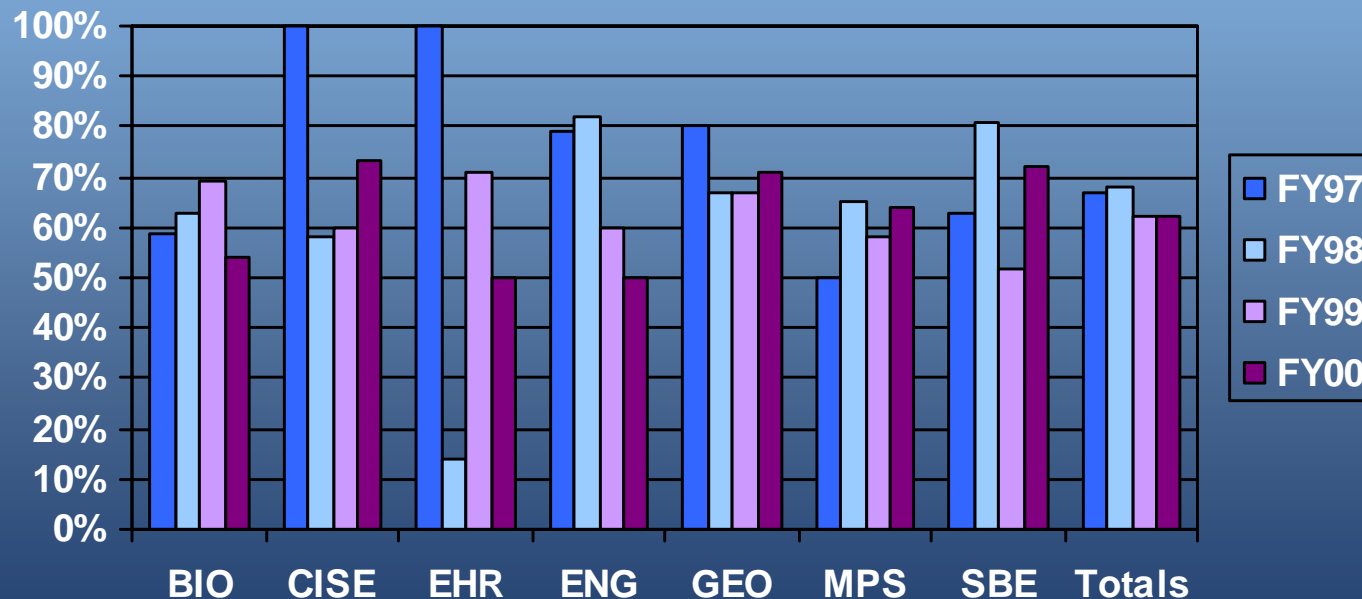
- E-mail questionnaire responses from 450 women scientists and engineers

- 40 in-depth interviews

- POWRE and CBL awardees

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Numbers and Disciplinary Distribution of Respondents to Questionnaire

Responses to E-mail Questions divided by Total Grants

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Dean, Ivan Allen College

Total Responses to Question 1

Question 1: What are the most significant issues/challenges/opportunities facing women scientists today as they plan their careers?

Legend:
- 1997
- 1998
- 1999
- 2000
- Current CBL Profs.
- Past CBL Profs.
- Total CBL Profs.

Categories:
- Balancing work with family responsibilities
- The management/balancing comm ttee responsibilities with research and teaching
- Low numbers of women, isolation and lack of camaraderie/mentoring
- Gaining credibility/respectability from peers and administrators
- "Two Career" problem

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Dean, Ivan Allen College
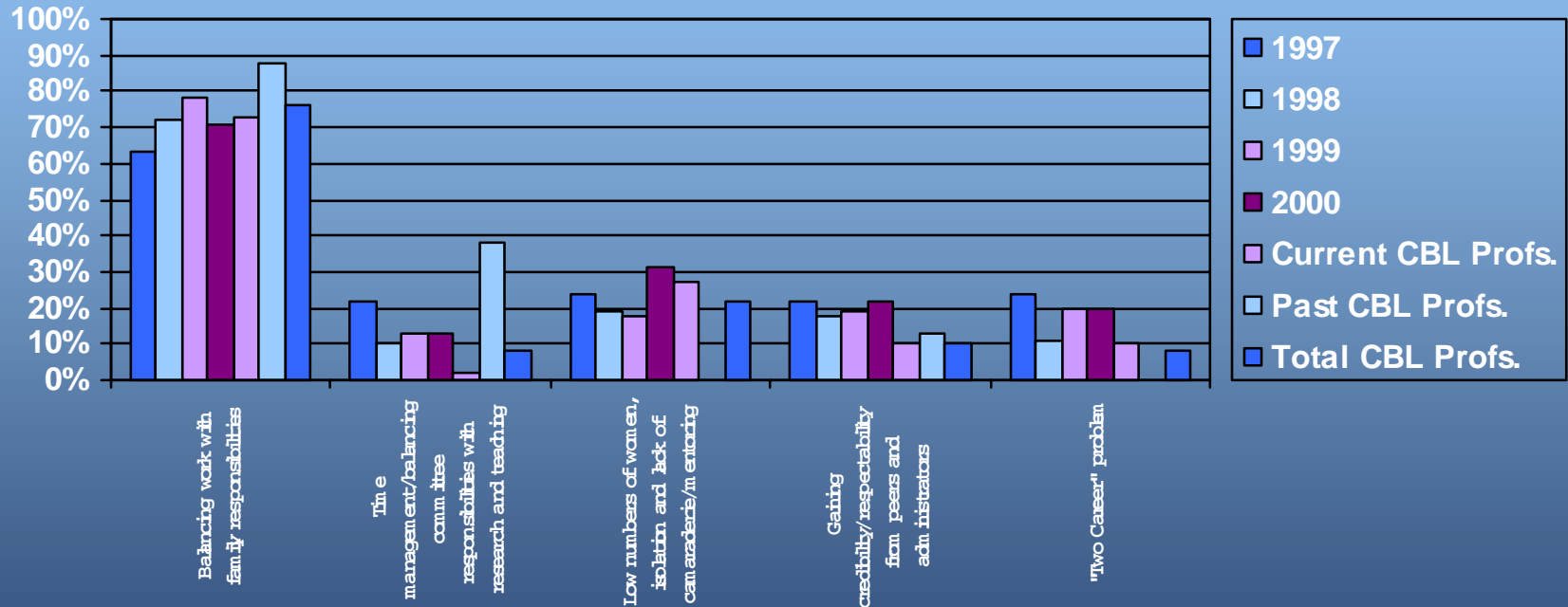
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Table 3. Total Responses to Question 1

Question 1: What are the most significant issues/challenges/opportunities facing women scientists today as they plan their careers?
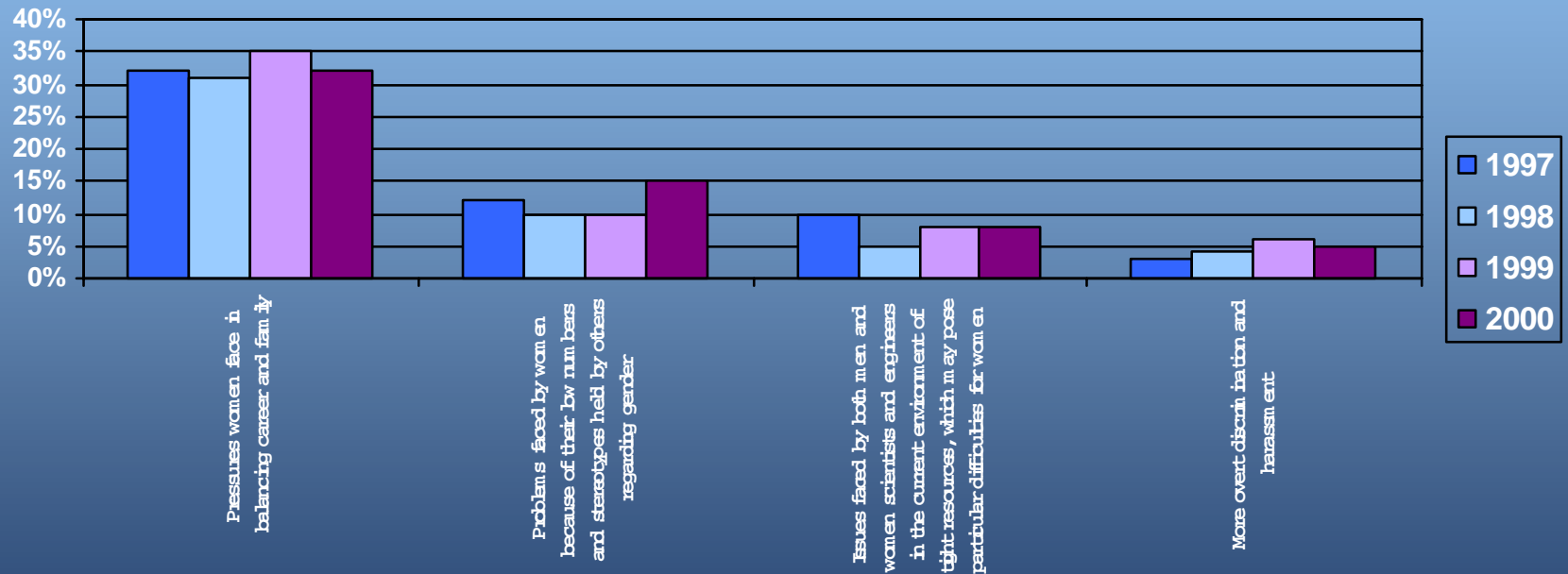
Categories		1997		1998		1999		2000	
		% of responses		% of responses		% of responses		% of responses	
1	Balancing work with family responsibilities (children, elderly relatives, etc.)	62.7	(42/67)	72.3	(86/119)	77.6	(76/98)	71.4	(75/105)
2	Time management/balancing committee responsibilities with research and teaching	22.4	(15/67)	10.1	(12/119)	13.3	(13/98)	13.3	(14/105)
3	Low numbers of women, isolation and lack of camaraderie/mentoring	23.9	(16/67)	18.5	(22/119)	18.4	(18/98)	30.5	(33/105)
4	Gaining credibility/respectability from peers and administrators	22.4	(15/67)	17.6	(21/119)	19.4	(19/98)	21.9	(23/105)
5	"Two career" problem (balance with spouse's career)	23.9	(16/67)	10.9	(13/119)	20.4	(20/98)	20.0	(21/105)
6	Lack of funding/inability to get funding	7.5	(5/67)	4.2	(5/119)	10.2	(10/98)	8.6	(9/105)
7	Job restrictions (location, salaries, etc.)	9.0	(6/67)	9.2	(11/119)	7.1	(7/98)	5.7	(6/105)
8	Networking	6.0	(4/67)	<1	(1/119)	0	(0/98)	4.8	(5/105)
9	Affirmative action backlash/discrimination	6.0	(4/67)	15.1	(18/119)	14.3	(14/98)	12.4	(13/105)
10	Positive: active recruitment of women/more opportunities	6.0	(4/67)	10.1	(12/119)	9.2	(9/98)	14.3	(15/105)
11	Establishing independence	3.0	(2/67)	0	(0/119)	6.1	(6/98)	2.9	(3/105)
12	Negative social images	3.0	(2/67)	3.4	(4/119)	2.0	(2/98)	<1	(1/105)
13	Trouble gaining access to nonacademic positions	1.5	(1/67)	1.7	(2/119)	1.0	(1/98)	1.9	(2/105)
14	Sexual harassment	1.5	(1/67)	<1	(1/119)	2.0	(2/98)	1.9	(2/105)
15	No answer	0	(0/67)	<1	(1/119)	1.0	(1/98)	1.9	(2/105)
16	Cut-throat competition	--	--	--	--	1.0	(1/98)	1.9	(2/105)

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Categorization of Question 1 across Year of Award

Question 1: What are the most significant issues/challenges/opportunities facing women scientists today as they plan their careers?

Legend: 1997, 1998, 1999, 2000

Categories:
- Pressures women face in balancing career and family
- Problems faced by women because of their low numbers and stereotypes held by others regarding gender
- Issues faced by both men and women scientists and engineers in the current environment of tight resources, which may pose particular difficulties for women
- More overt discrimination and harassment

Dr. Sue V. Rosser
Dean, Ivan Allen College

Category A: Pressures women face in balancing career and family

At the risk of stereotyping, I think that women generally struggle more with the daily pull of raising a family or caring for elderly parents, and this obviously puts additional demands on their time.

(2000 respondent 63)

Dr. Sue V. Rosser
Dean, Ivan Allen College

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Category A: Pressures women face in balancing career and family

At the risk of stereotyping, I think that women generally struggle more with the daily pull of raising a family or caring for elderly parents, and this obviously p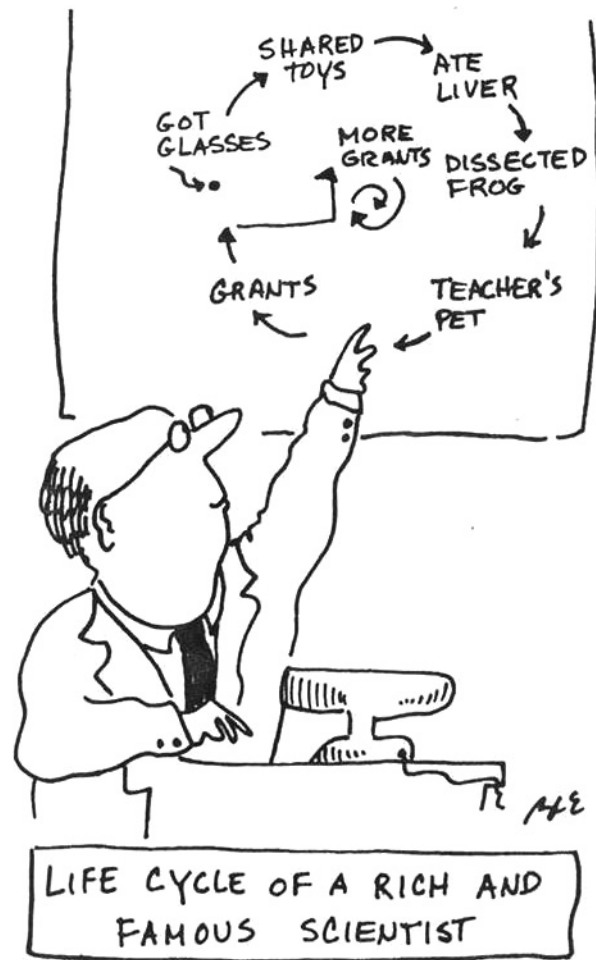uts additional demands on their time. This is true for younger women, who may struggle over the timing of having and raising children, particularly in light of a ticking tenure clock, but also for more senior women, who may be called upon to help aging parents (their own or in-laws). Invariably they manage, but not without guilt.

(2000 respondent 63)

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Dean, Ivan Allen College

Importance of Flexibility and Duration of Award

Child care benefits - I've never heard of anything similar elsewhere, and it's really a great way to make it easier for women in academia to balance work and family (not that it's ever easy).

(CBL respondent 37)

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Category A: Pressures women face in balancing career and family

Managing dual career families (particularly dual academic careers). Often women take the lesser position in such a situation. Ph.D. women are often married to Ph.D. men. Most Ph.D. men are not married to Ph.D. women.

(2000 respondent 16)

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Category B: Problems because of low numbers and stereotypes

The biggest challenge that women face in planning a career in science is not being taken seriously. Often women have to go farther, work harder and accomplish more in order to be recognized.

(2000 respondent 21)

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Importance of credibility/respectability

The CBL Professorship is a tremendous help in two regards. First, simply the prestige of having a named professorship has been useful. Second, the financial security provided by this fellowship has allowed me to undertake risky projects in the lab. Since these are the type of projects that have the highest possible reward, this flexibility is greatly appreciated.

(CBL respondent 28)

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Category B: Problems because of low numbers and stereotypes

In my field, (concrete technology) women are so poorly represented that being female certainly creates more notice for you and your work, particularly when presenting at conferences. This can be beneficial, as recognition of your research by your peers is important for gaining tenure; it can also add to the already large amount of pressure on new faculty.

(2000 respondent 70)

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Importance of credibility/respectability

People take notice that I have a named chair.

(CBL respondent 2)

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Category C: Issues faced by all, with particular difficulties for women

I have noticed some problems in particular institutions I have visited (or worked at) where women were scarce. As a single woman, I have sometimes been viewed as "available," rather than as a professional co-worker. That can be really, really irritating. I assume that single men working in a location where male workers are scarce can face similar problems. In physics and astronomy, usually the women are more scarce.

(1997 respondent 26)

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Category C: Issues faced by all, with particular difficulties for women

I still find the strong perception that women should be doing more teaching and service because of the expectation that women are more nurturing. Although research as a priority for women is given a lot of lip service, I've not seen a lot of support for it.

(2000 respondent 1)

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Dean, Ivan Allen College

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Importance of Flexibility and Duration of Award

The fund given in addition to the academic salary has been very useful, especially since the things it could be put toward were left up to us (within reason). I have been able to use this fund to start a new project in the lab (that I had not accounted for in my start-up package), hire an undergraduate technician for the summer, and buy computer equipment that made my teaching duties easier.

(CBL respondent 4)

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Category D: More overt discrimination and/or harassment

There are almost no women in my field, no senior women, and open harassment and discrimination are very well accepted and have never been discouraged in any instance I am aware of.

(1998 respondent 53)

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Category D: More overt discrimination and/or harassment

I have often buffered the bad behavior of my colleagues - and over the years I have handled a number of sexual harassment or "hostile supervision" cases where a more senior person (all of them male) was behaving inappropriately toward a lower social status woman (or in rarer cases a gay man).

(1999 respondent 59)

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Category D: More overt discrimination and/or harassment

The discrimination they continue to face in the workplace. We seem to be making virtually no gains in terms of rates at which women are granted tenure or promotion to full professor. The older I get, the more depressing these statistics become. Women's research is often marginalized. Women's approaches are not recognized. Men scientists want to judge women by "their" standard (i.e. the white male way of doing things!). Most men have no appreciation for the power and privilege of their whiteness and maleness.

(1999 respondent 70)

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Laboratory climate - positive

The most significant challenge I face is favoring "hacker" experience. In the computer science discipline in which I work, respect is conferred upon those who possess knowledge obtained primarily through countless hours investigating the nuances of hardware and operating systems. To many in my peer group, this is a relaxing hobby and way of life.

(1999 respondent 68)

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Laboratory climate - positive

The most significant challenge I face is favoring "hacker" experience. In the computer science discipline in which I work, respect is conferred upon those who possess knowledge obtained primarily through countless hours investigating the nuances of hardware and operating systems. To many in my peer group, this is a relaxing hobby and way of life. Though I learn these nuances as I need them for my research outside of my work, I read literature, am deeply interested in social issues and am committed to being involved in my child's life. I see this alternate experience base as an asset to my field. As Rob Pike of C language fame recently said, "Narrowness of experience leads to narrowness of imagination." But for now, the perception is still tilted against me.

(1999 respondent 68)

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Laboratory climate - positive

I find the laboratory climate more liberal than, say, the "office climate." I also feel autonomous, powerful and free in this environment (maybe it's because I get to use power tools?) In the laboratory climate, I am able to create and build. I am also able to ask for help and delegate responsibility. Sometimes my colleagues ask me for help.

(1997 respondent 27)

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Laboratory climate - positive

I find the laboratory climate more liberal than, say, the "office climate." I also feel autonomous, powerful and free in this environment (maybe it's because I get to use power tools?) In the laboratory climate, I am able to create and build. I am also able to ask for help and delegate responsibility. Sometimes my colleagues ask me for help. There is a hierarchical structure at the laboratory in which I work, but it is more fluid, roles switch as projects come through. Sometimes I will take the lead and other times I will follow. In terms of my career, working in a laboratory offers a fantastic opportunity to work alone, work with a large group and manage a project, offer support to a colleague, and to build a small community.

(1997 respondent 27)

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Dean, Ivan Allen College

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ADVANCE Initiative

- Successor to POWRE at NSF
- 1st awards given in 2001
- Focus on institutional transformation
- Center on advancing tenure-track women to senior and leadership positions
- 2nd awards given in 2003
- Models for what works
- 3rd awards should be forthcoming soon

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Dean, Ivan Allen College

Georgia Institute of Technology

2001 ADVANCE Institutional Transformation Awards

- The Georgia Institute of Technology is creating a network of termed professorships, institutionalizing a formal training process on tenure and promotion, gathering information on equity and advancement, holding leadership retreats, and strengthening family-friendly practices.

- New Mexico State University intends to increase the number of women in its tenure-track positions in science, mathematics and engineering by establishing a Committee on the Status of Women to monitor progress and identify ways in which university programs can be better targeted to support the advancement of women.

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2001 ADVANCE Institutional Transformation Awards

- The University of Washington is creating a center for Institutional Change to design and implement programs to eliminate obstacles to women's full participation and advancing in the science, engineering and mathematics fields.

- The University of Puerto Rico, Hamacoa, will improve training for new faculty and administrators to improve gender equity.

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2001 ADVANCE Institutional Transformation Awards

- The University of Colorado, Boulder, will increase the number of women serving in administrative positions in science, mathematics, engineering and technology programs through its Leadership Education for Advancement and Promotion Program.

- The University of Michigan is launching a campus climate initiative, a gender equity resource fund, and a department transformation initiative to provide interventions to improve opportunities for tenure-track women faculty in basic science and engineering fields.

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Dean, Ivan Allen College

Georgia Institute of Technology

2001 ADVANCE Institutional Transformation Awards

- The University of Wisconsin-Madison is establishing a National Women in Science and Engineering Leadership Institute to gather data, monitor results, and disseminate information on the best practices for advancing women. As part of its chancellor's endowment goals, the university is including the creation of ten professorships for the advancement of women in science and engineering.

- The University of California-Irvine will provide women a network of support and guidance through tenure and will set up a mentoring program for junior faculty. It will also establish two ADVANCE chairs, to be awarded to tenured faculty in the sciences with strong academic credentials and a demonstrated commitment to gender equity.

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2001 ADVANCE Institutional Transformation Awards

- Hunter College-CUNY joins NSF in the goal of contributing to the development of a national science and engineering academic workforce that include the full participation of women in all levels of faculty and academic administration, particularly at the senior academic ranks, through the transformation of institutional practices, policies, climate and culture via its Gender Equity Project.

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2nd Round ADVANCE Awardee Institutions

- Virginia Tech
- University of Alabama at Birmingham
- Case Western Reserve
- Kansas State
- University of Maryland—Baltimore County
- University of Montana
- University of Rhode Island
- University of Texas–El Paso
- Utah State
- Columbia University

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GT's ADVANCE Project Goals

A network of termed professorships established to mentor women faculty

A series of leadership retreats with women faculty and senior institutional leaders

A series of family-friendly policies

Data gathering and interviews to develop MIT-like Report to chart equity progress

A formal tenure and promotion training process to remove subtle gender, racial, and other biases

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Policy/Practice Areas
Ripe for Change

- Balancing career and family

- Low numbers of women and stereotyping

- Overt discrimination and harassment

- Issues of decreased funding

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