

Breaking Down Barriers

Researcher studies roadblocks impeding the progress of women scientists and engineers.

by T.J. BECKER



Sue Rosser, dean of Georgia Tech's Ivan Allen College of Liberal Arts, recently published a book, "The Science Glass Ceiling," that identifies obstacles that prevent women engineers and scientists from advancing at educational institutions and cause them to be underrepresented among faculty. Above, she speaks at the Ivan Allen College's Founder's Day celebration in 2004 at Georgia Tech.

PHOTO BY NICOLE CAPPELLO

Balancing work and family is the number one challenge for women scientists and engineers in academia, reports Sue V. Rosser, dean of Georgia Tech's Ivan Allen College of Liberal Arts.

In her new book, "The Science Glass Ceiling" (Routledge, May 2004), Rosser identifies obstacles that prevent women engineers and scientists from advancing at educational institutions and cause them to be underrepresented among faculty.

Even though the number of women majoring in science and technology has increased since the 1960s, the percentage of those pursuing advanced degrees and moving into the academic community remains low. In fact, only 19.5 percent of science and engineering faculty at four-year colleges and universities are women, with 10.4 percent being full professors, according to a 2000 National Science Foundation (NSF) study. At large research institutions, the percentages are even smaller.

The findings informed Rosser's discussion at the annual meeting of the American Association for the Advancement of Science in February 2004.

"These low numbers contribute to a variety of problems, such as the shortage of technical talent in

the United States," Rosser says. "The scarcity of women in engineering and science leads to isolation, lack of mentoring, performance stereotypes and difficulty in gaining credibility from male colleagues – which creates a self-perpetuating cycle."

Rosser's new book stems from research she began in 1998 with a simple survey she conducted while organizing a conference for Professional Opportunities for Women in Research and Education (POWRE), an NSF program that funded tenure-track women engineers and scientists at large universities.

Rosser contacted POWRE awardees from 1997, asking what significant issues they faced as women scientists and engineers. To her surprise, nearly 63 percent of respondents cited "balancing work with family responsibilities" as their biggest challenge. During the next three years, she repeated the survey with POWRE awardees and found even greater consensus – 73 to 78 percent of respondents said balancing career and family was their major problem.

Family issues loom large because many women scientists and engineers postpone children, Rosser observes: "By the time a woman completes her doctoral degree and post-doc work, she is typically in

her early 30s — an age where there is competition between the tenure clock and the biological clock.”

Because POWRE awards typically go to women at large research universities, Rosser wondered if similar problems exist at small liberal arts colleges, which have a reputation for being more “family friendly.”

With that in mind, Rosser surveyed winners of Clare Boothe Luce (CBL) Professorships, a program that provides funding primarily to assistant professors in engineering, science and mathematics at liberal arts colleges.

Seventy-five percent of CBL respondents cited “balancing family and work” as their number one problem, corroborating the results of the POWRE surveys.

The notion that small, private colleges provide more time and less pressure for women faculty than large research institutions was an illusion, Rosser discovered. “The pressures are just different,” she says.

Rosser’s book sheds light on specific issues that institutions must address to attract and retain women scientists and engineers. “Because the problem is systemic, solutions will vary from school to school,” Rosser says.

One encouraging initiative is NSF’s ADVANCE program, which replaced POWRE in 2001. Rather than providing money to individuals, ADVANCE funds institutions to develop model policies and practices that eliminate barriers faced by women faculty. Georgia Tech received a \$3.7 million award from ADVANCE, and Rosser is on a task force to help administer those funds.

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Sue Rosser, right, chats with Georgia Tech Provost Jean-Lou Chameau, center, and Gilles Andreani during the Sam Nunn Bank of America Policy Forum titled “Bio-Terrorism Preparedness: The Imperative for a Public-Private Partnership” in March 2004.

No Regrets

New study shows how African-American Ph.D. chemists overcame discrimination to build careers.

by JOHN TOON

A national study of career experiences among African-American Ph.D. chemists shows how these scientists dealt with discriminatory practices and attitudes to build careers in academia, industry and government. While seven out of 10 respondents felt they had been hindered by discrimination, less than a handful regretted choosing a career in chemistry.

“Regardless of the experiences they had, these people had remarkably positive feelings about chemistry,” says Willie Pearson, Jr., the study’s author and chair of the School of History, Technology and Society at the Georgia Institute of Technology. “If they had it to do all over again, they would still see chemistry as an attractive field.”

Pearson presented results of the study, “Beyond Small Numbers: Voices of African-American Ph.D. Chemists,” at the annual meeting of the American Association for the Advancement of Science in February 2004. The study explores the divergent career experiences of 44 randomly chosen, African-American Ph.D. chemists who received degrees before 1994.

“The opportunity structure differed dramatically in many cases over time,” says Pearson, who conducted face-to-face interviews with all but one of the scientists. “Most felt that race was an issue, and that it had impacted them in certain ways. But they didn’t let that cripple them or stifle their achievement. Racism was just part of the reality that confronted them.”

Most respondents began their careers in the academic world, with slightly more than half taking

PHOTO BY GARY MEEK



Willie Pearson Jr., chair of Georgia Tech’s School of History, Technology and Society, has completed a study of African-American Ph.D. chemists. The study, based on interviews, describes how they dealt with discriminatory practices and attitudes to build their careers.

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positions at historically black colleges and universities. Ph.D. chemists choosing academic careers were attracted to institutions similar to the ones where they obtained their undergraduate degrees.

Their experiences changed dramatically over time, affected by federal legislation such as the Civil Rights Act of 1964 and court decisions such as *Brown v. Board of Education*.

Other key findings include:

- The respondents often found themselves torn between the research they were trained to do and administrative roles that provided salary and advancement opportunities beyond what they could achieve as practicing chemists. For industrial chemists, these administrative positions were often in Equal Employment Opportunity, human resources or community outreach areas with little impact on company decision-making.

- Many of the respondents reported that good work overcame discrimination. "It's difficult not to reward excellence," Pearson says. "While there may be discriminatory practices, by and large, the system tended to work for those who did good work."

- In academia, as well as industry, experiences varied among departments even within the same institution. "While there might be a company culture, there are also individual unit cultures," he explains. "At one company, chemists reported different career advancement experiences depending on the division in which they worked. For example, in

one unit, a chemist had filed racial discrimination complaints, while chemists in two separate units reported supportive and welcoming environments."

- African-American women often had to also confront gender discrimination and were expected to meet a higher standard than their male counterparts. "But I think you would find the same thing with women in general because chemistry is still largely a male-dominated field," Pearson says.

- If they were the only persons of color in their organizations, African-American chemists sometimes suffered feelings of isolation, which caused stress and depression. In academia, isolated chemists often had difficulty attracting graduate students, which hurt their research and therefore their stature in the field.

- Among industrial chemists, eight of 13 respondents (62 percent) said they were satisfied or very satisfied with their jobs. Among the academic chemists, 16 of the 22 (72 percent) reported that level of satisfaction – while five said they were very dissatisfied.

- Segregation in the South contributed to a "brain drain" in which African-Americans pursuing chemistry doctorates entered universities outside the region. Most never returned.

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Willie Pearson Jr., center, chats with Georgia Tech President Wayne Clough, right, and Phillip McKnight, chairman of the School of Modern Languages, during a gathering of administrators and faculty.

PHOTO BY SUE CLUTES





PHOTO BY GARY MEER

Women Faculty of Color

Numbers are low and not increasing, but hope rests in some new strategies for improvement.

by JANE M. SANDERS

The numbers of women of color on academic faculties in the United States are very small and not increasing. There are even fewer such professors in the science, technology, engineering and mathematics fields. And the implications of this deficit are far-reaching, researchers suggest.

But some strategies for improvement exist at both the individual and institutional levels, and therein lies the hope, says Georgia Institute of Technology Associate Professor of Public Policy Cheryl Leggon. She spoke on the subject at the American Association for the Advancement of Science meeting in Seattle in February 2004.

"The numbers are grim across the board for males and females of color," Leggon says.

The situation has not improved much in the past decade. There have been only miniscule increases in faculty – especially women — of color in the science, technology, engineering and mathematics (STEM) fields, Leggon notes.

She cites several implications of these statistics. First is the effect of this deficit on students.

"The United States is becoming more diverse, and that is somewhat reflected in the student population in college and universities, but nowhere in the faculty population," explains Leggon, a sociologist. "That is problematic. What kind of message does it send to students? The implicit message is, 'You can't do this.' The absence of these groups does send a message."

Leggon cites two other important reasons to increase diversity among STEM faculty. "It significantly enhances the quality of scientific research insofar as it expands the pool from which the

United States draws its science talent," she says. "And it improves the quality of the educational experience for all students."

To improve conditions for women and men of color in the STEM fields in academia, strategies could be employed at both the individual and institutional levels, Leggon says.

For junior faculty members, particularly in underrepresented groups, administrators must make clear the criteria for getting tenure, Leggon says.

"Committee work is time-consuming and does not substitute for publications," she adds. "Also, because there are so few women faculty of color, students of color gravitate toward you. Again as a junior faculty member, you have to be careful it's not all-consuming. Sometimes, it's difficult to make that judgment. It's a dilemma because junior women of color are so passionate about mentoring. But to make the greatest impact in the long run, you have to get tenure first so you'll be here later."

Strategies to improve conditions for women of color and other underrepresented groups must also exist at an institutional level, Leggon says. "You can't depend on the good will of a few people," she adds. "I can't emphasize enough the importance of institutionalizing policies. If something is standard operating procedure, then it's one of the criteria on which performance is evaluated."

Programs such as the National Science Foundation's ADVANCE program for women faculty development are designed to transform institutional culture, Leggon says. At Georgia Tech, the ADVANCE program has sponsored sessions on how to get tenure, establish a research agenda and get published.

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The numbers of women of color on academic faculties in the United States are very small and not increasing. But some strategies exist for improvement, says Associate Professor of Public Policy Cheryl Leggon, left.

Institutional Transformation

Environments can help or hinder success of women in academia.

by T.J. BECKER

From scrutinizing evaluation policies to opening doors on insider knowledge, the Georgia Institute of Technology is making strides to address subtle inequities that can adversely affect women's advancement in academia.

"Environments do not necessarily operate uniformly or neutrally," says Mary Frank Fox, NSF ADVANCE professor of sociology at Georgia Tech and co-director of its Center for the Study of Women, Science & Technology. "The same setting can be experienced differently by individuals or groups and be unevenly helpful in their success – something that is especially consequential in science and engineering."

Launched by the National Science Foundation (NSF) in 2001, ADVANCE is geared to increase women's participation in academic science and engineering careers. Among 18 universities to win funding, Georgia Tech has received \$3.7 million from NSF to develop policies and best practices that advance

women faculty, and Fox serves as co-principal investigator on the project. She recently spoke about the project at the American Association for the Advancement of Science's annual meeting.

One hallmark of Georgia Tech's NSF ADVANCE program is its research-driven approach to institutional transformation, critical to determining how environments shape positive or negative outcomes. So Fox surveyed Georgia Tech faculty during the 2002-03 academic year to document their perceptions and experiences in four areas: research and teaching, work environments, evaluation processes, and family and household scenarios. Highlights were:

- Men (30 percent) are more likely than women (13 percent) to speak to colleagues about their research on a daily basis.
- Although a majority of faculty members have colleagues in their home units working on similar research, men report greater "willingness" of colleagues to collaborate with them.
- Men are more likely to characterize their home units as "exciting" or "helpful."

"The survey findings show areas in which women and men converge and diverge and areas in which they may experience the same work setting differently," Fox explains. "This reflects the influence of institutional settings."

And that can have important consequences. "Ease of collaboration is particularly important in science and engineering where work revolves around the cooperation of people in groups," Fox adds. "Research is a social process of communication, interaction and exchange. These factors, in turn, influence productivity and success in science."

To determine more specifics about how the academic environment can help women, Fox is following up with one-on-one interviews with survey participants. She's also conducting a faculty survey at eight other academic institutions to see how experiences compare among faculty.

Another key aspect of women's advancement in academia is equitable evaluations. So Georgia Tech's NSF ADVANCE program has created a committee to study the institution's policies and procedures for tenure and promotion.

The committee, chaired by Professor David McDowell, has also developed a Web-based tool for interactive learning, which contains a variety of case studies and an actual simulation. Aimed at two audiences, this instrument helps candidates prepare their records for evaluation. It also helps members of promotion and tenure committees understand how prejudices can creep into the review process.

Fox is one of four NSF ADVANCE professors at Georgia Tech who are spearheading different activities to support women's advancement. The program sponsors discussions and sessions that address what Fox calls "tacit knowledge." This informal knowledge, such as how to obtain grants, is available through networking, but not immediately known to all individuals in a given environment.

Fox is enthusiastic about NSF ADVANCE's momentum at Georgia Tech. "Leadership must signal that equity is a priority, and we have that at Georgia Tech," she says, noting that Provost Jean-Lou Chameau is principal investigator for the school's ADVANCE program.

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The National Science Foundation's ADVANCE program granted \$3.7 million to Georgia Tech to develop model policies and practices that eliminate barriers faced by women faculty. Professor Mary Frank Fox, shown here with students, is on a task force to help administer those funds.