

MEETINGS

Women, Work, and the Academy

PAGE 278

Harvard University President Lawrence Summers triggered an avalanche of media coverage and debate about the status of women in science in a 14 January 2005 speech. When Summers posited that the persistent absence of women in science could be due to a lack of "intrinsic aptitude" and an unwillingness to pursue high-intensity academic careers, he placed the blame on women and minorities.

Summers also made reference to economist Gary Becker, who developed the theory that market forces will eventually address any persistent discrimination because discrimination is costly and inefficient in a competitive market. These arguments are not supported by current research on implicit bias and organizational behavior.

A month before Summers' remarks, the Virginia C. Gildersleeve Fund at Barnard College and the U.S. National Science Foundation-funded ADVANCE program at the Earth Institute at Columbia University cosponsored a workshop to discuss the persistence of gender discrimination in academia in the United States in the post-civil rights era (<http://www.barnard.edu/bcrw/womenandwork/>). Convened by the Barnard Center for Research on Women, the workshop brought together 30 social and natural scientists to analyze the state of "Women, Work, and the Academy."

Using a data-driven approach, the participants first reviewed the latest research on the status of women in academic science. The impact of ongoing institutional initiatives in the sciences and engineering was considered, including the ADVANCE program to increase the representation of women in academic science and engineering (<http://research.cs.vt.edu/advance/tiki/tiki-index.php>).

The National Science Foundation (NSF) developed the ADVANCE Institutional Transformation Award in response to the Massachusetts Institute of Technology's (MIT) 1998 Study on Women Science Faculty, in a precedent-setting report that recognized that the barriers women face are institutional and systemic. Nineteen universities now have active ADVANCE programs, each funded for five years at \$3.5–4.2 million.

At the workshop, participants assessed the various ADVANCE program strategies and the institutional mechanisms that produce persistent gender bias. Alice Hogan, NSF program manager for ADVANCE, highlighted ongoing efforts to develop metrics for gauging the impact of the program nationwide.

The academic workforce within geosciences, as outlined by ADVANCE at the Earth Institute, is characterized by a gap between the number of women receiving doctorates and the number

hired into tenure-track academic positions. Women make up 33% of geosciences Ph.D. recipients but only 20% of assistant professors at Ph.D.-granting institutions [NSF 2004; Holmes et al., 2003]. Every year, more women earn geosciences doctorates, but there has not been a proportionate increase in the number of women in tenure-track positions.

Bias against women in contemporary academic settings has been well documented for decades, but the 1998 MIT study was the first to attract widespread recognition to the barriers women face in contemporary academic science. The report identified subtle differences in the treatment of men and women faculty in terms of resources, salary, and other material benefits, and found that women faculty felt marginalized and occasionally excluded from professional opportunities. The issues highlighted in the MIT report are now generally accepted as systemic, and a number of diversity initiatives are now under way.

The NSF ADVANCE program has invested heavily in both individuals and institutions, while private organizations, such as the Ford Foundation, have funded institutional gender equity initiatives. Many of the leaders of these initiatives attended the workshop.

Strategy for Institutional Change

In the course of the two-day discussion, a five-phase strategy for institutional change emerged: (1) generate awareness of the problem, (2) develop a widespread understanding of the underlying behaviors, (3) create and codify strategies to recruit and retain more women into academic science, (4) provide the tools that will enable underrepresented groups to succeed, and (5) institutionalize accountability.

Summers' comments raised the awareness of persistent gender disparities in the sciences, both at Harvard and nationwide. The ensuing controversy, however, has been rich in rhetoric, politics, and discourse about intrinsic ability, with little discussion of institutional culture or accountability. Institutional change in academic science cannot happen unless the members of the institution are aware of the problem, i.e., that gender bias persists even today, that it is an institutional problem, and that it results in a loss of human capital to the academic community.

ADVANCE institutions have sought to build this consensus by implementing self-studies, collecting institutional data, and conducting "climate" surveys of the work environment for faculty and research scientists. Institutions that have implemented surveys, such as the Georgia Institute of Technology and the University of Michigan, have found the resulting data to be useful for revealing the underlying causes of

gender imbalances. These surveys also establish a baseline for measuring future progress.

The second step, clarifying the underlying behaviors that cause gender bias, is a difficult one for any academic institution. The behaviors are often unintentional, and the symptoms are much more subtle than divided lunch counters. This process of discovery does not have to be antagonizing. By incorporating social science into the analysis, the process becomes data-driven and intellectually satisfying for both genders. This approach also shifts the focus of inquiry from specific individuals to collective behaviors.

Compelling research on implicit bias has emerged from a variety of fields, including experimental and applied psychology, sociology, and occupational behavior. For example, repeated psychological experiments have shown that both genders tend to overestimate men and underestimate women in a variety of contexts, from assessments of height to professional ability [Valian, 1998; Biernat et al., 1991]. These biases are often small, but even a 1% bias can accumulate into a major disparity over time [Martell et al., 1996], just as the accumulation of past interest is realized in a savings account. By using the scientific method of inquiry, observation, and hypothesis-testing, discussions about gender schemas become more objective and less personal.

Once the underlying behaviors are recognized, institutions can develop new policies and practices. Many of these solutions require that institutions put the "search" back into search committees, especially if women are not even applying for tenure-track positions (as is often the case at Columbia).

Strategies for identifying and mitigating unconscious bias need to be disseminated to search committees, administrators, and department chairs. These strategies vary depending on institutional culture. MIT adopted a prevention approach by establishing permanent gender equity committees that monitor hiring processes and faculty searches. The University of Michigan ADVANCE program adopted an advisory approach by creating a senior faculty working group made up of "ambassadors" that provides institutional data and social science literature to interested departments and search committees.

Once there is a general understanding of the underlying behaviors, the third step is to build the infrastructure that enables women scientists to succeed. This infrastructure includes transparent promotion policies as well as an active community of women with a collective identity. The importance of flexible tenure policies that allow women to manage both a career and a family has been widely documented [Finkel et al., 1994; Perna, 2001]. Implementation of these policies requires leadership from the most senior levels of the institution.

The fourth strategy articulated by the workshop participants is to cultivate a collective identity among the women scientists in an institution. At the workshop, Abigail Stewart, director of the ADVANCE program at the Uni-

versity of Michigan, explained how communities of women scientists can alleviate feelings of marginalization and provide critical support for university-wide institutional change efforts. These networks can be equally useful tools for developing communities of women within disciplines.

The final strategy for effective institutional change in academia is for universities and professional associations to assume accountability for persistent gender disparities over time. The initiatives at MIT and the University of Michigan would have been unsuccessful without leadership and vigilance from the senior administration.

The U.S. federal government can also assume accountability, as it did in the 1970s, when the government threatened to take away funding from several major universities, including Columbia, because of inadequate minority representation in the student body and among the faculty. At the workshop, the argument for applying Title IX (1972 legislation that bars sex discrimination at U.S. federally funded institutions) to academic departments was put forward by Debra Rolison, a chemist at the U.S. Naval Research Laboratory. Rolison cited a series of recent Congressional hearings and reports from the U.S. General Accounting Office that have recommended federal agencies do more to comply with Title IX.

Measuring Progress

Do these initiatives actually make a difference? At the Barnard workshop, Abigail Stewart presented data that showed a doubling in the number of successful offers made to women in science and engineering fields at the University of Michigan in just two years. At the University of Wisconsin-Madison, another ADVANCE institution, the percentage of women hired as junior professors in engineering grew from 6% to 43% in just two years [Carnes *et al.*, 2004].

At Columbia, where the ADVANCE program was launched six months prior to the workshop, anecdotal evidence of institutional change is already accumulating. One Columbia search committee, after reading recent literature on unconscious gender bias in reference letters [Trix and Psenka, 2003], revisited reference letters for the candidates under consideration. That committee subsequently revised its shortlist by adding an additional woman who was later hired.

Institutional change efforts are costly and time-consuming, but they promise to ultimately enhance scientific excellence. Expanding the pool of talent will only raise the standard of scholarship and teaching.

When the Ivy League colleges became co-educational, the caliber of the undergraduate student body increased markedly, as did the quality of classroom interactions. Following the addition of women to the student body of Cornell University, in 1872, the dropout rate fell from 26% to 16%, even as the university raised admission and exam requirements [Rosenberg, 2004]. When the top symphony orchestras in the United States began implementing blind auditions in the 1970s and 1980s, the proportion of female musicians increased from 5% to 25% [Goldin and Rouse, 2000; Gladwell, 2005]. As the five-part strategy indicates, academia should seek to proactively diversify the community by systematically defining gender inequalities with data, and by determining the causative behaviors with modern social science research. Institutional change means moving beyond diversity in the classrooms, to diversity in the scientific elite.

This is Lamont contribution 6802.

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—ROBIN E. BELL and JENNIFER D. LAIRD

LETTERS

Inaccessible Terminology

PAGE 278

I share Philip Mote’s appreciation for the opportunity to learn about disparate fields through reading *Eos* (*Eos* as an interdisciplinary communication tool, *Letters*, 86(20), 194, 17 May 2005), and I share his frustration at the frequency with which one encounters inac-

cessible terminology. *Eos* has consistently exhorted authors to write for a wide audience, but often scientists immersed in a field lack an adequate understanding of how much or how little of their work is understood by those outside the field.

In general, when a few people err, then the root of the problem lies with the individuals, and it is up to the individuals to solve it. However, as in this case, when many people err in the same way, then the problem lies in the social or institutional structure, and requires a social or institutional solution.

Exhorting individuals in such a circumstance is insufficient. Traditionally, manu-

scripts are reviewed by specialists in the subject matter, and rightly so. However, for an interdisciplinary publication such as *Eos*, perhaps manuscripts should also be routinely reviewed by a person far removed from the subject matter, with a specific mandate to ensure the manuscript’s clarity to nonspecialists. *Eos* is invaluable, and I suspect I’m not alone in reading more of it than any other Earth-science periodical I receive. Thanks!

—KATHLEEN BURNHAM, Oakland, Calif.