TESTIMONY

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Before the
Committee on Science and Technology
Subcommittee on Research and Science Education
United States House of Representatives
October 17, 2007

Chairman Baird, Ranking Member Ehlers, and distinguished members of the Subcommittee, thank you for the invitation to testify on the National Science Foundation's (NSF) role in advancing women's participation in academic science and engineering. The NSF considers this topic central for the continued vitality of the nation's scientific enterprise.

The focus on women in science and engineering constitutes a longstanding and important component of NSF's strategic investment portfolio. A high priority within that portfolio is broadening participation of groups underrepresented in science and engineering, namely, women, minorities, and persons with disabilities. Thus, some of the many NSF programs aimed at broadening participation in S&E focus specifically on women. These programs address the Learning goal in the NSF FY 2006-2011 Strategic Plan, *Investing in America's Future*: to cultivate a world-class, broadly inclusive science and engineering workforce, and to expand the scientific literacy of all citizens.

Increasing the number of women at all levels of the science and engineering academic workforce offers many benefits, including new and diversified perspectives to drive scientific research, as well as mentors and role models for undergraduate and graduate students that better represent the makeup of the student body. At the National Science Foundation, we are confident we can make an impact at the faculty workforce level because there is no shortage of scientific talent; women are earning doctorates in science and engineering in increasing numbers, but are currently less likely than their male peers to enter tenure track academic positions. For example, women have earned 23% of the doctoral degrees in the physical sciences since 1997, yet held only 14% of academic physical science faculty positions in 2003.

1. Describe what NSF through ADVANCE IT has learned about the biggest challenges and most promising solutions to achieving gender equity in faculty recruitment, retention, and general climate in science and engineering fields

The most significant challenges to achieving gender equity in academic science and engineering include:

- The continuing importance of well-established networks from which women have been excluded historically
- The impact of implicit bias
- The feeling of isolation when there are only a few women in equivalent positions within academic Science, Technology, Engineering, and Mathematics (STEM) settings
- Unclear hiring, tenure, and promotion policies
- The "two-body problem", which arises from the finding that women scientists and engineers are more likely than their male colleagues to have partners who are also scientists and engineers.

Traditional networking routes used for faculty recruiting can hinder increasing the representation of women professors in STEM fields. Many faculty and academic leaders chairing search committees come from male-dominated educational and professional experiences; when they turn to their informal networks to recruit faculty talent, they tend to create disproportionately male applicant pools. Further, when the perception exists that qualified women are very rare, it is often assumed that a woman candidate will not accept an offer – and so an offer is not made.

Implicit bias in recruitment and reappointment committees also creates a challenge to improving the representation of women in STEM faculty positions, where committee members are not aware of their misperception of the achievements and potential of women candidates and colleagues. Greater service obligations placed on women faculty, such as disproportionate participation on department committees and undergraduate advising loads, are quite common. This is particularly likely for a department eager to make its gender diversity visible. Participation in these activities detracts from time available for research activities, and colleagues frequently see performance of service obligations as an indicator of a weak commitment to scholarship.

Isolation is also a barrier to women. Studies have shown that informal mentoring, which many departments rely on to assist junior faculty, is offered less often to women than to men. In addition, fewer opportunities are presented for the informal socializing that leads to important academic information sharing and the building of collaborations.

Many academic institutions do not have clear personnel policies and practices. In these situations, information is often circulated through informal networks, and thus is less accessible to faculty who are not a part of the informal communication loop. This lack of clear, inclusive communication not only leads to misinformation about policies and procedures, but also to confusion and a greater feeling of isolation. Unclear personnel policies can ultimately lead to mistaken career decisions, low morale, and inequitable treatment by decision makers who are themselves unclear or misinformed about the policies.

There are significant barriers to the recruitment rates of women faculty in STEM fields that can continue to be barriers to retention, once they have been hired, which makes addressing these barriers doubly important. For instance, there is a greater likelihood that a woman will have a partner in an academic STEM field, and women continue to have greater responsibility for dependent care than do men. These realities make finding spousal employment and quality dependent care arrangements more crucial to the recruitment of new women faculty, as well as to the retention of women whose family situations change. When competing for promising candidates or for the retention of faculty members, industrial employment opportunities may offer significantly improved possibilities than academia for women's spousal placement and/or dependent care arrangements.

Potential solutions to these and other challenges have been developed by awardees of NSF's ADVANCE-Institutional Transformation Program, which began in 2001. Institutional transformation occurs through a top down, bottom up approach: when a committed senior leadership establishes policies that enhance the recruitment and retention of women and an institutional commitment to diversity, in cooperation with the individual members of the institution who initiate and incorporate change in their daily practice. The ADVANCE program will begin a multi-year program-level evaluation in 2008 in order to document the efficacy of the project level solutions that have been developed and implemented at the ADVANCE grantee sites. We know anecdotally that peer institutions, that have not received funding from ADVANCE, have adopted many of the solutions developed by ADVANCE Institutional Transformation grantees and we expect the program level evaluation will demonstrate this to be true.

ADVANCE awardees have become national leaders in the development of training experiences for department chairs, deans, recruitment committees, and tenure and promotion committees. Evidence indicates that awareness of research findings on implicit bias (one common focus of such trainings) has a significant impact on an individual's future decision-making. For example, those that evaluate faculty and write letters of reference for students become more cognizant of the impact of using gendered language (excitable vs. passionate) to describe an individual and their academic potential. Other initiatives focus on the development of mentoring programs, with training for people on both sides of the mentoring relationship.

Institutional changes have occurred with policies that ensure more thorough development of candidate pools, review of national information on the availability of candidates from diverse groups, and procedures that build in the use of effective approaches to successful recruitment. Many examples can be found by browsing individual awardee websites (http://www.nsf.gov/crssprgm/advance/itwebsites.jsp). In the case of ADVANCE at Hunter College in New York, women accounted for only 27% of new hires in the natural sciences before the Gender Equity Project, but from 2003 to 2006, after significant institutional change, women accounted for 61% of new hires.

Policy changes aimed specifically at work-family challenges include: allowing or automatically initiating a tenure-clock stop for faculty with new children or other emergent family obligations such as elder care. For example, Virginia Tech, a recipient of an ADVANCE grant, recently initiated part-time tenure track positions to better suit the long-term work-family arrangements of some faculty. Columbia University, another ADVANCE institution, is offering

small grants to faculty for the additional child care costs that arise when traveling to professional meetings.

2. What is NSF doing to broadly disseminate and encourage best practices identified through ADVANCE?

In order to disseminate information, we employ two main strategies: the strategic design of the ADVANCE program itself, and the NSF's leadership role in the scientific community.

The ADVANCE program has evolved from its start in 2001. Our approach is to build upon what we have learned about institutional transformation and increased participation of women in academic STEM careers. Proposals for new institutional transformation grants are required to incorporate lessons learned from current ADVANCE grantees as well as relevant social science research. This ensures that new grantees do not use time and resources reinventing the basics of institutional transformation. Instead, they build on what has been learned and use that to further innovate, contributing to our increased understanding of institutional change.

It is important to recognize that best practices and effective policies will differ depending on the type of institution. One of the great strengths of ADVANCE is that we have institutional transformation grants in a wide diversity of institutions, from public to private, small to large, primarily undergraduate to research intensive, and different levels of selectivity. To further our goal of greater dissemination of successful strategies from this wide variety of institutions, we established the Partnerships for Adaptation, Implementation and Dissemination (PAID) component of ADVANCE in 2006. Some PAID awardees are disseminating best practices through regional or national training. For example, the University of Wisconsin ADVANCE-PAID program provides training for teams from colleges and universities on ways to increase the hiring of women into STEM faculty positions. The University of Washington's ADVANCE-PAID provides leadership training workshops for STEM department chairs to improve their departmental climate. The workshops integrate issues of diversity throughout the meeting instead of holding a separate session on gender and minority issues. This ensures that diversity becomes an integral part of the everyday management and decision-making process.

ADVANCE Institutional Transformation awardees have developed a rich variety of materials that are available through their websites and the ADVANCE-IT web portal. For example, the "ADEPT" website at Georgia Tech is designed to train individual promotion and tenure committee members by utilizing an interactive training experience about the implicit biases that often interfere with gender equitable decision-making.

In addition, both PAID and IT awardees disseminate best practices at disciplinary conferences and at conferences for college and university leaders. Some PAID awards support groups of women in a particular STEM discipline nationallay or within a region. PAID awardees disseminate best practices (such as effective mentoring) through meetings held concurrently with larger disciplinary conferences, and through the development of web-based alliances.

For the research communities that look to NSF and other Federal agencies to support their work: along with the National Institutes of Health and the Department of Energy,

we have cosponsored a national workshop focused on gender equity for the department chairs of fifty major chemistry departments and another for the department chairs of fifty major physics departments.

At the request of the NSF Division of Chemistry, the University of Michigan ADVANCE IT grantee developed a brief training about implicit bias. The Chemistry Division at NSF has received training on this topic and it is now implemented at all Chemistry Division "panels" (groups of experts who meet together to review and make funding recommendations for proposals in their field). Through this effort in the Chemistry Division, hundreds of peer reviewers will be trained each year and will return to their home institutions with a new understanding of the ways that implicit bias diminishes equity in decision making. Dissemination to other units in NSF is underway, including mandatory program officer training on implicit bias during the merit review process.

3. In addition to activities already described, what else can NSF and other agencies do to promote a more favorable environment for women in academic science and engineering fields?

Commitment to this goal must be reflected broadly across the organization and at every level within the organization. At NSF, the commitment to workplace diversity and enhancing opportunities for women and other underrepresented minorities in STEM fields is prominently reflected in both our Strategic Plan and in our practice. In the senior leadership, besides myself, there are two female Assistant Directors, and the agency Inspector General is also a woman. We make it a priority to ensure that women are well represented at all levels throughout the scientific and support staff, on our advisory committees, our committees of visitors, and among our reviewers. To further focus attention on this important subject, our Committee on Equal Opportunities in Science and Engineering (CEOSE) advises us on how well we are doing and where we could do better.

The Science and Technology Equal Opportunities Act of 1980 authorizes the NSF to make awards to encourage the education, employment, and training of women in science and technology. This testimony discusses several such awards, including, of course, the entire ADVANCE program. Additionally, I want to emphasize that in all our grants policies and practices, NSF is committed to the fair inclusion of women, and indeed, has been successful in maintaining a high standard. The 2005 Rand study "Gender Differences in Major External Federal Grant Programs" found that, at NSF, there were no gender differences in the amount of grant funding requested or awarded. Additionally, our recent internal study on the Impact of Proposal and Award Management Mechanisms found that women and minorities have also not suffered disproportionately in the recent overall reductions in proposal funding rate. Within the Foundation, both the Biology and the Social and Behavioral Sciences Directorates have implemented practices to ensure women's participation in numbers appropriate to their representation in the field in all conferences, meetings, workshops, and international congresses for which those directorates provides funds.

Part of NSF's role as a leader in the scientific community is the communication of the importance of broadening the participation of women and other underrepresented groups such as minorities and persons with disabilities in the science and engineering enterprise. Internally, this

is communicated on an on-going basis through training opportunities and seminars. NSF has recently instituted a new requirement for on-going training in merit review for program officers. One goal of this training will be to ensure that the peer review process is free from the influence of implicit bias and to ensure agency staff are aware of the potential impact of implicit bias in their own decision-making. An example of how NSF leads the external community can be found in the most recent solicitation for chemistry-related instrumentation acquisitions, which requires a departmental plan for broadening participation as an addendum to each proposal. This demonstrates to the scientific community that NSF takes diversity seriously.

Finally, because of the global nature of the scientific enterprise and the growing importance of international scientific collaboration we see an international leadership role for NSF based on what has come from the ADVANCE IT sites. Dr. Bement and I, together with the Assistant Directors and leaders from the Directorate for Education and Human Resources have been actively participating in international meetings, bringing the lessons learned at NSF and from ADVANCE grantees to a global audience. We believe that NSF's international role in women's increased participation in academic science and engineering is in its early stages; we envision it expanding significantly through continued institutional commitment at NSF and through the ADVANCE Program.

Conclusion

Mr. Chairman, thank you again for the opportunity to testify before you today on this extremely important topic.

As you are well aware, NSF research and education efforts contribute to the nation's innovation economy and help keep America at the forefront of science and engineering. At the same time, NSF supported researchers produce leading edge discoveries that can serve society and spark the public's curiosity and interest. Discoveries coming from dozens of NSF programs and initiatives are enriching the entire science and engineering enterprise, and making education fun, exciting and achievement-oriented.

NSF is committed to cultivating a science and engineering enterprise that not only unlocks the mysteries of the universe, but that also addresses the challenges of America and the world. To echo the findings of the NAS *Beyond Bias and Barriers* report, our Nation cannot afford to neglect the lack of women in STEM careers. In order to preserve our competitive edge, we are firmly committed to aggressively pursuing and offering opportunities for everyone within the STEM enterprise – women and men.

Mr. Chairman and members of the Committee, I hope that this brief overview conveys to you the extent of NSF's commitment to advancing science and technology in the national interest. I look forward to continue working with you, and would be happy to respond to any questions that you have.

Biography

Credit: Sam Kittner/kittner.com

Dr. Kathie L. Olsen
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Dr. Kathie L. Olsen became Deputy Director of the National Science Foundation (NSF) in August 2005.

She joined NSF from the Office of Science and Technology Policy (OSTP) in the Executive Office of the President, where she was the Associate Director and Deputy Director for Science and responsible for overseeing science and education policy including physical sciences, life sciences, environmental science, and behavioral and social sciences.

Prior to the OSTP post, she served as the Chief Scientist at the National Aeronautics and Space Administration (NASA) (May 1999- April 2002) and the Acting Associate Administrator for the new Enterprise in Biological and Physical Research (July 2000-March 2002). As NASA Chief Scientist, she served not only as the Administrator's senior scientific advisor and principal interface with the national and international scientific community but also was the principal advisor to the Administrator on budget content of the scientific programs.

Before joining NASA in May 1999, Dr. Olsen was the Senior Staff Associate for the Science and Technology Centers in the NSF Office of Integrative Activities. From February 1996 until November 1997, she was a Brookings Institute Legislative Fellow and then an NSF detail in the Office of Senator Conrad Burns of Montana. Preceding her work on Capitol Hill, she served for two years as Acting Deputy Director for the Division of Integrative Biology and Neuroscience at the NSF, where she has worked and held numerous other science-related positions.

Dr. Olsen received her B.S. with honors from Chatham College, Pittsburgh, Pa., majoring in both biology and psychology and was elected to Phi Beta Kappa. She earned her Ph.D. in Neuroscience at the University of California, Irvine. She was a Postdoctoral Fellow in the Department of Neuroscience at Children’s Hospital of Harvard Medical School. Subsequently at SUNY-Stony Brook she was both a Research Scientist at Long Island Research Institute and Assistant Professor in the Department of Psychiatry and Behavioral Science at the Medical School. Her research on neural and genetic mechanisms underlying development and expression of behavior was supported by the National Institutes of Health.

Her awards include the NSF Director's Superior Accomplishment Award; the International Behavioral Neuroscience Society Award; the Society for Behavioral Neuroendocrinology Award for outstanding contributions in research and education; the Barry M. Goldwater Educator Award from the American Institute of Aeronautics and Astronautics-National Capital Section; the Barnard Medal of Distinction, which is the college's most significant recognition of individuals for demonstrated excellence in conduct of their lives and careers; and the NASA's Outstanding Leadership Medal. She has also received honorary degrees from Chatham College, Clarkson University, and University of South Carolina.