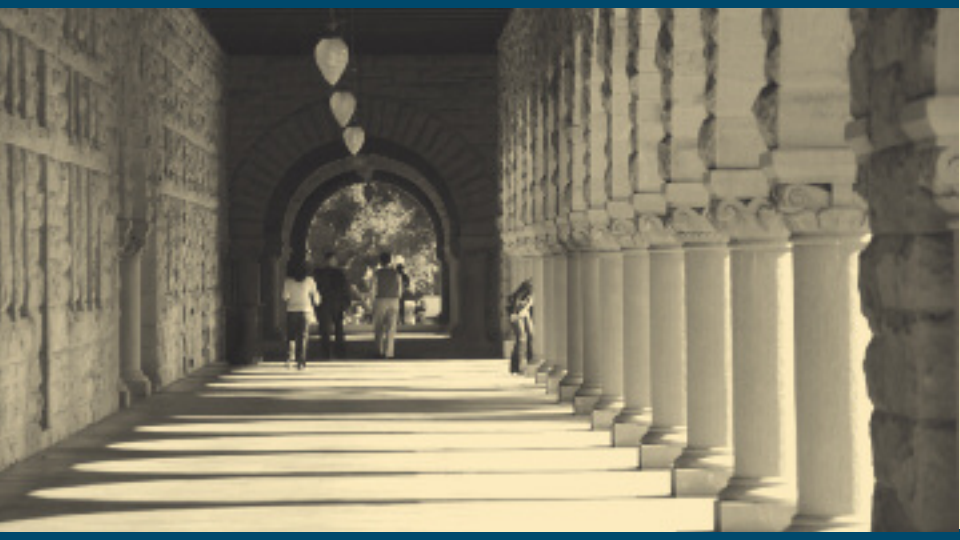
ADVANCE



Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers

NSF ADVANCE web site: **www.nsf.gov/advance**
ADVANCE web portal: **www.advance-portal.net**
Send inquiries to: **advance@nsf.gov**

Background

The goal of the National Science Foundation's (NSF) ADVANCE program is to increase the representation and advancement of women in academic science and engineering careers, thereby developing a more diverse science and engineering workforce. ADVANCE encourages institutions of higher education and the broader science, technology, engineering, and mathematics (STEM) community, including professional societies and other STEM-related, not-for-profit organizations, to address various aspects of STEM academic culture and institutional structure that may differentially affect women faculty and academic administrators. As such, ADVANCE is an integral part of the NSF's multifaceted strategy to broaden participation in the STEM workforce, and it supports the critical role of the Foundation in advancing the status of women in STEM academic careers.

For many decades, an increasing number of women have obtained STEM doctoral degrees, yet women continue to be significantly underrepresented in almost all STEM academic positions. The degree of underrepresentation varies among STEM disciplines, although women's advancement to senior ranks and leadership is an issue in all fields.

Research* has shown that women's representation and advancement in academic STEM positions are affected by many external factors that are unrelated to their ability, interest, and technical skills, such as:

- Organizational constraints of academic institutions;
- Differential effects of work and family demands;
- Implicit and explicit bias; and
- Underrepresentation of women in academic leadership and decision-making positions.

The cumulative effect of such diverse factors has been to create barriers that impact the number of women entering and advancing in academic STEM careers.



* A summary of the relevant research can be found in the 2007 National Academies' report *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering.*

ADVANCE Program

ADVANCE was established in 2001 when the NSF's Office of the Director allocated funding to its directorates and offices to support the program. The current supporting directorates and offices are:

- Directorate for Biological Sciences
- Directorate for Computer & Information Science & Engineering
- Directorate for Education & Human Resources
- Directorate for Engineering
- Directorate for Geosciences
- Directorate for Mathematical & Physical Sciences
- Directorate for Social, Behavioral & Economic Sciences
- Office of Cyberinfrastructure
- Office of International Science & Engineering
- Office of Polar Programs

This NSF-wide model continues to be the basis for the program's budget and management processes, with representatives from the participating NSF directorates and offices serving on the ADVANCE Implementation Committee (AIC). Since 2001, NSF has invested over $135M to support ADVANCE projects at more than one hundred different institutions of higher education and STEM-related, not-for-profit organizations in forty-one states, the District of Columbia, and Puerto Rico (including twenty-four Experimental Program to Stimulate Competitive Research, EPSCoR, jurisdictions).

The ADVANCE program currently supports the following types of projects:

Institutional Transformation (IT) supports comprehensive, institution-wide projects at institutions of higher education to transform institutional practices and climate. These projects must be based on the relevant social science literature. This organizational approach was identified as an important strategy by NSF because research indicates that the lack of women's full participation in science and engineering academic careers is often a systemic consequence of the academic culture and organizational structure of institutions of higher education.

IT-Catalyst supports self-assessment activities at institutions of higher education, such as basic data collection and analysis and the review of relevant policies and procedures, to provide the foundation necessary to undertake institutional transformation. Piloted in 2008 as IT-Start, this component is intended to increase the diversity of the types of universities and colleges ready to undertake institutional transformation. As a result of the pilot, eleven awards were made to institutions including predominately undergraduate institutions, minority-serving institutions, and a university with a significant population of disabled students.

Partnerships for Adaptation, Implementation, and Dissemination (PAID) supports institutions of higher education, professional societies, and/or other STEM-related, not-for-profit organizations to undertake projects that vary in size and scope. PAID projects are designed to broadly share lessons learned from institutional transformation projects, and also to provide information and training about gender in academic careers. For example, PAID projects may adapt IT strategies to new types of institutions and/or disseminate relevant research, strategies, tools, and materials to various audiences.

ADVANCE Strategies

ADVANCE Institutional Transformation awardees have developed and implemented many strateg faculty and leadership positions. Many of the ADVANCE PAID and Leadership awards have adap strategies, tools, and materials to various audiences.

Detailed information about the particular strategies of ADVANCE institutions, including the institu web sites through the ADVANCE web portal (www.advance-portal.net). It is important to note tha

Institutional Structure: Universities and colleges often have organizational barriers that can negatively impact the participation of women and other underrepresented individuals in academic careers.

STRATEGIES

- Review, revise, and increase the transparency and effective implementation of policies and procedures (particularly recruitment, promotion, and tenure policies).
- Develop systematic and recurring institutional data collection and reporting of faculty data and climate surveys, disaggregated by demographics and rank, for use in decision-making.
- Incorporate equity and diversity responsibilities and accountability into institution-wide administrative positions, departmental leadership, and faculty to ensure equitable distribution of resources, responsibilities, and commitment.

Work-Life Support: Retention of both female and male faculty is closely related to satisfaction with work-life balance. Women are disproportionally impacted by work-life issues because female scientists and engineers are much more likely to have a dual-career partner in science and engineering than their male colleagues and because women continue to have a larger share of dependent-care responsibilities.

STRATEGIES

- Implement flexible career policies that address needs identified by the community.
- Develop career and life transition support programs.
- Establish dual-career hiring programs tailored to the institution and region.
- Encourage department and institutional flexibility and support for dependent-care responsibilities.
- Create institutional and departmental climates that encourage faculty to take advantage of work-life programs and ensure that there are no negative impacts on a faculty member's career for participating in the programs.

In addition to creating a more equitable environment for women, ADVANCE IT awardees have r

- The strategies that work to recruit, retain, and promote women in STEM academic positions and persons with disabilities, as well as for men that now enter the work force with a greate
- The cost-benefit analysis of work-life programs indicates that the modest costs of these pro
- The institutions that have undertaken transformational activities are discovering that they a that have not implemented such activities.

1980
Congress passes the Science & Technology Equal Opportunities Act of 1980

1982
First NSF publication of statistics on women in *Women and Minorities in Science and Engineering*

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NSF Visiting Professor and Engi

gies to address organizational factors that impact women's representation in academic STEM
ted these approaches within different types of institutions or disseminated related research,

tional context in which the strategies were implemented, can be found at the ADVANCE grantee
t these approaches are most effective when adapted to suit specific institutional contexts.

Equitable Career Support: Career support programs, such as mentoring and leadership development, are important for retention and promotion of female and male faculty. Women are typically disadvantaged with respect to their male colleagues when career support activities are informal.

STRATEGIES

- Establish formal mentoring structures and provide recognition of service for the time and effort of mentors.
- Develop mechanisms to recognize professional excellence of both female and male faculty.
- Provide workshops, training, and coaching on the tenure and promotion processes to all faculty.
- Implement leadership development, career coaching, and network building programs.

Empowerment: Faculty, department leaders, and institutional administrators are empowered when introduced to the scholarly findings on gender equity barriers and given the tools and resources to address barriers in their decision-making.

STRATEGIES

- Provide faculty, department leaders, and institutional administrators with the tools and resources to address gender equity barriers.
- Provide training on effective strategies to reduce the stressors that result in a greater reliance on implicit biases when making decisions, especially in search committees and promotion and tenure committees.

eported several other benefits of undertaking institutional transformation, which include:

also improve the situation for other underrepresented groups such as racial/ethnic minorities
er interest in and expectation for work-life balance.

grams leads to savings as a result of improved faculty satisfaction and retention.

re more competitive in recruiting highly qualified and diverse faculty than peer institutions

2-1997
ships for Women in Science
neering (VPW)

1989
NSF Task Force on Programs for Women convened

1986-1998
NSF Research Planning Grants and Career Advancement Grants for Women Scientists & Engineers (RPG & CAA)

ADVANCE Awards

Institutional Transformation Awards

Cohort 1 (2001)

- Georgia Institute of Technology (GA)
- Hunter College, CUNY (NY)
- New Mexico State University (NM)
- University of California, Irvine (CA)
- University of Colorado, Boulder (CO)
- University of Michigan, Ann Arbor (MI)
- University of Puerto Rico, Humacao (PR)
- University of Washington (WA)
- University of Wisconsin, Madison (WI)

Cohort 2 (2003)

- Case Western Reserve University (OH)
- Columbia University (NY)
- Kansas State University (KS)
- University of Alabama, Birmingham (AL)
- University of Maryland, Baltimore County (MD)
- University of Montana (MT)
- University of Rhode Island (RI)
- University of Texas, El Paso (TX)
- Utah State University (UT)
- Virginia Tech (VA)

Cohort 3 (2006)

- Brown University (RI)
- California State Polytechnic University, Pomona (CA)
- Cornell University (NY)
- Iowa State University (IA)
- Rensselaer Polytechnic Institute (NY)
- University of Arizona (AZ)
- University of Illinois, Chicago (IL)
- University of North Carolina, Charlotte (NC)
- William Marsh Rice University (TX)

Cohort 4 (2008)

- Michigan State University (MI)
- North Dakota State University (ND)
- Northeastern University (MA)
- Ohio State University (OH)
- Purdue University (IN)
- Rutgers University (NJ)
- University of Nebraska, Lincoln (NE)
- Washington State University (WA)
- Wright State University (OH)

Four awards were made in 2006 to support promising projects:

- Duke University (NC)
- Marshall University (WV)
- New Jersey Institute of Technology (NJ)
- University of Maryland Eastern Shore (MD)



IT-Catalyst

- California Polytechnic State University, San Luis Obispo (CA)
- Delaware State University (DE)
- New York City College of Technology, CUNY (NY)
- Rochester Institute of Technology (NY)
- South Dakota School of Mines & Technology (SD)
- Towson University (MD)
- University of Alaska, Fairbanks (AK)
- University of Minnesota, Duluth (MN)
- University of Puerto Rico, Mayagüez (PR)
- University of Wisconsin, La Crosse (WI)
- Western Washington University (WA)

Partnerships for Adaptation, Implementation, and Dissemination (PAID) Awards

Leadership projects

- Bryn Mawr College (PA)
- Computing Research Association (DC)
- George Washington University (DC)*
- Georgia Institute of Technology (GA)
- Iowa State University (IA)*
- MentorNet (CA)
- Montana State University (MT)
- North Carolina State University (NC)
- Pennsylvania State University, Harrisburg (PA)*
- Pennsylvania State University, University Park (PA)
- Syracuse University (NY)
- University of California, Santa Barbara (CA)
- University of Michigan, Ann Arbor (MI)
- University of Missouri, Kansas City (MO)
- University of Nevada Desert Research Institute (NV)*
- University of Oklahoma (OK)*
- University of Oregon (OR)
- University of Washington (WA)*
- University of Wisconsin, Madison (WI)
- Virginia Commonwealth University (VA)*
- Wesleyan University (CT)*

Dissemination projects

- American Chemical Society (DC)
- American Economic Association (TN)
- Association of Women in Science (DC)
- Auburn University (AL)
- National Academy of Sciences (DC)
- National Postdoctoral Association (DC)
- New Mexico State University (NM)
- North Carolina State University (NC)
- Pennsylvania State University, University Park (PA)
- Spelman College (GA)
- University of California, Hastings College of Law (CA)
- University of California, Irvine (CA)
- University of Nebraska, Lincoln (NE)*
- University of Oklahoma (OK)
- University of Washington (WA)
- University of Wisconsin, Madison (WI)
- Utah State University (UT)

Adaptation projects

- Auburn University (AL)
- Boston University (MA)
- Grand Valley State University (MI)
- Harvey Mudd College (CA)*
- Hunter College, CUNY (NY)
- Idaho State University (ID)
- Michigan Technological University (MI)
- New York University (NY)
- North Carolina State University (NC)
- Oklahoma State University (OK)
- Skidmore College (NY)*
- Texas Tech University (TX)
- University of Delaware (DE)
- University of Miami (FL)
- University of Missouri, Columbia (MO)
- University of Washington (WA)
- Wayne State University (MI)

Research projects

- Clark Atlanta University (GA)
- Commission on Professionals in Science & Technology (DC)
- University of Oklahoma (OK)

* Awards with one or more partnering institutions.

The Leadership component became part of PAID in 2007 and the Fellows component ended in 2003.

Steps Toward Transformation

Since 2001, ADVANCE Institutional Transformation awardees have developed an understanding of the steps needed to create a more equitable environment for women faculty. Many of these steps can be incorporated into ongoing strategic planning efforts and implemented by existing institutional offices and administrative positions. In order to be successful and sustainable, these activities should involve the institutional leadership, mid-level administrators, and faculty.

Review the Research: Study the social science literature on organizational change, implicit and explicit bias, work-life issues, accumulated disadvantage, and other research related to the underrepresentation of women in STEM academic careers.

Collect and Analyze the Data: Identify the specific needs of faculty via surveys and consultation and gather basic institutional data, such as, but not limited to:

1. The distribution of faculty by gender, minority status, disability, tenure status, rank, and department.
2. The outcomes of recruitment, retention, and advancement by gender.
3. The gender distribution of STEM faculty in leadership positions.
4. The allocation of resources and opportunities for STEM faculty by gender.

Review and Revise Policies, Procedures, and Practices: Identify and review the relevant institutional and departmental policies, procedures, and practices that impact academic careers, such as recruitment, tenure, and promotion. Consider that many institutional practices are often not written down (e.g., recruiting faculty from a limited set of institutions), but can have significant impact on decisions and may differentially affect various demographic groups. Revise and clarify problematic or vague policies and practices and ensure that the policies and practices are consistently applied.

Adapt and Innovate Strategies: Research existing strategies that support faculty and identify ways to adapt them to the institutional context. New and innovative strategies may be needed, particularly to address challenges that are unique due to institution type, institutional mission, and geographic region. All strategies should be supported by the available literature and justified with the institutional data and outcomes of the policy, procedure, and practice review. New programs should be built into existing institutional offices and administrative positions whenever possible.

Keep the Institution Informed: Report the institutional data and the outcomes of the policy, procedure, and practice review and the resulting revisions.

Monitor and Revise: Monitor faculty policies and programs over time to evaluate the impact of changes and revisions. Institutional data, including the use of and attitudes about new and revised policies and programs, should be collected and analyzed on a regular basis in order to identify new issues and address areas that still need attention.

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