ADVANCE at Iowa State University:
Comprehensive Institutional Intervention Strategy

Susan L. Carlson, Principal Investigator

Proposal submitted
July 22, 2005
(modified October 3, 2005 and
March 6, 2006)

to the National Science Foundation,
ADVANCE: Institutional Transformation Program

Award received August, 2006, $3,296,157

Start date: August 1, 2006
End date: July 31, 2011
PROJECT SUMMARY
Iowa State University (ISU) proposes a Comprehensive Institutional Intervention plan, a multi-level approach for increasing the participation and advancement of women in science and engineering, and institutionalizing changes to university policies and practices by illuminating and eradicating the subtle and overt ways in which gender organizes university culture, practices, and structures. The goals of the program are to overcome known barriers to women’s advancement across STEM fields as well as department-specific barriers; institutionalize positive changes at the university level; and increase overall participation and advancement of women faculty in senior and leadership ranks. We propose a Participatory Action Model for achieving departmental level change by transforming the culture, practices and structures that impede advancement of women faculty and faculty of color. This approach, developed in the social sciences, nurtures change agents within STEM departments who collaborate with university leadership to ameliorate pervasive organizational problems.

Project activities will include:
- Infrastructure for administering and assessing progress of our multi-level approach.
- Intervention strategies involving department faculty as collaborators with ADVANCE team and ISU administration.
- Department diversity training for chairs and faculty.
- Mentoring and networking programs that span STEM departments, including an external mentoring program to enhance career development for women and for faculty of color.
- University-wide programs aimed at increasing career flexibility.
- ADVANCE toolkit, based on a participatory action model, for assessing and transforming department culture, practices, and structure.
- National Conference on *Recreating Academic Work in STEM* at ISU.
- ISU ADVANCE website that includes best practices, research, electronic newsletter.
- ISU STEM report-card: an annual university-level progress summary.

Intellectual Merit
Organizational research shows that culture, practice and structure are primary sustaining mechanisms of inequity, and thus, necessary intervention focal points for equity intervention strategies. The equity intervention strategies most apt to succeed and become self-sustaining are ones that involve organization members as active collaborators. Those who collaborate in developing intervention strategies are more invested in attaining program goals. Research based on the ISU comprehensive transformation model will contribute to understanding how ground-up intervention strategies involving faculty as collaborators affect organizational change and specifically how such strategies can remove the barriers for women in STEM.

Broader Impacts
Results of this proposed program have implications for research in multiple fields, including higher education, women’s and gender studies, ethnic studies, and labor studies. The national conference *Recreating Academic Work in STEM* will unite representatives from institutions nationwide to strategize and disseminate information on flexible careers and women in STEM. Applications of ISU’s Comprehensive Institutional Intervention model are far-reaching. The project will yield a valuable toolkit, based on the Participatory Action framework, that will be useful to other universities seeking comprehensive institutional transformation focused on STEM departments. The success of this program and others like it will strengthen the U.S. scientific work force by ensuring that women and people of color, two rapidly growing segments of the labor force, take positions of leadership in STEM fields.
ISU’S COMPREHENSIVE INSTITUTIONAL INTERVENTION STRATEGY

Introduction
Iowa State University (ISU) proposes a Comprehensive Institutional Intervention plan, a multi-level approach for increasing participation and advancement of women in science and engineering, and institutionalizing changes to university policies and practices. This plan is feasible given 1) the centrality of both diversity and Science, Technology, Engineering, and Mathematics (STEM) disciplines to ISU’s 2005-2010 Strategic Plan, 2) the firm support of the Provost, three deans and nine department chairs involved, and 3) the University’s prior planning (3 years) for the grant. Since hosting a 2002 NSF-sponsored conference on women in STEM, ISU ADVANCE TEAM has built a network of faculty and administrators who have participated in ISU STEM retreats for women; hosted national experts on diversity; and developed and revised key policies. Based on data collected at two ISU STEM faculty retreats (2003, 2005) and interviews with STEM women faculty, a team of ISU faculty and administrators has identified obstacles, (i.e., known barriers) to the advancement and retention of female STEM faculty. The ISU ADVANCE project’s primary components will address known barriers to participation and advancement of women STEM faculty at ISU, including women of color, as well as barriers specific to the departments and colleges in which STEM women work. ISU seeks to remove these barriers by implementing a grassroots model for affecting change from within departments (Participatory Action Model) while also implementing top-down policies for transforming the University. Our primary goals are:

1. Overcome known barriers to women’s advancement across ISU STEM fields by improving perceived levels of departmental transparency, reducing isolation from colleagues, improving quality and quantity of mentoring, and institutionalizing career flexibility.
2. Overcome department-specific barriers to women’s advancement in STEM by working with department chairs and faculty to improve department and university climate for women and historically underrepresented groups and to implement best practices guidelines.
3. Institutionalize positive changes at the university level by increasing awareness among and the proportion of top administrators actively supporting institutional transformation, improving faculty work satisfaction and organizational commitment, and reducing work/family conflict.
4. Increase overall participation/advancement of women faculty in senior and leadership ranks by increasing the number of women who submit tenure packets, receive tenure and promotion to full professor, and increasing the proportion of women in university leadership roles.

A Participatory Action Model for Comprehensive Institutional Intervention is an approach developed within the sociology of work and related fields (see Ely & Meyerson 2000a). This model will be particularly effective in reaching senior faculty and administrators who are well intentioned but often unknowingly participate in practices that create a chilly climate for women faculty. It maximizes effectiveness by creating agents of change from within departments. These agents, in turn, collaborate with university leadership to ameliorate organization-wide problems, and to address the unique needs of departments. Our model focuses on departmental cultures, practices, structures, and overall structure of the university to develop the most appropriate, self-sustaining change strategies. ISU will implement the Participatory Action Model in select focal departments over the grant period, and will use data from these departments to evaluate the program’s effectiveness and develop templates for university-wide dissemination. By implementing department interventions and top-down policies simultaneously, we seek to illuminate both subtle and overt impediments to equity, and design strategies to dissolve them, thus transforming ISU into an institution that facilitates retention and advancement of women and all underrepresented groups. Efforts funded by the grant will enhance ISU’s commitment to serve a diverse campus community.
Current Status of Women at Iowa State University

ISU, like most research-based universities, struggles to attract and retain women faculty in STEM. Attrition rates of women faculty are higher than those for male faculty and rates for faculty of color are higher than those for white faculty. Across ISU STEM departments, 26% of assistant professors, 22% of associate professors and 9% of full professors are women.

Hiring and rank profiles reveal discrepancies. ISU’s STEM faculty and student body are primarily white men. ISU mirrors most Carnegie Doctoral/Research Extensive institutions in terms of employment rates of women and men in Agriculture and Engineering, but lags in female faculty employed in the natural sciences (13.71% vs. 20.8% nationally), computer science, statistics and mathematics (combined: 13.68% vs. 33.4% nationally) (Glover and Parsad 2003). Women are underrepresented in almost all ISU STEM departments at all faculty ranks. Women make up only 9% of full professors in STEM fields, and ISU has 19.5% women in central leadership positions at the university compared to 27.6% for other similar AAU universities (ISU Institutional Research 2003; 2004). The percentage of faculty of color in ISU STEM fields is also low (18%) as it is nationally (19%). Of ISU’s 30 STEM departments, 16 have no female faculty of color, 15 have three or fewer, and only four have female chairs. Institutional Research shows that of 763 tenure-track faculty in STEM, 21 are female and 129 are male faculty of color. Despite a growing pool of extremely qualified female and people of color candidates, ISU, like other culturally and demographically isolated universities, has been challenged to attract and retain them.

Attrition of women and minorities in STEM is high. What has happened to set Iowa State behind in creating a diverse academic community? In part, we have failed to aggressively prioritize the recruitment and hiring of women and faculty of color. In the past 10 years, ISU hired male rather than female faculty 67% of the time, and whites rather than people of color 78% of the time (ISU Institutional Research 2004). Female and faculty of color we do hire do not stay long. Newly hired tenure-track women faculty have higher attrition rates than men faculty, especially in the first 3 yrs. In a 10 yr. study of faculty hired since 1994, by the end of yr. 3, 16% of women had resigned compared to 4% of men (ISU Committee on Women 2002). A five-year cohort study of STEM faculty through 2004 showed similar patterns. The resignation rate of women STEM faculty considerably increased between yrs. 2-3, (6% to 16%), a pattern different than for men faculty in the same period (Fig. 1). The resignation rate of faculty of color increased sharply in yrs. 3-4 (15-20%), almost 25% higher for faculty of color than for white faculty at yr. 4 (Fig. 2). Our attrition rates, queries to STEM faculty, and recent Campus Climate Study (Rankin 2004) suggest that we have a “chilly climate” for women and faculty of color at the department and university level.

![Fig. 1. Gender differences in total resignations in STEM departments in cohorts hired from 1993-1999.](image1)

![Fig. 2. Total minority resignations in STEM departments from cohorts hired from 1993-1999.](image2)
Specific Barriers to Women’s Advancement

Over the past three years, the ADVANCE TEAM has conducted a preliminary assessment of barriers to recruitment, retention and promotion of STEM women faculty. We organized a national conference on retention of women in STEM in 2002, hosted the visits of experts on diversity in STEM and higher education, and held two retreats for women STEM faculty (2003 and 2005). Four topical areas were discussed at both retreats: work/life balance, tenure and promotion, department and campus climate, and salary and resources. Chairs and deans from five colleges (Liberal Arts & Sciences, Engineering, Agriculture, Family & Consumer Sciences, Veterinary Medicine) participated. In addition to the retreats, individual interviews were conducted by ISU sociologists with women faculty in the College of Engineering (see Bird & Litt 2004). These data were used to identify the following pervasive barriers perceived by STEM female faculty.

• Women are challenged by a lack of transparency in departmental policies and procedures, criteria for measuring performance, and resource distribution. Women, and especially women of color, are unclear about expectations regarding service and feel pressured to dedicate more time to service activities, which detract from the research activities required for advancement.

• Women are isolated in some STEM departments, due to the high percentage of males in their departments. The situation for women of color is further exacerbated by the low number of under-represented faculty of color in STEM departments. Women report feeling left out of informal networking opportunities (e.g., exercise groups), which excludes them from information regarding resources available, formal policies, informal practices, and even colleagues’ research.

• Women report a lack of effective mentoring. Despite a university-wide mentoring and orientation program, women reported poor guidance and input on department, university, and disciplinary expectations/practices. This impairs women’s rate of promotion and leadership readiness.

• Women struggle to maintain work/family balance and receive little support for it from ISU. Pressures to maintain pre-established schedules for tenure and promotion, despite pregnancy and child-rearing obligations, magnify this struggle. Inadequate policies for partner accommodation leave many couples in tenuous states regarding future employment. Because female faculty are more likely than male faculty to have partners employed full-time, and women in academia are more likely than men to be partnered with other academics (Jacobs & Winslow 2004a), women are disproportionately affected by inadequate policies. ISU’s isolated location adds difficulty for partners seeking non-university jobs. Single women also find Ames’ social atmosphere limiting.

Conceptual framework of the proposed project: Culture, Practice, Structure

Three traditional social science approaches to organizational change inform ISU’s Comprehensive Institutional Intervention model. None of these alone is sufficient for creating lasting organizational change. Our strategy employs the most effective elements of the three approaches to devise a comprehensive strategy for transforming institutional culture, practice and structure.

Partial solutions: Traditional approaches. Most organizational approaches to gender equity transformations fall into one of three categories (Calas & Smircich 1996; Ely & Meyerson 2000b).

“Fixing the women.” The “ideal scholar,” like the “ideal worker” in work organizations, is one whose life is structured to accommodate the goals of the institution (Acker 1990; Connell 1995; Williams 2000). Those whose lives best fit the “ideal scholar” mold are more likely to be affirmed, valued, and promoted, and to experience greater personal success than those whose lives cannot conform to the “ideal worker” (Jacobs & Winslow 2004b). Institutions of higher education across the United States have implemented programs intended to provide women and people of color with skills and credentials that they presumably lack, but that white men presumably have, in order to enable women and people of color to “be” the ideal scholar (Carli & Eagly 1999). While this
approach can help many women succeed in the workplace (e.g., by providing skills for successfully negotiating for laboratory space), it has limited value because it does not address gendered structural barriers to women’s success (e.g., tenure policies that penalize one for devoting time/energy to child/elder care).

“Valuing “feminine” skills.” This approach seeks to educate men and women of the value that “feminine” skills bring to a department, e.g., co-operation as a strategy for collaboration and information sharing. This approach acknowledges diversity, but is problematic because it reinforces stereotypes that suggest women are essentially different from men. This approach also has the unintended effect of reinforcing the notion that a woman who leads or does research “like a man” is not “appropriately” feminine (Pierce 1995; Williams 1995). This is especially problematic because research has shown that men or women who deviate from gender expectations are granted less authority than those who conform (Valian 1998).

“Breaking down institutionalized barriers.” Universities nation-wide have added policies intended to alleviate barriers posed by the assumptions behind the “ideal scholar” model. Parental leave, delaying the tenure clock, and part-time tenure tracks are examples of top-down policies created and implemented in an attempt to remove institutional barriers to women’s success. While this approach helps some women advance, it is often inadequate because it does not address organizational culture. Such policies cannot have their full, intended effect unless the culture and practices of departments and universities are organized such that people actually take advantage of them (American Council on Education 2005).

**Limitations to “traditional” approaches and need for ISU’s comprehensive approach.** The drawbacks outlined above point to the need for a more comprehensive approach to institutional transformation. Gender and race play significant and often implicit roles in work culture, ranging from norms of professionalism that systematically disadvantage women (Acker 1990; Valian 1998), to models of managerial competency and leadership that result in recognition of traditionally masculine values of independence and self reliance (Connell 1995; Bird, Litt & Wang 2004; Ridgeway 1997), to notions of the ideal worker as always available and not encumbered by family responsibilities (Ely & Meyerson 2000a). Notions of the ideal worker may be especially detrimental to those for whom family serves not only as a responsibility, but as refuge from broader societal problems. People of color who work in predominantly white settings may seek refuge from unwelcoming work cultures by maintaining high involvement with communities of color outside the university. White colleagues, however, may view such adaptation strategies as unwillingness to put in the time required to become an “ideal” scholar (Collins 1991; Turner & Myers, Jr. 2000). Studies of academic workplace racism show, further, that racism is most prevalent in powerful positions: faculty and administrators (Feagin 2002). More generally, norms of successful scholars as those who rarely take time away from work lead to negative judgments of those who take advantage of family leave policies (Fried 1998; Blair-Loy 2003; Perlow 1997). In practice, those who have the most need for flexibility may be those least likely to take advantage of it (Blair-Loy & Wharton 2002). “Traditional” approaches alone are insufficient, given the drawbacks outlined above. Top-down approaches, without bottom-up participation, also often fail, particularly when changes rely on a single administrator and that person leaves the institution (National ADVANCE PI meeting abstracts 2005).

**Comprehensive Institutional Intervention approach proposed for ISU-ADVANCE.** We propose a Comprehensive Institutional Intervention approach for increasing the retention and advancement of women in STEM fields (Rosser 1999; Stewart, La Vaque-Manty & Malley 2004; see also Ely & Meyerson 2000a). This framework draws components from all three traditional approaches to
create a new, more integrative approach that seeks to create change from the “bottom-up” as well as from the “top down” in order to ensure that agents of change are self-sustaining over time.

**Culture, Practice, and Structure all need to change.** Comprehensive Institutional Intervention focuses on three interrelated institutional aspects: Culture, practice and structure. *Culture* consists of common understandings of socially prevailing workplace ideologies (views and attitudes), norms (rules of conduct) and shared beliefs (formal and informal). Culture is embedded in institutions. *Practice* consists of what people do and say and how this affects patterns of inclusion and exclusion (intended or not). *Structure* consists of physical and social arrangements, including how work is organized, how workers interact, promotion patterns, and institutional policies. Comprehensive Institutional Intervention as a gender equity strategy requires implementation of formal policies that ensure that underrepresented groups receive equitable treatment. It also requires intervention into the *actual practices* in which organizational members engage given the *structure* of the work and the *culture* within which work takes place (Calas & Smircich 1996; Coleman & Rippin 2000; Gherardi 1995).

**Transforming Culture and Practice.** Changing culture and practice is challenging because it is difficult for administrators to legislate cultural norms and informal behavior. There are some patterns of intervention that focus on training individuals about the negative effects of often unconscious gender schemas (Valian 1998). A comprehensive culture approach shifts interventions from merely focusing on the individual level to those that also include the level of social interactions. This transformation strategy requires grassroots, participatory programs (Participatory Action Model) of assessment of practices and work culture; the assessment is then used to illuminate the taken-for-granted organization of work that systematically advantages men over women, whites over non-whites (Ely & Meyerson 2000a; Meyerson & Kolb 2000). In other words, the members of STEM departments who share a work culture need to be in charge of developing a clear and accurate assessment of how culture sustains particular patterns of work, work evaluation procedures, social networks, processes of inclusion and exclusion, and the effects of these on the individual opportunities of department members (Meyerson & Kolb 2000). Our approach will provide training and direction to facilitate these assessments/analyses. Research on work organizations in private industry suggests that such comprehensive strategies are best suited to long-term transformations (Ely & Meyerson 2000a; also Utah State ADVANCE proposal 2002).

**Transforming Structure.** Most gender equity strategies are top-down and focus on structure in terms of policy change. While from an administrative perspective it is natural to think of institutional change in terms of policy change, policies without corresponding changes in culture and practice have only limited impact. This is the weakness of the “breaking down institutional barriers” approach. For example, a structure such as a flexible part-time tenure policy can only result in institutional change if departmental cultures value flexibility and faculty do not, knowingly or unknowingly, cast negative judgments on those who use this flexibility. If department cultures view such policies negatively, prudent candidates will not use them (Blair-Loy & Wharton 2002; Jacobs & Winslow 2004). Thus, our plan for structural transformation links structural initiatives to department level assessments of culture and practice.

**Performance Plan and Methodology**
The ISU-ADVANCE program will achieve Comprehensive Institutional Intervention through the implementation of a Participatory Action change model, while implementing/continuing university level programs for enhancing retention and advancement of women. Coordinating with the Agriculture, Engineering, and Liberal Arts & Sciences deans we will initiate cultural change in two focal departments per college (Animal Science; Chemical & Biological Engineering; Ecology,
Evolution, & Organismal Biology; Genetics, Development & Cell Biology; Mechanical Engineering; and Physics & Astronomy). We will add another focal department per college in the third year (Chemistry; Plant Pathology; and Materials Science & Engineering) for a total of 9 overall.

ISU-ADVANCE TEAM has worked with the deans to select departments of sufficient size (at least 15 members with prospects for multiple hires over next 5 years), with some established diversity, and with a commitment to ADVANCE goals. Working with focal departments is an effective model for ADVANCE programs, as shown by programs at Case Western Reserve, Kansas State, and Utah State. Involvement of department chairs also has been important in achieving ADVANCE goals at Case Western Reserve, Kansas State, Wisconsin, Washington and University Maryland Baltimore County (Natl. ADVANCE PI mtg. abstr. 2005). To facilitate knowledge transfer among focal departments, chairs will meet quarterly under the direction of ADVANCE TEAM member Dr. Vance. (See management plan for detail regarding roles of TEAM members.)

Prior to commencing intervention within focal departments, one Equity Advisor per focal college, and one ADVANCE professor per designated focal department will be established. Diversity and leadership training for persons in these positions (and focal department chairs) will be held to orient these participants to the ADVANCE program and its goals, and to ensure proficiency in practices and policies for supporting diversity. Table 1 outlines key aspects of our focal department strategy.

In each focal department, we will use a 3-step Participatory Action Model process:

**Step 1: Focus group meetings.** The purpose of focus group meetings is to determine if there are additional barriers that women and underrepresented groups face in the context of their departments. Focus group meetings also provide department members opportunity to discuss their perspectives, thus illuminating how various barriers are experienced by department members in terms of departmental culture, practices and structures, how they affect work, productivity, effectiveness, and job satisfaction, and the impact this has on the effectiveness and success of the department (Ely & Meyerson 2000b).

**Step 2: Needs assessment meetings.** The purposes of the needs assessment meetings are to develop department buy-in, share with departments results from focus groups, make explicit aspects of culture and practice that selectively reduce opportunities or isolate individuals (e.g., unintentionally exclusive language/networks), and develop training strategies tailored to the unique needs of each department.

**Step 3: Interventions.** The purpose of the interventions is to change department-specific aspects of culture, practice and structure that systematically impede the advancement, recruitment and retention of women faculty and underrepresented faculty of color. Interventions will be projects of collaboration involving ADVANCE departmental teams and appropriate department members.

In the second and third year of the project, the ADVANCE TEAM will compile an ISU ADVANCE Toolkit summarizing results from steps 1, 2, and 3. We will use this toolkit to implement Comprehensive Institutional Intervention in three additional focal departments in the third and fourth years of the grant. This toolkit will enable implementation of our comprehensive cultural change program in other departments after ADVANCE grant funding ends, and it is a key part of our dissemination plans. The administrative structure and accountability measures that will enable execution of interventions within focal departments and across STEM fields over the next five years are outlined under Management Plan.
Three-step process for change in focal department culture, practice and structure

The 3-step focal department participatory action plan will aid in retention and promotion of female faculty and underrepresented faculty of color (and facilitate recruitment) by cultivating department culture and practices that involve more transparent decision making processes, decreased levels of isolation among women and faculty of color, better mentoring for faculty across status groups, and greater receptivity toward and support of flexible career policies. The steps outlined below focus on subtle and overt causes of barriers to equity, and eradicating barriers by first making them explicit and then employing department members as agents of change.

Step 1: Focus group meetings (year 1 in 6 focal departments [start with 2 in first semester, then bring in other 4 after fine-tuning basic procedures], and year 3 add final 3 focal departments).

### Table 1. Focal Department Participatory Action Plan for Comprehensive Institutional Intervention

<table>
<thead>
<tr>
<th>Focus</th>
<th>Step 1: Department focus groups</th>
<th>Step 2: Needs Assessment Meetings</th>
<th>Step 3: Intervention</th>
<th>Ensuring Intervention Success</th>
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<tr>
<td>Culture &amp; Practice</td>
<td>Focus groups conducted by diversity facilitators, to illuminate: A) Aspects of culture and practice that contribute to known barriers: transparency, isolation, effective mentoring, and use of flexible career policies; and B) Aspects of culture and practice unique to the department that pose additional barriers to women/faculty of color.</td>
<td>Process: -Evaluation of departmental culture using focus group information by ADVANCE Dept. Teams. -Advance professors present focus group summary to department in order to make explicit what was implicit regarding known barriers and other barriers identified. Examples of potential issues: -Gendered/racialized language, evaluative norms. -Culture/practices that enhance likelihood of success for men and whites more than women and people of color. -Culture/practices that create patterns of inclusion/exclusion.</td>
<td>Based on assessments in steps 1 and 2, ADVANCE Teams develop and implement “best cultural practices” guidelines regarding known barriers, additional barriers (identified in step 1) and existing university diversity policies and programs.</td>
<td>Accountability measures: Departments report to Deans/Assoc. Deans. Equity Advisor schedules, oversees and follows up on intervention meetings.</td>
</tr>
<tr>
<td>Structure</td>
<td>Focus groups conducted by diversity facilitators, to illuminate: A) Aspects of department structure that contribute to known barriers: (listed above); and B) Aspects of department structure unique to dept. that pose additional barriers to women/faculty of color.</td>
<td>Process: Same as above. Examples of potential issues: -Existing documentation of department evaluative standards and their availability to department faculty. -Avenues for facilitating greater integration of women/people of color into formal/informal networks. -Mentoring strategies/programs. -Best practices for ensuring proper implementation of existing and new policies.</td>
<td>Best practices for departments identified by ADVANCE teams; university-wide cross-disciplinary STEM retreats, networking meetings, external mentoring pgms., flexible career options.</td>
<td>Departments report to Deans, Assoc. Deans Equity Advisor coordinates meetings and follows up; reports to other colleges and Provost office. University-wide policies (see p. 8-9).</td>
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Discussion of department culture and practice will explore the experiences of women faculty, especially women of underrepresented race/ethnic groups, and will center on: (1) Aspects of culture and practice that pose barriers to transparency, isolate women and underrepresented faculty of color, hinder effective mentoring, and discourage implementation/use of flexible career policies; and (2) Aspects of culture and practice unique to the department that pose additional barriers to women and underrepresented faculty of color. Discussion of department structure will focus on: (1) Aspects of department operating procedures that pose barriers to transparency, isolate women and faculty of color, hinder effective mentoring, and discourage implementation/use of flexible career policies; and (2) Aspects of structure unique to the department that pose additional barriers to women and underrepresented faculty of color.

Step 2: Assessment meetings (year 1 in 6 focal departments and year 3 in additional 3 focal departments). Regarding department culture and practice, these meetings will address questions such as: What are the dominant symbols? What kinds of language and practices prevail? What are the evaluative norms of workplace culture in the department, and do they include gender or race biases? How do culture and practice create patterns of inclusion/exclusion that potentially isolate traditionally underrepresented groups? For example, departments may find an underlying culture that values the “ideal scientist” as one who has responsibilities only in the lab. Since women scientists continue to bear primary responsibility for child care this could result in negative value judgments, which may not be conscious, but could affect women’s advancement. Regarding department structure, these meetings will cover topics such as existing networking structure within departments and avenues for facilitating greater integration of women and people of color into existing networks and/or establishing new networks.

Step 3: Interventions (years 2-5). Regarding department culture and practice, interventions will include ADVANCE departmental teams developing “best practices” based on the outcomes of focal group and assessment meetings, designed to foster culture and practices of inclusion and support. ADVANCE departmental teams will design training for search committees, P&T committees, and curriculum committees. For example, regarding isolation, best practices may include avoiding sports metaphors in formal department meetings, or making conscious efforts to make eye contact with members of all status groups among faculty in department meetings or job candidate meetings. Regarding department structure, interventions will include department-specific actions as well as policies and programs implemented across STEM fields, and in some cases, university-wide. Best practices applicable across the institution will be developed to address known barriers that exist across STEM departments and barriers unique to individual departments.

Interventions to address university-wide structural issues
Most of this project’s restructuring goals will require leadership from administrative offices above the departmental level. Thus, in addition to department-level actions, the Associate Provost for Faculty Advancement and Diversity (PI Carlson) and college-designated representatives will play key roles in assessments and interventions that involve structural issues, including many already identified in the last three years. Existing ADVANCE programs at Georgia Tech, Utah State, and Michigan show that assessment of current practices and change of policies are important to institutional change (Natl. ADVANCE PI mtg. abstr. 2005).

Create transparency: Public documentation of evaluative standards in university decision-making/routine practices (e.g., committee assignments, salary increases, lab space, etc.).

Combat isolation: Program will ameliorate the negative effects of isolation by capitalizing on existing diversity. ISU-ADVANCE TEAM will continue to hold semi-annual cross-disciplinary
STEM retreats. Retreats will include men and women, as well as non-tenure-track faculty, and will focus on sharing research in progress, pedagogical strategies for making teaching more enjoyable/efficient, professional development, and social connections. These retreats will facilitate changes in department, college and university culture and practice for women as well as men by increasing networking opportunities, illuminating subtle and persistent barriers to inclusion, and educating faculty about new and on-going policies and programs. Twice a semester we will also hold networking meetings for women STEM faculty, at socially pleasing venues and offer a speaker or activity related to professional development. Retreats and meetings that include information on career building skills have been well received in ADVANCE programs such as U-Texas El Paso, Utah State and Colorado (Natl. ADVANCE PI mtg. abstr. 2005).

Mentoring: Equity Advisors in conjunction with the Associate Provost for Faculty Advancement and Diversity will overhaul the university mentoring program, building on the successful “circle of advisors” concept (Natl. ADVANCE PI mtg. abstr. 2005). This program will target incoming faculty and faculty career transitions. The goals of this program are to sustain interventions in culture and practice, and to lay a foundation for expanding these changes beyond focal departments by initiating women and men into a culture and practice of gender equity. Mentoring at transitions between career stages is designed to facilitate advancement of faculty up promotion ladders, with special attention to women. Provost-level funding for this program will continue. Mentoring projects have been successful also at U-Texas El Paso and Utah State (Natl. ADVANCE PI mtg. abstr. 2005). Because of the extremely low numbers of women from underrepresented race/ethnic groups in STEM fields at ISU we will also develop an external mentoring program to encourage connections between underrepresented female faculty of color at ISU and at other institutions. This innovative program is intended to enhance the recruitment, retention and advancement of minority women. Individual faculty who desire external mentoring will have the option to apply for an external mentor, a senior-faculty member in the faculty member’s research area. The program will support tele-conferencing and campus visits for both mentee and mentor. ADVANCE funds will be available to fly external mentors or mentees to visit once per year for consultation. Our External mentoring program draws upon lessons learned from other External mentoring programs (University of Maryland Baltimore County) (Natl. ADVANCE PI mtg. abstr. 2005).

Flexible career options and partner accommodation: ISU has made several significant policy advances regarding career flexibility. For example, the current tenure and promotion policy defines scholarship as a combination of research, teaching, and professional practice/extension, the Faculty Senate and ISU President have approved an Arrival of Children Policy and the Senate is currently considering a Part-time Tenure-track Policy. The Comprehensive Institutional Intervention plan will play an instrumental role in ensuring implementation and long-term effectiveness of these policies. The ADVANCE Council (which includes all ADVANCE TEAM members; see management plan) will work with the Provost to appoint a taskforce to review the current partner accommodation practices, in conjunction with a conference in the second year of the project on “Recreating Academic Work in STEM” (see Dissemination). In 2005-2006 an administrative intern (a STEM department chair) is working on these issues in the Provost’s Office.

Strategies for expanding participation of women from underrepresented minority groups
As noted throughout this document, female (and male) faculty of color are highly underrepresented in STEM departments at ISU, and face unique barriers to retention/advancement. ISU has created and implemented numerous programs and policies in the past decade to attract and retain more faculty of color at various ranks in positions across campus. These efforts include 1) the “Keeping our Faculty of Color Team” (faculty and administrators), which is overseeing university efforts to create a more welcoming culture, 2) regular meetings of college Diversity Committee Chairs, under
the leadership of the Associate Provost for Faculty Advancement and Diversity, and 3) 2003-04 Climate Survey to assess overall climate for women and under-represented persons on campus. In addition, the external mentoring program is designed specifically to increase the quantity and quality of mentoring for faculty of color at ISU.

Formative Evaluation

Our evaluation plan involves collection of baseline and progress data in four interrelated categories: (1) Overcoming ISU “known barriers” to retention and advancement of women and people of color in STEM, (2) Overcoming Department specific barriers to retention and advancement of women and people of color in STEM, (3) Institutionalizing change, and (4) Increasing overall retention and advancement of women faculty into senior and leadership ranks. There is overlap among categories 1-3 because the issues are inextricable. Key to the effectiveness of our institutional transformation plan are the ADVANCE Researchers and one of our External Advisors. ADVANCE researchers, representing social sciences, statistics and women’s studies, will use formative evaluation data to refine operating procedures, develop best practices toolkits, and contribute to our knowledge on women in STEM fields. Professor Sullivan (ISU ADVANCE External Advisor, Utah State ADVANCE Co-PI) will assist in establishing routine information sharing between U-State and ISU regarding department-level interventions and toolkit development. Bi-annual teleconferences will enable ADVANCE teams from each school to learn from one another’s successes and challenges.

Indicators of Progress toward Overcoming ISU's “Known Barriers.” Our efforts to document progress toward overcoming ISU “known barriers” to the recruitment and advancement of women in STEM fields will be enhanced by ISU’s participation in the Harvard directed Collaborative on Academic Careers in Higher Education survey (COACHE) (Harvard Study of New Scholars 2005). COACHE baseline data on the satisfaction of tenure-eligible faculty will be collected in Fall 2005, and a follow-up survey to assess progress will be done in Fall 2007. ISU will develop additional questions for the COACHE survey to enhance the usefulness of the data for the ADVANCE project. Examples of types of indicators, and the data to be collected are:

Overcoming Lack of Transparency
- Proportion of departments with clear and accessible documentation of decision-making processes in key areas, e.g., space allocation, salary increases, resource allocation, promotion and tenure.
- STEM faculty members’ perceptions of transparency in decision-making.

Overcoming Isolation
- STEM faculty members’ perceptions of networking opportunities within department and the college, and across campus (COACHE survey, baseline Fall 2005).
- STEM faculty’s perceived levels of isolation in departments, colleges, university.
- Proportion of STEM faculty whose perceptions of isolation have improved.

Overcoming Lack of Mentoring
- Increase in quantity and quality of mentoring for women and underrepresented faculty of color.
- STEM faculty’s perceptions of the effectiveness of mentoring programs on increasing access to networking and other career opportunities, research teams, promotion and tenure information, etc.

Overcoming Lack of Career Flexibility
- STEM faculty use of existing and new career flexibility policies.
- STEM faculty’s perceptions of how career flexibility policies affect own and others’ progress toward tenure, promotion, salary increases, teaching assignments, and leadership opportunities.

Indicators of Progress toward Overcoming Department-Specific Barriers
- Proportion of department chairs who have received training in diversity and inclusive leadership.
- Changes in proportion of faculty within focal departments who support and/or are actively involved in achieving equity objectives (including participation in workshops, seminars, etc.).
• Proportion of STEM departments that have developed and implemented “best practices” guidelines for achieving equity objectives.
• Proportion of faculty within focal departments who report changing routine work activities (including teaching, research, service) to ensure positive equity outcomes.

**Indicators of Progress toward Institutionalized Change** (see ADVANCE Institutional Transformation Indicators Working Group, 2005)

*Outcomes of institutional processes of recruitment and advancement.*
• No. of faculty who submit tenure packets, and number awarded tenure, by gender and department.
• No. of tenured associate professors by department and gender with years-in-rank.
• No. of faculty hired and who leave by rank, gender, and department.
• Cohort analyses of tenure and promotion, including to full professor.

*Allocation of resources for science and engineering faculty at ISU.*
• Study of salaries of men and women faculty (with controls, e.g., department, rank, years in rank).
• Study of space allocation of STEM faculty by gender (with controls).
• Study of start-up packages of newly hired faculty by gender (with controls).

**Indicators of Increased Overall Retention and Advancement of Women Faculty in Senior and Leadership Ranks** (see ADVANCE Institutional Transformation Indicators Working Group, 2005)

*Distribution of science and engineering faculty.*
• Number of men and women tenured and tenure-track faculty by department, rank and gender.
• Number of non-tenured men and women faculty (e.g., Instructional, Research, Clinical, Postdoc.).

*Distribution of science and engineering faculty in leadership positions in the institution.*
• Proportion of STEM women and underrepresented faculty of color in leadership positions.

Data on key indicators of progress toward ADVANCE goals will be collected in each of years 1-4, enabling us to establish a baseline for assessing progress. We will submit baseline data in the yearly Annual Report, and will provide data on changes in key indicators in subsequent reports. Because demographics and dynamics in STEM and Social and Behavioral Science (SBS) departments often differ (see ADVANCE Institutional Transformation Indicators Working Group, 2005) we will examine and report baseline and progress data/analyses separately for STEM and SBS.

**Management Plan**

The ISU ADVANCE management plan will utilize the three-level academic structure (department-college-provost) through which expectations for faculty work, policy development, and faculty development operate at the university. This structure will be augmented with new ADVANCE groups and positions to ensure the full integration of efforts into academic decision-making.

Since 2001, PI Carlson, Associate Provost for Faculty Advancement and Diversity, has led campus-wide efforts to improve diversity. She will have the assistance of a program director and full time program assistant funded by ADVANCE. As PI she will supervise the ADVANCE Program Director and oversee staffing, resource allocation and compliance to the terms of the grant. She will provide weekly updates on the project’s status to the Provost. ADVANCE duties will complement her ongoing efforts to improve the climate for all underrepresented groups on campus.

**Focal Departments.** The strength of this proposal lies in the use of the focal departments to make an institutional change, which is supported throughout all levels of university administration. In each of the focal departments there will be an ADVANCE team consisting of the department chair, ADVANCE Professor, 3 faculty and the college Equity Advisor. This team will coordinate the focus groups, supervise needs assessments in the department, and develop training strategies, while interacting with ADVANCE teams from other focal departments. Each ADVANCE departmental team will be led by the ADVANCE Professor and will meet bimonthly. ADVANCE TEAM
member Dr. Vance, Chair of Mechanical Engineering, will serve as special liaison with all chairs involved. ADVANCE Professors (selected via nomination) will be senior STEM professors appointed to 2 year terms with responsibility for coordinating departmental activities and collecting department-level progress data.

**STEM Colleges.** At the college level, the College Coordinating Council (CCC) will be composed of the Dean or associate dean, ADVANCE Professors, College Equity Advisor, the focal Department Chairs and the ADVANCE Program Director. The CCC will meet twice per month and coordinate activities across the focal departments. The Equity Advisors will be part-time appointments for senior faculty, filled by the Dean. They will coordinate college-level assessments, training and interventions, while also overseeing follow-up on the departmental activities.

**Provost.** Coordination at the Provost level will be through the ADVANCE Council (Associate Provost, the Dean or Associate Dean from each college, ADVANCE Program Director, Program Assistant and the ADVANCE TEAM members), which will meet bimonthly to review development of programs and ensure that faculty and administrative issues are addressed. Each year, three of the nine ADVANCE TEAM members will receive release time to take on additional responsibilities to supervise training, liaison with individual faculty, and ensure the implementation of the ADVANCE proposal vision. The Council will also meet periodically with the Director of the Program for Women in Science and Engineering, the Director of Equal Opportunity and Diversity, and others who can assist in the institutional transformation. The ADVANCE Program Director, housed in a central campus location, will be a full time staff person who is knowledgeable about STEM faculty issues. This Director will manage the day-to-day responsibilities for the program and supervise the Program Assistant and graduate students while interacting frequently with the Associate Provost. She/he will also work closely with the evaluation and assessment team.

ADVANCE Council will coordinate participation of all external partners (below).

**ADVANCE External Advisory Board** will be comprised of four experts in issues of institutional transformation:

- Jacquelyn Litt, Ph.D., Associate Prof. and Director of Women’s & Gender Studies at the University of Missouri, Columbia,
- Ronda Callister, Ph.D., Associate Prof. of Management & Human Resources and ADVANCE Co-PI at Utah State University,
- Caroline Turner, Ph.D., Prof. of Education, Leadership and Policy Studies at Arizona State Univ.,
- Claire Van Ummersen, Ph.D., Vice President of the American Council on Education and Director of the Office of Women in Higher Education.

Three of four External Advisors will visit campus once per year to give advice on major program decisions, including dissemination of efforts beyond ISU. Also, Dr. Van Ummerson and the Office of Women in Higher Education will be a partner in sponsoring the ISU Conference, *Recreating Academic Work in STEM,* and Dr. Sullivan will coordinate information sharing between Utah State and Iowa State regarding department-level interventions and toolkit development.

**External Mentors** for faculty in STEM will be nominated by faculty members and invited by ISU President Geoffroy, a strategy proven effective elsewhere (Natl. ADVANCE PI mtg. abstr. 2005).

**Diversity Facilitators** (1 external diversity training expert working with 1 internal expert) will conduct dept. focal group meetings and train ADVANCE team members and the Equity Advisors.

**External Evaluators,** teams of faculty or staff with assessment expertise in STEM, in consultation with the NSF ADVANCE Program Director, will conduct two reviews during the term of the grant.
**Schedule of Major Activities.** The project will begin by focusing on review of current practices and training exercises in yr. 1. The national conference, *Recreating Academic Work in STEM,* will occur in yr. 2. ADVANCE toolkit will be developed in yr. 3. As the program matures in yrs. 4 and 5, the focus will turn to dissemination and plans for the future.

**Sustainability of ISU ADVANCE**

In its 2005-2010 Strategic Plan, ISU has recommitted itself to prominence in science and technology and to supporting diversity to enliven “the exchange of ideas” and broaden scholarship. The Provost and President have made the creation of endowed chairs to support women in STEM a priority of the University’s upcoming capital campaign. ISU has shown firm commitment to improving the situation for women and underrepresented groups in STEM, and has pledged ongoing support. Such commitment is critical (Natl. ADVANCE PI mtg. abstr. 2005).

ISU, the first land-grant university in the nation, was the first institution of higher learning in Iowa to admit women and was one of the first predominantly white universities in the country to admit people of color. George Washington Carver, the famous African American scientist and inventor, studied at ISU in the 1890s. Ada Hayden (botany), Darleane Hoffman (chemistry), and Bernice Watt (food nutrition and chemistry) were among the renowned women scientists who graduated with advanced degrees from Iowa State. To strengthen this tradition, ISU has undertaken three years of planning and coordination for the ADVANCE program application, including:

- 2002 national NSF-funded conference, “Retention of Women Graduate Students and Early Career Academics in Science and Engineering,” hosted by ISU Women’s Studies Program, which resulted in multiple publications (e.g., Bystydzienski 2004; Bystydzienski & Bird 2005).
- Visits of three experts in equity issues for faculty: Drs. Denise Denton (2003), Joan Williams (2003), and Caroline Turner (2004), all of whom consulted with the ISU ADVANCE TEAM.
- A university-wide “Climate Survey” focused on issues of concern to women and underrepresented groups, conducted during 2003-04 by Sue Rankin and Associates, culminating in an implementation plan to improve campus climate. Implementation plans are due to ISU President by August, 2005.
- Creation of President’s Advisory Committee on Diversity, 2002.
- Provost’s Office intern, 2005-06, to put in place university-wide policies/training leading to more diverse faculty hiring (intern is a female STEM field department chair). The Provost has also agreed to devote 1 intern/year to an ADVANCE related task during the life of the grant.
- Development of “Arrival of Children” (2002) and “Part-Time Tenure Track Appointments” (2004-2005) policies; final approval in process.

The sustainability of these efforts is indicated beyond the life of the grant. ISU’s President and Provost have pledged continued support. Several campus organizations also are committed to improving the campus for women in STEM: Program for Women in Science & Engineering, Archives of Women in Science & Engineering, University Committee on Women, and Women’s Leadership Consortium.

**ISU ADVANCE TEAM: Interdisciplinary Leadership and Expertise**

Two key strengths of the 9–member ISU ADVANCE TEAM are its interdisciplinary nature, with members from sciences & engineering (Bowen, Debinski, Heising, Vance), education, women’s studies, social science & humanities (Bird, Bystydzienski, Carlson, Fehr, Laanan), and its unity over the past several years. Comprehensive study of women in science requires interdisciplinary
research (Rosser 1986; 2002). ISU Women’s Studies program has taken a lead in coordinating interdisciplinary work, by organizing the 2002 ISU conference on women in STEM. Four TEAM members have published on issues of women and people of color in STEM (Bird, Bystydzienski, Fehr, Laanan). Co-PI Judy Vance has been a leader in organizing the NSF ADVANCE-sponsored Women in Engineering Leadership Institute (WELI). Several of the ADVANCE TEAM members also have been active in producing ISU reports on the status of women and minorities including studies of the colleges of Agriculture and Engineering (Debinski, Vance, Heising, Carlson, Bird).

The TEAM will continue to direct the ADVANCE efforts, under the direction of PI Carlson, but also through their various roles in the execution of the plan. This team has already developed a cross-disciplinary collaboration that will allow it to handle both disciplinary-based issues in STEM and institutional transformation issues modeled on social science research. The team will take on the following roles in addition to all serving on the ADVANCE Council: ADVANCE leadership roles (all team members, on a rotating basis), department chair of focal department and convenor of focal department chairs (Vance), ADVANCE Professor in focal departments (Debinski), evaluation and assessment, publication of project research results (Bird, Bystydzienski, Fehr, Laanan), Diversity facilitators (Fehr), Equity Advisors. It is intentional that TEAM members be scattered among various levels of management, so that we can collaborate with our many campus partners.

**Dissemination**

ISU ADVANCE will ensure dissemination beyond the institution in the following ways:

- Conference at ISU (in year 2), co-sponsored by Office of Women in Higher Education (ACE), *Recreating Academic Work in STEM*. Conference will bring together faculty and administrators with experience in recruitment and retention, underrepresented groups in academe, part-time tenure, partner accommodation, and retirement, and will also focus on transitions between career stages, re-entry into faculty roles, and provisions for the arrival of children.

- Focal departments will collect data to present to major disciplinary conferences. ADVANCE professors will be responsible for department-level dissemination, Deans/Associate deans for interdisciplinary dissemination, and Associate Provost for institution-wide dissemination.

- Routine inter-institutional dissemination between ISU and a currently funded ADVANCE institution, Utah State, will be enhanced by bi-annual teleconferences between the two schools, coordinated and facilitated by Ronda Callister (Utah State).

- ISU ADVANCE interactive website will provide program development details, best practices, research results, electronic newsletters, achievements, and archived presentations.

- ADVANCE Toolkit developed in focal departments will be available on ISU ADVANCE web site and shared at appropriate professional venues.

- ISU will develop a STEM report-card as a part of its collection of data. While ADVANCE efforts are targeted at faculty, the report-card will also detail progress in student success.

**Prior NSF Support**

**PI:** Jill Bystydzienski. **Award Information:** #0094556, 3/15/01-5/31/03, $55,257. **Title:** Retention of Women Graduate Students and Early Academics in STEM. The award funded a conference at ISU at which recent research on barriers to women and minorities in STEM was presented. Participants included 150 attendees, including teams of 5-7 faculty, graduate students and administrators (women’s studies and science and engineering) from 13 universities. Bystydzienski, J.M. & Bird, S.R. (eds.). 2005. Removing Barriers: Women in Academic Science, Technology, Engineering and Mathematics. Bloomington: Indiana University Press.

**PI:** Diane Debinski. **Award Information:** #0518150, 7/1/05-6/30/06, $60,000. **Title:** LTREB: Quantifying Early Indicators of Global Climate Change. This project will use long-term biodiversity data in concert with remotely sensed data to quantify the effects of climate change on
ecological communities in montane meadows of the Greater Yellowstone Ecosystem. These meadows may be some of the first areas to be affected because of their steep environmental gradients and extremely dynamic seasonal changes. This new award has no products yet.

**PI:** Carla Fehr. **Award Information:** #0450821, 6/1/05-7/31/06, $53,289. **Title:** Pragmatic Mechanism and Explanatory Pluralism. This project will use the methods of naturalized philosophy of biology to develop a view of mechanistic explanation, pragmatic mechanism, which takes seriously philosophical accounts of explanatory pluralism in biology. The PI will write a book and 3 articles. This will broaden opportunities for women in science by developing an understanding of how social factors involved in scientific reasoning can be developed to better meet needs of women scientists.

**PI:** Frankie Laanan. **Award Information:** #0507882, 7/1/05-6/30/07, $200,000. **Title:** GSE/DIS Pathway to a STEM Baccalaureate Degree: Research Trends, Exemplary Practices, and Successful Strategies. ISU is developing materials to encourage the transfer of female and minority students in community colleges to STEM baccalaureate study. Products will include: a video, a transfer student guide, and a website combining research, recommendations, student reflections, timeline, and a transfer checklist. This project will enhance understanding of the role of 2-year colleges in providing educational access to minorities and women to STEM bachelor's degrees.

**PI:** Judy M. Vance. **Award Information:** #0245084, 8/1/03-7/31/06, $218,962. **Title:** Collaborative Research: The Women in Engineering Faculty Leadership Network. This project unites 6 U.S. institutions, led by ISU, in an effort to facilitate senior women engineering faculty as they explore their interest in academic leadership, especially at the department level. Faculty from 10 more institutions, including a Canadian one, are involved as consultants or advisors. Leadership conferences have provided leadership training, mentoring, and networking opportunities. An Engineering Summit joined leaders of organizations supporting women engineers, and developed strategies to overcome barriers for women in engineering leadership. The resulting Summit Report has been widely distributed to stakeholders. Several presentations/publications have resulted.

**Intellectual Merit**

Organizational research shows that culture, practice and structure are primary sustaining mechanisms of inequity, and thus, necessary focal points for intervention strategies aimed at producing positive equity outcomes. The equity intervention strategies most likely to succeed and become self-sustaining are ones that involve organization members as active collaborators invested in attaining program goals. Research based on ISU’s Comprehensive Institutional Intervention plan will contribute to our understanding how ground-up intervention strategies affect organizational change and specifically how such strategies can remove barriers for women in STEM. Research from this project, including papers based on the participatory action model for departmental transformation, will be submitted to scholarly journals including Educational Research Journal, American Sociological Review, Journal of Women & Minorities in Science & Engineering, Sociology of Education Journal, National Women’s Studies Association Journal, Race, Ethnicity & Education Journal, Research in Higher Education, and Research in Organizational Behavior.

**Broader Impacts**

As noted throughout this proposal, results of this proposed program have implications for research in many disciplines. The national conference Recreating Academic Work in STEM will bring together representatives from institutions nationwide that are making progress in the areas of flexible careers and women in STEM. Applications of the Comprehensive Institutional Intervention model are far-reaching in higher education and beyond. The project will yield a valuable toolkit, based on ISU’s Participatory Action framework, that will be useful to other universities seeking to bring about comprehensive institutional transformation focused on STEM departments.
References


Iowa State University Office of Institutional Research. 2003. *Females in Major Administrative Positions at Selected Universities*.


Utah State University ADVANCE team. 2002. ADVANCE-US: A Supportive Workplace Initiative to improve Gender Equity and Faculty Effectiveness. Grant proposal to NSF.

