COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/INVITATION NO./CLOSING DATE: If not in response to a program announcement/invitation enter NSF 11-1

NSF 10-593 11/07/11

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S): (Indicate the most specific unit known, i.e., program, division, etc.)

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EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN) SHOW PREVIOUS AWARD NO. IF THIS IS AN ACCOMPLISHMENT-BASED RENEWAL IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES NO IF YES, LIST ACRONYM(S)

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Otterbein College Otterbein College

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0031104000 Otterbein College Otterbein College

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[] SMALL BUSINESS FOR-PROFIT ORGANIZATION WOMAN-OWNED BUSINESS

[] IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT

IT Catalyst - Equity through Inquiry: ADVANCE at Otterbein University

REQUESTED AMOUNT PROPOSED DURATION (1-60 MONTHS) REQUESTED STARTING DATE SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE

$199,744 24 months 07/01/12

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

[ ] BEGINNING INVESTIGATOR (GPG I.G.2)

[ ] HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number

Exemption Subsection ______ or IRB App. Date Pending

[ ] DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)

[ ] INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)

[ ] PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)

[ ] HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)

[ ] HISTORIC PLACES (GPG II.C.2.i)

[ ] VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date

P1/PD DEPARTMENT P1/PD POSTAL ADDRESS P1/PD FAX NUMBER

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United States
Certification for Authorized Organizational Representative or Individual Applicant:

By signing and submitting this proposal, the Authorized Organizational Representative or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding debarment and suspension, drug-free workplace, lobbying activities (see below), responsible conduct of research, nondiscrimination, and flood hazard insurance (when applicable) as set forth in the NSF Proposal & Award Policies & Procedures Guide, Part I: the Grant Proposal Guide (GPG) (NSF 11-1). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U. S. Code, Title 18, Section 1001).

Conflict of Interest Certification

In addition, if the applicant institution employs more than fifty persons, by electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative of the applicant institution is certifying that the institution has implemented a written and enforced conflict of interest policy that is consistent with the provisions of the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.A; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the institution’s expenditure of any funds under the award, in accordance with the institution’s conflict of interest policy. Conflicts which cannot be satisfactorily managed, reduced or eliminated must be disclosed to NSF.

Drug Free Work Place Certification

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification

(If answer “yes”, please provide explanation.)

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

Certification Regarding Lobbying

The following certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding $100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding $150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any Federal loan, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure of Lobbying Activities,” in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Certification Regarding Nondiscrimination

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Grant Proposal Guide.

Certification Regarding Flood Hazard Insurance

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:

(1) community in which that area is located participates in the national flood insurance program; and

(2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:

(1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and

(2) for other NSF Grants when more than $25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

Certification Regarding Responsible Conduct of Research (RCR)

(This certification is not applicable to proposals for conferences, symposia, and workshops.)

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative of the applicant institution is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research. The undersigned shall require that the language of this certification be included in any award documents for all subawards at all tiers.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE

NAME

Diane E Nance

SIGNATURE

Electronic Signature

DATE

Nov 7 2011 10:53AM

TELEPHONE NUMBER

614-823-1846

ELECTRONIC MAIL ADDRESS

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FAX NUMBER

614-823-3101

* EAGER - Early-concept Grants for Exploratory Research

** RAPID - Grants for Rapid Response Research
Summary

Otterbein University will conduct a self-assessment that will identify barriers to equitable employment policies and practices for women faculty in STEM disciplines. As a primarily undergraduate institution (PUI), we are uniquely positioned to conduct this assessment from a largely underappreciated perspective. While stereotypes, bias, and work-life imbalances persist at both primarily undergraduate and large research intensive schools, STEM women at small schools also face a unique set of unexamined challenges. In conducting our assessment, we will raise the profile of these issues on campus and develop recommendations and policies that serve as a model for other small liberal arts and comprehensive institutions.

Our assessment will focus on four main categories: (1) Bias and Climate, (2) Service Obligations, (3) Work-Life Balance, and (4) Invisible Women and Dual-Career Couples. We define invisible women as those who serve in part-time, adjunct or lecturer positions and who are not well integrated into departments. We suspect that women are more likely to be put in such positions because of work-life balance issues or because they are the trailing spouse in a dual-career couple. We are particularly interested in the invisible women component of the study because very little, if any, existing research addresses their plight. To conduct our investigation, we will (1) compile data from pre-existing sources on campus; (2) conduct surveys and interviews and convene focus groups and professional learning communities; and (3) visit ADVANCE-funded institutions.

Intellectual Merit

The proposed project is critical to advancing knowledge of issues faced by STEM women because of its focus on two often-ignored populations—invisible women and primarily undergraduate institutions (PUIs). Although some literature on STEM women at large research universities provides a starting point for institutional change at PUIs, the issues that women at smaller schools face vary greatly from those at larger schools because of considerable differences in their focus on service, teaching, and scholarship. To ensure we are as successful as possible, we take an evidenced-based approach by grounding our project in the social scientific literature on stereotyping, implicit bias, motherhood penalties, and work-life balance. With a long history of posing important human and political questions, and with a proven set of methods for their exploration, the social sciences provide a well-established model both for collecting data that can deepen our understanding of corrosive attitudes and behavior and for using such understanding to effect positive change. By adopting this perspective, we maximize the likelihood that we will develop informative recommendations and begin to implement positive change in lives of STEM women at Otterbein and beyond.

Broader Impacts

The broader impact we seek to make is to increase representation of and equality for women in STEM disciplines. The most noteworthy way in which our project will have an impact is by contributing to knowledge on two populations that have been virtually ignored by the literature: (1) “invisible women,” who serve in part-time, adjunct, lecturer, or contingent positions, and (2) female STEM faculty at primarily undergraduate institutions (PUIs). Finding ways to increase the numbers of successful, satisfied female scientists working in tenure-track or other, alternatively imagined positions, will ensure the presence of strong role models for young STEM female students, who may otherwise have difficulty imagining themselves as scientists. Furthermore, our assessments and analyses will serve other similarly-sized institutions as well, since we will disseminate through our ADVANCE website and other outreach efforts. We see our project as having an important regional—and perhaps even national—impact in light of our two unique focal points. With at least 10 small institutions within an hour’s drive of our campus, we will host a conference in which faculty and administrators from these schools will be invited to learn about our findings, share their own thoughts and experiences, and discuss the steps necessary for the execution of systemic change we hope to have modeled. To reach an even wider audience, we will further disseminate our findings via a session or symposium at a joint meeting of the Association of American Colleges and Universities and the American Conference of Academic Deans.
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For font size and page formatting specifications, see GPG section II.B.2.

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*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.*
Equity through Inquiry: ADVANCE at Otterbein University

Otterbein University requests $199,742 over a two-year period to conduct a self-assessment that will identify barriers to equitable employment policies and practices for women faculty in STEM disciplines. As a primarily undergraduate institution (PUI), we are uniquely positioned to conduct this assessment from a largely underappreciated perspective (Karukstis, 2009). While stereotypes, bias, and work-life imbalances persist at both primarily undergraduate and large, research-intensive schools, STEM women at small schools also face a unique set of unexamined challenges. In conducting our assessment, we will raise the profile of these issues on campus and develop recommendations and policies to serve as a model for other PUIs.

Our assessment will focus on four main categories: (1) Bias and Climate, (2) Service Obligations, (3) Work-Life Balance, and (4) Invisible Women and Dual-Career Couples. We define invisible women as those who serve in part-time, adjunct or lecturer positions, and are not well integrated into departments. We suspect these women are typically pushed into their positions because of work-life balance issues or because they are the trailing spouse in a dual-career couple. We are particularly interested in the invisible women component of the study because very little, if any, existing research addresses their plight.

To conduct our investigation, we will (1) compile data from existing sources on campus; (2) conduct surveys, interviews, focus groups, and professional learning communities; and (3) visit ADVANCE-funded institutions. Funding from the IT Catalyst grant will provide the resources required for our research, including travel to ADVANCE-funded institutions and compensation for project participants. Critical to our success is a guarantee from the Otterbein administration to release principal investigators from a full slate of institutional responsibilities, so that they have adequate time to manage and execute the project effectively.

Background

The Institution

Otterbein University is a leading comprehensive institution that acknowledges the liberal arts as the broad base of all learning. There are approximately 3,000 students at Otterbein, 60% of whom are women, and 35% of whom are first-generation college students. STEM departments and programs in NSF-support fields include Biology & Earth Sciences, Biochemistry & Molecular Biology, Chemistry, Mathematical Sciences, Physics, Psychology, Political Science, Economics and Sociology & Anthropology. We have 179 full-time faculty members, 26% of whom are in STEM disciplines.

Otterbein is an institution in transition. In implementing our 2007 Strategic Plan, the university undertook a 20 million dollar renovation of the Science Center, entirely transformed the General Education curriculum, moved from a quarter to a semester calendar, and changed its name from college to university. In 2009, our President retired after 25 years, and Otterbein welcomed its first female President, Dr. Kathy Krendl. In her first two years, Dr. Krendl has led a sweeping change in administration, hiring three female vice presidents (Academic Affairs, Business Affairs, and Advancement), replacing the predominantly male former administration. Dr. Krendl’s commitment to improve women’s professional pathways by example has led to the development of leadership programs for school-aged girls, university students, and established women in the business community. For example, despite her full schedule, she personally teaches a first-year seminar course on Women and Leadership for incoming female students. She acknowledges that, although Otterbein employs a dynamic, productive group of women scientists, full-time women faculty still lag behind men in rank and tenure-track assignments at Otterbein. This grant represents another important step in the President’s drive to move Otterbein toward true gender equality.

Increases in women’s leadership opportunities might be the first steps to changing the culture of the university, but only thoughtful, evidence-based plans championed by the Board of Trustees will achieve long-lasting systemic efforts in recruiting women in the sciences and providing them essential foundational support. Data collection needs to move from the anecdotal to the systematic to catalyze a productive dialogue among faculty, Trustees, Vice Presidents, and the President of the Institution. In a time of dwindling resources, however, we lack the human and financial resources required for the first
steps. As a tuition-driven school Otterbein has suffered the effects of the global recession and double-digit Midwestern unemployment rates. Recent declines in enrollment led to salary and hiring freezes, cuts to retirement benefits, and across the board cuts in discretionary budgets. Although we collect or can easily retrieve basic data such as the percentage of women faculty in the STEM departments and programs, these data exist in different places in the institution. Thus, the data presented here are neither deep nor systematic. Support from the ADVANCE program will enable the focused, diagnostic, and strategic conversations required for institutional transformation.

**Female STEM faculty at Otterbein**

Otterbein STEM women are a dynamic group of dedicated scientists who lead active academic lives. They are talented teachers and active scholars who serve as important role models for our female students. An informal inquiry to the University Center for Teaching and Learning revealed that 100% of female STEM faculty have attended professional development opportunities offered by the center. Female psychologists have won the New Teacher of the Year award two of the last three years, and alumni cite mentorship by women biologists as instrumental in their own development as scientists (Otterbein University, n.d.; 2007)

Much of the scientific activity on campus owes thanks to the efforts of Otterbein women. In recent years, Biology and Chemistry women have secured and administered two three-year grants from the Merck · AAAS Undergraduate Science Research Program to support interdisciplinary research between the Biology & Earth Science and Chemistry Departments. Additionally, a female chemist was instrumental in launching our NSF S-STEM funded Cardinal Science Scholars Program, designed to recruit women and minority students into our Chemistry and Physics programs. Female scientists also maintain active research labs and regularly attend local, regional and national conferences with students and publish in peer-reviewed journals (albeit at a lower frequency than their counterparts at larger research universities). With funding from two NSF Research Opportunity Awards, a biologist spent the last three summers conducting research at the Smithsonian Tropical Research Institute in Panama. A second biologist is particularly adept at mentoring students at obtaining funding, and her students have accumulated an impressive list of awards. Additionally, a chemist recently secured funding from the National Institute of Standards and Technology, and women psychologists have received grants from the Ohio Commission on Minority Health and the U.S. Army Research Institute.

**Preliminary Data**

Women are a productive component of Otterbein STEM departments. Their productivity has tempered any significant institutional review of anecdotal evidence that suggests some gender-based discrepancies exist in hiring, promotion, and the use of institutional resources. The presence of female STEM faculty demonstrates Otterbein’s commitment, but is no substitute for the kind of comprehensive inquiry and institutional action this NSF grant will catalyze. Our initial investigations reveal concerning patterns related to the status of women scientists at Otterbein. Deliberate discrimination may not be occurring, so we need to investigate the potential underlying factors behind this differential resource allocation. We recognize that these initial patterns should be viewed cautiously because our institutional size means that we are necessarily analyzing smaller than desired samples. For this reason, when sample sizes are low, we present both percentages and raw numbers. We recognize that a proper analysis requires more sophisticated techniques, such as a multiple regression model that incorporates other important variables, including gender, experience, and field of study (Travis et al., 2009). Per NSF guidelines, we sometimes separate traditional STEM departments from the Social and Behavioral Science (SBS) Departments. Outside of this section, all references to STEM include SBS.
At Otterbein, women hold approximately 60% of full-time faculty positions in non-STEM disciplines, whereas they hold only 40% of STEM/SBS positions (28% of STEM only). These numbers contrast sharply with the student body where nearly 60% of STEM/SBS majors are women (Fig. 1). The absolute number of STEM/SBS women has remained constant from 2007 to 2011, with the increase in percent of women faculty (35 to 40%) due to a reduction in male faculty members rather than an increase in the number of women. Interestingly, the gender bias in percent women only afflicts full-time faculty; women fill 52% of all part-time STEM/SBS positions. Significant gender disparities are also apparent when comparing STEM/SBS and non-STEM faculty positions by rank. Within non-STEM disciplines, the percentage of female assistant, associate, and full professors varies between 66, 70, and 50%, respectively (Fig. 2). That same comparison within STEM/SBS disciplines indicates a steady decline with rank from 55 to 38 to 23%. Of the five women full professors, 3 are in psychology and 1 is in each of Mathematics and Biology & Earth Science (Table 1). There are no female full professors in Chemistry, and no women at all in Physics or Economics.

STEM/SBS women are also largely absent from important leadership roles at the University. Four women from Psychology and Sociology & Anthropology serve as either department chairs or program directors (Honors program and Senior Year Experience program), and our new Provost is a psychologist. Two other women (both in behavioral and social science) also serve on promotion and tenure committees at different levels, and a chemist currently serves on the Faculty Council Executive Committee. However, STEM/SBS women are currently absent from other prominent roles, including those of Center Directors, Deans, Associate Deans, and Vice Presidents. One STEM woman did serve as Dean of Special Programs and Interim Provost and Vice President of Academic Affairs for one year, but she has since left the university.

![Figure 1. Percent female faculty and students in STEM/SBS and non-STEM disciplines at Otterbein over the past five years.](image1.png)

![Figure 2. Percent female faculty in STEM/SBS and non-STEM disciplines as a function of rank. Numbers above bars are number of women : men.](image2.png)

<table>
<thead>
<tr>
<th>STEM Department</th>
<th>Number of Women : Men</th>
<th>% Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio. &amp; Earth Science</td>
<td>2:1 1:0 1:4</td>
<td>67 100 20</td>
</tr>
<tr>
<td>Chemistry</td>
<td>1:0 1:1 0:2</td>
<td>100 50 0</td>
</tr>
<tr>
<td>Physics</td>
<td>0:1 0:2 0:0</td>
<td>0 0 0</td>
</tr>
<tr>
<td>Math</td>
<td>1:1 0:2 1:6</td>
<td>50 0 14</td>
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</table>

<table>
<thead>
<tr>
<th>SBS Department</th>
<th>Number of Women : Men</th>
<th>% Women</th>
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</thead>
<tbody>
<tr>
<td>Economics</td>
<td>0:0 0:0 0:2</td>
<td>--- --- 0</td>
</tr>
<tr>
<td>Political Science</td>
<td>0:1 1:1 0:0</td>
<td>0 50 ---</td>
</tr>
<tr>
<td>Psychology</td>
<td>2:0 0:0 3:2</td>
<td>100 --- 60</td>
</tr>
<tr>
<td>Soc. &amp; Anthropology</td>
<td>2:0 1:0 0:0</td>
<td>100 100 ---</td>
</tr>
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Table 2. Otterbein STEM and SBS Faculty Salary by Sex and Rank.

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th>Men</th>
</tr>
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<tbody>
<tr>
<td><strong>STEM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assistant Professor</td>
<td>$50,352</td>
<td>$50,793</td>
</tr>
<tr>
<td>Associate Professor</td>
<td>$56,622</td>
<td>$57,349</td>
</tr>
<tr>
<td>Professor</td>
<td>$68,250</td>
<td>$71,291</td>
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<tr>
<td><strong>SBS</strong></td>
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<td></td>
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<tr>
<td>Assistant Professor</td>
<td>$49,215</td>
<td>$50,167</td>
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<tr>
<td>Associate Professor</td>
<td>$57,905</td>
<td>$61,765</td>
</tr>
<tr>
<td>Professor</td>
<td>$66,743</td>
<td>$76,477</td>
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</table>

Gender disparities are also revealed in a simple examination of salary. Men make more than their female counterparts at all levels, a gap particularly pronounced at higher ranks (Table 2). Although the pattern holds for both STEM and SBS, the gap is larger in SBS. In some cases, gender-based discrepancies become more prominent at the specific departmental level. For example, STEM men make $441 more per year than women overall. However, in one of our larger departments, Biology and Earth Science, male assistant and full professors earn $2,032 and $3,362 more than their female counterparts, respectively.

Our preliminary data suggest a gender-biased distribution of resources to faculty. For example, in the past five years, there were 14 new STEM/SBS hires. Within Biology, Chemistry, and Physics, men received higher average start-up packages than women in those same departments ($15,846 vs. $12,667). Women in Social and Behavioral Sciences received less funding ($7,375); no men were hired in that area during that time period. Differences may exist in the extent to which STEM/SBS women apply for internal research funds. From 2003-2005, only one grant out of 25 was awarded to a STEM/SBS woman, while 12 were awarded to STEM/SBS men. Support from an IT catalyst grant will allow us to conduct an in-depth analysis of these data (including a longer timespan) and expand the analysis to include patterns in the distribution of conference travel and sabbatical funds.

Female scientists serve as valued mentors for both junior faculty and students. At Otterbein, we suspect that women bear a heavier burden in this area than men. In our formal mentoring program, new women faculty typically request female mentors. Because women represent a lower percentage of STEM/SBS faculty, there are fewer available female mentors. In an effort not to overburden senior STEM women, female scientists may be assigned non-STEM mentors. While these relationships can be highly successful, issues often emerge that are best discussed with other STEM women, resulting in more informal mentoring by senior STEM faculty. Just as female faculty look to other women as mentors, so do female students. Nearly 60% of Otterbein STEM/SBS students are women, whereas only 40% of STEM faculty are women, resulting in the potential for increased advising loads. As part of our self-examination, we plan to analyze the mentoring and advising load of Otterbein women over the last five years.

We currently lack the data necessary to examine other equity issues. For instance, we currently have no data regarding hiring, retention, and attrition of faculty. This project will allow us to collect, maintain and analyze appropriate data and incorporate it as standard practice for the institution. Data collection initiatives for this project are outlined in each of the sections below and the summary table.

**STEM Women at Primarily Undergraduate Institutions (PUIs)**

Although most science faculty are educated at research institutions, few will actually work there. The majority will take jobs at PUIs (Gaff & Lambert, 1996), which pose special challenges to women scientists. Unfortunately, after being trained at a research institution, there is often a negative stigma associated with choosing a PUI, which may result in a lack of support from mentors and colleagues (Webb, 2008). In terms of representation of women in STEM fields, these schools mirror the patterns at research universities. In fact, the percentage of women STEM senior faculty at small institutions is increasing much more slowly than it is at research institutions, leading to a call for more research on women scientists at small institutions (Karukstis, 2009).

Many women actively seek smaller, PUIs because of either a passion for teaching and working closely with undergraduates or because they see it as an opportunity to maintain better work-life balance (Oberst, 2010). A large survey of Ph.D. students found that 73% of women thought that teaching-
intensive institutions were the most family-friendly choice, a belief that study author Mary Ann Mason calls “wishful thinking” (Jaschik, 2009). Female scientists who have primarily experienced research institutions are usually unaware of the wide variety of roles they will occupy, particularly if they find themselves at this type of institution because of current job availability or because they are trailing spouses seeking work within a limited geographic area. The NSF-funded Preparing Future Faculty program was one attempt to bridge this gap by having Ph.D. students mentored by faculty at teaching colleges (Pruitt-Logan et al., 2002).

At PUIs, all faculty are expected to be excellent teachers, and to teach a wide variety of classes both within and outside their discipline. Faculty are also expected to take an active role with service to both institution and students. Effective undergraduate research mentoring can be much more labor intensive than graduate student or postdoc advising, and it produces a slower return in terms of scholarly output. Barriers to scholarly productivity include the isolation that many scientists experience at small institutions because there is typically only one of any given kind of scientist (Oberst, 2010). It can also be challenging to produce collaborative research with scientists outside the university because of limited travel funds. As part of this project, we plan to investigate the extent to which women faculty have redressed this isolation by forging relationships with researchers at other institutions. We plan to identify factors that both facilitate and inhibit such collaborations based on the inspiring work reported by the ADVANCE grant “Collaborative Research for Horizontal Mentoring Alliances” (Karukstis, 2009).

Smaller institutions also are more likely to suffer from “mission drift,” leading to changing and unclear expectations for faculty (Wolf-Wendel & Ward, 2006). Performance criteria are less clear for junior faculty at these schools, and tenure decisions may seem more linked to non-performance factors (Trower & Bleak, 2004). There have been few projects looking at the representation and development of STEM faculty at smaller institutions; one of the broader impacts of this project is to contribute to the knowledge base on issues specific to women at PUIs and disseminate that information to similar institutions.

Biases and Climate

Literature

An expansive literature documents the small and large ways in which women professionals face more challenges than men. Professional women are more likely to be single, less likely to have children, and more likely to have token status in the upper echelons of business and science (Valian, 1999, Livingston & Kohn, 2010). In the 2010 report Why So Few?, commissioned by the AAUW, several disquieting, irrefutable facts emerge. Women are underrepresented as professors in STEM fields relative to men. Women faculty are less likely to have tenure-track jobs, less likely to be satisfied with their jobs, and less likely to become full professors than their male colleagues. The preliminary data presented above suggest Otterbein is not an exception to this pattern. Stereotypes and biases permeate the work environment of STEM women and influence interactions with both their male and female colleagues as well as students.

Many gender discrepancies in science can be attributed to some form of sexism, in which men enjoy privileges which women do not receive. This contributes to the “chilly climate” in which it is more challenging for women to work (Settles et al., 2006). One manifestation of the chilly climate is differential standards for evaluating men and women (Biernat & Kobrynowicz, 1997), which may emerge in hiring, tenure and promotion decisions (Steinpreis, 1999), and student evaluations. Student evaluations represent an important part of the review process at PUIs and heavily impact tenure and promotion decisions (Wright, 2006). Students reward female faculty for adhering to expected nurturing gender roles but punish them for seeming less knowledgeable, whereas male faculty receive more latitude (Bachen, et al., 1999; Freeman, 1994). Benevolent sexism, in which there is high regard for women as long as they do not deviate from their prescribed roles (e.g., stay-at-home mother) has a potent effect on perceptions of female scientists when they are undeniably occupying the mother role, such as when pregnant or
breastfeeding (Glick & Fiske, 1996; Kilian & Rudman, 1998; Acker, 2009; Masser, Grass, & Nesic, 2007).

The content of the female stereotype also dictates how they should act. Women are expected to be warm and nurturing, whereas men are expected to be competent and assertive (Cuddy et al., 2008). In academe, this caretaking role includes serving as a mentor, fulfilling requests to serve on ad-hoc committees, and providing social support to colleagues. Unfortunately, behaving communally may be seen as maternal rather than communitarian, and diminish perceived competence (Williams, 2005). Female junior faculty are often advised to limit their service commitments and time with students. This advice might backfire, however, because women who violate their expected gender roles tend to be disregarded, disliked, and distrusted (Phelan et al., 2008; Cuddy et al., 2004). Women who demonstrate competence and assertiveness are typically disliked because they fail to fulfill the communal nature of the stereotype, and this has the potential to negatively impact one’s career (Fiske, et. al., 1991; Heilman et al., 2004; Heilman & Okimoto, 2007, Phelan et al., 2008). Unfortunately, the content of the female stereotype is not consonant with the qualities deemed necessary for professional success (Diekman et.al 2010).

Besides the general gender stereotype of women as warm and nurturing, there are particular variants based on the individual woman. These include the double burden visited upon minority women, who must contend with additional ethnic stereotypes (Essien, 1997), and with the specific subtype of women as mothers. The costs of the stereotypical lens through which professional mothers are viewed are both multiple and material. These costs include lower pay, less restricted opportunities for advancement, and inaccurate judgments of motivation, dedication, and competence (Crosby et al., 2004; Mason & Goulden, 2002; 2004; Williams, 2004; 2005). This so-called “maternal wall” occurs when women become mothers, and evaluations of their competence decreases along with their potential for hiring and promotion (Correll et al., 2007).

STEM women are also significantly disadvantaged by unconscious or implicit biases. The most egalitarian, well-intentioned person knows the cultural stereotype of women (e.g., Devine, 1989), and might be influenced by it despite personal and situational factors that discourage its application (Nelson, Acker, & Manis, 1996). Extensive research, including experimental demonstrations using the Implicit Association Task (IAT), reveals the surprising pull of unconscious stereotypic beliefs that associate men with science (Nosek et al., 2002a). The fact that such biases operate at an automatic level does not mean they cannot be modified (Blair, 2002), but it does mean attention must be paid to these underground processes, and focused effort expended to change them. For instance, examples of female leaders as role-models change the automatic association of men with leadership (Dasgupta & Asgari, 2004). Similarly we could expect examples of female science professors should change the association of men with science for our students.

Stereotypes and biases also impact how women see themselves. With a strong association between men and science, it may be more difficult for women to incorporate “scientist” as part of their personal identity (Cheryan et al., in press; Eccles, 1987; Nosek et al., 2002b). Women scientists are well-aware of cultural stereotypes, and of their tenuous position in academic science. This may lead to stereotype threat, whereby women become so concerned with not fulfilling a stereotype that they inadvertently do so because their anxiety undermines their performance (Steele, 1997). Such is the corrosive effect of entrenched stereotypes, leading those captured by them to have to constantly calculate how particular actions might be construed by colleagues. This in turn leads to a practice of bias avoidance by women scientists, and the suppression of anything consistent with the stereotype, such as expressing emotions or discussing children (Drago et al., 2006). Importantly, this means that these processes consume an enormous amount of energy that male scientists do not have to expend. Often women are aware of general impact of stereotypes and biases but they do not recognize their effects on their own career. This phenomenon of “personal/group discrimination discrepancy” results from motivational and cognitive biases that protect one’s esteem and happiness in the face of discrimination. The collection of aggregate data is therefore critical as we cannot rely on individuals to perceive the degree to which they are discriminated against (Crosby & Clayton, 2001). Furthermore, we can educate female faculty members about research on stereotypes so they can strategically minimize the effect of gender stereotypes.
and prescriptive gender norms. This, however, is only a stopgap measure; we should work to change the system, not the women (Cress & Hart, 2009).

**Otterbein Experience**

The prevalence of bias and stereotypes at Otterbein is unknown, although we expect it will resemble national data. Anecdotally, women report that they feel perceived differently from men by students in the classroom and worry that this impacts their course evaluations and potential for promotion and tenure. Women may also be disadvantaged at Otterbein by an unawareness of stereotypes and biases at work. For example, in preliminary conversations related to this proposal, many women discounted the possibility that gender-based differences existed in salary or resources. The preliminary data were eye opening and energized the development of this proposal. For the past 15 years, we have had a single female scientist of color. It is impossible to separate the effects of race and gender from those of the individual person, but it is crucial to learn why recruitment has lagged so seriously. This suggests that we also need to look at the impact of racial biases and stereotypes on our campus. We do not currently have any baseline climate or faculty job satisfaction data at Otterbein.

**Assessment**

We will take a comprehensive approach to assess the prevalence and impact of gender stereotypes and biases, based on practices from other ADVANCE institutions, and the NSF-Advance IT Indicators toolkit.

1. Contract The Collaborative on Academic Careers in Higher Education (COACHE) to survey all tenure-track faculty to assess campus climate and perceptions.
2. Expand our preliminary data as it relates to numbers of women in STEM fields, salary and benefits, and use of campus resources (e.g., internal grants) and conduct a more sophisticated analysis of these data.
3. Interview women who have left the faculty over the last 10 years.
4. Examine policies used to evaluate faculty (e.g., tenure and promotions documents) and search committee materials for transparency and clarity, both of which reduce the impact of stereotypes.
5. Analyze STEM applicant pools and hiring decisions over the last 5 years with regard to gender and race.
6. Follow the model of other ADVANCE grantees (e.g., University of Miami, Council of Colleges of Arts and Sciences) and use the Gender Implicit Association Task (IAT) on campus—first as a diagnostic tool for individuals, and second, as a starting point for a Professional Learning Community devoted to examining bias and stereotypes about gender.
7. Facilitate discussion and/or a focus group on stereotyping following self-diagnosis. Permission will be sought to transcribe these conversations anonymously to examine the perceptions of implicit stereotyping on campus.

**Potential Solutions**

All faculty participants will be invited to join Professional Learning Communities (PLCs) focused on stereotyping and bias. PLCs are inquiry groups of 5-12 people who meet bi-monthly to learn about a topic of shared interest related to teaching and learning in a collegial and supportive context. Since 2003, Otterbein’s Center for Teaching and Learning has sponsored 25 PLCs on a wide variety of topics (e.g., undergraduate research, scholarship of teaching and learning, first-generation students, issues of diversity in teaching and learning). PLCS are well-established and highly successful at Otterbein, and are a natural fit for our project. A stereotyping and bias PLC for faculty will be facilitated by Dr. Acker, and a second PLC for administrators will be facilitated by Program Coordinator, Dr. Garrett Mills.

Although many ADVANCE institutions have examined factors of implicit stereotyping and work-life balance issues for mothers, little effort has focused on identifying and resolving stereotypes of mothers. Dr. Acker has a thesis student developing an IAT that looks at implicit perceptions of motherhood using the program DirectRT. Continued development of this tool and its administration to
members of the university community will allow us to examine biases and develop potential solutions. We will also explore the potential use of materials developed at other ADVANCE institutions to demonstrate biases in hiring and promotion to raise awareness of best evaluation practices (ADEPT, 2011; Gender Bias Bingo 2001). The WAGES-academic simulation which increases knowledge of the cumulative effect of biases in the academic workplace may be particularly useful (Shields, Zawadzki, & Johnson, 2011). Finally, the review of many ADVANCE institutions’ websites (e.g., University of Michigan, University of Miami, and University of Missouri) has convinced us of the viability of interactive theatre as a means to raise awareness and initiate discussions about the impact of subtle biases and stereotypes. Otterbein has a nationally recognized theater program, making this a feasible, inexpensive option to consider.

Service Obligations

Literature

Although faculty at all institutions engage in service work, there is an increased emphasis on such work at PUIs. There are fewer people to share the work, and often more emphasis on shared governance (Pruitt-Logan et al., 2002). Faculty must also do service to students in the form of academic advising and research mentoring. In the process, they are expected to develop meaningful relationships. This leads to many more co-curricular after-hours obligations in an effort to create a “family” on campus. However, the after-hours and weekend time comes at the expense of individuals’ families (Wolf-Wendel & Ward, 2006). Although there are increased expectations for service, there are typically few, if any, increased rewards.

Anecdotally, many women at Otterbein feel they carry more than their share of the service load, and research indicates this is common. At one institution, women spent 220 hours more per year on teaching, mentoring, and service than male faculty, and the gap was even wider between men and women in STEM disciplines (Misra et al., 2011). Men were also more likely to engage in service to their discipline, which is more prestigious (e.g., editorial boards), whereas women’s service was more likely to be to their university. Women spend more time mentoring, and doing lower-level teaching (Park, 1996). This gendered pattern of service work is not by choice; most women indicated they would prefer to spend their time differently (Misra et al., 2011). However, limiting their commitments carries a cost in that it places women at odds with the stereotypic demand that they be helpful and communal. Advising individual women on how to handle such requests ignores the more pervasive problem of the fair distribution of service and emphasizes individual responsibility over the need for collective change at the university (Park, 1996). The desire to include underrepresented groups of women (e.g., minority faculty; STEM faculty) on every committee exacerbates this problem, in that it increases the load disproportionately on a group that is small by definition. Additionally, committee meetings and functions are often squeezed in at the beginning and end of the workday, making it difficult for those with children to participate due to childcare hour limitations. Many single female faculty report feeling overburdened with requests to do things at such times to support those with children (Williams, 2010). This gendered pattern of service results in women with and without children doing more than men, and in women becoming polarized based on their parental status.

Otterbein Experience

Although Otterbein is proud of its heritage of shared governance, there are few formal policies outlining the amount and kind of service that is expected and its relationship to tenure and promotion. It is an open question as to whether women perform more service than their male colleagues. Otterbein STEM women occupy fewer leadership positions on campus. To understand these issues at a deeper level, we propose to investigate the number and types of service commitments that women have carried over the last 5-10 years. This will be a time-consuming task because it involves an audit of records that were not designed for this purpose.
**Assessment**

Our assessment of service obligations undertaken by STEM women will determine the type and amount of service done and will involve comparisons across groups, such as women versus men. Specific assessments will include:

1. Ask female and male faculty members to complete time-use diaries for one week. Because this task is time-consuming, we will provide an incentive.
2. Analysis of the types of teaching done by women and men, including the number of new preparations each year, laboratory sections taught, lower and upper level courses taught, as well as course scheduling (e.g., propitious times).
3. Audit service-related policies on campus, both at the departmental and institutional levels.
4. Quantify service obligations over the past 5 years in the following areas: committee and task force membership and leadership; general participation in governance; number of advisees; number of theses and distinction projects supervised; and number of students mentored in scholarship in other ways (e.g., research assistants in laboratories).
5. Conduct interviews with females in leadership positions, with a focus on identification and examination of pathways to leadership.

**Potential Solutions**

Based on our assessment findings, we will begin to work towards equalizing service levels and bringing clarity to service expectations for all faculty on campus. For example, we will develop institutional and departmental service statements that provide clear guidelines for service expectations, following the process we recently completed for scholarship expectations and modeled on the University of Arizona ADVANCE materials. Intervention at the chair level can be an effective way to facilitate equity in the responsibilities expected of male and female faculty (Baker & Zey-Ferrell, 1982; Ward & Wolf-Wendel, 2007). Developing a set of shared expectations within departments that is informed by data on current obligations can help maintain an equitable focus. Other potential solutions include having the dean consult with chairs on first-year faculty teaching schedules and reducing obligations by assessing overall college service loads. We will also specifically look at ways to increase leadership of female STEM faculty. In particular, based on work at other ADVANCE funded institutions, we will explore the concept of horizontal mentoring between senior women across schools (Karukstis, 2010).

**Finding Balance**

**Literature**

A common theme with female academics is the challenge of balancing the multiple commitments of teaching, research, and service, with personal lives. The career of a science professor is simultaneously flexible and never-ending (Auriemma & Klein, 2010). Although one has the ability to leave work to care for an ill child, the job never really leaves the person (Fothergill & Feltey, 2003). Once at home, women are more likely to do the work needed to maintain a home and family. For single STEM women there is no one else at home to cook dinner, do laundry and do the mundane activities of daily life; thus there is a disproportionate burden compared to those who are partnered. On the other hand, being partnered does not help as much as it ought to too. Professional women, including scientists, typically do significantly more housework than men (Schiebinger & Gilmartin, 2010, Laster, 2010). Female scientists spend 100 hours per week in combined work and household responsibilities as compared to 86 for male scientists (Mason et al., 2010). The model of academic careers was built during a time when women were not only missing from the work place, but were at home allowing men to devote all of their energy to work. The ideal academic is one that is married to his or her work (Williams, 2000). This is antithetical to the notion of balance, and difficult for many women to maintain.

Although not all women in the United States become mothers, the percentage is high: 80% of all women, and 73% of women with advanced degrees (Livingston & Kohn, 2010). It is thus critical to the
success of working women to consider issues relevant to motherhood. Academic mothers are twice as likely to have non-tenure-track, adjunct type positions than academic fathers (Mason & Goulden, 2002). Mothers have lower salaries and fewer benefits than childless women (the “motherhood penalty”), and they are more likely to step out of the paid workforce, an immediate financial cost, but also a much greater financial cost over time (Crittenden, 2001; Chang, 2010). Childbearing and breastfeeding have a sex-specific impact on women’s careers, and denigring this biological reality does a disservice to women (Kittelstrom, 2006). Having children is often viewed as a lack of commitment to the field (Trower & Bleak, 2004), despite strong evidence to the contrary (McQuillan et al., 2008). Women who have babies within 5 years of their doctorate are significantly less likely than men to receive tenure, and over 65% of women who begin tenure-track jobs childless will remain childless (Mason & Goulden, 2004). Because of the alignment of biological and academic career clocks, many women will delay childbearing and may face fertility issues (Dunson et al., 2002; Hewlett et al., 2008). Many faculty women only try to have babies during the non-teaching season because of the difficulty of balancing a baby with their career (Wilson, 1999). A significant proportion of female scientists report having fewer children than they wanted, especially compared to the degree to which male scientists wished for more children (Mason & Goulden, 2004; Ecklund & Lincoln, 2011). All of these issues make urgent the need for family-friendly policies and programs at universities.

Family-friendly policies are in fact growing at colleges and universities. For example, 78% of institutions in one survey offer paid time off for biological mothers. However, only 36% offer paid paternity leave and only 65% offer tenure clock extensions (CEW, 2007). These policies vary by institution size, and smaller colleges tend to lag behind in family-friendly policies. For female scientists, concerns go beyond maternity leave and tenure clocks. Mothers may not be able to work in a lab with hazardous chemicals while pregnant, or they may have reduced flexibility to travel to remote field sites. Additionally, lab work may require frequent checks at off-hours, and living organisms need regular care. Female science professors at PUIs often do all of this work themselves. NSF’s new policy allowing female scientists to hire people with grant funds to maintain their lab helps alleviate some of these challenges (Hebel, 2011). However, caution must be taken in implementing family-friendly policies as women (and men) may fear that there will be repercussions in how they are judged by their colleagues if they use them (Drago et al., 2006; Valdata, 2005). One must also be sure that family-friendly policies do not create a “mommy track,” where climate is good, but potential for advancement is not (Gerten, 2011; King et al., 2009).

Of greatest concern for working mothers is high quality childcare, which is expensive and difficult to find. Organizations that provide on-site child care centers benefit from increased job commitment and morale, less absenteeism, and the ability to recruit higher-quality candidates (Connelly et al., 2004). Unfortunately, on-site daycare is rare, with one study reporting that only 10% of 70 universities surveyed provided on-site care (Gevin, 2005). Other oft-requested, but still uncommon, benefits are dedicated lactation spaces to support breastfeeding mothers, professional travel childcare support, and emergency care for sick children (Mason et al., 2005; STEM family travel 2011). Having such benefits for faculty mothers aids considerably their quest to balance career and family (Comer & Stites-Doe, 2006).

**Otterbein Experience**

Otterbein is in the midst of significant change in its mission and programs, and according to research on institutions in flux (Wolf-Wendel & Ward, 2006), this creates a strain on faculty responsibilities, particularly in institutions striving to move beyond their original mission (O’Meara & Bloomgarden, 2010). Consistent with research, Otterbein faculty report that there is more work than hours in the day. Female STEM faculty are particularly likely to be pressured by increased demands of research, service and teaching when they are also managing a household or family. Otterbein’s policies toward work/family balance are mixed. There is currently no formal maternity leave policy beyond what is covered by short-term disability (six weeks leave) and what is mandated by the federal Family Medical Leave Act. Arrangements for faculty are typically made with the Dean and vary significantly. The
capriciousness with which maternity leave is handled creates stress and anxiety for pregnant women as they must strategize how to best negotiate for their leave. Currently, there are no childcare accommodations on campus, and there are few excellent daycares near the school, causing many faculty to log significant hours in transport time. There is significant interest in having a child care center on campus to serve childcare needs and the academic missions of the departments of Psychology, Nursing, and Education. As part of the 2007 Strategic Planning process, an Enhancing the Work Environment subcommittee formally proposed revisions of the parental leave policy based on a survey of our peer institutions and modeled after the University of California Faculty Family Friendly Edge (Mason et al., 2005). The subcommittee also made recommendations related to domestic partner benefits, elder care, medical leave, breastfeeding accommodations, and child care. The majority of the recommendations were not implemented due to cost concerns, but the university has since instituted domestic partner benefits and a policy allowing one to stop the tenure clock.

Assessment

To investigate and assess issues related to work/life balance, we will:
1. Survey all faculty about their thoughts and experiences related to families and children. Because it is possible to customize the COACHE survey in some ways, we will ask that items be added to assess these issues. If these types of questions cannot be added, we will create our own measure.
2. Conduct an audit of current policies (or lack thereof) relevant to work/life balance, such as maternity, paternity, and adoption leave, day care benefits, health insurance, and guidelines for promotion and tenure.
3. Survey all faculty members to investigate regular and occasional (e.g., travel, illness) child care needs, both past and present.
4. Conduct focus groups with female STEM faculty regarding how their parenting role relates to their experience as female scientists, the degree to which they are experiencing work and family conflict, and potential solutions.
5. Employ time-use diaries to assess the proportion of time people do spend on aspects of their life, and host facilitated discussion of the findings and faculty satisfaction.

Potential Solutions

Our assessments will be used to inform data-driven proposals for instituting favorable work-life balance policies at Otterbein. We will further develop recommendations made during the 2007 Strategic Planning by consulting policies developed at other ADVANCE institutions and explore new options such as the University of Rhode Island’s award-winning ADVANCE lactation program. We will explore additional solutions by considering time periods over which women are evaluated, support for adoption and fertility treatments, and part-time tenure-track positions (Drago & Williams, 2000; Mason & Goulden, 2002)

“Invisible Women” and Dual Career Issues

Literature

One specific group of women in STEM and SBS disciplines who face many issues of work-life balance, but who often go unnoticed, are those in part-time, adjunct, or lecturer positions, referred to by Mason and Goulden (2004) as the “second-tier” of academia. We refer to these women as “invisible” because they are often not well integrated into the departments in which they work or into the broader campus community. They may be pushed into part-time positions by the pressures associated with work-life balance, as described above, or by being a part of a dual-career couple in which both partners seek employment in academia. Similarly, some women facing these pressures may have left academia altogether.

Invisible women are not just unseen on campuses; research specifically addressing marginalized women in academia is almost non-existent, particularly in STEM disciplines. The severity of the problem
has been documented by one study that analyzed data from the Survey of Doctorate Recipients, which followed the careers of more than 160,000 individuals receiving PhDs, as well as data from over 4,000 individuals at all levels in the University of California system (Mason & Goulden, 2004). Women with infants were 29% less likely to enter tenure-track positions than those without, and those who were married were 20% less likely than their single counterparts to enter such positions. Similarly, 50% of all undergraduate courses are now taught by faculty (often mothers) who are part of the second tier (Mason & Goulden, 2004). Other women enter jobs on the tenure-track only to find the task of balancing work-life situations either too difficult or unsatisfying. For instance, Fogg (2003) describes the struggles faced by Karen Gual, an anthropologist at a liberal arts college and single mother. Gual was about to receive tenure when she left her job because of the difficulties she faced in balancing work and family obligations. Fogg notes that “Ms. Gual’s story hits home for many career-minded women on the faculty who want a family.” This anecdote illustrates that work-life balance issues are driving qualified women from the academy. Reducing teaching positions to part-time is sometimes proposed as a solution to these types of work-life balance challenges faced by academic women. For instance, Drago and Williams (2000) propose a half-time tenure-track position available to both men and women for up to 12 years if they are in the position of taking care of a child or an ill or elderly family member. However, even this type of alternative represents a difficult professional compromise that women may feel forced to make. Clearly, more research is needed to determine how many invisible women work in STEM disciplines—particularly those at institutions focused on undergraduate education, like Otterbein, that are often excluded from this type of research—and why they have chosen this option.

Some invisible women settle for second-tier jobs or abandon academia altogether because of the immense challenge of finding academic positions both for themselves and their partner. The “two-body problem” represents a taxing struggle for many in academia. While the number of faculty with academic partners has remained stable over the last few decades, universities are increasingly beginning to hire dual-career couples (Schiebinger, Henderson, & Gilmartin, 2008). Yet, while about 25% of universities have policies on dual-hiring, only 44% of these are formal, written policies (Wolf-Wendel, Twombly, & Rice, 2003). In addition, these policies are more common at research universities, leaving couples in which one or both partners seek careers at PUIs with fewer solutions. In addition, women are disproportionately affected by dual-career issues compared to their male counterparts. Female scientists are substantially more likely than males to marry other scientists (83% of female scientists vs. 54% of males have a partner who is also a scientist; Schiebinger et al., 2008; NSF, 2006). This increases the frequency with which women in STEM fields must grapple with the challenge of the two-body problem. Despite societal progress regarding gender equality, 50% of men with academic partners said that their career takes priority over their spouse’s, while only 20% of women with academic spouses answered in this way (Schiebinger et al., 2008). Similarly, it is still the case that female academics are more likely to follow their male partners (Hewlett et al., 2008; Kaplan, 2010). Lingering cultural traditions play a role, but even when two spouses have attained equal levels of education, males are likely to earn more money. And, in fact, many men reported privileging their career over that of their academic spouse because of this discrepancy in income (Schiebinger et al., 2008). Although literature assessing the scope of dual-career issues is available, more work is required to help PUIs address this problem.

Otterbein Experience

To date, Otterbein has no data related to part-time faculty employees or dual-career couples. However, we suspect that the problem of “invisible women” may be substantial, given our heavy reliance on adjunct faculty, particularly in STEM departments (e.g., in Biology & Earth Science, 40% of courses are taught by either part-time people or faculty overload). Even less is known about the extent to which individuals in the Otterbein community face dual-career issues, as no formal records have been maintained. Anecdotally, we know of several women who teach part-time in our STEM departments and who have spouses in Otterbein tenure-track positions. Several other faculty are currently members of dual-career couples where both partners have acquired full-time positions, but are in less-than-ideal living situations (e.g., living in separate residences in different states). In addition, many individuals have
struggled with dual-career issues in the past and have resolved these issues in a variety of ways, from leaving the academy to finding tenure-track positions in the same geographic area. Clearly, challenges posed to dual-career couples are a problem at Otterbein; for the university to craft a solution, we must first document the extent of the problem.

**Assessment Plan**

To assess the plight of invisible women and the issues faced by dual-career couples, we will:

1. Describe the “invisible women” problem by assessing how many women are in adjunct STEM positions and documenting their path to this position. All STEM departments will be asked to submit the names of all non-tenure-track female instructors who have taught in their department in the previous 5 years. These women will be invited to participate in interviews and/or focus groups where the following issues (among others) will be discussed: (a) path to adjunct or part-time position, (b) challenges of adjunct or part-time positions, and (c) needed university support for women in adjunct or part-time STEM positions.

2. Determine how many individuals on campus are currently or have in the past been affected by dual-career issues by conducting an online survey of all part-time and full-time faculty.

3. Conduct interviews and/or focus groups with Otterbein women who are have been affected by dual-career situations (and their partners, when relevant) to determine (a) their current situation and the path that led them there, (b) the current and past challenges they have faced as a dual-career couple, and (c) what solutions they or the administration have explored.

4. Collect information from universities and colleges who have begun to address these issues. This will be done by contacting and visiting institutions with ADVANCE funding who addressed similar issues (e.g., Washington State University’s work/life support initiative, Columbia University’s financial resources for transitions in caregiving, and The Wright State University LEADER Consortium’s assistance with dual-career issues) and by compiling information on formal policies at other universities (e.g., resources as described online by the University of Michigan, Stanford University, and the Clayman Institute for Gender Research).

**Potential Solutions**

After our initial assessments are complete, we will form PLCs to further explore the aspects of invisible women and dual-career issues that have been emphasized by the women at Otterbein. These PLCs will be comprised at least in part of individuals who have experience with the challenges at hand. Meetings will likely involve discussion of relevant literature, Otterbein assessment results, personal experiences, and development of formal recommendations for the university. As with the other topics we will assess, the information we gain on invisible STEM women and dual-career couples will be used to formulate recommendations which will be disseminated to administrators and other interested parties.

**Overall Plan and Personnel Responsibilities**

We have developed an ambitious, comprehensive two-year plan to achieve our project objectives (Table 3). To ensure that we have the time, expertise, and resources to successfully implement our plan and to initiate meaningful change at Otterbein, we have established four tiers of support. First, the five co-PIs together will lead the group, provide oversight, travel to peer institutions, and communicate findings to the university community. In addition, the three co-PIs who will be primarily responsible for implementing and managing assessments, Drs. Acker, Bouchard, and Pempek, will share primary responsibility for developing assessment instruments, overseeing data collection, facilitating focus groups and interviews, conducting data analysis, interpreting data, developing reports and other materials to disseminate findings, and ensuring that faculty are aware of and invested in the efforts of the ADVANCE team. These individuals will each be paid one month of summer salary and will receive release time from institutional responsibilities to ensure sufficient time to execute the project. The co-PIs who also serve as
Deans, Drs. Eisenstein and Fatherly, will be instrumental in disseminating results, developing recommendations, and ensuring that the administration is invested in implementing change.

Second, an interdisciplinary group of 14 faculty members will serve as the Research Advisory Committee. This group, which represents diversity in rank (pre-tenure, tenured, adjunct), age, discipline, and gender, will meet monthly to help launch assessments, discuss results, and develop implementation plans. Because of the large scope of this project, this group will be divided into subcommittees such that each committee will be responsible for one of the four major areas of our assessment: biases, service, balance, and invisible women. This will allow each member to participate in ways that incorporate his or her unique strengths and interests and make use of relevant personal experiences. Co-PIs will lead each subcommittee so that continuity is maintained.

Third, the Strategic Advisory Committee will include all members of the Faculty Advisory Committee as well as key administrators, including President Kathy Krendl; Provost and Vice-President for Academic Affairs, Victoria McGillin; Vice President for Business Affairs, Rebecca Vazquez-Skillings; Executive Director of Information Technology Services, Jeff Kasson; Associate Dean for Institutional Effectiveness, Barbara Wharton; Human Resources and Benefits Coordinator, Laura Ford; Dean of the School of Professional Studies and Dean of the Graduate School, Dr. Barbara Schaffner; Chair of the University Personnel Committee, Robert Johnson; and Chair of the Faculty Council Executive Committee, John Stefano. Liaisons from the Board of Trustees, as well as other university stakeholders, will also participate in the project as members of this committee. This group will meet 2-3 times per year to learn about ongoing findings and recommendations for implementing change.

Fourth, we will employ several support personnel. A part-time project administrator, Dr. Jessica Garrett Mills, currently an adjunct professor at Otterbein, will oversee day-to-day planning and implementation of the project. Specifically, Dr. Garrett Mills will work closely with the PIs and will help develop assessment instruments, collect and analyze data, and report results. She will also maintain the ADVANCE website and oversee student employees. In addition, work study students will be employed for 10-15 hours per week during the school year, and students will be employed for 10 hours per week over the summer. These individuals will work in support of the project coordinator and will be engaged in supervised data collection. Finally, an external evaluator, Julie Graber, CEO of The Institute on Women, will conduct formative (Yr. 1) and summative (Yr. 2) evaluation of our assessments and implementations.

In addition to these four tiers of support, this project also has unqualified support from Otterbein’s President and Provost. With an increase in the number of women in leadership positions and the presence of motivated women in STEM departments, Otterbein is taking steps to change the culture of the university. The data we will collect will set the groundwork for these changes by providing needed research on women in adjunct positions and women at small institutions, two populations that are typically ignored by research on challenges faced by STEM women. An ADVANCE catalyst grant will allow us to develop innovative approaches to the advancement of STEM women at all levels and to serve as a models for other PUIs.

Otterbein is well-positioned to disseminate the results of our work to initiate change in our broader geographic region. Within approximately one hour of our campus, there are at least 10 small colleges or universities with whom we can share information (e.g., Antioch College, Ohio Wesleyan University, Denison University, Ohio Dominican University, Kenyon College, Wittenberg University, Capital University, Mount Vernon Nazarene University, Central State University, and Wilberforce University) and possibly partner on future initiatives, as has been done by other ADVANCE awardees, such as SUN—Skidmore Union Network or the LEADER Consortium at Wright State. We will hold a regional summit at the conclusion of the project for participants for these schools. To broaden our impact to the national level, we will also present our outcomes at a joint meeting of the AAC & U and the American Conference of Academic Deans (ACAD).

In summary, our project is well-informed by practices instituted in 19 NSF ADVANCE institutions. Data collection and change will occur at all levels of the institution, and participants will come from adjunct professors through the President and Board of Trustees. We will institute continued monitoring of equity data and disseminate our findings widely (Bilimoria et al., 2008). Without
intervention, it is estimated that equity for female faculty will take at least another hundred years (Cress & Hart, 2009; Valian, 1999). This is no time for resignation. We are poised to act decisively at Otterbein, first by understanding what needs to be changed, and then by developing strategic plans for institutional transformation.

Table 3. Project summary, including research objectives and timeline.

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Activity Type</th>
<th>Year 1</th>
<th>Year 2</th>
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<td>FA</td>
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References


