

The goal of this project is to contribute to the development of a national science and engineering academic workforce that includes the full participation of women at all levels of faculty and academic leadership, particularly at the senior academic ranks, through the transformation of institutional practices, policies, climate, and culture. Case Western Reserve University (CWRU) proposes a multifaceted project called Academic Careers in Engineering and Science (ACES) to increase the number of women faculty in science and engineering at all academic ranks. The ACES project will operate on 3 levels: (1) At the highest levels of leadership of the University, including the President, Provost, and Deputy Provost. This leadership is committed to fundraising for 5 endowed chairs to attract senior women scientists and engineers and to annual evaluation of deans' progress toward transformational change. (2) At the school and departmental level with intensive coaching, mentoring, networking, and training and development of deans, chairs, faculty, and students in 4 test departments in Phase 1, and extension of the best practices to all science and engineering departments in Phase 2. (3) At the campus-wide level with distinguished lectureships for senior women in science and engineering, mentoring opportunities, a spousal hiring networks, and a unique minority pipeline initiative including faculty exchanges with Fisk University and summer research internships.

The outcome of the proposed institutional transformation will be increased transparency and accountability as well as more equitable practices, procedures, and structures. Throughout the ACES project, CWRU will self-study, evaluate, and disseminate our findings so that other private institutions can benefit from our work, building on a resource equity study begun two years ago. Case Western Reserve University is at a pivotal time in its history. We are poised to make transformational change at every level of our university.

TABLE OF CONTENTS

For font size and page formatting specifications, see GPG section II.C.

Section	Total No. of Pages in Section	Page No.* (Optional)*
Cover Sheet for Proposal to the National Science Foundation		
A Project Summary (not to exceed 1 page)	<u>1</u>	_____
B Table of Contents	<u>1</u>	_____
C Project Description (Including Results from Prior NSF Support) (not to exceed 15 pages) (Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	<u>15</u>	_____
D References Cited	<u>2</u>	_____
E Biographical Sketches (Not to exceed 2 pages each)	<u>8</u>	_____
F Budget (Plus up to 3 pages of budget justification)	<u>14</u>	_____
G Current and Pending Support	<u>4</u>	_____
H Facilities, Equipment and Other Resources	<u>0</u>	_____
I Special Information/Supplementary Documentation	<u>11</u>	_____
J Appendix (List below.) (Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)	_____	_____
Appendix Items:		

*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.

Introduction

Case Western Reserve University (CWRU) is proposing an innovative, integrated approach to institutional transformation that will effect tangible positive change for women in science and engineering (S&E). The University is an ideal site for an NSF ADVANCE Institutional Transformation Award since it is representative of other major American private research universities. While our approaches are tailored to the culture of CWRU, we believe our model will yield valuable results with relevance to other private institutions. For private universities, these barriers to culture change include lack of transparency in faculty recruitment, advancement, and promotion policies; and lack of accountability at the departmental level because of a decentralized university structure.

CWRU's institutional transformation, entitled Academic Careers in Engineering and Science (ACES), will be a multifaceted initiative that will operate simultaneously on 2 levels: (1) leadership and endorsement of this program from a new management team of President, Provost and University Vice President, and Deputy Provost and Vice President for Academic Programs, each of whom has already demonstrated strong personal commitment to women's advancement and diversity; and (2) resources to create the opportunity for individual S&E faculty members, department chairs, and deans to participate and "buy into" the institution's commitment to change. The advantage of this energized new leadership is built into our program through Deputy Provost Lynn Singer, the PI, and some of CWRU's most respected female and male senior scientists, who will direct the ACES project.

Institutional commitment to this transformation is evidenced by \$150,000 of the Provost Opportunity Fund being set aside for ACES programs; an agreement with Fisk University, a historic black university, establishing a joint degree program, faculty exchange, and summer research program; and partnering with Lubrizol Corporation to sponsor joint networking events.

ACES will directly address our challenges, which are typical of our peer private institutions. The percentage of female faculty at CWRU (29% overall, 22% in S&E) has remained flat over the last five years. The proposed ACES project will take full advantage of our institutional assets. These will include our nationally regarded Organizational Behavior faculty based in the Weatherhead School of Management, who participated in designing ACES and will themselves be a test department and will help evaluate our outcomes. Uniquely, the ACES project will use proven methods of increasing women's participation from industry, which has in some cases achieved greater success in diversifying its workforce than have American universities. Innovative industry strategies that will be adapted to our program will include personalized coaching, mentoring, networking, and training and development of individual S&E deans, chairs, and faculty.

Based on this overall approach, the specific elements of our proposed ACES project will employ a range of incentives and resources to stimulate *university-wide* change. Simultaneously, in Phase 1 a more in-depth experiment focused in 4 schools will be carried out. These include one key department from each of the participating schools, where each chair has agreed to take a primary role and where measurable targets for higher percentages of women hired and promoted will be set. In Phase 2, the best practices learned from evaluation and self-study in Phase 1 will be extended into all ACES program areas.

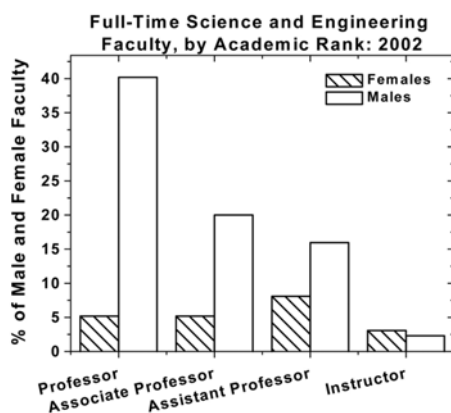
Background

Case Western Reserve University is the largest private research university in Ohio. The University was formed in 1967 by the federation of the Case Institute of Technology (established 1880) and Western Reserve University (established 1826). Currently, CWRU comprises 8 schools: Case School of Engineering, College of Arts and Sciences, Frances Payne Bolton School of Nursing, Mandel School of Applied Social Sciences, School of Dentistry, School of Law, School of Medicine, and Weatherhead School of Management.

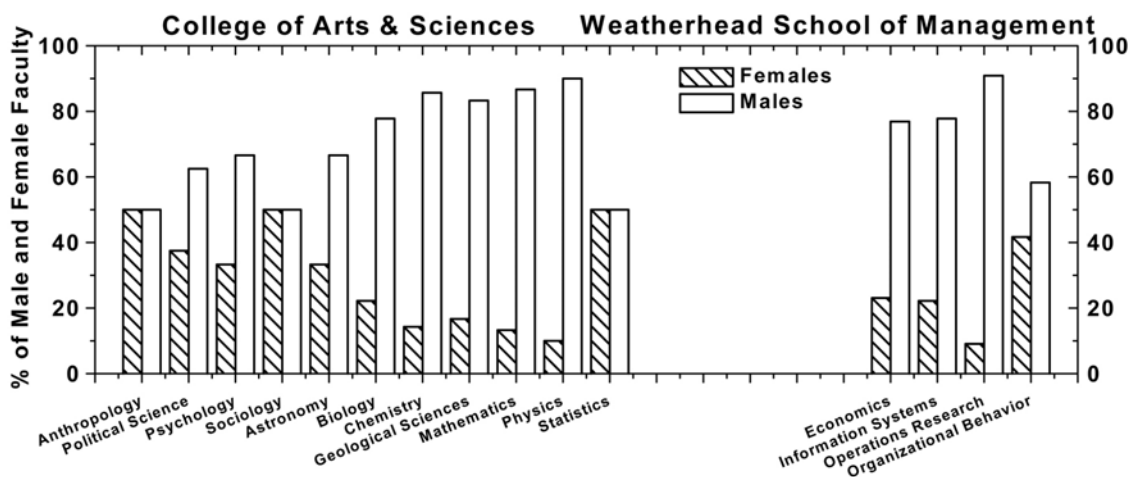
Over 9,500 students are enrolled in undergraduate, graduate, and professional degree programs. More than 75% of CWRU graduates eventually earn advanced degrees; CWRU ranks 7th among 233 research and doctoral universities in the United States in the percentage of bachelor's degree recipients who later earn doctoral degrees. CWRU students come from all 50 states and 95 nations, bringing a vibrant mix of economic, religious, ethnic, and educational backgrounds: 15% of the CWRU student population is

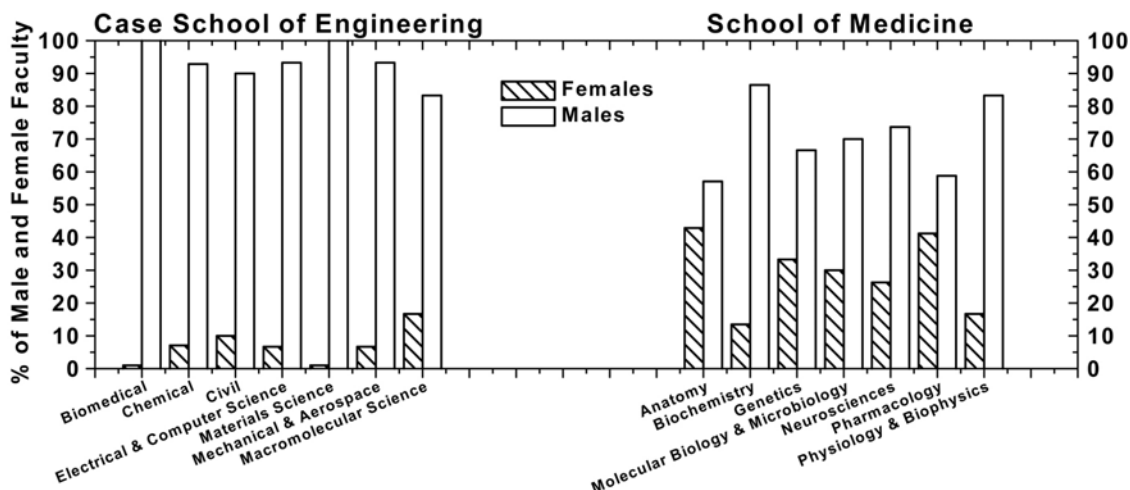
international, 9% Asian/Pacific Islander, 5% African American, 2% Hispanic, and 6% other. The student body is 56% male and 44% female.

The percentage of female faculty at CWRU has remained constant over the last five years at about 29%. (Note that this percentage includes tenure and non-tenure track faculty and instructors for the entire University.) However, the 2001–2002 percentage of female faculty in S&E was only 22%. Of these, fewer than 1% (3 women) were underrepresented minorities. The breakdown by academic rank is given below. In 1995, the national average for female faculty in S&E was 25% (National Research Council, 2001). Clearly, CWRU lags behind in percentage of S&E women faculty.



The purpose of the ACES project is to increase the number of tenure-track women faculty at all ranks in the S&E departments of 4 schools: Case School of Engineering (CSE), College of Arts and Sciences (CAS), School of Medicine (SOM), and Weatherhead School of Management (WSOM). Within these schools, 29 departments represent National Science Foundation program areas. CSE: Biomedical Engineering, Chemical Engineering, Civil Engineering, Electrical Engineering & Computer Science, Macromolecular Science & Engineering, Materials Science & Engineering, and Mechanical & Aerospace Engineering. CAS: Anthropology, Astronomy, Biology, Chemistry, Geological Sciences, Mathematics, Physics, Political Science, Psychology, Sociology, and Statistics. SOM: Anatomy, Biochemistry, Genetics, Molecular Biology & Microbiology, Neurosciences, Pharmacology, and Physiology & Biophysics. WSOM: Economics, Information Systems, Operations Research, and Organizational Behavior. The percentage of women faculty in these departments in 2000–2001 is shown below.





Recent Institutional Progress

As in a number of private universities, the 8 schools of CWRU operate as semi-autonomous units in both procedural and financial matters. For example, deans may set different policies; some deans let tenured faculty review their yearly performance evaluations, while other deans do not. These policy differences are further compounded by the common practice of private universities to consider many records, including salaries, as confidential information. This contrasts with public universities, where salary information is a matter of public record. The procedures for obtaining additional laboratory space, bridge funding, or graduate student support are not always openly discussed. This leaves many women faculty at a disadvantage in gaining access to the tools they need to be successful.

To begin to look at university-wide procedures, especially as they relate to women, CWRU has institutionalized several new initiatives in the last 2 years. The Resource Equity Committee (REC) was created by the Provost in 2000 in response to the MIT Report (1999). The REC was charged to conduct a self-study of resource allocation among CWRU faculty and the impact of gender on CWRU faculty careers. Six focus groups addressed issues of resources, institutional culture, university procedures, and work-family integration. The REC has completed thematic coding of focus group transcripts and anticipates completing a formal report by December 2002. The REC comprises 5 faculty from 4 schools with expertise in evaluation, including Professor Bilimoria from WSOM.

In 2001, The President's Advisory Council on Women (PACOW) was created to "serve CWRU by providing the president with ongoing insights regarding the campus environment as it relates to women in the University community." The PACOW comprises 6 faculty including Professors Singer and Barkley (chair), 4 staff, 2 graduate students, and 2 undergraduates, and works closely with the parallel President's Advisory Council on Minorities. One of the PACOW's first recommendations was the immediate creation of a Women's Center to be a central hub of communication, education, research, and programming on the CWRU campus for women faculty, staff, and students. The President endorsed the creation of a comprehensive Women's Center, and the first Director, Dr. Dorothy Miller, was hired in September 2002.

Other initiatives include: The creation of Women in Science and Engineering Roundtable (WISER) in 2001, which links women science and engineering students in a community with other students, women faculty, and postdocs. Directed by Professors Heather Morrison and Beverly Saylor, it includes seminar course offerings and mentoring/networking activities. Recently, the University created an *ad hoc* committee to evaluate feasibility and financing for an on-campus childcare center. This is the follow-up to a campus-wide survey on family friendly benefits conducted by the Women's Faculty Association in January 2002, which documents a huge demand for childcare services. Additionally, the creation of the position of Faculty Diversity Officer, reporting directly to the President of the University, by the

appointment of Professor Beth McGee in January 2002. Also in 2002, the creation of the Provost Opportunity Fund to assist departments in recruitment and retention of woman and minority faculty.

Transformational Environment

In August 2002, Edward M. Hundert was appointed President of CWRU. President Hundert has already demonstrated his commitment to gender equity. The offices of the president and provost were combined his second week on campus into the Office of the President and Provost and three women were appointed to senior leadership positions: Dr. Singer, the ACES PI, as Deputy Provost and Vice President for Academic Programs; an Executive Vice President and Chief Operating Officer; and a Vice President of the Corporation. CWRU has a long tradition of excellence in science, engineering, and medicine. The Organizational Behavior Department has a major focus on individual and institutional change and development. Capitalizing on these combined strengths will enable the ACES project to become a successful program of institutional transformation that will serve as a model for other private research universities.

Our institutional transformation will promote a campus-wide culture characterized by equality, participation, openness, and accountability. We envision a campus climate in which all academic departments and all faculty members are vitally encouraged and supported in cutting-edge knowledge discovery and dissemination activities. Within this environment, every faculty member is properly valued, equitably treated, appropriately mentored, and is achieving his or her fullest potential as a professor, scholar, and university community member (Valian, 1998). We believe that as we specifically target our efforts through ACES to improve the participation and leadership of women faculty in S&E disciplines, simultaneously these efforts will improve the overall campus climate for all faculty and all university members, including our students and staff. Additionally, all faculty members will benefit from several programmatic activities that address cultural change, as modeled by and instituted by top administrators and senior faculty members, both male and female. For enduring institutional transformation, we propose a multi-pronged approach, encompassing administrators, faculty, and students, aimed at (1) recognizing and minimizing the existing barriers and (2) catalyzing positive culture change at both the institutional and departmental levels.

Departmental Transformation

The ACES project can only be considered successful if any positive changes that are brought about in the 4 test departments are made permanent in those departments *and* made a part of the institutional structure for *all* departments. We consider this a crucial part of the proposed program and will devote significant attention to it.

We will concentrate on institutionalizing change in 4 areas: coaching, mentoring, networking, and training and development. All are critical aspects of faculty development. By “institutionalizing change” we mean that these improved programs will be brought into the normal school, departmental, and committee structure. Where our results indicate that policies should be changed, we will go to the appropriate faculty and administrative bodies with suggestions for policy changes. For example, we believe that the formal mentoring programs are weak throughout the university. Based on the experience in the 4 test departments, we will recommend specific changes in mentoring practice and annual reviews both in the Faculty Handbook, that spells out the contractual relationship between the university and the faculty, and in the policies of the separate schools. As a further part of the institutionalization of positive change, we will suggest that appropriate measures of success for women and minority advancement be a part of the evaluation of administrators at all levels, from chairs and deans to provosts and the president.

We also plan to institutionalize other initiatives started under the auspices the ACES project. Some of these will require obtaining funding from other sources. As an example, the new university administration, under the leadership of President Hundert, has been very supportive and has agreed to raise funds for 5 endowed chairs for women faculty. Other areas that we plan to continue are the distinguished lectureships, minority pipeline initiatives, and spousal hiring network. In the latter we will work with local economic development groups and foundations.

Test Departments

Because academic careers evolve for the most part within departments, especially at the early stages, the ACES project emphasizes change at the level of individual departments. Several programs in Phase 1 will focus intensely on 4 departments, one from each of the participating schools: Mechanical & Aerospace Engineering (CSE), Chemistry (CAS), Physiology & Biophysics (SOM), and Organizational Behavior (WSOM). These departments offer a variety of cultures and challenges to develop and test models for increasing numbers and advancement of women faculty. After evaluation of Phase 1 outcomes at the end of Yr 2, successful models will be extended to other S&E departments in Yrs 3–5 of the ACES project. The 4 test departments were chosen by the PIs in consultation with the deans. Selection criteria included opportunity for hiring new faculty in the next 2 years, nucleus of women faculty, good pipeline of female candidates, large (for CWRU) department size, and cooperative department chair. The environments in these departments range from insular to interactive. The percentages of women faculty also vary considerably (12–42%). Thus, we will gain experience with a spectrum of organizational cultures in developing strategies to deploy in Phase 2. Moreover, the 4 departments will test both recruitment at the junior and senior levels and promotion from within the department.

Mechanical & Aerospace Engineering: The history of the Mechanical & Aerospace Engineering Department extends to the founding of the Case Institute of Technology in 1880. It took its present name in 1975 when the Departments of Fluid, Thermal & Aerospace Sciences and Solid Mechanics, Structures & Design were joined. Departmental faculty enjoy international recognition and significant extramural funding. The department currently has 16 tenure-track faculty. The first woman faculty member was hired as associate professor with tenure in 1996. A second woman will join the department in January 2003 at the assistant professor level. Of the 310 student majors, 220 undergraduates and 90 graduate students, 15% are women. Over the past 12 years, the Mechanical & Aerospace Engineering Department has made it a priority to attract talented women faculty and students to the department. The number of women students in both undergraduate and graduate programs has risen steadily during this period from 5 to 15%. The department has yet to advance a woman through the promotion and tenure process.

Chemistry: The Chemistry Department at CWRU was formed in 1965 from 2 chemistry departments after the merger of Case Institute of Technology and Western Reserve University. The ensuing department of about 50 faculty shrunk by attrition over the years to its present size of 21 tenure-track faculty. Typical of chemistry departments elsewhere, it is a conservative department with a long tradition of autonomous research groups in separate research laboratories. The first women faculty were hired in 1996, one professor and one assistant professor. Both hires were strongly supported by the dean and provost at a time when there were no women faculty in this core science department. A third female assistant professor joined the department in 1998. Prior to 1996, the Chemistry Department had made offers to 5–10 other women, all of whom declined. Women comprise 47% (43 of 91) of undergraduate chemistry majors with 5% (2 of 43) of them being underrepresented minorities, and 30% of graduate students in Chemistry. Since 1996, Chemistry has been hiring replacement faculty at the rate of about one per year. Although 50% of the new faculty are women, the department has never advanced a woman through promotion and tenure.

Physiology & Biophysics: The Physiology & Biophysics Department has grown in size from 3 faculty in 1986 to its present size of 34 faculty, 6 of whom are women. During this time it rose in national ranking from 90th to 5th percentile. The department has faculty at 3 sites: CWRU School of Medicine (24 total, 3 women), Lerner Research Institute at the Cleveland Clinic Foundation (7 total, 3 women), and Rammelkamp Center for Education and Research at MetroHealth Medical Center (3 total, no women). The department offers a harmonious, supportive environment for both graduate students and faculty with many shared facilities and collaborative research projects. Women comprise about 50% of graduate students in physiology and biophysics. Beginning in the last decade, the Physiology & Biophysics Department tried to recruit more women faculty, albeit with modest success. Two women were hired as

assistant professors: one failed to gain tenure and one was recently promoted to professor. Ten competitive offers to women at both junior and senior levels were declined.

Organizational Behavior: The Organizational Behavior Department at CWRU, the first department of its kind, was formed in 1960 at the Case Institute of Technology. Subsequent evolutions of the department have resulted in continued innovation in research ideas and methods, particularly around the themes of organizational and global development and change, personal growth, competency-oriented leadership and management, small groups, and multiculturalism and diversity. The department leads the Weatherhead School of Management in the representation of women faculty – currently 6 of 13 tenure-track faculty are women. The first female graduate student to receive her Ph.D. was in 1966, the first female faculty member hired was in 1975, and the first female faculty member to receive tenure was in 1995. There were 4 women faculty during the period 1975–1989, but none were advanced through promotion and tenure. Of the department’s 6 women faculty, 4 are associate professors (2 advanced through internal promotion and tenure, 1 hired with tenure, and 1 just promoted without tenure) and 2 are assistant professors. Students in the department consist of about 30% women in the WSOM MBA program, about 80% women in the Masters in Organizational Development program, and about 50% women in the Organizational Behavior doctoral program. The department has yet to promote a woman to full professor.

Recruitment

The proportionate representation of women and minority faculty at all levels is a priority for S&E departments (Trower & Chait, 2002; National Science Foundation, 2000; CAWMSET, 2000; Fox 1996; Vetter, 1996; Sonnert & Holten, 1995). To facilitate and support departmental efforts at recruiting women faculty, we propose a series of new initiatives aimed at diversifying candidate pools, increasing the number of female candidates interviewed, and increasing the number of female candidates offered jobs. In particular, we will undertake training efforts to educate search committees as follows.

During Phase 1 of the ACES project, the co-PIs will work together with the Faculty Diversity Officer and a full-time ACES manager appointed in the Office of Equal Opportunity and Diversity to train and assist the search committees of the test departments in diversifying their search pools. Efforts will include: recruiting trips by departmental faculty and chairs to scientific meetings and minority institutions to identify potential candidates; educating search committees regarding hidden “diversity myths” related to women and underrepresented minorities; diversifying search committees by adding women and minorities from other departments at CWRU or other institutions; assisting search committees in creating an equitable and attractive interview process; and reviewing the candidate pool for diversity before candidates are invited for interviews. In Phase 2 of the project, this training and assistance will be expanded to include all departments.

Additionally, the co-PIs will work with search committee chairs at all stages in the recruitment process, attend search committee meetings in the test departments as observers, and interview female candidates who decline job offers extended by the test departments. The Faculty Diversity Officer will work with the ACES project manager to create a database that includes professional organizations for women and underrepresented minorities in each discipline for use in making contacts to enlarge the applicant pool. They will also create and maintain an on-line confidential faculty applicant affirmative action survey to determine what the CWRU applicant pool is on a yearly basis and to ascertain if search strategies are positively addressing the appropriate candidate pools.

Retention and Advancement

To redress the low rate of advancement of women faculty observed in S&E disciplines (CAWMSET, 2000; Mark *et al.*, 2001; Fox, 1996; Vetter, 1996; Sonnert & Holten, 1995), we propose a series of initiatives focused on coaching, mentoring, and networking. Institutional efforts to retain and advance women faculty will involve career-based coaching of women faculty, the creation and institutionalization of mentoring committees, networking opportunities, and the conduct of 2nd-year entrance interviews and exit interviews.

Professional Coaching of Women Faculty: Women faculty at all levels in the test departments will receive professional coaching aimed at identifying and developing their career vision, paths, and success, as well as the steps needed to enhance their overall academic leadership impact and contributions (Erskine, 1999). In Phase 1 of the project we envisage that women faculty in the test departments will receive at least 3 coaching sessions.

Mentoring of Women Faculty: For each test department during Phase 1, a mentoring committee will be created for each female faculty member at the assistant and associate professor levels, and a development committee will be created for each female faculty member at the full professor level. Each committee will be composed of one departmental senior colleague (male or female), one external professional colleague (male or female) from the same discipline from another university, and one senior female faculty member from a related S&E discipline at CWRU. Departmental mentors and chairs will be encouraged to meet with the female faculty member on a regular basis. Mentoring committees will be charged with assisting and advising junior faculty regarding grants, publications, pre-tenure leave, committee service, student advising duties, and departmental promotion and tenure expectations. The mentoring committees will receive guidance and training on mentoring women to advance in the academic ranks. Departmental mentors will be educated on the promotion and tenure policies of the school. Lessons learned from the functioning of the mentoring and development committees in the test departments during Phase 1 will be shared with the deans and chairs of the participating schools, with the goal of expanding to other S&E departments in Phase 2.

Professional Networking Opportunities: For the purposes of creating a collegial cohort of women faculty in S&E disciplines within and outside the department and university, the ACES project will sponsor, through our Women's Center, an annual series of networking events geared around issues of interest to S&E women faculty. We envision bringing in national professional and academic speakers to keynote networking workshops twice a semester. Additionally, Lubrizol Corporation has agreed to partner with us by sponsoring joint networking events between the women faculty in our S&E disciplines and their own women scientists, professionals, and managers. Headquartered in Cleveland, Lubrizol is a global \$1.8 billion corporation that produces fuel additives and specialty chemicals. Lubrizol is undertaking cutting-edge diversity work in improving the status of women and minorities in the corporation, and their cost-sharing partnership with us addresses potential academic-practitioner links that are important to the professional development of women faculty. The Women's Center will coordinate these networking opportunities.

2nd-Year Entrance Interviews and Exit Interviews: The Faculty Diversity Officer and ACES manager will undertake 2nd-year entrance interviews to assess satisfaction of new women faculty and address problems before the faculty member may decide to leave or be recruited by another institution. They will also conduct exit interviews of all departing female faculty members, both face-to-face and questionnaires, to determine what factors contribute to faculty attrition.

Leadership Coaching and Development for Current Deans and Chairs: Deans and chairs are critical factors in the performance, success, and satisfaction of women faculty (McIlwee & Robinson, 1992; MIT, 1999; Zuckerman, 1991; Delamont, 1989). Significant cultural change in the desired directions is most likely when institutional and departmental leadership visibly creates, guides, and supports the changes needed to advance S&E women faculty. To provide this leadership, administrators need to develop a deep understanding of the behavioral, structural, and cultural issues, challenges and barriers affecting women in S&E (e.g., token dynamics, marginalization, exclusion, and gender stereotyping), as well as become familiar with a variety of successful methods and approaches that can be creatively employed (e.g., championing women for campus and external awards, flexible responses to dual career or work-family integration concerns). Coaching, peer retreats, and other developmental inputs to deans and chairs will be provided in order to help these key administrators gain increased insight about and ownership of issues affecting women in S&E.

In addition to the general educational inputs discussed above, targeted consultation on the advancement and retention of women faculty will be provided to deans and chairs. As appropriate, data generated from faculty focus groups, student focus groups, and faculty exit interviews will be shared with

the purpose of providing information for analysis and departmental action. Additionally, targeted leadership coaching provided to deans and chairs will focus on recognizing, analyzing, and changing prevailing structures, policies, and practices both at the school and departmental level that inhibit access of women faculty to resources, opportunities, and power (e.g., pay equity, retention perks, service expectations, teaching loads, leadership opportunities, promotion and tenure processes, and work-family integration needs).

To ensure sustainable institutional transformation, the buy-in of deans and chairs is essential. Deans will be held accountable by the Provost on a series of criteria tracking progress in the recruitment, advancement, and retention of women faculty in S&E disciplines (see Table 1). Annual activity reports, generated by deans and chairs, will be required to include a section on the outcomes achieved and efforts undertaken over the reporting year to advance women and minorities.

Table 1: Criteria for Accountability of Deans – Indicators of ACES Success

Overall

Increase the percentage of S&E women faculty at CWRU over baseline by 20% over the 5-year period.

Recruitment

Increase the percentage of women faculty at the assistant professor level

Recruit one new senior woman as a full professor with endowed chair in each test department

Increase women as a percentage of all candidates in search pools

Increase women as a percentage of candidates invited to visit CWRU

Increase women as a percentage of candidates offered jobs

Advancement and Retention

Increase the percentage of women faculty at the associate professor level through promotion from within

Increase the percentage of women faculty at the full professor level through promotion from within

Increase the percentage of women department chairs

Increase the percentage of women in academic administration at the school level

Institutional Climate

Significantly improve qualitative perceptions and ratings of climate, as ascertained through focus groups, interviews, and surveys

Increase resource equity for women faculty, including salary equity, teaching loads, laboratory space, retention perks, etc.

Increase the percentage of women invited to campus as distinguished lectureships, visiting professors/scholars, etc.

Faculty Development

Create and institutionalize coaching and mentoring mechanisms, and increase faculty participation rates

Conduct relevant training workshops and events for all faculty, and increase faculty participation rates

Create and utilize school level opportunity grants for the development of women and minorities

Assessment and Development Tools for Departmental Faculty: Culture change at the departmental level is essential since it is here that most women faculty experience day-to-day difficulties and challenges. Our aim is to facilitate the development of respectful, collegial, and professional relations within each department that will result in an improved overall climate for all faculty members and positively impact the productivity and long-term success of women faculty. Academic departments in S&E are well-known for their “chilly climate” (AWIS, 2002; Fox, 2001) affecting both senior women (MIT, 1999; Lawler, 1999; Sonnert & Holten, 1995) and junior women (CAWMSET, 2000; Schneider, 2000; Tracy, 1998; Finkel & Olswang, 1996, Tack and Patitu, 1992; Hensel, 1991). Women academics consistently report facing stereotyping, marginalization, and exclusion by their male colleagues. Women faculty also perceive inequities in teaching and service loads, space and equipment resources, and salaries (CAWMSET, 2000; MIT, 1999; Fox, 1995). These factors cumulatively result in women’s lower tolerance for continuing in academia. To eradicate the pervasive cultural bias against women faculty in

S&E, and to generate the kinds of departmental practices, policies, and structures that advance all faculty, department members need to become aware of existing faculty practices and policies that serve as barriers to women's retention, and be provided with examples of strategies, policies, and structures that enable women's advancement in S&E.

Assessment tools, workshops, and consultation will be provided to help departments assess their current climates and address problem areas. We will conduct customized experiential workshops and programs for departmental faculty, in small groups and as whole departments, to address critical faculty process issues relevant to the advancement of women, such as gender-based stereotyping, lifestyle myths, collegial interpersonal relations, team building, group decision making, professional development, mentoring, and tenure policy and models.

Student Training: An important factor affecting the long-term success and satisfaction of women faculty are student evaluations of their teaching performance. Prior evidence indicates that women faculty members tend to be evaluated more harshly by students in disciplines strongly associated with male stereotypes (Moore, 1997; Basow, 1995). Additionally, women faculty consistently report being subjected to criticism from and unrealizable expectations of their undergraduate and graduate students, as well as being disproportionately burdened by student requests for counseling, mentoring, and support (CAWSMET, 2000; Fox, 1995). Preliminary data generated from focus groups of women faculty within and between different levels in the academic hierarchy of CWRU, conducted last year by the Resource Equity Committee, indicate that women faculty perceive themselves as experiencing more criticism ("from grades to clothes") and more resentment for high standards from students, more confrontation by male students, and more nurturing expectations from female students than male faculty members receive. Given these gender-specific patterns of behavior among CWRU student populations, we propose training for undergraduate and graduate students in S&E departments, focusing on gender-based stereotyping and differential expectations of male and female faculty members. This training will be done by the Women's Center Director assisted by a graduate student. In Phase 1, we envision training for undergraduates in all large courses and for all first-year graduate students in the test departments. Student training will be extended to all departments in Phase 2.

All S&E Departments

Concurrently with intensive focus on individual departments, additional ACES programs designed to change the institutional culture at CWRU will be offered to all S&E departments. These range from opportunities for distinguished lectureships, endowed chairs, and small grants to development of networks, including two aimed at increasing the pipeline of minority women graduate students in S&E.

Distinguished Lectureships: The ACES project will sponsor 10 distinguished lectureships a year. ADVANCE Distinguished Lectureships will support 1–2 week visits by senior women scientists or engineers. Each ADVANCE Lecturer will be invited by an S&E department based on mutual research interests with faculty in the host department. She will give 3–6 lectures, one of which is a public lecture followed by a reception; the others are specialized seminars or course lectures. During her visit, the ADVANCE Lecturer will interact with faculty and students in the host and other departments. Distinguished lectureships will be awarded to S&E departments on a competitive basis by the ACES steering committee, after review by the ACES internal advisory team. With 29 S&E departments, each department can expect to host 1–2 ADVANCE Lecturers during the 5-year grant period. The Women's Center Director will seek private funding to continue the distinguished lectureships after the grant period. Distinguished lectureships offer benefits to recipient departments beyond the obvious one of the lectures themselves. First, the 1–2 week visit to a department facilitates recruitment of senior women faculty, by giving both visitor and department a chance to look each other over. It also augments mentoring and networking activities for both men and women faculty, postdocs, and students. This could be an effective strategy for recruiting minority women faculty, for example, from industrial positions. Last year, the Statistics Department at CWRU successfully used distinguished lectureships funded by another source to recruit a female associate professor. Second, and perhaps as important, the presence of 10 ADVANCE

Lecturers on campus for 1–2 week periods will raise the visibility of S&E women faculty on campus for both men and women of all academic levels.

Endowed Professorships: President Hundert has committed to raise money for 5 endowed chairs to attract women faculty to the University. No funds are requested from NSF for these endowed chairs. One endowed chair will be for a junior, entry-level faculty and the other 4 for senior faculty. One chair will be designated for each of the 4 participating schools and one for any school on a competitive basis. The 4 test departments will have the first opportunity to fill the endowed chairs. However, if they do not find suitable candidates after 1 year, the opportunity to fill the endowed chair will be opened to other S&E departments in the school. The goal here is primarily to increase the number of women faculty at higher ranks. This alone will have a significant influence on changing the campus culture.

Opportunity Grants: The primary focus of the NSF ADVANCE program is institutional change and most of the requested funding supports that goal. However, in addition, we request modest support for women faculty already here. The goal is to avoid attrition of the existing base of women faculty. Therefore, annual funding of about \$65,000 will be available for strategic interventions to maximize the chance of success for women faculty. These can include, for example, seed funding for unusual research opportunities, bridge funding when ongoing research funding has been suspended, grants to support writing of books, and travel grants to explore new techniques or attend advanced training courses. ADVANCE Opportunity Grants will be awarded on a competitive basis by the ACES steering committee, after review by the ACES team.

Mentoring Network: Mentoring and networking will be provided to all women faculty through three programs: professional networking workshops as discussed above, informal social events with women postdocs and students, and a campus-wide database of women faculty. These programs will be organized by the Women's Center Director assisted by the graduate student and ACES secretary. Invited social events for women students, postdocs, and faculty in S&E will be held twice a semester to facilitate informal mentoring and networking. Finally, a campus-wide database of women faculty will be created and maintained. Presently, there is no centralized source of information about women faculty in the 8 schools of CWRU. This database will contain career and limited personal information for use by S&E departments in identifying women faculty to serve on search committees and mentoring teams and to assist with recruiting.

Spousal Hiring Network. Finding suitable professional positions for spouses/partners of prospective or existing women faculty is a serious, ongoing obstacle to their recruitment or retention at CWRU, a relatively small institution. We have anecdotal evidence in several recent cases that the decision to accept an offer or to remain on the faculty of CWRU rested entirely on the availability of suitable employment for the husband/partner. Increasingly, this has become an issue for male faculty as well. A program will be initiated to address this problem. We plan to establish a web-based network with colleges, universities, research institutions, industries, professional organizations, economic development groups, and relocation firms in the greater Cleveland/Northeast Ohio area. In this effort we will collaborate with the CWRU Career Planning and Placement Office to share information about hiring plans and job openings with network participants. This information will be made available to all faculty candidates during recruiting visits.

Minority Pipeline. Despite strenuous efforts to recruit S&E minority women faculty, the low numbers of minority women Ph.D.s coupled with intense competition for these few women conspire to make this a difficult goal. Even recruiting minority students (male or female) to doctoral programs in S&E requires creative interventions. With this in mind, we plan a 2-pronged approach to growing our own minority women Ph.D.s with the hope that at least some of them will pursue academic careers in S&E either at CWRU or elsewhere.

Faculty Exchange with Fisk University: CWRU recently signed a memorandum of understanding with Fisk University, a historic black college/university (HBCU) in Nashville, TN, to establish a joint degree program, in which undergraduate students spend 3 years at Fisk and 2 years at CWRU. Fisk University awards B.A., B.S., and M.S. degrees in 8 fields of S&E: biology, chemistry, computer science, math, physics, political science, psychology, and sociology. It boasts the highest percentage of

minority graduates going on to earn Ph.D.s of any school in the United States. Virtually all Fisk faculty have Ph.D.s. The ACES project will sponsor one exchange of S&E women faculty annually, in which the Fisk faculty member spends one semester at CWRU and the CWRU faculty member gives a 2-week short course at Fisk University. The Fisk faculty member will receive an ADVANCE Visiting Professorship, including stipend and housing allowance during her stay in Cleveland. The ADVANCE Visiting Professor will guest lecture in several undergraduate courses in her discipline and work in a research laboratory in her area of interest. She will also meet with deans and department chairs in the participating schools, serve on the ACES steering committee and faculty search committees in related S&E departments, and mentor S&E minority undergraduate and graduate students, the majority of whom are women. While at Fisk University, the CWRU faculty member will network with faculty and students in addition to teaching a short course. From our standpoint, the goal of the women faculty exchange is to build a strong bridge with Fisk University for minority students and provide role models for minority women students at CWRU. By Yr 4 of the grant, we expect to have other funding in place to support the Fisk University faculty exchange program.

Summer Research Program: Our second ACES pipeline initiative will be a summer research program for S&E minority women undergraduate and masters level students. The ACES program will piggy-back on two highly successful minority summer student programs run by the School of Medicine, an intensive 6-week summer school for 125 pre-med students funded by the Robert Wood Johnson Foundation and a summer research program for 15 students funded by the National Heart, Lung, and Blood Institute of NIH. CWRU has one of the highest percentages of minority medical students (12–16% over the past 15 years) of any American medical school, due in large part to the Robert Wood Johnson summer program. A full 30% of minority medical students at CWRU are graduates of that program. In Yrs 1–2 of the grant, the ACES project will sponsor 5 minority women students, who have expressed interest in graduate school in S&E, for 10–12 week summer research internships. The students will receive a stipend, room and board on campus, and funds for travel and supplies. The ACES students will work under the supervision of faculty in S&E departments of the participating schools. They will attend weekly noon lectures by S&E faculty and give poster presentations at the end of the summer with the NIH-funded summer research students. In addition, they are welcome to sit in on some of the pre-med courses, which include biology, chemistry, organic chemistry, and physics, and to partake of all social events and outings for the pre-med students and NIH-funded summer research students. We will target recruitment of ACES students from CWRU, Fisk University, Louisiana State University, and the Meyerhoff Scholars Program at the University of Maryland, Baltimore County, with which we have prior experience. We will also work with Mr. Joseph Williams in the School of Medicine, who recruits at HBCUs for their two summer student programs. If successful by Yr 3 of the grant, we will obtain funding from other sources to support and expand the minority women summer research program.

Evaluation and Self-Study

The emphasis on self-study and evaluation is an innovative feature of the ACES project. In addition to evaluating the impact of transformational activities on the 4 test departments, we will continue the self-study of institutional climate begun by the Resource Equity Committee (REC). Both the evaluation and self-study will employ mixed designs of qualitative and quantitative data collection and analysis. The results of Phase 1 evaluations will guide the implementation of the ACES project in Phase 2. The External Advisory Board will conduct annual reviews of progress, results, and future plans of the ACES project. As they become available, ACES project results will be presented at national meetings and published in scientific journals as well as disseminated through the ACES website.

Phase 1

Develop Baseline Data for All S&E Departments: During Phase 1, the PIs will work with the REC to create baseline data for assessing institutional transformation. These data will be developed from two sources: (1) personnel information (e.g., salary, rank, years in rank, named professorships, administrative supplements, discipline, school) of all faculty from S&E departments and (2) a structured survey of all

faculty in S&E departments. We will survey all faculty rather than a sample to assure sufficient statistical power in schools with few women. The survey will collect information on additional resources not contained in personnel records. We will also gather evidence regarding both attitudinal and experiential indicators of resource equity, chilly climate, and work-family integration identified through a review of available literature (e.g. MIT, 1999; Hollenshead, *et al.*, 1996; Blackburn & Lawrence, 1995; Sonnett & Holton, 1995) and continued analysis of focus group transcripts conducted by the REC. Appropriate multivariate analyses will be used to assess the prevalence, distribution, and antecedents of gender inequities in these departments.

Develop Baseline Data for Test Departments: The gender equity database described above will provide quantitative baseline data for the 4 test departments. In addition, we will conduct focus groups in these departments before intervention begins. The qualitative data generated through focus groups will provide insights into meanings and processes that shape the everyday experiences and career advancement of women faculty. These focus groups will use the discussion guide developed by the REC for the focus groups already completed. We anticipate conducting 6 focus groups: one in each of the test departments, one composed of the 4 department chairs, and one composed of the women faculty from the 4 departments (this last focus group will be conducted after departmental groups). Focus groups will be audio-recorded and tapes will be transcribed and analyzed through open coding and thematic analyses.

Success Factors for Women's Advancement in CWRU S&E Disciplines: A study, to be conducted by Dr. Bilimoria, will consist of two concurrent investigations – first, a case study examination of the Neurosciences Department as an example of a department with a history of strong participation and advancement of women faculty. The goal will be to identify the departmental conditions that foster full participation of women at all academic ranks. The Neurosciences Department is nationally ranked in the 7th percentile. It has 19 faculty, 5 of whom are women, 2 at the full professor level. The female department chair was recently elected to the National Academy of Sciences. Although the department has no defined policies in this area, it provides an excellent case study site for examining the working environment conducive to the advancement of women faculty and students.

A second investigation will examine the views of department chairs and women faculty at all levels about the key factors needed for women to obtain tenure and other positions of leadership in S&E departments, and to determine the extent and areas of significant overlap and distance between these sets of views. By understanding the differences and similarities in the views held by women faculty and their chairs regarding the individual, structural, and cultural factors advancing or inhibiting progression in the academic hierarchy, we will be able to shed light on existing constraints on excellence and the critical leverage points amenable to institutional transformation.

Interim Evaluation of Coaching, Mentoring, Networking, and Training Interventions in the Test Departments: At the end of Phase 1, we will undertake an evaluation of the interventions with the deans, chairs, department members, and female faculty members of the 4 test departments. Because of small sample sizes, qualitative evaluation methods (e.g., focus groups, interviews) will be primarily used.

Phase 2

Assessing Institutional Transformation in All S&E Departments: The quantitative data set developed at the beginning of Phase 1 will be replicated during Phase 2. Personnel data will be updated, and the survey of all faculty in S&E departments will be replicated. A comparison of measures of the various dimensions of gender equity in Phase 2 with the baseline scores will provide an assessment of the effectiveness of our transformational activities both globally and within specific departments. In addition, a comparison of coefficients in the multivariate analyses will provide insights into the areas in which transformation activities have been most effective in altering the processes that contributed to gender inequities.

We will also replicate the focus group study already completed by the Resource Equity Committee (REC). We propose to conduct 9 focus groups: 2 of tenured women, 2 of not-yet-tenured women, 2 of tenured men, 2 of not-yet-tenured men, and one of department chairs. After responding to the same set of questions, participants in these focus groups will review a list of issues raised during the 2001 sessions.

Each group will be asked to evaluate the relevance of these issues to the CWRU climate at the present (i.e., Phase 2) time. These focus groups will be audio-recorded and transcribed. Trained researchers who did not participate in the 2001 sessions will conduct open and thematic coding. Although qualitative data are not appropriate for statistical tests, a comparison of the 2 sets of themes will provide insights into the institutional areas that have undergone the most significant transformation.

Assessing Institutional Transformation in Test Departments: Comparison of baseline and follow-up data from the gender equity database will also provide a mechanism for assessing the impact of institutional transformation within the test departments. Including other S&E departments in these comparisons is important in differentiating the impact of our intervention from other environmental changes (within either the university or the larger society). Insights into the meaning and process of institutional transformation in the careers and everyday lives of faculty in the test departments will be gained through replication of the Phase 1 focus groups conducted in the test departments.

Administration

ACES PIs and Staff: The PI will be Professor Lynn Singer, who is in the Office of the President and Provost and therefore participates in decision making at the highest levels of the University. Her 20% effort on the ACES project without cost to NSF is considered part of her responsibility as Deputy Provost. ACES project headquarters including the ACES secretary will be located in the Women's Center. In addition to the PI, two other administrators will spend 10% effort on the ACES project without cost to NSF: the Faculty Diversity Officer, Professor Beth McGee, and Women's Center Director, Dr. Dorothy Miller.

The co-PIs will be Professors John Angus, Mary Barkley, and Diana Bilimoria. The co-PIs will assume primary responsibility for the ACES project in the participating schools: Dr. Angus for Case School of Engineering (CSE), Dr. Barkley for the College of Arts & Sciences (CAS) and School of Medicine (SOM), and Dr. Bilimoria for Weatherhead School of Management (WSOM). They will work with deans, department chairs, and search committees to set departmental goals, develop appropriate training, workshops, and other strategies to achieve these goals, and monitor progress toward them. Dr. Barkley will develop a spousal hiring network and coordinate minority pipeline activities. Dr. Bilimoria will direct a graduate student research project on success factors for S&E women faculty. Drs. Angus, Barkley, and Bilimoria will devote 15, 30, and 15% effort, respectively, to the ACES project.

The ACES manager, a Ph.D. in women's or ethnic studies, will train search committees in faculty recruitment skills, provide web-based and other tools to assist search committees in diversifying applicant pools, conduct 2nd-year entrance and exit interviews of women faculty, and collect qualitative and quantitative data on recruitment and retention activities and outcomes. The co-PIs, Faculty Diversity Officer, and department chairs will work with the ACES manager to develop the training programs and interview questions. Continued funding for this position after Yr 2 will be provided by CWRU.

A humanities or social sciences graduate student will train graduate and undergraduate students to eliminate gender bias toward women faculty. The Women's Center Director and co-PIs will work with the graduate student in designing appropriate training programs for different venues. Continued funding for this position after Yr 2 will be provided by CWRU.

Committees: The ACES steering committee will meet monthly to guide the direction and facilitate implementation of the ACES project. The steering committee will comprise the PIs, deans of the 4 participating schools: Professors Mohen Anvari (WSOM), Jerold Goldberg (SOM), Samuel Savin (CAS), and Robert Savinell (CSE) as well as the Faculty Diversity Officer and Women's Center Director.

The Resource Equity Committee (REC) will meet monthly to plan studies and review results. Each Committee member (except Dr. Bilimoria) will devote one month effort to the ACES project. The REC will be assisted in the design, implementation, and analysis of focus groups and questionnaires by a postdoc and social science graduate student.

The ACES External Advisory Board will comprise 5 members from out-of-state plus 2 members from the local business community. Professor Lotte Bailyn is in the Department of Organizational Behavior in the Sloan School of Management Science at MIT. Dr. Jeanette Grasselli Brown is Chair of the Ohio

Board of Regents. Professor Janie Fouke is Dean of the College of Engineering at Michigan State University. Professor Isiah Warner is Vice-Chancellor of Strategic Initiatives at Louisiana State University. Ms. Christine Russell is the President of Women in Lubrizol Leadership and a member of the African American Resource Group at Lubrizol. The External Advisory Committee will also include two PIs of successful ADVANCE Institutional Transformation Awards, one from 2002 and one from 2003.

ACES Team: The ACES team comprises 14 faculty from S&E departments in the 4 participating schools, including the co-PIs. This group and the President's Advisory Council on Women (PACOW) developed our proposal for an ADVANCE Institutional Transformation Award. The ACES team will continue to serve as an internal advisory board for the ACES project. It will also review proposals for the ADVANCE Distinguished Lectureships and Opportunity Grants.

Table 2: Timeline for ACES

Year 1

Training of search committees and students; Coaching of deans and chairs; Formation of mentoring committees; Baseline data for all S&E and test departments; Minority pipeline initiatives

Year 2

Coaching of women faculty; Departmental development; Continuation of search committee and student training, mentoring, and minority pipeline initiatives

Year 3

Evaluation of interventions in test departments; Implementation of best practices in new departments

Year 4

Continuation of implementation of best practices

Year 5

Continuation of implementation of best practices; Evaluation of institutional transformation in all departments

All Years

Distinguished lectureships; Opportunity grants; Networking events; Spousal hiring network; Self-study and evaluation; Research on success factors; External Advisory Board; Dissemination of results

Achievements Under Prior NSF Support

Materials Research Group on Diamond, John C. Angus, PI, DMR 91-21479, 9/1/89 to 7/31/97. An integrated, interdisciplinary program on the fundamentals of chemical vapor deposition of diamond was performed under a Materials Research Group grant. Approximately 100 publications in refereed journals were published; one was, for a time, the most cited publication in chemistry.¹ A total of 16 graduate students did thesis work on the project; 7 of these students were female.

Dopants in Diamond: Their Interactions and Relationships to Charge Transport in Electrochemistry, John C. Angus, PI, Alfred B. Anderson, Co-PI, CHEM 9816345, 3/1/99 to 2/28/2003. In this work we addressed one of the major problems facing diamond science: the lack of a viable dopant to produce n-type conducting diamond.² We also developed theoretical methods for screening for potential dopants that can be examined experimentally,³ and we successfully used conducting diamond as a transparent electrode for *in situ* infrared spectroscopy during electrochemical experiments.⁴ Four graduate students have been associated with this project; 2 are female.

Bulk Growth of Group III Nitrides, John C. Angus, PI, Kathleen Kash, Co-PI, DMR 9901499, 7/1/99 to 6/30/03. Polycrystalline indium nitride was synthesized by saturating molten indium with nitrogen from microwave plasma sources.⁵ It is believed that these are the first faceted indium nitride crystals ever synthesized. We used these crystals for fundamental studies of the properties of indium nitride, including accurate determination of lattice parameters and assignment of Raman modes.⁶ Two graduate students have been associated with this project; one is female.

1. J.C. Angus and C. Hayman, "Low pressure growth of diamond and 'diamondlike' phases," *Science* **241**, 913-921 (1988).
2. S.C. Eaton, A.B. Anderson, J.C. Angus, J.E. Evstefeeva, and Y.V. Pleskov, "Co-doping of diamond with boron and sulfur," *Electrochem. and Solid State Lett.* **5**, G65-G68 (2002).
3. T. Albu, A.B. Anderson, and J.C. Angus, Dopants in diamond nanoparticles and in the bulk: density functional study of substitutional B, N, P, SB, S, PN, O, NN, and interstitial H," *J. Electrochem. Soc.* **149**, E143 (2002).
4. H.B. Martin and P.W. Morrison, Jr., "Application of a diamond thin film as a transparent electrode for *in situ* infrared spectroelectrochemistry," *Electrochem. and Solid State Lett.* **4**, E17, (2001).
5. J.S. Dyck, K. Kash, C.C. Hayman, A. Argoitia, M.T. Grossner, and J.C. Angus, "Synthesis of bulk polycrystalline indium nitride at sub-atmospheric pressure," *J. Mater. Res.* **14**, 2411-2417 (1999).
6. J.S. Dyck, K. Kim, S. Limpijumnog, W.R.L. Lambrecht, K. Kash and J.C. Angus, "Identification of Raman-active phonon modes in oriented platelets of InN and polycrystalline InN," *Solid State Comm.* **114**, 355-60 (2000).

References

Association of Women in Science (AWIS) (2002). "Chilly Climate: Addressing the Climate for Women in Academia." <http://www.chillyclimate.org/index.asp>.

Basow, S.A. (1995). "Student evaluations of college professors: When gender matters." *Journal of Educational Psychology* **87**, 656-665.

Blackburn, R., & Lawrence, J. (1995). Faculty at work: Motivation, expectation, satisfaction. Baltimore: Johns Hopkins University Press.

Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development (CAWMSET) (2000). "Land of plenty: Diversity as America's competitive edge in science, engineering and technology." <http://www.nsf.gov/od/cawmset>.

Erskine, M. (1999). "A view from the trenches." In C.C. Selby (Ed.), Women in science and engineering: Choices for success (219-223). New York: New York Academy of Sciences.

Finkel, S.K., & Olswang, S. (1996). "Child rearing as a career impediment to women assistant professors," *Review of Higher Education*," **19(2)**, 123-139.

Fox, M.F. (2001). "Women, science and academia: Graduate education and careers," *Gender and Society* **15**, 654-666.

Fox, M.F. (1996). "Women, academia, and careers in science and engineering." In C.S. Davis, A.B. Ginorio, C.S. Hollenshead, B.B. Lazarus, & P.M. Rayman (Eds.), The equity equation: Fostering the advancement of women in the sciences, mathematics and engineering (pp. 265-289). San Francisco: Jossey-Bass Publishers.

Fox, M.F. (1995). "Women and higher education: Gender differences in the status of students and scholars." In J. Freeman (Ed.), Women: A Feminist Perspective (220-237). Mountain View, CA: Mayfield Press.

Hensel, N. (1991). Realizing gender equality in higher education: The need to integrate women/family issues. ASHE:ERIC Higher Education Report No. 2. Washington, DC: George Washington University.

Hollenshead, C.S., Wenzel, S.A., Dykens, M.N., Davis, C.S., Ginorio, A.B. Lazarus, B.B., & Rayman, P. M. (1996). "Ensuring educational and career equity for women: A research and policy agenda." In C.S. Davis, A.B. Ginorio, C.S. Hollenshead, B.B. Lazarus, & P.M. Rayman (Eds.), The equity equation: Fostering the advancement of women in the sciences, mathematics and engineering (pp. 321-334). San Francisco: Jossey-Bass Publishers.

Lawler, A. (1999). "Tenured women battle to make it less lonely at the top," *Science* **286**, 1272-1276.

Mark, S., Link, H., Morahan, P., Pololi, L., Reznik, V., & Tropez-Sims, S. (2001). "Innovative mentoring programs to promote gender equity in academic medicine," *Academic Medicine* **76**, 39-42.